HEGGIES

REPORT 10-6757-R1

Revision 2

Frasers Broadway Site Concept Plan

Acoustic Report

CONFIDENTIAL

PREPARED FOR

Frasers Broadway
C/- Incoll Management
Level 1, 73 Miller Street,
NORTH SYDNEY NSW 2060

7 MAY 2008

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ABN 29 001 584 612

Incorporating New Environment Graeme E. Harding & Associates Eric Taylor Acoustics

Frasers Broadway Site Concept Plan

Acoustic Report

CONFIDENTIAL

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EXECUTIVE SUMMARY

Heggies Pty Ltd has conducted a preliminary acoustic assessment of the Frasers Concept Plan for the Frasers Broadway site. The scope of the assessment includes establishing criteria for noise emission from mechanical plant and noise intrusion into the development site; and conducting a preliminary assessment of road traffic noise intrusion into the site. Additional information and criteria are provided in relation to sound insulation requirements between residential dwellings, based on Building Code of Australia and City of Sydney DCP requirements. The key findings of this assessment are as follows:

Mechanical Noise Emission - Mechanical noise emission criteria for the site have been established. This issue is to be reviewed at the detailed design stage, when mechanical items have been selected, located, and if necessary treated, to ensure that compliance with the established criteria is achieved at all noise-sensitive receivers.

Road Traffic Noise Intrusion - A review of the predicted facade noise levels suggests that, at buildings with facades at the perimeter of the site (adjacent to Broadway, Abercrombie Street and, to a lesser extent, Regent Street), daytime and night-time noise levels will exceed ECRTN criteria (for residential buildings). It is therefore recommended that, for residential receivers (as a minimum) on facades predicted to exceed ECRTN criteria that internal acoustic amenity be protected by way of improved glazing and the provision of air-conditioning and mechanical ventilation to enable windows to be kept shut to limit noise intrusion and to comply with Sydney City Council internal noise criteria, refer **Section 2.2.2**.

It is noted that under the Frasers Concept Plan for the site, the predominant land use at the most road traffic noise-affected perimeter locations of the site is commercial, not residential. Noise mitigation measures may also need to be developed for commercial receivers with facades on the most road traffic noise-exposed perimeters of the site. The extent of any acoustic treatment for all building types should be further developed during the DA stage and detail designed stage of the project once the proposed building designs are developed and finalised.

Sleep Disturbance - Measured L_{A1} noise levels on the site indicates some exceedance of the established Sleep Disturbance criteria. However, these external levels equates to internal levels that are slightly above the sleep awakening levels. As a minimum, (for residential spaces) bedroom windows and doors facing the major roads may need to be kept closed to comply with the criterion. Further investigation of the potential for sleep disturbance should be conducted during the development applications for the project.

Aircraft Noise Intrusion - Based on the latest ANEF 2023/4 charts, the proposed development lies outside of the 20 ANEF contour. As such, the development is classified as acceptable and there is no need to provide protection specifically against aircraft noise.

Rail Noise and Vibration - The Central Railway Line is approximately 100 m from the proposed Frasers Broadway Site, which is beyond the SRA/RIC assessment zone of 60 m from an operational rail line. Therefore no specific assessment of rail-related noise and vibration is required now, or at later stages of the development.

Sound Insulation Requirements - Compliance with the sound insulation requirements of Building Code of Australia and City of Sydney DCP 1996 are to be achieved within the residential components of the proposed development.

Passive Recreation Areas - The computer model predictions suggest that the ECRTN criteria ($L_{Aeq(15hour)}$ 55 dBA) will be achieved at all locations that could reasonably be considered Passive Recreation Areas within the centre of the site.

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1 INTRODUCTION

This document sets out noise and vibration criteria applicable to the proposed Frasers Concept Plan of the Frasers Broadway site and present results of preliminary assessments of noise intrusion into the site, noise levels within outdoor Passive Recreation Areas, control of noise within and between residential spaces and control of noise emission to surrounding noise-sensitive receivers.

The following (Concept) planning issues are addressed in the report:

- The impact of external noise sources on the development including:
  - Road traffic noise intrusion.
  - Rail noise and vibration impact.
  - Aircraft noise intrusion.
- Control of mechanical plant noise emission to noise-sensitive receivers (including those within the development itself) from the use of the development.
- Application of Building Code of Australia (BCA) internal acoustic requirements for residential components of the development.
- Preliminary review of road traffic noise levels within Passive Recreation Areas

The noise criteria and recommended noise levels presented in throughout **Section 2** have been adopted to assess:

- Noise intrusion **into**, the proposed development, and
- Noise emission **from** the operation of the proposed development.

Note that criteria for noise emission from the development site have been set using the lower (more stringent) data from the noise survey data obtained during a comprehensive on-site noise survey during August 2006, refer to **Appendix B**.

2 NOISE CRITERIA

Responsibility for the control noise emission in New South Wales is vested in Local Government and the Department of Environment and Climate Change (DECC), formerly the Environment Protection Authority (EPA).

Noise emissions impacting on the proposed development and noise emissions from the proposed facility should therefore be assessed in accordance with:

- The NSW Government's *Industrial Noise Policy* (INP) for industrial-type noise emissions;
- The NSW Government's *Environmental Criteria for Road Traffic Noise* (ECRTN) for vehicle-related noise emissions on public roads;
- The recommendations set out in the EPA's Environmental Noise Control Manual (ENCM) for sleep disturbance associated with night-time operations;
- City of Sydney's *Central Sydney DCP 1996*; (updated January 2002) and
- Aircraft noise intrusion into the proposed development should be assessed in accordance with guidelines provided in Australian Standard AS 2021:2000 - *Acoustics - Aircraft Noise Intrusion - Building Siting and Construction.*

This assessment sets noise criteria taking into account all of the above guidelines.

