

Acoustic Associates Sussex Ltd

Noise Assessment

BS4142:2014 Assessment of Overnight Operations in Building A

Site: **Finecast Foundry (Building A), 1 Lineside Way, Wick.**
Client: **Finecast Limited**

Report by: Scott Castle BSc (Hons) CEnv, MCIEH PGDip: Acoustics MIOA

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Issue 1



Sound Insulation Testing - Acoustic Design of Buildings - BS4142 - PPG24 - Schools Acoustics BB93 -
Vibration - Expert Witness Testimony - Noise at Work - Air Tightness Testing - Auditorium Acoustics

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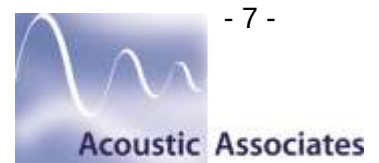


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1 Introduction

Acoustic Associates have been appointed to undertake an acoustic assessment relating to a proposed extension to Building A and proposed overnight working at the Finecast Factory located at the Lineside Industrial Estate in Wick, Littlehampton. The assessment is likely to support a future planning application for overnight working (inside Building A).

The purpose of the assessment was as follows:

- Assess typical sound levels from external plant located at the Finecast site
- Understand internal sound pressure levels already occurring inside Building A
- Predict the impact of a North Westerly extension to Building A and specifically to determine overnight working.
- Assess the impact of overnight working in line with BS4142:2014.

Two class one sound level meters were installed on the Finecast Site from 29th August 2019 to 3rd September 2019. The meters were set up to record background sound levels at the nearest noise sensitive receptor at 19 Egan Way at a position representative of the first-floor bedroom window. An additional sound level meter was installed inside Building A to provide an account of realistic working conditions during the daytime and night time periods.

The focus of the report has been on supporting overnight operations inside the newly extended Building A and accordingly measured background sound levels ($L_{A90,15\text{minutes}}$) have been derived from a period without any overnight working or early morning operations. The representative measured background sound level for the overnight period (ie 23:00-07:00 hours) has been calculated as 34dB $L_{A90,15\text{minutes}}$.

Noise modelling software was used to combine the consented Kingspan profiled cladding for the newly extended Building A, as well as using the highest internally measured overnight single hour period for inside Building A. The predictions of the IMMI noise modelling software suggest a specific sound level of 31.1 dB at the nearest noise sensitive receptor at 19 Egan Way. A BS4142:2014 assessment when considering both uncertainty and context indicates that the predicted Rating Level is 31.1dB which is 2.9 dB below measured background sound levels. In line with BS4142:2014, a Rating Level below measured background levels suggests a low to no impact with both uncertainty and context having been taken into consideration.

Accordingly, overnight working may occur within Building A, albeit with the caveats indicated and discussed in Section 8.4.

2 Context, Noise Criteria & Noise Assessment Methodology

2.1 Context

Finecast operate on the Lineside Industrial Estate, Wick, Littlehampton, and have a number of buildings, split across the site. This particular report is focused on Building A.

The principal work carried out within Building A is the casting of metal alloys into specially designed and pre-prepared moulds within sand boxes. The location of Building A can be seen below in Figure 1.

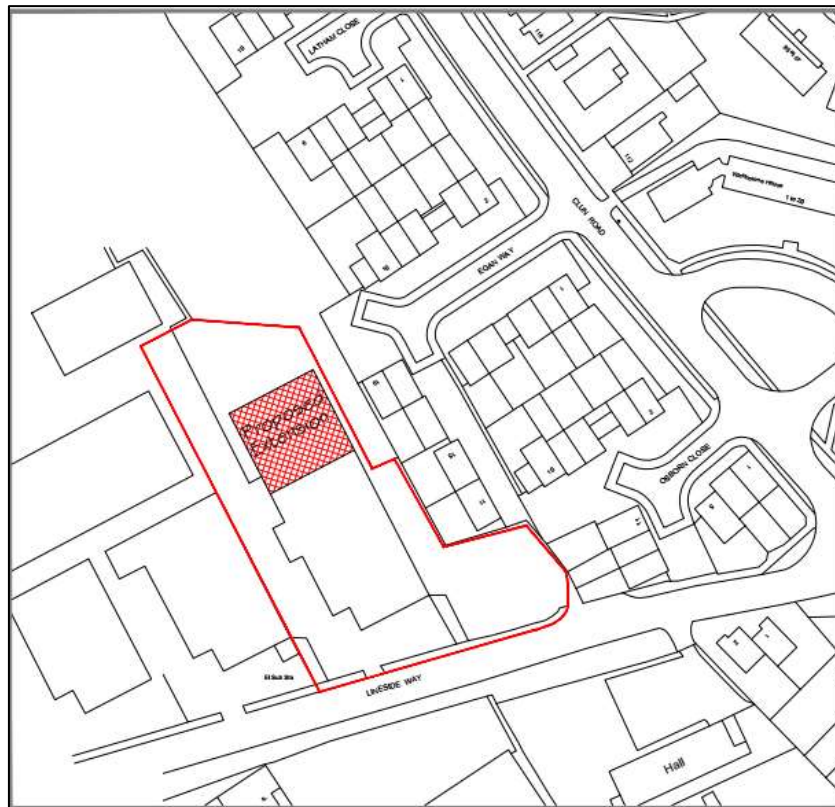


Figure 1. Site Plan showing the Northern Extension to Building A

2.2 Current Operations and Constraints

The proposal to extend Building A to the North is already consented via Arun District Council however, overnight working inside Building A is not.

