Bourne Court, Ruislip

Planning Condition 19 Discharge Report

On behalf of **Taylor Wimpey West London**

Project Ref: 50181/3001 | Rev: 0 | Date: February 2021

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1 Introduction

1.1 Background

1.1.1 Stantec (UK) Ltd has been commissioned by Taylor Wimpey West London to undertake an external building fabric assessment in relation to Bourne Court, Ruislip.

1.1.2 An environmental sound survey has been undertaken by Stantec (UK) Ltd, to establish the existing environmental sound levels associated with transportation sources incident on the proposed development.

1.1.3 The results of the environmental sound survey have been used to establish façade incident noise levels for the proposed development which form the basis of our assessment of the acoustic requirements of the building façade.

1.1.4 This report presents the relevant results of the environmental sound surveys, details of our assessment and proposed acoustic specifications for the critical elements of the building facade.

1.1.5 An explanation of the acoustic terminology used in this report is included in **Appendix A**.

1.2 Site Description and Location

1.2.1 The proposed development site is located to the north of Station Approach and approximately 100 m to the west of South Ruislip train station. The proposed development site falls within the jurisdiction of Hillingdon Council.

1.2.2 The site is currently unused land and bounded by residential/commercial premises to the east, residential properties to the south and west and a business park to the north.

1.2.3 The location of the proposed site is detailed in **Figure 1**.

Figure 1: Site Location Plan

Image courtesy of ESRI, Maxar, Microsoft

1.3 Aircraft Movements from RAF Northolt

1.3.1 The Ministry of Defence (MOD) has confirmed that operating hours for civilian aircraft are between 08:00-16:00 hours, Monday to Friday, and for military aircraft are 07:00-01:00 hours, Monday to Sunday.

1.3.2 The MOD has also confirmed that the daily flight programme varies dramatically and can be impacted by the weather.

1.3.3 From available information from freedom of information requests from online sources, the number of historic aircraft movements at RAF Northolt is as follows:

Table 1.1: Historical Aircraft Movements at RAF Northolt

Year	Number of Movements				Total
	Military	London Air Ambulance	Non-Commercial Civil	Commercial	
2013	4,068	847	14	9,227	14,156
2014	4,023	592	447	9,366	14,428
2016	3,810	832	276	10,610	15,528
2018	2,075	783	1,380	4,632	8,870

1.3.4 Based on the movement figures of the highest year (2016) and assuming flights are evenly spread throughout the year, it is anticipated that there would be on average 43 aircraft movements per day in total.

1.3.5 The direction of take-off would be dependent on wind conditions at the time of take-off, and therefore the number of aircraft movements over the proposed development is likely to be below this, as aircraft would take off in other directions.

1.4 Scope of Report

1.4.1 The scope of this report is to:

- Establish, by means of an environmental sound survey, the existing environmental sound levels at selected positions.
- Propose appropriate internal ambient noise level design criteria with respect to external noise ingress for habitable spaces based on the requirements of Hillingdon Council.
- Provide a detailed assessment of the likely airborne noise ingress into habitable spaces and determine the required acoustic performance of the critical elements of the building façade in order to achieve the proposed criteria.

1.4.2 Advice and recommendations within this report will need to be integrated, coordinated and ratified with the design by the principal designer and design team to ensure that all other design interfaces, buildability, workmanship and other requirements are considered. Any sketches or drawings provided illustrate acoustic principles only.

2 Guidance and Standards

2.1.1 This section of the report outlines the target criteria derived from relevant British Standards and guidance.

2.2 Planning Condition 19

2.2.1 In granting planning permission to the development, The Council of the London Borough of Hillingdon has imposed a number of planning conditions. Condition 19 of the Planning Application (Ref: 11891/APP/2018/3414) is as follows.

> *"Prior to the commencement of works above damp proof course level, a noise assessment shall be submitted to the Council for approval of external noise levels incl. reflected and re-radiated noise and details of the sound insulation of the building envelope, orientation of habitable rooms away from major noise sources and of acoustically attenuated mechanical ventilation as necessary to achieve internal room - and (if provided) external amenity noise standards in accordance with the criteria of BS8233:2014. Approved details shall be implemented prior to occupation of the development and thereafter be permanently retained.*
>
> *REASON*
> *To ensure that the amenity of the occupiers of the proposed development is not adversely affected by (road traffic) (rail traffic) (air traffic) (other) noise in accordance with Policy OE5 of the Hillingdon Local Plan: Part Two - Saved UDP Policies (November 2012)."*

2.2.2 It is noted that specific reference in Condition 19 is made to BS 8233:2014 rather than Hillingdon's Noise Supplementary Planning Document. This assessment therefore considers the guidance and criteria detailed in BS 8233:2014.

