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BRINGING BUILDINGS TO LIFE

34 CHERRY STREET, WERRIBEE
COMMERCIAL DEVELOPMENT

PRELIMINARY DESIGN REPORT

ACOUSTIC SERVICES

WYNDHAM CITY COUNCIL
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AWI: AWI
30508/6/1
23 August 2022

Citinova Development Managers
280 Macaulay Road
NORTH MELBOURNE VIC 3051

Attention: Mr Ben Wongseelashote

Dear Ben

**34 CHERRY STREET, WERRIBEE COMMERCIAL DEVELOPMENT
PRELIMINARY DESIGN REPORT
ACOUSTIC SERVICES**

As requested, we enclose a copy of the report on the Acoustic Services for the above project.

We trust that the report provides sufficient information for your immediate purpose, and we would be most pleased to further discuss any aspect upon your request.

Yours faithfully
BESTEC PTY LTD

Angusw

**ANGUS WILLIAMS
ACOUSTIC SERVICES ENGINEER**

Encl

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REPORT ISSUE REGISTER

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REVISION	DATE	REVISION DESCRIPTION
01	23.08.22	Initial Issue

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Introduction

BESTEC Pty Ltd has been engaged to provide acoustic engineering services during the design and construction stages of the mixed-use development on 34 Cherry Street Werribee, Victoria. This document presents the proposed acoustic design criteria, the methodology and results of our traffic noise survey, calculation of the traffic noise levels incident on the building facade and preliminary recommendations for acoustic treatment to achieve the selected design criteria.

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Executive Summary

In summary:

- An attended traffic noise survey was conducted on site to establish the traffic noise levels incident to the building envelope of the proposed development. The noise levels resulting from traffic were recorded over 15-minute intervals (survey results summarised in Table 1).
- Appropriate acoustic design criteria have been nominated in accordance with SEPP N-1 and AS/NZS 2107-2016.
- The external noise impact on the building envelope was determined and the sound transmission through the façade and the glazing was calculated.
- Acoustic design recommendations to achieve the selected criteria for noise intrusion were provided, including:
 - Recommendations for external glazing configuration to ensure the internal noise levels within the different components of the development.
 - Preliminary recommendations for construction of the building facade.
 - Recommendations for construction of the division walls and floors were provided based on our experience with similar successful jobs
 - Generic recommendations for noise and vibration control of engineering services plant.

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Acoustic Analysis

References

The following documents have been referenced within the preparation of this report:

- [1] Melbourne Planning Scheme consolidated 10 July 2020. **Date Plans Provided: 8/09/2022**
- [2] Environment Protection Regulations 2021.
- [3] Noise limit and assessment protocol for the control of noise from commercial, industrial and trade premises and entertainment venues, EPA Victoria, 2021.
- [4] AS/NZS 2107:2016 "Acoustics – Recommended design sound levels and reverberation times for building interiors".
- [5] AS ISO 140.4–2006 "Acoustics – Measurement of sound insulation in buildings and of building elements. Part 4: Field measurements of airborne sound insulation between rooms".
- [6] EPA Publication 1254 – Noise control guidelines, October 2008.
- [7] AS ISO 2670.1– 2001 "Mechanical vibration and shock-Evaluation of human exposure to whole-body vibration, Part 1 General requirements."
- [8] BS 7385-2:1993 "Evaluation and measurement of vibration in buildings – Part 2: Guide to damage levels from ground borne vibration".
- [9] DIN 4150 "Structural vibration, Part 3: Effect of vibration on structures".

Site Description

The site is located on land zoned Commercial Zone designated C1Z in the Melbourne Planning Scheme [1] with the following boundaries:

- North – Residential housing zoned as General Residential Zone – Schedule 1
- East – Commercial developments – Currently a new development being erected
- South – Princess highway and a public park and recreational zone
- West – Commercial developments, Ampol Petrol station directly to the west

Proposed Development and Conditions

It is proposed a new Mixed-use development to be constructed on the site, comprising:

- Ground floor – Offices, Retail stores, health clinic and private car parking space
- Level 1 - 4 – Office tenancies and public car parking space
- Level 5 – Rooftop area for plant equipment, private and public car parking space

Noise Surveys

An attended noise survey was conducted on 1 August 2022 at 4:00pm at the locations indicated with blue circles in figure 1, using a Bruel & Kjaer Hand-held Analyser Type 2270 (Serial Number: 3006966). A-weighted equivalent continuous sound pressure levels ($L_{Aeq, 15min}$), maximum sound pressure levels (L_{Amax}) and statistical noise levels (L_{A10} and L_{A90}) were measured over the 15-minute intervals with the survey results summarised in Table 1. Five measurements were conducted at the locations show below to measure the traffic noise incident to each of the building façades. The traffic noise survey was conducted during the peak-hours of the day to obtain the worst-case scenario of noise intrusion into the proposed development.



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Figure 1: Measurement locations during the traffic noise test surveys

Measurement Locations	Start Time	Noise Descriptor, dBA				Comment
		L _{Aeq}	L _{Amax}	L _{A10}	L _{A90}	
1	4:15pm	56	79	57	51	Noise from Jellicoe St traffic. Noise blocked by commercial developments from Princes Hwy traffic
2	4:30pm	60	78	61	54	Noise from Cherry St traffic and Princes Hwy traffic
3	4:45pm	61	79	64	54	Noise from Cherry St traffic and Princes Hwy traffic
4	5:00pm	59	80	62	53	Noise from Cherry St traffic, Kelly St traffic and the operational Ampol petrol station
5	5:15pm	58	83	61	53	Noise from Kelly St traffic and the operational Ampol petrol station

Table 1: Summary of the attended noise survey results

Design Criteria

Environmental Noise

The criteria for environmental noise from the proposed development relate to noise associated with the operation of the commercial tenancies and mechanical services plant serving areas of the building. The nearest noise sensitive receivers are:

- The residential houses located to the north and east of the proposed development.
- The public park located across the road to the southwest.

