DA ACOUSTIC ASSESSMENT

60, 62 & 64 Showground Road, Gosford, NSW

Prepared for CHP Fund

Prepared by RCA Australia

RCA ref 16091a-401/3

December 2022

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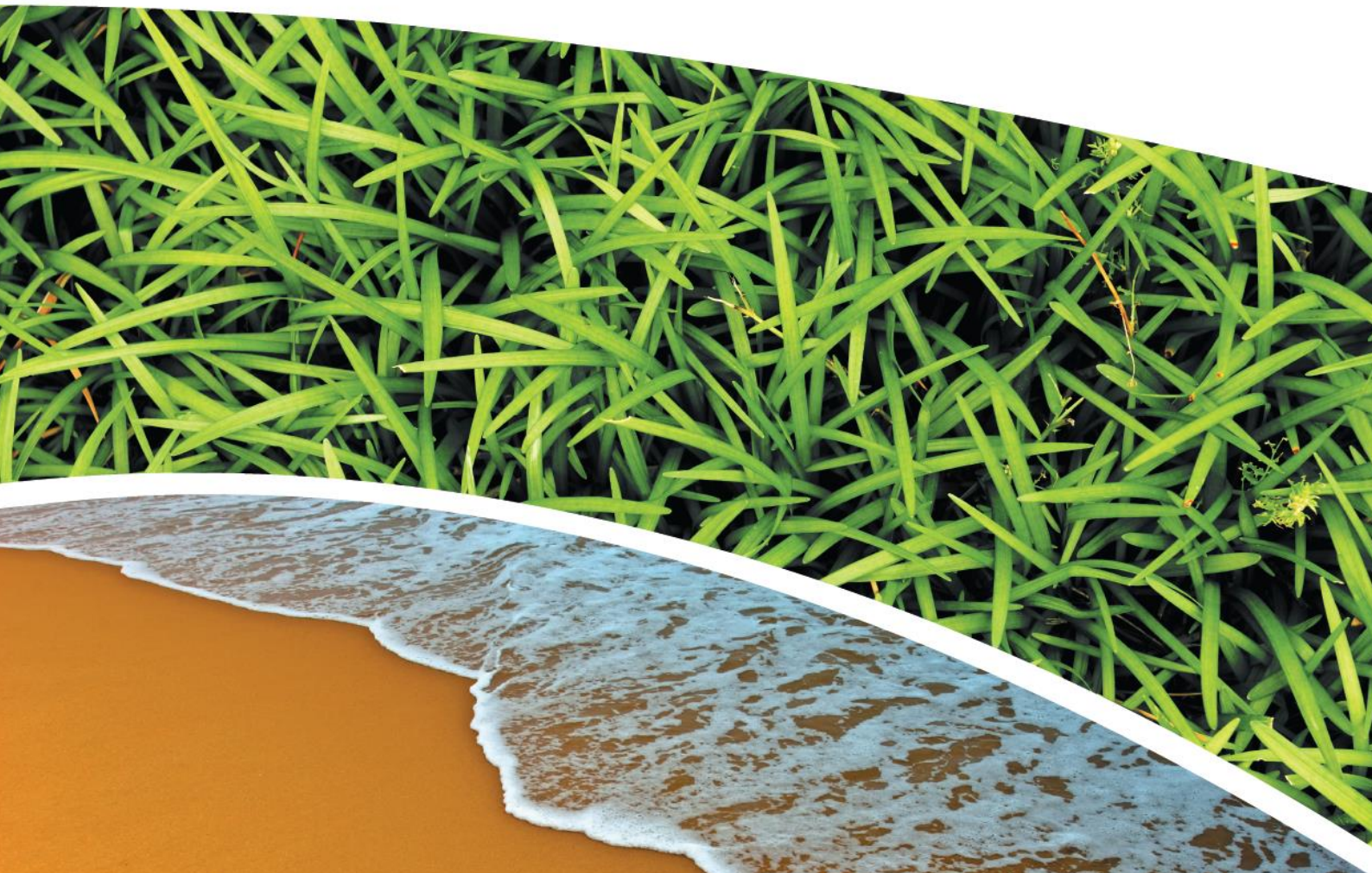

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16 December 2022

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DA ACOUSTIC ASSESSMENT
60, 62 & 64 SHOWGROUND ROAD, GOSFORD NSW

1 INTRODUCTION

RCA Australia (RCA) has been engaged to conduct an acoustic assessment to support a Development Application (DA) for a proposed mixed development at 60, 62 and 64 Showground Road, Gosford NSW. The development will include: basement carparking, commercial and medical tenancies on the ground floor, four levels of medical tenants and disability (SDA) units on the fifth floor. Only detailed plans of the SDA units on the fifth floor are currently available. General façade construction advice can be provided for the medical tenancies, however this will need to be reviewed when the layout and specific room use and corresponding internal noise objectives of these spaces is known. This report also includes a Construction Noise and Vibration Assessment to determine likely impacts to nearby existing receivers.

