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IKEA TEMPE

ENVIRONMENTAL NOISE IMPACT ASSESSMENT

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Prepared for:

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DOCUMENT CONTROL

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1 INTRODUCTION

Renzo Tonin & Associates were engaged to carry out a noise impact assessment for the proposed IKEA development at Tempe.

During our previous work at this site in 2005 we conducted noise monitoring at nearby residential premises. We do not expect that noise levels have decreased since 2005 and therefore the previously monitored noise levels are used for this new assessment.

Noise emissions from the site are predicted and compared to the noise guidelines set out in the NSW Department of Environment and Climate Change's (DECC) "Industrial Noise Policy" (INP) and reference is made to the "Environmental Noise Control Manual" (ENCM). Noise from site generated traffic is assessed against the DECC's "Environmental Criteria for Road Traffic Noise".

In-principle noise mitigation measures are provided where required.

The work documented in this report was carried out in accordance with the Renzo Tonin & Associates Quality Assurance System, which is based on Australian Standard / NZS ISO 9001.

2 PROJECT DESCRIPTION

The proposed IKEA development includes a showroom, warehouse, loading dock and carpark. The site is bound by the Princes Highway to the east, Bellevue St to the north, a container storage area to the west and adjoining commercial premises to the south.

Potential noise emissions from the development impacting upon nearby residential premises include:

- Continuous noise from mechanical plant,
- Intermittent noise from the loading dock when in use,
- Intermittent noise from carpark activity, and
- Site generated traffic increasing noise levels on surrounding local roads,

The proposed hours of operation of the IKEA store are:

Table 1 - Proposed Hours of Operation

Day	Shopping Centre	Loading Dock
Monday – Wednesday and Friday - Sunday	9am – 7pm	24 hours
Thursday	9am - 9pm	24 hours

Inspection of the area surrounding the site identified the following residential locations as critical receivers potentially affected by either stationary noise or traffic noise emanating from the development;

1. Residences on the opposite side of Princes Highway. Residences are generally single storey and of masonry construction.
2. Four semi-attached residences on Bellevue Street. Single storey and masonry construction.

3 EXISTING ACOUSTIC ENVIRONMENT

3.1 Noise Monitoring Methodology

Noise monitoring was conducted to quantify the existing noise environment so that noise criteria for the development could be determined. Long-term noise monitoring was conducted between Friday 11th March and Friday 18th March 2005 to establish existing ambient and background noise levels.

Appendix C details the noise monitoring methodology and the graphical recorded output from long term noise monitoring is included in **Appendix D**.

3.2 Noise Monitoring Locations

Noise measurements are to be taken at the nearest or potentially most affected residential locations. Monitoring was conducted at 'Location L1' and 'Location L2' as described below and are shown on Figure 1 in Appendix B.

- **Location L1** **535 Princes Highway, Tempe.**

  Logger placed in the front yard beside the dwelling's north-facing facade, and in line with the front facade. Noise environment dominated by traffic noise from the Princes Highway, with intermittent noise from aircraft using Sydney Airport.

- **Location L2** **4 Bellevue Street, Tempe.**

  Logger placed in the front yard beside the dwelling's east-facing facade, and in line with the front facade. Noise environment dominated by traffic noise from both the Princes Highway and Bellevue Street, with intermittent noise of aircraft using Sydney Airport.

3.3 Existing Background, Ambient & Traffic Noise Levels

Existing ambient noise levels and road traffic-noise levels are presented in Table 2 and Table 3 below.

Table 2 presents the measured L_{eq} and L_{90} noise levels for the day, evening and night periods as defined in the DECC's INP.

- **Day** is defined as 7:00am to 6:00pm, Monday to Saturday and 8:00am to 6:00pm Sundays & Public Holidays.
- **Evening** is defined as 6:00pm to 10:00pm, Monday to Sunday & Public Holidays.

- **Night** is defined as 10:00pm to 7:00am, Monday to Saturday and 10:00pm to 8:00am Sundays & Public Holidays.

Table 2 - Measured Existing Background (L_{90}) & Ambient (L_{eq}) Noise Levels, dB(A)

Noise Monitoring Location		L_{90} Background Noise Levels			L_{eq} Ambient Noise Levels		
		Day	Evening	Night	Day	Evening	Night
L1	535 Princes Hwy, Tempe	63	56	46	74	72	70
L2	4 Bellevue St, Tempe	53	49	40	72	68	65

Notes: Day is defined as 7:00am to 6:00pm, Monday to Saturday; 8:00am to 6:00pm Sundays & Public Holidays.
Evening is defined as 6:00pm to 10:00pm, Monday to Sunday & Public Holidays.
Night is defined as 10:00pm to 7:00am, Monday to Saturday; 10:00pm to 8:00am Sundays & Public Holidays.

Traffic noise levels are assessed separately for daytime and nightime periods, defined by the DECC's 'Environmental Criteria for Road Traffic Noise' (ECRTN) as follows:

- **Day** is defined as 7:00am to 10:00pm;
- **Night** is defined as 10:00pm to 7:00am.

In order to assess existing traffic noise, $L_{Aeq(15hr)}$ and $L_{Aeq(9hr)}$ traffic noise descriptors were measured as suited for arterial roads and $L_{Aeq(1hr)}$ were measured as suited for collector roads.

The noise monitor was positioned outdoors in the open (ie away from building facades) at Locations L1 and L2. However, traffic noise measurements are required to be measured at 1m from the residential facade. Therefore, a facade correction has been applied to obtain the L_{eq} traffic noise levels presented in Table 3.

Table 3 - Measured Existing Road Traffic (L_{eq}) Noise Levels

Noise Monitoring Location		Road Traffic Noise Source	Distance from Road (m)	L_{eq} Traffic Noise Levels, dB(A)	
				Day	Night
L1	535 Princes Hwy, Tempe	Princes Hwy	7	LAeq,15hr = 76	LAeq,9hr = 73
L2	4 Bellevue St, Tempe	Bellevue St	10	LAeq,1hr = 59-77	LAeq,1hr = 45-78

Notes: Day is defined as 7:00am to 10:00pm; Night is defined as 10pm to 7am

4 ACOUSTIC CRITERIA

4.1 NSW DECC'S INP

Marrickville Council refers to DECC criteria for noise assessments of commercial / industrial premises. The DECC sets noise guidelines in its 'Industrial Noise Policy' (INP) which have been used for the purpose of this assessment.

The INP has two components:

- Controlling intrusive noise impacts in the short term for residences
- Maintaining noise level amenity for particular land uses for residences and other land uses.

4.1.1 Intrusive Noise

The INP recommends, in general, that the L_{Aeq} noise level from a newly-introduced source not exceed the background (L_{90}) noise level by more than 5dB(A). Regard must be given, however, to the extent of the existing background noise and whether such a level is appropriate for the specific development and land-use of the receiver area.

The intrusiveness of an industrial noise source may generally be considered acceptable if the L_{Aeq} (equivalent continuous A-weighted level of noise) from the source, measured over a 15 minute period, does not exceed the Rating Background Level (RBL) by more than 5dB(A). That is;

$$\mathbf{L_{Aeq,15min} \leq RBL + 5dB(A)}$$

Further, where the character of the noise in question is assessed as particularly annoying (ie if it contains certain characteristics such as tonality, impulsiveness, intermittency, irregularity or dominant low frequency content), then a correction is to be added to the measured value to penalize the noise for its potential increase in annoyance.

Noise emissions from the proposed development's operations are determined not to be particularly annoying in character at the nearest residential areas. Therefore, an annoyance penalty is not applicable to this noise impact assessment.

4.1.2 Protecting Noise Amenity

Section 2.2 of the DECC's INP provides guidelines to assist in the planning for noise controls. Table 2.1 recommends 'acceptable' and 'maximum' L_{Aeq} noise levels for different land uses. Where the existing noise level from industrial noise sources is close to the acceptable noise level, the noise level from any new sources must be controlled to preserve the amenity of an area.

Section 2.2.3 of the INP provides guidance for setting amenity criteria in a high traffic noise environment. Since traffic noise is the dominant noise source in the area, and since nosie

levels at residences nearby to the IKEA site have been measured to be more than 10dB above the INP 'acceptable' noise levels, the amenity nosie criteria can be set to 10dB below the measured L_{Aeq} for each period.

4.1.3 Industrial Noise Criteria

Based on the background and ambient noise monitoring carried out at the nearest affected residential locations, the DECC's industrial noise criteria are:

Table 4 - DECC's Industrial Noise Criteria, dB(A)

Location		Intrusiveness Criteria L_{Aeq},15min			Amenity Criteria[2] L_{Aeq},period		
		Day	Evening	Night	Day	Evening	Night
L1	535 Princes Hwy, Tempe[1]	63+5 = 68	56+5 = 61	46+5 = 51	64	62	60
L2	4 Bellevue St, Tempe[1]	53+5 = 58	49+5 = 54	40+5 = 45	62	58	55

Notes: *1. Residential locations have been categorised as 'Urban' for Location 1 and 2.*

2. Given that the existing noise environment is not influenced by existing industry, the Amenity Criteria have not been modified in accordance with Table 2.1, NSW DECC's INP.

4.2 Traffic Noise

Road traffic noise impact is assessed in accordance with the DECC's "Environmental Criteria for Road Traffic Noise".

"Table 1 - Road Traffic Noise Criteria for Proposed Road or Residential Land Use Developments" divides land use developments into different categories and lists the respective criteria for each case.

Princes Highway is classed as an 'arterial' road and Bellevue Street is a 'local' road. The ECRTN criteria relevant to the proposed development are reproduced below.

Table 5 - DECC's Environmental Criteria for Road Traffic Noise

Type of Development	Criteria		
	Day, dB(A)	Night, dB(A)	Where Criteria are Already Exceeded
7. Land use developments with potential to create additional traffic on existing freeways/arterials	$L_{Aeq(1hr)}$60	$L_{Aeq(1hr)}$55	Where feasible and reasonable, existing noise levels should be mitigated to meet the noise criteria. Examples of applicable strategies include appropriate location of private access roads; regulating time of use; using clustering; using 'quiet' vehicles; and using barriers and acoustic treatments. In all cases, traffic arising from the development should not lead to an increase in existing noise levels of more than 2 dB
13. Land use developments with potential to create additional traffic on local roads	$L_{Aeq(1hr)}$55	$L_{Aeq(1hr)}$50	Where feasible and reasonable, existing noise levels should be mitigated to meet the noise criteria. Examples of applicable strategies include appropriate location of private access roads; regulating time of use; using clustering; using 'quiet' vehicles; and using barriers and acoustic treatments. In all cases, traffic arising from the development should not lead to an increase in existing noise levels of more than 2 dB

Type of Development	Criteria		
	Day, dB(A)	Night, dB(A)	Where Criteria are Already Exceeded

Notes: Daytime is defined as 7:00am-10:00pm
Night-time is defined as 10:00pm-7:00am

4.3 Loading Dock Noise

L_{eq} Noise Criteria

Loading dock activity noise is defined here as the noise generated by any activity associated with the operation of the loading dock after a delivery vehicle enters the site. That is, the noise of vehicles is considered to be part of the overall noise from the dock once the vehicle is off public roads and is on private property. The DECC defines and assesses such noise under their Industrial Noise Policy (INP). Therefore, the relevant noise criteria for loading dock activities is the same as that outlined in Section 4.1.

L_1 Sleep Disturbance Criteria

Noise emanating from the site after 10:00pm and before 7:00am, has the potential for creating sleep disturbance. The DECC's INP does not address the issue of sleep disturbance however, the DECC has issued the following policy statement:

> *"Peak noise level events, such as reversing beepers, noise from heavy items being dropped or other high noise level events, have the potential to cause sleep disturbance. The potential for high noise level events at night and effects on sleep should be addressed in noise assessments for both the construction and operational phases of a development. The INP does not specifically address sleep disturbance from high noise level events.*
>
> *DECC reviewed research on sleep disturbance in the NSW Environmental Criteria for Road Traffic Noise (ECRTN) (EPA, 1999). This review concluded that the range of results is sufficiently diverse that it was not reasonable to issue new noise criteria for sleep disturbance.*
>
> *From the research, DECC recognised that current sleep disturbance criterion of an LA1, (1 minute) not exceeding the LA90, (15 minute) by more than 15 dB(A) is not ideal. Nevertheless, as there is insufficient evidence to determine what should replace it, DECC will continue to use it as a guide to identify the likelihood of sleep disturbance. This means that where the criterion is met, sleep disturbance is not likely, but where it is not met, a more detailed analysis is required.*
>
> *The detailed analysis should cover the maximum noise level or LA1, (1 minute), that is, the extent to which the maximum noise level exceeds the background level and the number of times this happens during the night-time period. Some guidance on possible impact is contained in the review of research results in the*

appendices to the ECRTN. Other factors that may be important in assessing the extent of impacts on sleep include:

- *how often high noise events will occur*
- *time of day (normally between 10pm and 7am)*
- *whether there are times of day when there is a clear change in the noise environment (such as during early morning shoulder periods).*

The LA1, (1 minute) descriptor is meant to represent a maximum noise level measured under 'fast' time response. DECC will accept analysis based on either LA1, (1 minute) or LA, (Max)."

The policy confirms that a sleep disturbance criterion of $L_{A1(1min)} \leq L_{A90(15min)}$ + 15dB(A), should only be used as a first step 'guide' as it is 'not ideal' and 'where it is not met, a more detailed analysis is required'. That detailed analysis includes a reference to the research material contained in the ECRTN in the assessment of the subject proposal. In reviewing that material and more recent research, notwithstanding DECC's policy, noise levels less than "background + 15dB(A)" may have the capacity to disturb sleep. Noise from the subject premises is included in the background noise level when assessing sleep disturbance.

The sleep disturbance criteria described in the DECC's policy indicated above is used for the purpose of noise impact assessment for this report and is summarised in the following table.

These levels are assessable outdoors at the facades of residential premises.

Table 6 - Sleep Intrusiveness Criteria

Location	L_{A1} Criteria
Princes Highway	L1,1min ≤ 46 + 15 = 61
Bellevue St	L1,1min ≤ 40 + 15 = 55

4.4 Carpark Noise

L_{eq} Noise Criteria

Noise emissions from vehicles moving within the IKEA car park can be assessed to the DECC's INP as outlined in Section 4.1.