Currently hours of use are restricted by the site planning consent which is LU/2/19/PL and restricts hours from 07:30 to 18:00 hours for Monday through to Saturday only.

2.3 Proposed Operations

It is proposed to extend Building A further to the North West, by approximately another 20m. The extension area to Building A can be seen in Figure 1 above. The extension to the footprint of the already existing Building A will remove the current yard operating area.

It is proposed to carry out overnight operations within Building A with approximately six employees.

2.3.1 Overnight Operations

It is relevant to note that overnight operations would only involve internal operations inside Building A with windows and doors all closed. It is relevant to note that no external plant would be run to support overnight working. The process of knocking out, ie the use of hammers to break apart the moulds is not to be carried out overnight.

Overnight hours within the acoustic report are considered to be 23:00 to 07:00 hours

2.4 Applicable Standards

As an extension to the current operating footprint of Building A, and the proposal to support overnight working, an assessment under BS4142:2014 would be likely. Accordingly, a worst-case hour approach may be applied.

2.5 Methodology

To determine the likely sound levels generated overnight it is proposed to construct a noise model within the IMMI noise modelling software. With the model constructed of materials consented by the planning application, internal sound levels will be set to those measured internally.

No external activities are proposed overnight.

The noise modelling software will therefore be used to assess the predicted noise impact at the closest residential receptor, with the specific noise level, and rating level, being assessed against the measured overnight background sound levels.

2.6 Nearest Residential Receptors/Neighbours

For the purposes of the report, the nearest residential property is that of 19 Egan Way, shown in Figure 2 below. A bedroom window is present at approximately 4m in height on the Western façade. It is relevant to note that between the application site and the nearest residential property is a timber 3.6m fence (measured from top to ground floor level at 19 Egan Way).

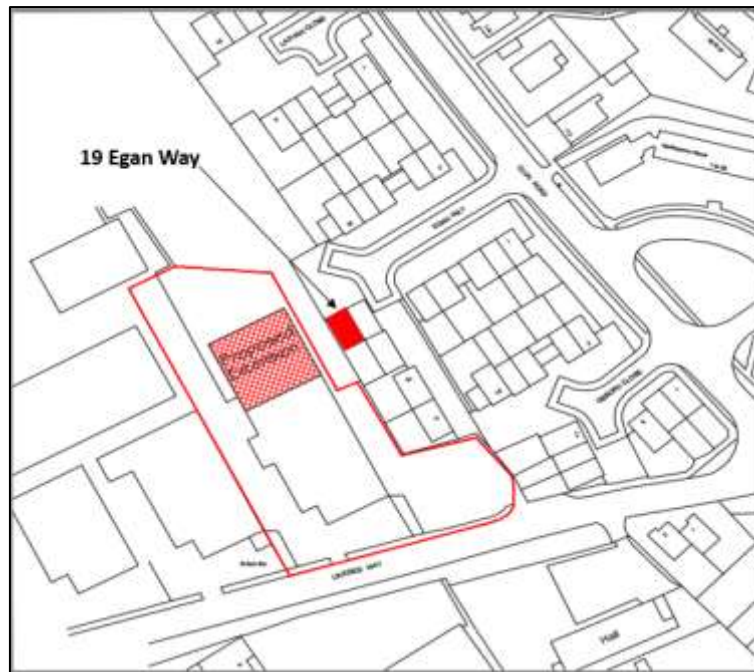


Figure 2. Location of Nearest Noise Sensitive Receptor

3 Background Sound Survey Baseline Conditions & Results

3.1 Methodology

A class one sound level meter (Rion N-18) was installed just above the 3.6m high fence-line separating Finecast from the nearest neighbouring property at 19 Egan Way. The Rion NL18 sound level meter logged data set at 15-minute intervals, commensurate with the requirements of BS4142:2014 with the filters set to Fast and A weighted. The sound level meter was also calibrated before and after the survey without any drift having occurred.

The meter was installed as close as possible to be in line with the first-floor bedroom window which was on the Western façade of the property and sheltered somewhat from activities in the back gardens. Notwithstanding this, the period of interest without any activity occurring is that of the Saturday night into the early hours of Sunday morning, 23:00-07:00 hours.

In line with BS4142:2014, a tripod mounted, Maplin's Easyweather, weather station was also installed in the same side alleyway on the Western façade to ensure that the weather conditions were appropriate for environmental noise monitoring. The data indicated wind speeds reaching a maximum of 0.7m/s, gusts of 1.4m/s, nil precipitation and temperatures ranging from a low of 12.9°C to 17.3°C. The weather data was considered to be ideal for environmental monitoring without any need to remove data from the overnight dataset.

3.2 Background and Existing Noise Survey Details

Survey(s) carried out by	Scott Castle BSc (Hons) Env Health, MCIEH CEnvH PGDip Acoustics MIOA
Equipment Used	Rion NL-18 – Serial Number 164315.
Equipment Used	Castle Group Acoustic Calibrator – GA607-Serial.040430
Duration of Survey	Start 10:00 29/8/2019 / Stop 12:49 hours 3/9/2019
Location and Height	TQ 01983/02863, 4m above ground level.

Table 1. Survey Information



Figure 3. Image of Sound Level Meter Location

3.3 Sound Survey – Background Data

As stated above, the true background period, is that without any site works taking place and is extracted from the survey as being 23:00-07:00 from Saturday 31st August to Sunday 1st September 2019.

The most representative (most frequently occurring background sound level, ie L_{A90} , 15 minutes) has been calculated statistically and is presented in Figure 4 below.

