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Noise Impact Assessment

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1 INTRODUCTION

This report presents an analysis of acoustic impacts associated with the proposed Intercontinental Hotel renovation and extension development at 117 Macquarie Street, Sydney.

This report will:

- Conduct an external noise impact assessment (primarily traffic noise) and recommend acoustic treatments to ensure that a reasonable level of amenity is achieved for future users of the hotel.
- Identify potential noise sources generated by the site, and determine noise emission goals for the development to meet Council acoustic requirements to ensure that nearby developments are not adversely impacted.

This report has been based on the Intercontinental Hotel Master Plan provided by Mulpha Australia.

2 SITE DESCRIPTION

The existing Intercontinental Hotel development is located at 117 Macquarie Street, Sydney. The site is lined by Bridge Street to the south, Macquarie Street to the east and Phillip Street running along the western boundary. The northern boundary of the site is lined by the Transport House building at 99 Macquarie Street.

The development includes the renovation of the existing 32 story hotel building and the extension and refurbishment of the existing level 7 ballroom and pre-function area.

The most significant noise sources in the vicinity of the site is from road traffic along Macquarie Street, Phillip Street and Bridge Street. Map No. 16 of the traffic volume maps for the State Environmental Planning Policy (Infrastructure) 2007 (Infrastructure SEPP) on the RTA (now RMS) website, classifies Macquarie, Phillip and Bridge streets as “*local roads*” and as such does not require a mandatory noise intrusion assessment from road traffic movements to comply with the noise intrusion requirements of the SEPP. In addition to the local roads surrounding the site, the M1 Motorway and entrance/exit ramp to the Cahill Expressway are located approximately 65m to the east of the eastern façade of the Hotel. The M1 Motorway and Cahill Expressway both carry high traffic volumes and are classified as a roads in which an acoustic assessment is mandatory under the Infrastructure SEPP.

In addition to the noise intrusion criteria presented in the Infrastructure SEPP, the requirements presented in the City of Sydney Council DCP 2012 and AS2107:2000 - “*Recommended design sound level and reverberation times for building interiors*” are also applicable at the site with regard to noise from these roads.

The nearest affected noise sensitive receivers in the vicinity of the site include the following:

- Multi-level commercial building located at 99 Macquarie Street (Transport House Building). The proposed level 7 ballroom is to extend over the Transport House building to the north.
- Multi-level commercial hotel building (Sir Stamford at Circular Quay) to the north of the development at 93 Macquarie Street.
- Multi-level commercial building located across Phillip Street to the west of the site at 50 Bridge Street.
- Multi-level commercial building located across Bridge Street to the south of the site at 47 Bridge Street.
- Multi-level commercial building located across Phillip Street to the north west of the site at 33 Alfred Street.

Long term noise monitoring has been conducted at the site at the location indicated below to determine the environmental noise levels present at the site. In addition to the long term monitoring data, ALC has conducted extensive short term attended measurements to determine the road noise level impacting the site.

Refer to figure 2.1 for a satellite image of the proposed site and the relative location of all noise sources and receivers.

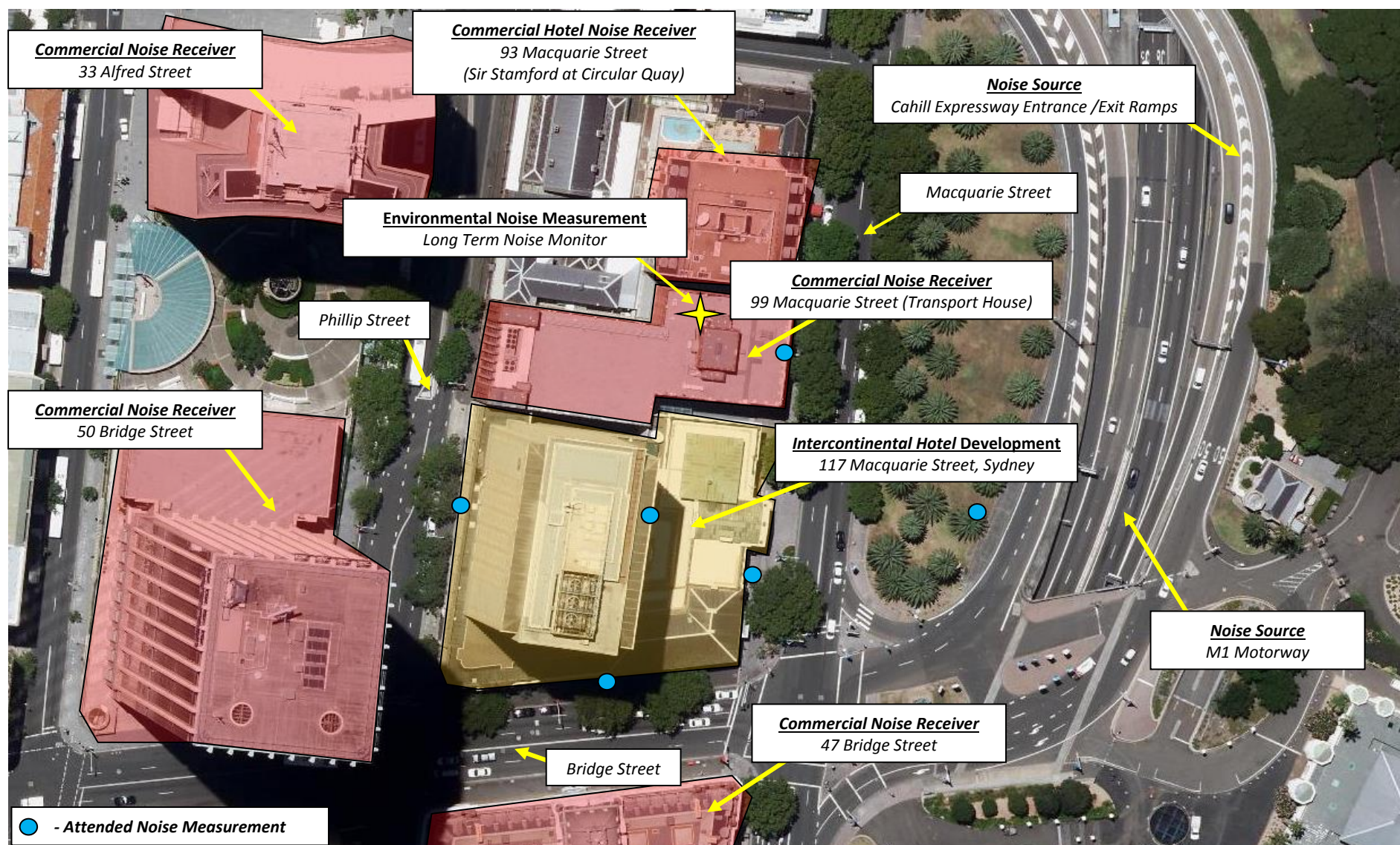


Figure 2.1 – Intercontinental Hotel Sydney

3 NOISE DESCRIPTORS

Traffic noise constantly varies in level, due to fluctuations in traffic speed, vehicle types, road conditions and traffic densities. Accordingly, it is not possible to accurately determine prevailing traffic noise conditions by measuring a single, instantaneous noise level. To accurately determine the effects of traffic noise a 15-20 minute measurement interval is utilised. Over this period, noise levels are monitored on a continuous basis and statistical and integrating techniques are used to determine noise description parameters. These parameters are used to measure how much annoyance would be caused by a particular noise source.

In the case of environmental noise three principle measurement parameters are used, namely L_{10} , L_{90} and L_{eq} .

The L_{10} and L_{90} measurement parameters are statistical levels that represent the average maximum and average minimum noise levels respectively, over the measurement intervals.

The L_{10} parameter is commonly used to measure noise produced by a particular intrusive noise source since it represents the average of the loudest noise levels produced at the source.

Conversely, the L_{90} level (which is commonly referred to as the background noise level) represents the noise level heard in the quieter periods during a measurement interval. The L_{90} parameter is used to set the allowable noise level for new, potentially intrusive noise sources since the disturbance caused by the new source will depend on how audible it is above the pre-existing noise environment, particularly during quiet periods, as represented by the L_{90} level.

The L_{eq} parameter represents the average noise energy during a measurement period. This parameter is derived by integrating the noise levels measured over the measurement period. L_{eq} is important in the assessment of traffic noise impact as it closely corresponds with human perception of a changing noise environment; such is the character of traffic noise.

Current practice favours the L_{eq} parameter as a means of measuring traffic noise, whereas the L_{10} parameter has been used in the past and is still incorporated in some codes. For the reasons outlined above, the L_{90} parameter is not used to assess traffic noise intrusion.

4 NOISE INTRUSION ASSESSMENT

The most significant noise sources in the vicinity of the site is caused by traffic movements along Phillip Street to the west of the site, Macquarie Street lining the eastern boundary of the site and Bridge Street lining the southern boundary of the site. In addition to these local roads directly adjacent to the site, road noise from the M1 and Cahill Expressway entrance and exit ramps also significantly impacts the site.

The following section presents the noise intrusion criteria applicable at the site, the details of all noise monitoring conducted at the site and the recommended acoustic treatments to reduce internal noise levels to those compliant with the relevant criteria.

4.1 ASSESSMENT CRITERIA

The following documents were used to determine the project criteria for noise intrusion into the development:

- City of Sydney Council DCP 2012 – Section 4.2.3.11 Acoustic Privacy
- NSW Government Department of Planning –*“Development near Rail Corridors and Busy Roads –Interim Guideline”*.
- State Environmental Planning Policy (Infrastructure) 2007.
- AS2107 – 2000 Acoustics – *Recommended design sound level and reverberation times for building interiors*.

4.1.1 City of Sydney Council DCP 2012

The City of Sydney Council DCP 2012 directly addresses noise intrusion from external noise sources:

4.2.3.11 Acoustic Privacy

- (7) *The repeatable maximum LAeq (1 hour) for residential buildings and serviced apartments must not exceed the following levels:*
 - (a) *For closed windows and doors:*
 - (i) *35dB for bedrooms (10pm-7am); and*
 - (ii) *45dB for main living areas (24 hours).*
 - (b) *For open windows and doors:*
 - (i) *45dB for bedrooms (10pm-7am); and*
 - (ii) *55dB for main living areas (24 hours).*
- (8) *Where natural ventilation of a room cannot be achieved, the repeatable maximum LAeq (1hour) level in a dwelling when doors and windows are shut and air conditioning is operating must not exceed:*
 - (a) *38dB for bedrooms (10pm-7am); and*
 - (b) *48dB for main living areas (24 hours).*
- (9) *These levels are to include the combined measured level of noise from both external sources and the ventilation system operating normally*

4.1.2 State Environmental Planning Policy (SEPP Infrastructure) 2007

As the development is located adjacent to a major roadway (M1 Motorway and Cahill Expressway) the provisions of the State Environmental Planning Policy (SEPP Infrastructure) 2007, additionally applies to this site.

Clause 102 & Clause 87 of the SEPP states:

“This clause applies to development for any of the following purposes that is on land in or adjacent to, a rail corridor (Clause 87) OR a road corridor for a freeway, a tollway or a transit way or any other road with an annual average daily traffic volume of more than 40,000 vehicles (based on the traffic volume data published on the website of the RTA) (Clause 102) and that the consent authority considers is likely to be adversely affected by road noise or vibration:

(a) a building for residential use,

If the development is for the purposes of a building for residential use, the consent authority must not grant consent to the development unless it is satisfied that appropriate measures will be taken to ensure that the following L_{Aeq} levels are not exceeded:

(a) in any bedroom in the building – 35 dB(A) at any time between 10 pm and 7am,

(b) anywhere else in the building (other than a garage, kitchen, bathroom or hallway) – 40 dB(A) at any time.”

Map No. 16 of the traffic volume maps for the Infrastructure SEPP on the RTA (now RMS) website (see below), classifies the M1 Motorway and Cahill Expressway as a road where a noise intrusion assessment is mandatory under clause 102 of the State Environmental Planning Policy (SEPP Infrastructure) 2007. See RMS map No. 16 and approximate location of the site below.