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The environmental noise criteria summarised below were derived in accordance with **Error! Reference source not found.** [4] and [5] for each of the nearest noise sensitive receivers (figure 2) based on the calculated zoning levels and the measured background noise levels:

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Figure 2: nearest noise sensitive receivers

Residential houses along the western northern and eastern boundaries:

- Daytime (7:00 – 18:00): 55dBA
- Evening (18:00 – 22:00): 49dBA
- Night (22:00 – 7:00): 44dBA

Public and recreational park to the southwest:

- Daytime (7:00 – 18:00): 56dBA
- Evening (18:00 – 22:00): 50dBA
- Night (22:00 – 7:00): 45dBA

Building Acoustics

The level of background and transient/intermittent noise, the speech privacy rating and the room acoustics define the quality of the acoustics within a building. The recommended criteria for each space are shown in table 2 below. Please refer to each individual section below for interpretation of the criteria.

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Type of occupancy/activity	Background Noise L_{Aeq} , dBA	Sound Insulation		
		Reverberation Time, sec	Weighted Sound Level Difference, D_w	Weighted Sound Reduction Index, R_w
Lobbies	< 50	Minimise as practical	N/A	N/A
Retail tenancy	45 - 50	Minimise as practical	40 ¹ 45 ²	45 50
Commercial tenancies	40 - 45	0.4 – 0.6	40 ³ 45 ⁴	45 50
Medical/Allied health/Dispensary	40 - 45	< 0.8	45	50
Amenities	< 55	N/A	40	45
Carpark	< 65	N/A	N/A	N/A
Meeting room	40 - 45	0.4 – 0.6	40 ⁵ 45 ⁶	45 50

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Table 2: Proposed building acoustic design criteria for the 34 Cherry Street, commercial development

Background Noise

AS 2107:2016 [4] sets the criteria for background noise in terms of A-weighted equivalent continuous sound pressure level (L_{Aeq}) in accordance with the use of the spaces and the location of the buildings. For developments located near major roads, the Standard recommends criteria for background noise levels for different spaces with no reference to the time of the day. The recommended background noise levels for the apartments are detailed in Table 2. Table 3 details the subjective response of individuals to the proposed sound levels for interpretation of the recommendations.

Average Sound Pressure Levels (dBA)	Subjective Rating
35 – 40	Audible but unobtrusive
40 – 45	Moderate but unobtrusive
45 – 50	Unobtrusive with low levels of surrounding activities
50 – 55	Unobtrusive with high levels of surrounding activities

Table 3: Subjective ratings for various average sound pressure levels

Sound Insulation

There is no Australian or International Standard for sound insulation between rooms in commercial or retail buildings. Instead, criteria for sound insulation / speech privacy are based on Client's requirements, budget constraints and experience from previous projects. The criteria for speech privacy proposed in table 4 are presented in terms of Weighted Sound Level Difference as defined by AS ISO 140.4–2006 [5] (D_w), which is related to the sound level difference between two spaces and detailed in Table 3⁷. The criteria are based on our experience in the acoustic design of similar facilities. Table 4 details the subjective response of individuals to the proposed privacy ratings for interpretation of the recommendations.

D_w Rating	Subjective Rating
50-55	Confidential privacy
45-50	Very good privacy. Speech inaudible unless raised
40-45	Good privacy. Speech audibles but unintelligible
35-40	Normal privacy. Neighbouring conversations are audible and may be understood
<35	Privacy not required

Table 4: Subjective perceptions for various privacy ratings

¹ Between retail tenancy and adjacent corridors

² Between adjacent retail tenancies

³ Between commercial tenancies and adjacent corridors (between offices and the corridors)

⁴ Between adjacent commercial tenancies (horizontally and vertically) (between two offices next to each other, at a common boundary)

⁵ To the corridor

⁶ To adjacent tenancy

⁷ The corresponding Weighted Sound Reduction Index R_w is also provided for interpretation of the recommendations.

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Room Acoustics

AS 2107-2016 [4] sets out the design criteria for reverberation times within occupied spaces. The reverberation time defines the time taken for sound to decay within a space and thus the degree of intelligibility of both unassisted speech and sound reinforcement systems. The criterion for a given space depends on the volume of the space, with Table 5 outlining the subjective impression for spaces with varying volume. Criteria considered appropriate for the various public spaces within the development are listed in Table 2.

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Reverberation Time (sec)			Subjective Rating
Small (100m ³)	Medium (1,000 m ³)	Large (10,000m ³)	
<0.3	0.3-0.5	0.6-0.8	Dead
0.3-0.5	0.5-0.7	0.8-1.0	Medium dead
0.5-0.7	0.7-1.0	1.0-1.5	Average
0.7-1.0	1.0-1.5	1.5-2.5	Medium live
1.0-2.0	1.5-2.5	2.5-4.5	Live

Table 5: Subjective response to various reverberation times and room volumes

Building Vibration

AS 2670-2001 [7] sets criteria for maximum allowable human exposure to building vibration in accordance with the type of occupancy of the spaces.

For commercial premises, the recommended criteria are:

- Continuous or intermittent vibration (Day/Night-time) – vibration velocity not exceeding the combined direction criteria curve 4 on figure 3.
- Transient vibration excitation with several occurrences per day – vibration velocity not exceeding the combined direction criteria curves 60 - 128 on figure 3 below.

