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Piedimonte Developments Pty Ltd
12-Dec-2018

Acoustics Planning Report

Piedimonte's Mixed Use Redevelopment

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Client: Piedimonte Developments Pty Ltd

Co No.: 620 126 070

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Rev	Revision Date	Details	Authorised	
			Name/Position	Signature
0	12-Dec-2018	Acoustics Planning Report	Pablo Reboredo Gasalla Senior Acoustic Engineer	

Table of Contents

1.0 Introduction

AECOM have been commissioned by Piedimonte Developments Pty Ltd to provide acoustics consultancy services for the proposed multi-use Piedimonte's redevelopment at 37-49A Best Street, Fitzroy North.

This report presents acoustic advice for the proposed development for planning purposes, and addresses the following items that will influence noise intrusion from the external environment, and noise emission from the building to the external environment, including:

- Acoustic comparison of the previous planning permit application (PLN17/0618) completed by Peddle Thorpe with the proposed multi-use Piedimonte's redevelopment by Jackson Clements Burrows Architects. Description of the acoustic benefits of the proposed schemes with the previous scheme planning application.
- Identification and measurements of potential noise sources:
  - Road traffic associated with Scotchmer Street, Best Street, St. Georges Road and Egremont Street;
  - Trams travelling along St. Georges Road;
  - Activities associated with the commercial premises adjacent to the proposed site;
  - Noise and structure-borne noise sources potentially impacting the residential premises within the building due to the operation of supermarket, back-of-house and loading dock areas.
- Environmental noise limits that will apply to the proposed development with respect to noise emission from the development to surrounding residential premises (including new residences within the development, and existing residential properties).
- Acoustic design of the façade glazing to achieve internal noise criteria recommended by Australian Standards.
- Conceptual advice regarding noise and vibration isolation of the loading bay, back of house and supermarket areas to minimise transfer of noise and vibration from trolley movements, pallet jacks, lift platforms and trucks to adjacent dwellings and to the existing residential properties located in Egremont Street.
- Conceptual acoustic recommendations for mechanical services.

The acoustic design details presented in this report have been based on the following architectural drawing set:

- A-SD1, 18-038_Piedimontes_TP SET WIP_181030, Jackson Clements Burrows Architects.

The acoustic nomenclature used throughout the report is presented in Section 13.0 of the report.

2.0 Acoustic comparison of the previous planning permit application with the proposed multi-use Piedimonte's redevelopment

The proposed Piedimonte's redevelopment has been designed with a focus on acoustic performance to minimise emission of noise and vibration to the surroundings and apartments within the development. Table 2-1 below lists the acoustic benefits of the proposed redevelopment in comparison with the previous scheme planning application.

Table 2-1 Acoustic benefits of the proposed multi-use Piedimonte's redevelopment

Previous Planning Application, Summary of Acoustic Objections PLN17/0618	Proposed Planning Application, Acoustic Benefits
Waste collection from Egremont Street including odour and noise concerns	• Waste collection will be relocated from the Laneway to within the building at Basement Level 1. The supermarket will be accessed by one waste collection vehicle per day between 7am-6pm. The environmental noise impacts will be eliminated.
Location of A/C and plant and proximity to residential zone including noise and vibration from services	• All mechanical plant operation and services will be acoustically treated using appropriate measures such as attenuators to fans, vibration isolation systems, acoustic barriers and enclosures to minimise emission of noise to the surroundings and this achieve the relevant noise criteria at the nearest residences and apartments; • Relocation of the mechanical plant to Level 7, combined with appropriate noise control, will reduce to noise emission from plant to the Egremont Street residences.
Loading dock design	• Piedimonte is proposing to create a formal loading bay to accommodate the trucks and thus improve the safety of the operation (refer to architectural drawing set -A-SD1_181030). The design has been designed with a focus on acoustic performance, with the loading bay and back of house being isolated from adjoining apartments and from the existing dwellings at Egremont Street via pedestrian laneway (refer to Figure 6) and enclosing the loading bay and back of house within the building.
Inadequate acoustic treatment	• The acoustic design for the proposed Piedimonte's activities and services shall be based on achieving the acoustic criteria (e.g. Australian Standards, EPA noise policy) outlined in this report. Building services and Piedimonte's operations will be acoustically treated to achieve the acoustic and vibration criteria at all residences and apartments by the way of the area being fully enclosed with no access or opening onto the rear Laneway which fully controls any unforeseen breakout noise; • The acoustic design of the interior partitions (walls and floors), exterior walls (façade) and building services of the proposed building will be undertaken during the detailed design phase to ensure that the noise emissions from the building (including Piedimonte's activities) are not excessive and comply with the relevant EPA environmental noise guidelines and policies or other relevant standards.

3.0 Site Description

The proposed Piedimonte's redevelopment at 37-49A Best St, Fitzroy North is shown on the locality plan in Figure 1, overleaf. The existing use of the site comprises Piedimonte's Supermarket and residences.

The site is bounded to the north by Scotchmer Street, commercial premises to the south, and by residences to the south-west. The development is bounded to the east by Best Street and St. Georges Road and west by Egremont Street.

Based on the current architectural drawings, the proposed development will consist of the following components:

- **Basement 3** – Car parking for the residential and storage areas;
- **Basement 2** – Car parking for the residential, supermarket customers and storage areas;
- **Basement 1** – Loading zone, commercial waste, supermarket car park, trolley bay, bike store, substation, switch room, services and liquor store;
- **Ground floor** – Loading zone, back-of- house, supermarket, liquor store, residences (Scotchmer Street townhouses, SOHO's), cool rooms, lobby spaces and storage/access areas;
- **Level 1** – Supermarket, back-of-house, offices, boardroom, cafe and residences (townhouses);
- **Level 2 to 6** – Townhouses (level 2) and apartment spaces (level 2 to level 6);
- **Level 7** – Rooftop plant services and communal terrace.

The Piedimonte's redevelopment site is zoned Commercial 1 (C1Z) within the Yarra City Council. Land to the west is zoned Neighbourhood Residential (NRZ1).

Figure 1 Proposed Piedimonte's redevelopment (Ground Level) – Site Location (Image source: Google Earth accessed November 2018)

4.0 Acoustic Design Standards

The acoustic design for the building shall be based on achieving the design criteria outlined in the following sections of this report. The design criteria for the project have been developed using various standards, guidelines and policies that are applicable to the design of a building of this type and usage.

Table 4-1 below lists the standards, guidelines and policies that are relevant to each acoustic design consideration.

Table 4-1 Design Standards, Guidelines and Policies for Each Acoustic Design Consideration

Acoustic Design Consideration	Design Standard/Guideline/Policy
Internal Noise Levels: Noise due to building services and external noise intrusion	• Australian Standard AS 2107:2016; • Victorian Better Apartments Design Standards: 2016; • World Health Organisation (WHO) Guidelines for Community Noise; • Rail Noise Intrusion – Association of Australian Acoustical Consultants Guideline for Commercial Buildings Acoustics (2010); • EPA NSW Rail Infrastructure Noise Guideline; • NSW Road Noise Policy; • State Environment Protection Policy No. N-1 (Control of Noise from Commerce Industry and Trade) (SEPP N-1, Schedule A1.4 – A2.4).
Sound Insulation: Acoustic privacy/separation between adjacent apartments	• National Construction Code (NCC) of Australia: 2018.
Reverberation Time: Acoustic reverberation within internal spaces of the building	• Australian Standard AS 2107: 2016.
Vibration Isolation: Vibration impacts on human comfort	• Australian Standard AS 2670.2:1990; • NSW Environmental Noise Management – Assessing Vibration: a technical guide: 2006.
Environmental noise emission: Noise impact on residential premises from building plant operation and supermarket operations	• State Environment Protection Policy No. N-1 (Control of Noise from Commerce Industry and Trade) (SEPP N-1).

5.0 Noise Criteria

5.1 Internal Noise Criteria

Internal noise criteria have been nominated for the purpose of targeting appropriate noise levels within the building with respect to occupant comfort and the functional uses of the spaces.

The internal noise level criteria have been determined for each type of room in the building by using Australian Standard AS 2107 as the basis. The AS 2107 Standard provides recommended design sound levels for building services noise and noise intrusion from the external environment.

Table 5-1 presents the internal noise criteria that have been nominated for the building. The criteria have been expressed in terms of an A-weighted Equivalent Continuous Sound Pressure Level (L_{Aeq}), which generally describes the average decibel level in A-weighted form.

Table 5-1 Internal Noise Level Criteria

Type of occupancy	Internal Noise Levels, L_{Aeq} dB(A)
Apartment – Sleeping Areas	35 – 40
Apartment – Living Areas	35 – 45
Apartment common areas – Corridors/Lobby	45 – 50
Supermarket	< 55
Enclosed carpark	< 65
Meeting Room	35 – 40
Office	40 – 45
Common Areas	45 – 50
Toilets	45 – 55

Table 5-2 presents the noise levels required by the *Better Apartments Design Standard* that will apply to all apartment developments in Victoria to protect residents from external and internal noise sources. The criteria have been expressed in terms of an A-weighted Equivalent Continuous Sound Pressure Level (L_{Aeq}), which generally describes the average decibel level in A-weighted form.