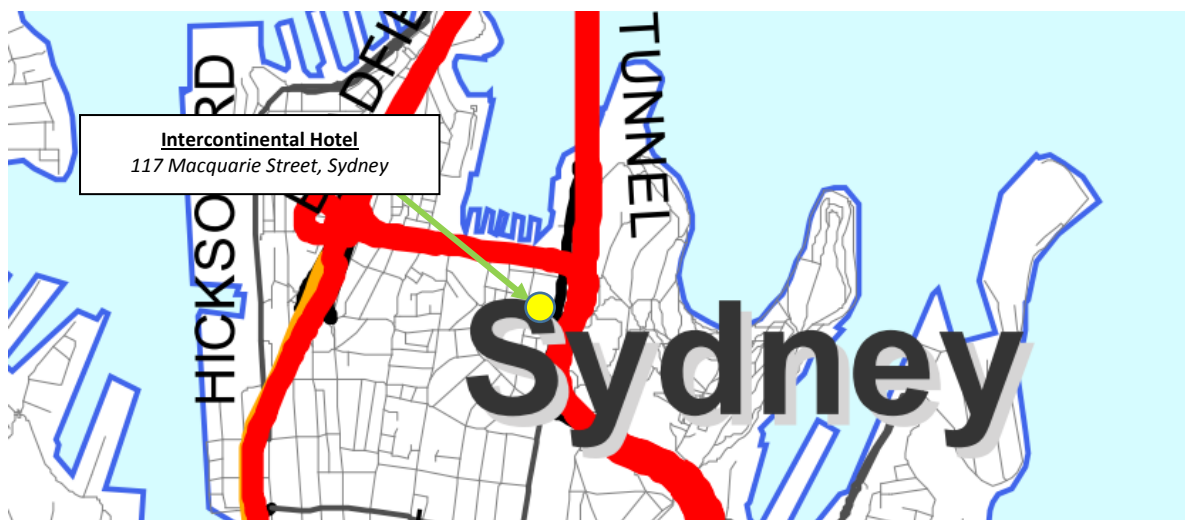


Figure 4.1 – RMS Traffic Volume Maps (Map 16)

4.1.1 Australian Standard AS 2107:2000

Australian Standard 2107 – “*Recommended Design Sound Levels and Reverberation Times for Building Interiors*”, will be used to establish the internal noise levels for the common areas and entertainment/function areas of the development.

Table 4.1 – Recommended Design Sound Levels for Commercial Spaces

Space /Activity Type	Recommended Maximum Design Sound Level dB(A) L_{eq}
Apartment Common Areas (e.g. foyer, lift lobby etc.)	55
Function Areas	45

4.1.2 Project Criteria Summary

A summary of the projects internal noise level criteria incorporating all relevant legislative requirements are detailed in the table below.

Table 4.2 – Internal noise Level Summary

Space /Activity Type		Project Internal Noise Level Criteria
Function Areas		45dB(A) $L_{eq(15hr/9hr)}$
Common Areas		55dB(A) $L_{eq(15hr/9hr)}$
Residential	Sleeping Areas	35 dB(A) $L_{eq(1hr)}$ between 10pm and 7am
	Living Areas	40 dB(A) $L_{eq(15hr)}$

4.2 MEASURED NOISE LEVELS

Environmental noise monitoring was conducted at the site of the proposed development to determine the noise levels at the facade. Both short term attended and long term unattended noise measurements were taken to quantify the traffic noise incident at the façade of the development.

Measurements were performed generally in accordance with the Australian Standard AS1055 – “Description and measurement of environmental noise – General Procedures”.

4.2.1 Measurement Locations

The on-site measurements were conducted at the locations shown in figure 2.1.

Noise monitoring was conducted at the level of the lowest hotel apartment rooms located at the site. The monitor was located approximately in line with the eastern façade facing the major noise source to the east (M1/Cahill Expressway). Additionally, attended measurements were also conducted at the location of the southern, eastern and western façade to measure the spectral characteristics of the environmental noise impacting the site.

4.2.2 Measurement Period

The attended noise measurements were taken on Tuesday 25th October 2016 between 3:00pm and 5:00pm to assess the noise levels effective at the façade of the site.

Long term noise monitoring was conducted on site from Wednesday 12th October 2016 – Tuesday 25th October 2016.

4.2.3 Measurement Equipment

Attended noise measurements were conducted using a Norsonic 140 sound level analyser, set to A-weighted fast response. The sound level analyser was calibrated before and after the measurements, no significant drift was noted.

Monitoring was conducted using an Acoustic Research Laboratories noise monitor set to A-weighted fast response. The monitor was calibrated at the start and end of the monitoring period using a Rion NC-73 calibrator. No significant drift was noted. Noise logger data is provided in Appendix A.

4.2.4 Measurement Results

The traffic noise levels listed in the table below were determined based on the short term attended measurements and the long term noise monitoring conducted on site. In determination of acoustic treatments at each façade, the measured level is adjusted for distance and orientation and any barrier effects applicable in the design.

Table 4.2 – Measured Traffic/Train Noise Levels

Measurement Location	Measurement Time	Measured Noise level
Northern Façade	Day (7am – 10pm)	65dB(A) _{Leq(15hr)} / 66dB(A) _{Leq(1hr)}
	Night (10pm – 7am)	61dB(A) _{Leq(9Hr)} / 65dB(A) _{Leq(1hr)}
Eastern Façade (Facing M1/ Cahill Expressway)	Day (7am – 10pm)	68dB(A) _{Leq(15hr)} / 69dB(A) _{Leq(1hr)}
	Night (10pm – 7am)	64dB(A) _{Leq(9Hr)} / 68dB(A) _{Leq(1hr)}
Southern Façade (Facing Bridge Street)	Day (7am – 10pm)	65dB(A) _{Leq(15hr)} / 66dB(A) _{Leq(1hr)}
	Night (10pm – 7am)	61dB(A) _{Leq(9Hr)} / 65dB(A) _{Leq(1hr)}
Western Façade (Facing Philip Street)	Day (7am – 10pm)	67dB(A) _{Leq(15hr)} / 68dB(A) _{Leq(1hr)}
	Night (10pm – 7am)	62dB(A) _{Leq(9Hr)} / 65dB(A) _{Leq(1hr)}

A complete record of the noise levels recorded on site can be found in Appendix A.

4.3 RECOMMENDED CONSTRUCTIONS

Internal noise levels will primarily be as a result of noise transfer through the windows and doors as these are relatively light building elements that offer less resistance to the transmission of sound. Noise transfer through the masonry elements will not be significant and need not be considered further.

A preliminary review of traffic noise intrusion has revealed that compliance with acoustic guidelines is achievable with single layer glazed windows with acoustic seals.

The indicative window recommendations to comply with design noise levels are shown in the following section. Exact glazing thicknesses and acoustic treatments are to be determined after window sizing and room layouts are finalised in the detailed design phase of the project.

All recommendations are based on noise levels measured on site. Noise levels have been adjusted based on distances from any major noise source, any barrier effects from objects in the direct path of the sound source and the orientation of the building façade with respect to the sound source.

4.3.1 Glazed Windows and Doors

The following constructions are recommended to comply with the traffic noise objectives stated in Section 4.1. Thicker glazing may be required for structural, safety or other purposes. Where it is required to use thicker glazing than recommended above, this will also be acoustically acceptable. It is recommended that only window systems having test results indicating compliance with the required ratings obtained in a certified laboratory be used where windows with acoustic seals have been recommended.

Table 4.3 – Recommended Glazing

Façade	Room	Glazing	Acoustic Seals
North	All Hotel Rooms	10.38mm Laminated	Yes
	Ballroom/Function	6.38mm Laminated	Yes
	Common Areas	6mm	Yes
East	All Hotel Rooms	10.38mm Laminated	Yes
	Ballroom/Function	10.38mm Laminated	Yes
	Common Areas	6mm	Yes
South	All Hotel Rooms	10.38mm Laminated	Yes
	Ballroom/Function	6.38mm Laminated	Yes
	Common Areas	6mm	Yes
West	All Hotel Rooms	10.38mm Laminated	Yes
	Ballroom/Function	6.38mm Laminated	Yes
	Common Areas	6mm	Yes

We note the existing glazing installed across all facades of the development are sufficient to reduce internal noise levels to levels complying with the relevant noise intrusion criteria stated in section 4.1. In the event the existing façade is retained as part of the development – no further acoustic treatment is required.

In addition to complying with the minimum scheduled glazing thickness specified above, the STC rating of the glazing fitted into operable frames and fixed into the building opening should not be lower than the values listed in Table 4.4 for all rooms. Where nominated, this will require the use of acoustic seals around the full perimeter of operable frames and the frame will need to be sealed into the building opening using a flexible sealant. Note that all these windows are assumed as aluminium awning windows and **mohair seals in windows and doors are not acceptable where acoustic seals are required within new glazing systems.**

Table 4.4 - Minimum STC of Glazing

Glazing Assembly	Acoustic Seals	Min STC of Installed Window
4mm	Yes	27
6mm	Yes	29
6.38mm Laminated Glass	Yes	31
10.38mm Laminated Glass	Yes	35
12.38mm Laminated Glass	Yes	36

4.3.2 External Walls

Noise intrusion through the external masonry walls will be negligible and will not contribute to internal noise levels.

The project drawings provided for acoustic assessment indicate that all walls making up the external shell of the development are of masonry construction. In the event that any light weight wall systems are incorporated into the final design, any such wall should be first approved by the acoustic consultant prior to construction.

4.3.3 Roof / Ceiling Construction

Areas where there is proposed to be concrete slab roofing is acoustically acceptable and the roof/ceiling below will not need to be acoustically upgraded for reasons related to external noise intrusion with the exception of the floor slab separating the rooftop plant and the hotel rooms on the uppermost levels. Acoustic treatments to these areas would be subject to investigation in the detailed design phase of the project when plant items and plant locations are known.

In the event that any light weight external roof/ceiling systems are incorporated into the final design, any such system should be reviewed by the acoustic consultant prior to construction.

5 NOISE EMISSION ASSESSMENT – OPERATIONAL NOISE

Noise emissions from the site should be assessed to ensure that the amenity of nearby land users is not adversely affected.

The primary noise emission sources associated with the development have been identified below;

- Noise from mechanical plant.
- Level 7 ballroom and pre-function area.

The nearest affected noise sensitive receivers in the vicinity of the site include the following (see figure 2.1 for receiver locations):

- Multi-level commercial building located at 99 Macquarie Street (Transport House Building). The proposed level 7 ballroom is to extend over the Transport House building to the north.
- Multi-level commercial hotel building (Sir Stamford at Circular Quay) to the north of the development at 93 Macquarie Street.
- Multi-level commercial building located across Phillip Street to the west of the site at 50 Bridge Street.
- Multi-level commercial building located across Bridge Street to the south of the site at 47 Bridge Street.
- Multi-level commercial building located across Phillip Street to the north west of the site at 33 Alfred Street.

5.1 BACKGROUND NOISE MONITORING

Unattended background noise monitoring was conducted from Wednesday 12th October 2016 – Tuesday 25th October 2016 using an Acoustic Research Laboratories noise monitor set to A-weighted fast response. The monitor was calibrated at the start and end of the monitoring period using a Rion NC-73 calibrator. No significant drift was noted. Noise logger data is provided in Appendix A.

Measured background noise levels are presented below. Refer to Appendix A for unmanned noise monitoring data.