2.3 Standards

British Standard 8233: 2014 'Guidance on Sound Insulation and Noise Reduction for Buildings'

2.3.1 BS 8233, in relation to this development, sets out desirable guideline values in habitable rooms, such as living rooms and bedrooms.

2.3.2 The guideline values relate to steady external noise without a specific character, previously termed 'anonymous noise'. According to the standard, noise has a specific character if it contains features such as a distinguishable, discrete and continuous tone, is irregular enough to attract attention, or has strong low-frequency content, in which case lower noise limits might be appropriate. Examples of noise with a character may include tonal/intermittent plant noise emissions, music playback, and workshop noise. Examples of external steady noise sources may include environmental noise sources such as busy road traffic.

2.3.3 The desirable internal ambient noise levels for dwellings are presented in **Table 2.1**.

Table 2.1: BS 8233 Desirable Internal Ambient Noise Levels for Dwellings

Activity	**Location**	**Desirable Internal Ambient Noise Level**	
		07:00 to 23:00 hours	**23:00 to 07:00 hours**
Resting	Living room	35 dB $L_{Aeq,16h}$	-
Dining	Dining room/area	40 dB $L_{Aeq,16h}$	-
Sleeping (daytime resting)	Bedroom	35 dB $L_{Aeq,16h}$	30 dB $L_{Aeq,8h}$
*Note 4 Regular individual noise events (for example, scheduled aircraft or passing trains) can cause sleep disturbance. A guideline value may be set in terms of SEL or $L_{Amax,f}$, depending on the character and number of events per night. Sporadic noise events could require separate values.			
Note 5 If relying on closed windows to meet the guide values, there needs to be an appropriate alternative source of ventilation that does not compromise the façade insulation or the resulting noise levels.			
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 5dB and reasonable internal conditions still achieved.			
*A selection of the available notes			

2.3.4 The standard also provides advice in relation to desirable levels for external noise. It states in paragraph 7.7.3.2 that:

> *"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 centre 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."*

2.4 Guidance

World Health Organisation, Guidelines for Community Noise, 1999 (WHO)

2.4.1 The World Health Organisation (WHO) Guidelines for Community Noise (1999) also sets out guidance on suitable internal and external noise levels in residential properties. The following internal noise levels are recommended by the WHO:

- 35 dB $L_{Aeq,T}$ in living rooms over a 16 hour day; and
- 30 dB $L_{Aeq,T}$ in bedrooms during the 8 hour night.

2.4.2 With respect to the night-time maximum noise levels, the WHO guidelines state:

> *"For a good sleep, it is believed that indoor sound pressure levels should not exceed approximately 45 dB L_{AFmax} more than 10-15 times per night."*

Professional Practice Guidance on Planning and Noise, 2017

2.4.3 The Professional Practice Guidance on Planning and Noise (ProPG) provides guidance on a recommended approach to the management of noise within the planning system in England and is limited to new residential development that will be predominantly exposed to airborne noise from transport sources.

2.4.4 With respect to internal ambient noise levels in habitable rooms, ProPG recommends that noise levels set out in BS 8233 are used for residential development. However, an additional criterion is proposed by ProPG for night-time L_{Amax} levels as follows:

> *"[…] In most circumstances in noise-sensitive rooms at night (e.g. bedrooms) good acoustic design can be used so that individual noise events do not normally exceed 45 dB $L_{Amax,\ F}$ more than 10 times a night. However, where it is not reasonably practicable to achieve this guideline then the judgement of acceptability will depend not only on the maximum noise levels but also on factors such as the source, number, distribution, predictability and regularity of noise events."*

2.5 Proposed Internal Ambient Noise Level Criteria

2.5.1 The levels used as the proposed assessment criteria for transport related noise are detailed in **Table 2.2** and **Table 2.3**. In addition, a night-time maximum noise level criterion has been proposed, based on guidance detailed within BS 8233:2014, ProPG and WHO guidelines.