Table 5-2 Internal Noise Level Criteria – Better Apartment Design Standards for Victoria

Type of occupancy	Internal Noise Levels, $L_{Aeq,}$ dB(A)
Sleeping Areas	$L_{Aeq,8h(10pm\ to\ 6am)}$ 35
Living Areas	$L_{Aeq,16h(6am\ to\ 10pm)}$ 40

Achieving internal noise levels as specified by the *Better Apartments Design Standard* will achieve the levels equal to, or lower than noise levels recommended by AS2107 for apartments near major roads.

Smoke control systems, including but not limited to stair pressurization fans and smoke spill fans, must be designed to achieve the noise requirements of smoke spill systems, as specified in Australian Standard AS1668.1:1998. In section '4.6 Noise' of AS 1668.1:1998, it states that the noise levels from the operation of the smoke control systems (including smoke-spill fans and air pressurization fans) shall not exceed the following:

- 65 dB(A) in occupied spaces, or 5 dB(A) above the ambient noise levels to a maximum level of 80 dB(A),
- 80 dB(A) in fire-isolated exits, such as a stairwell.

5.2 Sleep Disturbance

5.2.1 Tram Noise

It is recommended that tram noise be assessed by considering the average of the maximum noise level represented by $L_{Amax,avg}$. To maintain an appropriate level of acoustic amenity inside the apartments and to minimise the potential for sleep disturbance, $L_{Amax,avg}$ should be no more that 10dB higher than the maximum recommended design sound level (L_{Aeq}) in AS 2107:2016.

This is generally consistent with the criteria nominated by the NSW Road Noise Policy for maximum noise levels due to road traffic noise, as discussed below.

5.2.2 Road Noise

There is no Victorian document that provides specific requirements with regard to sleep patterns due to road traffic noise. The NSW Road Noise Policy does address sleep disturbance, and specifies internal noise levels to minimise disruption of a person's normal sleep patterns due to road traffic noise. From the NSW Road Noise Policy on sleep disturbance it can be concluded that:

- Maximum internal noise levels below 50-55 dB(A) are unlikely to awaken people from sleep;
- One or two noise events per night, with maximum noise levels of 65-70 dB(A), are not likely to affect health and wellbeing significantly.

Consequently, internal noise criteria for road traffic noise levels during the night period (10pm to 7am) are provided in Table 5-3. A noise level 5 dB higher than the criterion for sleeping areas has been adopted for living areas, consistent with the approach used in AS2107.

Table 5-3 Maximum internal noise levels for sleep disturbance due to road traffic

Room	Internal Noise Levels, L_{Amax} dB(A)
Apartment – Sleeping Areas	≤55
Apartment – Living Areas	≤60

5.2.3 Structure-Borne Noise Impact

Sleep disturbance criteria have been considered in relation to noise intrusion from supermarket activities. Structure-borne noise is perceived as being more intrusive than airborne noise, therefore more stringent criteria have been considered for structurally-transmitted noise from the supermarket activities. The criteria have been based on the recommendations of the World Health Organisation (WHO) Guidelines for Community Noise.

The sleep disturbance criteria have been expressed in terms of A-weighted Maximum Sound Pressure Levels (L_{Amax}), as it is the maximum noise levels that have the potential to cause sleep disturbance. Also, the L_{Amax} noise level best represents the sound level and character of short single sound events, such as an impact to the building structure, e.g. dropping a heavy object, or truck movements within the loading bay and back of house.

Table 5-4 below, presents the recommended maximum noise level (L_{Amax}) for sleeping areas within apartments. The WHO Guidelines recommend that as a rule for planning for short-term or transient noise events, for good sleep the indoor Sound Pressure Level measured as a maximum instantaneous value should not exceed 45 dB(A) L_{Amax} more than 10 to 15 times per night.

Table 5-4 Internal noise level criteria for sleep disturbance due to structure-borne impacts to the building structure

Room	Internal Noise Levels, L_{Amax} dB(A) Single Event Noise
Apartment – Sleeping Areas	45

5.3 Rain Noise

Noise intrusion in top floor levels due to rainfall on the roof should be mitigated to be no greater than 5dB above the maximum recommended design sound level (L_{Aeq}) in AS 2107:2016, from Table 5-1.

6.0 Environmental Noise Emission

The environmental noise emission criteria will form the basis for the design of external noise emission control for the building, and are established in accordance with the prescribed methods of the EPA State Environment Protection Policy No.N-1 (SEPP N-1).

6.1 State Environment Protection Policy No. N-1 (SEPP N-1)

State Environment Protection Policy (Control of Noise from Industry, Commerce and Trade) No.N-1 (SEPP N-1) prescribes the methods prescribed by the EPA for setting environmental noise limits in Metropolitan Melbourne for commercial, industrial and trade premises. The noise limits apply at all noise sensitive locations, such as residential dwellings, with respect to noise due to commercial, industrial and trade operations.

For the proposed development, the SEPP N-1 noise limits will apply to common building plant e.g. exhaust and ventilation fans, heating and cooling and refrigeration plant. The SEPP N-1 limits will also apply to noise emissions associated with the operation of the supermarket, such as loading dock and back of house activities.

The SEPP N-1 noise limits that apply at noise sensitive locations are based on several factors. These determining factors include the following:

- The *background noise level* in the vicinity of the noise sensitive location. The background noise level is measured in the absence of noise from commercial, industrial or trade premises.
- The *zoning* of the land in the vicinity of the residential location. The zoning is based on the Department of Planning and Community Development Planning Schemes.
- The *time period* of the day; different noise limits apply during different periods of the day.

The noise emissions are considered in terms of their impact over a continuous 30-minute period. Adjustments to the measured noise level are applied to account for the effects of duration, tonality, intermittency and impulsiveness of the noise. The measured, adjusted 30-minute noise level is the 'Effective Noise Level', which is assessed in relation to the noise limits, i.e. the Effective Noise Level must not exceed the SEPP N-1 noise limit for the period under consideration.

6.1.1 Time Periods

SEPP N-1 prescribes different noise limits for different periods of the day to account for the varying ambient acoustic conditions over the duration of a day.

For example, the noise limits during the night time are more stringent than during the day time as the ambient noise levels are generally lower during the Night period due to less road traffic being present. Thus the noise impact is more critical during the Night period; particularly during times of sleep.

The time period classifications according to SEPP N-1 are presented in Table 6-1 below.

Table 6-1 Time Periods of SEPP N-1

Period	Time
Day	7am to 6pm Monday – Friday 7am to 1pm Saturdays
Evening	6pm to 10pm Monday – Friday 1pm to 10pm Saturdays 7am to 10pm Sundays and Public Holidays
Night	10pm to 7am

6.1.2 Background Noise Levels

To determine the background noise levels for use in the calculation of the environmental noise criteria, noise monitoring was undertaken at three locations; as indicated in Figure 2 below.

Monitoring was performed at Location 1, on the roof of Piedimonte's Supermarket, to determine the background noise levels in the vicinity of the proposed residential component of the redevelopment exposed to St Georges Road traffic, trams and activity, which will be the residences along the northern and eastern boundaries of the site. This location also represents existing residences to the north and east of the development site.

Monitoring was performed at Location 2, in the courtyard of the residence at 29 Best Street, to determine the background levels within the existing residential area to the south and west of the site, which are shielded by noise from St Georges Road. This location is also used to represent the proposed residences on facades of the redevelopment that will face west and/or will be shielded from noise from St. Georges Road.

Monitoring was performed at Location 3, in the courtyard of the nearest residence to the proposed development, 36 Egremont Street, to determine the background levels within the existing residential area to the south and west of the site.

Figure 2 Noise Logger Location on site

Figure 3 below presents the photographs of the noise monitors on site.

Figure 3 Photos of Noise Monitor installed on site

The details of the noise monitors that were used for the measurements are shown in Table 6-2 below. The noise monitors were checked for calibration prior to and following the noise monitoring.

Table 6-2 Noise Monitor Specifications

Specification Details	Logger 1	Logger 2	Logger 3
Instrument	Sound Level Meter	Sound Level Meter	Sound Level Meter
Model	Rion NL-21	Rion NL-31	Rion NL-21
Serial No.	00465445	01273093	00865769
Calibration	Current	Current	Current

The background noise levels were measured on a continuous basis from 13 to 20 September 2018 (i.e. loggers 1 and 2) and from 13 to 20 November 2018 (i.e. logger 3). As required by SEPP N-1, the noise levels were measured in terms of L_{A90} hourly Sound Pressure Levels.

The L_{A90} level is the A-weighted Sound Pressure Level that is exceeded for 90% of the measurement duration, and is commonly used to represent 'background noise'.

Table 6-3 below presents the results of the background noise measurements for each period of the day.