Table 5.1 – Measured Background Noise Levels

Location	Background noise level dB(A)L ₉₀		
	Daytime (7am-6pm)	Evening (6pm-10pm)	Night (10pm-7am)
99 Macquarie Street, Sydney & Surrounding Development	59	56	51

5.2 NOISE EMISSION OBJECTIVES

5.2.1 City of Sydney Council – Noise General

The standard City of Sydney Council conditions for noise emissions from a venue includes the following:

(1) NOISE - GENERAL

- (a) The emission of noise associated with the use of the premises including the cumulative operation of any mechanical plant and equipment, and air conditioning shall comply with the following:
 - (i) The $L_{Aeq, 15 \text{ minute}}$ noise level emitted from the use must not exceed the project specific noise level for that receiver as determined in accordance with the *NSW EPA Industrial Noise Policy*. Noise must be measured in accordance with the Industrial Noise Policy and relevant requirements of Australian Standard AS 1055-1997 Acoustics – Description and measurement of environmental noise.
 - (ii) Project specific noise levels shall be determined by establishing the existing environmental noise levels, in complete accordance with the assessment $L_{A90, 15 \text{ minute}}$ / rating $L_{A90, 15 \text{ minute}}$ process to be in accordance with the requirements for noise monitoring listed in the *NSW EPA Industrial Noise Policy* and relevant requirements of Australian Standard AS1055-1997 Standard AS 1055-1997 Acoustics – Description and measurement of environmental noise.
 - (iii) Modifying factors in Table 4.1 of the *NSW EPA Industrial Noise Policy* are applicable.
- (b) An $L_{Aeq, 15 \text{ minute}}$ noise level emitted from the use must not exceed the $L_{A90, 15 \text{ minute}}$ noise level by more than 3dB in any Octave Band Centre Frequency (31.5 Hz to 8 kHz inclusive) when assessed inside any habitable room of any affected residence or noise sensitive commercial premises provided that;
 - (i) Where the $L_{A90, 15 \text{ minute}}$ noise level is below the threshold of hearing, T_f at any Octave Band Centre Frequency as defined in Table 1 of International Standard ISO 226 : 2003- Normal Equal-Loudness-Level Contours then the value of T_f corresponding to that Octave Band Centre Frequency shall be used instead.
 - (ii) The $L_{Aeq, 15 \text{ minute}}$ noise level and the $L_{A90, 15 \text{ minute}}$ noise level shall both be measured with all external doors and windows of the affected residence closed;
 - (iii) The relevant background noise level ($L_{A90, 15 \text{ minute}}$) is taken to mean the day, evening or night rating background noise level determined in complete accordance with the methodology outlined in the *NSW EPA Industrial Noise Policy* and Australian Standard AS1055.1997 Acoustics – Description and measurement of environmental noise.
 - (iv) Background noise shall be established in the absence of all noise emitted from the use but with the ventilation equipment normally servicing the affected residence operating. Background noise

measurements are to be representative of the environmental noise levels at the affected location.

- (v) Modifying factors in Table 4.1 of the *NSW EPA Industrial Noise Policy* are applicable. Internal Noise measurements are not to be corrected for duration.

(2) NOISE - ENTERTAINMENT VENUES

- (a) The $L_{A10, 15 \text{ minute}}$ noise level emitted from the use must not exceed the background noise level ($L_{A90, 15 \text{ minute}}$) in any Octave Band Centre Frequency (31.5 Hz to 8 kHz inclusive) by more than 5dB between the hours of 7.00am and 12.00 midnight when assessed at the boundary of any affected residence.
- (b) The $L_{A10, 15 \text{ minute}}$ noise level emitted from the use must not exceed the background noise level ($L_{A90, 15 \text{ minute}}$) in any Octave Band Centre Frequency (31.5 Hz to 8 kHz inclusive) between the hours of 12.00 midnight and 7.00am when assessed at the boundary of any affected residence.
- (c) Notwithstanding compliance with (a) and (b) above, noise from the use when assessed as an $L_{A10, 15 \text{ minute}}$ enters any residential use through an internal to internal transmission path is not to exceed the existing internal $L_{A90, 15 \text{ minute}}$ (from external sources excluding the use) in any Octave Band Centre Frequency (31.5 Hz to 8 kHz inclusive) when assessed within a habitable room at any affected residential use between the hours of 7am and 12midnight. Where the $L_{A10, 15 \text{ minute}}$ noise level is below the threshold of hearing, T_f at any Octave Band Centre Frequency as defined in Table 1 of International Standard ISO 226 : 2003- Normal Equal-Loudness-Level Contours then the value of T_f corresponding to that Octave Band Centre Frequency shall be used instead.
- (d) Notwithstanding compliance with (a), (b) and (c) above, the noise from the use must not be audible within any habitable room in any residential use between the hours of 12.00 midnight and 7.00am.
- (e) The $L_{A10, 15 \text{ minute}}$ noise level emitted from the use must not exceed the background noise level ($L_{A90, 15 \text{ minute}}$) in any Octave Band Centre Frequency (31.5 Hz to 8 kHz inclusive) by more than 3dB when assessed indoors at any affected commercial premises.

Note: The $L_{A10, 15 \text{ minute}}$ noise level emitted from the use is as per the definition in the Australian Standard AS1055-1997 Acoustics – Description and measurement of environmental noise. The background noise level $L_{A90, 15 \text{ minute}}$ is to be determined in the absence of noise emitted by the use and be representative of the noise sensitive receiver. It is to be determined from the assessment L_{A90} / rating L_{A90} methodology in complete accordance with the process listed in the NSW EPA Industrial Noise Policy and relevant requirements of AS1055.1997.

5.2.2 INP - Intrusiveness Assessment

Intrusiveness criteria permit noise generation to be no more than 5dB(A) above existing background noise levels at adjacent properties.

Table 5.2 – Intrusiveness Assessment

Location	Time of Day	Background noise Level – dB(A) L_{90}	Intrusiveness Noise Objective dB(A) $L_{eq(15min)}$ (Background + 5dB)
Surrounding Development	Day Time (7am - 6pm)	59	64
	Evening (6pm - 10pm)	56	61
	Night (10pm - 7am)	51	56

5.2.3 INP - Amenity Assessment

The Amenity criteria set additional criteria based on the land use of the noise sensitive receivers. Amenity criteria are as follows:

Table 5.3 – Amenity Criteria

Receiver Location	Land Type	Time of Day	Amenity Noise Objective dB(A) $L_{eq(Period)}$
All Potentially Affected Residential Properties	Urban	Day Time (7am – 6pm)	60
		Evening (6pm – 10pm)	50
		Night (10pm-7am)	45
All Commercial Developments	All	When in use	65

5.3 RECOMMENDATIONS

5.3.1 Mechanical Plant

Mechanical plant items are not typically selected at selected at DA stage.

Detailed review of all external mechanical plant should be undertaken at construction certificate stage (once plant selections and locations are finalised). Acoustic treatments should be determined in order to control plant noise emissions to the levels set out in section 5.2 of this report.

It is practical and possible to treat noise emissions from mechanical plant to levels complying with noise emission criteria through appropriate location and (if necessary) standard acoustic treatments such as noise screens, enclosures, in-duct treatments (silencers/lined ducting) or similar.

5.3.2 Level 7 Ballroom and Pre-Function Area

As part of the development there is a possible ballroom and functions areas.

Control of noise from the proposed alterations and additions to the ballroom and pre-function area of the development will be reviewed in the detailed design phase of the project to eliminate noise transmission to surrounding development.

The acoustic treatment to these areas will include suitable treatments such that the noise level criteria detailed in this report and will include treatments such as upgrade external glazing such as 10.38mm laminated glazing and upgraded roof/ceiling constructions. As details of the ballroom and function area are not detailed at this stage specific treatments cannot be specified at this stage of the project, however all treatments and controls will be developed during the design stage of the project.

Experience with other similar projects show that treatment to the proposed ballroom and function area of the project are both possible and practical.

6 NOISE & VIBRATION EMISSION ASSESSMENT – CONSTRUCTION WORKS

This section of report addresses noise impact associated with the proposed renovation and extension works at the Intercontinental Hotel Sydney development.

6.1 HOURS OF WORK

Table 1 in section 2.2 of the Environment Protection Authority (EPA) Interim Construction Noise Guideline lists the recommended standard hours of construction and section 2.3 outlines the situations, where construction work may need to be undertaken outside these hours.

Table 6.1 – Recommended Standard Hours for Construction Work (EPA)

Work Type	Recommended Standard Hours of Work
Normal Construction	Monday to Friday 7am to 6pm Saturday 8am to 1pm No work on Sundays or public holidays
Blasting	Monday to Friday 9am to 5pm Saturday 9am to 1pm No work on Sundays or public holidays

Situations, where construction work may need to be undertaken outside these hours are:

- The delivery of oversized plant or structures that police or other authorities determine require special arrangements to transport along public roads;
- Emergency work to avoid the loss of life or damage to property, or to prevent environmental harm;
- Maintenance and repair of public infrastructure where disruption to essential services and/or considerations of worker safety do not allow work within standard hours;
- Public infrastructure works that shorten the length of the project and are supported by the affected community; and
- Works where a proponent demonstrates and justifies a need to operate outside the recommended standard hours.

6.2 APPLICABLE CONSTRUCTION NOISE EMISSION GUIDELINES

Where feasible and practical; measures to reduce noise and vibration levels from the construction / demolition related activities should be applied to comply with the criteria imposed in this City of Sydney Code of Practice (1992) document.

In addition to complying with the criteria typically applied by the City of Sydney Council; Australian Standard AS2436 – “*Guide to Noise Control on Construction, Maintenance and Demolition Sites*” also applies. Incidentally; Australian Standard AS2436 is also referenced in the City of Sydney “*Construction Hours/Noise within the Central Business District – Code of Practice 1992*” document.

The guidelines as presented in the EPA’s Interim Construction Noise Guideline is also applicable at the site.

A summary of the applicable criteria is detailed below.

6.2.1 City of Sydney Council – “Construction Hours/Noise within the CBD – 1992”

Construction noise emissions for sites located within the Sydney CBD area are typically required to comply with the guidelines presented City of Sydney Council document titled “*Construction Hours/Noise within the Central Business District – Code of Practice 1992*”.

The noise goals contained within the document for demolition and construction activities from the subject site are aimed at minimising adverse impacts within the commercial and residential buildings surrounding the site. The noise goals adopted by the code of practice are outlined below:

Table 6.2 – Construction Noise Criteria

Day	Time Zone	Noise Criteria L ₁₀ (15 minute)
Monday to Saturday	7am to 8am	Background Noise + 5
Monday to Friday	8am to 7pm	Background Noise + 10
Saturday	8am to 5pm	Background Noise + 10

The Code also mentions that the guidelines for control of construction noise as outlined in AS2436 shall be applied, where appropriate.

6.2.2 AS2436 – “Guide to Noise Control on Construction Maintenance and Demolition Sites”

The Australian Standard AS2436 states that where all reasonable and available measures have been taken to reduce construction noise, mitigation strategies may be put in place to reduce levels noise levels to within a reasonable and acceptable level.

For the control and regulation of noise from construction sites AS2436 “*Guide to noise control on construction, maintenance and demolition sites*” nominates the following:

- a. That reasonable suitable noise criterion is established,
- b. That all practicable measures be taken on the building site to regulate noise emissions, including the siting of noisy static processes to locations of the site where they can be shielded, selecting less noisy processes, and if required regulating construction hours, and

- c. The undertaking of noise monitoring where non-compliance occurs to assist in the management and control of noise emission from the demolition, excavation and construction site.

The guideline reflects on feasible and reasonable mitigation strategies, management controls and public liaising in the effort to reach realistic compromises between construction sites and potential noise affected receivers.

6.2.3 EPA Construction Noise Guideline

The Environmental Protection Authority (EPA) have developed a specific construction noise guideline in the aid of reducing the impact of construction associated noise.

The guideline provides recommended construction noise management levels which will limit the potential for adverse community reaction to noise emanating from the site.

Table 6.3 – EPA Recommended Construction Noise Criteria

Noise criteria	Receiver	External sound level, $L_{Aeq\ 15\ min}$ dB(A)
EPA	Residential (Including Hotels)	Background + 10dB(A) ¹
		75dB(A) ²
	Commercial Offices	70dB(A) externally ³

1: Where the predicted or measured $L_{Aeq\ 15\ min}$ is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to minimise noise. (EPA CNG, 2008).

