

Roadside Services Development, Wrexham

Planning Noise Assessment

Report 14/0670/R2-2

Roadside Services Development, Wrexham

Planning Noise Assessment

Report 14/0670/R2-2

Liberties Properties Developments Ltd

5th Floor, HQ
St. Nicholas Street
Chester
CH1 2NP

Issue	Description	Date	Prepared by	Checked by
0	1 st Issue	27 May 2016	Philip Hankin	Andy Emery
1	1 st Revision	31 May 2016	Philip Hankin	Andy Emery
2	2 nd Revision	20 June 2016	Philip Hankin	Andy Emery

Prepared by

Checked by

This report and associated surveys have been prepared and undertaken for the private and confidential use of our client only. If any third party whatsoever comes into possession of this report, they rely on it at their own risk and Cole Jarman Limited accepts no duty or responsibility (including in negligence) to any such third party.



Table of Contents

20 June 2016

1	Introduction	1
2	Site Description	1
3	Planning and Noise	2
3.1	Planning Guidance (Wales), Technical Advice Note (Wales) 11, Noise (1997)	2
3.2	Internal Noise Criteria to Residential Flat Over Public House	3
3.3	Mechanical Services Plant Noise and Pub Delivery Noise to Existing Residential Dwellings	4
3.4	Noise Egress from Inside the Public House	5
3.5	Noise from External Seating Area, Coffee Shop Drive Through and Petrol Filling Station	6
4	Noise Survey Methodology and Instrumentation	7
5	Plant Noise Emission Limits	8
6	Plant Noise Assessment	9
7	Residential Accommodation above Public House	10
7.1	Road Traffic Noise	10
7.2	External Shell to Residential Accommodation above Public House	11
8	Noise Egress from Public House	13
9	Noise Impact of Deliveries	14
10	Noise impact of external seating area	16
11	Petrol Filling Station and Coffee Shop Activity Noise	17
12	Conclusions	18



Attachments

14/0670/F1-1

Plan showing site location, layout and noise survey measurement positions

14/0670/TH01

Time history graph showing results from measurement position P1

14/0670/SCH1

Schedule of measurement results at position P2

14/0670/SCH2

Schedule of plant noise data

14/0670/SCH3

Silencer Schedule

14/0670/SCH4

Source noise data for beer deliveries, petrol filling station/coffee shop activities

14/0670/SCH5

Assessed levels of noise impact for coffee shop and petrol filling station

14/0670/SPC1

Silencer construction specification

Glossary of Acoustic Terms

Appendix A

Plant Noise Calculation Sheet

Appendix B

Internal Noise Egress Calculation Sheet

Appendix C

Garden Noise Calculation Sheet

Appendix D

Delivery Noise Calculation Sheet



1 Introduction

- 1.1 Planning permission is being sought for the construction of a mixed use development featuring a new public house, drive through coffee shop and petrol filling station on a site adjacent next to the junction between the A534 and A5156 on the north east outskirts of Wrexham.
- 1.2 The public house is to incorporate limited residential accommodation at first floor level, in the form of a single flat for the use of the manager. This will be subject to an environmental noise assessment considering relevant planning guidance will be considered.
- 1.3 Potential noise impact of the public house will be considered in relation to existing residential properties. The noise impact of mechanical services plant, deliveries, noise from activities within the building and from external seating areas are considered.
- 1.4 Potential noise impact of the drive through coffee shop will be considered in respect of noise from vehicles using the drive through and loudspeaker ordering point. Limits for any mechanical services plant associated with this part of the site will also be set.
- 1.5 Potential noise impact of the petrol filling station will be considered in respect of noise from vehicles using the pumps. Limits for any mechanical services plant associated with this part of the site will also be set.
- 1.6 This report sets out the results of a noise survey that has been carried out on site and the subsequent assessment of the impact of each of the three operations.

2 Site Description

- 2.1 The proposed development is to be located on a vacant site on the outskirts of Wrexham, to the north east of the roundabout where the A534 and A5156 roads meet.
- 2.2 The site currently comprises an open field and is bounded to the north by another field, with Wrexham Golf Course to the north and north east beyond.
- 2.3 Beyond the A534 to the south are open agricultural fields.
- 2.4 To the south west and west beyond the A534 and A5156 is a large area of residential housing, representing the only noise sensitive receivers in any proximity so as to be potentially affected by the development site.
- 2.5 The site location and proposed layout are shown on the attached site plan 14/0670/F1-1.



3 Planning and Noise

The proposed assessment methodology for the various types of noise source was proposed in advance of any survey or assessment work originally in November 2014, and was agreed at the time in principle by Ian Jones, Environmental Protection Team Leader at Wrexham County Borough Council.

3.1 Planning Guidance (Wales), Technical Advice Note (Wales) 11, Noise (1997)

- 3.1.1 Relevant planning guidance in respect of sites under consideration for residential development which are affected by an existing noise source can be found in the TAN 11 document, paragraph 7 states:

Noise Exposure Categories (NECs) (see Annex A) have been derived to assist local planning authorities in their consideration of planning applications for residential development near transport related noise sources.

- 3.1.2 NECs are described in detail in Annex A of TAN 11. Paragraph 1 states:

When assessing a proposal for residential development near a source of noise, local planning authorities should determine into which of the four noise exposure categories (NECs) (Table 1) the proposed site falls, taking account of both day and night-time noise levels. Local planning authorities should then have regard to the advice in the appropriate NEC, as below

- A Noise need not be considered as a determining factor in granting planning permission, although the noise level at the high end of the category should not be regarded as desirable.*
- B Noise should be taken into account when determining planning applications and, where appropriate, conditions imposed to ensure an adequate level of protection.*
- C Planning permission should not normally be granted. Where it is considered that permission should be given, for example, because there are no alternative quieter sites available, conditions should be imposed to ensure a commensurate level of protection against noise.*
- D Planning permission should normally be refused."*

- 3.1.3 A recommended range of noise levels can be found in Table 2 of Annex A. In this particular case the public house site is affected by road traffic noise. Those parts relating to sites affected by this noise source are tabulated in table T1.

- 3.1.4 Footnote no. 2 to the above table in TAN 11 states:

Night-time noise levels (2300-0700): sites where individual noise events regularly exceed 82dBL_{Amax} (S time weighting) several times in any hour should be treated as being in NEC C, regardless of the L_{Aeq,8H} (except where the L_{Aeq,8H} already puts the site in NEC D)"

**Time Period / Noise Source****Noise Exposure Category**

		A	B	C	D
Road Traffic	0700-2300	<55	55-63	63-72	>72
	2300-0700	<45	45-57	57-66	>66

T1 Noise levels corresponding to the noise exposure categories for new dwellings, $L_{Aeq,T}$.

3.1.5 The values described above refer to noise levels on an open site, measured away from existing buildings and 1.2m to 1.5m above ground level.

3.2 Internal Noise Criteria to Residential Flat Over Public House

3.2.1 In Annex F to TAN 11, reference is made to BS8233:1987 "Sound insulation and noise reduction for buildings". This standard contains general guidance in respect of various aspects of the acoustic design of buildings, it is a relevant source of guidance when considering the design of new residential buildings exposed to a noise source.

3.2.2 The 1987 version of the standard has been superseded; for dwellings BS8233:2014¹ gives the following guidance in respect of internal noise levels for residential dwellings:

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

Note 7 Where development is considered necessary or desirable, despite external noise levels above WHO guidelines, the internal target levels may be relaxed by up to 5 dB and reasonable internal conditions still achieved.

T2 Table 4 of BS 8233:2014

¹ British Standard 8233:2014 Guidance on sound insulation and noise reduction for buildings



3.2.3 In order to provide suitable levels for the amenity of future occupants and having due regard for the guidance in BS8233, the following internal noise level criteria are proposed for the project:

- Residential flat above public house living rooms (and bedrooms during the daytime) $L_{Aeq,16h}$ 35dB
- Residential flat above public house bedrooms night-time $L_{Aeq,8h}$ 30dB
- Residential flat kitchens (where separate) and bathrooms $L_{Aeq,16h}$ 40dB

3.3 Mechanical Services Plant Noise and Pub Delivery Noise to Existing Residential Dwellings

3.3.1 Section 1.1 of BS4142:2014 states the following:

This British Standard describes methods for rating and assessing sound of an industrial and/or commercial nature, which includes:

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

3.3.2 The methodology in the standard compares the measured or calculated rating level of the noise from the source and compares it to the representative existing measured L_{A90} background noise level for the period concerned.

3.3.3 The higher the excess of rating level over background noise level, the greater the likelihood of complaint. BS4142:2014 gives the following guidance:

Typically, the greater this difference, the greater the magnitude of the impact.

A difference of around +10dB or more is likely to be an indication of a significant adverse impact, depending on the context.

A difference of around +5dB is likely to be an indication of an adverse impact, depending on the context.

The lower the rating level is relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact or a significant adverse impact. Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending on the context.