L_1 Sleep Arousal Criteria

Short-term noises from the proposed developments carpark after 10pm at night are assessed to the sleep arousal criteria as outlined in Section 4.3 above.

5 NOISE SOURCES

5.1 Mechanical Plant

Although the location of rooftop plant rooms are shown on drawings, the details and noise emission levels of all mechanical plant items are not yet finalised at this early stage of the project. Therefore, noise emissions from these sources are dealt with in a general manner in the following sections of this study.

5.2 Traffic

5.2.1 Existing Traffic

- Princes Highway - Existing traffic was obtained from the RTA's Traffic Volume Data 2005: Sydney Region Volume 1, which contains hourly traffic data for the Princes Highway at Cooks River. The proportion of day and night vehicles was directly applied to the 2006 AADT of 62075 which was supplied in the traffic report by Transport and Traffic Planning Associates dated June 2008;

  Princes Highway 15hr traffic volume (7am – 10pm) = 52702 vehicles
  Princes Highway 9hr traffic volume (10pm – 7am) = 9373 vehicles

  During the Saturday peak hour there are approximately 3000vph travelling on Princes Highway in front of the site.

- Bellevue Street – The existing traffic on Bellevue St during the Saturday peak hour is shown in Figure 5c of the traffic study by Transport and Traffic Planning Associates dated June 2008. Existing flows along Bellevue Street were counted to be 163 vehicles per hour. This includes traffic associated with the Salvation Army site. It is also known from site inspections that the road is currently heavily used by trucks on weekdays to access the container storage facility at the end of Bellevue Street.

5.2.2 Future Traffic

The Transport and Traffic Planning Associate traffic study predicts future traffic generation due the IKEA development. As a worse case scenario we refer to Fig 7b of the traffic report which shows that:

- A total of 664 vehicles per hour will use the main IKEA access (two-way) during a Saturday peak hour.
- A total of 203 vehicles will use Bellevue Street access during the Saturday peak hour. This is an additional 40 vehicles over the existing flow.

Additionally, since it is proposed that the IKEA store loading dock operate on a 24 hour basis and that all trucks will use the Bellevue Street access, additional heavy vehicle traffic will use Bellevue Street at night. It is expected the IKEA loading dock will have a maximum of 4

deliveries per hour between 1.00AM – 4.00AM where heavy trucks (>12,000kg) will be used to deliver 40ft overseas containers. In addition, smaller trucks (<12,000kg) for various other deliveries and pick-ups for waste, recycling, cash and restaurant will be used during the morning period between 6.00AM – 10.00AM.

5.3 Loading Dock

On the proposed development, the major noise sources associated with loading dock operations are:

- the IKEA store loading dock and;
- trucks accessing the site via Bellevue St.

Renzo Tonin & Associates have measured loading dock noise during past projects. Typical dock activities commonly causing noise include:

1. Reversing alarms on trucks when backing into the loading dock area
2. Truck engines starting & doors closing
3. Operation of refrigeration equipment mounted on refrigerated vehicles
4. Trolleys and palettes being moved
5. People talking
6. PA system
7. Electric cardboard compactor
8. Compressed air.

Table 7 below summarises typical short-term L_{Aeq} and L_{Amax} sound power levels of various loading dock activities.

Table 7 - Typical Short-term L_{Aeq} Sound Power Levels of Loading Dock Activities

Main Activities (refer to activity list above)	Sound Power Level (SWL), dB(A)	
	L_{Aeq}	L_{Amax}
4, 8	< 78	< 97
2, 4	88	100
3, 4	89	110
3, 4	< 78	< 103
2, 7	84	105
1, 2, 4	91	108
4, 7	86	115
1, 2, 6	89	111
1, 2, 4, 5, 6	< 78	< 108
Mean	**85**	**106**

5.4 Carparks

Since the traffic study indicates 700 vehicles per hour accessing the site carpark during the Saturday peak hour, then for the purpose of carpark noise calculations, is assumed 175 vehicles per 15 minute period would be moving around the carpark. It is also assumed that:

- The lower level of the carpark is shielded from residences, and
- There will be little or no carpark activity outside the IKEA store's proposed hours of operation.

Noise generated by car park activities which may contribute to the overall L_{Aeq} noise level emission from the site includes vehicle doors closing, vehicle engines starting, vehicles accelerating and vehicles moving. To assess this noise, the L_{Aeq} noise level was determined for the relevant time period based on the number of vehicle activities expected to occur during that period at the nearest affected residential premises. The following sound exposure level (SEL) measurements from our database and library files were used for the purpose of this assessment.

Table 8 - Sound Power Levels – Car Park Activities, dB(A) re 1pW

Activity	Sound Power Level, dB(A) re 1pW	
	SEL	L_1
Vehicle door closing	84	100
Vehicle engine starting	90	100
Vehicle accelerating	93	95
Vehicle moving (10-30km/h)	84	85
Truck moving on site (<10km/hr)	106	107

Separate to vehicles within the carpark, cars and trucks will also be moving along the main access driveway and the service road to Bellevue Street. In the course of our work for previous projects, we have conducted many noise measurements of traffic arriving and departing various developments from known distances and these results are held in our office library files and databases. The data includes individual sound exposure levels (SEL) for a variety of cars and trucks.

In general, the SELs used for the on-site traffic noise calculations of cars and trucks on service roads are:

- 63dB(A) for a passenger vehicle, measured at 20 metres
- 79dB(A) for a truck, measured at 20 metres

In predicting the noise levels at the neighbouring residence, these values are adjusted for the peak number of vehicles expected and the resultant level is distance corrected to account for the separation distance between the vehicle and the neighbouring residence.

6 PREDICTED NOISE LEVELS

6.1 Mechanical Plant

As the type or numbers of mechanical plant items such as air-conditioning, condenser units, fans or compressors are not yet finalised at this early stage of the design process, their noise emissions cannot be calculated to assess their noise impact. Therefore, all mechanical plant, once selected, shall have their noise specifications and their proposed locations checked prior to their installation on site to ensure that they shall not, either singularly or in total, emit noise levels that exceed the noise limits specified in Section 4.1 above.

Most mechanical plant items will be located within the rooftop plant rooms. Noise from plant can be readily controlled to comply with DECC limits by:

1. Incorporating commercially available silencers, screens and enclosures,
2. Procurement of 'quiet' plant, and
3. Strategically positioning plant away from residences, maximising shielding between the plant and neighbouring residences.

6.2 Traffic

The future noise levels due to traffic on Princes Highway and Bellevue Street have been predicted based on the traffic volumes outlined in Section 5.2.

6.2.1 Princes Highway

Based on the RTA's Traffic Data 2005 and 2006 AADT which was supplied in the traffic report by Transport and Traffic Planning Associates dated June 2008, the average daytime traffic volume on Princes Highway is 3513 vehicles per hour. Traffic counts conducted in 2007 indicate a peak flow of approximately 3000 vehicles per hour on a Saturday.

Based on the worst case generation of 700 vehicles per hour by the IKEA site during the Saturday peak, the increase in L_{Aeq} traffic noise levels due to the proposed development is predicted to be less than 1dB(A), which is considered to be inconsequential.

6.2.2 Bellevue Street

The proposed IKEA development is expected to add 40 vehicles per hour to Bellevue Street during the Saturday peak and up to 4 trucks during the night for deliveries.

During the Saturday peak, traffic noise levels on Bellevue St in one hour are expected to increase by 0.9dB(A). This small increase would not be noticeable to the human ear and is therefore considered inconsequential.

At night, we estimate that if 4 heavy trucks per hour are using Bellevue St due to the operation of the loading dock, an additional 60dB(A) will be generated. Therefore, should this truck traffic occur during a low noise period, IKEA traffic may cause noise levels up to 10dB(A) above

the ECRTN criteria. However, long-term measurements show that the peak night time $L_{Aeq(1hr)}$ noise levels already far exceed 60dB(A) and we also expect that for much of the night period, the additional IKEA traffic will not increase noise levels by more than 2dB.

In summary, traffic noise impacts would only exceed the ECRTN criteria during the night if IKEA truck deliveries coincided with a lull the existing traffic. Usually however, no exceedance of the criteria would be experienced.

6.3 Loading Dock

Noise emissions from loading dock activities were predicted to the nearest receivers. Predictions take into account the locations of the loading dock and access ramps as shown on drawings of the development floor plan. Noise generated by the IKEA loading dock has been predicted to four locations that are representative of the most affected residences. The locations of the receivers are shown in Figure 1 of Appendix B and are as follows;

Receiver R1 - 535 Princess Hwy

Receiver R2 - 4 Bellevue St

Receiver R3 - 551 Princes Hwy

Receiver R4 - 635 Princes Hwy, Tempe, which is the nearest residential receiver to the IKEA loading dock

Calculations for the IKEA loading dock conservatively assume 10dB shielding by the proposed IKEA store building to residential receivers R1, R2 and R3. The tables below present the predicted 15-minute L_{Aeq} intrusive noise levels and night time L_1 noise levels at residential receivers based on the sound power levels from the loading dock quoted in Section 5.3.

Table 9 – Daytime $L_{Aeq,15min}$ Loading Dock Intrusiveness Assessment

Receiver	Noise Criteria	L_{Aeq} Operational Noise Levels	Complies?
R1 - 535 Princes Hwy	68	17	Yes
R2 - 4 Bellevue St	58	15	Yes
R3 – 551 Princes Hwy	68	20	Yes
R4 - 635 Princes Hwy	68	34	Yes

Table 10 - Night-Time L_{A1} Loading Dock Sleep Disturbance Assessment

Location	Sleep Arousal Criterion (L_{A1})	Calculated Noise Level (L_{A1})	Complies?
R1 - 535 Princes Hwy	61	38	Yes
R2 - 4 Bellevue St	55	36	Yes
R3 – 551 Princes Hwy	61	41	Yes
R4 - 635 Princes Hwy	61	55	Yes

Noise levels from the loading dock are predicted to comply with both the daytime intrusiveness criteria and the night time sleep disturbance criteria at the nearest residential receivers. Since these worst case 15-minute noise levels are well below the amenity criteria, then compliance with the amenity criteria over the day and evening periods is also achieved.

6.4 Carpark

Noise predictions are conducted for the Saturday daytime peak period as this is the worst case operation of the carpark. Although IKEA is to operate into the evening period up until 7pm on weekdays (except Thursday), carpark activity is expected to be much lower in the evening. Furthermore, background noise levels do not drop off significantly up to 7pm since Princes Highway remains fairly busy. Therefore an assessment of Saturday peak activity is expected to be the worst case assessment.

The table below compare predicted L_{eq} noise levels from vehicle activities in the carpark to the most affected receivers. Predictions assume the Saturday peak vehicle movements as outlined in Section 5.4. Predictions take into vehicle movement in the carpark, and also on the main entry road. Predictions do not take into account shielding from parked cars within the site which gives a conservative assessment.

Table 11 - Carpark Daytime $L_{Aeq,15min}$ Intrusiveness Assessment

Receiver	Noise Criteria	L_{Aeq} Operational Noise Levels	Complies?
R1 - 535 Princes Hwy	68	48	Yes
R2 - 4 Bellevue St	58	47	Yes
R3 – 551 Princes Hwy	68	50	Yes
R4 - 635 Princes Hwy	68	47	Yes

L_{Aeq} operational noise levels from carpark activities are predicted to comply with intrusiveness criteria at the nearest residential receivers. Since these worst case 15-minute noise levels are well below the amenity criteria, then compliance with the amenity criteria over the day and evening periods is also achieved.

6.5 Total Site Noise

Should the worst case operation of the carpark and the loading dock occur concurrently, the combined noise levels would still not exceed they daytime noise criteria. Furthermore, as long as mechanical plant is designed with the daytime and evening noise criteria in mind, then total noise from the site will comply with the set criteria.

7 RECOMMENDATIONS

The following recommendations summarise the in-principle noise control solutions recommended to reduce noise impacts to residential receivers. This information is presented for the purpose of Council approvals process and cost planning and shall not be used for construction unless otherwise approved in writing by the acoustic consultant. Assistance of an acoustic consultant must be sought at the detailed design phase of these works to provide the necessary design details and specifications prior to Construction Certification.

Before committing to any form of construction or committing to any contractor, advice should be sought from an acoustic consultant to ensure that adequate provisions are made for any variations which may occur as a result of changes to the form of construction.

The advice provided here is in respect of acoustics only. Supplementary professional advice may need to be sought in respect of fire ratings, structural design, buildability, fitness for purpose and the like.

7.1 Mechanical Plant

All mechanical plant shall have their noise specifications and their proposed locations checked prior to their installation on site, to ensure that they shall not either singularly or in total emit noise levels which exceed the INP noise criteria.

If the calculated noise emissions from these plant items are in excess of the set limits, then appropriate acoustic treatment shall be implemented to ensure compliance with noise limits. In general, noise controls for mechanical plant are standard and commercially available, and can be readily added to silence any potentially noisy plant. Such noise control treatment may include any of the following:

- procurement of 'quiet' plant,
- installation of commercially available silencers over noisy fans,
- installation of acoustic screens and barriers between plant and sensitive neighbouring premises,
- installation of partially-enclosed or fully-enclosed acoustic enclosures over plant.

7.2 Traffic

Future traffic noise levels on Princes Highway have been calculated to be within 1dB(A) of the existing noise levels. Future traffic noise levels on Bellevue St will commonly be within 2dB(A) of the existing levels, and would only exceed the ECRTN criteria during the night if IKEA truck deliveries coincided with a lull the existing traffic.

Since residences around the IKEA site are already exposed to high traffic noise levels, and since future traffic noise levels are generally expected to be within 2dB(A) of existing levels, no traffic noise mitigation is warranted for this project.

7.3 Loading Dock

Predicted noise levels from the operation of the IKEA loading dock are assessed as complying with the criteria outlined in the DECC's INP. Therefore specific mitigation of noise from the loading dock is not required.