The client has received a request for information (RFI) from the Department of Planning and Environment which includes items relevant to this acoustic report. RCA will address items raised in the RFI in the body of this report but will also summarise RCA's response to the RFI in **Section 7**.

1.1 SITE DESCRIPTION AND NOISE ISSUES

The site is located at 60, 62 and 64 Showground Road, Gosford. The site is adjacent to the Gosford Hospital and is approximately 50 m from the Central Coast and Newcastle rail line. The site is shown in **Figure 1** with the location of attended noise monitoring marked red.

This assessment will consider transport noise from Showground Road and the rail line, as well as nearby rooftop mechanical plant, the Gosford Hospital car park and emergency helicopter flights.

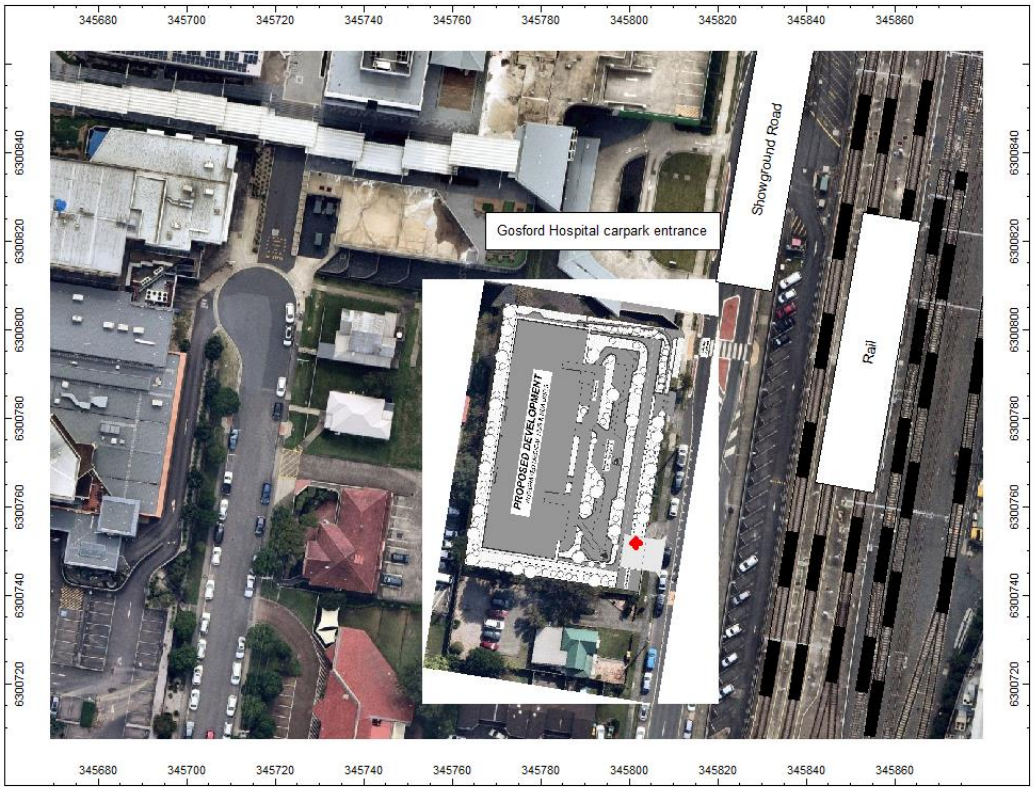

Figure 1 *Proposed development and attended noise monitoring location marked red*

2 NOISE MONITORING

There are two approaches to noise monitoring for a project like this. Unattended noise monitoring involves deploying a noise logger on site for several days to continuously record over this period. The advantage to this method is that a larger dataset is acquired. The downside to this method is that the site cannot always offer a secure location to leave the expensive noise monitoring equipment.

The other method is attended noise monitoring. This is where an operator stands with the noise monitor for a briefer period, such as an hour, but makes detailed observations such as traffic counts which can later be used to prepare a validated computer noise model. This method removes concern for equipment security but does provide a smaller dataset. The smaller dataset is not a concern provided we have confidence that the resulting external design noise levels are conservative. After conducting a site inspection, RCA found that there was no suitable location to deploy an unattended noise logger which gave clear line of sight to road and rail noise sources while also provided equipment security. For this reason, RCA proceeded with attended monitoring in combination with a validated noise model approach to determine conservative external design noise levels for this assessment.

Attended noise monitoring was conducted between 10 am – 11 am on the 16th June 2022 at the location marked in red on **Figure 1**. Concurrent manual traffic counts were taken for Showground Road and train movements were also noted during this time. The purpose of this monitoring was to quantify the transport noise at this site and later use this data to prepare a 3D computer noise model that can predict the transport noise incident upon the building façades.