Table 2.2: LOAEL and SOAEL Noise Levels (Indoor Ambient Noise Levels)

Proposed LOAEL and SOAEL for Indoor Ambient Noise Levels in New Residential Dwellings		
Adverse Effect Level	**Daytime (07:00 hours to 23:00 hours)**	**Night-time (23:00 hours to 07:00 hours)**
LOAEL	35 dB $L_{Aeq,16\ hours}$ 45 dB $L_{Aeq,\ 5\ minutes}$	30 dB $L_{Aeq,8\ hours}$ 45 dB $L_{Amax,f}$ (no more than 10 times per night)
SOAEL	45 dB $L_{Aeq,16\ hours}$ 55 dB $L_{Aeq,5\ minutes}$	40 dB $L_{Aeq,8\ hours}$

2.5.2 Criteria for the assessment of the short-term dB $L_{Aeq,5minutes}$ associated with aircraft noise has been based on a level that is 10 dB above the 16-hour daytime ambient level, as short-term noise levels in excess of this are likely to increase the daytime ambient sound level ($L_{Aeq,16hours}$).

2.5.3 Based on guidance detailed within BS 8233:2014, ProPG and WHO guidelines, the proposed LOAEL and SOAEL external noise levels in amenity areas are detailed in **Table 2.3**.

Table 2.3: Proposed LOAEL and SOAEL Noise Levels (External Noise Levels in Amenity Areas)

Proposed LOAEL and SOAEL for Outdoor Ambient Noise Levels (Free Field) in New Residential Dwelling Amenity Areas	
Effect Level	**Daytime (07:00 hours to 23:00 hours)**
LOAEL	55 $L_{Aeq,16h}$ dB
SOAEL	65 $L_{Aeq,16h}$ dB

3 Environmental Sound Survey

3.1 General

3.1.1 Due to the impact of COVID-19 and associated reduction in transportation activities, some sound surveys may no longer be representative due to lower levels of traffic on road, rail and air systems of travel. However, the noise impact assessment (in Section 4) is based on a worst-case measured noise level across the site due to aircraft fly-over events, which apart from frequency of operations, should be representative of a worst-case fly-over event during normal operating conditions.

3.2 Procedure

3.2.1 An unattended environmental sound survey was undertaken between approximately 12:45 hours on Friday 8 January 2021 and approximately 11:00 hours on Friday 15 January 2021 in order to determine the existing sound climate at locations considered representative of sound levels incident on the future development.

3.2.2 The survey was undertaken over a week-long period. Measurements were made over 5-minute periods of the L_{Aeq}, L_{A90} and L_{AFMax} sound levels.

3.2.3 The sound level meters were located in environmental cases. The microphones were connected to the meters via an extension cable and fitted with the manufacturer's windshield.

3.2.4 The instrumentation used in the survey (including calibration information) is listed in **Appendix B.**

3.2.5 Field calibrations were performed before and after the measurements with no significant fluctuations recorded (< 0.5 dB). Calibration certificates are available upon request.

3.3 Measurement Locations

3.3.1 Sound measurements were undertaken at two positions at the site. The measurement positions are detailed in **Figure 2** and described in **Table 3.1.**

Figure 2: Sound Survey Locations

Image courtesy of ESRI, Maxar, Microsoft

Table 3.1: Description of Measurement Locations

Position	Description
LT1	The microphone was positioned in a free-field location, at an approximate height of 3.5 m above general ground level on a pole, approximately 50m from Station Approach to the south.
LT2	The microphone was positioned in a free-field location, at an approximate height of 1.5 m above ground level on a pole, approximately 35 m from Odyssey Business Park to the north and approximately 40 m from The Runway to the east.

3.4 Meteorological Conditions

3.4.1 Due to the nature of the survey (i.e. unattended), it is not possible to accurately comment on the meteorological conditions throughout the entire survey period. However, based on a review of publicly available weather forecasts and observations at the beginning and end of the survey period, the weather conditions are detailed in **Table 3.2**.

Table 3.2: Meteorological Conditions

Description	08/01/2021 – 15/01/2021
Temperature (°C)	0 - 5
Average precipitation per day over measurement period (mm)	0 – 0.33
Cloud Cover (%)	Overcast
Wind Description	Light to gentle breeze
Wind Speed (m/s)	0.12 – 0.61
Wind Direction	SSW

3.4.2 These conditions are considered suitable for obtaining representative sound level measurements.

3.4.3 Rain was noted to occur between 20:30 on 12 January 2021 to 00:00 13 January 2021. A review of the measurement data has determined that rainfall during this period had little to no effect on measured sound levels.