In accordance with SEPP N-1 procedure C1.3, an adjustment of -2dB has been made to the levels measured by logger 2 and 3 to account for the acoustically reflecting wall behind the noise logger in the court yard of the residences.

A graph of the measured hourly background noise levels is presented in Appendix A of this report.

Table 6-3 Background Noise Levels

SEPP N-1 Period	Background Noise Levels, L_{A90} dB(A)		
	Logger 1 (Scotchmer Street)	Logger 2 (29 Best Street, Courtyard to Laneway)	Logger 3 (36 Egremont Street, Courtyard to Laneway)
Day	56	46	48
Evening	53	43	46
Night	51	42	43

6.1.3 Zoning Levels

Using the Department of Planning and Community Development Planning Scheme for Yarra, the Zoning Levels were determined in accordance with Schedule B2 of SEPP N-1.

The Zoning Levels were determined for the north-eastern portion of the redevelopment site, the north-western portion, and for the existing residential area to the south west of the site. The Zoning Levels for these locations represent the range of Zoning Levels that would apply across the redevelopment site and nearby existing residential areas.

The calculated Zoning Levels are presented in the following tables.

Table 6-4 Zoning Levels for Southern Residences – 29 Best Street (Courtyard to Laneway)

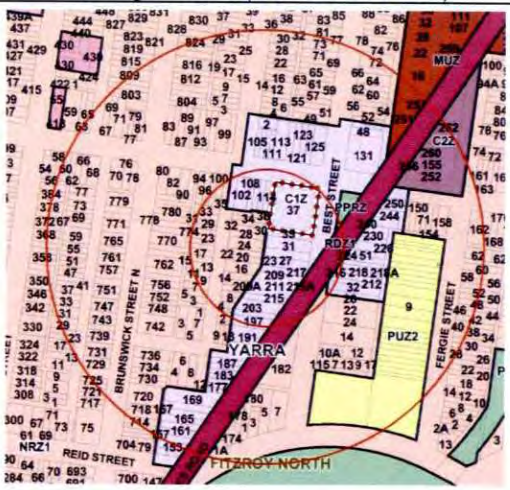
Time Period	Zoning Levels, dB(A)
Day	**55**
Evening	**49**
Night	**44**
Zoning Level Calculations	Zoning Circles (140m and 400m)
140m circle: Type 3: 11% Type 2: 54% Type 1: 35% **400m circle:** Type 3: 7% Type 2: 16% Type 1: 77% **Influencing Factor (IF):** 0.26	

Table 6-5 Zoning Levels for Northern Residences – 102/108 Scotchmer Street

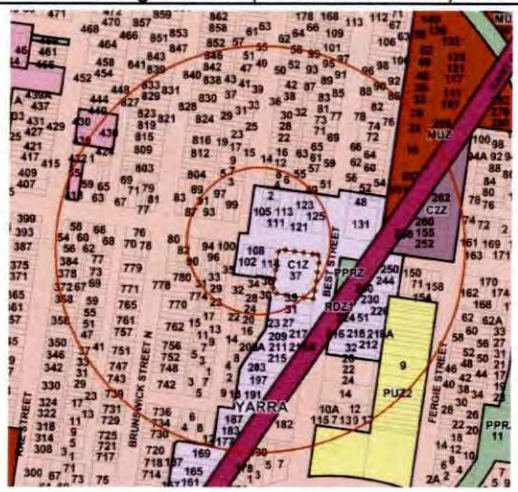
Time Period	Zoning Levels, dB(A)
Day	**54**
Evening	**48**
Night	**43**
Zoning Level Calculations	Zoning Circles (140m and 400m)
140m circle: Type 3: 0% Type 2: 48% Type 1: 52% **400m circle:** Type 3: 4% Type 2: 25% Type 1: 71% **Influencing Factor (IF):** 0.21	

Table 6-6 Zoning Levels for Northern Residences – 37-49 Best Street with Scotchmer Street

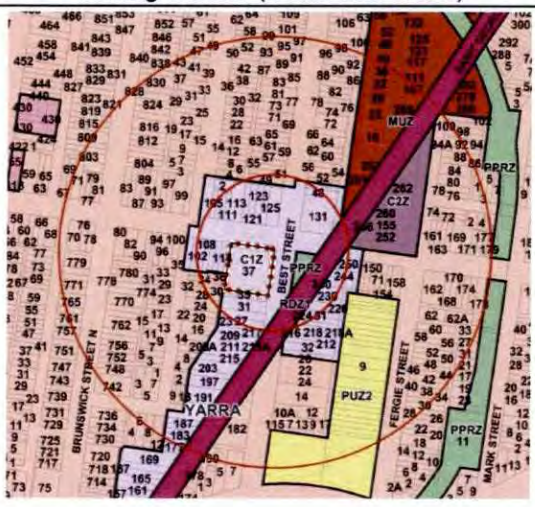
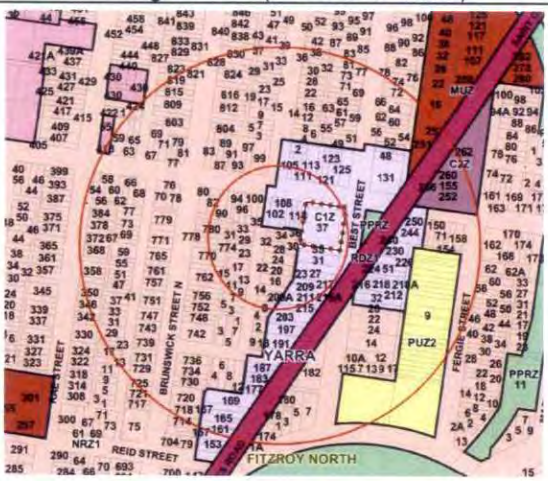
Time Period	Zoning Levels, dB(A)
Day	**57**
Evening	**51**
Night	**46**
Zoning Level Calculations	Zoning Circles (140m and 400m)
140m circle: Type 3: 14% Type 2: 82% Type 1: 4% **400m circle:** Type 3: 6% Type 2: 31% Type 1: 63% **Influencing Factor (IF):** 0.38	

Table 6-7 Zoning Levels for South West Residences – 36 Egremont Street (Courtyard to Laneway)

Time Period	Zoning Levels, dB(A)
Day	**54**
Evening	**48**
Night	**43**
Zoning Level Calculations	Zoning Circles (140m and 400m)
140m circle: Type 3: 0% Type 2: 52% Type 1: 48% **400m circle:** Type 3: 6% Type 2: 29% Type 1: 65% **Influencing Factor (IF):** 0.22	

6.1.4 Environmental Noise Emission Criteria

Table 6-8 below presents the SEPP N-1 environmental noise limits that have been determined using the measured background noise levels and the calculated Zoning Levels.

The SEPP N-1 noise limits (Table 6-8) and indoor limits (Table 6-9) apply to the loading dock and back of house noise activities on balconies and inside the apartments respectively.

The noise limits have been calculated using the prescribed methods in Schedule B1 and B3 of SEPP N-1, as follows:

High background levels:

- For the Day period: If the Background Level plus 6 dB(A) exceeds the Zoning Level, the Noise Limit shall be the Background Level plus 6 dB(A).
- For the Evening and Night periods: If the Background Level plus 3 dB(A) exceeds the Zoning Level, the Noise Limit shall be the Background Level plus 3 dB(A).

Neutral background levels:

- For the Day period: If the Background Level is at least 6 dB(A), and no more than 12 dB(A)below the Zoning Level, the Noise Limit shall be the Zoning Level.
- For the Evening and Night periods: If the Background Level is at least 3 dB(A), and no more than 9 dB(A)below the Zoning Level, the Noise Limit shall be the Zoning Level.

For cases where the noise source is a standby generator, standby boiler or fire pump, an additional allowance is provided for the noise limit. For the Day period, the noise limit is increased by 10 dB(A). For the Evening and Night period, the noise limit is increased by 5 dB(A).

Table 6-8 Environmental Noise Level Criteria

SEPP N-1 Period	SEPP N-1 Noise Limit; L_{Aeq} dB(A)			
	Scotchmer Street	Best Street	Best Street (Courtyard to Laneway)	Egremont Street
Day	62	62	55	54
Evening	56	56	49	49
Night	54	54	45	46

The Scotchmer Street and Best Street limits were calculated using background levels measured at monitoring location 1. The Best Street (i.e. courtyard to Laneway) limits were calculated using the background levels measured at monitoring location 2. The Egremont Street limits were calculated using the background levels measured at monitoring location 3.

Additionally, if the primary sound transmission path is through a solid wall, ceiling or floor or sealed window then the procedures according to Schedule A1.4 and A2.4 of SEPP N-1 shall apply and the assessment point shall be located inside the affected dwelling with the applicable SEPP N-1 noise limit adjusted as follows:

- Adjustment of -15 dB if the noise is transmitted through a single glazed window,
- Adjustment of -15 dB if the noise (including vibration induced noise) is transmitted through a solid wall, ceiling or floor,
- Adjustment of -25 dB if the noise is transmitted through a fixed double glazed window.

