global environmental solutions

Acoustic Assessment

Proposed Mixed Use Development

Bankstown Compass Centre

Report Number 610.15515

12 October 2016

Fioson Pty Ltd
Level 34, 225 George St
Sydney NS, 2000

Version: v3.0

Acoustic Assessment

Proposed Mixed Use Development

Bankstown Compass Centre

PREPARED BY:

SLR Consulting Australia Pty Ltd
ABN 29 001 584 612
2 Lincoln Street
Lane Cove NSW 2066 Australia
(PO Box 176 Lane Cove NSW 1595 Australia)
T: +61 2 9427 8100 F: +61 2 9427 8200
sydney@slrconsulting.com www.slrconsulting.com

DOCUMENT CONTROL

Reference	Status	Date	Prepared	Checked	Authorised
610.15515-R1	Revision 3	12 October 2016	Mark Russell	Rob Hall	Mark Russell
610.15515-R1	Revision 2	2 May 2016	Mark Russell	Tom Cockings	Tom Cockings
610.15515-R1	Revision 1	18 January 2016	Mark Russell	Tom Cockings	Tom Cockings

Table of Contents

TABLES

Table of Contents

FIGURES

APPENDICES

1 INTRODUCTION

SLR Consulting Australia Pty Ltd (SLR Consulting) has been engaged by Fioson Pty Ltd to prepare a noise impact assessment for a proposed mixed used commercial and residential development at 83-99 North Terrace and 63 The Mall, Bankstown.

The purpose of this acoustic assessment is to:

- Address potential noise impacts on the development.
- Provide an acoustic specification for noise emissions from the site to meet the appropriate noise criteria at the surrounding sensitive receivers.
- Where necessary, recommendations are provided to demonstrate compliance with the relevant acoustic criteria is achievable.

The assessment has been prepared to accompany the Development Application (DA) to Bankstown Council.

1.1 Relevant Guidelines

The noise impacts of the project have been assessed in accordance with the relevant NSW Government Environmental Protection Authority (EPA) guidelines.

For road traffic noise impacts on the development, Clause 102 of the State Environmental Planning Policy (Infrastructure) 2007 (the 'Infrastructure SEPP') relates to residential development of land that may be adversely affected by road noise. Advice on the application of the Infrastructure SEPP is contained in the NSW Department of Planning document *Development near Rail Corridors and Busy Roads – Interim Guideline*.

For operational noise from fixed facilities, the relevant documents are the NSW EPA *Noise Guide for Local Government* and *Industrial Noise Policy* (INP).

Reference has also been to following documents

- Bankstown Local Environment Plan 2015
- Bankstown Development Control Plan 2015

1.2 Terminology

Specific acoustic terminology is used within this assessment. An explanation of common terms is included as **Appendix A**.

1.3 Site Description

The site is bounded by North Terrace, Fetherstone Street, The Mall and The Appian Way and comprises of an existing retail complex with site thru link connections, office tower and includes the existing council facility housing the former Bankstown Library and on grade car parking.

The existing properties on the lots are planned to be demolished and replaced with;

- 4 separate towers ranging between 4 and 20 storeys
- 2-4 levels of combined retail and commercial space.
- A new Council Civic Centre administration building with 86 car spaces.

