ACOUSTIC LOGIC CONSULTANCY
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3 May 2010

Report: 2010305.1/2004A/R2/TA

Prepared for: Coffey Projects

AUSTRALIAN HEARING HUB

NOISE AND VIBRATION INTRUSION & ENVIRONMENTAL NOISE ASSESSMENT

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1. INTRODUCTION

This report presents our assessment of potential impact of vibration and noise on the Australian Hearing Hub to be located within Macquarie University.

The potential impact associated with vibration generated on the Northern Railway corridor and noise generated by car movements on surrounding streets has been assessed in order to determine any possible adverse impacts on the future tenants of the Australian Hearing Hub.

The assessment has been based on vibration levels measured on site, generated by train movements on the Northern Railway corridor which runs under Macquarie University to the northeast of the proposed development. The noise intrusion assessment has been based on measured traffic noise levels generated by vehicle movements on Western Road, Macquarie Drive and University Avenue.

Although the site is outside any statutory vibration assessment zone, due to the sensitive nature of the daily operations of the proposed occupants, discrete structural vibrations within the development have been evaluated. If necessary, appropriate vibration attenuation treatments will be recommended to prevent excessive impacts on tenants.

This assessment has been conducted as required by the Director General's Requirement number 8 for the development.

In addition to the Director General's Requirements, noise intrusion through the building façade has also been assessed in accordance with internal noise levels presented in Indoor Environment Quality (IEQ) 12 of The Green Building Council of Australia (GBCA) Office Design Guide - Version 3.

Potential noise impact on surrounding developments from operation of the development will be assessed based on the requirements of the Director General, Ryde City Council and Department of Environment, Climate Change and Water NSW (DECCW) guidelines as well as ambient noise measurements obtained from long-term unattended monitoring and manned measurements at the site. Indicative ameliorative measures will be recommended where potentially adverse impacts are identified.

We note that detailed plant and equipment selections are not available at the time of assessment, and as such, a detailed acoustic treatment of mechanical has not yet been completed. However, noise goals will be set and the future plant and equipment will be designed and selected so that noise levels at the nearest affected receivers comply with criteria nominated in this report.

2. SITE DESCRIPTION

The subject site is located in between Macquarie Drive and University Avenue and currently operates as University car parking. The western boundary of the site abuts Western Road. Macquarie Drive, University Avenue and Western Road all carry low volumes of traffic and are primarily used by students and staff accessing car parking and various areas of the University.

To the north of the site, across Macquarie Drive, the new Learning and Research Centre is currently under construction, as with the Cochlear Precinct which lies to the southeast of the site. The eastern boundary of the site abuts the C1 car parking area of the University.

The nearest potentially affected residential receiver for operational noise is the Baptist Community Services' Dorothy Henderson Lodge to the southwest of the site. The lodge comprises of both Residential Aged Care (RAC) and Independent Living Units (ILUs).

To the south of the site, lies the Gumnut Cottage, a child care centre.

The site is shielded all sides from major roadways or significant airborne noise sources.

The Northern Railway corridor is situated approximately 300m to the northeast of the site.

Figure 1 details the site and traffic noise and vibration measurement positions, unattended ambient noise measurement positions and affected receivers.

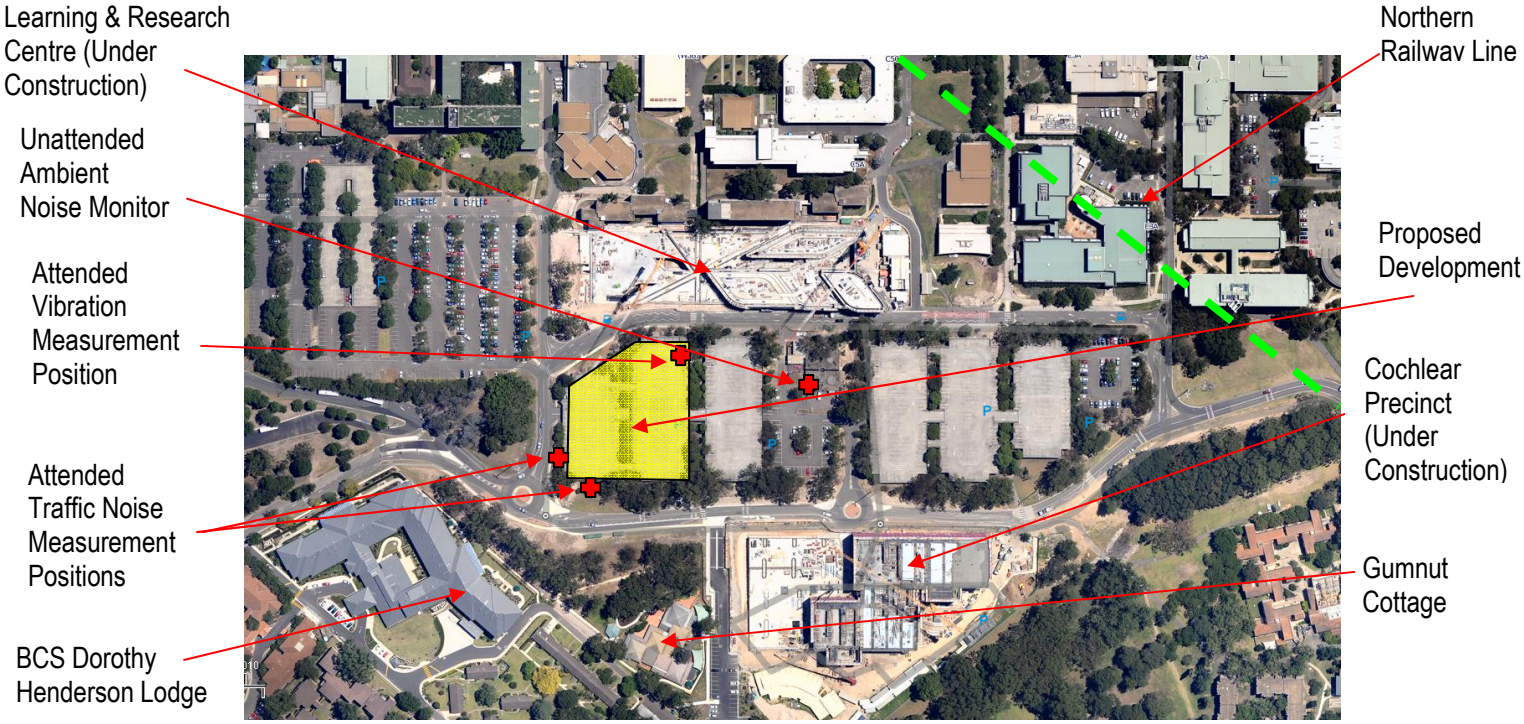

Figure 1 – Site Map

3. TRAFFIC NOISE ASSESSMENT

3.1 ACOUSTIC CRITERIA

The Director General's Requirement number 8 for the development states that:

> *"The EA shall address the issue of noise and vibration impact from nearby roads and railway and provide detail of how this will be managed through the design of the proposed building, in compliance with relevant Australian Standards and the Department's Interim Guidelines for Development near Rail Corridors and Busy Roads."*

The NSW Department of Planning's policy, Development Near Rail Corridors And Busy Roads – Interim Guideline, sets out internal noise level criteria adapted from the State Environmental Planning Policy (Infrastructure) 2007 (the 'Infrastructure SEPP') for developments with the potential to be impacted by traffic or rail noise and vibration.