The calibration of the noise monitoring equipment was checked before and after the monitoring period and was found to be within 0.5 dB tolerance of 94 dB. All equipment holds current NATA calibration certificates. Additional notes regarding the noise monitoring equipment are provided in **Table 1.**

Table 1 *Equipment details*

Make/Model	Serial Number	Settings
SVAN / 979	92044	'A' weighted 'Fast' time response
Calibrator BnK Type 4230	1558684	-

3 CRITERIA

The *Infrastructure SEPP (2007)* sets internal noise criteria for residential developments near public transport infrastructure. These criteria are also provided in the The Department of Planning document *Development Near Rail Corridors and Busy Roads- Interim Guideline (DoP)* and are reproduced in **Table 2**.

Table 2 *Transport noise criteria for new residential developments*

Residential Buildings		
Type of occupancy	**Noise level**	**Applicable time period**
Sleeping areas (bedrooms)	35 dBA	Night: 10 pm – 7 am
Other habitable rooms (excluding garages, kitchens, bathrooms and hallways)	40 dBA	At any time

Note: airborne noise is calculated as Leq (9hr) (night) and Leq (15hr) (day).

Additionally, The Road Noise Policy (EPA, 2011) provides advice on sleep disturbance due to transient events. This advice is not legislated and is provided here for additional information and best practice. This advice is particularly relevant to noise from the Gosford Hospital carpark and rooftop Heli-pad. The Road Noise Policy states:

From the research on sleep disturbance to date it can be concluded that:

- Maximum internal noise levels below 50 – 55 dBA are unlikely to awaken people from sleep.

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

AS2107-2016 *Acoustics – Recommended design sound levels and reverberation times for building interiors* also provides design advice for the medical tenancies, however this standard is specifically for quasi-steady state noise sources, and explicitly excludes transient noise events such as railway or noise from low volume road traffic. We present this general design advice in **Table 3** for additional information until specific room uses and floor layouts are known.

Table 3 *Internal sound design levels for medical tenancies*

Health buildings	***Design sound level, LAeq, dBA***	***Design reverberation time, seconds***
Consulting rooms	45 - 50	0.4 – 0.6
MRI/CT Scan/X-Ray areas/Ultra sound	45 - 50	See note 1
Office areas	35 - 45	0.4 – 0.7
Pharmacies	45 - 50	0.4 – 0.6
Waiting rooms, reception areas	40 - 50	< 0.7

Without knowing the layout of the medical tenancy floors, this assessment will adopt an indicative internal design target of 40 dBA for all medical tenancy spaces to determine indicative façade construction requirements. An internal target of LAeq 40 dBA is noted to satisfy all identified room uses in **Table 3**.

4 METHODOLOGY & RESULTS

4.1 MEASURED TRANSPORT NOISE

RCA undertook one hour of attended measurements on site and concurrently undertook manual traffic counts on Showground Road and made note of freight train movements**.** Passenger train movements were observed to have negligible effect on the measured ambient noise level. The first 15-minute measurement included a freight train which is shown to have increased the measured LAeq,15-minute level above the other three 15-minute measurements without a freight train event. Results are shown in

Table 4. These manual traffic counts and noise measurements were later used to create and validate a worst-case transport noise model.

Table 4 *Noise measurements and traffic counts 16 June 2022*

Time	Light vehicles northbound	Heavy vehicles northbound	Light vehicles southbound	Heavy vehicles southbound	Measured LAeq, dBA	Measured LA90, dBA
10:00 – 10:15	61	1	52	1	62.5 LAeq,15 min	49.0
10:15 – 10:30	59	0	53	1	59.5 LAeq,15 min	47.5
10:30 – 10:45	52	5	58	1	60.4 LAeq,15 min	47.6
10:45 – 11:00	60	1	62	3	60.1 LAeq,15 min	49.0
Totals	**232**	**7**	**225**	**6**	**60.8 LAeq,1 hour**	**-**

4.2 PREDICTED EXTERNAL NOISE LEVELS

RCA has prepared a 3D noise model using software CadnaA to predict transport noise based on the measurements presented in

Table 4. The RMS traffic volume viewer was inspected but did not include any recent traffic counts on Showground Road. The closest recent count station was station ID 05796, which has survey data from several years taken on Manns Road / Pacific Highway. It is reasonable to assume that Showground Road has a similar hourly profile as this, and we note that about 7% of the total Manns Road / Pacific Highway daily traffic occurs between 10 am and 11 am. This observation leads us to calculate that the total daily traffic on Showground Road is less than 10,000 vehicles and would not be considered a “busy road” as per the definition in the SEPP 2007 Infrastructure, or the Department of Planning’s “Development Near Rail Corridors and Busy Roads” guideline.

The following noise models were prepared. A noise model is considered to have been validated and suitable for making noise predictions if it is shown to be within 2 dB of measurement.

Table 5 *Validated noise model*

Model	Measured, dBA	Predicted, dBA	Validated?
1-hour	LAeq,1 hr 60.8	LAeq,1 hr 61.1	Yes
Worst 15 minutes	LAeq,15 min 62.5	LAeq,15 min 63.5	Yes

As a matter of conservatism, the worst case 15-minute model was adopted for both day and night time external design levels. This is conservative because it assumes a freight train passes each and every 15 minutes all day and all night. Taking this conservative approach will also offer protection against sleep disturbance events. In addition to the transport noise sources, the closest rooftop mechanical plant west of the proposal has been modelled with a conservative sound power of 100 dBA.

