NOISE IMPACT ASSESSMENT
EXTENSION TO WAREHOUSE AND PALLETISER, HEINEKEN UK LIMITED, MANCHESTER

REC REFERENCE: AC106799-4R1

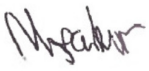
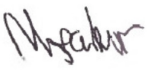
REPORT PREPARED FOR: HEINEKEN UK LIMITED

DATE: 27TH JANUARY 2020



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Issue/revision	Issue 1	Revision 1	Revision 2	Revision 3
Remarks	Draft for comment	Revision 1		
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EXECUTIVE SUMMARY

Attended Background and Ambient Sound Measurements have been completed in positions representative of the existing residential properties in the vicinity of the Site but in the absence of existing sound from the brewery. Existing specific sound level measurements have also been undertaken at the receptor locations to establish a baseline as well as on-site measurements of all dominant sources of sound.

This assessment only considers the extension to the northern warehouse and two additional palletisers within the extension, as well as any associated increase in Heavy Goods Vehicles and external loading activities and its impact on the existing sound climate. It does not consider any existing noise impacts due to the operation of the brewery.

The Noise Impact Assessment has indicated that due to the extension, additional palletisers, external loading and an increase in HGV movements, the predicted rating level at the receptors is not likely to increase by more than 1dB during the daytime and during the night-time period. This level of increase is not considered adverse. Furthermore, the existing assessment between the rating level and background sound level remains unchanged. As such, the extension and additional palletisers and HGVs would not result in an adverse impact at the closest receptors.

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1. INTRODUCTION

Resource and Environmental Consultants (REC) Limited have been commissioned by Heineken UK Limited to undertake a Noise Impact Assessment for the proposed extension to the northern warehouse and two additional internal palletisers, at the existing Heineken Brewery, Denmark Road, Manchester, to be referred to hereafter as '*the facility*'.

This assessment has been undertaken to identify the key noise sources associated with the extension which may have the potential to impact upon the closest non-associated residential receptor to the Facility following the development.

All acronyms used within this report are defined in the Glossary presented in Appendix II.

1.1 Site Location and Proposed Development

The brewery is located within a mixed-use area and is surrounded by existing commercial and residential uses.

The closest Noise Sensitive Receptors (NSRs) to the Site are as follows:

- NSR1 – Quinney Crescent to the south west;
- NSR2 – Barnhill Street to the south;
- NSR3 – Charles Halle Road to the east;
- NSR4 – Greenheys Lane to the north; and
- NSR5 – Westwood Street to the south east.

The NSRs are adopted from a previously completed Noise Impact Assessment undertaken by Golder Associates in March 2017.

The warehouse to be extended is in the north western area of the Site and is a direct extension of existing operations. An additional two internal palletisers are proposed and daily Heavy Goods Vehicle (HGV) movements is set to increase from, on average, 16 per day to 20 per day, a 25% increase. It is assumed that internal operations and HGV movements can take place 24 hours per day over 7 days.

1.2 Limitations

Where a noise survey is required to inform the assessment, REC will endeavour to ensure that all noise measurements taken are robust, representative and reliable in order to inform an accurate noise impact assessment.

Where mitigation measures are specified in our report, it should be noted that these measures are relative to a specific sound source, both in terms of the measured sound pressure level and the character of the source. Where either the sound pressure level or the character of the sound varies following completion of the sound survey, REC cannot be held responsible for any subsequent variations in the proposed mitigation performance.

Further limitations of this report are presented in Appendix I.

1.3 Confidentiality

REC has prepared this report solely for the use of the Client and those parties with whom a warranty agreement has been executed, or with whom an assignment has been agreed. Should any third party wish to use or rely upon the contents of the report, written approval must be sought from REC; a charge may be levied against such approval.

2. ASSESSMENT METHODOLOGY

2.1 National Planning Practice Guidance

Noise needs to be considered when new developments may create additional noise and when new developments would be sensitive to the prevailing acoustic environment. When preparing local or neighbourhood plans, or taking decisions about new development, there may also be opportunities to consider improvements to the acoustic environment.

Local planning authorities' plan-making and decision making should take account of the acoustic environment and in doing so consider:

- Whether or not a significant adverse effect is occurring or likely to occur;
- Whether or not an adverse effect is occurring or likely to occur; and
- Whether or not a good standard of amenity can be achieved.

In line with the Explanatory Note of the Noise Policy Statement for England, this would include identifying whether the overall effect of the noise exposure (including the impact during the construction phase wherever applicable) is, or would be, above or below the significant observed adverse effect level and the lowest observed adverse effect level for the given situation.

The Observed Effect Levels are as follows:

- Significant observed adverse effect level: This is the level of noise exposure above which significant adverse effects on health and quality of life occur.
- Lowest observed adverse effect level: this is the level of noise exposure above which adverse effects on health and quality of life can be detected.
- No observed effect level: this is the level of noise exposure below which no effect at all on health or quality of life can be detected.

Table 1 summarises the noise exposure hierarchy, based on the likely average response.