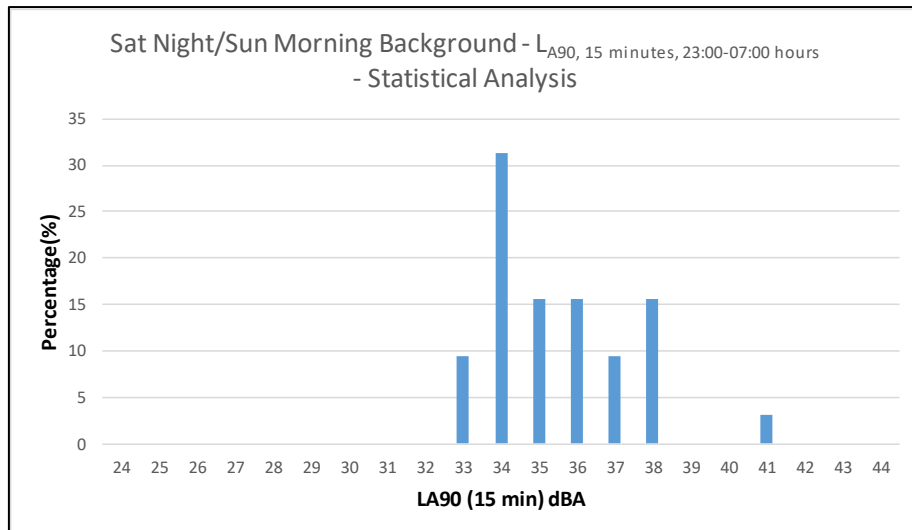


Figure 4. Measured Overnight Background Data without Overnight Operations

From Figure 4 above, it is apparent that 34dB $L_{A90,15 \text{ minutes}}$ is the most frequently occurring background sound level without any works occurring and may be used within the BS4142:2014 assessment.

4 Building A - Internal Measurements

An additional class 1 sound level meter (01dB Black Solo), was installed inside Building A, secured against a metallic sand hopper, to provide an idea of internal sound levels and L_{Amax} , or rather short instantaneous sounds which were generated over a number of daytime and night time periods.

The sound level meter ran from 12:00 hours on the 29th August through to 04:10 hours on the 2nd September 2019. The orange trace is the L_{Amax} whereas the blue trace is the L_{Aeq} , both set to 5-minute intervals.

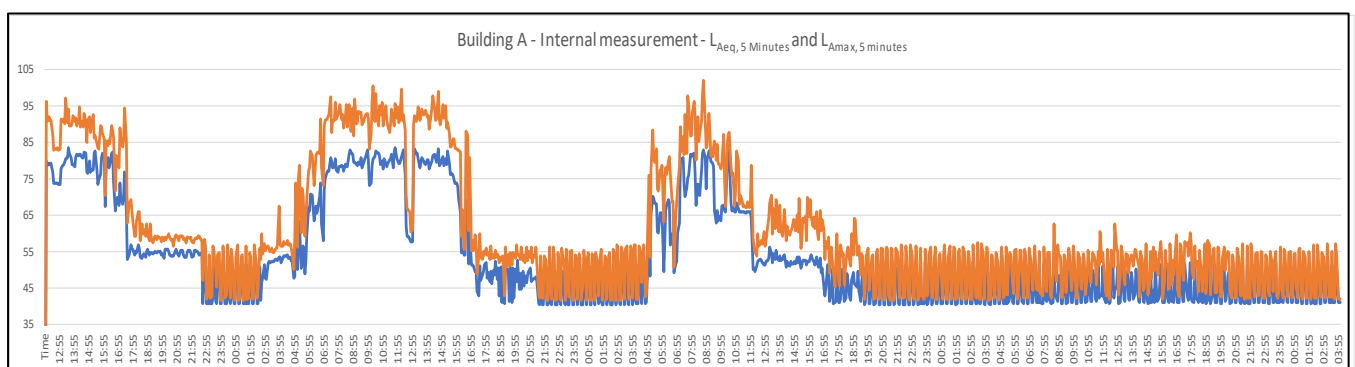


Figure 5. Internal 5 Minute Measurements from inside Building A

Whilst Figure 5 above shows 5-minute readings, Figure 6 below shows 1-hour periods with the daytime and night time periods clearly apparent.

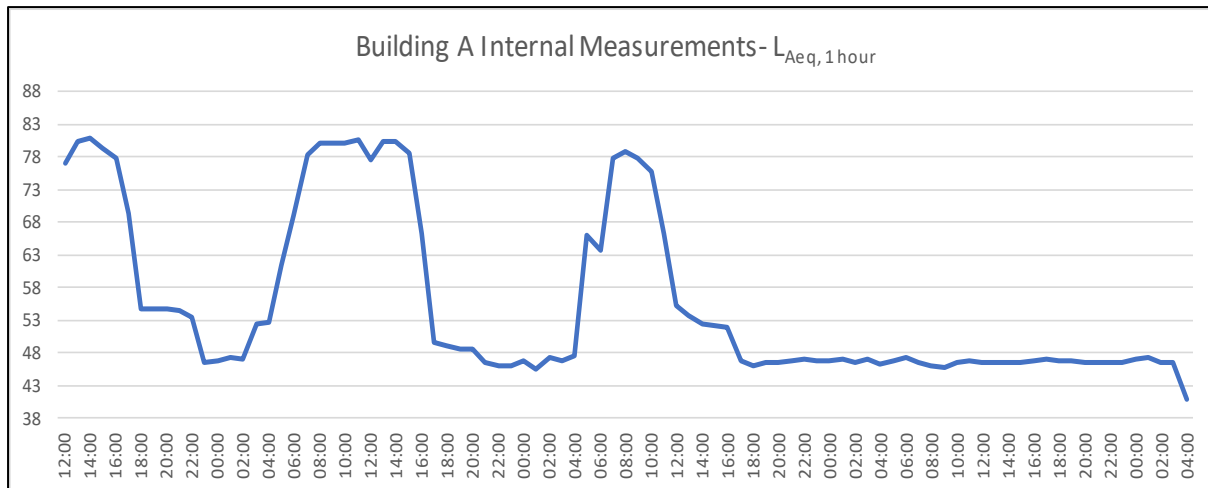


Figure 6. Internal 1 hour Measurements from inside Building A

The night time hours have been recorded and presented in Table 2 below with both the hours received inside Building A, with hours also taken from the survey location at 19 Egan Way.

