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Report: 2009725/0710A/R3/TA

Prepared for: Welles Thomas Pty Ltd

WELLES THOMAS PLAZA, CHATSWOOD

APPLICATION NUMBER (MP 09_0066)

TRAFFIC AND RAILWAY NOISE AND VIBRATION ASSESSMENT

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1. INTRODUCTION

This report presents our assessment of potential noise and vibration impact associated with the proposed mixed use development, Welles Thomas Plaza, located on Thomas Street and Albert Avenue, Chatswood.

The following have been addressed to determine the potential for adverse noise and vibration impacts:

- Potential impact associated with traffic movements generated by the development and other noise emitted by the proposed development on surrounding receivers;
- Potential impact associated with noise generated on the Pacific Highway and surrounding local streets; and
- Potential impact associated with noise and vibration generated on the North Shore Railway corridor.

This assessment has been conducted as required by the Director General's Requirement number 1 for Application Number (MP 09_0066).

The assessment has been based on noise and vibration levels generated by train movements on the North Shore Train Line which runs adjacent to the east of the site, and traffic noise from the Pacific Highway, Thomas Street and Albert Avenue.

Noise and vibration results have been used to predict internal noise levels within the development. If necessary, appropriate indicative noise/vibration attenuation treatments will be recommended to prevent excessive impacts on residents.

This report is based on architectural plans A-0100 – A-0132 by PTW Architects dated 10 September 2009.

2. SITE DESCRIPTION & PROPOSED DEVELOPMENT

The subject site is located on Thomas Street and Albert Avenue, Chatswood and currently operates as a car park. Approximately 40 metres to the west of the site lies the Pacific Highway, which carries high volumes of traffic. The development is shielded from the Pacific Highway by commercial and retail developments located between 763 - 773 Pacific Highway, Chatswood. Albert Avenue, which bounds the south of the site, carries medium volumes of traffic and mainly acts as a conduit for residents accessing local streets and as an access route to the Chatswood CBD. Thomas Street carries low volumes of traffic and is predominantly utilised by employees of local businesses accessing car parking. The site may potentially be impacted by noise generated by traffic on these roads.

Approximately 50 metres to the east of the site is the North Shore Train Line and could potentially be impacted by train noise and railway vibration from the adjacent railway line. The site is shielded from the railway corridor by commercial development located on Albert Avenue and Thomas Street.

The proposed development consists of:

- Construction of a 21 storey tower comprising 23657sqm of commercial and retail floorspace;
- A 29 storey tower comprising 208 apartments;
- A public urban plaza of approximately 1440sqm linking the two buildings; and
- Approximately 506 carparking spaces arranged over 5 basement levels.

Figure1 details the site and surrounding noise sources. Figure 2 details the proposed development.

Figure 1 – Site Map

Figure 2 – Proposed Development

3. TRAFFIC & TRAIN NOISE ASSESSMENT

3.1 ACOUSTIC CRITERIA

The Director General's Requirement number 12 for Application Number (MP 09_0066) states that:

> *"The EA shall address the issue of noise and vibration impact from the railway corridor and Pacific Highway and provide detail of how this will be managed and ameliorated through the deign of the 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."*

As the site is located within 60m of a passenger rail line it would be deemed as a Zone B site (refer to table 3.1 of the guidelines), and an acoustic assessment is recommended in accordance with SEPP Infrastructure criteria.

The Infrastructure SEPP sets out the following criteria for internal noise levels from airborne rail and traffic noise:

> *"For Clauses 87 (Rail) and 102 (Road):*
>
> *"If the development is for the purpose of a building for residential use, the consent authority must be satisfied that appropriate measures will be taken to ensure that the following LAeq levels are not exceeded:*
>
> *in any bedroom in the building : 35dB(A) at any time 10pm–7am*
>
> *anywhere else in the building (other than a garage, kitchen, bathroom or hallway): 40dB(A) at any time."*

For commercial and retail occupancies, recommended noise levels in AS2107-2000 "Recommended Design Sound Levels and Reverberation Times for Building Interiors" will be adopted. Although this standard is not strictly applicable to noise generated by rail corridors, the absence of any other standard or guideline relating to railway noise intrusion to commercial and retail premises means AS2107-2000 is used.

Pursuant to this, the following assessment criteria would apply to the proposed development for traffic and train noise intrusion.

Table 1 – Traffic & Train Noise Criteria for All Spaces

Space/Activity Type	Noise Level dB(A) L_{eq}
Bedrooms	35 (9 hour)
Living Areas	40 (15 hour)
Office Areas	45 (9 Hour)
Retail Areas	50 (9 Hour)

3.2 TRAFFIC NOISE MEASUREMENTS

Traffic noise measurements were obtained along the Pacific Highway (See Figure 1) during the afternoon peak of 23 September 2009 and on Thomas Street during the morning peak of 30 September 2009. A Norsonic 140 Sound Level Analyser was used for the noise measurements. The analyser was set to fast response and calibrated before and after the measurements using a Norsonic 1251 calibrator. No significant drift was noted.