The Infrastructure SEPP defines busy roads that are subject to an acoustic assessment as:

> *"Roads specified in Clause 102 of the Infrastructure SEPP: a freeway, tollway or a transitway or any other road with an average annual traffic (AADT) volume of more than 40,000 vehicles (based on the traffic volume data provided on the website of the RTA).*
>
> *Any other road – with an average annual daily traffic (AADT) volume of more than 20,000 vehicles (based on the traffic volume data published on the website of the RTA).*
>
> *Any other road – with a high level of truck movements or bus traffic."*

The NSW Department of Planning's policy, Development Near Rail Corridors And Busy Roads – Interim Guideline does not specify internal noise goals for commercial developments, however does state the following:

> *"Some commercial premises may incorporate special components that may be noise and or vibration sensitive, such as auditoria, laboratories and board rooms, and although not a specific requirement of the Infrastructure SEPP, these areas should be assessed accordingly. While low rise buildings may benefit from shielding provided by topography, barriers or other buildings, high rise buildings usually receive less shielding and noise mitigation needs to be considered at the outset in the layout and building design."*

Pursuant to this, the internal noise criteria presented in Indoor Environment Quality (IEQ) 12 of The Green Building Council of Australia (GBCA) Office Design Guide - Version 3 has been adopted in order to assess all areas of the building accordingly. Indoor Environment Quality (IEQ) 12 states the following:

> *"Up to two points are awarded where 95% of the project's NLA does not exceed the 'Satisfactory' ambient internal noise levels in accordance with AS/NZS 2107:2000, as follows:*
>
> *Building Services Design*
> *- One point is awarded where, within the entire base building general office space, noise from the building services does not exceed 40dBAeq.*
>
> *Overall Building*
> *- One point is awarded where within the base building office space, the sound level does not exceed 40dBAeq (assuming open plan offices)."*

As stated above, the overall building should achieve internal noise levels of 40dB(A)L_{eq}. In accordance with this requirement, the internal noise goal for the external noise intrusion will be 37dB(A)$L_{eq\ (9\ hour)}$

and the noise goal for the building mechanical services will be 37dB(A)L_{eq}. An internal noise level of 37dB(A)L_{eq} from external noise combined with 37dB(A)L_{eq} from mechanical services noise results in an overall level of 40dB(A)L_{eq}.

3.2 TRAFFIC NOISE MEASUREMENTS

3.2.1 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_{10} 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.

3.2.2 Measured Noise Levels

Measurements were performed generally in accordance with the Australian Standard AS1055 – Description and Measurement of Environmental Noise – General Procedures.

3.2.3 Measurement Period, Location and Equipment

Manned measurements were taken on 29 March 2010 between 4pm and 6pm in line with the proposed façade of the building. Measurements were taken using a Norsonic 140 sound level meter, set to A-weighted fast response. The sound level meter was calibrated before and after the measurements using a Norsonic 1251 sound calibrator, and no significant drift was recorded.

3.2.4 Measured Noise Levels

The traffic noise levels were determined based on the manned measurements and are presented below. In determination of acoustic treatments, the measured level is adjusted for distance, barrier attenuation and orientation.

Table 1 – Measured Noise Levels

Location	Traffic Noise Level $dB(A)L_{eq(9\ hour)}$ (9am-5pm)
Australian Hearing Hub Façade	64 $dB(A)L_{eq\ (9hour)}$

3.3 EVALUATION OF NOISE INTRUSION

Internal noise levels will primarily be as a result of noise transfer through the glass façade as it is a relatively light building element that offers less resistance to the transmission of sound. **All external other elements of the façade and roof are proposed to be heavy masonry elements that will not require upgrading.**

The predicted noise level through the glass façade is discussed below. The predicted internal noise level has been based on the measured level and spectral characteristics of the external noise, the area of building elements exposed to traffic noise, the absorption characteristics of the building and the noise reduction performance of the building elements.

Calculations were performed taking into account the orientation of glass façade, barrier effects (where applicable), the total area of glazing, facade transmission loss and the likely room sound absorption characteristics. In this way the likely interior noise levels can be predicted.

In all cases, the specified transmission loss (refer below) reduces internal noise levels to within the nominated criteria for the various space types.

3.3.1 Recommended Transmission Loss

The following table presents the recommended transmission loss for this project to achieve the internal traffic noise requirements. The transmission loss (TL) presented below is needed to satisfy acoustic requirements and do not take into account other requirements such as structural, safety or other considerations. These additional considerations may require the glazing thickness to be increased beyond the acoustic requirement.

Table 2 – Recommended Transmission Loss (TL) of Glass

Frequency	63Hz	125Hz	250Hz	500Hz	1000Hz	2000Hz	4000Hz	8000Hz
TL	25	27	33	36	38	39	51	54

In addition to meeting the minimum glazing thickness requirements given, the design of the façade mullions, perimeter seals and the installation of the façade shall not reduce the TL rating of the glazing assembly below the values nominated in the table above.

The glass suppliers should provide evidence that the systems proposed have been tested in a registered laboratory and comply with the minimum listed TL requirements. Also, the glazing installer should certify that the glass has been constructed and installed in a manner equivalent to the tested samples.

3.4 ROOF / CEILING

The roof is comprised of concrete elements and will not require any additional acoustic treatment.

4. TRAIN & VEHICLE VIBRATION ASSESSMENT

Trains and vehicles induce ground born vibration that is transmitted through the subsoil. This vibration can be perceptible close to railways and major roads, both as tactile vibration and as structure borne noise.

4.1 VIBRATION CRITERIA

The Director General's Requirement number 8 for the Australian Hearing Hub Project states that:

> *"The EA shall address the issue of noise and vibration impact from nearby roads and railway and provide detail of how this will be managed through the design of the proposed building, in compliance with relevant Australian Standards and the Department's Interim Guidelines for Development near Rail Corridors and Busy Roads."*

Although the site is outside the assessable vibration assessment zones presented in the Department's Interim Guidelines for Development near Rail Corridors and Busy Roads, due to the sensitive nature of the daily operations of the proposed occupants, discrete structural vibrations within the development have been evaluated.

