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Plant Noise
Impact Assessment

On behalf of

space.
engineering services

Project Reference: 90017 | Revision: - | Date: 2nd June 2021

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Document Information

Project Name	:	**Tesco Express, 32 - 34 High Street, Manningtree**
Project Reference	:	**90017**
Report Title	:	**Plant Noise Impact Assessment Report**
Doc Reference	:	**90017/NIA**
Date	:	**2nd June 2021**

	Name	Qualifications	Initials	Date
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For and on behalf of Noise Solutions Ltd				

Revision	Date	Description	Prepared	Reviewed/ Approved

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Appendices

1.0 Introduction

1.1. Noise Solutions Ltd (NSL) has been commissioned by Space Engineering Services to undertake a noise impact assessment of new plant serving an existing Tesco store located along High Street in Manningtree.

1.2. An environmental sound survey has been undertaken to establish the prevailing background sound pressure levels at a location representative of the sound levels outside the nearest noise sensitive receptors to the site.

1.3. Plant noise emission levels for the proposed plant have been predicted at the most affected noise sensitive receptors and assessed against the local authority's usual requirements.

1.4. To assist with the understanding of this report a glossary of acoustic terms can be found in Appendix A. An in-depth glossary of acoustic terms can be viewed online at www.acoustic-glossary.co.uk.

2.0 Details of development proposals

2.1. The Tesco store occupies an end of terrace building located along High Street in Manningtree.

2.2. New refrigeration plant will be located in a service yard to the east of the store. The refrigeration plant will potentially operate 24 hours a day, although it should be noted that these units operate as required to meet demand and that store demands for cooling are generally reduced at night.

2.3. Appendix B contains a table with the manufacturer's published sound pressure levels for the proposed plant.

2.4. In order to sufficiently mitigate against acoustic reflections from the proposed plant, acoustic wall lining will be required on the wall to the west of the unit. This should ensure compliance with proposed criteria in section 5.

3.0 Nearest noise sensitive receptors

3.1. The area surrounding the site is mixed residential and commercial in nature. The closest residential dwelling is the adjoining property located to the east of the Tesco store (Reference R1) approximately 5m from the closest plant item. These windows are screened from the plant by the wall around the plant area. The nearest residential windows with a potentially-unobstructed view of the plant (Receptors R2 and R3) are approximately 8 and 9m form the unit, respectively.

3.2. An aerial photograph showing the site and surrounding area, the nearest noise sensitive

properties and noise monitoring location used in this assessment is presented in **Appendix C.**

4.0 Existing noise climate

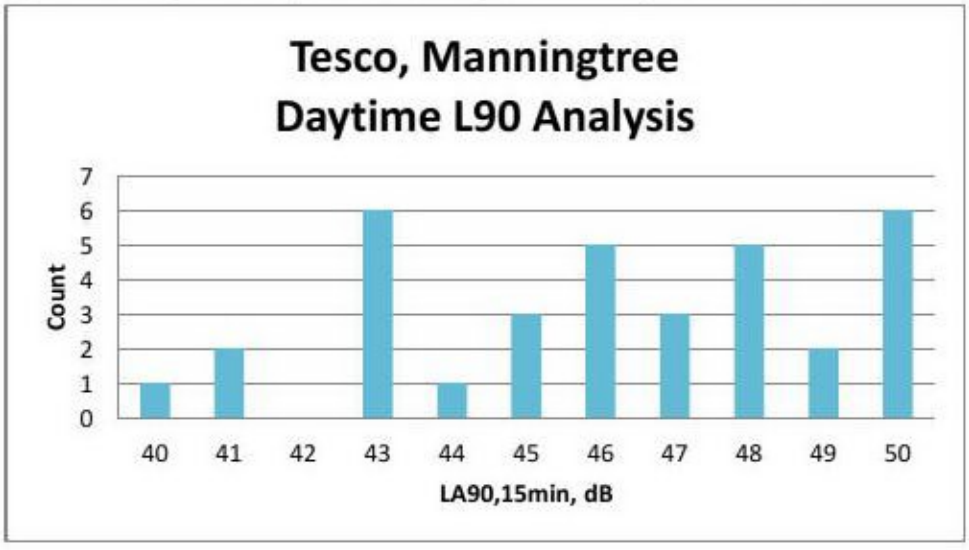
4.1. An environmental noise survey was undertaken to establish the typical background sound levels at a location representative of the noise climate outside the façades of the nearest noise sensitive receptors to the proposed plant area during the quietest times at which the plant will operate.

