The Christie,
Car Park Development

ENVIRONMENTAL NOISE IMPACT
ASSESSMENT REPORT 17433/NIA1

For :

The Christie Hospital NHS Foundation Trust
Wilmslow Road
Manchester
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This report has been prepared by Hann Tucker Associates Limited (HTA) with all reasonable skill, care and diligence in accordance with generally accepted acoustic consultancy principles and the purposes and terms agreed between HTA and our Client. Any information provided by third parties and referred to herein may not have been checked or verified by HTA unless expressly stated otherwise. This document contains confidential and commercially sensitive information and shall not be disclosed to third parties. Any third party relies upon this document at their own risk.

1.0 INTRODUCTION

This report presents an environmental noise impact assessment for a proposed multi-storey car park development on land off Frith Road in South Manchester to serve the Christie Hospital.

Our assessment considers the potential noise impact of vehicular movements and fixed plant items to nearby residential properties.

This report presents our findings.

2.0 OBJECTIVES

2.1 To establish, by means of unmanned continuous noise monitoring, the prevailing A-weighted (dBA) and octave band L_{eq}, L_{90} and L_{max} sound levels representative of those at the nearest noise sensitive residential properties.

2.2 To undertake sample noise level measurements of typical vehicular movements at an existing multi-storey car park to use as source noise level data for a vehicle noise impact assessment.

2.3 Based on the results of the baseline environmental noise survey, to propose plant noise emission limits in accordance with Local Authority requirements.

2.4 Based on predicted traffic flow data provided by the traffic consultants and the results of the aforementioned noise surveys, to undertake a detailed noise impact assessment of car park operational activities on nearby noise sensitive residential properties and comment upon the acceptability.

2.5 To discuss possible noise mitigation measures, if required.

3.0 ACOUSTIC STANDARDS & CRITERIA

3.1 PPG24 Planning Policy Guidance

PPG24 outlines the considerations to be taken into account in determining planning applications both for noise-sensitive developments and for those activities which will generate noise.

The document advised the use of various documents and standards in order to assess the potential impact of a noise emitting development on noise sensitive properties depending on the nature of the noise source.

In relation to industrial noise (such as plant or other fixed sources), PPG24 advises that “the likelihood of complaints about noise from industrial development can be assessed, where the Standard is appropriate, using guidance in BS4142”.

3.2 Plant Noise Emissions (BS 4142, Local Authority Requirements)

BS 4142 provides an assessment method for determining the likelihood of complaints from plant noise based on the difference between the noise from the new development and the existing background noise. The noise from the new development is expressed in terms of a rating level, calculated from the specific noise source plus any 'acoustic feature corrections', and is given as an $L_{Aeq,T}$ noise level.

The 'acoustic feature correction' (+5dB) is applied in instances where the source emits noise of a tonal, impulsive or intermittent nature.

T is the assessment time interval, which is 1-hour for operations during daytime hours (07:00-23:00 hours) and 5-minutes for operations during night-time hours (23:00-07:00 hours).

The existing background noise level is expressed in terms of an $L_{A90,T}$ noise level. The standard states that the greater the difference the greater the likelihood of complaints.

- A difference of +10dB or more indicates that complaints are likely.
- A difference of +5dB is of marginal significance.
- If the rating level is more than 10dB below the background then this is a positive indication that complaints are unlikely.

However, we understand Manchester City Council employ the following criterion relating to noise emissions from new items of plant.

> *"Externally mounted ancillary plant, equipment and servicing shall be acoustically treated in accordance with a scheme designed so as to achieve a noise level of 5dB below the existing background (L_{A90}) in each octave band at the nearest noise sensitive location."*

We understand "noise sensitive locations" to comprise buildings used for residential and commercial purposes, schools, hospitals, places of worship etc.

3.3 Noise from Vehicular Movements (Subjective Human Response)

BS 4142 is not considered appropriate for assessing noise emissions from non-fixed sources. As such, Hann Tucker Associates would usually assess the noise impact of vehicular movements against the following table, which relates the resultant change in ambient noise level at a given receptor to the subject impression and human response.

Change in Sound Level dB(A)	Interpretation	
	Subjective Impression	Human Response to change in noise level
< 2	Imperceptible change in loudness	Negligible
3 to 5	Perceptible change in loudness	Noticeable
6 to 10	Up to a doubling or halving of loudness	Significant
11 to 15	More than a doubling or halving of loudness	Substantial
16 to 20	Up to a quadrupling or quartering of loudness	Substantial
21 or more	More than a quadrupling or quartering of loudness	Very Substantial

Unless stated, the noise impact can be calculated outside a residential property, although any subjective impacts ("Insignificant", "Noticeable", etc.) apply internally and externally since the sound insulation performance of residential façades are constant.

The noise impact of vehicular movements can be assessed using the time intervals of BS4142, i.e. 1 hour for daytime activities, and 5 minutes for night-time activities.

4.0 DRAWINGS

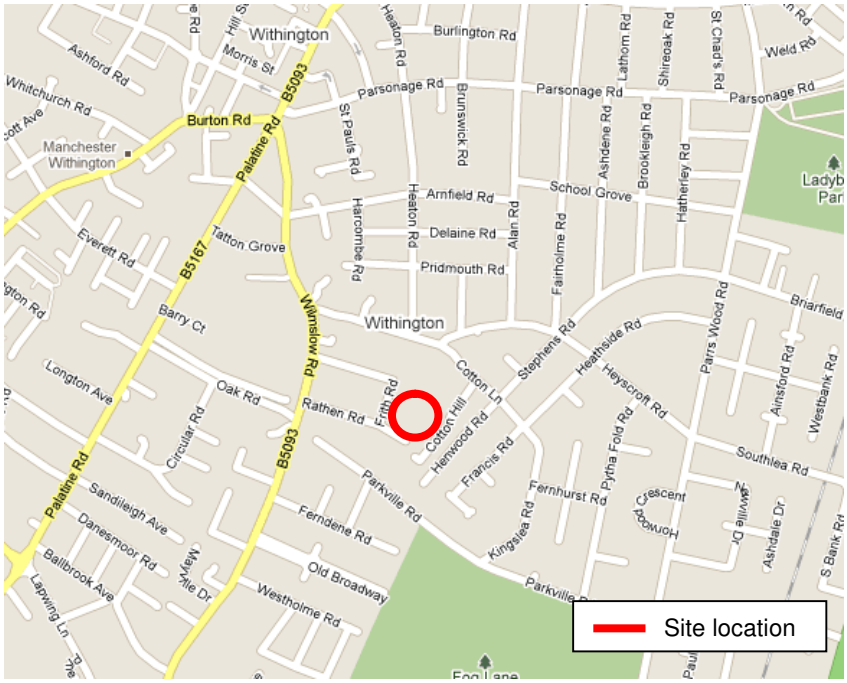
The following drawings by Wilson Mason Architects have been used in our assessments.