Table 1 Noise Exposure Hierarchy

Perception	Examples of Outcomes	Increasing Effect Level	Action
Not Noticeable	No Effect	No Observed Effect	No specific measures required
Noticeable and not intrusive	Noise can be heard but does not cause any change in behaviour or attitude. Can slightly affect the acoustic character of the area but not such that there is a perceived change in the quality of life.	No Observed Adverse Effect	No specific measures required
Lowest Observed Adverse Effect Level			

Perception	Examples of Outcomes	Increasing Effect Level	Action
Noticeable and intrusive	Noise can be heard and causes small changes in behaviour and/or attitude, e.g. turning up volume of television; speaking more loudly; where there is no alternative ventilation, having to close windows for some of the time because of the noise. Potential for some reported sleep disturbance. Affects the acoustic character of the area such that there is a perceived change in the quality of life.	Observed Adverse Effect	Mitigate and reduce to a minimum
Significant Observed Adverse Effect Level			
Noticeable and disruptive	The noise causes a material change in behaviour and/or attitude, e.g. avoiding certain activities during periods of intrusion; where there is no alternative ventilation, having to keep windows closed most of the time because of the noise. Potential for sleep disturbance resulting in difficulty in getting to sleep, premature awakening and difficulty in getting back to sleep. Quality of life diminished due to change in acoustic character of the area.	Significant Observed Effect	Avoid
Noticeable and very disruptive	Extensive and regular changes in behaviour and/or an inability to mitigate effect of noise leading to psychological stress or physiological effects, e.g. regular sleep deprivation/awakening; loss of appetite, significant, medically definable harm, e.g. auditory and non-auditory	Unacceptable Adverse Effect	Prevent

The subjective nature of noise means that there is not a simple relationship between noise levels and the impact on those affected. This will depend on how various factors combine in any particular situation.

These factors include:

- The source and absolute level of the noise together with the time of day it occurs. Some types and level of noise will cause a greater adverse effect at night than if they occurred during the day – this is because people tend to be more sensitive to noise at night as they are trying to sleep. The adverse effect can also be greater simply because there is less background noise at night;
- For non-continuous sources of noise, the number of noise events, and the frequency and pattern of occurrence of the noise;
- the spectral content of the noise and the general character of the noise. The local topology and topography should also be taken into account along with the existing and, where appropriate, the planned character of the area.

More specific factors to consider when relevant:

- where applicable, the cumulative impacts of more than one source should be taken into account along with the extent to which the source of noise is intermittent and of limited duration;
- consideration should also be given to whether adverse internal effects can be completely removed by closing windows and, in the case of new residential development, if the proposed mitigation relies on windows being kept closed most of the time. In both cases a suitable alternative means of ventilation is likely to be necessary. Further information on ventilation can be found in the Building Regulations.

- If external amenity spaces are an intrinsic part of the overall design, the acoustic environment of those spaces should be considered so that they can be enjoyed as intended.

2.2 Manchester City Council (2015) *'Planning & Noise Technical Guidance'*

Industrial / commercial developments

BS 4142 should be used to assess the likely impact of noise from industrial and commercial sources at noise sensitive premises. One of the indications of the impact of a BS 4142 assessment is the lower the rating level is relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact or a significant adverse impact. Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, *depending on the context*.

The Council consider that new developments should contribute and enhance the area in which they are located and where possible, contribute to the improvement of people's health and quality of life as per the NPSE. With this in mind, the design objective should be:

'The development should be designed so as to achieve a rating level of 5dB (L_{Aeq}) below the typical background (L_{A90}) level at the nearest noise sensitive location'.

Where this criterion cannot be achieved, the various noise control measures considered as part of the assessment should be fully explained (i.e. relocation of noise sources, use of quieter equipment, enclosures, screening, restriction of the hours of operation) and the achievable noise level should be identified. This information will allow us to make a judgement concerning the application and its likely impact on the surrounding area.

In addition to the above, maximum noise levels should also be adequately controlled. Where Uses generate high noise levels of a short duration (e.g. loud bangs) on a regular basis, these should aim to be controlled so as not to exceed 60 dB (L_{Amax}) at the façade of noise sensitive premises nearby in accordance with the recommendations of the World Health Organisation.

Deliveries and collections are usually controlled by restricting operational hours but depending on the extent of these activities, a Noise Management Plan (NMP) may be requested, which would include an assessment of noise. This would usually involve assessing the noise upon arrival, loading/unloading period and then departure.

The NMP may also need to include controls such as acoustically sealed delivery bays, and restrictions on vehicle mounted refrigeration units and audible alarm systems. Where applicable, the noise assessment will take account of multiple noise sources operating simultaneously and the state cumulative level of these.

2.3 BS4142: 2014 '*Methods for rating and assessing industrial and commercial sound*'

This standard describes methods for rating and assessing sound of an industrial or commercial nature which includes:

- Sound from industrial and manufacturing processes;

- Sound from fixed installations which comprise mechanical and electrical plant and equipment;
- Sound from the loading and unloading of goods and materials at industrial and / or commercial premises; and
- Sound from mobile plant and vehicles that is an intrinsic part of the overall sound emanating from processes or premises, such as that from forklift trucks, or that from train or ship movements on or around an industrial or commercial Site.

The procedure detailed in the standard compares the measured or predicted noise level 'the specific noise level' from any of the above detailed noise sources with the background sound level at a residential dwelling. The measured background sound level at a receptor should be reliable and should not necessarily ascertain a lowest measured background sound level, but rather to quantify what is typical.'
The specific noise level also acknowledges the following reference time intervals depending upon whether the noise source operates during daytime or night-time periods:

- Daytime (07:00 – 23:00) 1 hour; and
- Night-time (23:00 – 07:00) 15 minutes.

There are a number of 'penalties' which can be attributed to the specific sound level depending upon the 'acoustic features' of the sound level under investigation as follows. These penalties vary in their weighting depending upon the severity of the acoustic feature, as follows:

Tonality

- +2dB: where the tonality is just perceptible;
- +4dB: where the tonality is clearly perceptible; and
- +6dB: where the tonality is highly perceptible.

Impulsivity

- +3dB: where the impulsivity is just perceptible;
- +6dB: where the impulsivity is clearly perceptible; and
- +9dB: where the impulsivity is highly perceptible.

