ARDENT CONSULTING ENGINEERS

ST GEORGE PLC

PROPOSED MIXED-USE DEVELOPMENT: CAMDEN GOODS YARD, PFS SITE, TEMPORARY STORE

PLANT NOISE AND VIBRATION ASSESSMENT
PLANNING CONDITIONS 10, 11 AND 12
(2017/3847/P)
BREEAM CREDIT POL-5

REPORT REF: NO 196125-01C
PROJECT NO: 196125
SEPTEMBER 2020

CAMDEN GOODS YARD,
PFS SITE TEMPORARY STORE

PLANT AND VIBRATION ASSESSMENT
PLANNING CONDITIONS 10,11 AND 12 (2017/3847/P)
BREEAM CREDIT POL-5

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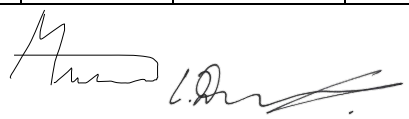
CONTENTS **Page**

APPENDICES

DOCUMENT CONTROL SHEET

REV	ISSUE PURPOSE	AUTHOR	CHECKED	APPROVED	DATE
-	Submission	MNR	LD	MNR	01/05/2020
A	Additional plant data provided and assessed	MNR	LD	MNR	11/05/2020
B	Additional plant data provided and assessed. BREEAM credit POL-5 information Added	MNR	SJH	MNR	04/08/2020
C	Information to address Condition 11 added.	MNR	MNR	LD	09/09/2020



DISTRIBUTION

1.0 INTRODUCTION

1.1 Ardent Consulting Engineers (ACE) has been appointed by St George PLC to advise on the noise and vibration aspects of the proposed redevelopment of the Camden Goods Yard site. This Noise and Vibration Assessment (NVA) has been prepared to address noise and vibration pertinent planning condition associated with the temporary store proposed on the current petrol filling station (PFS) site.

1.2 Planning approval was granted for a mixed-use scheme at the application site in June 2018 under planning permission reference 2017/3847/P (the 'June 2018 Consented Scheme'). This was amended by 2019/0153/P dated 6th Feb 2019, 2019/2962/P dated 4th July 2019 and 2019/6301/P dated 24 December 2019. A Noise and Vibration Impact Assessment (NVIA) was prepared by ACE in June 2017 (report reference: **160630-10**) in support of planning application 2017/3847/P. Report Ref: **160630-10** is appended to this report at **Appendix D** for further context and reference.

1.3 The planning approval (2017/3847/P) was granted subject to a number of conditions this report provides information to London Borough of Camden (LBC) and its consultees and seeks to discharg Conditions 10 and 12 and the noise pertinent components of Condition 11. The conditions are reproduced below for clarity.

1.4 Condition 10 is specifically worded as follows:

"10 Fixed Mechanical plant noise

Prior to installation of the relevant plant/ machinery/ equipment, details shall be submitted to and approved in writing by the Council, of the external noise level emitted from that plant/ machinery/ equipment and mitigation measures as appropriate. The mitigation measures shall ensure that the external noise level emitted from plant, machinery/ equipment will be lower than the lowest existing background noise level by at least 10dBA, by 15dBA where the source

is tonal, as assessed according to BS4142:2014 at the nearest and/or most affected noise sensitive premises, with all machinery operating together at maximum capacity.

Reason: To ensure that the amenity of occupiers of the development / surrounding premises is not adversely affected by noise from mechanical installations/ equipment, in accordance with Policy A4 of the Camden Local Plan 2017."

1.5 Condition 11 is specifically worded as follows

"Plant associated with Food & Drink uses

Prior to commencement of the relevant ground floor food and drink use hereby approved, details of any extract ventilating system associated with the relevant ground floor food and drink uses hereby approved, shall be submitted to and approved in writing by the Local Planning Authority.

Such details to include routing of ducts and discharge points and associated acoustic isolation and sound and vibration attenuation measures and an Acoustic Impact report prepared by a suitably qualified and experienced acoustic engineer which sets out how the equipment would meet the Council's published noise (as set out in condition 10 above) and vibration (as set out in Table A of Appendix 3 to the Local Plan 2017) standards.

Such details shall also include details of the ventilation and filtration equipment to suppress and disperse fumes and/or smells created from cooking activities on the premises. No primary cooking shall take place within the relevant premises unless all such measures as approved have been installed and are in full working order.

The equipment and any associated mitigation measures shall be installed in accordance with the details thus approved and shall thereafter be maintained in accordance with the manufacturers' recommendations. In the event of no

satisfactory ventilation being provided, no primary cookingshall take place on the premises.

Reason: To safeguard the amenities of the adjoining premises and the area generally in accordance with the requirements of policies G1, A1, A4, D1, TC1, TC2 and TC4 and TC5 of the Camden Local Plan 2017."

1.6 Condition 12 is specifically worded as follows:

"12 Petrol Filling Station (PFS) site plant - noise and vibration

Prior to installation of any plant/machinery/equipment on the building on the PFS site, an acoustic report setting out details of how the external noise levels from such equipment would meet the Council's noise (as set out in condition 10 above) and vibration (as set out in Table A of Appendix 3 to the Local Plan 2017) standards shall be submitted to and approved in writing by the local planning authority. Such details to include any acoustic mitigation and anti-vibration measures as required.

All such noise and anti-vibration mitigation measures shall be put in place prior to first use of the relevant plant/machinery/equipment and shall thereafter be retained. The plant/machinery/equipment shall thereafter be maintained and operated in accordance with the manufacturers' recommendations.

Reason: To ensure that the amenity of occupiers of the development / surrounding premises is not adversely affected by noise from mechanical installations/ equipment, in accordance with Policy A4 of the Camden Local Plan 2017."

1.7 An application (2020/0034/P) to vary the planning permission specifically covering an amended provision for the temporary store was submitted in January 2020 and approved in April 2020. The wording of the permission contains the definitive development description as follows:

Variation of Condition 4 (approved drawings) of planning permission 2017/3847/P dated 15/06/2018 (as amended by 2019/6301/P dated 24/12/2019, 2019/0153/P dated 06/02/2019 and 2019/2962/P dated 04/07/2019) for redevelopment of the petrol filling station site and main supermarket site; namely for a single storey temporary food store on the Petrol Filling Station site with associated parking, servicing, access and landscaping. This application is accompanied with an addendum to the original Environmental Statement.

1.8 The site is located in a largely industrial and commercial area and sits between Chalk Farm Road to north and the Northern Line railway line to the south elevated on a viaduct there residential properties immediately beyond the railway line to the south and on the opposite side of Chalk Farm Road, which are considered the closest noise sensitive receptors.

1.9 The site in the context of the surrounding area is presented in **Figure 1.1.**

Figure 1.1 – Site context plan

1.10 The proposed temporary store is presented at **Figure 1.2** below:

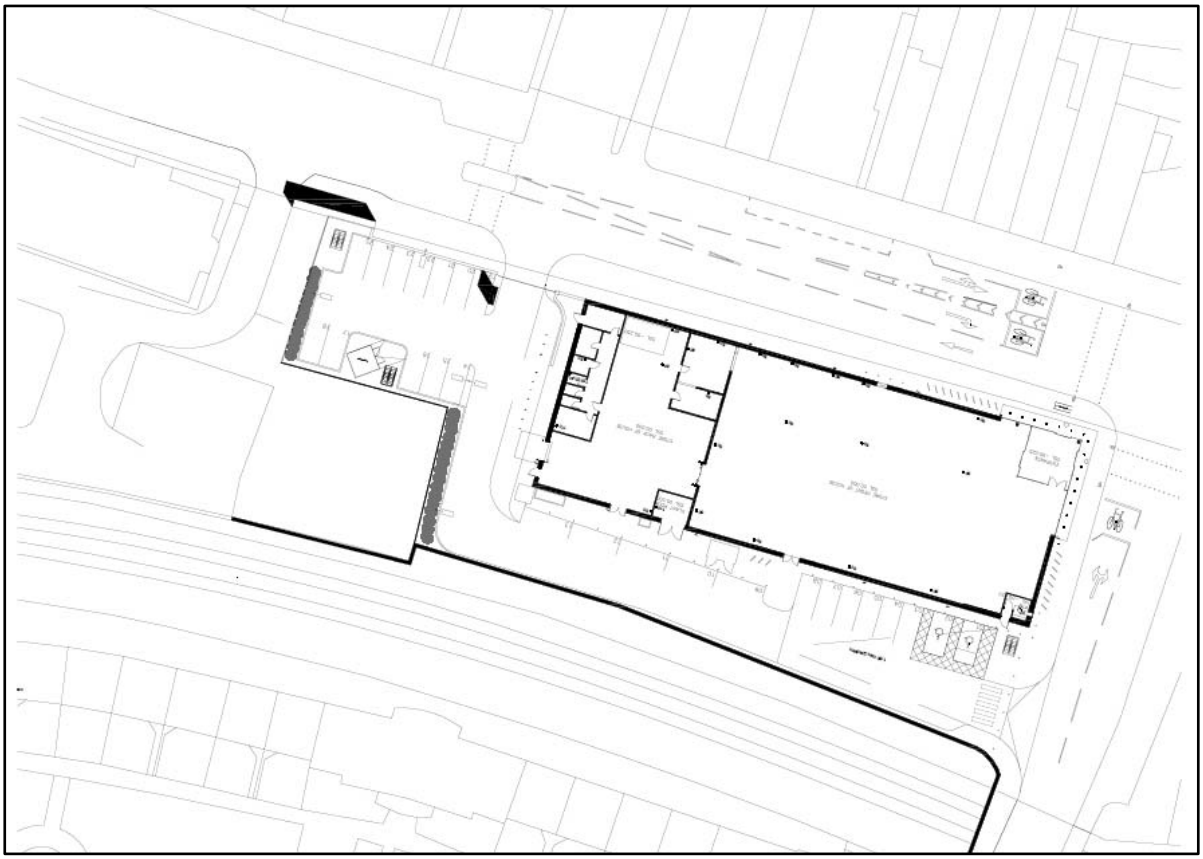


Figure 1.2 – Proposed site plan

2.0 GUIDANCE AND CRITERIA

BS4142:2014 Methods for Rating Industrial and Commercial Sound

2.1 BS4142:2014 uses a comparison between the Rating and Background Sound Levels to establish an Initial Estimate of the Likely Significance of Impact. The context of the assessment must then be considered, which can significantly alter the outcome of the assessment.

Local Authority Guidance – Camden Local Plan 2017 – Appendix 3

2.2 Appendix 3 of the Camden Local Plan contains guidance for noise and vibration from on and from proposed developments. In the context of this assessment Appendix 3 makes specific refence to the assessment criteria of BS4142. The appendix specifies that: a 'Rating Level' of 10 dB below background (15dB if tonal components are present) should be considered as the design criterion. This interpretation of BS4142 presents a requirement more onerous than the standard allows for and forms the basis of conditions 10 and 12.

2.3 Further guidance and criteria are outlined within report **160630-10** which is appended to this report at **Appendix D.**

3.0 SURVEY

3.1 Residual sound level measurements were taken over a period of approximately one week as part of the original planning application between the 6th and 13th July 2016. Measurements were undertaken continuously at 4 locations to provide a base reference for the noise assessment report **160630-10.**

3.2 **Figure 3.1** shows the extent of the site (red), the nearest sensitive receptors that will me most exposed to plant noise (blue) and the survey positions.

3.3 Position 1 is deemed to most closely representative of the conditions at these sensitive receptors and has been analysed for the use within the assessment of plant noise.

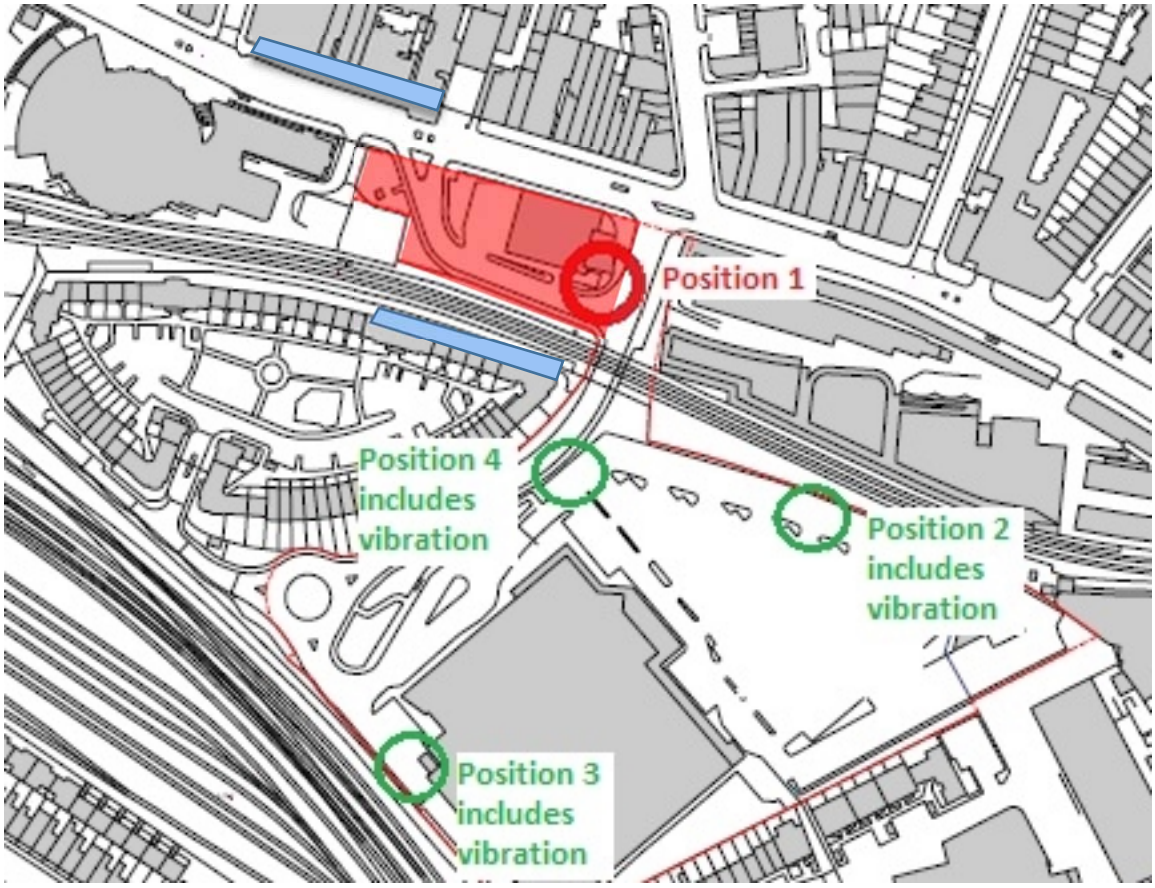


Figure 3.1 – Noise and Vibration Measurement locations

3.4 All measurement data used in this assessment is presented in **Appendix A**. With full details of all noise and vibration data presented within report **160630-10** at **Appendix D**.

3.5 To avoid the occurrence of instrument over or under-loading, noise levels were observed prior to measurement to determine the dynamic measurement range for the instrument for each measurement scenario.

3.6 Measurements were undertaken by Clement Acoustics Ltd. Staff involved with the measurements and observations are fully competent with regard to the requirements of environmental noise measurement. Measurement procedures used within this assessment conformed to relevant guidance within *BS 7445* and *CRN* where appropriate.

3.7 Continuous measurements were taken using the following equipment:

- Position 1: Svantek 977 (noise);
- Position 2: Svantek 977 (noise);
- Position 3: Svantek 958 (vibration) and Svantek 957 (noise), other periods Svantek 977 (noise);
- Position 4: Svantek 958 (vibration) and Svantek 957 (noise), other periods Svantek 977 (noise).

3.8 All of the sound level meters used are Class 1. GRAS Environmental Microphones were used in conjunction with the meters.

3.9 Measurements for background noise were taken at a height of 1.2m to 1.3m from the ground and would be considered free field.

3.10 All equipment used has been professionally calibrated, and calibration certificates are presented in **Appendix D**. Field calibration of the sound level meters was undertaken before and after measurement to ensure no drifting of the calibration signal. Staff involved with the measurements and observations are fully competent with regard to the requirements of environmental noise measurement. Measurement procedures used within this assessment conformed to relevant guidance within *BS 7445*.

3.11 Weather conditions were noted during the survey. It is considered that the local weather conditions at the time of the survey were within the limits set out in the guidance and appropriate for measurements to be taken.

3.12 A summary of background noise measurements at Position 1 analysed for use within this assessment is shown in **Table 3.1** below and presented as a time history at **Appendix A**:

Position	Period	Background Noise dB $L_{A90(T)}$
1	Day	60 – 69
	Night	57 - 68

Table 3.1 Background Noise Measurement summary

3.13 In order to establish representative background sound levels, the measurement data has been analysed and histograms have been prepared, as presented in **Figure 3.2** and **Figure 3.3.**.

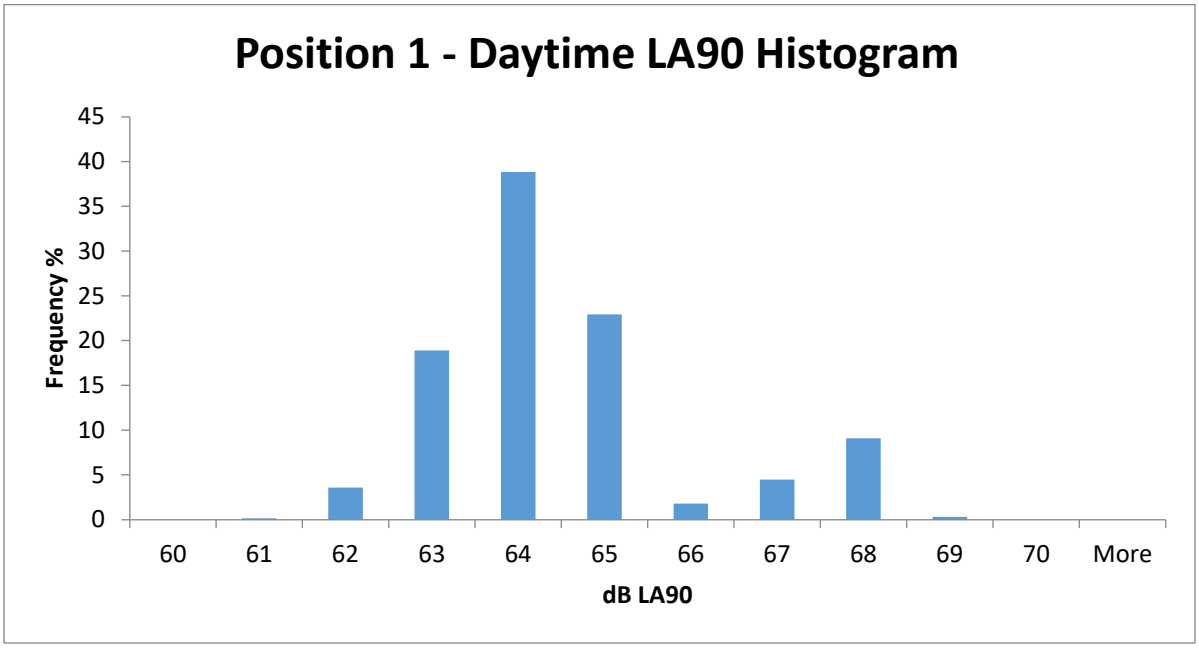


Figure 3.2 Position 1 – Daytime LA90 Histogram

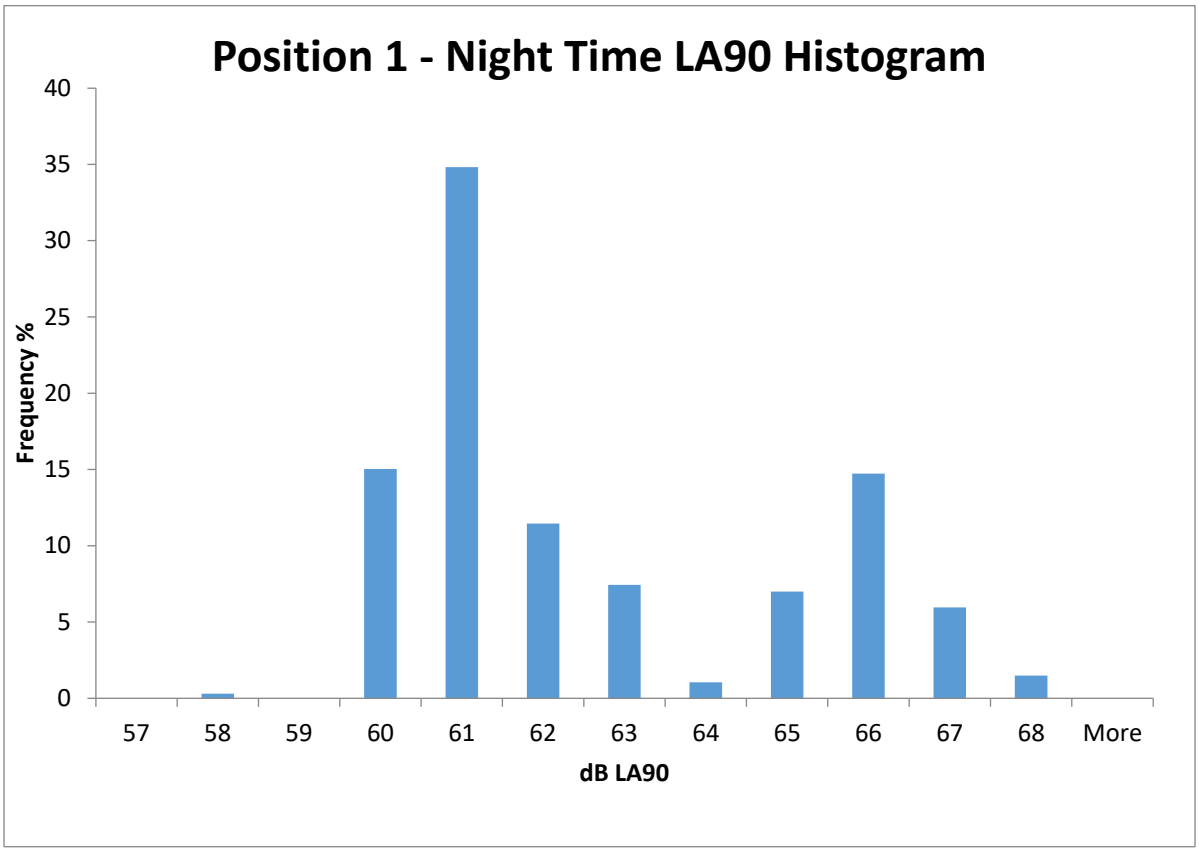


Figure 3. Position 1 – Night time LA90 Histogram

3.14 Taking all of the above factors into account and the context of the acoustic environment, a representative Background Sound Level of **64dBA** for daytime assessment purposes and a Background Sound Level of **61dBA** will for night time at measurement Position 1. This is based on representative levels over the periods of interest.

3.15 The specific wording of Condition 10 requires that the lowest background noise level be used which is more onerous than the requirements of BS4142. An assessment in accordance with the lowest background noise levels has therefore been included in Section 4. The lowest background noise level experienced at the time of the survey are **61dBA** during the day and **46dBA** during the night,

4.0 ASSESSMENT – PLANT NOISE

4.1 Noise associated with the proposed commercial use, such as fixed plant and equipment has been assessed to ensure that existing residents are not impacted by the development.

4.2 Layout, elevations and details of fixed plant has been provided by the scheme's Mechanical and Electrical Consultant. Plant noise mitigation is largely provided by appropriate specification of plant in addition to the provision of acoustic screens / enclosures to the condensers and acoustic louvres for the main supply and extracts to the store. All details of fixed plant are provided within **Appendix B.**

4.3 As detailed in **Section 1**, Planning condition 10 sets a specific criterion for plant noise levels as which is repeated as follows:

"Prior to installation of the relevant plant/ machinery/ equipment, details shall be submitted to and approved in writing by the Council, of the external noise level emitted from that plant/ machinery/ equipment and mitigation measures as appropriate. The mitigation measures shall ensure that the external noise level emitted from plant, machinery/ equipment will be lower than the lowest existing background noise level by at least 10dBA, by 15dBA where the source is tonal, as assessed according to BS4142:2014 at the nearest and/or most affected noise sensitive premises, with all machinery operating together at maximum capacity."

4.4 The representative background sound level, determined by statistical analysis, during the day and night is **64dBL_{A90}** and **61dBL_{A90}** respectively. The lowest measured background noise levels during the day and night are **61dBL_{A90}** and **46dB L_{A90}** respectively.

4.5 Calculations have been undertaken to determine the noise level experienced at the nearby noise sensitive properties under the operating conditions required by the conditions with all plant operating maximally simultaneously for the day and night time periods. The calculations allow for propagation distance, any screening and modest assumptions for the performance of enclosures and louvres.

4.6 Due to the complexity of the plant it is assumed that there will be a tonal source present and therefore, in accordance with Condition 10, the maximum noise level permitted will be 15dBA below background. **Table 4.1** summarises the results of the assessment against representative background noise and **Table 4.2** summarises the results of the assessment against lowest background noise taking all the above into consideration and under worst case, maximum simultaneous operations.

Receptor Location	Time Period	Representative Background Noise dB $L_{A90(T)}$	Combined Plant noise dB $L_{Aeq(T)}$	Plant Noise - Background Noise (dBA)
Chalk Farm Road	Day (T=16 hour)	64	39	-25
	Night (T = 8 hour)	61	26	-35
Juniper Crescent	Day (T=16 hour)	64	40	-24
	Night (T = 8 hour)	61	25	-36

Table 4.1. Summary of Plant Noise Assessment – Representative Background Noise

4.7 As summarised in **Table 4.1** above, the assessment at Chalk Farm Road for daytime noise is 25dB below representative background during the day and 35dB below representative background at night. The assessment at Juniper Crescent for daytime noise is 24dB below representative background during the day and 36dB below representative background at night

Receptor Location	Time Period	lowest Background Noise dB $L_{A90(T)}$	Combined Plant noise dB $L_{Aeq(T)}$	Plant Noise - Background Noise (dBA)	Condition 10 and 12 Compliance
Chalk Farm Road	Day (T=16 hour)	61	39	-22	Yes
	Night (T = 8 hour)	46	26	-20	Yes
Juniper Crescent	Day (T=16 hour)	61	40	-21	Yes
	Night (T = 8 hour)	46	25	-21	Yes

Table 4.1. Summary of Plant Noise Assessment – Lowest Background Noise

4.8 As summarised in **Table 4.2** above, the assessment at Chalk Farm Road for daytime noise is 22dB below the lowest measured background during the day and 20dB below the lowest measured background at night. The assessment at Juniper Crescent for daytime noise is 21dB below lowest measured background during the day and 21dB below lowest measured at night. The results of these assessments indicate that the requirements of the Conditions and The Camden Local Plan 2017 - Appendix 3 can be satisfied.

5.0 VIBRATION

5.1 Ambient vibration measurements were taken over a period of approximately one week as part of the original planning application between the 6th and 13th July 2016. Measurements were undertaken continuously at 2 locations to provide a base reference for the noise assessment report **160630-10**

5.2 **Table 5.1** below summarises the vibration dose value in 3 axes from Locations 3 and 4 (shown at **figure 3.1)**:

Location	Time Period	Axis	Vibration Dose Value (VDV) $ms^{-1.75}$
3	Daytime	X	0.026
		Y	0.068
		Z	0.117
3	Night time	X	0.011
		Y	0.016
		Z	0.084
4	Daytime	X	0.154
		Y	0.259
		Z	0.144
4	Night time	X	0.005
		Y	0.009
		Z	0.007

Table 5.1: Summary of Vibration Dose Value Measurements

5.3 Table 3 from *BS 6472* is reproduced in **Table 5.2** on the following page.

Place and time	Low probability of adverse comment ($ms^{-1.75}$)	Adverse comment possible ($ms^{-1.75}$)	Adverse comment probable ($ms^{-1.75}$)
Residential buildings (16 hour day)	0.2 - 0.4	0.4 - 0.8	0.8 – 1.6
Residential buildings (8 hour night)	0.1 – 0.2	0.2 - 0.4	0.4 - 0.8

Table 5.2: (Table 3 from BS 6472) – Threshold VDV values

5.4 A comparison between measured vibration levels and the criteria from Table 3 of *BS 6472* (above) shows the measurements recorded fall significantly below the threshold of low probability of adverse comment in most cases. The exception is at Location 4 during the day, where the Y-axis result indicates a low probability of adverse comment. This higher result is due to two isolated events; it is not known if these are related to train passes or an unrelated event adjacent to the meter.

5.5 Ambient vibration was considered negligible and will not require mitigation.

5.6 Robust mitigation of plant vibration has been provided by the appropriate selection of plant. The isolation of significant vibrations sources such as all the refrigeration and AC condensers being mounted on a concrete plinth with anti vibration mounts where needed. With the plant and mitigation specifically designed not to pass vibrations into the building and the surrounding area and the specific site context of separation distance, the presence of a railway viaduct and busy road network there will be no perceptible vibration from plant at the nearest sensitive receptors.