Reference	Description	Date
5443L(00)01	Site Plan	10.06.11
5443L(1-)01	Basement Plan	10.06.11
5443L(1-)02	Ground Floor Plan	10.06.11
5443L(1-)03	First Floor Plan	10.06.11
5443L(1-)04	Second Floor Plan	10.06.11
5443L(1-)05	Third Floor Plan	10.06.11
5443L(1-)06	Fourth Floor Plan	10.06.11
5443L(2-)01	Sections	13.06.11
5443L(2-)02	Sections	13.06.11
-	Elevations	-

5.0 SITE DESCRIPTION

5.1 Location

The site is located off Frith Road in Withington, South Manchester. The approximate site location is indicated below.



Location map (maps.google.co.uk)

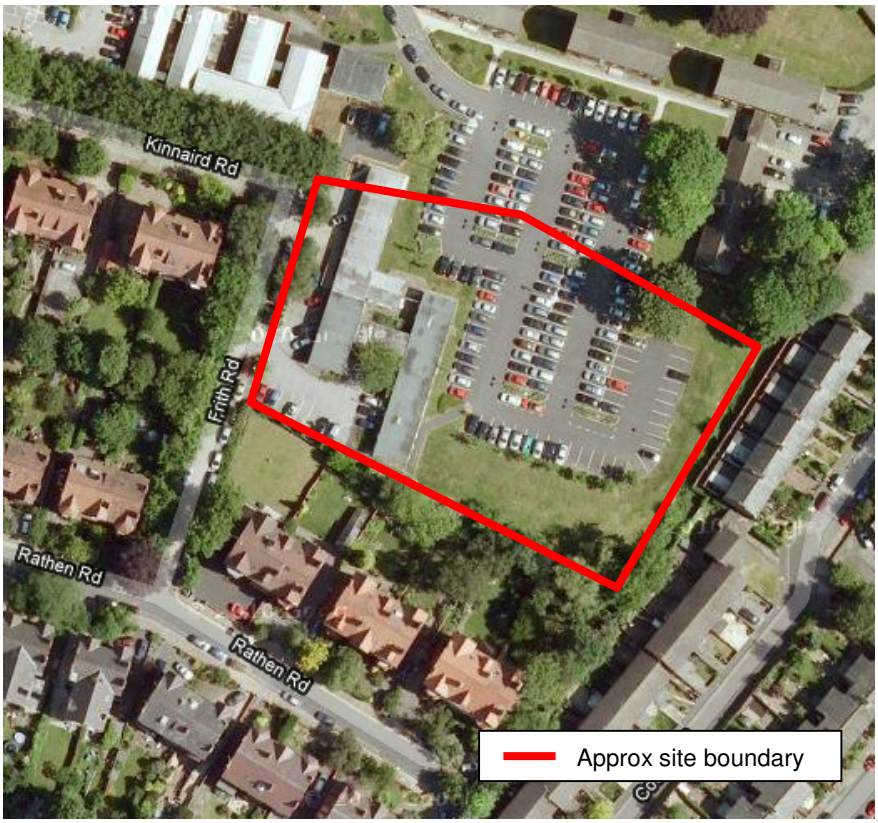
5.2 Description

The site is currently occupied by a single storey office block and associated ground-level open-air car park, which will be demolished as part of the works.

The site is bounded by residential properties immediately to the South and East with residential properties to the West over Frith Road. Land to the North is owned by The Christie and has the potential for future development.

Frith Road is considered a minor residential access road and provides no major thoroughfare. The road is however connected to Kinnaird Road which is currently used for on-street parking by visitors and staff of The Christie Hospital. Nevertheless, vehicular movements along this road are relatively sparse.

An indicative site plan is provided below.



Proposed Site plan (maps.google.co.uk)

6.0 ACOUSTIC TERMINOLOGY

For an explanation of the acoustic terminology used in this report please refer to Appendix A enclosed.

7.0 BASELINE ENVIRONMENTAL NOISE SURVEY

7.1 Procedure

Fully automated environmental noise monitoring was undertaken from approximately 10:00 hours on Thursday 23 June 2011 to 14:00 hours on Friday 24 June 2011. The purpose of the survey was to establish environmental noise levels representative of those at the adjacent residential properties.

Due to the nature of the survey, i.e. unmanned, it is not possible to accurately comment on weather conditions throughout the survey period. However, at the beginning and end of the survey, wind conditions were calm and the sky was generally overcast. Based on local weather reports, we understand there were no periods of rainfall. These conditions were considered suitable for obtaining representative measurement results.

Measurements were taken of the A-weighted (dBA) and octave band L_{90}, L_{eq} and L_{max} sound pressure levels over continuous 15 minute intervals.

7.2 Measurement Position

The sound level measurements were undertaken at a single position located within the existing car park approximately 50 metres from the boundary of the dwellings to the South and 45 metres from the boundary of the dwellings to the East, as indicated below. The microphone was positioned approximately 2 metres from the ground in free-field conditions.



Site plan showing approximate measurement position (maps.google.co.uk)

7.3 Instrumentation

The instrumentation used during the survey is presented in the Table below:

Description	Manufacturer	Type	Serial Number	Latest Lab Calibration
Type 1 Precision Sound Level Meter	Larson Davis	824	3701	10/03/11
Type 1 Calibrator	Larson Davis	CAL200	3083	31/01/11

The sound level meter was mounted on a tripod and fitted with a Larson Davis microphone windshield. The equipment was calibrated prior to and on completion of the survey. No significant deviations occurred (no more than 0.1dB).