The indoor limits will apply to the townhouses and apartments adjacent to and above the fully enclosed loading bay area and back of house. Based on the indoor adjustment, the SEPP N-1 indoor noise limits are shown in Table 6-9.

Table 6-9 SEPP N-1 Indoor Noise Limits

SEPP N-1 Period	SEPP N-1 Internal Noise Limits; L_{Aeq} dB(A)			
	Scotchmer Street	Best Street	Best Street (Courtyard to Laneway)	Egremont Street
Day	47	47	40	39
Evening	41	41	34	34
Night	39	39	30	31

7.0 Noise Measurements

Noise measurements have been performed at the site for the purposes of determining the acoustic requirements that the new building façade and roof need to satisfy to achieve the internal noise criteria (presented in Sections 5.0 and 6.0) with respect to intrusion of noise from external sources, including road traffic, trams and plant noise.

The noise measurements were performed over short durations (e.g. up to 10 minutes) during the day time to capture acoustics conditions during traffic flow representative of a typical working day. The measurements were performed on 13 September 2018 (i.e. location 1 to 5) and on 13 November 2018 (i.e. location 6). The locations of the noise measurements are shown in Figure 4.

Figure 4 Attended Noise Measurements

The specifications and details of the instrumentation used to conduct the short-term noise measurements are presented in Table 7-1 below.

Table 7-1 Instrumentation for Noise Measurements

Specification	Details
Instrument	Sound Level Meter
Model	Brüel & Kjaer 2270
Serial No.	3009262
Calibration	Current

Table 7-2 below presents a summary of the results of the noise measurements that were performed at the site, including a description of the events that took place and the locations of the measurements.

Table 7-2 External Noise Measurements Results

Location	Measured Noise Level dB(A)	Description of Noise Events
R1	50 L_{Aeq} 68 L_{Amax}	Main source of noise – Traffic noise and mechanical services from residences
R2	63 L_{Aeq} 73 L_{Amax}	Main source of noise – Traffic noise
R3	69 L_{Aeq} 85 L_{Amax}	Main source of noise – Traffic noise
R4	65 L_{Aeq} 77 L_{Amax}	Main source of noise – Traffic and tram noise
R5	63 L_{Aeq} 74 L_{Amax}	Main source of noise – Traffic and tram noise
R6	49 L_{Aeq} 63 L_{Amax}	Main source of noise – Traffic noise and mechanical services from residences and Piedimonte's rooftop plant

8.0 Loading Bay, Back of House and Supermarket Activities

The existing Piedimonte Supermarket has a loading bay to Scotchmer Street; it is relatively small in size and cannot accommodate larger trucks. As such, semi-trailers currently reverse into the rear lane abutting the supermarket from Scotchmer Street for the unloading of goods and temporally restrict public vehicle access.

Piedimonte is proposing to create a formal loading bay to accommodate the trucks and thus improve the safety of the operation (refer to architectural drawing set -A-SD1_181030). The design has been designed with a focus on acoustic performance, with the loading bay and back of house being isolated from adjoining apartments and from the existing dwellings at Egremont Street via pedestrian laneway (refer to Figure 6) and enclosing the loading bay and back of house within the building.

Note that smaller vans and truck movements have been taken to the basement and all rubbish refuse points are in the basement. The loading dock configuration has been design to improve unloading manoeuvres reducing noise impacts to adjacent residences.

Waste collection will be located at Basement 1 adjacent to the loading bay as shown in Figure 5. The supermarket will be accessed by one waste collection vehicle per day between 7am-6pm.

The loading bay, back of house and supermarket areas will be fully enclosed with ingress and egress from Scotchmer Street as shown in Figure 5, Figure 6 and Figure 7 below.