6.0 BREEAM ASSESSMENT – CREDIT POL-5

6.1 The development is to be BREEAM rated and as part of the rating pollution reduction Credit POL-5 is being applied for. The specific requirements of credit POL-5 are reproduced below:

"1. Where there are, or will be, no noise-sensitive areas or buildings within 800m radius of the assessed site.

OR

2. Alternatively, where the building does have noise-sensitive areas or buildings within 800m radius of the site, one credit can be awarded as follows:

a. Where a noise impact assessment in compliance with BS 7445[1] has been carried out and the following noise levels measured/determined:

i. Existing background noise levels at the nearest or most exposed noise-sensitive development to the proposed development or at a location where background conditions can be argued to be similar.

ii. The rating noise level resulting from the new noise source

3. The noise impact assessment must be carried out by a suitably qualified acoustic consultant holding a recognised acoustic qualification and membership of an appropriate professional body (see Relevant definitions in the Additional information section).

4. The noise level from the proposed site/building, as measured in the locality of the nearest or most exposed noise-sensitive development, is a difference no greater than +5dB during the day (07:00 to 23:00) and +3dB at night (23:00 to 07:00) compared to the background noise level.

5. Where the noise source(s) from the proposed site/building is greater than the levels described in criterion 4, measures have been installed to attenuate the noise at its source to a level where it will comply with criterion 4."

6.2 As the nearest noise sensitive properties are less than 800m from the proposed temporary store the first criteria point cannot be met, therefore points 2 – 5 must be satisfied. The following paragraphs outline how these are met by this assessment report:

Criteria 2

6.3 This assessment has used the methodologies withing BS7445 and BS4142 to establish baseline and the rating noise level at the nearest and most exposed noise sensitive properties. The requirements of this criteria point are therefore satisfied.

Criteria 3

6.4 The author of this report who has undertaken this assessment has 13 years of acoustic consultancy experience at the time of writing this report. The author holds a Post Graduate Diploma in Acoustics and Noise Control from the Institute Of Acoustics (IOA) and is an Associate Member of the IOA. The requirements of this criteria point are therefore satisfied.

Criteria 4

6.5 Predicted noise levels from the development are far lower than the required maximums of this point as demonstrated by **Table 4.1.** The requirements of this criteria point are therefore satisfied.

Criteria 5

6.6 The inherent mitigation measures proposed to satisfy criteria 4 would mean that criteria 5 are also comfortably met. The requirements of this criteria point are therefore satisfied.

6.7 It is therefore concluded that the requirements of BREEAM Pollution Reduction Credit – POL-5 are satisfied by the development and the credit should be awarded.

7.0 CONCLUSION

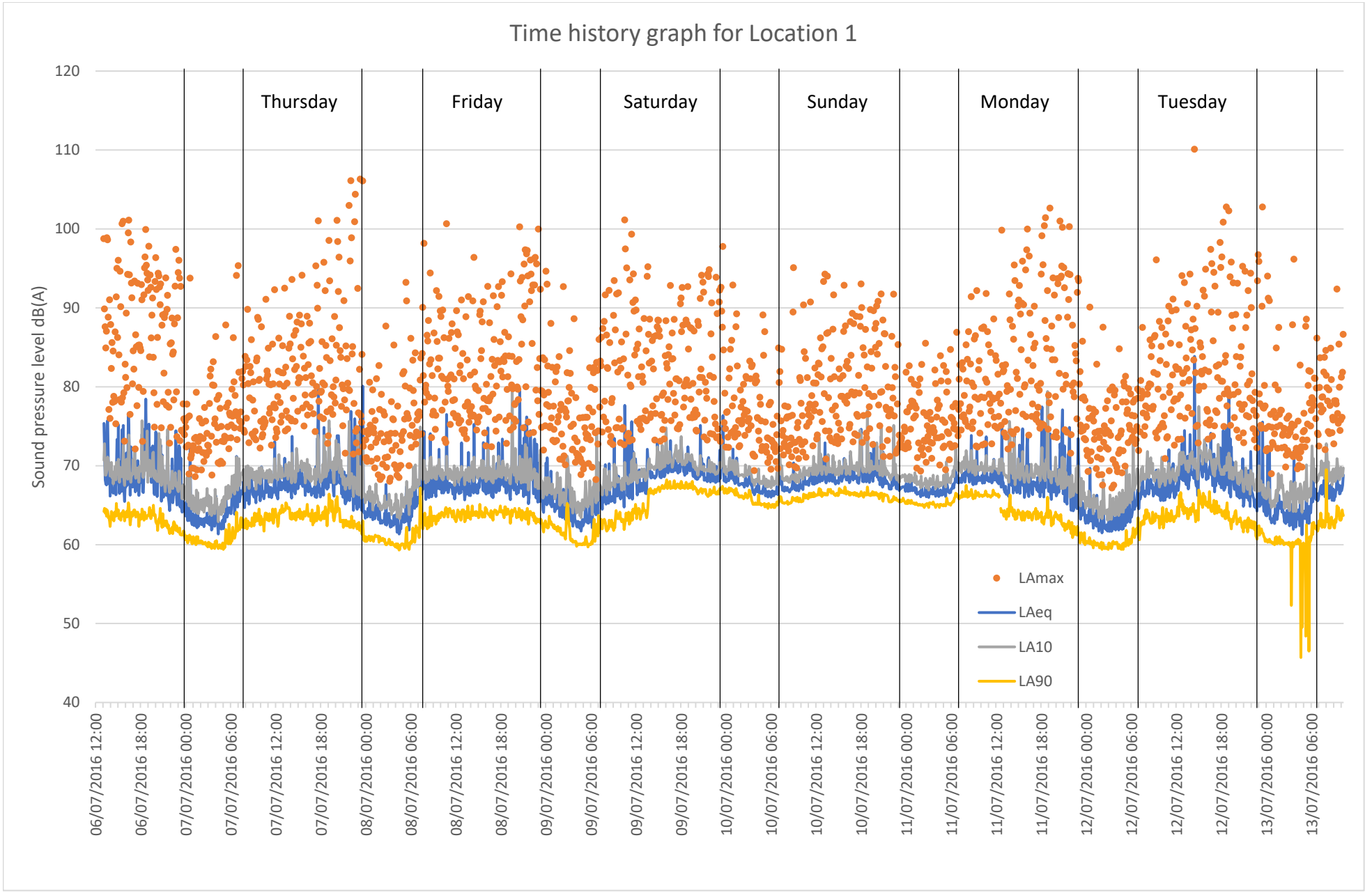
7.1 Ardent Consulting Engineers has been appointed by St George PLC to provide a Plant Noise and Vibration Assessment for proposed fixed plant associated with the temporary store the petrol filling station site.

7.2 It is concluded that plant noise has been designed to comply and significantly improve upon the requirements of Planning Conditions 10, 11 and 12 and the specific requirements of the Camden Local Plan 2017 – Appendix 3. This assessment would be suitable for submission to The London Borough of Camden to demonstrate that the conditions 10 and 12 can discharged for the temporary store on the PFS Site in addition to the noise and vibration pertinent components of condition 11.

7.3 This report demonstrates the requirements of BREEAM Credit POL-5 can comfortably met, and that the credit should be awarded for the development.

Appendix A

Measurement Data


Time history graph for Location 1
Sound pressure level dB(A)
120
110
100
90
80
70
60
50
40
Thursday
Friday
Saturday
Sunday
Monday
Tuesday
LAmax
LAeq
LA10
LA90
06/07/2016 12:00
06/07/2016 18:00
07/07/2016 00:00
07/07/2016 06:00
07/07/2016 12:00
07/07/2016 18:00
08/07/2016 00:00
08/07/2016 06:00
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12/07/2016 00:00
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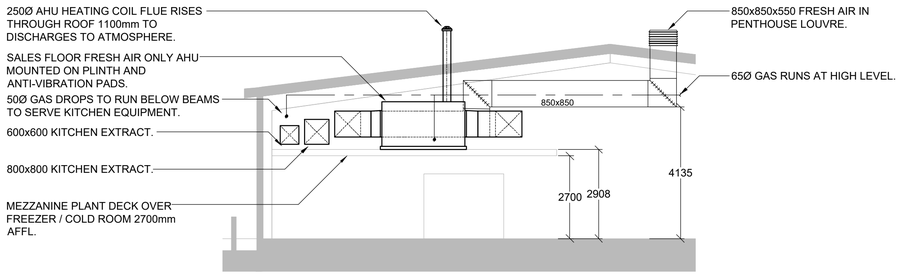
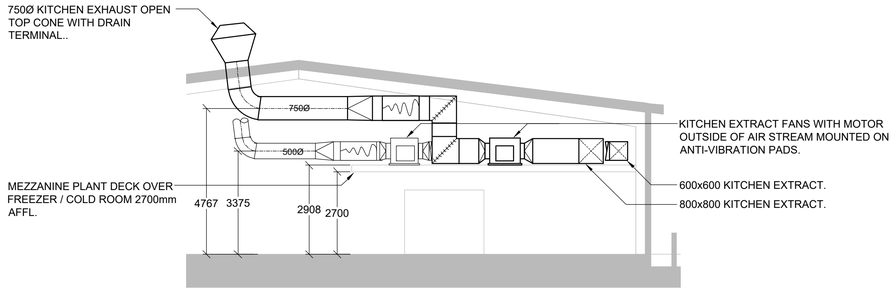
13/07/2016 06:00

Appendix B

Plant Data



SECTION A-A
SCALE 1:100



SECTION B-B
SCALE 1:100

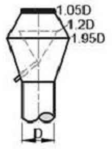


FIG 12e - OPEN TOP CONE AND DRAIN

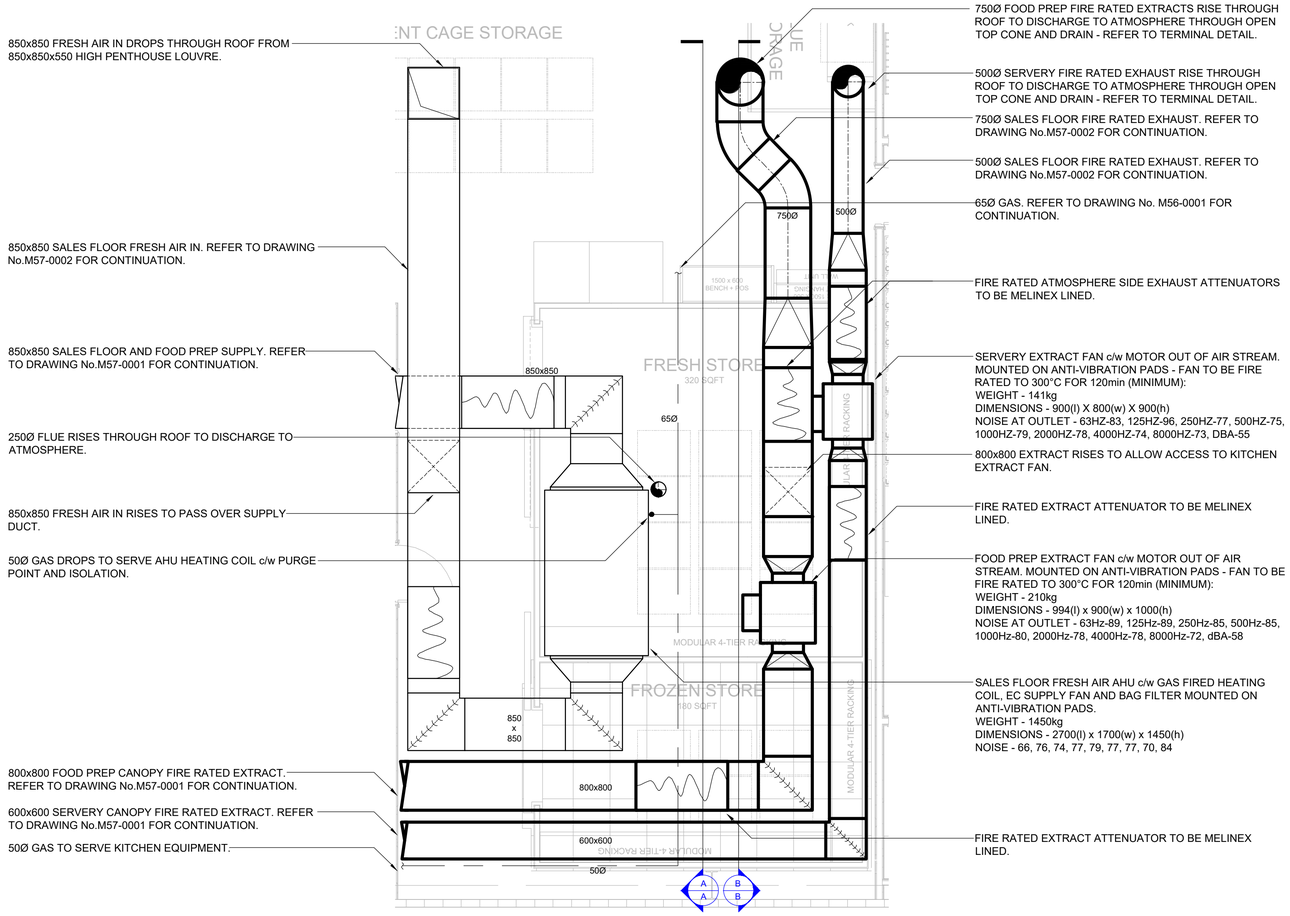
KITCHEN EXHAUST TERMINAL - TYPICAL

BUILDING SERVICE PERFORMANCE SPECIFICATION - PART L2A SBEM REQUIREMENTS

MECHANICAL SERVICES:
- SALES FLOOR AHU SPECIFIC FAN POWER TO BE NO GREATER THAN 1.0W/L/S.
- SERVERY EXTRACT FAN SPECIFIC FAN POWER TO BE NO GREATER THAN 1.0W/L/S.
- FOOD PREP EXTRACT FAN SPECIFIC FAN POWER TO BE NO GREATER THAN 1.0W/L/S.
- SALES FLOOR EXTRACT FAN SPECIFIC FAN POWER TO BE NO GREATER THAN 0.5W/L/S.
- BOH ADMIN / STAFF AREA MECHANICAL VENTILATION WITH HEAT RECOVERY UNIT SPECIFIC FAN POWER TO BE NO GREATER THAN 1.5W/L/S
- BOH ADMIN / STAFF AREA MECHANICAL VENTILATION WITH HEAT RECOVERY UNIT TO HAVE BY-PASS CAPABILITIES.
- BOH ADMIN / STAFF AREA MECHANICAL VENTILATION WITH HEAT RECOVERY UNIT EFFICIENCY TO BE NO LESS THAN 75%.
- SALES FLOOR VRF EFFICIENCIES TO BE: SEER - 6.40, SCOP - 4.30
- GENERAL OFFICE DX AC EFFICIENCIES TO BE: SEER - 8.65, SCOP - 5.10
- CANTEEN DX AC EFFICIENCIES TO BE: SEER - 6.38, SCOP - 4.10
- TRAINING ROOM DX AC EFFICIENCIES TO BE: SEER - 6.17, SCOP - 4.24

ELECTRICAL SERVICES:
- SALES FLOOR LIGHTING PERFORMANCE - 115lm/W GENERAL LIGHTING, 100lm/W DISPLAY LIGHTING
- ALL OTHER LIGHTING 100lm/W
- PIR LIGHTING CONTROLS TO ALL STAFF / ADMIN AREAS.

HODKINSON CONSULTANCY SBEM BRUKL REPORT TO BE CONSULTED FOR ADDITIONAL MINIMUM PERFORMANCE REQUIREMENTS. THIS MUST BE FOLLOWED TO ENSURE PART L2A COMPLIANCE IS ACHIEVED AND PLANNING CARBON REDUCTION REQUIREMENTS MET.



MEZZANINE PLANT DECK
SCALE 1:50

GENERAL NOTES

1. THIS DRAWING SHALL BE READ IN CONJUNCTION WITH ALL ASSOCIATED SERVICES DRAWINGS, ARCHITECTS AND STRUCTURAL DRAWINGS TOGETHER WITH THE SCHEMATIC DRAWINGS AND ALL MECHANICAL, ELECTRICAL AND OTHER RELEVANT SPECIFICATIONS.
2. ALL SERVICES INSTALLATIONS SHALL BE CO-ORDINATED AND FULLY INTEGRATED WITH THE MECHANICAL AND ELECTRICAL SERVICES, ARCHITECTURAL FEATURES, SPECIALIST PLANT AND STRUCTURAL ELEMENTS.
3. THE SERVICES CONTRACTORS SHALL FAMILIARISE THEMSELVES WITH THE MECHANICAL AND ELECTRICAL SERVICES, ARCHITECTURAL FEATURES, SPECIALIST PLANT AND STRUCTURAL ELEMENTS.
4. THE INSTALLING SUB-CONTRACTOR SHALL ISSUE FULL 'WORKING DRAWINGS' IN LINE WITH THE SPECIFICATION PROVIDED. THE 'WORKING DRAWINGS' SHALL BE ISSUED TO ALL DESIGN TEAM MEMBERS FOR THEIR COMMENT PRIOR TO INSTALLATION. THE INSTALLATION AND CO-ORDINATION OF SERVICES WITH OTHER SERVICES, THIRD PARTY SUPPLIERS AND THE BUILDING FABRIC IS THE RESPONSIBILITY OF THE INSTALLING SUB-CONTRACTOR.

SAFETY, HEALTH & ENVIRONMENTAL INFORMATION

Refer to the DDA Ltd project specific risk assessment and design criteria for the M&E services installation. The installing contractor must prepare method statements for the installation works and agree all works in advance with the main contractor.

It is assumed that all works associated with this drawing will be carried out by competent operatives working, where appropriate, to an approved method.

NOTES

STEEL DUCTWORK

FIRE RATED DUCTWORK

FOR PLANNING

Rev	Date	Description	Eng
A	09-06-20	1. XREF UPDATED TO LATEST LAYOUT 2. DUCTWORKS RESIZED TO ACCOMODATE NEW KITCHEN REQUIREMENTS 3. EXTRACT TERMINAL DETAILS ADDED AND UPDATED.	AP

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Client
Morrisons

Project
MORRISONS
CAMDEN TEMPORARY STORE

Drawing Title
MEZZANINE
PLANT DECK
LAYOUT

Scale at A1 1:50	Date 27-03-20
Drawn A. PARRY	Engineer A. PARRY
Status PLANNING	Checked P. GUEST
Drawing No. 19/3359/M50-0101	Rev A

Do not scale

A0

BUILDING SERVICE PERFORMANCE SPECIFICATION - PART L2A SBEM REQUIREMENTS

MECHANICAL SERVICES:
- SALES FLOOR AHU SPECIFIC FAN POWER TO BE NO GREATER THAN 1.0W/L/S.
- SERVERY EXTRACT FAN SPECIFIC FAN POWER TO BE NO GREATER THAN 1.0W/L/S.
- FOOD PREP EXTRACT FAN SPECIFIC FAN POWER TO BE NO GREATER THAN 1.0W/L/S.
- SALES FLOOR EXTRACT FAN SPECIFIC FAN POWER TO BE NO GREATER THAN 0.5W/L/S.
- BOH ADMIN / STAFF AREA MECHANICAL VENTILATION WITH HEAT RECOVERY UNIT SPECIFIC FAN POWER TO BE NO GREATER THAN 1.5W/L/S
- BOH ADMIN / STAFF AREA MECHANICAL VENTILATION WITH HEAT RECOVERY UNIT TO HAVE BY-PASS CAPABILITIES.
- BOH ADMIN / STAFF AREA MECHANICAL VENTILATION WITH HEAT RECOVERY UNIT EFFICIENCY TO BE NO LESS THAN 75%.
- SALES FLOOR VRF EFFICIENCIES TO BE: SEER - 6.40, SCOP - 4.30
- GENERAL OFFICE DX AC EFFICIENCIES TO BE: SEER - 8.65, SCOP - 5.10
- CANTEEN DX AC EFFICIENCIES TO BE: SEER - 6.38, SCOP - 4.10
- TRAINING ROOM DX AC EFFICIENCIES TO BE: SEER - 6.17, SCOP - 4.24

ELECTRICAL SERVICES:
- SALES FLOOR LIGHTING PERFORMANCE - 115lm/W GENERAL LIGHTING, 100lm/W DISPLAY LIGHTING
- ALL OTHER LIGHTING 100lm/W
- PIR LIGHTING CONTROLS TO ALL STAFF / ADMIN AREAS.

HODKINSON CONSULTANCY SBEM BRUKL REPORT TO BE CONSULTED FOR ADDITIONAL MINIMUM PERFORMANCE REQUIREMENTS. THIS MUST BE FOLLOWED TO ENSURE PART L2A COMPLIANCE IS ACHIEVED AND PLANNING CARBON REDUCTION REQUIREMENTS MET.

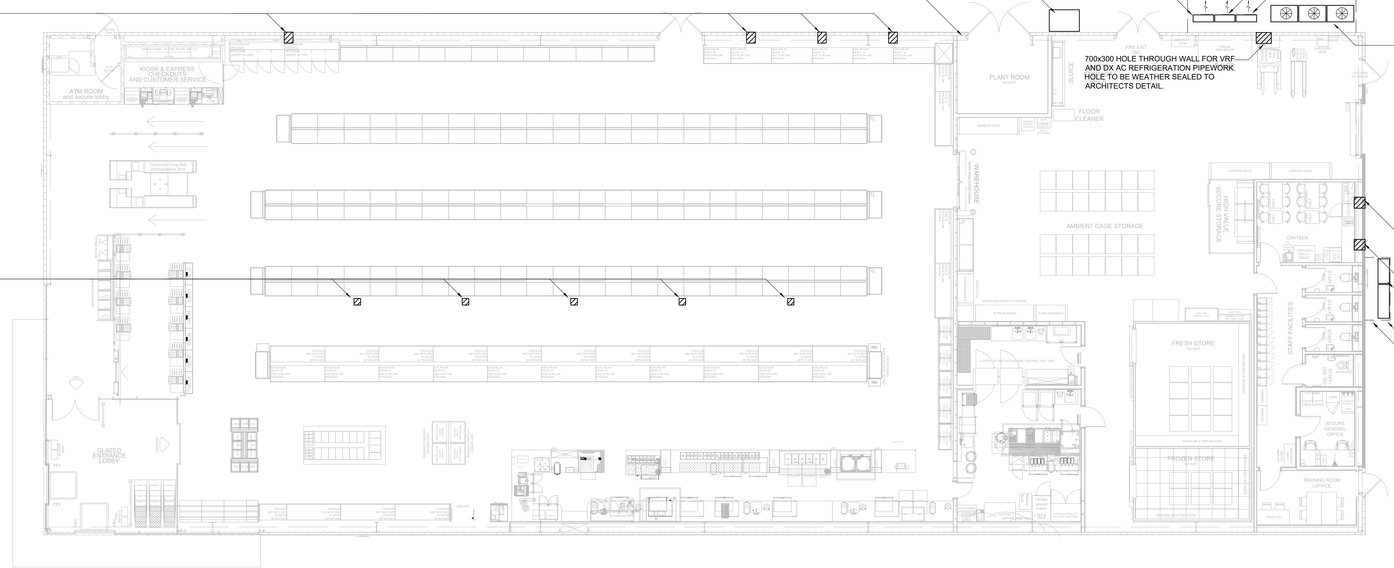
TRAINING ROOM DX SPLIT AC CONDENSER MOUNTED ON CONCRETE PLINTH (BY LANDLORD) c/w ANTI VIBRATION PADS.
RXM25N9:
DIMENSIONS - 550(h) x 765(w) x 285(d)
WEIGHT - 32kg
SOUND PRESSURE - 47dbA
SOUND POWER - 58dbA
63Hz-49db, 125Hz-50 250Hz-49, 500Hz-47 1000Hz-42, 2000Hz-37, 4000Hz-33, 8000Hz-25

NEW GRP GAS KIOSK TO HOUSE GAS METER (U60 METER) TO BE SPECIFIED AND SUPPLIED BY DEVELOPER (MAXIMUM kW PEAK - 3000kWP / HOUR) - DIMENSIONS TO BE CONFIRMED.

INCOMING 50Ø PROTECTA LINE WATER SUPPLY - 1.5l/s AVERAGE FLOW RATE. WATER METER TO BE FITTED IN PLANT ROOM.

4No. 300x300 WALL LOUVRES FOR HEAT DISSIPATION EXTRACT FANS MOUNTED ABOVE INTEGRAL CHILLERS / FROZEN CASES. REFER TO ELEVATION A, DRAWING No. M50-EX02.

5No. ROOF MOUNTED HEAT DISSIPATION EXTRACT FANS MOUNTED AT ROOF RIDGE.



700x300 HOLE THROUGH WALL FOR VRF AND DX AC REFRIGERATION PIPEWORK. HOLE TO BE WEATHER SEALED TO ARCHITECTS DETAIL.

PLANT ENCLOSURE c/w ACCESS DOOR BY PROJECT ARCHITECT.

GENERAL OFFICE DX SPLIT AC CONDENSER MOUNTED ON CONCRETE PLINTH (BY LANDLORD) c/w ANTI VIBRATION PADS.
RXM20N9:
DIMENSIONS - 550(h) x 765(w) x 285(d)
WEIGHT - 32kg
SOUND PRESSURE - 47dbA
SOUND POWER - 59dbA
63Hz-49db, 125Hz-51, 250Hz-49, 500Hz-46, 1000Hz-42, 2000Hz-37, 4000Hz-33, 8000Hz-25

CANTEEN DX SPLIT AC CONDENSER MOUNTED ON CONCRETE PLINTH (BY LANDLORD) c/w ANTI VIBRATION PADS.
RXM35N9:
DIMENSIONS - 550(h) x 765(w) x 285(d)
WEIGHT - 32kg
SOUND PRESSURE - 49dbA
SOUND POWER - 61dbA
63Hz-53db, 125Hz-53, 250Hz-57, 500Hz-49, 1000Hz-44, 2000Hz-39, 4000Hz-36, 8000Hz-28

SALES FLOOR VRF CONDENSERS MOUNTED ON CONCRETE PLINTH (BY LANDLORD) c/w ANTI VIBRATION PADS. 3No. CONDENSERS MAKE UP SINGLE VRF SYSTEM - RYYQ52U.
CONDENSER 1 RYMQ16U:
DIMENSIONS - 1685(h) x 1240(w) x 765(d)
WEIGHT - 291kg
SOUND PRESSURE - 63dbA
SOUND POWER - 85.6dbA
63Hz-10db, 125Hz-88, 250Hz-87, 500Hz-86, 1000Hz-81, 2000Hz-74, 4000Hz-70, 8000Hz-66
CONDENSER 2 RYMQ18U:
DIMENSIONS - 1685(H) X 1240(W) X 765(D)
WEIGHT - 308KG
SOUND PRESSURE - 62DBA
SOUND POWER - 83.8DBA
63HZ-10DB, 125HZ-86, 250HZ-85, 500HZ-85, 1000HZ-81, 2000HZ-75, 4000HZ-71, 8000HZ-66
CONDENSER 3 RYMQ18U:
DIMENSIONS - 1685(H) X 1240(W) X 765(D)
WEIGHT - 308KG
SOUND PRESSURE - 62DBA
SOUND POWER - 83.8DBA
63HZ-10DB, 125HZ-86, 250HZ-85, 500HZ-85, 1000HZ-81, 2000HZ-75, 4000HZ-71, 8000HZ-66

500x500 FRESH AIR IN LOUVRE SERVING STAFF FACILITIES HEAT RECOVERY UNIT. LOUVRE c/w 50% FREE AREA WITH ANTICIPATED VELOCITY OF 2.5m/s MAXIMUM. REFER TO ELEVATION B, DRAWING No. M50-EX02.

500x500 EXHAUST LOUVRE SERVING STAFF FACILITIES HEAT RECOVERY UNIT. LOUVRE c/w 50% FREE AREA WITH ANTICIPATED VELOCITY OF 2.5m/s MAXIMUM. REFER TO ELEVATION B, DRAWING NO. M50-EX02.

REFRIGERATION HT CONDENSING UNIT MOUNTED ON A CONCRETE PLINTH (BY LANDLORD) c/w ANTI-VIBRATION PADS. CONDENSER TO BE LOCATED 500mm FROM WALL.
DIMENSIONS - 1545(w) x 605(h) x 513(d)
SOUND POWER - 38dbA @ 10m

REFRIGERATION LT CONDENSING UNIT MOUNTED ON A CONCRETE PLINTH (BY LANDLORD) c/w ANTI-VIBRATION PADS. CONDENSER TO BE LOCATED 500mm FROM WALL.
DIMENSIONS - 1150(w) x 802.5(h) x 513(d)
SOUND POWER - 41dbA @ 10m

PLANT ENCLOSURE c/w ACCESS DOOR BY PROJECT ARCHITECT.