Section 3.6.3 of the Interim Guidelines for Development near Rail Corridors and Busy Roads states that:

> *"Vibration levels such as the intermittent vibration emitted by trains should comply with the criteria in Assessing Vibration: A Technical Guideline (DECC 2006)".*

Assessing Vibration: A Technical Guide 2006 assesses the annoyance of intermittent vibration by using the Vibration Dose Value (VDV). Alternatively the VDV may be estimated by the eVDV which is derived by a simpler calculation using an empirical factor. The VDV or eVDV is calculated for the two periods of the day being the "Daytime" (7am-10pm) and "Night time" (10pm-7am). The overall value is then compared to the levels in Table 1. As the Australian Hearing Hub will contain precision laboratories within tenancies, the development has been classed as a "*critical area*" in accordance with the Guideline, and as a result, is subject to the most stringent vibration criteria. For this project the aim to be below the "*Preferred Value*" presented in Table 3.

Table 3 - Acceptable Vibration Dose Values for Intermittent Vibration ($m/s^{1.75}$) in Critical Areas

Place	Period	Preferred Value	Maximum Value
Critical Areas	Day (7am -10pm)	0.1	0.2
	Night (10pm -7am)	0.1	0.2

4.2 RAIL & VEHICLE VIBRATION MEASUREMENTS

Vibration measurements were taken conducted in line with the potentially worst affected north-eastern façade. The attended measurements were carried out from 6:00am to 9:00am on 16 March 2010 and 20 April 2010 between 6:00pm and 8:00pm.

A Svan 912 AE Analyser was used for the vibration measurements. The analyser was connected to a SV08 four channel input module fitted with a Dytran triaxial accelerometer.

Measurements were undertaken at the location set out in Figure 1.

4.2.1 Measurement Results: Vibration Dose Values

The maximum train passby ground vibration acceleration, the typical passby period and the estimated number of train passbys coupled with vehicle vibration were used to calculate the overall eVDV values for each period of the day. The results are presented in Table 4.

eVDV values were determined on the assumption that there will be one train every three minutes during the daytime and every five minutes during the night period. The VDV per train used in the eVDV calculation was determined by using the highest measured vibration level during a passby.

Table 4 - Vibration Dose Values

Test Location	Time Period	Calculated eVDV $m/s^{1.75}$	Criteria eVDV $m/s^{1.75}$	Complies
Critical Areas	Day (7am -10pm)	0.083	0.1	Yes
	Night (10pm -7am)	0.064	0.1	Yes

In the event the future train and vehicle use increases, say by 10%, predicted eVDV will not increase significantly (no more than approximately 0.01 more than the levels predicted in the table above) and will not impact any recommended vibration isolation treatments.

4.3 RECOMMENDATIONS

The results of the vibration investigation indicate that internal Vibration Dose Values will comply with project requirements without treatment.

5. NOISE EMISSION OBJECTIVES

5.1 BACKGROUND NOISE MEASUREMENTS

Background noise measurements were conducted in order to characterise the existing acoustic environment. The measurement location selected is illustrated in Figure 1. The location was selected as being representative of the existing acoustic environment currently experience by the nearest potentially affected residential receivers in the absence of noise generated by the proposed development.

Unattended noise monitoring was conducted during the period of 14 and 22 April 2010.

Ambient noise levels were monitored using an Acoustic Research Laboratories noise logger. The monitor would continuously measures noise levels and every 15 minutes stores statistical data within memory. The stored data was downloaded at the end of the measurement period. The monitor was calibrated before and after the measurement using a Rion NC-73 calibrator. No significant drift was recorded.

The monitored noise levels are given in Appendix 1. Measured background noise levels are presented below.

Table 5 - Representative Background Noise Levels at Receivers Surrounding the Proposed Development

Time Period	Measured Ambient Noise Levels dB(A) L_{A90}
Day (7am – 6pm)	51*
Evening (6pm – 10pm)	47
Night (10pm-7am)	39

*This noise level has been determined using noise levels obtained that are unaffected by construction noise from the surrounding sites (Cochlear and The Learning & Research Centre).

5.2 NOISE EMISSION LIMITS

In the absence of criteria within City of Ryde Council's Development Control Plan, in this assessment we have adopted the Department of Environment and Climate Change (DECC) New South Wales Industrial Noise Policy, as it is an up to date tool for the assessment and control of noise from commercial premises. Furthermore, the policy sets out a process to assess noise impact, potential noise mitigation strategies and describes a procedure for predicting, assessing and measuring noise.

This assessment also uses the EPA *"Environmental Criteria for Road Traffic Noise (1999)"* guideline for the purpose of assessing noise emissions from vehicle movements on public roads arriving and departing from the proposed development.

5.3 INDUSTRIAL NOISE POLICY OBJECTIVES/GUIDELINES

The DECC NSW Industrial Noise Policy provides guidelines for the assessment of noise impacts from industrial and commercial/retail premises. The recommended assessment objectives vary depending on the nearest potentially affected receivers, the time of day and the type of noise source. The DECC

NSW Industrial Noise Policy has two requirements that must both be satisfied; that is, an intrusiveness criterion and an amenity criterion.

5.3.1 Intrusiveness Criterion

The guideline is intended to limit the audibility of noise emissions, and requires that noise emissions measured using the L_{eq} descriptor not exceed the existing background noise level by more than 5 dB(A) Where applicable, the intrusive noise level should be penalised *(increased)* to account for any annoying characteristics such as tonality.

5.3.2 Amenity Criterion

The guideline is intended to limit the absolute noise level from all noise sources to a level that is consistent with the general environment.

The DECC NSW Industrial Noise Policy sets out acceptable noise levels for various localities. Table 2.1 titled *"Amenity Criteria"* on page 16 of the Policy designates four categories to distinguish different residential areas. They are rural, suburban, urban and urban/industrial interface. The DECC NSW Industrial Noise Policy also includes recommended noise levels for other land uses such as commercial and industrial premises. The DECC NSW Industrial Noise Policy states that residential receivers such as those neighbouring the proposed development, by virtue of their location and surroundings are classified such that the suburban amenity criterion is applied.

Table 6 presents the amenity criteria applicable to the nearest potentially affected residential receivers. The receiver type utilised against the indicative noise amenity area is defined by the suburban criteria.

Table 6 – DECC Recommended Acceptable Noise Levels for Nearest Potentially Affected Residential Receivers

Time of Day	Recommended Acceptable Noise Level dB(A) L_{Aeq}	Recommended Maximum Noise Level dB(A) L_{Aeq}
Day (7am to 6pm)	55	60
Evening (6pm to 10pm)	45	50
Night (10pm to 7am)	40	45

5.4 TRAFFIC GENERATION

5.4.1 Environmental Criteria for Road and Traffic Noise

For land use developments with the potential to create additional traffic on local roads the development should comply with the requirements detailed in the EPA *"Environmental Criteria for Road and Traffic Noise - 1999"*. Criteria applicable to the development are detailed below. It is noted that under this policy, all surrounding roadways are deemed to be local roads. If existing noise levels exceed those in Table 7, a 2dB increase in noise is allowed.