Internal Measured Hourly Data - Building A					Externally Measured Data	
Time	Thu	Fri	Sat	Sun	Fri-outside	Sat-Outside
23:00	47	46	47	47	47	48
00:00	47	47	47	47	44	45
01:00	47	46	47	47	45	44
02:00	47	47	47	47	45	41
03:00	52	47	47	46	42	42
04:00	53	48	46	41	47	45
05:00	61	66	47		52	51
06:00	69	64	47		53	49

Table 2. Measured Internal and External Hours inside Building A.

The internally measured hours when plotted on a time history graph can be seen in Figure 7 below.

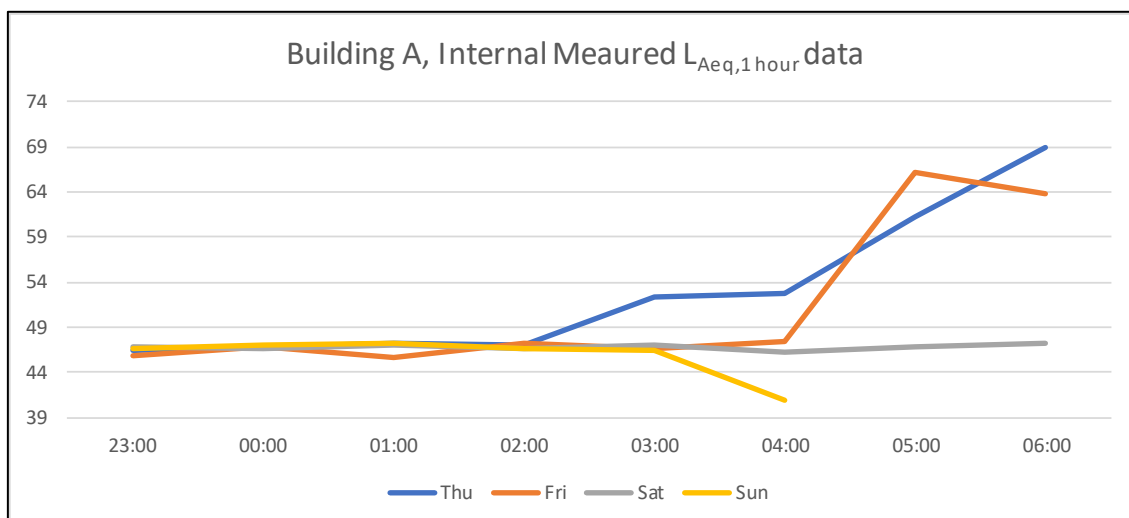


Figure 7. Time History Presentation, Overnight inside Building A (23:00-07:00)

The measured data in Figure 7 above suggests that activities commenced internally inside Building A around 02:00 Friday morning and 04:00 hours Saturday morning.

Figure 7 is again replicated below, but has added the same hours for the Friday and Saturday nights plotted which were received on the boundary sound level meter (Rion) at 19 Egan Way. These external hours recorded at the site boundary have been shown with dashed lines, essentially showing that the increase in the internal soundscape is *currently* detected externally also.

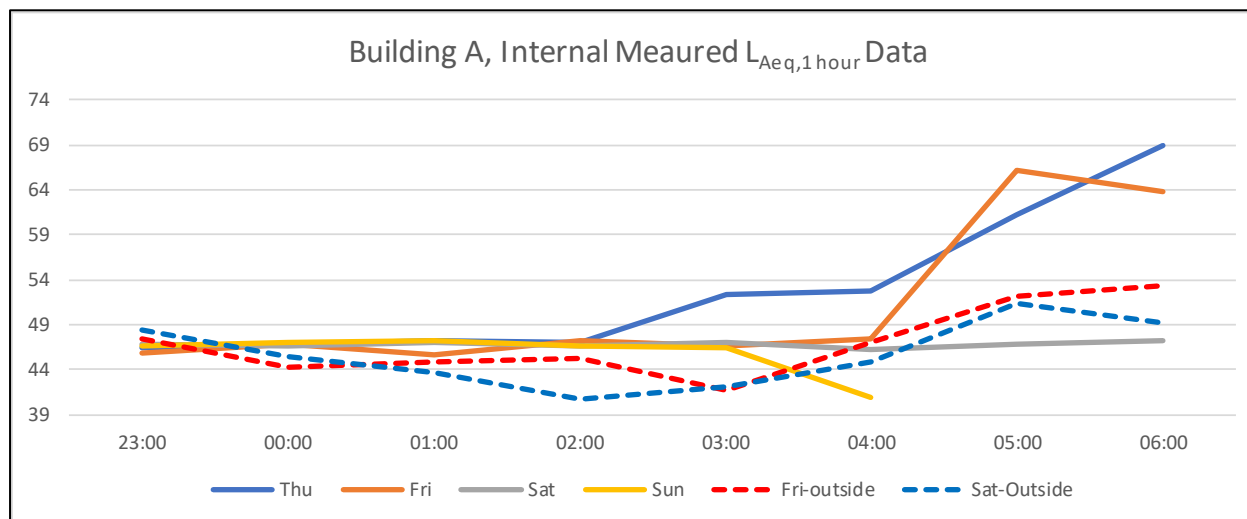


Figure 8. Internal Measurements from Building A with external data applied from background survey location.