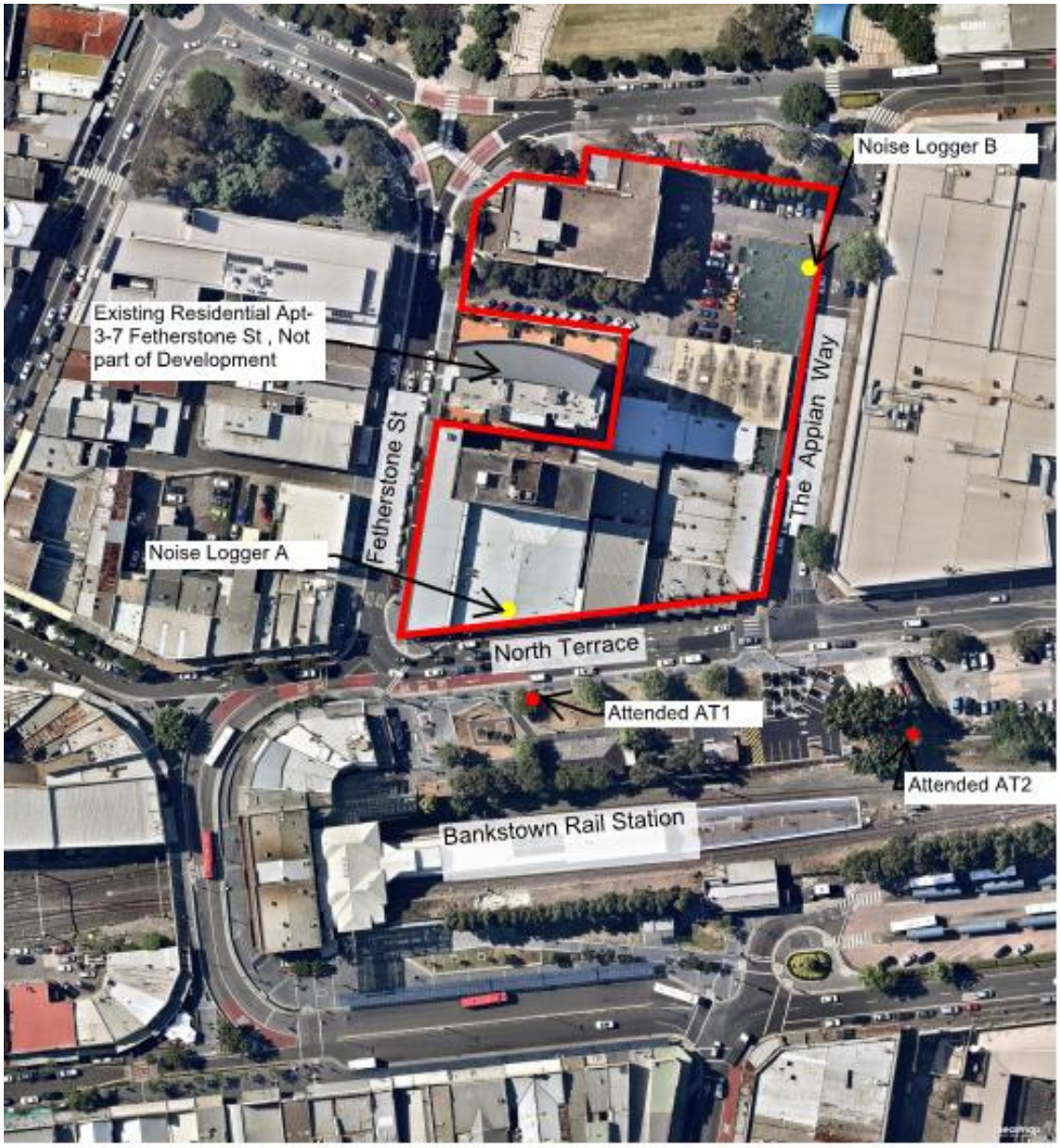
- Approximately 471 residential units
- Carparks for approximately 870 cars.
- A podium level will be provided and accessible by residents, and will include amenities such as communal outdoor spaces and a pool

An aerial photograph illustrating the development site is shown in **Figure 1**.

The DA drawings of the development used in preparing this assessment were DA-100-001 to 002, DA-110-B01 to 200 and DA-250-001 to 601, issued on 4 February 2016.

The nearest existing sensitive receivers to the development are located within the proposed development, a residential apartment building at 3 -7 Fetherstone St. Other nearby properties are occupied by commercial businesses, predominantly comprising of retail and restaurants.

Figure 1 Bankstown Compass Centre



2 AMENITY NOISE SURVEY

2.1 Unattended Noise Monitoring

Measured ambient background noise levels are required in order to define project specific noise levels based on the relevant criteria/guidelines. Unattended continuous noise monitoring was undertaken at two locations at the proposed development site: one (Location A) on top of the existing shopping centre, approximately 7.5 m above the ground and 7 m from the nearest lane of flowing traffic; and the other (location B) at the rear of the property on the roof of existing shops overlooking The Appian Way, approximately 5.5 m above ground level and 5 m from the nearest lane of flowing traffic. The noise monitoring occurred for seven days during the period 23 – 30 November 2015. Two SVAN 957 noise loggers (serial numbers 20674 and 21425) were deployed at these locations as indicated in **Figure 1**.

The results of the unattended noise survey are tabulated in **Table 1** and **Table 2**.

Table 1 Ambient Noise Survey Levels - Location A[1]

Date	Logger SN	Time Period	RBL[2]	LAeq[3]
15/07/2013 to 22/07/2013	23247	Day	57	65
		Evening	56	64
		Night-time	47	59

Note 1: The logger was placed at approximately 7 m from North Terrace Road and 7.5 m above ground.

Note 2: The RBL (rating background level) noise level is representative of the average minimum background sound level (in the absence of the source under consideration), or simply the background level.

Note 3: The L_{Aeq} is the energy averaged sound level. It is defined as the steady sound level that contains the same amount of acoustical energy as a given time-varying sound.

Table 2 Ambient Noise Survey Levels – Location B[1]

Date	Logger SN	Time Period	RBL[2]	LAeq[3]
15/07/2013 to 22/07/2013	20667	Day	56	67
		Evening	52	66
		Night-time	41	60

Note 1: The logger was placed at approximately 5 m from The Appian Way, at a height of 5.5 m above ground level.

Note 2: The RBL (rating background level) noise level is representative of the average minimum background sound level (in the absence of the source under consideration), or simply the background level.

Note 3: The L_{Aeq} is the energy averaged sound evel. It is defined as the steady sound level that contains the same amount of acoustical energy as a given time-varying sound.

