

Acoustic Associates Sussex Ltd

Noise Assessment

Examination of Night Time Noise

Site: Austin Divall Steelwork, Unit J, Rudford Industrial Estate,
Climping, West Sussex

Client: **Austin Divall Steelwork Fabrication Limited**

Report by: Scott Castle BSc (Hons) AMIOA

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1 Introduction

Acoustic Associates have been appointed to undertake an acoustic assessment relating to the steel fabrication workshop/factory located on the Rudford Industrial Estate at Climping, West Sussex.

The purpose of the assessment was as follows:

- Measure and assess existing background noise levels
- Assess noise levels both inside and outside the factory workshop and model how the sound is likely to propagate across the site
- Provide recommendations to reduce noise levels for both the longer-term site proposals and the interim period to support the current planning application.

Noise levels have been assessed in terms of and following the guidelines of the following documents:

- BS4142 (2014)
Methods for rating and assessing industrial and commercial sound
- WHO (1999)
World Health Organisation - Guidelines for Community Noise
- BS8233 (2014)
Guidance on sound insulation and noise reduction for buildings
- ISO9613 (1996)
Attenuation of sound during propagation outdoors

An unattended acoustic survey has been undertaken between 14th February and 21st February 2018. Sound level meters were placed inside the factory unit, as well as being located at the Western end of the open steels yard. Internal measurements have been used to determine night time operations and the representative internal soundscape. The noise data obtained, combined with the noise modelling software and careful replication of the Western façade of the workshop with the voids for the travelling crane and doors has identified likely noise break out. Modelling of the night time L_{Amax} events shows that for the night time period considered, these could break out of the factory through the Western facade and possibly reach residents and be noticeable with windows open.

Measurement of the night time background noise levels adjacent to the nearest residential properties also suggests that the singular loud L_{Amax} events have the potential to be heard over background noise levels. Whilst not continuous in their character, the loud bangs/events are likely to be noted outside.

Recommendations have been made for both longer term mitigation measures which include the enclosure of the yard and extension of the building, as well as shorter term measures to yield a positive noise benefit and reduce where practicable and possible noise levels at source.

It is also strongly recommended that the application of noise mitigation measures must not be solely applied to the main factory workshop, but the principles applied also to the Aluminium Shop which is closer in proximity to the nearby residents to the South.

Whilst the focus of the report has been on night time operations, the worst case daytime noise levels have been examined and included in noise prediction and modelling software to ensure that suitable and sufficient mitigation measures are introduced to ensure that residents are not impacted. When modelling the longer-term proposals against the current noise model there is seen to be a considerable noise reduction of 16dB(A) at the nearest residential receptor.

Given that the planning application proposes a partial structural enclosure of the yard, it is likely to yield a positive benefit to the local soundscape. For the reasons above it is considered that planning permission would not likely be refused on noise grounds, assuming that the mitigation measures as reported in sections 9 and 10 are implemented on site.

2 Context, Noise Criteria & Noise Assessment Methodology

2.1 Context

Austin Divall Steelwork Fabrication Limited have operated on an industrial estate since 1991. The work undertaken at the site is the assembly of steel frameworks which can involve banging and cutting to ensure that precision measurements are achieved. This is typically carried out in the daytime. During a night shift period, the steelwork is welded in situ in the main factory/workshop area with the main doors closed.

The site is comprised of Six main areas. These are as follows:

- A fully enclosed paint shop building
- An outside yard area where steel beams and components are stored and
- A large factory workshop with long benches and internal cranes
- Offices are located on the first-floor South elevation
- A press guillotine is also on site, albeit to the South
- An aluminium workshop adjacent to the guillotine area.

Due to the weight of the steelwork, a number of gantry operated travelling cranes are used to lift and move the steel beams. With a need to deliver the steel lengths inside of the workshop the gantry crane rails transit through the Western elevation of the main workshop. This is seen in Figure 1 below.

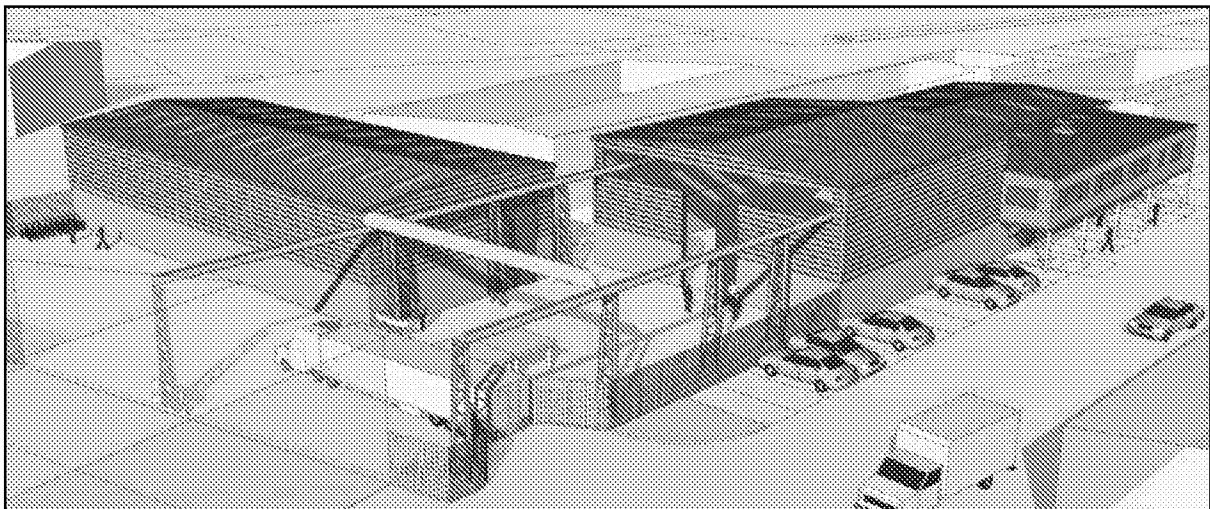


Figure 1. 3D View of site layout

Figure 2 below shows a shot from inside of the factory looking out of the Western elevation. Aside from the gaps around the crane, it is noted that the large steel doors are ill fitting and have an upper portion of perforations which is doing little to contain the noise generated inside the factory.



Figure 2. Looking out of the Western facade with the travelling crane parked in the aperture

The night shift is made up of 4 individuals and operates from 18:00 hours until 03:00-04:00 hours and uses three welding sets.

2.2 Nearest Residential Receptors/Neighbours

The nearest residential neighbours, likely to be considered as noise sensitive receptors are located to the South of Horsemere Green Lane, are May Close, Waterford Gardens, and Cropthorne Drive. In terms of proximity, the closest neighbour is likely to be approximately, 112m due South of the factory/workshop.

2.3 Current Situation

It is understood that there have been recent complaints made directly to Austin Divall and additionally Arun District Council with allegations of noisy working from the site. Specific reference has been made to noisy night time operations.

It is also understood, that Austin Divall are currently in the process of submitting a planning application to regularise hours and to future proof the site by ensuring that a more robust enclosure of the entire site is achieved.

2.4 Scope

Acoustic Associates Sussex Limited have attended site and left survey equipment running to identify noise levels and better understand the soundscape. Aside from two unattended sound level meters, a mid-week night time visit was made to subjectively listen and obtain background noise measurements closer to the residential properties.

The focus of the investigation has been to better understand the night time working, and why this may be attracting complaints and to recommend mitigation measures to assist in the longer-term proposals and the interim period.

2.5 Methodology and Approach

Two sound level meters were installed on site. One was located inside the workshop/factory unit and recorded 1 and a half days and 2 nights of data before it inadvertently lost power.

An additional sound level meter was located at the Western end of the steels yard to monitor levels but also record audio events where sound levels went above a certain level. By having inside and outside measurements, this assisted in being able to produce a noise model to better examine propagation of sound levels across the site and environs.

The noise model was tailored to reflect the fact that the Western elevation was not a closed structure and has the crane parked in the gantry aperture. The model was also tailored to ensure that the large steel double doors were also perforated for approximately 40% of their upper structure.

With night time background sound level readings taken close to the residential properties, short term change in background levels, impact may be assessed by considering the output of the model versus current measurements.

The L_{Amax} indices as an indicator of short term high level single events has also been used to compare against established current guidance.

2.6 National Planning Policy Framework 2012

The National Planning Policy Framework (March 2012) defines the Government's planning policies for England and how these are expected to be applied. It sets out the Government's requirements for the planning system only to the extent that it is relevant, proportionate and necessary to do so. It provides a framework within which local people, and their answerable councils can produce their own distinctive local and neighbourhood plans, which reflect the needs and priorities of their communities.

Paragraph 123 within NPPF Section 11 (Conserving and enhancing the natural environment) states the following:

Planning policies and decisions should aim to:

- *avoid noise from giving rise to significant adverse impacts on health and quality of life as a result of new development;*
- *mitigate and reduce to a minimum other adverse impacts on health and quality of life arising from noise from new development, including through the use of conditions;*
- *recognise that development will often create some noise and existing businesses wanting to develop in continuance of their business should not have unreasonable*

restrictions put on them because of changes in nearby land uses since they were established; and

- *identify and protect areas of tranquillity which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason.*

2.7 Noise Policy Statement for England (NPSE)

2.7.1 NPSE Mission Statement

The document "Noise Policy Statement for England" sets out the following vision for on- going noise policy:

"Promote good health and quality of life through the effective management of noise within the context of Government policy on sustainable development."

This vision should be achieved through the following Noise Policy Aims:

"Through the effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development: avoid significant adverse impacts on health and quality of life; mitigate and minimise adverse impacts on health and quality of life; and where possible, contribute to the improvement of health and quality of life".

2.7.2 NPSE Noise "Effect Levels"

To achieve these objectives the Noise Policy Statement sets out three noise levels to be defined by the assessor:

- NOEL - No Observed Effect Level
This is the level below which no effect can be detected. In simple terms, below this level there is no detectable effect on health and quality of life due to the noise.
- LOAEL - Lowest Observed Adverse Effect Level
This is the level above which adverse effects on health and quality of life can be detected.
- SOAEL - Significant Observed Adverse Effect Level
This is the level above which significant adverse effects on health and quality of life occur.

The Noise Policy Statement considers that noise levels above the SOAEL would be seen to have, by definition, significant adverse effects and would be considered unacceptable.

Where the assessed noise levels fall between the LOAEL and the SOAEL noise levels, the Policy Statement requires that:

"all reasonable steps should be taken to mitigate and minimize adverse effects on health and quality of life while also taking into account the guiding principles of sustainable development... .. This does not mean that such adverse effects cannot occur."

Where noise levels are below the LOAEL it is considered there will be no adverse effect. Once noise levels are below the NOEL there will be no observable change.

2.7.3 Guidance Documents

For guidance as to a numerical definition of LOAEL, while this is not provided specifically, it is helpful to refer to the following Standards.

- BS8233: 2014: Guidance on Sound insulation and noise reduction for buildings

- World Health Organization (WHO) - Guidelines for Community Noise 1999
- BS4142: 2014: Method for rating and assessing industrial and commercial sound

2.8 BS4142: 2014: Methods for rating and assessing industrial and commercial sound

This document provides a means of assessing the impact of industrial or commercial sound upon nearby noise-sensitive receptors, including residential properties.

It does this by comparing the Rating Level of the noise from the industrial or commercial source with the pre-existent L_{90} background noise level affecting the same noise-sensitive premises. The Standard provides guidance that:

- 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 noise level, this is an indication of the specific sound source having a low impact, depending on the context.

2.9 WHO Internal Noise Criteria

The target internal levels are based on guidelines laid out by the World Health Organisation (WHO) and are as follows:

Room Type	Target Maximum Internal Level - Leq dB (A)
Living rooms	35 (Daytime only)
Bedrooms	30 (Night)

The target maximum internal noise level for a bedroom during the night time corresponds to the threshold of sleep disturbance. WHO state that the noise level outside a bedroom window would be less than 45dB(A) this assumes that an open window provides 15dB attenuation.

2.10 WHO External Noise Criteria

With regard to outdoor amenity areas WHO states the following:

To protect the majority of people from being seriously annoyed during the daytime, the outdoor sound level from steady, continuous noise should not exceed 55dB(A) on balconies, terraces and in outdoor living areas.

To protect the majority of people from being moderately annoyed during the daytime, the outdoor sound level from steady, continuous noise should not exceed 50dB(A) on balconies, terraces and in outdoor living areas.

2.11 BS8233 Noise Criteria

Table 4 of BS8233 provides the following guideline values:

Activity	Location	Time period of day	
		07:00-23:00	23:00-07:00
Resting	Living Rooms	35dB $L_{Aeq,16hour}$	-
Dining	Dining Room/Area	40dB $L_{Aeq,16hour}$	-
Sleeping (daytime resting)	Bedroom	35dB $L_{Aeq,16hour}$	30dB $L_{Aeq,8hour}$

Table 1: BS8233 Criteria

2.12 World Health Organisation, Night Noise Guidelines 2009

The World Health Organisation, Night Noise Guidelines 2009 require that internal L_{Amax} levels inside a bedroom during the night time period, should not be above 42dB L_{Amax} .