2: Where noise is above this level, the proponent should consider very carefully if there is any other feasible and reasonable way to reduce noise to below this level. If no quieter work method is feasible and reasonable, and the works proceed, the proponent should communicate with the impacted residents by clearly explaining the duration and noise level of the works, and by describing any respite periods that will be provided. (EPA CNG, 2008).

3: In ALC's experience, a 10dB(A) reduction can be expected across an open façade and a minimum 20dB(A) reduction across a closed façade. It is assumed all surrounding commercial office buildings have a closed façade and no requirement for ventilation through an open window.

6.2.4 Summary of Construction Noise Guidelines

The construction noise guidelines presented in table 6.4 have been formulated based on background noise monitoring conducted at the site (see section 5.1) in the absence of any works occurring on site. The objectives are summarised below in accordance with the recommended noise management guidelines presented above.

Table 6.4 – Construction Noise Objectives Summary

Time of Day	Existing Background Noise Level dB(A) L90(15min)	Construction Noise Objective dB(A) L _{eq} (15min)	
		Residential (Including Hotels)	Commercial
Daytime (7:00am to 8:00am)	59	64	70
Daytime (8:00am to 6:00pm)	59	69	70
Evening (6:00pm to 10:00pm)	Not applicable		
Night (10:00pm to 7:00am)	Not applicable		

6.3 APPLICABLE VIBRATION CRITERIA

Vibration generated by demolition, renovation and construction activity must be limited to the criteria presented in the following documents when assessed at any surrounding sensitive structure:

- For structural damage vibration, German Standard DIN 4150-3 *Structural Vibration: Effects of Vibration on Structures*; and
- For human exposure to vibration, the evaluation criteria presented in the EPA's "Assessing Vibration: A Technical Guideline" (Feb 2006).

The criteria and the application of this standard are discussed in separate sections below.

6.3.1 Structural Damage Vibration Criteria

German Standard DIN 4150-3 (1999-02) provides vibration velocity guideline levels for use in evaluating the effects of vibration on structures. The criteria presented in DIN 4150-3 (1999-02) are presented in Table 5.1.

It is noted that if measured vibration levels are below the guidelines listed below, damage that will reduce the serviceability of the building will not occur and if damage to the building does occur, it is assumed that the damage is related to other activities or sources. Furthermore, the DIN4150-3 guideline states the following regarding the limits presented in Table 5.1:

"Exceeding the values in table 1 (table 5.1) does not necessarily lead to damage; should they be significantly exceeded, however, further investigations are necessary."

Table 4.5– DIN 4150-3 (1999-02) Safe Limits for Building Vibration

TYPE OF STRUCTURE		PEAK PARTICLE VELOCITY (mms ⁻¹)			
		At Foundation at a Frequency of			Plane of Floor of Uppermost Storey
		< 10Hz	10Hz to 50Hz	50Hz to 100Hz	All Frequencies
1	Buildings used in commercial purposes, industrial buildings and buildings of similar design	20	20 to 40	40 to 50	40
2	Dwellings and buildings of similar design and/or use	5	5 to 15	15 to 20	15
3	Structures that because of their particular sensitivity to vibration, do not correspond to those listed in Lines 1 or 2 and have intrinsic value (e.g. buildings that are under a preservation order)	3	3 to 8	8 to 10	8

It is noted that the peak velocity is the absolute value of the maximum of any of the three orthogonal component particle velocities as measured at the foundation, and the maximum levels measured in the x- and y-horizontal directions in the plane of the floor of the uppermost storey.

6.3.2 Human Comfort Vibration Criteria

The EPA “Assessing Vibration: A Technical Guideline” (Feb 2006) will be used to assess human discomfort caused by vibration generated by demolition activities. Vibration criteria for building damage will be based on the following as detailed in Table C1.1 of aforementioned guideline.

Table 4.6 – DECC Recommended Vibration Criteria

		RMS acceleration (m/s ²)		RMS velocity (mm/s)		Peak velocity (mm/s)	
Place	Time	Preferred	Maximum	Preferred	Maximum	Preferred	Maximum
Continuous Vibration							
Residences	Daytime	0.01	0.02	0.2	0.4	0.28	0.56
Impulsive Vibration							
Residences	Daytime	0.3	0.6	6.0	12.0	8.6	17.0

Note 1: Continuous vibration relates to vibration that continues uninterrupted for a defined period (usually throughout the daytime or night-time), e.g. continuous construction or maintenance activity. (DECC, 2006)

Note 2: Impulsive vibration relate to vibration that builds up rapidly to a peak followed by a damped decay and that may or may not involve several cycles of vibration (depending on frequency and damping), with up to three occurrences in an assessment period, e.g. occasional loading and unloading, or dropping of heavy equipment. (DECC, 2006)

6.4 EVALUATION OF NOISE AND VIBRATION IMPACTS

A review of the potential noise and vibration impacts is presented below.

6.4.1 Noise impacts

Noise impacts from the renovation and extension works at the Intercontinental Hotel Sydney development at nearby development will be dependent on the type of demolition and renovation activities conducted at the site and the relative location of the works on the site.

Demolition and renovation works associated with concrete façade removal are to be the loudest typical activity. Work close to the southern and western façade will have greatest impact on the surrounding commercial development while work along the northern boundary of the site will have greatest impact on surrounding hotel (93 Macquarie Street - Sir Stamford Hotel) tenancies surrounding the development.

Once construction of the building shell is complete, noise from hand tools will be relatively low, as the new building façade will provide considerable noise attenuation. Once the building shell is largely complete, use of hand tools in internal areas is unlikely to exceed EPA recommended levels.

Noise impacts can be minimised using the following:

- Selection of equipment and process.
- Location of static plant (particularly concrete pumps and cranes etc.) away from receivers
- Use of screens or enclosures (typically only feasible for static plant).
- Scheduling of noisy activities and provision of respite periods.

Detailed construction noise emission planning is typically undertaken after engagement of a builder and a construction program is prepared and therefore, detailed planning is not possible at this stage.

In light of the above, we recommend:

- On completion of the construction program, acoustic review of proposed construction activities and plant/methods should be undertaken to identify work items likely to exceed the guidelines nominated in section 6.2.
- For the most noise intensive activities, the analysis should identify where on the construction site are the areas likely to result in high noise levels. This will then assist in determining the likely time period for which high noise levels will occur at nearby properties.
- Identify feasible acoustic controls or management techniques (use of screens, scheduling of noisy works, notification of adjoining land users, respite periods) when excessive levels may occur.
- For activities where acoustic controls and management techniques still cannot guarantee compliant noise levels, implement a notification process whereby nearby development is made aware of the time and duration of noise intensive construction processes.

Through adoption of the above, noise impacts on nearby development can be suitably managed to prevent excessive impact.

6.4.2 Vibration Impacts

Demolition of the existing structural elements of the hotel is the primary vibration generating activities to be conducted at the site.

Due to its proximity, vibration impacts on the surrounding commercial developments across Bridge and Phillip Streets, and similarly the commercial hotel to the north of the site, are unlikely to be higher than the levels of vibration to be generated at the boundary of the adjacent commercial building to the north (99 Macquarie Street).

Given no significant demolition or bulk excavation works are proposed as part of the development, vibration levels exceeding building damage criteria at the location of the nearest vibration sensitive structures is unlikely.

Notwithstanding the above, we recommend consultation with the surrounding tenancies prior to demolition/renovation works to determine if there is any particularly vibration sensitive equipment items or activities to be conducted at the site boundaries in order to determine appropriate vibration criteria (if required).

Adoption of the above will provide a framework to ensure that appropriate systems for monitoring and management of vibration can be implemented.

7 CONCLUSION

This report presents our DA acoustic assessment for the proposed Intercontinental Hotel renovation and extension development at 117 Macquarie Street, Sydney.

Traffic noise impacts on future occupants of the development have been assessed in accordance with the City of Sydney Council DCP 2012, NSW Department of Planning *“Development near Rail Corridors and Busy Roads – Interim Guideline”* requirements and Australian Standard 2107 – *“Recommended Design Sound Levels and Reverberation Times for Building Interiors”*.

Provided that the treatments set out in section 4.3 of this report are employed, traffic noise impacts on hotel will comply with relevant acoustic criteria.

Noise emission objectives for the proposed development has also been determined based on on-site noise logging and noise emission guidelines typically adopted by City of Sydney Council, and have been presented in section 5. Recommendations for control of noise emissions have been presented in section 5.3 where it is recommended that specific acoustic treatment to plant servicing the building is determined in the detailed design phase of the project when detailed plant items are known.

We trust this information is satisfactory. Please contact us should you have any further queries.

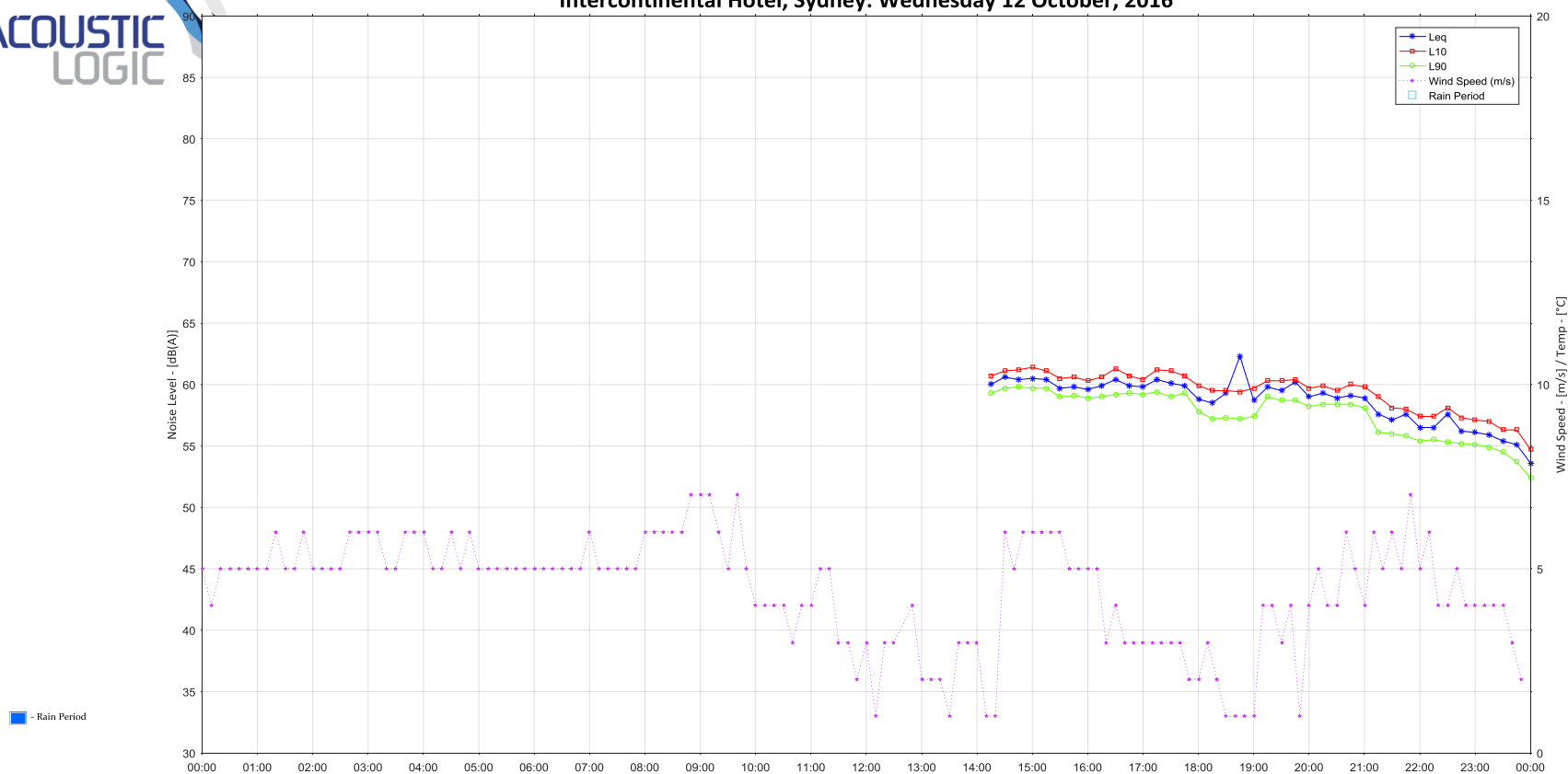
Yours faithfully,

A handwritten signature in black ink, appearing to read 'J Robinson', with a horizontal line extending from the end.