Unattended noise monitoring was conducted on Albert Avenue during the period of 23 to 30 September 2009 using an Acoustic Research Laboratories Pty Ltd noise monitor. The monitor was programmed to store 15-minute statistical noise levels throughout the monitoring period. The noise monitors were calibrated at the beginning and the end of the measurement using a Rion NC-73 calibrator; no significant drift was detected. Measurements were taken on A-frequency weighting and fast time weighting.

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

The results of traffic noise monitoring at are detailed in the table below.

Table 2 - Measured Traffic Noise Levels

Location	Time of Day	Noise Level - L_{Aeq}
Pacific Highway – 8m from Curb	7:00am – 10:00pm	71dB(A) $L_{Aeq\ (15Hr)}$
	10:00pm – 7:00am	68*dB(A) $L_{Aeq\ (9Hr)}$
Thomas Street – 3m from Curb	7:00am – 10:00pm	60dB(A) $L_{Aeq\ (15Hr)}$
	10:00pm – 7:00am	55dB(A) $L_{Aeq\ (9Hr)}$
Albert Avenue – 8m from Curb	7:00am – 10:00pm	65dB(A) $L_{Aeq\ (15Hr)}$
	10:00pm – 7:00am	60dB(A) $L_{Aeq\ (9Hr)}$

*The 9hr (night) noise level was determined based on measurements conducted on site and unattended noise monitoring conducted on the carriageway at 210 - 216 Pacific Highway, Lindfield.

3.3 TRAIN MEASUREMENTS

Measurements were performed generally in accordance with the Australian Standard AS 1055 - "Description and measurement of environmental noise - General Procedures". Rail noise measurements were conducted in line with the future proposed eastern façade which is the potentially worst affected façade nearest to the railway lines.

Unattended noise monitoring was conducted during the period of 23 and 30 September 2009. Train noise levels were monitored using an Acoustic Research Laboratories noise logger. The monitor 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.

3.3.1 Measured Noise Levels

The external noise levels from measurements conducted on site are detailed in Table 3 below. These noise levels were influenced by traffic noise generated on Albert Street and are conservative representations of actual train noise.

Table 3 –External Noise Levels

Location	Day dB(A) $L_{eq,15hr}$	Night dB(A) $L_{eq,9hr}$
Eastern Façade	65	60

4. EVALUATION OF NOISE INTRUSION

Internal noise levels will primarily be as a result of noise transfer through the windows and doors and roof, as these are relatively light building elements that offer less resistance to the transmission of sound. All external walls are proposed to be heavy masonry elements that will not require upgrading.

The predicted noise levels through the windows, doors and roof are discussed below. The predicted noise levels have 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 rooms and the noise reduction performance of the building elements.

Calculations were performed taking into account the orientation of windows, 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.

Table 4 – Residential Glazing

Facade	Room	Glazing requirements
North (Thomas St)	Bedrooms	Medium to heavy weight single glazing with acoustic seals
	Living Rooms	Light to medium weight single glazing with acoustic seals
South (Albert Ave)	Bedrooms	Medium to heavy weight single glazing with acoustic seals
	Living Rooms	Light to medium weight single glazing with acoustic seals
East (Rail Corridor)	Bedrooms	Medium to heavy weight single glazing with acoustic seals
	Living Rooms	Light to medium weight single glazing with acoustic seals
West (Pacific Highway)	Bedrooms	Medium to heavy weight single glazing with acoustic seals
	Living Rooms	Light to medium weight single glazing with acoustic seals

Table 5 – Commercial/Retail Glazing

Facade	Area	Glazing requirements
All	Commercial / Retail	6mm / 12mm air gap / 6mm

The glazing thicknesses recommended are those 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.

Noise intrusion through the masonry walls will be negligible and will not contribute to internal noise levels. Similarly, noise intrusion through the concrete slab roof construction will not be significant.

4.1 MECHANICAL VENTILATION

As internal levels cannot be achieved with windows open it is required that an alternative outside air supply system or air conditioning be installed to meet AS 1668.2 requirements. Any mechanical ventilation system that is installed should be acoustically designed such that the acoustic performance of the recommended constructions are not reduced by any duct or pipe penetrating the wall/ceiling/roof. Noise emitted to the property boundaries by any ventilation system shall comply with DECCW Guidelines.

5. TRAFFIC NOISE GENERATED BY THE DEVELOPMENT

All traffic associated with the basement car park will enter from Albert Avenue. Potential noise impacts from traffic movements generated by the development on public roads have been assessed for properties located to the south of the site. The assessment is based on the traffic data detailed in the Assessment of Traffic and Parking Implications Report, conducted by Transport and Traffic Planning Associates dated October 2009.

Table 5 – Noise Associated with Traffic Generation

Location	% Increase In Traffic	Increase in Noise Level dB(A)
Albert Avenue	23%	Less than 1 dB(A)
Pacific Highway	3%	Less than 1 dB(A)

The investigation indicates that there will not generate a perceptible increase in noise from the predicted increase in traffic flows around the site.