3 Background Sound Survey Baseline Conditions & Results

A noise survey was carried between the 14th February 2018 to 21st February 2018 to assess the background and ambient sound levels at the site. As stated, the initial focus has been on understanding night time noise levels.

Whilst daytime levels have been recorded and are critical to understanding the soundscape, focus has been on the night shift period from 21:00 hours to 04:00 hours when there should be minimal influence from other noise sources on the industrial estate. It is also assumed that grinding did not occur after 21:00 hours, as there is a curfew of 21:00 hours in place.

The position of the Steels yard sound level meter was directly in line with the factory workshop, located at the end of the yard (28m from the factory). A second sound level meter was installed inside the factory to quantify internal sound levels, but in close proximity to where beams/steel lengths are turned.

3.1 Background and Existing Noise Survey Details

Survey(s) carried out by	Scott Castle BSc (Hons) Env Health, MCIEH CEnvH PGDip Acoustics AMIOA
Equipment Used	Svantek Castle Mirrus - Type 1 Sound Level Meter
Equipment Used	01dB Symphonie– Type 1 Sound Level Meter with 1 channel output
Equipment Used	Castle Group Acoustic Calibrator – GA607-Serial.040430
Equipment Used	Easy Weather Station
Duration of Survey	Start 11:30 14/2/2018 / Stop 08:30 hours 21/2/2018
Height	2.2m

Table 2. Survey Information

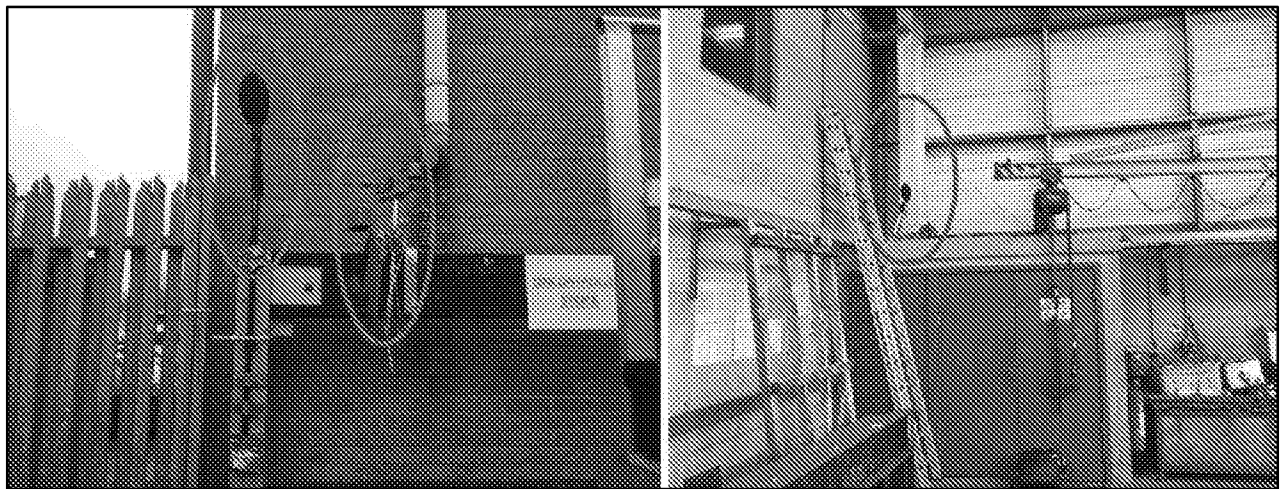


Figure 3. Survey Location showing microphones outside, inside and a co-located weather station

The sound level meters were calibrated before and after commencing the noise measurements (@94dB no drift).

Whilst measurements made by the Svantek Castle Mirus in the steels yard were set to 15 minutes, the 01dB sound level meter located inside the factory provides a more accurate 1 minute time period and recording.

Figure 4 shows the layout of the industrial estate with Austin Divall's buildings marked in blue. Figure 4 is also useful in showing the context with neighbouring residential properties located further South and an additional line of single storey industrial units which are likely to act as a barrier for any sounds leaving the factory site.

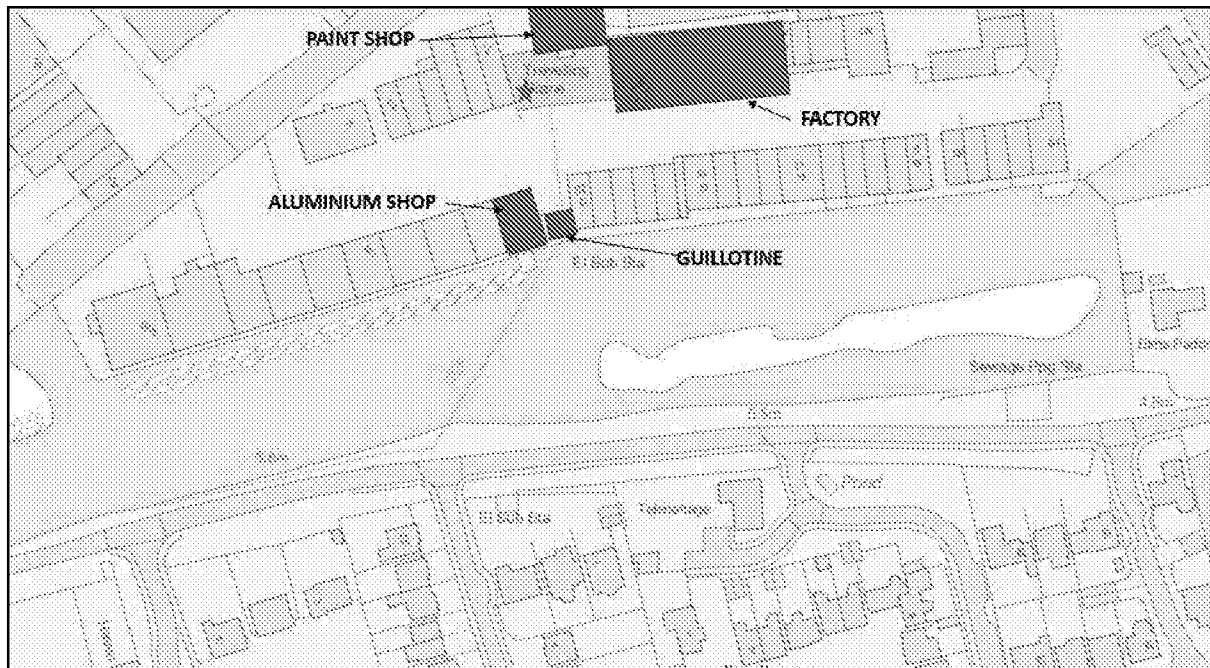


Figure 4. Survey position with Austin Divall buildings shown in blue and the residential estate located further South.

3.2 Weather Conditions

Weather conditions for the survey period were mainly dry and ideal for noise monitoring. A co-located weather station was also installed, confirming that the noise data collected was done so during representative conditions. From the data below, it is seen that the wind speed including gusts was below 5m/s^{-1} for the survey period.

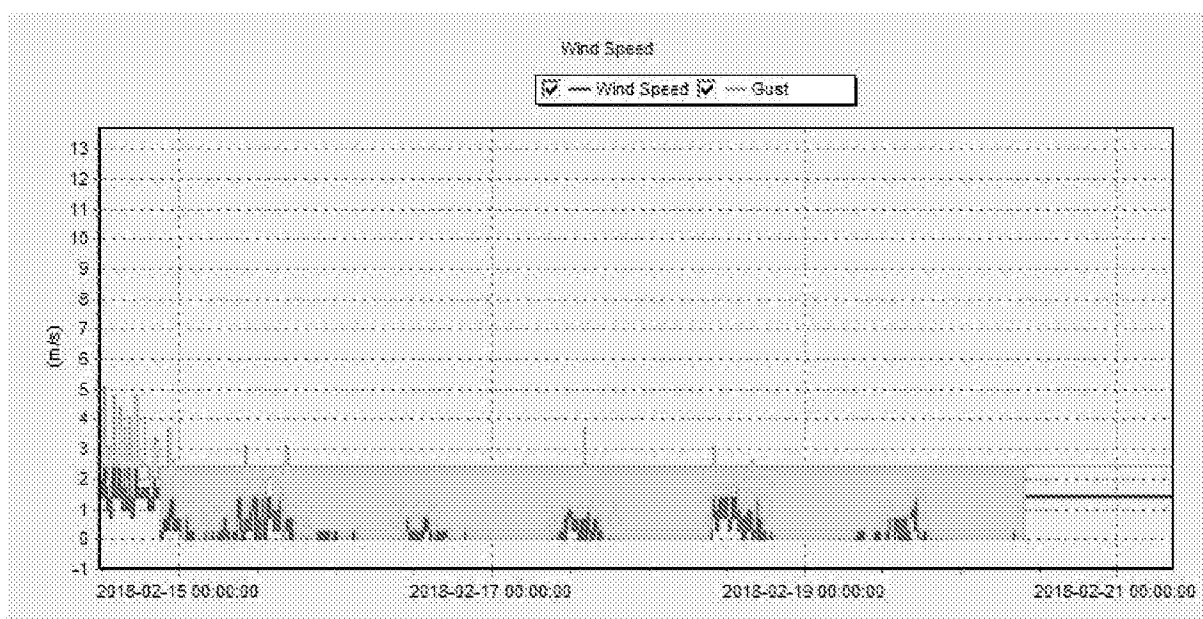


Figure 5. Wind Information for the duration of the survey period

3.3 Hours of Operation

It is understood that the large steel doors in the Western elevation are closed at 18:00 hours. Additionally, at 18:00 hours, the travelling crane is placed into the doorway aperture (see Figure 2 above). From 18:00 to 21:00 hours grinding of steel is permitted but ceases thereafter. From 21:00 hours until the finish of the night shift, there should not be any banging or grinding, only the welding of steels.

The site operates six days a week and are not operational Sundays.

3.4 Noise Survey Results

A summary of the noise survey results for the daytime (15th Feb 2018) and 2 recorded night times are seen below in Figures 6, 7 and 8. These were all recorded inside the factory and the graphs show the three parameters of L_{Aeq} , ie average noise level for the one-minute time period, the L_{A90} which describes the noise for 90% of the time period and is referred to as the background noise level. and the L_{Amax} figure which relates to the short term and high-level noise events.

It is useful to see the profiles of the factory working during the daytime, night time and the external microphone located in the Steels yard.

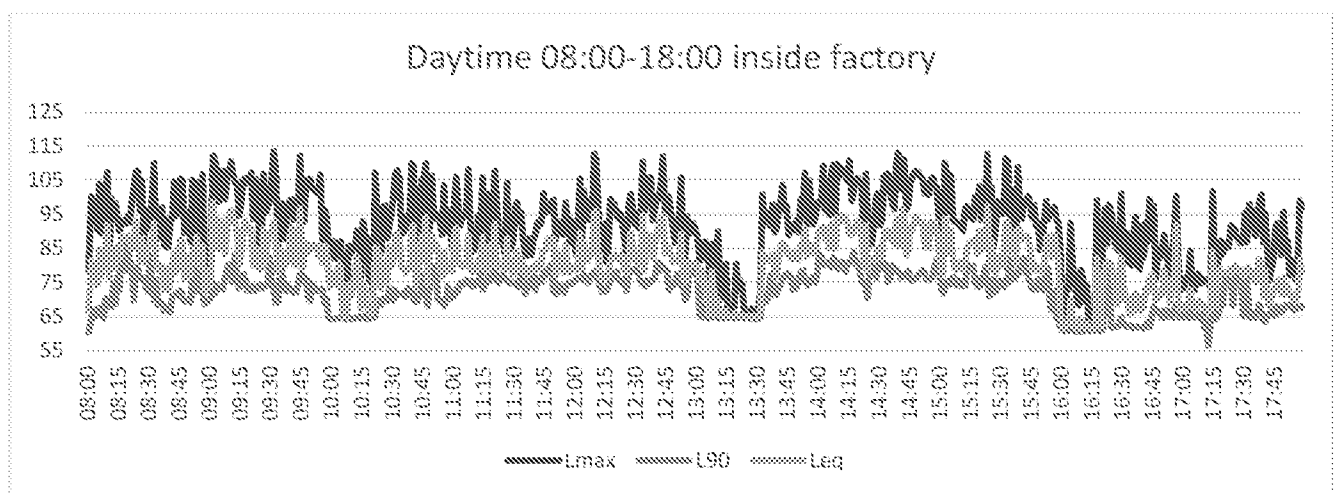


Figure 6. Daytime Noise Levels inside the factory

Note the scale of the daytime graph and the L_{Amax} events are in the region of 95dB to 105dB. The graph is also indicative of a lunch break or shut down around 13:00 to 13:30 hours where the noise levels are reduced.

