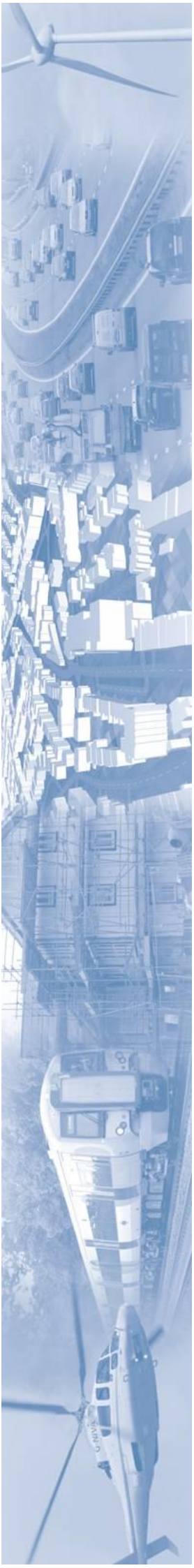

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ENVIRONMENTAL CONSULTANTS

Report for:

Vogue Assets Ltd
c/o Macniven Quays Ltd

34-38 Southampton Street, Reading

Noise Impact Assessment

Status: FINAL **Date: 15.06.2018**

34-38 Southampton Street, Reading

Noise Impact Assessment

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1. INTRODUCTION

ACCON UK Limited (ACCON) has been commissioned by Macniven Quays Ltd on behalf of Vogue Assets Ltd to carry out a noise impact assessment to support a planning application for the proposed redevelopment of The Red Lion Public House, 34-36 Southampton Street, Reading and the adjacent property at 38 Southampton Street, Reading. The Proposed Development will provide eleven residential units.

The Site is located on the A327 Southampton Street, approximately 50m to the south of the Oracle Roundabout and approximately 65m to the south of the A329 elevated carriageway which passes over the Oracle Roundabout. St. Giles in Reading Church is located opposite the Site on Southampton Street. It is noted that bell-ringing practice occurs on Wednesday evenings for approximately 1 hour between 2000 hrs and 2100 hrs and the bells are also rung on a Sunday morning before the Church service. The Site is located within the administrative boundary of Reading Borough Council (RBC).

An environmental noise survey has been carried out at the Site and road traffic noise has been identified as the dominant noise source. The results of the noise measurement survey have been utilised in order to assess the impact of road traffic noise on the Proposed Development. Where appropriate, recommendations for mitigation have also been provided.

A glossary of acoustic terminology is provided in **Appendix 1** and a location plan is displayed in **Figure 1.1** below.

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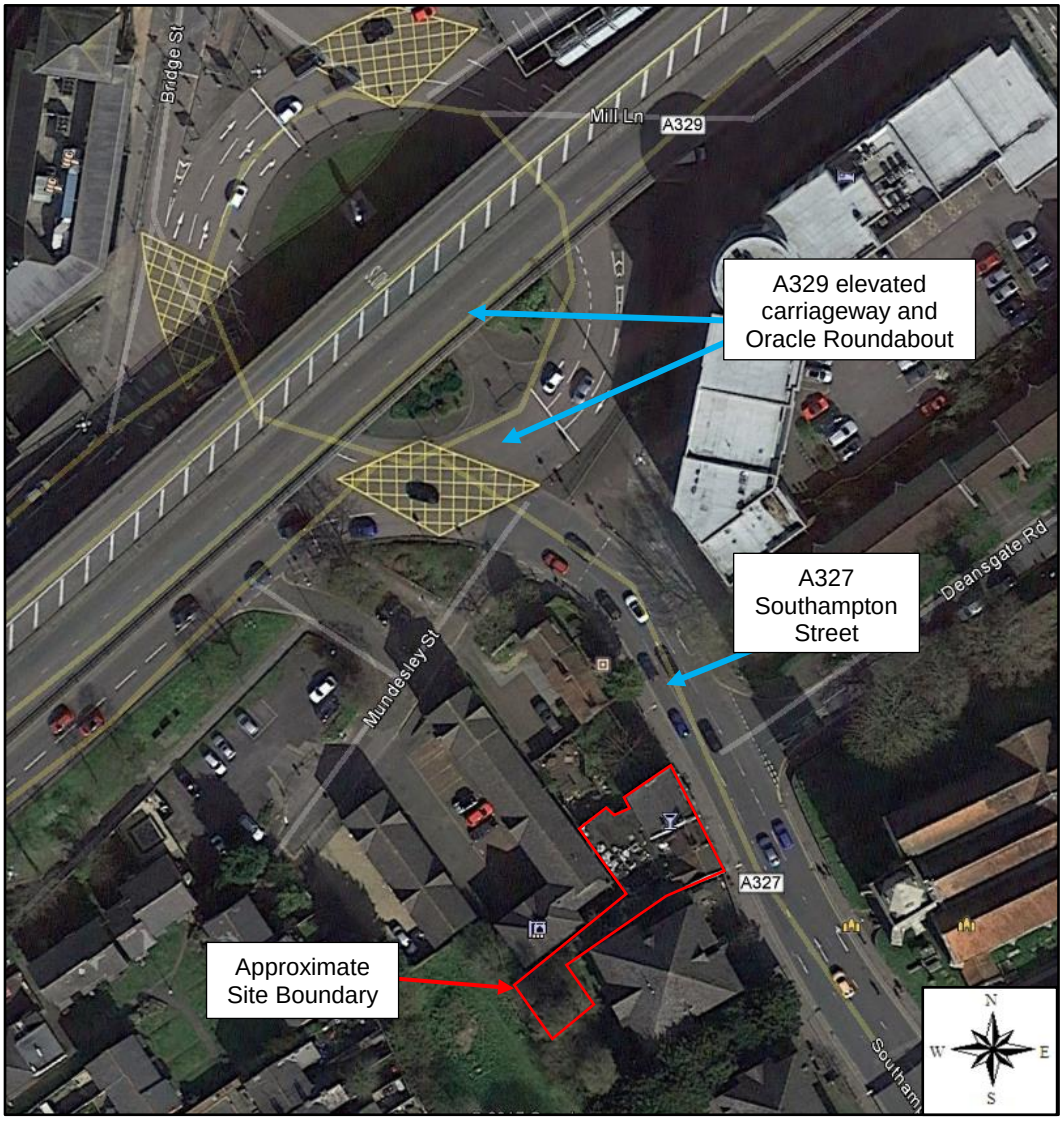
Figure 1.1: Site Location



