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Toll IPEC - Freight Transport Facility

Noise Impact Assessment

Report Number 670.10233R3

27 November 2012

Goodman Property Services (Australia)
Level 17
60 Castlereagh Street
Sydney NSW 2000

Version: Revision 1

Toll IPEC - Freight Transport Facility

Noise Impact Assessment

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DOCUMENT CONTROL

Reference	Status	Date	Prepared	Checked	Authorised
670.10233R3	Revision 1	27 November 2012	Martin Davenport	John Cotterill	John Cotterill
670.10233R3	Revision 0	22 November 2012	Martin Davenport	John Cotterill	John Cotterill

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1 INTRODUCTION

SLR Consulting Australia Pty Ltd (SLR Consulting) has been commissioned by Goodman Property Services (Australia) [GPSA] to prepare a noise impact assessment (NIA) for the proposed Toll IPEC Freight Transport Facility in the Huntingwood West Estate (formerly known as Bungarribee Industrial Estate).

The noise assessment has been prepared with reference to Australian Standards (AS) 1055:1997 *Description and Measurement of Environmental Noise* Parts 1, 2 and 3 and in accordance with the New South Wales (NSW) Environment Protection Authority (EPA) *NSW Industrial Noise Policy* (INP), *Environmental Noise Control Manual* (ENCM), *NSW Interim Construction Noise Guideline* (ICNG) and *NSW Road Noise Policy* (RNP).

The scope of the assessment was also designed to address the Director-Generals Requirements (DGR's) for the project with regard to noise. A synopsis of these requirements is provided in **Table 1**.

Table 1 Director-General's Requirements

Director-General's Requirement	Section Addressed
Noise and Vibration	
Identify and provide a quantitative assessment of the main noise generating sources and activities at all stages of construction and any noise sources during operation, including traffic noise. Outline measures to minimise and mitigate the potential noise impacts on surrounding occupiers of land.	**Section 7**
Relevant Polices and Guidelines: - NSW Industrial Noise Policy (EPA) - Interim Construction Noise Guideline (DECC)	 **Sections 3, 4, 5, 6 and 7** **Sections 3, 4, 6 and 7**

The report uses specialist acoustic terminology. An explanation of common terms is provided in **Appendix A**.

2 PROJECT DESCRIPTION

2.1 Proposal

The proposed development consists of a freight transport facility and distribution warehouse and associated offices in the Huntingwood West Estate (formerly known as Bungarribee Industrial Estate).

The proposal seeks approval for the construction and operation of a freight warehouse and distribution centre with associated offices, workshop, weighbridge, truck wash, gatehouses, car parking and landscaping for Toll IPEC.

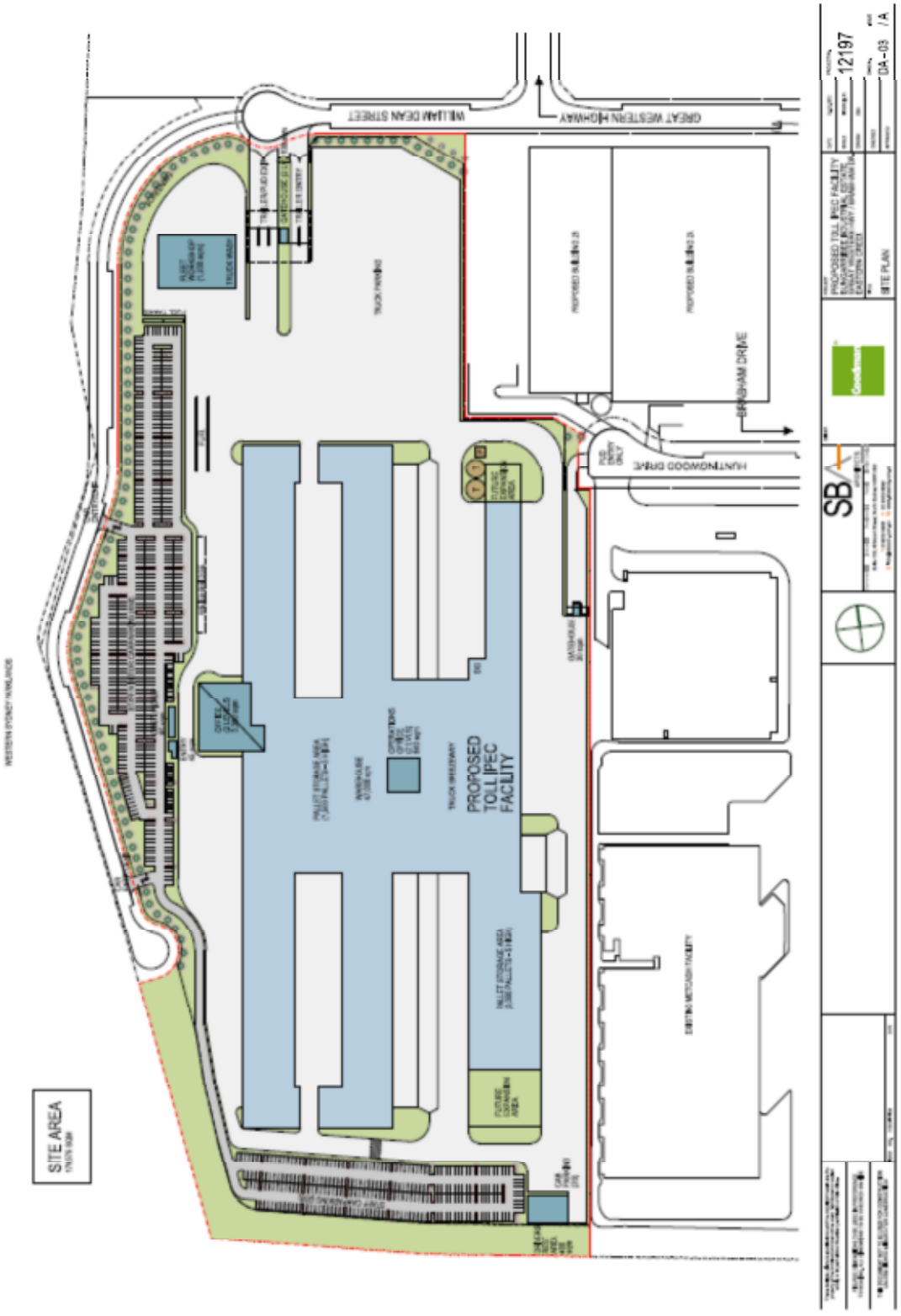
The major components of the proposal are as follows:

- One large warehouse building with ancillary offices and staff amenities as well as workshop and gatehouses having a total GFA of 53,305sqm which represents a FSR 0.3:1.
- Car parking for 700 cars, 14 disabled spaces and an additional 154 spaces for truck parking.
- Associated hardstand, loading and servicing areas.
- Landscaping of the site boundaries, entrances and throughout the car park.
- Fit-out and use of the completed building for operation by Toll IPEC.