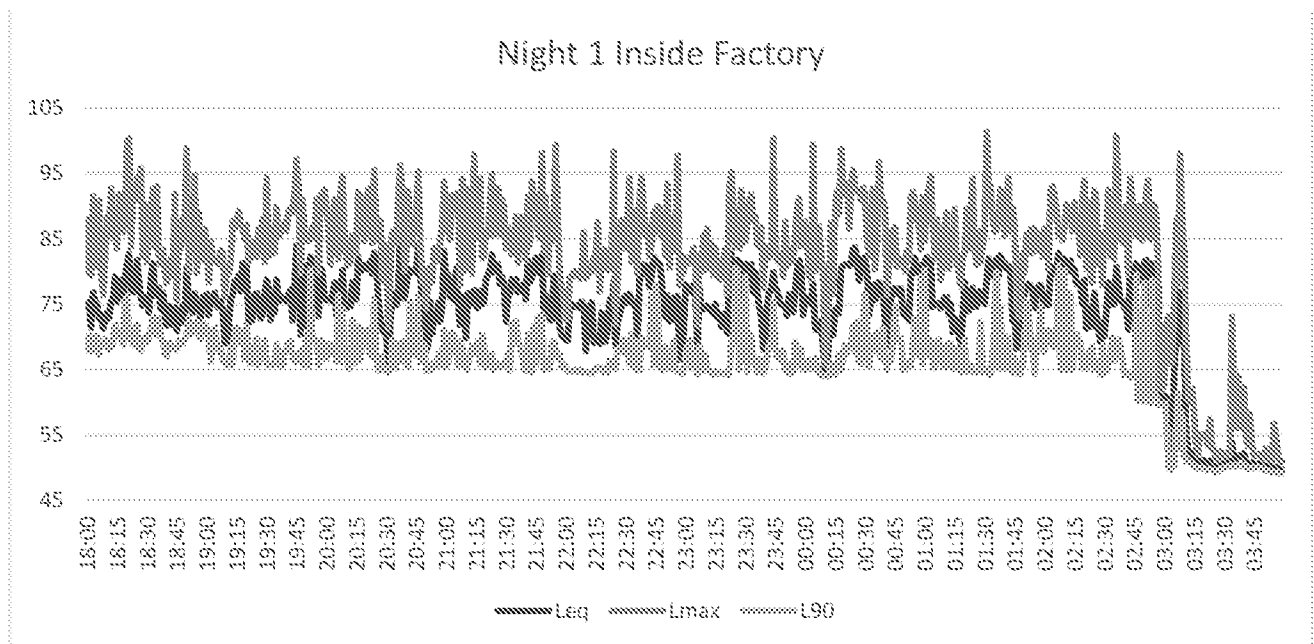


Figure 7. Night 1 inside the factory -18:00 04:00 hours

Figure 7 above shows that the L_{Amax} during the first night still frequently occurs, albeit in the 85-95dB(A) range. Also apparent is the finish of the night shift and production ceasing around 03:00 hours where noise levels are seen to reduce.

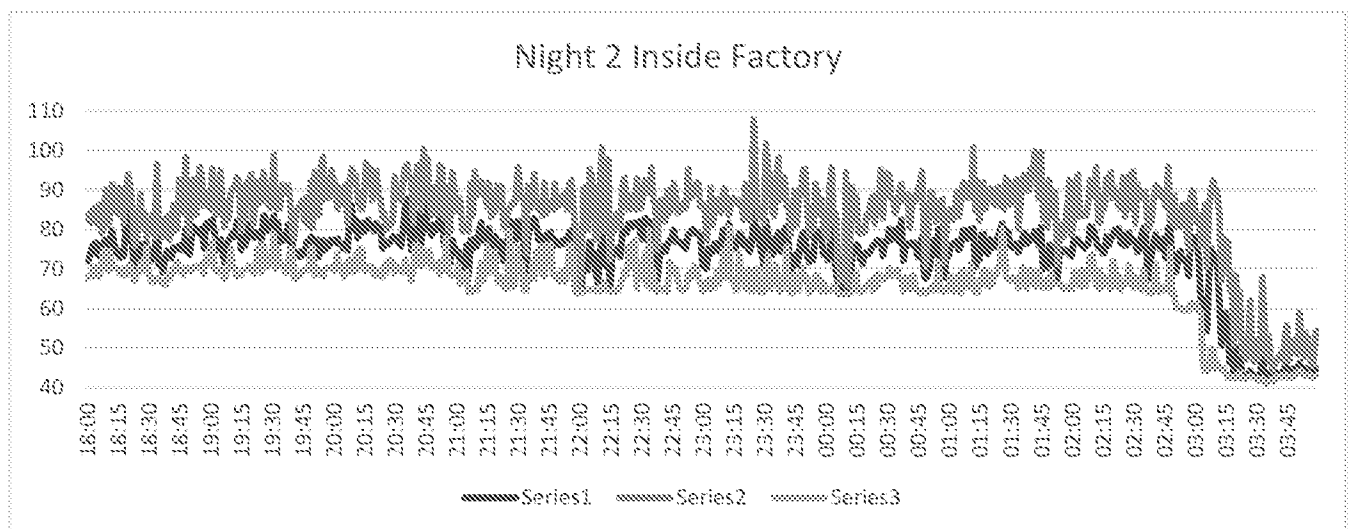


Figure 8. Night 2 Inside the Factory 18:00 to 04:00 hours

Figure 8 above also shows numerous maximum events (L_{Amax}) in the 85-95 dB(A) area, although 108dB(A) L_{Amax} was recorded at 23:25 hours.

When assessing the night time sound levels created, attention has been paid to the 21:00 to 04:00 hours on the basis that at these hours, the sound levels for the yard should not be unduly influenced by other units on the industrial estate. The impact of other units and/or activities will be discussed separately.

3.5 Sound Levels and Assessment Criterion

It is relevant to note that the sounds produced by the inside of the factory are not continuous and anonymous noise sources such as passing road traffic on a nearby busy road. This is important when comparing to British Standards or Guidance.

The sounds created are likely to be short but noisy events and may be examined by looking at L_{Amax} as the suitable measurement indices. It will be relevant to note how frequently such maximum events are occurring throughout a typical night in order to be able to compare against relevant criterion or guidance.

In terms of British Standards, the night time period is defined as being from 23:00 to 07:00 hours.

3.5.1 L_{Amax}

Recently published guidance on night time events (ProPG, 2017) and internal L_{Amax} levels in bedrooms focused on a level of no more than 10 events per night at 45dB L_{Amax} . Whilst describing likely awakenings at or above these levels, the noise source does however relate to transportation noise for newly constructed dwellings.

As an industrial noise source, it is relevant to consider the World Health Organisation Night Noise Guidelines 2009. The WHO Guidance suggests no more than 42dB L_{Amax} inside a bedroom.

3.5.2 BS8233:2014- Revisions to internal noise levels

As indicated above, it is relevant to note that BS8233:2014 is based on continuous and anonymous noise source. For a noise source which has short and high-level events, it may be appropriate to reduce the internal noise threshold for sleep for a night time period, ie 23:00 to 07:00 hours. Section 2.11 above states that 30dB $L_{Aeq,8\text{ hour}}$ may be considered relevant for night time internal bedroom sound levels. However, for the purposes of this assessment, 25dB, $L_{Aeq, 8\text{ hour}}$ will be used as a descriptor for internal noise levels inside a bedroom.

3.5.3 BS4142:2014

BS4142:2014 is useful as a criterion for assessing impact, but not necessarily deriving or determining nuisance.

4 Subjective Assessment of background noise levels

To reinforce the data from the unattended sound level meters, a visit was also made mid-week around 22:00 hours to the nearest residential receptors at May Close. These were selected on the basis that any noise created may be funnelled in between the low level single storey industrial units to the South.

The visit was useful in that it identified that there was other noise not related to Austin Divall being heard. Whilst there are numerous pumps which serve the sewerage infrastructure on the industrial estate, (running 24/7), and are considered to be part of the normal operating background soundscape, the sounds heard were thought to be plant moving or earth moving equipment. With Viridor in relatively close proximity, this is likely to be an area for further investigation.

Accordingly, night time activities and spot checks around the neighbourhood will form a part of the proposed further works in the report. It is understood that at night, key fobs are needed to access the industrial estate and accordingly, site management are well placed to be able to walk the site perimeter and identify additional noise sources.

From the visit made, a background noise level of 41dB $L_{A90,15 \text{ minutes}}$ was measured in close proximity to the nearest property in May Close. This will be used in further calculations throughout the report.

5 Current Operating Levels

The sound level meters were interrogated to provide an hour by hour analysis of average noise levels or $L_{Aeq(T)}$. The results are logarithmically averaged over 1 hour. Figure 9 shows the levels recorded inside the factory and suggesting that noisier activities such as grinding may have been occurring in the 18:00 to 21:00 hours period. 82dB $L_{Aeq, 1 \text{ hour}}$ was the noisiest 1-hour period recorded on the second night between 18:00 and 21:00 hour. From 21:00 to 04:00 hours, the loudest noise period recorded was 78dB $L_{Aeq, 1 \text{ hour}}$. These two figures will be applied to a noise model in due course.

Inside Factory		
Hours	Night 1	Night2
18:00-19:00	77	78
19:00-20:00	78	79
20:00-21:00	79	82
21:00-22:00	78	78
22:00-23:00	76	78
23:00-24:00	78	77
00:00-01:00	78	76
01:00-02:00	78	77
02:00-03:00	78	77
03:00-04:00	63	66

Figure 9. $L_{Aeq, 1 \text{ hour}}$ measured inside the factory

Noise levels were also examined for the sound level meter located in the Steels yard and are shown below in Figure 10. Again, there is a noticeable difference between 18:00 hours to 21:00 hours where 64dB $L_{Aeq, 1 \text{ hour}}$ was recorded as the loudest hour, and reducing to 58dB $L_{Aeq, 1 \text{ hour}}$ post 21:00 to 04:00 hours.

Yard Levels Hour by hour		
Time Period	Night1	Night 2
18:00-19:00	64	60
19:00-20:00	59	60
20:00-21:00	59	61
21:00-22:00	58	57
22:00-23:00	56	57
23:00-24:00	56	58
00:00-01:00	57	56
01:00-02:00	57	57
02:00-03:00	57	57

Figure 10. Steels Yard Sound Level Meter.

In making a comparison between Figures 9 and 10, given that the data was split hour by hour, it may be possible to compare the inside factory measurements with those outside. It should be remembered, that the sound level meter in the yard is 28m distant. Figure 11 below shows the direct correlation of hours between Night 1 and Night 2. This shows a very approximate loss of 19-21dB between the two sound level meters.

Night 1 difference	Night 2 difference
13	18
19	19
20	21
20	21
20	21
22	19
21	20
21	20
21	20

Figure 11. Comparative Difference between sound level meters inside and outside in the Steels Yard hour by hour.

As seen from the night time profiles in Figures 7 and 8 for the measurements made inside the factory, there are elevated L_{Amax} events during the night shift. These were reviewed for only the sound level maxes between 90dB and 100dB+ and grouped into their respective hours when they occurred.

Figure 12 below shows there is variation between the two nights and also between the two periods of prior to 21:00 hours and after. With high level grinding events occurring in the 18:00 to 21:00 period, it would be assumed that these would show the more frequently occurring maximum events, however this is not the case. Accordingly, on the first night, the greatest number of maximum events above 90dB L_{Amax} occurred between midnight and 01:00 hours suggesting that another activity or process may be responsible for the high L_{Amax} events during the night.

L_{Amax} events 90dB-100+		
Time Period	Night 1	Night 2
18:00-19:00	17	14
19:00-20:00	8	26
20:00-21:00	13	31
21:00-22:00	19	15
22:00-23:00	8	17
23:00-00:00	9	16
00:00-01:00	22	11
01:00-02:00	10	24
02:00-03:00	20	15
03:00-04:00	1	2
Total#	62	68
#23:00-04:00		

Figure 12. Number of L_{Amax} events above 90dB(A) grouped by hour

The maximum events can also be seen by examining the sound level meter located in the yard. It is noted that the noise meter is some 28 metres distant and it is assumed that the travelling crane is parked in the façade aperture and that the large steel doors are closed.

