

SHARPS REDMORE

ACOUSTIC CONSULTANTS ▪ Established 1990



Report

Tesco Extra store, Portman Road, Reading

Environmental Noise
Assessment to consider
impact of night time
deliveries

Prepared by

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Project No 2120158

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Disclaimer

This report has been prepared with all reasonable skill, care and diligence commensurate with an acoustic consultancy practice under the terms and brief agreed with our client at that time. Sharps Redmore provides no duty or responsibility whatsoever to any third party who relies upon its content, recommendations or conclusions.

1.0 Introduction

- 1.1 SR has been instructed to undertake an assessment to determine the noise impact of night time deliveries at the Tesco store at Portman Road, Reading (a site location plan is presented at Appendix A)
- 1.2 Deliveries to the Tesco store at Portman Road, Reading are controlled by planning condition 32 of planning permission 06/00010/FUL/RE. Planning condition 32 states:

“There shall be no deliveries to the foodstore between 23:00 and 07:00 on any day. Reason: to protect the neighbours of the adjacent properties from any unreasonable disturbance from delivery vehicles and to be in accordance with Policy NE8 (Environmental Pollution) of the Reading Borough Local Plan (1998).”
- 1.3 The Covid 19 pandemic period lead to the Government temporarily lifting all delivery hour curfews imposed on foodstore operators through directed non-enforcement of planning conditions. This change, to improve the availability of goods to customers during periods of unprecedented demand, has resulted in deliveries being received at times that would not normally be permitted. Consequently, this situation has enabled the direct impact of noise from ‘out of hours’ delivery activity to be directly determined.
- 1.4 Since the lifting of delivery curfews in April 2020, Tesco has been taking deliveries outside of those permitted in planning. Tesco keep a rolling record of delivery times at their stores; a record of the arrival times for deliveries to the Tesco store at Portman Road, Reading is presented at Appendix B. The record of deliveries indicates that deliveries have been regularly received during the night time period.
- 1.5 This assessment is presented to determine the noise impact of deliveries made during the night time period to the closest residential properties in Chester Street to the west of the Tesco site (as indicated at Appendix A). The rear gardens of the properties in Chester Street back onto the Tesco site. The service yard is located on the western side of the Tesco site and is fully enclosed.
- 1.6 Appropriate assessment methodology and criteria are detailed in Section 2 of this report, whilst details of a noise survey undertaken at the site are displayed in Section 3.
- 1.7 An assessment of noise from deliveries is presented in section 4.
- 1.8 The assessment conclusions are presented in section 5, and a guide to the acoustic terminology used in this report is shown in Appendix D.

2.0 Assessment methodology and criteria

2.1 In considering the noise impact of deliveries occurring during the night time period, the principle method would be in the context of national planning policy and guidance. However, since the deliveries are already occurring at between 2300 and 0700 hours, the presence or otherwise of noise complaints from residents is also of significance.

2.2 The National Planning Policy Framework (NPPF), February 2019, sets out the Government's planning policies for England and "these policies articulate the Government's vision of sustainable development." In respect of noise, Paragraph 180 of the NPPF states the following:

"Planning policies and decisions should also ensure that new development is appropriate for its location taking into account the likely effects (including cumulative effects) of pollution on health, living conditions and the natural environment, as well as the potential sensitivity of the site or the wider area to impacts that could arise from the development. In doing so they 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 the 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; and*
- c) limit the impact of light pollution from artificial light on local amenity, intrinsically dark landscapes and nature conservation".*

2.3 Guidance on the interpretation of the policy aims contained within the NPPF is contained within National Planning Policy Guidance (NPPG). The NPPG introduces the concept of a noise exposure hierarchy based on likely average response. The guidance contained in the NPPG is summarised in the table below:

TABLE 1: Noise Exposure Hierarchy

Response	Examples of Outcomes	Increasing Effect Level	Action
No Observed Effect Level			
Not noticeable	No Effect	No Observed Effect	No specific measures required
No Observed Adverse Effect Level			
Present and not intrusive	Noise can be heard, but does not cause any change in behaviour, attitude or other physiological response. Can slightly affect the acoustic character of the area but not such that there is a change in the quality of life.	No Observed Adverse Effect	No specific measures required
Lowest Observed Adverse Effect Level			
Present and intrusive	Noise can be heard and causes small changes in behaviour, attitude or other physiological response, 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 small actual or perceived change in the quality of life.	Observed Adverse Effect	Mitigate and reduce to a minimum
Significant Observed Adverse Effect Level			
Present and disruptive	The noise causes a material change in behaviour, attitude or other physiological response, 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 Adverse Effect	Avoid
Present and very disruptive	Extensive and regular changes in behaviour, attitude or other physiological response and/or an inability to mitigate effect of noise leading to psychological stress, e.g. regular sleep deprivation/awakening; loss of appetite, significant, medically definable harm, e.g. auditory and non-auditory	Unacceptable Adverse Effect	Prevent