4.2. The results of the environmental sound survey are summarised in Table 1 below. The full set of measurement results and details of the survey methodology are presented in **Appendix D.**

Table 1 Summary of survey results

Measurement period	Range of recorded sound pressure levels (dB)			
	$L_{Aeq(15mins)}$	$L_{Amax(15mins)}$	$L_{A10(15mins)}$	$L_{A90(15mins)}$
Daytime (07.00 – 23.00 hours)	53-66	69-89	53-68	40-50
Night-time (23.00 – 07.00 hours)	43-61	51-81	43-64	31-43

Figure 1 Histogram of daytime L_{A90} background sound pressure levels



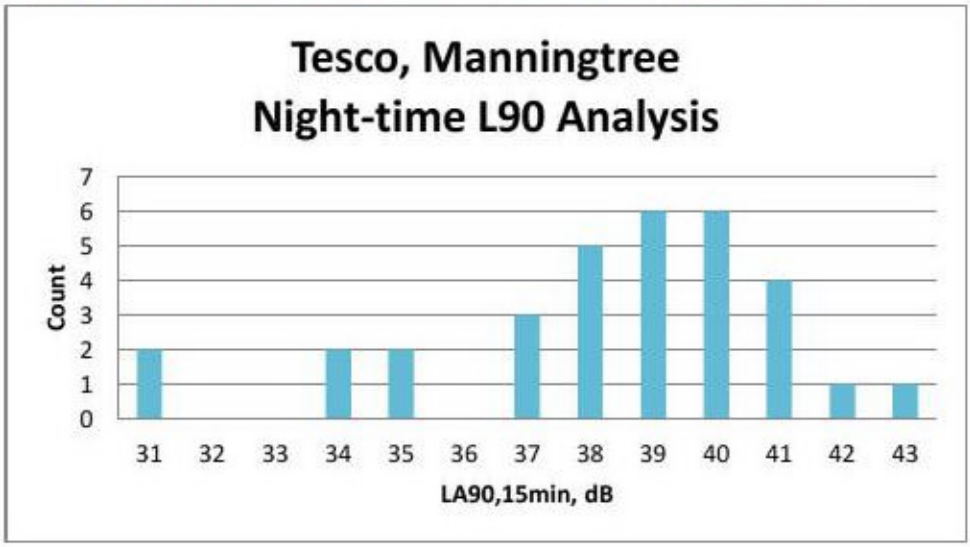
4.3. Further statistical analysis has been carried out on the data, and the mean and median values are shown in Table 2 below.

Table 2 Statistical analysis of $L_{A90,15min}$ levels during the daytime period

dB, L_{A90} daytime period	
mean	46
modal	50
median	46

4.4. From the histogram analysis, 43dB has been selected to be a robust representation of the background noise level during the daytime period.

Figure 2 Histogram of night-time L_{A90} background sound pressure levels



4.5. Further statistical analysis has been carried out on the data and the mean and median values are shown in Table 3 below.

Table 3 Statistical analysis of $L_{A90,15min}$ levels during the night-time period

dB, L_{A90} night-time period	
mean	38
modal	40
median	39

4.6. Again, from the histogram analysis, 37dB has been chosen to be representative of the background sound level during the night-time period.

4.7. Therefore, the following values are considered representative of the existing background sound pressure levels at nearby noise sensitive premises:

- 43dB L_{A90} during the daytime period; and
- 37dB L_{A90} during the night-time period.

Covid-19

4.8. It should be noted that the environmental noise survey discussed in this report was undertaken in May 2021, at a time when the coronavirus pandemic was causing a disruption to typical working patterns and other activity. It is therefore likely that recorded sound levels are slightly lower than would otherwise be expected where dominated by road or air traffic. While the data should therefore be treated with an element of caution, where it has been used to establish background sound levels it is likely to understate the more-usual background sound levels and therefore result in a robust assessment.

5.0 Plant noise design criteria

National Planning Policy Framework

5.1. A new edition of NPPF was published in February 2019 and came into effect immediately. The original National Planning Policy Framework (NPPF[1]) was published in March 2012, with a revision in July 2018 - this document replaced the existing Planning Policy Guidance Note 24 (PPG 24) "Planning and Noise." The 2019 revised edition contains no new directions or guidance with respect to noise, and hence, all previous references remain extant. The paragraph references quoted below relate to the February 2019 edition.