Calibration of the equipment was checked prior to and following measurements. Drift in calibration did not exceed ±0.5 dBA. All equipment carried appropriate and current NATA (or manufacturer) calibration certificates. The noise loggers were fitted with a wind shield at all times.

Charts presenting summaries of the measured daily noise data are attached in **Appendix B**. The charts present each 24 hour period by incorporating the L_{Amax}, L_{A1}, L_{A10}, L_{Aeq} and L_{A90} noise levels for the corresponding 15 minute periods.

The measured data has been filtered to remove periods affected by adverse weather conditions, following consultation of weather reports recorded at the Bureau of Meteorology (BOM) Canterbury weather station. The filtered data is shown in **Appendix B**.

It is noted that mechanical plant servicing the existing shopping centre and associated shops was located on the same roof as both logger location A and B. Whilst locations were selected so that the influence of plant would be minimal and traffic noise levels would dominate, noise generated form the mechanical plant may have contributed to the unattended measurements. Attended noise measurements have been conducted to supplement unattended noise logging and identify the contribution of various noise sources.

2.2 Attended Noise Monitoring

Short-term attended noise monitoring was also undertaken at the logger locations in order to qualify the unattended noise monitoring data.

Instrumentation for the survey comprised of a B&K 2260 sound level meter (serial number 2414605) and a B&K 2270 sound level meter (serial number 3003729), both fitted with microphone windshields. Calibration of the sound level meter was checked prior to and following measurements. Drift in calibration did not exceed ±0.5 dBA. The sound level meter carried appropriate and current NATA (or manufacturer) calibration certificates.

Measurements were conducted in accordance with AS 1055.1-1997: *Acoustics - Description and measurement of environmental noise - General procedures*.

The results of the operator attended noise survey are presented in **Table 3** together with a description of the various source contributions to the measured noise levels present at the time of the survey.

Table 3 Attended Noise Measurements

Date / Start Time	Location	Primary Noise Descriptor (dBA)		Typical Maximum Levels (dBA)
		LA90	LAeq	
30/11/2015 11:22 pm 15 Minute Measurement	Logger location A	56	62	Traffic on North Terrace Rd Cars 60 to 63 dBA Bus 64 to 69 dBA Trains <58 dBA (Just audible)
30/11/2015 11:22 pm 15 Minute Measurement	Ground Level measurement opposite Location A (noted as **AT1** in **Figure 1**)	-	63	Traffic on North Terrace Rd Cars 60 to 65 dBA Bus 68 to 74 dBA Trains <58 dBA (Just audible) Bus idling 65 dBA
30/11/2015 12:06 pm 15 Minute Measurement	Logger Location B	58	67	Traffic on The Appian Way Cars 60 to 65 dBA Bus 76 to 80 dBA Bus idling 66 to 69 dBA
30/11/2015 Train pass by measurement, approximately 14 m from centre of the nearest track (Up Line)	Train Passby's measurement location (noted as **AT2** in **Figure 1**)	Train on Up Line (line closest to the development), both passby's where of a passenger train leaving Bankstown Station Passby 1 – LAeq 72, LAmax 76 Passby 2 – LAeq 70, LAmax 76		

During all surveys road traffic noise from North Terrace and The Appian Way was identified as the dominant noise source. Train noise in the rail corridor 50 m to the south of the site was observed, but did not dominate the noise environment. Due to the location of Bankstown station in relation to the proposed development, all observed train movements where slowing and or stopping at the station, resulting in no measurable noise emissions over the existing traffic dominated environment. In addition to site observations, passby noise levels at the façade of the proposed development are predicted to by 59 dBA which supports site observations. By controlling traffic noise ingress through acoustic design of the building facade, rail noise emissions will also be controlled.

Site observations noted that at both unattended noise monitoring locations mechanical plant was not audible throughout attended surveys and that the typical noise levels measured during attended surveys was consistent with noise levels measured throughout the unattended noise monitoring period.

3 CRITERIA/GUIDELINES AND PROJECT SPECIFIC NOISE LEVELS

3.1 Road Traffic Noise Intrusion - Residential

The Department of Planning's *Development near Rail Corridors and Busy Road – Interim Guideline (2008)* aims to assist in the planning, design and assessment of developments in, or adjacent to busy road and supports the specific provisions of SEPP (Infrastructure) 2007 in relation to road traffic noise.

Table 4 details the internal noise criteria applicable for new residential buildings near main roads as specified in the Infrastructure SEPP.

Table 4 Road Traffic Noise Assessment Criteria

Internal Space	Time period	Internal noise level (with windows closed)
Sleeping areas	Night-time (10pm to 7am)	35 dBA
Other habitable rooms	At any time	40 dBA

Note: Airborne noise is calculated as $L_{Aeq(9hour)}$ (night-time) and $L_{Aeq(15hour)}$ (daytime).

If internal noise levels with windows or doors open exceed the criteria by more than 10 dB, the design of the ventilation for these rooms should enable occupants to close windows during noisier periods, and also meet the ventilation requirements of the Building Code of Australia.