Construction Noise and Vibration

Construction Noise

There are no specific statutory construction noise limits, which are applicable to the proposed development. Instead, guidelines for control of noise associated with construction sites are provided in the EPA Publication 1254 [6], which recommends the following limits:

- Monday to Friday (7:00 to 18:00) and Saturday (7:00 to 13:00) – no specific construction noise limit applies, but construction noise emissions must not be “unreasonable” in accordance with S48A(3) of the Environment Protection Act 1970 [2]. To avoid unreasonable noise emissions, construction work should be conducted in accordance with the good practice guidelines provided in EPA Publication 1254 under Sections “Community Consultation and Work Scheduling” and “Work requirements”.
- Weekend / evening work hours – Monday to Friday (18:00 – 22:00), Saturdays (13:00 – 22:00), Sundays and public holidays – noise levels at any residential premises should not exceed the background noise levels by:
 - 10dBA or more for up to 18 months after project commencement.
 - 5dBA or more after 18 months.
- Night period – if construction work during night period (22:00 – 7:00) is conducted, the noise levels associated with the works should not be audible within the habitable rooms of any residential premises.

Construction Vibration

There are two types of criteria that must be achieved:

- Criteria for structural integrity – as there is no Australian Standard specifying criteria for structural integrity, the vibration velocities associated with construction activities should be limited to the maximum allowable vibration velocity levels nominated by either DIN 4150-3 [9] or BS 7385-2:1993 [8]. As DIN 4150 provides more conservative criteria, we recommend the criteria specified in the Standard and summarised in 6 below be used during the construction.

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Type of structure	Vibration velocity levels for different frequency ranges, mm/s		
	< 10Hz	10 to 50Hz	50 to 100Hz
Buildings used for commercial purposes, industrial buildings and buildings of similar design (Industrial)	20	20 to 40	40 to 50
Dwellings and buildings of similar design and/or occupancy (Residential)	5	5 to 15	15 to 20
Structures that, because of their particular sensitivity to vibration, cannot be classified under the above two classifications and are of great intrinsic value (e.g. listed buildings under preservation order). (Heritage)	3	3 to 8	8 to 10

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Table 6: Acceptable Ground Vibration Levels at Building Foundations as Specified within DIN 4150

- Criteria for human exposure to building vibration – we recommend the criteria for maximum allowable human exposure to building vibration set by AS 2670-2001 [7] be used. Please refer to Section Building Vibration above and figure 3 below.

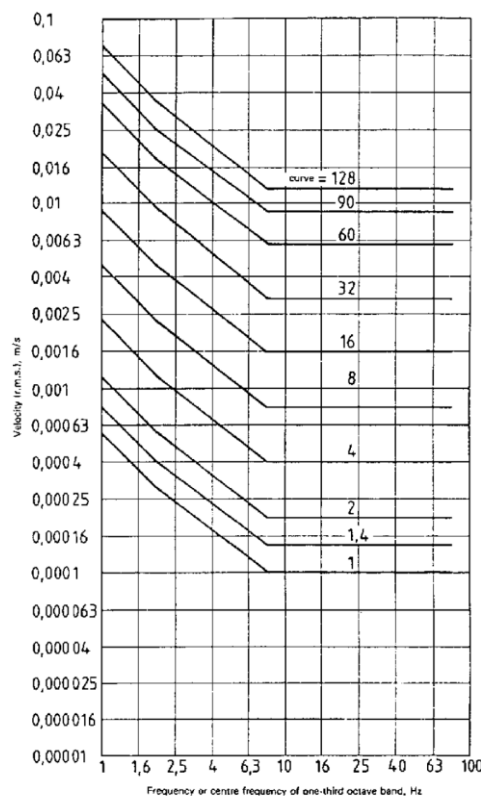


Figure 3: Vibration in buildings – combined direction criteria curves (reproduced from Figure 5a in AS 2670-2001)

Assessment and Recommendations

General

Acoustic Sealants

We note that for the acoustic integrity of building elements to be maintained, all gaps and interfaces along the junctions and joints of linings must be sealed with an appropriate acoustic grade sealant. Penetrations for mechanical or electrical services must be properly caulked and sealed around the ductwork and cabling to ensure the intended acoustic rating of the partition is retained.

Appropriate acoustic caulking products include:

- Bostik Firemastic.
- Bostik Seal-n-flex 2637.
- Pyropanel Multiflex.
- Boral Fyreflex.

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- Dow-Corning 790 Silicone.
- Dow-Corning 795 Silicone.
- Sika Sikaflex-11 FC.
- Fosroc Flamex 3.

Cavity Infill

Where a cavity infill is recommended, equivalent alternatives are:

- Fibreglass – 50mm, 12kg/m³.
- Rockwool – 50mm, 38kg/m³.
- Polyester – 900gsm.

Ceiling Overlay

Where a ceiling overlay is recommended, equivalent alternatives are:

- Glasswool – 100mm, 12kg/m³.
- Rockwool – 100mm, 38kg/m³.
- Polyester – 100mm, 32kg/m³.

Where higher durability and/or water resistance is required, 6mm compressed fibre cement sheeting could be used in lieu of the 13mm fire-rated plasterboard and 9mm compressed fibre cement sheeting in-lieu of 16mm fire-rated plasterboard.

Noise Intrusion

The minimum required construction of the building envelope in order to control traffic noise intrusion have been listed below:

- Solid façade:
 - Minimum 150mm precast concrete
 - Minimum 9mm fibre cement on the external side of 92mm steel studs with infill of 50mm, 14kg/m² glasswool and 1 layer of 13mm fire rated plasterboard on the internal side.
- Glazing:
 - 10.38mm laminated glass as required structurally; or
 - Double glazing consisting of 6mm annealed glass - 8mm air cavity - 6.38mm laminated glass (R_w 39)

Indicative façade thickness based on double glazing constructed of 8.5mm VLam Hush glass – 12mm air space - 8.5mm VLam Hush glass in 100mm deep aluminium frame:

- Framed façade minimum thickness will be 115 mm.
- Masonry façade minimum thickness would be 150mm.

Please note:

- Any operable glazing should be fitted with compressible acoustic seals (Raven or Schlegel ranges).
- The recommendations above will be revised once the building elevations and glazed areas are available and further updated as required when the selection of the engineering services plant is available.