2.1.1 DECC *Industrial Noise Policy*

The DECC now oversees the *Industrial Noise Policy* (INP), released by the EPA in January 2000 which provides a framework and process for deriving noise criteria for consents and licences that will enable the DEC and others 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 the amenity for specific land uses;
- Use the criteria as the basis for deriving project specific noise levels;
- Promote uniform methods to estimate and measure noise impacts;
- Outline a range of mitigation measures that could be used to minimise noise impacts;
- 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; and to
- Carry out functions relating to the prevention, minimisation and control of noise from premises scheduled under the Act.

The INP criteria for industrial-type noise sources (eg mechanical plant and equipment) have two components:

- Controlling the intrusive noise impacts for residents and other sensitive receivers in the short term; and
- Maintaining noise level amenity for particular land uses for residents and sensitive receivers in other land uses.

Assessing Intrusiveness

For assessing intrusiveness, the background noise generally needs to be measured. The intrusiveness criterion essentially means that the equivalent continuous noise level (L_{Aeq}) of the source(s) under consideration should not be more than 5 decibels above the measured (or default) Rated Background Level (RBL), over any 15 minute period.

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. If present, the existing noise level from industry is generally 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 the impact. In order to determine the amenity noise goal, the maximum ambient L_{Aeq} noise levels within an area should not normally exceed the acceptable noise levels specified in **Table 1**. Where existing L_{Aeq} noise levels approach or exceed the acceptable noise levels given in **Table 1**, L_{Aeq} noise design goals are set below the existing L_{Aeq} levels in order to limit any further increase or "creep" in the ambient levels.

An extract from the NSW INP that relates to the amenity criteria is given in **Table 1**. Land uses and their respective criteria that are of relevant to the Frasers Concept Plan of the FRASERS BROADWAY site are highlighted in red text.

Table 1 Amenity Criteria - L_{Aeq} Noise Levels from Industrial Noise Sources

Type of Receiver	Indicative Noise Amenity Area	Time of Day	Recommended L_{Aeq} Noise Level	
			Acceptable	Recommended Maximum
Residence	Rural	Day	50 dBA	55 dBA
		Evening	45 dBA	50 dBA
		Night	40 dBA	45 dBA
	Suburban	Day	55 dBA	60 dBA
		Evening	45 dBA	50 dBA
		Night	40 dBA	45 dBA
	Urban	Day	60 dBA	65 dBA
		Evening	50 dBA	55 dBA
		Night	45 dBA	50 dBA
	Urban/Industrial Interface For existing situations only	Day	65 dBA	70 dBA
		Evening	55 dBA	60 dBA
		Night	50 dBA	55 dBA
School Classrooms - Internal	All	Noisiest 1-hour period when in use	35 dBA	40 dBA
Hospital ward				
- Internal	All	Noisiest 1-hour period	35 dBA	40 dBA
- External	All	Noisiest 1-hour period	50 dBA	55 dBA
Place of Worship - Internal	All	When in use	40 dBA	45 dBA

Type of Receiver	Indicative Noise Amenity Area	Time of Day	Recommended L_{Aeq} Noise Level	
Area specifically reserved for passive recreation	All	When in use	50 dBA	55 dBA
Active recreation area (eg School playground, golf course)	All	When in use	55 dBA	60 dBA
Commercial Premises	All	When in use	65 dBA	70 dBA
Industrial Premises	All	When in use	70 dBA	75 dBA

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 LAeq index corresponds to the level of noise equivalent to the energy average of noise levels occurring over a measurement period.

As the site is near commercial districts, the noise criteria under "Urban" apply to this development.

The assessment procedure relating to industrial type noise impact is presented in **Section 3.1.**

The noise emission from any mechanical plant associated with the proposed development, (such as air conditioning condensers, exhaust fans, co-generation equipment or other equipment on site) should be controlled to avoid impacting upon the acoustic amenity of existing (and future(noise-sensitive receivers.

Appropriate project-specific noise criteria have been and are presented in red in **Table 2** below.

Table 2 Criteria for Mechanical Noise Emissions to Nearby Residences

Time of Day	Noise Level dBA re 20 µPa				
	ANL[1] (period)	Measured RBL $L_{A90(15minute)}$[2]	Measured L_{Aeq} (15minute)	INP Criteria	
				Intrusive	Amenity
				$L_{Aeq(15minute)}$ Criterion for New Sources	$L_{Aeq(Period)}$ Criterion for New Sources[3]
Day	60	50	62	55	52
Evening	50	47	58	52	48
Night	45	45	56	50	46

Note 1: ANL Acceptable Noise Level for an urban area
Note 2: RBL Rating Background Level
Note 3: Assuming existing noise levels unlikely to decrease
Note 4: Project Specific Criteria are shown in bold

In summary, the project specific noise emission criteria established by the INP for this site are:

- Day 52 dBA.
- Evening 48 dBA.
- Night 46 dBA.

Assuming continuous and constant mechanical noise emission throughout the day, evening and night time periods, the controlling criterion is the night time criterion of **46 dBA** at the nearest residential boundary.

The assessment procedure relating to industrial type noise emissions is presented in **Section 3.1**.

2.2 Road Traffic Noise

Buildings within the Frasers Broadway development will potentially be impacted by noise due to heavy and continuous traffic flows noise on:

- Broadway.
- Abercrombie Street.
- Regent Street.