- 2.4 The NPPF and NPPG reinforce the March 2010 DEFRA publication, “Noise Policy Statement for England” (NPSE), which states three policy aims, as follows:

“Through the effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development:

- *avoid significant adverse impacts on health and quality of life;*
- *mitigate and minimise adverse impacts on health and quality of life; and*
- *where possible, contribute to the improvement of health and quality of life.”*

- 2.5 Together, the first two aims require that no significant adverse impact should occur and that, where a noise level which falls between a level which represents the lowest observable adverse effect and a level which represents a significant observed adverse effect, then according to the explanatory notes in the statement:

“... all reasonable steps should be taken to mitigate and minimise adverse effects on health and quality of life whilst also taking into consideration the guiding principles of sustainable development. This does not mean that such effects cannot occur.”

- 2.6 Taking an overview of national policy aims and guidance it is clear that when considering the impact of noise that the fact can be heard and causes impact, is not reason to refuse an application as consideration should also be given to the significance of the impact and the mitigation measures available.

- 2.7 It is possible to apply objective standards to the assessment of noise and the effect produced by the introduction of a certain noise source may be determined by several methods. However, in this instance for the assessment of deliveries received during the night time period, the WHO Guidelines for Community Noise offer the most relevant assessment criteria.

- 2.8 The most critical factor for deliveries occurring at night is the absolute level of noise in relation to recognised sleep disturbance criteria. During the night time period generally people are inside their properties. Therefore, the outcome of a BS 4142 assessment (which might be typically undertaken to assess noise from delivery activity that may occur during the daytime), which considers the difference between the external background noise level at the receptor and the external rating level of the specific noise source under consideration, does not reflect the true nature of the noise impact at the receptors.

- 2.9 The WHO “Community Noise Guidelines” (CNG) values are appropriate to what are termed “critical health effects”. This means that the limits are at the lowest noise level that would result in any psychological or physiological effect. They are, as defined by NPSE, set at the Lowest Observed Adverse Effect Level (LOAEL), but do

not define the level above which effects are significant (the SOAEL). Compliance with the LOAEL should, therefore, be seen as a robust aim.

- 2.10 The relevant World Health Organisation (CNG) noise values are summarised in the following table:

TABLE 2: WHO CNG values

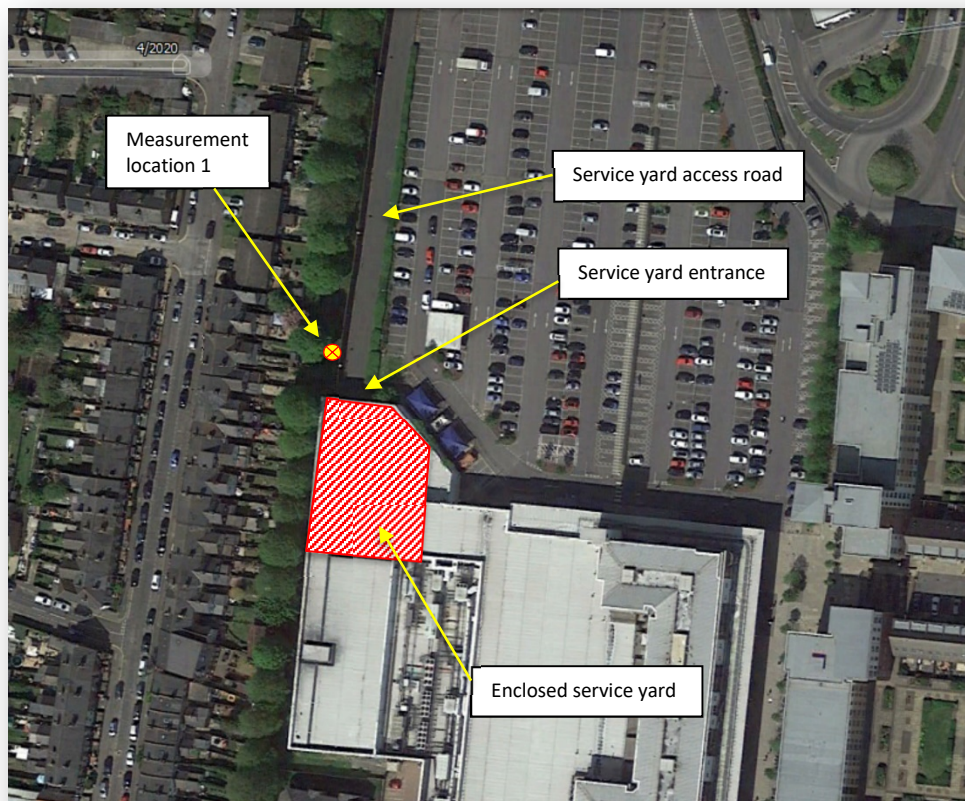
Document	Level	Guidance
World Health Organisation "Community Noise 2000"	$L_{AeqT} = 55 \text{ dB}$	Serious annoyance, daytime and evening. (Continuous noise, outdoor living areas)
	$L_{AeqT} = 50 \text{ dB}$	Moderate annoyance, daytime and evening. (Continuous noise, outdoor living areas).
	$L_{AeqT} = 35 \text{ dB}$	Moderate annoyance, daytime and evening. (Continuous noise, dwellings, indoors)
	$L_{AeqT} = 30 \text{ dB}$	Sleep disturbance, night-time (indoors)
	$L_{Amax} = 60 \text{ dB}$	Sleep disturbance, windows open at night. (Noise peaks outside bedrooms, external level).
	$L_{Amax} = 45 \text{ dB}$	Sleep disturbance at night (Noise peaks inside bedrooms, internal level)