5 Performance of the Separating Fence/Acoustic Fence

Whilst present on site, a simultaneous measurement (09:15-09:30, 3rd Sept) was undertaken with two class one sound level meters, one located above the fence-line which divides the commercial/industrial site from the neighbouring residents as seen in Figure 3. The measured 15-minute period, made with plant operating and yard operations occurring was compared against a measurement taken located on a tripod mounted at 1.5m in the rear garden of 19 Egan Way.

Location	$L_{Aeq, 15\text{ minutes}}$
Fence-line (4m)	62.5 dB
Rear Garden – 1.5m	50.4 dB
Difference	12.1dB

Table 3. Performance of the adjacent fence-line

The separating fenceline between Finecast and 19 Egan Way breaks the line of sight between the residential garden and the operational yard at Finecast. However, whilst sat in the residential garden, subjectively, a lot of the yard operations were easily audible and included hisses of compressed air, repetitive reverse beepers, repeating metallic clanging and whining of a motor or engine, possibly a fork lift truck.

It is relevant to note that the external yard would disappear to accommodate the Northern extension to Building A.

6 Noise Modelling Software

IMMI noise modelling software was used to construct a model with the proposed extension of Building A using approved plans found on the Arun Planning website. The model was constructed as accurately as possible with building heights taken from scaled architects plans and having measured the separating fence between the site and 19 Egan Way.

The IMMI (Wolfel, 2015) noise modelling software is useful as it applies and faithfully replicates the methodology in ISO9613 for sound propagation and details the noise contours for how the sound will travel across the site, including distance attenuation, reflection, ground effects etc.

6.1 Modelling Inputs

6.1.1 Extent of the Modelling

Only the extension has been modelled within the noise modelling software, as the walls and roof of Building A in its current format differ from one another and were not subject to acoustic testing.

The store room building to the North has also been included within the modelling, as it is likely to have an impact on any site generated reflections.

For the purposes of the overnight working and the extension to Building A, external plant has **not** been applied into the modelling.

6.1.2 Receptor Positions

With overnight processes being modelled, the adjacent residential garden area has been discounted and the bedroom window of 19 Egan Way which overlooks the site, plotted as a receptor position in order for the noise modelling software to calculate a sound pressure level.

6.1.3 Kingspan Walls and Roof

Within the approved plans, it is stated that the walls and roofs will use Kingspan KS1000RW or Kingspan KS2000RW. Both products provide an Rw or transmission loss of 25dB. Whilst the roof panel has a stated 25 Rw, in reality it will be less than this due to the number of skylights suggested (36 skylights measuring a total area of 54m² of the total roof space of approximately 1129m²). Therefore, whilst the walls will be modelled as 25dB Rw, the roof will be reduced to 22.6dB Rw, calculated using a composite calculator with an assumed skylight Rw of 15dB.

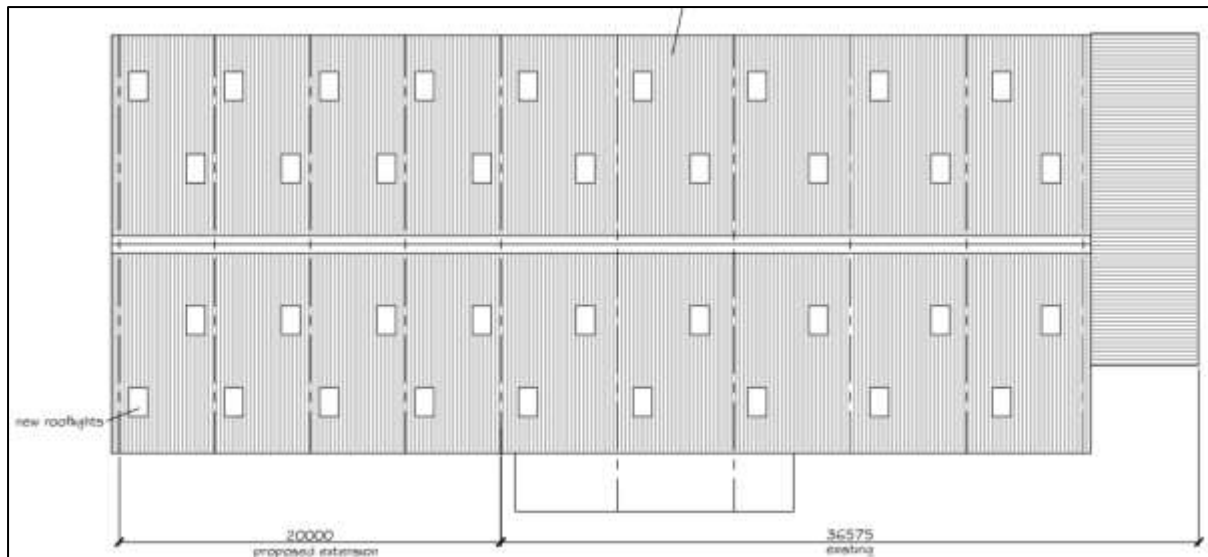


Figure 9. Existing and Proposed Roof Profile in Plan

6.1.4 Roller Shutter Doors

The approved plans make reference to electronically operated roller shutter doors. A similar factory site had new electronically operated acoustic roller shutter doors installed which were measured on a different site and found to be 23dB Rw. The acoustic roller shutter doors measured did not exhibit any whines or alarms associated with their operation.