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2. THE NATURE, MEASUREMENT AND EFFECT OF NOISE

Noise is often defined as sound that is undesired by the recipient. Whilst it is impossible to measure nuisance caused by noise directly, it is possible to characterise the loudness of that noise. 'Loudness' is related to both sound pressure and frequency, both of which can be measured. The human ear is sensitive to a wide range of sound levels. The sound pressure level of the threshold of pain is over a million times that of the quietest audible sound. In order to reduce the relative magnitudes of the numbers involved, a logarithmic scale of decibels (dB) is normally used, based on a reference level of the lowest audible sound.

The response of the human ear is not constant over all frequencies. It is therefore usual to weight the measured frequencies to approximate the human response. The resulting 'A' weighted decibel, dB (A), has been shown to correlate closely to the subjective human response.

When related to changes in noise, a change of ten decibels from say 60 dB (A) to 70 dB (A) would represent a doubling in 'loudness'. Similarly, a decrease in noise from 70 dB (A) to 60 dB (A) would represent a halving in 'loudness'. A change of 3 dB (A) is generally considered to be just perceptible[1]. **Table 2.1** details typical noise levels.

Table 2.1: Typical Noise Levels

Approximate Noise Level (dB(A))	Example
0	Limit of hearing
30	Rural area at night
40	Library
50	Quiet office
60	Normal conversation at 1 m
70	In car noise without radio
80	Household vacuum cleaner at 1 m
100	Pneumatic drill at 1 m
120	Threshold of pain

[1] Institute of Environmental Management and Assessment (2014). Guidelines for environmental noise impact assessment.

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3. NOISE ASSESSMENT CRITERIA

3.1. National Planning Policy Framework

The National Planning Policy Framework (NPPF) was published in March 2012 and has replaced the Planning Policy Guidance which previously covered planning and pollution control and new development in England. The purpose of the planning system is to contribute to the achievement of sustainable development. There are three dimensions to sustainable development: economic, social and environmental. The environmental role is to contribute to protecting and enhancing our natural, built and historic environment; and as part of this, helping to improve biodiversity, use natural resources prudently, minimise waste and pollution, and mitigate to adapt to climate change including moving to a low carbon economy.

One of the core planning principles is to contribute to conserving and enhancing the natural environment and reducing pollution. Allocations of land for development should prefer land of lesser value, where consistent with other policies in the Framework. The planning system should contribute to and enhance the natural and local environment by 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.

Paragraph 123 of the NPPF states that planning policies and decisions should aim to:

- Avoid noise from giving rise to significant adverse impacts (see Explanatory Note to the Noise Policy Statement for England (DEFRA)) on health and quality of life as a result of new development;
- Mitigate and reduce to a minimum other adverse impacts (see Explanatory Note to the Noise Policy Statement for England (DEFRA)) 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 use since they were established (Subject to the provisions of the Environmental Protection Act 1990 and other relevant law); 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.

3.2. Noise Policy Statement for England

The Noise Policy Statement for England (NPSE) was developed by DEFRA and published in March 2010. The vision of the NPSE is to: "*Promote good health and good quality of life through the effective management of noise within the context of Government policy on sustainable development.*"

The NPSE aims to: *"through the effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development:*

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

3.3. Planning Practice Guidance

The Planning Practice Guidance (PPG), published March 2014 as an online resource, provides advice on how to determine the noise impact on development:

"Local planning authorities' plan-making and decision taking should take account of the acoustic environment and in doing so consider:

- *whether or not a significant adverse effect is occurring or likely to occur;*
- *whether or not an adverse effect is occurring or likely to occur; and*
- *whether or not a good standard of amenity can be achieved.*

In line with the Explanatory Note of the Noise Policy Statement for England, this would include identifying whether the overall effect of the noise exposure (including the impact during the construction phase wherever applicable) is, or would be, above or below the significant observed adverse effect level and the lowest observed adverse effect level for the given situation. As noise is a complex technical issue, it may be appropriate to seek experienced specialist assistance when applying this policy."

The document goes on to provide a definition for the levels of noise exposure at which an effect may occur:

"***Significant observed adverse effect level:*** *this is the level of noise exposure above which significant adverse effects on health and quality of life occur.*

Lowest observed adverse effect level: *this is the level of noise exposure above which adverse effects on health and quality of life can be detected.*

No observed effect level: *this is the level of noise exposure below which no effect at all on health and quality of life can be detected.*"

It is important to understand that as the PPG does not provide any advice with respect to specific noise levels/ limits for different sources of noise, it is appropriate to consider other sources of advice and guidance documents when considering whether new developments would be sensitive to the prevailing acoustic environment.

3.4. Reading Borough Council

A pre-application planning consultation (ref: 162081) was carried out with RBC in December 2016. Ross Jarvis, Senior Technical Officer in the Environmental Protection Team responded to the consultation stating that:

"*A noise assessment should be submitted in support of applications for new residential proposed in noisy areas.*

The noise assessment will be assessed against the recommendations for internal noise levels within dwellings and external noise levels within gardens/balconies in accordance with

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BS 8233: 2014 and WHO Guidelines for Community Noise. The report should identify any mitigation measures that are necessary to ensure that the recommended standard is met.