2.2.1 External Traffic Noise Criteria

Responsibility for the control of noise emission in New South Wales is vested in Local Government and the DECC. Traffic noise emission impacting on the proposed development should therefore be assessed in accordance with:

The NSW Government's *Environmental Criteria for Road Traffic Noise* (ECRTN) for vehicle-related noise emissions on public roads.

The ECRTN document presents recommended road traffic noise criteria for various types of road and land use developments. The relevant criteria relating to new residential land use developments (the most noise-sensitive land use within the proposed development) affected by "*freeway/arterial*" road traffic noise is summarised in **Table 3**.

Table 3 DEC's Guidelines for Road Traffic Noise at Residences

Type of Development	Criteria		
	Day (7 am to 10 pm)	Night (10 pm to 7 am)	Where Criteria are Already Exceeded
New residential land use developments affected by freeway/arterial traffic noise	$L_{Aeq(15hr)}$ 55 dBA	$L_{Aeq(9hr)}$ 50 dBA	Where feasible and reasonable, existing noise levels should be reduced to meet the noise criteria via judicious design and construction of the development. Locations, internal layouts, building materials and construction should be chosen so as to minimise noise impacts.

Definitions: New residential development affected by traffic noise - addresses the acceptable level of road traffic noise impact for new residential developments at 1m from the facade of the new residences.

It should be noted that the noise criteria presented within the ECRTN noise policy document are guidelines and non-mandatory. In achieving compliance with the noise criteria, consideration needs to be given to aesthetics, cost implications, equity, community preferences and practicality. Where noise criteria cannot be achieved in consideration of the above, the benefits of the project would need to be evaluated and weighed up against the acoustical impacts.

2.2.2 Noise Intrusion - Internal Noise Criteria

Requirements for noise intrusion are detailed in the City of Sydney's "Central Sydney DCP 1996" in Clauses 6.1.13 and 6.1.16 that are reproduced below:

> *6.1.13 Soundproofing of all dwelling units by such means as acoustic glazing is required to reduce noise impacts on residents*
>
> *6.1.16 All residential buildings and serviced apartments are to be constructed so that the repeatable maximum $L_{Aeq(1hour)}$ level does not exceed the following levels:*

(1) In a naturally ventilated - windows closed condition:

Sleeping areas (night-time only: 2200-0700) *35 dBA.*

Living areas (24 hours) *45 dBA.*

(2) In a naturally ventilated - windows open condition, (i.e. windows open up to 5% of the floor area, or attenuated natural ventilation open to 5% of the floor area):

Sleeping areas (night-time only: 2200-0700) *45 dBA.*

Living areas (24 hours) *55 dBA.*

(3) Where a naturally ventilated - windows open condition cannot be achieved, it is necessary to incorporate mechanical ventilation or air-conditioning.

(4) The following repeatable maximum LAeq(1hour) levels shall not be exceeded when doors and windows are shut and mechanical ventilation or air-conditioning is operating.

Sleeping areas (night-time only: 2200-0700) *38 dBA.*

Living areas (24 hours) *46 dBA*

(These levels correspond to the combined measured level .of external sources and the ventilation system operating normally.)

The assessment procedure relating to noise intrusion is presented in **Section 3.2**.

2.3 Maximum Noise Levels and Potential for Sleep Disturbance

The Department of Environment and Climate Change (DECC) *Environmental Criteria for Road Traffic Noise* (ECRTN) provides guidance as to the likelihood of sleep disturbance and notes the following:

- There is no universally accepted criterion governing the likelihood of sleep disturbance. In other words, 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 (for all or even a majority of people).
- The most commonly applied criterion (in NSW) used to assess road traffic and other types of noise assesses the emergence of maximum noise levels above ambient noise levels.
- The emergence of maximum noise levels can be made relative to either ambient LAeq levels or ambient background (L_{A90}) noise levels. However, the assessment should include a consideration of the number of exceedances above this benchmark occurring per given period and the emergence of these exceedances (i.e. the degree to which the criterion adopted is exceeded) and not simply the possibility that the criterion might be exceeded in an overall sense.
- In the case of road traffic, factors that are potentially related to awakening reactions include maximum noise levels, the extent to which these maximum noise levels exceed ambient noise levels, the duration of noise events and the likely number of noise event exceedances during any given period.

The ECRTN also notes:

- Maximum internal noise levels below 50 dBA to 55 dBA are unlikely to result in awakening reactions. (i.e. external facade noise levels of 60 to 65 dBA (windows open) and 70 to 75 dBA (windows closed).

- One or two noise events per night with maximum internal noise levels of 65 to 70 dBA, are not likely to affect health and wellbeing significantly.

2.3.1 Sleep Disturbance Criteria - Operational Noise

In order to minimise the risk of sleep disturbance from the industrial operations during night-time operation, the DECC's ENCM recommends that:

> *The $L_{A1(60second)}$ noise level outside a bedroom window should not exceed the L_{A90} background noise level by more than 15 dBA during night-time period (10.00 pm to 7.00 am). The $L_{A1(60second)}$ noise level may conservatively be estimated by the typical maximum level of noise emission.*

Based on the measured background noise levels during the night-time period at the Fraser's Broadway site, the sleep disturbance criterion for residential receivers (within and beyond the boundaries of the development site) is presented in **Table 4**.

Table 4 Night-time Sleep Arousal Criteria

Location	**Sleep Arousal Criteria**	
	Measured RBL	**Criteria LA1(60second)**
Logger Location 1: Proposed Residential Buildings Area	46 dBA	61 dBA

The assessment procedure relating to sleep disturbance is presented in **Section 3.4**.