7.4 Carpark

Predicted noise levels from the carpark are assessed as complying with the criteria outlined in the DECC's INP. Therefore further mitigation of carpark noise is not required.

8 CONCLUSION

Renzo Tonin & Associates have investigated the potential noise impact from the proposed IKEA Tempe store. The findings of this study are:

- Future traffic noise levels on Bellevue St will commonly be within 2dB(A) of the existing levels, and would only exceed the ECRTN criteria during the night if IKEA truck deliveries coincided with a lull the existing traffic. Since future traffic noise levels are generally expected to be within 2dB(A) of existing levels, no traffic noise mitigation is warranted for this project.
- Noise from the loading dock and carpark are expected to easily comply with the set noise criteria.
- In-principle noise management measures for mechanical plant as described in this report should be implemented where necessary during the detailed design phase to control noise to acceptable levels.

APPENDIX A - GLOSSARY OF ACOUSTIC TERMS

The following is a brief description of the technical terms used to describe noise to assist in understanding the technical issues presented.

Adverse Weather — Weather effects that enhance noise (that is, wind and temperature inversions) that occur at a site for a significant period of time (that is, wind occurring more than 30% of the time in any assessment period in any season and/or temperature inversions occurring more than 30% of the nights in winter).

Ambient Noise — The all-encompassing noise associated within a given environment at a given time, usually composed of sound from all sources near and far.

Assessment Period — The period in a day over which assessments are made.

Assessment Point — A point at which noise measurements are taken or estimated. A point at which noise measurements are taken or estimated.

Background Noise — Background noise is the term used to describe the underlying level of noise present in the ambient noise, measured in the absence of the noise under investigation, when extraneous noise is removed. It is described as the average of the minimum noise levels measured on a sound level meter and is measured statistically as the A-weighted noise level exceeded for ninety percent of a sample period. This is represented as the $\mathbf{L_{90}}$ noise level (see below).

Decibel [dB] — The units that sound is measured in. The following are examples of the decibel readings of every day sounds:

0dB The faintest sound we can hear

30dB A quiet library or in a quiet location in the country

45dB Typical office space. Ambience in the city at night

60dB Martin Place at lunch time

70dB The sound of a car passing on the street

80dB Loud music played at home

90dB The sound of a truck passing on the street

100dB The sound of a rock band

115dB Limit of sound permitted in industry

120dB Deafening

dB(A):	A-weighted decibels The ear is not as effective in hearing low frequency sounds as it is hearing high frequency sounds. That is, low frequency sounds of the same dB level are not heard as loud as high frequency sounds. The sound level meter replicates the human response of the ear by using an electronic filter which is called the "A" filter. A sound level measured with this filter switched on is denoted as dB(A). Practically all noise is measured using the A filter.
Frequency	Frequency is synonymous to pitch. Sounds have a pitch which is peculiar to the nature of the sound generator. For example, the sound of a tiny bell has a high pitch and the sound of a bass drum has a low pitch. Frequency or pitch can be measured on a scale in units of Hertz or Hz.
Impulsive noise	Having a high peak of short duration or a sequence of such peaks. A sequence of impulses in rapid succession is termed repetitive impulsive noise.
Intermittent noise	The level suddenly drops to that of the background noise several times during the period of observation. The time during which the noise remains at levels different from that of the ambient is one second or more.
L_{max}	The maximum sound pressure level measured over a given period.
L_{min}	The minimum sound pressure level measured over a given period.
L_1	The sound pressure level that is exceeded for 1% of the time for which the given sound is measured.
L_{10}	The sound pressure level that is exceeded for 10% of the time for which the given sound is measured.
L_{90}	The level of noise exceeded for 90% of the time. The bottom 10% of the sample is the L_{90} noise level expressed in units of dB(A).
L_{eq}	The "equivalent noise level" is the summation of noise events and

	integrated over a selected period of time.
Reflection	Sound wave changed in direction of propagation due to a solid object obscuring its path.
SEL	Sound Exposure Level (SEL) is the constant sound level which, if maintained for a period of 1 second would have the same acoustic energy as the measured noise event. SEL noise measurements are useful as they can be converted to obtain Leq sound levels over any period of time and can be used for predicting noise at various locations.
Sound	A fluctuation of air pressure which is propagated as a wave through air.
Sound Absorption	The ability of a material to absorb sound energy through its conversion into thermal energy.
Sound Level Meter	An instrument consisting of a microphone, amplifier and indicating device, having a declared performance and designed to measure sound pressure levels.
Sound Pressure Level	The level of noise, usually expressed in decibels, as measured by a standard sound level meter with a microphone.
Sound Power Level	Ten times the logarithm to the base 10 of the ratio of the sound power of the source to the reference sound power.
Tonal noise	Containing a prominent frequency and characterised by a definite pitch.

APPENDIX B - MONITORING AND RECEIVER LOCATIONS

Figure 1 – Map of Monitoring Locations and Receivers

APPENDIX C - LONG TERM NOISE MONITORING METHODOLOGY

Noise Monitoring Equipment

All long term noise monitoring was conducted using RTA Technology noise loggers. The noise monitoring equipment used here complies with Australian Standard 1259.2-1990 "Acoustics - Sound Level Meters" and is designated as a Type 2 instrument suitable for field use.

A noise monitor consists of a sound level meter and a computer housed in a weather resistant enclosure. Ambient noise levels were recorded at a rate of 10 samples per second. Every 15 minutes, the data is processed statistically and stored in memory. The equipment was calibrated prior and subsequent to the measurement period using a Bruel & Kjaer Type 4230 calibrator. No significant drift in calibration was observed.

Meteorology during Monitoring

Measurements affected by extraneous noise, wind (greater than 5m/s) or rain were excluded from the recorded data in accordance with the INP. The Bureau of Meteorology (BOM) provided meteorological data, which is considered representative of the site, for the duration of the noise monitoring period. The data was modified to allow for the height difference between the BOM weather station, where wind speed and direction is recorded at a height of 10m above ground level, and the microphone location, which is at 1.5m above ground level. The correction factor applied to the data was taken from *Australian Standard AS1170.2 1989 Section 4.2.5.1*.

Noise vs Time Graphs

Noise almost always varies with time. Noise environments can be described using various descriptors to show how a noise ranges about a level. In this report, noise values measured or referred to include the $\mathbf{L_{10}}$, $\mathbf{L_{90}}$, and $\mathbf{L_{eq}}$ levels. The statistical descriptors $\mathbf{L_{10}}$ and $\mathbf{L_{90}}$ measure the noise level exceeded for 10% and 90% of the sample measurement time. The $\mathbf{L_{eq}}$ level is the equivalent continuous noise level or the level averaged on an equal energy basis. Measurement sample periods are usually ten to fifteen minutes. The Noise -vs- Time graphs in Appendix D illustrate these concepts.

Noise levels are commonly measured in units of A-weighted decibels or dB(A). The "A-weighting" refers to a standardised amplitude versus frequency curve used to "weight" sound measurements to represent the response of the human ear. The human ear is less sensitive to low pitch sound than it is to high pitch sound. Overall A-weighted measurements quantify sound with a single number to represent how people subjectively hear different frequencies at different levels.

Background noise is the term used to describe the noise measured in the absence of the noise under investigation. It is described as the average of the minimum noise levels measured on a sound level meter and is measured statistically as the A-weighted noise level exceeded for ninety percent of a sample time period. This is represented as the $\mathbf{L_{90}}$ noise level.

APPENDIX D - LONG TERM NOISE MONITORING RESULTS

535 Princes Highway, Tempe

BACKGROUND & AMBIENT NOISE MONITORING RESULTS
NSW EPA's 'INDUSTRIAL NOISE POLICY', 2000

	L90 Background Noise Levels[5]			Leq Ambient Noise Levels		
Day	Day	Evening	Night	Day	Evening	Night
Friday-11-March-2005	63	55	47	74	72	70
Saturday-12-March-2005	57	56	46	74	72	70
Sunday-13-March-2005	49	54	43	73	72	70
Monday-14-March-2005	61	56	41	74	72	70
Tuesday-15-March-2005	62	57	43	75	72	71
Wednesday-16-March-2005	64	60	47	74	72	70
Thursday-17-March-2005	69	62	48	75	73	70
Friday-18-March-2005	63	-	-	73	-	-
Saturday-19-March-2005	-	-	-	-	-	-
Sunday-20-March-2005	-	-	-	-	-	-
Monday-21-March-2005	-	-	-	-	-	-
Tuesday-22-March-2005	-	-	-	-	-	-
Wednesday-23-March-2005	-	-	-	-	-	-
Thursday-24-March-2005	-	-	-	-	-	-
Friday-25-March-2005	-	-	-	-	-	-
Saturday-26-March-2005	-	-	-	-	-	-
Representative Level	**63**	**56**	**46**	**74**	**72**	**70**

Notes:

1. Day is taken to be 7:00am to 6:00pm
2. Evening is taken to be 6:00pm to 10:00pm.
3. Night is taken to be the remaining periods.
4. Partial day's monitoring
5. Assessment Background Level (ABL)
6. Rating Background Level (RBL) for L90 and logarithmic average for Leq

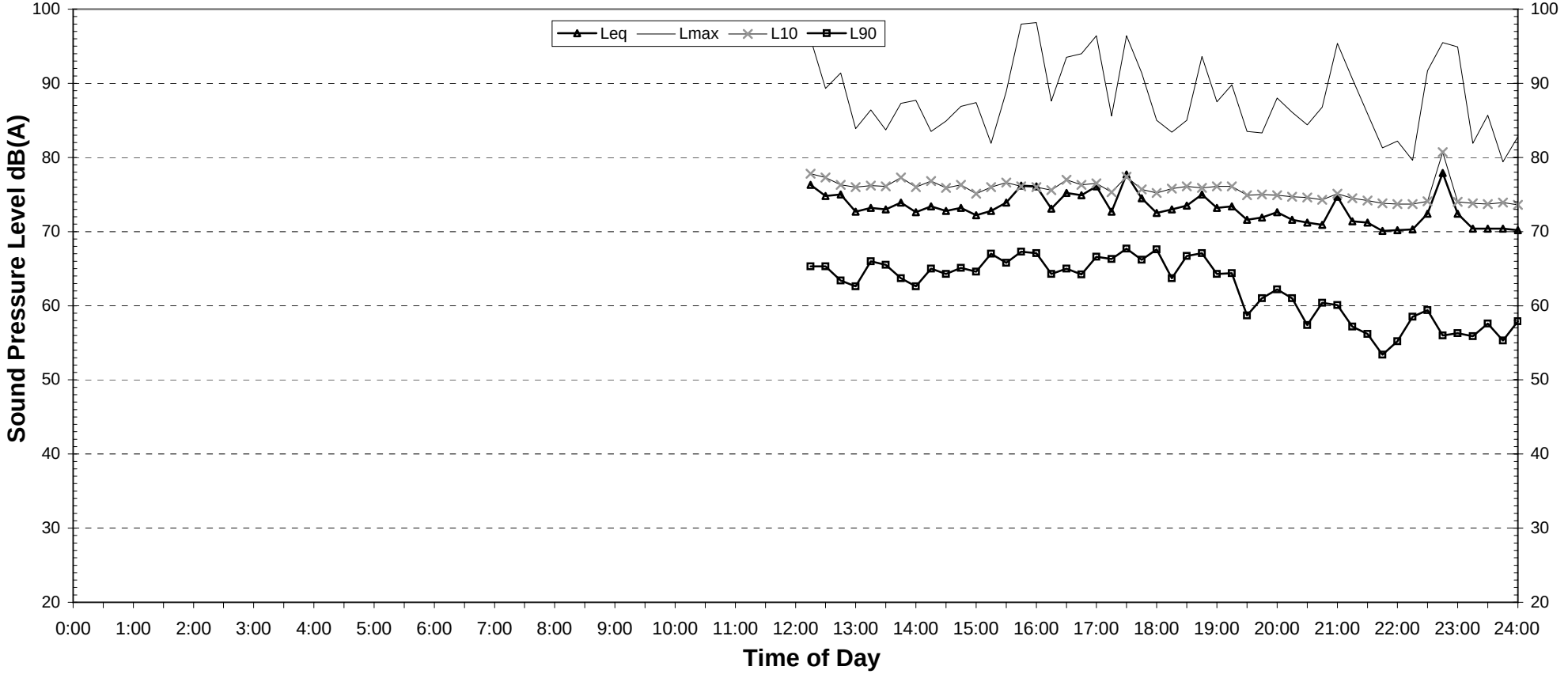
TRAFFIC NOISE MONITORING RESULTS
NSW EPA 'ENVIRONMENTAL CRITERIA FOR ROAD TRAFFIC NOISE', 1999

	Leq Noise Levels		Leq 1hr Noise Levels			
Day	Day	Night	Day - Up	Day - Low	Night - Up	Night - Low
Friday-11-March-2005	76	72	77	73	77	69
Saturday-12-March-2005	76	72	78	74	77	69
Sunday-13-March-2005	76	72	78	72	76	66
Monday-14-March-2005	76	73	78	74	78	67
Tuesday-15-March-2005	77	73	79	73	78	67
Wednesday-16-March-2005	76	72	77	74	73	68
Thursday-17-March-2005	76	73	77	74	76	68
Friday-18-March-2005	76	-	76	75	-	-
Saturday-19-March-2005	-	-	-	-	-	-
Sunday-20-March-2005	-	-	-	-	-	-
Monday-21-March-2005	-	-	-	-	-	-
Tuesday-22-March-2005	-	-	-	-	-	-
Wednesday-23-March-2005	-	-	-	-	-	-
Thursday-24-March-2005	-	-	-	-	-	-
Friday-25-March-2005	-	-	-	-	-	-
Saturday-26-March-2005	-	-	-	-	-	-
Representative Weekday	**76**	**73**	**77**	**74**	**77**	**68**
Representative Weekend	**76**	**72**	**78**	**73**	**76**	**68**

EXISTING AMBIENT NOISE LEVELS

535 Princes Highway, Tempe

Friday, 11 March 2005



EPA Industrial Noise Policy (Free Field)			
Descriptor	Day 7am-6pm	Evening 6pm-10pm	Night[2] 10pm-7am
L90	63.4	55.2	46.6
Leq	74.4	72.5	70.0

NOTES:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.