- 3.3.4 In the case of mechanical services noise, this is a constant noise source operating for much of the day and night, and mechanical services plant is inherently amenable to noise control. We would therefore suggest that plant noise at existing residences should be designed to a rating level no higher than the lowest existing L_{A90} background noise levels recorded during the relevant time period. This would apply in respect of overall plant noise emissions from the development, i.e. the combination of noise from the pub, coffee shop and petrol filling station.
- 3.3.5 Delivery noise is a more infrequent activity with limited scope for noise control in many instances, and will be assessed in accordance with BS4142 methodology to enable the resultant noise levels to be reviewed against the existing noise climate.

3.4 Noise Egress from Inside the Public House

- 3.4.1 The proposed public house in this instance is a family food offer with some background music played internally, rather than an entertainment venue.
- 3.4.2 In order to enable the breakout of internal noise to be considered in an objective way, suitable noise emission limits need to be set.
- 3.4.3 Guidance has emerged in the form of the Institute of Acoustics publication "Good practice guide on the control of noise from pubs and clubs". A working draft Annex on Criteria, Measurement Guidelines and Other Information was published in the IOA Bulletin Vol.28 No.6 in November 2002. This document proposed various noise emission criteria from entertainment venues and states that the criteria attempt to ensure that:

"For premises where entertainment takes place on a regular basis, music and associated sources should not be audible inside noise sensitive-property at any time. In the absence of the objective criteria mentioned in 2.3, what is 'regular' should be determined on a local basis to reflect local expectations and should be incorporated by local authorities in their planning and enforcement policies.

For premises where entertainment takes place less frequently, music and associated sources should not be audible inside noise sensitive property between 2300 and 0700 hours. For other times, appropriate criteria need to be developed which balance the rights of those seeking and providing entertainment, with those who may be disturbed by the noise."

- 3.4.4 While the public house is not strictly an entertainment venue (the main noise sources being customer voices and background music), to produce a robust assessment it is deemed reasonable to utilise criteria applying to entertainment noise when considering the impact of music noise upon neighbouring properties. On this basis, we would propose the following criterion as contained in the IOA working draft Annex:

A2.3 Venues where entertainment takes place more than once per week or continues beyond 2300 hours. Criteria applicable for both external and internal assessments at noise-sensitive properties. The L_{Aeq} of the entertainment noise should not exceed the representative background noise level L_{90} (without entertainment noise), and the L_{10} of the entertainment noise should not exceed the representative background noise level L_{90} (without entertainment noise)



in any $\frac{1}{3}$ octave band between 40Hz and 160Hz. If the above criteria are met entertainment noise will be virtually inaudible inside noise sensitive property.

3.5 Noise from External Seating Area, Coffee Shop Drive Through and Petrol Filling Station

- 3.5.1 At some times of the day there will be noise generated by persons using seating in the external terrace and garden areas. The potential impact of these on existing dwellings needs to be considered.
- 3.5.2 BS4142 does not cover this type of noise, instead the approach taken to assessing any such noise impact is one of assessing environmental impact with regard to changes in L_{Aeq} noise level at different times or over different periods of the day.
- 3.5.3 A 1-hour interval is typically regarded as suitable for the assessment of noise from the garden areas.
- 3.5.4 At the drive through coffee shop and petrol filling station, the main noise source is traffic using the facilities. In the context of the existing noise environment dominated by traffic on the adjacent roads, it is also appropriate to consider changes in L_{Aeq} noise levels at different times or over different periods of the day
- 3.5.5 The basis for this form of assessment can be found in the Institute of Environmental Management and Assessment “Guidelines for Environmental Noise Impact Assessment” (IEMA 2014).
- 3.5.6 Section 7.2 of this document advises:

For some particular situations, guidance does exist that can assist with the assessment process, but generally there is no precise guidance that is available regarding determining the overall significance of the noise impact.

- 3.5.7 Section 7.2 of this document advises:

In some situations, the conclusion about the degree of the impact will be clear and straightforward; but in others it is likely that, ultimately, a professional judgement will have to be made by the assessor. It must be remembered that the effects of noise are primarily subjective, and while it is desirable to include as much objectivity as possible into the assessment process in order to obtain consistency, there should be no concern in allowing professional judgement to come in the final analysis.

- 3.5.8 Table 7.14 from the document gives an example of the impact caused by change in the sound levels is reproduced as table T3 in this report.



Long-term Impact Classification	Short-term Impact Classification	Sound Level Change dB $L_{Aeq,T}$ (positive or negative)
Negligible	Negligible	≥ 0 dB and < 1 dB
	Minor	≥ 1 dB and < 3 dB
Minor	Moderate	≥ 3 dB and < 5 dB
Moderate	Major	≥ 5 dB to < 10 dB
Major		≥ 10 dB

T3 Noise impact descriptors

- 3.5.9 The approach shall therefore be to consider the relative change in the existing ambient noise levels at the nearest residential dwellings against the guidance in table T3, and consider other relevant factors relating to the environment to determine the overall impact and what (if any) mitigation measures would be appropriate.

4 Noise Survey Methodology and Instrumentation

- 4.1 Attended noise measurements were undertaken at the site in order to quantify the existing noise climate (the site was not secure to allow unattended equipment to be left). Measurements were made during the following periods:
- Weds 3rd December 0500-1300
 - Weds 3rd December 2000 – Thursday 4th December 0300
- 4.2 These measurement times were chosen to quantify the existing background and ambient noise levels at the nearby houses during typical daytime periods as well as during the evening and night time. The measurements were also intended to quantify levels of road traffic noise incident upon the proposed public house building during the worst case times of the day and night, to allow the effect of this noise on the design of the residential elements to be considered.
- 4.3 Measurements were made at two locations as shown in the attached figure 14/0670/F1-1, details of these positions were as follows:
- P1: 1m from the boundary fence to the closest residential properties fronting onto The Links to the west of the site on the opposite side of the A5156.
- P2: In a free field position at the location of the closest facade of the residential part of the proposed public house to the A5156.



- 4.4 Measurements at all locations were made at 1.5m above local ground level over 15 minute periods. Position P1 used a noise monitor recording continuously during each measurement session.
- 4.5 Measurements of the L_{Amax} , L_{Aeq} , L_{A10} and L_{A90} indices were made (refer to the Glossary of Acoustic Terms for explanation of noise indices used).
- 4.6 Noise measurements were made using the equipment listed in table T4.

Item	Manufacturer	Type
Sound Level Analyser	Norsonic	118
Acoustic Calibrator	Norsonic	1251
Sound Level Analyser	Brüel & Kjær	2260
Acoustic Calibrator	Brüel & Kjær	4231
Weatherproof windshield	Brüel & Kjær	UA1404

T4 Equipment used during attended noise survey.

- 4.7 The microphones were fitted with windshields and were calibrated before and after each survey period, no significant drift was noted to have occurred.
- 4.8 The weather throughout the survey periods was noted to have been cold and dry with clear skies. There were only slight winds, well below 5m/s when checked with an anemometer.
- 4.9 The results from the continuous measurements at position P1 are shown in the attached time history graph 14/0670/TH01.
- 4.10 The results of the attended measurements are shown in the attached schedule 14/0670/SCH1, along with a derivation of the daytime and night time noise levels using the DEFRA method.
- 4.11 During the survey, the noise climate was noted to be controlled by traffic on the A534 and A5156 roads. Later on in the night when traffic flows on the roads reduced significantly after 2300 hours, steady noise from Wrexham Industrial estate in the far distance to the south east became audible at a low level.

5 Plant Noise Emission Limits

- 5.1 Based upon the commentary in section 3.3.4, table T5 contains plant noise emission limits at the existing residential dwellings to the west of the site.
- 5.2 The noise limits are set for the different parts of a normal 24 hour period when different plant items will operate in relation to the opening hours of the different facilities. Plant noise limits



are split between the three operations such that the overall noise emission do not exceed the lowest existing measured L_{A90} background noise level.

- 5.3 Noise limits apply to the combined effect of all plant items that run during any particular period at 1m from the facade of any of the existing houses to the west of the site.

Location	Plant Noise Emission Limit, dB(A)	
	Daytime and late evening (0700-0100)	24 Hour (0000-0700)
Plant associated with Public House	33	30
Plant associated with Coffee Shop	33	30
Plant associated with Petrol Filling Station	33	30

T5 Plant Noise Limits

6 Plant Noise Assessment

Public House

- 6.1 A mechanical services plant noise assessment has been conducted for the public house to the houses to the west for comparison against the noise limits set out in table T5. Our assessment is based upon drawings provided by *Axiom Architects*. Details of the proposed plant are shown in the attached plant noise schedule 14/0670/SCH2 and represent a typical public house ventilation installation, the final plant items must be selected so as not to exceed these noise levels.
- 6.2 Plant for the public house is to be located on the central flat roof well, meaning that many of the items will be well screened from the houses to the west.
- 6.3 Our plant noise calculations have taken distance attenuation, radiation, screening and directivity into account. We have assumed that between 0700 and 0100 all plant operates, with only the beer cooler, cold store and freezer units operating 24 hours a day, the plant control systems must be set to match this operational regime.
- 6.4 In order to meet the plant noise limits set, the following works will be necessary:
- The kitchen extract system need to be fitted with an atmospheric side silencer as per the attached schedule 14/0670/SCH3. Details regarding the construction, configuration and installation of the required silencers can be found in attached specification 14/0670/SPC1.