2.4 Aircraft Noise Intrusion

Aircraft noise intrusion to within the proposed development should be assessed in accordance with guidelines provided in Australian Standard AS 2021:2000 - *Acoustics - Aircraft Noise Intrusion - Building Siting and Construction.*

The assessment procedure is presented in **Section 3.5**.

2.5 Rail Noise Intrusion and Vibration

The State Rail Authority (SRA) and Rail Infrastructure Corporation (RIC) guidelines, *"Consideration of Rail Noise and Vibration in the Planning Process - Interim Guidelines for Applicants"* and *"Interim Guidelines for Councils"* published November 2003 provide rail noise assessment criteria and refer to BS 6472 - 1992 *"Evaluation of Human Exposure to Vibration in Buildings (1 Hz to 80 Hz*)" for the assessment of vibration associated with railway activities.

The SRA/RIC guidelines provide simplified methodology and criteria for the assessment of residential buildings subject to rail noise and vibration. The initial criterion which must be addressed in this simplified assessment procedure is to determine whether the residential development is within the "acoustic assessment" area, which is defined as the area within sixty (60) meters from an operational railway line.

A preliminary rail noise assessment has been included in this report addressing the residential component of the Frasers Broadway site area only. The required assessment procedure is presented in **Section 3.6**.

2.6 City of Sydney Council Internal Acoustic Isolation Requirements

City of Sydney Council – Central Sydney DCP Requirements:

The requirements of Council are detailed in Clauses 6.1.14 and 6.1.15 of Central Sydney DCP 1996" as reproduced below:

6.1.14 In order to assist acoustic control of airborne noise between units:

(1) A wall shall have a Field Sound Transmission Class (FSTC) of not less than 50 if it separates;

(a) Sole occupancy units,

(b) A sole occupancy unit from a plant room, stairway, public corridor, hallway or the like.

(2) A wall separating a bathroom, sanitary compartment, laundry or kitchen in one sole occupancy unit from a habitable room (other than a kitchen) in an adjoining unit, shall have an FSTC of not less than 55.

(3) A floor separating sole occupancy units must not have an FSTC less than 50.

6.1.15 In order to assist acoustic control of impact noise between units:

(i) A floor shall have an Impact Isolation Class (IIC) of not less than 50 if it separates:

(a) Habitable rooms of sole occupancy units.

(b) A sole occupancy unit from a plant room, stairway, public corridor, hallway or the like.

(ii) A floor separating a bathroom, sanitary compartment, laundry or kitchen in one sole occupancy unit from a habitable room (other than a kitchen) in an adjoining unit, shall have an IIC of not less than 55.

(iii)Walls between sole occupancy units shall comply with the impact sound resistance standards specified in the BCA.

2.7 Internal Sound Insulation Requirements (BCA)

The development will be required to comply with the Building Code of Australia (BCA) requirements that are in effect at the time of the Construction Certificate (for a given part of the development) being granted. As a reference, the current code (BCA 2007) requirements are presented in **Table 5**. These are the current minimum acoustic performance criteria required for residential components of the project and in some cases these are exceeded by those presented in the Central Sydney DCP.

Table 5 Building Code of Australia Sound Insulation Requirements

Construction	BCA Requirements	
	Laboratory Rating	**Verification**
Walls between sole occupancy units	$R_w + C_{tr}$ not < 50	$D_{nT,w} + C_{tr}$ not < 45
Walls between a bathroom, sanitary compartment, laundry or kitchen in one sole occupancy unit and a habitable room (other than a kitchen) in an adjoining unit	$R_w + C_{tr}$ not < 50 AND **Must have a minimum 20 mm cavity between two separate leaves**	$D_{nT,w} + C_{tr}$ not < 45 "Expert Judgment" Comparison to the "Deemed to satisfy" Provisions
Walls between sole occupancy units and a plant room or lift shaft	R_w not < 50 AND **Must have a minimum 20 mm cavity between two separate leaves**[1]	$D_{nT,w}$ not < 45
Walls between sole occupancy units and a stairway, public corridor, public lobby or the like, or parts of a different classification	R_w not < 50	$D_{nT,w}$ not < 45
Door assemblies located in a wall between a sole-occupancy unit and a stairway, public corridor, public lobby or the like	R_w not < 30[2]	$D_{nT,w}$ not < 25
Floors between sole-occupancy units or between a sole-occupancy unit and a plant room, lift shaft, stairway, public corridor, public lobby or the like, or parts of a different classification.	$R_w + C_{tr}$ not < 50 $L_{n,w} + C_I$ not > 62	$D_{nT,w} + C_{tr}$ not < 45 $L'_{nT,w} + C_I$ not > 55
Soil, waste, water supply and stormwater pipes and ductwork to habitable rooms	$R_w + C_{tr}$ not < 40	n/a
Soil, waste, water supply and stormwater pipes and ductwork to kitchens and other rooms	$R_w + C_{tr}$ not < 25	n/a
Intra-tenancy Walls	No Statutory Requirements	

Note 1. A wall must be of "discontinuous construction" if it separates a sole occupancy unit from a plant room or lift shaft. Clause F5.3(c) defines "discontinuous construction" as a wall having a minimum 20 mm cavity between two separate leaves with no mechanical linkage except at the periphery.

Note 2. Clause FP5.3(b) in the BCA states that the required insulation of a floor or wall must not be compromised by a door assembly.

2.8 Noise Criteria Relevant to Passive Recreational Areas

Noise levels in the immediate vicinity of the Frasers Broadway site and specifically, the passive recreational area (public space in the centre of the site), are controlled by surrounding arterial road traffic noise, distant rail traffic noise and Sydney "CBD" noise.