Where windows must be closed, the adopted ventilations system must meet the requirements of the Building Code of Australia and Australian Standard 1668 – *The use of ventilation and air conditioning in buildings*.

3.2 Road Traffic Noise Intrusion – Non-Residential

AS/NZS 2107:2000 *Acoustics – Recommended design sound levels and reverberation times for building interiors* provides recommended design sound levels for different areas of occupancy in buildings. This includes recommended internal design sound levels for small retail stores and cafés. To meet these criteria, it is assumed that windows are closed

Table 5 AS 2107:2000 Recommended Design Sound Levels for Non-Residential Occupancy

Type of Occupancy	Recommended Design Sound Level (LAeq) dBA		Recommended Reverberation Time (T) s
	Satisfactory	Maximum	
Small retail stores (general)	45	50	Reverberation Time should be reduced as far as practicable for noise control
Speciality shops (where detailed discussion is necessary in transactions)	40	45	
Supermarkets	50	55	
Shopping malls	45	55	
General office areas	40	45	0.4 to 0.6
Private offices	35	40	0.6 to 0.8
Medical Rooms	40	45	0.4 to 0.6
Medical Waiting Rooms	40	50	0.4 to 0.7
Restaurants	45	50	<1.0

3.3 Noise Emissions

Responsibility for the control of noise emissions in New South Wales is vested in Local Government and the NSW Environment Protection Authority (EPA).

The EPA oversees the Industrial Noise Policy (INP) which provides a framework and processes for deriving noise criteria. The INP criteria for industrial noise sources have two objectives:

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

3.3.1.1 Intrusiveness Criterion

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 should not be more than 5 dBA above the measured Rated Background Level (RBL), over any 15 minute period.

3.3.1.2 Amenity Criterion

The amenity criterion is based on land use and associated activities (and their sensitivity to noise emission). The cumulative effect of noise from industrial sources needs to be considered in assessing the impact. The criteria relate only to industrial-type noise sources 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 industrial-type noise sources, (including air-conditioning mechanical plant) need to be designed so that the cumulative effect does not produce total noise levels that would significantly exceed the criterion.

3.3.1.3 Area Classification

The INP, for the purposes of determining the appropriate noise amenity criteria, characterises an “Urban” noise environment as an acoustical environment that:

- Is dominated by “urban hum” or industrial source noise
- Has through traffic with characteristically heavy and continuous traffic flows during peak periods
- Is near commercial districts or industrial districts, and
- Has any combination of the above.

Where “urban hum” means the aggregate sound of many unidentifiable, mostly traffic-related sound sources.

For the purposes of this assessment, the area surrounding the nearest sensitive receivers satisfies the “Urban” area classification.

3.4 Project Specific Noise Criteria

The noise emission criteria for the operation of any mechanical plant at the project site have been established based on ambient noise levels presented in **Table 6**.

Table 6 Operational Noise Criteria for Sensitive Receivers Surrounding the Development Site

Receiver	Time of Day	ANL [1] LAeq(period)	Measured RBL [2] LA90(15minute)	Measured LAeq(period) Noise Level	Criteria for New Sources	
					Intrusive LAeq(15minute)	Amenity [3] LAeq(period)
Residential Based on Logger A	Day	60	57	65	62	56
	Evening	50	56	64	61	54
	Night	45	47	58	52	48
Residential Based on Logger B	Day	60	56	67	61	57
	Evening	50	52	66	57	56
	Night	45	41	60	46	50

Note 1: ANL = "Acceptable Noise Level" for residences in Urban Areas.
Note 2: RBL = "Rating Background Level".

Compliance with the most stringent design criteria – the amenity and intrusiveness criteria during the night-time period – will automatically ensure compliance in the other time periods, noting the intrusive criteria applies to any 15 minute period and the amenity criteria applies to the total period

3.5 Internal Sound Insulation Requirements

The development shall be designed and constructed to meet the National Construction Code (NCC) requirements, most notably Part F5 *Sound Transmission and insulation.* **Table 7** details the minimum acoustic performance required for the development to comply with the NCC.

Table 7 NCC 2015 Sound Insulation Requirements

Construction	NCC 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 > 62

Construction	NCC Requirements	
	Laboratory Rating	**Verification**
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	There is no statutory requirement for airborne isolation via intra-tenancy walls.	

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 2012 BCA states that the required insulation of a floor or wall must not be compromised by a door assembly.

