Southlands Remediation and Development Project

Environmental Assessment
Project Application (MP 06_0191)

Appendix M: Noise Assessment

August 2009

HEGGIES

REPORT 30-1596R1

Revision 3

Southlands Remediation & Redevelopment Project

Noise and Vibration Assessment

PREPARED FOR

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Southlands Remediation & Redevelopment Project

Noise and Vibration Assessment

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EXECUTIVE SUMMARY

This report presents the results and findings of a detailed noise and vibration assessment for the construction and operation of the proposed Southlands development, Banksmeadow, NSW.

Analysis of Potential Noise and Vibration Impacts

Noise

In order to determine the noise impact of the proposed Southlands development on surrounding residential, school and industrial/commercial receivers the site was computer modelled. Predictions of noise levels were made at the nearest existing residential, school and commercial/industrial locations for two (2) scenarios likely to represent peak and daily average activity at the site.

Meteorological records indicated that prevailing winds and temperature inversions were not a feature of the area. Therefore, the proposed Southlands development was assessed in accordance with the Department of Environment and Climate Change (DECC) NSW Industrial Noise Policy (INP) under calm weather conditions only

Under calm weather conditions the noise generated by the proposed operation is predicted to meet the project specific acoustic design goals for construction and operation during the daytime, evening and night-time period at all existing neighbouring residential and school locations, and the adjoining commercial/industrial sites without the necessity for any noise mitigation.

Traffic generated by the proposed Southlands site is insignificant compared to current traffic volumes along Botany Road and therefore will not increase traffic noise impact at residents located along or near Botany Road.

Likely maximum noise levels produced onsite during the night-time period have been assessed and predicted not to cause sleep disturbance at the nearest effected residential locations.

Vibration

The vibration levels associated with operation and construction of the Southlands remediation and redevelopment will be well below the preferred vibration levels set out in *Assessing Vibration: a technical guideline* produced by (DECC) for all residential and school receivers.

Conclusion

On the basis of this assessment it is concluded that construction and operation of the proposed Southlands development located at Banksmeadow, will meet the acoustic and vibration requirements of the DECC at all assessed receivers for all periods of proposed construction and operation.

Night-time L_{Amax} noise levels were assessed and it is concluded that sleep disturbance will not occur at any of the assessed residential locations if night-time operation is to occur.

Traffic generated by the Southlands development will create a negligible increase in traffic noise levels which will not be noticed by residents located along or near Botany Road and therefore will meet all relevant criteria set within the Environmental Criteria for Road Traffic Noise (ECRTN)

TABLE OF CONTENTS

TABLE OF CONTENTS

1 INTRODUCTION

Heggies Australia Pty Ltd (Heggies) has been commissioned by DBL Property Pty Ltd on behalf of Goodman International Pty Ltd and Orica Australia Pty Ltd (Orica) to conduct a noise assessment of the construction and operation of the proposed Southlands development at Banksmeadow, NSW.

The Southlands site is an Orica owned property that is to be cooperatively remediated and developed as a high quality industrial warehouses estate. The Project is to be developed in three stages, with a project application for stages 1 and 2 being lodged with the Minister for Planning as State Significant Development. This assessment has reviewed development of the total site involving construction and delivery of Stages 1 – 3, although it is understood that Stage 3 will be the subject of a separate project application.

The Director General of the Department of Planning has issued requirements (DGR's) for the preparation of an Environmental assessment for the Project which includes a requirement to consider acoustic issues as follows:

Noise and Vibration Impacts *– the Environmental assessment must include an assessment of the noise impacts of the project in accordance with the NSW Industrial Noise Policy (EPA 2000) and noise control guidelines Construction Site Noise (previously Chapter 171 of the Environmental Noise Control manual, 1994). With respect to potential vibration impacts, the Environmental Assessment must include consideration in accordance with the DEC's Environmental Assessment – Assessing Vibration: a Technical Guideline. The Environmental assessment must consider noise and vibration impacts during construction and operation, and a cumulative context with existing developments.*

The primary objective of this assessment is therefore to meet the requirements of the DGR's and to identify potential acoustic and vibration impacts on the surrounding residential, industrial and commercial receivers.

The Noise Impact Assessment has been prepared in general accordance with Australian Standard 1055-1997 "*Description and Measurement of Environmental Noise*" Parts 1, 2 and 3 and with reference to the NSW Industrial Noise Policy (INP). Where issues relating to noise are not addressed in the INP, such as sleep disturbance and construction noise, reference has been made to the NSW Environmental Noise Control Manual (ENCM). Assessment of potential vibration impact has been done in accordance with NSW DECC Assessing Vibration: a technical guideline.

2 PROJECT DESCRIPTION

2.1 Description of Proposed Southlands Development

The proposed Southland development is to become a major industrial and warehousing estate which will service Port Botany and the Sydney Metropolitan Area. At this stage onsite activity will be generally warehouse based, consisting of storage and distribution of goods with no onsite processing proposed.

Acoustically significant plant and equipment assumed to be utilised during the remediation and construction of the site will consist of the following:

- Scrapers (3 of)
- Compactor
- Dozer (2 of)
- Articulated dump trucks (2 of)
- Genset
- Concrete boom pump
- Transit mixer
- Delivery truck
- Crane
- Hand-tools (eg. Grinder)

Acoustically significant plant and equipment relevant to the proposed site usage will consist of the following:

- Gas powered forklifts
- Delivery trucks (as required)
- Rooftop plant for cooling and heating purposes
- Employee vehicles ie cars/trucks

A new link road is proposed between Botany Road and McPherson Street, intersecting the existing Macquarie Goodman Discovery Cove estate to access the proposed Southlands development as a precursor to Stage 2 of the development.