Where appropriate, the noise assessment data should also include noise events (L_{Amax}) and the design should aim to prevent noise levels from noise events exceeding 45 dB within bedrooms at night. Noise levels above 45 dB are linked with sleep disturbance."

3.5. British Standard BS 8233:2014

BS 8233: *Guidance on sound insulation and noise reduction for buildings* has a number of design criteria for intrusive external noise. The guidelines are designed to achieve reasonable resting/sleeping conditions in bedrooms and good listening conditions in other rooms and the most appropriate to the residential environment are reproduced in **Table 3.1**.

Table 3.1: Indoor Ambient Noise Levels for Dwellings

Activity	Location	07:00 – 23:00	23:00 – 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 $L_{Aeq,8hour}$

With respect to external noise levels, BS 8233 states:

"For traditional external areas that are used for amenity space, such as gardens and patios, it is desirable that the external noise level does not exceed 50 dB $L_{Aeq,T}$, with an upper guideline value of 55 dB $L_{Aeq,T}$ which would be acceptable in noisier environments. However, 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."

3.6. World Health Organization Guidelines for Community Noise

The World Health Organization (WHO) has developed guidelines designed to minimise the adverse effects of noise. The guidelines relevant to residential noise exposure are detailed in **Table 3.2**. For each specific environment the stated noise levels are the maximum noise levels to avoid the health effect noted.

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Table 3.2: WHO Community Noise Guideline Values

Specific Environment	Critical health effect(s)	L_{Aeq} dB	Time Base (hours)	L_{Amax} (fast) dB
Outdoor living area	Serious annoyance, daytime and evening	55	16	-
	Moderate annoyance, daytime and evening	50	16	-
Dwelling, indoors	Speech intelligibility and moderate annoyance, daytime and evening	35	16	-
Inside bedrooms	Sleep disturbance, night-time	30	8	45
Outside bedrooms	Sleep disturbance, window open (outdoor values)	45	8	60

The WHO guidelines state that with respect to the L_{Amax} threshold that, "*For a good sleep, it is believed that indoor sound pressure levels should not exceed approximately 45dB L_{Amax} more than 10 – 15 times per night (Vallet and Vernet 1991)*". Therefore, ACCON consider that it is appropriate to assess against the 10th to 15th highest L_{Amax} level during the night-time period as opposed to the highest level in order to represent typical L_{Amax} levels and provide a realistic compromise between protection from sleep disturbance and achievable mitigation.

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4. NOISE MEASUREMENT SURVEY

A detailed noise measurement study has been carried out at the Site over a 24-hour period. The noise measurements were carried out from Wednesday 31st May 2017 to Thursday 1st June 2017 at two semi-permanent noise monitoring locations which are indicated on a plan in **Appendix 2**. It is noted that, whilst the noise measurements were carried out during the school half-term, the A327 and the A329 are both highly trafficked routes within Reading town centre. There may have been a very slight decrease in traffic volume during the AM peak period, however, it is expected that the traffic volumes would have increased at other times of the day due to an increase in visitors to the town centre.

The weather on Wednesday 31st May 2017 was dry and overcast with a light southerly wind (<1.0 m/s) and a temperature of up to 20°C. Overnight the weather was recorded as being dry and clear with increasing cloud over in the early morning and a lowest measured temperature of 11°C[2]. The weather on Thursday 1st June 2017 was dry and clear with a light southerly wind (<1 m/s) and a temperature of up to 22°C.

The noise measurements utilised Norsonic 118 and Rion NL-52 Type 1 precision sound level meters which hold current certificates of calibration. Before and after the measurement period the equipment was calibrated in order to ensure that the equipment had remained within reasonable calibration limits (±0.5 dB). The noise measurements were carried out between 1000 hrs on Wednesday 31st May 2017 and 1045 hrs on Thursday 1st June 2017.

Measurement position 1 (MP1) was located approximately 1m from the existing building façade overlooking Southampton Street. The microphone was approximately 6m above local ground level. The noise measurements have been corrected to free-field noise levels by applying a -3 dB correction for façade reflections.

Measurement position 2 (MP2) was located in a free-field location within the external area to the north of the existing building, approximately 6m from the north façade of the existing building. The tripod was located on a 0.65m high decked amenity area with the overall height of the microphone at approximately 4m above the local ground level (approximately 3.35m above the decking).

The measured daytime and night-time free-field noise levels are summarised in **Table 4.1** below. For MP1, these are the noise levels which have been corrected for façade reflections. The detailed noise measurements results are displayed in **Appendix 3**.

[2] http://www.metoffice.gov.uk/

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Table 4.1: Summary of Measured Noise Levels

Measurement Position	Measurement Period (hrs)	L_{Aeq} (dB)	L_{Amax} (dB)	L_{A10} (dB)	L_{A90} (dB)
MP1	Daytime (0700 – 2300)	70.3	93.1	69.1	59.1
	Night-time (2300 – 0700)	60.4	81.0	62.3	45.9
MP2	Daytime (0700 – 2300)	62.0	83.6	63.0	55.4
	Night-time (2300 – 0700)	56.7	73.8	59.1	45.4

Note: The L_{Aeq} is logarithmically averaged over the measurement periods, the L_{Amax} is the arithmetic average of the highest L_{Amax} levels recorded in each hour of the measurement period and the L_{A10} and L_{A90} are arithmetically averaged over the measurement periods.

The noise climate at MP1 and MP2 was dominated by road traffic noise from the A327 and A329. The road traffic was typically comprised of cars, HGVs, scooters and motorbikes. It is noted that sirens from police vehicles and ambulances are also common in the vicinity of the site. Occasionally aircraft were audible passing over the site. On Wednesday evening, bell-ringing practice occurred between approximately 2000 hrs and 2100 hrs at St Giles in Reading Church which is located on Southampton Street, opposite the site: this period can be identified in the time history graphs of the noise measurement results which are displayed in **Appendix 3**.