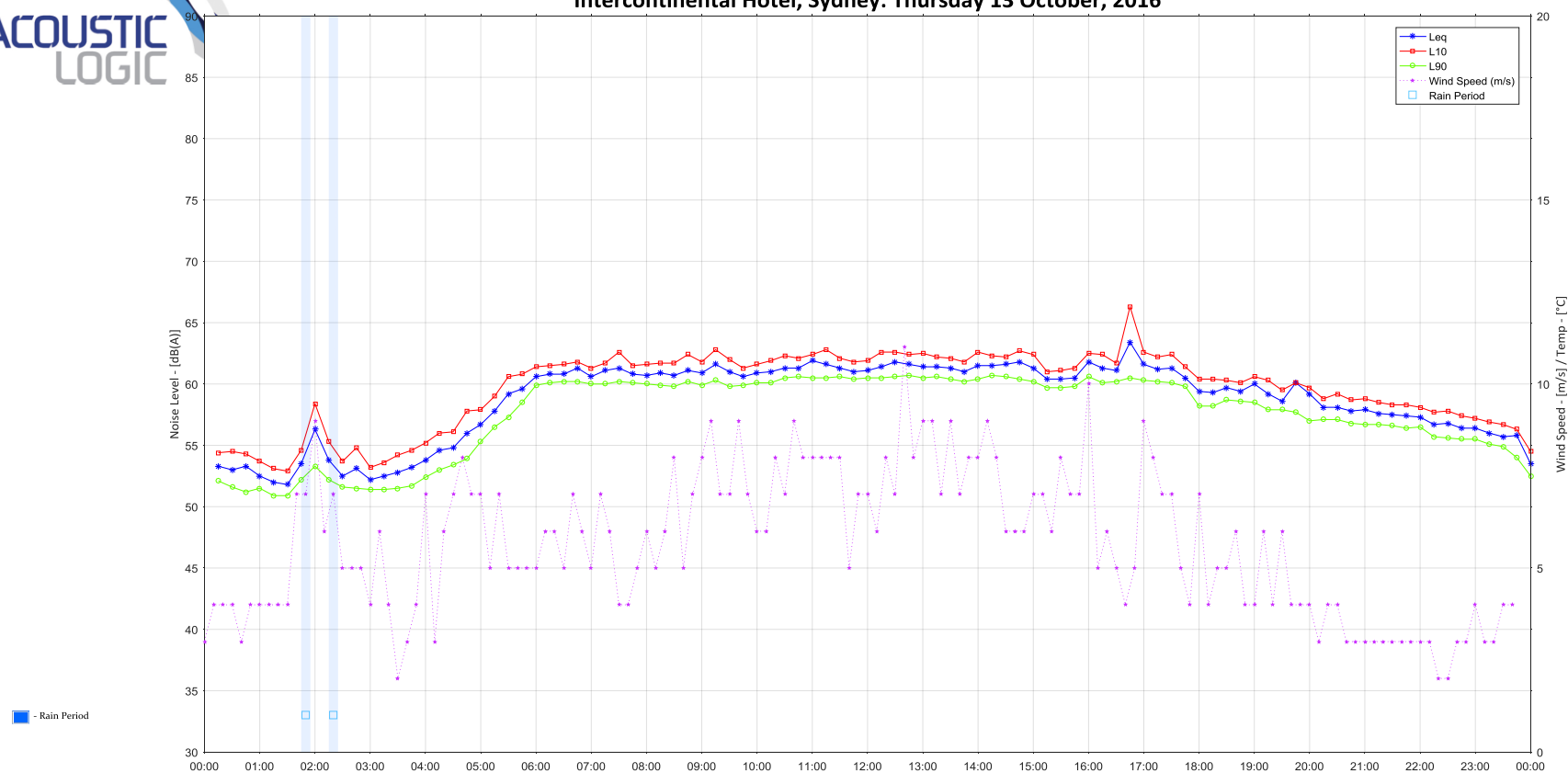
Acoustic Logic Consultancy Pty Ltd
Jeff Robinson

APPENDIX A – NOISE MONITORING DATA

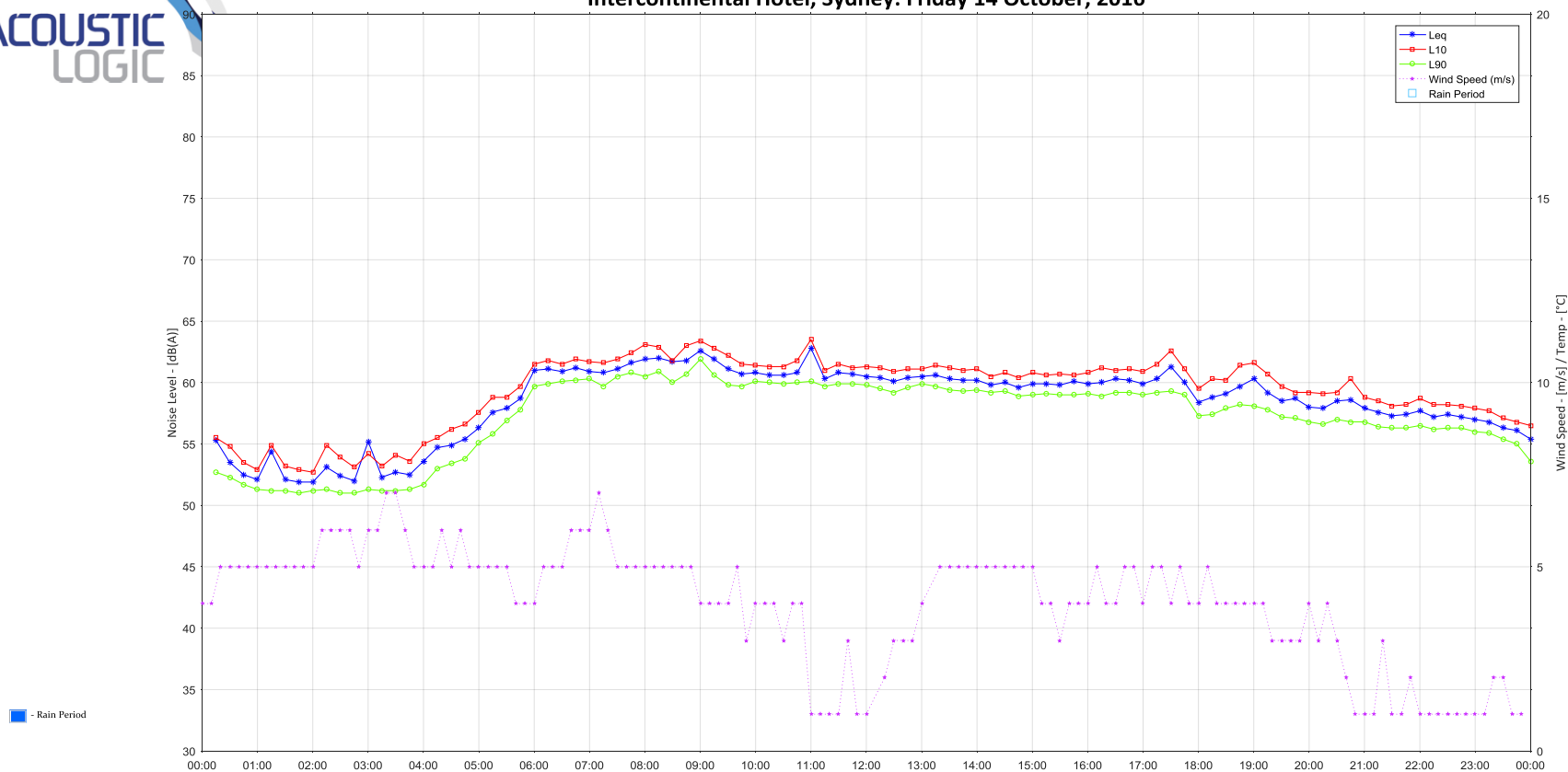
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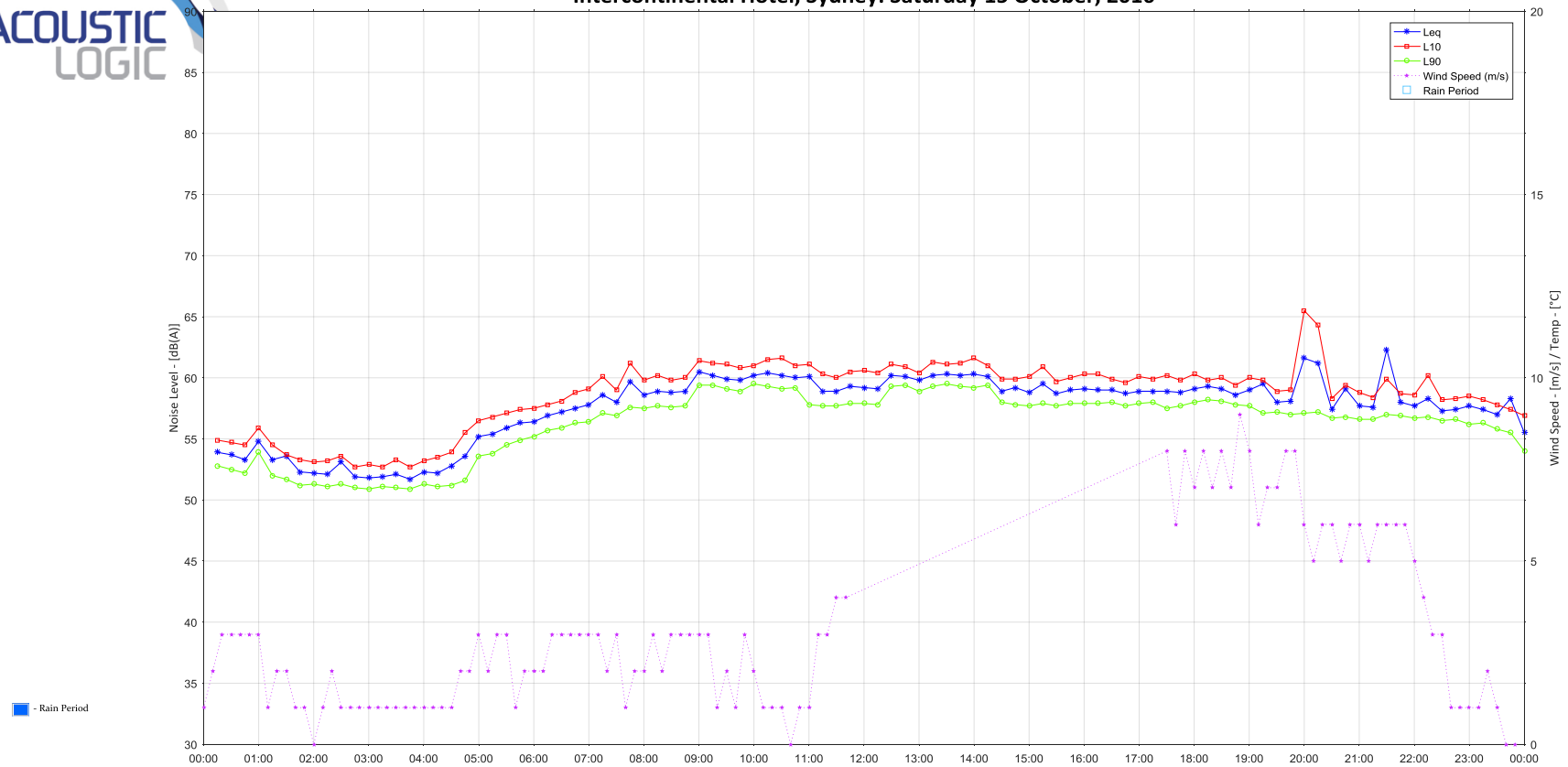
Intercontinental Hotel, Sydney: Thursday 13 October, 2016