6. RAILWAY VIBRATION

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

6.1 VIBRATION CRITERIA

The Director General's Requirement number 12 for Concept Application (MP 09_0066) states that:

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

As the site is located within 60m of a passenger rail line is deemed to require an acoustic assessment (refer to table 3.2 of the guidelines).

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 presented in Table 6. For this project the aim will be for a low probability of adverse comment.

Table 6 - Vibration Dose Values ($m/s^{1.75}$) above which various degrees of adverse comment may be expected in residential buildings.

Place	Low Probability of adverse comment	Adverse comment possible	Adverse comment probable
Residential buildings 15hr day	0.2 to 0.4	0.4 to 0.8	0.8 to 1.6
Residential buildings 9hr night	0.13	0.26	0.51
Commercial buildings 15hr day	0.4	0.8	1.6
Commercial buildings 9hr night	0.4	0.8	1.6

Section 3.6.2 of the Interim Guidelines for Development near Rail Corridors and Busy Roads states that:

> *"Where buildings are constructed over or adjacent to land over tunnels, ground borne noise may be present without the normal masking effect of airborne noise. In such cases, residential buildings should be designed so that the 95th percentile of train pass-bys complies with a ground borne LAmax noise limit of 40dBA (daytime) or 35dBA (night-time) measured using the "slow" response time setting on a sound level meter.*
>
> *The Interim Guidelines for the Assessment of Noise from Rail Infrastructure Projects (DECC 2007) provides further guidance on this issue."*

Vibration generated by train passbys adjacent to the proposed development will potentially generate structure born vibration which will be radiated of internal building elements such as walls, floors and ceiling as audible noise. Internal noise levels associated with structure born noise generated from train passbys should comply with Table 3 of the Interim Guidelines for the Assessment of Noise from Rail Infrastructure Projects (DECC 2007) which sets out internal noise goals for structure borne noise. These objectives are detailed in Table 7.

There are no documented rail structure borne noise level objectives for commercial buildings. For this reason, the rail structure borne noise level objectives will be based on the noise level recommended by Interim Guidelines for the Assessment of Noise from Rail Infrastructure Projects (DECC 2007) for residential buildings. The residential requirement is that the resulting structure borne noise level should not exceed 40 dB(A) L_{max}. Assuming this has been applied to limit loss of amenity in residential bedrooms, the corresponding difference in noise levels recommended in AS 2021 for these spaces will be used to adjust the bedroom level. AS 2021 recommends a noise level of 50 dB(A) L_{max} in sleeping areas, 65 dB(A) in generally office areas and 75 dB(A) in retail areas. Extrapolating this difference to railway induced noise gives a requirement of 55 dB(A) L_{max} in office areas and 65dB(A) L_{max} in retail ares. At this level, structure radiated noise levels may be audible but would not be excessively intrusive.

Table 7 - Internal Railway Noise Level Criteria

Location	dB(A) L_{MAX}
Sleeping Areas	35
Living	40
Office Areas	55
Retail Areas	65

Train vibration measurements conducted as part this assessment will be used to calculate internal noise levels generated from structure born vibration.

6.2 RAIL TRAFFIC VIBRATION MEASUREMENTS

Train vibration measurements were taken conducted in line with the potentially worst affected eastern façade. The attended measurements were carried out from 4:00pm to 5:00pm on 23 September 2009.

A Svan958 four–channel vibration meter and analyser fitted with a Dytran triaxial accelerometer was used for the vibration measurements.

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

6.2.1 Measurement Results: Vibration Dose Values

The maximum train passby ground vibration acceleration, the typical passby period (gained from both the noise and vibration measurements) and the estimated number of train passbys were used to calculate the overall eVDV values for each period of the day. The results are presented in Table 8.

eVDV values were determined on the assumption that there will be one train every 2 minutes during the daytime. The VDV per train used in the eVDV calculation was determined by using the highest measured vibration level during a passby.

Table 8 - Vibration Dose Values

Test Location	Time Period	Calculated eVDV $m/s^{1.75}$	Criteria eVDV $m/s^{1.75}$	Complies
Residential	Day (7am – 10pm)	0.04	0.2	Yes
	Night (10pm -7am)	0.03	0.13	Yes
Commercial	Day (7am – 10pm)	0.04	0.4	Yes
	Night (10pm -7am)	0.03	0.4	Yes

In the event the future train 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 recommended vibration isolation treatments.

6.3 STRUCTURE BORN NOISE MEASUREMENTS

Internal noise levels as a result of structure born noise have been calculated at a number of positions within the development. Noise levels have been determined based on on-site measurements of rail induced vibration.

Table 9 - Structure Born Vibration Levels

Level	Noise Level Criteria dB(A)L_{MAX}	Calculated/Measured Noise Level dB(A)L_{Max}	Complies
Ground (Office)	55	29	Yes
Level 1 (Retail)	65	26	Yes
Level 2 (Residential)	35	25	Yes

6.4 RECOMMENDATIONS

The results of the structure born vibration investigation indicate that internal structure borne noise levels will comply with project requirements without treatment.