Table 7 - Criteria for Traffic Noise for New Developments

Location	Recommended Traffic Noise Level	
	Day (7am to 10pm)	Night (10pm to 7am)
Local Roads	55dB(A)$L_{Aeq(1hr)}$	50dB(A)$L_{Aeq(1hr)}$

5.5 SUMMARY OF APPLICABLE ASSESSMENT CRITERIA

The intrusiveness and amenity criteria for this project have been determined using the guidelines presented in the DECC NSW Industrial Noise Policy and the unattended noise monitoring data. These are summarised below.

5.5.1 Day Time

Table 8 presents the measured L_{A90} background noise levels, and the assessment criteria based on the suburban interface criteria. The day period applies between 7am to 6pm Monday to Saturday; and 8am to 6pm Sundays and public holidays.

Table 8 – Day Time Period Criteria

Location	Measured L_{A90} Noise Level dB(A)	Intrusiveness Criterion dB(A) $L_{Aeq(15min)}$	Amenity Criterion dB(A) $L_{Aeq(Daytime)}$
Residential Receivers	51	56	55

Table 8 indicates that the amenity noise level criterion is more stringent than the intrusiveness criterion for the nearest potentially affected residential receivers. The amenity criterion is applied when noise events are steady throughout the four hour period. For intermittent events, the intrusiveness criterion is still subject to application.

5.5.2 Evening

Table 9 presents the measured L_{A90} background noise levels, and the assessment criteria based on the suburban interface criteria. The evening time period applies between 6pm to 10pm.

Table 9 – Evening Time Period Criteria

Location	Measured L_{A90} Noise Level dB(A)	Intrusiveness Criterion dB(A) $L_{Aeq(15min)}$	Amenity Criterion dB(A) $L_{Aeq(Evening)}$
Residential Receivers	47	52	45

Table 9 indicates that the amenity noise level criterion is more stringent than the intrusiveness criterion for the nearest potentially affected residential receivers. The amenity criterion is applied when noise events are steady throughout the four hour period. For intermittent events, the intrusiveness criterion is still subject to application.

5.5.3 Night Time

Table 10 presents the measured L_{A90} background noise levels, and the assessment criteria based on the suburban criteria. The evening time period applies between 10pm to 7am and 10pm to 8am Sundays and Public Holidays. In addition, an assessment of potential sleep arousal will be conducted.

Sleep Arousal - Figure B4 of the NSW EPA Environmental Criteria for Road Traffic Noise states that any short term event with an internal level below 55dB(A)L_{max} is unlikely to cause any sleep arousal and that one or two noise events per night with maximum internal levels of 65 -70 dB(A)L_{max} are unlikely to effect health or wellbeing significantly.

Table 10 – Night Time Period Criteria

Location	Measured L_{A90} Noise Level dB(A)	Intrusiveness Criterion dB(A) $L_{Aeq(15min)}$	Sleep Arousal Criterion (internal) dB(A) L_{Amax}	Amenity Criterion dB(A) $L_{Aeq(Night)}$
Residential Receivers	39	44	55	40

Table 10 indicates that the amenity noise level criterion is more stringent than the intrusiveness criterion for the nearest potentially affected residential receivers. The amenity criterion is applied when noise events are steady throughout the four hour period. For intermittent events, the intrusiveness criterion is still subject to application.

5.5.4 Assessment Criteria Summary

Table 11 presents a summary of the prevailing assessment criteria applicable to the subject site to the nearest potentially affected residential receivers as illustrated in Figure 1.

Table 11 – Noise Objectives

Location	Day Time Noise Objective dB(A) L_{Aeq}	Evening Time Noise Objective dB(A) L_{Aeq}	Night Time Noise Objective dB(A) L_{Aeq}	Sleep Arousal Objective (internal) dB(A) L_{Amax}
Residential Receivers	55*	45*	40*	55

* The amenity criterion is applied when noise events are steady throughout the four hour period. For intermittent events, the intrusiveness criterion is still subject to application.

Table 12 presents a summary of the criteria for vehicle movements created by the proposed development in accordance with requirements of the EPA *"Environmental Criteria for Road and Traffic Noise - 1999"*. It is noted that if the existing noise levels exceed those in Table 3, a 2dB increase in noise is allowed.

Table 12 - Criteria for Traffic Noise

Location	Recommended Traffic Noise Level	
	Day (7am to 10pm)	Night (10pm to 7am)
Macquarie Drive - (Local Road)	55dB(A)$L_{Aeq(1hr)}$	50dB(A)$L_{Aeq(1hr)}$
University Avenue - (Local Road)	55dB(A)$L_{Aeq(1hr)}$	50dB(A)$L_{Aeq(1hr)}$

5.6 PLANT NOISE AND VIBRATION – RECOMMENDED CO\NDITIONS

A detailed design for the services plant is not available at this stage. Noise emissions from all services plant to any adjacent properties should comply with the following requirements which from the City of Ryde Council's general conditions.

Condition 1. All noise emission from the mechanical plant shall comply with DECC NSW Industry Noise Policy requirements.

Condition 2. External noise levels at the property boundaries should not exceed the levels given in AS 1055.

AS 1055 nominates typical background noise levels that would occur, considering the general activities in the vicinity. Given the levels of road traffic and the existence of commercial activities in the area, the appropriate ambient noise category given in AS 1055 applying to the development would be R4. The corresponding night-time background noise levels for the R4 category are 45 dB(A) at night and 55 dB(A) during the day.

Condition 3. Use of the premises shall not create an offensive noise as defined in the Protection of the Environment Operations Act 1997.

Condition 4. Vibration from plant should not be perceptible within an adjacent property.

The required treatment in the form of enclosures, silencers, lined ducting, etc would be determined during the design process to meet the stated noise objectives.

Noise emissions compliance certification testing will be conducted during the occupation certificate stage of the project to certify compliance with the noise goals presented in Section 5.5.

6. CONCLUSION

This report presents our assessment of vibration impact on the Australian Hearing Hub from the Northern Railway corridor located to the northeast of the development and noise impact on the development from surrounding roadways.

Vibration impacts have been measured on site and assessed against all relevant statutory guidelines, and it has been found that the levels are in compliance with formulated criteria at all times without the addition of ameliorative treatment.

Noise impacts on the development have been assessed in accordance with the Director General's Requirement number 8 for the development. Provided the selected glazing system complies with the transmission loss presented in Section 3.3.1, the development will be in compliance with GBCA internal noise level requirements and as result, comply with the requirements of the Director General and other relevant statutory authorities.

Criteria for noise emissions from the operation of the Hearing Hub have been presented in this report and are to be adopted during the assessment of noise emissions from the development.