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5. NOISE IMPACT ASSESSMENT

The noise impact assessment has been carried out with reference to the following Somorjay & Talliss drawings:

- Drawing No. 202 P 02 (01/05/18), Ground Floor Plan – As Proposed Revision A;
- Drawing No. 202 P 03 (01/05/18), First Floor Plan – As Proposed;
- Drawing No. 202 P 04 (01/05/18), Second Floor Plan – As Proposed;
- Drawing No. 202 P 05 (01/05/18), Third Floor Plan – As Proposed;
- Drawing No. 202 P 06 (01/05/18), Roof Plan – As Proposed;

5.1. Internal Period Noise Levels

It is proposed to provide a suitable standard of sound insulation to the proposed residential dwellings in order to ensure that the living conditions within habitable rooms are acceptable in accordance with BS 8233 and the WHO guidelines (35 dB $L_{Aeq,16hr}$ and 30 dB $L_{Aeq,8hr}$), which will be in line with the requirements of RBC.

Table 5.1 indicates the minimum required composite A-weighted sound insulation of the external building fabric of the building in order to ensure that the internal noise criteria are achieved in line with BS 8233 and the WHO guidelines.

Table 5.1: Predicted Average Internal Noise Levels

Location	External Noise Levels (dB)		Minimum Sound Insulation of Building Envelope (dBA)	Internal Noise Levels (dB)		Compliance with Criteria	
	Daytime $L_{Aeq,16hr}$	Night-time $L_{Aeq,8hr}$		Daytime $L_{Aeq,16hr}$	Night-time $L_{Aeq,8hr}$	BS 8233	WHO
East and South Façades, overlooking Southampton Street	70	60	36	34	24	✓	✓
North Façade, orientated towards A329	62	57	28	34	29	✓	✓
West and South Façades overlooking communal garden access, screened from road traffic noise sources	<62(1)	<57(1)	28(1)	<34	<29	✓	✓

Notes: (1) Any habitable rooms on the west or south façades of the building which overlook the access to the communal garden area will be screened from the road traffic noise sources. Therefore, the noise levels at these facades will be lower than those measured at MP1 or MP2 and a typical double glazing specification should readily achieve the internal noise criteria.

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A double glazed window system should be provided for all habitable rooms. A glazing system in a 6/16/10.4 (with acoustic laminate) configuration (or equivalent) to give a Sound Reduction Index (SRI) of 36 dB could be utilised for all habitable rooms in the east and south façades which overlook the A327 Southampton Street. A typical glazing system in a 4/16/4 configuration (or equivalent) to give an SRI of 28 dB could be utilised for all other habitable rooms. It is assumed that the rest of the façade build-up would achieve a SRI of 55 dB.

5.2. Internal Maximum Noise Levels

For bedrooms which overlook the A327 Southampton Street or the A329, **Table 5.2** identifies the estimated internal maximum noise levels, L_{Amax}, that have been determined using the construction assumptions outlined in the previous section. The SRIs as stated would achieve the criterion provided in the WHO guidelines for the night-time period.

Table 5.2: Predicted Maximum Internal Noise Levels

Location	External Noise Levels (dB)	Minimum Sound Insulation of Building Envelope (dBA)	Internal Noise Levels (dB)	Compliance with Criteria
	Night-time L_{Amax}(1)		Night-time L_{Amax}	WHO
East and South Façades, overlooking Southampton Street	81	36	45	✓
North Façade, orientated towards A329	71	28	43	✓

Note (1): The L_{Amax} utilised in this assessment is the 10th highest 5-minute L_{Amax} measured during the night-time period in accordance with the WHO guidelines as stated in Section 3.5.2 of this report.

5.3. Ventilation

Due to the high road traffic noise levels on Southampton Street, it is recommended that acoustically attenuated through-wall ventilators or acoustic air bricks are utilised to achieve the background ventilation requirements for habitable rooms on the east façade.

For all other habitable rooms, acoustically treated trickle ventilation would be suitable for background ventilation.

The provision of a positive input ventilation (PIV) system or similar should be considered in order to provide a suitable flow of fresh air during warmer summer months. This would ensure that residents do not need to rely on opening the windows for comfort cooling which would significantly increase the internal noise levels above the BS 8233 and WHO guidelines noise criteria.

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5.4. External Noise Levels

The plans identified at the beginning of this section indicate the following private external amenity areas:

- Private Garden Area located to the south west corner of the building for ground floor Apt 1;
- Private Garden Areas located to the north and south west of the building for ground floor Apt 3;
- Balcony for Apt 4 at first floor level located on the south façade of the building;
- Balcony for Apt 7 at second floor level located on the south façade of the building;
- Balcony for Apt 10 at third floor level located on the south & east façades of the building;
- Balconies for Apt 11 at third floor level located on the south, north and east façades of the building;

The balconies for Apt 4 and Apt 7 should be suitably screened from road traffic noise sources such that noise levels will be below the upper external amenity area criterion of 55 dB $L_{Aeq,16hr}$.

For the other external amenity area (Apt 3), external noise levels will exceed the upper criterion.

The PPG[3] provides a list of potential measures which can be considered in order to mitigate the impact of noise on residential developments. "*The noise impact may be partially off-set if residents of those dwellings have access to:*

- *A relatively quiet façade (containing windows to habitable rooms) as part of their dwelling, and/or:*
- *A relatively quiet external amenity space for their sole use, (e.g. a garden or balcony). Although the existence of a garden or balcony is generally desirable, the intended benefits will be reduced with increasing noise exposure and could be such that significant adverse effects occur, and/or:*
- *A relatively quiet, protected, nearby external amenity space for sole use by a limited group of residents as part of the amenity of their dwellings, and/or:*
- *A relatively quiet, protected, external publically accessible amenity space (e.g. a public park or a local green space designated because of its tranquillity) that is nearby (e.g. within a 5 minutes walking distance).*"

Apts 1, 3, 4, 6, 7, 9, 10 and 11 all have access to the quieter west and south façades of the building which are orientated away from the road traffic noise sources.