4 NOISE ASSESSMENT

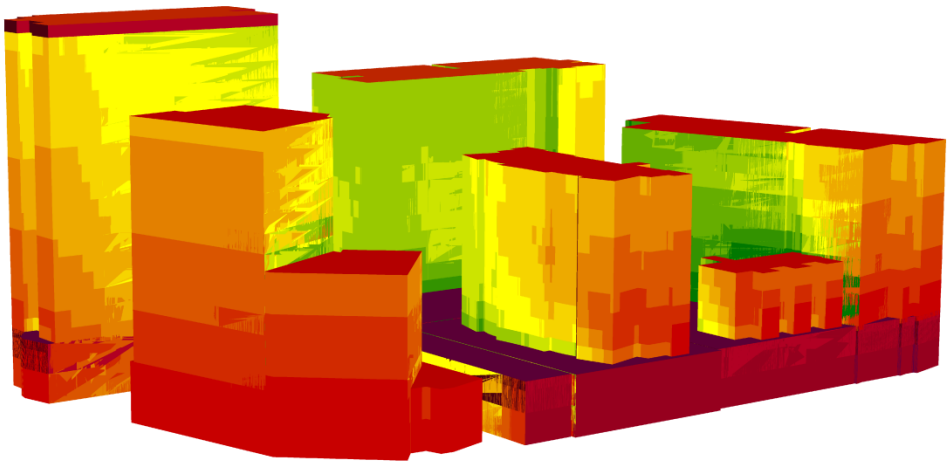
Due to the complexity of the site and numerous road sources and surrounding buildings, calculations were conducted within a 3D computer modelling package (SoundPLAN 7.1). The model incorporated all major buildings and roads near and around the subject site, and predicts façade levels to all locations of the building (allowing for distance from sources to receiver, shielding from surrounding buildings, ground and air attenuation etc.). The calculation was conducted using the ISO9613 calculation algorithms. A graphical representation of the model is shown in **Figure 2**.

Current road traffic noise levels for adjoining roads have been determined using the measurements from the unattended noise monitoring.

4.1 Road Traffic Noise Intrusion

Based on buildings of this type of façade construction, being primarily concrete panel and glass, the main acoustical weakness is the glazing. Concrete panels typically provide 45 dBA or more noise reduction compared to glass which provides typically 20 dBA to 30 dBA noise reduction. As such, it is the glazing that requires specific attention in regards to noise intrusion.

Figure 2 3D Computer Model of the Proposed Development



4.1.1 Predicted External Noise levels

The predicted external noise levels in addition to internal levels with standard glazing treatments are provided in **Table 8** to **Table 12**. Standard window glazing (ie typical window area and thickness) of a building will typically attenuate these levels by 20 dBA with windows closed and 10 dBA with windows open (allowing natural ventilation).

Figure 3 Acoustic Building References[1]

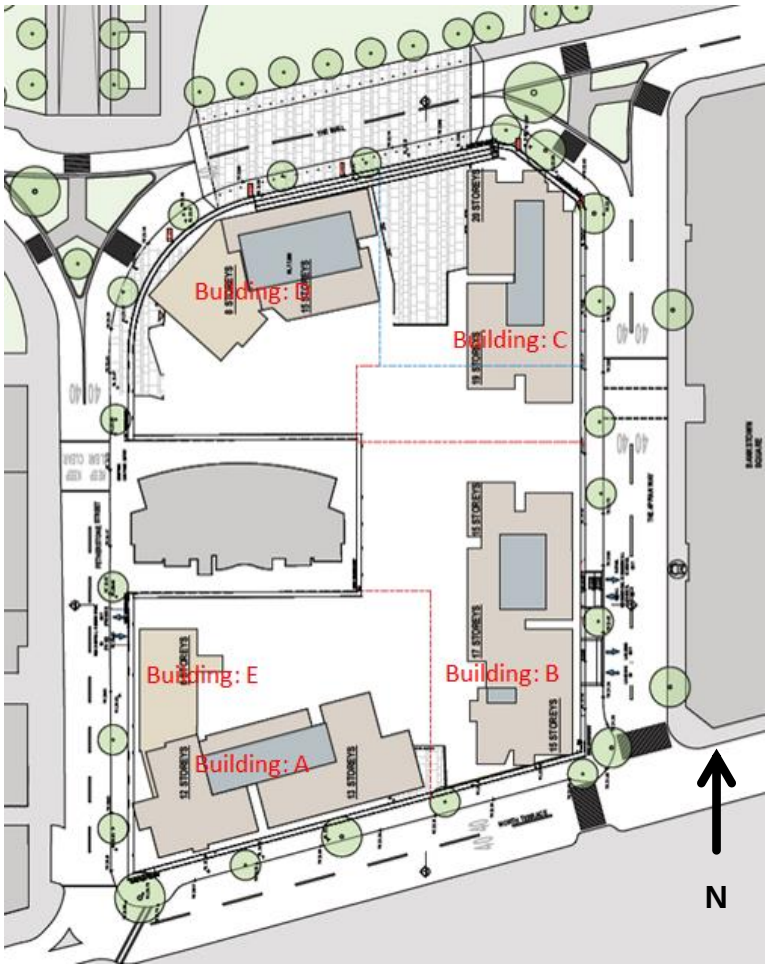


Table 8 Highest Predicted External Noise Levels – Building A

Facade	Floor	Highest Predicted External Noise Level (dBA) [1]		Internal Noise Levels dBA (Based on standard Glazing)	
		Daytime LAeq(15hour)	Night-time LAeq(9hour)	Windows Closed [2] Day / Night	Windows Open Day / Night [3]
North	2 – 12	59	53	39 / 33	49 / 43
West	1	76	70	56 / 50	66 / 60
	2 - 12	74	68	54 /48	64 / 58
East	2 – 12	66	60	46 / 40	56 / 50
South	1	74	68	54 / 48	64 / 58
	2 - 12	72	66	52 / 46	62 / 56

Notes:
1. Noise levels include a facade correction factor of +2.5 dB.
2. Assumes 20 dB outside to inside noise reduction with windows closed
3. Assumes 10 dB outside to inside noise reduction with windows open

[1] Building references that have been used throughout this report relate to the acoustic assessment only and may be different to references used in other technical reports.