5.2. Paragraph 170 of the NPPF states that the planning system should contribute to and enhance the natural and local environment by, (amongst others) *"preventing both new and existing development from contributing to or being put at unacceptable risk from, or being adversely affected by unacceptable levels of soil, water or noise pollution or land stability."*

5.3. The NPPF goes on to state in Paragraph 180:

"planning policies and decisions should ...

a) Mitigate and reduce to a minimum potential adverse impacts resulting from noise from new development, - and avoid noise giving rise to significant adverse impacts on health and quality of life;

b) identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason ...

5.4. The NPPF document does not refer to any other documents or British Standards regarding noise other than the Noise Policy Statement for England (NPSE[2]).

[1] National Planning Policy Framework, DCLG, March 2012

[2] Noise Policy Statement for England, DEFRA, March 2010

5.5. Paragraph 2 of the NPPF states that *"planning law requires that applications for planning permission must be determined in accordance with the development plan unless material considerations indicate otherwise."*

5.6. Paragraph 12 of the NPPF states that *"The presumption in favour of sustainable development does not change the statutory status of the development plan as the starting point for decision making. Where a planning application conflicts with an up-to-date development plan (including any neighbourhood plans that form part of the development plan), permission should not usually be granted. Local planning authorities may take decisions that depart from an up-to-date development plan, but only if material considerations in a particular case indicate that the plan should not be followed".*

5.7. Paragraph 117 states that *"Planning policies and decisions should promote an effective use of land in meeting the need for homes and other uses, while safeguarding and improving the environment and ensuring safe and healthy living conditions. Strategic policies should set out a clear strategy for accommodating objectively assessed needs, in a way that makes as much use as possible of previously-developed or 'brownfield' land".*

Tendring District Council

5.8. For similar applications, Tendring District Council has previously confirmed that the Council will work in accordance with the guidance provided in BS 4142:2014 'Methods for rating and assessing industrial and commercial sound'.

BS 4142:2014 'Methods for Rating and Assessing Industrial and Commercial Sound'

5.9. BS 4142:2014 is intended to be used to assess the likely effects of sound on people residing in nearby dwellings. The scope of BS 4142:2014 includes *"sound from fixed plant installations which comprise mechanical and electrical plant and equipment".*

5.10. The procedure contained in BS 4142:2014 is to quantify the *"specific sound level"*, which is the measured or predicted level of sound from the source in question over a one-hour period for the daytime and a 15 minute period for the night-time. Daytime is defined in the standard as 07:00 to 23:00 hours, and night-time as 23:00 to 07:00 hours.

5.11. The specific sound level is converted to a rating level by adding penalties on a sliding scale to account for either potentially tonal or impulsive elements. The standard sets out objective methods for determining the presence of tones or impulsive elements but notes that it is acceptable to subjectively determine these effects.

5.12. The penalty for tonal elements is between 0dB and 6dB, and the standard notes: "Subjectively, this can be converted to a penalty of 2 dB for a tone which is just perceptible at the noise receptor, 4 dB where it is clearly perceptible, and 6 dB where it is highly perceptible."

5.13. The penalty for impulsive elements is between 0dB and 9dB, and the standard notes: "Subjectively, this can be converted to a penalty of 3 dB for impulsivity which is just perceptible at the noise receptor, 6 dB where it is clearly perceptible, and 9 dB where it is highly perceptible."

5.14. The assessment outcome results from a comparison of the rating level with the background sound level. The standard states:

- *Typically, the greater this difference, the greater the magnitude of the impact.*
- *A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context;*
- *A difference of around +5 dB is likely to be an indication of an adverse impact, depending on the context;*
- *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.*

5.15. The standard does state that "*adverse impacts include, but are not limited to, annoyance and sleep disturbance. Not all adverse impacts will lead to complaints and not every complaint is proof of an adverse impact.*"

5.16. The standard goes on to note that: *"Where background sound levels and rating levels are low, absolute levels might be as, or more, relevant than the margin by which the rating level exceeds the background. This is especially true at night."*

5.17. In addition to the margin by which the Rating Level of the specific sound source exceeds the Background Sound Level, the 2014 edition places emphasis upon an appreciation of the context, as follows:

"An effective assessment cannot be conducted without an understanding of the reason(s) for the assessment and the context in which the sound occurs/will occur. When making assessments and arriving at decisions, therefore, it is essential to place the sound in context."