A staged development is proposed. The most significant operational acoustic impact will occur when the development is fully constructed and in operation therefore Southlands operational noise has been assessed on a project complete basis (i.e with development complete and activity in each of the three project stages).

2.2 Plant and Equipment Noise Levels

2.2.1 Remediation and Construction Plant and Equipment

The sound power levels of the major noise generating plant and equipment to be used in the remediation and construction of the proposed Southlands development are given in **Table 1**.

Table 1 Acoustically Significant Equipment Sound Power Levels (SWL)

Equipment	Sound Power Level dBA
Scraper	111
Dozer 10	110
Compactor flat	110
Dump Truck	102
Genset	107
Transit Mixer	111
Concrete boom pump	107
Delivery Truck	102
Crane	104
Hand tools (grinder)	104

2.2.2 Acoustically Significant Operational Plant and Equipment

Details of acoustically significant plant and equipment relevant to the operation of the proposed development are displayed in **Table 2.** Further details of sound power levels used in the noise model are provided in **Appendix B**.

Table 2 Acoustically Significant Plant & Equipment Sound Power Levels (SWL)

Equipment	Sound Power Levels (L_{Aeq}, dBA)
Rooftop plant	93
Delivery Truck	90
Gas powered forklift	97
Truck drive off	83
Car drive off	73

2.3 Hours of Operation

2.3.1 Remediation and Construction

The ENCM states that construction noise design goals are applicable between the hours of 7.00 am and 6.00 pm Monday to Friday, and 8.00 am to 1.00 pm Saturdays. For all other times construction noise must be inaudible at the receiver. No audible construction work is to take place on Sundays or Public Holidays.

As construction hours have not yet been defined, it is recommended and therefore assumed that construction will occur within the applicable hours of the ENCM noise design goals i.e. between the hours of 7.00 am and 6.00 pm Monday to Friday, and 8.00 am to 1.00 pm Saturdays.

2.3.2 Southlands Operation

At this stage operating hours are not clearly defined. Therefore a worst case acoustical scenario has been assumed, i.e. the site will operate 24 hours a day, seven (7) days a week.

3 SITE DETAILS

Southlands is an approximately 18.3 hectare vacant site owned by Orica. It is situated fronting McPherson Street, Banksmeadow, NSW, within the Botany Bay Local Government area.

The proposed site is bounded in all directions by industrial and commercial estates. The Botany Goods Railway passes the north-eastern site boundary and Sir Charles Kingsford Smith airport is located approximately 2.5 km to the west-south-west of the site which contributes to ambient noise levels at both the proposed site and surrounding suburbs.

The nearest potentially affected receivers are residents located in Botany to the west and Hillsdale to the east.

The acoustical environment at both Botany and Hillsdale typify an urban environment, with heavy and continuous traffic flows from the road, rail and air with residences located near industrial districts. The residences located in these suburbs have therefore been assessed under the "urban" receiver type.

Figure 1 Proposed Site Location & Noise Monitoring Locations

4 IMPACT ASSESSMENT PROCEDURES

4.1 General Objectives – Operational Noise

4.1.1 Existing Residential Receivers

Responsibility for the control of noise emission in New South Wales is vested in Local Government and the DECC. The DECC released an Industrial Noise Policy in December 1999 that provides a framework and process for deriving noise criteria for consents and licences that will enable the DECC to regulate premises that are scheduled under the Protection of the Environment Operations Act 1997.

The specific policy objectives 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 premises scheduled under the Act.

4.1.2 Assessing Intrusiveness

For assessing intrusiveness, the background noise needs to be measured. The intrusiveness criterion essentially means that the equivalent continuous noise level (L_{Aeq}) of the source should not be more than five (5) decibels above the measured background level (L_{A90}).

4.1.3 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. The cumulative effect of noise from industrial sources needs to be considered in assessing impact.

An extract from the INP that relates to the amenity criteria is given in **Table 3**. To determine cumulative impact adjustment of the amenity criterion based upon **Table 4** needs to be undertaken.

Table 3 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	All	Noisiest 1 hour period	35	40
- external			50	55
Place of worship - internal	All	When in use	40	45
Area specifically reserved for passive recreation (eg National Park)	All	When in use	50	55
Active recreation area (eg 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

Notes For Monday to Saturday, 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 4 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 3**.

4.1.4 Assessing Sleep Disturbance

The DECC 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. Not withstanding the preceding, sleep arousal has been assessed using the guidelines set out in the Environmental Noise Control Manual 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).

4.1.5 Road Traffic Noise

The Environment Protection Authority released the "*Environmental Criteria for Road Traffic Noise*" in May 1999. The policy sets out noise criteria applicable to different road classifications for the purpose of defining traffic noise impacts. (The relevant road traffic noise criteria for the subject development are provided in **Table 5)**

Table 5 Road Traffic Noise Criteria

Type of Development	Criteria		
	Day 7 am - 10 pm	Night 10 pm - 7 am	Where Criteria are Already Exceeded
Land use developments with potential to create additional traffic on arterial road	LAeq(15hour) 60 dBA	LAeq(9hour) 55 dBA	Where feasible, existing noise levels should be mitigated to meet the noise criteria. Examples of applicable strategies include appropriate location of private access roads; regulating times 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.