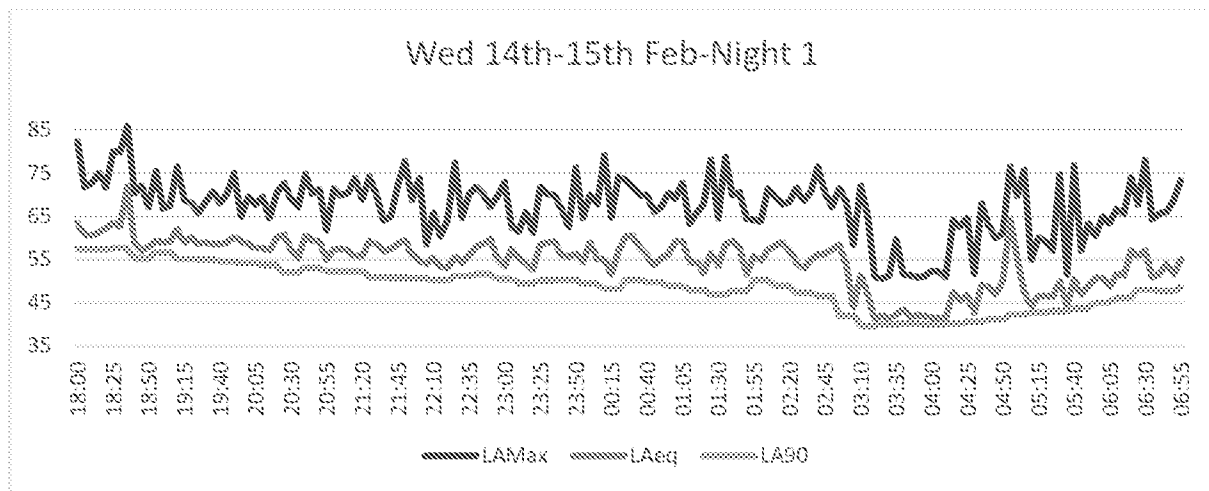


Figure 13. Night 1. Outside Yard

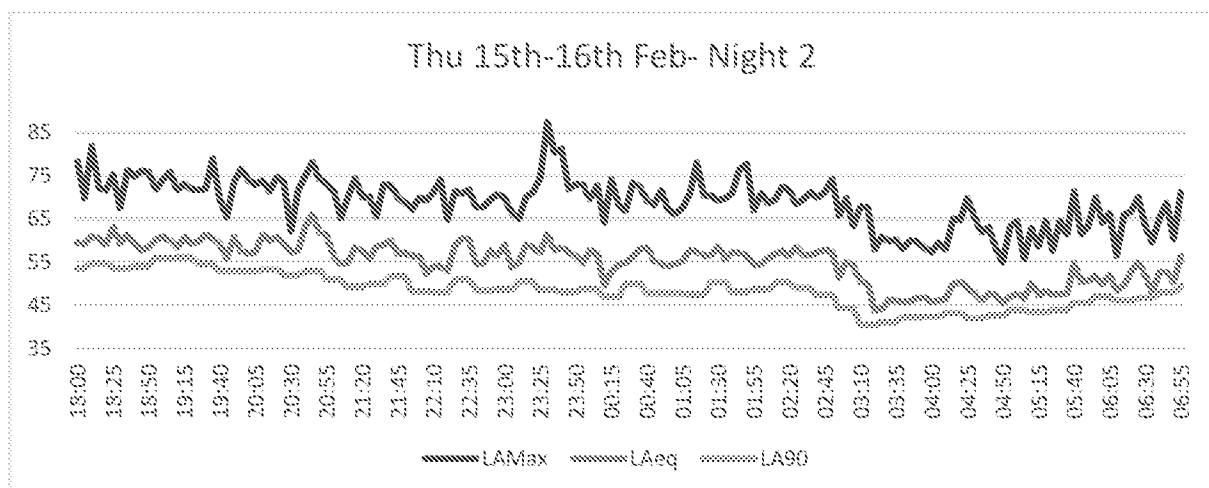


Figure 14. Night 2 Outside Yard

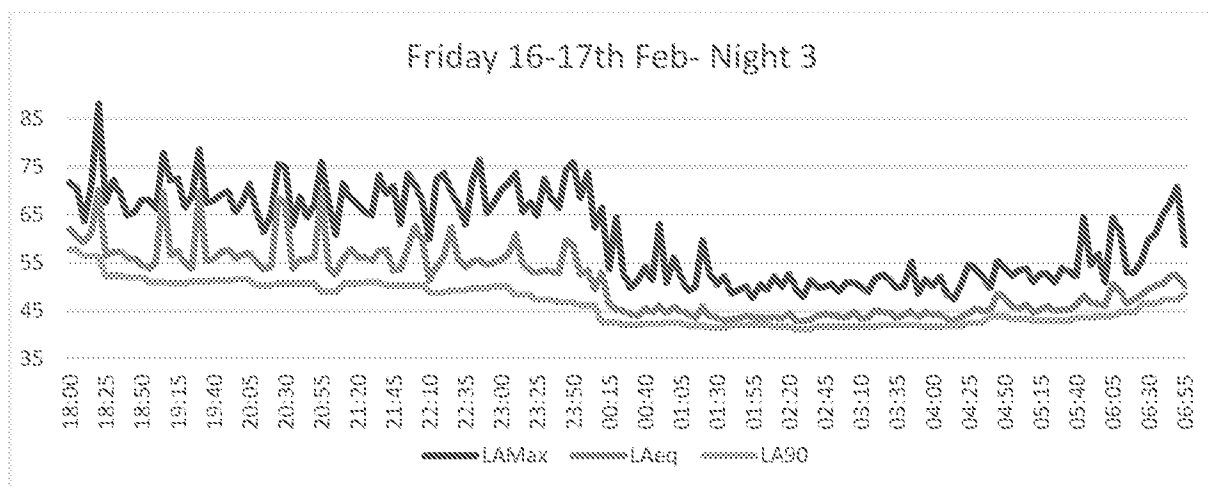


Figure 15. Night 3 Outside Yard

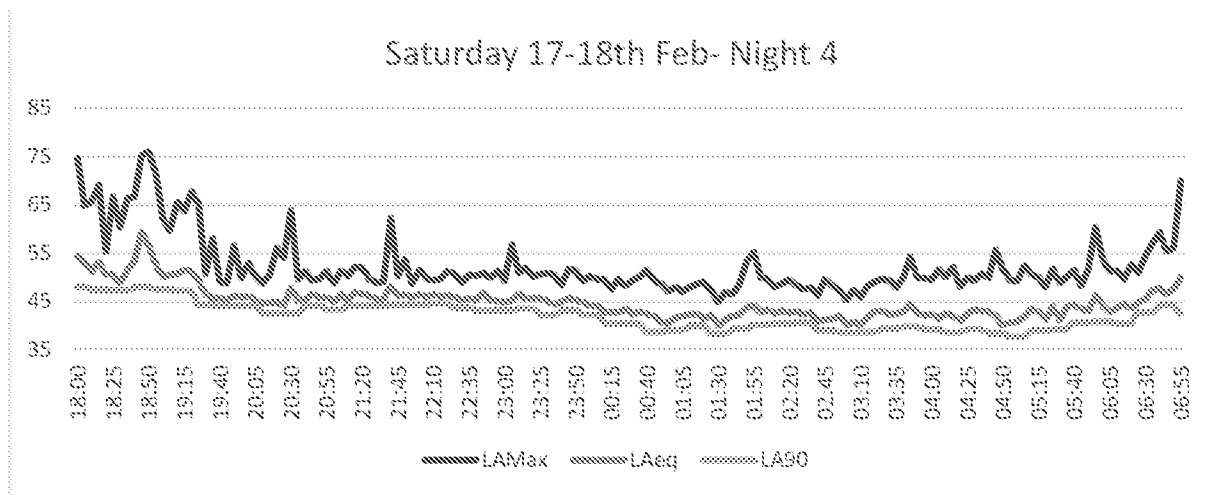


Figure 16. Night 4 Outside Yard

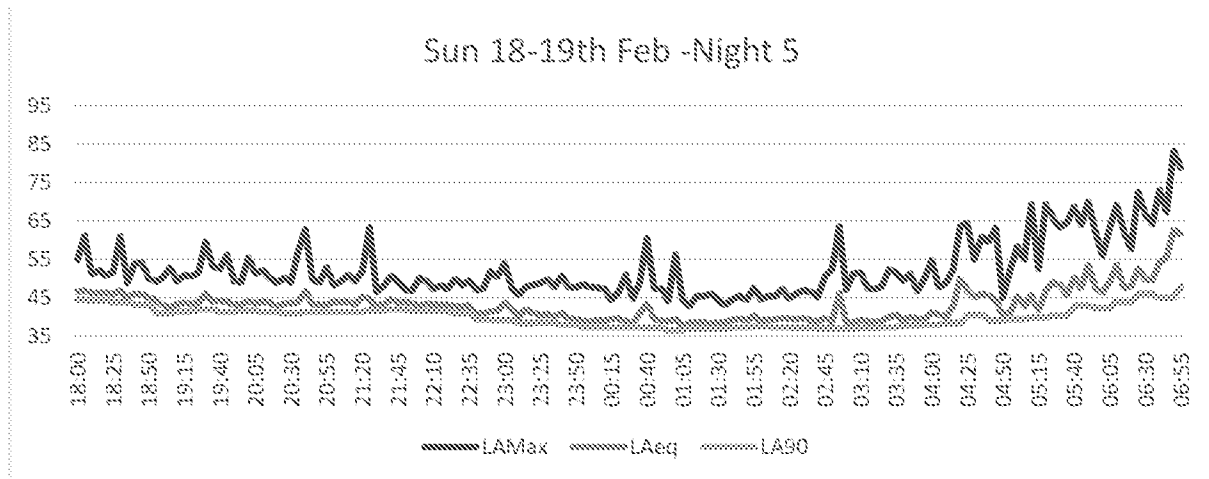


Figure 17. Night 5 Outside Yard

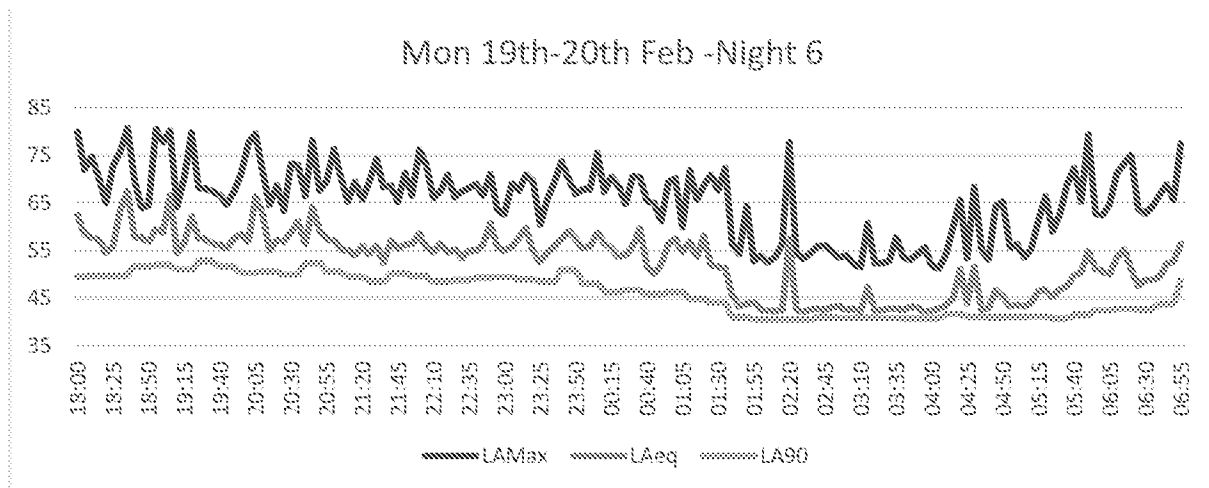


Figure 18. Night 6 Outside Yard

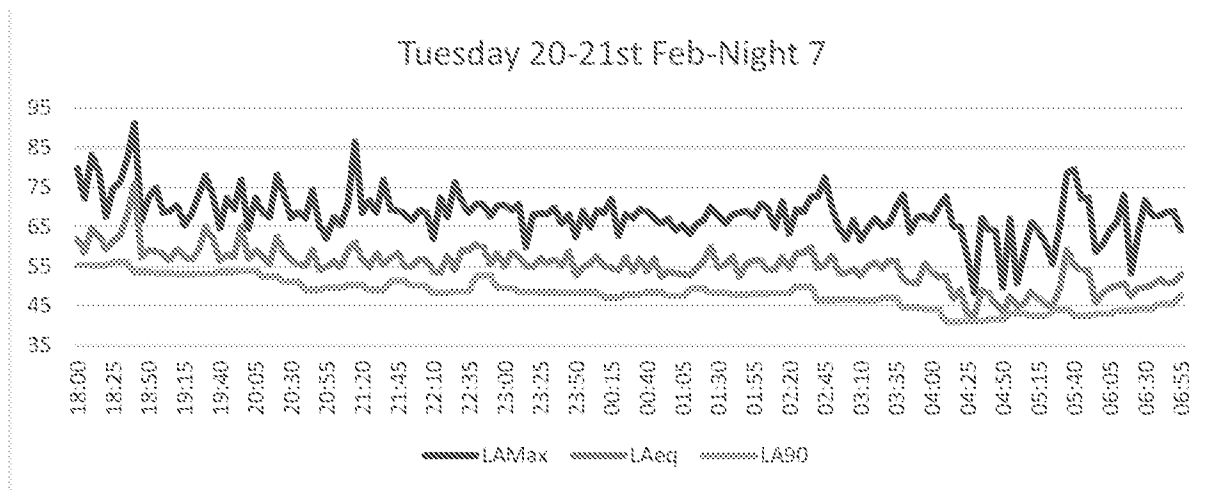


Figure 19. Night 7 Outside Yard

6 Noise Modelling and Prediction

An IMMI (Wolfel) noise model was constructed using the main factory workshop as an area noise source. This allows the model inputs to take account of the differing characteristics of the walls and roof, and to be able to set what level of sound insulation is present. The model was constructed initially using 82dB $L_{Aeq,1\text{hour}}$ as the interior noise source representative of the 18:00 to 21:00 hour period, as per the results of Figure 9.