Intermittency

- +3dB: where the intermittency is readily distinctive against the acoustic environment.

In addition to the above acoustic features, there is a penalty for 'other sound characteristics' of +3dB where a sound exhibits characteristics that are neither tonal nor impulsive, though are readily distinctive against the acoustic environment.

BS4142 goes on to state that the rating level is equal to the specific sound level if there are no such features present or expected to be present.

Assessment of the rating level relative to the background noise level can yield the following commentary:

- Typically, the greater this difference (between the rating level and the background sound level), the greater the magnitude of impact;
- A difference of around +10dB or more is likely to be an indication of a significant adverse impact, depending on the context;

- A difference of around +5dB is likely to be an indication of an adverse impact, depending on the context; and
- 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. Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact.

With the above in mind, it is common that a LPA will specify their own criteria for the rating level relative to the background sound level and, where this is the case, this criterion usually takes precedence over a simple comparison of the rating level against the background sound level.

3. NOISE SURVEYS

All positions are shown in Figure 1 of Appendix III.

3.1 Background and Residual Sound Surveys – Proxy Monitoring Positions

REC has conducted attended Background and Residual Sound Surveys in order to quantify the existing levels of background sound at the closest residential receptors to the Brewery but in the absence of noise from such. The survey was carried out over the following time periods:

- 01:30 to 04:40 Wednesday 9th January 2019; and
- 18:30 to 00:00 Wednesday 9th January 2019.

The above periods relate to the most sensitive daytime and night-time periods and are considered to inform a worst-case assessment. The following noise measurement positions were chosen for the Survey and relate to the Alternative Monitoring Positions given in the March 2017 Assessment:

- Proxy Monitoring Position 1/2 (P1/P2): On Quinney Crescent, equidistant from Princess Road but to the south of the NSR1. Dominant sources of noise included road traffic sound;
- Proxy Monitoring Position 3 (P3): Denmark Road/Pencroft Way Junction to the east of the NSR3. Dominant sources of noise included road traffic sound;
- Proxy Monitoring Position 4 (P4): Boundary Lane/Coupland Street Junction to the north east of the brewery and NSR4. Dominant sources of noise included road traffic sound; and
- Proxy Monitoring Position 5 (P5): Moss Lane East/Acomb Street Junction to the east of the brewery and NSR5. Dominant sources of noise included road traffic sound.

Table 2 details the measured background and residual sound levels.

Table 2 Measured Background and Residual Sound Pressure Levels

Location	Measurement Period	Measured Residual Sound Pressure Level, $L_{Aeq,T}$ (dB)	Measured Background Sound Pressure Level, $L_{A90,T}$ (dB)
P1/P2	18:28 – 19:28	58.2	52.5
	19:28 – 20:28	58.2	52.5
	01:30 – 01:45	53.6	47.0
	01:45 – 02:00	53.3	46.7
	03:11 – 03:26	52.8	45.3
	03:26 – 03:41	55.3	47.7
P3	21:57 – 22:57	60.5	45.4

Location	Measurement Period	Measured Residual Sound Pressure Level, $L_{Aeq,T}$ (dB)	Measured Background Sound Pressure Level, $L_{A90,T}$ (dB)
	02:07 – 02:22	55.6	46.9
	03:48 – 04:03	52.9	43.6
P4	23:04 – 00:04	64.9	48.3
	02:30 – 02:45	52.9	48.1
	04:07 – 04:22	49.9	48.8
P5	20:47 – 21:47	64.2	48.5
	02:50 – 03:05	57.5	44.0
	04:27 – 04:42	56.5	45.2

3.2 Baseline Specific Sound Surveys – NSR Positions

REC has conducted attended specific sound surveys at each NSR during the daytime and night-time periods to quantify a baseline level of sound due to the brewery. The surveys were carried out over the following time periods:

- 01:25 to 04:33 Wednesday 9th January 2019; and
- 18:20 to 23:49 Wednesday 9th January 2019.

Measurements were undertaken at positions representative of the closest NSRs (as stated in Section 1.2) in positions shown in Figure 1 of Appendix III.

Table 3 details the average measured specific noise levels.

Table 3 Attended Specific Sound Level Results

Location	Measurement Period	Measured Specific Sound Pressure Level, $L_{Aeq,T}$ (dB)	Observations
NSR1	18:20 – 19:20	62.6	Site inaudible over road traffic sound
	01:25 – 01:40	53.4	Barely audible over road traffic. Steady hum in background
	03:12 – 03:27	58.2	

Location	Measurement Period	Measured Specific Sound Pressure Level, $L_{Aeq,T}$ (dB)	Observations
NSR2	19:27 – 20:27	59.5	Inaudible when traffic moving. Specific sound level includes road traffic sound.
	01:47 – 03:02	53.8	Barely audible over road traffic. Steady hum in background
NSR3	20:32 – 21:32	57.9	HGV movements audible here as well as fixed plant.
	02:32 – 02:47	58.9	HGV movements audible here as well as fixed plant.
	03:56 – 04:11	51.9	
NSR4	21:40 – 22:40	65.8	Not audible over road traffic.
	02:51 – 03:06	64.2	
	04:18 – 04:33	58.3	
NSR5	22:49 – 23:49	58	Fixed plant only audible when road traffic is low.
	02:08 – 02:23	53.3	
	03:35 – 03:50	50.6	

3.3 Source Noise Level Measurements of Existing Palletisers

REC has conducted attended source measurements of the existing palletisers during typical operations.

Measurements were undertaken at positions as close as possible to each stage of the palletiser and wherever different processes or noticeable changes in noise level occurred.