4.2 General Objectives – Construction Noise

The construction noise goals are based upon the ENCM, Chapter 171, which sets out noise criteria applicable to construction site noise for the purpose of defining intrusive noise impacts. This document presents a staged approach, where different levels of noise can be tolerated for different periods of time, generally with higher noise levels corresponding to a shorter time period. Based upon this document the construction noise design goals outlined in **Table 6** would normally apply to a construction project.

Table 6 Construction Site Noise Goals

Total Construction Period	Acceptable LA_{10} Noise Level[1]
4 weeks and under	Background LA_{90} plus 20 dBA
4 weeks to 26 weeks	Background LA_{90} plus 10 dBA
Greater Than 26 Weeks	Background LA_{90} plus 5 dBA

1. Applicable between the hours of 7.00 am and 6.00 pm Monday to Friday, and 8.00 am to 1.00 pm Saturdays. For all other times construction noise must be inaudible at the receiver. No audible construction work is to take place on Sundays or Public Holidays.

Such noise level goals allow for a short period of intense, noisy activity typically required by most construction sites, while still catering for long term amenity of the adjoining residences by reducing the noise limit for activities occurring over a longer duration.

The ENCM does not provide defined construction noise goals for school, commercial and/or industrial receivers. For assessment purposes the INP amenity criteria has been used to set a maximum construction noise limit throughout the duration of the construction phase for receivers classified as commercial/industrial.

4.3 Vibration Goals

4.3.1 Human Response

The NSW DECC released *Assessing Vibration: a technical guideline* (the Guideline) in February 2006. The Guideline presents preferred and maximum vibration values for use in assessing human responses to vibration and provides recommendations for measurement and evaluation techniques. The Guideline is based on British Standard BS 6472-1992 *Evaluation of human exposure to vibration in buildings (1-80Hz)* which is similar to Australian Standard AS-2670.2-1990 but includes additional guidelines in relation to intermittent vibration. The criteria presented in the Guideline are non-mandatory. Where all feasible and reasonable mitigation measures have been applied and vibration values are still beyond the maximum value, the operator would need to negotiate directly with the affected community.

Intermittent vibration is the most likely from of vibration caused by train pass-bys at the nearest potentially affected receivers. Section 2.4 of the Guideline provides acceptable values for intermittent vibration in terms of vibration dose values (VDV) which requires the measurement of the overall weighted rms acceleration over the frequency range 1 Hz to 80 H. To calculate VDV we use the following formula:

$$VDV = \left[\int_0^T a^4(t)dt \right]^{0.25}$$

where VDV is the vibration dose value in $m/s^{1.75}$, *a(t)* is the frequency-weighted acceleration in m/s^2 and *T* is the total period of the day (in seconds) during which vibration may occur.

The acceptable VDV are reproduced here in **Table 7**.

Table 7 Acceptable Vibration Dose Values for Intermittent Vibration

Location	Daytime		Night-time	
	Preferred Value	Maximum Value	Preferred Value	Maximum Value
Residences	0.20 $m/s^{1.75}$	0.40 $m/s^{1.75}$	0.13 $m/s^{1.75}$	0.26 $m/s^{1.75}$
Schools/educational institutions	0.40 $m/s^{1.75}$	0.80 $m/s^{1.75}$	n/a	n/a

Note: Daytime is 7.00 am to 10.00 pm, Night-time is 10:00pm to 7:00am

There is a low probability of adverse comment or disturbance to building occupants at vibration values below the preferred values. Adverse comment or complaints may be expected if vibration values approach the maximum values. The Guideline states that activities should be designed to meet the preferred values where an area is not already exposed to vibration.

Appendix A of the Guideline provides a methodology for estimating VDV as an initial screening method. Appendix B2 of the Guideline describes an alternative calculation of vibration dose using root-mean-squared (rms) velocity instead of rms acceleration.

4.3.2 Building Response

British Standard 7385: Part 2-1993 "*Evaluation and measurement for vibration in buildings Part 2*" provides criteria against which the likelihood of building damage from ground vibration can be assessed.

Sources of vibration which are considered in the standard include blasting (carried out during mineral extractions or construction excavation), demolition, piling, ground treatments (compaction), construction equipment, tunnelling, road and rail traffic and industrial machinery.

The standard states that the guide values relate predominantly to transient vibration which does not give rise to resonant responses in structures, and to low-rise buildings. Where the dynamic loading caused by continuous vibration is such as to give rise to dynamic magnification due to resonance, especially at the lower frequencies where lower guide values apply, then the guide values may need to be reduced by up to 50%. Since the nearest buildings could potentially experience resonance effects, a conservative level of continuous "minimal risk of cosmetic damage" criterion has been adopted here and is shown in **Table 8**.

Table 8 Transient Vibration Guide Values – Minimal Risk of Cosmetic Damage

Type of Building	Peak Component Particle Velocity in Frequency Range of Predominant Pulse	
	4 Hz to 15 Hz	15 Hz and Above
Reinforced or framed structures - Industrial and heavy commercial buildings	25 mm/s at 4 Hz and above	
Unreinforced or light framed structures - Residential or light commercial type buildings	7.5 mm/s at 4 Hz increasing to 10 mm/s at 15 Hz	10 mm/s at 15 Hz increasing to 25 mm/s at 40 Hz and above

Note: Values referred to are at the base of the building being considered.