3.5 Assumptions/Limitations

3.5.1 During the time of the survey, construction works were being carried out at a commercial premises along The Runway. These works would not have taken place in evenings or night-time periods. In order to provide a worst-case assessment, construction periods have not been omitted from our analysis, and therefore the reported and assessed sound levels may be slightly higher than if construction works were not taking place.

3.5.2 This report refers, within the limitations stated, to the environment of the site in the context of the surrounding area at the time of the inspections. Environmental conditions can vary. No warranty is given as to the possibility of changes in the environment of the site and surrounding area at differing times.

3.6 Environmental Sound Climate

3.6.1 Due to the nature of the survey (i.e. unattended), it is not possible to accurately comment on the dominant noise sources or specific noise events during the entire survey period. However, at the beginning and end of the survey period, it was noted that on-site sound levels were dominated by vehicular movements on Station Approach to the east, rail vehicle (including freight train) movements on the Central line and Chiltern Main Line to the north and occasional aircraft passes overhead.

3.6.2 A one-off event of noise relating to animal activity close to the monitoring equipment was recorded at 21:56 on 9 January 2021. Data relating to this event has been excluded from our assessment.

4 Environmental Sound Survey Results

4.1.1 The results of the survey are presented in the time history graphs in **Appendix C**.

4.1.2 A summary of the survey results is detailed in **Table 4.1**.

Table 4.1: Summary of Measured Environmental Sound Survey Results

Location	Period, T	Daily Averaged Measured Sound Levels (dB)		
		$L_{Aeq,T}$	Typical* L_{AFMax}	Typical** $L_{A90,5mins}$
LT1	Daytime (07:00 – 23:00 hours)	55	-	48
	Night-time (23:00 – 07:00 hours)	50	70	32
LT2	Daytime (07:00 – 23:00 hours)	53	-	40
	Night-time (23:00 – 07:00 hours)	47	64	31

* Based on the 10th highest measured L_{Amax} level.
** Calculated based on the statistical distribution of background sound levels during the measurement period in general accordance with guidance in BS4142:2014

4.1.3 The highest measured $L_{Aeq,5mins}$ event was measured at LT1 and LT2 at 17:10 on 13 January 2021. Based on a review of the measurement data this event is considered to relate to aircraft movement from the RAF Northolt site, approximately 500 m to the west of the proposed development.

4.1.4 The highest measured $L_{eq,5minute}$ sound levels in octave-bands between 63-8000 Hz are presented **Table 4.2**.

Table 4.2: Highest Measured $L_{eq, 5\text{-}minute}$ Sound Levels

Date, Time	Location	Measured $L_{eq, 5\text{-}minute}$ Sound Level (dB)								dBA
		63	125	250	500	1 k	2 k	4 k	8 k	
17:10 13/01/2021	LT1	64	62	61	59	61	60	61	58	67
	LT2	69	64	65	64	65	65	68	69	74

5 Environmental Sound Assessment

5.1 Overview

5.1.1 Analysis of the proposed external building fabric has been undertaken in order to determine the required acoustic performance of glazing elements to achieve the criteria detailed in **Table 2.2**. Compliance with the acoustic performance specification detailed herein is expected to result in compliance with the proposed acoustic criteria.

5.2 Ventilation

5.2.1 The requirements for building ventilation in dwellings are detailed in Approved Document F (ADF) and include provision for 'whole dwelling ventilation', 'extract ventilation' and 'purge ventilation'.

- Whole Dwelling Ventilation - Nominally continuous ventilation of rooms or spaces at a relatively low rate to dilute and remove pollutants not removed by operation of extract ventilation or purge ventilation.
- Extract Ventilation - The removal of air directly to the outside. May be provided by passive or mechanical means.
- Purge Ventilation - Manually controlled ventilation at a relatively high rate to rapidly dilute pollutants and/or water vapour. Purge ventilation is typically provided by means of openable windows. Due to the temporary nature of purge ventilation, significant noise impacts are not normally expected.

5.2.2 ADF provides four 'template' systems which comply with the ventilation requirements for new dwellings and can be adopted to demonstrate compliance. These are:

- System 1: Background ventilators and intermittent extract fans;
- System 2: Background ventilators and passive stack ventilation;
- System 3: Continuous Mechanical Extract (MEV) with trickle ventilators providing inlet air.; and
- System 4: Continuous Mechanical Supply and Extract with Heat Recovery (MVHR).

5.2.3 Each system has different noise implications, however in the context of this assessment external noise ingress via the ventilation system is the primary concern. Generally, for systems 1-3 this is via the ventilators and for system 4 (MVHR) this is via the inlet and exhaust grilles within the dwelling associated with the MVHR system.