The site is located on land to the east of the M7 and south of the Great Western Highway and is bounded to the south by the M4 motorway and the east by an existing industrial estate (refer to **Figure 1** and **Figure 2**).

Figure 1 Locality Map

Figure 2 Proposed Development



2.2 Nearest Residential Receivers

The nearest most potentially affected receivers are located to the west of the proposed development and are shown in **Figure 3**. Receiver 1 and Receiver 2 are located approximately 440 metres and 620 metres, respectively from the project site.

Figure 3 Nearest Potentially Affected Receiver Locations

3 NOISE IMPACT ASSESSMENT PROCEDURES

3.1 General Objectives

Responsibility for the control of noise emission in NSW is vested in Local Government and the EPA. The INP was released in January 2000 and provides a framework and process for deriving noise criteria for consents and licences that will enable the EPA to regulate premises that are scheduled under the *Protection of the Environment Operations Act, 1997* (PoEO Act).

The specific policy objectives of the INP are:

- To establish noise criteria that would protect the community from excessive intrusive noise and preserve amenity for specific land uses.
- To use the criteria as the basis for deriving Project specific noise levels.
- To promote uniform methods to estimate and measure noise impacts, including a procedure for evaluating meteorological effects.

- To outline a range of mitigation measures that could be used to minimise noise impacts.
- To provide a formal process to guide the determination of feasible and reasonable noise limits for consents or licences that reconcile noise impacts with the economic, social and environmental considerations of industrial development.
- To carry out functions relating to the prevention, minimisation and control of noise from the premises scheduled under the PoEO Act.

The INP provides two forms of noise criteria with the aim of achieving environmental noise objectives: one to account for intrusive noise which involves setting a noise goal objective relative to the existing acoustic environment and the other to protect the amenity of particular land uses.

3.2 Assessing Intrusiveness

For assessing intrusiveness, the background noise level must be measured. The intrusiveness criterion essentially means that the L_{Aeq} of the source (e.g. the Project) should not be more than five decibels above the measured background level (L_{A90}).

3.3 Assessing Amenity

The amenity assessment is based on noise criteria specific to land use and associated activities. The criteria relate only to industrial-type noise and do not include road, rail or community noise. The existing noise level from industry is measured. If it approaches the criterion value, then noise levels from new industries need to be designed so that the cumulative effect does not produce noise levels that would significantly exceed the criterion. For high-traffic areas there is a separate amenity criterion.

Extracts from the INP that relate to the amenity criteria are given in **Table 2** and **Table 3**.

Table 2 Amenity Criteria – Recommended L_{Aeq} Noise levels from industrial Noise Sources

Type of Receiver	Indicative Noise Amenity Area	Time of Day	Recommended $L_{Aeq(Period)}$ Noise Level (dBA)	
			Acceptable	Recommended Maximum
Residence	Rural	Day	50	55
		Evening	45	50
		Night	40	45
	Suburban	Day	55	60
		Evening	45	50
		Night	40	45
	Urban	Day	60	65
		Evening	50	55
		Night	45	50
	Urban/Industrial Interface (for existing situations only)	Day	65	70
		Evening	55	60
		Night	50	55
School classrooms - internal	All	Noisiest 1 hour period when in use	35	40
Hospital wards - internal - external	All	Noisiest 1 hour period	35 50	40 55
Place of worship - internal	All	When in use	40	45
Area specifically reserved for passive recreation (e.g. National Park)	All	When in use	50	55
Active recreation area (e.g. school playground, golf course)	All	When in use	55	60
Commercial premises	All	When in use	65	70
Industrial premises	All	When in use	70	75

Note: Daytime 7.00 am - 6.00 pm; Evening 6.00 pm - 10.00 pm; Night-time 10.00 pm - 7.00 am.
On Sundays and Public Holidays: Daytime 8.00 am - 6.00 pm; Evening 6.00 pm - 10.00 pm;
Night-time 10.00 pm - 8.00 am.
The L_{Aeq} index corresponds to the level of noise equivalent to the energy average of noise levels occurring over a measurement period.

Table 3 Modification to Acceptable Noise level (ANL) to Account for Existing Levels of Industrial Noise

Total Existing L_{Aeq} noise level from Industrial Noise Sources	Maximum L_{Aeq} Noise Level for Noise from New Sources Alone, dBA
≥ Acceptable noise level plus 2 dBA	If existing noise level is *likely to decrease* in future acceptable noise level minus 10 dBA If existing noise level is *unlikely to decrease* in future existing noise level minus 10 dBA
Acceptable noise level plus 1 dBA	Acceptable noise level minus 8 dBA
Acceptable noise level	Acceptable noise level minus 8 dBA
Acceptable noise level minus 1 dBA	Acceptable noise level minus 6 dBA
Acceptable noise level minus 2 dBA	Acceptable noise level minus 4 dBA
Acceptable noise level minus 3 dBA	Acceptable noise level minus 3 dBA
Acceptable noise level minus 4 dBA	Acceptable noise level minus 2 dBA
Acceptable noise level minus 5 dBA	Acceptable noise level minus 2 dBA
Acceptable noise level minus 6 dBA	Acceptable noise level minus 1 dBA
< Acceptable noise level minus 6 dBA	Acceptable noise level

ANL = recommended acceptable L_{Aeq} noise level for the specific receiver, area and time of day from **Table 2.**

3.4 INP Project Specific Criteria

The INP Project Specific Noise Criteria are the more stringent of either the amenity or intrusive criteria. The INP states that these criteria have been selected to protect at least 90% of the population living in the vicinity of industrial noise sources from the adverse effects of noise for at least 90% of the time. Provided the criteria in the INP are achieved, it is unlikely that most people would consider the resultant noise levels excessive.