7. CONCLUSION

This report presents our assessment of potential noise and vibration impact associated with the proposed mixed use development, Welles Thomas Plaza, located on Thomas Street and Albert Avenue, Chatswood.

- Noise generated by traffic movements associated with the development impacting on surrounding receivers has been assessed in accordance with the DECCW Environmental Criteria for Road Traffic Noise and has been found to be compliant at all times as there would be no perceptible change in traffic noise.
- Traffic noise impact on the development from surrounding streets has been assessed in accordance with Director General Requirement number 12, the State Environmental Planning Policy (Infrastructure) 2007 and AS2107-2000 "Recommended Design Sound Levels and Reverberation Times for Building Interiors" and will comply with internal noise goals at all times with the implementation of constructions detailed in Section 4.
- Noise and vibration generated on the North Shore Railway corridor has been assessed for its impact on the development in accordance with criteria presented in Director General Requirement number 12, the State Environmental Planning Policy (Infrastructure) 2007 and AS2107-2000 "Recommended Design Sound Levels and Reverberation Times for Building Interiors". It has been found that with the installation of the proposed constructions detailed in Section 4, noise levels will comply with these requirements.

As a result, noise and vibration impact associated with the proposed development will comply with the requirements of the Director General and other relevant statutory authorities.

Report prepared by

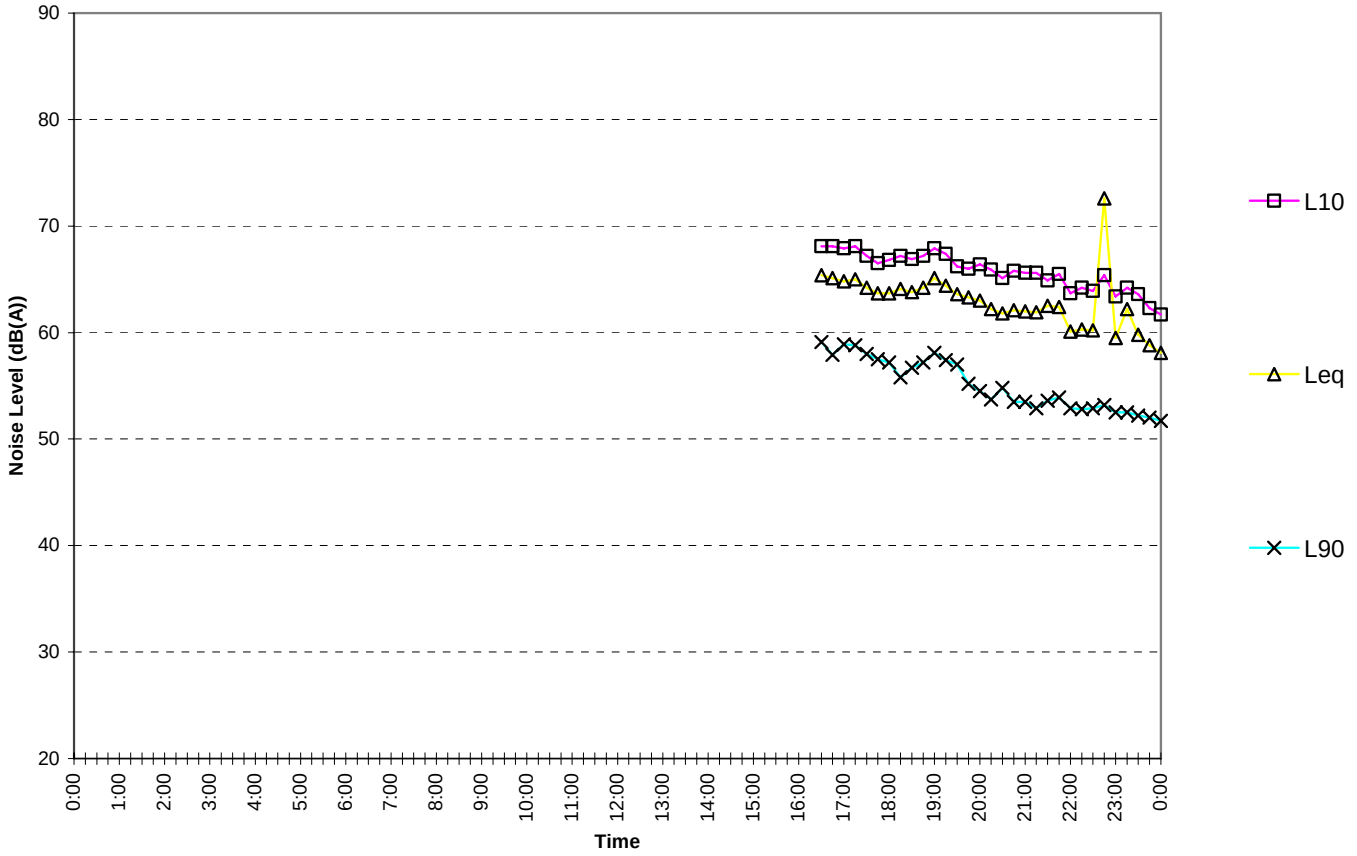
ACOUSTIC LOGIC CONSULTANCY PTY LTD
Tom Aubusson