5.18. BS 4142:2014 requires uncertainties in the assessment to be considered, and where the uncertainty is likely to affect the outcome of the assessment, steps should be taken to reduce the uncertainty.

Proposed Criteria

5.19. In order that there is no worse than a "low impact" according to the guidance in BS 4142:2014, noise emissions should be controlled such that the rating level does not exceed the otherwise prevailing background noise level.

Table 4 Plant sound emission limits at residences

Receptor	Period	Cumulative plant rating level, dB(A)
Residential	Daytime (07.00 – 23.00 hours)	43
	Night-time (23.00 – 07.00 hours)	37

6.0 Plant noise impact assessment

6.1. Plant noise level at the most affected noise sensitive receptor has been predicted based on manufacturer's noise data for the proposed equipment. The assessment has taken into consideration distance attenuation and directivity.

6.2. It should be noted that the proposed plant is not anticipated to exhibit any tonal or impulsive characteristics providing it is well maintained. The proposed plant will be inverter driven and, therefore, will gently ramp up and down depending on the demands on the various systems. To be robust, however, a +3dB feature correction as advised in BS 4142:2014 has been applied for the condenser plant for the possible presence of *"...characteristics that are neither tonal nor impulsive, though otherwise are readily distinctive against the residual acoustic environment..."*.

6.3. Table 5 summarises the results of the assessment at the most affected properties. All other nearby receptors benefit from increased distance/screening to the plant such that resulting noise levels will be lower than at the receptors considered. The full set of calculations can be found in **Appendix E**.

Table 5 Assessment of predicted rating levels at the nearest noise sensitive receptors

Receptor	Period	Predicted rating level at receptor, L_{Aeq} (dB)	Criterion (dB)	Difference
R1	Daytime (07.00 - 23.00 hours)	38	43	-5
	Night-time (23.00 - 07.00 hours)	33	37	-4
R2	Daytime (07.00 - 23.00 hours)	39	43	-4
	Night-time (23.00 - 07.00 hours)	34	37	-3
R3	Daytime (07.00 - 23.00 hours)	38	43	-5
	Night-time (23.00 - 07.00 hours)	33	37	-4

6.4. The noise level predictions demonstrate that cumulative noise emissions from the proposed plant will comply with the proposed limits at the nearest noise sensitive properties.

6.5. Where possible uncertainty in the above assessments has been minimised by taking the following steps:

- The meter and calibrator used have a traceable laboratory calibration and the meter was field calibrated before and after the measurements.
- Uncertainty in the calculated impacts has been reduced by the use of a well-established calculation method.
- Care was taken to ensure that the measurement positions were representative of the noise climate outside the nearby residential dwellings and not in positions where higher noise levels were present.

6.6. As BS 4142:2014 advises, the impact must be considered within the context of the site and the surrounding acoustic environment. The following must, therefore, also be taken into consideration when determining the potential impact that may be experienced:

- The assessment was undertaken in a location representative of the nearest residential windows to the proposed new plant. The impact on all other nearby windows will be lower due to screening and distance attenuation.

- It should be noted that the above assessment is based on all plant operating at maximum daytime/night-time duty. Given that the plant will not operate at maximum design duty all of the time (particularly in the evening and night-time when ambient temperatures are lower and demands on the refrigeration system are likely to be reduced) the above assessment is considered to be representative of the worst case.

7.0 Summary

7.1. Noise Solutions Ltd (NSL) has been commissioned by Space Engineering Services to undertake a noise impact assessment of new plant serving an existing Tesco store located along High Street in Manningtree.

7.2. An environmental noise survey has been undertaken to establish the existing prevailing noise levels at locations representative of the noise climate outside the nearest noise sensitive receptors to the proposed plant area.

7.3. In order to sufficiently mitigate against acoustic reflections from the proposed plant, acoustic wall lining will be required on the wall to the west of the unit.

7.4. Plant noise emission levels for the proposed plant (incorporating noise control measures) have been predicted at the most affect noise sensitive receptor locations and assessed taking into consideration the typical requirements of Tendering District Council. Therefore, the plant proposals should not be a reason for refusal of planning permission.