- 6.5 Calculations are shown in the attached Appendix A, noise levels predicted at the closest residential properties to the west are shown in table T6.

Location	Assessed Plant Noise Level, dB(A)	
	<i>(Plant Noise Limit)</i>	
	Daytime (0700-0000)	Night (0000-0700)
Dwellings to the west	32 <i>(33)</i>	24 <i>(30)</i>

T6 Calculated plant noise levels

- 6.6 It can be seen by comparing the calculated noise level shown in table T6 that the limits are assessed as being met at all times.

Coffee Shop and Petrol Filling Station

- 6.7 These units will both incorporate a limited amount of mechanical services plant for ventilation, heating/cooling and refrigeration equipment. The petrol filling station may also include a coin operated tyre inflation device and vacuum for customers to use and a vacuum cleaner, these items should be included as part of the plant noise assessment for this unit.
- 6.8 The plant installation for these two units should be assessed against the limits in table T5 once the detailed specific design is available (not available at the time of preparing this report). A planning condition could be imposed to require details of an assessment to be submitted for approval for review against the noise limits in table in T5 to ensure the design takes due account of the need for noise control.

7 Residential Accommodation above Public House

7.1 Road Traffic Noise

- 7.1.1 The results from survey position P2 have been used to calculate the day and night time free field noise level at the location of the facade to the first floor residential accommodation above the public house.
- 7.1.2 The calculated day and night time noise levels in the positions can be seen in the following table:



Location	Calculated Noise Level	
	Daytime ($L_{Aeq, 16h}$)	Night time ($L_{Aeq, 8h}$)
Noise level at proposed public house living accommodation (P2)	60	52

T7 Calculated daytime and night time noise levels at MP2.

- 7.1.3 Considering the guidance in TAN 11 it can be seen that for the residential elements of the scheme the site falls within Noise Exposure Category B, night time maximum noise levels do not place the site into a higher category.

7.2 External Shell to Residential Accommodation above Public House

- 7.2.1 We have considered noise intrusion to the proposed public house residential elements to the building, using the layout provided by *Axiom Architects*.
- 7.2.2 In order to control the ingress of noise to meet the proposed internal criteria as appropriate for a site within Noise Exposure Category B, an appropriate construction for the external shell of the buildings must be used.
- 7.2.3 The glazing to each of the habitable rooms in the flat above the public house will need to achieve the minimum sound insulation performance set out in table T8.

Location	Installed Sound Reduction Index (dB) at Octave Band Centre Frequency (Hz)					
	125	250	500	1k	2k	4k
All habitable rooms <i>Indicative glazing configuration:</i> <i>4mm glass / 16mm air gap / 4mm glass</i>	20	18	26	30	30	30

T8 Glazing acoustic performance requirement

- 7.2.4 Typical glazing configurations are quoted for guidance only and alternatives may be utilised, in any case acoustic performance of the system proposed must be demonstrated. The sound reduction performance quoted above must be achieved by the glazing system taken as a whole in its installed condition. The specification therefore applies to the glazing, the frames and all seals on any openable parts of the systems and any required ventilation or condensation control mechanisms. This list is not exhaustive: no part of the glazing system shall cause the above figures not to be achieved.



- 7.2.5 The supplier should be expected to prove by means of certified test results that the above sound reduction figures can be achieved by the system being proposed. The tests shall be conducted in accordance with BS EN ISO 10140 Part 2:2010 or BS EN ISO 140-5:1998.
- 7.2.6 For the residential flat above the public house, standard residential size trickle vents should be allowed for to remove the need to open windows for background ventilation. Windows may be openable, provided that they meet the required sound reduction performance when closed.
- 7.2.7 The external walls should be of cavity masonry construction. Alternatively, a single external skin of masonry may be used (minimum laid weight 145kg/m²), if lined internally with at least one layer of 15mm Plasterboard on timber or metal studs mounted independently of the masonry, with 100mm lightweight fibreglass quilt in the cavity.
- 7.2.8 If using a lightweight external wall construction then following minimum specification would be appropriate:
- External insulated render finish, over 15mm cement bonded particle board.
 - Minimum 100mm deep Metsec or timber studs.
 - 100mm Rockwool RW3 or 100mm fibreglass insulation in the cavity.
 - Internal lining of 2 layers of 15mm Soundbloc plasterboard, with staggered joints between board layers.
- 7.2.9 The roof over the public house residential accommodation should be treated as follows in order to ensure adequate control of external noise ingress:
- Ceiling formed from at least 1 layer of 15mm Soundbloc plasterboard fixed directly to the underside of the roof timbers. The boards should be fixed, staggered and with taped joints as per manufacturer's instructions.
 - Minimum 100mm thick lightweight fibreglass quilt laid on the rear face of the ceiling (can be thicker if required).
 - Outer roof formed from tiles on timber battens with breathable membrane.
- 7.2.10 Allowing for the sound reduction performances of the external building fabric elements set out above, the assessment indicates the internal noise criteria set out in table T2 can be achieved.
- 7.2.11 In light of the above, it is considered acceptable to locate a residential flat above the public house as part of the scheme, and to incorporate a suitable scheme of noise attenuation into the design so as to provide suitable levels of amenity for future occupants.
- 7.2.12 It should be considered that the residential flat is not a housing development, it is only a single flat for the manager of the facility, which is tied to the use of the public house.



8 Noise Egress from Public House

- 8.1 Based on the commentary in section 3.4 of this report, table T9 details our proposed limits for noise from the public house, in terms of L_{Aeq} noise levels measured at 1m from the façade of the relevant noise sensitive property.

Location	L_{Aeq} Public House Noise Emission Limit, dB Operational Hours (0700-0000 only)
Residential dwellings to the west	38

T9 Noise emission limits at the nearest noise sensitive receptors.

- 8.2 We have assessed noise breakout from the building, using levels measured inside a busy London restaurant, fitted out with mostly hard internal surface finishes so as to provide a typical worst case assessment. These noise levels are described in table T10.

	Sound Pressure level (dB) @ Octave Band Centre Frequency (Hz)							
	63	125	250	500	1k	2k	4k	8k
In restaurant dining area (when full)								
L_{Amax} – 88dB	90	80	78	89	84	86	79	78
L_{Aeq} – 79dB	68	67	71	76	74	74	67	64

T10 Internal noise levels in busy large restaurant with background music

- 8.3 The building design incorporates the following control measures to contain noise within:
- Mechanical ventilation so as to avoid the need to open windows.
 - The main entrance door is lobbied, to control noise breakout.
 - Emergency exit doors are to be either double glazed to match the windows or a minimum 44mm solid core timber items with seals around the edges.
 - Double glazed windows.
 - The roof over the occupied areas will be will be a traditional pitched construction using tiled outer layer on timber trusses, with a 15mm plasterboard ceiling to the underside and thermal quilt on the rear face of the ceiling (quilt at least 100mm thick).



- 8.4 We have undertaken calculations of noise egress from the building for comparison against the criteria in table T9 based on typical window/wall areas in the external walls as proposed by the architect and these are presented in the attached Appendix B.
- 8.5 Most of the time the windows on the building will be closed however windows may be opened by a limited amount (maximum 10% of total window area) in order to enhance the ventilation during hot weather. It is assumed that the very limited area of glazing on the northern facade would not be opened.
- 8.6 The calculations indicate that at the closest residential properties to the west L_{Aeq} noise levels would be 25dB(A) below the noise emission limit set out in table T9. For the limited times when windows were partially open, noise levels would be 7dB(A) below the limit.
- 8.7 On this basis the proposed construction and noise mitigation measures are considered to be acceptable in the context of the type of customer offer proposed for the building.

9 Noise Impact of Deliveries

- 9.1 Most of the deliveries will be by vans and as such have little potential for generating a noise impact. Beer deliveries by rigid body lorry will be the main significant delivery activity.
- 9.2 It is understood that beer deliveries will occur fairly infrequently during the week and would generally occur during the day time.
- 9.3 The exact duration of the beer deliveries can vary, but an assumption has been made that a delivery will last at least an hour. Therefore, the predicted noise has been assessed for a delivery over an hour, comprising the unloading of 56 full kegs (an unloading rate of 1 ton per 15 minutes), and the loading back onto the dray lorry of 56 empty kegs.
- 9.4 Measurements were obtained at another public house, of beer kegs being dropped onto a resilient mat from a delivery lorry, empty kegs being loaded back onto the lorry, and the beer kegs being rolled to/from the cellar. This source noise data is presented here as schedule 14/0670/SCH4.
- 9.5 Pass-by noise from delivery lorries has been obtained from our database of such noise sources. We have assumed that the HGV will enter the site, drive across the car park turning north east briefly before reversing back to park across from the service yard. After unloading, the HGV would start and drive back south east across the car park to the exit.
- 9.6 The impact assessment was achieved by calculating the $L_{Aeq,1h}$ as a result of the various activities in the form of the lorry movements and unloading/loading of barrel. For the moving of barrels, a 6dB correction has been added to this element of the noise as it is considered that this has impulsivity which would be clearly perceptible in the context of the existing noise climate.
- 9.7 The derivation of the daytime $L_{Aeq,1hour}$ rating level can be seen in the attached Appendix D. During night time hours BS4142 suggests an assessment period of 15 minutes, so a calculation



was undertaken for the worst case vehicle noise element (departure) and the loading and rolling of 15 empty barrels in a 15 minute period.