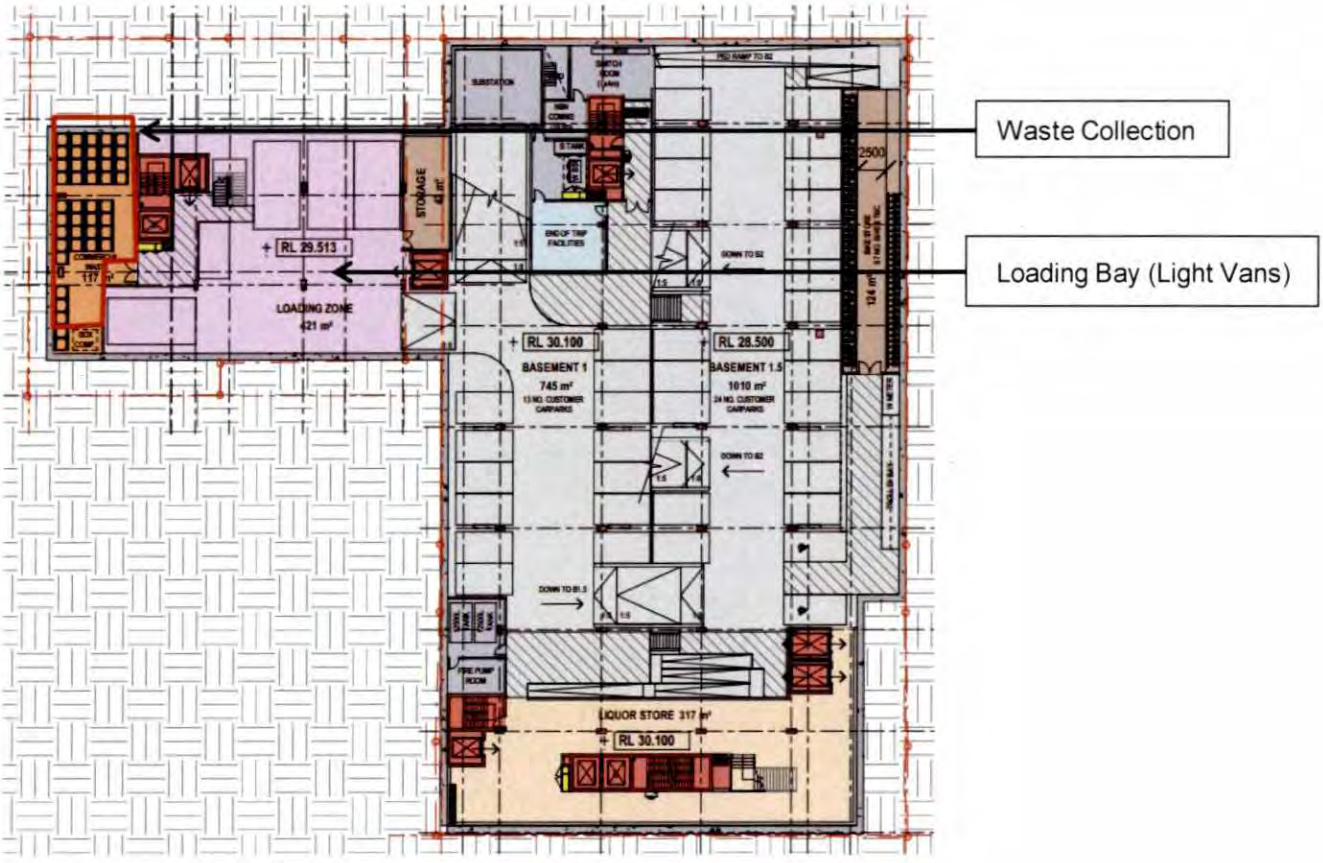


Figure 5 Loading Bay and waste collection – Basement 1

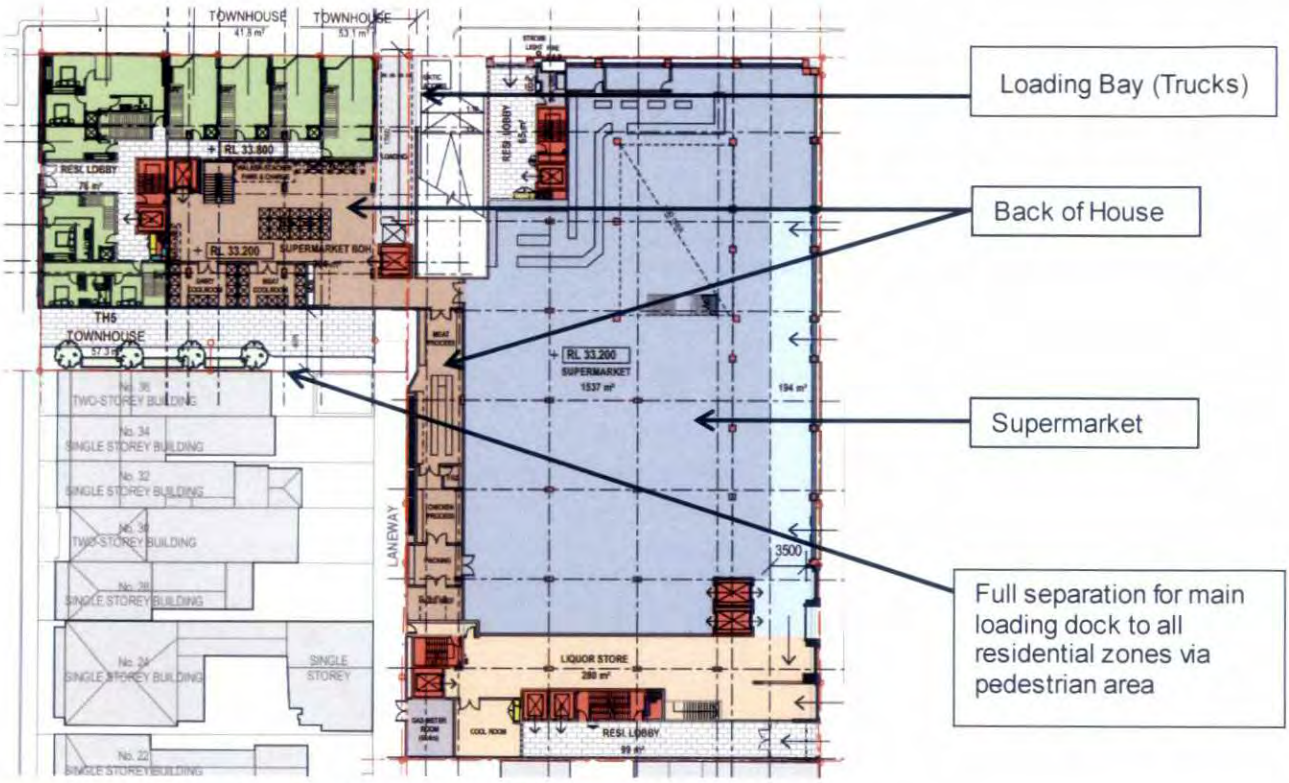


Figure 6 Back of house and supermarket – Ground Floor

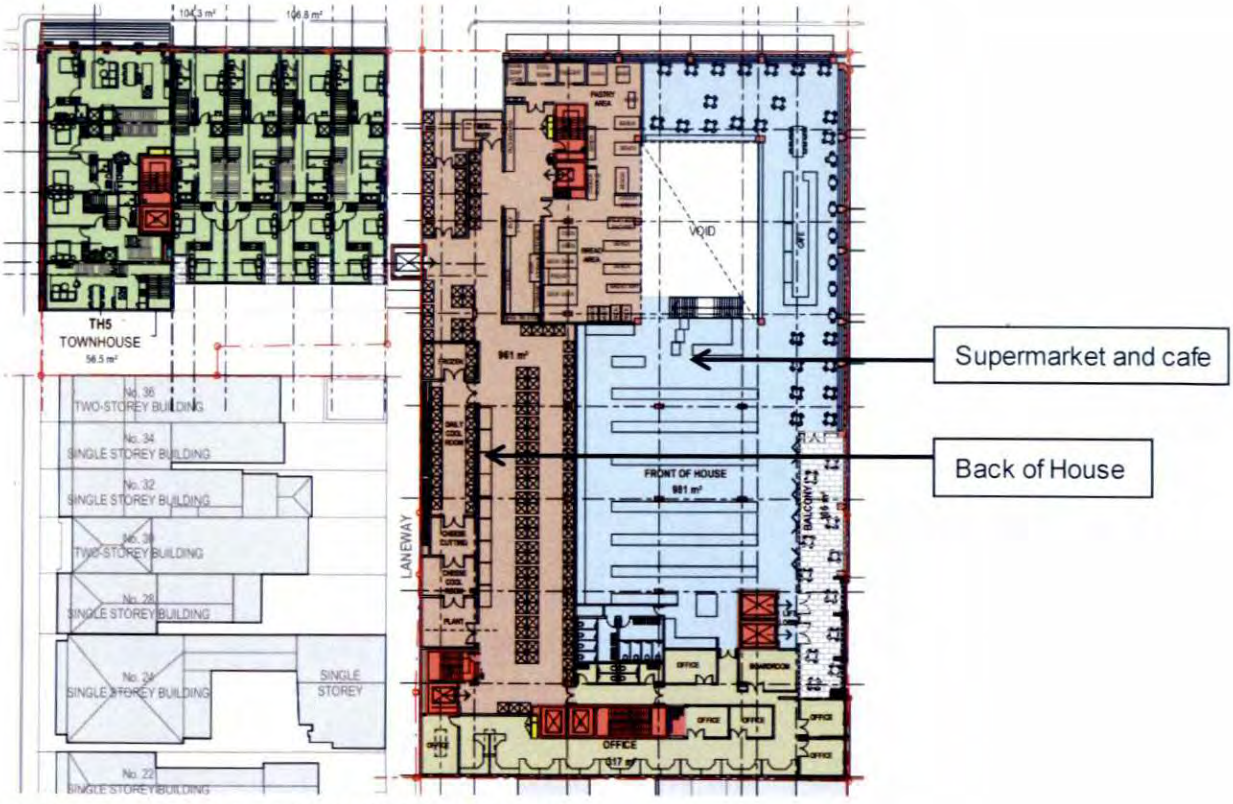


Figure 7 Back of house, supermarket and cafe – Level 1

Based on the truck volumes and schedule provided by Piedimonte's Supermarket, the following delivery vehicle volumes and types are proposed for the new development as shown in Table 8-1 and Table 8-2.

Table 8-1 Loading bay vehicle types and volumes per week

Vehicle type	Number per week
Vans	161
1-5 tonne trucks	90
5 tonne trucks	14
Semi-trailer articulated	12

The design of the loading will be in the basement for vans to deal with the majority of loading and, therefore, the loading will be limited for semi-trailers. A total of 277 vehicles are anticipated over a week between Monday to Saturday. Vans will be located at Basement 1 and 1-5 tonne trucks, 5 tonne trucks and semi-trailers will access the ground level loading dock.

Table 8-2 Loading bay vehicle types and volumes per week

Day	Vehicle type			
	Van	1-5 Tonne	>5 Tonne	Semi-trailer
Monday	22	15	4	3
Tuesday	34	18	1	2
Wednesday	31	23	4	3
Thursday	30	16	4	1
Friday	38	14	1	3
Saturday	6	4	0	0
Total	**161**	**90**	**14**	**12**

The delivery and waste collection schedule will be as follows:

- The site is expected to generate on average approximately 50 truck deliveries a day with at least 30 of these deliveries occurring in the basement level which leaves 20 deliveries at ground level.
- The ground level movements can be evenly split over a 10 hour period which equates to two deliveries every hour or one delivery every 30 minutes (two vehicle movements in and out combined), taking into account the time to unload. Deliveries are not anticipated in the Evening periods and typically on Monday to Friday between 7am – 7pm.
- The supermarket will generate one waste collection vehicle per day (between 7am – 6pm) normally occurring in the early morning to afternoon period (two movements in and out combined in any 30-minute period).
- The resident waste collection may be up to three times a week and will not occur within the same 30-minute interval. Deliveries will take place on Monday to Friday between 7am – 7pm.

Noise level data for delivery trucks and loading bay activities has been sourced from AECOM's noise level database of similar supermarket activities. Typical Sound Pressure Levels (L_{Aeq} and L_{Amax}) of truck movements, loading activity, compactor and dropping of timber and plastic pallets onto the store room floor data are provided in Table 8-3.

Table 8-3 Loading bay activity and truck delivery noise emission data

Description	Measured Noise Level dB(A)
5 ton truck idling at 2 metres	78 L_{Aeq} 92 L_{Amax}
Semi-Truck – reversing at 2 metres (+ alarm)	79 L_{Aeq}
Semi-Truck – driving forward at 2 metres (+ start)	84 L_{Aeq}
Semi-Truck – loading (pallets) at 2 metres	74 L_{Aeq}
Compactor at 1 metre	71 L_{Aeq} 80 L_{Amax}
Trolley – movement at 1 metre	81 L_{Aeq} 88 L_{Amax}
Plastic pallet jacks – dropping to floor at 1 metre	94 L_{Aeq} 106 L_{Amax}
Timber pallet jacks – dropping to floor at 1 metre	102 L_{Aeq} 114 L_{Amax}
Semi-Truck – starting engine at 1 metre	76 L_{Aeq} 84 L_{Amax}
Semi-Truck – reversing back with beeper including air brake release at end at 1 metre	85 L_{Aeq} 101 L_{Amax}
Van – car door slam while idling at 1 metre	76 L_{Aeq} 89 L_{Amax}

Based on the measured noise level data presented above, dropping a timber pallet and a truck reversing generated the highest measured noise levels of 114 dB(A) L_{Amax} and 85 dB(A) L_{Aeq}, respectively. Therefore the walls and floor-ceiling construction of the back-of-house areas and loading bay should attenuate noise from these activities to acceptable levels inside apartments.