Table 9 Highest Predicted External Noise Levels – Building B

Facade	Floor	Highest Predicted External Noise Level (dBA) [1]		Internal Noise Levels dBA (Based on standard Glazing)	
		Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$	Windows Closed[2] Day / Night	Windows Open[3] Day / Night
North	2 -15	62	55	42 / 35	52 / 45
West	2 - 15	66	60	46 / 40	56 / 50
East	1	72	66	52 / 46	62 / 56
	2 - 15	70	64	50 / 46	60 / 54
South	1	74	68	54 / 48	64 / 58
	2 - 15	72	66	52 / 46	62 / 56

Notes:
1. Noise levels include a facade correction factor of +2.5 dB.
2. Assumes 20 dB outside to inside noise reduction with windows closed
3. Assumes 10 dB outside to inside noise reduction with windows open

Table 10 Highest Predicted External Noise Levels – Building C

Facade	Floor	Highest Predicted External Noise Level (dBA) [1]		Internal Noise Levels dBA (Based on standard Glazing)	
		Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$	Windows Closed[2] Day / Night	Windows Open[3] Day / Night
North	2 – 20	71	65	51 / 45	61 / 55
West	2 - 20	70	64	50 / 44	60 / 54
East	2 - 20	67	61	47 / 41	57 / 51
South	2 -20	61	55	41 / 35	51 / 45

Notes:
1. Noise levels include a facade correction factor of +2.5 dB.
2. Assumes 20 dB outside to inside noise reduction with windows closed
3. Assumes 10 dB outside to inside noise reduction with windows open

Table 11 Highest Predicted External Noise Levels – Building D

Facade	Floor	Highest Predicted External Noise Level (dBA) [1]		Internal Noise Levels dBA (Based on standard Glazing)	
		Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$	Windows Closed[2] Day / Night	Windows Open[3] Day / Night
North	4 -14	72	66	52 / 46	62 / 56
West	4 -14	69	63	59 / 43	59 / 53
East	4 -14	68	62	48 / 42	58 / 52
South	4 -14	59	53	39 / 33	49 / 43

Notes:
1. Noise levels include a facade correction factor of +2.5 dB.
2. Assumes 20 dB outside to inside noise reduction with windows closed
3. Assumes 10 dB outside to inside noise reduction with windows open

Table 12 Highest Predicted External Noise Levels – Building E

Facade	Floor	Highest Predicted External Noise Level (dBA) [1]		Internal Noise Levels dBA (Based on standard Glazing)	
		Daytime LAeq(15hour)	Night-time LAeq(9hour)	Windows Closed[2] Day / Night	Windows Open[3] Day / Night
North	2 -6	67	61	47 / 41	57 / 51
West	2 -6	73	67	53 / 47	63 / 57
East	2 -6	52	46	32 / 26	42 / 36
South	2 -6	-	-	No Exposed Facade	

Notes: 1. Noise levels include a facade correction factor of +2.5 dB.
2. Assumes 20 dB outside to inside noise reduction with windows closed
3. Assumes 10 dB outside to inside noise reduction with windows open

The internal design noise levels of 35 dBA for bedrooms and 40 dBA for living areas are predicted to be exceeded by more than 10 dB with windows open for most facades of the proposed development and thus alternative ventilation will be required to enable windows and doors to remain closed during noisier periods and also meet the ventilation requirements of the Building Code of Australia.

Noise ingress generally involves several pathways, and is most common via the windows, doors, ventilation opening and the roof. The overall sound reduction of a building element is dependent upon the mass of the construction, the effective area and the extent of any gaps or openings. Recommendations relating to the building construction are provided in below.

4.2 Design Recommendations

The calculations take into account the following:

- Area and orientation of the glass.
- The size and amount of absorption within the room.
- The sound level and spectrum of the external noise source.
- The sound insulation performance rating of the proposed glass across the entire sound spectrum.

At this preliminary stage of the project the exact area of glazing for each apartment is unknown and will be documented during detail design. In-order to provide guidance as to the glazing requirements to control traffic noise ingress, recommendations for glazing upgrades have been provided for a range of window sizes. It should be noted that where the required reduction index (R_W) is predicted to be higher than R_W+C_{TR} 40, winter gardens may be considered as a means of controlling traffic noise intrusion and should be considered during detail design.