9.8 On this basis the night time assessment results are as follows:

Time period	Rating Noise Level (dB)	L_{A90,15min} Background noise levels	Excess of Rating over Background
0530-0545	47	48	-1
0545-0600	47	48	-1
0600-0615	47	48	-1
0615-0630	47	50	-3
0630-0645	47	51	-4
0645-0700	47	53	-6

T11 Night time BS4142 assessment results 0530-0700

9.9 The results in table T11 indicate rating noise levels below the existing background noise levels, so any noise impact would only be at a low level in the context of the existing noise climate dominated by road traffic.

9.10 At times before 0530 the background noise levels are at least 2dB (or more) lower than the rating level, indicating a potential adverse impact, so deliveries before 0530 should be avoided.

9.11 During the daytime from the measurements made from 0700-1300 and from 1945-2015 the range of L_{A90,15 min} values was 46-57dB, of this data the mean value was 52dB, the median value was 52dB and the mode value 49dB. Taking the mode value as being representative of reasonable worst case conditions would give us a background level of 49dB. On this basis the daytime assessment results are as follows:

Time period	Rating Noise Level (dB)	L_{A90,15min} Representative Background Noise Level	Excess of Rating over Background
0700-2015	45	49	-4

T12 Daytime BS4142 assessment results 0700-2015

9.12 The result in table T12 indicates rating noise levels below the representative background noise level, so any noise impact would only be at a low level in the context of the existing noise climate, which is dominated by road traffic.



- 9.13 At times after 2015 and up until 0000, the background noise levels start to drop, meaning that the rating level would at times be 2-7dB above the background noise level. This indicates a potential adverse impact, so deliveries after 2015 should be avoided.

10 Noise impact of external seating area

- 10.1 Data in respect of noise levels generated by persons talking under different conditions can be found in BS ISO 9921-1:2003. The standard considers the ambient noise level and presents a range of speech levels of increasing volume, and gives guidance as to what speech levels would typically be employed to converse with a person standing close by.
- 10.2 Taking due account of the existing ambient noise levels measured at survey position P2, the corresponding sound pressure levels at 1m from the speaker, at each location are therefore taken to be as follows:

Location	Typical Speech Median Level dB(A)	Speech Upper Level dB(A)
Seating Area	65	68

T13 Typical voice effort noise levels against typical measured ambient of L_{Aeq} 60dB

- 10.3 It is also proposed to place a children's play area next to the garden area in the south west of the proposed public house. For this an upper end of this level range of 68dB(A) @1m has been used.
- 10.4 We have calculated the corresponding speech noise levels at the closest noise sensitive receivers, the first floor window of the closest residential properties to the west.
- 10.5 Our calculations assume one person talking at each table and assume a total of 17 tables distributed around the external garden and terrace area. Even though some of the tables will seat several people, in normal conversation it would be unusual for people to talk over each other, so this is considered to be a reasonable assumption.
- 10.6 We have assumed two children's voices on the play equipment, and have assumed that the garden and play equipment could be used between 0900 hours and 0000 hours.
- 10.7 Calculations used in our assessment can be found in the attached Appendix C, along with an indication of the change in existing ambient noise levels as a result of the use of the garden.
- 10.8 From the assessment calculations in Appendix C it can be seen that there is an increase of less than 1.0dB throughout the day from 09h00-00h00 to the assessed residences, equating to a negligible impact in both the short term and long term.



- 10.9 In reality it is considered unlikely that the garden area would be fully occupied to this extent for sustained periods of time, particularly in the morning and late evening periods, so the assessment is considered to be worst case from this perspective. During colder periods of the year, there would be few people outside at any time.
- 10.10 It should also be considered as set out earlier that the establishment is a family food offer with the manager living on site. As a result the premises will be well staffed and this is consistent with maintaining good order and behaviour in these external areas to help control any undue impact.

11 Petrol Filling Station and Coffee Shop Activity Noise

- 11.1 The main noise generating activity at these establishments is as follows:
- Cars driving at low speed along the access road to reach each site.
 - At the coffee shop, cars driving into the site around to the drive-through point, ordering via the communication system, then driving to pay and collect, before driving around the perimeter and out of the site.
 - At the petrol filling station, cars driving into the site and up to a petrol pump, the driver gets out and shuts the door before filling up. After paying the driver shuts the door, starts up and drives out of the site.
- 11.2 Both of these facilities will be open 24 hours a day, but in reality the very low traffic flows witnessed during the noise survey at night, mean that the daytime will be the busiest trading period.
- 11.3 We have obtained data on typical vehicle movements during the period 0600-1300 and 2000-2200 from Sanderson Associates, the traffic consultants for the scheme. The data uses the TRIX database and is based on site usage of similar facilities based on studies of similar establishments in the UK to predict the typical pattern of use.
- 11.4 Typical noise levels data for vehicles in car parks and at petrol filling stations we have utilised in our assessment is presented in the attached schedule 14/0670/SCH4, this data comes from measurements made at a supermarket car park and from guidance in BS ISO 9921-1:2003 for the order and collection point at the coffee shop.
- 11.5 We have taken the typical pattern for one vehicle using the facilities and scaled this up accordingly, assuming an even spread of the different petrol pumps at the station being used.
- 11.6 Each activity was identified as a line source or point source as appropriate. Distances and angles of view from the sources to the resident's window were estimated and appropriate losses were taken. Noise levels were assessed to first floor level at the house opposite the petrol filling station and coffee shop, any screening offered by landscaping at the site perimeter has been ignored so as to produce a worst case assessment.



- 11.7 The results from the assessment are set out in the attached schedule 14/0670/SCH5, noise levels have been compared against the ambient noise levels from the survey.
- 11.8 At all times during the trading hours of 0600-1300 and 2000-2200, the maximum change in noise level at residences was calculated to be between 0.4 and 1.2dB corresponding to negligible-minor short term impact and a negligible long term impact.
- 11.9 No traffic flow data is available for hours outside these periods, however the usage of the site is assumed to be low, based on observations of traffic flows along the roads and the site during the noise survey, meaning that customer numbers would also likely be limited.
- 11.10 Vehicles only move slowly when driving around car parks and facilities such as this, so in the context of the ambient noise climate controlled by traffic on the main road, the noise generation and subsequent impact is limited.

12 Conclusions

- 12.1 Planning permission is being sought for the construction of a mixed use scheme on a site adjacent to the A534 and A5156 junction on the north east outskirts of Wrexham.
- 12.2 An attended environmental noise survey has been undertaken at the site, the sources and nature of the existing noise climate noise have been quantified.
- 12.3 In respect of the limited residential accommodation to be included at first floor level of the pub building, the site has been found to fall within NEC B with regard to guidance in TAN 11. Accordingly, the results of the survey have been used to determine a suitable scheme of sound insulation, in order to ensure suitable levels of amenity for future occupants.
- 12.4 Noise emission limits for new mechanical services plant have been proposed. An assessment of noise from the proposed new mechanical services installation for the public house has been undertaken and mitigation measures specified in order to ensure that the noise emission criteria can be met. Noise limits for the public house and coffee shop have been set, to allow these to be considered at detail design phase post-planning.
- 12.5 The potential noise impact from beer deliveries to the public house, and of noise from the garden area have been assessed and found not to cause any significant noise impact, for a delivery time window of 0530-2015 and for use of the garden throughout the day.
- 12.6 Suitable criteria in respect of internal noise egress from within the operational public house building have been derived from the survey results and an assessment undertaken. With the mitigation measures proposed, levels of noise egress are found to be well within the criteria.
- 12.7 The impact of vehicles and customers at the drive through coffee shop and petrol filling station has been undertaken based on typical daytime trading hours as the busiest during a 24 hour period. The long term noise impact has been found to be negligible at all times.