2. "Night" relates to period from 10pm on this graph to 7am on the following graph.

3. Graphed data measured in free-field; tabulated results facade corrected

4. Night time Lmax values are shown only where Lmax > 65dB(A) and where Lmax- Leq ≥ 15dB(A)

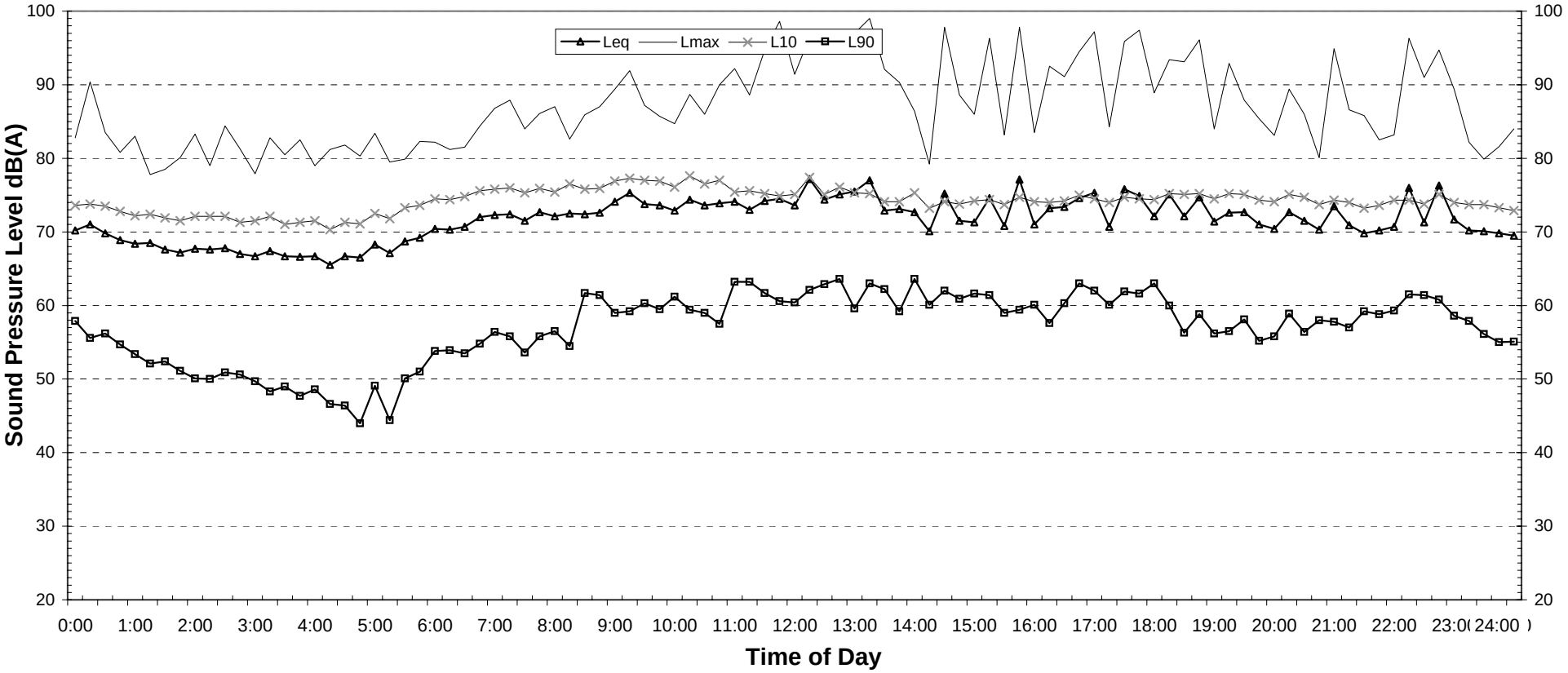
EPA Traffic Noise Policy (1m from facade) (see note 3)		
Descriptor	Day 7am-10pm	Night[2] 10pm-7am
Leq 15 hr and Leq 9 hr	76.2	72.5
Leq 1hr upper 10 percentile	77.5	76.8
Leq 1hr lower 10 percentile	73.3	69.4

Night Time Maximum Noise Levels (see note 4)			
Lmax (Range)	82.8	to	95.5
Lmax - Leq (Range)	15.3	to	21.2

EXISTING AMBIENT NOISE LEVELS

535 Princes Highway, Tempe

Saturday, 12 March 2005



EPA Industrial Noise Policy (Free Field)			
Descriptor	Day 7am-6pm	Evening 6pm-10pm	Night[2] 10pm-7am
L90	56.5	55.8	45.9
Leq	73.9	72.1	69.8

NOTES:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.

2. "Night" relates to period from 10pm on this graph to 7am on the following graph.

3. Graphed data measured in free-field; tabulated results facade corrected

4. Night time Lmax values are shown only where Lmax > 65dB(A) and where Lmax-Leq ≥ 15dB(A)

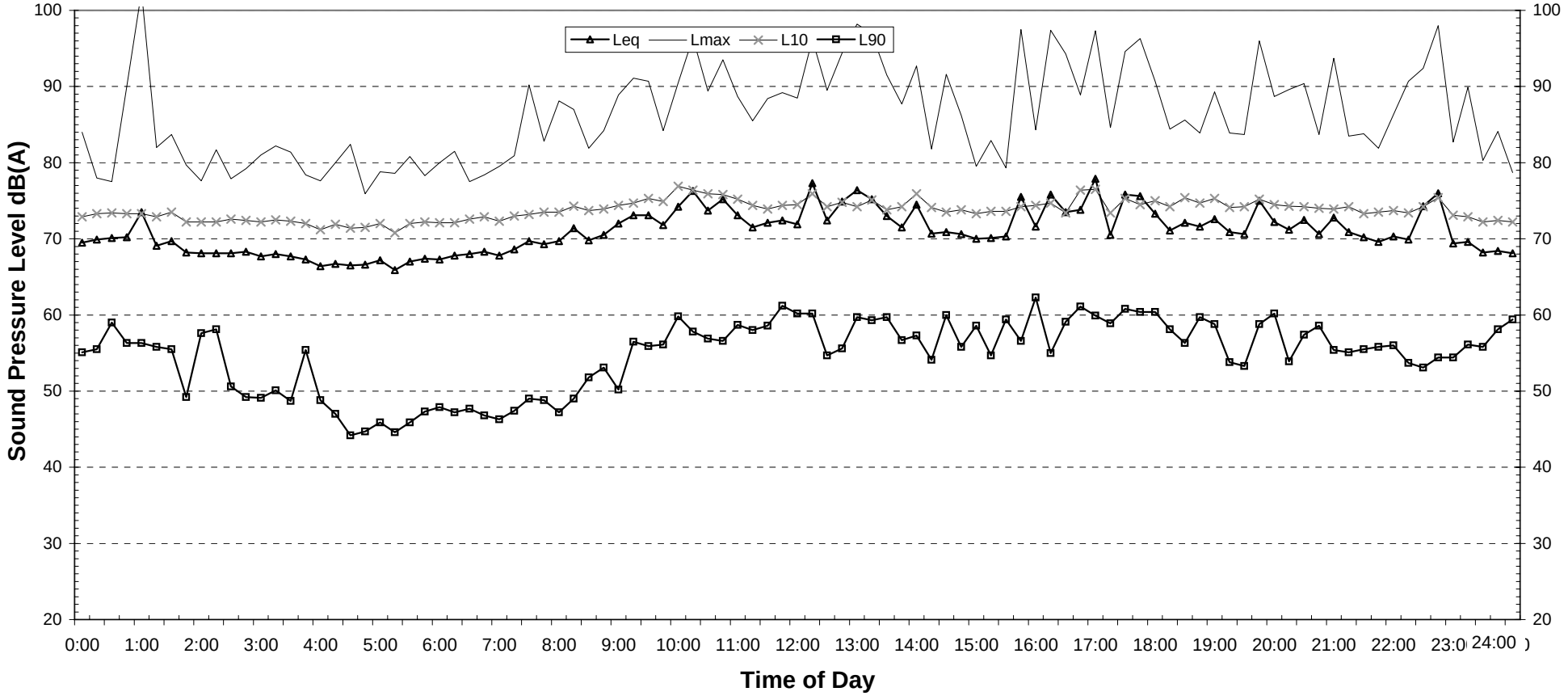
EPA Traffic Noise Policy (1m from facade) (see note 3)		
Descriptor	Day 7am-10pm	Night[2] 10pm-7am
Leq 15 hr and Leq 9 hr	76.0	72.3
Leq 1hr upper 10 percentile	77.6	76.9
Leq 1hr lower 10 percentile	73.7	69.3

Night Time Maximum Noise Levels (see note 4)			
Lmax (Range)	82.4	to	102.5
Lmax - Leq (Range)	15.6	to	31.3

EXISTING AMBIENT NOISE LEVELS

535 Princes Highway, Tempe

Sunday, 13 March 2005



EPA Industrial Noise Policy (Free Field)			
Descriptor	Day 7am-6pm	Evening 6pm-10pm	Night[2] 10pm-7am
L90	49.0	53.8	42.7
Leq	73.4	71.7	69.5

NOTES:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.

2. "Night" relates to period from 10pm on this graph to 7am on the following graph.

3. Graphed data measured in free-field; tabulated results facade corrected

4. Night time Lmax values are shown only where Lmax > 65dB(A) and where Lmax-Leq ≥ 15dB(A)

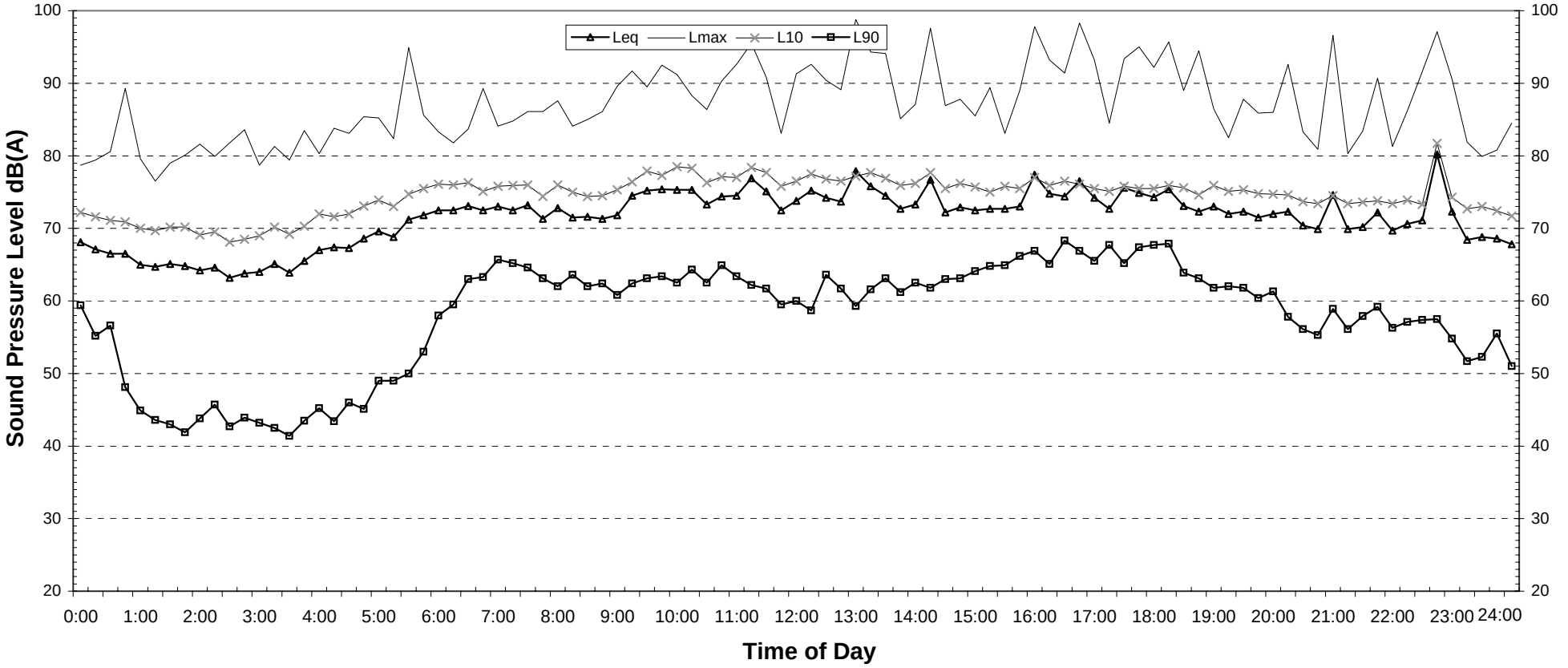
EPA Traffic Noise Policy (1m from facade) (see note 3)		
Descriptor	Day 7am-10pm	Night[2] 10pm-7am
Leq 15 hr and Leq 9 hr	75.5	72.0
Leq 1hr upper 10 percentile	78.1	75.8
Leq 1hr lower 10 percentile	72.3	66.4

Night Time Maximum Noise Levels (see note 4)			
Lmax (Range)	81.6	to	98.0
Lmax - Leq (Range)	16.5	to	24.7

EXISTING AMBIENT NOISE LEVELS

535 Princes Highway, Tempe

Monday, 14 March 2005



EPA Industrial Noise Policy (Free Field)			
Descriptor	Day 7am-6pm	Evening 6pm-10pm	Night[2] 10pm-7am
L90	60.8	56.1	41.2
Leq	74.3	72.2	70.2

NOTES:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.

2. "Night" relates to period from 10pm on this graph to 7am on the following graph.