Table 4 provides the methodology for the noise impact assessment for the Project's intrusive and amenity assessment criteria.

Table 4 Noise Impact Assessment Methodology

Assessment Criteria	Project Specific Criteria	Noise Management Zone	Noise Affectation Zone
Intrusive	Rating background level plus 5 dBA	≤ 5 dBA above Project specific criteria	> 5 dBA above Project specific criteria
Amenity	INP based on existing industrial level	≤ 5 dBA above Project specific criteria	> 5 dBA above Project specific criteria

For the purposes of assessing the potential noise impacts the Project specific, management and affectation criteria are further defined as follows.

3.4.1 Project Specific Criteria

Most people in the broader community would generally consider exposure to noise levels corresponding to this zone acceptable.

3.4.2 Noise Management Zone

Depending on the degree of exceedance of the Project specific criteria (1 dBA to 5 dBA) noise impacts could range from negligible to moderate. It is recommended that management procedures be implemented including:

- prompt response to any community issues of concern;
- noise monitoring on site and within the community;
- refinement of on-site noise mitigation measures and plant operating procedures where practical;
- consideration of acoustical mitigation at receivers; and
- consideration of negotiated agreements with property holders.

3.4.3 Noise Affectation Zone

Exposure to noise levels exceeding the Project specific criteria by more than 5 dB(A) may be considered unacceptable by some property holders and the INP recommends that the proponent explore the following:

- discussions with relevant property holders to assess concerns and provide solutions;
- implementation of acoustical mitigation at receivers; and
- negotiated agreements with property holders, where required.

3.5 Assessing Sleep Disturbance

The EPA has acknowledged that the relationship between maximum noise levels and sleep disturbance is not currently well defined. Criteria for assessing sleep disturbance has not been defined under the INP but it is assumed that conformance with the INP would protect against the likelihood of awakening reactions. Notwithstanding the preceding, sleep arousal has been assessed using the guidelines set out in the ENCM Section 19-3.

To avoid the likelihood of sleep disturbance the ENCM recommends that the $L_{A1(1minute)}$ of the noise source under consideration should not exceed the background noise level (L_{A90}) by more than 15 dBA when measured outside the bedroom window of the receiver during the night-time hours (10.00 pm to 7.00 am).

The RNP provides further guidance with regard to sleep disturbance and calls upon a number of studies that have been conducted into the effect of maximum noise levels on sleep. The EPA policy document acknowledges that, at the current level of understanding, it is not possible to establish absolute noise level criteria that would correlate to an acceptable level of sleep disturbance. However, the RNP provides that maximum internal noise levels below 50 to 55 dBA are unlikely to cause awakening reactions and one or two events per night, with maximum internal noise levels of 65 to 70 dBA (inside dwellings) are not likely to significantly affect health and wellbeing.

3.6 Construction Noise

The EPA has prepared an interim guideline covering construction noise. The ICNG sets out noise criteria applicable to construction site noise for the purpose of defining intrusive noise impacts. **Table 5** sets out the noise management levels and how they are to be applied for residential receivers. The approach is intended to provide respite for residents exposed to excessive construction noise outside the recommended standard hours whilst allowing construction during the recommended standard hours without undue constraints.

Table 5 Construction Noise Goals

Time of Day	Management Level	How to apply
Recommended standard hours : Monday to Friday 7:00 am to 6:00 pm Saturday 8:00 am to 6:00 pm No work on Sundays or public holidays	Noise affected RBL* + 10 dBA	The noise affected level represents the point above which there may be some community reaction to noise. Where the predicted or measured $L_{Aeq(15minute)}$ is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to minimise noise. The proponent should also inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration, as well as contact details.
	Highly noise affected 75 dBA	The highly affected noise level represents the point above which there may be strong community reaction to noise. Where noise is above this level, the proponent should consider very carefully if there is any other feasible and reasonable way to reduce noise below this level. If no quieter work method is feasible and reasonable, and the works proceed, the proponent should communicate with the impacted residents by clearly explaining the duration and noise levels of the works, and by describing any respite periods that will be provided.
Outside recommended standard hours	Noise affected RBL* + 5 dBA	A strong justification would typically be required for works outside the recommended standard hours. The proponent should apply all feasible and reasonable work practices to meet the noise affected level. Where all feasible and reasonable practices have been applied and noise is more than 5 dBA above the noise affected level, the proponent should negotiate with the community.

* Rating Background Level as described by the NSW Industrial Noise Policy.

Note: $L_{Aeq(15minute)}$ represents the equivalent continuous noise level of a 15 minute period.

3.7 Road Traffic Noise

The RNP presents guidelines for road traffic noise assessment. The policy document provides road traffic noise criteria for "land use development with the potential to generate additional traffic on existing roads".

Two criteria specified in the RNP are relevant to the Project; the road traffic noise assessment criteria and relative increase criteria (**Table 5**). In accordance with the RNP, if exceedances of both the noise assessment criteria and relative increase criteria are predicted, the greater of the exceedances is the controlling criteria.

Table 6 Road Traffic Noise Criteria for Residential Land Uses

Assessment Criteria	Road Category	Type of Project/Land Use	Assessment Criteria/Total Traffic Noise Level Increase	
			Day	Night
Noise Assessment Criteria	Freeway/arterial/ Sub-arterial Roads	Existing residences affected by additional traffic on existing freeways/arterial/sub-arterial roads generated by land use developments	$L_{Aeq(15hour)}$ 60 dBA (external)	$L_{Aeq(9hour)}$ 55 dBA (external)
Relative Increase	Freeway/arterial/ Sub-arterial Roads	New road corridor/redevelopment of existing road/land use development with the potential to generate additional traffic on existing road	Existing traffic $L_{Aeq(15hour)}$ + 12 dB (external)	Existing traffic $L_{Aeq(9hour)}$ + 12 dB (external)

Note: Day 7:00 am to 10:00 pm; Night 10:00 pm to 7:00 am.