7.4 Results

The results have been plotted on Time History Graphs 17433/TH1 to 17433/TH2 enclosed presenting the hourly A-weighted (dBA) L_{eq}, L_{90} and L_{max} levels throughout the duration of the survey.

For the purpose of proposing plant noise emission limits in accordance with Section 3.2, we present the lowest measured octave band background L_{90} noise levels below.

Period	Lowest Background L_{90} Noise Level (dB) at Octave Band Centre Frequency (Hz)								dBA
	63	125	250	500	1k	2k	4k	8k	
Daytime	48	43	39	40	41	30	20	18	44
Night-time	44	40	36	38	37	29	20	19	41

7.5 Discussion of Noise Climate

Due to the nature of the survey, i.e. unmanned, it is not possible to accurately comment on the noise climate throughout the duration of the survey. However, at the beginning and end of the survey period, the dominant source of noise was noted to be distant road traffic from the surrounding road network.

8.0 PLANT NOISE EMISSION LIMITS

Based on the requirements set out in Section 3.2 and the lowest background L_{90} noise levels recorded during our environmental noise survey, we propose the following plant noise emission limits to be achieved at 1 metre from the nearest noise sensitive windows with all building services plant operational.

Period	Plant Noise Emission Limit (dB) at Octave Band Centre Frequency (Hz)								dBA
	63	125	250	500	1k	2k	4k	8k	
Daytime	43	38	34	35	36	25	15	13	39
Night-time	39	35	31	33	32	24	15	14	36

N.B. Daytime should constitute the hours of 07:00 to 23:00 and night-time 23:00 to 07:00.

The above limits are subject to the final approval of Manchester City Council.

Plant noise emissions should be assessed in accordance with BS 4142 with the resultant rating levels compared against the above criteria.

We understand the car park will be naturally ventilated without any emergency plant, although some minor cooling plant may be incorporated into the scheme. All plant items must be designed to satisfy the above limits.

9.0 VEHICLE NOISE IMPACT ASSESSMENT

9.1 Source Noise Levels

In order to assess operational noise from cars using the proposed car park, Hann Tucker Associate undertook a series of sound level measurements at an existing multi-storey car park.

The sound level measurements were undertaken on Monday 27 June 2011 at the Great Northern multi-storey car park in Manchester City Centre. The survey was undertaken on the ground floor where the car park was partially enclosed with a series of large openings within the facades, similar to the arrangement proposed at The Christie. A Brüel & Kjær 2250 Precision 1 sound level meter was used for the measurements. Road surfaces were dry throughout.

The following measurements were taken using a typical modern car (Ford Focus 1.6l petrol 2008 model):-

- Car passby on a quiet road (free-field) with the car travelling at ~20mph to simulate a car arriving/leaving the proposed car park;
- Car passby in the covered car park with the car travelling at ~10mph to simulate a car finding a parking space or leaving a parking space;
- A car manoeuvring (reversing) into a parking space;
- A car manoeuvring out of a parking space.

Measurements of activities in the covered car park were recorded adjacent to large openings in the car park façade so that corrections for internal-to-external are accounted for within the source levels.

The results of our measurements, corrected to a standard distance of 10 metres, are summarised below:-

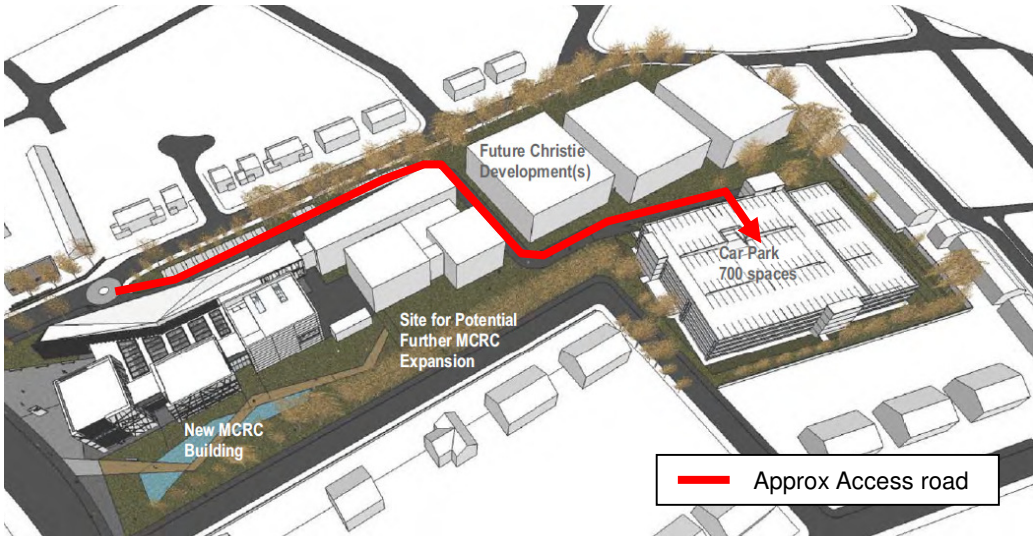
Event	Duration (secs)	A-weighted Sound Level (dBA) at 10m	
		L_{eq}	L_{max}
Free-field car passby ~20mph	4	61	63
Car passby (in covered car park) ~10mph	5	59	63
Car manoeuvring into a space (in covered car park)	20	55	62
Car manoeuvring out of a space (in covered car park)	14	59	67

9.2 Traffic Flow Data

The following table presents the predicted traffic data for vehicles using the car park over a typical 24-hour weekday period, as provided by the traffic consultants Aecom. NB We understand the car park is unlikely to be used on weekends.