3. Graphed data measured in free-field; tabulated results facade corrected

4. Night time Lmax values are shown only where Lmax > 65dB(A) and where Lmax-Leq ≥ 15dB(A)

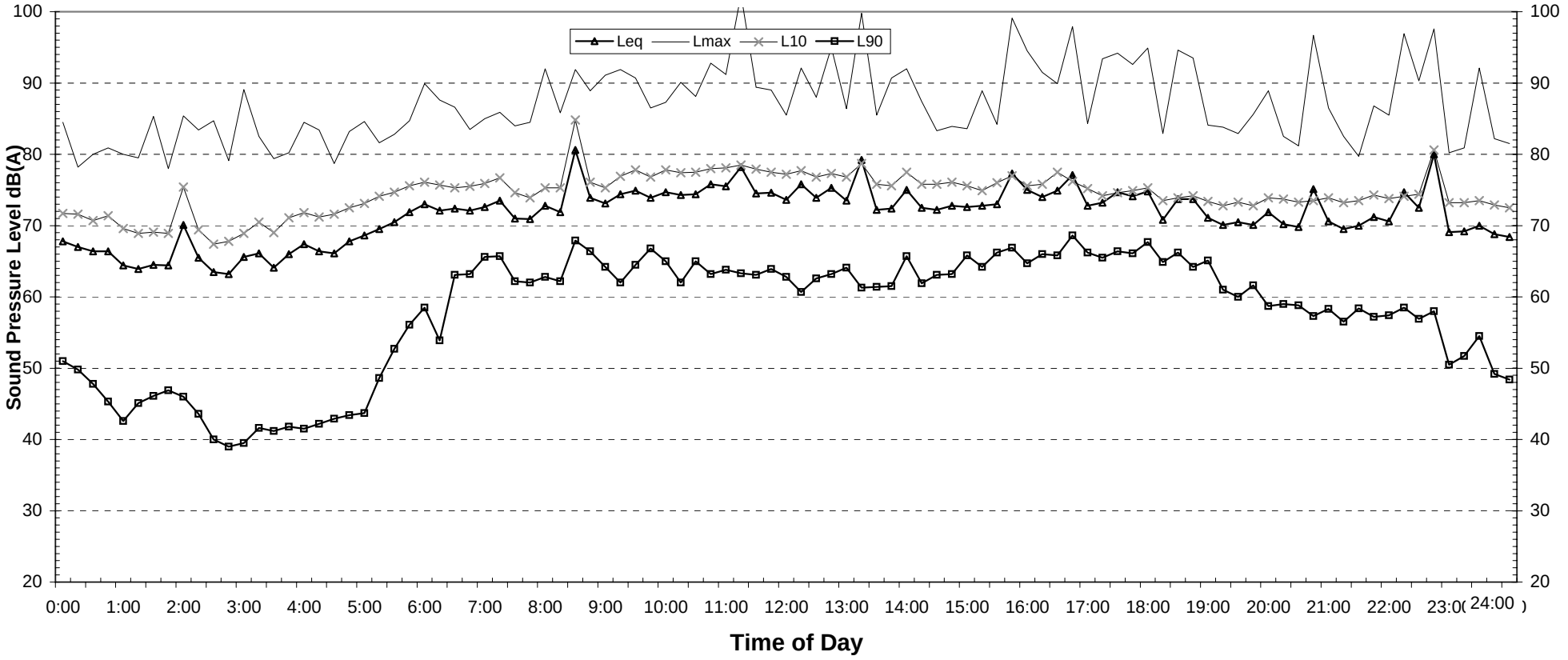
EPA Traffic Noise Policy (1m from facade) (see note 3)		
Descriptor	Day 7am-10pm	Night[2] 10pm-7am
Leq 15 hr and Leq 9 hr	76.4	72.7
Leq 1hr upper 10 percentile	77.9	78.1
Leq 1hr lower 10 percentile	73.6	67.1

Night Time Maximum Noise Levels (see note 4)			
Lmax (Range)	84.5	to	97.1
Lmax - Leq (Range)	15.3	to	24.5

EXISTING AMBIENT NOISE LEVELS

535 Princes Highway, Tempe

Tuesday, 15 March 2005



Time of Day

EPA Industrial Noise Policy (Free Field)			
Descriptor	Day 7am-6pm	Evening 6pm-10pm	Night[2] 10pm-7am
L90	61.9	57.2	43.4
Leq	74.8	71.5	70.6

NOTES:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.

2. "Night" relates to period from 10pm on this graph to 7am on the following graph.

3. Graphed data measured in free-field; tabulated results facade corrected

4. Night time Lmax values are shown only where Lmax > 65dB(A) and where Lmax-Leq ≥ 15dB(A)

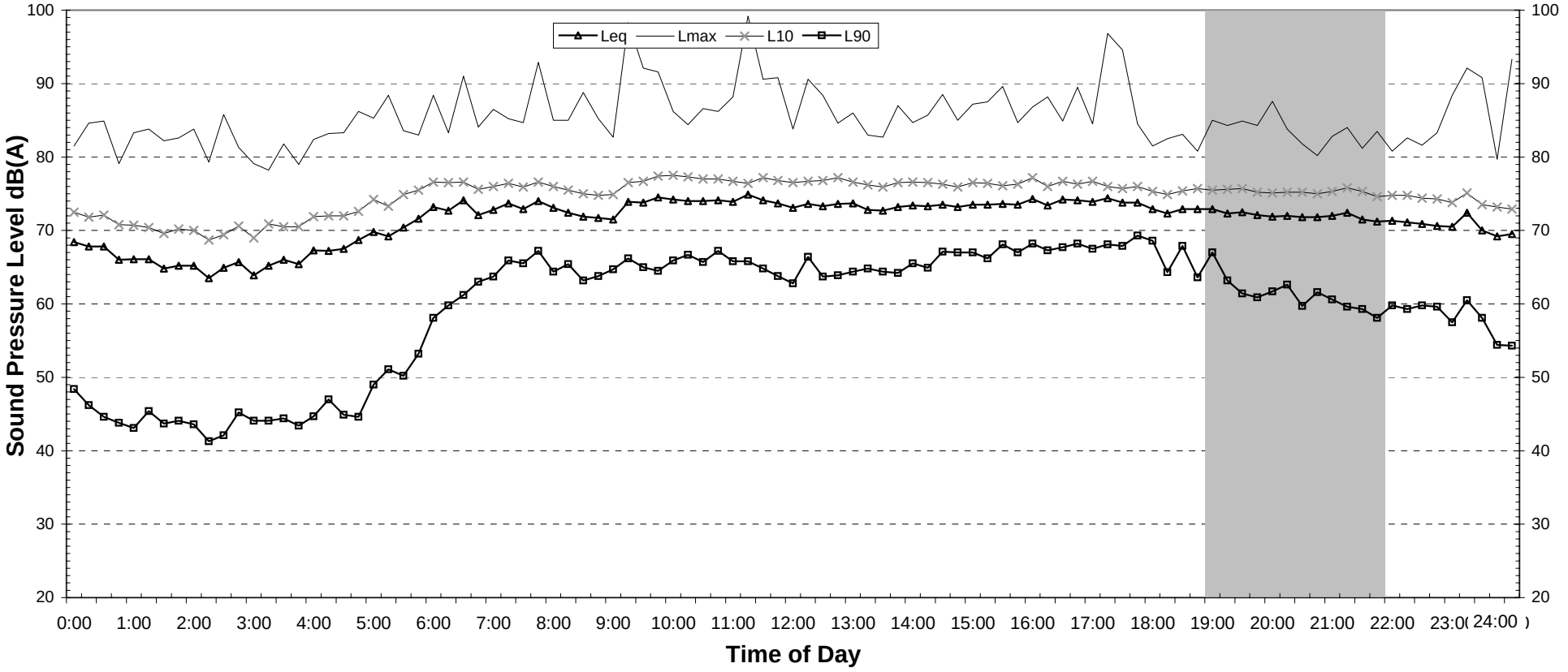
EPA Traffic Noise Policy (1m from facade) (see note 3)		
Descriptor	Day 7am-10pm	Night[2] 10pm-7am
Leq 15 hr and Leq 9 hr	76.6	73.1
Leq 1hr upper 10 percentile	78.6	78.4
Leq 1hr lower 10 percentile	73.0	67.1

Night Time Maximum Noise Levels (see note 4)			
Lmax (Range)	82.4	to	97.6
Lmax - Leq (Range)	16.3	to	23.0

EXISTING AMBIENT NOISE LEVELS

535 Princes Highway, Tempe

Wednesday, 16 March 2005



EPA Industrial Noise Policy (Free Field)			
Descriptor	Day 7am-6pm	Evening 6pm-10pm	Night[2] 10pm-7am
L90	63.8	59.8	47.1
Leq	73.6	72.4	69.7

NOTES:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.

2. "Night" relates to period from 10pm on this graph to 7am on the following graph.

3. Graphed data measured in free-field; tabulated results facade corrected

4. Night time Lmax values are shown only where Lmax > 65dB(A) and where Lmax-Leq ≥ 15dB(A)

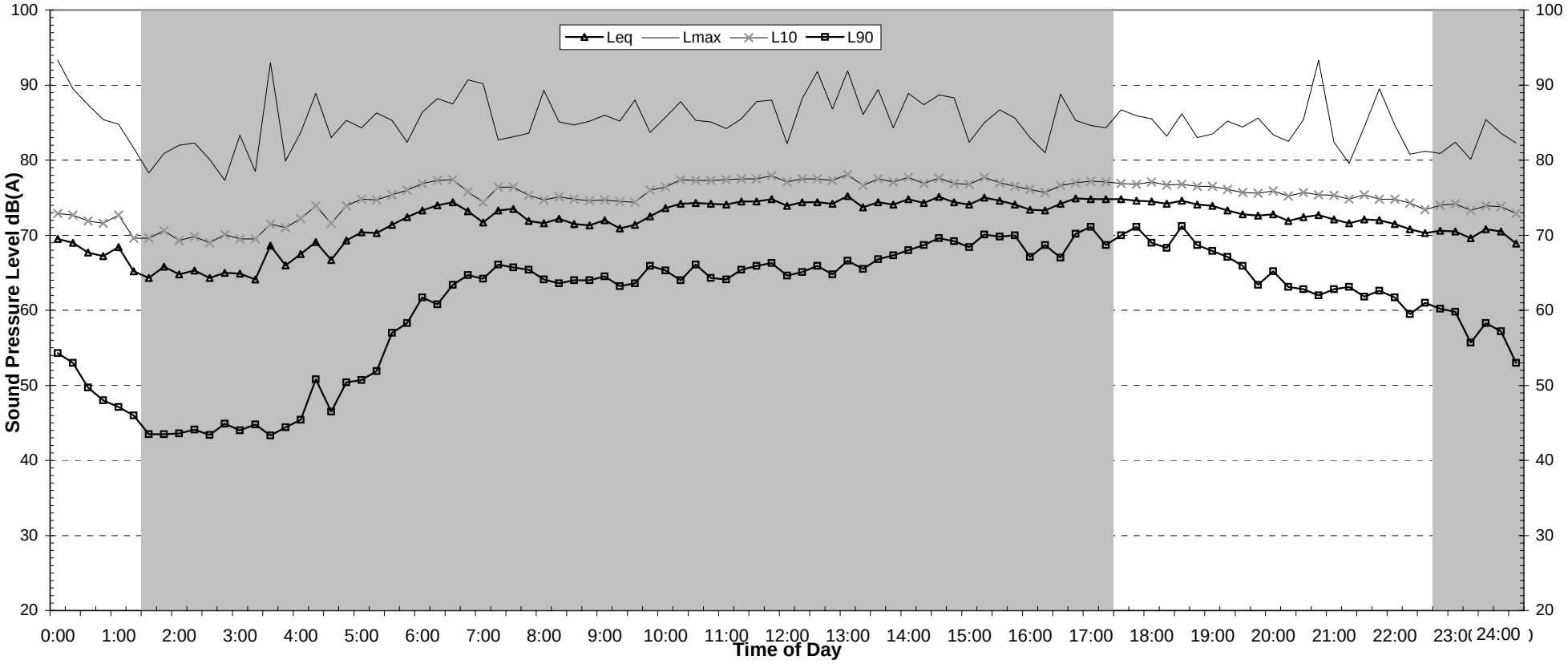
EPA Traffic Noise Policy (1m from facade) (see note 3)		
Descriptor	Day 7am-10pm	Night[2] 10pm-7am
Leq 15 hr and Leq 9 hr	76.0	72.2
Leq 1hr upper 10 percentile	76.6	73.3
Leq 1hr lower 10 percentile	74.0	67.7

Night Time Maximum Noise Levels (see note 4)			
Lmax (Range)	81.6	to	93.3
Lmax - Leq (Range)	16.4	to	22.8

EXISTING AMBIENT NOISE LEVELS

535 Princes Highway, Tempe

Thursday, 17 March 2005



EPA Industrial Noise Policy (Free Field)			
Descriptor	Day 7am-6pm	Evening 6pm-10pm	Night[2] 10pm-7am
L90	69.0	61.8	48.4
Leq	74.6	72.9	70.3

NOTES:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.

2. "Night" relates to period from 10pm on this graph to 7am on the following graph.