Figure 2 *Noise model showing facade assessment locations*

The SDA external façade noise levels are shown in Appendix C. A summary of external façade noise levels follows.

Table 6 *Summary of predicted external facade noise levels*

Facade	Maximum LAeq noise levels at sleeping area facades, dBA	Required reduction to achieve 35 dBA inside sleeping areas, dBA	Maximum LAeq noise levels at other habitable area facades/medical tenancies, dBA	Required reduction to achieve 40 dBA inside habitable areas / medical tenancies, dBA	Main noise source
SDA North	59	24	-	-	Transport
SDA East	51	16	51	11	Transport
SDA South	-	-	57	17	Transport
SDA West	49	14	49	9	Rooftop mechanical plan
Medical tenancies	-	-	65	25	Transport

Additionally, noise from the Gosford Hospital car park has been considered at the exposed facades of the SDA units. Acoustic Logic prepared a noise impact assessment for the Gosford Hospital in 2014 titled “Gosford Hospital Precinct Redevelopment SSD Acoustic Assessment”. This report included a sleep disturbance assessment at the boundary of 62 – 64 Showground Road due to car engines and door slams at the drop off zone. The Acoustic Logic report predicted a LA1,1 minute level of 57 dBA at this boundary. It is not clear whether this noise source is at ground level or potentially at the same elevation as the proposed SDA units. If car engine and door slam noise sources occur at the same elevation as the SDA units then 10 dBA is a reasonable addition the predicted level to account for the closer proximity and greater line of sight between source and receiver. This is adopted below and compared against internal noise targets to avoid sleep disturbance.

Table 7 *Sleep disturbance impacts from hospital car park*

SDA Facade	Predicted car engine and door slams, LA1,1 minute dBA	Internal sleep disturbance target level	Reduction required to avoid sleep disturbance impacts, dBA
North and west	67	Less than LAmax 55 dBA	12 dB

It is also noted that the Gosford Hospital has a rooftop Helipad but it is unknown how often this is used or details of the approach and take-off route. RCA has taken noise measurements of a twin engine helicopter at another site and use the findings to provide design advice for the SDA apartments. The SDA apartments are approximately 250 m distance from the Helipad, though RCA provide façade design advice below based on the helicopter coming within 100 m of the SDA units.

Table 8 *Sleep disturbance impacts from Helipad*

Measured twin engine helicopter LAmax at ~500 m	Predicted helicopter LAmax at 250m, dBA	Predicted helicopter LAmax at 100m, dBA	Internal sleep disturbance target level	Reduction required to avoid sleep disturbance impacts (at 100 m distance), dBA
Typically less than 80 dBA	86 dBA	94 dBA	Less than LAmax 55 dBA	39 dB

It is seen that avoiding potential sleep disturbance impacts from the Helipad becomes the limiting design criteria for the SDA units.

5 DESIGN DISCUSSION AND RECOMMENDATIONS

Appendix C of The Department of Planning guideline provides noise treatment construction categories and associated required reductions (Rw) of façade elements to achieve internal noise targets. These categories are reproduced below.

Table 9 *Noise treatment construction categories - DoP guideline*

Category of noise control treatment	Rw of building element (minimum assumed)				
	Windows / sliding doors	Frontage facade	roof	Entry door	Floor
Category 1	24	38	40	28	29
Category 2	27	45	43	30	29
Category 3	32	52	48	33	50
Category 4	35	55	52	33	50
Category 5	43	55	55	40	50

While the noise reduction requirements for the SDA units to mitigate steady state noise is not particularly high, RCA has increased the design requirements for the SDA units based on the adopted required noise reduction of 39 dB due to the hospital Helipad.

RCA recommend that all SDA unit façades (excluding bedroom windows) are constructed to noise treatment category 2. Construction examples are provided in Appendix C of the DoP guideline. RCA recommend that the SDA roof be constructed to noise treatment category 3 and that all bedroom external glazing achieve Rw 39 to protect against sleep disturbance events from the operation of the Heli-pad. It is noted that Rw 39 rated windows may only be available within a commercial glazing system. The window system (including frame and seals) must be rated to achieve the Rw 39, not just the glass. External glazing to areas other than bedrooms have no specific acoustic rating since sleep disturbance is not a concern.

It is generally accepted that an open window can provide 10 dB reduction between external and internal noise levels. It follows then, that if the predicted external noise level is more than 10 dB above the internal noise target, the internal noise target cannot be achieved with the window open. All SDA unit bedroom windows therefore need to remain closed in order to achieve internal noise targets in sleeping areas, and alternative fresh air delivery would be required to these rooms. Living spaces either generally do not have external noise levels greater than 10 dB above the internal noise target, or, they have another façade they can draw fresh air from.