5 EXISTING ACOUSTICAL ENVIRONMENT

In order to determine existing ambient noise levels in the vicinity of the proposed site, operator attended noise surveys and unattended noise monitoring were conducted at the nearest existing residential locations. Details of the monitoring locations are provided in **Table 9** and shown in **Figure 1**.

Table 9 Ambient Noise Monitoring Locations

Location	Details
NM1	56 Stephen Road, Botany (west of site)
NM2	68 Denison Street, Hillsdale (east of site)

The objective of the unattended ambient noise survey was to measure $L_{A90(15minute)}$ and $L_{Aeq(15minute)}$ noise levels at the nearest potentially affected residences during daytime, evening and night-time periods. This information enables the determination of the intrusiveness and amenity criteria for the proposed development in accordance with the INP.

Background noise levels were monitored by Heggies. Two ARL Type EL316 environmental noise loggers were deployed at the monitoring locations. The background noise survey was conducted at the Denison Street location over a 7-day period from Friday 22 September to Friday 29 September 2006 inclusive and at the Stephen Road location over a 9-day period from Tuesday 3 October to Wednesday 11 October 2006 inclusive. The noise loggers were programmed to record statistical noise level indices continuously in 15 minute intervals, including the L_{Amax}, L_{A1}, L_{A10}, L_{Aeq}, L_{A90} and L_{Amin}.

Operator attended noise surveys were conducted by a Heggies operator during the daytime on Friday 22 September 2006 at both monitoring locations. The purpose of these surveys was to determine the existing L_{Aeq} noise contribution from existing industrial sources and to establish the character and duration of any other acoustically significant ambient noise sources.

All acoustic instrumentation employed by Heggies throughout the monitoring programme has been designed to comply with the requirements of AS 1259.2-1990, "*Sound Level Meters*" and carries current NATA or manufacturer calibration certificates. Instrument calibration was checked before and after each measurement survey, with the variation in calibrated levels not exceeding ±0.5 dBA.

Weather data for the survey periods was obtained from the Bureau of Meteorology station at Sydney Airport. Noise data during periods of any rainfall and/or wind speed in excess of 5 m/s (approximately 18 km/h) were discarded in accordance with INP data exclusion methodology. A summary of the results of the ambient noise surveys is given in **Table 10**.

Table 10 Summary of Existing Ambient Noise Levels

Location	Description	Background Noise Level L_{A90}	Measured Existing L_{Aeq} Noise Level	Existing Industrial Noise Contribution L_{Aeq}
		Rating Background Level		
NM1	Day	51 dBA	64 dBA	< 46 dBA
	Evening	51 dBA	60 dBA	< 46 dBA
	Night	49 dBA	58 dBA	< 46 dBA
NM2	Day	54 dBA	68 dBA	< 47 dBA
	Evening	49 dBA	64 dBA	< 47 dBA
	Night	49 dBA	63 dBA	< 47 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.

L_{Aeq} - The equivalent continuous noise level is defined as the level of noise equivalent to the energy average of noise levels occurring over a measurement period.

6 PROJECT SPECIFIC NOISE EMMISION DESIGN GOALS

6.1 Operational Noise Design Goals

Results from attended surveys conducted at potentially affected residential locations in the vicinity of the proposed development indicate that the existing ambient noise levels are dominated by significant continuous traffic noise with a slight contribution from existing industry.

The intrusiveness criteria have been set from measurements at the nearest residences to the site. The amenity criteria have been set in accordance with the INP. The resulting design goals for residential receivers are given in **Table 11**.

Table 11 Noise Design Goals - Residential Receiver

Location	Period	Intrusiveness Criteria ($L_{Aeq(15minute)}$)	Amenity Criteria $L_{Aeq(Period)}$	Project Specific Noise goals $L_{Aeq(15minute)}$
Nearest effected residents at Botany	Day	56	60	**56**
	Evening	56	50	**50**
	Night	54	45	**45**
	Sleep disturbance noise goal is **64 dBA** $L_{A1(1minute)}$ during the night-time period			
Nearest effected residents at Hillsdale	Day	59	60	**59**
	Evening	54	50	**50**
	Night	54	45	**45**
	Sleep disturbance noise goal is **64 dBA** $L_{A1(1minute)}$ during the night-time period			

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.
L_{Aeq} - The equivalent continuous noise level is defined as the level of noise equivalent to the energy average of noise levels occurring over a measurement period.

Noise emission design goals, expressed as amenity levels, also exist for nearby industrial/commercial and school buildings. **Table 12** outlines the design goals for these "other" receiver types.

Table 12 Noise Design Goals - Other Receiver

Location	Indicative Noise Amenity Area	Time of Day	Amenity Criterion $L_{Aeq(period)}$	
			Acceptable	Recommended Maximum
Other Industrial/Commercial sites	Commercial Premises	When in use	65	70
	Industrial Premises	When in use	70	75
Banksmeadow Public School	School Classroom (internal)	Noisiest 1-hour period when in use	35	40

6.2 Remediation and Construction Noise Design Goals

The noise design goals for remediation and construction activity are shown in **Table 13**.

Table 13 Construction Noise Design Goals

Location	Acceptable LA_{10} Noise Level (4 weeks and under)	Acceptable LA_{10} Noise Level (between 4 and 26 weeks)	Acceptable LA_{10} Noise Level (> than 26 weeks)
Botany Residential	71	61	56
Hillsdale Residential	74	64	59
Surrounding* Commercial Premises	70	70	70
Surrounding* Industrial Premises	75	75	75
Banksmeadow Public School*	40 (internal)	40 (internal)	40 (internal)

* Construction noise design goals have been extracted from the INP amenity criteria table presented in section 5 for assessment at commercial, industrial and school receivers.