The apartments also benefit from access to an adjacent communal garden located to the west of the building (identified in **Figure 5.1**). The communal garden is screened from the

[3] Planning Practice Guidance – Noise, Paragraph: 009 Reference ID: 30-009-20140306

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primary road traffic noise sources by the surrounding existing buildings. Noise levels within the communal garden would be below 55 dB $L_{Aeq,16hr}$.

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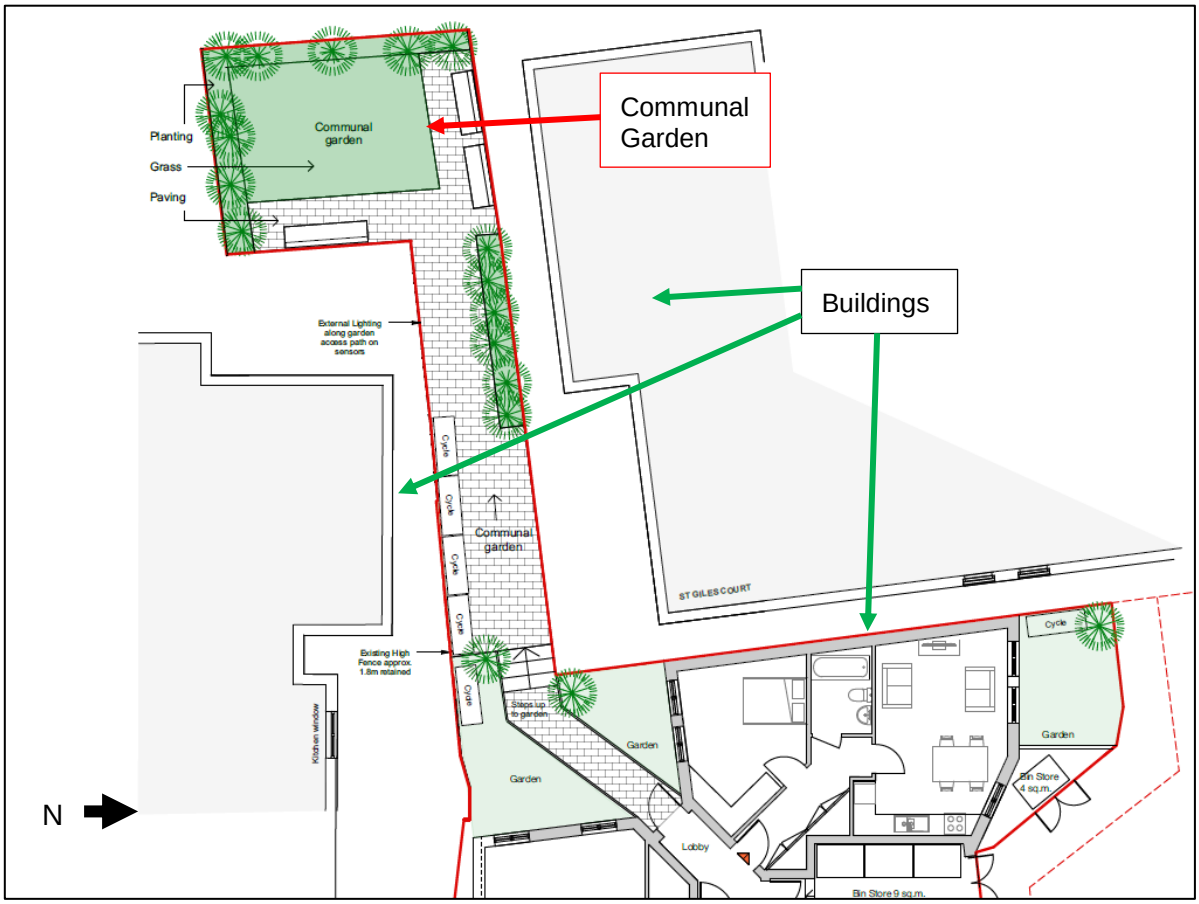
Figure 5.1: Location of Communal Garden



A number of nearby public park areas are located within approximately a 10-20 minute walk from 34-38 Southampton Street including:

- Waterloo Meadows – Approximately 11 minutes' walk
- Coley Recreation Ground – Approximately 12 minutes' walk
- The Forbury Gardens – Approximately 12 minutes' walk
- Cintra Park – Approximately 20 minutes' walk

Additionally, the River Kennet is approximately a two minute walk from the Site which has a variety of pedestrian paths providing access to tranquil areas alongside the river.

The majority of future residents will have access to a relatively quiet façade and/or a relatively quiet private amenity area. All residents will also have access to a relatively quiet communal garden area to the west of the site and all residents are within approximately 10-20 minutes' walk of a range of external, publically accessible amenity spaces including Waterloo Meadows, Coley Recreation Ground and the Forbury Gardens. This demonstrates that the high external noise levels can be off-set in line with Paragraph 009 of the Planning Practice Guidance for noise.

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6. CONCLUSIONS

This assessment has considered the noise levels which would be experienced at the proposed development site at 34-38 Southampton Street in Reading.

The assessment of noise for the development has shown that, with the provision of double glazing with an SRI of 36 dB for all habitable rooms overlooking Southampton Street and 28 dB SRI for all other habitable rooms as well as suitably acoustically treated ventilation provision, the target internal noise criteria can be achieved, including the consideration of maximum (L_{Amax}) noise levels at night. The predicted internal noise levels are in line with the requirements of RBC and the noise criteria provided in BS 8233 and the WHO guidelines.

The provision of a positive input ventilation (PIV) system or similar would ensure that residents do not need to rely on opening the windows for comfort cooling which would otherwise significantly increase the internal noise levels above the BS 8233 and WHO guidelines noise criteria.