Table 4 details the average measured specific noise levels.

Table 4 Palletiser Source Noise Levels

Source/Process	Measured Specific Sound Pressure Level, $L_{Aeq,T}$ (dB)	Distance to Source (m)	Calculated Sound Power Level, L_W (dB)
Conveyor	84.6	1	92.6
Alignment Machine	83.0	1	91.0

Source/Process	Measured Specific Sound Pressure Level, $L_{Aeq,T}$ (dB)	Distance to Source (m)	Calculated Sound Power Level, L_W (dB)
Robotised Arms	82.3	1	90.3
Crates Stacked on Pallet	79.9	1	87.9
Wrapping Pallets	82.7	1	90.7

The following equipment was used for the Noise Surveys. Calibration due dates relate to those at the time of the surveys.

Table 5 Noise Measurement Equipment

Equipment Description	Manufacturer & Type No.	Serial No.	Calibration Due Date
Sound Level Meter	01dB-Metravib Black Solo	65771	25th October 2019
Pre-amplifier	01dB-Metravib PRE 21 S	16640	
Microphone	01dB Metravib MCE212	16539	
Calibrator	01dB-Metravib CAL-21	34634218	24th April 2019
Sound Level Meter	01dB-Metravib Fusion	11536	27th November 2020
Pre-amplifier	01dB Metravib	Internal	
Microphone	GRAS 40CE	291871	
Calibrator	01dB-Metravib CAL-21	34554787	11th June 2019

The sound level meters were field-calibrated on Site prior to and after noise measurements were taken. No significant drift was witnessed. Calibration certificates are available upon request.

4. NOISE IMPACT ASSESSMENT

When considering the introduction of new plant items or variation to existing processes into an existing industrial premise, it is important to consider the existing specific sound levels at the receptors.

REC attended the Site to measure the loudest plant items across the entire brewery in order to inform a noise model. A previous report for the Site, undertaken in March 2017, determined that the sound from the brewery was secondary to road traffic. Indeed, this was found to be the case here. During the surveys at the NSR locations, sound from the brewery was only briefly audible when no cars were passing, which was rare, especially during the daytime periods. As such, it is not entirely possible to quantify a specific sound level from measurements alone.

As such, the input of the loudest sources, determined through audibility on Site and measurements, into the noise model yields specific sound levels at the NSRs without the contamination of road traffic. In order to verify the model, NSR3 was used to compare the measured specific level to that modelled. Here, the site was audible for the longest periods with little impact due to traffic. The measured specific during the night-time period, when road traffic was at its lowest, was 43.7dB, allowing a 10dB reduction as still the site source was secondary to the constant road traffic. This implies that site noise doesn't contribute to the sound climate that is dominated during road traffic movements.

The modelled level at NSR3 is 44.1dB. This correlates well with that measured and the model is considered accurate and verified. It is important to note, for clarity, that the modelled levels will be lower than those measured in March 2017 as remedial measures have taken place since then to rectify several issues resulting in exceedences previously. Additionally, the previous report simply used the background sound level to inform the assessment which is more than worst case.

For the BS4142:2014 assessments, penalties are applied to the specific sound level in order to provide the rating level. These penalties relate to the acoustic features of the sound source. Accordingly, the following objective and subjective features have been accounted for in the assessment, in accordance with the subjective method detailed in BS4142:2014, for the Site as a whole operation. Note, not all penalties will apply to all NSRs as they are subject to different sources and are subject to different acoustic features.

Table 6 Acoustic Penalties

Source	Penalty	Applicable?	Attributable Penalty	Comment
The Brewery	Tonality	Yes	2-4dB	Objective method determined +6dB correction for pumps associated with the on-site Waste Water Treatment and in the central area to the south. However, given the distance to the receptors and the dominance of road traffic the tone is considered just to clearly perceptible.
	Impulsivity	No	-	No impulsivity associated with the operations.
	Intermittency	Yes	3dB	Intermittent movements of HGVs, audible at NSR3.
	Other Sound Characteristics	No	-	Other Penalties applied

4.1 BS4142:2014 Daytime Assessment – Existing Scenario

The Noise Model has been used to predict the specific noise level at the receptors during the daytime period.

Table 7 details the calculated specific noise levels at the receptors, applies the penalties and compares the rating level with the lowest measured 1-hour background sound levels. Levels are predicted at a height of 1.5m above local ground level to account for a person stood in the garden, NSR3 is predicted at first floor level.

Table 7 BS4142:2014 Assessment –Daytime Residential Assessment - Existing

Receptor	Predicted Specific Noise Level, $L_{Aeq,1hr}$ (dB)	Acoustic Penalties (Table 6) (dB)	Combined Rating Level, $L_{A,r}$ (dB)	Background Sound Level, $L_{A90,1hr}$ (dB)	Difference +/- (dB)
NSR1	38.4	4dB (Clearly Perceptible Tones)	42	53	-11
NSR2	35.3	4dB (Clearly Perceptible Tones)	39	53	-14
NSR3	47.6	5dB (Just Perceptible Tones and Intermittency)	53	45	+8
NSR4	40.3	2dB (Just Perceptible Tones)	42	48	-6
NSR5	29.1	4dB (Clearly Perceptible Tones)	33	49	-16

The above determines that the MCC criterion of $L_{A,r} = L_{A90}$ -5dB is achieved at NSR1, NSR2, NSR4 and NSR5. Although there is predicted to be an exceedence at NSR3, no external areas exist here and, as such, is considered more prudent to assess internally. This results in an internal specific noise level of 33dB assuming an open window. As the site runs continuously, the application of BS8233:2014 here is considered robust.