Time Period	Vehicles In Per Hour	Vehicles Out Per Hour
07:00-08:00	258	2
08:00-09:00	258	4
09:00-10:00	129	4
10:00-11:00	43	9
11:00-12:00	26	9
12:00-13:00	17	17
13:00-14:00	13	17
14:00-15:00	13	43
15:00-16:00	9	86
16:00-17:00	9	172
17:00-18:00	9	258
18:00-19:00	4	129
19:00-20:00	2	43
20:00-21:00	2	43
21:00-22:00	4	13
22:00-23:00	4	0
23:00-00:00	0	0
00:00-01:00	0	0
01:00-02:00	0	0
02:00-03:00	0	0
03:00-04:00	0	0
04:00-05:00	0	0
05:00-06:00	0	9 (assumed 5 in worst case 5-min period)
06:00-07:00	60 (assumed 10 in worst case 5-min period)	2 (assumed 2 in worst case 5-min period)

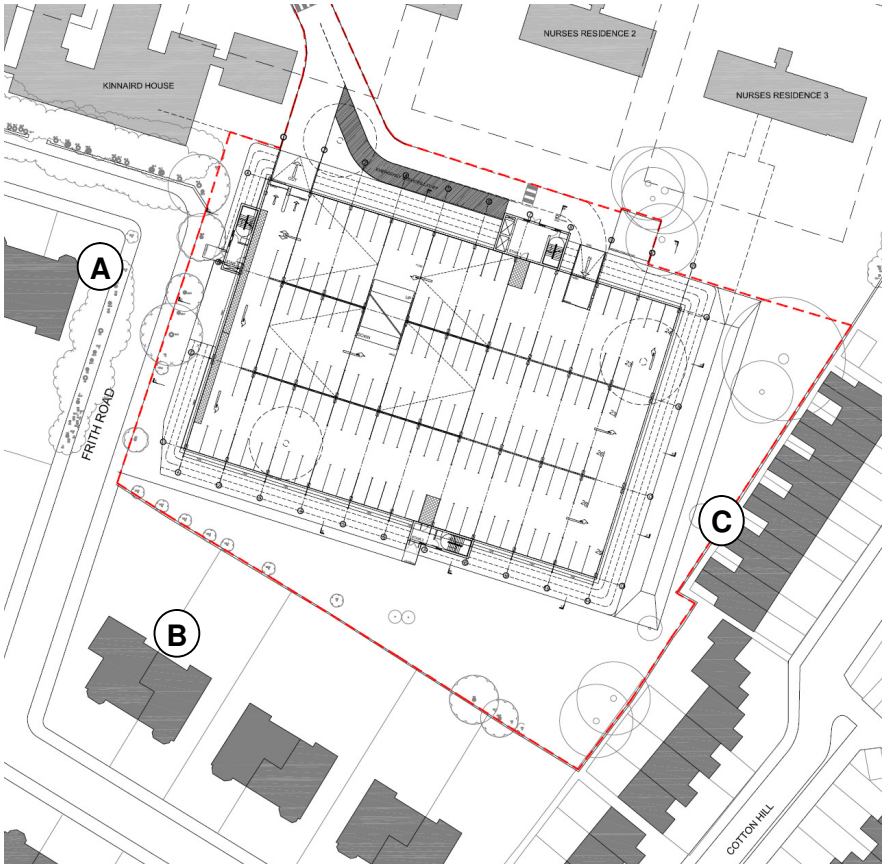
We understand vehicles will enter and exit the site from the North via a new access road which will run through the middle of The Christie site, as indicated below.



Traffic route (Image courtesy of Wilson Mason Architects)

9.3 Selected Noise Sensitive Receptors

We have considered the noise impact of vehicle movements to three receptors at 1m from residential facades, as indicated below (referenced A to C).



Site plan showing noise sensitive receptor locations (maps.google.co.uk)

9.4 Assessment Method

Since BS4142 is only intended to assess fixed or steady industrial noise sources, we have assessed vehicle noise by reviewing the subsequent change in ambient noise levels at the nearest noise sensitive receptors against the typical human response using the table presented in Section 3.3.

In accordance with Section 3.3, we have assessed the noise impact over 1-hour periods during the daytime (07:00-23:00 hours) and 5-minute periods during the night-time (23:00-07:00 hours).

For each event of a car entering the car park, the Section 9.1 source data for an 'open-air car passby', a 'car passby (in covered car park)' and 'car manoeuvring into a space' have been used.

For each car leaving the car park, the Section 9.1 source data for a 'car manoeuvring out of a space', a 'car passby (in covered car park)' and an 'free-field car passby' have been used.

Corrections for distance loss, screening loss, angle of view and reflections have been applied where applicable. These losses have been calculated in accordance with industry standards.

Based on the Wilson Mason drawings we understand the proposed West, South and East elevations of the car park will be finished with hit-and-miss cladding. We have assumed the free-area of each elevation will be approximately 50%.

Our calculations have also considered the layout of the car park and the location of the car park in relation to the buildings it serves. The current road layouts indicate up/down ramps to the West and a one-way system which will direct the majority of car passbys to the North edge of the car park, which is furthest point from the nearest residential properties.

Furthermore, the Christie hospital is located to the North and West of the proposed car park site, which would suggest users will favour the North/North-West side to park their vehicles.

Full calculation sheets have been included within Appendix C.

9.5 Assessment Results Summary

The following table presents the calculated pre-to-post development increase in hourly (daytime) and 5-minute (night-time) ambient noise levels at each receptor over a typical 24-hour period.

Time Period	Calculated Increase In Ambient Noise Level, L_{Aeq} (1-hour day, 5-min night), dB		
	Receptor A	Receptor B	Receptor C
07:00-08:00	+ 5	+ 3	+ 4
08:00-09:00	+ 4	+ 3	+ 3
09:00-10:00	+ 2	+ 1	+ 2
10:00-11:00	+ 2	+ 1	+ 1
11:00-12:00	+ 1	0	+ 1
12:00-13:00	0	0	0
13:00-14:00	+ 1	+ 1	+ 1
14:00-15:00	+ 1	+ 1	+ 1
15:00-16:00	+ 2	+ 1	+ 2
16:00-17:00	+ 2	+ 1	+ 2
17:00-18:00	+ 2	+ 2	+ 2
18:00-19:00	+ 2	+ 1	+ 2
19:00-20:00	+ 1	+ 1	+ 1
20:00-21:00	+ 1	0	+ 1
21:00-22:00	0	0	0
22:00-23:00	0	0	0
23:00-00:00	0	0	0
00:00-01:00	0	0	0
01:00-02:00	0	0	0
02:00-03:00	0	0	0
03:00-04:00	0	0	0
04:00-05:00	0	0	0
05:00-06:00	+ 3	+ 2	+ 3
06:00-07:00	+ 4	+ 3	+ 3

Our calculations indicate a **negligible** noise impact on residents between 9am and 5am, which is a 20-hour period encompassing the majority of the daytime, the evening and the majority of the night-time.