6.1.5 Overnight Activities and Attributable Sound Levels

From the measured data inside Building A, as was discussed above, it was noted that the internal soundscape increased from 02:00 on the early hours of Friday 20th August 2019 and again around 04:00 hours on Saturday 21st August 2019 in terms of the ambient or average sound pressure levels.

The use of the noisiest internal overnight hour (ie 06:00-07:00 hours), ie 69dB $L_{Aeq, 1 \text{ hour}}$ from night 1 in Table 2 will include the raised soundscape seen in Figure 10 below.

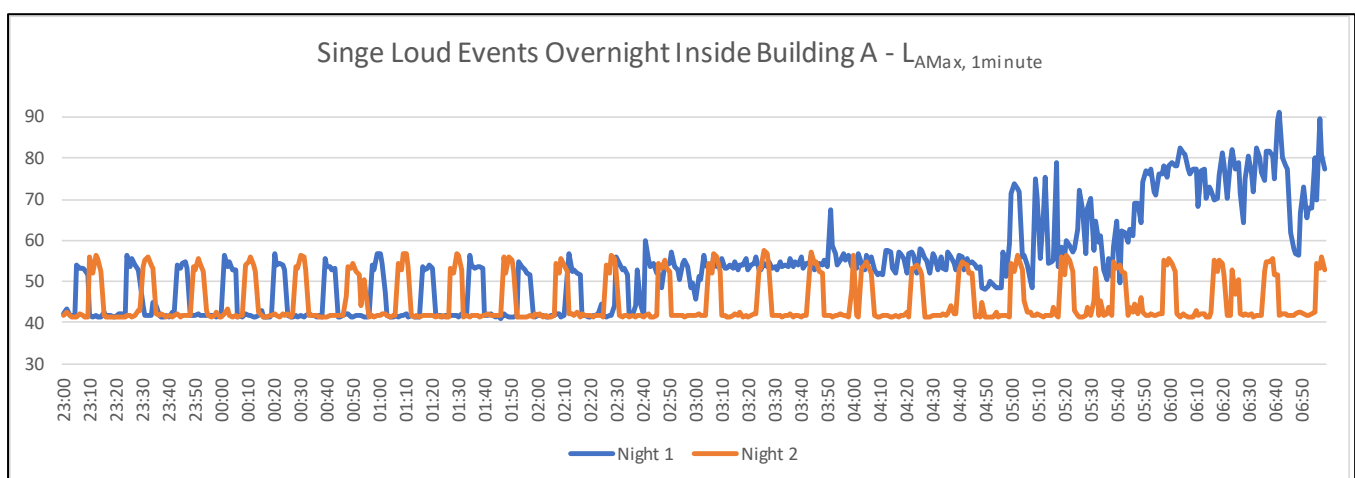


Figure 10. Internally recorded (Building A) Measurements $L_{Amax, 1 \text{ minute}}$

From Figure 10 it is also apparent that there may well be a piece of plant occurring with a regular cycle, as the shape and recurrence of the night 2 cycle appear very repetitive and similar. It is understood that there should not be any internal or external plant operational and the matter is being looked into by management.

The worst-case applicable hour to apply to the noise modelling process is therefore 69dB $L_{Aeq, 1 \text{ hour}}$ from Table 2.

7 Noise Modelling Results

As stated above, the highest worst-case hour for the night time period (recorded 06:00-07:00 hours) has been used in the modelling process. The worst case overnight hour has been entered into the noise model, along with the additional items discussed in Section 6 above.

Figure 11 below presents a graphical presentation of the noise contours around the site, showing limited break out from within Building A and minimal break out in the areas of the roller shutter doors which were included within the modelling. Note that the predicted sound level from the IMMI noise modelling software is 31.1 dB $L_{Aeq, 1 \text{ hour}}$ at 19 Egan Way.