From a noise perspective, the façades of the ground floor and proceeding four floors of medical tenancies would achieve suitable noise reduction if they were built to a minimum noise treatment category of 3. This does not consider any structural or wind loading requirements. In reality, most commercial constructions would surpass noise treatment category 3.

A summary of noise treatment recommendations is provided in **Table 10.**

Table 10 *Summary of noise treatment*

Room / facade	Noise treatment construction
All bedroom glazing	Minimum Rw 39 (noting rating applies to whole window system including seals)
Other SDA glazing	No acoustic rating
All SDA facades	Minimum treatment category 2 (except for glazing).
SDA Roof	Minimum category 3
SDA alternative ventilation	Alternative ventilation provided to all SDA bedrooms
Commercial / medical tenancy facades	Minimum category 3

6 CONSTRUCTION NOISE AND VIBRATION ASSESSMENT

The following section presents a construction noise and vibration assessment based on currently available construction information. RCA recommends a Construction Noise and Vibration Management Plan be prepared based on detailed construction methodologies and proposed plant at the Construction Certificate stage.

This assessment is prepared in accordance with the advice presented in the *Interim Construction Noise Guideline* (ICNG) (Department of Environment & Climate Change NSW, 2009) and Australian Standard AS2436-2010 "*Guide to noise and vibration control on construction, demolition and maintenance sites".*

6.1 AVAILABLE CONSTRUCTION INFORMATION

Construction on site is planned to start with demolition activities in late 2022, with construction planned to be completed by mid-2024. All construction activities will be undertaken during standard construction hours, Monday – Friday between 7 am and 6 pm and Saturdays between 8 am and 1 pm.

A table of indicative noise and vibration generating plant required during major construction stages is provided below. Sound power levels have been taken from AS2436

Table 11 *Sound power levels of typical construction equipment*

Stage	Required plant	Typical sound power level (SWL) dB(A)	Adopted total activity sound level (SWL) dB(A)
Demolition	Excavator	107	110
	Truck	108	
Early works including excavation and piling	Excavator	110	110 during excavation 125 during piling
	Bob cat	108	
	Truck	107	
	Piling rigs	125	
Structure and building works	Crane	105	110
	Concrete pump truck	108	
	Truck	107	
	Hand tools	102	

6.2 RECEIVERS

The nearest receivers to the site have been identified from aerial imagery with details provided below.

Table 12 *Receivers identified for construction noise and vibration assessment*

Receiver ID	Address	Receiver type	Direction from site	Approximate distance from site boundary
-	66 Showground Rd	Car park entrance. Not assessed	North	Share northern boundary
E1	77 Holden St	Education – Gosford Precinct – The University of Newcastle	North and North-West	50 m with limited line of sight
R1	56 – 58 Showground Rd	Residential	South	Shares southern boundary. Structure approx. 8 m from boundary
C1	67-77 Holden St	Commercial / office	South-West	Approx. 40 m
C2	69 – 71 Holden St	Commercial / office	South-West	Approx. 16 m
C3	73 – 75 Holden St	Commercial / office	West	Approx. 17 m
H1	Holden St	Health – Central Coast Local Health District	West and North-West	70 m with limited line of sight

These receivers are shown in **Figure 3**.

RCA note here that a primary concern raised within the RFI received by the client was that receivers C1, C2 and C3 should perhaps have been assessed as “Health” receivers. RCA has aimed to assess identified receivers in line with the ICNG and believe that the appropriate receiver type has been selected. A few notes on the receiver types offered by the ICNG are provided in **Table 13**.

Table 13 *Receiver types offered by the ICNG and RCA's commentary on applicability*

ICNG Receiver type	RCA commentary
Classrooms at school and other education institutions	Not applicable to C1, C2 or C3
Hospital wards and operating theatres	Not applicable to C1, C2 or C3
Places of worship	Not applicable to C1, C2 or C3
Active recreation areas	Not applicable to C1, C2 or C3
Passive recreation areas	Not applicable to C1, C2 or C3
Community centres	Might be applicable. However, the reader is directed to AS2107 for advice on appropriate internal noise objectives. When you read the Application section of AS2107, the standard explicitly says it is not intended to be used to assess noise from construction.
Industrial premises	Not applicable to C1, C2 or C3
Offices, retail outlets	This was adopted as “commercial”. RCA believe it to be the most relevant land use.
Other businesses that may be sensitive to noise. Examples include theatre and childcare centres.	Might be applicable. However, the reader is directed to AS2107 for advice on appropriate internal noise objectives. When you read the Application section of AS2107, the standard explicitly says it is not intended to be used to assess noise from construction.