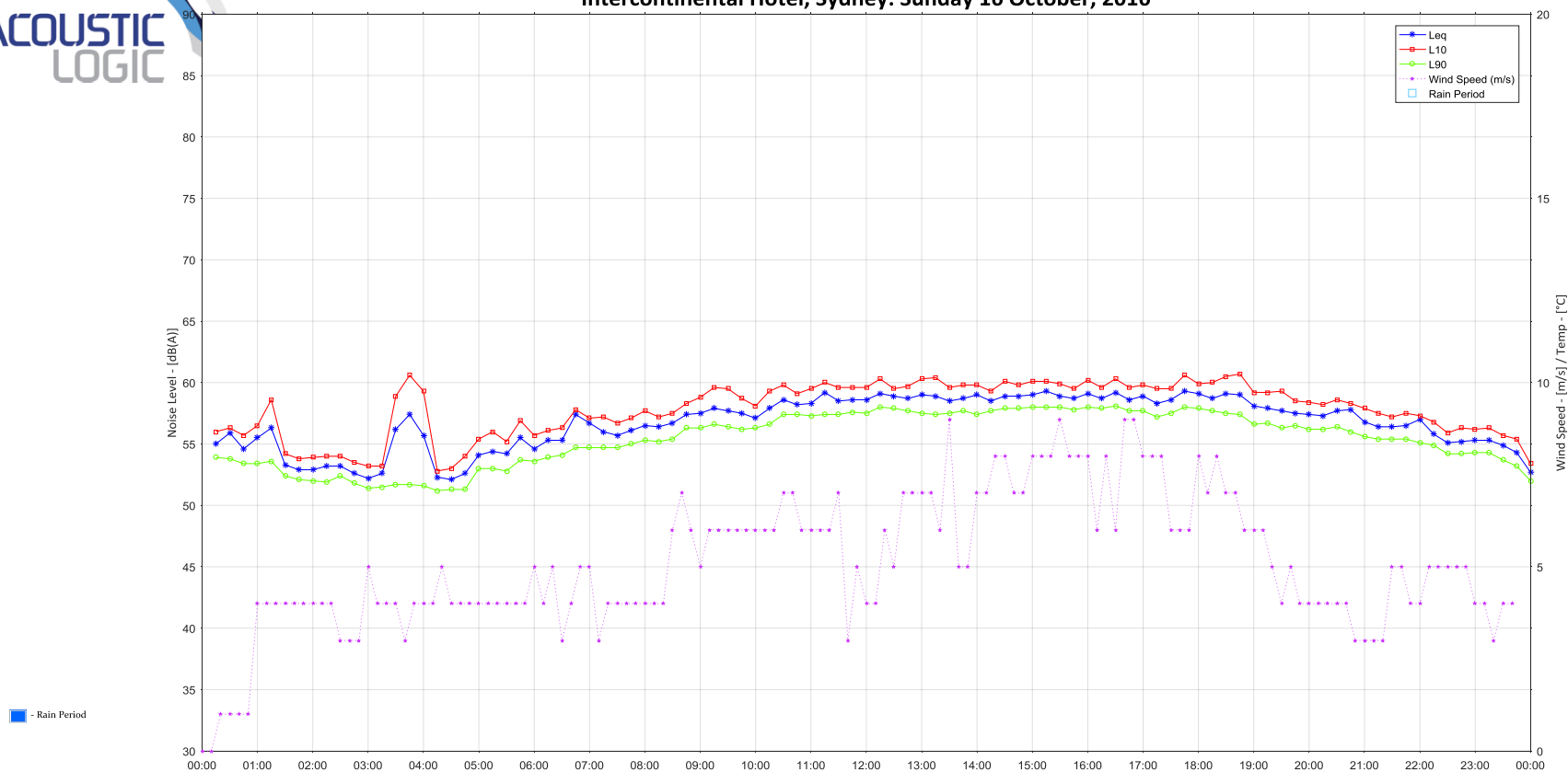
Intercontinental Hotel, Sydney: Friday 14 October, 2016



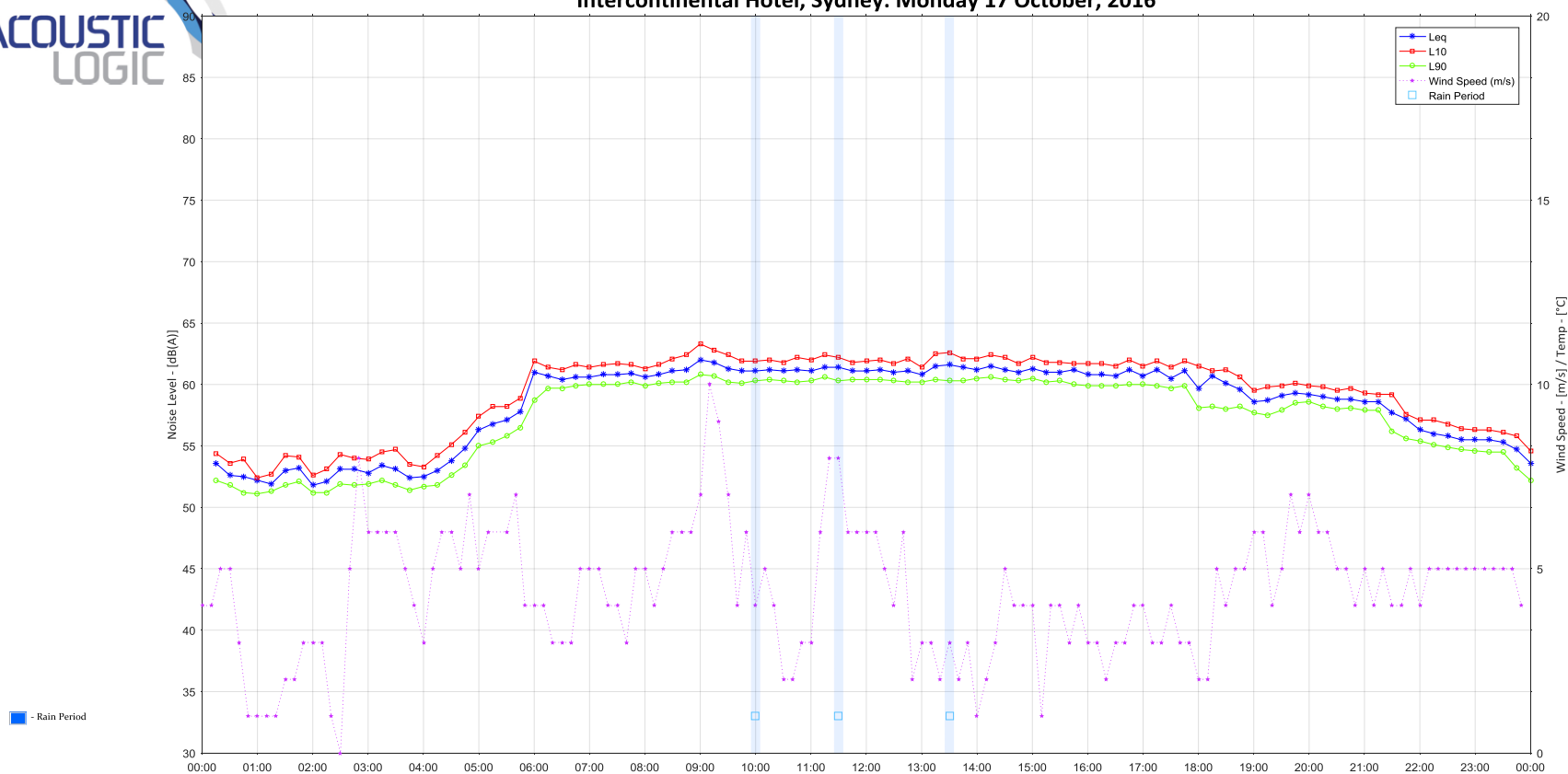
Intercontinental Hotel, Sydney: Saturday 15 October, 2016