4 EXISTING ACOUSTICAL ENVIRONMENT

SLR Consulting conducted ambient background noise monitoring at two (2) locations within close proximity to the Project area as part of the noise impact assessment for the existing Metcash facility in Huntingwood West Estate adjacent the project site (refer SLR Consulting report 30-2154-R2R1 Huntingwood West Estate Noise Impact Assessment dated 20 December 2010).

A summary of the results of the ambient noise monitoring from this report is provided in **Table 7**.

Table 7 Summary of Ambient Background Noise Levels

Location	Period	Rating Background Level (RBL)	Measured Existing LAeq(period) Noise Level	Estimated Existing Industrial Contribution LAeq
Receiver 1 47 Pikes Lane	Day	50 dBA	55 dBA	<55 dBA
	Evening	51 dBA	54 dBA	<44 dBA
	Night	46 dBA	54 dBA	<39 dBA
Receiver 2 711 Great Western Highway	Day	50 dBA	56 dBA	<55 dBA
	Evening	50 dBA	56 dBA	<44 dBA
	Night	46 dBA	55 dBA	<39 dBA

Note: Daytime 7.00 am to 6.00 pm; Evening 6.00 pm to 10.00 pm; Night-time 10.00 pm to 7.00 am
On Sundays and Public Holidays: Daytime 8.00 am to 6.00 pm; Evening 6.00 pm to 10.00 pm; Night-time 10.00 pm to 8.00 am
The L_{A90} represents the level exceeded for 90% of the interval period and is referred to as the average minimum or background noise level
The LAeq represents the equivalent continuous noise level and is defined as the level of noise equivalent to the energy average of noise levels occurring over a measurement period.

The ambient noise environment at Receiver 1 and 2 was typical of an urban location. Ambient noise levels were dominated by heavy and continuous traffic flow from the M7 and Great Western Hwy.

5 INP ASSESSMENT OF PREVAILING WEATHER CONDITIONS

5.1.1 Wind

Wind has the potential to increase noise at a receiver when it is light and stable and blows from the direction of the source of the noise. As the strength of the wind increases the noise produced by the wind will obscure noise from most industrial and transport sources.

Wind effects need to be considered when wind is a feature of the area under consideration. The INP states that where wind blows from the source to the receiver at speeds up to 3 m/s for more than 30% of the time in any season, then wind is considered to be a feature of the area and noise level predictions must be made under these conditions.

As part of the noise impact assessment for the existing Metcash facility in Huntingwood West Estate adjacent the project site (refer SLR Consulting report 30-2154-R2R1 Huntingwood West Estate Noise Impact Assessment dated 20 December 2010) 12 months of weather data from September 2009 to September 2010 was obtained from the Bureau of Meteorology automatic weather station at Horsley Park, approximately 6km south of the subject site.

This data was analysed to determine the frequency of occurrence of winds of speeds up to 3 m/s in each season during the day, evening and night time periods. The results of the wind analysis for daytime, evening, and night-time winds are presented in **Table 8**, **Table 9** and **Table 10**, respectively. In each table, the wind directions and percentage occurrence are those dominant during each season.

Table 8 Seasonal Frequency of Occurrence of Wind Speed Intervals – Daytime

Period	Calm	Wind Direction	0.5 to 2 m/s	2 to 3 m/s	0.5 to 3 m/s
Summer	2.0%	N±45	4.4%	6.6%	10.9%
Autumn	4.8%	NNW±45	8.2%	7.8%	16.0%
Winter	10.7%	NW±45	8.1%	7.1%	15.2%
Spring	2.2%	N±45	3.4%	5.5%	8.9%

Table 9 Seasonal Frequency of Occurrence of Wind Speed Intervals – Evening

Period	Calm	Wind Direction	0.5 to 2 m/s	2 to 3 m/s	0.5 to 3 m/s
Summer	6.4%	SE±45	4.8%	9.4%	14.2%
Autumn	16.4%	SW±45	7.7%	9.8%	17.5%
Winter	17.6%	WSW±45	7.1%	11.2%	18.3%
Spring	10.5%	E±45	5.3%	7.7%	13.0%

Table 10 Seasonal Frequency of Occurrence of Wind Speed Intervals – Night-time

Period	Calm	Wind Direction	0.5 to 2 m/s	2 to 3 m/s	0.5 to 3 m/s
Summer	21.2%	SSW±45	10.0%	15.2%	25.2%
Autumn	24.4%	WSW±45	12.1%	15.8%	27.9%
Winter	19.7%	W±45	11.0%	9.7%	20.7%
Spring	23.9%	SW±45	9.7%	9.2%	18.9%

Seasonal wind records indicate that significant winds (of up to 3 m/s) are not a feature of the area since the 30% threshold is not exceeded during any period. Therefore, prevailing winds have not been considered as part of this assessment.

5.1.2 Temperature Inversion

Temperature inversions, when they occur, have the ability to increase noise levels by focusing sound waves. Temperature inversions occur predominantly at night during the winter months. For a temperature inversion to be a significant characteristic of the area it needs to occur for approximately 30% of the total night-time during winter, or about two nights per week.

The NSW INP states that temperature inversions need only be considered for the night-time noise assessment period (10.00 pm to 7.00 am). Temperature inversion data was not attainable from the Horsley Park weather station. Therefore, in accordance with the INP, operational noise levels representing a worst case scenario were modelled using the INP default temperature inversion value of 3^{o}C/100 m for the night-time period (10.00 pm – 7.00 am).

6 PROJECT SPECIFIC NOISE CRITERIA

The noise emission design criteria for the proposed development have been established with reference to the INP outlined in **Section 3** of this report.

The amenity criteria have been established using the results of ambient noise measurements. The acoustical environment adjacent to the Great Western Highway, M4 and M7 typifies an urban environment, with heavy and continuous traffic flows, and residences near industrial districts. Therefore, the nearest potentially affect residences in Eastern Creek (refer to **Figure 3**) have been assessed as an "urban" receiver type.