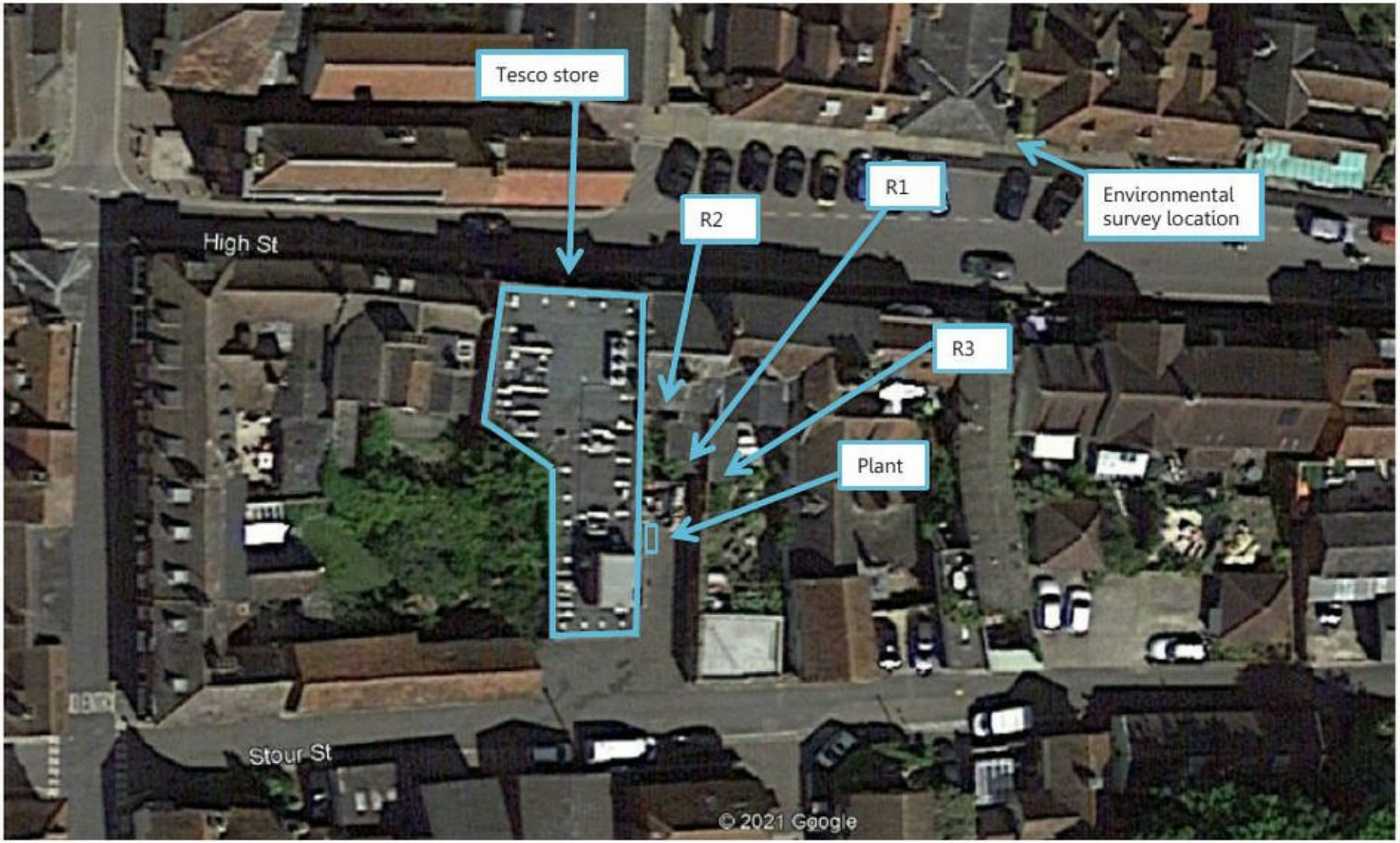
Appendix A Acoustic terminology

Parameter	Description
Ambient Noise Level	The totally encompassing sound in a given situation at a given time, usually composed of a sound from many sources both distant and near ($L_{Aeq,T}$).
Decibel (dB)	A scale for comparing the ratios of two quantities, including sound pressure and sound power. The difference in level between two sounds s1 and s2 is given by 20 $\log_{10}$ (s1/s2). The decibel can also be used to measure absolute quantities by specifying a reference value that fixes one point on the scale. For sound pressure, the reference value is 20μPa. The threshold of normal hearing is in the region of 0 dB and 140 dB is the threshold of pain. A change of 1 dB is only perceptible under controlled conditions.
dB(A), L_{Ax}	Decibels measured on a sound level meter incorporating a frequency weighting (A weighting) which differentiates between sounds of different frequency (pitch) in a similar way to the human ear. Measurements in dB(A) broadly agree with people's assessment of loudness. A change of 3 dB(A) is the minimum perceptible under normal conditions, and a change of 10 dB(A) corresponds roughly to halving or doubling the loudness of a sound. The background noise in a living room may be about 30 dB(A); normal conversation about 60 dB(A) at 1 metre; heavy road traffic about 80 dB(A) at 10 metres; the level near a pneumatic drill about 100 dB(A).
Fast Time Weighting	Setting on sound level meter, denoted by a subscript F, that determines the speed at which the instrument responds to changes in the amplitude of any measured signal. The fast time weighting can lead to higher values than the slow time weighting when rapidly changing signals are measured. The average time constant for the fast response setting is 0.125 (1/8) seconds.
Free-field	Sound pressure level measured outside, far away from reflecting surfaces (except the ground), usually taken to mean at least 3.5 metres
Façade	Sound pressure level measured at a distance of 1 metre in front of a large sound reflecting object such as a building façade.
$L_{Aeq,T}$	A noise level index called the equivalent continuous noise level over the time period T. This is the level of a notional steady sound that would contain the same amount of sound energy as the actual, possibly fluctuating, sound that was recorded.