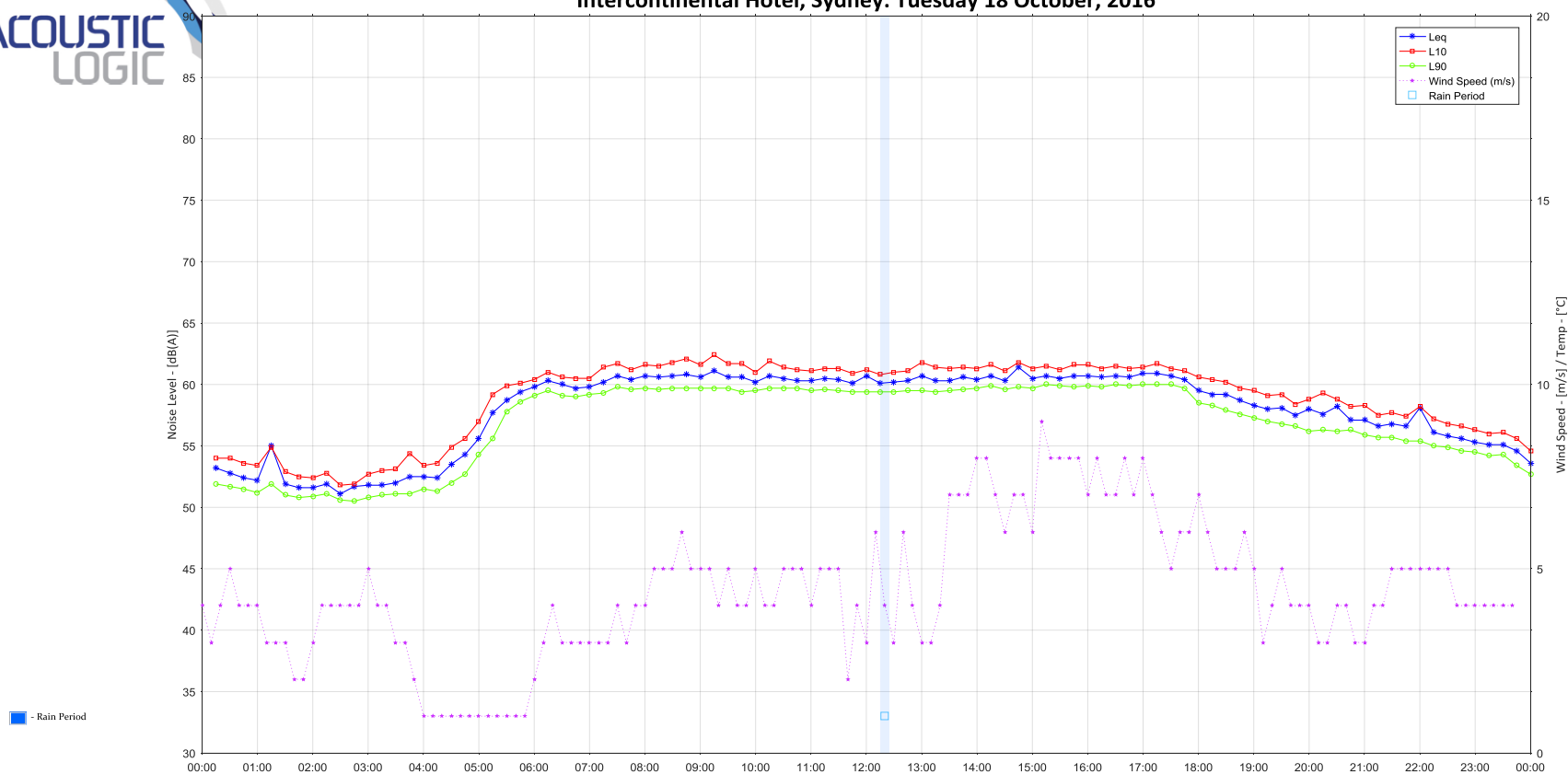
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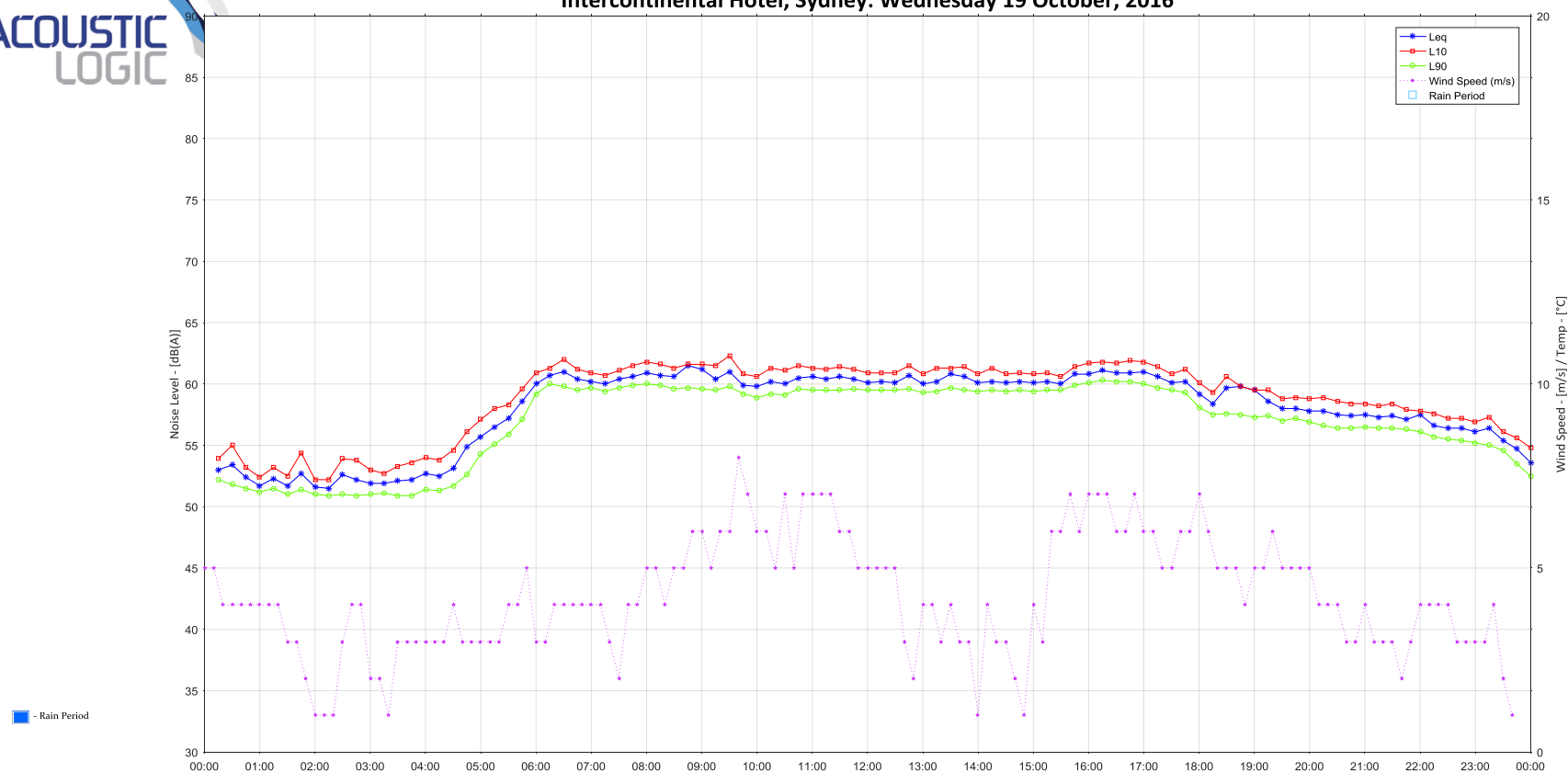
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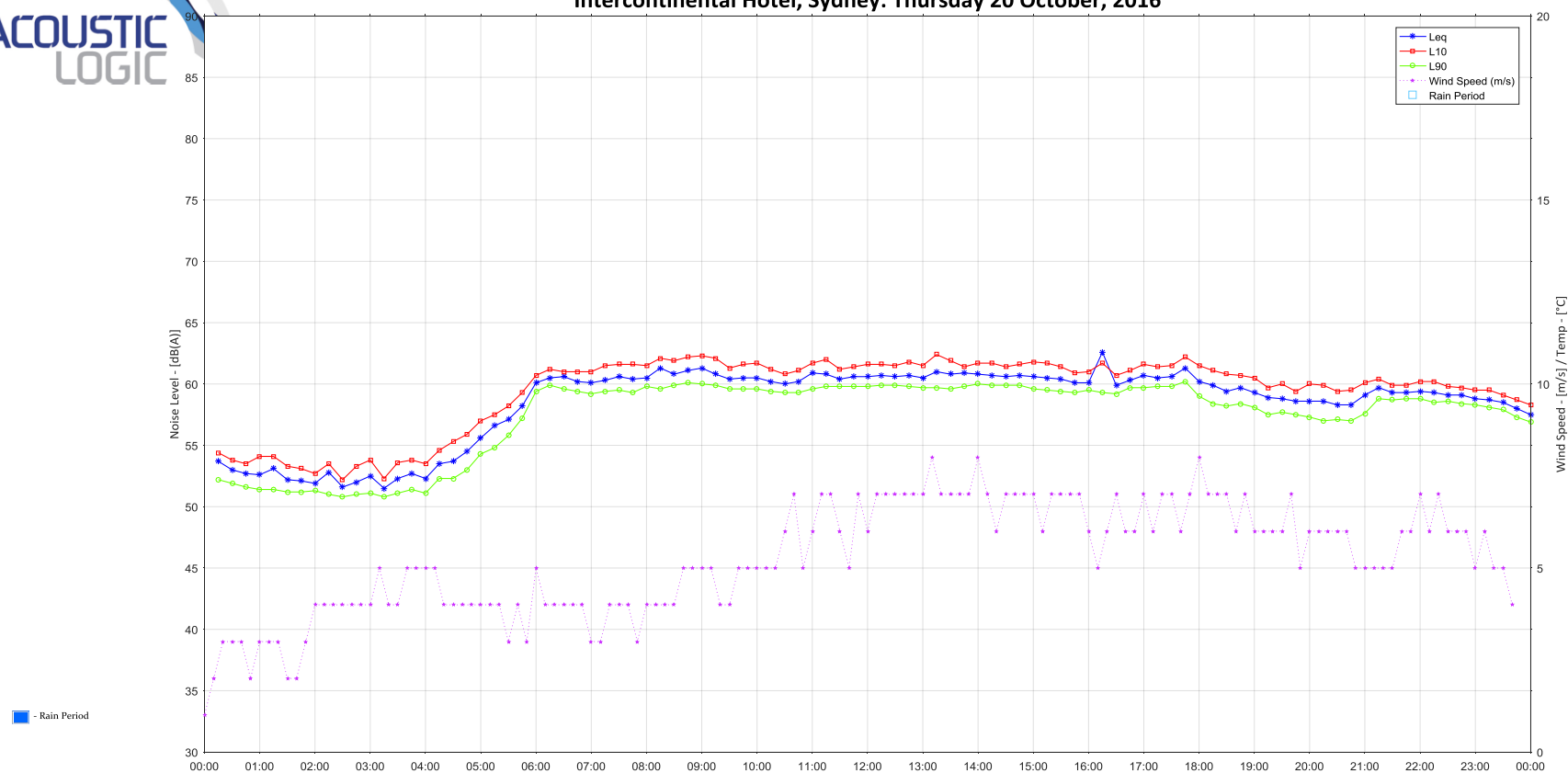
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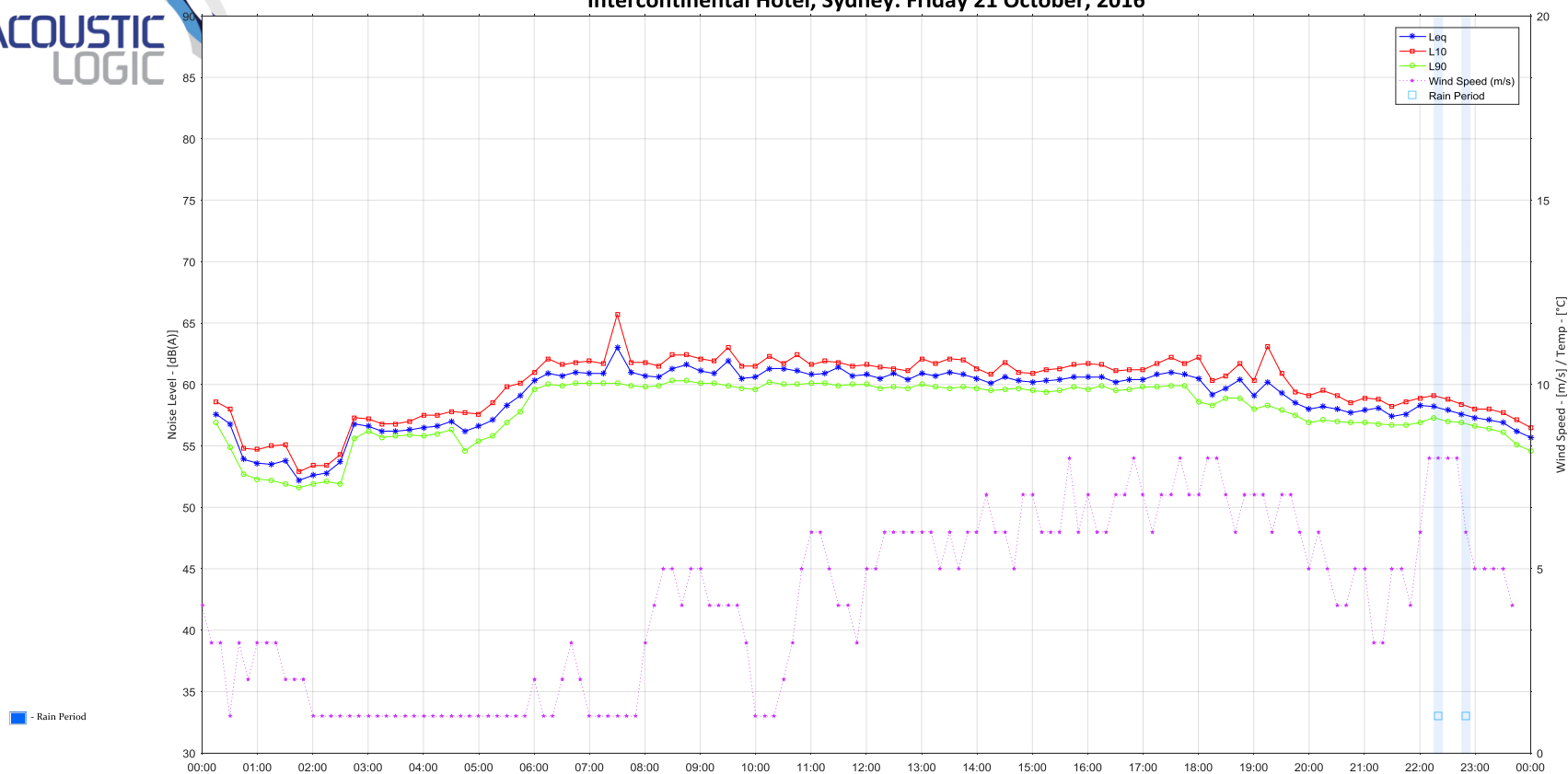
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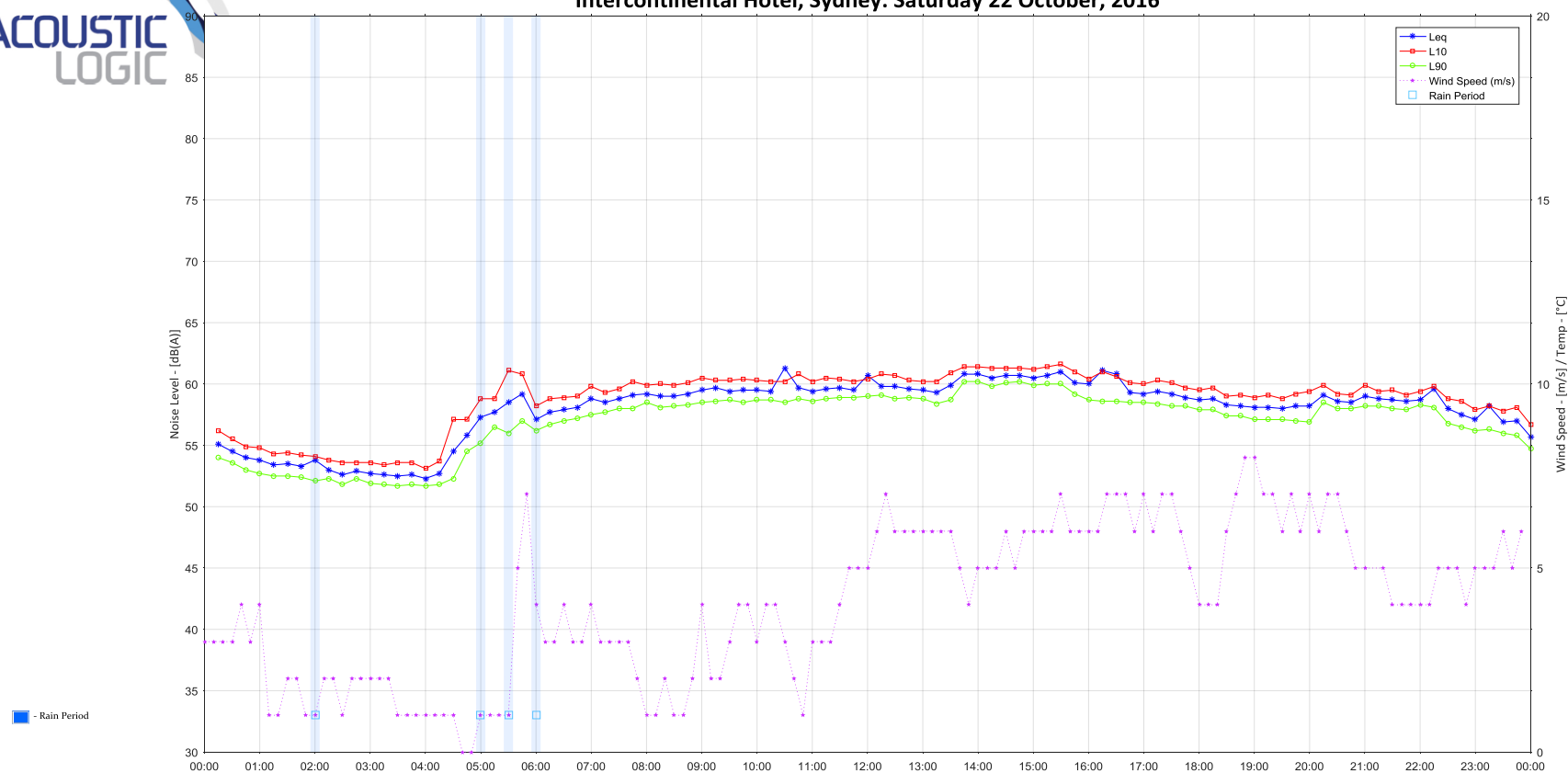
Intercontinental Hotel, Sydney: Thursday 20 October, 2016