Sound Insulation

The recommended construction of the building structure separating adjacent spaces is detailed below. Please refer to the markups in Appendix for the internal walls can be viewed in Appendix B

Car park to commercial tenancies, carpark to medical/allied health and carpark to end-of-trip facilities

We recommend the following alternative constructions:

- 1 layer of 9mm fibre cement to the carpark side of 92mm steel studs and 1 layer of 13mm plasterboard to the retail tenancy side with cavity infill as specified in Section General; or
- 150mm precast concrete; or
- 140mm core fired masonry blockwork

Retail Tenancy

- Masonry - 150mm precast concrete or 140mm core fired masonry blockwork.
- Partitions:

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- Between retail tenancies and other tenancies, we recommend 2 layers of 13mm plasterboard to one side and 1 layer of 13mm plasterboard to the other side of 64mm staggered steel studs with 92mm track, extending to the structure above with cavity infill of 75mm, 14kg/m³ glasswool. **PLEASE NOTE: The plans that are being provided to you may not reflect what is ultimately approved by Council however they are the most recent version as at the date shown below:**
- Between retail tenancies and adjacent corridors - 2 layers of 13mm plasterboard to one side and 1 layer of 13mm plasterboard to the other side of 76mm steel studs with cavity infill as specified above extending to the structure above. **Date Plans Provided: 8/09/2022**
- Internal glazing – 10.38mm laminated glass in aluminium frame
- Doors – 10.38mm laminated glass in aluminium frame.
- Amenities - 2 layers of 13mm plasterboard to one side and 1 layer of 13mm plasterboard to the other side of 76mm steel studs with cavity infill as specified above extending to the structure above.

Commercial Tenancies

- Between commercial tenancies and between commercial and retail tenancies:
 - Masonry - 150mm precast concrete or 140mm core fired masonry blockwork or 190mm 1800kg/m³ hollow concrete blocks.
 - Partitions - 2 layers of 13mm plasterboard to one side and 1 layer of 13mm plasterboard to the other side of 64mm staggered steel studs with 92mm track, extending to the structure above with cavity infill of 75mm, 14kg/m³ glasswool.
 - Amenities - 2 layers of 13mm plasterboard to one side and 1 layer of 13mm plasterboard to the other side of 76mm steel studs with cavity infill as specified above extending to the structure above.
 - Internal glazing between commercial tenancy and adjacent corridors – 8.38mm Laminated glass (Rw 35) in aluminium frame
- Doors to commercial tenancies and adjacent corridors – 8.38mm Laminated glass (Rw 35) in aluminium frame fitted with compressible acoustic seals (Raven or Schlegel ranges).

Allied Health Dispensary

- Between Allied Health and retail tenancy:
 - Masonry - 150mm precast concrete or 140mm core fired masonry blockwork or 190mm 1800kg/m³ hollow concrete blocks.
 - Partitions - 2 layers of 13mm plasterboard to one side and 1 layer of 13mm plasterboard to the other side of 64mm staggered steel studs with 92mm track, extending to the structure above with cavity infill of 75mm, 14kg/m³ glasswool. Doors to the carpark - 8.38mm Laminated glass in aluminium frame or solid core doors with Weighted Sound Reduction Index of Rw 35. The doors should be fitted with compressible acoustic seals (Raven or Schlegel ranges).
- Amenities - 2 layers of 13mm plasterboard to one side and 1 layer of 13mm plasterboard to the other side of 76mm steel studs with cavity infill as specified above extending to the structure above. 40mm solid core doors to amenities are acceptable from acoustic point of view as long as there are no relief air grilles incorporated in the doors.

End of trip facility

- Walls end of trip facility and car park:
 - Masonry - 150mm precast concrete or 140mm core fired masonry blockwork or 190mm 1800kg/m³ hollow concrete blocks.
 - Partitions - 1 layer of 9mm fibre cement to the carpark side of 76mm steel studs and 1 layer of 13mm plasterboard to the end of trip facility side with cavity infill as specified in Section General. Or 150mm precast concrete, or 140mm core fired masonry blockwork.
- Doors - solid core doors with Weighted Sound Reduction Index of Rw 35.

Meeting Rooms

- Partition between the meeting room and office space - 2 layers of 13mm plasterboard to one side and 1 layer of 13mm plasterboard to the other side of 64mm staggered steel studs with 92mm track, extending to the structure above. With cavity infill of 75mm, 14kg/m³ glasswool.
- Between the meeting room and lift shaft – 1 layer of 13mm plasterboard to one side of 64mm studs with 20mm airspace to the building core, and cavity infill as specified in Section General.
- Glass partition to hallway – 8.38mm Laminated glass (Rw 35) in aluminium frame.

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- Doors – 8.38mm Laminated glass (Rw 35) in aluminium frame or solid core doors with Weighted Sound Reduction Index of Rw 35. The doors should be fitted with compressible acoustic seals.
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Environmental Noise

Engineering Services Plant (roof plant)

The preliminary mechanical services specification indicate the following plant:

- 1 off air-conditioning condensing unit for medical/allied health/dispensary with nominal dimensions 1680(H) x 930(W) x 765(D) and radiated sound power level (dB re 1pW) of 77dB.
- 1 off carpark exhaust fan with in-duct sound power level 9dB re 1pW) of 85dB.
- 25-off air-conditioning condensing units for ground floor and level 1 tenancies each with nominal

Based on the above data we have calculated the resulting noise level within the commercial tenancy on Level 4 and at the noise sensitive receivers to the north and south taking into account the thickness of the roof concrete slab, the distances to the noise sensitive receivers and the shielding provided by the building structure and note:

- The proposed 180mm thick slab (post-tensioned) will provide sufficient sound transmission loss for the selected background noise criterion to be achieved in the commercial office tenancy on Level 4.
- The calculated noise levels at the nearest noise sensitive receivers (will achieve the selected environmental noise criteria.