Report prepared by

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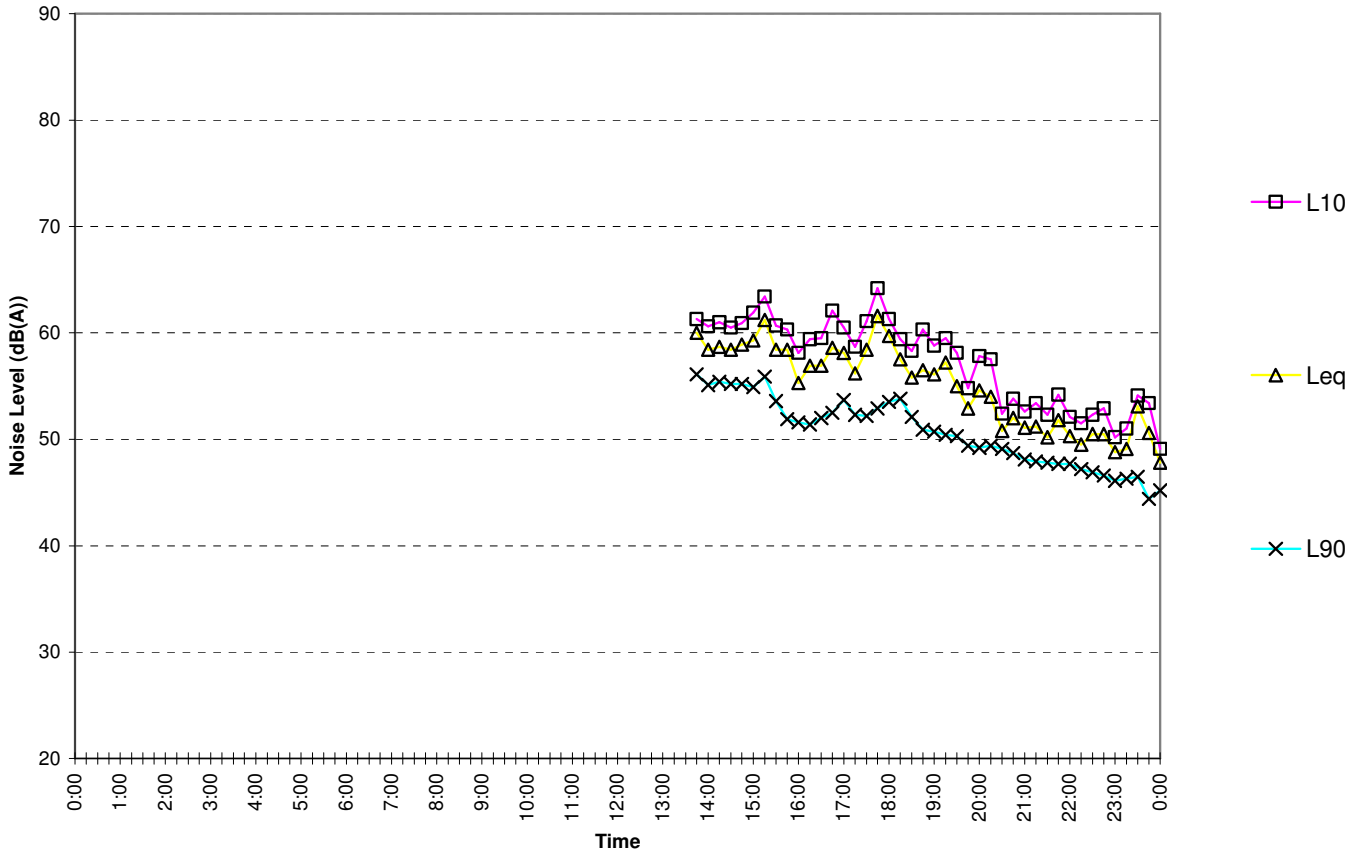
Tom Aubusson