Care was taken to use plans and accurate detailing to replicate the openings in the Western façade through which the travelling crane operates. It is assumed that by focusing on the night time noise levels that the doors were closed and that the exterior travelling crane was parked in the appropriate aperture providing a limited barrier effect. Additionally, the rationale for examining night time levels, was to minimise the influence of other local noise sources and industrial units.

The model is useful in showing the current attenuation of noise as it includes barrier calculations and faithfully replicates the methodology in ISO9613.

The model was calibrated by reviewing the internal sound levels within the factory as well as those received during the same time period outside in the yard, some 28m distant. When the model replicated the same conditions as experienced in the yard, it was felt that it was operating correctly.

Receptor points were then added for the nearest residential properties located to the South. Assuming a night time scenario, the receptor points for the residents were modelled at 4m in height replicating a 1st floor bedroom window.

The model was run for various scenarios, prior to 21:00 hours when one can reasonably expect noisier activities such as grinding occurring and additionally, the time period between 21:00 hours to 04:00 hours.

The first model, depicted in Figure 20 shows 82dB $L_{Aeq, 1\text{ hour}}$ during 18:00-21:00 hours, whereas the next model presents 78dB $L_{Aeq, 1\text{ hour}}$ and 21:00-04:00 hours.

The IMMI noise modelling demonstrates how the noise from within the factory is likely to be propagating at present. The structure of the workshop and surrounding buildings as barriers can also be seen influencing the radiation of the sound with the plan showing the majority of the noise escaping via or through the Western façade.

Whilst the noise model was run with sound levels known in the workshop, these assume a constant noise source. This is unlikely to be the case, as the noise measurements are made up of various noise sources.

Given that the noise model replicates how sound is likely to travel, further models were also run by swapping L_{Aeq} or average internal noise levels for maximum events (L_{Amax}) to see how these may propagate. These were all modelled with the Western façade containing voids for the crane and the perforated steel doors.

It is worthy of note that, although not detailed in the model, the rooflights, believed to be of lightweight acrylic construction, may also give rise to a degree of noise breakout.



Figure 20. Current Sound Propagation (82dB $L_{Aeq,1minute}$) 18:00-21:00 hours

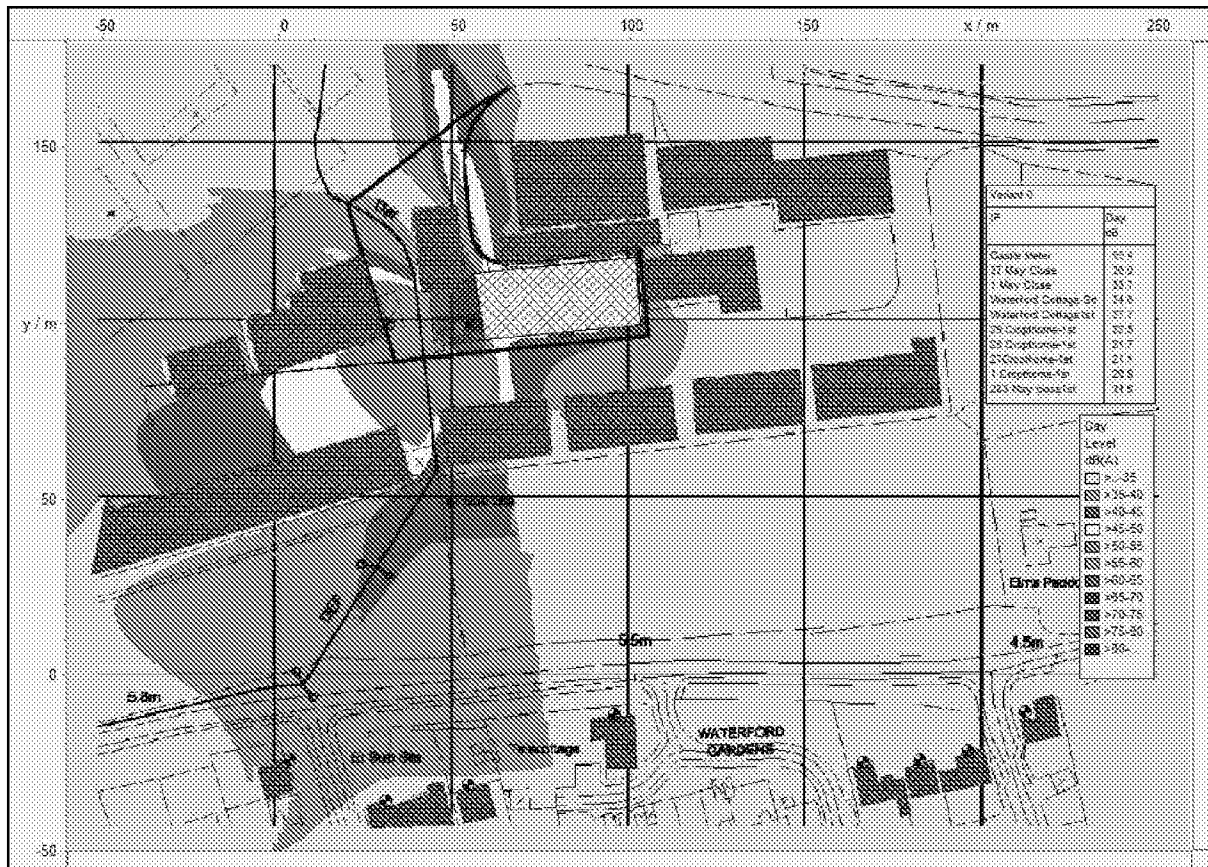


Figure 21. Current Sound Propagation (78dB $L_{Aeq, 1\text{minute}}$) 21:00-04:00 hours

Both Figures 20 and 21 show a limited impact on the residential receptors based on 82 dB $L_{Aeq1\text{ hour}}$, and 78dB $L_{Aeq, 1\text{ hour}}$ alone.

However, as previously stated, the noise output from the factory is not a continual and steady noise source and the noise model with the same parameters was used to swap the average noise energy for the L_{Amax} events to see how the elevated noise levels propagate across the site. Both 95dB (A) and 107dB (A) were used to represent L_{Amax} events.



Figure 22. Sound Propagation using 95dB $L_{A_{Max}}$ inside the factory premises

Figure 22 above shows a marked difference in the sound energy arising from the Western façade and the noise contours show how the soundscape has changed from Figures 20 and 21 above.



Figure 23. Sound Propagation using 107dB L_{Amax} inside the factory premises

Figure 23 above shows the output of the noise model at 107dB L_{Amax} , with further sound energy located at the Western façade of the factory and again the change in soundscape. Whilst these are one off single events, it is relevant to see how far they are likely to spread, with the noise model using reflections and barriers of the buildings on the Industrial Estate.

It is also evident that the Western façade, as suspected is the weak point of the factory with its openings for the crane and perforated steel upper doors (though please also see the note re rooflights on page 21 above).

It has also been possible to compare the model using the existing worst case daytime L_{Amax} (113dB(A)) for the existing site, against the proposed partially enclosed building to determine the likely improvements in soundscape.

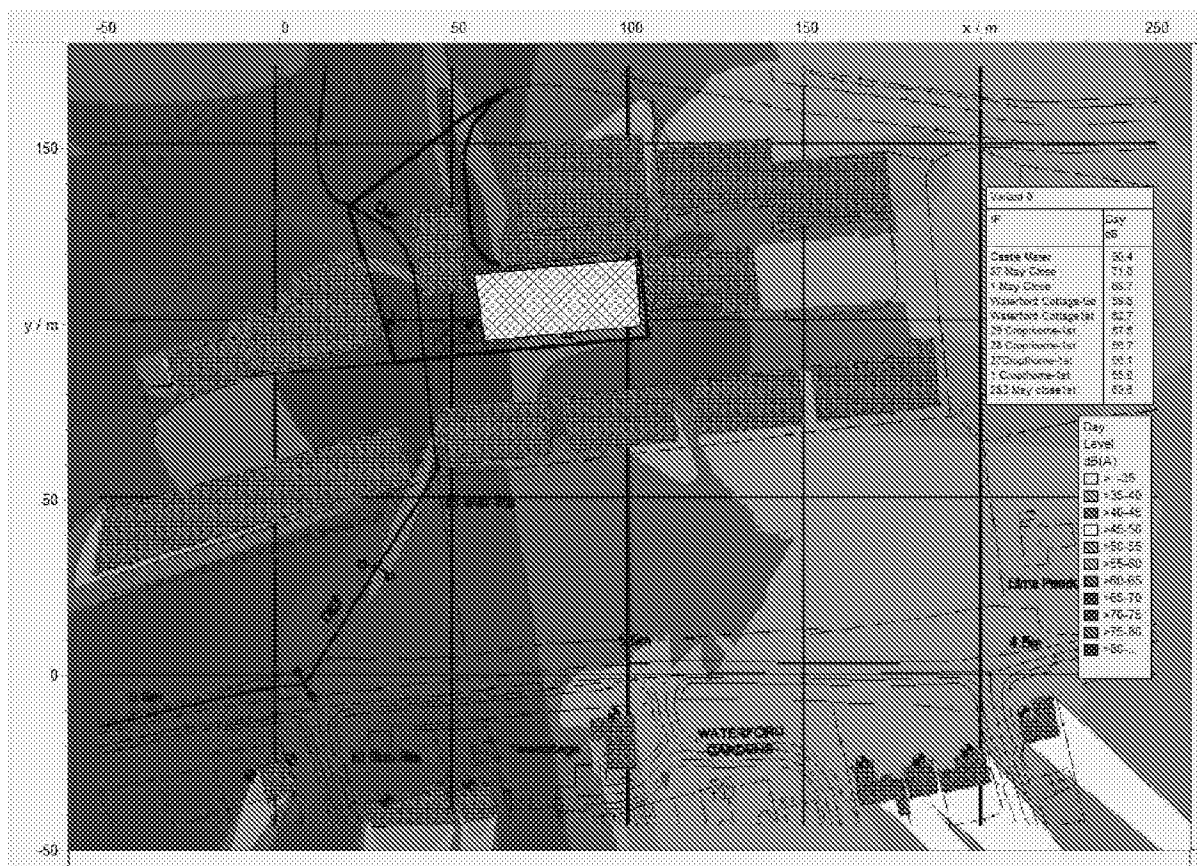


Figure 24. Existing Factory using highest daytime 113 dB L_{Amax} event.



Figure 25. Partially Enclosed Yard using 113 dB L_{Amax}

Figures 24 and 25 show a considerable difference in the soundscape with the majority of the sound energy in Figure 24 breaking out to the West and with Figure 25, this is seen to break out in a Northerly direction. To demonstrate the improvement that may be achieved with a partially enclosed building and improved sound insulation is seen by comparing the predicted specific noise levels at the closest residential receptors.

Location	Existing Arrangement	Proposed Long Term Solution	Difference
2&3 May Close	70dB	54dB	16dB improvement

Table 3. Comparison of current daytime level against proposed long-term solution

7 Analysis of the model output

The IMMI noise modelling can also be used to output the model data in figures showing the night time periods of 18:00-21:00 hours and 21:00 to 03:00 hours with the likely sound levels being experienced at the residential receptor locations.

7.1 Assumptions Made

In drawing conclusions from the data, two assumptions have been used. The first being that an open window will reduce outside noise levels to inside noise levels by 15dB(A). The second assumption being that a standard thermal double-glazed window when set in a masonry façade will provide a R_w or reduction of 33dB. Both assumptions are cited in BS8233:2014.

Table 4 below shows existing levels and that with the highest recorded L_{Amax} which occurred before midnight, with residential accommodation with windows open, this is likely to be heard at a level that may disturb sleep and cause awakenings, predominantly in the May Close area. With windows closed, such loud events should not normally be audible. It is reasonable to anticipate that the average individual may choose to have their windows open at night.

The green cells depict where internal noise levels should not normally be a problem. The red cells are where the predicted noise level exceeds the World Health Organisation Night Noise Guidelines 2009 of 42dB L_{Amax} inside a bedroom.