The construction noise design goals are applicable between the hours of 7.00 am and 6.00 pm Monday to Friday, and 8.00 am to 1.00 pm Saturdays. For all other times construction noise must be inaudible at the receiver. No audible construction work is to take place on Sundays or Public Holidays.

7 EFFECTS ON METEOROLOGY ON NOISE LEVELS

7.1 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. 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.

Weather data was obtained, for a period of 12 months, from a Bureau of Meteorology weather station located at Sydney Airport. This data was analysed to determine the frequency of occurrence of winds up to speeds of 3 m/s for daytime, evening and night in each season. A summary of the most frequently occurring winds for each period is contained within **Table 14**, **Table 15** and **Table 16**.

Table 14 Seasonal Frequency of Occurrence Wind Speed Intervals - Daytime

Period	Calm	Wind Direction	0.5 to 2 m/s	2 to 3 m/s	0.5 to 3 m/sec
Summer	0.5%	NNE±45	0.5%	1.2%	1.6%
Autumn	0.1%	W±45	0.5%	2.8%	3.3%
Winter	0.5%	WNW±45	0.9%	3.8%	4.7%
Spring	0.2%	WNW±45	0.4%	2.1%	2.4%

Table 15 Seasonal Frequency of Occurrence Wind Speed Intervals - Evening

Period	Calm	Wind Direction	0.5 to 2 m/s	2 to 3 m/s	0.5 to 3 m/sec
Summer	1.7%	ESE±45	0.6%	2.3%	2.9%
Autumn	0.6%	NE±45	1.4%	5.7%	7.1%
Winter	1.7%	W±45	3.0%	8.9%	11.9%
Spring	1.4%	NE±45	1.4%	4.1%	5.5%

Table 16 Seasonal Frequency of Occurrence Wind Speed Intervals - Night

Period	Calm	Wind Direction	0.5 to 2 m/s	2 to 3 m/s	0.5 to 3 m/sec
Summer	3.3%	N±45	2.3%	7.8%	10.1%
Autumn	1.0%	NW±45	1.7%	7.7%	9.4%
Winter	1.2%	NW±45	2.3%	8.2%	10.6%
Spring	2.9%	NNW±45	2.9%	8.9%	11.8%

Seasonal wind records indicate that winds of up to 3 m/s are not a feature of the area, as the frequency of such wind is below the 30% threshold. Modelling under prevailing wind was therefore not conducted as part of this investigation.

7.2 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 (2) nights per week.

Seasonal records indicate that temperature inversions are not a feature of the area, as the frequency of such conditions is below the 30% threshold. Modelling under temperature inversive conditions was therefore not conducted as part of this investigation.

8 OPERATIONAL & CONSTRUCTION NOISE MODELLING

8.1 Methodology

A computer model was used to predict representative noise emissions from the Southlands development. The Environmental Noise Model (ENM) used has been produced in conjunction with the DECC. A map giving all relevant topographic information was digitised. The model used this map, together with noise source data, ground cover, shielding by barriers and/or adjacent buildings and atmospheric information to predict noise levels.

Weather conditions under which noise level predictions were made are given in **Table 17**.

Table 17 Weather conditions for noise predictions

Weather Condition	Temperature	Humidity	Wind Speed	Direction	Temperature Gradient
Calm	20°C	65 %	N/A	N/A	N/A

L_{Aeq} noise contributions were predicted at five (5) representative residential locations in Botany, three (3) representative locations in Hillsdale, one (1) school receiver in Botany and at each of the proposed site boundaries to assess noise emission at surrounding commercial and/or industrial receivers. The assessment locations are displayed graphically in **Appendix A.**

8.1.1 Operational Noise

Given the assumed warehouse based onsite activity, the major noise sources will be delivery vehicles (trucks), during arrival, departure and associated loading and unloading activities. Two (2) situations were modelled to assess a worst case day-time operation and typical 15 minute evening and night-time operation. These two (2) scenarios are detailed as follows:

- AM/PM peak day-time period acoustical scenario – The peak periods are assumed to be between 7am - 9am and 3pm - 5pm. From these assumed peak periods, a 15 minute average of the proposed peak traffic volume has been determined. Refer to **Table 18** for specific numbers. In addition, all roof-top plant is assumed to be running at full power throughout the 15 minute period as well as typical 15 minute operational scenario.
- Evening and night-time acoustical scenario – This is based upon assumed onsite activity during a typical 15 minute period in the evening and night-time. Refer to **Table 18** for specific vehicle numbers. All roof-top plant is assumed to be running at full power throughout the 15 minute period.

Table 18 Operational Modelling Parameters – Onsite Traffic

Operational Description	Vehicle Movements		Forklifts required to load Trucks
	Cars	Trucks	
AM & PM Daytime Peak Periods (15 Min. period)	64	23	8
Evening	6	12	8
Night-time	6	12	8

Note 1: All equipment is assumed to be operating outside the building. This is likely to represent an absolute worst-case situation.

Note 2: 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.