Therefore, no further acoustic treatment for control of airborne noise is required.

We provide the following preliminary recommendations for control of vibration and structure borne noise, which will be re-assessed once the plant selection is finalised:

- The air-conditioning condensing units should be installed on double deflection mounts with minimum static deflection of 6mm;
- The carpark exhaust fan should be suspended on seismically restrained vibration spring isolators with minimum static deflection of 25mm.

Rain noise

Our analysis has concluded that the proposed 180mm concrete slab that will be located on the roof top will provide sufficient noise transmission loss against rainfall, and therefore we will not make further recommendations on the design of the rooftop.

Noise Associated with Rubbish Collection

The architectural drawings indicate the refuse zone located next to the loading dock and we assume the rubbish bins will be wheeled and collected from the loading dock. Based on that, we note that the noise emissions associated with rubbish collection will be contained in the loading dock and therefore, the environmental noise criterion will be achieved at the nearest noise sensitive premises.

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**APPENDIX A
PARTITION MARKUP**

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KEY	
Very good privacy (Rw 50)	
Good privacy (Rw 45)	
Car park partition (Rw > 45)	
Partition separating the building core from adjacent rooms (Rw > 55)	

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Table A1: key

Description of building component	Recommended Minimum performance criteria
Wall between offices	R _w 50 dB
Wall between retail tenancies	R _w 50 dB
Wall between retail and office tenancies	R _w 50 dB
Wall between retail and Allied Health Dispensary	R _w 50 dB
Wall between meeting room and office	R _w 50 dB
Wall between amenities and adjacent office	R _w 50 dB
Walls within amenities/ between amenities and tenancies they are within	R _w 45 dB
Walls between retail tenancies and corridors	R _w 45 dB
Walls between offices and corridors	R _w 45 dB
Wall between tenancies/end of trip facility and car park	R _w > 45 dB
Wall between meeting room and lift	R _w > 55 dB (discontinues construction)
Wall between office and lift	R _w > 55 dB (discontinues construction)
Glazing between offices/meeting room and corridor	R _w 35 dB
Office and retail tenancy doors	R _w 35 dB
Wall between end of trip facility and hydraulic room	R _w 45 dB

Table A2: recommended performance rating for different building components

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Recommended acoustic rating	Indicative construction (partitions)
Very good privacy (Rw 50)	2 layers of 13mm plasterboard to one side and 1 layer of 13mm plasterboard to the other side of 64mm staggered steel studs with 92mm track, extending to the structure above. With cavity infill of 75mm, 11kg/m ³ , 75mm acoustic wall batts.
Good privacy (Rw 45)	2 layers of 13mm plasterboard to one side and 1 layer of 13mm plasterboard to the other side of 76mm steel studs with cavity infill as specified in Section General extending to the structure above.
Car park partition (Rw > 45)	1 layer of 9mm fibre cement to the carpark side of 76mm steel studs and 1 layer of 13mm plasterboard to the retail tenancy side with cavity infill as specified in Section General. (Rw 44) OR 150mm precast concrete (Rw 55) OR 140mm core fired masonry blockwork (Rw 54)
Partition separating the building core from adjacent rooms (Rw > 55)	1 layer of 13mm plasterboard to one side of 64mm studs with 20mm airspace to the building core cavity infill as specified in Section General. (Rw Depends on building core however it will be >55)

Table A3: Indicative construction requirements for partitions

Recommended acoustic rating	Indicative construction (glazing)
Internal glazing (Rw 35)	8.38mm Laminated glass in aluminium frame
Building glazing (single glaze, Rw 37)	10.38mm Laminated glass
Building glazing (double glaze, Rw 39)	6mm annealed glass - 8mm air cavity - 6.38mm laminated glass

Table A4: Indicative construction requirements for Glazing

Recommended acoustic rating	Indicative construction (Doors)
(Rw 35) To commercial tenancies	8.38mm Laminated glass in aluminium frame fitted with compressible acoustic seals (Raven or Schlegel ranges). OR Solid core doors fitted with compressible acoustic seals (Raven or Schlegel ranges).
(Rw 37) To retail tenancies	10.38mm laminated glass in aluminium frame fitted with compressible acoustic seals (Raven or Schlegel ranges).

Table A5: Indicative construction requirements for Doors

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Figure A.1: Partition Markup ground floor