- 2.11 Tesco are not aware of any complaints from residents in respect of night time deliveries at the Portman Road, Reading store.

3.0 Noise survey details

- 3.1 An attended noise survey was carried out during the early hours of Friday 5th March 2021. The purpose of the noise survey was to directly measure the noise from delivery activity at the boundary of the Tesco site and the closest residential properties in Chester Street to the west of the Tesco site. The measured noise levels are then be adjusted for screening and distance attenuation to provide predicted noise levels at a position of the closest properties.
- 3.2 Noise level measurements were taken above the Tesco service yard boundary (acoustic grade, 3.5 metres high) fence with the rear of the two storey properties in Chester Street. Noise measurements were taken with the microphone at 4.2 metres above ground level, in free field conditions. The microphone was approximately 10 metres from the enclosed service yard access roller shutter door.
- 3.3 The delivery activity noise measurement location is indicated at Figure 1 below.

FIGURE 1: Delivery activity noise measurement location

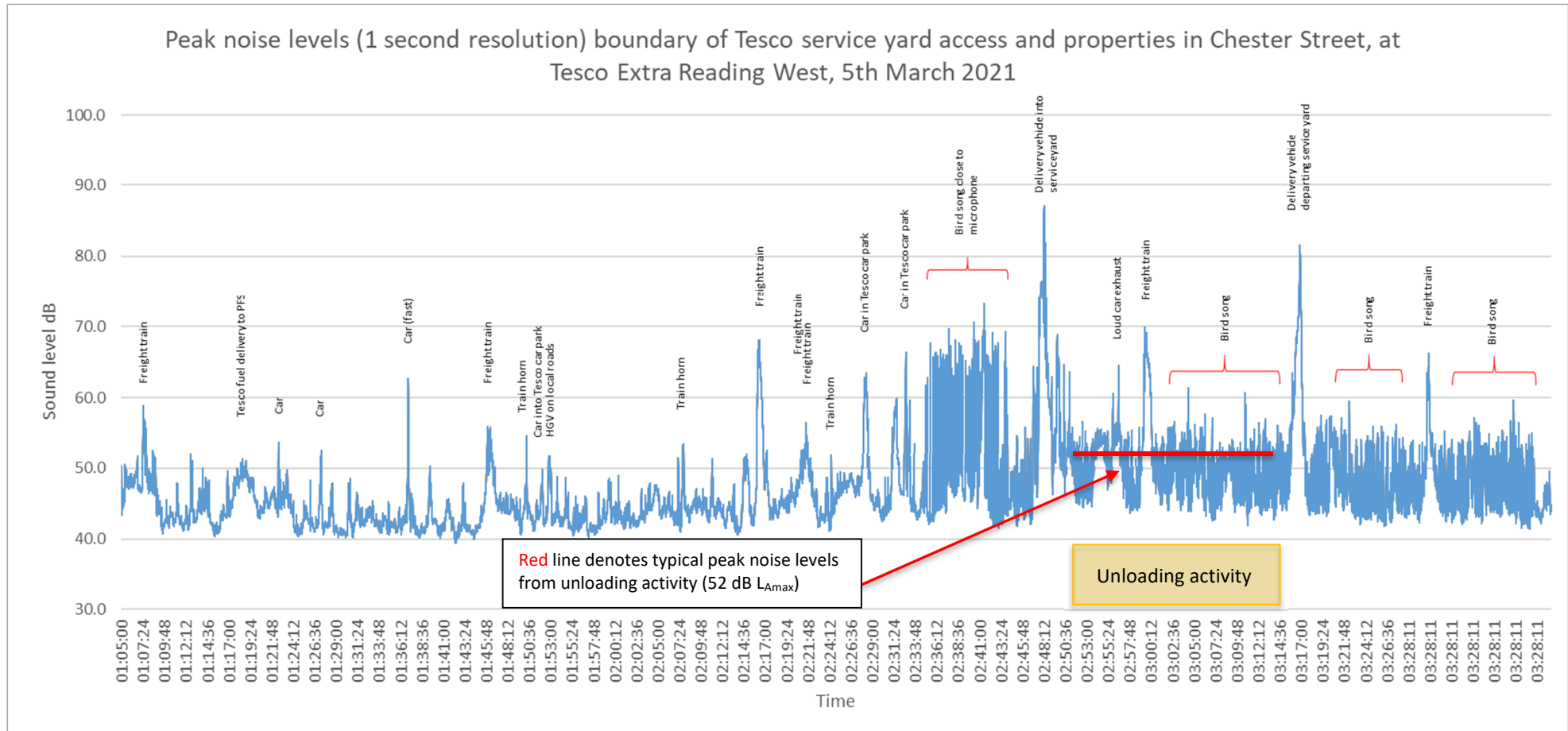


- 3.4 The weather conditions during each survey were dry, overcast and cold (5°C), with very light north easterly winds (<5m/s). Weather conditions are therefore not considered to have affected the measured noise levels during the surveys.
- 3.5 The delivery noise measurements were carried out using a Norsonic 118 sound level meter. The sound level meter was calibrated at the start and end of the