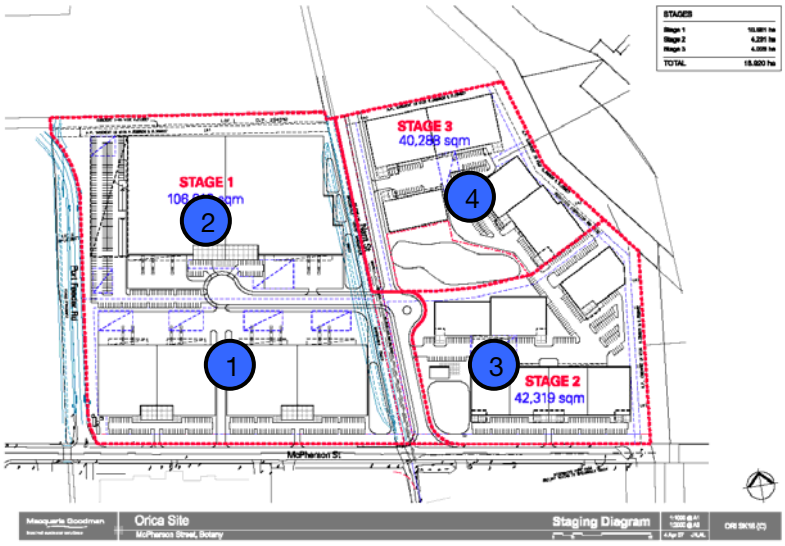
Note 3: Numbers displayed represent vehicles entering and exiting the site over a typical 15 minute period.

8.1.2 Construction Noise

As each proposed stage of the development is constructed, the noise impact on surrounding receivers will change depending on the location of the construction activity. To assess this change in noise impact as construction activity repositions around the site; noise will be assessed from each of the four (4) locations as displayed in **Figure 2.**

As construction exceeds the 26 week period the limiting criteria will be at its most stringent therefore predicted noise levels have been assessed against the 26 weeks and over criteria as set out in the ENCM.

Figure 2 Construction Noise Assessment – Approximate Assessment Locations



n Approximate assessment locations

8.2 Noise Modelling Results

8.2.1 Southlands Operation

Operational noise modelling was undertaken for both scenarios. The predicted noise contribution from each scenario was found to be within INP noise guidelines at the nearest residential and commercial/industrial and school receiver locations. Refer to **Table 19, Table 20** and **Table 21** for the noise modelling results.

Table 19 Predicted $L_{Aeq(15minute)}$ Noise Emission – Residential Receivers

Location		Predicted Noise Levels $L_{Aeq(15\ minute)}$ dBA – Calm Conditions		
		Daytime (Peak Period)	**Evening**	**Night-time**
Botany	1	30	30	30
	2	34	34	34
	3	35	34	34
	4	33	32	32
	5	34	34	34
Project Specific Noise Goal		**56**	**50**	**45**
Hillsdale	1	33	33	33
	2	32	32	32
	3	31	31	31
Project Specific Noise Goal		**59**	**50**	**45**

Table 20 Predicted $L_{Aeq(15minute)}$ Noise Emission – Commercial/industrial Receivers

Location (Site Boundaries)	Period	Predicted Noise Level	Commercial Premises Amenity Criteria (dBA)	Industrial Premises Amenity Criteria
North	When in use	43 dBA	65 dBA	70 dBA
South		30 dBA	65 dBA	70 dBA
East		49 dBA	65 dBA	70 dBA
West		30 dBA	65 dBA	70 dBA

Table 21 Predicted $L_{Aeq(15minute)}$ Noise Emission – School Receiver

Location (Site Boundaries)	Period	Predicted Noise Level Daytime (peak period)	School Receiver Amenity Criteria
Banksmeadow Public School	Noisiest 1-hour period when in use	33 dBA (external)	35 dBA (internal)

Ambient L_{Aeq} operational noise levels are predicted to meet the relevant criteria at all residential, school and commercial and/or industrial receiver locations during the day, evening and night time periods.

8.2.2 Remediation and Construction

Construction noise was predicted at five (5) representative residential locations in Botany, three (3) in Hillsdale and the nearest effected school receiver in Botany (Banksmeadow Public School) (see **Appendix B**). Predictions were also performed at each of the site boundaries to assess the potential construction noise emission at surrounding industrial/commercial receivers. A summary of the results of these predictions is contained within **Table 22, Table 23** and **Table 24.**

Table 22 Predicted $L_{A10(15minute)}$ Construction Noise Emission – Residential

Location	Assessment Point	Predicted Noise Level L_{A10} dBA				Construction Design Goal L_{A10} dBA
		Assessment Location				
		1	2	3	4	
Botany Residential	1	45	46	45	43	56
	2	47	54	51	49	
	3	47	55	50	48	
	4	48	47	45	46	
	5	52	48	49	45	
Hillsdale Residential	6	46	48	49	47	59
	7	43	44	46	47	
	8	43	43	45	48	

Ambient L_{A10} noise levels are predicted to meet the relevant criteria at all residential locations during each of the three (3) proposed construction phases.

Table 23 Predicted $L_{Aeq(15\ minute)}$ Construction Noise Emission – Commercial / Industrial

Location	Assessment Point	Predicted Noise Level L_{Aeq} dBA				Commercial Construction Design Goal L_{Aeq} dBA	Industrial Construction Design Goal L_{Aeq} dBA
		Assessment Location					
		1	2	3	4		
Surrounding Commercial/ Industrial Receivers	North	57	73	55	58	70	75
	South	48	40	41	37	70	75
	East	59	58	75	64	70	75
	West	41	40	32	34	70	75

The land to the north and east of the Southlands site is classified as industrial and therefore construction noise at stages 1 through 3 will meet the relevant criteria at all surrounding commercial / industrial receivers.