5.2.4 It is understood that ventilation to dwellings is to be provided by Mechanical Ventilation Heat Recovery (MVHR) units (i.e. System 4) located within each dwelling

5.2.5 MVHR has much greater resistance to external noise ingress than trickle ventilators and in the context of this site noise ingress via the MVHR system is not considered to be significant.

5.3 Internal Sound Levels (External Building Fabric Assessment)

5.3.1 Our external building fabric analysis has assumed the following:

Room Absorption

5.3.2 We have assumed the bedrooms and living rooms to be acoustically 'soft' with carpets, curtains and other soft furnishings. For the purposes of our analyses we have assumed the average equivalent absorption coefficients detailed in **Table 5.1**.

Table 5.1: Average Equivalent Acoustic Absorption Coefficients

Room	Average Equivalent Acoustic Absorption Coefficient ($\bar{\alpha}$) at Octave-band Centre Frequency (Hz)				
	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz
Bedrooms / Living Rooms	0.18	0.25	0.27	0.31	0.32

Proposed External Building Fabric

5.3.3 We have based our assessment on a typical brick/block cavity wall external wall build-up. Please note that assessment of internal sound transfer falls outside the scope of this report and should be assessed in detail by the relevant specialists. **Table 5.2** details typical sound reduction indices associated with the assumed external building fabric construction, providing an indicative overall performance of 52 dB R_w.

Table 5.2: Assumed External Wall Sound Reduction Performance

Construction	Sound Reduction Index (R) at Octave-band Centre Frequency (Hz)				
	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz
External Wall	41	45	45	54	58

5.3.4 Our calculations have been based on building and window dimensions obtained from drawings produced by WaM Architecture.

5.4 Glazing and Ventilation Acoustic Specification and Guidance on Construction

5.4.1 Glazing specifications have been consolidated so that a minimum number of different specifications are provided.

5.4.2 The glazing performance specifications apply to the glazing package as a whole inclusive of glazing, louvres, spandrel panels, framing, opening lights, doors, seal etc. The performance of the glazing system will depend on many factors such as the glazing configuration, size of windows panels, quality of framing, quality of sealing etc.

5.4.3 The proposed windows should be tested in accordance with BS EN ISO 10140-2:2010 and the quoted minimum sound reduction specifications should be met by the system as a whole, including frames etc. as appropriate, and not just the glass.

5.4.4 For guidance purposes we would suggest that a construction based around the following configurations, provided in **Table 5.3**, is likely to prove commensurate with achieving the sound insulation performance specifications detailed within **Appendix D**.

Table 5.3: Glazing Guidance Constructions

Zone	Area	Guidance Glazing
All facades	Living Spaces	4 mm glass / 12 mm cavity / 6mm glass
	Bedrooms	

5.4.5 The guidance construction detailed above is provided for costing purposes only. Selected glazing and ventilation systems should be capable of meeting the performance specifications shown in **Appendix D**, with laboratory test certificates being made available in support of the quoted performance. Glazing proposals which simply reflect the guidance constructions indicated in this report will not, in isolation, be sufficient evidence that a glazing configuration will meet the performance specification.

5.4.6 The acoustic specifications will need to be integrated, coordinated and ratified with the design by the principal designer and design team to ensure that all other design interfaces, buildability, workmanship and other requirements are considered.

5.4.7 Based on the results of the external building fabric assessment, the internal ambient sound levels are likely to meet the proposed criteria during daytime and night-time periods.

5.5 Sound Levels in External Amenity Areas

5.5.1 The site plans indicate that balconies are to be incorporated as part of the proposed development. These are likely to feature on north, south, east and west facing facades.

5.5.2 The measured external ambient levels indicate that sound levels at balconies meet or fall below the proposed LOAEL of 55dB $L_{Aeq,\ 16hours}$ during the daytime period.

5.5.3 With reference to BS 8233:2014, Paragraph 7.7.3.2 states that:

> "*Other locations, such as balconies, roof gardens and terraces are also important in residential buildings where normal external amenity space might be limited or not available, i.e. in flats, apartment blocks, etc. In these locations, specification of noise limits is not necessarily appropriate. Small balconies may be included for uses such as drying, washing or growing pot plants, and noise limits should not be necessary for these uses.*

5.5.4 Furthermore, Paragraph 7.7.3.2 also states that:

> *"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 recognised 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."*

6 Conclusions

6.1.1 Stantec (UK) Ltd has been commissioned by Taylor Wimpey West London to undertake an external building fabric assessment in relation to Bourne Court, Ruislip.