The dominant noise in many locations across the development site is road traffic noise. Traffic noise emission impacting upon the proposed Passive Recreation Areas should be assessed in accordance with:

The NSW Government's *"Environmental Criteria for Road Traffic Noise"* (ECRTN), 1999.

The ECRTN document presents recommended road traffic noise criteria for various types of road and land use developments as well as criteria for other sensitive land uses.

Table 6 ECRTN Noise Criteria for Sensitive Land Uses

Sensitive Land Use	**L_{Aeq} Criterion**	
	Daytime 7am to 10pm	**Noise Mitigation Measures**
Area Specifically Reserved for Passive Recreation (Free-field noise level)	Freeways and Arterial Roads $L_{Aeq(15hour)}$ 55 dBA	In the medium to longer term, strategies such as exhaust noise from in-service vehicles, limitations on exhaust brake use, and restricting access for sensitive areas or during sensitive times to low noise vehicles can be applied to mitigate noise impacts across the road system. Other measures include improved planning, design and construction of sensitive land use developments; reduced new vehicle emission standards; greater use of public transport; and alternative methods of freight haulage. These medium- to long-term strategies apply equally to mitigating internal and external noise levels. Where existing levels of traffic noise exceed the criteria, all feasible and reasonable noise control measures should be evaluated and applied. Where this has been done and the internal or external criteria (as appropriate) cannot be achieved, the proposed road or land use development should be designed so as not to increase existing road traffic noise levels by more than 0.5 dBA for new roads and 2 dBA for redeveloped roads or land use development with potential to create additional traffic.

3 NOISE ASSESSMENT

3.1 Continuous Mechanical Emission

Mechanical plant associated with the development has the potential to impact noise-sensitive receivers within the development itself and noise-sensitive receivers beyond the site boundaries.

At this stage of the project the location and selection of mechanical plant has not been made. Therefore appropriate assessment will need to be conducted during the Development Application or, more likely, at the detailed design (Construction Certificate) stage of the project.

It is envisaged that the mechanical plant noise sources will be controllable by common engineering methods that may consist of:

- Judicious location.
- Barriers.
- Silencers.
- Acoustically lined ductwork.

The selected mechanical equipment must be reviewed and assessed for conformance with established criteria at the detailed design stage of the project when specific plant selection and location is determined. At the Construction Certificate stage of the project appropriate noise control measures can be determined.

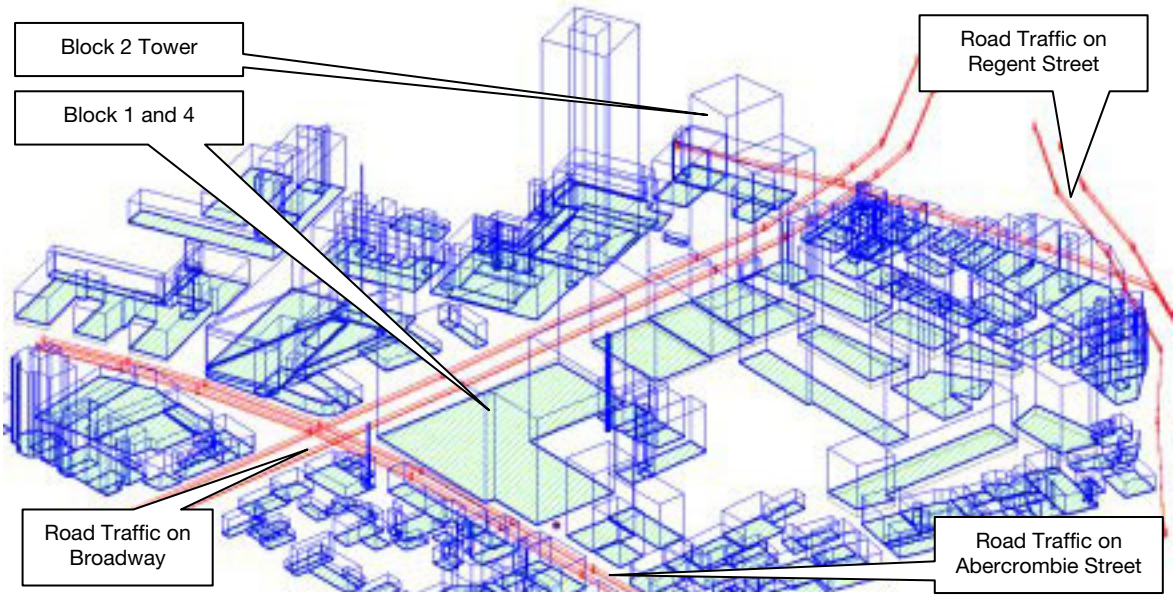
3.2 Road Traffic Noise

3.2.1 External Road Traffic Noise Levels

In order to assess traffic noise impact from nearby arterial roads on the proposed development a SoundPLAN computer noise model of the project area was developed.

A screenshot of the 3D wire frame model for the Frasers Broadway Site Concept Plan from SoundPLAN V 6.4's Geo-Database Module is presented in **Figure 1**:

Figure 1 SoundPLAN 3D Wire Frame Model of Frasers Broadway Site



Calculation of Road Traffic Noise (CoRTN)

Noise modelling of the project area was undertaken using the UK Department of Transport, *"Calculation of Road Traffic Noise"* (CoRTN 1988) algorithms as implemented within the SoundPLAN V 6.4 noise modelling software.

CoRTN is one of the Department of Environment and Climate Change's (DECC) accepted calculation procedures to model road traffic noise (refer *Environmental Criteria for Road Traffic Noise* (ECRTN) Section C5).