Table 24 Predicted $L_{Aeq(15\ minute)}$ Construction Noise Emission – School Receiver

Location	Assessment Point	Predicted Internal Noise Level LA_{eq} dBA				Commercial Construction Design Goal
		Assessment Location				
		1	2	3	4	LA_{eq} dBA
Banksmeadow Public School	4	38	37	35	36	40 (internal)

To determine compliance with the internal design goal for the school, a façade noise reduction of 10 dBA has been assumed. In Heggies previous experience, the assumption of 10 dBA is seen as conservative and therefore has been used to equate the external predicted noise levels to an internal noise levels. Based on this result, noise emissions during each stage of Southlands construction will meet project specific noise goals when the school is in use.

8.3 Cumulative Impact

The Southlands site is situated within an area that encompasses many other industrial and commercial developments.

Potential cumulative noise impacts from existing and successive 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. Therefore, the cumulative impact of the proposed Southlands remediation and redevelopment with existing industrial noise sources has been assessed in the determination of the amenity levels at surrounding potentially noise sensitive areas

8.4 Sleep Disturbance

In assessing sleep disturbance, typical L_{Amax} noise levels of acoustically significantly plant and equipment to be used at the subject site were used as input to the ENM acoustic model and predictions were made at the nearest residential areas under calm weather conditions during the night-time period. Noise events considered include truck reversing alarms, car/truck door slams and forklift loading and unloading activities. The use of the L_{Amax} noise level provides a worst-case prediction since the $L_{A1(1minute)}$ noise level of a noise event is likely to be less than the L_{Amax}.

The highest L_{Amax} noise level at any residential area is predicted to occur during forklift loading and unloading. External noise levels up to L_{Amax} 45 dBA may occur at the nearest residential receivers (Botany receivers 2, 3 & 5). Therefore maximum noise levels produced by potential night-time operation of Southlands are below the relevant criteria of 64 dBA meaning that operation of the proposed Southlands development is not likely to cause sleep disturbance.

8.5 Road Traffic Noise Assessment

Operational Traffic

Traffic to and from the proposed Southlands development is not expected to significantly increase the existing road traffic experienced at the nearest residential locations. The most dominant increase in traffic volume will occur on the local industrial streets feeding into the site and on the proposed access road in later stages. Given the distance of this road to the nearest affected receivers and the barrier effect of the surrounding commercial/industrial buildings it is highly unlikely that traffic noise produced on this road will to impact surrounding residents.

Southlands is proposed to generate approximately 465 traffic movements during both peak hour periods, assumed to be between 7am - 9am and 3pm - 5pm. It has been assumed that all traffic will access the site via local industrial roads in the initial stage of development and the proposed link road which will be accessed from the existing arterial Botany Road. Annual Average Traffic Data (AADT) records along Foreshore Drive [MR170] show 35826 vehicle movements per day.

If it is assumed that 94% of AADT occurs during the period between 6am and 10pm this equates to an average hourly traffic flow of 1592 during this period. Hence traffic generation from the proposed development represents an approximate 7% increase in existing traffic volume. This in turn equates to a road traffic noise level increase of less the 0.5 dBA which is seen as negligible and will not be noticed at any residents located along or near Foreshore Drive/Botany Road.

Construction Traffic

It should be noted that the number of vehicle moments that occurs during construction at the site will be significantly less than those which occur during the operational phase of the development. Therefore the impact of noise from construction traffic will be less than that during operation and consequently will result in a negligible increase in existing traffic noise levels.

8.6 Vibration Assessment

8.6.1 Construction Vibration

The major vibration generating activities at the Southlands site will occur during the earthworks in preparing the site; activities such as digging and the use of scrapers and rollers. The nearest residential premises to such construction activity is approximately 450 m (proximity of Hillsdale assessment location 3). Due to the large separation distance to this location, Banksmeadow Public School and other residences, the level of vibration caused by construction activities at the Southlands site is predicted to be below the level of human perception at any of the nearest residential or school locations.

8.6.2 Operational Vibration Levels

Due to the large separation distance between the nearest receivers and the proposed activity within the site, the level of vibration caused by operation at Southlands is predicted to be below the level of human perception at any of the nearest residential and school locations.

The construction and operational vibration levels will be significantly below the preferred vibration levels set out in *Assessing Vibration: a technical guideline* produced by (DECC).