6.1.2 An environmental sound survey has been undertaken by Stantec (UK) Ltd, to establish the existing environmental sound levels associated with transportation sources incident on the proposed development.

6.1.3 The results of the environmental sound survey have been used to establish façade incident noise levels for the proposed development which form the basis of our assessment of the acoustic requirements of the building façade. The assessment has been based on a worst-case aircraft fly-over event.

6.1.4 Assessment criteria have been proposed based on the requirements of planning Condition 19 and applicable guidance documents.

6.1.5 Analysis of the proposed external building fabric has been undertaken in order to determine the acoustic performance of the glazed and ventilation elements. Compliance with the acoustic performance specification detailed herein is expected to result in compliance with the proposed acoustic criteria.

6.1.6 The acoustic specifications will need to be integrated, coordinated and ratified with the design by the principal designer and design team to ensure that all other design interfaces, buildability, workmanship and other requirements are considered.

Appendix A Acoustic Terminology

Parameter	Description
A-Weighted Decibel (dBA)	A decibel level that has been corrected for the A-Weighting curve.
A-Weighting	Octave band and 1/3 octave band filters that correlate to the response of the human hearing system to sound pressure levels at different frequencies.
Background Sound Level ($L_{A90,T}$)	A-weighted sound pressure level that is exceeded by the residual sound at the assessment location for 90% of a given time interval, T, measured using a fast time-weighting and quoted to the nearest whole number of decibels.
Decibel (dB)	A logarithmic unit used to describe the ratio between the measured level and a reference level of 0 dB. The ratio can be sound pressure, intensity or power. The reference value for sound pressure is 20 µPa and for sound power is 1 ρW.
Equivalent Continuous A-Weighted Sound Pressure Level ($L_{Aeq,T}$)	Value of the time-averaged A-weighted sound pressure level, in decibels (dB), of a continuous steady sound for the duration of the specified time interval, T.
Fast Time Weighted	The speed at which the instrument responds to changes in amplitude of the measured signal. The response time of a fats time-weighted instrument is 0.125 seconds.
Free-Field Level	The sound pressure level measured away from any reflective surfaces.
Frequency (f)	The number of cycles of pressure fluctuations within a given period of time. Measured in Hertz.
Hertz (Hz)	The unit of frequency or pitch of a sound. One hertz is equal to one cycle per second.
L_{Amax}	The maximum A-weighted level measured during a given time period.
Octave Band	Band of frequencies where the upper limit of the band is twice the frequency of the lower limit. E.g., the 1000 Hz band contains noise energy at all frequencies from 707 to 1414 Hz.
Percentile Level ($L_{AN,T}$)	The A-Weighted Sound Pressure Level which is exceeded for N% of the specified time interval. E.g., the LA90,1hour is the A-weighted sound level exceeded for 90% of 1 hour/
Reference Time Interval (T)	Specified interval over which the specific sound level is determined.
Sound Pressure	The difference between the pressure caused by a sound wave and the ambient pressure of the medium the sound wave is passing through. Measured in Pascals.
Sound Pressure Level (L_p)	The logarithm of the ratio of a given sound pressure (p) to the reference sound pressure (p0). The reference value for sound pressure is 20 µPa. Defined as: $L_p = 20log\left(\frac{p}{p_0}\right)$

Appendix B Instrumentation

B.1.1 The instrumentation used in the survey is listed in Table B1.

Table B1: Instrumentation

Description	Manufacturer	Type	Serial Number	Laboratory Calibration Date
Sound Level Meter	RION	NL-52	542903	06/02/2019
½" Pre-polarised microphone		UC-59	06480	06/02/2019
Pre-amplifier		NH-25	42931	06/02/2019
Sound Level Meter	RION	NL-52	1043456	13/02/2019
½" Pre-polarised microphone		UC-59	7231	13/02/2019
Pre-amplifier		NH-25	43485	13/02/2019
Sound Calibrator	Brüel & Kjær	4231	2619374	21/09/2020