measurements and no variation in level was observed. Measurements were taken over 1 second time intervals to obtain a level recording of delivery activity that could be analysed and annotated to assist identifying the likely magnitude of any noise impact.

3.6 Delivery activity noise levels are summarised in Figure 2 below.

FIGURE 2: Tesco delivery activity, peak noise levels (L_{Amax}) at Tesco Reading West Extra



- 3.7 Typical peak noise levels attributed solely to unloading activity at a position of the sound level meter, outside the enclosed service yard, were around 52 dB L_{Amax} . Subjectively other noise sources, including train activity, distant road traffic and particularly birdsong (indicated by regular rapid changes in peak noise levels on the chart at Figure 2), were the dominant features of the noise climate during the delivery event.
- 3.8 The roller shutter door that covers the entrance to the enclosed service yard was closed during the delivery event. The roller shutter door is made from heavy duty flexible plastic sections which allow for quiet movement on opening and closing. The roller shutter door does not appear to have any specific acoustic properties, although levels of delivery noise breaking out of the entrance seem subjectively low, possibly due to the large area of the enclosed service yard and distance to the unloading bays.
- 3.9 The highest peak noise levels were measured as the delivery vehicle passed within approximately 3 metres of the sound level meter microphone; these were 88 dB L_{Amax} as the delivery vehicle arrived, and 82 dB L_{Amax} as the delivery vehicle departed. These delivery activity source noise levels are used as the basis of the assessment in section 4 of this report.