Furthermore, RCA previously prepared a Construction Noise and Vibration Management Plan for the contractor who undertook the construction of the Gosford car park extension. This management plan included long term vibration monitoring at receiver C3. At the time of preparing that management plan, receivers C1, C2 and C3 were all identified (to the satisfaction of the consenting authority and to all nearby receivers) to be “administrative offices”. This current assessment report is therefore consistent with the previous Construction Noise and Vibration Management Plan prepared for construction on the adjacent site

After considering the viewpoints offered in the RFI, the ICNG and the previous Construction Noise and Vibration Management Plan prepared for the Gosford Hospital car park extension, RCA believe that all identified receivers have been appropriately assessed.

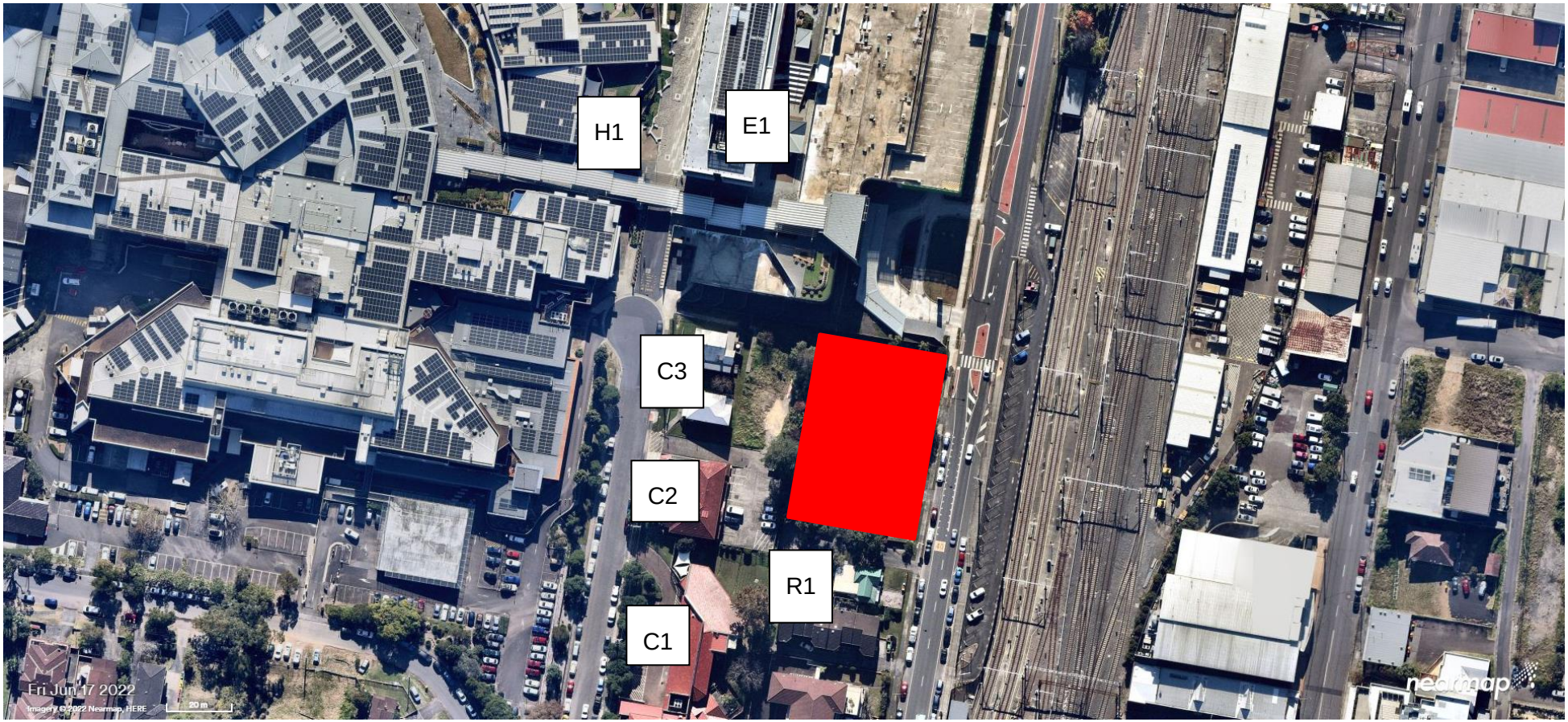

Figure 3 *Construction site in red and nearest assessed receivers labelled*

6.3 CONSTRUCTION NOISE ASSESSMENT

The ICNG states that a quantitative construction noise assessment is required for projects that will impact receivers for greater than three weeks. Noise criteria for each identified receiver type is presented in the ICNG. For residential receivers during standard construction hours, the 'Noise Affected' level represents the point above which there may be some community reaction to noise. This noise affected level is determined by adding 10 dB to the adopted background noise level. For this assessment, the rating background level (RBL) has been determined using the short-term method outlined in the Noise Policy for Industry (EPA, 2017) as the lowest individual 15-minute LA90 measured on site shown in **Table 4**.

For residential receivers during standard construction hours, the 'Highly Noise Affected' level of 75 dBA represents the point above which there may be strong community reaction to noise. Construction noise criteria for residential receivers is summarised in **Table 14**.