■ End of Section

Figure 14/0670/F1-1



Title: Plan indicating proposed site layout and noise survey measurement positions

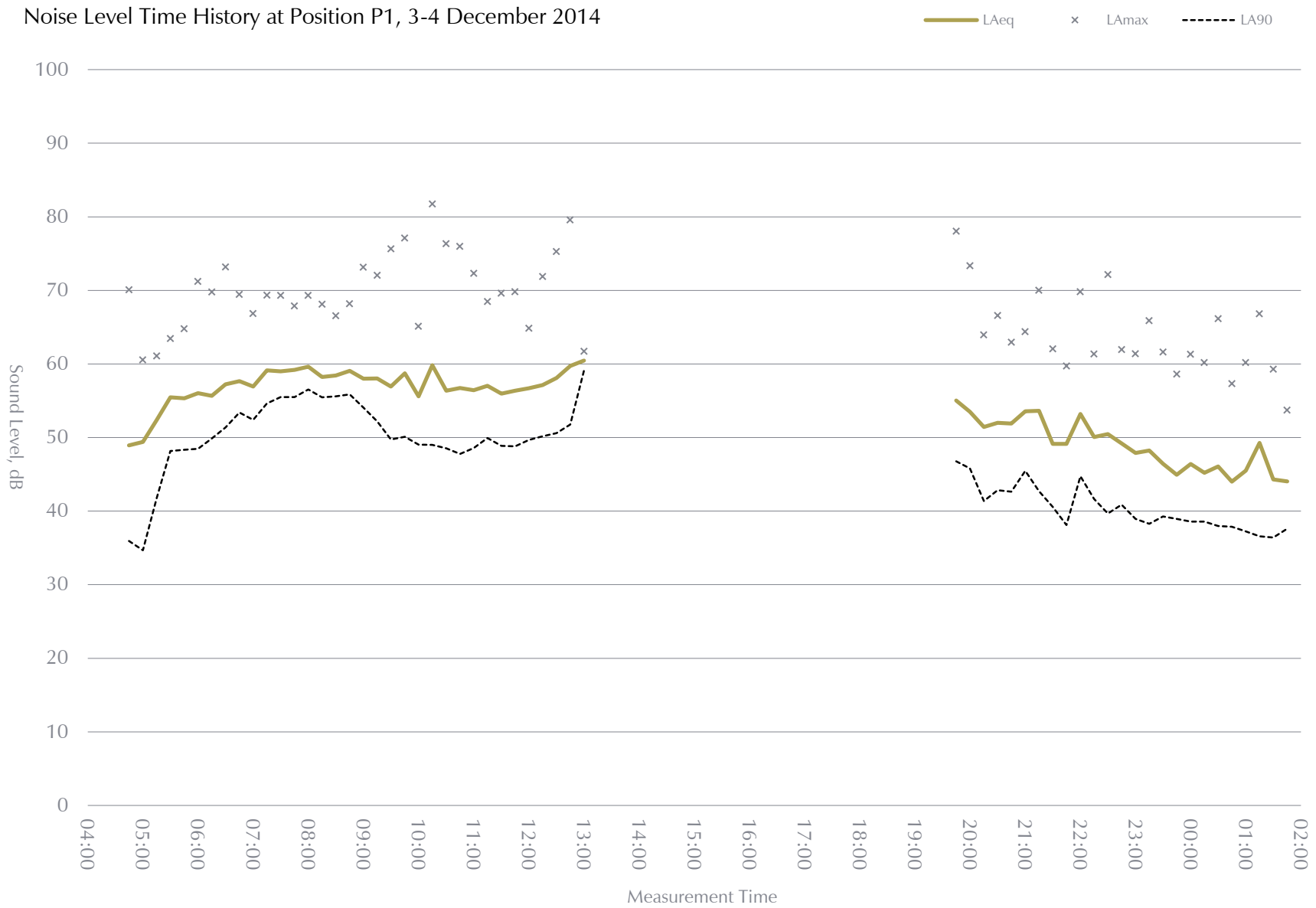
Project: Roadside Services Development, Wrexham

Date: May 2016

Scale: Not to scale



Figure 14/0670/TH01





Noise Survey Results

Measurement Position 2

Period	L _{Aeq}	L _{Amax}	L _{A10}	L _{A90}
0500-0600	61	70	64	57
0600-0700	63	79	64	60
0700-0800	64	74	66	62
0800-0900	64	76	65	62
0900-1000	61	75	63	58
1000-1100	60	75	63	56
1100-1200	60	72	62	56
1200-1300	61	77	63	56
2000-2100	59	69	62	52
2100-2200	57	71	60	46
2200-2300	56	74	59	47
2300-0000	52	64	57	41
0000-0100	50	64	55	40
0100-0200	50	63	54	38
0200-0300	49	63	53	36

Calculate Daytime L_{Aeq,16h} and Night Time L_{Aeq,8h}

Average L_{A10} 1000-1300 =

L_{A10,3h} 62.8 dB

Using shortened measurement procedure in CRTN

L_{A10,18h} = 61.8 dB

L_{day} = 0.95 x L_{A10,18h} + 1.44

L_{day} = 60.2 dB

L_{evening} = 0.97 x L_{A10,18h} - 2.87

L_{evening} = 57.1 dB

L_{night} (L_{Aeq,8h}) = 0.90 x L_{A10,18h} - 3.77

L_{Aeq,8h} = 51.9 dB

L_{Aeq,16h} = 10 log { (1/16) x [(12 x 10^{L_{day}/10}) + (4 x 10^{L_{evening}/10})] }

L_{Aeq,16h} = 59.6 dB



Schedule of Mechanical Services Plant Noise Levels, dB

Item	System	Details	Duty ¹	Data Type ²	Octave Band Centre Frequency, Hz								
					63	125	250	500	1k	2k	4k	8k	
1	Kitchen Supply Daikin UATYQ-250-MCY1	Roof	-	Mfr/L _w	91	91	79	78	78	72	68	61	
2	Kitchen Extract Fan, Woods Powerbox GF 80-630-3	Roof	-	Mfr/L _w (outlet)		98	92	88	85	82	77	71	
3	Rotisserie Extract Fan Elta long cased axial SLC-315/2-3	Roof	-	Mfr/L _w	80	76	79	79	77	74	74	68	
4	FOH Supply	Roof	-	Mfr/L _w	74	78	82	82	78	73	69	64	
5	FOH Extract	Roof	-	Mfr/L _w	74	78	82	82	78	73	69	64	
6	Male Staff Toilet Extract	Roof	-	Mfr/L _p @ 3m									41dB(A)
7	Female Staff Toilet Extract	Roof	-	Mfr/L _p @ 3m									41dB(A)
8	En-suite extract	Roof	-	Mfr/L _p @ 3m									41dB(A)
9	Store Room Extract	Roof	-	Mfr/L _p @ 3m									41dB(A)
10	Flat Kitchen Extract	Roof	-	Mfr/L _p @ 3m									45dB(A)
11	Office Extract	Roof	-	Mfr/L _p @ 3m									30dB(A)
12	Glass Wash Extract	Roof	-	Mfr/L _p @ 3m									41dB(A)



Item	System	Details	Duty ¹	Data Type ²	Octave Band Centre Frequency, Hz							
					63	125	250	500	1k	2k	4k	8k
13	Dishwasher Extract	Roof	-	Mfr/L _p @ 3m					51dB(A)			
14	Staff Shower Extract	Roof	-	Mfr/L _p @ 3m					41dB(A)			
15	Cold Store Unit	Roof	-	Mfr/L _p @ 10m					38dB(A)			
16	Freezer Unit	Roof	-	Mfr/L _p @ 10m					45dB(A)			
17	Cellar Unit	Roof	-	Mfr/L _p @ 10m					46dB(A)			
18	Beer Store Unit (x3)	Roof	-	Mfr/L _p @ 1m					62dB(A)			

Notes

¹ Duty in flow velocity (m³/s) @ system pressure (Pa) unless otherwise stated

² Mfr refers to data supplied by the equipment manufacturer, Emp refers to data calculated using empirical formulae



Schedule of external silencers and required insertion loss, dB¹.

Item ²	System	Location	m ³ /s ⁽³⁾	Pa ⁽⁴⁾	Dimensions (mm) ⁵			Octave Band Centre Frequency (Hz)							
					H	W	L	63	125	250	500	1k	2k	4k	8k
AS1	Kitchen Extract Fan ⁽⁶⁾ Atmospheric Discharge	Roof	TBC	<35	Face Velocity <4.50m/s		1200	7	12	23	28	31	21	15	10

Notes

¹ To be read in conjunction with specification 14/0670/SPC1

² RS, CT and AS notation refers to Room Side, Cross Talk and Atmospheric Side respectively.

³ Volume flow rate through silencer, m³/s

⁴ Maximum resistance or pressure drop, Pa

⁵ Where “velocity” is stated instead of height and width dimension, silencers should be sized such that the stated air velocity (in m/s) is not exceeded. Air velocity is evaluated by dividing the flow rate by the entire cross-sectional area of the silencer, not just the open or free area.