The modelling takes into account traffic volume and mix, type of road surface, vehicle speed, road gradient, reflections off building surfaces, ground absorption and shielding from ground topography and physical noise barriers.

For this study, SoundPLAN has been used to generate Grid Noise Maps (GNM) across the project area to demonstrate road traffic noise at various heights at 1 m from building facades within the development - and the acoustic shielding effects of buildings around the perimeter of the site upon the Passive Recreation Area in the centre of the site.

Deviations from CoRTN

The Calculation of Road Traffic Noise (CoRTN, 1988) calculation algorithms have been modified as follows:

- A 'three source height model' has been used in lieu of CoRTN's 'single source height' model.

Vehicle source heights have been modelled as follows:

- Cars: 0.5 m above the carriageway.
- Heavy Vehicle Tyres: 0.5 m above the carriageway.
- Heavy Vehicle Engines: 1.5 m above the carriageway.
- Heavy Vehicle Exhausts: 3.6 m above the carriageway.

Appropriate sound power adjustments have been made to the heavy vehicle sources to correctly distribute the source power over the three source heights, being:

- Heavy Vehicle Tyres: - 5.44 dB.
- Heavy Vehicle Engines: - 2.43 dB.
- Heavy Vehicle Exhausts: - 8.45 dB.

Physical Inputs

The SoundPLAN program requires topographical data building locations and heights to be entered into the model.

A summary of all the input information that was available during the course of this study is summarised in **Table 7**, together with the source of the data:

Table 7 Available Physical Information

Modelling Input	Source
Ground Topography, existing buildings around the subject site and structures within the site that will remain under the Frasers Broadway Concept Plan	From previous Concept Plan scheme
Frasers Scheme Building Height and Layout	Foster Architects/Incoll Management
Traffic Volumes and Mix Broadway	From previous Concept Plan scheme
Traffic Volumes and Mix Abercrombie Street	(Based on RTA 2002 Traffic Data)
Traffic Volumes and Mix Regent Street	
Traffic Speed	Posted Speed Limits (50 kph throughout)

Correction Values

The CoRTN algorithm uses 18 hour traffic flows (6:00 am to 12 Midnight) as inputs, and, correspondingly, provides $L_{A10(18hour)}$ noise levels as output. In order to assess road traffic noise intrusion at the site against the specified $L_{Aeq(15hour)}$ and $L_{Aeq(9hour)}$ criteria, it is necessary to 'correct' the output of CoRTN to provide $L_{Aeq(15hour)}$ and $L_{Aeq(9hour)}$ values.

To this end, the data obtained from the unattended noise loggers (refer Appendix B) was processed and analysed to determine the site-specific correction factors between the various relevant noise indices. The processed data from Loggers 3, 4 and 5 was used to determine the *average* 'correction factor' to be applied to the computer noise model output, so that it would effectively yield noise descriptors used to assess road traffic noise in NSW.

The correction factors for the Frasers Broadway site are:

- $L_{A10(18hour)}$ to $L_{Aeq(15hour)}$: -3.1 dBA.
- $L_{A10(18hour)}$ to $L_{Aeq(9hour)}$: -6.5 dBA.

Traffic Data

The traffic volumes used in the SoundPLAN computer noise model are presented in **Table 8**: These values are the same as those used during a previous Concept Plan study undertaken by Heggies for others, and are based on RTA Year 2002 traffic volumes. These traffic numbers need to be refined during later design stages when more detailed and/or more recent traffic numbers are obtained.

Table 8 Year 2007 Calibration Inputs

Road	Heading	Speed, kph	Car Traffic Volume, 18 hours[1]	Heavy Vehicle Traffic Volume, 18 hours [1]
Broadway				
	East	50	20,770	3,670
	West	50	20,770	3,670
Abercrombie Street				
	North (East Lanes)	50	10,150	1,130
	North (West Lanes)	50	10,150	1,130
Regent Street (Intersects with Harris Street)				
	South	50	8,460	940
Regent Street (Intersects with Lee Street)				
	North	50	16,920	1,880
	South	50	16,920	1,880

Note 1: The 18 hour traffic flow represents all traffic flows that occur between 6.00 am and 12 midnight.

Grid noise maps at 1:2000 scale for the project site have been generated and are presented in **Appendix A** for the daytime $L_{Aeq(15hour)}$ and Night-time $L_{Aeq(9hour)}$ periods.

For each of these periods, horizontal cross sections have been taken at various heights to demonstrate noise levels at:

- Ground Floor (1.5 m above ground).
- Mid Levels (15 m above ground).
- Upper Levels (30 m above ground).
- High Levels (60 m above ground).

Noise Contours Daytime Scenarios

Appendix A presents the daytime road traffic noise levels at various heights across the Frasers Broadway site. For reference, the dark green colour indicates compliance with daytime ECRTN criteria (55 dBA $L_{Aeq(15hour)}$).

Appendix A presents the night-time road traffic noise levels at various heights across the Frasers Broadway site. For reference, the dark green colour indicates compliance with night-time ECRTN criteria (50 dBA $L_{Aeq(9hour)}$).

3.3 Traffic Noise Contour Analysis

A review of the noise contours shown on the grid noise maps (**refer Appendix A**) generated using the SoundPLAN V 6.4 Graphics Module indicates that at many building facades, the road traffic noise levels at 1 m from building facades exceed the ECRTN criteria for road traffic noise intrusion for **residential** receivers (set out in **Section 2.2**). It is therefore advantageous that under the Frasers Concept Plan scheme, many buildings on the most road traffic noise-exposed perimeters of the site have been reserved for **commercial** uses.