Table 14 *Noise criteria at residences*

	Standard Hours (Day)	**Out of Hours (Evening & Night)**
RBL	48	NA
Noise Affected ($L_{Aeq,15min}$)	58	NA
Highly Noise Affected ($L_{Aeq, 15min}$)	75	NA

The ICNG also presents noise criteria for other receiver types. These are shown below.

Table 15 *Noise criteria for other receiver types*

Receiver type	**Construction noise target**
Commercial /offices	70 dB(A) LAeq,15 minute (external)
Hospital wards and educational institutions	45 dB(A) LAeq,15 minute (internal)

The appropriate noise criteria during standard construction hours are then summarised for all identified receivers below.

Table 16 *Project specific construction noise criteria*

Receiver ID	**Receiver type**	**Criteria, LAeq,15 minute, dBA**
E1	Education	45 (internal)
R1	Residential	Noise affected 58 (external) Highly noise affected 75 (external)
C1	Commercial / offices	70 (external)
C2	Commercial / offices	70 (external)
C3	Commercial / offices	70 (external)
H1	Health	45 (internal)

Using the adopted activity sound power levels shown in **Table 11**, a conservative typical worst-case scenario sound pressure level has been predicted for each identified receiver using hemispherical spreading only. An additional 5 dB reduction has been applied to E1 and H1 to account for the limited line of sight to this receiver. External sound pressure levels for each receiver are shown below. Levels that exceed the residential 'highly noise affected' level of 75 dBA are shown in red font.

Table 17 *Construction sound pressure levels (external) at each receiver*

		R1	C2 & C3	C1	E1	H1
Activity	**Activity SWL, dB(A)**	**8 m**	**15 m**	**40 m**	**50 m**	**70 m**
Demolition	110	84	78	70	63	60
Excavation	110	84	78	70	63	60
Piling	125	99	93	85	78	75
building	110	84	78	70	63	60

We see that all construction activities are expected to exceed the highly noise affected level of 75 dBA at the nearest residential receiver (R1). This indicates that all reasonable and feasible mitigation measures will need to be investigated. This can only be undertaken with any accuracy at the time of preparing a Construction Noise and Vibration Management Plan, after a contractor has been appointed.

All construction activities are predicted to exceed the construction noise objective at C2 and C3, with piling being the loudest activity. Only piling activities are predicted to exceed the noise objective at C1.

The noise objective for both E1 and H1 is 45 dBA (internal). Given that these buildings have been built next to an operating helipad, RCA expect that the façade reduction would be at least 30 – 40 dBA. Assuming a reduction of 35 dBA would give a maximum internal level of 43 dBA and 40 dBA within E1 and H1 respectively during the noisiest activity, piling works. Construction noise impacts at E1 and H1 are therefore not anticipated.

It should also be noted that the levels presented in **Table 17** represent typical worst-case 15-minute periods, where the noisiest plant are operating for the full 15 minutes. There will be many periods during the day where construction noise levels are much lower than those presented above.

6.4 VIBRATION ASSESSMENT

The amount of vibration generated will depend on the size of plant, which will be confirmed when a construction contractor is appointed. This preliminary vibration assessment is therefore based on general advice presented in the RMS *Construction Noise and Vibration Guideline* (CNVG) (2013). The CNVG includes a table which provides minimum working distances from typical plant to avoid cosmetic and human comfort vibration impacts. This table is reproduced below. The final two columns have been added for this assessment and indicates any identified receivers that are within these minimum working distances.

Table 18 *RMS recommended minimum working distances for vibration intensive plant*

Plant item	Rating / description	Minimum working distance		Receiver within cosmetic impact distance	Receiver within human response impact distance
		Cosmetic damage (BS7385)	Human response (OH&E vibration guideline)		
Vibratory roller	< 50 kN (typically 1-2t)	5 m	15 m to 20 m	None	R1, C2, C3
	< 100 kN (typically 2-4t)	6 m	20 m	None	R1, C2, C3
	< 300 kN (typically 7-13t)	12 m	40 m	R1	R1, C1, C2, C3
	> 300 kN (> 18 t)	20 m	100 m	R1, C2, C3	Potentially all identified receivers
Small hydraulic hammer	5 – 12t excavator	2 m	7 m	None	None
Medium hydraulic hammer	12 – 18t excavator	7 m	23 m	None	R1, C2, C3
Large hydraulic hammer	18 – 34t	22 m	73 m	R1, C2, C3	R1, C1, C2, C3, E1
Vibratory pile driver	Sheet piles	2 m	20 m	None	R1, C2, C3
Pile boring	Up to 800 mm	2 m	4 m	None	None
Jackhammer	Hand held	1 m	2 m	None	None

6.5 CONSTRUCTION NOISE AND VIBRATION MITIGATION MEASURES

An updated Construction Noise and Vibration Management Plan (CNVMP) is to be prepared at the Construction Certificate stage for this project, based on the proposed construction methodologies and plant. General in-principal mitigation measures are presented below.