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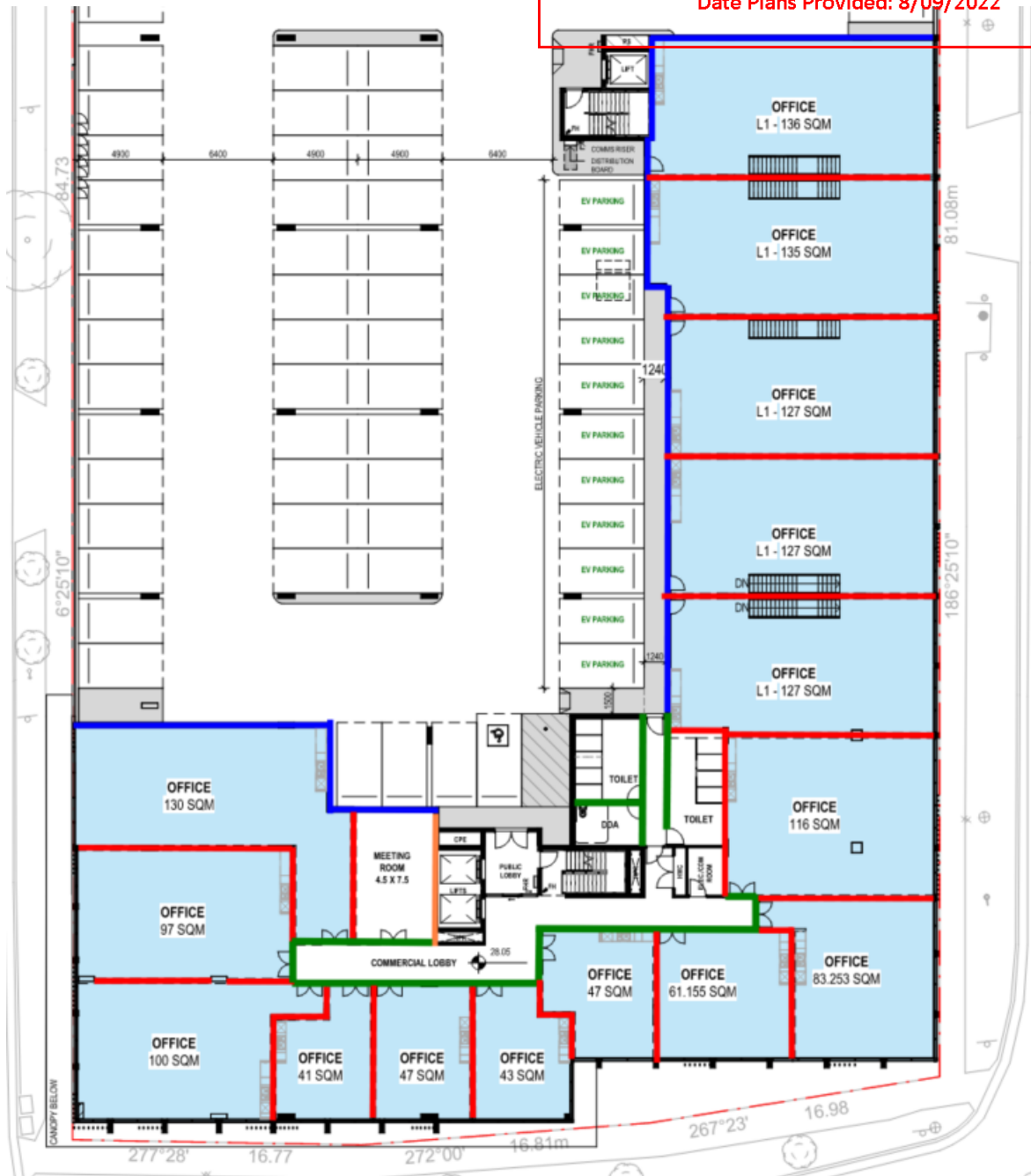


Figure A.2: Partition Markup level 1

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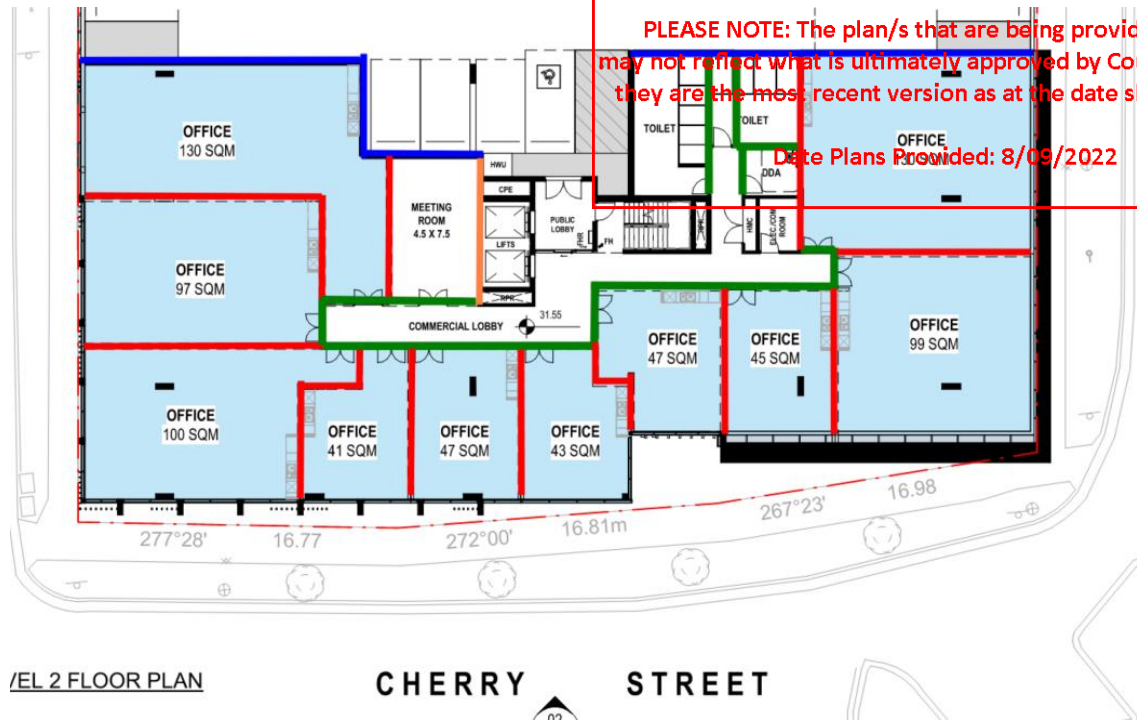