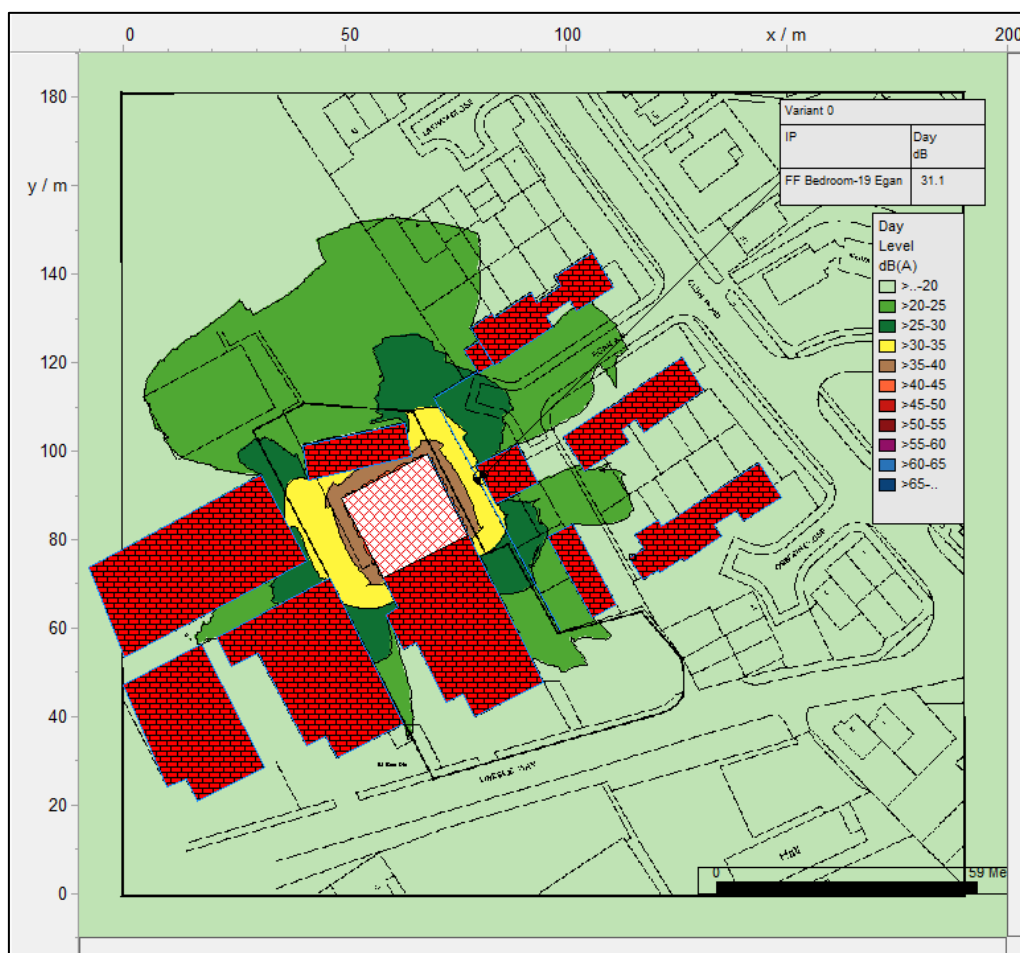


Figure 11. IMMI Noise Modelling Predicted Noise Contours using 69dB $L_{Aeq, 1 \text{ hour}}$ internally.

The noise contours from Figure 11 can also be seen in 3D below in Figure 12.

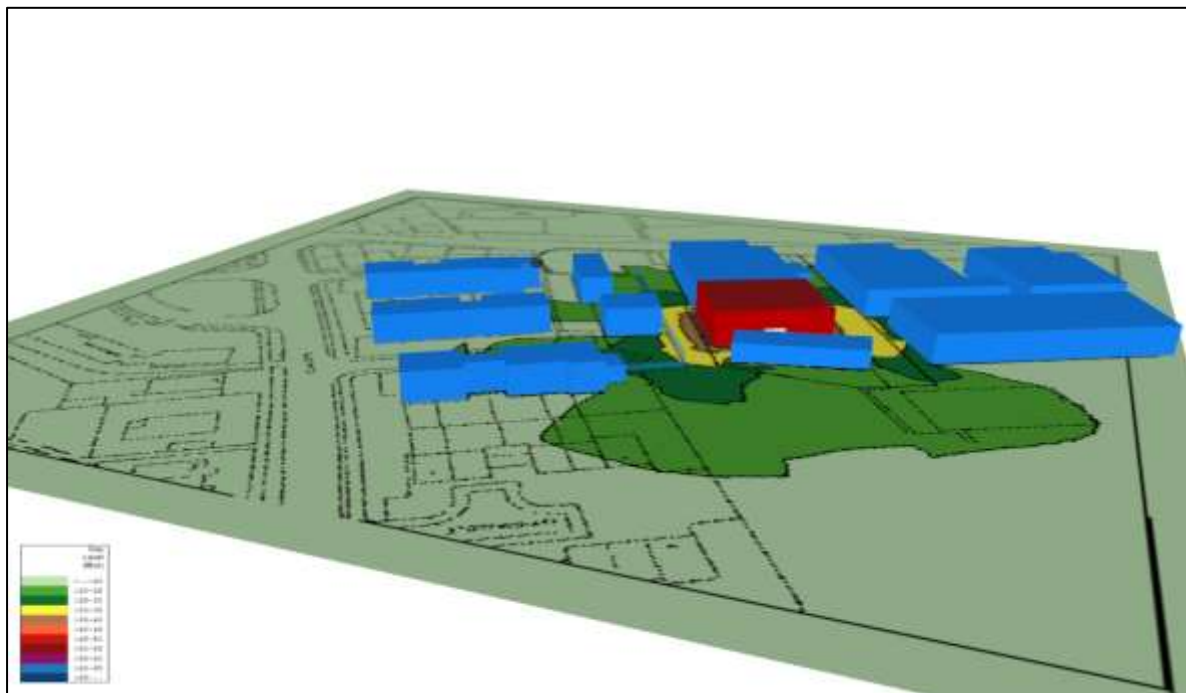


Figure 12. 3D Noise Mapping

8 BS4142:2014 Assessment

The relevant factors to be considered are as follows:

8.1 Measured Background Sound Levels

As per Figure 4 above, the measured and representative background sound level is 34dB $L_{A90,15\text{ minutes}}$ for 23:00 to 07:00 hours, measured over a weekend when the site was not operating.

8.2 Character Corrections

BS4142:2014 applies a character correction where the specific sound might contain attributes which would make it more noticeable at the receptor position. These might include tonality, impulsivity and intermittency.

Without any internal machinery or external plant running during the overnight period, one can discount tones. The fact that moulds would not be knocked out overnight also avoids the need for any impulsivity character corrections to be applied.

For a small compliment of staff working internally, it is not proposed to add any character corrections to the specific sound level. The Rating Level or $L_{A,T,r}$ will therefore be the same as the prediction being generated by the IMMI noise modelling software.