GENERAL NOTES

1. THIS DRAWING SHALL BE READ IN CONJUNCTION WITH ALL ASSOCIATED SERVICES DRAWINGS, ARCHITECTS AND STRUCTURAL DRAWINGS TOGETHER WITH THE SCHEMATIC DRAWINGS AND ALL MECHANICAL, ELECTRICAL AND OTHER RELEVANT SPECIFICATIONS.
2. ALL SERVICES INSTALLATIONS SHALL BE CO-ORDINATED AND FULLY INTEGRATED WITH THE MECHANICAL AND ELECTRICAL SERVICES, ARCHITECTURAL FEATURES, SPECIALIST PLANT AND STRUCTURAL ELEMENTS.
3. THE SERVICES CONTRACTORS SHALL FAMILIARISE THEMSELVES WITH THE MECHANICAL AND ELECTRICAL SERVICES, ARCHITECTURAL FEATURES, SPECIALIST PLANT AND STRUCTURAL ELEMENTS.
4. THE INSTALLING SUB-CONTRACTOR SHALL ISSUE FULL 'WORKING DRAWINGS' IN LINE WITH THE SPECIFICATION PROVIDED. THE 'WORKING DRAWINGS' SHALL BE ISSUED TO ALL DESIGN TEAM MEMBERS FOR THEIR COMMENT PRIOR TO INSTALLATION. THE INSTALLATION AND CO-ORDINATION OF SERVICES WITH OTHER SERVICES, THIRD PARTY SUPPLIERS AND THE BUILDING FABRIC IS THE RESPONSIBILITY OF THE INSTALLING SUB-CONTRACTOR.

SAFETY, HEALTH & ENVIRONMENTAL INFORMATION

Refer to the DDA Ltd project specific risk assessment and design criteria for the M&E services installation. The installing contractor must prepare method statements for the installation works and agree all works in advance with the main contractor.

It is assumed that all works associated with this drawing will be carried out by competent operatives working, where appropriate, to an approved method.

NOTES

FOR PLANNING

Rev	Date	Description	Eng
D	9/6/20	1. XREF UPDATED. 2. GENERAL UPDATES.	AP
C	02/6/20	1. MECHANICAL EQUIPMENT REMOVED FROM DRAWING.	AP
B	03/4/20	1. XREF UPDATED TO LATEST.	AP
A	01/4/20	1. AC CONDENSERS RELOCATED.	AP

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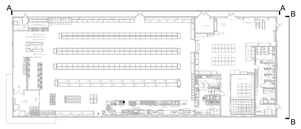
Client: Morrisons

Project: MORRISONS CAMDEN TEMPORARY STORE

Drawing Title: EXTERNAL MECHANICAL SERVICES LAYOUT

Scale at A0: 1:100	Date: 26-03-20
Drawn: A. PARRY	Engineer: A. PARRY
Status: PLANNING	Checked: P. GUEST
Drawing No.: 19/3359/M50/EX01	Rev: D

Do not scale



LOCATION PLAN
SCALE 1:500

GENERAL NOTES

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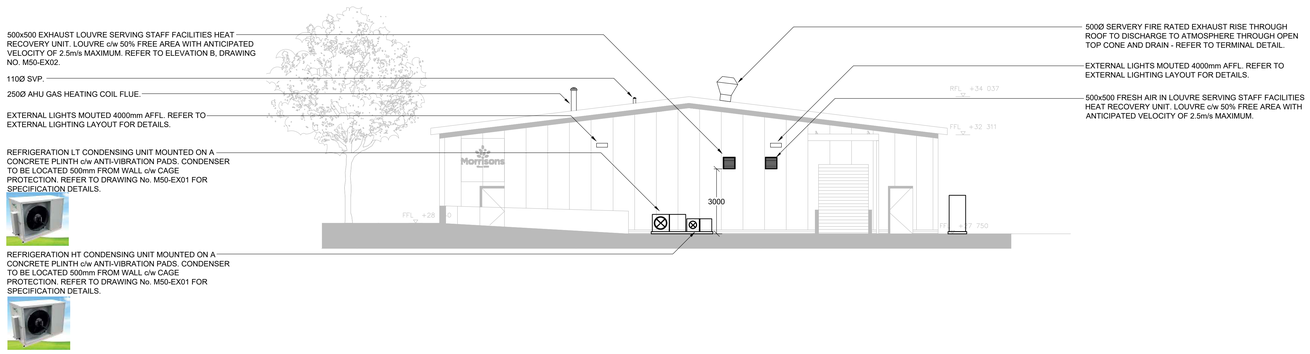
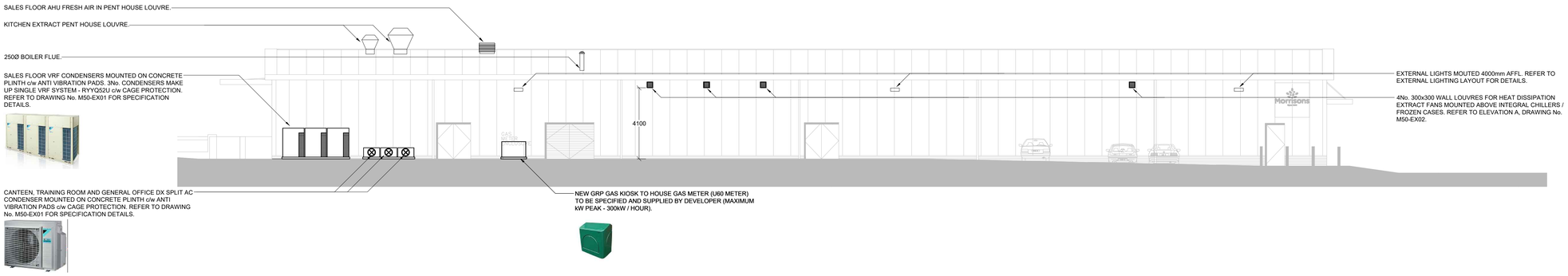


ELEVATION B



ELEVATION A

SAFETY, HEALTH & ENVIRONMENTAL INFORMATION

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NOTES

FOR PLANNING

Rev	Date	Description	Eng
C	10/6/20	1. KITCHEN EXHAUST TERMINALS REVISED 2. GENERAL UPDATES.	AP
B	02/6/20	1. MECHANICAL EQUIPMENT REMOVED FROM DRAWING.	AP
A	01/2/20	1. EXTERNAL CONDENSERS RELOCATED.	AP

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Client

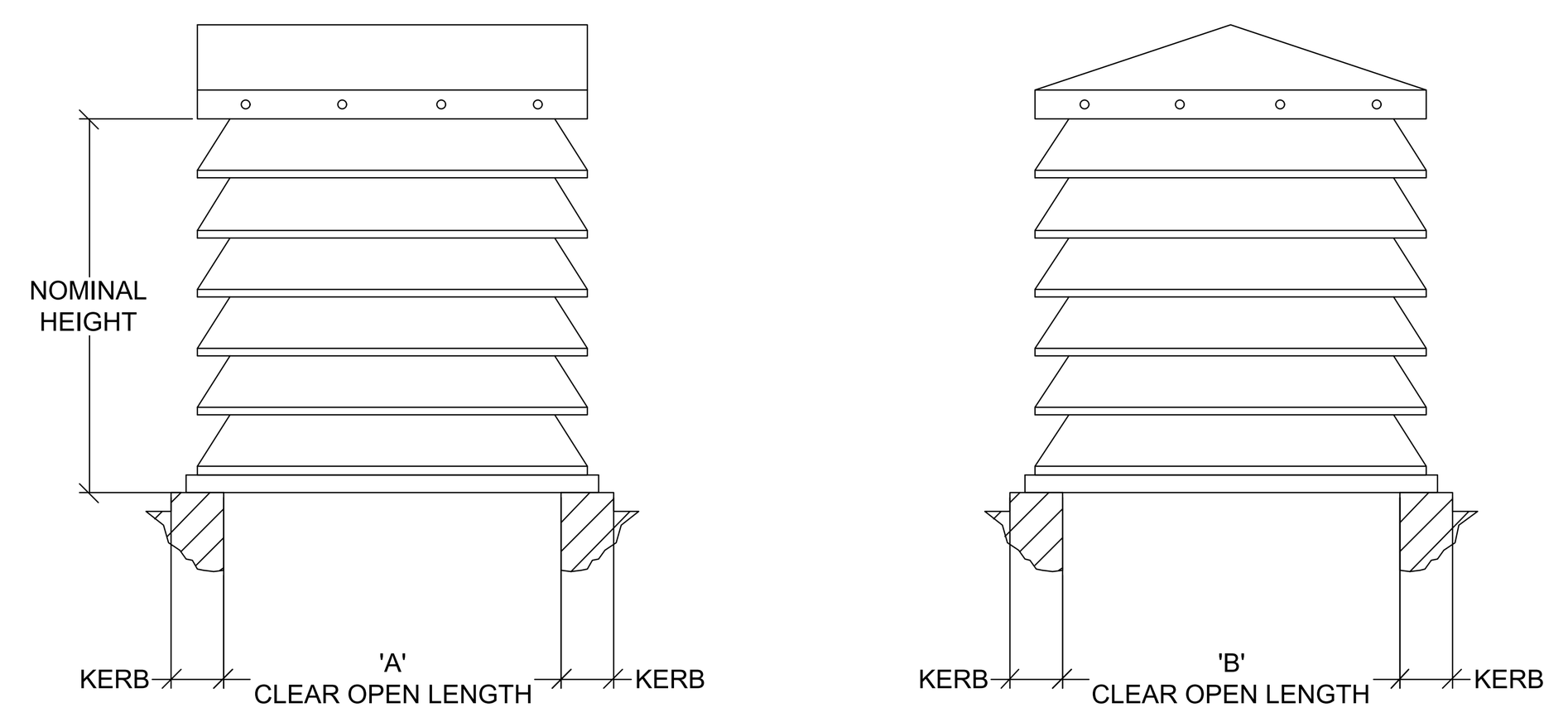
Morrisons

Project
MORRISONS
CAMDEN TEMPORARY STORE

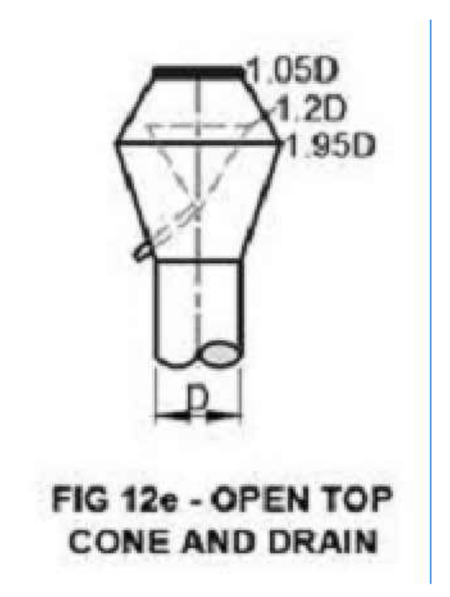
Drawing Title
EXTERNAL
MECHANICAL SERVICES
ELEVATIONS

Scale at A0 1:100	Date 26-03-20
Drawn A. PARRY	Engineer A. PARRY
Status PLANNING	Checked P. GUEST
Drawing No. 19/3359/M50/EX02	Rev C

Do not scale



TYPICAL AHU ROOF TURRET DETAIL
N.T.S



KITCHEN EXHAUST TERMINAL - TYPICAL

GENERAL NOTES

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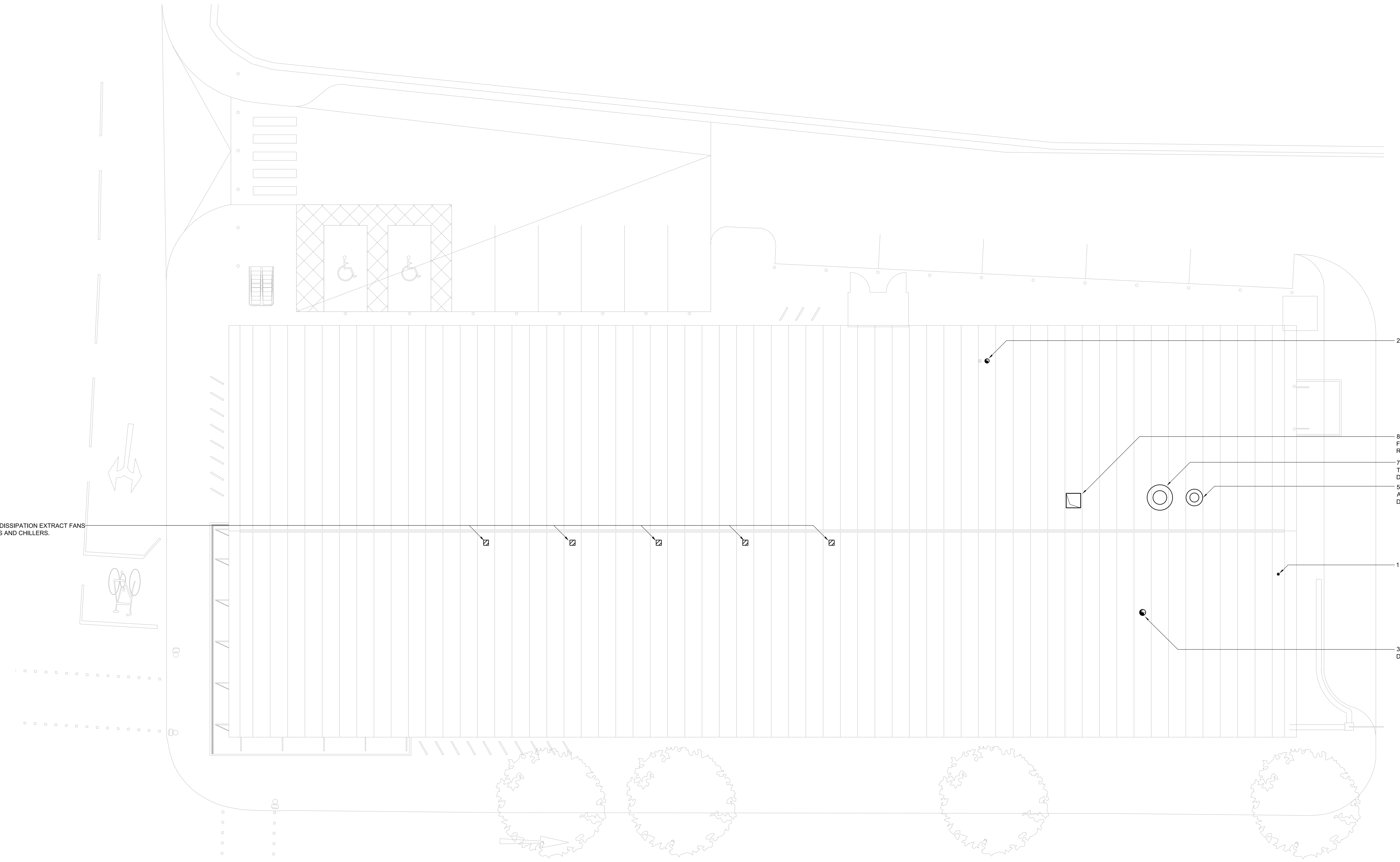

SAFETY, HEALTH & ENVIRONMENTAL INFORMATION

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NOTES

FOR PLANNING

Rev	Date	Description	Eng
B	10/2/20	1. ROOF PENETRATIONS AND DISCHARGE TERMINALS REVISED.	AP
A	01/2/20	1. MECHANICAL EQUIPMENT REMOVED FROM DRAWING	AP

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Client: Morrisons

Project: MORRISONS CAMDEN TEMPORARY STORE

Drawing Title: ROOF MECHANICAL SERVICES LAYOUT

Scale at A0: 1:100	Date: 26-03-20
Drawn: A. PARRY	Engineer: A. PARRY
Status: PLANNING	Checked: P. GUEST
Drawing No.: 19/3359/M50/RF01	Rev: B

Do not scale

8 Sound data

8 - 1 Sound Power Spectrum

VAM800FC

Power level data (in case of Total Heat Exchange mode)

(dB) (dBA)

Unit model name	Hz / Fan speed	63	125	250	500	1000	2000	4000	8000	Total
VAM800FB	U-H	58.0	58.0	52.5	49.5	48.5	41.5	33.5	26.0	53
	H	58.5	57.0	51.5	49.5	47.0	40.5	31.0	27.5	52
	L	54.5	54.5	47.5	44.5	43.0	35.5	24.5	23.5	47

NOTES

1. dBA = A-weighted sound power level (A-scale according to IEC).
2. Reference acoustic intensity 0dB = 10E-6µW/m^2
3. Measured according to ISO 3744.
4. The operating sound level may become higher than this value depending on the operating conditions, reflected sound and peripheral noise.
5. The power levels have been calculated in the assumption that the measuring point is immediately under the source of operating sound.

4D082467

VAM1000FC

Power level data (in case of Total Heat Exchange mode)

(dB) (dBA)

Unit model name	Hz / Fan speed	63	125	250	500	1000	2000	4000	8000	Total
VAM1000FB	U-H	62.0	58.5	54.0	50.5	49.0	42.0	36.5	28.0	53
	H	61.0	57.0	52.0	50.0	48.0	38.5	31.0	25.5	52
	L	58.0	55.0	49.0	45.5	43.5	36.5	27.5	24.0	48

NOTES

1. dBA = A-weighted sound power level (A-scale according to IEC).
2. Reference acoustic intensity 0dB = 10E-6µW/m^2
3. Measured according to ISO 3744.
4. The operating sound level may become higher than this value depending on the operating conditions, reflected sound and peripheral noise.
5. The power levels have been calculated in the assumption that the measuring point is immediately under the source of operating sound.

4D082468

VAM1500FC

Power level data (in case of Total Heat Exchange mode)

(dB) (dBA)

Unit model name	Hz / Fan speed	63	125	250	500	1000	2000	4000	8000	Total
VAM1500FB	U-H	60.5	61.0	55.5	52.5	50.5	46.0	39.5	29.5	55
	H	60.5	60.0	53.5	51.5	49.5	44.5	37.0	31.0	54
	L	58.5	58.0	51.0	49.0	47.0	39.5	30.5	31.0	51

NOTES

1. dBA = A-weighted sound power level (A-scale according to IEC).
2. Reference acoustic intensity 0dB = 10E-6µW/m^2
3. Measured according to ISO 3744.
4. The operating sound level may become higher than this value depending on the operating conditions, reflected sound and peripheral noise.
5. The power levels have been calculated in the assumption that the measuring point is immediately under the source of operating sound.

4D082469

VAM2000FC

Power level data (in case of Total Heat Exchange mode)

(dB) (dBA)

Unit model name	Hz / Fan speed	63	125	250	500	1000	2000	4000	8000	Total
VAM2000FB	U-H	65.0	61.5	57.0	54.0	53.0	45.0	39.5	32.5	57
	H	64.0	60.0	55.0	53.0	51.0	41.5	34.5	30.5	55
	L	62.0	58.0	51.5	50.0	48.5	40.5	32.5	30.5	53

NOTES

1. dBA = A-weighted sound power level (A-scale according to IEC).
2. Reference acoustic intensity 0dB = 10E-6µW/m^2
3. Measured according to ISO 3744.
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4D082470

ECOflo Condensing Water Heater

The ECOflo range of storage water heaters are fully condensing, offering excellent energy efficiency, low NO_x and exceptional hot water recovery rates.

The Vitraglas® lined, thermally efficient tanks are protected by maintenance free anodes, and are equipped with a Hydrojet® sediment reduction system which enhances the performance and prolongs the life of the product.

ECOflo is suitable for installation on a conventional flue or a concentric balanced flue.

Technical specification

35-79kW	Up to 98%	Up to 1,400 l\hr at 50°C rise	As low as 32mg/kWh
OUTPUT	GROSS EFFICIENCY	RECOVERY RATE	NO_x EMISSIONS (0% O_2)

Features	Benefits
Up to 98% gross efficiency	For energy efficient, cost effective operation
Recovery rates of up to 1,400 litres per hour	Can satisfy the most demanding applications
Vitraglas® lined storage tank and maintenance free, factory fitted Correx® anodes	Offering protection to the steel storage tank
Factory installed Hydrojet® sediment reduction system	Gives a longer and more efficient working life
Supported by a three year vessel warranty	Peace of mind for the customer
Two storage capacities available	Increased flexibility – larger storage option for peak demand
Room-sealed balanced or conventional flue	Ease of installation
Three pass flue system (unique and patented)	Increased efficiency
Ultra-quiet operation	Increased comfort
Electronic controls	Ease of use and maintenance
Factory installed Correx® powered anode system	Maintenance free
Large hand-hole clean-out opening	Easy inspection and cleaning

Specifications

			Model			
			EC230/600	EC230/700	EC230/960	EC380/740
Energy	Heat input (gross)	kW	36.6	43.9	58.3	43.9
	Heat output (gross)	kW	35.1	41.3	54.2	43
	Gross thermal efficiency	%	96	94	93	98
	Standby heat loss	kW/1/day	0.0012	0.0013	0.00135	0.00694
ErP	NO_x emissions (0% O_2)	mg/kWh	33	37	40	32
	ErP efficiency rating		A	A	A	A
	Noise level*	dBA	51	51	51	51
Gas data	Gas flow rate	m^3/hr	3.41	4.09	5.43	4.09
	Supply pressure	mbar	20	20	20	20
Water	Storage capacity	litre	230	230	230	380
	Recovery rate through 50°C Δt	litre/hr	600	700	960	740
	Recovery rate through 56°C Δt	litre/hr	537	632	830	658
	Minimum working pressure	bar	0.8	0.8	0.8	0.8
	Maximum pressure	bar	10	10	10	10
Electrical	Fuse rating	amp	5	5	5	5
	Electrical power consumption	W	120	120	120	120
	Electrical supply		230V/50Hz	230V/50Hz	230V/50Hz	230V/50Hz
Misc	Weight full	kg	450	450	450	760
	Weight empty	kg	259	259	259	408
	Maximum flue runs (concentric)	m	16	16	16	16
	Maximum flue runs (conventional)	m	32	32	32	32
Flue diameter	Conventional	mm	100	100	100	100
	Concentric	mm	100/150	100/150	100/150	100/150

*@ 2m from flue terminal

Specifications

			Model		
			EC380/980	EC380/1220	EC380/1400
Energy	Heat input (gross)	kW	58.3	73.2	85
	Heat output (gross)	kW	57.1	71	79.1
	Gross thermal efficiency	%	98	97	93/96
	Standby heat loss	kW/1/day	0.00098	0.00115	0.00122
ErP	NO_x emissions (0% O_2)	mg/kWh	40	40	55
	ErP efficiency rating		A	A	A
	Noise level*	dBA	51	51	51
Gas data	Gas flow rate	m^3/hr	5.43	6.82	7.92
	Supply pressure	mbar	20	20	20
Water	Storage capacity	litre	380	380	380
	Recovery rate through 50°C Δt	litre/hr	980	1,220	1,400
	Recovery rate through 56°C Δt	litre/hr	874	1,087	1,211
	Minimum working pressure	bar	0.8	0.8	0.8
	Maximum pressure	bar	10	10	10
Electrical	Fuse rating	amp	5	5	5
	Electrical power consumption	W	120	120	120
	Electrical supply		230V/50Hz	230V/50Hz	230V/50Hz
Misc	Weight full	kg	760	760	760
	Weight empty	kg	408	408	408
	Maximum flue runs (concentric)	m	16	16	16
	Maximum flue runs (conventional)	m	32	32	32
Flue diameter	Conventional	mm	100	100	100
	Concentric	mm	100/150	100/150	100/150

*@ 2m from flue terminal

Plant Data Provided from End User by St George Plc - 05/05/2020 - Unchanged in Revision B

Staff WC and Ancillaries
45dBA (Sound Pressure based on VAM 2000) – See data sheet, this has been increased to allow highest possible operation.

Sales Floor AHU
63Hz-64, 125Hz-74, 250Hz-75, 500Hz-77, 1KHz-80, 2kHz-78, 4kHz-79, 8kHz-76 – 85dBA

Refrigeration Packs
41dBA (LT Condenser), 38dBA (HT Condenser)

AC VRF
Condenser 1 - 63Hz-10, 125Hz-88, 250Hz-87, 500Hz-86, 1KHz-81, 2kHz-74, 4kHz-70, 8kHz-66

Condenser 2 - 63Hz-10, 125Hz-86, 250Hz-85, 500Hz-85, 1KHz-81, 2kHz-75, 4kHz-71, 8kHz-66

Condenser 3 - 63Hz-10, 125Hz-86, 250Hz-85, 500Hz-85, 1KHz-81, 2kHz-75, 4kHz-71, 8kHz-66

AC Splits
Condenser 1 - 63Hz-53, 125Hz-53, 250Hz-57, 500Hz-49, 1KHz-44, 2kHz-39, 4kHz-36, 8kHz-28

Condenser 2 - 63Hz-49, 125Hz-51, 250Hz-49, 500Hz-46, 1KHz-42, 2kHz-37, 4kHz-33, 8kHz-25

Condenser 3 - 63Hz-49, 125Hz-50, 250Hz-49, 500Hz-47, 1KHz-42, 2kHz-37, 4kHz-33, 8kHz-25

Appendix C

Calculations

MORISONS CAMDEN - TEMPORARY STORE PLANT CALCS DAY - CHALK FARM ROAD

		Dwelling																
		Source									Distance				Day		
Details	m	(A)	63	125	250	500	1k	2k	4k	8k	XY (m)	Atten	Scrn	LpA	Atten	LpA	Notes
AC Condenser 1		51.7	53	53	57	49	44	39	36	28	58.0	-43	-10	-2	-5	-7	Acoustic Screen / Enclosure
AC Condenser 2		47.7	49	51	49	46	42	37	33	25	58.0	-43	-10	-6	-5	-11	Acoustic Screen / Enclosure
AC Condenser 3		48	49	50	49	47	42	37	33	25	58.0	-43	-10	-5	-5	-10	Acoustic Screen / Enclosure
6 X Refrigeration Unit Fans (total)	3	48									80.0	-29	-10	9		9	
Sales floor AC condenser 1		86.5	10	88	87	86	81	74	70	66	56.0	-43	-10	34	-5	29	Acoustic Screen / Enclosure
Sales floor AC condenser 2		85.9	10	86	85	85	81	75	71	66	56.0	-43	-10	33	-5	28	Acoustic Screen / Enclosure
Sales floor AC condenser 3		85.9	10	86	85	85	81	75	71	66	56.0	-43	-10	33	-5	28	Acoustic Screen / Enclosure
Sales Floor AHU		85.3	64	74	75	77	80	78	79	76	59.0	-43	-5	37	-10	27	Acoustic Louvred
Boiler Flue	2	51									62.0	-30	-10	11		11	
Kitchen Extract (355)		51.6	63	62	51	51	41	37	30	28	54.0	-43	-5	4		4	
Refrigeration HT Condenser	10	38									44.0	-13		25	-5	20	Acoustic Screen / Enclosure
Refrigeration LT Condenser	10	41									44.0	-13		28	-5	23	Acoustic Screen / Enclosure
Kitchen Extract (750)		86.9	89	89	85	85	80	78	78	72	52.0	-42		45	-10	35	Acoustic dampened and exhaust cowl
Kitchen Extract (500)		85.2	83	96	77	75	79	78	74	73	52.0	-42		43	-10	33	Acoustic dampened and exhaust cowl
Staff WC and Ancilleries		56.9	65	62	57	54	53	45	40	33	47.0	-41		15		15	
Cumulative level at dwellings (Chalk Farm Road)														48		39	
Background Noise Day (Point 1)																61	
Assessment																-22	

MORISONS CAMDEN - TEMPORARY STORE PLANT CALCS NIGHT - CHALK FARM ROAD

		Dwelling																
		Source									Distance				Night		
Details	m	(A)	63	125	250	500	1k	2k	4k	8k	XY (m)	Atten	Scrn	LpA	Atten	LpA	Notes
6 X Refrigeration Unit Fans (total)	3	48									80.0	-29	-10	9		9	
Boiler Flue	2	51									62.0	-30	-5	16		16	
Refrigeration HT Condenser	10	38									44.0	-13		25	-5	20	Acoustic Screen / Enclosure
Refrigeration LT Condenser	10	41									44.0	-13		28	-5	23	Acoustic Screen / Enclosure
Cumulative level at dwellings (Chalk Farm Road)														30		26	
Background Noise Night (Point 1)																46	
Assessment																-20	

MORISONS CAMDEN - TEMPORARY STORE PLANT CALCS DAY - JUNIPER CRESCENT

	Dwelling																	Day		
	Source										Distance									
Details	m	(A)	63	125	250	500	1k	2k	4k	8k	XY (m)	Atten	H	Dir	Scrn	Spd	LpA	Atten	LpA	Notes
AC Condenser 1		51.7	53	53	57	49	44	39	36	28	32	-38	0.0		-10		4	-5	-1	Acoustic Screen / Enclosure
AC Condenser 2		47.7	49	51	49	46	42	37	33	25	32	-38	0.0		-10		0	-5	-5	Acoustic Screen / Enclosure
AC Condenser 3		48	49	50	49	47	42	37	33	25	32	-38	0.0		-10		0	-5	-5	Acoustic Screen / Enclosure
6 X Refrigeration Unit Fans (total)	3	48									39	-22	0.0		-5		21		21	
Sales floor AC condenser 1		86.5	10	88	87	86	81	74	70	66	33	-38	0.0		-10		38	-5	33	Acoustic Screen / Enclosure
Sales floor AC condenser 2		85.9	10	86	85	85	81	75	71	66	33	-38	0.0		-10		38	-5	33	Acoustic Screen / Enclosure
Sales floor AC condenser 3		85.9	10	86	85	85	81	75	71	66	33	-38	0.0		-10		38	-5	33	Acoustic Screen / Enclosure
Sales Floor AHU		85.3	64	74	75	77	80	78	79	76	42	-40	0.0		-5		40	-10	30	Acoustic Louvred
Boiler Flue	2	51									34	-25	0.0		-5		21		21	
Kitchen Extract (355)		51.6	63	62	51	51	41	37	30	28	48	-42	0.0		-10		0		0	
Refrigeration HT Condenser	10	38									48	-14	0.0		-10		14	-5	9	Acoustic Screen / Enclosure
Refrigeration LT Condenser	10	41									48	-14	0.0		-10		17	-5	12	Acoustic Screen / Enclosure
Kitchen Extract (750)		86.9	89	89	85	85	80	78	78	72	41	-40	0.0		-5		42	-10	32	Acoustic dampened and exhaust cowl
Kitchen Extract (500)		85.2	83	96	77	75	79	78	74	73	41	-40	0.0		-5		40	-10	30	Acoustic dampened and exhaust cowl
Staff WC and Ancilleries		56.9	65	62	57	54	53	45	40	33	42	-40	0.0		-10		6		6	
Cumulative level at dwellings (Juniper Crescent)																	47		40	
Background Noise Day (Point 1)																			61	
Assessment																			-21	

MORISONS CAMDEN - TEMPORARY STORE PLANT CALCS NIGHT - JUNIPER CRESCENT

	Dwelling																	Night		
	Source										Distance									
Details	m	(A)	63	125	250	500	1k	2k	4k	8k	XY (m)	Atten	H	Dir	Scrn	Spd	LpA	Atten	LpA	Notes
6 X Refrigeration Unit Fans (total)	3	48									38.5	-22	0.0		-5		21		21	
Boiler Flue	2	51									33.7	-25	0.0		-5		21		21	
Refrigeration HT Condenser	10	38									47.5	-14	0.0		-10		14	-5	9	Acoustic Screen / Enclosure
Refrigeration LT Condenser	10	41									47.5	-14	0.0		-10		17	-5	12	Acoustic Screen / Enclosure
Cumulative level at dwellings (Juniper Crescent)																	25		25	
Background Noise Night (Point 1)																			46	
Assessment																			-21	

Appendix D

Report 160630-10

PROPOSED RESIDENTIAL / RETAIL DEVELOPMENT:
MORRISONS, CHALK FARM ROAD, CAMDEN

NOISE AND VIBRATION IMPACT ASSESSMENT

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REPORT REF. 160630-10
PROJECT NO. 160630
JUNE 2017

SAFEWAY STORES LIMITED & BDW TRADING LIMITED

PROPOSED RESIDENTIAL / RETAIL DEVELOPMENT:
MORRISONS, CHALK FARM ROAD, CAMDEN

NOISE AND VIBRATION IMPACT ASSESSMENT

REPORT REFERENCE NO. 160630-10
PROJECT NO. 160630
JUNE 2017

DOCUMENT CONTROL

REV	ISSUE PURPOSE	AUTHOR	CHECKED	APPROVED	DATE
-	Draft for Client Comments	LL	MNR	Draft only	16/6/17
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CAMDEN MORRISONS 160630-10
NOISE AND VIBRATION IMPACT ASSESSMENT JUNE 2017

CONTENTS

Page

Plate 1: Site boundaries (image © OS Open Data)

1.5 Given its location within Camden Town Centre, the surrounding area includes a wide range of commercial, retail and leisure uses, including Camden Market along with residential development.