The resulting operational project specific noise criteria for the proposed development are shown in **bold** within **Table 11.**

Table 11 Project Specific Noise Criteria

Location	Period	Intrusiveness Criteria $L_{Aeq(15minute)}$	DECCW Acceptable Amenity Criteria $L_{Aeq(Period)}$	Project Specific Noise Criteria
Receiver 1 47 Pikes Lane	Daytime	55	60	55 dBA $L_{Aeq(15minute)}$
	Evening	55	50	50 dBA $L_{Aeq(Period)}$
	Night	51	45	45 dBA $L_{Aeq(Period)}$
Receiver 2 711 Great Western Highway	Daytime	55	60	55 dBA $L_{Aeq(15minute)}$
	Evening	55	50	50 dBA $L_{Aeq(Period)}$
	Night	51	45	45 dBA $L_{Aeq(Period)}$

6.1 Sleep Disturbance Noise Goals

Night-time sleep disturbance noise goals have been set with reference to the ENCM as outlined in **Section** Error! Reference source not found.**3.5** of this report and are presented in **Table 12.** These noise goals have been determined based on the minimum $L_{A90(15minute)}$ noise level recorded at Receiver 1 and Receiver 2 during the night-time over the noise monitoring period and thus provide a conservative assessment.

Table 12 Sleep Disturbance Noise Goals

Location	Period	Sleep Disturbance $L_{A1(1minute)}$ Noise Goal
Receiver 1 47 Pikes Lane	Night-time (10 pm – 7 am)	61
Receiver 2 711 Great Western Highway		

6.2 Construction Noise Criteria

The daytime background noise level (L_{A90}) has been determined at the most potentially affected residential locations. The project specific construction noise goals applicable to the proposed development are presented in **Table 13**.

Table 13 Construction Noise Goals – Potentially Affected Residential Areas

Location	Construction $L_{Aeq(15minute)}$ Nose Goal (dBA)	
	Noise Affected	**Highly Noise Affected**
Receiver 1 47 Pikes Lane	60	75
Receiver 2 711 Great Western Highway		

Note: Recommended standard hours: Monday to Friday 7am to 6pm, Saturday 8am to 1pm and no work Sundays or public holidays

6.3 Road Traffic Noise Criteria

The site is located on land to the east of the M7 and south of the Great Western Highway and is bounded to the south by the M4 motorway and the east by an existing industrial estate (refer to **Figure 1**).

The proposed development will be accessed from either Brabham Drive or Huntingwood Drive via Great Western Highway.

It is noted that no residentially zoned land is located near Brabham Drive or Huntingwood Drive and only industrial/commercial zoned land surrounds Brabham Drive or Huntingwood Drive. As such only the Great Western Highway has been assessed with relation to road traffic noise from the proposed development and the criteria outlined in **Table 6** have been adopted.

7 ASSESSMENT OF NOISE IMPACTS

7.1 Noise Modelling

SoundPLAN V7.1 with CONCAWE algorithm has been used to calculate the noise emissions from the subject development. A three-dimensional digital terrain map giving all relevant topographic information was used in the modelling process. The model used the following parameters to predict noise levels at the nearest potentially affected receivers:

- The topographic map
- Noise source data
- Ground cover
- Shielding by barriers and/or adjacent buildings
- Atmospheric information.

7.2 Noise Modelling Parameters

Prediction of operational noise under calm and prevailing meteorological condition (temperature inversion) was conducted. Atmospheric parameters under which noise predictions were made are given in **Table 14**.

Table 14 Meteorological Parameters for Noise Predictions

	Temperature	Humidity	Wind Speed	Wind Direction	Temperature Gradient
Calm (all Periods)	20^0C	70%	N/A	N/A	N/A
Temperature inversion	10^0C	90%	N/A	N/A	3^oC/100 m

7.3 Operational Noise Modelling Scenario

The following worst-case operational scenario was used to predict $L_{Aeq(15minute)}$ noise levels during the day, evening and night-time from the proposed site. The scenario assumes the following equipment is in operation continuously for a 15-minute period:

- 30 delivery trucks on site and operating outside the building enclosure.
- 30 forklifts operating outside the building enclosure.
- 8 external condenser units operating.
- 8 external compressor units operating.
- 30 light vehicles operating on site.

It should be noted that this operational scenario is considered to be a worst-case scenario for the site as actual operational activity would be less than those modelled. It should also be noted that this level of operational activity was assumed to occur at any 15-minte period during the daytime, evening and night-time period to provide a conservative assessment of potential noise impacts.

The sound power level for acoustically significant items of plant and equipment from proposed operations are given in **Table 15**. **Appendix B** provides the octave band plant and equipment sound power levels used in the noise modelling.

Table 15 Equipment Sound Power Levels

Plant and Equipment	L_{Aeq} Sound Power Level (dBA re 10^{-12} W)
Truck departure/arrival	92
Condenser unit (single unit)	95
Gas powered forklift	95
Light vehicle/car	83
Compressor Unit (single unit)	92

7.4 Operational Noise Modelling Results

Predicted noise emission levels from the proposed development at the nearest most potentially affected residential receivers are provided in **Table 16**.

Table 16 Predicted Operational Noise Levels – Residential Receivers

Location	Period	Predicted Noise Level $L_{Aeq(15minute)}$ (dBA)			Project Specific Noise Level
		Calm	Prevailing Wind	Temperature Inversion	
Receiver 1 47 Pikes Lane	Day	41	N/A	N/A	55 dBA LAeq(15minute)
	Evening	41	N/A	N/A	50 dBA LAeq(Period)
	Night	41	N/A	45	45 dBA LAeq(Period)
Receiver 2 711 Great Western Highway	Day	35	N/A	N/A	55 dBA LAeq(15minute)
	Evening	35	N/A	N/A	50 dBA LAeq(Period)
	Night	35	N/A	40	45 dBA LAeq(Period)

Noise predictions indicate that noise emissions from the proposed development would comply with project specific noise criteria at all locations for operation during the day, evening and night periods under calm and prevailing weather conditions. It should also be noted that predictions provided here are based on a worst case 15 minute operational period. $L_{Aeq(period)}$ noise emissions from the site during the evening and night-time would be less than those provided in **Table 16**.