APPENDIX ONE –

AMBIENT NOISE MONITORING

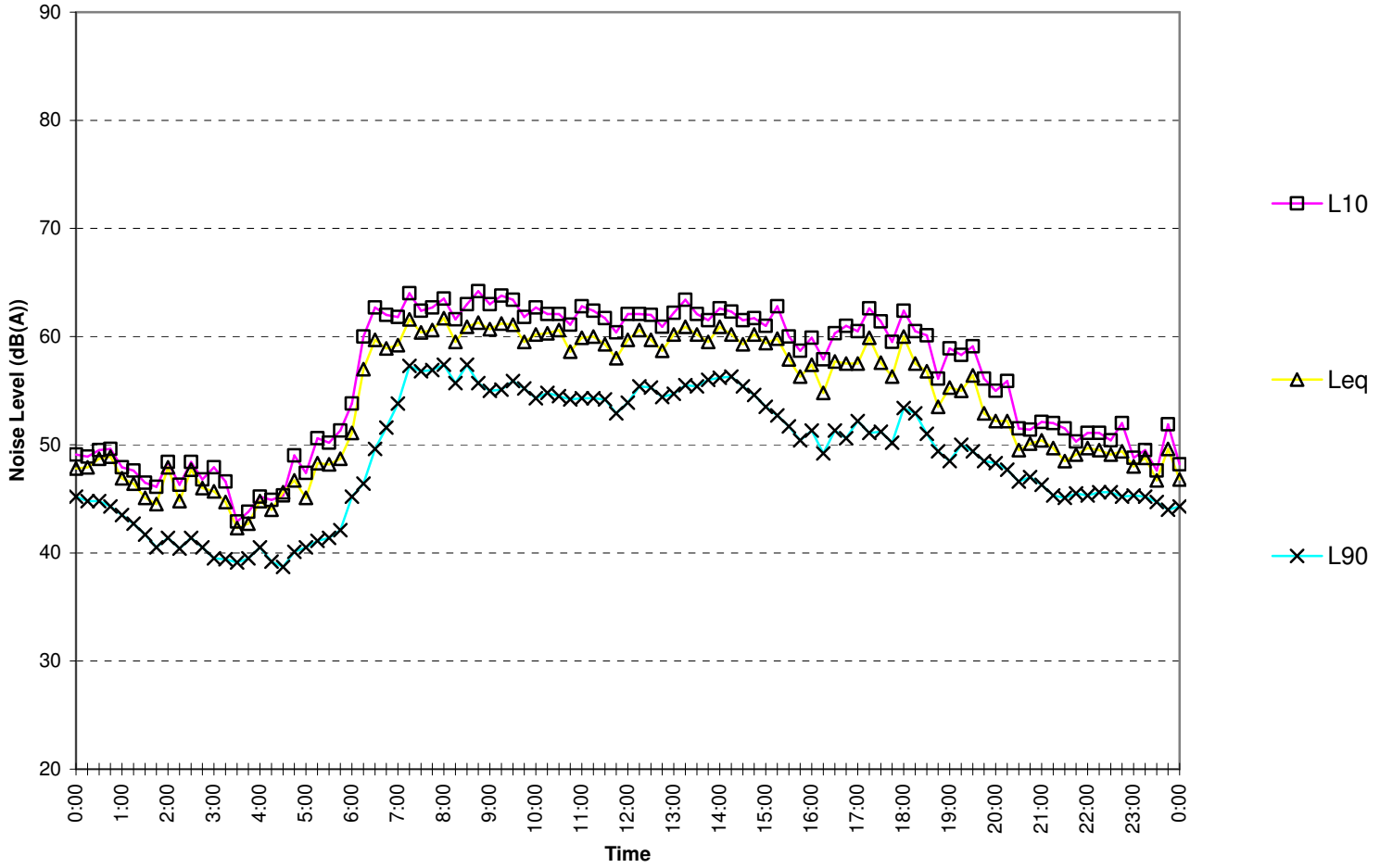
Macquarie Hearing Hub

Thursday April 15,2010



Macquarie Hearing Hub

Friday April 16,2010



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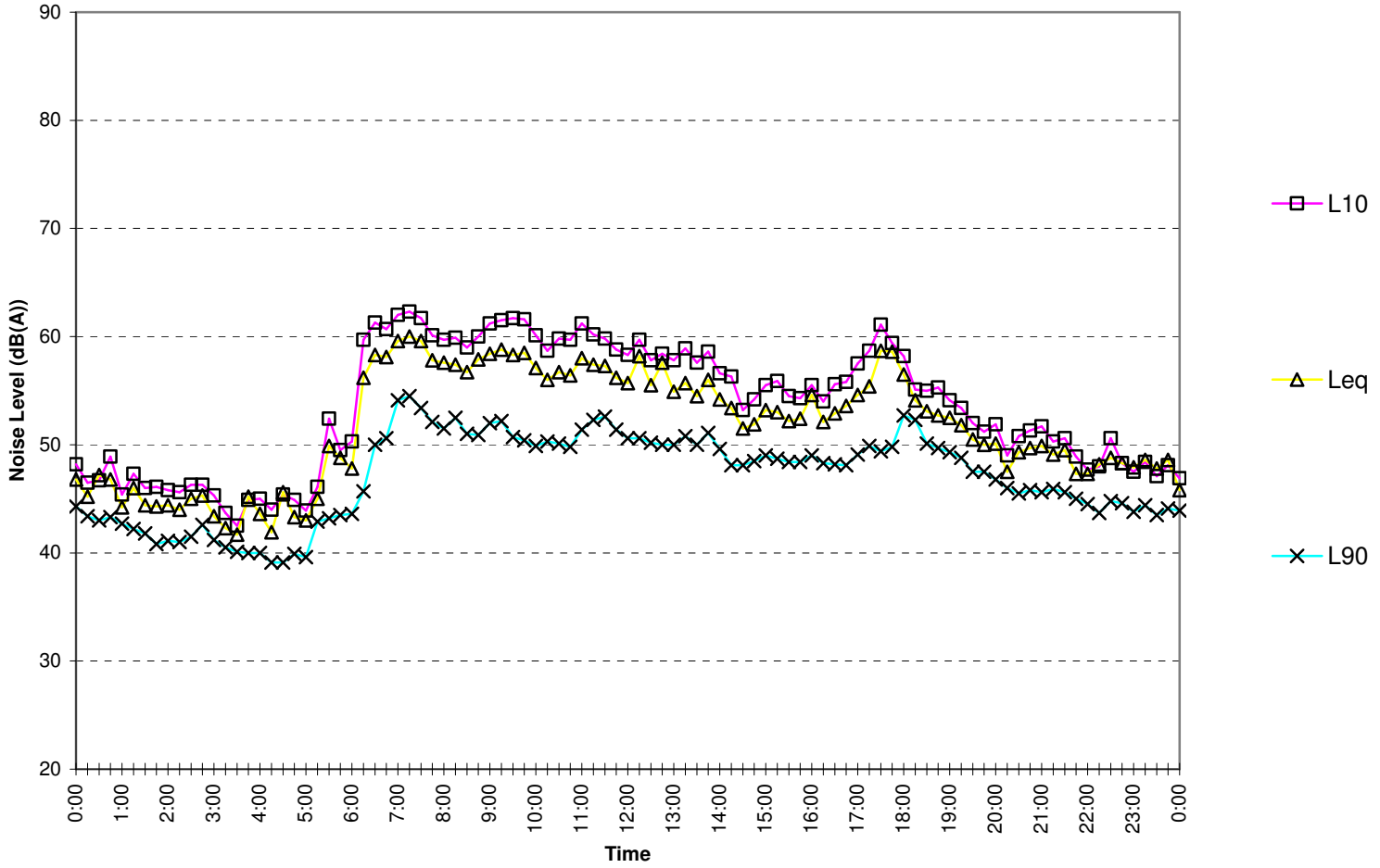
Saturday April 17,2010