9.0 Noise Control Recommendations

9.1 Building Facade

Noise intrusion to the proposed building from the external environment and supermarket activities has the potential to affect occupant comfort and the acoustic amenity within the living environment. The following sections of this report provide general advice for minimising the impact of external noise on the internal acoustic environment.

The acoustic design of the façade has considered the noise generated by traffic, tram and noise associated with the existing commercial areas on site as well as supermarket activities as shown in Table 7-2 and Table 8-3. Advice is provided for façade glazing to achieve appropriate internal noise levels where possible.

9.1.1 Façade Glazing

Based on the noise intrusion criteria that have been established, the noise measurements that were performed at the proposed site and the noise levels expected to be generated in the supermarket, back-of-house and loading dock areas, glazing specifications have been recommended for each of the windows of the building.

The noise levels were calculated for each level of the building with calculations performed for habitable areas on levels ground to 6. Façade glazing types are defined in Table 9-1 below.

Table 9-1 establishes a 'glass type label' (A to F) for each glazing configuration; Table 9-2 uses these labels to specify the locations on the proposed building where each glazing type should be constructed.

Note, the glazing R_W ratings and constructions presented below are provided as examples only; there are various glazing options that can be used to achieve the established internal noise level criteria, and the final configurations will be determined during the design stages, taking into account façade constructions, window orientation, and window size.

Table 9-1 Façade Glazing Types

Glass type label	Acoustic Performance Rating[1]	Glazing Construction	
		Double glazing	Single Glazing
A 	**R_w 47**	• 8.5mm Vlam Hush • 16mm air space; • 12.5mm Vlam Hush	• N/A
B 	**R_w 44**	• 10mm VFloat glass • 16mm air space; • 10.5mm Vlam Hush	• N/A
C 	**R_w 42**	• 10.76mm laminated glass • 12 mm air space; • 6.76 mm laminated glass	• N/A
D 	**R_w 40**	• 10.38mm laminated glass • 12 mm air space; • 6 mm glass	• 12.5mm VLam Hush
E 	**R_w 39**	• 6.38mm laminated glass • 12mm air space; • 6mm glass	• 10.5 VLam Hush
F 	**R_w 36**	• 6mm glass • 12mm air space • 6mm glass	• 10.38 laminated glass

1) The **Acoustic Performance Rating (R_w)** is indicative only, and is provided for informative purposes. The glazing should not be based solely on the R_w rating; the glazing construction needs to satisfy the construction requirements described in the table; or alternatively be reviewed by the acoustic consultant.

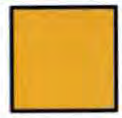
   For example, not all glazing systems that achieve an R_w rating of 40 would be suitable for Glass Type B. The combination of the glass thicknesses, the type of laminate used, and the air gap, all need to be assessed to ensure that a glazing system is suitable.

2) All glass doors (sliding and hinged) and openable windows will need to incorporate appropriate acoustic seals. Please note, mohair seals are not acceptable.

The apartments most affected by noise from the loading bay activities are three townhouses located at north/east corner adjacent to loading access and apartments type 2A on Level 2 and Level 3.

Table 9-2 Façade Glazing Types for the Proposed Development

Level	Façade	Room	Glazing Type
Ground floor and Level 1	North	3 Townhouses (i.e. north/east corner adjacent to loading access; 110sqm, 107sqm, 107sqm) – Bedrooms	A 
		Townhouse – Bedrooms	B 
		Townhouse – Living Area	C 
	South and West	Townhouse – Bedrooms	D 
		Townhouse – Living Area	E 
Level 2	North and East	3 Townhouses and Apartment type 2A (i.e. corner adjacent to loading access) – Bedrooms	A 
		Apartment and Townhouse – Bedrooms	C 
		Apartment and Townhouse – Living Area	D 
	South and West	Apartment Type 2A – Bedrooms	C 
		Apartment and Townhouse – Bedrooms	D 
		Apartment and Townhouse – Living Area	E 
Level 3	North and East	Apartment type 2G and 2A (i.e. corner adjacent to loading access) – Bedrooms	B 

		Apartment – Bedrooms	C 
		Apartment – Living Area	F 
	South and West	Apartment – Bedrooms	E 
		Apartment – Living Area	F 
Level 4 to Level 6	**North and East**	Apartment type 2A and 2G (i.e. corner adjacent to loading access) – Bedrooms	C 
		Apartment – Bedrooms	D 
		Apartment – Living Area	F 
	South and West	Apartment – Bedrooms	E 
		Apartment – Living Area	F 

Note that where the glazing to the living areas and bedrooms is operable, compressible acoustic seals are required.

9.1.2 Exterior Walls Apartments, Supermarket and Back-of-House and Loading Zones

The design of the exterior walls should be carried out during the detailed design phase.

9.2 Roof Construction

A detailed assessment of the roof and suspended ceiling structure will need to be conducted once the engineering services design is developed, for e.g. design of rooftop building plant at Level 7.

It is expected that if a concrete slab roof structure is used, the roof structure will provide suitable sound isolation from external noise.

For apartments located below to the communal terrace, careful consideration needs to be given to the airborne and impact noise rating assigned to the floor slab system. To minimise transmission of vibration and structure-borne noise from activities in the communal terrace the floor must be isolated from the main structural floor with an elastomeric base isolation system.

The airborne and impact sound insulation recommendations will be provided in further stages of the project.

9.3 Doors

9.3.1 Back-of-House and Loading Zone Entrance

To minimise noise transmission through the access door (Scotchmer Street) from the back of house and car parking areas to the environment it is recommended that the access door is selected to provide a minimum sound insulation specification, to be determined during the design stages The door should be closed during loading and unloading activities.

The access door recommendation will be provided in further stages of the project.

10.0 Structural Vibration, Airborne and Impact Sound Isolation

To minimise transmission of vibration from activities in the supermarket back-of-house (i.e. ground level and level 1), loading dock areas (i.e. basement 1 and ground level) and supermarket areas (i.e. ground and level 1) to adjacent apartments and townhouses, the floors must be isolated from the main structural floor with an elastomeric base isolation system, i.e. there must be no rigid connection between the floor surfaces and the structural floor, walls and columns.

To minimise transmission of vibration from impacts to structural columns and walls, the walls and columns should be encased with vibration isolation and there must be no rigid connection between the internal wall studs and the main structural walls that form part of the structure supporting apartments above and adjacent.

Due to the separation between the loading dock areas and the existing residential zones via the pedestrian area (refer to Figure 6), the transmission of vibration from impacts will be eliminated.

The full detail of the structural vibration recommendations will be provided in further stages of the project.

For apartments located above and adjacent to back-of-house, loading dock areas and supermarket areas (i.e. front of house and cafe), careful consideration needs to be given to the airborne and impact noise rating assigned to the floor slab system and walls. The airborne and impact sound insulation performance of these systems needs to be based on the noise levels and impacts generated in the supermarket, back-of-house and loading dock areas (refer to Table 8-3), and must attenuate these to achieve the internal noise criteria.

Due to proximity of the existing residences located at Egremont Street (i.e. numbers 36 to 24) to the proposed back-of-house and loading dock areas, careful consideration needs to be given to the airborne noise rating assigned to the façade walls. The airborne sound insulation performance of these external walls needs to be based on the noise levels generated in the back-of-house and loading dock areas, and must attenuate these to achieve the EPA environmental noise guidelines and policies.

The airborne and impact sound insulation recommendations will be provided in further stages of the project, and must comply with the National Construction Code (NCC), EPA environmental noise guidelines and policies or other relevant standards.

11.0 Building Services Noise and Vibration

Building services plant shall incorporate appropriate noise and vibration control measures to ensure that compliance is achieved with the internal noise level criteria established for the building.

Noise generated by externally-located plant (Rooftop plant at Level 7), or equipment that exchanges air with the external environment, shall be appropriately attenuated to ensure that the noise emissions from the building are not excessive and comply with the relevant EPA environmental noise guidelines and policies.

The following measures shall be observed for the general installation of plant and services:

- All hydraulic services shall be isolated at support points to minimise vibration being transmitted to the building structure.
- All pipework that passes through the ceiling spaces or dividing walls of noise-sensitive spaces, shall be acoustically treated with acoustic lagging and insulation as necessary.
- All services penetrations shall have a clearance of 10mm around the pipe/duct/cable that shall be acoustically sealed with a flexible caulking (polyurethane or silicone).
- All plant shall be installed on vibration isolation mounts in accordance with the manufacturer's requirements.
- All louvres and ventilation openings between plant areas and the external or internal building environment shall be acoustically treated using appropriate measures, such as acoustic louvres, acoustically lined ductwork, and attenuators.
- All ductwork shall be acoustically treated using appropriate measures, such as acoustically lined ductwork, acoustically wrapped ductwork, flexible acoustic ductwork, and in-duct attenuators.
- All plant rooms shall be acoustically treated to ensure that noise transmission via walls, floors, ceiling, doors, and louvres does not exceed the specified noise criteria of adjacent spaces.
- Mechanical plant operation shall be acoustically treated using appropriate measures such as attenuators to fans, acoustic barriers and enclosures to minimise emission of noise to the surroundings and this achieve the relevant noise criteria at the nearest residences and apartments.
- Relocation of the mechanical plant to Level 7 and applying the required noise control treatment, will significantly improve the acoustic environment to the Egremont Street residences.