7.5 Sleep Disturbance

The potential for sleep disturbance at nearby residence locations has been assessed as the proposed development is proposed to operate 24 hours a day 7 days per week. Typical L_{Amax} noise levels for night-time activities are provided in **Table 17**.

Table 17 Equipment Maximum Sound Power Levels

Plant and Equipment	L_{Amax} Sound Power Level (dBA re 10^{-12} W)
Truck departure/arrival	97
Condenser unit (single unit)	100
Gas powered forklift	100
Air-conditioning Unit (single unit)	70
Compressor Unit (single unit)	97

The predicted sleep disturbance worst case scenario noise levels associated with the proposed development operations are present in **Table 18**. Error! Not a valid bookmark self-reference.**Appendix B** provides the octave band plant and equipment sound power levels used in the noise modelling.

Table 18 Predicted Sleep Disturbance Noise Levels at Residential Receivers

Assessment Location	Predicted L_{Amax} Noise Level (dBA)	Night-time $L_{A1(1minute)}$ Noise Consent Criterion (dBA)
	Temperature Inversion	
Receiver 1 47 Pikes Lane	47	61
Receiver 2 711 Great Western Highway	43	

The L_{Amax} noise levels are predicted to be below the sleep disturbance noise goals provided in **Table 12** for night-time operation of the proposed development. This being the case, sleep disturbance is unlikely to occur at residential locations surrounding the subject site.

7.6 Cumulative Noise Impact

As discussed in **Section 3** the NSW Industrial Noise Policy (INP) prescribes detailed calculation routines for establishing "project specific" $L_{Aeq(15minute)}$ intrusive criteria and $L_{Aeq(period)}$ amenity criteria at potentially affected receivers for a development (in isolation).

Potential cumulative noise impacts from existing and successive resource developments are embraced by the INP procedures by ensuring that the appropriate noise emission criteria (and consent limits) are established with a view to maintaining acceptable noise *amenity* levels for residences.

An indicative cumulative noise impact assessment can be based upon an evaluation of predicted noise emission level of surrounding industrial operations. There is potential for the simultaneous operation of the proposed development and the neighbouring existing Metcash facility. The acceptable noise amenity criteria can be assessed by adding the predicted noise levels from the existing and proposed developments together. The cumulative intrusive $L_{Aeq(15minute)}$ noise level from each development is adjusted (by -3 dB) to the equivalent amenity level for comparison with the relevant amenity criteria for each location.

Predicted noise levels for the existing Metcash facility have been taken from the noise impact assessment for the site (refer SLR Consulting report 30-2154-R2R1 Huntingwood West Estate Noise Impact Assessment dated 20 December 2010).

Predicted cumulative noise levels based on the predicted noise levels from the proposed development and existing Metcash facility are provided in **Table 19**.

Table 19 Predicted Cumulative Noise Levels

Receiver Location	Period	Predicted Noise Level $L_{Aeq(period)}$				Cumulative Noise Level $L_{Aeq(period)}$	
		Project		Metcash Facility			
		Calm	Meteorologically Enhanced	Calm	Meteorologically Enhanced	Calm	Meteorologically Enhanced
Receiver 1 47 Pikes Lane	Day	38	N/A	34	N/A	39	N/A
	Evening	38	N/A	34	N/A	39	N/A
	Night	38	42	34	38	39	43
Receiver 2 711 Great Western Highway	Day	32	N/A	30	N/A	34	N/A
	Evening	32	N/A	30	N/A	34	N/A
	Night	32	37	30	35	34	39

Based on the results presented in **Table 19**, the estimated cumulative $L_{Aeq(period)}$ amenity levels are below the INP acceptable amenity criteria of 60 dBA, 50 dBA and 45 dBA during the daytime, evening and night-time periods, respectively.

7.7 Construction

Following discussions with GPSA acoustically significant plant and equipment used in the construction of the project would typically consist of the following:

Earthworks

- Scraper (3 off)
- Compactor
- Dozer (2 off)
- Articulated dump truck (2 off)

Building Construction

- Concrete agitators
- Concrete boom pump
- Cranes
- Hand tools (various)
- Delivery trucks
- Genset

The sound power levels of the major noise generating plant and equipment to be used in the construction of the proposed development are given in **Table 20**. Sound power levels for equipment used in the assessment have been obtained from a SLR Consulting database of similar equipment.

Table 20 Acoustically Significant Equipment Sound Power Levels

Building Construction Equipment	Sound Power Level (dBA re 10^{-12} W)
Earthworks	
Scraper	111
Compactor	110
Dozer (2 off)	110
Articulated dump trucks (2 off)	102
Building Construction	
Concrete transit mixers	111
Concrete boom pump	107
Mobile Cranes	104
Hand tools	up to 104
Delivery trucks	92
Genset	107

7.7.1 Construction Noise Modelling Results

The noise levels from the proposed construction were predicted at two (2) nearest potentially affected residential locations (see **Figure 3**). A summary of the results of these predictions are contained within **Table 21**.

Table 21 Predicted Construction Noise Levels at Residential Receivers

Assessment Location	Predicted $L_{Aeq(15minute)}$ Noise Level (dBA)	Construction $L_{Aeq(15minute)}$ Design Goal (dBA)	
		Noise Affected	Noise Affected
Receiver 1 47 Pikes Lane	50	60	75
Receiver 2 711 Great Western Highway	44		

The modelling results in **Table 21** indicate that the predicted $L_{Aeq(15minute)}$ noise levels for construction meet the relevant construction noise goals at all residences for recommended construction hours.

7.8 Road Traffic Noise Assessment

Existing road traffic volumes on the Great Western Highway during the day and night-time period were not available to SLR Consulting at the time of reporting. However the NSW Roads and Maritime Services 2005 AADT traffic data for the Great Western Highway indicates an existing daily traffic volume of 47,628 vehicles. From data provided by GPSA the proposed development is predicted to generate an additional 1135 movements on the Great Western Highway. With the addition of project related traffic on the Great Western Highway noise levels are predicted to rise by 0.1 dBA. This is a negligible increase and as such additional traffic noise generated by the proposed development is unlikely to cause noise impacts at the nearest residential locations.

8 CONCLUSION

SLR Consulting has undertaken a noise impact assessment for the construction and operation of the proposed Toll IPEC Freight Transport Facility.