APPENDIX ONE –

UNATTENDED NOISE MONITORING RESULTS

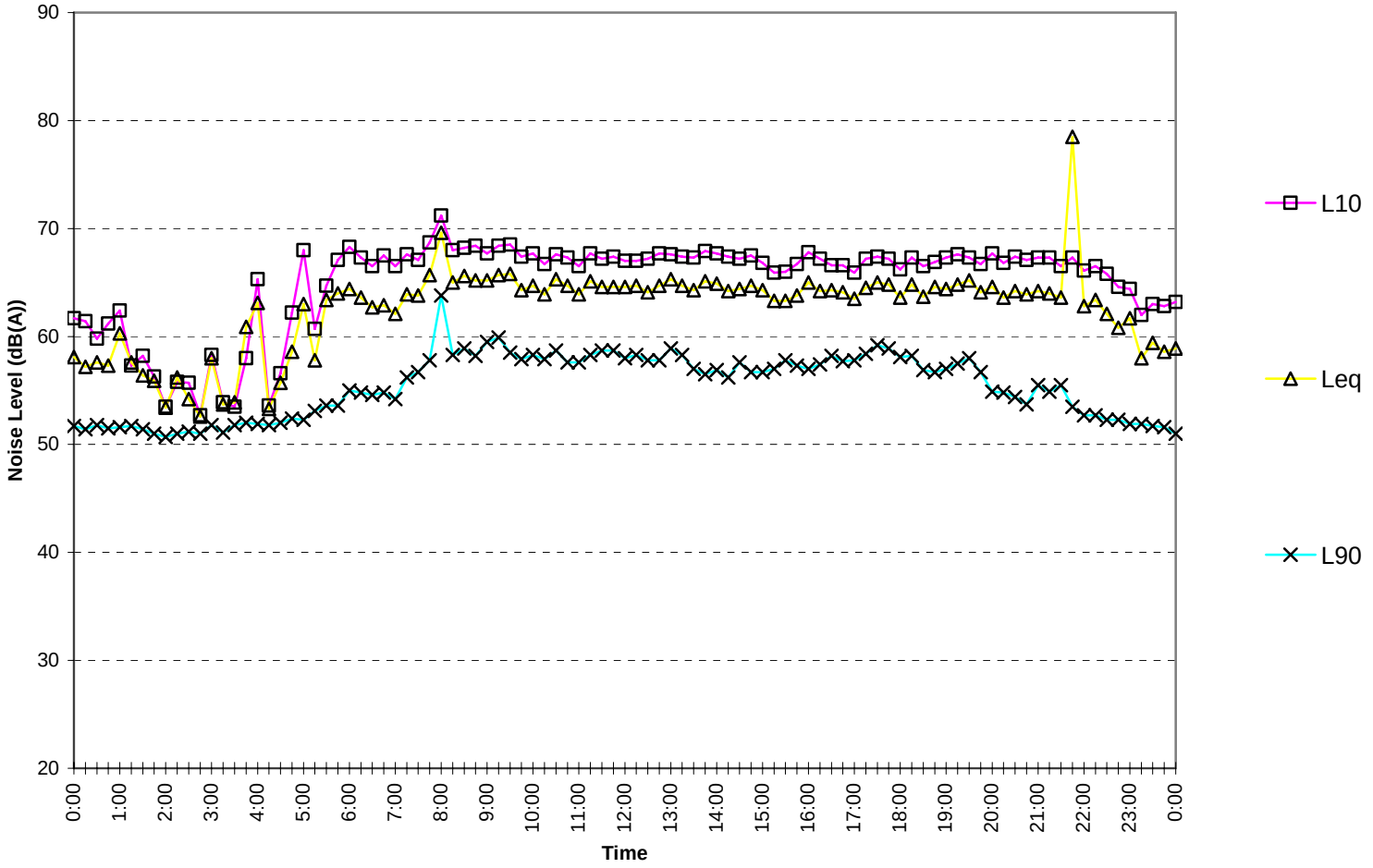
Welles Thomas Plaza

Wednesday September 23,2009