1.6 The North London Line railway line runs along the boundary of both parts of the site, parallel to Chalk Farm Road, whilst the railway lines along the southwestern boundary run into Euston station to the south.

Existing Use

1.7 The existing Morrisons Foodstore measures 7,203sqm gross floor area, of which 5,018sqm is retail store floor area. As well as retailing food and groceries the store also includes other services such as an in-store café, dry-cleaning, and a pharmacy. The store's current opening hours are 0800 to 2300 hours Monday to Friday, 0700 to 2300 hours on Saturday, and 1000 to 1600 hours on Sundays. The Morrisons store has been operating since 2005, prior to which it was a Safeway store.

1.0 INTRODUCTION

1.1 Ardent Consulting Engineers has been commissioned by by Safeway Stores Limited & BDW Trading Limited to carry out a Noise and Vibration Impact Assessment (NVIA) for the proposed residential and retail development at the existing Morrisons Foodstore at Chalk Farm Road, Camden, NW1 8AA.

1.2 This NVIA has been undertaken to support a full planning application to the local planning authority, the London Borough of Camden (LBC).

1.3 This NVIA has been prepared in accordance with the National Planning Policy Framework (NPPF), the Noise Policy Statement for England (NPSE) and other relevant policy and guidance detailed in **Appendix B**.

Site Location

1.4 The site comprises the existing Morrisons Camden Foodstore, which is located to the south-west of Chalk Farm Road, towards the north-western end of Camden Town Centre. The site area includes the Morrisons store and associated car park, which are located to the south-west of the Northern Line underground rail line, as well as the Morrisons Petrol Filling Station (PFS), which is situated in between Chalk Farm Road and the Northern Line. The main part of the site (foodstore) is bound by the site access road to the north-west, the Northern Line to the north-east, residential properties to the south-east, and national rail lines to the south-west. **Plate 1** overleaf shows the indicative site boundaries:

Development Proposals

1.8 The development proposals comprise the following:

1.9 Demolition of existing buildings (Class A1 foodstore and Sui Generis petrol filling station) and associated highways and site works including removal of existing surface level car parking and retaining walls along with road junction alterations.

1.10 Redevelopment of petrol filling station site to include the erection of a new building of up to six storeys and up to 11,243 sq m GEA floorspace to accommodate a petrol filling station (Sui Generis), flexible Class A1, A3 and A4 floorspace, Class B1 floorspace and a winter garden; associated cycle parking; public green space; public toilets and other associated works and highways works. For a temporary period of up to thirty months part of the ground and all of the 1st floor of the building will be used for a Class A1 foodstore with associated car parking.

1.11 Redevelopment of the main supermarket site to include the erection of buildings (Blocks A to F, including Blocks E1 and E2) of up to 14 storeys accommodating up to 573 homes and up to 60,568 sq m GEA of residential floorspace together with up to 28,333 sq m GEA non-residential floorspace within Class A1 (foodstore), flexible Class A1 and A3, Class B1a and B1c, Class D2 community centre, Sui Generis use at roof level of 'Block B' for food and plant growing/production facility (including small scale brewing and distilling) with associated ancillary office, storage, education, training, café and restaurant activities; together with associated new streets and squares; hard and soft landscaping and play space; lifts; public cycle parking and cycle hire facility; and other associated works, including highways works.

1.12 An extract of the development proposals submitted for planning purposes and prepared by the scheme's Architect, is provided at **Plate 2** below:

Plate 2: Indicative masterplan (extract – ground floor)

2.0 NOISE MEASUREMENTS

2.1 Noise measurements to establish the base line conditions and for validation of the predictive noise calculations, have been undertaken at the monitoring locations shown at **Plate 3** below:

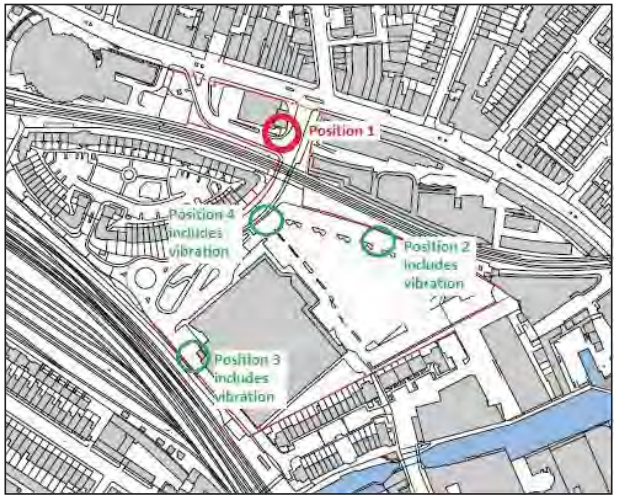


Plate 3: Noise and vibration monitoring locations

2.2 Noise measurements were undertaken at the site between the 6th and 13th July 2016. Measurements were taken continuously at these locations to provide a base reference for the noise assessment. Noise measurements can be found in **Appendix C** and are summarised in the relevant following sections.

Measurement Procedures

2.3 To avoid the occurrence of instrument over or under-loading, noise levels were observed prior to measurement to determine the

dynamic measurement range for the instrument for each measurement scenario.

2.4 Measurements were undertaken by Clement Acoustics Ltd. Staff involved with the measurements and observations are fully competent with regard to the requirements of environmental noise measurement. Measurement procedures used within this assessment conformed to relevant guidance within *BS 7445* and *CRN* where appropriate.

Instrumentation

2.5 Manually observed noise measurements were taken across the site using a Cirrus Research CR821A – Class 1 Sound Level Meter (SLM).

2.6 Continuous measurements were taken using the following equipment:

- Position 1: Svantek 977 (noise);
- Position 2: Svantek 977 (noise);
- Position 3: Svantek 958 (vibration) and Svantek 957 (noise), other periods Svantek 977 (noise);
- Position 4: Svantek 958 (vibration) and Svantek 957 (noise), other periods Svantek 977 (noise).

2.7 All of the sound level meters used are Class 1. GRAS Environmental Microphones were used in conjunction with the meters.

2.8 Measurements for background noise were taken at a height of 1.2m to 1.3m from the ground and would be considered free field.

2.9 All equipment used has been professionally calibrated, and calibration certificates are presented in **Appendix D**. Field calibration of the sound level meters was undertaken before and after measurement to ensure no drifting of the calibration signal.

Staff involved with the measurements and observations are fully competent with regard to the requirements of environmental noise measurement. Measurement procedures used within this assessment conformed to relevant guidance within *BS 7445*.

Observations

2.10 The following observations were made of the noise climate at each monitoring location. It should be noted that the noise climate can only be described for the moments in time the survey was being set up and collected.

Position 1 – 6th July to 13th July 2016

2.11 Car traffic noise from Chalk Farm Road. During the installation and collection, the rail noise was not considered significant. It is understood that there are some local late night venues in the surrounding area, which is expected to have significantly contributed to the noise climate during the evenings.

Position 2 - 6th July to 13th July 2016

2.12 Rail noise from the adjacent railway was noted to be driving the maximum levels. There were also traffic movements during the installation and collection of equipment from the nearby offices and Morrison's car parks.

Position 3 – 6th July to 13th July 2016

2.13 This was noted to be predominantly railway noise at the time of setting up the equipment. It was also noted that there was some construction works near the lines. It is expected that due to the microphone being in Morrison's yard, some lorry movements and noise from loading and unloading to the store would have impacted the measurements.

Position 4 – 6th July to 11th July 2016

2.14 This location was dominated by road traffic noise from the road joining Chalk Farm Road and the Morrison's roundabout. Some noise impact from the nearby railway but the road traffic was more significant. Possibly subject to noise from local late night venues throughout the evening/night period.

Results

2.15 The L_{Aeq}, L_{Amax}, L_{A10} and L_{A90} acoustic parameters were measured in 15 minute samples throughout the duration of the survey. These have been collated to show hourly parameters. Measured levels are shown as time histories in **Appendix C.**

2.16 **Table 2.1** below provides a summary of the measured noise surveys:

	Daytime L_{Aeq} (7am-11pm) dB(A)	Night-time L_{Aeq} (11pm-7am) dB(A)	Representative night-time L_{Amax} dB(A)
Position 1	69.3	66.2	82
Position 2	66.9	68.3	88
Position 3	70.3	63.9	87
Position 4	63.6	58.6	78

Table 2.1: Site average noise levels for daytime and night-time

3.0 RAIL TRAFFIC NOISE

3.1 The working timetable was consulted to establish the train movements on the lines to the south of the development, which lead into London Euston. These lines are the Caledonian Sleeper, London Midland, Overground and Virgin Trains. These are summarised below in **Table 3.1**.

Time table	Day passes	Night passes
T60	89	12
T65	249	19
T66	298	30
Total	**636**	**61**

Table 3.1: Summary of train movements on lines into Euston Station

Consultation with Network Rail:

3.2 Network Rail were consulted regarding the North London Line which passes between the two parts of the site. They responded on 21st February 2017 with the following information:

You are quite correct that there are no passenger train services between Camden Road and South Hampstead. These ended in 1992 with the closing of Primrose Hill station on the line. This is now a freight only line connecting to the West Coast Main Line where freight services usually go into either Wembley or Willesden Yards for crew changes etc. The North London Line at Camden Road is incredibly busy at this point with all freight services which either use the freight only line through Primrose Hill or the North London Line via Kentish Town West and Gospel Oak passing through Camden Road station.

The Working timetable has official paths for 60 class 4 freight trains (able to run at up to 75mph and usually intermodal container traffic to/from Felixstowe) and 70 class 6 freight trains (able to run at up to 60mph and usually aggregates traffic) per day giving the possibility of some 130 freight services per 24 hour period passing through Camden Road Station. It is important to note that a significant proportion of these trains will not run on a daily basis, particularly class 6 aggregates traffic as it is only pathing space in the WTT. Many paths will purely state 'runs when required'. Therefore we can cut the total number by 60-70% to get a more realistic number for actual trains which run per day through the area. On this let's say 60 trains per 24 hour period.

Maximum linespeed on the NLL is 45mph and through Camden Road Station it is 20mph. Therefore noise and vibration from freight trains will be significantly lower than if they were running at top speeds for their class (e.g. 4 or 6). Class 6 aggregates traffic will also have a significantly different noise profile than class 4 intermodal traffic due to the heavier weights of the trains and different wagon types so it would be good to take this into account in your calculations.

3.3 From the survey results, the line was quieter overall on the Saturday and Sunday, but does not generally appear to be quieter at night than during the day.

Links	Speed (kph)	All Vehicles	% HDVs
Chalk Farm Road (east)	50	8158	11
Chalk Farm Road (west)	50	7509	11
Juniper Crescent	50	1261	49
Ferdinand Street	50	1844	11

Table 4.4: Summary of AAWT 18-hour traffic: Demolition and Construction Phase (inc. cumulative impact of HS2 and committed development construction traffic)

Links	Speed (kph)	All Vehicles	% HDVs
Chalk Farm Road (east)	50	8996	10
Chalk Farm Road (west)	50	7851	8
Juniper Crescent	50	3405	13
Ferdinand Street	50	1858	11

Table 4.5: Summary of AAWT 18-hour traffic: Completed Development (inc. cumulative impact of HS2 and committed development construction traffic)

4.2 Using the predicted traffic flow data, basic noise levels for the surrounding road network have been calculated in accordance with CRTN. The basic noise level was then corrected for the mean vehicle speed HGV percentage and road surface. This process was repeated for the site generated traffic and the results compared to give approximate changes in road traffic noise. The basic noise level is the sound pressure level anticipated at 10m from the channel line, assuming approximately level topography and that no barriers are present. This information should be used for comparison purposes only. The results are summarised in **Table 4.6** to **4.9** below.

CAMDEN MORRISONS 160630-10
NOISE AND VIBRATION IMPACT ASSESSMENT JUNE 2017

4.0 ROAD TRAFFIC NOISE

4.1 Traffic flow data used to calculate the change in noise levels for each stage of development is presented in **Tables 4.1** to **4.5** below.

Links	Speed (kph)	All Vehicles	% HDVs
Chalk Farm Road (east)	50	8508	8
Chalk Farm Road (west)	50	7485	7
Juniper Crescent	50	2715	7
Ferdinand Street	50	1858	11

Table 4.1: Summary of AAWT 18-hour traffic: 2024 Future Baseline

Links	Speed (kph)	All Vehicles	% HDVs
Chalk Farm Road (east)	50	7762	9
Chalk Farm Road (west)	50	7253	10
Juniper Crescent	50	841	44
Ferdinand Street	50	1844	11

Table 4.2: Summary of AAWT 18-hour traffic: Demolition and Construction Phase

Links	Speed (kph)	All Vehicles	% HDVs
Chalk Farm Road (east)	50	8716	8
Chalk Farm Road (west)	50	7711	7
Juniper Crescent	50	2985	8
Ferdinand Street	50	1858	11

Table 4.3: Summary of AAWT 18-hour traffic: Completed Development

Road Link Description	HGV, Mean Speed and Road Surface Corrected Basic Noise Level (BNL) (dB) LA10,18-hour		Change in Corrected BNL (dBA)	Magnitude of Impact (dB) from Table 3.2 of DMRB (Long Term)
	2024 Baseline	2024 Baseline + Demolition and Construction + HS2		
Chalk Farm Road (east)	67.2	67.6	0.5	Negligible
Chalk Farm Road (west)	66.3	67.3	0.9	Negligible
Juniper Crescent	61.9	64.0	2.1	Negligible
Ferdinand St	61.2	61.2	0.0	No change

Table 4.8: Summary of traffic noise impact due to Demolition and Construction (inc. cumulative impact of HS2 and committed development construction traffic)

Road Link Description	HGV, Mean Speed and Road Surface Corrected Basic Noise Level (BNL) (dB) LA10,18-hour		Change in Corrected BNL (dBA)	Magnitude of Impact (dB) from Table 3.2 of DMRB (Long Term)
	2024 Baseline	2024 Baseline + Completed Development + HS2		
Chalk Farm Road (east)	67.2	67.9	0.7	Negligible
Chalk Farm Road (west)	66.3	66.8	0.5	Negligible
Juniper Crescent	61.9	64.2	2.3	Negligible
Ferdinand St	61.2	61.2	0.0	No change

Table 4.9: Summary of traffic noise impact due to Completed Development (inc. cumulative impact of HS2 and committed development construction traffic)

Road Link Description	HGV, Mean Speed and Road Surface Corrected Basic Noise Level (BNL) (dB) LA10,18-hour		Change in Corrected BNL (dBA)	Magnitude of Impact (dB) from Table 3.2 of DMRB (Long Term)
	2024 Baseline	2024 Baseline + Demolition and Construction		
Chalk Farm Road (east)	67.2	67.0	-0.2	No change
Chalk Farm Road (west)	66.3	66.9	0.6	Negligible
Juniper Crescent	61.9	61.9	-0.1	No change
Ferdinand St	61.2	61.2	0.0	No change

Table 4.6: Summary of traffic noise impact due to Demolition and Construction phase

Road Link Description	HGV, Mean Speed and Road Surface Corrected Basic Noise Level (BNL) (dB) LA10,18-hour		Change in Corrected BNL (dBA)	Magnitude of Impact (dB) from Table 3.2 of DMRB (Long Term)
	2024 Baseline	2024 Baseline + Completed Development		
Chalk Farm Road (east)	67.2	67.3	0.1	Negligible
Chalk Farm Road (west)	66.3	66.5	0.1	Negligible
Juniper Crescent	61.9	62.6	0.7	Negligible
Ferdinand St	61.2	61.2	0.0	No change

Table 4.7: Summary of traffic noise impact due to Completed Development

4.3 In accordance with DMRB Volume 11 Section 3 Part 7 HA213/08 Table 3.1, the following significance can be attached to the difference in noise levels resulting from the change in traffic flows.

Increase in road traffic noise due to Demolition and Construction

4.4 As shown in **Table 4.6**, some parts of the local road network are predicted to be subject to an decrease in road traffic noise due to the Demolition and Construction Phase, defined as **no change** as per the DMRB. Chalk Farm Road (west) will be subject to a slight increase, defined as **negligible**.

Increase in road traffic noise due to Completed Development

4.5 As shown in **Table 4.7**, Juniper Crescent and Chalk Farm Road (east and west) are shown to have a **negligible** increase in road traffic noise due to the Completed Development. Ferdinand Street is predicted to have **no change**.

Increase in road traffic noise due to Demolition and Construction (including cumulative impact of HS2 and committed development construction traffic)

4.6 As shown in **Table 4.8**, the local road network (except for Ferdinand Street) is predicted to be subject to a small increase in road traffic noise due to Demolition and Construction with HS2 and other committed development construction traffic, defined as **negligible** as per the DMRB. Ferdinand Street has no increase, therefore **no change** as per the DMRB.

Increase in road traffic noise due to Completed Development (inc. cumulative impact of HS2 and committed development construction traffic)

4.7 As shown in **Table 4.9**, the local road network is predicted to be subject to an increase in road traffic noise due to the Completed Development and the HS2 and other committed development construction traffic, defined as **negligible** on Chalk Farm Road east and west, and on Juniper Crescent. There would be **no change** on Ferdinand Street.

5.0 CONSIDERATION OF ADDITIONAL NOISE SOURCES

Entertainment Noise

5.1 There are many late-night music venues in the local area. The noise survey was undertaken over a full week, so one weekend was captured which is likely to be the noisiest time in terms of entertainment. Position 1, by the petrol filling station on Chalk Farm Road, is likely to have picked up a significant amount of noise from entertainment venues but is also affected by traffic noise. Measurement locations 3 and 4 would not necessarily have picked up as much entertainment noise as at ground level they would be have been sheltered from Camden Market and Chalk Farm Road.

5.2 Location 2 is shielded from road traffic noise; railway noise affects the L_{Aeq}, L_{A10} and L_{Amax} but does not affect the L_{A90} to such an extent. There is a distinctive drop in the L_{A90} levels at around 2am each night, which is likely to be due to entertainment noise ceasing. This drop is consistent over the 7 nights measured, from around 51dB to 48dB L_{A90}. Therefore it can be deduced that night-time noise at this location consists of approximately 48dB general background plus 48dB entertainment noise, which will add 3dB to the general background.

5.3 This measurement was made at approximately 1.5m above ground level, and is sheltered from the market by adjacent buildings. It is likely that upper floors which have a direct line of sight to the market and road will experience higher noise levels from entertainment noise, although noise from the railway line will decrease with height.

Aircraft Noise

5.4 Noise contours for the nearest international airports were studied. The site is significantly outside the lowest noise exposure contour (57dB) for all approaches, take-off patterns and wind directions, therefore the impact of aircraft noise is not considered significant.

Proposed Commercial Noise - Fixed Mechanical Plant Noise

5.5 At this stage of the development, there are no definitive proposals for the type and size and fixed mechanical plant associated with the commercial use. However, to ensure the amenity of neighbouring sensitive receptors it would be prudent to ensure that local policy can be met by setting reasonable limits for plant noise.

5.6 It is likely that a planning condition will be imposed on the development limiting its plant noise output when measured at neighbouring noise sensitive properties, to ensure that background noise does not increase.

5.7 The cumulative plant noise from the development when measured at noise sensitive properties cannot exceed a noise level greater than 10dB (L_{Ar}) below current background noise levels (L_{A90}). This cumulative plant noise must include all the plant specified through the detailed design of the development and assessed in accordance with BS4142: 2014.

5.8 In the context of the current background noise and typical plant noise associated with these commercial uses, the limitations provided in paragraph 5.7 should be practicably achievable.

Proposed Commercial Noise - Commercial to Residential Party Floor / Wall construction

5.9 The design of the separating floors / walls between commercial and residential properties will give consideration to the requirements for

6.0 VIBRATION ASSESSMENT

6.1 Vibration meters with a vibration dose value module and mounting plate was set up at Locations 3 and 4, shown at **Plate 3**, for a continuous 48 hour period. The meters were set to monitor and calculate the vibration dose value in 3 axes. The results were compared to Table 3 within *BS 6472* to give a probability of adverse comment.

6.2 **Table 6.1** below summarises the vibration dose value in 3 axes from Locations 3 and 4:

Location	Time Period	Axis	Vibration Dose Value (VDV) $ms^{-1.75}$
3	Daytime	X	0.026
		Y	0.068
		Z	0.117
3	Night time	X	0.011
		Y	0.016
		Z	0.084
4	Daytime	X	0.154
		Y	0.259
		Z	0.144
4	Night time	X	0.005
		Y	0.009
		Z	0.007

Table 6.1: Summary of Vibration Dose Value Measurements

CAMDEN MORRISONS 160630-10
NOISE AND VIBRATION IMPACT ASSESSMENT JUNE 2017

internal noise within dwellings, specified in BS 8233:2014, as repeated at **Table 5.1**:

Activity	Location	07:00 to 23:00	23:00 to 07:00
Resting	Living room	35dB $L_{Aeq,(16hour)}$	-
Dining	Dining room / area	40dB $L_{Aeq,(16hour)}$	-
Sleeping (Daytime resting)	Bedroom	35dB $L_{Aeq,(16hour)}$	30dB $L_{Aeq,(8hour)}$

Table 5.1: Extract from Table 4 – Indoor ambient noise levels in dwellings

5.10 It is not envisaged that the end use for the commercial areas will increase noise significantly over those currently operating on site. Further consideration will be given at the detailed design stage to the design and specification of party walls / floors between the proposed commercial and residential uses. The floor / wall details shall be verified by a suitably qualified Architectural Acoustic Consultant and its performance shall be validated by pre-completion testing prior to occupation. The applicant must meet the minimum performance requirements of Approved Document E.

5.11 The specifications for facade treatments such as glazing proposed within this report give adequate consideration to all noise sources including the commercial noise currently experienced on the site.

monitored vibration levels and will be adhered to by the contractors when planning vibration causing operations:

Table B.1 Guidance on effects of vibration levels

Vibration level	Effect
0.14 mm·s^{-1}	Vibration might be just perceptible in the most sensitive situations for most vibration frequences associated with construction. At lower frequencies, people are less sensitive to vibration.
0.3 mm·s^{-1}	Vibration might be just perceptible in residential environments.
1.0 mm·s^{-1}	It is likely that vibration of this level in residential environments will cause complaint, but can be tolerated if prior warning and explanation has been given to residents.
10 mm·s^{-1}	Vibration is likely to be intolerable for any more than a very brief exposure to this level.

Table 6.3: (Table B.1) BS 5228-2: 2009

6.3 Table 3 from *BS 6472* is reproduced below in **Table 6.2**.

Place and time	Low probability of adverse comment ($ms^{-1.75}$)	Adverse comment possible ($ms^{-1.75}$)	Adverse comment probable ($ms^{-1.75}$)
Residential buildings (16 hour day)	0.2 - 0.4	0.4 - 0.8	0.8 – 1.6
Residential buildings (8 hour night)	0.1 – 0.2	0.2 - 0.4	0.4 - 0.8

Table 6.2: (Table 3 from BS 6472) – Threshold VDV values

6.4 A comparison between measured vibration levels and the criteria from Table 3 of *BS 6472* (above) shows the measurements recorded fall significantly below the threshold of low probability of adverse comment in most cases. The exception is at Location 4 during the day, where the Y-axis result indicates a low probability of adverse comment. This higher result is due to two isolated events; it is not known if these are related to train passes or an unrelated event adjacent to the meter.

6.5 Ambient vibration is considered negligible and will not require mitigation.

6.6 The current construction programme does not provide detailed operations at this stage. In addition, exact plant type, numbers and simultaneous operations are not available. Considering the above variables, it would not be possible to predict the likely levels of vibration and its propagation across the development.

6.7 Construction vibration should be monitored at sensitive properties during times of likely high vibration levels to ensure that reasonable levels are not exceeded. Table B1 of *BS 5228-2: 2009* (reproduced in **Table 6.3** overleaf) outlines vibration effects relative to

7.0 BUS STOP NOISE

Bus stop location

7.1 It is understood that three new bus stops are proposed on Juniper Crescent in connection with the developments at Camden Morrisons. The location of these bus stands is shown below in **Plate 4**. There are two bus stands on the southern side of the road where people are dropped off / driver waits. A third stand is located on the northern side of the road, towards the roundabout, which will only be used when the two others are full. This is unlikely to occur during night-time periods. The two remaining stands on the northern side are to pick people up.

Plate 4: Location of proposed bus stops on Juniper Crescent

7.2 The information presented below should give a greater understanding of the difference in noise levels associated with buses

passing by, as is currently the case, and idling and pulling away, as would be the case with the proposed bus-stops.

Bus noise

7.3 The following sound pressure levels (SPLs) are taken from Presentation on Electric Buses and Noise by Janos Turcsany, Volvo, retrieved 7/4/2017 from http://www.bullernatverket.se/wp-content/uploads/2014/05/Electric-buses-and-noise_Volvo-Bus.pdf. The values shown in **Table 7.1** are representative of noise levels from diesel buses.