4.0 Assessment of noise impact from delivery activity

- 4.1 As explained at paragraph 2.8, the most appropriate assessment method in this instance to objectively determine delivery noise impact is the comparison of measured delivery activity noise levels with the WHO peak noise criteria, in relation to sleep disturbance, as opposed to considering delivery noise in accordance with the methodology in BS 4142:2014+A1:2019.
- 4.2 The level recordings at 1 second resolution at Figure 2 indicate that peak noise events from delivery unloading activity are well below 60 dB. However, the measurement location is not directly representative of the noise level that would be experienced at a position of the closest residential property in Chester Street (no. 66). In order to determine predicted peak noise levels at 66 Chester Street, the measured noise levels at Figure 2 would need to be adjusted for distance attenuation, and screening attenuation provided by the 3.5 metre noise barrier which runs alongside the service yard access road ^[1].
- 4.3 The calculations at Appendix C indicate that peak noise levels of 56 dB L_{Amax} could be expected at 66 Chester Street as the delivery vehicle arrives at the store. During unloading activity the resultant peak noise levels are 44 dB L_{Amax} , and as the vehicle departs peak noise levels of 50 dB L_{Amax} are received.
- 4.4 The WHO guidance is that when events regularly (10 to 15 times in a night time period) exceed 60 dB L_{Amax} that the onset of sleep disturbance may occur. This is not to say that individuals will wake when peak noise events exceed 60 dB L_{Amax} (45 dB inside bedrooms), rather than their restorative sleep state may be disturbed, such that periods of deep sleep become lighter. The absence of any noise complaints regarding night time deliveries over the past year is a further strong indication that this activity is not giving rise to disturbance.
- 4.5 In consideration of the measured and predicted noise levels from delivery activity, coupled with an absence of noise complaints regarding night time deliveries (received during the Covid-19 pandemic delivery curfew relaxation), it is considered that noise from night time delivery activity at Tesco Portman Road, Reading, would be indicative of low noise impact.

¹ As explained at Appendix C1, screening attenuation has only been applied to the delivery arrival and departure components of the delivery process.

5.0 Assessment conclusions

- 5.1 Sharps Redmore (SR) has undertaken an environmental noise assessment to determine the likely noise impact of deliveries, occurring during the night time, to the Tesco store at Portman Road, Reading.
- 5.2 Direct noise measurements were taken of a delivery occurring between 0245 and 0330 hours at the store (during the Covid-19 period during which the Government relaxed delivery curfews to stores nationwide), to help to establish the noise impact at the closest residential properties.
- 5.3 In consideration of the measured and predicted noise levels from delivery activity, coupled with an absence of noise complaints regarding night time deliveries, it is considered that noise from deliveries to the fully enclosed service yard at Tesco Portman Road, Reading would be indicative of low noise impact.
- 5.4 In the context of nationally recognised standards and planning guidance, this assessment has objectively demonstrated that noise levels from night time deliveries would not give rise to significant adverse impact and hence would comply with the requirements of the NPPF.