During the remaining 4-hours (between 6am and 9am), our calculations indicate a **noticeable** noise impact on residents, although the increase in noise levels should fall short of being considered significant.

These results would suggest additional measures to mitigate vehicle noise should not be required. However, should any significant changes to the scheme be made (e.g. variations in access road location, car park layout or façade constructions) we should be notified so we can verify changes against our calculations.

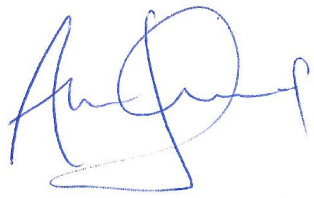
10.0 CONCLUSIONS

This report presents a detailed environmental noise impact assessment relating to the potential noise impact associated with the operation of the proposed car park.

An environmental noise survey was undertaken to establish baseline noise levels representative of those at the nearest noise sensitive properties for use in our assessments.

The results of the environmental noise survey have been used to propose plant noise emission limits in accordance with the requirements of the Local Authority, Manchester City Council. We understand the car park will be naturally ventilated with no emergency plant, although we would suggest any plant items, no matter how minor, must be designed to achieve our proposed limits.

The potential rise in ambient noise levels due to vehicle movements has been assessed against the typical human response to change in noise levels. The results of our assessment have indicated a noticeable but not significant impact may be expected between the hours of 6am-9am, and a negligible impact at all other times. This would suggest additional measures to mitigate vehicle noise should not be required, although we should be notified of any change to design which may affect operational noise emissions.



Andrew Jameson
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APPENDIX A
Acoustic Terminology

The acoustic terms used in this report are as follows:

dB : Decibel - Used as a measurement of sound pressure level. It is the logarithmic ratio of the noise being assessed to a standard reference level.

dB(A) : The human ear is more susceptible to mid-frequency noise than the high and low frequencies. To take account of this when measuring noise, the 'A' weighting scale is used so that the measured noise corresponds roughly to the overall level of noise that is discerned by the average human. It is also possible to calculate the 'A' weighted noise level by applying certain corrections to an un-weighted spectrum. The measured or calculated 'A' weighted noise level is known as the dB(A) level.

Because of being a logarithmic scale noise levels in dB(A) do not have a linear relationship to each other. For similar noises, a change in noise level of 10dB(A) represents a doubling or halving of subjective loudness. A change of 3dB(A) is just perceptible.

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, as being a high average, it takes into account the increased annoyance that results from the non-steady nature of traffic noise.

L_{eq} : The concept of L_{eq} (equivalent continuous sound level) has up to recently been primarily used in assessing noise in industry but seems now to be finding use in defining many other types of noise, such as aircraft noise, environmental noise and construction noise.

L_{eq} is defined as a notional steady sound level which, over a stated period of time, would contain the same amount of acoustical energy as the actual, fluctuating sound measured over that period (e.g. 1 hour).

The use of digital technology in sound level meters now makes the measurement of L_{eq} very straightforward.

L_{max} : L_{max} is the maximum sound pressure level recorded over the period stated. L_{max} is sometimes used in assessing environmental noise where occasional loud noises occur, which may have little effect on the L_{eq} noise level.

Free-field : A sound level determined at a point away from reflective surfaces other than the ground with no significant contributions due to sound from other reflective surfaces.

SEL : Sound Exposure Level - Used for assessing the acoustic energy of a particular event, such as an individual train or car passby. It is the notional steady sound level which over a one second period would contain the same amount of acoustic energy as the actual event recorded over a specified time period.

The SEL is related to the L_{eq} by the equation:

$$L_{eq(T)} = SEL + 10\log_{10}(N) - 10\log_{10}(T)$$

where N = number of events during time period, T
T = time period of interest e.g. 1 hour, 5 minutes, etc