⁶ Silencer with inlet fairings and melinex internal facings to the splitters



Delivery Noise Sources

Noise levels	L _{Amax}	L _{Aeq}	Duration; t (seconds)	SEL	Number of events; N
Loading barrel onto truck	81.5	75.8	1	75.8	56
Unload barrel drop onto mat	84.4	58.4	3	63.2	56
Roll barrel	80.7	72.6	5	79.6	112
Lorry pass-by	78			82	1
Lorry depart	81			87	1

Petrol Filling Station and Coffee Shop Activity Noise levels

Car arrival and departure	65dBL _{AE} @ 10m
Fill-up at pump	62dBL _{AE} @ 10m
Door Slams (assume 2 per visit)	64dBL _{AE} @ 10m
Car start up for departure	72dBL _{AE} @ 10m
Collection/order point 1 minute order speech	63dBL _{AE} @ 10m



Petrol Filling Station and Coffee Shop
Activity Noise Impact Assessment Results

Noise sensitive premises to the west

Period	PFS Predicted L _{Aeq}	Coffee Shop Predicted	Existing L _{Aeq} Measured	L _{Aeq} Resultant	Difference	Impact
0600-0700	46.2	36.5	56.7	57.1	0.4	Negligible
0700-0800	48	37.5	58.7	59.1	0.4	Negligible
0800-0900	48.4	37.2	58.9	59.3	0.4	Negligible
0900-1000	48.4	39.9	58	58.5	0.5	Negligible
1000-1100	48.2	40.3	57.5	58.1	0.6	Negligible
1100-1200	48.2	41.1	56.5	57.2	0.7	Negligible
1200-1300	48.7	43.1	58.1	58.7	0.6	Negligible
2000-2100	46.7	39.2	52.3	53.5	1.2	Negligible
2100-2200	45.5	39.1	51.9	53	1.1	Negligible

Specification 14/0670/SPC1

Project: Roadside Services Development, Wrexham
Subject: Acoustic specification of duct silencers
Date: May 2016

1 General

1.1 Description

- 1.1.1 Furnish and install duct silencers of the types and sizes shown on the schedule.
- 1.1.2 Transitions and support or suspension systems are not included.

1.2 Quality Assurance

- 1.2.1 The dynamic insertion loss shall meet or exceed the values given in the schedules.
- 1.2.2 The static pressure drop shall not exceed the value given in the silencer schedules.
- 1.2.3 The levels of airflow noise generated by the silencers themselves at the operating conditions shall be provided by the supplier, if requested.
- 1.2.4 Performance data relating to dynamic insertion loss, static pressure drop and self-noise shall be obtained in accordance with BS 4718:1971 or BS EN ISO 7235 : 1996.

1.3 Submittals

- 1.3.1 Data sheets on the specific silencers utilised.
- 1.3.2 An itemised list showing the specific silencer utilised, its size, pressure drop at the required airflow volume, certified test data on dynamic insertion loss and self-noise power levels.

2 Materials and Construction

2.1 Outer casings and interior construction

- 2.1.1 Outer casings of rectangular silencers shall be made of 18 gauge galvanized steel or thicker in accordance with the HVCA recommended construction for high pressure rectangular ductwork. Seams shall be lock formed and mastic sealed.



- 2.1.2 Interior partitions for rectangular silencer splitters shall be made of not less than 26 gauge galvanized perforated steel.
- 2.1.3 Interior construction of tubular silencers shall be compatible with the outside casings.
- 2.1.4 Splitters in rectangular silencers of length not less than 900mm shall have aerodynamically shaped leading and trailing edges. Square or blunt ends are not acceptable.
- 2.1.5 Silencers shall be fitted with drilled angle flange connections unless other forms of connection are specified by the Mechanical Services Consultant or Contractor.

2.2 Configuration

- 2.2.1 Splitters within the silencer should generally be aligned with half width splitters affixed to each side wall of the casing. Splitters shall preferably be aligned vertically, and there shall be a regular splitter/airway dimension across the full width of the silencer. Horizontal splitters, where this orientation is required, shall be suitably supported and stiffened to prevent sagging and restriction of the airways. It is of particular importance that the supplier ensures that parallel splitter elements are orientated to suit the aerodynamic conditions arising from the adjacent duct geometry, particularly in the vicinity of bends and other transitions.
- 2.2.2 For silencers manufactured in modules, this specification shall apply to the unit as a whole.
- 2.2.3 The supplier shall comply with the cross-sectional sizes as shown in the schedule, unless alternative dimensions are agreed and approved by the Mechanical Services Contractor and the Acoustic Consultant. Silencers which are constructed to alternative cross-sectional dimensions must achieve the dynamic insertion loss and pressure drop requirements as set out in the schedule.

2.3 Standard silencers

- 2.3.1 Filler material shall be of inorganic mineral or glass fibre of a density sufficient to obtain the specified acoustic performance and be packed under not less than 5% compression to eliminate voids due to vibration and settling. Material shall be inert; not vermin and moisture proof; non-combustible and non-hygroscopic.
- 2.3.2 The filler material shall be retained in the splitters in such a manner that there is no egress of the fibres into the air stream at the prevailing flow conditions. Splitters will normally be faced with perforated galvanised sheet steel: any other facing material must be approved by the Acoustic Consultant.

2.4 Silencers with non-porous fibre protection membrane

- 2.4.1 Filler material shall be of inorganic mineral or glass fibre of a density sufficient to obtain the specified acoustic performance and be packed under not less than 5% compression to eliminate voids due to vibration and settling. Material shall be inert; not vermin and moisture



proof; non-combustible and non hygroscopic. Filler material shall be totally encapsulated and sealed with Melinex film of a thickness no less than 0.03mm.

2.5 **Special silencers with no acoustical fill**

- 2.5.1 No acoustic fill material: glass fibre, mineral wool, foam, etc., are not permitted.
- 2.5.2 Insertion loss provided by broadly tuned resonators and impedance membranes.

2.6 **Special Operating Conditions**

- 2.6.1 Where corrosive or toxic gases are contained in the air stream, special constructions and materials may be specified as an addendum to this specification.
- 2.6.2 Silencers which are expected to operate at high temperatures (e.g. turbine exhausts, boiler flues etc.) shall be constructed of a suitable gauge material, with precautions taken to allow for thermal expansion and shock. The filler material inside the splitters shall generally comply with the provisions outlined in Paragraph 2.1.C, with modifications as required to accommodate the high operating temperature. For very high temperatures, steel wool or equivalent approved may be used as the filler material.

3 Execution

- 3.1 Silencer units shall be delivered to site with blocked ends to prevent the ingress of rubble prior to installation and to reduce the risk of damage. The silencer identification shall be clearly marked on the casing, as shall the direction of airflow.
- 3.2 The silencers shall be installed in accordance with the manufacturer's recommendations to obtain the published acoustic and air flow performance.
- 3.3 The silencers shall be located as shown in the drawings.
- 3.4 Orientate the internal silencer splitters as follows for rectangular silencers:
 - Silencer splitters be oriented so as to be parallel to the plane of the turn if the silencer is located in a position less than 3 duct diameters in distance from the elbow. The duct diameter shall be based upon the maximum duct cross sectional dimension of the silencer.
 - If the silencer is located greater than 3 duct diameters away from an elbow, the orientation is not critical.
- 3.5 Locate no rectangular or circular silencers within one duct diameter from elbows, fan suction or discharge openings takeoffs, etc., unless indicated on the drawings and/or approved by the Acoustic Consultant.



4 Potential Product Suppliers

4.1 Allaway Acoustics

- Contact: Jim Grieve
- Telephone: 01992 550825
- enquiries@allawayacoustics.co.uk
- Address
 - Old Police Station
 - 1 Queens Road, Hertford,
 - Hertfordshire, SG14 1EN
- www.allawayacoustics.co.uk

4.2 Caice Acoustic Air Movement Ltd

- Telephone: 0118 9186470
- enquiries@caice.co.uk
- Head Office Address
 - Riverside House
 - 3 Winnersh Fields
 - Gazelle Close, Winnersh
 - Wokingham, RG41 5QS
- www.caice.co.uk

4.3 Environmental Equipment Corporation

- Contact: Tim Meed
- Telephone: 01932 230940
- info@eecnoisecontrol.co.uk
- Address
 - Richmond House
 - Churchfield Road
 - Walton-on-Thames,
 - Surrey, WV13 3RS
- www.eecnoisecontrol.co.uk

4.4 Noico Ltd

- Telephone: 01256 766207
- sales@noico.co.uk
- Address
 - Patrick House
 - Station Road, Hook
 - Hampshire, RG27 9HU
- www.noico.co.uk

4.5 TEK Limited

- Contact: Paul Virgo
- Telephone: 0121 766 5005
- sales@tek.ltd.uk
- Address
 - Seeleys Road, Greet
 - Birmingham B11 2LQ
- www.tek-ltd.com

■ End of Section



Glossary of Acoustic Terms

L_{Aeq} :

The notional steady sound level (in dB) which over a stated period of time, would have the same A-weighted acoustic energy as the A-weighted fluctuating noise measurement over that period. Values are sometimes written using the alternative expression dB(A) L_{eq} .