The external noise levels in the proposed external amenity area for Apt 3 at ground floor level will not achieve the external noise level criterion of 55 dB $L_{Aeq,16hr}$. However, the majority of residents will either have access to a relatively quiet façade or a relatively quiet, protected private external amenity space and all residents will have access to the communal garden area which is screened from the primary road traffic noise sources, and external, publically accessible amenity spaces which are located within a 10-20 minute walk from the site including Waterloo Meadows, Coley Recreation Ground and The Forbury Gardens as well as the River Kennet footpaths. This demonstrates that the high external noise levels can be off-set in line with the PPG.

Achievement of the target noise criteria will ensure compliance with the aims of the NPPF and the PPG in that it will avoid noise from giving rise to significant adverse impacts on health or quality of life for future occupiers of the proposed development.

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Appendix 1
Glossary of Acoustic Terms

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Appendix 1: Glossary of Terms

Term	Description
'A'-Weighting	*This is the main way of adjusting measured sound pressure levels to take into account human hearing, and our uneven frequency response.*
Decibel (dB)	*This is a tenth (deci) of a bel. The decibel can be a measure of the magnitude of sound, changes in sound level and a measure of sound insulation. Decibels are not an absolute unit of measurement but are an expression of ratio between two quantities expressed in logarithmic form.*
$L_{Aeq,T}$	*The equivalent steady sound level in dB containing the same acoustic energy as the actual fluctuating sound level over the given period, T. T may be as short as 1 second when used to describe a single event, or as long as 24 hours when used to describe the noise climate at a specified location.* $L_{Aeq,T}$ *can be measured directly with an integrating sound level meter.*
L_{A10}	*The 'A'-weighted sound pressure level of the residual noise in decibels exceeded for 10 per cent of a given time and is the* L_{A10T}*. The* $L_{A10,18h}$ *is used to describe the levels of road traffic noise at a particular location when evaluated as the average level for each hour between 0600 and 0000 hrs on a weekday.*
L_{A50}	*The 'A'-weighted sound pressure level of the residual noise in decibels exceeded for 50 per cent of a given time and is the* L_{A50T}*.*
L_{A90}	*The 'A'-weighted sound pressure level of the residual noise in decibels exceeded for 90 per cent of a given time and is the* L_{A90T}*. The* L_{A90} *is used to describe the background noise levels at a particular location.*
L_{Amax}	*The 'A'-weighted maximum sound pressure level measured over a measurement period.*

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Appendix 2
Noise Monitoring Positions

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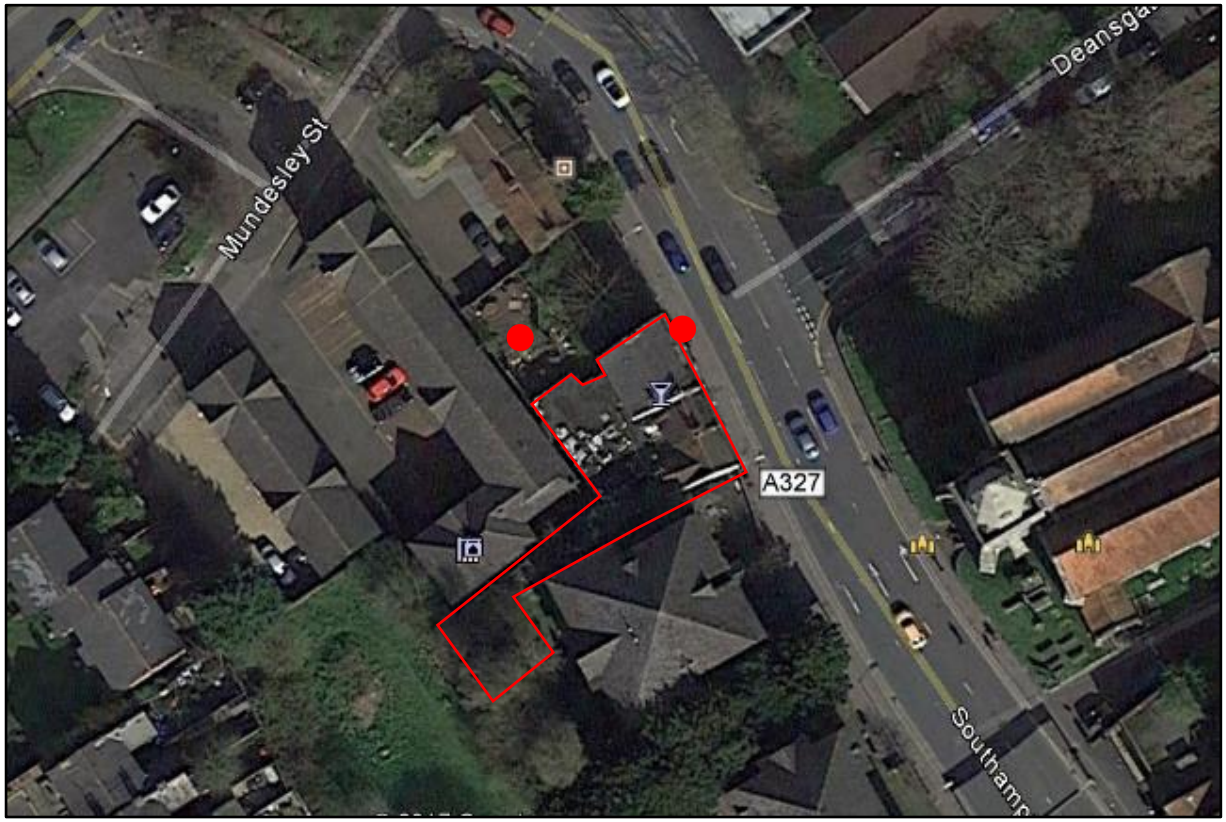
Appendix 2: Noise Monitoring Positions