12.0 Summary

AECOM was commissioned to provide acoustic consultancy services in relation to the proposed development at 37-49A Best Street, Fitzroy North.

The key acoustic design items that need to be incorporated into the design of the development are façade glazing and façade walls with acoustic specifications to reduce noise levels inside habitable spaces, as recommended in this report.

Environmental noise emission criteria have also been established for the development for the purposes of setting noise limits for future building activities and services plant that will serve the development.

The back-of-house, loading dock areas and supermarket has been designed to account for the best acoustic performance possible with the loading bay and back of house being fully isolated from adjoining apartments and from the existing dwellings at Egremont Street.

To minimise transmission of noise and vibration from back-of-house, loading dock areas and supermarket to the adjacent apartments and townhouses, vibration isolation recommendations must be implemented.

The acoustic design of the interior partitions (walls and floors), exterior walls (façade) and building services of the proposed building should be carried out during the detailed design phase to ensure that the noise emissions from the building (including Piedimonte's activities) are not excessive and comply with the relevant EPA environmental noise guidelines and policies or other relevant standards as shown in Section 5.0.

AECOM confirms that the proposed development will comply with all relevant requirements in terms of potential noise and vibration impacts on all nearby residential properties once the noise recommendations are implemented as indicated in this report, particularly in Section 10.0.

13.0 Nomenclature

The following nomenclature has been used throughout the acoustic report.

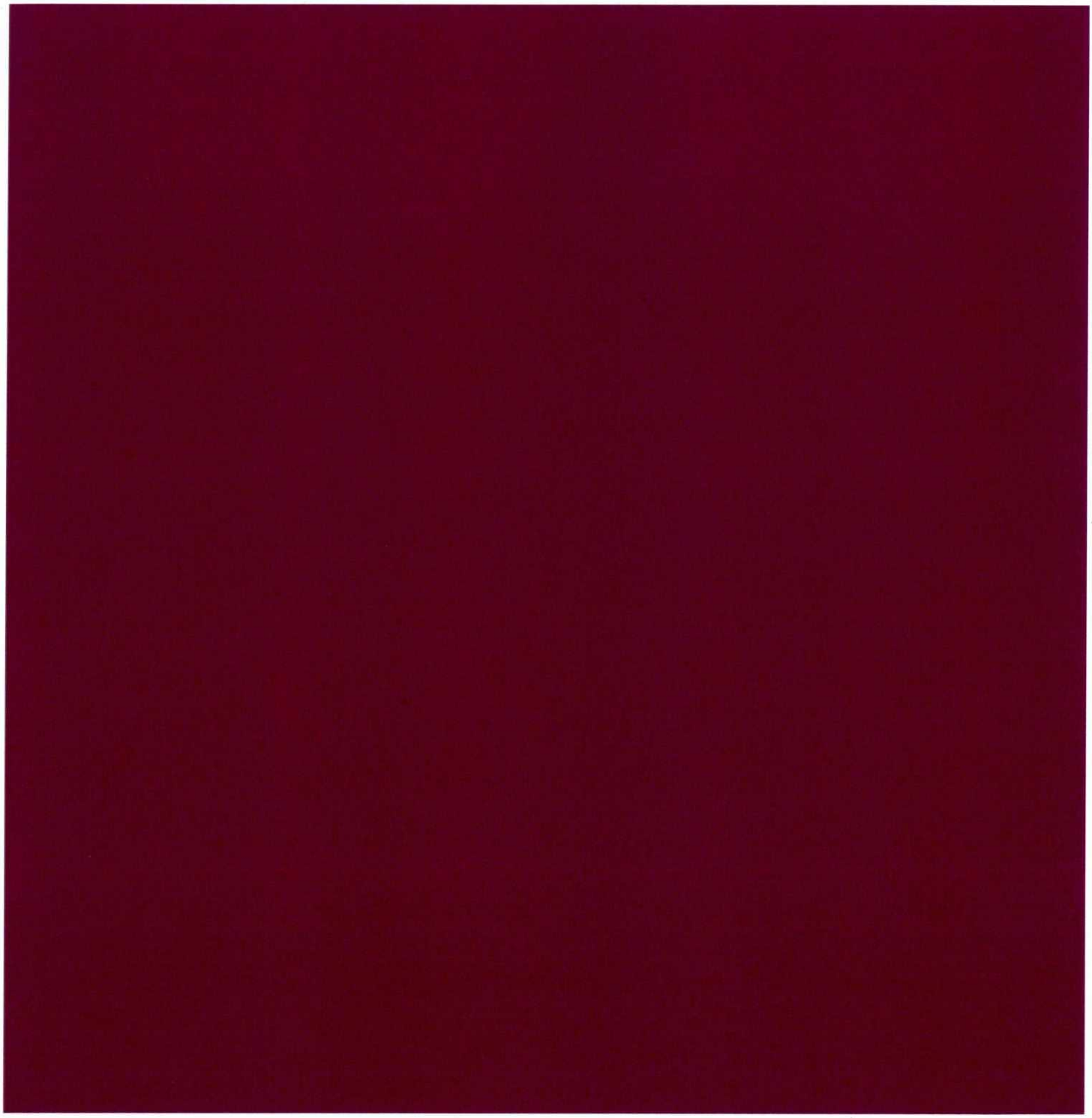
Term	Definition
dB(A)	Decibels expressed with an A-weighting. The 'A' weighting adjusts the frequency spectrum to reflect the subjective loudness perceived by the human ear.
R_w	Weighted Sound Reduction Index (R_w) – A single-number quantity that is a measure of the sound insulation performance of a building element, determined over the frequency range of 100 to 3150Hz. A higher number indicates a greater level of sound isolation.
L_{Aeq}	Sound Pressure Level expressed in terms of an A-weighted Equivalent Continuous level. It is the A-weighted value of Sound Pressure Level of a continuous steady sound; often referred to as average Sound Pressure Level. Unit: dB(A).
$L_{n,w}$	Weighted Normalised Impact Sound Pressure Level ($L_{n,w}$) – A measurement of the Sound Pressure Level in a room due to a standardised impact on the other side of a floor. A lower number indicates a floor construction with greater impact isolation.
NRC	Noise Reduction Coefficient (NRC) is a measure of sound absorbed by a material. The single number represents an average of the sound absorption coefficients at 250, 500, 1000 & 2000 Hz. Values approaching 1.0 have the highest levels of absorption.
Reverberation Time	Reverberation Time quantifies the acoustic ambience and echo within a closed space (i.e. room). It is a measure of the time that would be required for the reverberantly decaying sound pressure level in the room to decrease by 60 decibels. Unit: Seconds.
L_{Amax}	The maximum A-weighted Sound Pressure Level that occurs during the measurement period.