18:00 -21:00 hours		Prediction	Open Window	42 and above	Closed window	42 and above	Background	Impact
82dB								
IPkt002	37 May Close	40	25		7		41	-1
IPkt003	1 May Close	37.7	22.7		4.7		41	-3.3
IPkt004	Waterford Cottage-Gd	28.6	13.6		-4.4		41	-12.4
IPkt005	Waterford Cottage 1st	31.7	16.7		-1.3		41	-9.3
IPkt006	29 Cropthorne-1st	26.5	11.5		-6.5		41	-14.5
IPkt007	28 Cropthorne-1st	25.7	10.7		-7.3		41	-15.3
IPkt008	27Cropthorne-1st	25.1	10.1		-7.9		41	-15.9
IPkt009	1 Cropthorne-1st	24.8	9.8		-8.2		41	-16.2
IPkt010	2&3 May close1st	38.6	23.6		5.6		41	-2.4
21:00-03:00								
78dB								
IPkt002	37 May Close	36	21		3		41	-5
IPkt003	1 May Close	33.7	18.7		0.7		41	-7.3
IPkt004	Waterford Cottage-Gd	24.6	9.6		-8.4		41	-16.4
IPkt005	Waterford Cottage 1st	27.7	12.7		-5.3		41	-13.3
IPkt006	29 Cropthorne-1st	22.5	7.5		-10.5		41	-18.5
IPkt007	28 Cropthorne-1st	21.7	6.7		-11.3		41	-19.3
IPkt008	27Cropthorne-1st	21.1	6.1		-11.9		41	-19.9
IPkt009	1 Cropthorne-1st	20.8	5.8		-12.2		41	-20.2
IPkt010	2&3 May close1st	34.6	19.6		1.6		41	-6.4
95dB								
IPkt002	37 May Close	53	38		20		41	12
IPkt003	1 May Close	50.7	35.7		17.7		41	9.7
IPkt004	Waterford Cottage-Gd	41.6	26.6		8.6		41	0.6
IPkt005	Waterford Cottage 1st	44.7	29.7		11.7		41	3.7
IPkt006	29 Cropthorne-1st	39.5	24.5		6.5		41	-1.5
IPkt007	28 Cropthorne-1st	38.7	23.7		5.7		41	-2.3
IPkt008	27Cropthorne-1st	38.1	23.1		5.1		41	-2.9
IPkt009	1 Cropthorne-1st	37.8	22.8		4.8		41	-3.2
IPkt010	2&3 May close1st	51.6	36.6		18.6		41	10.6
107dB								
IPkt002	37 May Close	65	50		32		41	24
IPkt003	1 May Close	62.7	47.7		29.7		41	21.7
IPkt004	Waterford Cottage-Gd	53.6	38.6		20.6		41	12.6
IPkt005	Waterford Cottage 1st	56.7	41.7		23.7		41	15.7
IPkt006	29 Cropthorne-1st	51.5	36.5		18.5		41	10.5
IPkt007	28 Cropthorne-1st	50.7	35.7		17.7		41	9.7
IPkt008	27Cropthorne-1st	50.1	35.1		17.1		41	9.1
IPkt009	1 Cropthorne-1st	49.8	34.8		16.8		41	8.8
IPkt010	2&3 May close1st	63.6	48.6		30.6		41	22.6

Table 4. IMMI Modelling data with windows opened and closed and change in background noise level

Table 4, aside from predicting likely internal levels in the bedroom, also uses the background noise level which was collected close to the residential receptors of 41dB L_{A90,15 minutes} and the associated audibility above background noise levels. The data in the table illustrates that where internal factory levels reach an L_{Amax} of 95dB, these will be audible at 5 of the 8 residential locations

A similar effect will be likely to be experienced where the L_{Amax} internally reaches 107dB(A), it will be audible at all of the residential locations. It is also unclear what may have caused the loud event/s.

The audibility above the recorded background noise levels, whilst showing an adverse result is not a formal BS4142:2014 assessment as it lacks any penalties having been applied. If a formal BS4142:2014 assessment was to be considered, it would have to consider penalties for onset and short sharp noises and how these are perceived at the receptor locations. BS4142:2014 would also use a longer L_{Aeq} and L_{A90} sample period, rather than relying on L_{Amax} data.

7.2 Assessment and Discussion of current position

The processes and activities associated around steel fabrication can be noisy. Whilst the later time periods of the night have been chosen to minimise the influence of other industrial sites on the soundscape, it is clear that there are loud events inside the factory during the night shift. It is also clear that the louder single events may well be audible at distance and heard in bedrooms with windows open.

The origins of these loud events are not entirely clear and further discussions will need to be had with the night shift to identify what practices are being undertaken that are likely to generate such levels. Only then can plans be put into place to minimise these. Part of the rationale for the placement of the internal sound level meter was to ensure that the process of steel turning was captured in relatively close proximity. This uses a smaller crane and associated chains to lift steel lengths and turn them, on solid metal benches.

It is understood that whilst welding, it is common to have weld spatter on other parts of the steelwork which needs to be removed and a process of chipping is carried out to knock the welds off of the form work. It is possible that this may be the cause of the high L_{Amax} events, but not certain.

The noise mapping also shows that it is the Western façade of the factory which is allowing the break out of sound into the neighbourhood. This is not entirely surprising given the voids around the parked travelling crane and the ill-fitting doors.

Aside from the need to observe the night shift and their practices further with a view to identifying quieter alternative practises, there is a need for site management to conduct regular perimeter checks of the industrial estate to identify who else is working and generating sounds which may be wrongly attributed to Austin Divall. It is recommended that Senior Site management carry out these checks at night, as access is freely available on and around the industrial estate. It may also be appropriate to consider inviting the relevant Council enforcement officers onto such site walkovers.

Aside from the influence of other industrial units, it was discussed that Biffa attended site very early to empty bins and that this is a noisy process. It may be worth asking Biffa for a breakdown of their waste collection timings, as their lorries are often equipped with GPS and can be traced to a specific location at a specific time. This should identify any early events which are not created by Austin Divall.

As a matter of good practice and being a good neighbour, it is also strongly recommended that listening checks are carried out by site management regularly at the May Close area with a view to identifying, what if any sounds are being generated by the factory and why. This may also be an opportunity to determine whether voluntarily applied curfews on processes and plant are being adhered to.

As previously stated, audio capture is a mechanism within the sound level meter whereby when a sound reaches a particular volume, it automatically triggers an audio recording for the listener to be able to replay. The following events in Table 5 were noted and it is relevant to consider that the sound level meter recording them was 28m distant from the Western elevation. What remains unclear is the state of the doors at these times or where exactly the grinding was taking place.

Time and Date	Event
07:30	Delivery vehicle air brakes being released as it drove away
07:30	Banging of steels
20:50	Grinding and banging
07:40	Grinding
07:25	Grinding
20:10	Grinding
07:50	High pitch of crane motor being operated.

Table 5. Audio Capture recorded in the Steels Yard

When reviewing the impact of the site, BS4142:2014 uses an approach whereby 5dB above background is likely to be an adverse impact depending on the context, whereas 10dB is likely to be an indication of a significant adverse impact depending on the context. The highest noise level shows that for 107dB L_{Amax} , it is up to 23 dB above the measured background noise levels. However, caution needs to be applied when considering BS4142:2014, as in 7.1 above, it is relevant to consider that penalties have not been applied and a formal BS4142:2014 has not been carried out.

8 Reducing Noise Levels

Noise and how it is able to travel to the receiver location can be complex, but in summary there are a few principles which may be applied to reduce noise levels.

The first is that the actual root cause of the noise level must be understood to be able to change or implement alternative practices or processes.

Reduction of noise at source is also likely to yield a positive impact and being aware of what is generating loud noise events needs to be better understood.

Noise absorption. The internal factory environment is a large and reverberant space with numerous hard surfaces and finishes which encourage the onward reflection of sound energy. Interrupting the sound waves as they are incident on a surface using absorption will reduce sound levels.

Sound Insulation. There is room for further sound insulation to occur in the walls of the current factory premises which will insulate the inside sound levels from the outside quieter environment.

Containment. The Western façade requires a treatment or solution to help contain the noise inside the factory premises.

Attention may be required to the (believed) acrylic roof lights to reduce noise transmission from inside to outside via these elements.

Management Review. Management may need to conduct a review of existing practices and curfews to determine if these are sufficient, or whether further interventions are necessary.

9 Noise Mitigation Measures and works already carried out

There is a need for both a longer-term solution and some interim measures to reduce noise levels from inside the factory. The following works indicate Austin Devall's commitment to resolving any noise problems.

Works which have already been implemented are as follows:

- Senior Management will conduct impromptu checks around the industrial estate at night time and additionally inside Austin Divall. The checks are also to be carried out in close proximity to May Close to the South of the site to determine what, if any sounds are being generated by the factory activities. Any attended checks by management will also review the effectiveness of currently applied curfews and record the findings.
- All angle grinders and mobile plant are subject to regular checking, servicing and maintenance regimes to ensure that the plant is capable of operating in optimal conditions and that any deterioration in condition is quickly identified.
- Where steel beams or formwork are turned on metal benches inside the factory, this is likely to generate loud singular events which, within a reverberant factory space are likely to be reflected and re-radiated off of hard surfaces. To reduce the noise impact associated with this particular operation, timber and rubber have been added to the benches where steel formwork is turned and this appears to be successful in reducing the noise signature and the L_{Amax} events.
- An additional source of loud singular events is created by the formwork being struck with metallic hammers. Whilst it is noted that the hammers require sufficient mass and weight to be able to move the formwork into the desired positions, this is a loud process. It is noted that wooden chocks have now been introduced between the hammer strike to prevent a metal on metal impact and reduce the loud L_{Amax} events.
- It is noted that there have been complaints received about the guillotine unit located in between two single storey units to the South, as seen in Figure 4. A new composite Kingspan panel (KS1000RW) system has been ordered and is expected to arrive imminently which will be constructed around a scaffold frame. The enclosure will provide a new surround for the immediate guillotine environment. The current sound absorbing blankets which are located to the rear of the guillotine will be retained and reinforce the sound insulation properties inside the new enclosure.
- It is apparent, that behind the guillotine, there is no obvious barrier to prevent the passage of sound generated in the immediate area to travel South towards the residential properties. Accordingly, a new timber barrier has been implemented behind the guillotine area to minimise any sound generated in the immediate area.



Figure 26. Newly constructed barrier behind Guillotine

- Austin Divall remain in regular contact and communicate with the residents located to the South. A resident's spokesperson has been appointed and I am given to understand that regular dialogue is held, ensuring that any complaints go straight to Austin Divall for a timely investigation and feedback accordingly.
- Definitive end times have also been introduced for the night shift period to ensure that there is a known cut off for the Austin Divall operations. No works will be carried out beyond 03:00 hours and it is noted that on occasions some of the night shift have departed at 02:30 hours.
- It is noted in sections 2.5 and 6 that the current steel doors which serve access to the Western façade contain a perforated section which is not likely to be helpful in containing any noise created within the larger factory space. A weatherproof wooden interior section to the door with specific focus on the perforated areas to create greater mass is in the process of being commissioned.

10 Longer Term Works

Whilst the measures above are likely to reduce noise levels at source, longer term structural works are being implemented as part of the current planning application to future proof the site.

As discussed in section 6, the longer-term plan and the subject of the current planning application is to partially enclose the site. The enclosure will effectively weatherproof the steels yard which is currently open to the elements and additionally overcome the current issues with the gantry cranes having to transit through the building structure. Other additional noise sources such as the external yard crane and deliveries being made to and from the site would also be minimised by being contained at source. An opening would remain on the Northern wall façade to the West of the paint shop areas which has been modelled as a 12m in width.

The daytime activities by their very nature, are likely to be elevated above those L_{Aeq} and L_{Amax} levels encountered during the night time period. It would therefore be wise to implement numerous measures to ensure that sound levels generated inside the workshop area are capable of being reduced.

By designing to accommodate the L_{Aeq} and L_{Amax} levels seen during the daytime profile (as high as 113dB L_{Amax} in Figure 6 above, the lower night time profile, should by default be capable of being operated without disturbance to neighbours.

Accordingly, a noise model has been created using the same data inputs, but with a longer and more substantially enclosed building, with only the Northern opening as discussed above. The sound insulation of the ceiling/roof and the walls has not been changed in the graphical representation below. Figure 27 below shows the model output in terms of receptors and figures.