Operational noise emissions from the proposed development are predicted to be within the project specific noise criteria at all assessed receivers under calm and prevailing weather conditions.

Cumulative impacts from the operation of the proposed development and the existing Metcash facility are predicted to be below the acceptable INP amenity criterion.

Noise levels are predicted to be below the sleep disturbance noise goals for the night-time operation of the proposed development. As such night-time operation of the proposed development is unlikely to cause sleep disturbance at the nearest residential locations.

Construction noise levels are predicted to meet the relevant construction noise goals at the nearest residential locations.

Additional traffic generated by the proposed development is predicted to cause a negligible increase in road traffic noise levels from the Great Western Highway.

1 Sound Level or Noise Level

The terms "sound" and "noise" are almost interchangeable, except that in common usage "noise" is often used to refer to unwanted sound.

Sound (or noise) consists of minute fluctuations in atmospheric pressure capable of evoking the sense of hearing. The human ear responds to changes in sound pressure over a very wide range. The loudest sound pressure to which the human ear responds is ten million times greater than the softest. The decibel (abbreviated as dB) scale reduces this ratio to a more manageable size by the use of logarithms.

The symbols SPL, L or L_P are commonly used to represent Sound Pressure Level. The symbol L_A represents A-weighted Sound Pressure Level. The standard reference unit for Sound Pressure Levels expressed in decibels is 2E-5 Pa.

2 "A" Weighted Sound Pressure Level

The overall level of a sound is usually expressed in terms of dBA, which is measured using a sound level meter with an "A-weighting" filter. This is an electronic filter having a frequency response corresponding approximately to that of human hearing.

People's hearing is most sensitive to sounds at mid frequencies (500 Hz to 4000 Hz), and less sensitive at lower and higher frequencies. Thus, the level of a sound in dBA is a good measure of the loudness of that sound. Different sources having the same dBA level generally sound about equally loud.

A change of 1 dBA or 2 dBA in the level of a sound is difficult for most people to detect, whilst a 3 dBA to 5 dBA change corresponds to a small but noticeable change in loudness. A 10 dBA change corresponds to an approximate doubling or halving in loudness. The table below lists examples of typical noise levels

Sound Pressure Level (dBA)	Typical Source	Subjective Evaluation
130	Threshold of pain	Intolerable
120 110	Heavy rock concert Grinding on steel	Extremely noisy
100 90	Loud car horn at 3 m Construction site with pneumatic hammering	Very noisy
80 70	Kerbside of busy street Loud radio or television	Loud
60 50	Department store General Office	Moderate to quiet
40 30	Inside private office Inside bedroom	Quiet to very quiet
20	Unoccupied recording studio	Almost silent

Other weightings (eg B, C and D) are less commonly used than A-weighting. Sound Levels measured without any weighting are referred to as "linear", and the units are expressed as dB(lin) or dB.

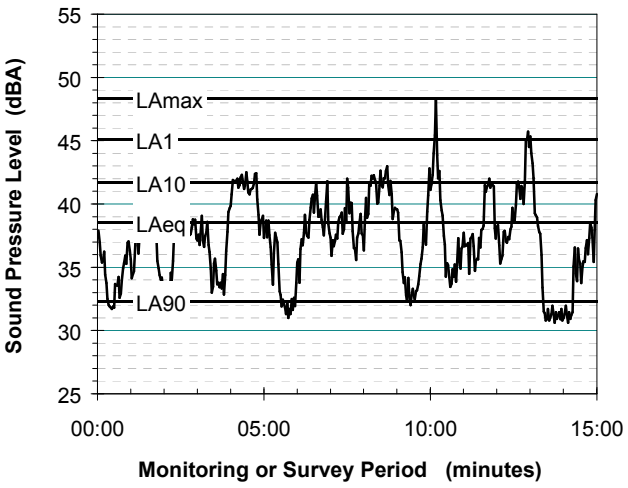
3 Sound Power Level

The Sound Power of a source is the rate at which it emits acoustic energy. As with Sound Pressure Levels, Sound Power Levels are expressed in decibel units (dB or dBA), but may be identified by the symbols SWL or LW, or by the reference unit 1E-12 W.
The relationship between Sound Power and Sound Pressure may be likened to an electric radiator, which is characterised by a power rating, but has an effect on the surrounding environment that can be measured in terms of a different parameter, temperature.

4 Statistical Noise Levels

Sounds that vary in level over time, such as road traffic noise and most community noise, are commonly described in terms of the statistical exceedance levels L_{AN}, where L_{AN} is the A-weighted sound pressure level exceeded for N% of a given measurement period. For example, the L_{A1} is the noise level exceeded for 1% of the time, L_{A10} the noise exceeded for 10% of the time, and so on.

The following figure presents a hypothetical 15 minute noise survey, illustrating various common statistical indices of interest.



Of particular relevance, are:

L_{A1} The noise level exceeded for 1% of the 15 minute interval.

L_{A10} The noise level exceed for 10% of the 15 minute interval. This is commonly referred to as the average maximum noise level.

L_{A90} The noise level exceeded for 90% of the sample period. This noise level is described as the average minimum background sound level (in the absence of the source under consideration), or simply the background level.

L_{Aeq} The A-weighted equivalent noise level (basically the average noise level). It is defined as the steady sound level that contains the same amount of acoustical energy as the corresponding time-varying sound.

When dealing with numerous days of statistical noise data, it is sometimes necessary to define the typical noise levels at a given monitoring location for a particular time of day. A standardised method is available for determining these representative levels.

This method produces a level representing the "repeatable minimum" L_{A90} noise level over the daytime and night-time measurement periods, as required by the EPA. In addition the method produces mean or "average" levels representative of the other descriptors (L_{Aeq}, L_{A10}, etc).

5 Tonality

Tonal noise contains one or more prominent tones (ie distinct frequency components), and is normally regarded as more offensive than "broad band" noise.

6 Impulsiveness

An impulsive noise is characterised by one or more short sharp peaks in the time domain, such as occurs during hammering.