LEGEND

Semi-Permanent Noise Monitoring Positions

Approximate Building Area

N
W E
S

Client: Macniven Quays Ltd		Description: Noise Monitoring Positions		Design	RE	06.06.2018
				Drawn	RE	06.06.2018
Rev: A	Description: FINAL	Project: 34-38 Southampton Street, Reading		Checked	SS	06.06.2018

Appendix 2

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Appendix 3
Summary of Noise Measurements

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Appendix 3: Summary of Noise Measurements

Semi-Permanent Measurement Positions

Time	MP1 – Corrected to remove Façade Reflections			
	$L_{Aeq, T}$ (dB)	$L_{AF(max)}$ (dB)	L_{A10} (dB)	L_{A90} (dB)
0700 - 0800	66.6	79.6	70.0	59.4
0800 - 0900	68.9	101.7	69.5	59.9
0900 - 1000	70.2	99.9	69.2	59.3
1000 - 1100	66.2	90.8	68.8	59.5
1100 -1200	74.0	107.3	69.9	59.5
1200 - 1300	66.2	82.6	69.1	59.9
1300 - 1400	66.6	95.1	69.0	59.5
1400 - 1500	65.9	85.8	68.7	59.8
1500 - 1600	75.8	103.2	68.7	59.7
1600 - 1700	74.2	104.1	68.8	59.7
1700 - 1800	66.8	96.7	68.2	59.4
1800 - 1900	70.4	101.7	68.3	59.0
1900 - 2000	68.0	78.4	70.3	58.9
2000 - 2100	71.3	86.2	73.7	63.0
2100 - 2200	65.1	96.6	67.1	55.3
2200 - 2300	62.6	80.6	66.2	53.6
2300 - 0000	62.6	89.5	65.3	50.6
0000 - 0100	59.2	76.4	63.2	46.5
0100 - 0200	56.9	81.9	59.7	42.5
0200 - 0300	55.6	74.0	58.4	39.0
0300 - 0400	57.4	77.5	60.0	43.0
0400 - 0500	57.4	79.9	59.9	43.0
0500 - 0600	61.2	87.1	64.1	47.4
0600 - 0700	64.7	81.9	68.1	55.0
0700 - 2300	**70.3**	**93.1**	**69.1**	**59.1**
2300 - 0700	**60.4**	**81.0**	**62.3**	**45.9**

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Time	MP2			
	$L_{Aeq, T}$ (dB)	$L_{AF(max)}$ (dB)	L_{A10} (dB)	L_{A90} (dB)
0700 - 0800	61.5	80.7	64.0	56.0
0800 - 0900	63.0	89.5	64.6	56.2
0900 - 1000	62.2	86.8	63.3	55.6
1000 - 1100	60.6	80.1	62.9	55.6
1100 -1200	64.3	90.3	63.8	56.3
1200 - 1300	60.6	76.5	62.9	56.0
1300 - 1400	61.3	86.7	62.6	55.4
1400 - 1500	60.9	81.8	62.3	55.6
1500 - 1600	64.7	92.1	63.5	55.5
1600 - 1700	63.2	90.7	63.0	55.4
1700 - 1800	59.9	80.5	62.0	54.7
1800 - 1900	62.3	89.6	62.4	55.2
1900 - 2000	61.3	76.4	63.4	55.7
2000 - 2100	63.9	79.3	66.2	58.3
2100 - 2200	58.8	82.3	61.1	53.0
2200 - 2300	57.5	73.8	60.3	51.5
2300 - 0000	56.2	76.3	58.7	49.5
0000 - 0100	54.0	68.9	57.1	46.2
0100 - 0200	52.5	76.1	55.6	42.5
0200 - 0300	50.6	68.2	54.5	39.1
0300 - 0400	57.0	76.2	60.2	43.1
0400 - 0500	58.1	71.1	62.4	42.7
0500 - 0600	58.2	72.9	61.8	46.8
0600 - 0700	60.0	80.8	62.7	53.3
0700 - 2300	**62.0**	**83.6**	**63.0**	**55.4**
2300 - 0700	**56.7**	**73.8**	**59.1**	**45.4**

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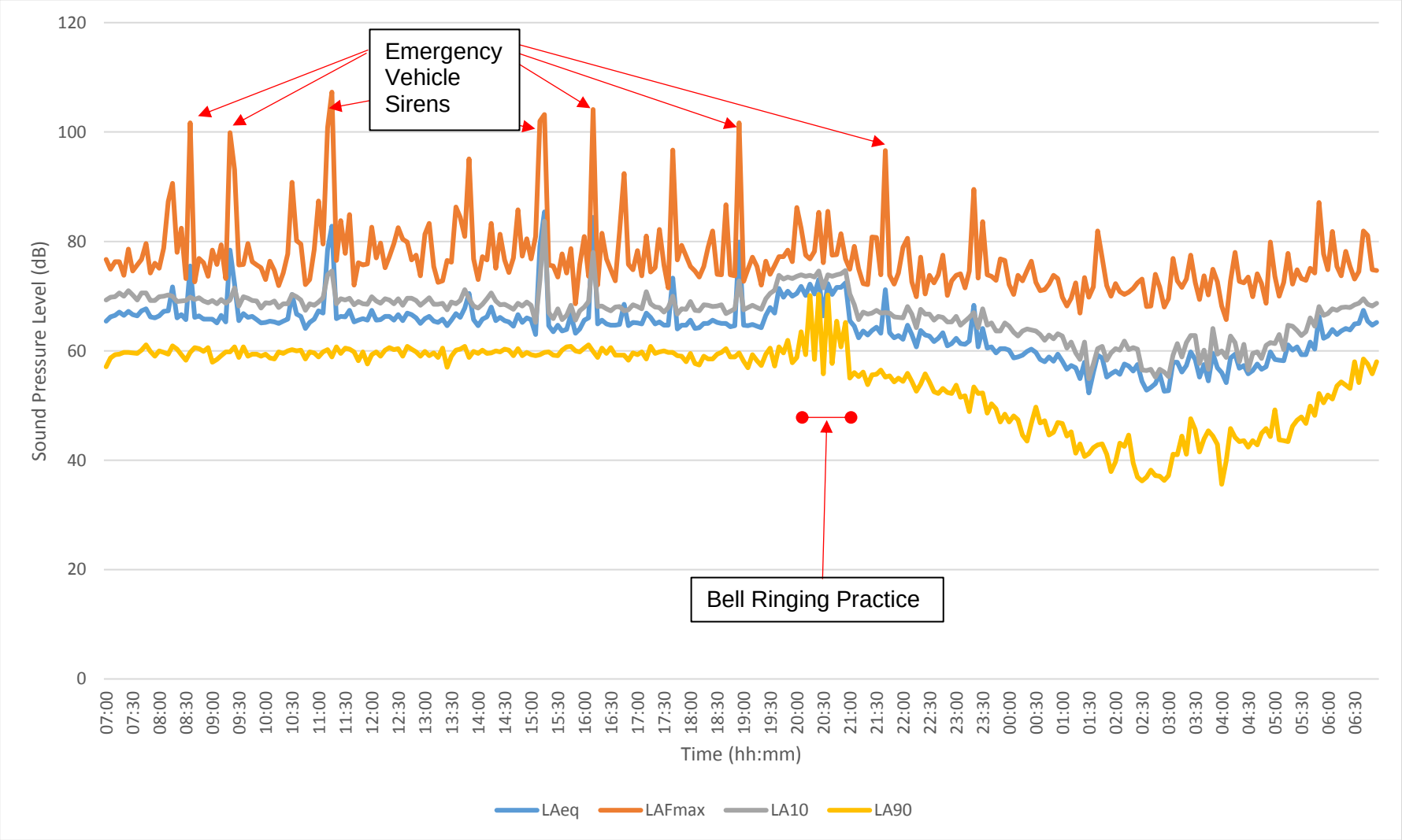
Time History Graph – MP1 (Corrected to remove façade reflections)