APPENDIX A

SITE PLAN

Appendix A: Site plan, Tesco, Portman Road, Reading



APPENDIX B

TESCO PORTMAN ROAD, READING, DELIVERY ARRIVAL TIMES FEBRUARY 2021 TO APRIL 2021

All Visits 1st February 2021 00:00 To 3rd April 2021 23:59

4000 Delivery On Time Report executed: 26/04/2021 08:53 By ReadingInt

For Depots: Didcot DC; For Stores: Reading Battle Hospital Extra.Com

Store Name	Actual Arrival Time
Reading Battle Hospital Extra.Com	01/02/2021 01:53:32
Reading Battle Hospital Extra.Com	01/02/2021 14:27:13
Reading Battle Hospital Extra.Com	01/02/2021 20:03:34
Reading Battle Hospital Extra.Com	02/02/2021 01:59:56
Reading Battle Hospital Extra.Com	02/02/2021 12:13:21
Reading Battle Hospital Extra.Com	02/02/2021 16:59:06
Reading Battle Hospital Extra.Com	02/02/2021 21:42:41
Reading Battle Hospital Extra.Com	03/02/2021 01:35:07
Reading Battle Hospital Extra.Com	03/02/2021 20:05:23
Reading Battle Hospital Extra.Com	03/02/2021 21:35:26
Reading Battle Hospital Extra.Com	04/02/2021 01:13:55
Reading Battle Hospital Extra.Com	04/02/2021 15:31:42
Reading Battle Hospital Extra.Com	04/02/2021 17:26:58
Reading Battle Hospital Extra.Com	04/02/2021 20:25:15
Reading Battle Hospital Extra.Com	05/02/2021 01:51:11
Reading Battle Hospital Extra.Com	05/02/2021 16:15:58
Reading Battle Hospital Extra.Com	05/02/2021 19:01:02
Reading Battle Hospital Extra.Com	05/02/2021 20:42:03
Reading Battle Hospital Extra.Com	06/02/2021 02:26:54
Reading Battle Hospital Extra.Com	06/02/2021 15:59:28
Reading Battle Hospital Extra.Com	06/02/2021 17:03:24
Reading Battle Hospital Extra.Com	07/02/2021 00:02:09
Reading Battle Hospital Extra.Com	07/02/2021 12:20:22
Reading Battle Hospital Extra.Com	07/02/2021 16:11:05
Reading Battle Hospital Extra.Com	08/02/2021 00:22:10
Reading Battle Hospital Extra.Com	08/02/2021 13:44:33
Reading Battle Hospital Extra.Com	08/02/2021 09:09:27
Reading Battle Hospital Extra.Com	08/02/2021 18:32:49
Reading Battle Hospital Extra.Com	09/02/2021 02:33:30
Reading Battle Hospital Extra.Com	09/02/2021 09:00:13
Reading Battle Hospital Extra.Com	09/02/2021 14:31:56
Reading Battle Hospital Extra.Com	09/02/2021 18:10:16
Reading Battle Hospital Extra.Com	10/02/2021 02:33:29
Reading Battle Hospital Extra.Com	10/02/2021 06:37:34
Reading Battle Hospital Extra.Com	10/02/2021 15:27:24
Reading Battle Hospital Extra.Com	10/02/2021 20:53:57
Reading Battle Hospital Extra.Com	11/02/2021 04:25:49
Reading Battle Hospital Extra.Com	11/02/2021 15:26:33
Reading Battle Hospital Extra.Com	11/02/2021 17:27:09
Reading Battle Hospital Extra.Com	11/02/2021 21:16:20
Reading Battle Hospital Extra.Com	12/02/2021 02:35:37
Reading Battle Hospital Extra.Com	12/02/2021 13:54:55
Reading Battle Hospital Extra.Com	12/02/2021 21:54:02
Reading Battle Hospital Extra.Com	12/02/2021 20:45:50
Reading Battle Hospital Extra.Com	13/02/2021 03:33:44
Reading Battle Hospital Extra.Com	13/02/2021 18:38:30
Reading Battle Hospital Extra.Com	13/02/2021 13:48:26
Reading Battle Hospital Extra.Com	14/02/2021 02:20:09
Reading Battle Hospital Extra.Com	14/02/2021 13:53:25
Reading Battle Hospital Extra.Com	14/02/2021 20:03:59
Reading Battle Hospital Extra.Com	15/02/2021 03:23:06
Reading Battle Hospital Extra.Com	15/02/2021 19:23:20
Reading Battle Hospital Extra.Com	15/02/2021 19:21:45
Reading Battle Hospital Extra.Com	16/02/2021 03:10:49
Reading Battle Hospital Extra.Com	16/02/2021 16:56:48
Reading Battle Hospital Extra.Com	16/02/2021 18:51:43
Reading Battle Hospital Extra.Com	17/02/2021 02:18:56
Reading Battle Hospital Extra.Com	17/02/2021 13:39:47
Reading Battle Hospital Extra.Com	17/02/2021 20:30:57
Reading Battle Hospital Extra.Com	18/02/2021 01:07:00
Reading Battle Hospital Extra.Com	18/02/2021 14:34:28
Reading Battle Hospital Extra.Com	18/02/2021 18:14:01
Reading Battle Hospital Extra.Com	18/02/2021 21:00:26
Reading Battle Hospital Extra.Com	19/02/2021 01:36:56
Reading Battle Hospital Extra.Com	19/02/2021 13:54:12
Reading Battle Hospital Extra.Com	19/02/2021 19:19:58
Reading Battle Hospital Extra.Com	19/02/2021 21:29:15
Reading Battle Hospital Extra.Com	20/02/2021 01:50:20
Reading Battle Hospital Extra.Com	20/02/2021 15:24:25
Reading Battle Hospital Extra.Com	20/02/2021 18:46:06
Reading Battle Hospital Extra.Com	21/02/2021 01:33:56
Reading Battle Hospital Extra.Com	21/02/2021 17:04:20
Reading Battle Hospital Extra.Com	21/02/2021 09:52:16
Reading Battle Hospital Extra.Com	21/02/2021 19:04:41