Appendix C Time History Graphs

Figure C1: Environmental Sound Survey Time History Graph – LT1

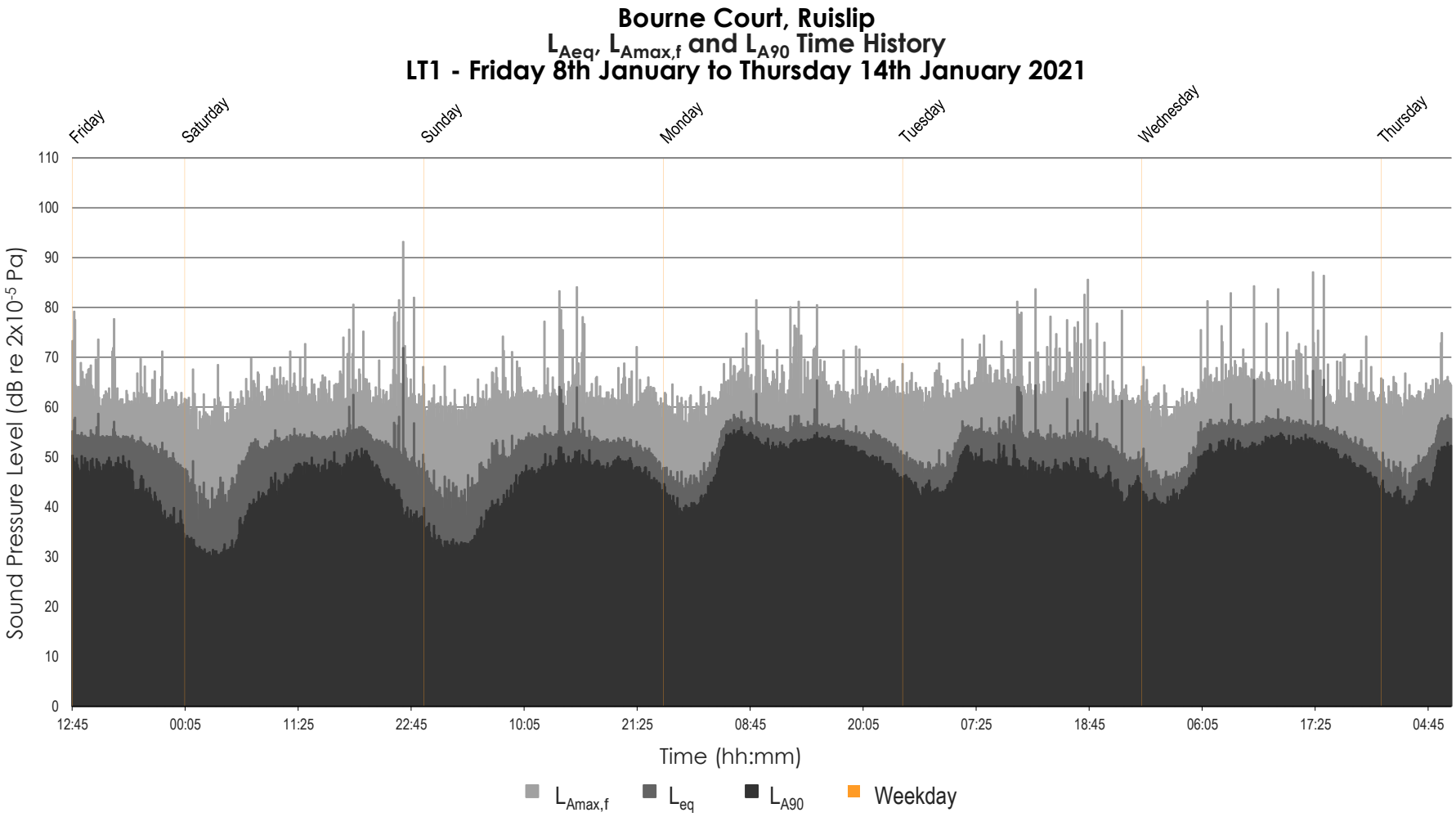
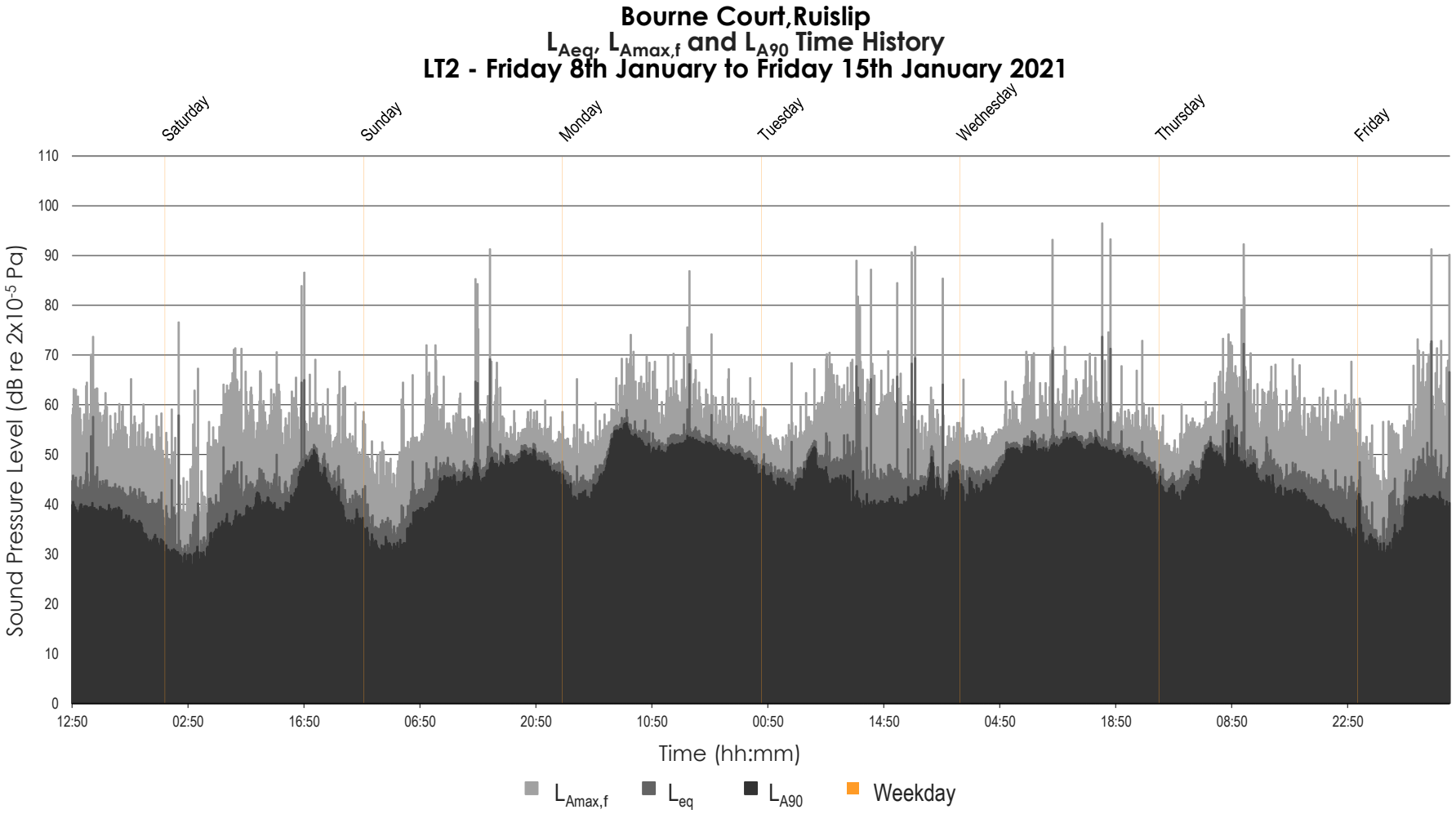