Note that the dark green contours indicate predicted road traffic facade noise levels that are less than 55 dBA (daytime) and 50 dBA (night-time) and as such indicate strict compliance with ECRTN residential receiver criteria for the relevant period. On facades where this is demonstrated, no architectural measures will be necessary.

For those buildings that are reserved for Residential use, (such as Block 8 adjacent to Abercrombie Street and the upper levels of Block 2C adjacent to Broadway) where feasible and reasonable, noise mitigation in the form of architectural measures (e.g. improved facade glazing, alternative means of ventilation) should be used to achieve internal noise levels that would have normally prevailed if the external noise criteria were achieved.

The extent of the acoustic treatment necessary should be refined during the DA stage and detailed design stage of the project once the design of residential buildings are finalised (eg orientation of living and sleeping areas, etc).

It is noted that in some cases, for commercial buildings with facades on the most road traffic noise-exposed perimeters of the site, improved facade glazing may also be required to ensure that internal noise levels in commercial spaces are brought into line with yet to be determined project specific internal noise criteria.

3.3.1 Architectural Treatment

The following recommendations are proposed for residential receivers where it has been demonstrated that facade noise levels exceed the established external traffic noise criteria.

Architectural treatment measures (typically involving acoustic treatment of facades by way of improved glazing) are designed to achieve internal noise levels that would have normally prevailed if the external noise criteria were achieved. It is therefore recommended that the internal amenity be protected by way of improved glazing and the provision of air-conditioning and/or mechanical ventilation to enable windows to be kept shut to limit noise intrusion and to comply with Sydney City Council criteria, refer **Section 2.2.2** .

Provision of air-conditioning (or mechanical ventilation at a minimum), would enable windows to be shut, resulting in internal noise levels approximately 20 dBA lower than those predicted in **Appendix A**

In addition to the provision of air-conditioning, mechanical ventilation and architectural treatment, more fundamental options for reducing noise intrusion may include land use planning by locating and/or orienting noise-sensitive areas (i.e. bedrooms and living areas) away from major roads.

3.4 Sleep Disturbance Assessment

Review of the long term noise logger results from the August 2006 noise survey indicate that the L_{A1} noise levels impacting on the site are in the order of 65 to 75 dBA. This indicates that the established external sleep disturbance criterion is exceeded. However, these external noise levels equate to internal noise level of only 55 to 60 dBA (with windows open to allow for natural ventilation) and 45 to 55 dBA (with windows closed). In accordance with guidance in the ECRTN, (refer **Section 2.3**) maximum internal noise levels below 50 to 55 dBA are unlikely to result in awakening reactions.

Based on this preliminary assessment and, as a minimum, bedroom windows and doors facing the major roads may need to be kept closed to comply with the Sleep Disturbance Criteria. The issue of ventilation will need to be investigated during the detailed design stage. Alternatively, noise-sensitive areas i.e. bedrooms should be located away from major roads. Given that a few events were recorded that exceeded 75 dBA during the monitoring periods, this should be further investigated during the subsequent development applications of the project - to determine if such noise levels would be likely after development of the site.

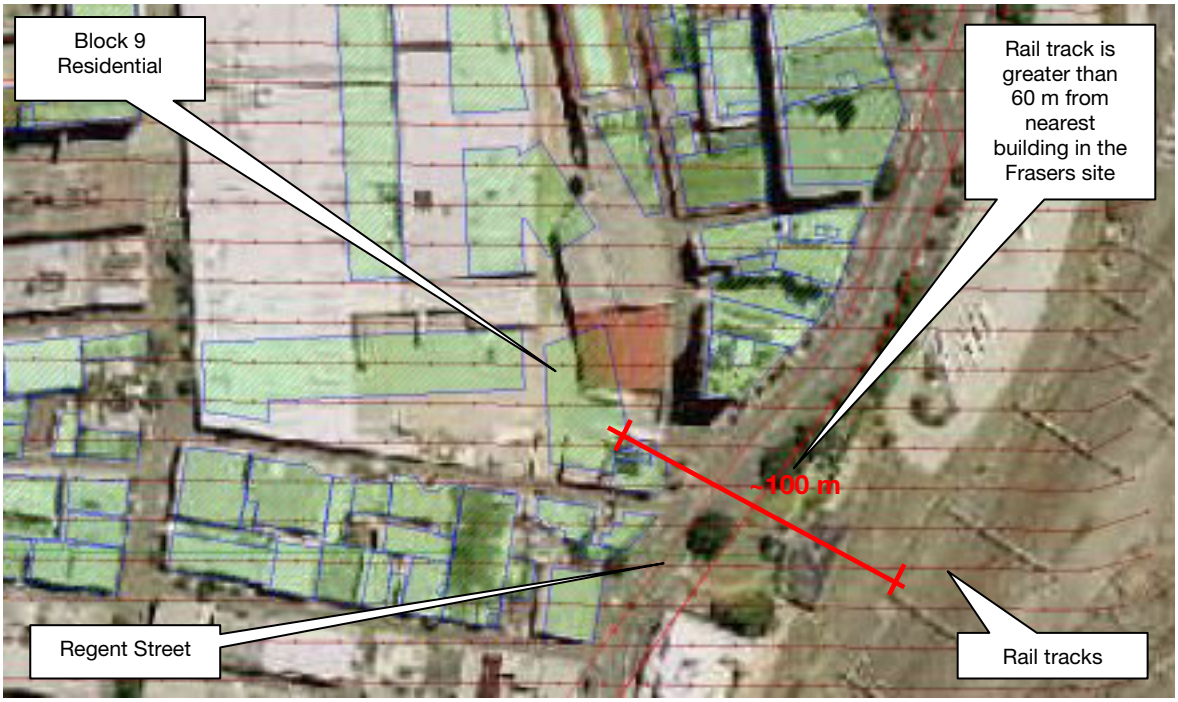
3.5 Aircraft Noise Intrusion

As the proposed development is located in the vicinity of the Sydney Kingsford Smith Airport (KSA) there is the possibility for aircraft noise intrusion. An analysis of the most recent Australian Noise Exposure Forecasts (ANEF 2023/24) chart for KSA has been made and it has been determined that the proposed development lies **outside** the 20 ANEF contour. As such, the development is classified as 'Acceptable' and there is no need to provide protection specifically against aircraft noise.