3. Graphed data measured in free-field; tabulated results facade corrected

4. Night time Lmax values are shown only where Lmax > 65dB(A) and where Lmax-Leq ≥ 15dB(A)

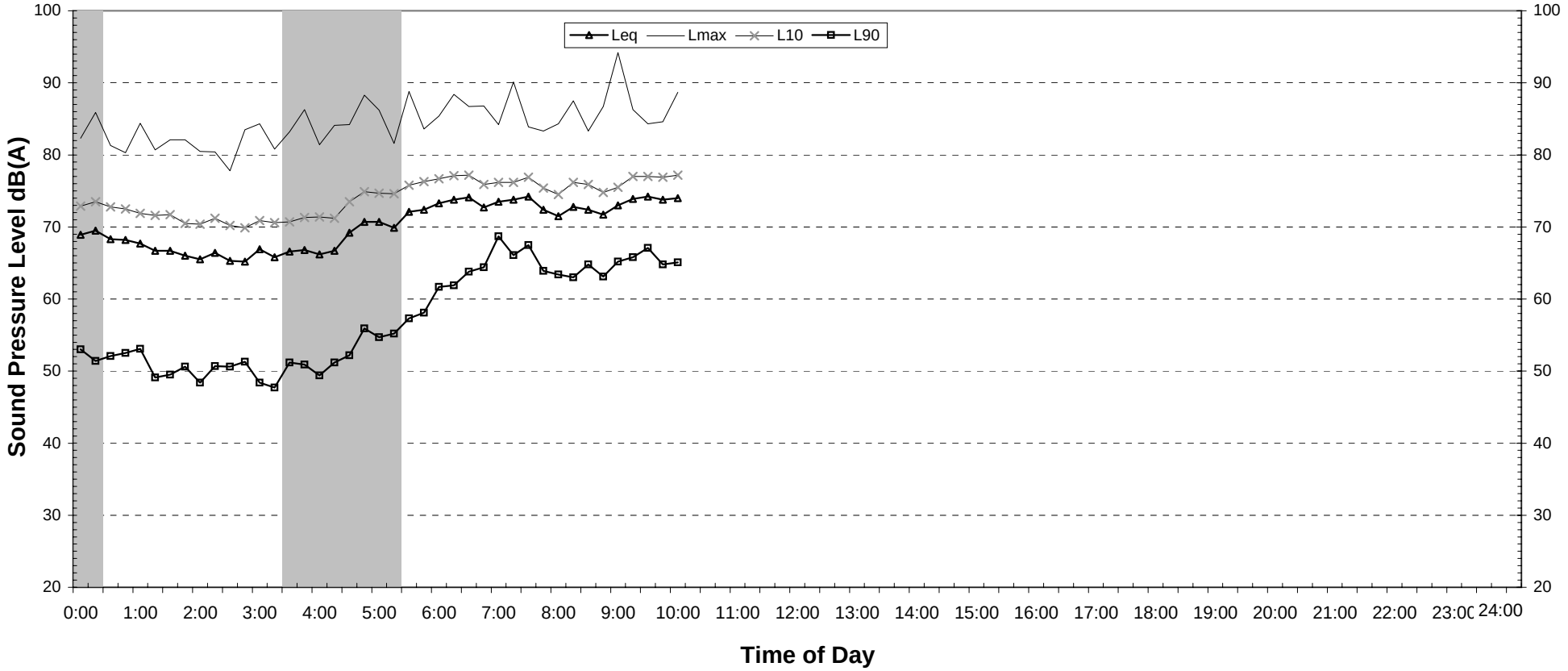
EPA Traffic Noise Policy (1m from facade) (see note 3)		
Descriptor	Day 7am-10pm	Night[2] 10pm-7am
Leq 15 hr and Leq 9 hr	75.7	72.8
Leq 1hr upper 10 percentile	77.1	76.1
Leq 1hr lower 10 percentile	74.3	68.3

Night Time Maximum Noise Levels (see note 4)			
Lmax (Range)	80.8	to	88.8
Lmax - Leq (Range)	15.0	to	18.3

EXISTING AMBIENT NOISE LEVELS

535 Princes Highway, Tempe

Friday, 18 March 2005



EPA Industrial Noise Policy (Free Field)			
Descriptor	Day 7am-6pm	Evening 6pm-10pm	Night[2] 10pm-7am
L90	63.1	-	-
Leq	73.2	-	-

NOTES:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.

2. "Night" relates to period from 10pm on this graph to 7am on the following graph.

3. Graphed data measured in free-field; tabulated results facade corrected

4. Night time Lmax values are shown only where Lmax > 65dB(A) and where Lmax-Leq ≥ 15dB(A)

EPA Traffic Noise Policy (1m from facade) (see note 3)		
Descriptor	Day 7am-10pm	Night[2] 10pm-7am
Leq 15 hr and Leq 9 hr	75.7	-
Leq 1hr upper 10 percentile	76.5	-
Leq 1hr lower 10 percentile	75.0	-

Night Time Maximum Noise Levels (see note 4)			
Lmax (Range)	-	to	-
Lmax - Leq (Range)	-	to	-

4 Bellevue St, Tempe

BACKGROUND & AMBIENT NOISE MONITORING RESULTS
NSW EPA's 'INDUSTRIAL NOISE POLICY', 2000

	L90 Background Noise Levels[5]			Leq Ambient Noise Levels		
Day	Day	Evening	Night	Day	Evening	Night
Friday-11-March-2005	-	49	40	-	66	64
Saturday-12-March-2005	48	45	39	72	68	64
Sunday-13-March-2005	42	48	39	71	67	64
Monday-14-March-2005	53	50	40	72	67	65
Tuesday-15-March-2005	51	48	43	71	68	67
Wednesday-16-March-2005	55	51	43	71	68	64
Thursday-17-March-2005	57	54	46	71	72	67
Friday-18-March-2005	58	-	-	73	-	-
Saturday-19-March-2005	-	-	-	-	-	-
Sunday-20-March-2005	-	-	-	-	-	-
Monday-21-March-2005	-	-	-	-	-	-
Tuesday-22-March-2005	-	-	-	-	-	-
Wednesday-23-March-2005	-	-	-	-	-	-
Thursday-24-March-2005	-	-	-	-	-	-
Friday-25-March-2005	-	-	-	-	-	-
Saturday-26-March-2005	-	-	-	-	-	-
Representative Level	**53**	**49**	**40**	**72**	**68**	**65**

Notes:

1. Day is taken to be 7:00am to 6:00pm
2. Evening is taken to be 6:00pm to 10:00pm.
3. Night is taken to be the remaining periods.
4. Partial day's monitoring
5. Assessment Background Level (ABL)
6. Rating Background Level (RBL) for L90 and logarithmic average for Leq

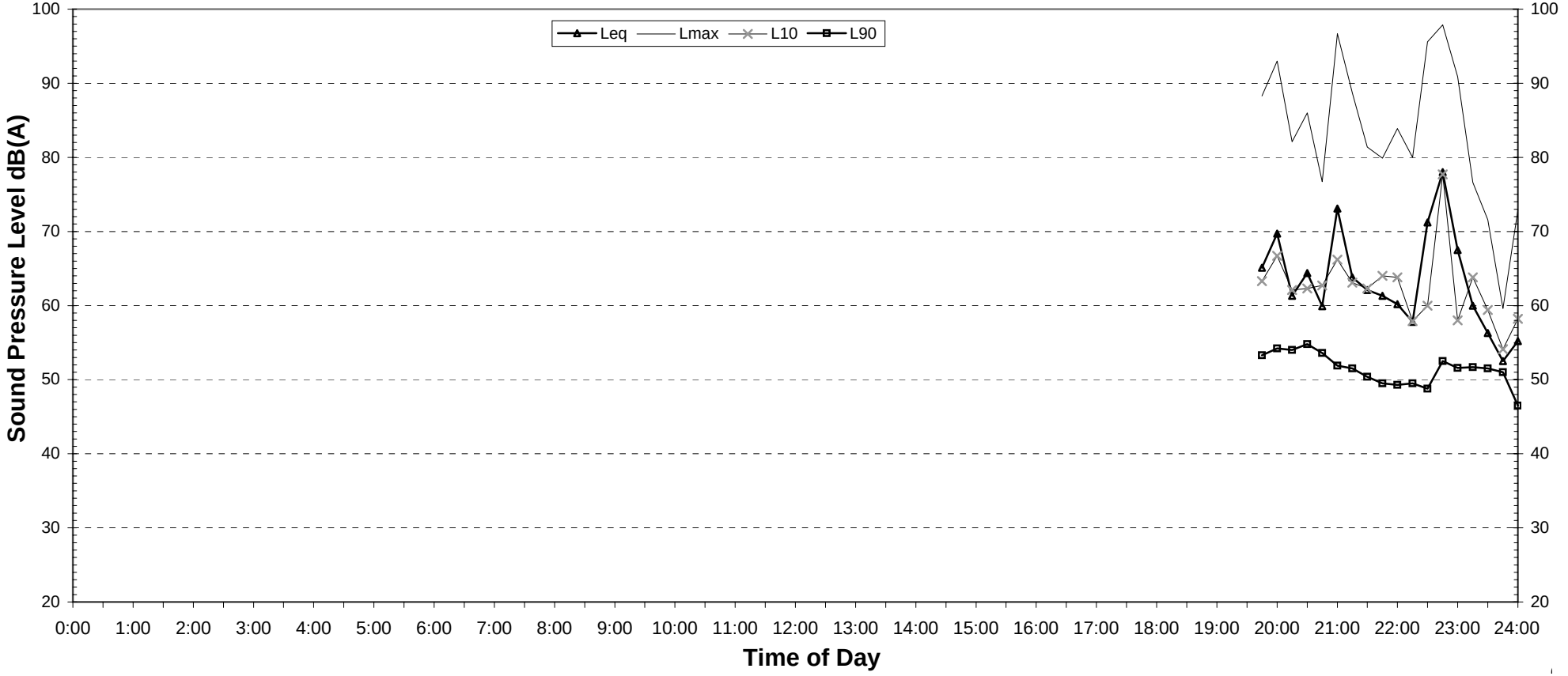
TRAFFIC NOISE MONITORING RESULTS
NSW EPA 'ENVIRONMENTAL CRITERIA FOR ROAD TRAFFIC NOISE', 1999

	Leq Noise Levels		Leq 1hr Noise Levels			
Day	Day	Night	Day - Up	Day - Low	Night - Up	Night - Low
Friday-11-March-2005	69	67	71	65	76	56
Saturday-12-March-2005	74	67	77	62	76	45
Sunday-13-March-2005	73	66	77	59	74	58
Monday-14-March-2005	74	68	76	67	77	46
Tuesday-15-March-2005	73	70	76	66	78	49
Wednesday-16-March-2005	74	66	76	70	71	49
Thursday-17-March-2005	74	69	75	73	76	52
Friday-18-March-2005	76	-	76	75	-	-
Saturday-19-March-2005	-	-	-	-	-	-
Sunday-20-March-2005	-	-	-	-	-	-
Monday-21-March-2005	-	-	-	-	-	-
Tuesday-22-March-2005	-	-	-	-	-	-
Wednesday-23-March-2005	-	-	-	-	-	-
Thursday-24-March-2005	-	-	-	-	-	-
Friday-25-March-2005	-	-	-	-	-	-
Saturday-26-March-2005	-	-	-	-	-	-
Representative Weekday	**74**	**68**	**75**	**71**	**76**	**52**
Representative Weekend	**73**	**67**	**77**	**61**	**76**	**55**

EXISTING AMBIENT NOISE LEVELS

4 Bellevue St, Tempe

Friday, 11 March 2005



EPA Industrial Noise Policy (Free Field)			
Descriptor	Day 7am-6pm	Evening 6pm-10pm	Night[2] 10pm-7am
L90	-	49.4	40.1
Leq	-	66.5	64.1

NOTES:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.

2. "Night" relates to period from 10pm on this graph to 7am on the following graph.

3. Graphed data measured in free-field; tabulated results facade corrected

4. Night time Lmax values are shown only where Lmax > 65dB(A) and where Lmax- Leq ≥ 15dB(A)

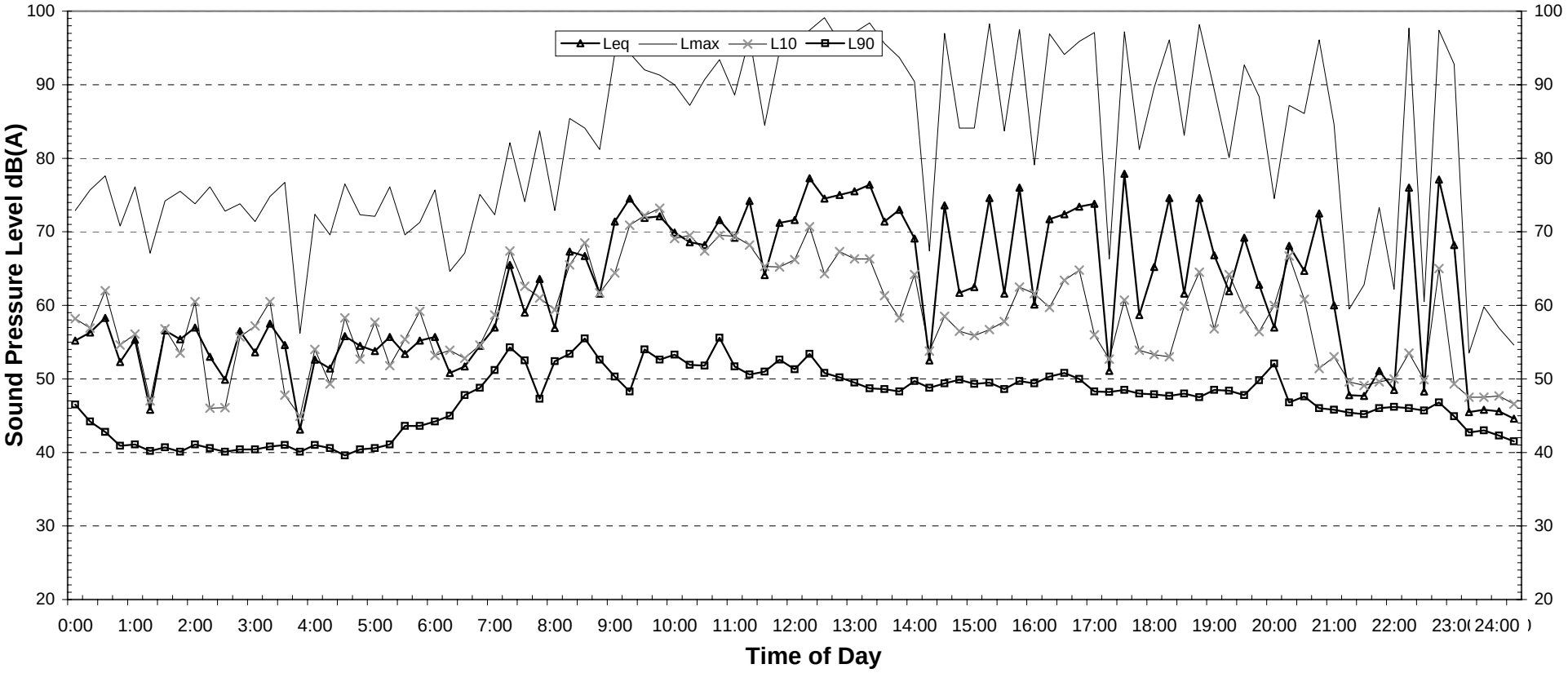
EPA Traffic Noise Policy (1m from facade) (see note 3)		
Descriptor	Day 7am-10pm	Night[2] 10pm-7am
Leq 15 hr and Leq 9 hr	69.0	66.6
Leq 1hr upper 10 percentile	70.5	75.6
Leq 1hr lower 10 percentile	64.6	56.4

Night Time Maximum Noise Levels (see note 4)			
Lmax (Range)	75.1	to	97.9
Lmax - Leq (Range)	19.8	to	24.8

EXISTING AMBIENT NOISE LEVELS

4 Bellevue St, Tempe

Saturday, 12 March 2005



EPA Industrial Noise Policy (Free Field)			
Descriptor	Day 7am-6pm	Evening 6pm-10pm	Night[2] 10pm-7am
L90	48.3	45.4	39.2
Leq	71.8	68.2	64.4

NOTES:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.