Figure A.3: Partition Markup level 2

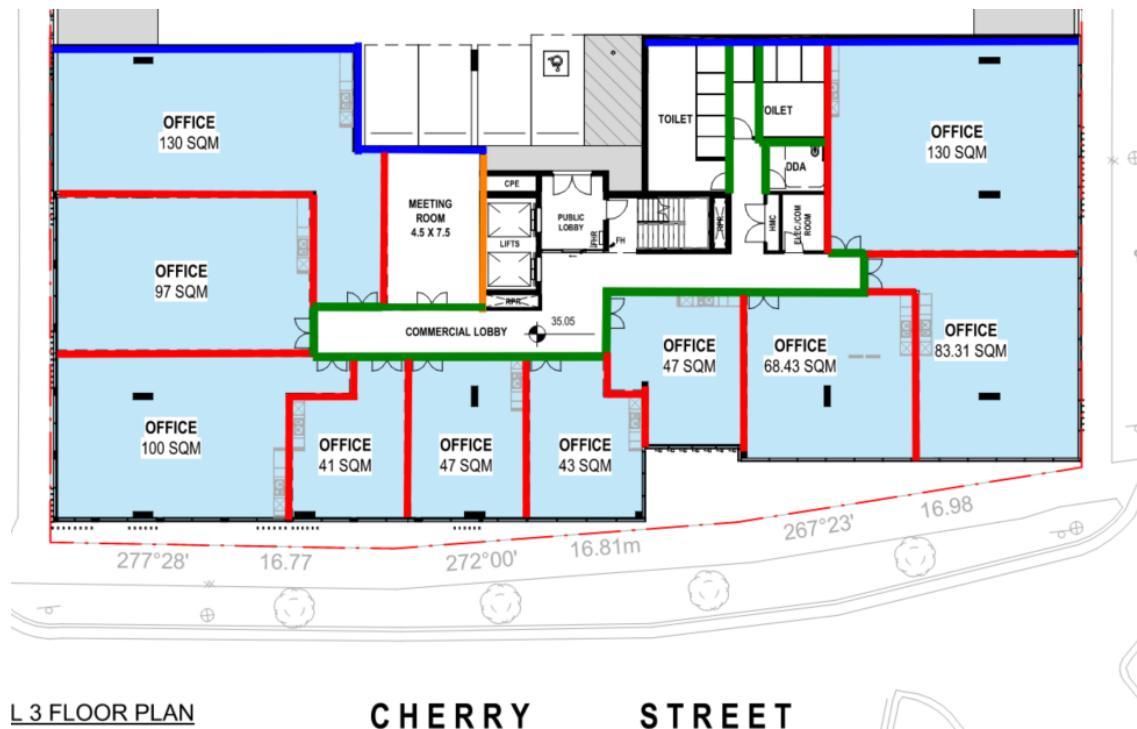


Figure A.4: Partition Markup level 3

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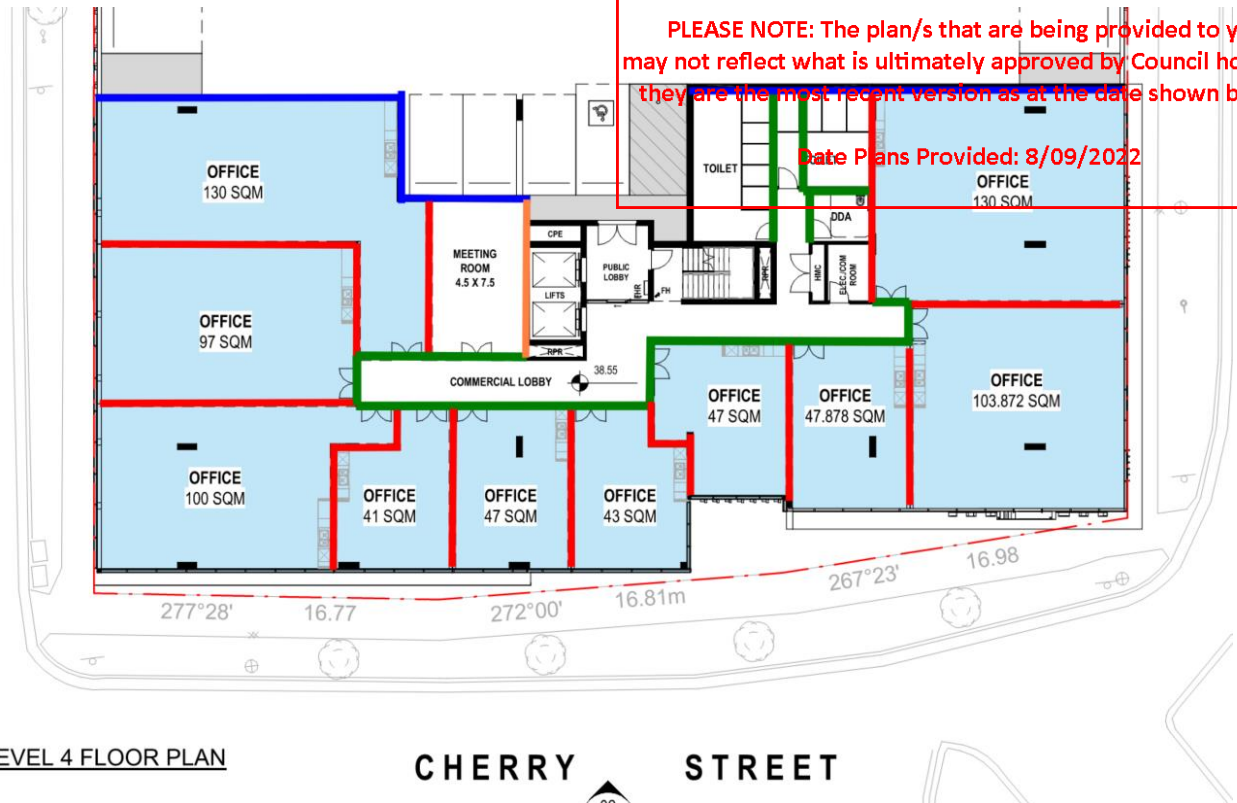
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LEVEL 4 FLOOR PLAN

CHERRY STREET
Figure A.5: Partition Markup level 4

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APPENDIX B
GLOSSARY OF ACOUSTIC TERMINOLOGY

dB(A)

Also referred to as dBA. A unit of measurement, decibels (A), of sound pressure level which has its frequency characteristics modified by a filter ("A-weighted") so as to more closely approximate human ear response at a loudness level of 40 phons. The table below outlines the subjective rating of different sound pressure levels.