Store Name	Actual Arrival Time
Reading Battle Hospital Extra.Com	22/02/2021 03:20:24
Reading Battle Hospital Extra.Com	22/02/2021 14:56:25
Reading Battle Hospital Extra.Com	22/02/2021 09:21:40
Reading Battle Hospital Extra.Com	22/02/2021 16:32:59
Reading Battle Hospital Extra.Com	23/02/2021 01:38:08
Reading Battle Hospital Extra.Com	23/02/2021 18:58:45
Reading Battle Hospital Extra.Com	23/02/2021 19:14:12
Reading Battle Hospital Extra.Com	24/02/2021 02:04:41
Reading Battle Hospital Extra.Com	24/02/2021 16:28:24
Reading Battle Hospital Extra.Com	24/02/2021 20:02:50
Reading Battle Hospital Extra.Com	25/02/2021 03:15:06
Reading Battle Hospital Extra.Com	25/02/2021 16:13:55
Reading Battle Hospital Extra.Com	25/02/2021 13:25:44
Reading Battle Hospital Extra.Com	25/02/2021 21:24:18
Reading Battle Hospital Extra.Com	26/02/2021 03:52:50
Reading Battle Hospital Extra.Com	26/02/2021 16:46:43
Reading Battle Hospital Extra.Com	26/02/2021 19:51:11
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Reading Battle Hospital Extra.Com	27/02/2021 14:39:51
Reading Battle Hospital Extra.Com	27/02/2021 20:03:00
Reading Battle Hospital Extra.Com	28/02/2021 03:08:28
Reading Battle Hospital Extra.Com	28/02/2021 14:08:06
Reading Battle Hospital Extra.Com	28/02/2021 17:02:07
Reading Battle Hospital Extra.Com	01/03/2021 02:31:38
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Reading Battle Hospital Extra.Com	28/03/2021 19:29:53
Reading Battle Hospital Extra.Com	28/03/2021 18:18:42
Reading Battle Hospital Extra.Com	29/03/2021 03:22:09
Reading Battle Hospital Extra.Com	29/03/2021 16:37:29
Reading Battle Hospital Extra.Com	29/03/2021 19:38:41
Reading Battle Hospital Extra.Com	29/03/2021 20:51:54
Reading Battle Hospital Extra.Com	30/03/2021 02:20:34
Reading Battle Hospital Extra.Com	30/03/2021 12:45:35
Reading Battle Hospital Extra.Com	30/03/2021 17:18:10
Reading Battle Hospital Extra.Com	30/03/2021 21:26:56
Reading Battle Hospital Extra.Com	31/03/2021 03:24:59
Reading Battle Hospital Extra.Com	31/03/2021 14:30:57
Reading Battle Hospital Extra.Com	31/03/2021 18:57:05
Reading Battle Hospital Extra.Com	31/03/2021 20:56:26
Reading Battle Hospital Extra.Com	01/04/2021 02:05:40
Reading Battle Hospital Extra.Com	01/04/2021 10:13:22
Reading Battle Hospital Extra.Com	01/04/2021 18:22:05
Reading Battle Hospital Extra.Com	01/04/2021 22:32:35
Reading Battle Hospital Extra.Com	02/04/2021 01:50:52
Reading Battle Hospital Extra.Com	02/04/2021 12:44:41
Reading Battle Hospital Extra.Com	02/04/2021 10:30:35
Reading Battle Hospital Extra.Com	02/04/2021 18:57:32
Reading Battle Hospital Extra.Com	02/04/2021 19:51:34
Reading Battle Hospital Extra.Com	03/04/2021 00:30:04
Reading Battle Hospital Extra.Com	03/04/2021 15:46:28

APPENDIX C

DELIVERY NOISE PREDICTIONS

APPENDIX C1

Assessment project: Tesco Reading West Extra	Delivery component		
	Arrival	Unloading	Departure
Delivery noise activity - predicted peak noise levels (L_{Amax})			
Closest residential property address:	66 Chester Street		
Source noise level at 10 metres L_{Amax}	78	52	72
Distance between noise source and residential property in metres	26	26	26
Screening attenuation dB	14	0	14
Distance attenuation correction - dB	-8.3	-8.3	-8.3
Peak noise level L_{Amax}	56 dB	44 dB	50 dB

Notes:

1. The source noise levels used in this assessment are based on the measured levels of the components of the delivery process at Tesco Reading West Extra (normalised to 10 metres)
2. Screening has not been taken to the unloading source since the top of the entrance to the service yard is above the height of the acoustic fence.