Speed (kph)	SPL dB(A)
20	68
30	69
40	72
50	72

Table 7.1: Cruise-by sound pressure levels from diesel buses

7.4 The same source indicates that the exterior take-off noise (i.e. what would be heard at the bus-stop) would be a SPL of 73dB(A).

7.5 The following table and graph are taken from FROST, M. W. and ISON, S. G., 2007. Comparison of noise impacts from urban transport. Proceedings of the Institution of Civil Engineers, Transport, 160 (4), 165-172. Retrieved 7/4/2017 from https://dspace.lboro.ac.uk/dspace-jspui/bitstream/2134/4331/1/comp%20of%20noise.pdf.

Operation condition	Tram	Bus	Car
At speed (30 mph)	86	82 (77–84)	77 (75–80)
Slow (10–15 mph)	82	82 (75–84)	73 (68–77)
Leaving a stop	81	83 (79–85)	79 (76–82)
Accelerating hard from a stop	82	87 ($SEL_{(max)}$)	82 ($SEL_{(max)}$)
Waiting at stop/idling	Ambient ($La_{(eq)}$) (limited emission)	72 $La_{(eq)}$ (68–73)	55 $La_{(eq)}$

Table 7.2: On-street vehicle pass, average SEL (dB(A)) normalised to 7.5m (plus (range))

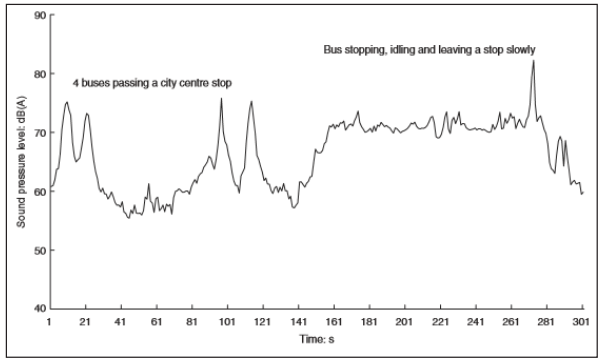


Plate 5: Raw data for buses passing and stopping at a city centre stop. (The stop is in a lay-by; measurements made 7.5m from lay-by)

Discussion

7.6 A bus passing by at 50kph (30 mph) has a SPL of 72dB(A), while the SPL of a bus pulling away is 73dB(A) (1). This indicates that a bus pulling away would be 1dB(A) louder than when it passes by at 30mph. This level of increase would typically be imperceptible. The overall time taken will be longer, although idling is a relatively low noise level.

7.7 The SEL of a bus leaving a stop is 83dB(A), while the SEL of a bus travelling at 30mph is 82dB(A) (2). (Note that the SEL of an event is the equivalent energy over 1 second, providing an easy comparison.) Idling is lower, with an L_{Aeq} of 72dB(A). This correlates well with the SPL values.

7.8 The graph of instantaneous sound pressure levels (raw data), i.e. how the noise level fluctuates over a short time period, shows a higher noise level for a bus leaving than for a pass-by. However, this is over a much shorter time period, and when the SEL is calculated (i.e. the equivalent energy over 1 second) the noise levels are only 1dB(A) higher. The bus idling averages at 72dB(A), as per the table. (Note SEL values cannot be read directly from a graph of instantaneous SPL.)

7.9 Measured background noise levels are relatively high, the daytime L_{Aeq} measured near Juniper Crescent is 64dB(A), and the night-time L_{Aeq} is 59dB(A). This will serve to mask specific noise such as buses pulling away.

7.10 Currently buses stop within the Morrisons carpark, just off the entry roundabout. At this point, the ground is level with properties on the other side of Juniper Crescent, albeit further away. The main proposed bus stops are located in a significant cutting compared with ground floor level of the properties on Juniper Crescent as shown below, and therefore the line of sight to the buses is likely to be at least partially obscured providing significant attenuation to the bus noise experienced. Typically if a noise source is obscured, attenuation will be approximately 10dB; if it is only partially obscured the attenuation may be around 5dB. Properties are also 10m+ from the edge of the kerb. The additional drop-off bus stand is located on a level with properties, but this will be used less frequently.

8.0 CONSTRUCTION NOISE ASSESSMENT

8.1 Given the proximity of proposed construction to neighbouring noise sensitive properties such as residential areas, it is possible that construction noise may have a significant effect, although there are relatively high levels of existing ambient noise which may mask construction noise.

8.2 A detailed construction programme, specific plant data and operations are not available at this stage of the project. Therefore reasonable estimations of likely operations and the resultant noise levels will be used.

8.3 To assess the limits for reasonable construction noise experienced at the nearest residential properties, Example method 1 (the ABC Method) of BS 5228, within section E.3.2, will be used. Table E.1 from the standard is reproduced below in **Table 8.1:**

Table E.1 **Example threshold of significant effect at dwellings**

Assessment category and threshold value period (L_{Aeq})	Threshold value, in decibels (dB)		
	Category A [A]	Category B [B]	Category C [C]
Night-time (23.00–07.00)	45	50	55
Evenings and weekends [D]	55	60	65
Daytime (07.00–19.00) and Saturdays (07.00–13.00)	65	70	75

NOTE 1 A significant effect has been deemed to occur if the total L_{Aeq} noise level, including construction, exceeds the threshold level for the Category appropriate to the ambient noise level.

NOTE 2 If the ambient noise level exceeds the threshold values given in the table (i.e. the ambient noise level is higher than the above values), then a significant effect is deemed to occur if the total L_{Aeq} noise level for the period increases by more than 3 dB due to construction activity.

NOTE 3 Applied to residential receptors only.

[A] Category A: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are less than these values.

[B] Category B: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are the same as category A values.

[C] Category C: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are higher than category A values.

[D] 19.00–23.00 weekdays, 13.00–23.00 Saturdays and 07.00–23.00 Sundays.

Table 8.1: Table E.1 from BS 5228: Part 1, 2009

8.4 Existing ambient noise levels are predicted to indicate that that the background noise experienced at these residential properties will

Plate 5: Typical screening from the road near the location of temporary bus stop on Juniper Crescent

7.11 Specific noise from use of disabled ramps is likely to be shielded: on the south side this will face away from properties and be shielded by the bus itself, and on the north side it will be shielded by the cutting. It will also be masked by the noise from the idling engine and general background noise.

7.12 Perception of noise is frequently a subjective matter. It may be possible that residents identify a bus pulling away as distinct from a bus passing by, and even though the absolute noise levels are not substantially higher, the level of annoyance is significantly higher as this is identified as an unwanted event. This may be offset through consultation.

7.13 Considering all the above it is considered that the noise impact of a proposed bus stop, as compared to buses passing by, is likely to be negligible.

9.0 MITIGATION RECOMMENDATIONS

Proposed Residential Glazing

9.1 The noise mapping and proposed layout were used to undertake calculations, presented in **Appendix E**, for suitable façade treatments, as outlined in the following paragraphs.

External Building Fabric - Non Glazed Elements

9.2 It is currently assumed that the non-glazed external building fabric elements of the proposed development would comprise blockwork. This would contribute towards a significant reduction of ambient noise levels in combination with a good quality double-glazed window configuration, as shown in **Table 9.2.**

9.3 All non-glazed elements of the building facades have been assumed to provide a sound reduction performance of at least the figures shown in **Table 9.1** when tested in accordance with BS EN ISO 10140-2:2010:

Element	Octave band centre frequency SRI, dB						
	63	125	250	500	1k	2k	4k
Non glazed element SRI	39	41	43	48	50	55	55

Table 9.1: Non-glazed elements assumed sound reduction performance

External Building Fabric - Specification of Glazed Units

9.4 Sound reduction performance calculations have been undertaken in order to specify the minimum performance required from glazed elements in order to achieve recommended internal noise levels recommended in BS8233:2014.

place them within Category C of Table E.1. Therefore the following noise ambient noise levels (as a result of construction activities) will be deemed to have a significant effect.

Time Period	Noise levels (as a result of construction activities only) likely to have a significant effect L_{Aeq} (dB)
Night-time (23.00)	55
Evenings and Weekends	65
Daytimes (07.00-19:00) and Saturdays (07.00-13.00)	75

Table 8.2: Ambient noise levels as a result of construction activities at which a significant effect is likely (existing residential properties)

- **Glazing type C** is required for habitable rooms towards the centre of the main site, typically without a view of the railway lines.

9.9 It should be noted that there may be additional considerations for glazing requirements such as security and thermal performance, therefore the above specified glazing is merely guidance for how the acoustic criteria can be achieved. Alternative glazing could be used in place of the above specified units, assuming the minimum acoustic performance is met.

9.10 All major building elements should be tested in accordance with BS EN ISO 140-3:1995. Sole glass performance data would not necessarily demonstrate compliance with this specification. No further mitigation measures would be required to achieve the recommended internal noise levels.

Proposed residential ventilation

9.1 With the windows open in habitable rooms on exposed façades, desirable internal ambient noise levels will be exceeded. In order to achieve desirable internal ambient noise levels and maintain a suitable level of cooling and ventilation with the windows closed, ventilation will be required.

9.2 It is understood that whole-house mechanical heat recovery and ventilation (MHRV) is proposed for the development. Windows will still be openable for purge ventilation. It should be ensured that the units themselves do not significantly contribute to internal ambient noise levels.

9.5 Calculations have been based on habitable rooms with relatively higher ratios of glazing to masonry, in order to present a more onerous assessment. This specification therefore presents a robust assessment, for BS8233:2014 criteria for internal noise levels in all affected facades.

9.6 The calculations have been performed for bedrooms, with the requirement for night-time L_{Amax} levels driving the specification.

9.7 The glazing type for each building requiring special treatment is indicated on the noise mitigation plan in **Appendix F** and summarised below. The required performances for each window type is shown in **Table 5.2** below. The performance is specified for the whole window unit, including the frame.

Glazing Type reference, description and typical dimensions(mm)	Sound Reduction Index RW		Octave band centre Frequency (Hz) SRI (dB)						
			63	125	250	500	1k	2k	4k
Type A/B 16/12/16mm acoustic laminate	46	Sound reduction (dB)	30	32	37	45	46	46	57
Type C 6/12/8mm	35		21	23	23	30	39	36	43

Table 5.2: Minimum glazing specification

9.8 Areas requiring uprated glazing can be broadly defined as follows with the full extent shown in **Appendix F:**

- **Glazing type A/B** is required for habitable rooms on façades with a view of the railway lines, and all of Block G (facing Chalk Farm Road / the railway)

Private and Public Amenity Space

9.3 Balconies and shared amenity space should aim to meet desirable ambient noise levels defined in WHO Guidelines:1999 and BS8233:2014. However, BS8233 advises that:

> *'it is also recognized that these guideline values are not achievable in all circumstances where development might be desirable. In higher noise areas, such as city centres or urban areas adjoining the strategic transport network, a compromise between elevated noise levels and other factors, such as the convenience of living in these locations or making efficient use of land resources to ensure development needs can be met, might be warranted. In such a situation, development should be designed to achieve the lowest practicable levels in these external amenity spaces, but should not be prohibited.'*

9.4 The standard continues:

> "*In high-noise areas, consideration should be given to protecting these areas by screening or building design to achieve the lowest practicable levels. Achieving levels of 55 dB LAeq,T or less might not be possible at the outer edge of these areas, but should be achievable in some areas of the space.*"

9.5 There are balconies on most façades across the development, and recommended external noise levels are likely to be exceeded on exposed balconies across the site. However, across the majority of blocks there are public amenity areas which are shielded by the development, for example in the centre courtyard area of Block F, and these are likely to achieve lower ambient noise levels than the outer balconies. This will give residents a quieter option for outdoor

amenity space if required. Calculations for shared amenity space are presented in **Appendix E.**

Construction Mitigation Recommendations

9.6 Construction activities should not normally take place between the hours of 7pm and 7am, after 1pm on Saturdays and the remaining hours of the weekend without additional consideration to controlling noise and with the prior approval of the LPA.

9.7 During construction, the contractor will employ best practicable means to control noise from construction operations. This includes the selection of relatively quiet, modern and well-maintained construction plant.

9.8 Solid timber hoarding, a minimum of 2m in height and a surface density of at least 5kg/m^2 to areas of construction is to be used where adjacent to sensitive receptors. Consideration to neighbouring residential properties is to be given when locating the temporary site compound.

9.9 Stationary equipment and plant such as generators will be placed as far as practicable from noise sensitive properties, and preferably in areas benefiting from natural or purpose-built attenuation such as bunding or behind non-sensitive buildings.

9.10 Delivery of materials and removal of waste from the site will be planned to minimise disturbance to neighbouring properties. Idling of plant, machinery and delivery vehicles should be prohibited when not in use.

9.11 Ambient noise levels as a result of construction activities experienced at the affected properties will be monitored regularly by the contractor in accordance with *BS 5228* to ensure the above set

limits are not exceeded. In addition to the above all other guidance within *BS 5228–1: 2009* will be followed at all times.

10.0 CONCLUSIONS

10.1 Subject to appropriate mitigation measures such as those outlined in **Section 9**, habitable rooms within the proposed development have been demonstrated to be within desirable noise levels.

10.2 Recommended external noise levels are likely to be exceeded on some private balconies. However, there are public amenity spaces across the development which are better shielded and will provide a quieter external environment for residents.

10.3 Ambient vibration levels are well below the perceptible range.

10.4 The construction phase of the development is not predicted to have a significant impact when managed by a competent contractor.

10.5 The operation phase of the proposed development is demonstrated to not have a significant impact, in terms of noise, on the surrounding road network and should therefore not constitute a material reason for refusal.

ACOUSTIC TERMINOLOGY

The effects of noise on human beings may be expressed in terms of physiological damage and annoyance. It is, however, only the annoyance impacts that need to be considered in detail when addressing environmental noise impacts. Annoyance also includes the immediate effects of activity interference, for example sleep disturbance and speech interference.

The practice has become to measure sound levels in decibels (dB). The decibel scale is logarithmic rather than linear and it is useful to bear in mind that a noise level change of 3dB would be equivalent to doubling the energy level (for example doubling the volume of traffic) and that an increase of 10 dB is perceived, subjectively, as a doubling of loudness. The human ear responds differently to sounds of different frequency. The ear perceives high frequency sound of a given sound pressure level more loudly than a low frequency sound at the same level. The A-weighted sound level, dB(A), takes this response into consideration and is commonly used for measurement of environmental noise in UK. It thus indicates the subjective human response to sound.

Environmental noise levels vary continuously from second to second, it is clearly impractical to specify the sound level continuously and thus time averaging is required. In practice human response has been related to various units which include allowance for the fluctuating nature of sound with time. For the purpose of this report these include:

$L_{Aeq,T}$ the equivalent A-weighted continuous sound level.

This unit relates to the equivalent level of continuous sound for a specific time period T, for example 16 hours for daytime noise. It contains all the sound energy of the varying sound levels over the same time period and expresses it as a continuous sound level over that period. The unit is used for assessing traffic and industrial noise for planning purposes and in particular for PPG24.

$L_{A10,T}$: the A-weighted level of sound exceeded for 10% of the time period T.

This unit is used for traffic noise measurement and is the preferred unit for prediction of traffic noise in the publication, 'Calculation of Road Traffic Noise',

Appendix B
Relevant Policy

$L_{A90,T}$: the A-weighted level of sound exceeded for 90% of the time period T.

This unit is commonly used to represent the background noise and is used in assessing the effects of industrial noise in UK.

L_{Amax} : the maximum A-weighted level of sound over a period of measurement.

$L_{Ar,T}$ the rating level.

The specific Noise plus any adjustments for the characteristic features of the noise. Used for comparison between background levels with the noise source off.

S_{EL} the Sound Exposure Level.

Sound exposure level abbreviated as SEL and LAE, is the total noise energy produced from a single noise event condensed into a 1 second time period

- *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, air, water or noise pollution or land instability"*

1.6 The document also states that planning policies and decisions should aim to:

- *"avoid noise from giving rise to significant adverse impacts on health and quality of life as a result of new development;*
- *mitigate and reduce to minimum other adverse impacts on health and quality of life arising from noise from new development, including through the use of conditions;*
- *recognise that development will often create some noise and existing businesses wanting to develop in continuance of their business should not have unreasonable restrictions put on them because of changes in nearby land uses since they were established; and*
- *identify and protect areas of tranquillity which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason."*

1.7 As stated above, this document makes reference to avoiding noise generation from new developments that would adversely impact on health and quality of life. It effectively supersedes Planning Policy Guidance 24 (PPG24)[2].

Noise Policy Statement for England, 2010

1.8 To avoid and mitigate adverse noise effects on health arising from and impacting on new development, the NPPF makes reference to Noise Policy Statement for England (NPSE)[3].

[2] The Office of the Deputy Prime Minister, now the Department for Communities and Local Government, 1994. Planning Policy Guidance 24: Planning and Noise.
[3] Department of Environment, Food and Rural Affairs, 2010. Noise Policy Statement for England.

1.0 RELEVANT POLICY

1.1 The Department of the Environment, Food and Rural Affairs (Defra) is responsible for all aspects of noise policy in England. Management and enforcement of noise policy is the joint responsibility of the EA and Local Planning Authorities.

1.2 The aim of noise policy within England has been to protect individuals from excessive noise levels both in the workplace and within their homes. It has been recognised that severe annoyance to individuals due to noise can lead to sleep disturbance and adverse health effects.

National Legislation and Policy

National Planning Policy Framework, 2012

1.3 The NPPF[1] sets out the Government's economic, environmental and social planning policies for England. It attempts to summarise in a single document all previous national planning policy advice. Taken together, these policies articulate the Government's vision of sustainable development, which should be interpreted and applied locally to meet local aspirations.

1.4 The NPPF sets out the Government's requirements for the planning system only to the extent that it is relevant, proportionate and necessary to do so. It provides a framework within which local people and their accountable councils can produce their own distinctive local and neighbourhood plans, which reflect the needs and priorities of their communities.

1.5 Section 11: 'Conserving and enhancing the natural environment', states that the planning system should contribute to and enhance the natural and local environment by:

[1] Department for Communities and Local Government, 2012. Notional Planning Policy Framework, HMSO

1.9 The NPSE was published in March 2010 and covers all forms of noise other than occupational noise. For the purposes of this report 'Neighbourhood Noise' is most relevant as defined at paragraph 2.5:

- "*neighbourhood noise which includes noise arising from within the community such as industrial and entertainment premises, trade and business premises, construction sites and noise in the street.*"

1.10 The NPSE has three main aims, summarised as follows:

The first aim of the NPSE:

- *"Avoid significant adverse impacts on health and quality of life from environmental, neighbour and neighbourhood noise"*

The second aim of the NPSE:

- *"Mitigate and minimise adverse impacts on health and quality of life from environmental, neighbour and neighbourhood noise"*

The third aim of the NPSE:

- *"Where possible, contribute to the improvement of health and quality of life through the effective management and control of environmental, neighbour and neighbourhood noise"*

1.11 The explanatory note to the NPSE introduces three concepts relating to the adverse impacts of noise. The following three statements have been reproduced from the explanatory note:

- "NOEL – No Observed Effect Level: This is the level below which no effect can be detected. In simple terms, below this level, there is no detectable effect on health and quality of life due to the noise."
- "LOAEL – Lowest Observed Adverse Effect Level: This is the level above which adverse effects on health and quality of life can be detected"

- "SOAEL – Significant Observed Adverse Effect Level: This is the level above which significant adverse effects on health and quality of life occur."

1.12 The NPSE acknowledges that the values for NOEL, LOAEL and SOAEL are likely to vary depending on the noise source and environment and at present, there are no defined numerical values to allow flexibility within the policy until further evidence and guidance is presented. For the purpose of this assessment, the aim is to mitigate against and minimise noise levels as far practicable, thus minimising adverse effects.

Planning Practice Guidance

1.13 The PPG[4] relates the three concepts of NOEL, LOAEL and SOAEL to perceptions of noise, and gives guidance on how these different levels should be treated.

1.14 The three levels are summarised as follows, in terms of perceptions and the recommended action:

- NOEL: *"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."*
    - Action: No specific measures required;
- LOAEL: *"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*

[4] http://webarchive.nationalarchives.gov.uk/20140724121321/http://planningguidance.planningportal.gov.uk/blog/guidance/noise/noise-guidance/

1.18 Section 61 of the Act allows a contractor or developer to take the initiative and agree with the local authority the methods of construction, steps to minimise noise and hours of work, prior to works being undertaken. Aiming to avoid a significant impact on receptors through the use of quieter plant and equipment, techniques such as timing of works, and mitigation such as screening and distance separation as far as it is deemed practicable, is collectively referred to as 'Best Practicable Means' (BPM).

1.19 Where the site can be shown to be using BPM, this can be used as a defence against a notice being served or other enforcement action.

Regional Policy

The London Plan Spatial Development Strategy for London Consolidated with Alterations since 2011, 2016

1.20 In March 2016, the updated London Plan[6] was published by the GLA. The London Plan provides an overall strategic plan for London, setting out an integrated economic, environmental, transport and social framework for the development of London over the next 20–25 years. The Plan brings together the geographic and locational aspects of the Mayor's other strategies, including a range of environmental issues such as climate change (adaptation and mitigation), air quality, noise and waste.

1.21 Relevant policies to this assessment are summarised as follows:

- Policy '5.3 - Sustainable design and construction' lists sustainable design principles including "*minimising pollution (including noise, air and urban runoff).*"
- Policy '7.15 - Reducing and managing noise, improving and enhancing the acoustic environment and promoting appropriate soundscapes' states the following:

[6] Greater London Authority, 2016. The London Plan – Spatial Development Strategy for London Consolidated with alterations since 2011. London. GLA.

CAMDEN MORRISONS 160630-10
APPENDIX B: RELEVANT POLICY JUNE 2017

disturbance. Affects the acoustic character of the area such that there is a perceived change in the quality of life."

  - Action: Mitigate and reduce to a minimum.

- SOAEL: "*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.*"

  - Action: Avoid

1.15 PPG also introduces a final level, Unacceptable Adverse Effect. Based on the nature of the proposed development, the three earlier discussed levels have been considered within this assessment to address anticipated noise effects.

Control of Pollution Act, 1974

1.16 The Control of Pollution Act, 1974[5], Part III forms a refined combination of three earlier documents and replaces these. The three replaced documents are: the Public Health Act, 1936, the Noise Abatement Act 1960 and the Public Health Act 1990, Part III.

1.17 The LBC has powers under the Control of Pollution Act 1974 to control noise from construction sites. Section 60 of the Act allows a local authority to serve a notice of its requirements for the control of site noise. This notice may include specification of plant that is or is not to be used, hours during which the construction can be carried out and levels of noise emission.

[5] Secretary of State, 1974. Control of Pollution Act, HMSO.

Sustainable Design and Construction - Supplementary Planning Guidance

1.23 The Sustainable Design and Construction - Supplementary Planning Guidance[8] aims to ensure construction and development in London achieves the highest standard of sustainable design, in order to ensure a high level of environmental performance.

1.24 In terms of noise, the identified relevant priorities are as follows:

> "*Areas identified as having positive sound features or as being tranquil should be protected from noise; and*
> *Noise should be reduced at source, and then designed out of a scheme to reduce the need for mitigation measures*."

Local Policy

London Borough of Camden Core Strategy and Development Policies Documents 2010-2025, 2010

1.25 The LBC Core Strategy[9] sets out the key elements of the Council's planning vision and strategy for the borough. Policy 'CS5 – Managing the impact of growth and development' requires of development to protect and enhance the environment including the amenity and quality of life of local communities. In respect of amenity, paragraph 5.7 refers to noise as a particular issue in the borough.

1.26 Policy 'DP28 - Noise and vibration' of the Camden Development Policies[10] document states the following:

> *"The Council will seek to ensure that noise and vibration is controlled and managed and will not grant planning permission for:*
> *a) development likely to generate noise pollution; or*

[8] Mayor of London, April 2004. Sounder City, Sustainable Design and Construction - Supplementary Planning Guidance.

> *"Development proposals should seek to manage noise by:*
> *A avoiding significant adverse noise impacts on health and quality of life;*
> *B mitigating and minimising the existing and potential adverse impacts of noise on, from, within, as a result of, or in the vicinity of new development without placing unreasonable restrictions on development or adding unduly to the costs and administrative burdens on existing businesses;*
> *D separating new noise sensitive development from major noise sources (such as road, rail, air transport and some types of industrial development) through the use of distance, screening or internal layout – in preference to sole reliance on sound insulation; and*
> *E where it is not possible to achieve separation of noise sensitive development and noise sources, without undue impact on other sustainable development objectives, then any potential adverse effects should be controlled and mitigated through the application of good acoustic design principles;"*

The Mayor's Ambient Noise Strategy

1.22 The Mayor's Ambient Noise Strategy[7] aims to identify practical actions and ways forward in addressing noise nuisance, especially in transport and through the planning system. The strategy acknowledges that setting of blanket standards is not appropriate for noise issues and that "*Guidelines produced under the auspices of the World Health Organisation*" can be seen as aspirational targets based on the precautionary principle.

[7] Greater London Authority, 2004. Sounder City, The Mayor's Ambient Noise Strategy. London. GLA.

b) development sensitive to noise in locations with noise pollution, unless appropriate attenuation measures are provided.

1.27 Development that exceeds Camden's Noise and Vibration Thresholds will not be permitted. Relevant thresholds to this development (residential sites adjoiing railways) are summarised as follows:

- Table A: Noise levels at which planning permission will not be granted (levels 1m external from noise sensitive facade).

  Daytime and Evening (07:00 - 23:00): 74 dB $L_{Aeq,16hr}$
  Night-time (23:00 - 07:00): 66 dB $L_{Aeq,8hr}$

- Table B: Noise levels at which attenuation measured will be required (levels 1m external from noise sensitive facade).

  Daytime (07:00 - 19:00): 65 dB $L_{Aeq,12hr}$
  Evening (19:00 - 23:00): 60 dB $L_{Aeq,4hr}$
  Night-time (23:00 - 07:00): 55 dB $L_{Aeq,8hr}$

- Table C: Vibration levels at which planning permission will not be granted.

  Daytime and Evening (07:00-23:00): 0.2-0.4 $VDVms^{-1.75}$

1.28 The Council will only grant permission for plant or machinery if it can be operated without causing harm to amenity and does not exceed our noise thresholds.

1.29 The Council will seek to minimise the impact on local amenity from the demolition and construction phases of development. Where these phases are likely to cause harm, conditions and planning obligations may be used to minimise the impact."

London Borough of Camden Local Plan: Proposed Submission, 2016

1.30 The draft LBC Local Plan[11], would, when adopted, replace the Core Strategy and Development Policies documents.

1.31 Policy A4 in the draft plan is relevant to this assessment and covers noise and vibration, referencing Camden's Noise and Vibration Thresholds in Appendix 2 of the plan. It states that planning permission will not be granted for developments likely to generate unacceptable noise and vibration impacts, or noise sensitive development in locations which experience high levels of noise, unless appropriate attenuation measures can be provided. The impact on local amenity is sought to be minimised due to deliveries, and the demolition and construction phases of development.

Camden Planning Guidance 6 [CPG6] – Amenity, 2001

1.32 LBC has published a range of 'Camden Planning Guidance' (CPG)[12] documents that supports the policies set out in their LDF, confirming how these should be followed in practical terms. CPG5 relates to amenity and includes advice on how the impact on noise and vibration can be minimised via design, built fabric and by implementing features such as landscaping and barriers. The document outlines the Borough's preference hierarchy when controlling noise which is summarised as follows: reduce the noise at its source; separate the development from the noise source or to use barriers; and use of construction material such as acoustic glazing.

[11] London Borough of Camden, 2016. Camden Local Plan, Proposed Submission 2016.
[12] London Borough of Camden, 2001. Camden Planning Guidance 7 – Transport.

standard and compared against the measured existing background noise level.

- BS5228-1:2009 '*Code of practice for noise and vibration control on construction and open sites – Part 1: Noise*' [17] gives guidance on the effects of noise generated during the construction phase of a development. Methodology is proposed to predict the level of noise that will be experienced at noise sensitive receptors and guidance is given on mitigation techniques to minimise the impact of noise, including adoption of BPM.
- BS5228-2:2009 '*Code of practice for noise and vibration control on construction and open sites – Part 2: Vibration*'[16] provides guidance with regards to vibration in terms of effects on amenity of sensitive receptors as well as guidance on levels of vibration that cause damage to existing structures and buildings. The main factors to consider for vibration are the duration and frequency content of vibration as well as the sensitivity of receptors.
- Design Manual for Roads and Bridges [DMRB] Volume 11[18] gives the expected impact an increase in road traffic will have on sensitive receptors. Guidance is given on the significance impacts of short term increases (e.g. due to construction traffic) and long-term increases (e.g. due to the operation of the proposed development).

[17] British Standards Institution, 2014. BS 5228:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites, BSI.
[18] Highways Agency, 2011. Design Manual for Roads and Bridges Volume 11 Section 3 Part 7, HA.