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Noise Level (dBA)	Subjective Rating
25-30	Barely audible and very unobtrusive.
30-35	Audible but very unobtrusive.
35-40	Audible but unobtrusive.
40-45	Moderate but unobtrusive.
45-50	Unobtrusive with low levels of surrounding activity.
50-55	Unobtrusive with high levels of surrounding activity.

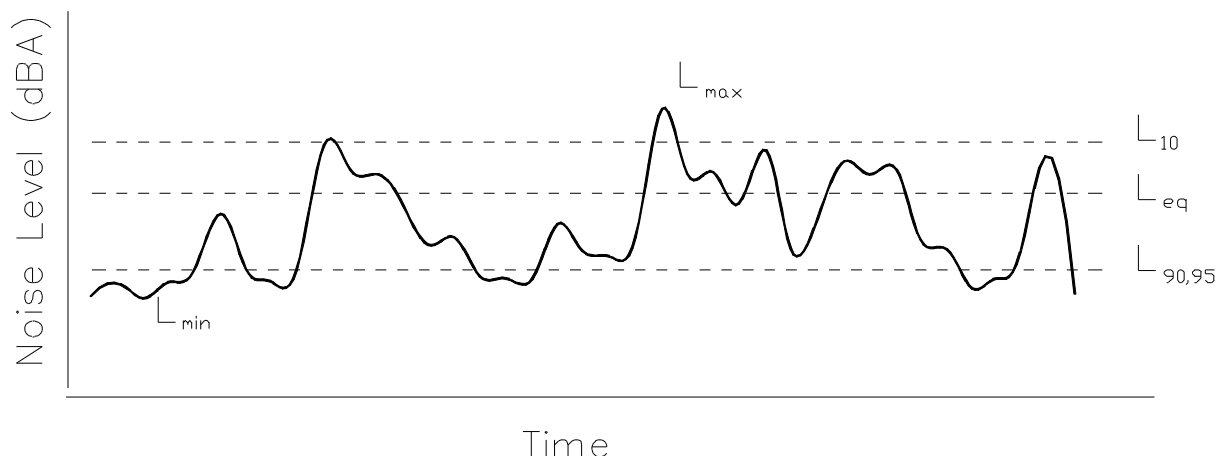
L₁ The noise level which is equalled or exceeded for 1% of the measurement period. L₁ is an indicator of the impulse noise level, and is used in Australia as the descriptor for intrusive noise (usually in dBA).

L₁₀ The noise level which is equalled or exceeded for 10% of the measurement period. L₁₀ is an indicator of the mean maximum noise level, and is used in Australia as the descriptor for intrusive noise (usually in dBA).

L₉₀, L₉₅ The noise level which is equalled or exceeded for 90% of the measurement period. L₉₀ or L₉₅ is an indicator of the mean minimum noise level, and is used in Australia as the descriptor for background or ambient noise (usually in dBA).

L_{eq} The equivalent continuous noise level for the measurement period. L_{eq} is an indicator of the average noise level (usually in dBA).

L_{max} The maximum noise level for the measurement period (usually in dBA).



Note: The subjective reaction or response to changes in noise levels can be summarised as follows: A 3dBA increase in sound pressure level is required for the average human ear to notice a change; a 5dBA increase is quite noticeable and a 10dBA increase is typically perceived as a doubling in loudness.

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STC/R_w

Sound Transmission Class or Weighted Sound Reduction Index. Provides a single number rating (from the sound transmission loss or sound reduction index for each frequency band) of the sound insulation performance of a partition. The higher the value, the better the performance of the partition. The subjective impression of different ratings is shown in the table below.

Type of noise source	STC/R _w Rating				
	40	45	50	55	60
Normal Speech	Audible	Just Audible	Not Audible		
Raised speech	Clearly Audible	Audible	Just Audible	Not Audible	
Shouting	Clearly Audible	Clearly Audible	Audible	Just Audible	Not Audible
Small television/small entertainment system	Clearly Audible	Clearly Audible	Audible	Just Audible	Not Audible
Large television/large hi-fi music system	Clearly Audible	Clearly Audible	Clearly Audible	Audible	Just Audible
DVD with surround sound	Clearly Audible	Clearly Audible	Clearly Audible	Audible	Audible
Digital television with surround sound	Clearly Audible	Clearly Audible	Clearly Audible	Audible	Audible

FSTC/R_w'

The equivalent of STC/R_w, unit for sound insulation performance of a building element measured in the field.

C_i, C_{tr}

The ratings (R_w, D_{nTw}, L_{nTw}) are weighted in accordance to a spectrum suited to speech. This term modifies the overall rating to account for noise with different spectra, such as traffic (C_{tr}) or footfalls (C_i). The ratings may be written as R_w+C_{tr}, or D_{nTw}/L_{nTw}+C_i.

NNIC/D_{nTw}

Normalised Noise Isolation Class, or Weighted Standardised Sound Level Difference. Provides a single number rating of the sound level difference between two spaces, and incorporates the effects of flanking noise between two spaces. This rating is generally accepted to be about 5 points less than the STC/R_w rating.

IIC/L_{nw}

Impact Insulation Class, or Weighted Normalised Impact Sound Level. L_{nw} = 110 - IIC. The higher the IIC rating, or the lower the L_{nw} rating the better the performance of the building element at insulating impact noise. The table below gives the subjective impression of different ratings:

IIC	L _{nw}	Subjective Rating
40	70	Clearly Audible
45	65	Clearly Audible
50	60	Audible
55	55	Audible
60	50	Just Audible
65	45	Inaudible

FIIC/L_{nTw}'

The equivalent of IIC/L_{nw}, but the performance is for the building element measured in the field.

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