2. "Night" relates to period from 10pm on this graph to 7am on the following graph.

3. Graphed data measured in free-field; tabulated results facade corrected

4. Night time Lmax values are shown only where Lmax > 65dB(A) and where Lmax-Leq ≥ 15dB(A)

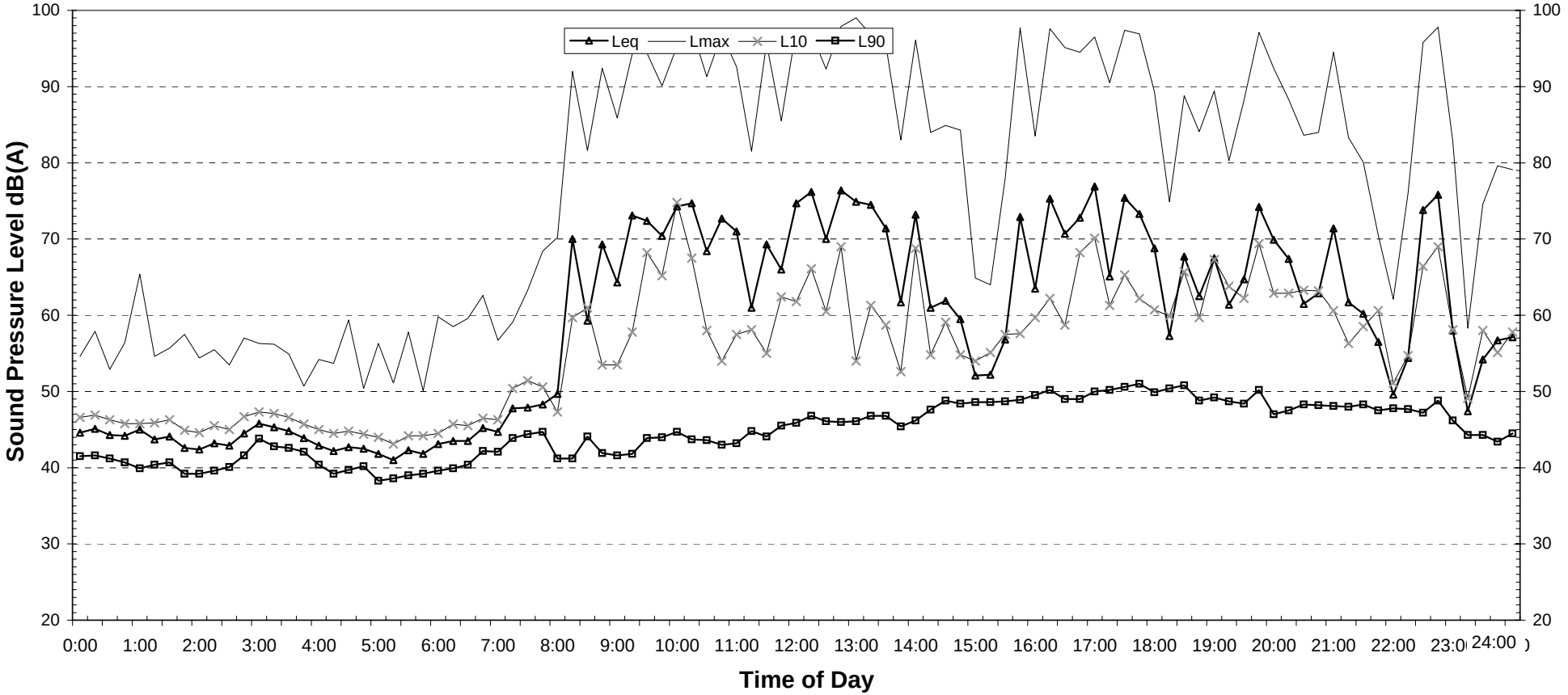
EPA Traffic Noise Policy (1m from facade) (see note 3)		
Descriptor	Day 7am-10pm	Night[2] 10pm-7am
Leq 15 hr and Leq 9 hr	73.6	66.9
Leq 1hr upper 10 percentile	77.2	76.4
Leq 1hr lower 10 percentile	62.2	44.6

Night Time Maximum Noise Levels (see note 4)			
Lmax (Range)	65.4	to	97.7
Lmax - Leq (Range)	17.1	to	23.8

EXISTING AMBIENT NOISE LEVELS

4 Bellevue St, Tempe

Sunday, 13 March 2005



EPA Industrial Noise Policy (Free Field)			
Descriptor	Day 7am-6pm	Evening 6pm-10pm	Night[2] 10pm-7am
L90	41.9	47.5	38.7
Leq	71.4	67.0	63.7

NOTES:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.

2. "Night" relates to period from 10pm on this graph to 7am on the following graph.

3. Graphed data measured in free-field; tabulated results facade corrected

4. Night time Lmax values are shown only where Lmax > 65dB(A) and where Lmax-Leq ≥ 15dB(A)

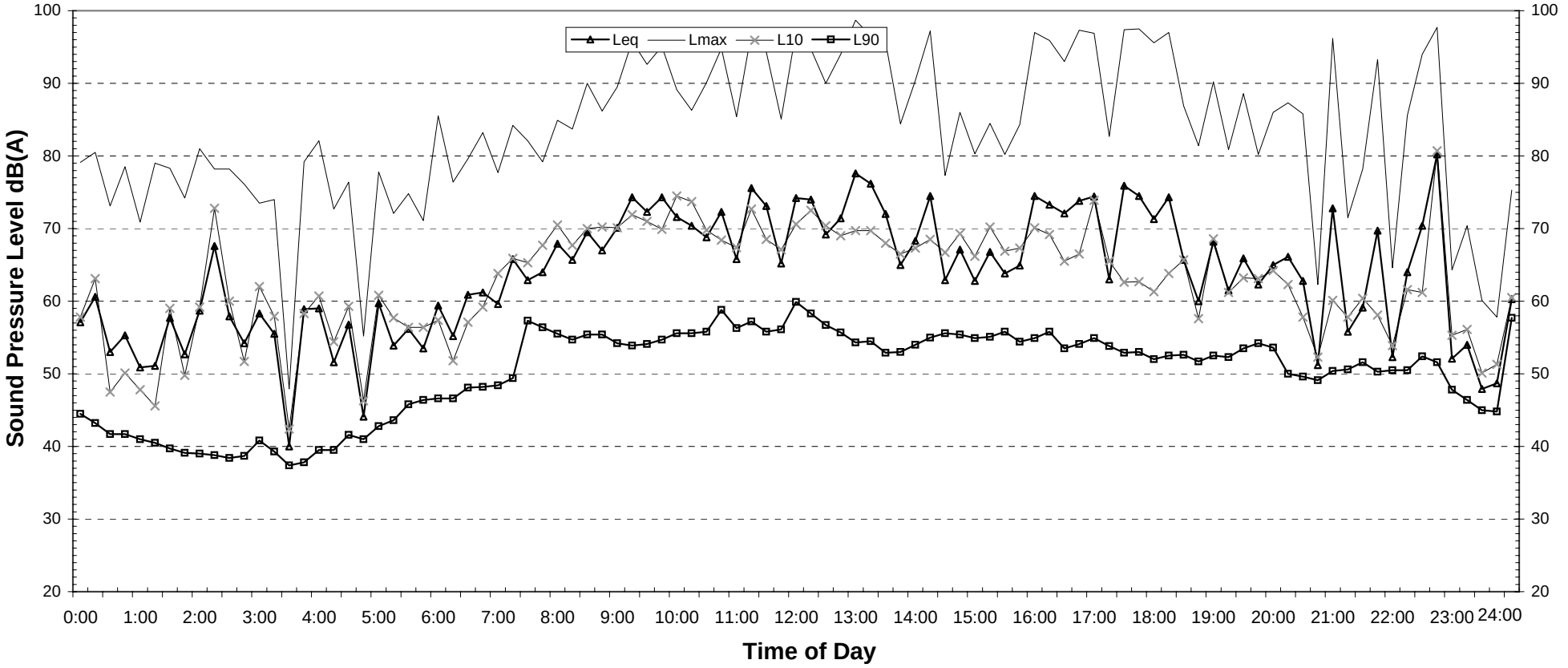
EPA Traffic Noise Policy (1m from facade) (see note 3)		
Descriptor	Day 7am-10pm	Night[2] 10pm-7am
Leq 15 hr and Leq 9 hr	73.1	66.2
Leq 1hr upper 10 percentile	77.3	74.5
Leq 1hr lower 10 percentile	58.7	57.6

Night Time Maximum Noise Levels (see note 4)			
Lmax (Range)	77.8	to	97.8
Lmax - Leq (Range)	15.6	to	29.1

EXISTING AMBIENT NOISE LEVELS

4 Bellevue St, Tempe

Monday, 14 March 2005



EPA Industrial Noise Policy (Free Field)			
Descriptor	Day 7am-6pm	Evening 6pm-10pm	Night[2] 10pm-7am
L90	53.0	49.6	39.6
Leq	71.8	67.2	65.4

NOTES:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.

2. "Night" relates to period from 10pm on this graph to 7am on the following graph.

3. Graphed data measured in free-field; tabulated results facade corrected

4. Night time Lmax values are shown only where Lmax > 65dB(A) and where Lmax-Leq ≥ 15dB(A)

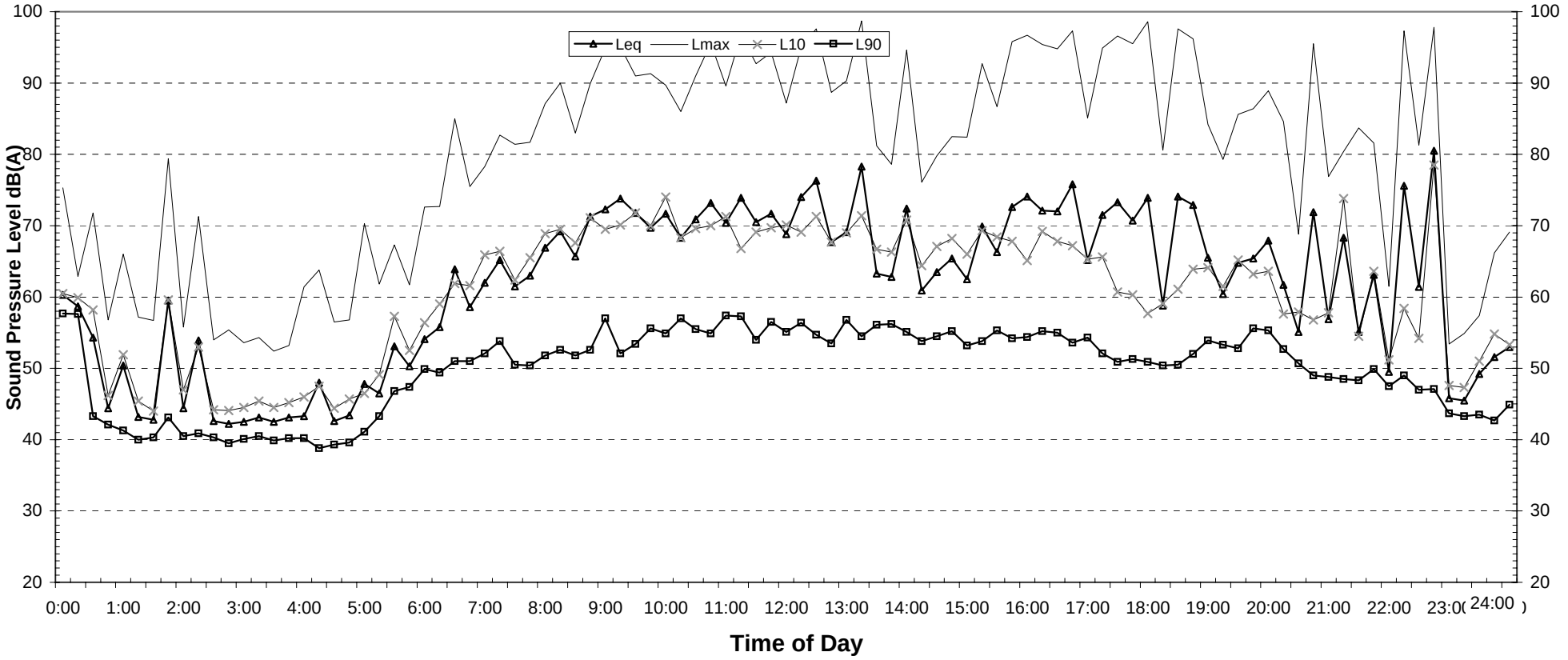
EPA Traffic Noise Policy (1m from facade) (see note 3)		
Descriptor	Day 7am-10pm	Night[2] 10pm-7am
Leq 15 hr and Leq 9 hr	73.5	67.9
Leq 1hr upper 10 percentile	76.3	77.2
Leq 1hr lower 10 percentile	66.7	45.5

Night Time Maximum Noise Levels (see note 4)			
Lmax (Range)	70.3	to	97.7
Lmax - Leq (Range)	17.2	to	25.6

EXISTING AMBIENT NOISE LEVELS

4 Bellevue St, Tempe

Tuesday, 15 March 2005



EPA Industrial Noise Policy (Free Field)			
Descriptor	Day 7am-6pm	Evening 6pm-10pm	Night[2] 10pm-7am
L90	51.3	48.3	42.7
Leq	71.4	67.5	67.1

NOTES:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.