CAMDEN MORRISONS 160630-10
APPENDIX B: RELEVANT POLICY JUNE 2017

Other Guidance

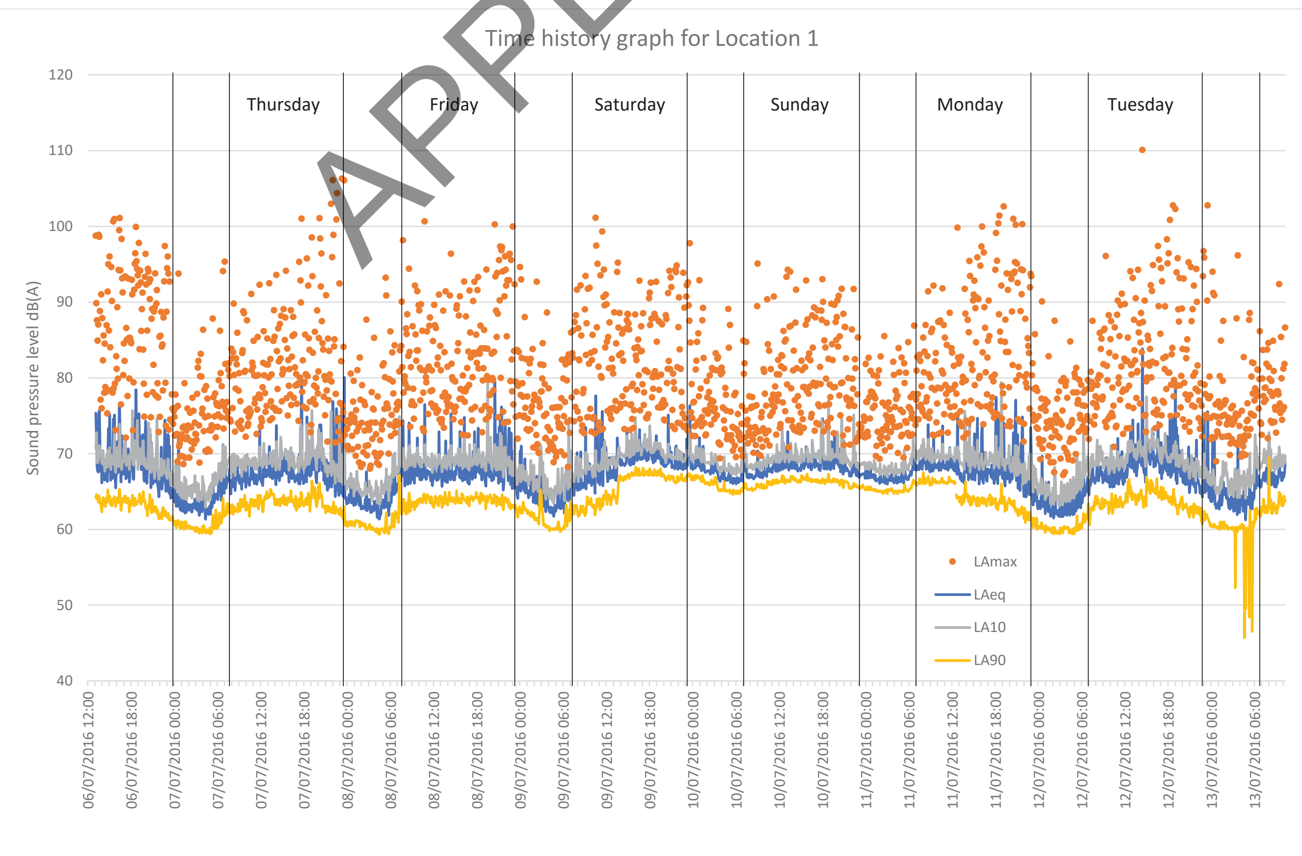
1.33 In addition to the above, consideration has been given by the guidance provided in the following British Standards and good practice documents:

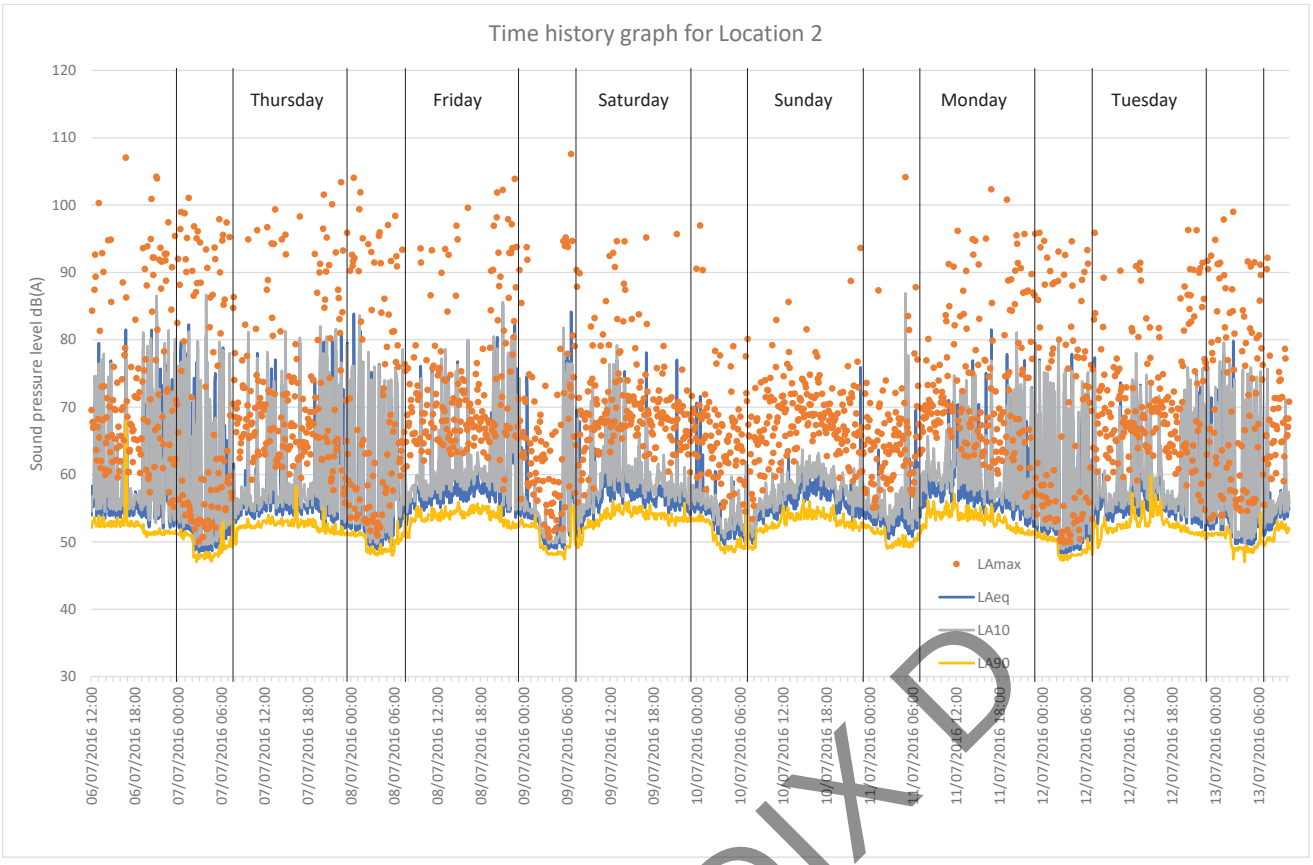
- BS8233:2014 '*Sound insulation and noise reduction for buildings*'[13] describes recommended acceptable internal noise levels for residential spaces during daytime and night-time hours. Guidance is given for internal spaces, such as living rooms and bedrooms, and for outdoor amenity space.
- BS6472-1:2008 '*Guide to evaluation of human exposure to vibration in buildings. Vibration sources other than blasting*'[14] prescribes measurement and analysis techniques for assessing whether vibration levels within different building types will have a negative impact on the amenity of occupants.
- World Health Organisation: '*Guidance for Community Noise'*[15] gives advice on ambient and maximum noise levels that should not be exceeded in order to provide a suitable living environment. The guidance shown above taken from BS8233:2014 and BS8233:1999 is based on these guidelines, so is largely the same.
- BS4142:2014 '*Methods for rating and assessing industrial and commercial sound*'[16] gives guidance on calculating and assessing the predicted noise emissions of proposed commercial and industrial noise sources in terms of likelihood of having a detrimental impact on existing noise sensitive receivers. Noise rating levels are calculated according to the

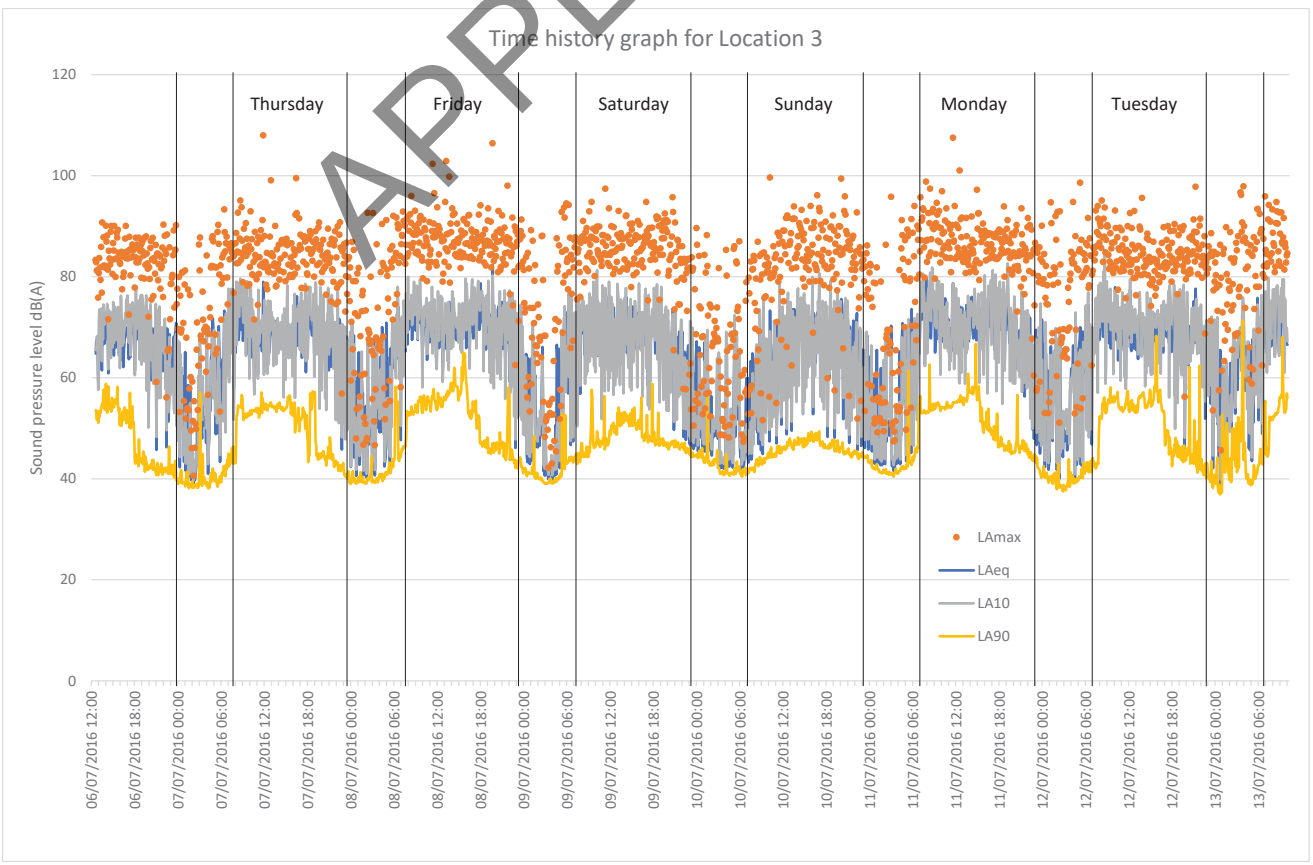
[13] British Standards Institution, 2014. BS 8233 2014 Guidance on sound insulation and noise reduction for buildings, BSI.
[14] British Standards Institution, 2008. BS 6472:2008 Guide to evaluation of human exposure to vibration in buildings. Vibration sources other than blasting, BSI.
[15] World Health Organisation. 2000. Guidelines for Community Noise. Geneva. WHO.
[16] British Standards Institution, 2014. British Standard 4142:2014 Method for Rating and Assessing Industrial and Commercial Sound. BSI.

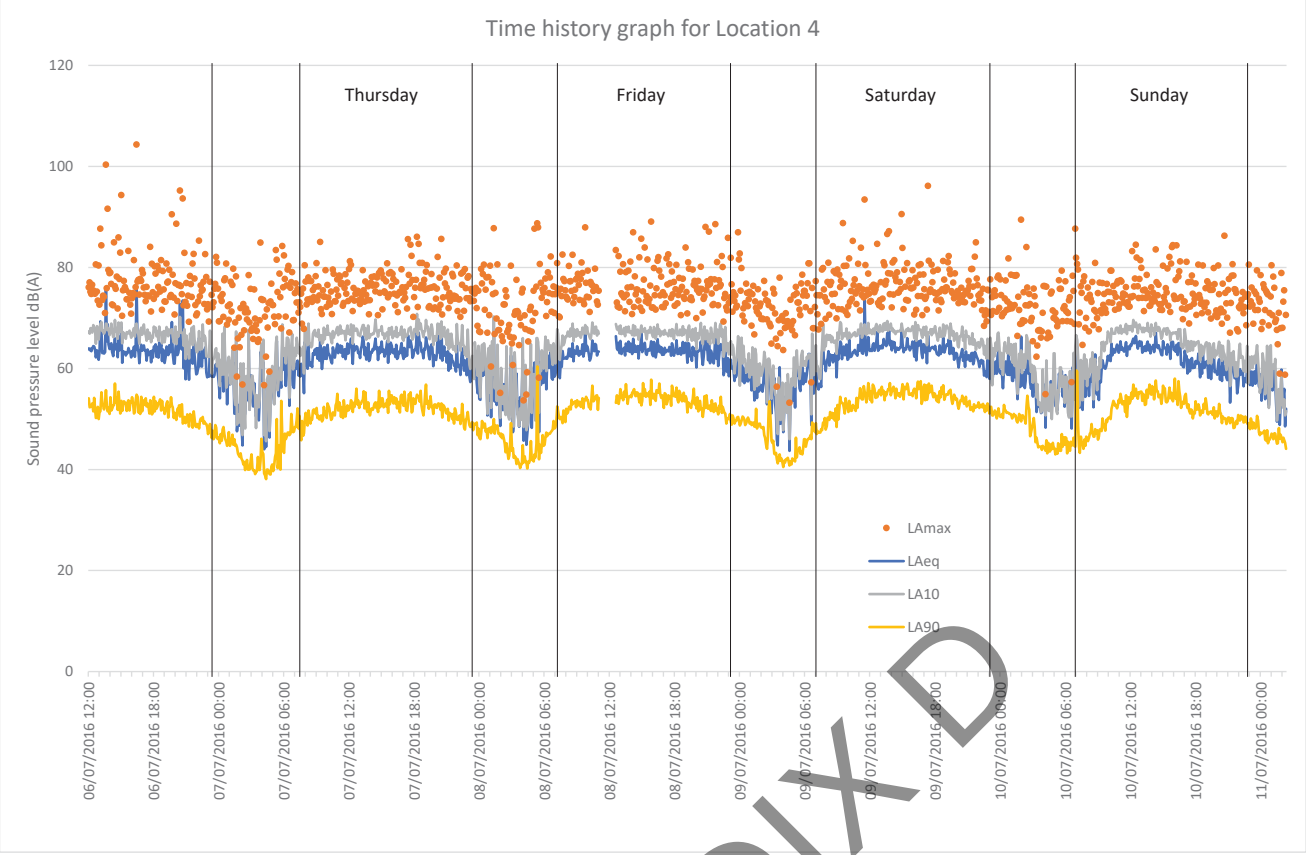
Appendix C
Noise Measurement Results

APPENDIX D




Time history graph for Location 2
Thursday
Friday
Saturday
Sunday
Monday
Tuesday
Sound pressure level dB(A)
LAmax
LAeq
LA10
LA90


Time history graph for Location 3
Thursday
Friday
Saturday
Sunday
Monday
Tuesday
Sound pressure level dB(A)
LAmax
LAeq
LA10
LA90



Appendix D
Calibration Certificates

The sound level meter was set up using a type 4231 sound calibrator supplied by this laboratory; it was set to frequency weighting A, and initially read 94.8 dB. It was then adjusted to read 93.7 dB (corresponding to 93.7 dB at standard atmospheric pressure). This reading was derived from the certified output level of the calibrator and manufacturers' information on the free-field response of the sound level meter when fitted with the windshield. The resulting calibration factor was 7.28; the calibration check frequency was 1 kHz.

The sound level meter was tested, and its overall sensitivity adjusted, in accordance with selected sections of IEC 61672-3:2006.

RESULTS

The sound level meter submitted for testing has successfully completed the class 1 periodic tests carried out, for the environmental conditions under which the tests were performed. However, no general statement or conclusion can be made about conformance of the sound level meter to the full requirements of IEC 61672-1 : 2002 (BS EN 61672-1 : 2003) because evidence was not publicly available, from an independent testing organization responsible for pattern approvals, to demonstrate that the model of sound level meter fully conformed to the requirements in IEC 61672-1 : 2002 (BS EN 61672-1 : 2003) and because the periodic tests carried out cover only a limited subset of the specifications in IEC 61672-1 : 2002 (BS EN 61672-1 : 2003).

The self-generated noise recorded with the microphone replaced by the electrical input device was:

12.0 dB (A) ; 12.0 dB (C) ; 12.0 dB(Z) (Under-range)

The environmental conditions recorded at the start and end of testing were:

Start: 24 to 25 °C, 38.9 to 48.9 %RH and 99.9 to 100.0 kPa
End: 24 to 25 °C, 31.6 to 41.6 %RH and 100.0 to 100.1 kPa

All measurement data are held at AV Calibration for a period of at least six years.

CERTIFICATE OF CALIBRATION

ISSUED BY AV CALIBRATION

Date of issue 26 January 2012 Certificate N° 1201027

AV Calibration
2 Warren Court
Chicksands, Shefford
Bedfordshire SG17 5QB
U.K.
Tel: +44 (0)1462 638600
Fax: +44 (0)1462 638601
Email: lab@avcalib.co.uk
www.avcalibration.co.uk

Signed
R.G.Tyler

CLIENT	Practical Acoustics Ltd 202 Uxbridge Road London W12 7JP
F.A.O.	Florian Clement
REF.	Job N° TRAC12/01018/03
DATE OF RECEIPT	24 January 2012
PROCEDURE	AV Calibration Engineer's Handbook, Section 19
IDENTIFICATION	Sound level meter Svantek type SVAN 957 [serial no. 15381] connected via a preamplifier type SV 12L [serial no. 18740] to a half-inch microphone type 7052H [serial no. 40822] fitted with a foam windshield type SA 22.
CALIBRATED ON	26 January 2012
PREVIOUS CALIBRATION	None known

Technical information including adjustment data specified in the manufacturers' Instruction Manual has been used to carry out this verification. Additional information was obtained by analogy with similar instruments from the same manufacturer. No information on the uncertainty of measurement of the adjustment data given in the instruction manual was published in the instruction manual or made available by the manufacturer or supplier. The uncertainty of measurement of these adjustment data has therefore been assumed to be numerically zero for the purposes of this periodic test. If these uncertainties are not actually zero, there is a possibility that the frequency response of the sound level meter may not meet the requirements of IEC 61672-1:2002 (BS EN 61672-1:2003).

No publicly-available evidence has been found that the SVAN 957 sound level meter design has undergone pattern evaluation in accordance with IEC-61672-2:2002 (BS EN 61672-2:2003) by any independent testing organization responsible for pattern approvals. In the absence of this information, the instrument has been assessed as a Class 1 meter in accordance with the manufacturers' claims.

LABORATORY MEASUREMENT UNCERTAINTIES

The measured errors obtained during testing have been extended by the laboratory's expanded measurement uncertainty before assessing conformance to the standard, and it is these extended errors which are quoted in the following pages. In accordance with convention, positive measured errors have been extended by the positive value of expanded uncertainty, and negative measured errors by the negative value. Where a bilateral extended error (± n.n dB) is given, this implies that the measured error was numerically zero.

The laboratory's expanded measurement uncertainties, including contributions from manufacturer-specified corrections where appropriate, are as follows:

Test ①: ± 0.23 dB @ 125 Hz; ± 0.23 dB @ 8 kHz
Tests ②⑧: (± dB) 0.23 @ 31.5 Hz; 0.23 @ 63 Hz; 0.23 @ 125 Hz; 0.23 @ 250 Hz; 0.23 @ 500 Hz; 0.23 @ 1kHz; 0.23 @ 2 kHz; 0.23 @ 4 kHz; 0.23 @ 8kHz; 0.23 @ 16kHz
Test ③: ± 0.13 dB
Tests ④⑤: ± 0.20 dB
Test ⑥: ± 0.27 dB
Test ⑦: ± 0.23 dB
Sound calibrator: ± 0.22 dB

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor *k*=2, providing a level of confidence of approximately 95%. The uncertainty evaluation has been carried out in accordance with the *Guide to the Expression of Uncertainty in Measurement* published by the International Organisation for Standardisation (ISO).

Measurement data - Test ① : Acoustical signal test of frequency weighting C (electrostatic actuator method)

Frequency,	Extended error, dB	Tolerance, dB
125 Hz	-0.29	± 1.5
8000.0	-0.96	+2.1, -3.1

The above data include manufacturer-specified corrections for case reflections

Measurement data - Test ② : Electrical signal tests of frequency weightings

Frequency, Hz	Extended error in A-weighting, dB		Extended error in C-weighting, dB		Extended error in Z-weighting, dB		Tolerance, dB
	most +ve	most -ve	most +ve	most -ve	most +ve	most -ve	
31.5	0.15	-0.31	0.25	-0.21	0.35	-0.11	± 2.0
63.0	0.15	-0.31	0.15	-0.31	0.25	-0.21	± 1.5
125.0	0.05	-0.41	0.15	-0.31	0.15	-0.31	± 1.5
250.0	-0.09	-0.55	0.01	-0.45	0.01	-0.45	± 1.4
500.0	0.03	-0.43	0.13	-0.33	0.13	-0.33	± 1.4
1000.0	REF	REF	REF	REF	REF	REF	REF
2000.0	0.31	-0.15	0.31	-0.15	0.21	-0.25	± 1.6
4000.0	-0.16	-0.62	-0.16	-0.62	-0.16	-0.62	± 1.6
8000.0	-0.43	-0.89	-0.43	-0.89	-0.53	-0.99	+2.1, -3.1
16000.0	-1.50	-1.96	-1.50	-1.96	-1.10	-1.56	+3.5, -17.0

The above data include manufacturer-specified corrections for the **measured** microphone response, and case reflections

Measurement data - Test ③ : Frequency and time weightings at 1 kHz

Parameter measured	Extended error, dB	Tolerance, dB
LAF	REF	REF
LCF	± 0.13	± 0.4
LZF	± 0.13	± 0.4
LAS	± 0.13	± 0.3
LAeq	± 0.13	± 0.3

Measurement data - Test ④: Level linearity on the reference level range (at 8 kHz, ref 94.0 dB); and also including the level range control (at 1 kHz, ref 114.0 dB on the reference range).

Reference range (High)		
Nominal reading, dB	Extended error, dB	Warning flags
35.0	U/R	U/R
36.0	0.60	¤
37.0	0.60	¤
38.0	0.50	¤
39.0	0.50	¤
40.0	0.50	¤
41.0	0.40	¤
44.0	0.30	¤
49.0	± 0.20	¤
54.0	± 0.20	¤
59.0	± 0.20	¤
64.0	± 0.20	¤
69.0	± 0.20	¤
74.0	± 0.20	¤
79.0	± 0.20	¤
84.0	± 0.20	¤
89.0	± 0.20	¤
94.0	Ref	¤
99.0	± 0.20	¤
104.0	± 0.20	¤
109.0	± 0.20	¤
114.0	± 0.20	¤
119.0	± 0.20	¤
124.0	± 0.20	¤
129.0	± 0.20	¤
131.0	± 0.20	¤
132.0	± 0.20	¤
133.0	± 0.20	¤

Reference range (High)		
Nominal reading, dB	Extended error, dB	Warning flags
134.0	± 0.20	¤
135.0	± 0.20	¤
136.0	± 0.20	¤
137.0	± 0.20	¤
138.0	± 0.20	¤
139.0	± 0.20	¤
140.0	± 0.20	¤
141.0	± 0.20	¤
142.0	± 0.20	¤
143.0	± 0.20	¤
144.0	O/L	O/L

Linearity including range control		
Instrument reading, dB	Range	Extended error, dB
41.0	Low	± 0.20

Linearity tolerances, dB	± 1.1

Measurement data - Test ⑤ Toneburst response

Parameter	Burst length ms	Extended error 1, dB	Extended error 2, dB	Extended error 3, dB	Tolerance, dB
LAFmax	200	± 0.20	± 0.20	± 0.20	± 0.8
	2	± 0.20	± 0.20	± 0.20	+1.3, -1.8
	0.25	-0.30	-0.30	-0.30	+1.3, -3.3
LASmax	200	± 0.20	± 0.20	± 0.20	± 0.8
	2	± 0.20	± 0.20	± 0.20	+1.3, -3.3
LAE	200	± 0.20	± 0.20	± 0.20	± 0.8
	2	± 0.20	± 0.20	± 0.20	+1.3, -1.8
	0.25	-0.40	-0.30	-0.40	+1.3, -3.3

Measurement data - Test ⑥ : Peak C sound level

Frequency, Hz	Burst length cycles	Extended error 1, dB	Extended error 2, dB	Extended error 3, dB	Tolerance, dB
8000	1	± 0.27	-0.87	± 0.27	± 2.4
500	+ ½	-0.37	-0.37	-0.37	± 1.4
	- ½	-0.47	-0.47	-0.47	± 1.4

Measurement data - Test ⑦ : Overload indication

Extended error in level of negative pulse required to trigger overload, relative to level of positive pulse required: 0.33 dB (tolerance ± 1.8 dB)

CERTIFICATE OF CALIBRATION

ISSUED BY AV CALIBRATION

Date of issue 06 Apr 2016 Certificate N° 1604163

AV Calibration
2 Warren Court
Chicksands, Shefford
Bedfordshire SG17 5QB
U.K.
Tel: +44 (0)1462 638600
Fax: +44 (0)1462 638601
Email: lab@avcalib.co.uk
www.avcalibration.co.uk

Approved Signatory

G. Parry [ ] B. Baker [ ]

Client	Clement Acoustics Ltd 202 Uxbridge Road London W12 7JP
Purchase Order No.	N/A
Instrument	Svantek SVAN958 Vibration Meter
Serial No.	15844 (Accelerometer used with channels 1 to 3)
Accelerometer Type	Dytran 3233A
Accelerometer Serial No.	547
Cable Type	N/A
Client Asset No.	N/A
Procedure ID.	SVAN958_80Hz_3Ch_Issue 2
Job Number	TRAC16/03088/01
Date of Calibration	06 Apr 2016
Previous Cert. number	N/A
Date of Previous Cert.	N/A
Calibration Status	**Reported Values Only**

This calibration is traceable to National Standards. AV Calibration sources used to perform calibrations are calibrated at the National Physical Laboratory or by UKAS laboratories accredited for the purpose.

The meter was calibrated at 80.0 Hz 10.00 m/s/s on the 316 m/s/s range HP10 weighting using a vibration table with a Dytran reference (precision grade) accelerometer type 3123A calibrated to National Standards as reference and the meter's accelerometer co-axially mounted. For a reading of 10.00 m/s/s on the meter, the calibration settings produced were -20.5 dB for Ch.1 (X), (was -20.6), -20.4 dB for Ch.2 (Y), (was -20.7), -20.3 dB for Ch.3 (Z), (was -20.8).
These readings should be set as the nominal level for future measurements.
The uncertainty on this reading is ±1.2% of reading for a confidence probability of not less than 95%.

The frequency response of each axis of the accelerometer was measured. Electrical tests were then conducted to the requirements of ISO 8041. As the tolerances in the Standard do not include any uncertainty budgets, no allowance for was made in these tests.

The meter meets the requirements and tolerances of ISO 8041 Class 1 for Hand-Arm, Whole-Body and general vibration measurements using the calibration settings listed above for those tests carried out over a dynamic range of greater than 80dB. (See Linearity results for channels 1 to 3).

Comment
This certificate reports recorded values after adjustment to the instrument was carried out.

CERTIFICATE OF CALIBRATION

ISSUED BY AV CALIBRATION

NOTES

1 The FF compensation filter only was switched on for all acoustic tests. All the compensation filters were switched off throughout the electrical tests.

2 No suitable microphone frequency response information was supplied with the instrument. It was therefore measured by this laboratory using the electrostatic actuator method.

3 The instrument was running the following firmware version: 6.12.5

4 The overload indicator was triggered for a reading of 143.9 dB on the reference range.

5 The level displayed on the HIGH range for the calibrator supplied, B&K 4231 serial no.1897774 was 93.6 with the FF filter ON, 93.9 with it switched OFF.