8.3 BS4142:2014 Assessment

Table 4 below shows that when assessed using the worst case hour, as advocated in BS4142:2014, using the consented building materials that the Rating Level or $L_{A,r,T,r}$ is 3.2dB below the measured background level. This indicates a low/no impact, albeit context needs to be considered.

Night-time			
Results	Measurement Parameter		Relevant Clause
Specific sound level	$L_{Aeq(T)}$	31.1	7.3.4
Acoustic feature correction	None	0	9.2
Rating level		31.1	9.2
Measured Background sound level	$L_{A90(T)}$	34	8
Excess of rating level over background sound level		-2.9	11
Assessment indicates a	No to low impact as below background		11
Uncertainty of the assessment	Discussed		10

Table 4. BS4142:2014 Assessment

8.4 Discussion of Results and Context

Both the Sussex Planning Guidance (Noise) dated 2015 and BS4142:2014 suggest that where background is matched, there should be a low/no impact, albeit with the caveat, depending on context. It is seen from Table 4 above that the proposed internal operations overnight are below the measured background sound levels when considered at the nearest residential property.

Understanding context is therefore critical to the overall evaluation process.

Contextually the following items are relevant:

1. The night time shift would have to be mindful of the operating environment and ensure that all doors and windows remain closed.
2. No external working or operations would occur outside of Building A.
3. No knocking out of moulds would occur overnight.
4. The external plant, such as the cooling tower, the compressor, the dust separators (Tornado, plus one other) and the external chimney stack would not be required to operate during night time hours (23:00-07:00 hours).
5. The Northern extension of Building A also significantly reduces the operational yard area which is known to be noisy during the day to day processes.

Considering the above points, the extension of Building A is considered to be a positive step and is likely to remove the noises associated with the operation of the yard. Overnight working, when assessed with the highest hour period measured overnight also indicates that this should not be a problem.

Notwithstanding this, it is recognised that the measured background sound levels overnight without the plant operating are very low at 34dB $L_{A90, 15minutes}$ and accordingly, Finecast will have to ensure Best Practicable Means and a likely noise management plan to reinforce what is expected of staff working overnight.

A caveat must however be applied, that a reassessment of noise impacts would be required, should changes to site or how Building A is used overnight (including the operation of any internal or external plant) to ensure that the neighbouring residents remain protected from an adverse soundscape.

9 Uncertainty

The reporting of uncertainty is key in any professional document. The following measures have been taken to reduce any uncertainty in both the measurement and data collection process as well as the noise modelling process.

- Sound level meters used on the site were calibrated before and after the survey without any drift having occurred to ensure that they operated in optimal conditions and that reliance may be placed on the resulting data.
- The siting of the sound level meter at the survey location to reflect appropriate background sound levels was done so in close proximity to the first-floor bedroom window.
- The data measured to populate the background sound levels was taken from a night when there did not appear to be any factory operations taking place, to ensure a true background.
- The meteorological conditions for the measured background sound levels were also examined and found to be acceptable for environmental monitoring.
- With any calculations made, including the determination of background sound levels, there has not been any additional rounding of numbers to prevent double handling, this has only occurred once at the final part of the sum and is presented to the reader with an easy to understand reference level or single figure.
- To ensure a robust assessment, the monitoring period was also designed to ensure that a weekend and accordingly any change in the soundscape was accurately captured.
- In constructing the noise model, approved plans from the Arun website were used to determine both actual location in terms of the Building A footprint, but also for height purposes.
- The highest night time internal sound level inside Building A was used to ensure that the model was robust. From Figure 10 above, it is noted that the noisy hour used included a number of increased L_{Amax} events incorporated within the L_{Aeq} for the single hour period.
- Only the proposed North extension to Building A has been assessed, as the materials and their acoustic behaviour are known and are commercially available (ie Kingspan KS1000RW). Whilst the existing building of Building A has been modelled as a building, it has not used any internal sound levels. It is therefore likely that as sounds are generated inside Building A, these will have more room for the sound energy to dissipate into, before striking building surfaces and either reflecting and/or passing through the materials. It would therefore be expected to see any high L_{Amax} levels reduce slightly with more available space.
- It is also relevant to reflect that Building A is currently partitioned into a number of areas with furnaces, offices, toilets etc, as well as the mould/casting area. The practicalities of noise modelling software prevent being able to model such compartmentalised areas and instead the whole extension has been used as an open space.
- At the time of writing the report, the proposed internal layout of the new Building A was not known
- Whilst the height and length of the separating barrier between Finecast and 19 Egan Way was plotted within the noise modelling software, there was also noted to be a low gabion wall in existence and some planting between the current yard area and the

closest residents. However, whilst such mass will assist in absorbing some of the generated sound levels, there still remains line of sight from the side bedroom window. The absence of the items within the noise modelling results are therefore felt to present a worst-case scenario.

10 Conclusion

Two class one sound level meters were installed on the Finecast Site from 29th August 2019 to 3rd September 2019. The meters were set up to record background sound levels at the nearest noise sensitive receptor at 19 Egan Way at a position representative of the first-floor bedroom window. An additional sound level meter was installed inside Building A to provide an account of realistic working conditions during the daytime and night time periods.

The focus of the report has been on supporting overnight operations inside the newly extended Building A and accordingly measured background sound levels ($L_{A90,15\text{minutes}}$) have been derived from a period without any overnight working or early morning operations. The representative measured background sound level for the overnight period (ie 23:00-07:00 hours) has been calculated as 34dB $L_{A90,15\text{minutes}}$.

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Accordingly, overnight working may occur within Building A, albeit with the caveats indicated and discussed in Section 8.4.