L_{Amax} :

The maximum A-weighted sound pressure level recorded over the period stated. L_{Amax} is sometimes used in assessing environmental noise when occasional loud noises occur, which may have little effect on the L_{Aeq} noise level. Unless described otherwise, L_{Amax} is measured using the “fast” sound level meter response.

L_{A10} & L_{A90} :

If non-steady noise is to be described, it is necessary to know both its level and degree of fluctuation. The L_{An} indices are used for this purpose. The term refers to the A-weighted level (in dB) exceeded for n% of the time specified. L_{A10} is the level exceeded for 10% of the time and as such gives an indication of the upper limit of fluctuating noise. Similarly L_{A90} gives an indication of the lower levels of fluctuating noise. It is often used to define the background noise.

L_{A10} is commonly used to describe traffic noise. Values of dB L_{An} are sometimes written using the alternative expression dB(A) L_n .

L_{AX} , L_{AE} or SEL

The single event noise exposure level which, when maintained for 1 second, contains the same quantity of sound energy as the actual time varying level of one noise event. L_{AX} values for contributing noise sources can be considered as individual building blocks in the construction of a calculated value of L_{Aeq} for the total noise. The L_{AX} term can sometimes be referred to as Exposure Level (L_{AE}) or Single Event Level (SEL).

Appendix A

Subject: Mechanical services noise calculation sheets
Project: Roadside Services Development, Wrexham
Date: May 2016

Plant noise calculation

Calculated to rear facade of nearest residences to the west, fronting onto The Links

		L	h	N	d	63	125	250	500	1000	2000	4000	8000	A
Public House Plant														
Plant Name	Kitchen Supply Daikin UATYQ-250-MCY1													
Sound Power						91	91	79	78	78	72	68	61	
Mutliplier				1		0	0	0	0	0	0	0	0	
Distance				90		-47	-47	-47	-47	-47	-47	-47	-47	
Screening loss	Fully screened by main roof					-10	-10	-10	-10	-10	-10	-10	-10	
On time correction (75% on)						-1.2	-1.2	-1.2	-1.2	-1.2	-1.2	-1.2	-1.2	
Total Lp						33	33	21	20	20	14	10	3	24
Public House Plant														
Plant Name	Kitchen Extract Fan, Woods Powerbox GF 80-630-3													
Sound Power						0	98	92	88	85	82	77	71	
Bend loss						0	0	0	0	-1	-2	-3	-3	
End reflection	0.27	0.9	0.3			-8.1	-3.6	-0	-0	-0	-0	-0	-0	
Mutliplier				1		0	0	0	0	0	0	0	0	
Attenuator	Melnex 1200mm 38%					-7	-12	-23	-28	-31	-21	-15	-10	
Distance				90		-50	-50	-50	-50	-50	-50	-50	-50	
Directivity	Stack @ 90 degrees					0	0	0	-1	-1	-2	-2	-2	
Screening loss	Fully screened by main roof					-10	-10	-10	-10	-10	-10	-10	-10	
Total Lp						-75	22	9	-1	-6	-3	-3	-4	9
Public House Plant														
Plant Name	Rotisserie Extract Fan Elta long cased axial SLC-315/2-3													
Sound Power						80	76	79	79	77	74	74	68	
Bend loss						0	0	0	0	-1	-2	-3	-3	
End reflection	0.09	0.3	0.3			-11.6	-7.2	-2.7	0	0	0	0	0	
Mutliplier				1		0	0	0	0	0	0	0	0	
Distance				90		-50	-50	-50	-50	-50	-50	-50	-50	
Directivity	Stack @ 90 degrees					0	0	0	-1	-1	-2	-2	-2	
Screening loss	Fully screened by main roof					-10	-10	-10	-10	-10	-10	-10	-10	
Total Lp						8	9	16	18	15	10	9	3	20
Public House Plant														
Plant Name	FOH Supply													
Sound Power						74	78	82	82	78	73	69	64	
End reflection		1	1			-3.8	-0	-0	-0	-0	-0	-0	-0	
Coils/filters						-5	-6	-7	-7	-7	-7	-7	-7	
Cowl						-3	-3	-3	-3	-3	-3	-3	-3	
Mutliplier				1		0	0	0	0	0	0	0	0	
Distance				90		-47	-47	-47	-47	-47	-47	-47	-47	
Screening loss	Fully screened by main roof					-10	-10	-10	-10	-10	-10	-10	-10	
Total Lp						5	12	15	15	11	6	2	-3	16
Public House Plant														
Plant Name	FOH Extract													
Sound Power		1	1			74	78	82	82	78	73	69	64	
End reflection						-3.8	-0	-0	-0	-0	-0	-0	-0	
Cowl						-3	-3	-3	-3	-3	-3	-3	-3	
Mutliplier				1		0	0	0	0	0	0	0	0	
Distance				90		-47	-47	-47	-47	-47	-47	-47	-47	
Screening loss	Fully screened by main roof					-10	-10	-10	-10	-10	-10	-10	-10	
Total Lp						10	18	22	22	18	13	9	4	23
Public House Plant														
Plant Name	Male staff toilet extract, Female staff toilet extract fans													
Sound pressure @3m														41
Distance loss					90									-30
Mutliplier				2										3
Total Lp														14
Public House Plant														
Plant Name	En-suite extract, Glass Wash extract													
Sound pressure @3m														41
Distance loss					90									-30
Mutliplier				2										3
Total Lp														14
Public House Plant														
Plant Name	Store Extract, staff shower extract													
Sound pressure @3m														41
Distance loss					90									-30
Mutliplier				2										3
Total Lp														14
Public House Plant														
Plant Name	Flat kitchen extract													
Sound pressure @3m														45
Distance loss					90									-30
Mutliplier				1										0
Total Lp														15
Public House Plant														
Plant Name	Office extract													
Sound pressure @3m														30
Distance loss					90									-30
Mutliplier				1										0
Total Lp														1
Public House Plant														
Plant Name	Dishwasher extract													
Sound pressure @3m														51
Distance loss					90									-30
Mutliplier				1										0
Screening loss	Fully screened by roof					-10	-10	-10	-10	-10	-10	-10	-10	-10
Total Lp														11
Public House Plant														
Plant Name	Freezer Unit													
Sound pressure @10m														45
Distance loss					90									-19
Mutliplier				1										0
Screening loss	Fully screened by roof					-10	-10	-10	-10	-10	-10	-10	-10	-10
Total Lp														16
Public House Plant														
Plant Name	Cold Room Unit													
Sound pressure @10m														38
Distance loss					90									-19
Mutliplier				1										0
Screening loss	Fully screened by roof					-10	-10	-10	-10	-10	-10	-10	-10	-10
Total Lp														9
Public House Plant														
Plant Name	Cellar Unit													
Sound pressure @10m														46
Distance loss					90									-19
Mutliplier				1										0
Screening loss	Fully screened by roof					-10	-10	-10	-10	-10	-10	-10	-10	-10
Total Lp														17
Public House Plant														
Plant Name	Beer Coolers													
Sound pressure @1m														62
Distance loss					90									-39
Mutliplier				3										5
Screening loss	Fully screened by roof					-10	-10	-10	-10	-10	-10	-10	-10	-10
Total Lp														18

Resultant Noise Level at façade (all plant operational)

Noise Emission Criterion (0700-0000 hour)

Resultant Noise Level at façade (night time plant only operational)

Noise Emission Criterion (24 hr)

dB(A)

32

33

24

30

Appendix B

Subject: Internal Noise Egress Calculation Sheets
Project: Roadside Services Development, Wrexham
Date: May 2016