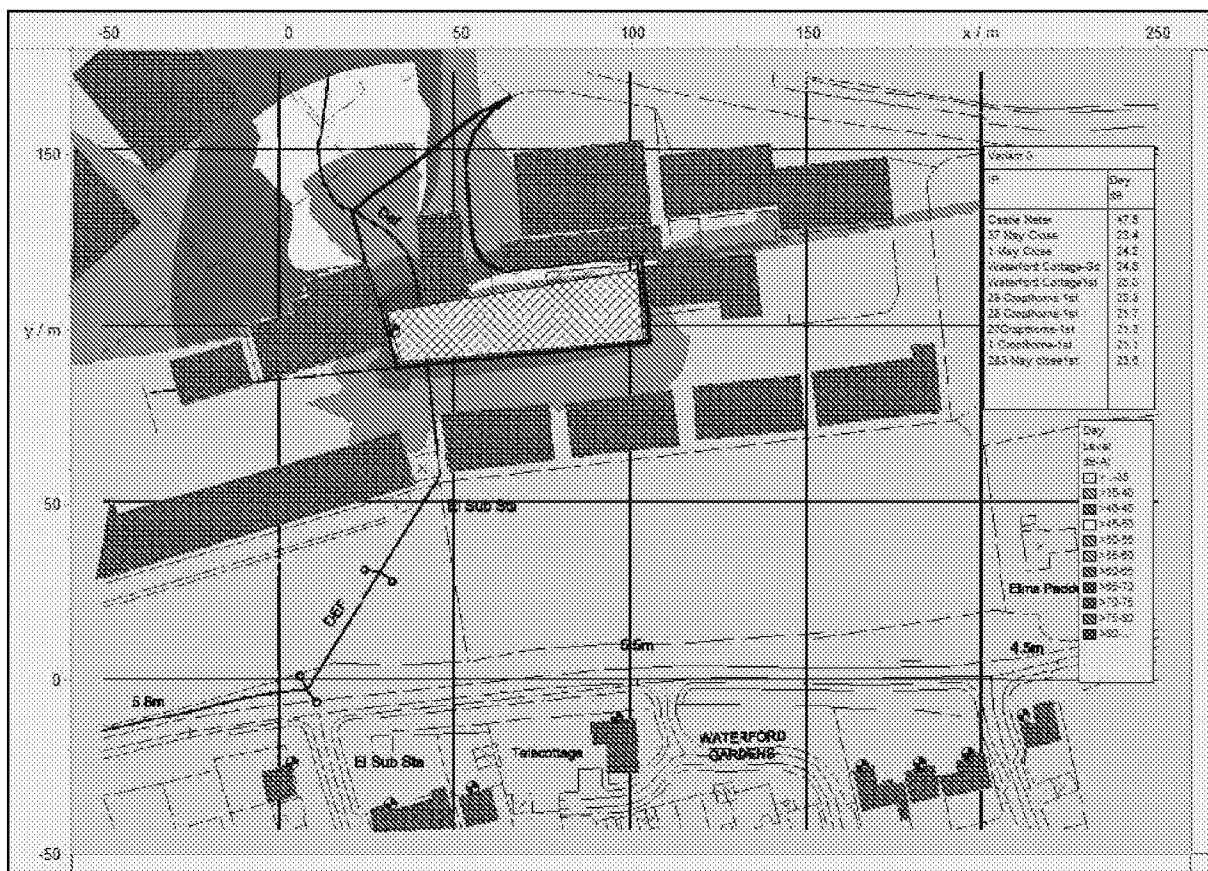


Figure 27 shows a much more directed radiation of sound from the Northern opening. Figure 28 below shows again a partial enclosure but with 107dB L_{Amax} entered and how the sound is able to propagate across the soundscape. The colourings and colour difference applied by the noise model shows a significant change to the soundscape.

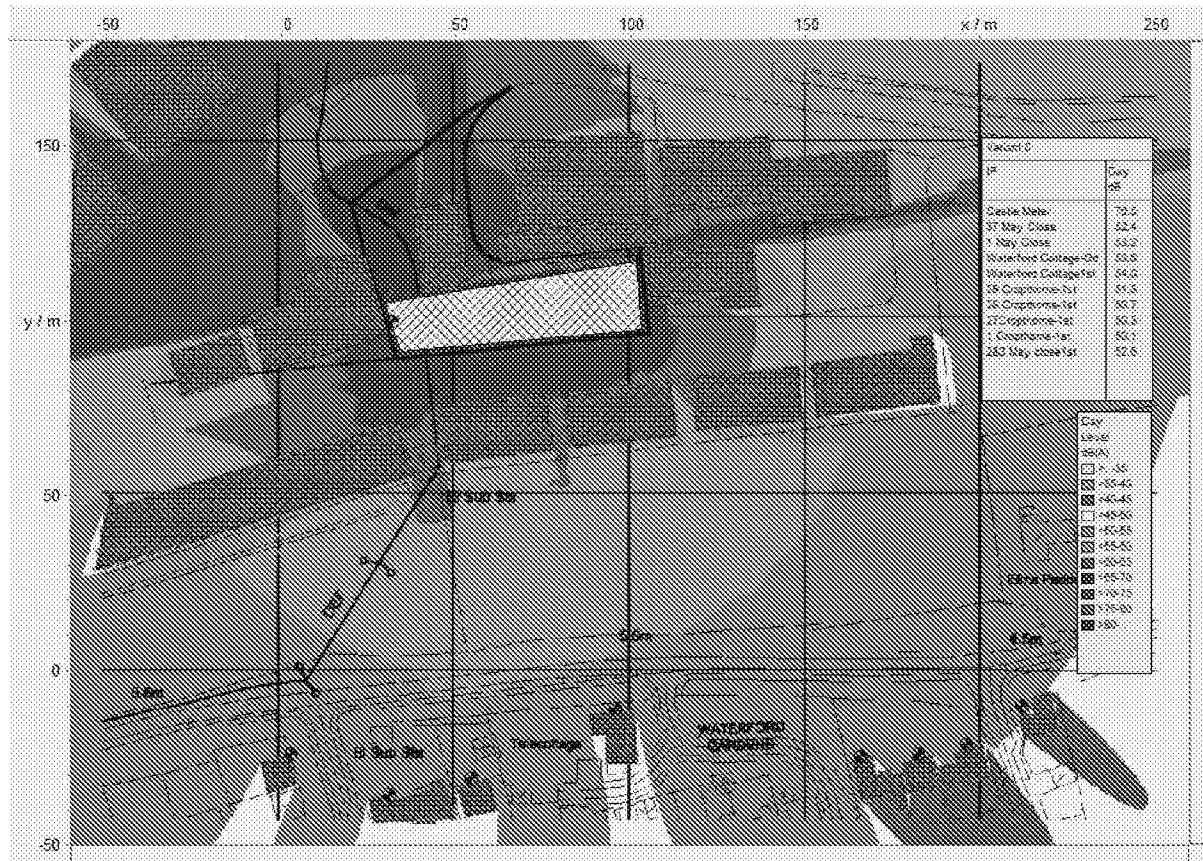


Figure 28. Partially Enclosed Building with 107dB L_{Amax}

As in the assessment of the current position, the output of the noise model can be viewed in terms of actual noise predictions for a partially enclosed building and its likely impact on the residents. It is noted that this is without any current changes to the sound insulation properties, only a partially enclosed building and is shown in Table 6 below.

Partially enclosed structure no openings-78 db			Open Window	42 and above	Closed window	42 and above	Background	Impact
IPkt002	37 May Close	18.6	3.6		-14.4		41	-22.4
IPkt003	1 May Close	20.1	5.1		-12.9		41	-20.9
IPkt004	Waterford Cottage-C	19.5	4.5		-13.5		41	-21.5
IPkt005	Waterford Cottage1s	19.8	4.8		-13.2		41	-21.2
IPkt006	29 Crophorne-1st	17	2		-16		41	-24
IPkt007	28 Crophorne-1st	16.4	1.4		-16.6		41	-24.6
IPkt008	27Crophorne-1st	16.1	1.1		-16.9		41	-24.9
IPkt009	1 Crophorne-1st	15.9	0.9		-17.1		41	-25.1
IPkt010	2&3 May close1st	19.2	4.2		-13.8		41	-21.8
Partially enclosed structure- no openings 95dB								
IPkt002	37 May Close	40.4	25.4		7.4		41	-0.6
IPkt003	1 May Close	41.2	26.2		8.2		41	0.2
IPkt004	Waterford Cottage-C	41.6	26.6		8.6		41	0.6
IPkt005	Waterford Cottage1s	42	27		9		41	1
IPkt006	29 Crophorne-1st	39.3	24.3		6.3		41	-1.7
IPkt007	28 Crophorne-1st	38.7	23.7		5.7		41	-2.3
IPkt008	27Crophorne-1st	38.3	23.3		5.3		41	-2.7
IPkt009	1 Crophorne-1st	38.1	23.1		5.1		41	-2.9
IPkt010	2&3 May close1st	40.6	25.6		7.6		41	-0.4
Partially enclosed structure-no openings 107dB								
IPkt002	37 May Close	52.4	37.4		19.4		41	11.4
IPkt003	1 May Close	53.2	38.2		20.2		41	12.2
IPkt004	Waterford Cottage-C	53.6	38.6		20.6		41	12.6
IPkt005	Waterford Cottage1s	54	39		21		41	13
IPkt006	29 Crophorne-1st	51.3	36.3		18.3		41	10.3
IPkt007	28 Crophorne-1st	50.7	35.7		17.7		41	9.7
IPkt008	27Crophorne-1st	50.3	35.3		17.3		41	9.3
IPkt009	1 Crophorne-1st	50.1	35.1		17.1		41	9.1
IPkt010	2&3 May close1st	52.6	37.6		19.6		41	11.6

Table 6. Model outputs for a partially enclosed building structure using L_{Amax} values

The night-time model outputs show that the predicted noise levels are reduced at the receptor locations, and individuals with windows open should not be impacted.

However, it is noted when carrying out an assessment of the audibility of short loud events over the measured background noise levels that with the very loudest input of 107dB(A), an L_{Amax} , does still appear up to 12dB above background sound levels at the receptor location. Whilst this is a significant improvement on 23dB seen in Table 4, there remains a requirement to reduce sound levels further.

With the model run at 107dB L_{Amax} , as per Figure 24, but with the sound insulation criteria changed to incorporate a further 10dB reduction in the roof and an additional 5dB in the walls, the model output shows a significant improvement in Figure 29 below.

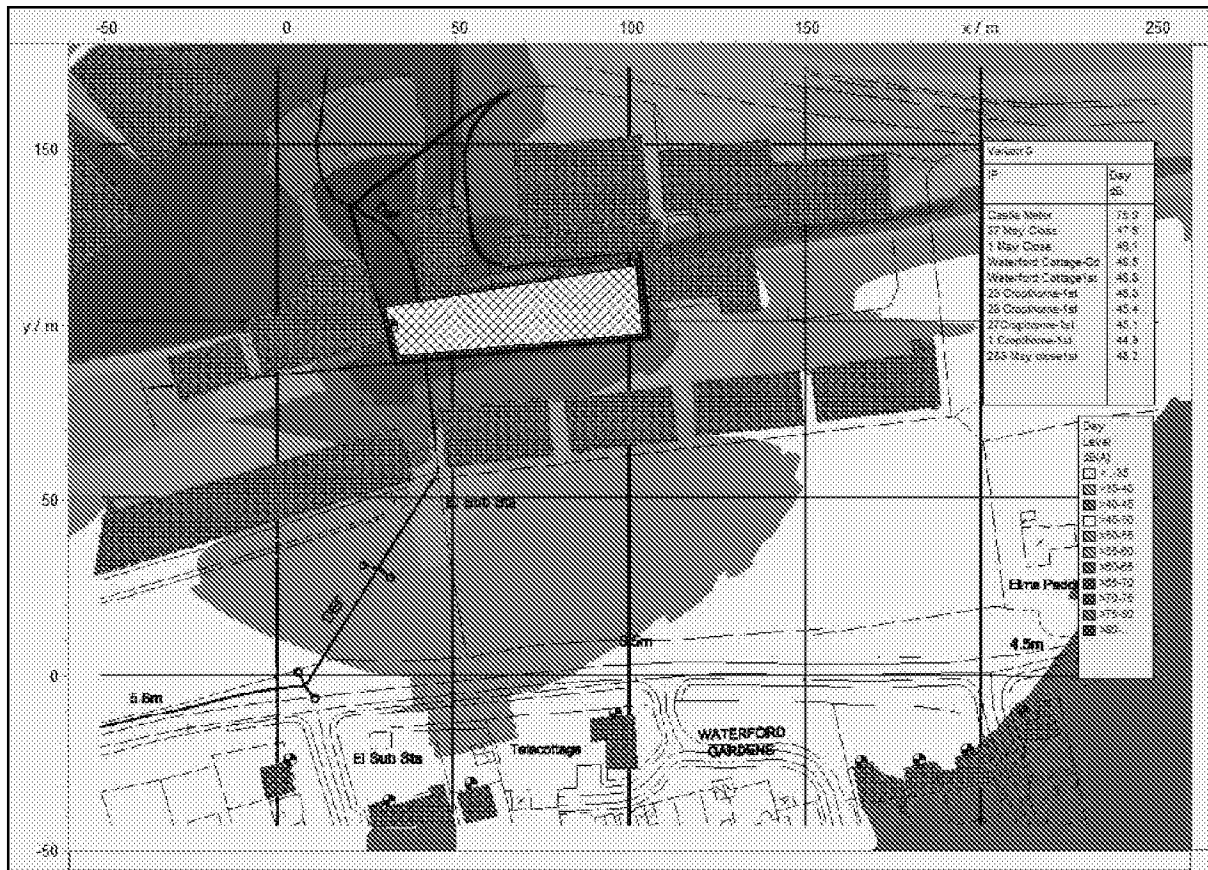


Figure 29. 107dB L_{Amax}, Partially Enclosed Building with improvements to sound insulation.

As discussed above, if designing for a worst case daytime scenario, the L_{Amax} levels are likely to be higher still and will warrant inclusion as an input into a further model. Therefore, 113dB L_{Amax} may be used as the model input as per Figure 30 below.