4.2 BS4142:2014 Night-time Assessment – Existing Scenario

Table 8 details the calculated specific noise levels at the receptors, applies the penalties and compares the rating level with the typical background sound levels. Levels are predicted at a height of 3.5m above local ground level to account first floor level.

Table 8 BS4142:2014 Assessment –Night-time Residential - Existing

Receptor	Predicted Specific Noise Level, $L_{Aeq,15mins}$ (dB)	Acoustic Penalties (Table 5) (dB)	Combined Rating Level, $L_{A,r}$ (dB)	Measured Background Sound Level, $L_{A90,15mins}$ (dB)	Difference +/- (dB)
NSR1	43	4	47	47	0
NSR2	38.6	4	43	47	-4
NSR3	47.6	5	53	45	+8
NSR4	44.0	2	46	48	-2
NSR5	30.2	4	34	44	-10

The above determines that the MCC criterion of $L_{A,r} = L_{A90}$ -5dB is achieved at NSR2 (marginally) and NSR5. The level difference at NSR1 is not considered adverse due to the locality of the receptor and the dominance of road traffic sound, indeed residual sound levels here at night are approximately 53dB, 9dB above the predicted specific noise level. This is also the case for NSR4.

Furthermore, there is predicted to be an exceedence at NSR3 but, again, it is considered more prudent to assess internally, especially as residents are likely to be inside, asleep. This results in an internal specific noise level of 33dB assuming an open window. This suggests a 3dB exceedence of the criterion. However, considering the locality of the receptors, in close proximity to the facility and main roads, it is considered prudent to apply the 5dB relaxation of internal levels here, as recommended in BS8233:2014.

4.3 BS4142:2014 Daytime Assessment –Warehouse Extension

During the on-site measurements, sound from the existing warehouse and internal palletisers were not audible externally, as such they weren't included in the model. In order to inform the assessment, the extension will be included in the model along with the operation of all palletisers, existing and 2 proposed, operating. The warehouse as a whole, including the extension, will be inputted into the model as an industrial building with the facades having area sources attributed to them. In order to determine the area sources, internal to external break-out calculations have been undertaken to determine the effect the structure has upon the internal plant items. Therefore, the noise levels of the facades of the Warehouse have been calculated as follows:

The direct sound pressure levels (Direct SPL) within the Warehouse as a result of the internal plant have been calculated based on the following formula:

$$\text{Direct SPL} = L_W + (10 \times \text{Log}\,(1/\,((4 \times 3.14) \times D^2)))$$

Where: L_W *is the sound power level of the source*
D *is the distance of the source from the facade*

Each Direct SPL of each item of plant on each façade have been logarithmically added together to provide the Direct SPL for each façade.

The reverberant sound pressure level (Reverb SPL) has been calculated as follows:

Reverb SPL = L_W + (10 x Log (4 / R_C)

Where: L_W is the sound power level of the source
R_C is the room constant

These have again been logarithmically added together to provide the Reverb SPL for each façade for all sources. The Reverb SPL has then been logarithmically added to the Direct SPL for each façade.

Assuming a Sound Reduction Index of 25dB for a Kingspan architectural profiled steel sheet for the Warehouse (brick is proposed for the lower part of the façade and so this is considered worst case), the following equation has been used to determine the sound power level of each façade:

$L_W = L_P + (10 \times \text{Log}(S))$

Where: L_P is the sound pressure level of the façade assuming -6 directivity
S is the surface area of the facade

Table 9 details the calculated sound power levels of each façade. The eastern and southern facades are not included as these adjoin existing buildings.

Table 9 Calculated Sound Power Levels of Facades

Façade	Assumed Surface Area (m^2)	Calculated Sound Power Level of Façade (dB)
North	483	72.1
West	756	75.1
Roof	3651	82.6

The external activities have been included to account for a forklift loading a HGV outside of the bay area and driving off using library data. A noise level of 75dB 15minues at 10m has been used and imputed at a point source 2m above ground level. This represents that the loading activity can take place in any given 15-minute period throughout the daytime and night-time. It should be noted that due the existing barrier positioned along the northern boundary any potential impact is negligible due to the line of sight removal from the loading activities to the nearest receptors.

Table 10 details the calculated specific noise levels at the receptors, applies the penalties and compares the rating level with the lowest measured 1-hour background sound levels. Levels are predicted at a height of 1.5m above local ground level to account for a person stood in the garden, NSR3 is predicted at first floor level. As part of the development, and in relation to a separate planning application, REC has assumed the relocation of the cooling towers, that are currently located within the footprint of the proposed extension, to the east of the main building in the current HGV park.

Figure 2 details the grid noise map with the extension assessed.

Table 10 BS4142:2014 Assessment –Daytime Residential Assessment – Warehouse Extension

Receptor	Predicted Specific Noise Level, $L_{Aeq,1hr}$ (dB)	Acoustic Penalties (Table 6) (dB)	Combined Rating Level, $L_{A,r}$ (dB)	Background Sound Level, $L_{A90,1hr}$ (dB)	Difference +/- (dB)
NSR1	38.8	4dB	43	53	-10
NSR2	35.1	4dB	39	53	-14
NSR3	47.5	5dB	53	45	**+8**
NSR4	41.4	2dB	43	48	-5
NSR5	29.3	4dB	33	49	-16

The above determines that the MCC criterion of $L_{A,r} = L_{A90}$ -5dB is achieved at NSR1, NSR2, NSR4 and NSR5. The exceedence at NSR3 remains unchanged. The level increases at the NSRs due to the extension are between 0.2dB (NSR2 and NSR3) and 1.1dB (NSR4). These levels of increase are not considered significant nor would they be perceptible.