6 As supplied, the Outdoor Environmental compensation filter was selected, and the calibrator level was set to 114 dB. These were changed to FF and 94 dB respectively prior to this verification.

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Certificate N° 1604163

Frequency Response of Accelerometer type Dytran 3233A serial no. 547.
Measured by comparison to Dytran 3123A reference accelerometer. Response in dB rel. to 80 Hz. measured at level of 10.0 m/s^2

Frequency Hz	Axis 1 (dB)	Axis 2 (dB)	Axis 3 (dB)
20	-0.1	0.0	0.0
40	-0.1	0.1	0.1
80	REF	REF	REF
160	-0.1	-0.1	0.0
315	-0.3	-0.1	-0.2
630	-0.6	0.2	-0.2
1250	-0.5	0.1	-0.3

Frequency Weightings, measured electrically on 316 m/s/s range, reference frequency 80 Hz, calibration setting as per page 1. Results reported as errors in dB.

HP10 Weighting at 80 Hz

Frequency Hz	Error - Ch 1 (dB)	Error - Ch 2 (dB)	Error - Ch 3 (dB)
1	1.2	1.2	1.3
2	1.0	1.0	1.0
4	0.7	0.7	0.7
8	0.1	0.1	0.1
20	0.0	0.0	0.0
40	0.0	0.0	0.0
80	REF	REF	REF
160	0.0	0.0	0.1
315	0.0	0.0	0.1
630	0.0	0.0	0.1
1250	0.0	0.0	0.0

HP10 is not defined in ISO8041. No tolerances are stated by the manufacturer in the instrument's handbook for the HP10 weighting.

Wd/Wk ref HP10 weighting at 80 Hz

Frequency Hz	Wd Weighting Error - Ch1 (dB)		Wd Weighting Error - Ch2 (dB)		Wk Weighting Error - Ch3 (dB)		Tolerance dB
1	-0.1		-0.1		-0.1		±1
2	-0.1		-0.1		0.0		±1
4	-0.1		-0.1		0.0		±1
8	-0.1		-0.1		0.0		±1
20	0.0		0.0		0.0		±1
40	0.0		0.0		0.0		±1
80	-0.1		-0.1		-0.1		±2
160	-0.2		-0.2		-0.2		+2/-∞

CERTIFICATE OF CALIBRATION

ISSUED BY AV CALIBRATION

Certificate N° 1604163

Environment
The ambient environmental conditions at the time of the calibration were;
Temperature: 21.9 ± 1°C, Humidity: 36 ± 5%RH, Atmospheric pressure 99.8 ± 1 kPa

Test results
Linearity Errors in dB measured at 80 Hz on the 316 m/s/s range, HP10 weighting, with calibration coefficients detailed on page 1. The reference level was set to read 10.0 m/s/s (approximately 17 dB below full scale). Signal level changes in dB; reading error in dB given for each axis.

Input Level (dB)	Target m/s^2	Error - Ch1 (dB)		Error - Ch2 (dB)		Error - Ch3(dB)	
18.0	79.43	-0.1	O/L	-0.1	O/L	-0.1	O/L
17.0	70.79	0.0	O/L	0.0		0.0	
16.0	63.10	0.0		0.0		0.0	
15.0	56.23	0.0		0.0		0.0	
10.0	31.62	0.0		0.0		0.0	
5.0	17.78	0.0		0.0		0.0	
0.0	10.00	0.0		0.0		0.0	
-10.0	3.162	0.0		0.0		0.0	
-20.0	1.000	0.0		0.0		0.1	
-30.0	0.3162	0.0		0.0		0.0	
-40.0	0.1000	0.0		0.1		0.1	
-50.0	0.0316	0.0		0.0		0.1	UR
-60.0	0.01000	0.0	UR	0.1	UR	0.0	UR
-70.0	0.00316	0.0	UR	0.0	UR	0.0	UR
-75.0	0.00178	0.1	UR	0.2	UR	0.0	UR
-80.0	0.00100	0.2	UR	0.5	UR	0.2	UR
-81.0	0.00089	0.6	UR	0.7	UR	0.4	UR
-82.0	0.00079	0.8	UR	0.9	UR	0.6	UR

O/L - meter indicates overload ; UR - meter indicates underrange

Permitted tolerance ± 0.5 dB

Inter-range Accuracy
Measured using an electrical signal at 80 Hz on HP10 weighting.
Reference point set at 10 m/s/s on the 316 m/s/s range.

Range m/s^2	Level m/s^2	Channel 1	Channel 2	Channel 3
316	10.00	10.0	10.0	10.0
17.8	0.5623	0.564	0.564	0.564
Range Change Error(dB)		0.0	0.0	0.0

Noise Floors
Noise floors measured on the 17.8 m/s/s range, HP10 weighting.

Axis	µm/s^2	Overload / Underrange
1	39.4	UR
2	40.4	UR
3	34.6	UR

CERTIFICATE OF CALIBRATION

ISSUED BY AV CALIBRATION

Certificate N° 1604163

Wh HAND-ARM, ref. HP10 Weighting at 80 Hz

Frequency Hz	Error - Ch1 (dB)		Error - Ch2 (dB)		Error - Ch3 (dB)		Tolerance dB
1	-0.2		-0.2		-0.2		+2/-∞
2	0.0		0.0		0.0		+2/-∞
4	0.0		0.0		0.1		±2
8	0.0		0.0		0.0		±1
20	0.0		0.0		0.0		±1
40	0.0		0.0		0.0		±1
80	0.0		0.0		0.0		±1
160	-0.1		-0.1		-0.1		±1
315	0.0		0.0		0.0		±1
630	0.0		0.0		0.0		±1
1250	0.5		0.5		0.5		±2

The total frequency response of the meter, to which the quoted tolerances for each weighting apply, will be obtained by adding together the PCB accelerometer response for each axis and the weighting response for that axis.

All responses, both with and without the accelerometer, are within the specifications in ISO 8041 for a Class 1 meter except for the points shown in RED

NOTE

The instrument was also supplied with a second accelerometer, Dytran 3233A s/no 470

For a reading of 10.0 m/s/s on the meter, the calibration settings produced were;

-20.3 dB for Ch.1 (x), -20.3 dB for Ch.2 (Y), -20.6 dB for Ch.3 (Z)

END OF CALIBRATION

CALIBRATED BY :- Allan Lloyd

ENVIRONMENTAL CONDITIONS

Temperature 25 °C	Relative humidity 42%	Ambient pressure 990 hPa

TEST EQUIPMENT

Item	Manufacturer	Model	Serial no.	Description
1.	SVANTEK	87		
2.	SVANTEK	SVAN 932A	6120	Sound & Vibration Analyser
3.	KEITHLEY	2000	0931035	Digital multimeter
4.	SVANTEK	SV30A	3369	Acoustic calibrator
5.	SVANTEK	ST03	-	Microphone equivalent electrical impedance (1kpF)
6.	DYTRAN	3233A	436	Reference accelerometer

CONFORMITY & TEST DECLARATION

1. Hetronik Svantek company declares that this instrument has been calibrated and tested in compliance with the internal ISO9001 procedures and meets all specifications mentioned in the user manual.
2. The calibration process has been performed using the Second Calibrator and is traceable to the GUM (Central Office of Measures) reference standard - sound level calibrator type 4231 No 2292773.
3. The vibrational calibration was performed using the Back-to-Back Comparison method and is traceable to the GUM (Central Office of Measures) reference standard - accelerometer type 8305 No 1433233.
4. The information appearing on this sheet has been compiled specifically for this instrument. This form is produced with advanced equipment & procedures which permit comprehensive quality assurance verification of all data supplied hereon.
5. This calibration sheet shall not be reproduced except in full without written permission of the SVANTEK Ltd

Calibration specialist: Krzysztof Czachor .....

Test date: 2015-07-20

SVANTEK

ISO9001 certified

FACTORY CALIBRATION DATA OF THE SVAN977 *No. 45351*

with preamplifier SVANTEK type SV12L No. 47602 and microphone ACO PACIFIC type 7052E No. 60647

SOUND LEVEL METER

1. CALIBRATION (electrical)

LEVEL METER function; Characteristic: A; f_{ref} = 1 kHz; Input signal = 100 dB.

	Range Low (120dB)	Range High (137dB)
Indication [dB]	114.0	114.0
Error [dB]	0.0	0.0

2. CALIBRATION* (acoustical)

LEVEL METER function; Range: High; Reference frequency: 1000 Hz; Sound Pressure Level: 113.90 dB

Characteristic	Correction value [dB]	Indication [dB]	Error [dB]
Z	113.90	113.84	-0.06
A	113.90	113.84	-0.06
C	113.90	113.84	-0.06

Calibration sustained with the microphone ACO PACIFIC type 7052E No 60647. Calibration factor -0.93 dB.

3. LINEARITY TEST* (electrical)

LEVEL METER function; Range: Low; Characteristic: A; f_{ref} = 315 Hz

Nominal result LEQ [dB]	24.0	25.0	26.0	28.0	30.0	40.0	60.0	80.0	100.0
Error [dB]	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0

LEVEL METER function; Range: Low; Characteristic: A; f_{ref} = 1000 Hz

Nominal result LEQ [dB]	24.0	25.0	26.0	28.0	30.0	40.0	60.0	80.0	100.0	120.0
Error [dB]	0.0	0.0	0.0	-0.0	-0.0	-0.0	-0.0	-0.0	0.0	-0.0

LEVEL METER function; Range: Low; Characteristic: A; f_{ref} = 8000 Hz

Nominal result LEQ [dB]	24.0	25.0	26.0	28.0	30.0	40.0	60.0	80.0	100.0	119.0
Error [dB]	0.0	0.0	-0.0	-0.0	-0.1	-0.0	-0.0	-0.0	0.0	-0.0

LEVEL METER function; Range: Low; Characteristic: A; f_{ref} = 1000 Hz

Nominal result LEQ [dB]	24.0	25.0	26.0	28.0	30.0	40.0	60.0	80.0	100.0	120.0
Error [dB]	0.0	0.0	0.0	-0.0	-0.0	-0.0	-0.0	-0.0	0.0	-0.0

LEVEL METER function; Range: High; Characteristic: A; f_{ref} = 315 Hz

Nominal result LEQ [dB]	35.0	36.0	37.0	38.0	40.0	60.0	80.0	97.0
Error [dB]	0.1	0.0	0.0	0.0	0.0	0.0	-0.0	0.0

LEVEL METER function; Range: High; Characteristic: A; f_{ref} = 1000 Hz

Nominal result LEQ [dB]	35.0	36.0	37.0	38.0	40.0	60.0	80.0	100.0	120.0	137.0
Error [dB]	0.1	0.1	0.0	0.0	0.0	-0.0	-0.0	0.0	-0.0	0.0

LEVEL METER function; Range: High; Characteristic: A; f_{ref} = 8000 Hz

Nominal result LEQ [dB]	35.0	36.0	37.0	38.0	40.0	60.0	80.0	100.0	120.0	136.0
Error [dB]	0.0	0.0	0.0	0.0	-0.0	-0.0	-0.0	0.0	-0.0	0.0

4. TONE BURST RESPONSE*

LEVEL METER function; Characteristic: A; f_{ref} = 4000 Hz. Burst duration: 2 s

Range: Low. Steady level nominal result = 113dB

	Result	Detector	Duration [ms]	1000	500	200	100	50	20	10	5	2	1	0.5	0.25
MAX	Nominal result LEQ [dB]	Fast	Indication [dB]	113.9	113.9	116.8	116.8	114.4	112.2	109.8	102.9	99.0	96.0	92.9	89.9
			Error [dB]	0.0	0.0	2.9	2.9	0.5	-1.7	-4.1	-11.0	-14.9	-17.9	-21.0	-24.0
		Slow	Indication [dB]	111.0	111.0	109.5	106.8	103.9	100.0	97.0	94.0	91.0	-	-	-
			Error [dB]	-2.9	-2.9	-4.4	-7.1	-10.0	-13.9	-16.9	-19.9	-22.9	-	-	-
SEL	-	-	Indication [dB]	113.9	114.0	116.9	116.9	114.5	112.3	109.9	103.0	99.0	96.0	93.0	89.9
			Error [dB]	0.0	0.0	3.0	3.0	0.6	-1.6	-4.0	-10.9	-14.9	-17.9	-20.9	-24.0

Range: Low; Steady level nominal result = 57dB

Result	Detector	Duration [ms]	1000	500	200	100	50	20	10	5	2	1
MAX	Fast	Indication [dB]	57.0	56.9	56.0	54.4	52.1	48.6	45.8	42.9	38.9	35.9
		Error [dB]	0.0	0.0	0.0	0.0	-0.0	-0.0	-0.0	0.0	-0.0	-0.1
	Slow	Indication [dB]	55.0	52.9	49.5	46.8	43.8	39.9	36.9	33.9	29.9	-
		Error [dB]	0.0	0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-
SEL	-	Indication [dB]	57.0	54.0	50.0	47.0	44.0	40.0	37.0	34.0	30.0	27.0
		Error [dB]	0.0	-0.0	0.0	0.0	0.0	0.0	0.0	-0.0	0.0	0.0

Range: Low; Steady level nominal result = 35dB

Result	Detector	Duration [ms]	1000	500	200
MAX	Fast	Indication [dB]	35.0	34.9	34.0
		Error [dB]	0.0	0.0	0.0
	Slow	Indication [dB]	33.0	31.0	27.6
		Error [dB]	0.0	0.1	-0.0
SEL	-	Indication [dB]	35.0	32.0	28.1
		Error [dB]	0.0	0.0	0.1

Range: High; Steady level nominal result = 134dB

Result	Detector	Duration [ms]	1000	500	200	100	50	20	10	5	2	1	0.5	0.25
MAX	Fast	Indication [dB]	134.0	133.9	133.0	131.4	129.2	125.7	122.8	119.9	116.0	113.0	109.9	106.9
		Error [dB]	0.0	-0.0	0.0	-0.0	-0.0	-0.0	-0.1	0.0	-0.0	-0.0	-0.1	-0.1
	Slow	Indication [dB]	132.0	129.9	126.6	123.8	120.9	117.0	114.0	111.0	107.0	-	-	-
		Error [dB]	0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-	-	-
SEL	-	Indication [dB]	134.0	131.0	127.0	124.0	121.0	117.0	114.0	111.0	107.0	104.0	100.9	97.9
		Error [dB]	0.0	-0.0	0.0	0.0	-0.0	0.0	-0.0	-0.0	-0.0	-0.0	-0.1	-0.1

Range: High; Steady level nominal result = 54dB

Result	Detector	Duration [ms]	1000	500	200	100	50
MAX	Fast	Indication [dB]	54.0	53.9	53.0	51.4	49.1
		Error [dB]	0.0	0.0	0.0	-0.0	-0.0
	Slow	Indication [dB]	52.0	49.9	46.6	43.8	40.8
		Error [dB]	0.0	0.1	0.0	0.0	-0.0
SEL	-	Indication [dB]	54.0	51.0	47.0	44.0	41.0
		Error [dB]	0.0	-0.0	0.0	0.0	0.0

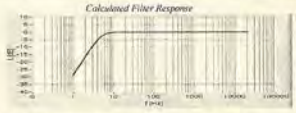
Range: High; Steady level nominal result = 46dB

Result	Detector	Duration [ms]	1000	500	200
MAX	Fast	Indication [dB]	46.0	45.9	45.0
		Error [dB]	0.0	0.0	0.0
	Slow	Indication [dB]	44.0	42.0	38.6
		Error [dB]	0.0	0.1	-0.0
SEL	-	Indication [dB]	46.0	43.0	39.1
		Error [dB]	0.0	0.0	0.1

5. FREQUENCY RESPONSE – BAND AUDIO* (electrical)

LEVEL METER function; Characteristic: Z; Range: High; Input signal =135 dB;

Calculated Filter Response



Measured Filter Response with Preamplifier SV12L (f - frequency, L - level)

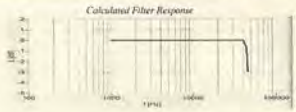
f [Hz]	L [dB]	f [Hz]	L [dB]	f [Hz]	L [dB]	f [Hz]	L [dB]	f [Hz]	L [dB]
1	-29.7	4	-3.9	16	0.0	250	0.0	16000	0.0
1.25	-25.5	5	-2.2	20	0.0	500	0.0	20000	0.0
1.6	-21.4	6.3	-1.4	25	0.0	1000	0.0		
2	-17.7	8	-0.5	31.5	0.0	2000	0.0		
2.5	-13.3	10	-0.2	63	0.0	4000	0.0		
3.15	-9.4	12.5	-0.0	125	0.0	8000	0.0		

All frequencies are nominal center values for the 1/3 octave bands

6. FREQUENCY RESPONSE – BAND ULTRA* (electrical)

LEVEL METER function: Characteristic: HPE; Range: High; Input signal =135 dB;

Calculated Filter Response



Measured Filter Response with Preamplifier SV12L (f - frequency, L - level)

f [Hz]	L [dB]	f [Hz]	L [dB]	f [Hz]	L [dB]
4000	0.0	16000	-0.0	40000	-0.1
5000	0.0	20000	-0.0	43656*	-0.6
6000	-0.0	25000	-0.0	45255*	-1.6
8000	-0.0	32000	-0.0		

All frequencies not marked by * are nominal center values for the 1/3 octave bands

7. INTERNAL NOISE LEVEL* (electrical - compensated)

LEVEL METER function ; Calibration factor: 0 dB

	Characteristic	Z	A	C
Range Low	Level [dB]	≤20	≤11	≤10
Range High	Level [dB]	≤40	≤23	≤22

* measured with preamplifier SVANTEK type SV12L No. 47602.

8. INTERNAL NOISE LEVEL (acoustical - compensated)

LEVEL METER function; Characteristic: A; (Backlight – off)

Range	Low	High
Indication [dB]	10.0	18.2

Noise measured in special chamber, with reference microphone G R.A.S type 40AN No. 73421

VIBRATION LEVEL METER

1. CALIBRATION (electrical)

LEVEL METER function; Characteristic: HP10; f=79.58 Hz; Input signal =140 dB;

Range	Low	High
Indication [dB]	140.0	140.0
Error [dB]	0.0	0.0

2. CALIBRATION (vibrational)

LEVEL METER function; Range: High; Input signal: 140dB;

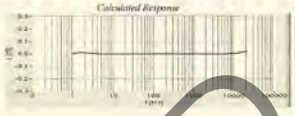
Characteristic	Reference frequency [Hz]	Correct value [dB]	Indication [dB]	Error [dB]
HP1	79.58	140.0	140.1	0.1

Calibration measured with the accelerometer DYTRAN type 3185D No. 3035. Calibration factor: -0.2dB

3. FREQUENCY RESPONSE (electrical)

LEVEL METER function; Characteristic: HP; Range: High; input=175 dB;

Calculated Response



Measured Response (f-frequency, L-level)

f [Hz]	L [dB]
1	-0.0
1000	-0.0
20000	-0.0

All frequencies are nominal center values for the 1/3 octave bands

4. INTERNAL NOISE LEVEL (electrical)

LEVEL METER function; Range: Low;

Characteristic	HP1
Indication [dB]	37.1

ENVIRONMENTAL CONDITIONS

Temperature	Relative humidity	Ambient pressure
25 °C	42%	990 hPa

TEST EQUIPMENT

Item	Manufacturer	Model	Serial no.	Description
1	SVANTEK	SVAN 401	87	Signal generator
2	SVANTEK	SVAN 912A	6120	Sound &Vibration Analyser
3	KEITHLEY	2000	0910165	Digital multimeter
4	SVANTEK	SV30A	5369	Acoustic calibrator
5	SVANTEK	ST02	-	Microphone equivalent electrical impedance (18pF)
6	DYTRAN	3233A	436	Reference accelerometer

CONFORMITY & TEST DECLARATION

1. Herewith Svantek company declares that this instrument has been calibrated and tested in compliance with the internal ISO9001 procedures and meets all specification given in the Manual(s) or respectively surpass them.
2. The acoustic calibration was performed using the Sound Calibrator and is traceable to the GUM (Central Office of Measures) reference standard - sound level calibrator type 4231 No 2292773.
3. The vibrational calibration was performed using the Back-to-Back Comparison method and is traceable to the GUM (Central Office of Measures) reference standard - accelerometer type 8305 No 1435233.
4. The information appearing on this sheet has been compiled specifically for this instrument. This form is produced with advanced equipment & procedures which permit comprehensive quality assurance verification of all data supplied herein.
5. This calibration sheet shall not be reproduced except in full, without written permission of the SVANTEK Ltd.

Calibration specialist: Krzysztof Czachor ..... Test date: 2015-07-20

SVANTEK ISO9001 certified

FACTORY CALIBRATION DATA OF THE SVAN977 *No. 45354*

with preamplifier SVANTEK type SV12L No. 47601 and microphone ACO PACIFIC type 7052E No. 60648

SOUND LEVEL METER

1. CALIBRATION (electrical)

LEVEL METER function; Characteristic: A; f_{cal}=1 kHz; Input signal =100 dB;

Range	Low (120dB)	High (137dB)
Indication [dB]	114.0	114.0
Error [dB]	0.0	0.0

2. CALIBRATION* (acoustical)

LEVEL METER function, Range: High; Reference frequency: 1000 Hz; Sound Pressure Level: 113.90 dB

Characteristic	Correct value [dB]	Indication [dB]	Error [dB]
Z	113.90	113.83	-0.07
A	113.90	113.83	-0.07
C	113.90	113.83	-0.07

Calibration measured with the microphone ACO PACIFIC type 7052E No. 60648. Calibration factor: -1.10 dB

3. LINEARITY TEST* (electrical)

LEVEL METER function; Range: Low; Characteristic: A; f_{cal}= 31.5 Hz

Nominal result LEQ [dB]	24.0	25.0	26.0	28.0	30.0	40.0	60.0	80.0
Error [dB]	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0

LEVEL METER function; Range: Low; Characteristic: A; f_{cal}= 1000 Hz

Nominal result LEQ [dB]	24.0	25.0	26.0	28.0	30.0	40.0	60.0	80.0	100.0	120.0
Error [dB]	0.0	0.0	0.0	-0.0	0.0	-0.0	-0.0	0.0	0.0	-0.0

LEVEL METER function; Range: Low; Characteristic: A; f_{cal}= 8000 Hz

Nominal result LEQ [dB]	24.0	25.0	26.0	28.0	30.0	40.0	60.0	80.0	100.0	119.0
Error [dB]	0.0	0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	0.0	-0.0

LEVEL METER function; Range: High; Characteristic: A; f_{cal}= 31.5 Hz

Nominal result LEQ [dB]	35.0	36.0	37.0	38.0	40.0	60.0	80.0	97.0
Error [dB]	0.1	0.0	0.0	0.0	0.0	-0.0	-0.0	-0.0

LEVEL METER function; Range: High; Characteristic: A; f_{cal}= 1000 Hz

Nominal result LEQ [dB]	35.0	36.0	37.0	38.0	40.0	60.0	80.0	100.0	120.0	137.0
Error [dB]	0.1	0.1	0.0	-0.0	0.0	-0.0	-0.0	0.0	-0.0	0.0

LEVEL METER function; Range: High; Characteristic: A; f_{cal}= 8000 Hz

Nominal result LEQ [dB]	35.0	36.0	37.0	38.0	40.0	60.0	80.0	100.0	120.0	136.0
Error [dB]	0.0	0.0	0.0	0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0

4. TONE BURST RESPONSE*

LEVEL METER function; Characteristic: A; f_{cal}= 4000 Hz; Burst duration: 2 s

Range: Low; Steady level nominal result = 113dB

Result	Detector	Duration [ms]	1000	500	200	100	50	20	10	5	2	1	0.5	0.25
MAX	Fast	Indication [dB]	116.9	116.8	115.9	114.5	112.1	108.6	105.8	102.8	98.9	95.9	92.8	89.8
		Error [dB]	0.0	0.0	0.0	0.0	-0.0	-0.0	-0.1	0.0	-0.0	-0.0	-0.1	-0.1
	Slow	Indication [dB]	114.9	112.9	109.5	106.7	103.8	99.9	96.9	93.9	89.9	-	-	-
		Error [dB]	0.0	0.1	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-	-	-
SEL	-	Indication [dB]	116.9	113.9	109.9	106.9	103.9	99.9	96.9	93.9	89.9	86.9	83.8	80.8
		Error [dB]	0.0	-0.0	0.0	0.0	-0.0	0.0	0.0	-0.0	-0.0	-0.0	-0.1	-0.1

Range: Low, Steady level nominal result = 57dB

Result	Detector	Duration [ms]	1000	500	200	100	50	20	10	5	2	1
MAX	Fast	Indication [dB]	56.9	56.8	55.9	54.3	52.1	48.6	45.7	42.8	38.9	35.8
		Error [dB]	-0.0	0.0	0.0	-0.0	-0.0	-0.0	-0.1	0.0	-0.0	-0.1
	Slow	Indication [dB]	54.9	52.8	49.5	46.7	43.8	39.8	36.9	33.9	29.9	-
		Error [dB]	0.0	0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-
SEL	-	Indication [dB]	56.9	53.9	49.9	46.9	43.9	39.9	36.9	33.9	29.9	26.9
		Error [dB]	0.0	-0.0	0.0	-0.0	-0.0	0.0	0.0	-0.0	0.0	-0.0

Range: Low, Steady level nominal result = 35dB

Result	Detector	Duration [ms]	1000	500	200
MAX	Fast	Indication [dB]	34.9	34.8	33.9
		Error [dB]	0.0	-0.0	0.0
	Slow	Indication [dB]	32.9	30.9	27.3
		Error [dB]	0.0	0.0	-0.0
SEL	-	Indication [dB]	34.9	31.9	28.0
		Error [dB]	0.0	0.0	0.1

Range: High, Steady level nominal result = 134dB

Result	Detector	Duration [ms]	1000	500	200	100	50	20	10	5	2	1	0.5	0.25
MAX	Fast	Indication [dB]	133.9	133.8	132.9	131.3	129.1	125.6	122.8	119.8	115.9	112.8	109.8	106.8
		Error [dB]	-0.0	0.0	0.0	0.0	-0.0	-0.0	-0.1	0.0	-0.0	-0.1	-0.1	-0.1
	Slow	Indication [dB]	131.9	129.8	126.5	123.7	120.8	116.9	113.9	110.9	106.9	-	-	-
		Error [dB]	0.0	0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0			
SEL	-	Indication [dB]	133.9	130.9	126.9	123.9	120.9	116.9	113.9	110.9	106.9	103.8	100.8	97.8
		Error [dB]	0.0	-0.0	0.0	-0.0	-0.0	0.0	-0.0	-0.0	-0.0	-0.1	-0.1	-0.1

Range: High, Steady level nominal result = 84dB

Result	Detector	Duration [ms]	1000	500	200	100	50
MAX	Fast	Indication [dB]	53.9	53.8	52.9	51.3	49.1
		Error [dB]	0.0	0.0	0.0	0.0	0.0
	Slow	Indication [dB]	51.9	49.8	46.5	43.6	40.8
		Error [dB]	0.0	0.1	-0.0	-0.0	0.0
SEL	-	Indication [dB]	53.9	50.9	46.9	43.9	40.9
		Error [dB]	0.0	-0.0	0.0	0.0	0.1

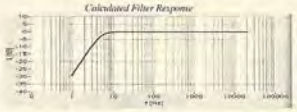
Range: High, Steady level nominal result = 46dB

Result	Detector	Duration [ms]	1000	500	200
MAX	Fast	Indication [dB]	45.9	45.8	45.0
		Error [dB]	0.0	0.0	0.0
	Slow	Indication [dB]	43.9	41.8	38.6
		Error [dB]	0.0	0.0	0.0
SEL	-	Indication [dB]	45.9	42.9	39.0
		Error [dB]	0.0	-0.0	0.1

5. FREQUENCY RESPONSE – BAND AUDIO* (electrical)

LEVEL METER function; Characteristic: Z; Range: High; Input signal =135 dB;

Calculated Filter Response



Measured Filter Response with Preamplifier SV12L (f - frequency, L - level)

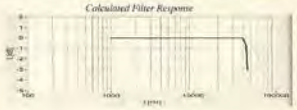
f [Hz]	L [dB]	f [Hz]	L [dB]	f [Hz]	L [dB]	f [Hz]	L [dB]	f [Hz]	L [dB]
1	-29.7	4	-6.8	16	0.0	250	0.0	16000	0.0
1.25	-23.5	5	-3.2	20	0.0	500	0.0	20000	-0.9
1.6	-23.4	6.3	-1.4	25	0.0	1000	0.0		
2	-17.5	8	-0.5	31.5	0.0	2000	0.0		
2.5	-13.5	10	-0.2	63	0.0	4000	0.0		
3.15	-9.5	12.5	-0.0	125	-0.0	8000	-0.0		

All frequencies are nominal center values for the 1/3 octave bands

6. FREQUENCY RESPONSE – BAND ULTRA* (electrical)

LEVEL METER function; Characteristic: HPE; Range: High; Input signal =135 dB;

Calculated Filter Response



Measured Filter Response with Preamplifier SV12L (f - frequency, L - level)

f [Hz]	L [dB]	f [Hz]	L [dB]	f [Hz]	L [dB]
1000	-0.0	16000	-0.0	40000	-0.1
2000	-0.0	20000	-0.0	43850*	-0.7
4000	-0.0	25000	-0.0	45255*	-3.1
8000	-0.0	32000	-0.1		

All frequencies not marked by * are nominal center values for the 1/3 octave bands

7. INTERNAL NOISE LEVEL* (electrical - compensated)

LEVEL METER function ; Calibration factor: 0 dB

	Characteristic	Z	A	C
Range Low	Level [dB]	≤20	≤11	≤10
Range High	Level [dB]	≤40	≤23	≤22

* measured with preamplifier SVANTEK type SV12L No. 47601.