$L_{max,T}$	A noise level index defined as the maximum noise level recorded during a noise event with a period T. L_{max} is sometimes used for the assessment of occasional loud noises, which may have little effect on the overall L_{eq} noise level but will still affect the noise environment. Unless described otherwise, it is measured using the 'fast' sound level meter response.
$L_{10,T}$	A noise level index. The noise level exceeded for 10% of the time over the period T. L_{10} can be considered to be the "average maximum" noise level. Generally used to describe road traffic noise. $L_{A10,18h}$ is the A –weighted arithmetic average of the 18 hourly $L_{A10,1h}$ values from 06:00-24:00.
$L_{90,T}$	A noise level index. The noise level that is exceeded for 90% of the measurement time interval, T. It gives an indication of the lower levels of fluctuating noise. It is often used to describe the background noise level and can be considered to be the "average minimum" noise level and is a term used to describe the level to which non-specific noise falls during quiet spells, when there is lull in passing traffic for example

Appendix B Plant information and manufacturer published sound pressure levels

Plant Item	Make/Model	Quantity	Sound pressure level (dBA)
Integrated refrigeration unit	Space Engineering/ECO2 MINI P S 2x0	1	34dBA at 10m - Day 29dBA at 10m - Night

Appendix C Aerial photograph site showing areas of interest



Appendix D Environmental sound survey

Details of sound surveys

D.1 Measurements of the existing background sound levels were undertaken between 19:30 hours on Thursday 27th May to 12:00 hours on Friday 28th May 2021.

D.2 The sound level meter was programmed to record the A-weighted L_{eq}, L_{90}, L_{10} and L_{max} noise indices for consecutive 15-minute sample periods for the duration of the noise survey.

Measurement position

D.3 The representative measurement position was located on a lamppost along high street in an area representative of the nearest noise sensitive receptor (location indicated on the site plan in Appendix C).

D.4 In accordance with BS 7445-2:1991 *'Description and measurement of environmental noise – Part 2: Guide to the acquisition of data pertinent to land use'*, the measurements were undertaken under free-field conditions.

Equipment

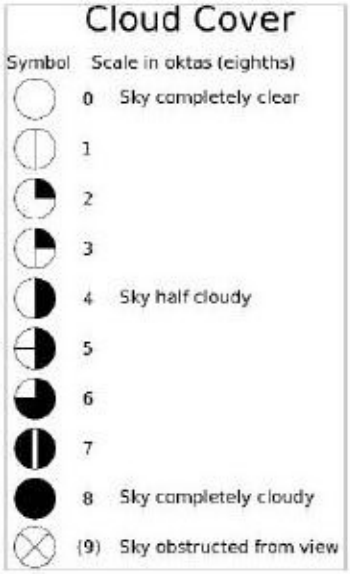
D.5 Details of the equipment used during the survey are provided in the table below. The sound level meter was calibrated before and after the survey; no significant change (+/-0.1 dB) in the calibration level was noted.