4.4 BS4142:2014 Night-time Assessment – Warehouse Extension

Table 11 details the calculated specific noise levels at the receptors, applies the penalties and compares the rating level with the typical background sound levels. Levels are predicted at a height of 3.5m above local ground level to account first floor level.

Table 11 BS4142:2014 Assessment –Night-time Residential – Warehouse Extension

Receptor	Predicted Specific Noise Level, $L_{Aeq,15mins}$ (dB)	Acoustic Penalties (Table 6) (dB)	Combined Rating Level, $L_{A,r}$ (dB)	Measured Background Sound Level, $L_{A90,15mins}$ (dB)	Difference +/- (dB)
NSR1	42.8	4	47	47	0
NSR2	38.6	4	43	47	-4
NSR3	47.5	5	53	45	**+8**
NSR4	44.9	2	47	48	-1
NSR5	30.6	4	35	44	-9

The above determines that the difference between the resultant rating level and existing background sound levels remain mostly unchanged due to the extension. As such, no adverse impact is predicted as a result of the extension. Albeit, the rating level at NSR4 and NSR5 is 1dB higher but the overall impact is still considered unchanged.

4.5 Additional HGV Movements

As part of the development, there is predicted to be an additional 4 HGV deliveries/collections per day, a 25% increase upon existing operations.

It should be noted that relatively large increases in road traffic movements would need to prevail in order for noticeable increases in road traffic noise levels to occur. Although the HGVs will be travelling along the Site internal roads, these internal roads run parallel to the existing highway, especially when considering NSR4 and NSR3. As such, the additional movements need to be considered in this context. As such, the additional movements will be considered along with the existing road traffic levels.

As a general guide, although not accounting for changes in the percentage of HGV's, a 25% increase in traffic movements will only result in a 1dB increase in noise levels. Similarly, a 58% increase would be required for 2dB and 100% increase for a 3dB increase. It should be noted that a 3dB increase in noise levels is generally barely perceptible to the average human.

As such, the on-site increase may result in a 1dB increase upon the source level of HGV movements, however, these movements are not considered significant in relation to fixed plant noise and existing road traffic noise levels. As such, the additional vehicle movements would not result in a perceptible change to road traffic sound levels at the receptors. It is worth noting that HGV movements are not considered in the model due to there intermittent movements and negligible contribution to the overall noise level resulting from the Site.

5. CONCLUSION

REC Limited has been commissioned by Heineken (UK) Limited to undertake a Noise Impact Assessment for the proposed extension to the main warehouse, at the existing Heineken Brewery in Manchester.

Attended Background and Ambient Sound Measurements have been completed in positions representative of the existing residential properties in the vicinity of the Site but in the absence of existing sound from the brewery. Existing specific sound level measurements have also been undertaken at the receptor locations to establish a baseline as well as on-site measurements of all dominant sources of sound.

This assessment only considers the extension to the northern warehouse and two additional palletisers within the extension, as well as any associated increase in Heavy Goods Vehicles and external loading activities and its impact on the existing sound climate. It does not consider any existing noise impacts due to the operation of the brewery.

The Noise Impact Assessment has indicated that due to the extension, additional palletisers, external loading and an increase in HGV movements, the predicted rating level at the receptors is not likely to increase by more than 1dB during the daytime and during the night-time period. This level of increase is not considered adverse. Furthermore, the existing assessment between the rating level and background sound level remains unchanged. As such, the extension and additional palletisers and HGVs would not result in an adverse impact at the closest receptors.

APPENDIX I LIMITATIONS

1. This report and its findings should be considered in relation to the terms of reference and objectives agreed between REC Limited and the Client as indicated in Section 1.2.

2. The executive summary, conclusions and recommendations sections of the report provide an overview and guidance only and should not be specifically relied upon without considering the context of the report in full.

3. REC cannot be held responsible for any use of the report or its contents for any purpose other than that for which it was prepared. The copyright in this report and other plans and documents prepared by REC is owned by them and no such plans or documents may be reproduced, published or adapted without written consent. Complete copies of this may, however, be made and distributed by the client as is expected in dealing with matters related to its commission. Should the client pass copies of the report to other parties for information, the whole report should be copied, but no professional liability or warranties shall be extended to other parties by REC in this connection without their explicit written agreement there to by REC.

APPENDIX II GLOSSARY OF ACOUSTIC TERMINOLOGY

Noise

Noise is defined as unwanted sound. Human ears are able to respond to sound in the frequency range 20 Hz (deep bass) to 20,000 Hz (high treble) and over the audible range of 0 dB (the threshold of perception) to 140 dB (the threshold of pain). The ear does not respond equally to different frequencies of the same magnitude, but is more responsive to mid-frequencies than to lower or higher frequencies. To quantify noise in a manner that approximates the response of the human ear, a weighting mechanism is used. This reduces the importance of lower and higher frequencies, in a similar manner to the human ear.

Furthermore, the perception of noise may be determined by a number of other factors, which may not necessarily be acoustic. In general, the impact of noise depends upon its level, the margin by which it exceeds the background level, its character and its variation over a given period of time. In some cases, the time of day and other acoustic features such as tonality or impulsiveness may be important, as may the disposition of the affected individual. Any assessment of noise should give due consideration to all of these factors when assessing the significance of a noise source.

The most widely used weighting mechanism that best corresponds to the response of the human ear is the 'A'-weighting scale. This is widely used for environmental noise measurement, and the levels are denoted as dB(A) or L_{Aeq}, L_{A90} etc., according to the parameter being measured.