In principle glazing recommendations to meet specific internal noise levels are provided in **Table 13** to

Table 13 Recommended Glazing Ratings– Building A

Facade	Level	Usage	Internal Noise Criteria	Minimum Glazing Performance Rw / Rw+CTR for specific window size (m^2)		
				Under 4m^2	4m^2 up to 8m^2	8m^2 up to 12m^2
North	2 – 12	Bedroom	35	28 / 26	28 / 26	28 / 26
		Livingroom	40	28 / 26	28 / 26	28 / 26
West	1 - 12	Bedroom	35	40 / 37	45 / 40	Not achievable with standard glazing
		Livingroom	40	40 / 37	45 / 40	45 / 40
East	2 – 12	Bedroom	35	32 /30	32 /30	34 / 32

Facade	Level	Usage	Internal Noise Criteria	Minimum Glazing Performance Rw / Rw+CTR for specific window size (m^2)		
				Under 4m^2	4m^2 up to 8m^2	8m^2 up to 12m^2
		Livingroom	40	32 /30	32 / 30	32 / 30
South	1	Bedroom	35	40 / 37	40 / 37	45 / 40
		Livingroom	40	36 / 33	40 /37	45 / 40
	2 – 12	Bedroom	35	36 / 33	40 / 37	45 / 40
	2 – 12	Livingroom	40	34 / 32	40 / 37	40 / 37

Notes: 1. The minimum assumed glazing performance is 4 mm float in quality sealed frames (Rw / Rw+CTR of 28/26).

Table 14 Recommended Glazing Ratings– Building B

Facade	Level	Usage	Internal Noise Criteria	Minimum Glazing Performance Rw / Rw+CTR for specific window size (m^2)		
				Under 4m^2	4m^2 up to 8m^2	8m^2 up to 12m^2
North	2 – 15	Bedroom	35	28 / 26	28 / 26	32 / 30
		Livingroom	40	28 / 26	28 / 26	32 / 30
West (central extent)	2 – 15	Bed Room	35	28 / 26	28 / 26	28 / 26
		Living Room	40	28 / 26	28 / 26	28 / 26
West Northern and southern extents	2 - 15	Bedroom	35	32 / 30	32 / 30	34 / 32
		Livingroom	40	32 / 30	32 / 30	34 / 32
East	1	Child Care	40	36 / 33	40 / 37	45 / 40
	2 – 15	Bedroom	35	32 / 30	36 /33	40/ 37
		Livingroom	40	32 / 30	34 / 32	36 /33
South	1	Medical Centre	40	40 / 37	45 / 40	Not achievable with standard glazing
	2 – 15	Bedroom	35	34 / 32	40 / 37	45 / 40
	2 – 15	Livingroom	40	34 / 32	40 / 37	40 / 37

Notes: 1. The minimum assumed glazing performance is 4 mm float in quality sealed frames (Rw / Rw+CTR of 28/26).

Table 15 Recommended Glazing Ratings– Building C

Facade	Level	Usage	Internal Noise Criteria	Minimum Glazing Performance Rw / Rw+CTR for specific window size (m^2)		
				Under 4m^2	4m^2 up to 8m^2	8m^2 up to 12m^2
North	2 – 20	Bedroom	35	34 / 32	40 / 37	40 / 37
		Livingroom	40	34 / 32	36 / 33	40 / 37
West (southern extent)	2 – 20	Bed Room	35	28 / 26	32 / 30	32 / 30
		Living Room	40	28 / 26	32 / 30	32 / 30
West (Northern extents)	2 - 20	Bedroom	35	32 / 30	34 / 32	40 / 37
		Livingroom	40	32 / 30	34 / 32	36 / 33
East	2 -20	Bedroom	35	32/30	32/30	34/32
		Livingroom	40	32/30	32/30	34/32
South	2 – 20	Bedroom	35	28 / 26	28 / 26	32 / 30

Facade	Level	Usage	Internal Noise Criteria	Minimum Glazing Performance Rw / Rw+CTR for specific window size (m^2)		
				Under 4m^2	4m^2 up to 8m^2	8m^2 up to 12m^2
		Livingroom	40	28 / 26	28 / 26	28 / 26

Notes: 1. The minimum assumed glazing performance is 4 mm float in quality sealed frames (Rw / Rw+CTR of 28/26).

Table 16 Recommended Glazing Ratings– Building D

Facade	Level	Usage	Internal Noise Criteria	Minimum Glazing Performance Rw / Rw+CTR for specific window size (m^2)		
				Under 4m^2	4m^2 up to 8m^2	8m^2 up to 12m^2
North	4- 14	Bedroom	35	34/ 32	40 / 37	45 / 40
		Livingroom	40	34 / 32	40 / 37	40 / 37
West	4- 14	Bedroom	35	32 / 30	34 / 32	36 / 33
		Livingroom	40	32 / 30	34 / 32	36 / 33
East	4- 14	Bedroom	35	32 / 30	34 / 32	36 / 33
		Livingroom	40	32 / 30	34 / 32	34 / 32
South	4- 14	Bedroom	35	28 / 26	28 / 26	28 / 26
		Livingroom	40	28 / 26	28 / 26	28 / 26

Notes: 1. The minimum assumed glazing performance is 4 mm float in quality sealed frames (Rw / Rw+CTR of 28/26).