Environmental noise survey

Description	Model / serial no.	Calibration date	Calibration certificate no.
Class 1 Sound level meter	Rion NL-52 / 00654035	29/05/2019	UCRT19/1634
Condenser microphone	Rion UC-59 /08290		
Preamplifier	Rion NH-25 / 54080		
Calibrator	Rion NC-74 /34235932	20/08/2020	TCRT20/1469

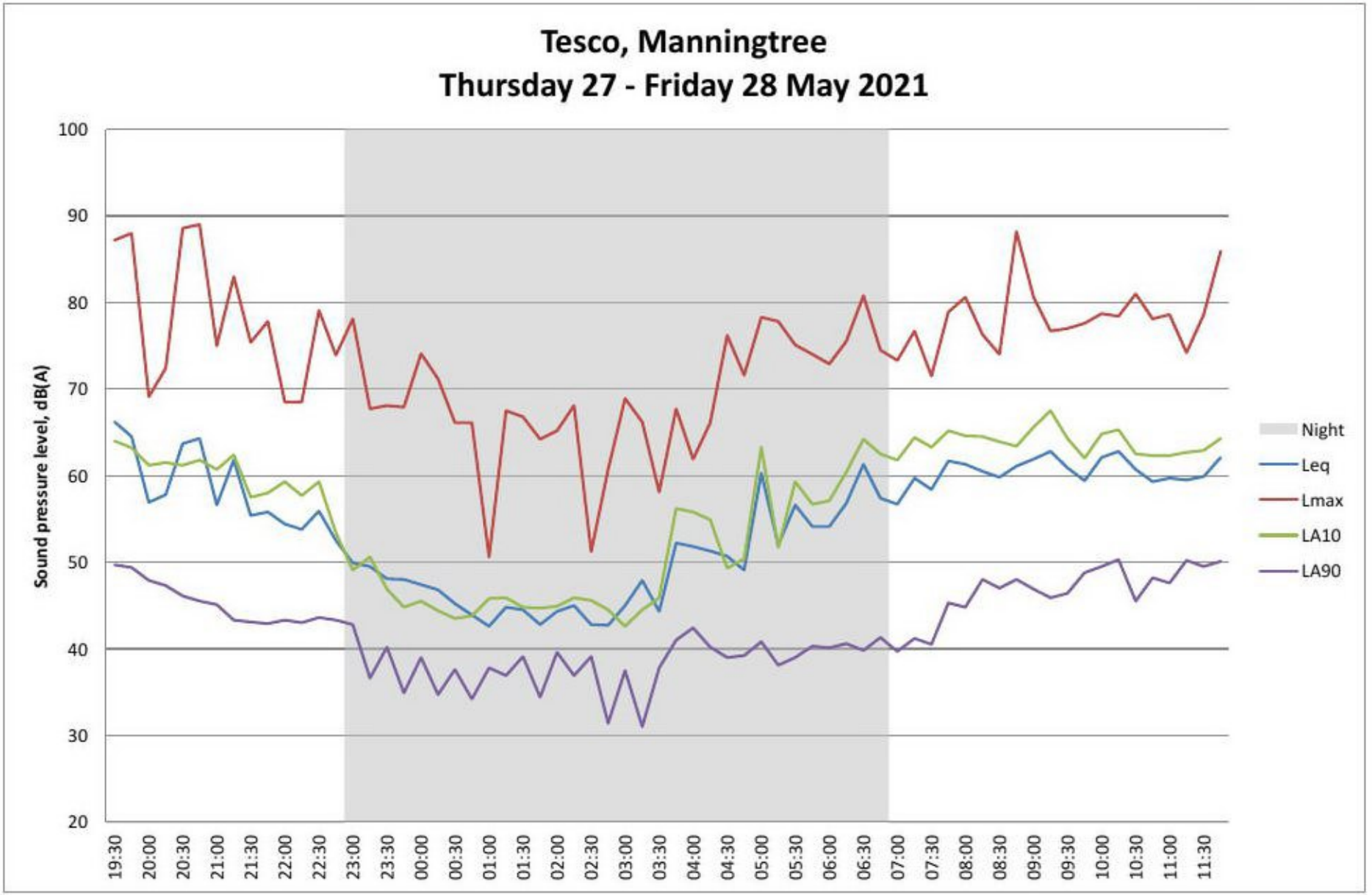
Weather Conditions

D.6 Weather conditions were determined both at the start and on completion of the survey. It is considered that the meteorological conditions were appropriate for environmental noise measurements. The table below presents the weather conditions recorded on site at the beginning and end of the survey.