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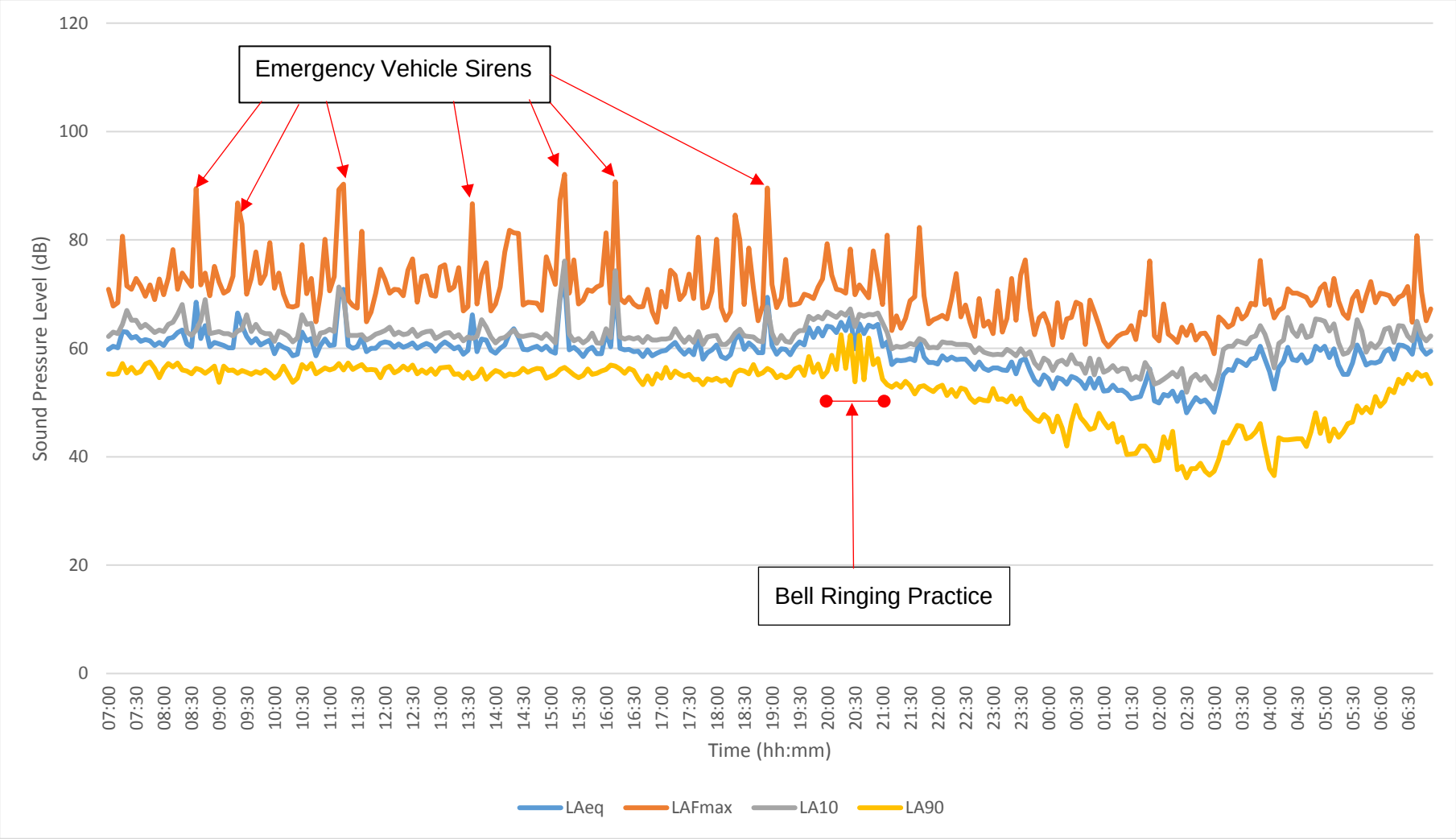
Time History Graph – MP2



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