Table 17 Recommended Glazing Ratings– Building E

Facade	Level	Usage	Internal Noise Criteria	Minimum Glazing Performance Rw / Rw+CTR for specific window size (m^2)		
				Under 4m^2	4m^2 up to 8m^2	8m^2 up to 12m^2
North	4- 14	Bedroom	35	32 / 30	32 / 30	34 / 32
		Livingroom	40	32 / 30	32 / 30	34 / 32
West	4- 14	Bedroom	35	36 / 33	40 / 37	45 / 40
		Livingroom	40	36 / 33	40 / 37	45 / 40
East	4- 14	Bedroom	35	28 / 26	28 / 26	28 / 26
		Livingroom	40	28 / 26	28 / 26	28 / 26

Notes: 1. The minimum assumed glazing performance is 4 mm float in quality sealed frames (Rw / Rw+CTR of 28/26).

When considering the recommended glazing requirements as documented in **Table 13** to **Table 17**, it is important to consider the following:

- Recommendations are based on the largest window area (m^2) for the given area (m^2) range.
- Recommendations are based on the highest predicted noise level for a given façade. This represents a conservative approach which details where glazing can and cannot be used.

Further glazing specifications are noted below:

Window frames are not to degrade the performance of windows. Frames are to be not less than 2.5 mm thick aluminium unless tests conducted in a NATA certified laboratory are provided demonstrating that the recommended acoustic ratings can be achieved with alternative products.

Sliding doors for apartments should be designed such that there is no degradation in the sound isolation (Both R_w and $R_w + C_{tr}$) due to perimeter sealing. To comply, the doors should:

- Each sliding door shall be fitted with at least one set of acoustic seals on both the inside and outside faces (i.e. 2 sets of acoustic rated seals for each sliding door). The seals are to be selected for both good acoustic performance and also ease of opening and closing. Acceptable seal systems include acoustic rated 'Q-lon' seals combined with felt inserts. Alternative fin and brush combined seals may also be acceptable.
- Seals should be regularly checked and maintained to ensure long term performance.
- Have been tested in a NATA certified acoustical laboratory, and the results of the tests provided to SLR consulting prior to ordering of materials for manufacture, or

The above recommendations are the minimum requirement for acoustics, and all glazing is also to conform to the relevant Codes.

4.3 On-site Acoustic Impacts (Mechanical Noise)

From review of the current planning drawings, the types of noise sources associated with this development are typical of mixed use / apartment developments and would include:

- Noise from mechanical equipment associated with the development, including air-conditioning, carpark ventilation fans, corridor ventilation system and carpark entry gates, substation, fire pump and fire control equipment.
- Domestic air-conditioner noise (from balcony mounted units etc.).
- Noise from loading bays and retail tenancies.

At this stage, details of the proposed mechanical plant and its precise location are not available, as this will take place during the detailed design stage of the project.

The external noise emission and location of mechanical plant associated with the development should be controlled so that the operation of such plant does not adversely impact upon neighbouring residential receivers and occupants within the proposed development. The criteria for the noise emissions from mechanical plant and equipment are documented in **Section 3.4**. Detailed assessment and verification of mechanical noise emissions should be carried out during the detailed design stage of the project ensuring that the nominated criteria for mechanical plant emissions are met.

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

- Selection of low-noise units
- Judicious location
- Barriers/enclosure
- 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.

It is recommended to locate the car park supply air fans as far as practicable from the nearest receivers.

It is also noted that noise from vehicles accessing the car park would also be considered to contribute to the site noise emissions. To minimise vehicle emissions (especially on the access ramp), it is recommended that acoustic ventilation louvres are used where ventilating open area is required

A combination of the above mitigation methods may be required to satisfy the design criteria.

5 CONCLUSION

SLR Consulting has conducted an Operational Noise Impact Assessment for the proposed mixed use development at Bankstown Compass Centre, Bankstown.

The scope of the assessment involved establishing project specific operational noise criteria in accordance with the NSW *Industrial Noise Policy* and the identification and assessment of potential noise emissions for submission to Bankstown Council.

The main off-site source of noise to the development was identified to be traffic noise. Recommendations have been provided for glazing to all façades of the development to control traffic noise ingress.

In relation to on-site amenity impacts, the building will be designed such that all mechanical plant and equipment, loading bay activities and the like achieve the relevant criteria. A full acoustical specification will be developed for the building that addresses all such noise sources and ensures they are controlled to the appropriate targets.

Based upon the findings of this assessment, the development as proposed appears satisfactory in terms of its general planning arrangement. Acceptable internal noise levels can be achieved within residential apartments with the incorporation of recommended controls.

Mechanical plant equipment details will be assessed as part of the detailed design stage however it is envisaged that the project specific noise criteria can be met through careful selection and location of the plant on each building, and the construction of barriers or enclosures if required.