Internal Noise Egress to houses to the West - Windows closed											dB(A)
				63	125	250	500	1000	2000	4000	
Noise egress through South West external wall											79.3
Internal noise level - Busy Restaurant with BG music	Leq	dB	unit	68.0	67.0	71.0	76.0	74.0	74.0	67.0	
Wall area	10*LOG(S)	82.5		19.2	19.2	19.2	19.2	19.2	19.2	19.2	
Reverberant to free field correction		-6		-6.0	-6.0	-6.0	-6.0	-6.0	-6.0	-6.0	
Wall composite SRI	Cavity masonry, double glazed windows			-22.4	-28.5	-29.5	-38.3	-43.3	-40.5	-45.4	
Distance to closest property	20*LOG(d)	95		-39.6	-39.6	-39.6	-39.6	-39.6	-39.6	-39.6	
Hemispherical radiation		-8		-8.0	-8.0	-8.0	-8.0	-8.0	-8.0	-8.0	
Façade correction		3		3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lp at residence from South West External wall				14.2	7.2	10.1	6.3	-0.7	2.1	-9.8	8.2
Noise egress through South East external wall											79.3
Internal noise level - Busy Restaurant with BG music	Leq	dB		68.0	67.0	71.0	76.0	74.0	74.0	67.0	
Wall area	10*LOG(S)	23.5		13.7	13.7	13.7	13.7	13.7	13.7	13.7	
Reverberant to free field correction		-6		-6.0	-6.0	-6.0	-6.0	-6.0	-6.0	-6.0	
Wall composite SRI	Cavity masonry, double glazed windows			-18.9	-24.9	-26.0	-34.9	-39.9	-37.0	-41.9	
Distance to closest property	20*LOG(d)	115		-41.2	-41.2	-41.2	-41.2	-41.2	-41.2	-41.2	
Hemispherical radiation		-8		-8.0	-8.0	-8.0	-8.0	-8.0	-8.0	-8.0	
Façade correction		3		3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lp at residence from South East External wall				10.6	3.5	6.5	2.6	-4.4	-1.5	-13.4	4.6
Noise egress through Roof											79.3
Internal noise level - Busy Restaurant with BG music	Leq	dB		68.0	67.0	71.0	76.0	74.0	74.0	67.0	
Roof area	10*LOG(S)	287		24.6	24.6	24.6	24.6	24.6	24.6	24.6	
Reverberant to free field correction		-6		-6.0	-6.0	-6.0	-6.0	-6.0	-6.0	-6.0	
Roof SRI	BS8233, Pitched roof with tiles plasterboard ceiling and quilt			-22.0	-28.0	-34.0	-40.0	-45.0	-49.0	-50.0	
Distance to closest property	20*LOG(d)	100		-40.0	-40.0	-40.0	-40.0	-40.0	-40.0	-40.0	
Hemispherical radiation		-8		-8.0	-8.0	-8.0	-8.0	-8.0	-8.0	-8.0	
Façade correction		3		3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lp at residence from roof				19.6	12.6	10.6	9.6	2.6	-1.4	-9.4	9.8
Receiver noise level		dB		21.1	14.1	14.2	11.8	4.8	4.8	-5.8	13
Noise limit											38

Internal Noise Egress to houses to the West - Windows partially open										dB(A)
			63	125	250	500	1000	2000	4000	
Noise egress through South West external wall										79.3
Internal noise level - Busy Restaurant with BG music	Leq	dB	68.0	67.0	71.0	76.0	74.0	74.0	67.0	
Wall area	10*LOG(S)	82.5	19.2	19.2	19.2	19.2	19.2	19.2	19.2	
Reverberant to free field correction		-6	-6.0	-6.0	-6.0	-6.0	-6.0	-6.0	-6.0	
Wall composite SRI	Cavity masonry, double glazed windows partially open		-17	-18	-18	-19	-19	-19	-19	
Distance to closest property	20*LOG(d)	95	-39.6	-39.6	-39.6	-39.6	-39.6	-39.6	-39.6	
Hemispherical radiation		-8	-8.0	-8.0	-8.0	-8.0	-8.0	-8.0	-8.0	
Façade correction		3	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lp at residence from South West External wall			19.4	17.4	21.4	26.1	24.1	24.1	17.1	29.4
Noise egress through South East external wall										79.3
Internal noise level - Busy Restaurant with BG music	Leq	dB	68.0	67.0	71.0	76.0	74.0	74.0	67.0	
Wall area	10*LOG(S)	23.5	13.7	13.7	13.7	13.7	13.7	13.7	13.7	
Reverberant to free field correction		-6	-6.0	-6.0	-6.0	-6.0	-6.0	-6.0	-6.0	
Wall composite SRI	Cavity masonry, double glazed windows partially open		-13.6	-14.6	-14.7	-14.9	-15.0	-15.0	-15.0	
Distance to closest property	20*LOG(d)	115	-41.2	-41.2	-41.2	-41.2	-41.2	-41.2	-41.2	
Hemispherical radiation		-8	-8.0	-8.0	-8.0	-8.0	-8.0	-8.0	-8.0	
Façade correction		3	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lp at residence from South East External wall			15.9	13.9	17.8	22.6	20.5	20.5	13.5	25.8
Noise egress through Roof										79.3
Internal noise level - Busy Restaurant with BG music	Leq	dB	68.0	67.0	71.0	76.0	74.0	74.0	67.0	
Roof area	10*LOG(S)	287	24.6	24.6	24.6	24.6	24.6	24.6	24.6	
Reverberant to free field correction		-6	-6.0	-6.0	-6.0	-6.0	-6.0	-6.0	-6.0	
Roof SRI	BS8233, Pitched roof with tiles plasterboard ceiling and quilt		-22.0	-28.0	-34.0	-40.0	-45.0	-49.0	-50.0	
Distance to closest property	20*LOG(d)	100	-40.0	-40.0	-40.0	-40.0	-40.0	-40.0	-40.0	
Hemispherical radiation		-8	-8.0	-8.0	-8.0	-8.0	-8.0	-8.0	-8.0	
Façade correction		3	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lp at residence from roof			19.6	12.6	10.6	9.6	2.6	-1.4	-9.4	9.8
Receiver noise level		dB	23.4	19.9	23.2	27.8	25.7	25.7	18.7	31
Noise limit										38

Appendix C

Subject: Garden Noise Calculation Sheets
Project: Roadside Services Development, Wrexham
Date: May 2016

Predicted speech noise levels from the external seating area to the nearest residences to the west

		Based on MP1 Measurements																	
		BS ISO 9921-1:1996 raised upper level for external ambie																	
Factor		Play equipment																	
Table/speaker location		PE	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Speech sound level for 1 person (Lp @ 1m)		68	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65
		2																	
Correct for No of speakers (+10LOG(N))		3.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Distance to façade		85	87	96	97	103	105	113	116	117	118	118	118	120	122	122	122	125	124
Distance correction (-20*log(d))		-38.6	-38.8	-39.6	-39.7	-40.3	-40.4	-41.1	-41.3	-41.4	-41.4	-41.4	-41.4	-41.6	-41.7	-41.7	-41.7	-41.9	-41.9
Screening									-5.0	-5.0	-5.0	-5.0	-5.0	-5.0	-5.0	-5.0	-5.0	-5.0	-5.0
Façade correction		3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Resultant Lp @ façade		32	29	28	28	28	28	27	22	22	22	22	22	21	21	21	21	21	21
										</									

Time	Existing Ambient Level LAeq (dB)	Existing + Predicted	Increase	Impact
0900-1000	58.0	58.0	0.0	None
1000-1100	57.5	57.6	0.1	Negligible
1100-1200	56.5	56.6	0.1	Negligible
1200-1300	58.1	58.1	0.0	Negligible
2000-2100	52.3	52.5	0.2	Negligible
2100-2200	51.9	52.1	0.2	Negligible
2200-2300	51.0	51.2	0.2	Negligible
2300-0000	47.1	47.7	0.6	Negligible

Appendix D

Subject: **Delivery Noise Calculation Sheet**
Project: **Roadside Services Development, Wrexham**
Date: **May 2016**

Beer delivery		15 kegs / 15 minutes		56 kegs / hr									
Daytime 1 hour full delivery													
Noise levels		L _{Aeq}	duration (t seconds)	SEL	No.	Total SEL	Distance	Distance correction	AOV	AOV correction	Character correction	SEL at residential	
a	Lorry arriving segment 1			82	1	82.0	90.0	-9.5	8.0	-13.5		58.9	@10m line
b	Lorry arriving segment 2			82	1	82.0	46.0	-6.6	3.0	-17.8		57.6	@10m line
c	Lorry arriving segment 3			82	1	82.0	46.0	-6.6	8.0	-13.5		61.9	@10m line
d	Loading barrel onto truck	75.8	1	75.8	56	93.3	104.0	-30.8			6	68.5	@3m point
e	Unload barrel drop onto mat	58.4	3	63.2	56	80.7	104.0	-30.8			6	55.9	@3m point
f	Roll barrel	72.6	5	79.6	112	100.1	104.0	-30.8			6	75.3	@3m point
g	Lorry start up and drive off			93	1	93.0	104.0	-20.3				72.7	@10m point
h	Lorry departing segment 3			82	1	82.0	46.0	-6.6	3.0	-17.8		57.6	@10m line
i	Lorry departing segment 1			82	1	82.0	90.0	-11.7	8.0	-13.5		56.8	@10m line
											Total SEL	78.0	
											Facade correction	2.5	
											1 hr L _{Aeq} @ receiver	44.9	
Worst Case Night time 15 minute part of delivery													
Noise levels		L _{Aeq}	duration (t seconds)	SEL	No.	Total SEL	Distance	Distance correction	AOV	AOV correction	Character correction	SEL at residential	
d	Loading barrel onto truck	75.8	1	75.8	15	87.6	104.0	-30.8			6	62.8	@3m point
f	Roll barrel	72.6	5	79.6	15	91.4	104.0	-30.8			6	66.6	@3m point
g	Lorry start up and drive off			93	1	93.0	104.0	-20.3				72.7	@10m point
h	Lorry departing segment 3			82	1	82.0	46.0	-6.6	3.0	-17.8		57.6	@10m line
i	Lorry departing segment 1			82	1	82.0	90.0	-11.7	8.0	-13.5		56.8	@10m line
											Total SEL	74.1	
											Facade correction	2.5	
											15 minute L _{Aeq} @ receiver	47.1	