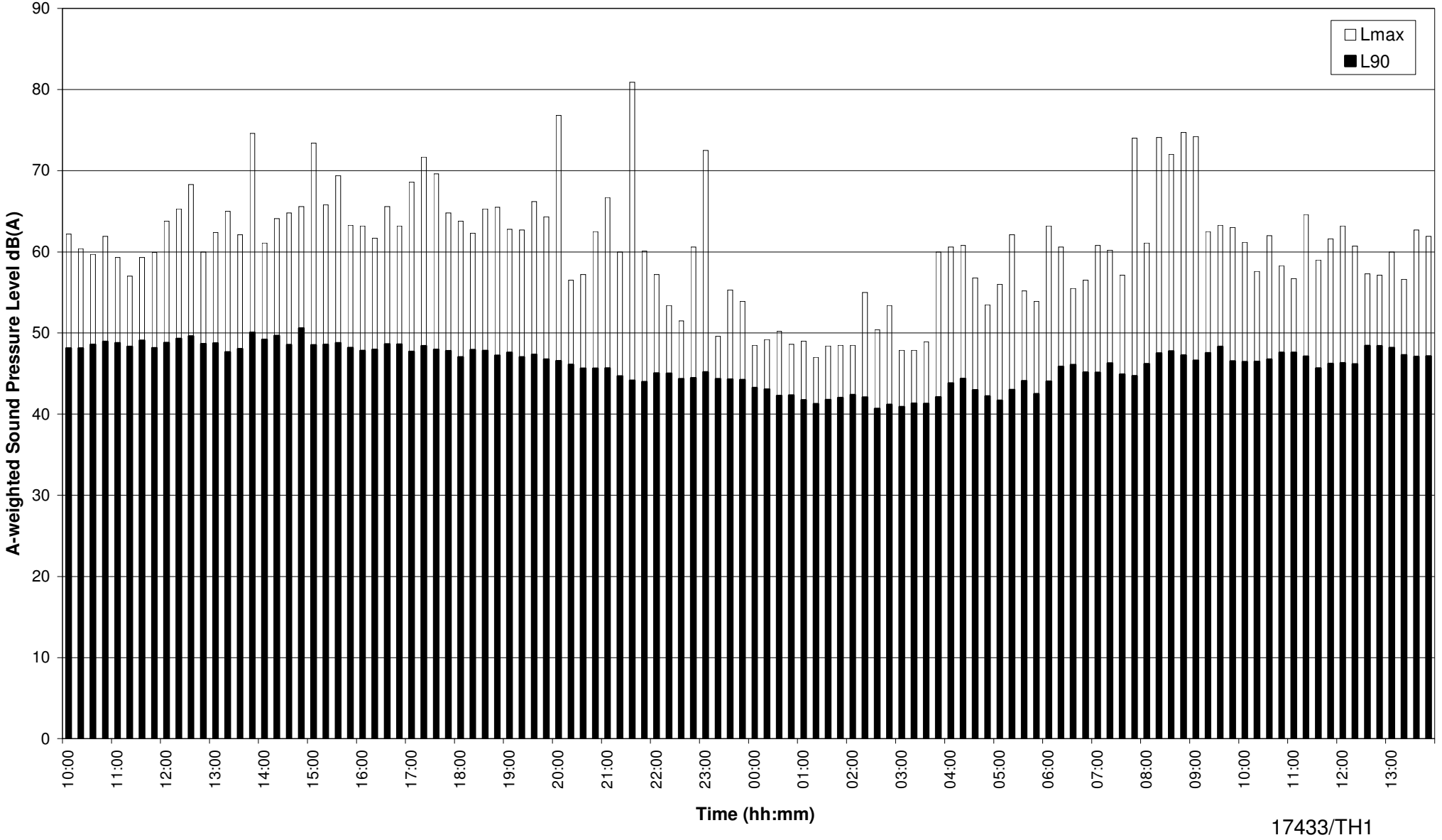
APPENDIX B

Time History Graphs

Car Park Development, The Christie

A-weighted $L_{max,15min}$ and $L_{90,15min}$ Sound Pressure Level at Automated Measurement Position

Thursday 23/06/2011 - Friday 24/06/2011



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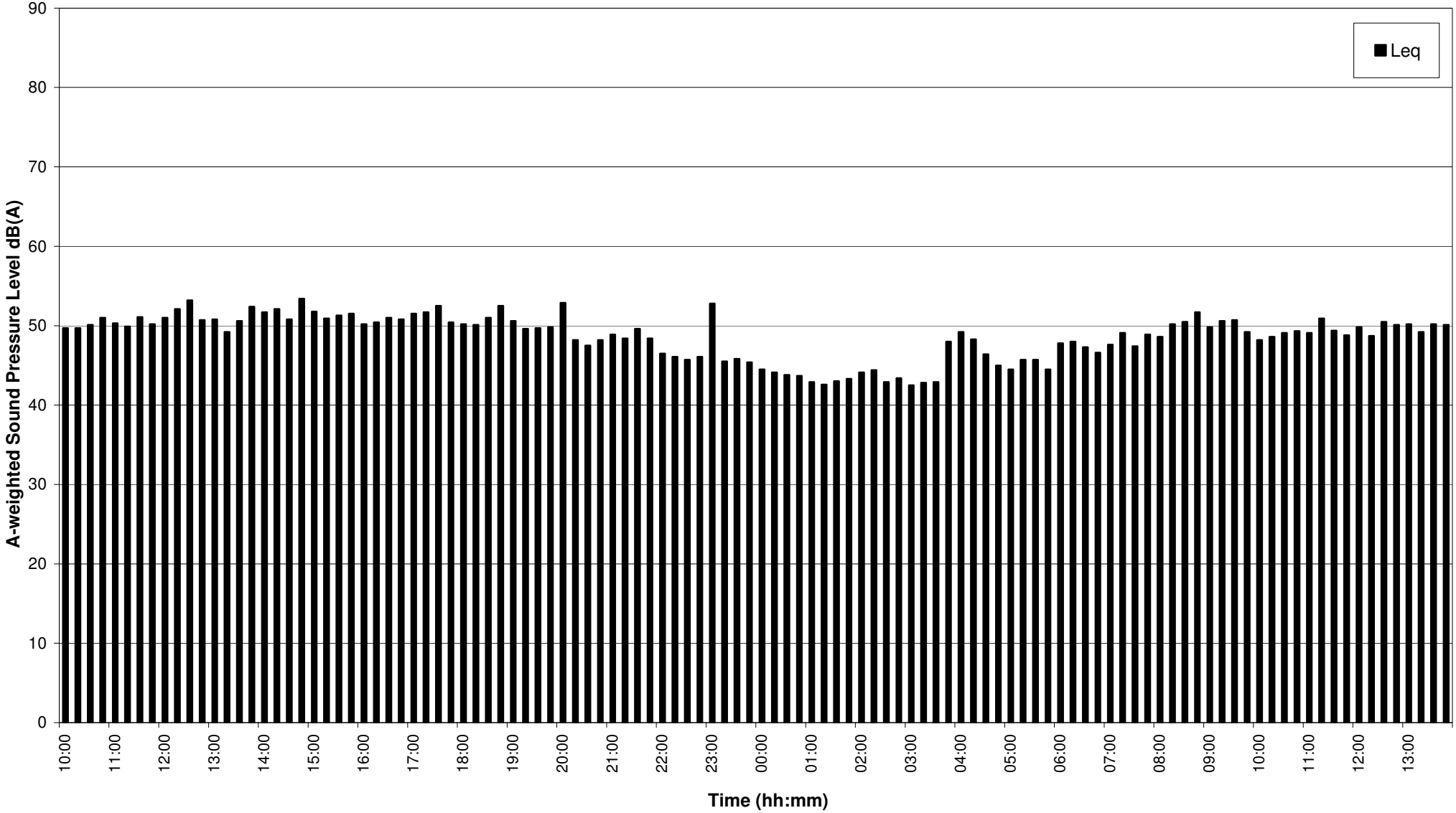
Car Park Development, The Christie