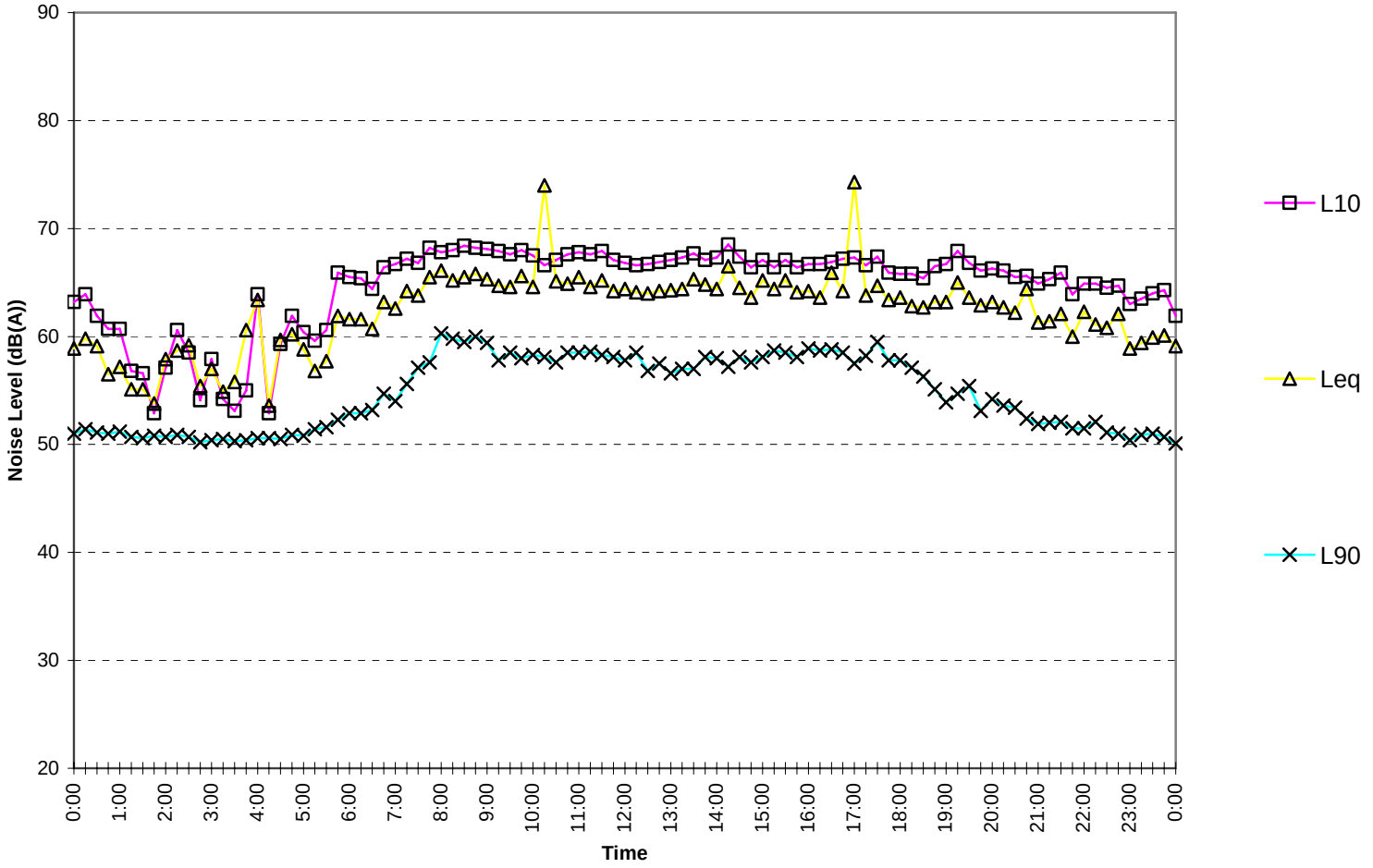
Welles Thomas Plaza

Thursday September 24,2009



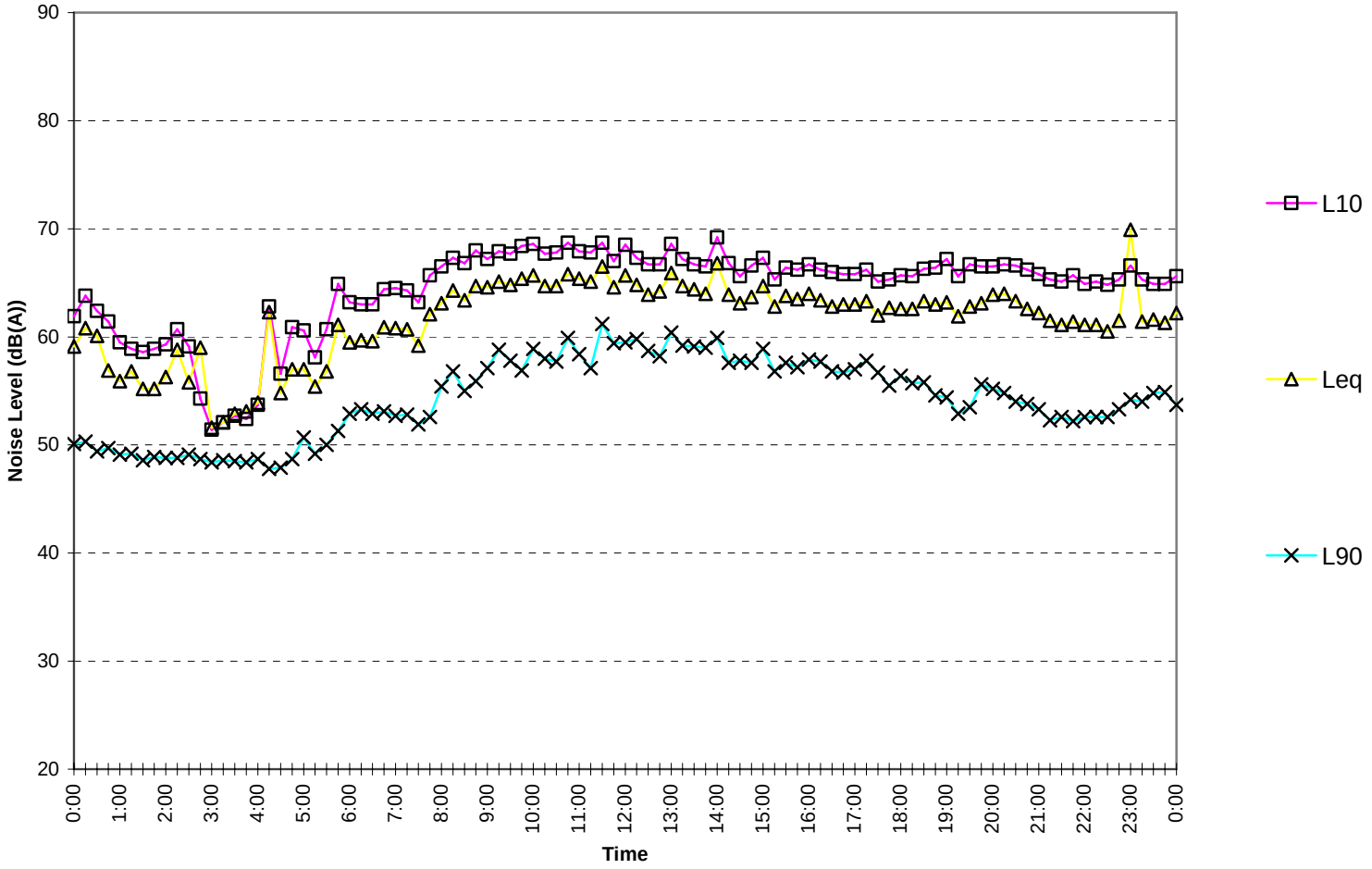
Welles Thomas Plaza

Friday September 25,2009