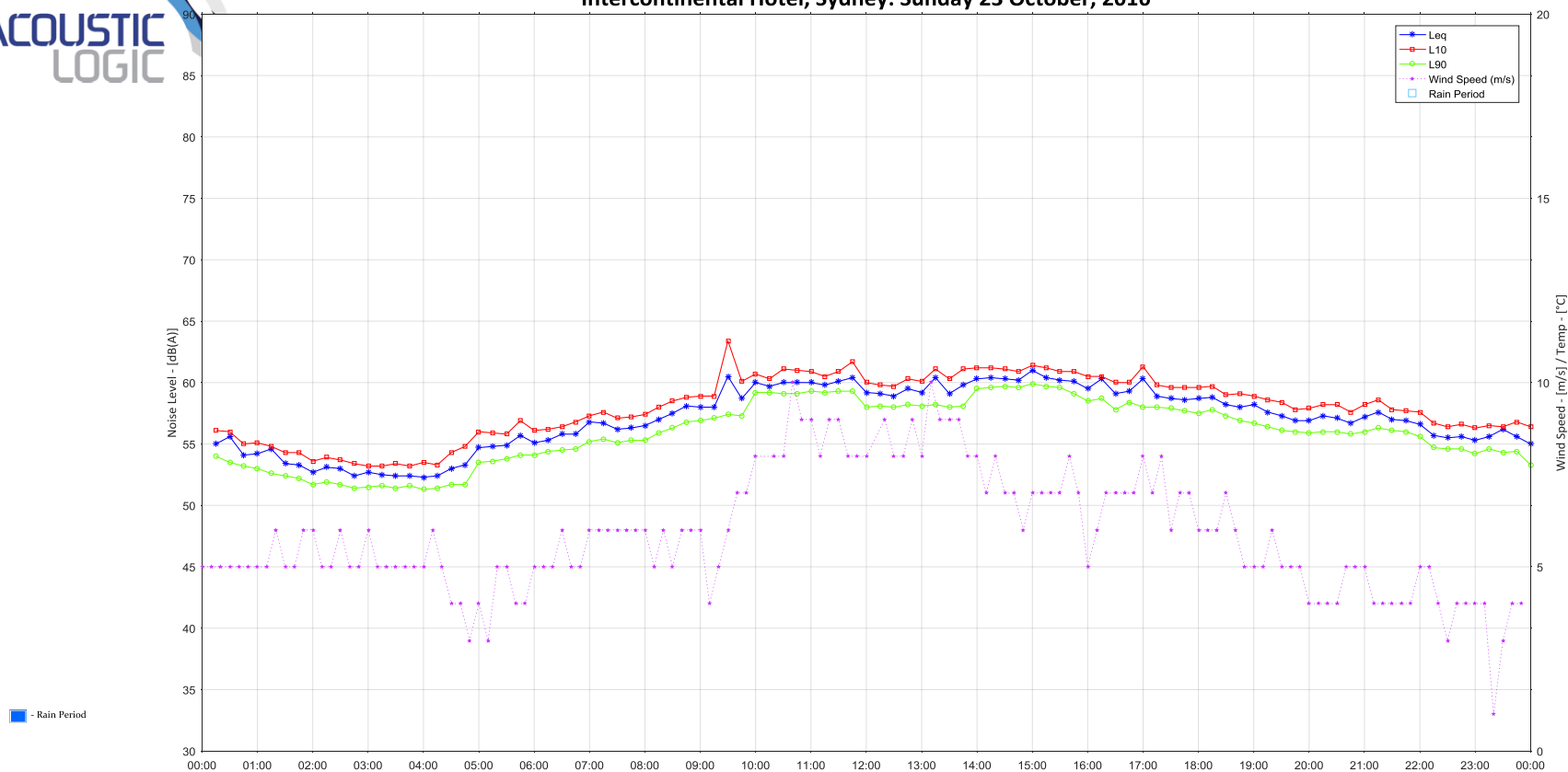
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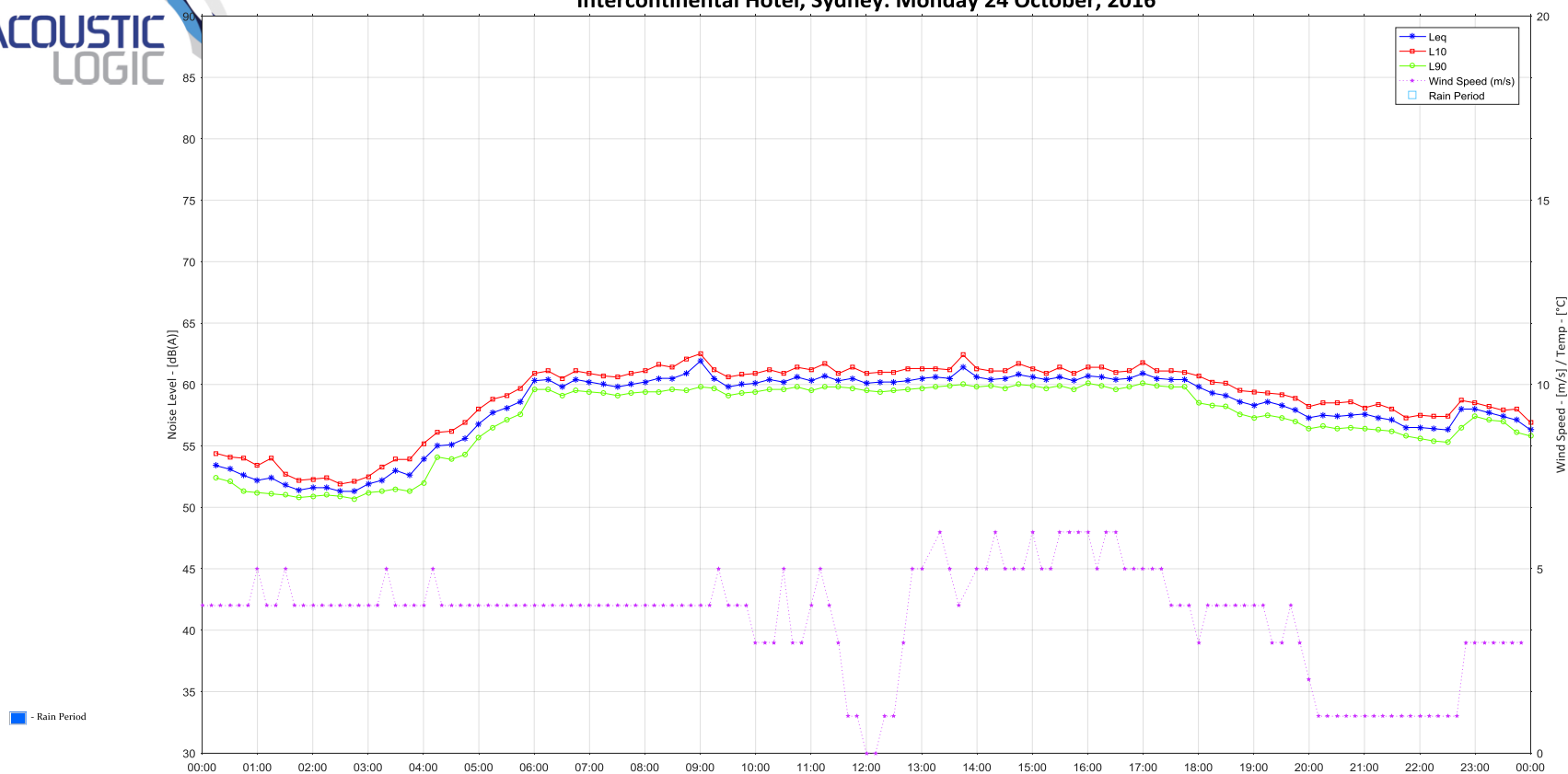
Intercontinental Hotel, Sydney: Saturday 22 October, 2016



Intercontinental Hotel, Sydney: Sunday 23 October, 2016



Intercontinental Hotel, Sydney: Monday 24 October, 2016



Intercontinental Hotel, Sydney: Tuesday 25 October, 2016