A-weighted $L_{eq,15min}$ Sound Pressure Levels at Automated Measurement Position

Thursday 23/06/2011 - Friday 24/06/2011



17433/TH2

APPENDIX C

Vehicle Noise Impact Assessment Calculation Sheets

RECEPTOR A - Corner House on Kinnaird Road/Frith Road

Calculation of Noise Level from Single Events

					Adjustments					
	Leq at 10m	M'ment Duration	SEL	Distance*	Dist. Loss	Screen Loss	Reflect'n Corr.	Angle/ view	Leq, 1hr	Leq, 5min
Car passby	61	4	67	60	-8	0	0	0	**24**	**34**
Car passby (in car park)	59	5	66	65	-8	0	0	0	**22**	**33**
Car manouevring into space	55	20	68	65	-16	0	0	0	**16**	**27**
Car manouevring out of space	59	14	70	65	-16	0	0	0	**19**	**29**

Calculation of Noise Level from Predicted Number of Events Over Typical 24-hour Period

Time Period	Assessment Period	Vehicles In	Car Passby	Car passby (in covered car park)	Car Manoeuvring into Space	Vehicle In Leq	Vehicles Out	Car Passby	Car passby (in covered car park)	Car Manoeuvring out of Space	Vehicle Out Leq	Total Vehicle Leq	Total Vehicle + Existing Leq	Existing Leq	Increase in Noise Level
07:00-08:00	1 hour	258	48	46	40	51	2	27	25	22	30	51	53	48	5
08:00-09:00	1 hour	258	48	46	40	51	4	30	28	25	33	51	54	50	4
09:00-10:00	1 hour	129	45	43	37	48	4	30	28	25	33	48	52	50	2
10:00-11:00	1 hour	43	40	39	33	43	9	33	32	28	36	44	51	49	2
11:00-12:00	1 hour	26	38	36	30	41	9	33	32	28	36	42	51	50	1
12:00-13:00	1 hour	17	36	35	28	39	17	36	35	31	39	42	51	51	0
13:00-14:00	1 hour	13	35	33	27	38	17	36	35	31	39	41	51	50	1
14:00-15:00	1 hour	13	35	33	27	38	43	40	39	35	43	44	53	52	1
15:00-16:00	1 hour	9	33	32	26	36	86	43	42	38	46	47	53	51	2
16:00-17:00	1 hour	9	33	32	26	36	172	46	45	41	49	49	53	51	2
17:00-18:00	1 hour	9	33	32	26	36	258	48	46	43	51	51	54	52	2
18:00-19:00	1 hour	4	30	28	22	32	129	45	43	40	48	48	53	51	2
19:00-20:00	1 hour	2	27	25	19	29	43	40	39	35	43	43	51	50	1
20:00-21:00	1 hour	2	27	25	19	29	43	40	39	35	43	43	51	50	1
21:00-22:00	1 hour	4	30	28	22	32	13	35	33	30	38	39	49	49	0
22:00-23:00	1 hour	4	30	28	22	32	0	0	0	0	0	33	46	46	0
23:00-00:00	5 minutes	0	0	0	0	0	0	0	0	0	0	3	49	49	0
00:00-01:00	5 minutes	0	0	0	0	0	0	0	0	0	0	3	44	44	0
01:00-02:00	5 minutes	0	0	0	0	0	0	0	0	0	0	3	43	43	0
02:00-03:00	5 minutes	0	0	0	0	0	0	0	0	0	0	3	44	44	0
03:00-04:00	5 minutes	0	0	0	0	0	0	0	0	0	0	3	45	45	0
04:00-05:00	5 minutes	0	0	0	0	0	0	0	0	0	0	3	48	48	0
05:00-06:00	5 minutes	0	0	0	0	0	5	41	40	36	45	45	48	45	3
06:00-07:00	5 minutes	10	44	43	37	47	2	37	36	32	41	48	51	47	4

Notes:-

* mean distance to centre of the access road (for free field car entry/exit) or the centre of car park activities

adjustments are typically -3dB for 50% angle of view, -5dB for 'just visible' screening, +3dB for façade reflection
distance loss for vehicle pass bys are calculated at 10xlog10(d/10) in accordance with BS 5228 for a moving source on a defined route
distance loss for manouevring activities are calculated at 20xlog10(d/10) as the engine is the principal noise source and is considered a quasi-stationary point source

RECEPTOR B - Houses on Rathen Road

Calculation of Noise Level from Single Events

					Adjustments					
	Leq at 10m	M'ment Duration	SEL	Distance*	Dist. Loss	Screen Loss	Reflect'n Corr.	Angle/ view	Leq, 1hr	Leq, 5min
Car passby	61	4	67	110	-10	-5	0	0	**16**	**27**
Car passby (in car park)	59	5	66	60	-8	0	0	0	**23**	**33**
Car manouevring into space	55	20	68	60	-16	0	0	0	**17**	**28**
Car manouevring out of space	59	14	70	60	-16	0	0	0	**19**	**30**

Calculation of Noise Level from Predicted Number of Events Over Typical 24-hour Period