2. "Night" relates to period from 10pm on this graph to 7am on the following graph.

3. Graphed data measured in free-field; tabulated results facade corrected

4. Night time Lmax values are shown only where Lmax > 65dB(A) and where Lmax-Leq ≥ 15dB(A)

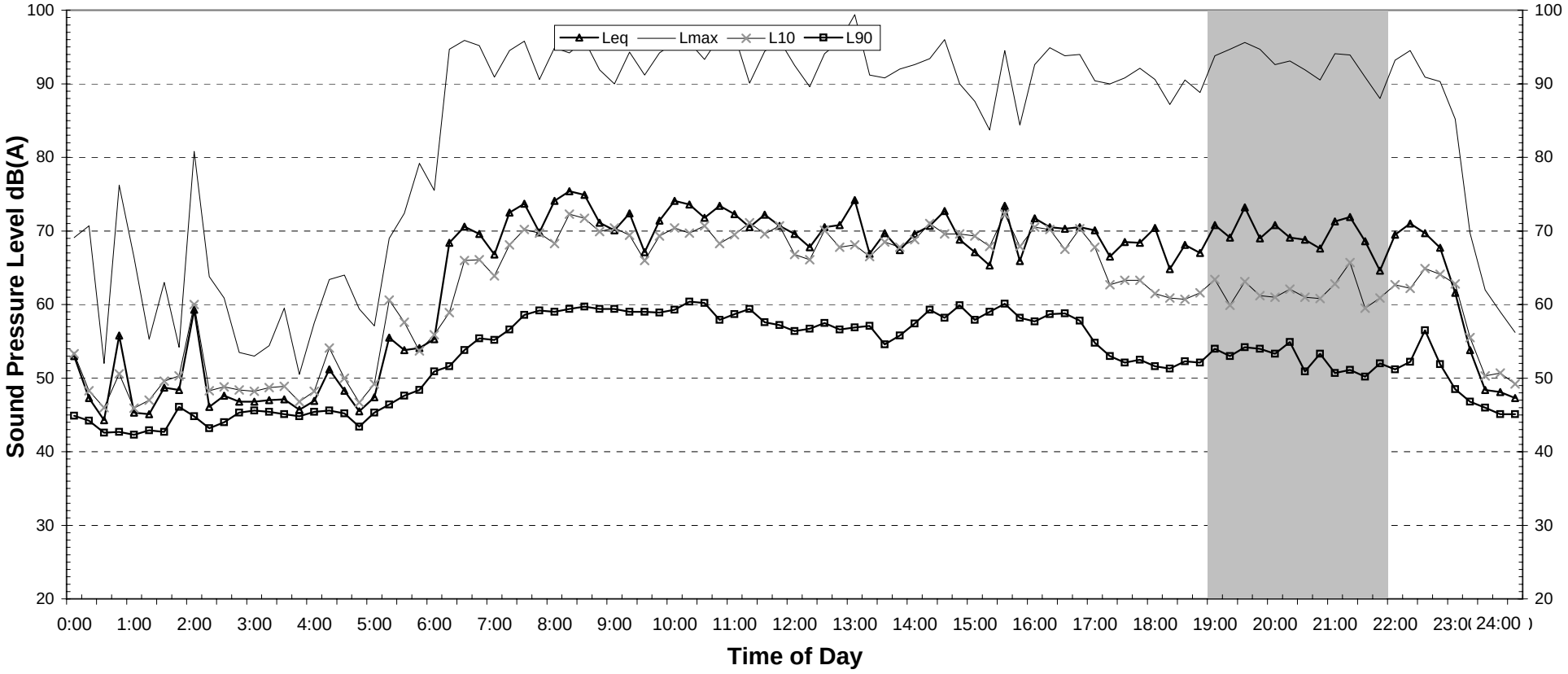
EPA Traffic Noise Policy (1m from facade) (see note 3)		
Descriptor	Day 7am-10pm	Night[2] 10pm-7am
Leq 15 hr and Leq 9 hr	73.2	69.6
Leq 1hr upper 10 percentile	75.8	78.2
Leq 1hr lower 10 percentile	66.0	49.2

Night Time Maximum Noise Levels (see note 4)			
Lmax (Range)	69.1	to	97.8
Lmax - Leq (Range)	15.4	to	26.8

EXISTING AMBIENT NOISE LEVELS

4 Bellevue St, Tempe

Wednesday, 16 March 2005



EPA Industrial Noise Policy (Free Field)			
Descriptor	Day 7am-6pm	Evening 6pm-10pm	Night[2] 10pm-7am
L90	54.6	51.2	43.2
Leq	71.3	67.7	63.6

NOTES:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.

2. "Night" relates to period from 10pm on this graph to 7am on the following graph.

3. Graphed data measured in free-field; tabulated results facade corrected

4. Night time Lmax values are shown only where Lmax > 65dB(A) and where Lmax-Leq ≥ 15dB(A)

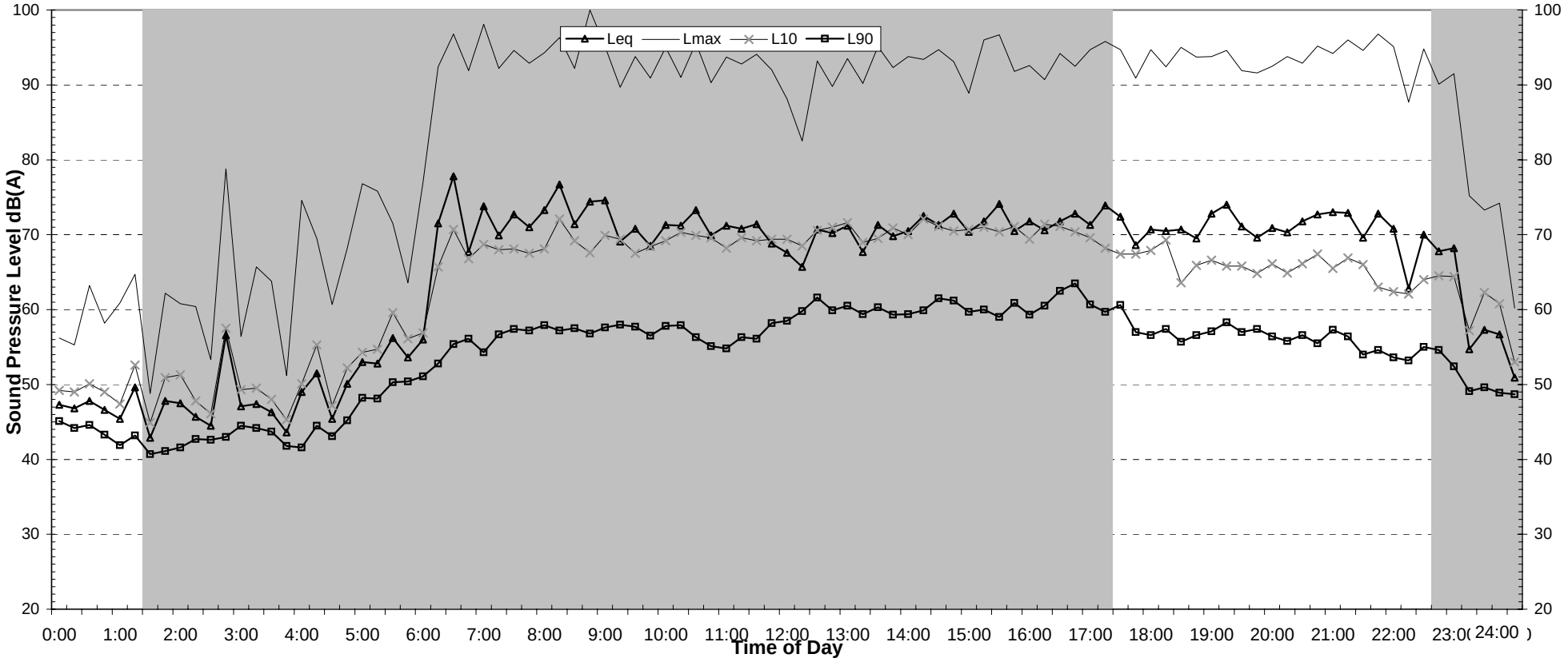
EPA Traffic Noise Policy (1m from facade) (see note 3)		
Descriptor	Day 7am-10pm	Night[2] 10pm-7am
Leq 15 hr and Leq 9 hr	73.6	66.1
Leq 1hr upper 10 percentile	75.8	71.1
Leq 1hr lower 10 percentile	69.9	49.2

Night Time Maximum Noise Levels (see note 4)			
Lmax (Range)	69.7	to	94.5
Lmax - Leq (Range)	15.1	to	25.9

EXISTING AMBIENT NOISE LEVELS

4 Bellevue St, Tempe

Thursday, 17 March 2005



EPA Industrial Noise Policy (Free Field)			
Descriptor	Day 7am-6pm	Evening 6pm-10pm	Night[2] 10pm-7am
L90	56.6	54.0	45.5
Leq	70.8	71.7	66.9

NOTES:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.

2. "Night" relates to period from 10pm on this graph to 7am on the following graph.

3. Graphed data measured in free-field; tabulated results facade corrected

4. Night time Lmax values are shown only where Lmax > 65dB(A) and where Lmax-Leq ≥ 15dB(A)

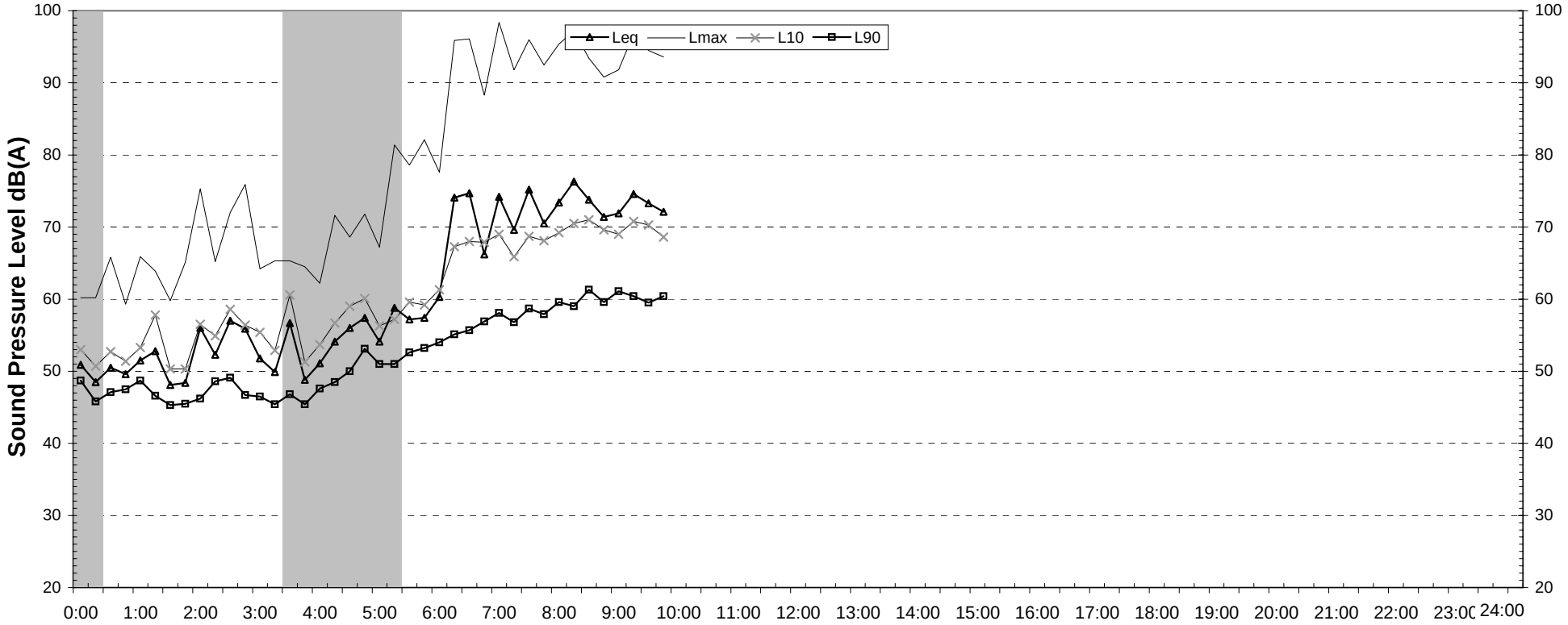
EPA Traffic Noise Policy (1m from facade) (see note 3)		
Descriptor	Day 7am-10pm	Night[2] 10pm-7am
Leq 15 hr and Leq 9 hr	74.0	69.4
Leq 1hr upper 10 percentile	74.6	75.8
Leq 1hr lower 10 percentile	73.3	52.4

Night Time Maximum Noise Levels (see note 4)			
Lmax (Range)	65.3	to	98.4
Lmax - Leq (Range)	15.3	to	27.1

EXISTING AMBIENT NOISE LEVELS

4 Bellevue St, Tempe

Friday, 18 March 2005



EPA Industrial Noise Policy (Free Field)			
Descriptor	Day 7am-6pm	Evening 6pm-10pm	Night[2] 10pm-7am
L90	57.9	-	-
Leq	73.3	-	-

NOTES:

1. Shaded periods denote measurements adversely affected by rain, wind or extraneous noise - data in these periods are excluded from calculations.

2. "Night" relates to period from 10pm on this graph to 7am on the following graph.

3. Graphed data measured in free-field; tabulated results facade corrected

4. Night time Lmax values are shown only where Lmax > 65dB(A) and where Lmax-Leq ≥ 15dB(A)

EPA Traffic Noise Policy (1m from facade) (see note 3)		
Descriptor	Day 7am-10pm	Night[2] 10pm-7am
Leq 15 hr and Leq 9 hr	75.8	-
Leq 1hr upper 10 percentile	76.3	-
Leq 1hr lower 10 percentile	75.2	-

Night Time Maximum Noise Levels (see note 4)			
Lmax (Range)	-	to	-
Lmax - Leq (Range)	-	to	-