3.6 Rail Noise Intrusion

Figure 2 shows that the nearest building proposed as part of the Frasers Broadway Site Concept Plan is greater than 60 m from the nearest railway track.

Figure 2 Distance from Rail Track to Nearest Building in the Frasers Broadway Site



Notwithstanding the fact that the site is well outside the 60 metre zone, Heggies personnel assessed the site during the August 2006 noise survey, and resolved that rail related vibration was not perceptible and were therefore well below measurable limits.

In addition, traffic noise dominated the acoustic environment on the eastern (Regent Street) side of the development; therefore control of traffic noise intrusion will in turn control rail-related noise on the eastern side of the site.

3.7 Passive Recreation Areas

The SoundPLAN model developed for the site was used to determine free-field daytime $L_{Aeq(15hour)}$ noise levels to allow an assessment of noise levels within Passive Recreation Areas (the public open space in the centre of the site) against ECRTN criteria for such spaces.

In order to assess compliance with the ECRTN criterion for Passive Recreation Areas it has been necessary to determine free-field noise levels, at 1.5 m above ground level, during the daytime period.

The site-specific correction factor used to derive free field noise levels for the daytime period is:

$L_{A10(18hour)}$ to $L_{Aeq(15hour)}$ Free-field: -5.6 dBA.

Appendix A shows the results of the noise modelling exercise with regard to the typical daytime acoustical environment within public open spaces in the centre of the site.

A review of **Appendix A** reveals that the buildings around the perimeter of the site provide significant acoustical shielding for ground floor receivers within public areas in the centre of the site. As such compliance with the ECRTN criterion is achieved at all areas that could reasonably be considered 'Passive Recreation Areas' within the site.

3.8 Summary

Heggies Pty Ltd has conducted a preliminary acoustic assessment of the Frasers Concept Plan for the Frasers Broadway site. The scope of the assessment includes establishing criteria for noise emission from mechanical plant and noise intrusion into the development site; and conducting a preliminary assessment of road traffic noise intrusion into the site. Additional information and criteria are provided in relation to sound insulation requirements between residential dwellings, based on Building Code of Australia and City of Sydney DCP requirements.

The key findings of this assessment are as follows:

Mechanical Noise Emission - Mechanical noise emission criteria for the site have been established. This issue is to be reviewed at the detailed design stage, when mechanical items have been selected, located, and if necessary treated, to ensure that compliance with the established criteria is achieved at all noise-sensitive receivers.

Road Traffic Noise Intrusion - A review of the predicted facade noise levels suggests that, at buildings with facades at the perimeter of the site (adjacent to Broadway, Abercrombie Street and, to a lesser extent, Regent Street), daytime and night-time noise levels will exceed ECRTN criteria (for residential buildings). It is therefore recommended that, for residential receivers (as a minimum) on facades predicted to exceed ECRTN criteria, that internal acoustic amenity be protected by way of improved glazing and the provision of air-conditioning and mechanical ventilation to enable windows to be kept shut to limit noise intrusion and to comply with Sydney City Council internal noise criteria, refer **Section 2.2.2**.

It is noted that under the Frasers Concept Plan for the site, the predominant land use at the most road traffic noise-affected perimeter locations of the site is commercial, not residential. Noise mitigation measures may also need to be developed for commercial receivers with facades on the most road traffic noise-exposed perimeters of the site. The extent of any acoustic treatment for all building types should be further developed during the DA stage and detail designed stage of the project once the proposed building designs are developed and finalised.

Sleep Disturbance - Measured L_{A1} noise levels on the site indicates some exceedance of the established Sleep Disturbance criteria. However, these external levels equates to internal levels that are slightly above the sleep awakening levels. As a minimum, (for residential spaces) bedroom windows and doors facing the major roads may need to be kept closed to comply with the criterion. Further investigation of the potential for sleep disturbance should be conducted during the development applications for the project.

Aircraft Noise Intrusion - Based on the latest ANEF 2023/4 charts, the proposed development lies outside of the 20 ANEF contour. As such, the development is classified as acceptable and there is no need to provide protection specifically against aircraft noise.

Rail Noise and Vibration - The Central Railway Line is approximately 100 m from the proposed Frasers Broadway Site, which is beyond the SRA/RIC assessment zone of 60 m from an operational rail line. Therefore no specific assessment of rail-related noise and vibration is required now, or at later stages of the development.

Sound Insulation Requirements - Compliance with the sound insulation requirements of Building Code of Australia and City of Sydney DCP1996 are to be achieved within the residential components of the proposed development.

Passive Recreation Areas - The computer model predictions suggest that the ECRTN criteria ($L_{Aeq(15hour)}$ 55 dBA) will be achieved at all locations that could reasonably be considered Passive Recreation Areas within the centre of the site.

SoundPLAN Noise Contour Plots @ 1:2000

Ambient Noise Survey, August 2006