8. INTERNAL NOISE LEVEL (acoustical - compensated)

LEVEL METER function; Characteristic: A; (Backlight – off)

Range	Low	High
Indication [dB]	10.7	17.9

Noise measured in special chamber, with reference microphone G R A.S type 40AN No. 73421

VIBRATION LEVEL METER

1. CALIBRATION (electrical)

LEVEL METER function; Characteristic: HP10; f=79.58 Hz; Input signal =140 dB;

Range	Low	High
Indication [dB]	140.0	140.0
Error [dB]	0.0	0.0

2. CALIBRATION (vibrational)

LEVEL METER function; Range: High; Input signal: 140dB;

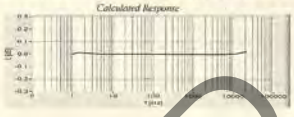
Characteristic	Reference frequency [Hz]	Correct value [dB]	Indication [dB]	Error [dB]
HP1	79.58	140.0	140.0	0.0

Calibration measured with the accelerometer DYTRAN type 3185D No. 3035. Calibration factor: -0.2dB

3. FREQUENCY RESPONSE (electrical)

LEVEL METER function; Characteristic: HP; Range: High; input=175 dB;

Calculated Response



Measured Response (f-frequency, L-level)

f [Hz]	L [dB]
1	0.0
1000	0.0
20000	-0.0

All frequencies are nominal center values for the 1/3 octave bands

4. INTERNAL NOISE LEVEL (electrical)

LEVEL METER function; Range: Low;

Characteristic	HP1
Indication [dB]	36.2

ENVIRONMENTAL CONDITIONS

Temperature	Relative humidity	Ambient pressure
25 °C	36%	991 hPa

TEST EQUIPMENT

Item	Manufacturer	Model	Serial no.	Description
1.	SVANTEK	SVAN 401	87	Signal generator
2.	SVANTEK	SVAN 912A	6120	Sound &Vibration Analyser
3.	KEITHLEY	2000	0910165	Digital multimeter
4.	SVANTEK	SV30A	5369	Acoustic calibrator
5.	SVANTEK	ST02	-	Microphone equivalent electrical impedance (18pF)
6.	DYTRAN	3233A	436	Reference accelerometer

CONFORMITY & TEST DECLARATION

1. Herewith Svantek company declares that this instrument has been calibrated and tested in compliance with the internal ISO9001 procedures and meets all specification given in the Manual(s) or respectively surpass them.
2. The acoustic calibration was performed using the Sound Calibrator and is traceable to the GUM (Central Office of Measures) reference standard - sound level calibrator type 4231 No 2292773.
3. The vibrational calibration was performed using the Back-to-Back Comparison method and is traceable to the GUM (Central Office of Measures) reference standard - accelerometer type 8305 No 1435233.
4. The information appearing on this sheet has been compiled specifically for this instrument. This form is produced with advanced equipment & procedures which permit comprehensive quality assurance verification of all data supplied herein.
5. This calibration sheet shall not be reproduced except in full, without written permission of the SVANTEK Ltd.

Calibration specialist: Krzysztof Czachor ..... Test date: 2015-07-21

SVANTEK ISO9001 certified

FACTORY CALIBRATION DATA OF THE SVAN977 *No. 45355*

with preamplifier SVANTEK type SV12L No. 47603 and microphone ACO PACIFIC type 7052E No. 60645

SOUND LEVEL METER

1. CALIBRATION (electrical)

LEVEL METER function; Characteristic: A; f_{ref}= 1 kHz; Input signal =100 dB;

Range	Low (120dB)	High (137dB)
Indication [dB]	114.0	114.0
Error [dB]	0.0	0.0

2. CALIBRATION* (acoustical)

LEVEL METER function; Range: High; Reference frequency: 1000 Hz; Sound Pressure Level: 113.90 dB

Characteristic	Correct value [dB]	Indication [dB]	Error [dB]
Z	113.90	113.84	-0.06
A	113.90	113.84	-0.06
C	113.90	113.84	-0.06

Calibration measured with the microphone ACO PACIFIC type 7052E No. 60645. Calibration factor: -1.26 dB

3. LINEARITY TEST* (electrical)

LEVEL METER function; Range: Low; Characteristic: A; f_{ref}= 31.5 Hz

Nominal result LEQ [dB]	24.0	25.0	26.0	28.0	30.0	40.0	60.0	80.0
Error [dB]	0.1	0.1	0.0	0.0	0.0	0.0	0.0	-0.0

LEVEL METER function; Range: Low; Characteristic: A; f_{ref}= 1000 Hz

Nominal result LEQ [dB]	24.0	25.0	26.0	28.0	30.0	40.0	60.0	80.0	100.0	120.0
Error [dB]	0.0	0.0	0.0	0.0	-0.0	-0.0	-0.0	-0.0	0.0	-0.0

LEVEL METER function; Range: Low; Characteristic: A; f_{ref}= 8000 Hz

Nominal result LEQ [dB]	24.0	25.0	26.0	28.0	30.0	40.0	60.0	80.0	100.0	110.0
Error [dB]	0.0	0.0	0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0

LEVEL METER function; Range: High; Characteristic: A; f_{ref}= 31.5 Hz

Nominal result LEQ [dB]	35.0	36.0	37.0	38.0	40.0	60.0	80.0	97.0
Error [dB]	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0

LEVEL METER function; Range: High; Characteristic: A; f_{ref}= 1000 Hz

Nominal result LEQ [dB]	35.0	36.0	37.0	38.0	40.0	60.0	80.0	100.0	120.0	137.0
Error [dB]	0.1	0.0	0.0	0.0	0.0	-0.0	-0.0	0.0	-0.0	0.0

LEVEL METER function; Range: High; Characteristic: A; f_{ref}= 8000 Hz

Nominal result LEQ [dB]	35.0	36.0	37.0	38.0	40.0	60.0	80.0	100.0	120.0	136.0
Error [dB]	0.1	0.0	0.0	-0.0	-0.0	-0.0	-0.0	0.0	-0.0	-0.0

4. TONE BURST RESPONSE*

LEVEL METER function; Characteristic: A; f_{ref}= 4000 Hz, Burst duration: 2 s

Range: Low, Steady level nominal result = 117dB

Result	Detector	Duration [ms]	1000	500	200	100	50	20	10	5	2	1	0.5	0.25
MAX	Fast	Indication [dB]	117.0	116.9	116.0	114.4	112.2	108.7	105.8	102.9	99.0	96.0	92.9	89.9
		Error [dB]	-0.0	0.0	0.0	-0.0	-0.0	-0.0	-0.1	0.0	-0.0	-0.1	-0.1	-0.1
	Slow	Indication [dB]	113.0	113.0	109.6	106.8	103.9	100.0	97.0	94.0	90.0	-	-	-
		Error [dB]	0.0	0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0			
SEL	-	Indication [dB]	117.0	114.0	110.0	107.0	104.0	100.0	97.0	94.0	91.0	87.9	83.9	80.9
		Error [dB]	0.0	-0.0	0.0	0.0	-0.0	0.0	-0.0	-0.0	-0.0	-0.1	-0.1	-0.1

Range: Low; Steady level nominal result = 57dB

Result	Detector	Duration [ms]	1000	500	200	100	50	20	10	5	2	1
MAX	Fast	Indication [dB]	57.0	56.9	56.0	54.4	52.1	48.6	45.8	42.9	38.9	33.9
		Error [dB]	0.0	0.0	0.0	0.0	-0.0	-0.0	-0.0	0.0	-0.0	-0.1
	Slow	Indication [dB]	55.0	52.9	49.5	46.8	43.9	39.9	36.9	33.9	29.9	-
		Error [dB]	0.0	0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-
SEL	-	Indication [dB]	57.0	54.0	50.0	47.0	44.0	40.0	37.0	34.0	30.0	27.0
		Error [dB]	0.0	-0.0	0.0	0.0	-0.0	0.0	-0.0	-0.0	0.0	0.0

Range: Low; Steady level nominal result = 35dB

Result	Detector	Duration [ms]	1000	500	200
MAX	Fast	Indication [dB]	33.0	34.9	34.0
		Error [dB]	0.0	0.0	0.0
	Slow	Indication [dB]	33.0	31.0	27.6
		Error [dB]	0.0	0.1	0.0
SEL	-	Indication [dB]	33.0	32.0	28.1
		Error [dB]	0.0	0.0	0.1

Range: High; Steady level nominal result = 134dB

Result	Detector	Duration [ms]	1000	500	200	100	50	20	10	5	2	1	0.5	0.25
MAX	Fast	Indication [dB]	134.0	133.9	133.0	131.4	129.2	125.7	122.8	119.9	116.0	112.9	109.9	106.9
		Error [dB]	0.0	0.0	0.0	0.0	-0.0	-0.0	-0.1	0.0	-0.0	-0.1	-0.1	-0.1
	Slow	Indication [dB]	132.0	129.9	126.6	123.8	120.9	117.0	114.0	111.0	107.0	-	-	-
		Error [dB]	0.0	0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-	-	-
SEL	-	Indication [dB]	134.0	131.0	127.0	124.0	121.0	117.0	114.0	111.0	107.0	104.0	100.9	97.9
		Error [dB]	0.0	-0.0	0.0	0.0	-0.0	0.0	-0.0	-0.0	-0.0	-0.0	-0.1	-0.1

Range: High; Steady level nominal result = 54dB

Result	Detector	Duration [ms]	1000	500	200	100	50
MAX	Fast	Indication [dB]	54.0	53.9	53.0	51.4	49.2
		Error [dB]	0.0	0.0	0.0	0.0	-0.0
	Slow	Indication [dB]	52.0	49.9	46.5	43.7	40.9
		Error [dB]	0.0	0.0	-0.0	-0.0	-0.0
SEL	-	Indication [dB]	54.0	51.0	47.0	44.0	41.0
		Error [dB]	0.0	0.0	0.0	0.0	0.0

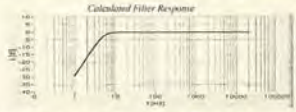
Range: High; Steady level nominal result = 46dB

Result	Detector	Duration [ms]	1000	500	200
MAX	Fast	Indication [dB]	46.0	45.9	45.0
		Error [dB]	0.0	-0.0	0.0
	Slow	Indication [dB]	44.0	41.9	38.6
		Error [dB]	0.0	0.0	-0.0
SEL	-	Indication [dB]	46.0	43.0	39.1
		Error [dB]	0.0	-0.0	0.1

5. FREQUENCY RESPONSE – BAND AUDIO* (electrical)

LEVEL METER function; Characteristic: Z; Range: High; Input signal =135 dB;

Calculated Filter Response



Measured Filter Response with Preamplifier SV12L (f - frequency, L - level)

f [Hz]	L [dB]	f [Hz]	L [dB]	f [Hz]	L [dB]	f [Hz]	L [dB]	f [Hz]	L [dB]
1	-29.7	4	-6.0	16	0.0	250	0.0	16000	0.0
1.25	-25.3	5	-3.2	20	0.0	500	0.0	20000	0.0
1.6	-21.8	6.3	-1.4	25	0.0	1000	0.0		
2	-17.7	8	-0.5	31.5	0.0	2000	0.0		
2.5	-13.3	10	-0.2	63	0.0	4000	0.0		
3.15	-9.5	12.5	-0.0	125	0.0	8000	0.0		

All frequencies are nominal center values for the 1/3 octave bands

6. FREQUENCY RESPONSE – BAND ULTRA* (electrical)

LEVEL METER function; Characteristic: HPE; Range: High; Input signal =135 dB;

Calculated Filter Response

Measured Filter Response with Preamplifier SV12L (f - frequency, L - level)

f [Hz]	L [dB]	f [Hz]	L [dB]	f [Hz]	L [dB]
1000	0.0	16000	-0.0	40000	-0.1
2000	0.0	20000	-0.0	43856*	-0.6
4000	0.0	25000	-0.0	48285*	-1.0
8000	-0.0	32000	-0.0		

All frequencies not marked by * are nominal center values for the 1/3 octave bands

7. INTERNAL NOISE LEVEL* (electrical - compensated)

LEVEL METER function ; Calibration factor: 0 dB

	Characteristic	Z	A	C
Range Low	Level [dB]	≤20	≤11	≤10
Range High	Level [dB]	≤40	≤23	≤22

* measured with preamplifier SVANTEK type SV12L No. 47603.

8. INTERNAL NOISE LEVEL (acoustical - compensated)

LEVEL METER function; Characteristic: A; (Backlight – off)

Range	Low	High
Indication [dB]	11.1	17.6

Noise measured in special chamber, with reference microphone G.R.A.S type 40AN No. 73421

VIBRATION LEVEL METER

1. CALIBRATION (electrical)

LEVEL METER function; Characteristic: HP10; f=79.58 Hz; Input signal =140 dB;

Range	Low	High
Indication [dB]	140.0	140.0
Error [dB]	0.0	0.0

2. CALIBRATION (vibrational)

LEVEL METER function; Range: High; Input signal 140dB;

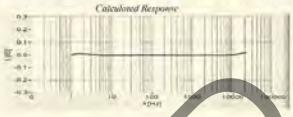
Characteristic	Reference frequency [Hz]	Correct value [dB]	Indication [dB]	Error [dB]
HP1	79.58	140.0	140.1	0.1

Calibration measured with the accelerometer DYTRAN type 3185D No. 3035. Calibration factor: -0.2dB

3. FREQUENCY RESPONSE (electrical)

LEVEL METER function; Characteristic: HP; Range: High; input=175 dB;

Calculated Response



Measured Response (f-frequency, L-level)

f [Hz]	L [dB]
1	-0.0
1000	-0.0
20000	-0.0

All frequencies are nominal center values for the 1/3 octave bands

4. INTERNAL NOISE LEVEL (electrical)

LEVEL METER function; Range: Low;

Characteristic	HP1
Indication [dB]	36.7

Camden Goods Yard, Glazing Type B

Glazing Specification Calculation V.2 According to EN 12354-3

Room Characteristics

Room Type	Bedroom	
Volume	40	m3
Total Façade Area	11	m2
Window Area	5	m2
Leq K	3	
Lmax K	3	
Trickle Vent	0	m2
Masonry Area	6	m2
RT	0.5	seconds

Incident Noise Level	Octave Band Centre Frequency (Hz)							
	63	*125*	*250*	*500*	*1000*	*2000*	*4000*	*dB(A)*
Measured Average Day Leq	73	66	65	64	63	62	64	**70**
Measured Average Night Leq	66	60	59	59	57	57	57	**64**
Measured Lmax	86	89	88	84	75	73	71	**87**

Composite Element Calculation	Octave Band Centre Frequency (Hz)							*Rw / Dn,e,W*
	63	*125*	*250*	*500*	*1000*	*2000*	*4000*	
46 Rw - Pilk 16/12/16mm acoustic laminate	30	32	37	45	46	46	57	**46**
**Standard Masonry from Template Re	39	41	43	48	50	55	55	
100 Dn,e,w - Mechanical Ventilation	98	100	100	100	100	100	100	**0**

	Octave Band Centre Frequency (Hz)						
	63	*125*	*250*	*500*	*1000*	*2000*	*4000*
Reduction from façade	-30.5	-32.5	-37.0	-44.1	-45.4	-46.5	-53.5

Internal Noise Level		Octave Band Centre Frequency (Hz)							
		63	*125*	*250*	*500*	*1000*	*2000*	*4000*	*dB(A)*
Internal Leq	Day	42.7	34	28	20	17	16	10	**25**
Internal Leq	Night	35	27	22	15	12	10	3	**20**
Internal Lmax	Night	55	56	51	40	30	27	17	**45**

Design Criterion	
LAeq	30
LAmax*	45

*If adopting BS8233:1999 max level

Camden Goods Yard, Glazing Type A

Glazing Specification Calculation V.2 According to EN 12354-3

Room Characteristics

Room Type	Bedroom	
Volume	40	m3
Total Façade Area	11	m2
Window Area	5	m2
Leq K	3	
Lmax K	3	
Trickle Vent	0	m2
Masonry Area	6	m2
RT	0.5	seconds

Incident Noise Level	Octave Band Centre Frequency (Hz)							
	63	*125*	*250*	*500*	*1000*	*2000*	*4000*	*dB(A)*
Measured Average Day Leq	69	65	60	58	57	61	61	**67**
Measured Average Night Leq	71	67	62	59	58	63	63	**68**
Measured Lmax	90	87	84	79	81	83	80	**88**

Composite Element Calculation	Octave Band Centre Frequency (Hz)							*Rw / Dn,e,W*
	63	*125*	*250*	*500*	*1000*	*2000*	*4000*	
46 Rw - Pilk 16/12/16mm acoustic laminate	30	32	37	45	46	46	57	**46**
**Standard Masonry from Template Re	39	41	43	48	50	55	55	
100 Dn,e,w - Mechanical Ventilation	98	100	100	100	100	100	100	**0**

	Octave Band Centre Frequency (Hz)						
	63	*125*	*250*	*500*	*1000*	*2000*	*4000*
Reduction from façade	-30.5	-32.5	-37.0	-44.1	-45.4	-46.5	-53.5

Internal Noise Level		Octave Band Centre Frequency (Hz)							
		63	*125*	*250*	*500*	*1000*	*2000*	*4000*	*dB(A)*
Internal Leq	Day	38.8	32	23	14	12	14	8	**22**
Internal Leq	Night	40	34	25	15	13	16	9	**24**
Internal Lmax	Night	59	54	47	35	35	37	27	**44**

Design Criterion	
LAeq	30
LAmax*	45

*If adopting BS8233:1999 max level

Calculations of Levels in External Amenity Spaces

Camden Goods Yard

Amenity Space: Block A Courtyard
Source: Measured Noise Levels at Position 3

	Frequency, Hz								
	63	125	250	500	1k	2k	4k	8k	dB(A)
Measured daytime ambient noise levels									
Position 3	73	66	65	64	63	62	64	64	70
Distance Correction (total distance 50m), dB	-7	-7	-7	-7	-7	-7	-7	-7	
Screening due to Block A building envelope	-1	-2	-3	-5	-8	-12	-13	-14	
Calculated ambient noise level in amenity space	**65**	**57**	**55**	**52**	**48**	**43**	**44**	**43**	**54**

Amenity Space: Block B Level 2 Central Courtyard
Source: Measured Noise Levels at Position 4

	Frequency, Hz								
	63	125	250	500	1k	2k	4k	8k	dB(A)
Measured daytime ambient noise levels									
Position 4	72	66	63	60	60	56	51	44	64
Screening due to surrounding envelope of Block B	-4	-6	-11	-15	-18	-21	-21	-21	
Calculated ambient noise level in amenity space	**68**	**60**	**52**	**45**	**42**	**35**	**30**	**23**	**50**

Amenity Space: Block C Roof Garden
Source: Measured Noise Levels at Position 2

	Frequency, Hz								
	63	125	250	500	1k	2k	4k	8k	dB(A)
Measured daytime ambient noise levels									
Position 2	69	65	60	58	57	61	61	59	67
Distance Correction (total distance 25m), dB	-4	-4	-4	-4	-4	-4	-4	-4	
Screening due to Block C roof edge	-2	-4	-7	-9	-11	-12	-15	-15	
Calculated ambient noise level in amenity space	**63**	**57**	**49**	**45**	**42**	**45**	**42**	**40**	**51**

Amenity Space: Block D Private Rear Gardens
Source: Measured Noise Levels at Position 2

	Frequency, Hz								
	63	125	250	500	1k	2k	4k	8k	dB(A)
Measured daytime ambient noise levels									
Position 2	69	65	60	58	57	61	61	59	67
Distance Correction (total distance 50m), dB	-7	-7	-7	-7	-7	-7	-7	-7	
Screening due to Block D Envelope	-2	-4	-6	-8	-12	-15	-17	-18	
Calculated ambient noise level in amenity space	**60**	**54**	**47**	**43**	**38**	**39**	**37**	**34**	**47**

Amenity Space: Block E1 Rear Garden Space
Source: Measured Noise Levels at Position 4

	Frequency, Hz								
	63	125	250	500	1k	2k	4k	8k	dB(A)
Measured daytime ambient noise levels									
Position 4	72	66	63	60	60	56	51	44	64
Screening due to surrounding envelope of Block E1	-1	-2	-4	-8	-12	-15	-15	-15	
Calculated ambient noise level in amenity space	**71**	**64**	**59**	**52**	**48**	**41**	**36**	**29**	**55**

Amenity Space: Block E2 Private Rear Gardens
Source: Measured Noise Levels at Position 3

	Frequency, Hz								
	63	125	250	500	1k	2k	4k	8k	dB(A)
Measured daytime ambient noise levels									
Position 3	73	66	65	64	63	62	64	64	70
Distance Correction (total distance 30m), dB	-5	-5	-5	-5	-5	-5	-5	-5	
Screening due to Block E2	-1	-2	-3	-6	-9	-10	-11	-11	
Calculated ambient noise level in amenity space	**67**	**59**	**57**	**53**	**49**	**47**	**48**	**48**	**57**

Camden Goods Yard, Glazing Type C

Glazing Specification Calculation V.2 According to EN 12354-3

Room Characteristics

Room Type	Bedroom	
Volume	40	m3
Total Façade Area	11	m2
Window Area	5	m2
Leq K	3	
Lmax K	3	
Trickle Vent	0	m2
Masonry Area	6	m2
RT	0.5	seconds

Incident Noise Level

	Octave Band Centre Frequency (Hz)							
	63	125	250	500	1000	2000	4000	dB(A)
Measured Average Day Leq	72	66	63	60	60	56	51	**64**
Measured Average Night Leq	69	62	57	55	54	51	46	**59**
Measured Lmax	85	79	71	71	72	69	69	**77**

Composite Element Calculation

	Octave Band Centre Frequency (Hz)							Rw / Dn,e,W
	63	125	250	500	1000	2000	4000	
35 Rw - SGG 6/12/8mm	21	23	23	30	39	36	43	**35**
**Standard Masonry from Template Re	39	41	43	48	50	55	55	
100 Dn,e,w - Mechanical Ventilation	98	100	100	100	100	100	100	**0**

	Octave Band Centre Frequency (Hz)							
	63	125	250	500	1000	2000	4000	
Reduction from façade	-22.0	-24.0	-24.1	-31.0	-39.7	-37.0	-43.8	

Internal Noise Level

		Octave Band Centre Frequency (Hz)							
		63	125	250	500	1000	2000	4000	dB(A)
Internal Leq	Day	49.8	42	38	29	20	19	7	**33**
Internal Leq	Night	47	38	33	24	14	13	2	**29**
Internal Lmax	Night	63	55	47	40	33	32	25	**45**

Design Criterion	
LAeq	30
LAmax*	45

*If adopting BS8233:1999 max level

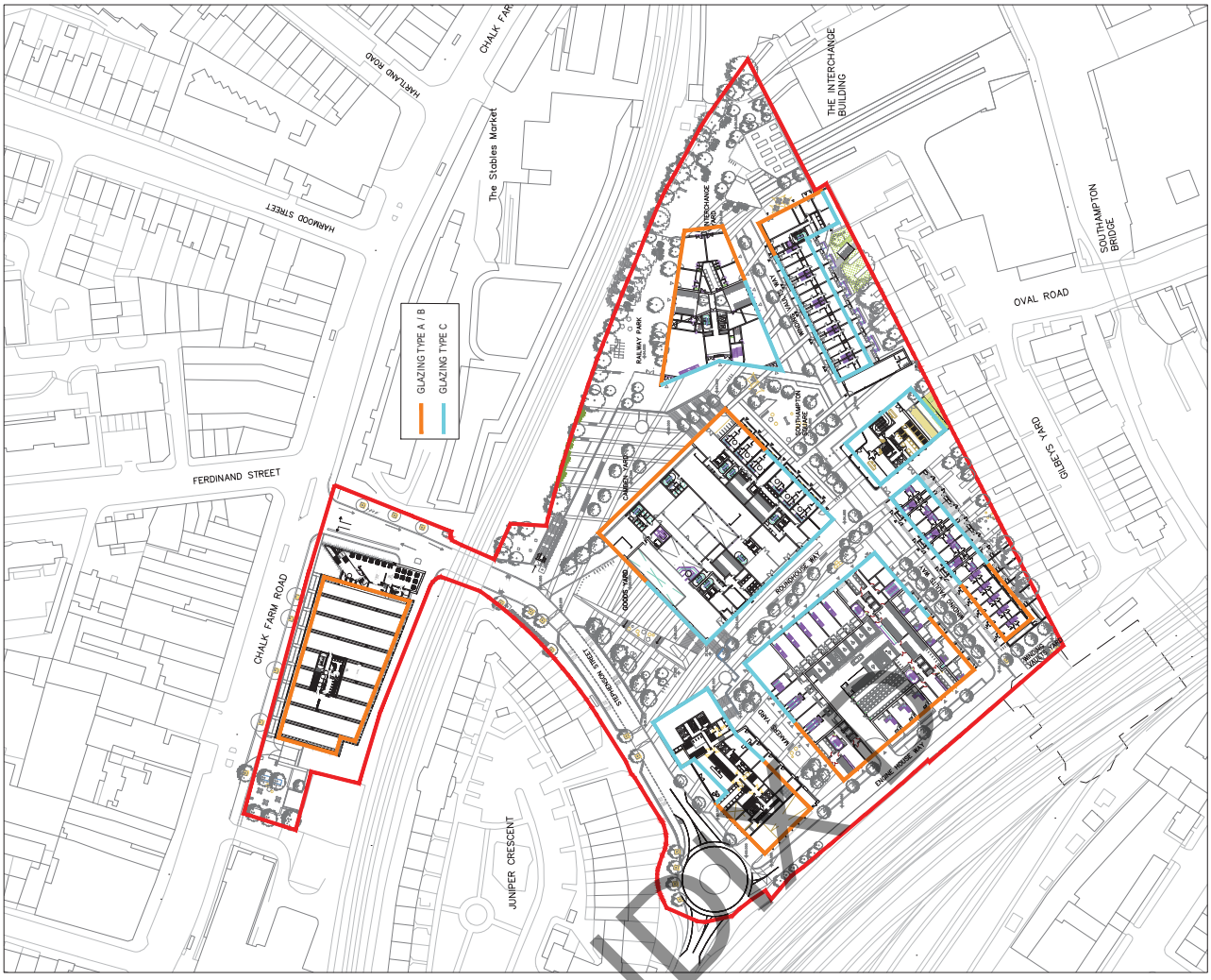
Appendix F
Noise Mitigation Plan

Amenity Space: Block F Central Courtyard
Source: Measured Noise Levels at Position 3

	Frequency, Hz								
	63	125	250	500	1k	2k	4k	8k	dB(A)
Measured daytime ambient noise levels									
Position 3	73	66	65	64	63	62	64	64	70
Distance Correction (total distance 40m), dB	-6	-6	-6	-6	-6	-6	-6	-6	
Screening due to surrounding Block F Courtyard	-4	-6	-11	-15	-18	-21	-21	-21	
Calculated ambient noise level in amenity space	**63**	**54**	**48**	**43**	**39**	**35**	**37**	**37**	**47**

Amenity Space: Block G Winter Garden
Source: Measured Noise Levels at Position 2

	Frequency, Hz								
	63	125	250	500	1k	2k	4k	8k	dB(A)
Measured daytime ambient noise levels									
Position 2	69	65	60	58	57	61	61	59	67
Distance Correction (total distance 18m), dB	-3	-3	-3	-3	-3	-3	-3	-3	
Screening due to Block C roof edge	-2	-3	-5	-8	-10	-12	-13	-15	
Calculated ambient noise level in amenity space	**64**	**59**	**52**	**47**	**44**	**46**	**45**	**41**	**53**


GLAZING TYPE A / B
GLAZING TYPE C
HARLAND ROAD
HARWOOD STREET
FERDINAND STREET
CHALK FARM ROAD
The Stables Market
JUNIPER CRESCENT
THE INTERCHANGE BUILDING
SOUTHAMPTON BRIDGE
OVAL ROAD
GILBEYS YARD
RAILWAY PARK
GOODS YARD
ROUNDHOUSE WAY
OVAL ROAD