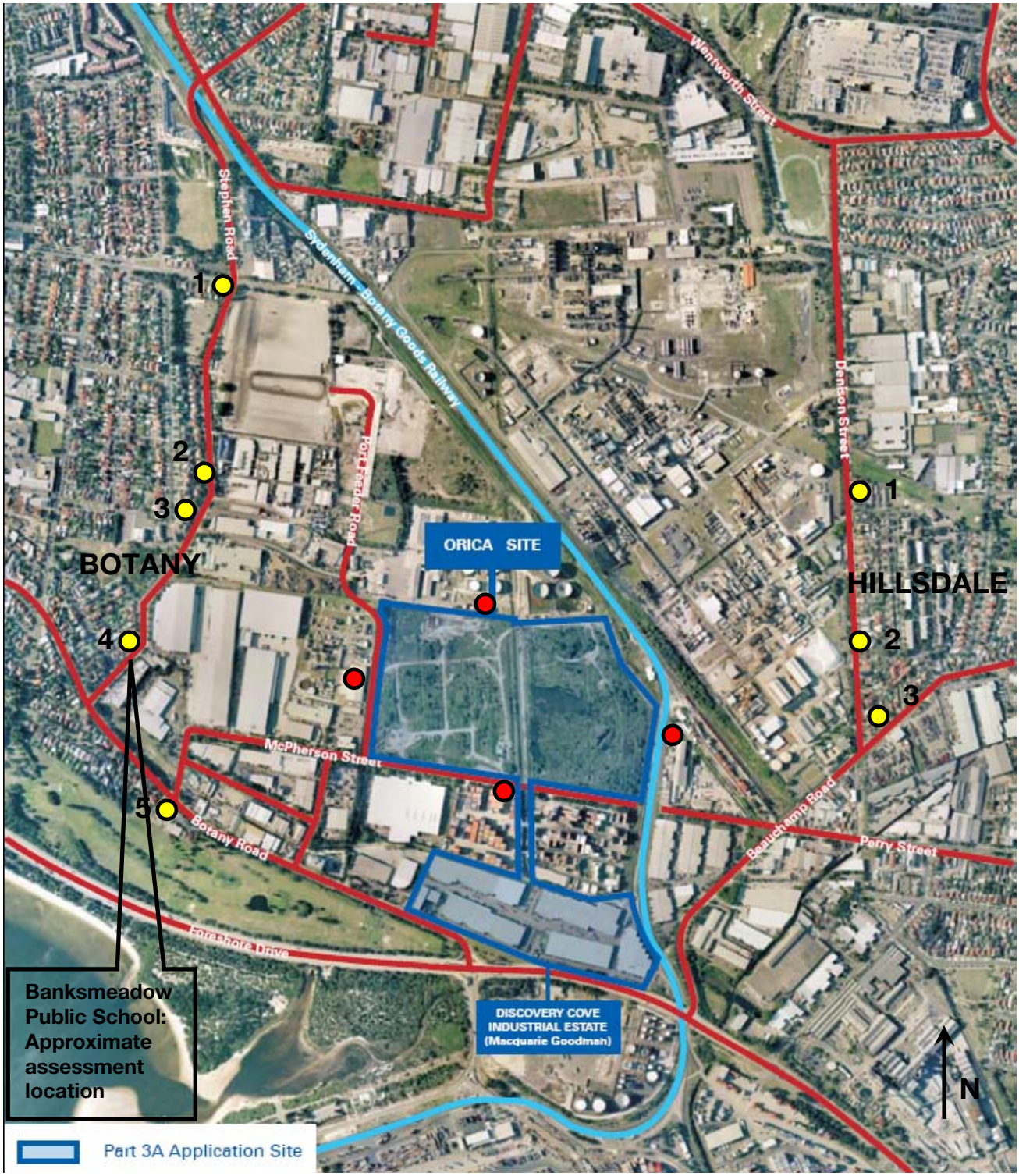
9 CONCLUSION

Heggies has conducted a noise impact assessment for the construction and operation of the proposed Southlands development, Banksmeadow, NSW. The assessment concludes that Southlands operation will comply with the NSW INP noise goals at all assessed residential and commercial/industrial receivers during the day, evening and night-time periods.

Construction noise is predicted to meet the relevant noise goals at all assessed residential and school receivers throughout the construction period. Land utilised to the north and east the Southlands site is classified as industrial and therefore all relevant noise goals are met throughout the construction period. Maximum noise levels were predicted to be significantly below the recommended sleep disturbance noise goal.

Vibration levels from activities associated with the construction and operation of Southlands are predicted to be below human perception levels at the nearest affected residential and school receivers to the site. The construction and operational vibration levels are predicted to be significantly below the preferred vibration levels set out in *Assessing Vibration: a technical guideline* produced by (DECC).

The proposed increase in road traffic volumes have been assessed against current AADT data which found that traffic generated by the Southlands development will cause a negligible increase in noise levels that will not affect any residential receivers located along or near Foreshore Drive/Botany Road.



Approximate Residential Assessment Locations

Approximate Commercial/Industrial Assessment Locations

Equipment Description	Octave Band centre Frequency – dBL re 1pW										dBA Overall
	31.5	63	125	250	500	1k	2k	4k	8k	16k	
Operational Plant & Equipment											
Rooftop plant	98	98	95	92	87	85	90	74	60	60	93
Truck delivery	96	98	86	83	85	86	83	75	67	68	90
Forklift	91	96	90	95	90	85	91	93	86	74	97
Truck drive off	89	92	80	77	79	80	77	69	61	62	83
Car drive off	79	82	70	67	69	70	67	59	51	52	73
Construction Plant & Equipment											
Scraper	111	116	115	109	107	106	104	97	92	92	111
Dozer 10	108	112	111	108	110	103	101	99	93	93	110
Compactor flat	99	104	109	112	107	105	102	96	90	90	110
Dump Truck	96	104	106	99	100	98	92	85	77	77	102
Genset	109	112	113	110	101	102	99	93	84	76	107
Transit Mixer	103	108	108	105	106	107	105	99	94	86	111
Concrete boom pump	100	106	113	110	104	98	97	92	88	88	107
Delivery Truck	96	104	106	99	100	98	92	85	77	77	102
Crane	103	109	99	99	102	100	96	92	90	90	104
hand tools (grinder)	63	67	65	67	75	84	95	100	100	95	104