The decibel scale is logarithmic rather than linear, and hence a 3 dB increase in sound level represents a doubling of the sound energy present. Judgement of sound is subjective, but as a general guide a 10 dB(A) increase can be taken to represent a doubling of loudness, whilst an increase in the order of 3 dB(A) is generally regarded as the minimum difference needed to perceive a change under normal listening conditions.

An indication of the range of sound levels commonly found in the environment is given in the following table.

Table A1 Typical Sound Pressure Levels

Sound Pressure Level	Location/Example
0	Threshold of hearing
20 - 30	Quiet bedroom at night
30 - 40	Living room during the day
40 - 50	Typical office
50 - 60	Inside a car
60 - 70	Typical high street
70 - 90	Inside factory
100 - 110	Burglar alarm at 1m away
110 - 130	Jet aircraft on take off
140	Threshold of pain

Acoustic Terminology

Table A2 Terminology

Descriptor	Explanation
dB (decibel)	The scale on which sound pressure level is expressed. It is defined as 20 times the logarithm of the ratio between the root-mean-square pressure of the sound field and a reference pressure (2x10-5Pa).
dB(A)	A-weighted decibel. This is a measure of the overall level of sound across the audible spectrum with a frequency weighting (i.e. 'A' weighting) to compensate for the varying sensitivity of the human ear to sound at different frequencies.
$L_{Aeq, T}$	L_{Aeq} is defined as the notional steady sound level which, over a stated period of time (T), would contain the same amount of acoustical energy as the A - weighted fluctuating sound measured over that period.
L_{Amax}	L_{Amax} is the maximum A - weighted sound pressure level recorded over the period stated. L_{Amax} is sometimes used in assessing environmental noise where occasional loud noises occur, which may have little effect on the overall Leq noise level but will still affect the noise environment. Unless described otherwise, it is measured using the 'fast' sound level meter response.
L_{10} & L_{90}	If a non-steady noise is to be described it is necessary to know both its level and the degree of fluctuation. The Ln indices are used for this purpose, and the term refers to the level exceeded for n% of the time. Hence L_{10} is the level exceeded for 10% of the time and as such can be regarded as the 'average maximum level'. Similarly, L_{90} is the 'average minimum level' and is often used to describe the background noise. It is common practice to use the L_{10} index to describe traffic noise.
Free-field Level	A sound field determined at a point away from reflective surfaces other than the ground with no significant contributions due to sound from other reflective surfaces. Generally as measured outside and away from buildings.
Fast	A time weighting used in the root mean square section of a sound level meter with a 125millisecond time constant.
Slow	A time weighting used in the root mean square section of a sound level meter with a 1000millisecond time constant.