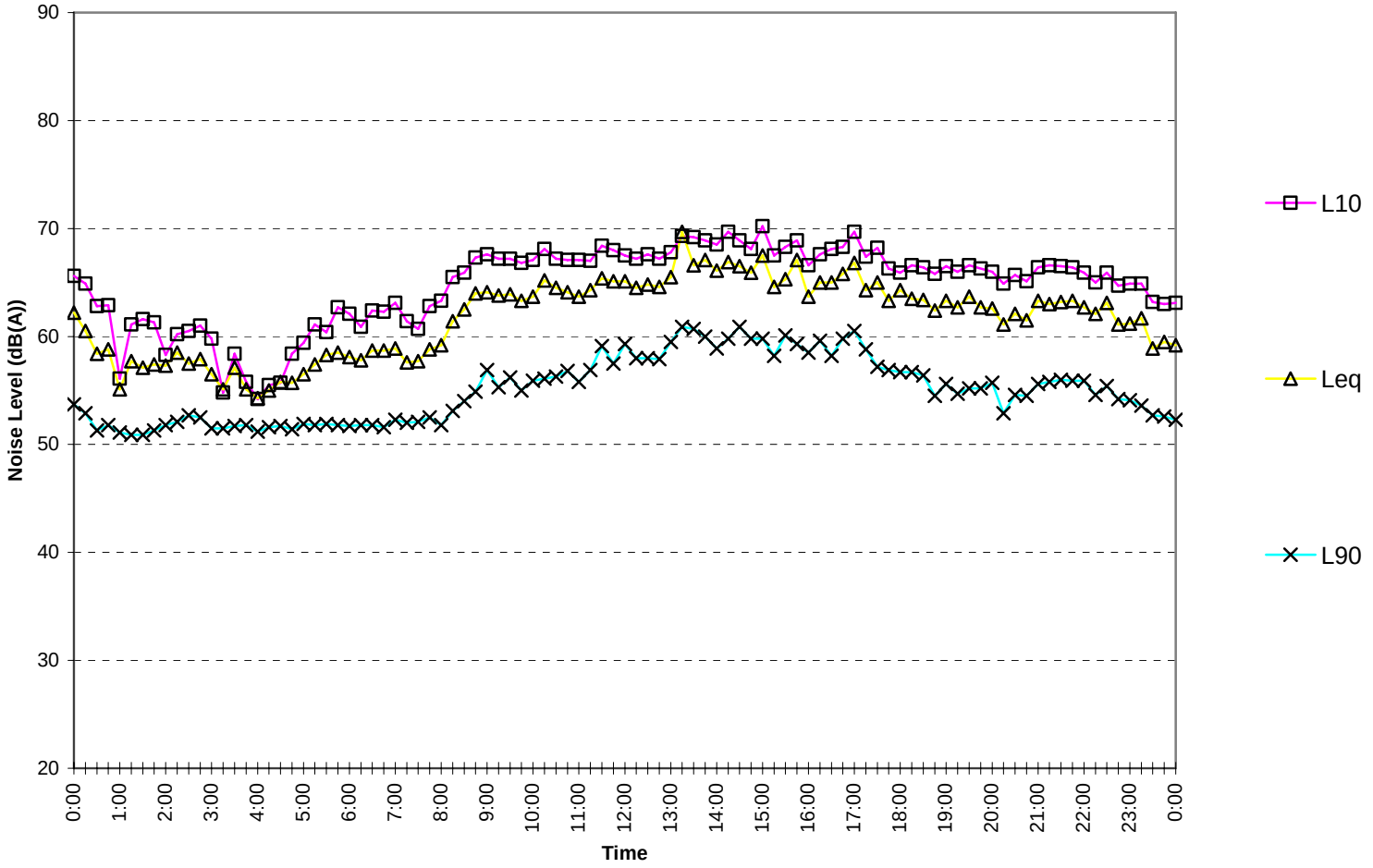
Welles Thomas Plaza

Saturday September 26,2009



Welles Thomas Plaza

Sunday September 27,2009

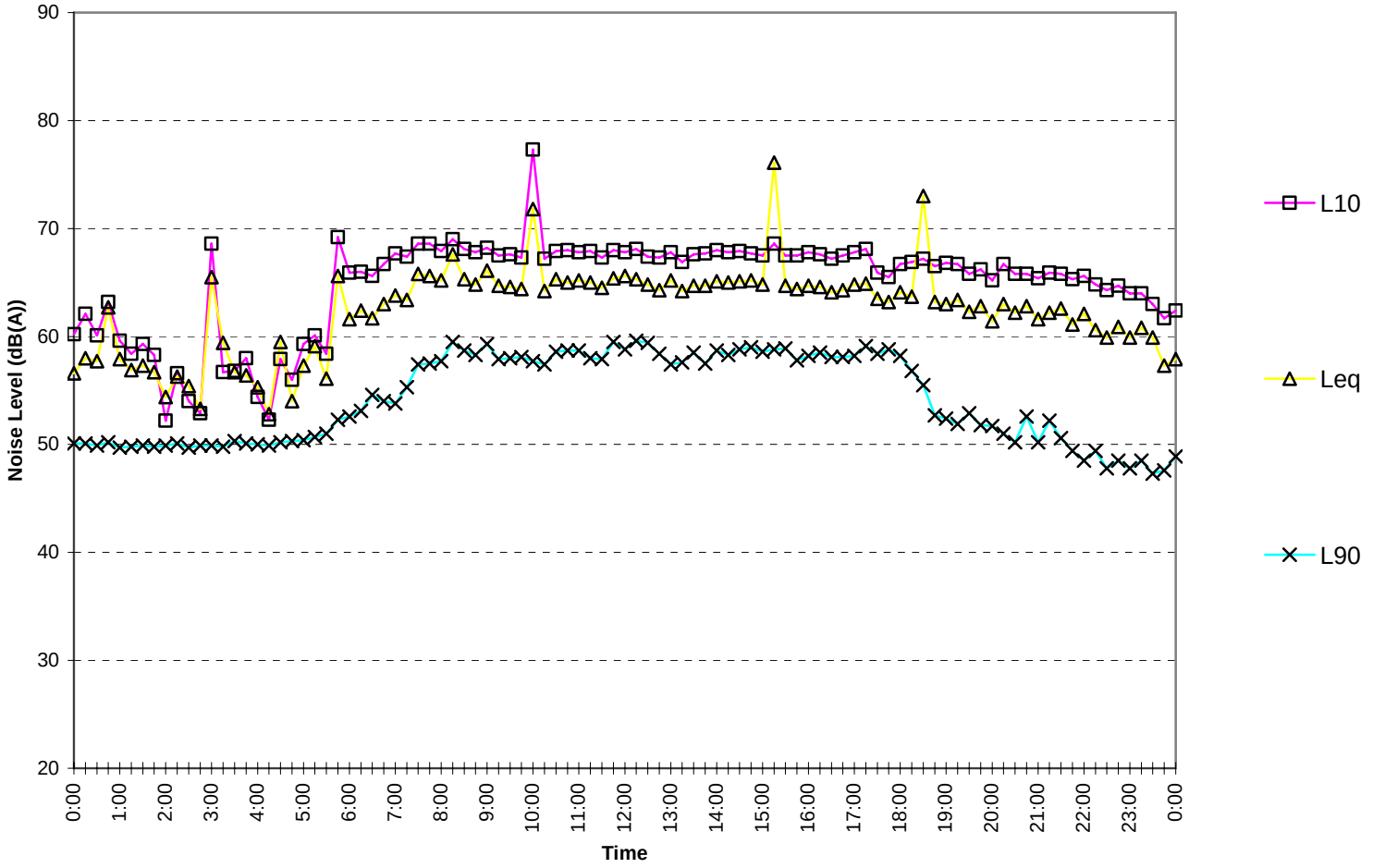


Welles Thomas Plaza

Monday September 28,2009

Welles Thomas Plaza

Tuesday September 29,2009



Welles Thomas Plaza

Wednesday September 30,2009