Figure C2: Environmental Sound Survey Time History Graph – LT2



Appendix D External Building Fabric Acoustic Performance Specification

D.1.1 The project criteria are expressed in terms of an overall A-weighted dB sound level. Alternative frequency specific performance levels may therefore be acceptable subject to confirmation from Stantec.

D.1.2 Fully detailed test reports from independent acoustic test authorities shall be supplied. All test reports shall be in English or, a full English translation.

D.1.3 Test data should include the 1/3 octave band results from 100 Hz to 3150 Hz inclusive, together with the corresponding octave band results from 125 Hz to 4000 Hz inclusive.

D.1.4 As a result of wind or other atmospheric effects, external building elements should not give rise to rattling, creaking or whistling.

D.2 Glazing Sound Insulation Performance

D.2.1 The complete glazing system (including frames, joints, seals, spandrel panels and opening lights and trickle vents (as appropriate)) shall achieve the following minimum sound reduction indices when tested in accordance with BS EN ISO 10140-2:2010.

Table D1: Minimum Sound Reduction Index for Glazing Specification

Minimum Sound Reduction Index (R) value (dB) at Octave Band Frequency (Hz)					**R_w***
125	**250**	**500**	**1k**	**2k**	
22	22	27	38	38	33

*The overall R_w figure is provided for guidance purposes only. The octave-band specification should be referred to in order to check compliance with the requirements.