Appendix C2.1

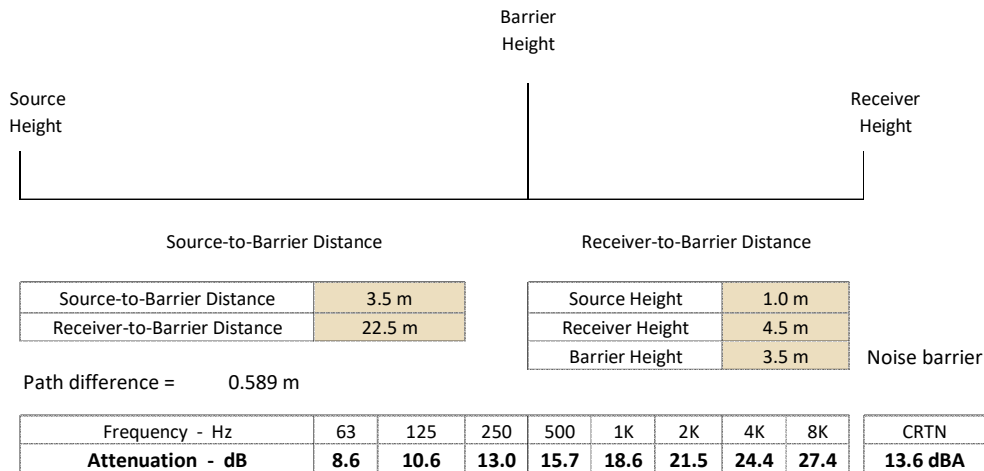
BASIC BARRIER ATTENUATION

(based on Maekawa or CRTN)

Receptor: **66 Chester Street**
Project: **Tesco Reading West Extra**

Source: **Delivery activity: arrival and departure**

Receiver: **66 Chester Street**



APPENDIX D

ACOUSTIC TERMINOLOGY

Acoustic Terminology

- D1 Noise, defined as unwanted sound, is measured in units of decibels, dB. The range of audible sounds is from 0 dB to 140 dB. Two equal sources of sound, if added together will result in an increase in level of 3 dB, i.e. $50 \text{ dB} + 50 \text{ dB} = 53 \text{ dB}$. Increases in continuous sound are perceived in the following manner:

1 dB increase - barely perceptible.

3 dB increase - just noticeable.

10 dB increase - perceived as twice as loud.

- D2 Frequency (or pitch) of sound is measured in units of Hertz. 1 Hertz (Hz) = 1 cycle/second. The range of frequencies audible to the human ear is around 20Hz to 18000Hz (or 18kHz). The capability of a person to hear higher frequencies will reduce with age. The ear is more sensitive to medium frequency than high or low frequencies.

- D3 To take account of the varying sensitivity of people to different frequencies a weighting scale has been universally adopted called "A-weighting". The measuring equipment has the ability automatically to weight (or filter) a sound to this A scale so that the sound level it measures best correlates to the subjective response of a person. The unit of measurement thus becomes dBA (decibel, A-weighted).

- D4 The second important characteristic of sound is amplitude or level. Two units are used to express level, a) sound power level - L_w and b) sound pressure level - L_p . Sound power level is an inherent property of a source whilst sound pressure level is dependent on surroundings/distance/directivity, etc. The sound level that is measured on a meter is the sound pressure level, L_p .

- D5 External sound levels are rarely steady but rise or fall in response to the activity in the area - cars, voices, planes, birdsong, etc. A person's subjective response to different noises has been found to vary dependent on the type and temporal distribution of a particular type of noise. A set of statistical indices have been developed for the subjective response to these different noise sources.

- D6 The main noise indices in use in the UK are:

L_{A90} : The sound level (in dBA) exceeded for 90% of the time. This level gives an indication of the sound level during the quieter periods of time in any given sample. It is used to describe the "background sound level" of an area.

L_{Aeq} : The equivalent continuous sound level in dBA. This unit may be described as "the notional steady noise level that would provide, over a period, the same energy as the intermittent noise". In other words, the energy average level. This unit is now used to measure a wide variety of different types of noise of an industrial or commercial nature, as well as aircraft and trains.

L_{A10} : The sound level (in dBA) exceeded for 10% of the time. This level gives an indication of the sound level during the noisier periods of time in any given

sample. It has been used over many years to measure and assess road traffic noise.

L_{AMAX}: The maximum level of sound measured in any given period. This unit is used to measure and assess transient noises, i.e. gun shots, individual vehicles, etc.

- D7 The sound energy of a transient event may be described by a term SEL - Sound Exposure Level. This is the L_{Aeq} level normalised to one second. That is the constant level in dBA which lasting for one second has the same amount of acoustic energy as a given A weighted noise event lasting for a period of time. The use of this unit allows the prediction of the L_{Aeq} level over any period and for any number of events using the equation;

$$L_{AeqT} = SEL + 10 \log n - 10 \log T \text{ dB.}$$

Where

n = Number of events in time period T.

T = Total sample period in seconds.

- D8 In the open, known as free field, sound attenuates at a rate of 6 dB per each doubling of distance. This is known as geometric spreading or sometimes referred to as the Inverse Square Law. As noise is measured on a Logarithmic scale, this attenuation in distance = 20 Log (ratio of distances), e.g. for a noise level of 60 dB at ten metres, the corresponding level at 160 metres is:

$$60 - 20 \log \frac{160}{10} = 60 - 24 = 36 \text{ dB.}$$