Weather Conditions				
Measurement Location	**Time/Date**	**Description**	**Beginning of Survey**	**End of Survey**
As indicated on Appendix C	19:30 27/5/21 to 12:00 28/5/21	Temperature (°C)	14	16
		Precipitation:	No	No
		Cloud cover (oktas - see guide)	1	7-8
		Presence of fog/snow/ice	No	No
		Presence of damp roads/wet ground	No	No
		Wind Speed (m/s)	2	1
		Wind Direction	Westerly	Westerly
		Conditions that may cause temperature inversion (i.e. calm nights with no cloud)	No	No

Results

D.7 The results of the environmental survey are considered to be representative of the background sound pressure levels at the façades of the nearest noise sensitive receptors during the quietest times at which the plant will operate. The noise climate during the survey period was dominated by intermittent local road traffic, with occasional noise from birdsong, voices, and a local public house. The results of the survey are presented in a time history graph overleaf.


Tesco, Manningtree
Thursday 27 - Friday 28 May 2021
Sound pressure level, dB(A)
100
90
80
70
60
50
40
30
20
19:30
20:00
20:30
21:00
21:30
22:00
22:30
23:00
23:30
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05:00
05:30
06:00
06:30
07:00
07:30
08:00
08:30
09:00
09:30
10:00
10:30
11:00
11:30
Night
Leq
Lmax
LA10
LA90

Appendix E Noise level predictions

Receptor R1 daytime

Plant	Maximum plant noise level at source		DISTANCE		Directivity (dB)	Screening (dB)	BS 4142:2014 feature correction	Plant rating noise level at receptor (dBA)
	L_p (dBA)	Distance (m)	Distance (m)	Correction (dB)				
Integrated refrigeration unit	34	10	5	6	0	-5	3	38
							Cumulative rating level (day)	**38**

Receptor R1 night-time

Plant	Maximum plant noise level at source		DISTANCE		Directivity (dB)	Screening (dB)	BS 4142:2014 feature correction	Plant rating noise level at receptor (dBA)
	L_p (dBA)	Distance (m)	Distance (m)	Correction (dB)				
Integrated refrigeration unit	29	10	5	6	0	-5	3	33
							Cumulative rating level (night)	**33**

Receptor R2 daytime

Plant	Maximum plant noise level at source		DISTANCE		Directivity (dB)	Screening (dB)	BS 4142:2014 feature correction	Plant rating noise level at receptor (dBA)
	L_p (dBA)	Distance (m)	Distance (m)	Correction (dB)				
Integrated refrigeration unit	34	10	8	2	0	0	3	39
							Cumulative rating level (day)	**39**

Receptor R2 night-time

Plant	Maximum plant noise level at source		DISTANCE		Directivity (dB)	Screening (dB)	BS 4142:2014 feature correction	Plant rating noise level at receptor (dBA)
	L_p (dBA)	Distance (m)	Distance (m)	Correction (dB)				
Integrated refrigeration unit	29	10	8	2	0	0	3	34
							Cumulative rating level (night)	**34**

Receptor R3 daytime

Plant	Maximum plant noise level at source		DISTANCE		Directivity (dB)	Screening (dB)	BS 4142:2014 feature correction	Plant rating noise level at receptor (dBA)
	L_p (dBA)	Distance (m)	Distance (m)	Correction (dB)				
Integrated refrigeration unit	34	10	9	1	0	0	3	38
							Cumulative rating level (day)	**38**

Receptor R3 night-time

Plant	Maximum plant noise level at source		DISTANCE		Directivity (dB)	Screening (dB)	BS 4142:2014 feature correction	Plant rating noise level at receptor (dBA)
	L_p (dBA)	Distance (m)	Distance (m)	Correction (dB)				
Integrated refrigeration unit	29	10	9	1	0	0	3	33
							Cumulative rating level (night)	**33**