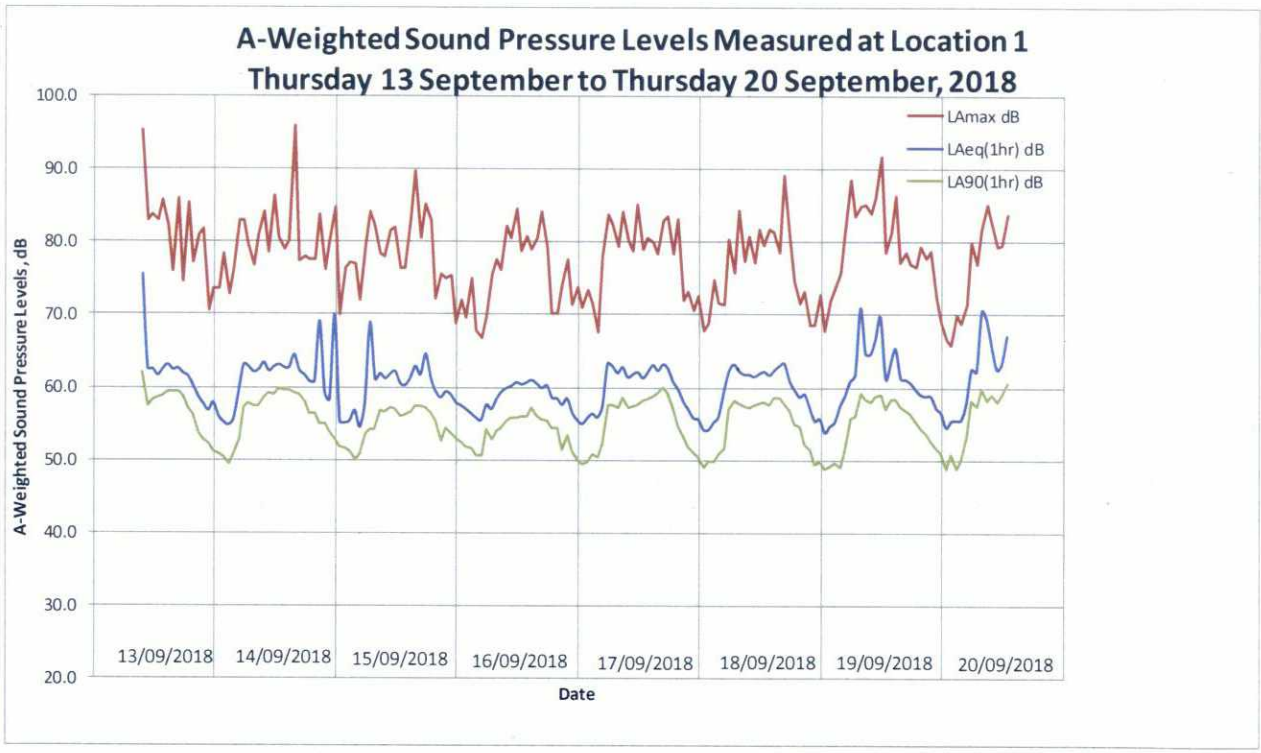
14.0 References

1. Australian Standard 2107 – 2016, Acoustics - Recommended Design Sound Levels and Reverberation Times for Building Interiors;
2. Australian Standard AS1668.1:1998, The use of ventilation and air conditioning in buildings, Part 1: Fire and smoke control in multi-compartment buildings;
3. World Health Organisation (WHO) Guidelines for Community Noise;
4. NSW Environmental Noise Management – Assessing Vibration: a technical guide (February 2006);
5. Better Apartments Design Standards for Victoria: 2016;
6. Victoria Environment Protection Authority, Noise from Industry in Regional Victoria;
7. Victorian Environment Protection Authority, State Environmental Protection Policy (Control of Noise from Commerce, Industry and Trade) No.N-1;
8. National Construction Code of Australia 2018;
9. Association of Australian Acoustical Consultants (AAAC) Guideline for Commercial Building Acoustics 2010;
10. NSW Road Noise Policy.

Appendix A

Noise Monitoring Results




A-Weighted Sound Pressure Levels Measured at Location 1
Thursday 13 September to Thursday 20 September, 2018
LAmax dB
LAeq(1hr) dB
LA90(1hr) dB
A-Weighted Sound Pressure Levels, dB
100.0
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
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16/09/2018
17/09/2018
18/09/2018
19/09/2018
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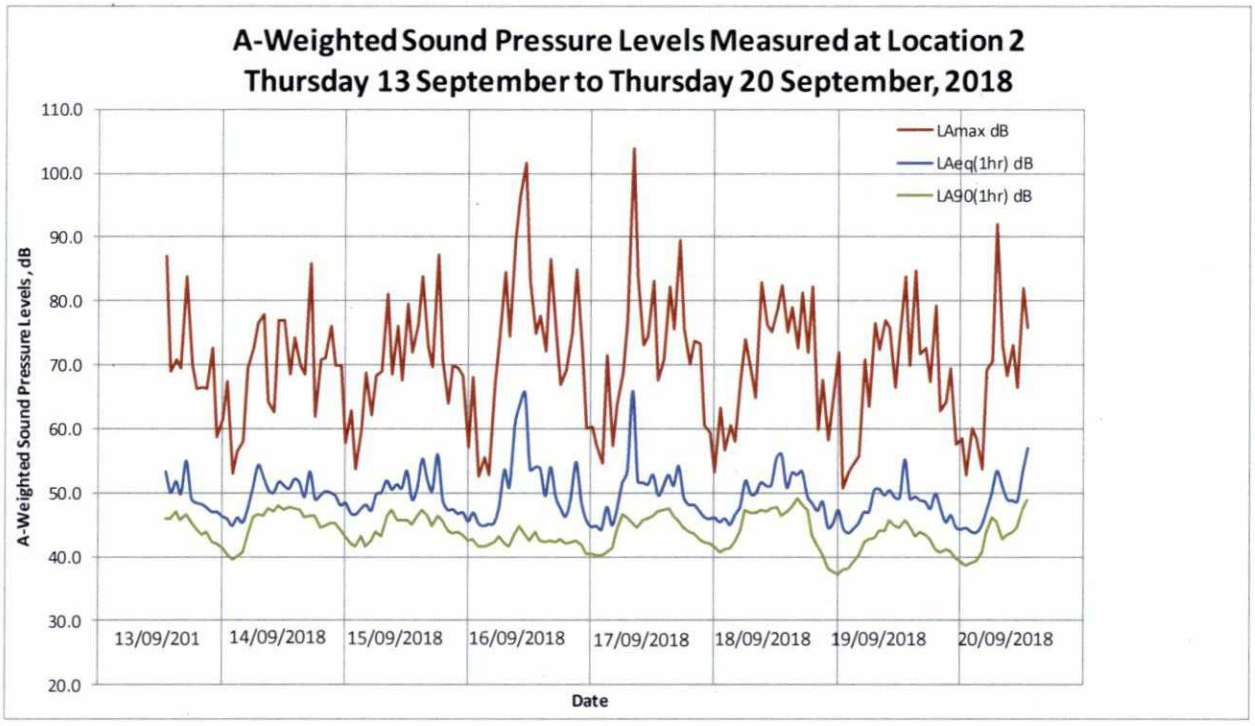
Date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LAmax dB
LAeq(1hr) dB
LA90(1hr) dB
A-Weighted Sound Pressure Levels, dB
110.0
100.0
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
13/09/201
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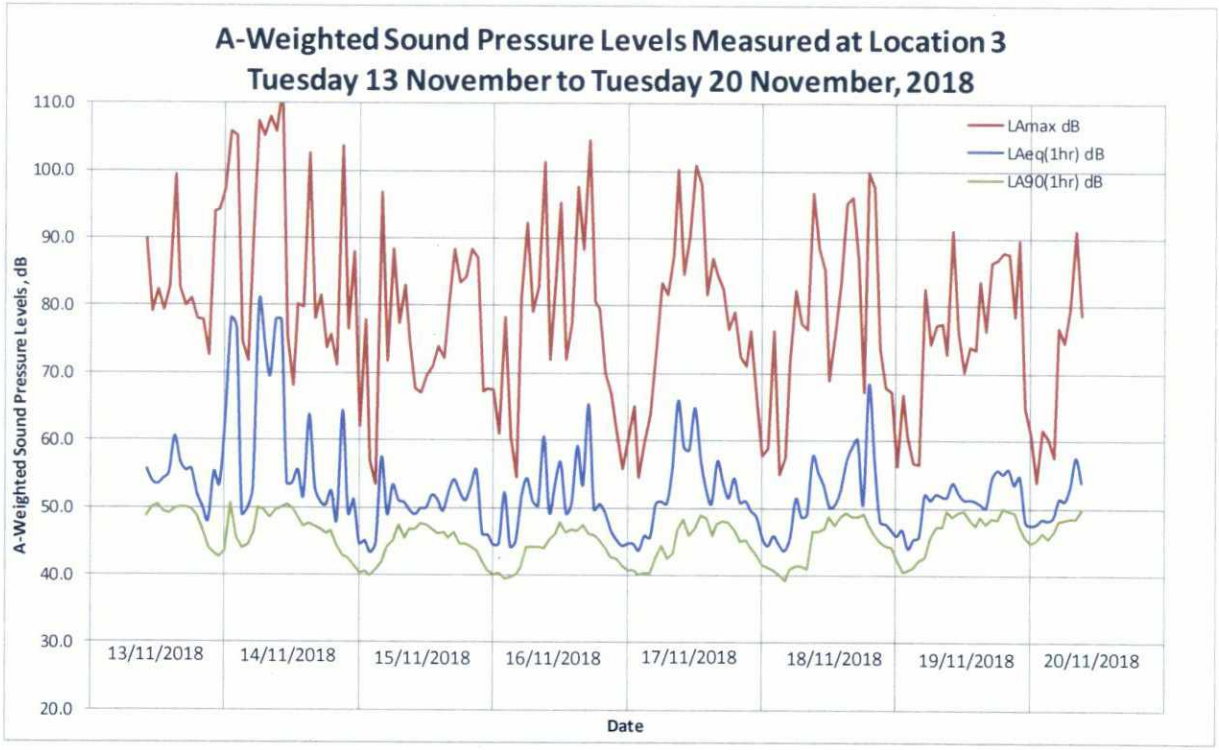
19/09/2018
20/09/2018
Date


A-Weighted Sound Pressure Levels Measured at Location 3
Tuesday 13 November to Tuesday 20 November, 2018
LAmax dB
LAeq(1hr) dB
LA90(1hr) dB
A-Weighted Sound Pressure Levels, dB
110.0
100.0
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
13/11/2018
14/11/2018
15/11/2018
16/11/2018
17/11/2018
18/11/2018
19/11/2018
20/11/2018
Date