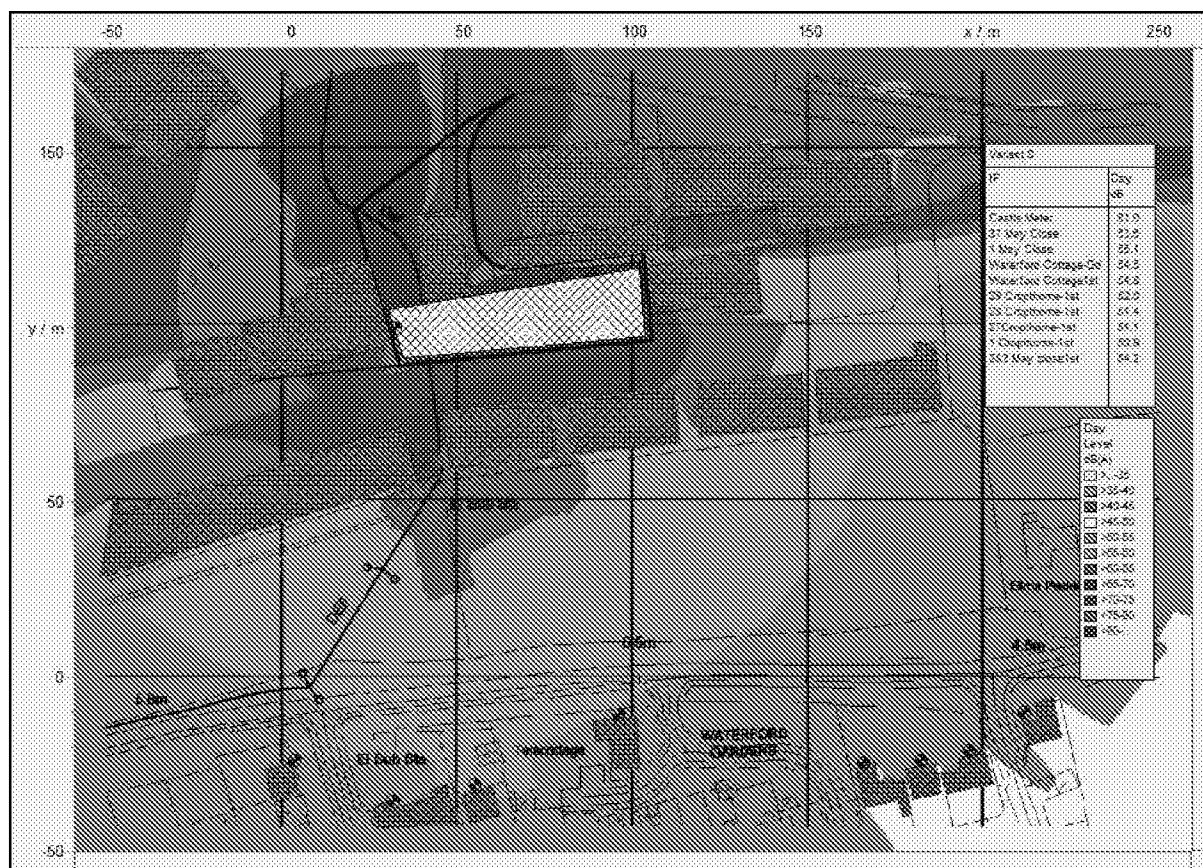


Figure 30. Model run at 113dB L_{Amax} will full enclosure, representative of daytime sound levels

Figure 30 above illustrates that with the highest recorded daytime sound level of 113dB L_{Amax} , this is likely to produce a specific noise level at the nearest residents of 54dB L_{Aeq} .

Partial enclosure of the building, incorporating additional sound insulation and designing to a worst case daytime scenario, should by default provide positive benefits for night time operations which are seen to be lower than daytime noise levels due to the change in practices carried out. This is demonstrated by the 16dB improvement at the residential receptor locations in Table 3.

Deliveries - Access and Egress.

Whilst a fully enclosed building provides improved acoustic benefits, there is still a requirement for steelwork to arrive and finished product to leave the factory site. Any door openings have the potential to act as a weak part of the structure and allow noise breakout and accordingly, it is suggested that a roller shutter door may be fitted to allow delivery vehicles into and out of the newly enclosed yard area.

If delivery vehicles could be enclosed, and operating space demarked in the design of any new building, that allowed doors to be opened and closed to contain the delivery vehicle, this would prevent the sound of crane noise and factory generated sounds escaping via any open-door panels.

In terms of improved work flow and preventing sound breaking out in the direction of the residents, it may be appropriate to consider the use of the Northern façade adjacent to the

paint shop as a dedicated access and egress point for vehicular traffic. This would ensure that any factory generated noise would be directed North as opposed to South at present.

To prevent any door system being the weak element of the structure, it needs to have an equal rating to the remainder of the walls. A brief internet search identified an acoustic roller shutter door which when mounted in tandem allowed for a reduction or R_w of 53 from inside to outside which is very effective. The following websites offer some suggestions:

<http://www.safe-door.co.uk/sound-solutions/soundroll/>

<http://www.safe-door.co.uk/sound-solutions/sound-slide/>

<http://www.boltongate.co.uk/products/thermal/sonaroll-acoustic-roller-shutters>

<https://www.ukrollershutters.co.uk/products/acoustic-roller-shutters/productsacoustic-roller-shutters27db-sound-reduction/>

Reverberant Noise Levels

With high impact noises such as metal being struck, there are likely to be high reverberant sound pressure levels inside of the current factory workshop. The resultant sound energy will bounce or echo off of the numerous internal hard surfaces and finishes.

An engineering method of controlling such reverberant sound pressure levels is to introduce ceiling hung baffles and/or roof panels. Whilst the crane gantries are located at high level and are not to be disturbed in their day to day operation, roof hung baffles are effective at reducing reverberant sound pressure levels and redistributed sound energy inside the workshop.

Given that hammering and/or noisy activities are likely to occur at specific locations ie at or around the steel benches, it may be appropriate to consider a hung or fixed horizontal panel with suitable absorbent material above the benches to assist with absorption. This will reduce the amount of airborne sound energy being radiated into the wider workshop spaces.

Increased Sound Insulation in Walls and Ceiling

With a new structure being proposed, it is strongly recommended that all walls have increased sound insulation provided with a minimum of $35R_w$. Any new roof covering should be able to achieve a sound insulation rating of at least $35R_w$. Whilst there are obvious benefits in allowing the passage of light through transparent panels into the workshop, these need to be selected with care to prevent them being a weak point for airborne noise to breakout. Recent examples seen in a timber workshop, again with high noise levels was the use of a second slightly lowered ceiling panel using an absorbent and insulating layer to minimise noise break out.

It may also be relevant to consider which operations require grinding and whether this might also be done via an alternative means, ie a plasma cutter with a reduced noise signature.

It is also possible that a localised steel frame with absorbent panels or hung acoustic barriers at 90° could be constructed and moved around as required to control and reduce further the impact of angle grinding and the re-radiated spread of sound energy into the factory environment. Figure 31 below shows a possible approach of hanging absorbent matts or barriers.



Figure 31. Hung Barrier Option on mobile frame

Any mineral fibre products used as absorbers in close proximity to angle grinding environment, must be suitably fire retardant.

Wall Mounted Absorbers

In addition to ceiling hung materials, it is noted that the similar products can be applied to the walls, again working on the principle of absorbing high levels of sound energy. Figure 30 provides an example which could be wall mounted with different products available below. Some websites providing useful information are below:

<http://www.cmsdanskinn.co.uk/industrial-construction/acoustic-enclosure-panels/iso-acoustic-enclosure-panels/#.WpfpcOfLhQI>

<http://www.soundsorba.com/acoustic-products/sound-absorption/bafflesorba/>

<http://www.soundsorba.com/acoustic-products/sound-absorption/steelsorba/>

<https://www.customaudiodirect.co.uk/acoustic-panels/acoustison-perforated-steel-sound-absorber>

Review of outside working practices

Austin Divall should consider exactly which operations are conducted outside, for how long, why, and more importantly to consider if these operations could be done via an alternative means or enclosed.

If for example it is critical that cutting is done in the outside environment, then consideration should be given to a mobile screen and an absorptive panel being placed underneath the metal being cut. The figure below is taken from BS5228:2014 which is engineered towards controlling noise on construction sites and whilst it is appreciated that an enclosed booth would be obstructive, it could well be manufactured with two sides and a 90° hinge to direct noise away from residents.

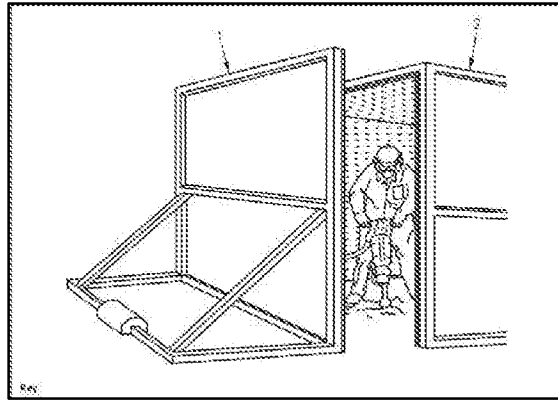


Figure 32. Enclosure/Shielding for outside working taken from BS5228:2014

On a similar level, a relatively simple barrier could be used to hang more effective acoustic blankets.

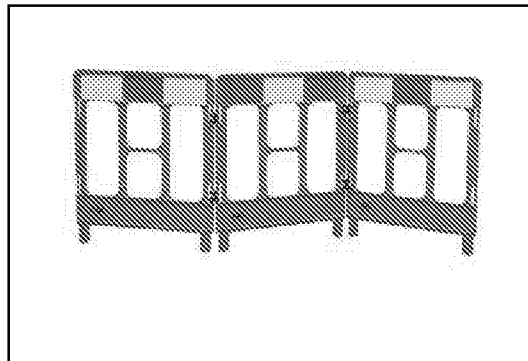


Figure 33. Simple work gate to attach acoustic matting/barriers to

It may also be appropriate to consider hot cutting (ie plasma cutting) as an alternative to angle grinding in some circumstances.

11 Health and Safety

With the implementation of noise mitigation measures suggested above, aside from containment measures, it is likely that sound levels inside the workshop will reduce. This has the positive benefit of reducing employee's exposure to noise levels under the Noise at Work Regulations 2005.

12 Uncertainty

The reporting of uncertainty is key within any report.

Given that the noise data was achieved from unattended monitoring, there are a number of assumptions that have been made which could impact the uncertainty of the report findings.

- It is assumed that for the duration of the two full nights of monitoring, that the travelling crane is parked at 18:00 hours in its final resting position within the aperture in the Western façade.
- It is also assumed that, from the two nights measured, these recorded representative data and that there was no reason to think that the night shift would have carried out activities or processes any differently.
- It is also assumed that the voluntarily applied curfews for grinding and banging were being followed and that neither grinding nor banging occurred post 21:00 hours.
- Whilst only one full day of data was obtained inside the workshop, it is assumed that the activities and noise levels were representative of other normal working days.

It is relevant to note that the default setting in the IMMI noise modelling software is set to hard ground which is not likely to provide any absorption. Between the nearest noise sensitive receptors and the industrial estate is an area of grassland approximately 56m deep. Specific noise levels predicted at residential properties may well be reduced due to absorption, though this absorptive effect would be reduced in wet weather.

Whilst recommendations and mitigation measures have been made in good faith, it may well be the case, that for day to day operational reasons, that these are not appropriate or suitable and alternative considerations or proposals may need to be considered.

13 Conclusion

An unattended acoustic survey has been undertaken between 14th February and 21st February 2018. Sound level meters were placed inside the factory unit, as well as being located at the Western end of the open steels yard. Internal measurements have been used to determine night time operations and the representative internal soundscape. The noise data obtained, combined with the noise modelling software and careful replication of the Western façade of the workshop with the voids for the travelling crane and doors has identified likely noise break out. Modelling of the night time L_{Amax} events shows that for the night time period considered, these could break out of the factory through the Western facade and possibly reach residents and be noticeable with windows open.

Measurement of the night time background noise levels adjacent to the nearest residential properties also suggests that the singular loud L_{Amax} events have the potential to be heard over background noise levels. Whilst not continuous in their character, the loud bangs/events are likely to be noted outside.

Recommendations have been made for both longer term mitigation measures which include the enclosure of the yard and extension of the building, as well as shorter term measures to yield a positive noise benefit and reduce where practicable and possible noise levels at source.

It is also strongly recommended that the application of noise mitigation measures must not be solely applied to the main factory workshop, but the principles applied also to the Aluminium Shop which is closer in proximity to the nearby residents to the South.

Whilst the focus of the report has been on night time operations, the worst case daytime noise levels have been examined and included in noise prediction and modelling software to ensure that suitable and sufficient mitigation measures are introduced to ensure that residents are not

impacted. When modelling the longer-term proposals against the current noise model there is seen to be a considerable noise reduction of 16dB(A) at the nearest residential receptor.

Given that the planning application proposes a partial structural enclosure of the yard, it is likely to yield a positive benefit to the local soundscape. For the reasons above it is considered that planning permission would not likely be refused on noise grounds, assuming that the mitigation measures as reported in sections 9 and 10 are implemented on site.