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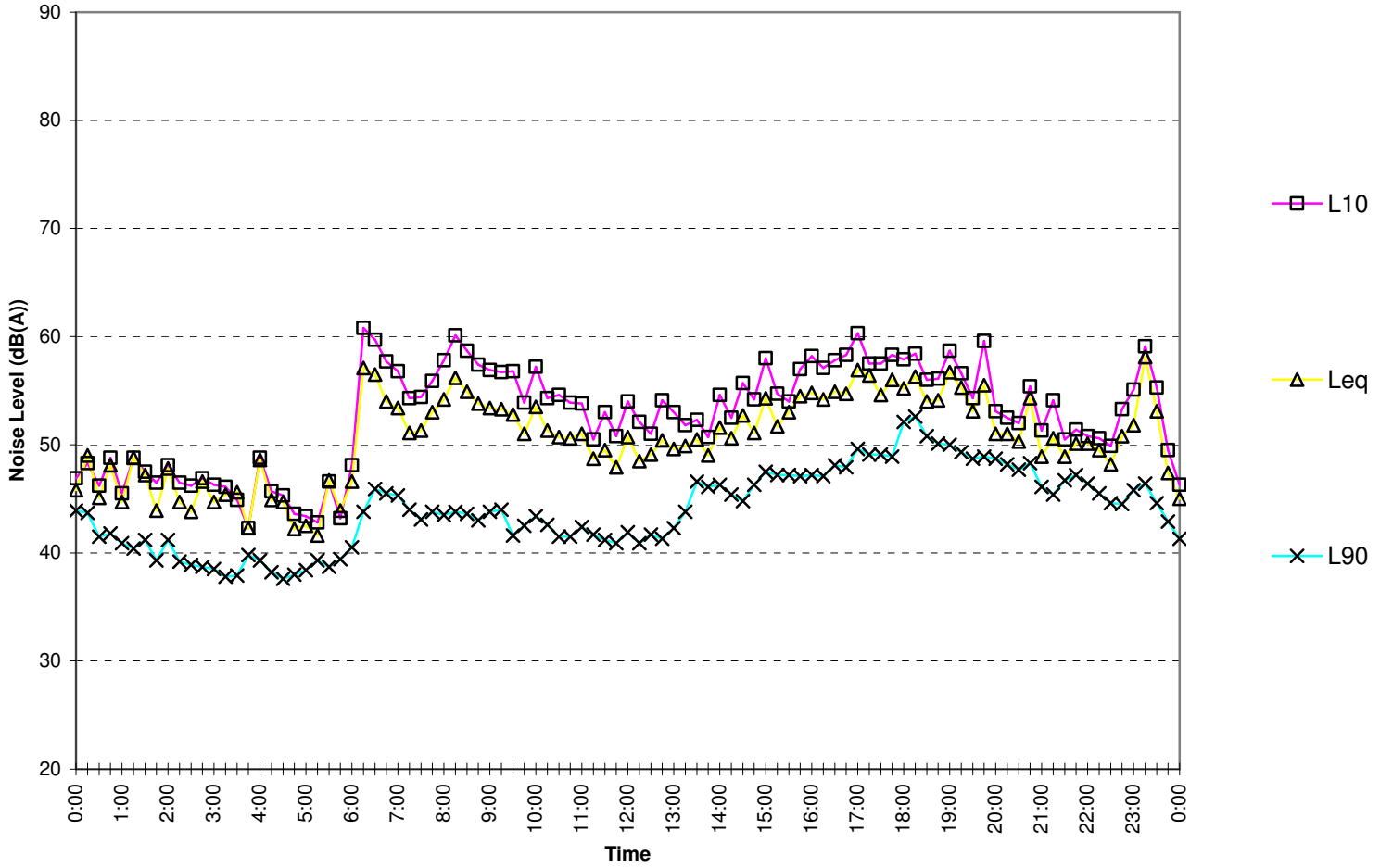

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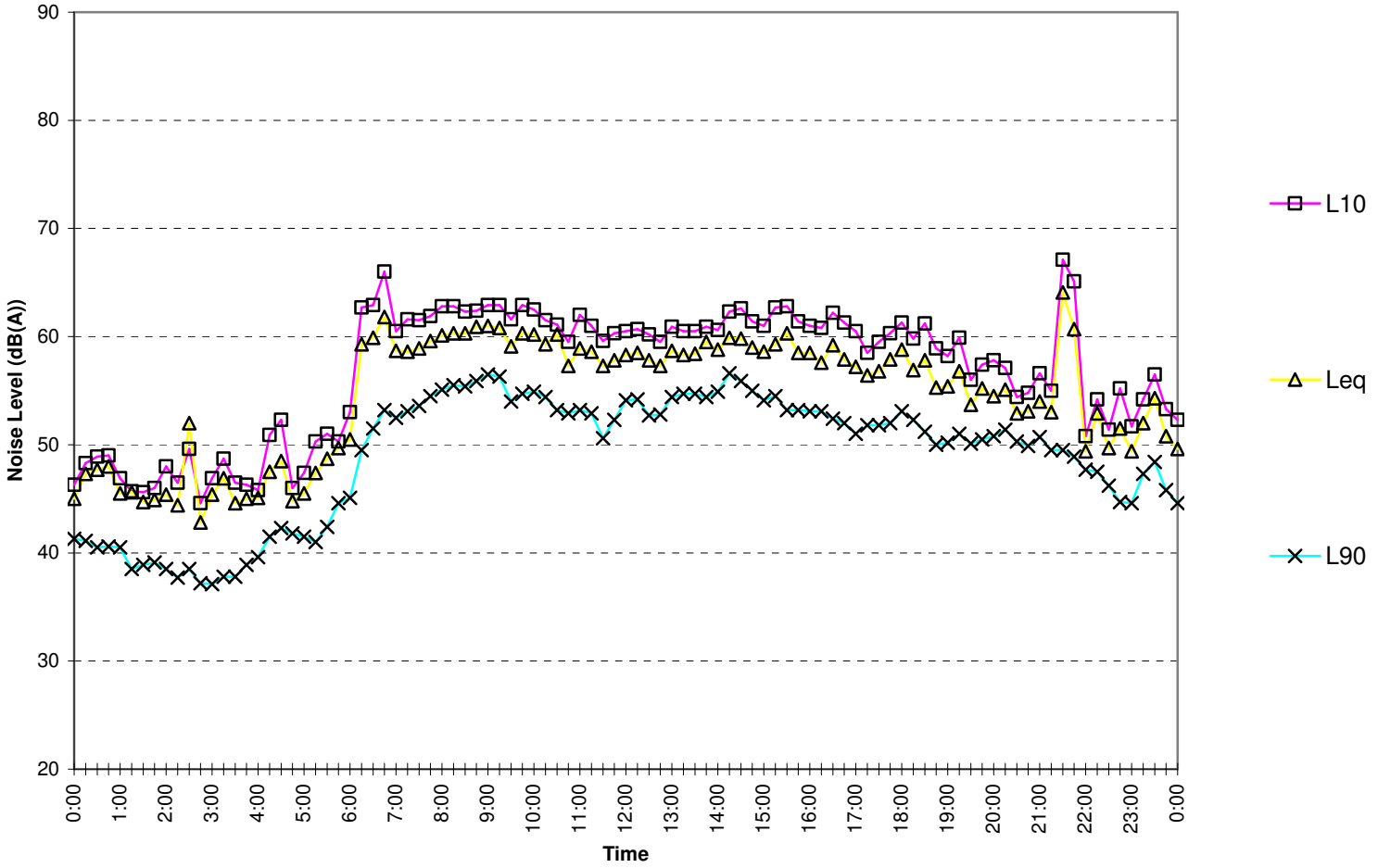