7 Frequency Analysis

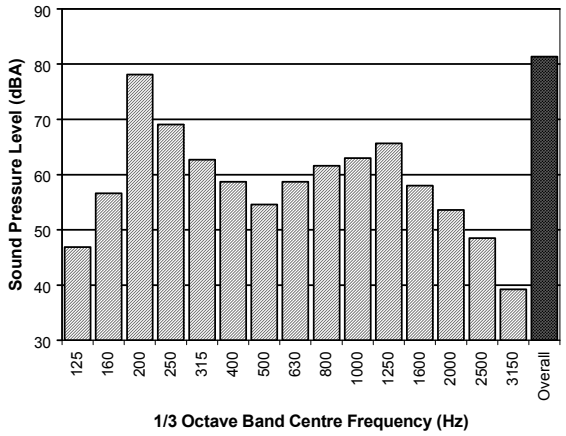
Frequency analysis is the process used to examine the tones (or frequency components) which make up the overall noise or vibration signal. This analysis was traditionally carried out using analogue electronic filters, but is now normally carried out using Fast Fourier Transform (FFT) analysers.

The units for frequency are Hertz (Hz), which represent the number of cycles per second.

Frequency analysis can be in:

- Octave bands (where the centre frequency and width of each band is double the previous band)
- 1/3 octave bands (3 bands in each octave band)
- Narrow band (where the spectrum is divided into 400 or more bands of equal width)

The following figure shows a 1/3 octave band frequency analysis where the noise is dominated by the 200 Hz band. Note that the indicated level of each individual band is less than the overall level, which is the logarithmic sum of the bands.



8 Vibration

Vibration may be defined as cyclic or transient motion. This motion can be measured in terms of its displacement, velocity or acceleration. Most assessments of human response to vibration or the risk of damage to buildings use measurements of vibration velocity. These may be expressed in terms of "peak" velocity or "rms" velocity.

The former is the maximum instantaneous velocity, without any averaging, and is sometimes referred to as "peak particle velocity", or PPV. The latter incorporates "root mean squared" averaging over some defined time period.

Vibration measurements may be carried out in a single axis or alternatively as triaxial measurements. Where triaxial measurements are used, the axes are commonly designated vertical, longitudinal (aligned toward the source) and transverse.

The common units for velocity are millimetres per second (mm/s). As with noise, decibel units can also be used, in which case the reference level should always be stated. A vibration level V, expressed in mm/s can be converted to decibels by the formula 20 log (V/V_o), where V_o is the reference level (1E-6 mm/s). Care is required in this regard, as other reference levels are used by some organizations.

9 Human Perception of Vibration

People are able to "feel" vibration at levels lower than those required to cause even superficial damage to the most susceptible classes of building (even though they may not be disturbed by the motion). An individual's perception of motion or response to vibration depends very strongly on previous experience and expectations, and on other connotations associated with the perceived source of the vibration. For example, the vibration that a person responds to as "normal" in a car, bus or train is considerably higher than what is perceived as "normal" in a shop, office or dwelling.

10 Over-Pressure

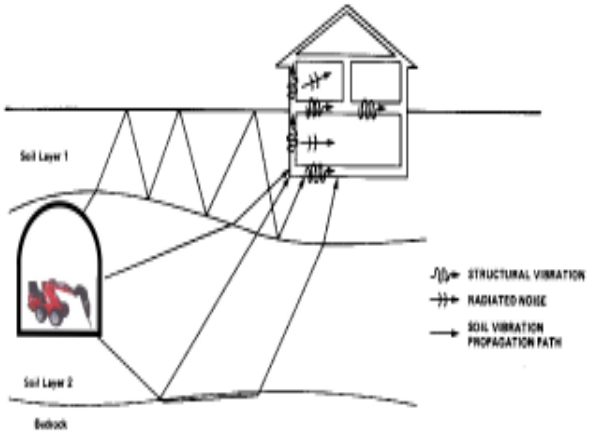
The term "over-pressure" is used to describe the air pressure pulse emitted during blasting or similar events. The peak level of an event is normally measured using a microphone in the same manner as linear noise (ie unweighted), at frequencies both in and below the audible range.

11 Regenerated Noise

Noise that propagates through a structure as vibration and is radiated by vibrating wall and floor surfaces is termed "regenerated noise", "structure-borne noise", or sometimes "ground-borne noise". Regenerated noise originates as vibration and propagates between the source and receiver through the ground and/or building structural elements, rather than through the air.

Typical sources of regenerated noise include tunnelling works, underground railways, excavation plant (eg rockbreakers), and building services plant (eg fans, compressors and generators).

The following figure presents the various paths by which vibration and regenerated noise may be transmitted between a source and receiver for construction activities occurring within a tunnel.



The term "regenerated noise" is also used to describe other types of noise that are emitted from the primary source as a different form of energy. One example would be a fan with a silencer, where the fan is the energy source and primary noise source. The silencer may effectively reduce the fan noise, but some additional noise may be created by the aerodynamic effect of the silencer in the airstream. This "secondary" noise may be referred to as regenerated noise.

Equipment Sound Power Levels

Operational Equipment Description	1/1 Octave Band LAeq Sound Power Levels (dB)										Overall (dBA)
	31.5	63	125	250	500	1k	2k	4k	8k	16k	
Truck departure/arrival	100	95	93	88	88	88	85	81	76	72	92
Forklift	-	102	93	93	91	89	88	80	72	-	95
Condenser unit (single unit)	84	85	98	93	90	90	88	84	75	66	95
Light vehicle/car	90	85	85	90	90	90	70	70	70	60	83
Compressor Unit (single unit)	81	82	96	90	87	87	85	81	72	69	92

LAmax Equipment Description	1/1 Octave Band Typical Maximum Sound Power Levels (dB)										Overall (dBA)
	31.5	63	125	250	500	1k	2k	4k	8k	16k	
Truck departure/arrival	105	100	98	93	93	93	90	86	81	77	97
Gas powered forklift	-	107	98	98	96	94	93	85	77	-	100
Condenser unit (single unit)	89	90	103	98	95	95	93	89	80	71	100
Air-conditioning Unit (single unit)	59	60	74	68	65	65	63	59	50	47	70
Compressor Unit (single unit)	86	87	101	95	92	92	90	86	77	74	97