Time Period	Assessment Period	Vehicles In	Car Passby	Car passby (in covered car park)	Car Manoeuvring into Space	Vehicle In Leq	Vehicles Out	Car Passby	Car passby (in covered car park)	Car Manoeuvring out of Space	Vehicle Out Leq	Total Vehicle Leq	Total Vehicle + Existing Leq	Existing Leq	Increase in Noise Level
07:00-08:00	1 hour	258	40	47	41	48	2	19	26	22	28	49	51	48	3
08:00-09:00	1 hour	258	40	47	41	48	4	22	29	25	31	49	53	50	3
09:00-10:00	1 hour	129	37	44	38	45	4	22	29	25	31	46	51	50	1
10:00-11:00	1 hour	43	32	39	33	41	9	26	32	29	34	42	50	49	1
11:00-12:00	1 hour	26	30	37	31	39	9	26	32	29	34	40	50	50	0
12:00-13:00	1 hour	17	28	35	29	37	17	28	35	32	37	40	51	51	0
13:00-14:00	1 hour	13	27	34	28	35	17	28	35	32	37	39	51	50	1
14:00-15:00	1 hour	13	27	34	28	35	43	32	39	36	41	42	53	52	1
15:00-16:00	1 hour	9	26	32	26	34	86	35	42	39	44	45	52	51	1
16:00-17:00	1 hour	9	26	32	26	34	172	38	45	42	47	47	52	51	1
17:00-18:00	1 hour	9	26	32	26	34	258	40	47	43	49	49	54	52	2
18:00-19:00	1 hour	4	22	29	23	30	129	37	44	40	46	46	52	51	1
19:00-20:00	1 hour	2	19	26	20	27	43	32	39	36	41	41	51	50	1
20:00-21:00	1 hour	2	19	26	20	27	43	32	39	36	41	41	50	50	0
21:00-22:00	1 hour	4	22	29	23	30	13	27	34	30	36	37	49	49	0
22:00-23:00	1 hour	4	22	29	23	30	0	0	0	0	0	30	46	46	0
23:00-00:00	5 minutes	0	0	0	0	0	0	0	0	0	0	3	49	49	0
00:00-01:00	5 minutes	0	0	0	0	0	0	0	0	0	0	3	44	44	0
01:00-02:00	5 minutes	0	0	0	0	0	0	0	0	0	0	3	43	43	0
02:00-03:00	5 minutes	0	0	0	0	0	0	0	0	0	0	3	44	44	0
03:00-04:00	5 minutes	0	0	0	0	0	0	0	0	0	0	3	45	45	0
04:00-05:00	5 minutes	0	0	0	0	0	0	0	0	0	0	3	48	48	0
05:00-06:00	5 minutes	0	0	0	0	0	5	34	40	37	43	43	47	45	2
06:00-07:00	5 minutes	10	37	43	38	45	2	30	36	33	39	46	50	47	3

Notes:-

* mean distance to centre of the access road (for free field car entry/exit) or the centre of car park activities

adjustments are typically -3dB for 50% angle of view, -5dB for 'just visible' screening, +3dB for façade reflection
distance loss for vehicle pass bys are calculated at 10xlog10(d/10) in accordance with BS 5228 for a moving source on a defined route
distance loss for manouevring activities are calculated at 20xlog10(d/10) as the engine is the principal noise source and is considered a quasi-stationary point source

RECEPTOR C - Houses on Cotton Hill

Calculation of Noise Level from Single Events

					Adjustments					
	Leq at 10m	M'ment Duration	SEL	Distance*	Dist. Loss	Screen Loss	Reflect'n Corr.	Angle/ view	Leq, 1hr	Leq, 5min
Car passby	61	4	67	120	-11	-10	0	0	**11**	**21**
Car passby (in car park)	59	5	66	43	-6	0	0	0	**24**	**35**
Car manouevring into space	55	20	68	43	-13	0	0	0	**20**	**31**
Car manouevring out of space	59	14	70	43	-13	0	0	0	**22**	**33**

Calculation of Noise Level from Predicted Number of Events Over Typical 24-hour Period

Time Period	Assessment Period	Vehicles In	Car Passby	Car passby (in covered car park)	Car Manoeuvring into Space	Vehicle In Leq	Vehicles Out	Car Passby	Car passby (in covered car park)	Car Manoeuvring out of Space	Vehicle Out Leq	Total Vehicle Leq	Total Vehicle + Existing Leq	Existing Leq	Increase in Noise Level
07:00-08:00	1 hour	258	35	48	44	50	2	14	27	25	29	50	52	48	4
08:00-09:00	1 hour	258	35	48	44	50	4	17	30	28	32	50	53	50	3
09:00-10:00	1 hour	129	32	45	41	47	4	17	30	28	32	47	52	50	2
10:00-11:00	1 hour	43	27	40	36	42	9	20	34	32	36	43	50	49	1
11:00-12:00	1 hour	26	25	38	34	40	9	20	34	32	36	41	51	50	1
12:00-13:00	1 hour	17	23	36	32	38	17	23	36	35	39	41	51	51	0
13:00-14:00	1 hour	13	22	35	31	37	17	23	36	35	39	41	51	50	1
14:00-15:00	1 hour	13	22	35	31	37	43	27	40	39	43	44	53	52	1
15:00-16:00	1 hour	9	20	34	29	35	86	30	43	42	46	46	53	51	2
16:00-17:00	1 hour	9	20	34	29	35	172	33	46	45	49	49	53	51	2
17:00-18:00	1 hour	9	20	34	29	35	258	35	48	46	51	51	54	52	2
18:00-19:00	1 hour	4	17	30	26	32	129	32	45	43	47	48	53	51	2
19:00-20:00	1 hour	2	14	27	23	29	43	27	40	39	43	43	51	50	1
20:00-21:00	1 hour	2	14	27	23	29	43	27	40	39	43	43	51	50	1
21:00-22:00	1 hour	4	17	30	26	32	13	22	35	33	38	39	49	49	0
22:00-23:00	1 hour	4	17	30	26	32	0	0	0	0	0	32	46	46	0
23:00-00:00	5 minutes	0	0	0	0	0	0	0	0	0	0	3	49	49	0
00:00-01:00	5 minutes	0	0	0	0	0	0	0	0	0	0	3	44	44	0
01:00-02:00	5 minutes	0	0	0	0	0	0	0	0	0	0	3	43	43	0
02:00-03:00	5 minutes	0	0	0	0	0	0	0	0	0	0	3	44	44	0
03:00-04:00	5 minutes	0	0	0	0	0	0	0	0	0	0	3	45	45	0
04:00-05:00	5 minutes	0	0	0	0	0	0	0	0	0	0	3	48	48	0
05:00-06:00	5 minutes	0	0	0	0	0	5	28	42	40	44	44	48	45	3
06:00-07:00	5 minutes	10	31	45	41	46	2	24	38	36	40	47	50	47	3

Notes:-

* mean distance to centre of the access road (for free field car entry/exit) or the centre of car park activities

adjustments are typically -3dB for 50% angle of view, -5dB for 'just visible' screening, +3dB for façade reflection
distance loss for vehicle pass bys are calculated at 10xlog10(d/10) in accordance with BS 5228 for a moving source on a defined route
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