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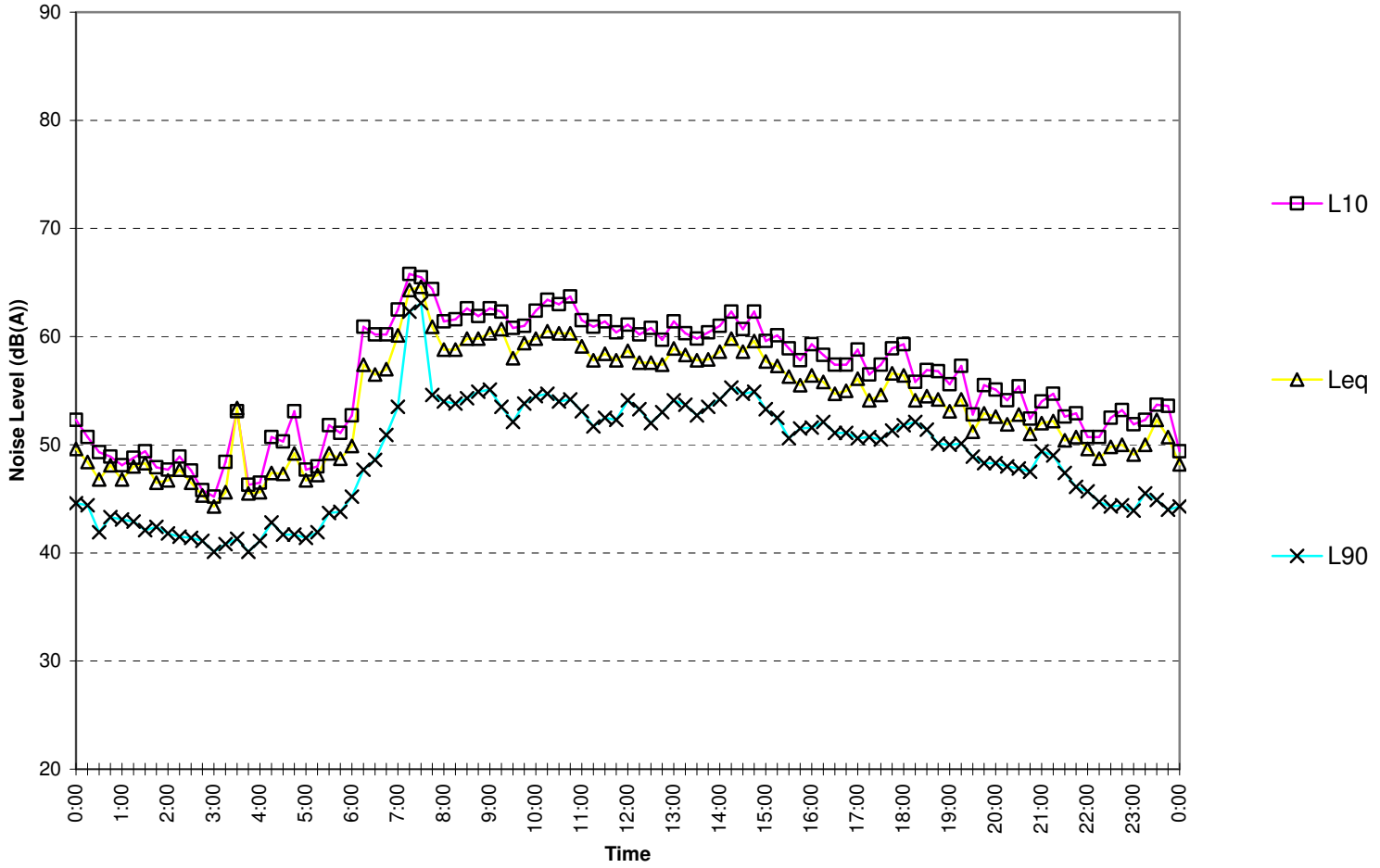

Macquarie Hearing Hub

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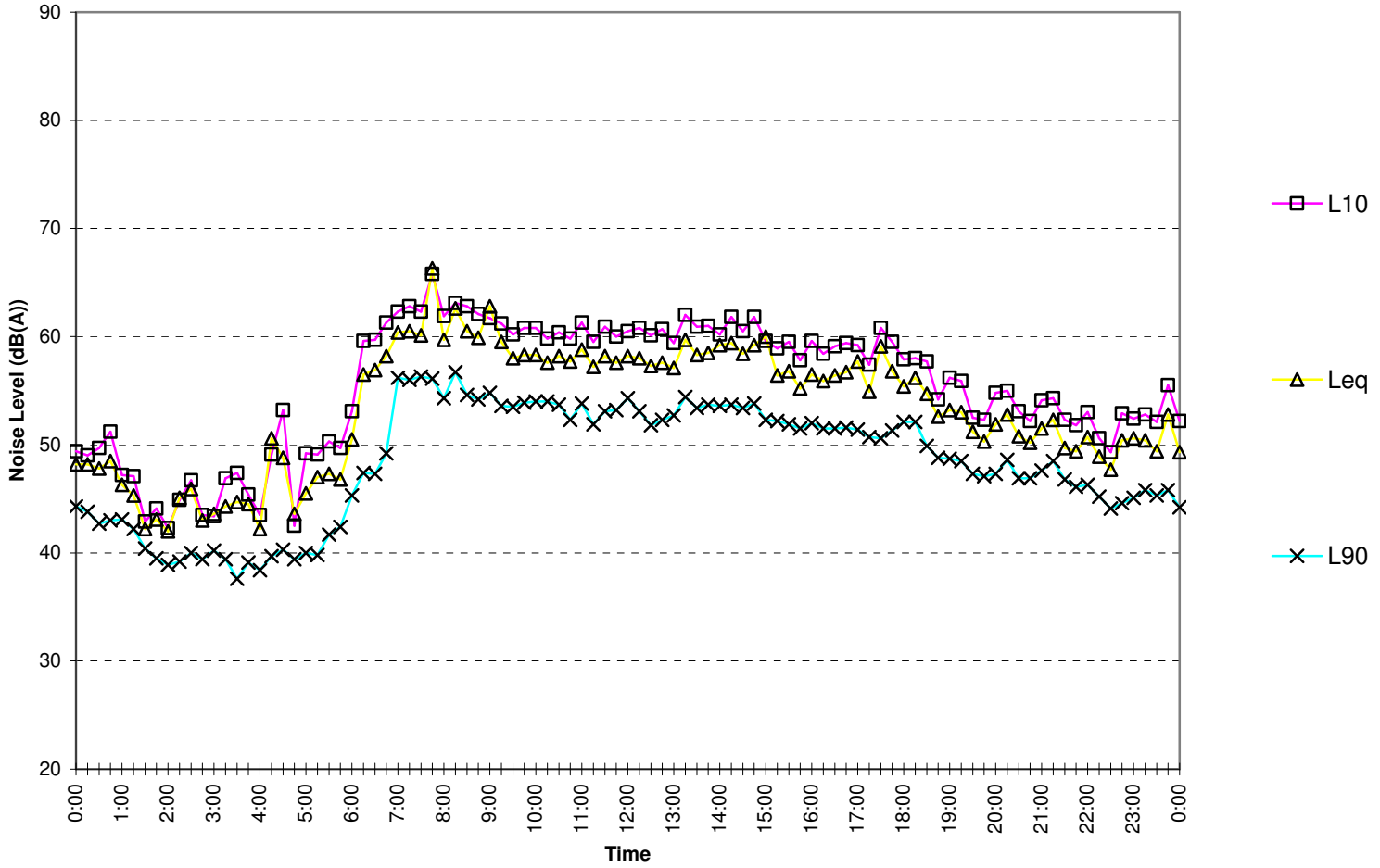

Macquarie Hearing Hub

Thursday April 22,2010