APPENDIX III FIGURES

Figure 1 - Noise Sensitive Receptor (NSR) and Proxy (P) Locations

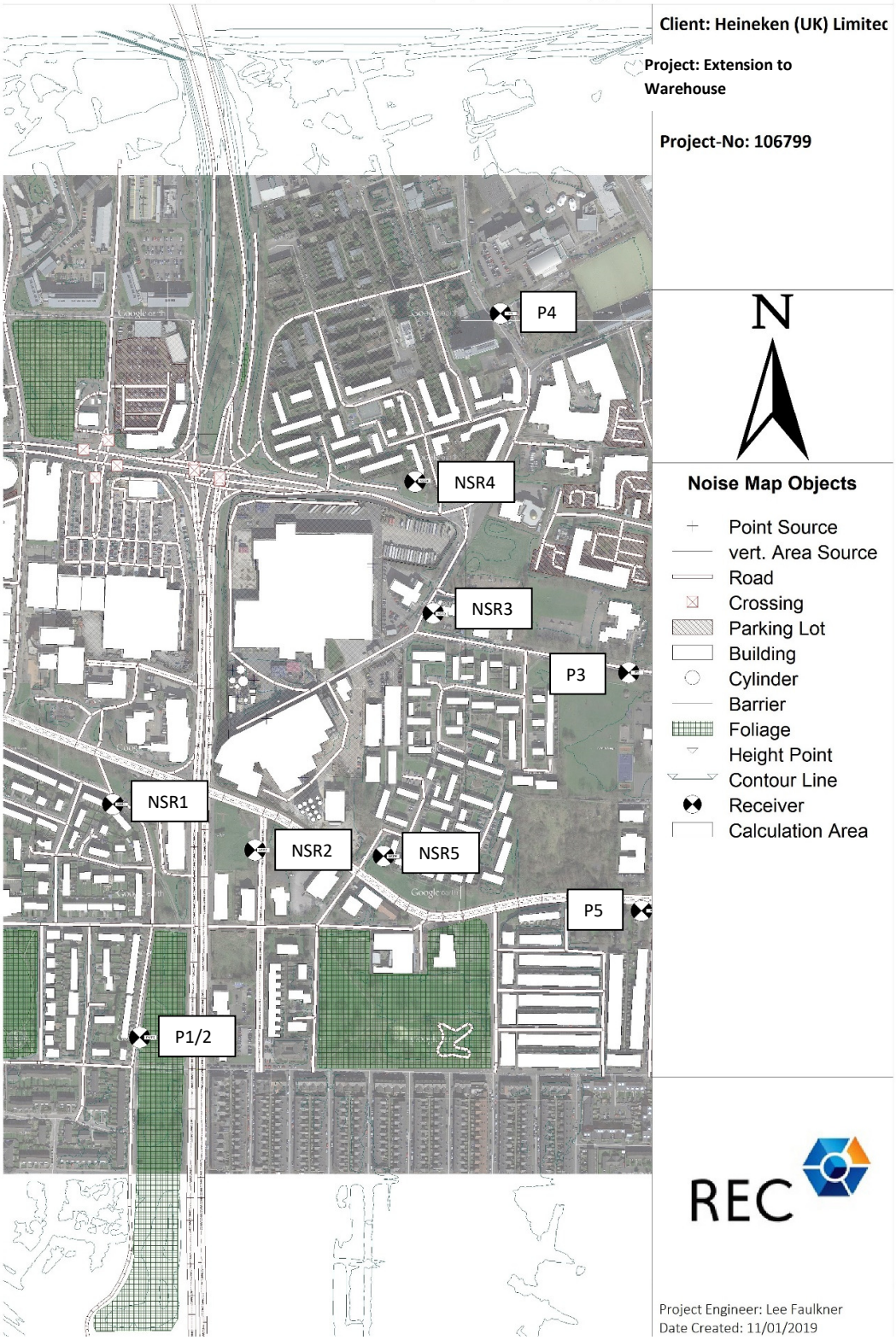
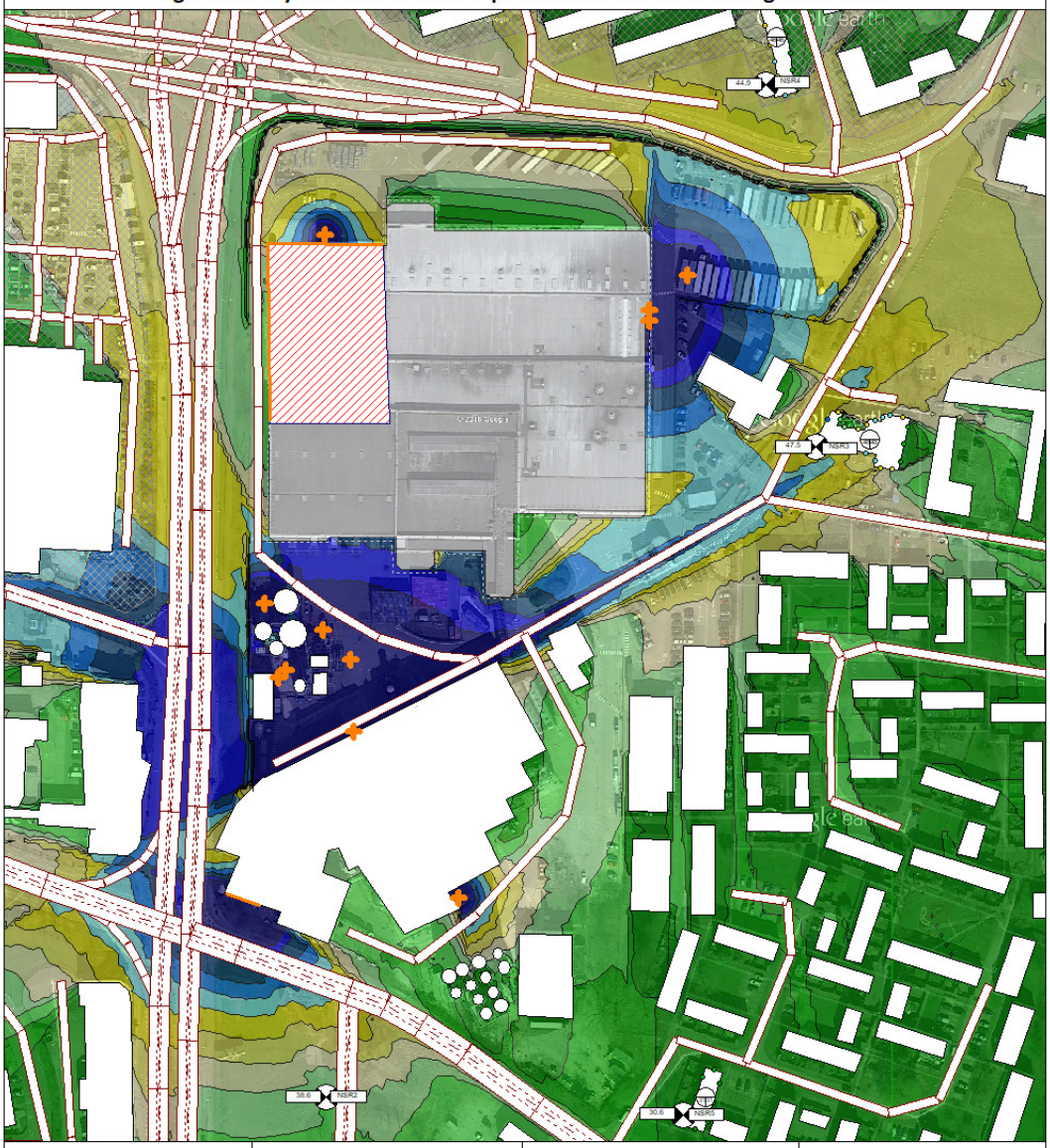


Figure 2 - Daytime Grid Noise Map - Calculation 1.5m above ground level



Project:
Heineken, Extension to Warehouse and Palletiser

Project-No:
AC106799-4r1

Specific Noise Level dB A

- ... < 30.0
- 30.0 <= ... < 32.5
- 32.5 <= ... < 35.0
- 35.0 <= ... < 37.5
- 37.5 <= ... < 40.0
- 40.0 <= ... < 42.5
- 42.5 <= ... < 45.0
- 45.0 <= ... < 47.5
- 47.5 <= ... < 50.0
- 50.0 <= ... < 52.5
- 52.5 <= ... < 55.0
- 55.0 <= ...

Noise Map Objects

- Point Source
- Area Source
- vert. Area Source
- Road
- Building
- Cylinder
- Barrier
- Height Point
- Receiver
- Building Evaluation
- Calculation Area

REC

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