- Construction activities will only occur during standard construction hours.
- The CNVMP is to predict noise and vibration at the nearest receivers based on proposed plant.
- The CNVMP will include both a noise and vibration monitoring plan. The noise monitoring plan will include verification noise measurements at the beginning of a new stage of works, and in response to a new complaint received.
- The efficacy of sound blankets or hoarding around the construction site is to be investigated as a noise barrier to protect the amenity of adjacent and nearby receivers.

- Impacted receivers to be consulted regarding the nature and timing of the works, including predicted noise and vibration impacts at their property and the mitigation measures that will be adopted.

- Nearby receivers are also to be provided with a site contact to direct any noise or vibration complaints.

- Any complaints received will be investigated and measurements will be undertaken and compared to predictions made in the CNVMP. If the measurements are not in line with predictions made, additional reasonable and feasible mitigation measures will be investigated.

- Plant will be selected with consideration to the sound and vibration output. Selected plant will not be any larger than what is required to undertake the activity.

- Sound barriers (either plywood hording or sound barrier mats hung from site fencing) will be erected around the site perimeter to extend to at least 1.8 m above ground level.

- Vibration monitors programmed to send text message alerts to the work crew are to be used at nearby receiver locations that are within the minimum working distance for cosmetic damage. This will depend on the plant being used and will be updated once plant have been selected.

7 RESPONSE TO RFI

RCA has reviewed and considered points raised in the RFI. These points were address within the body of the report above, but we also provide a response to each point in **Table 19** below.

Table 19 *Acoustic points raised in RFI and RCA response*

Noise or vibration concern raised (paraphrased)	RCA's response
	RCA general commentary: Construction activities are noisy by nature. The Interim Construction Noise Guideline (ICNG) sets non-mandatory construction noise objectives for identified receiver types. RCA's assessment identifies the likely exceedance of these non-mandatory noise objectives in order to determine likely negative reaction from the community. The assessment details will be fine-tuned when preparing the Construction Noise and Vibration Management Plan based on more detailed information when a Contractor has been appointed. However, verification measurements will test the effectiveness of mitigation measures and will identify if additional reasonable and feasible mitigation measures need to be explored. RCA also note that a few years ago the hospital carpark extension was built. RCA prepared the Construction Noise and Vibration Management Plan for those works on behalf of the Contractor, as well as undertaking long term vibration monitoring at receiver C3 (identified as an administration building at the time). RCA's current assessment is consistent with the previous assessment approach which was accepted by the regulatory authority and all nearby receivers at the time.
DPE #1: Consider and respond to concerns raised by NSW Health over acoustic impacts to adjoining health care receivers during construction.	This is addressed in **Section 6.2** above and also in response to NSW Health #2 below.
NSW Health #1: Suggest further assessment is required, and mitigation measures identified, to minimize impacts and protect the health and wellbeing of the surrounding community (this is expanded on below).	A Construction Noise and Vibration Assessment has been prepared based on currently available information. The Construction Noise and Vibration Management Plan will be prepared based on current construction information at the time. The Plan will then be updated based on verification measurements.

<table>
<tr><th>Noise or vibration concern raised (paraphrased)</th><th>RCA's response</th></tr>
<tr><td>NSW Health #2: Impacts to receivers at premises in Holden St may have been underestimated. The current report assesses these as commercial receivers. This may not be an appropriate classification since these properties are used by the District to provide healthcare services to vulnerable community members. We suggest that these properties be reclassified as 'health'</td><td>RCA believe the most appropriate receiver land use has been selected. The ICNG provides the following land use types:
<table>
<tr><td>Classrooms at school and other education institutions</td><td>Not applicable</td></tr>
<tr><td>Hospital wards and operating theatres</td><td>Not applicable</td></tr>
<tr><td>Places of worship</td><td>Not applicable</td></tr>
<tr><td>Active recreation areas</td><td>Not applicable</td></tr>
<tr><td>Passive recreation areas</td><td>Not applicable</td></tr>
<tr><td>Community centres</td><td>-might be applicable. However, the reader is directed to AS2107 for advice on appropriate internal noise objectives. When you read the Application section of AS2107, the standard explicitly says it is not intended to be used to assess noise from construction.</td></tr>
<tr><td>Industrial premises</td><td>Not applicable</td></tr>
<tr><td>Offices, retail outlets</td><td>-this was adopted as "commercial". RCA believe it to be the most relevant land use.</td></tr>
<tr><td>Other businesses that may be sensitive to noise. Examples include theatre and childcare centres.</td><td>-might be applicable. However, the reader is directed to AS2107 for advice on appropriate internal noise objectives. When you read the Application section of AS2107, the standard explicitly says it is not intended to be used to assess noise from construction.</td></tr>
</table></td></tr>
</table>

Noise or vibration concern raised (paraphrased)	RCA's response
NSW Health #3: Contrary to the Acoustic Report (p 12), the southern side of premises at 77 Holden St (E1) has direct line of sigher over the project site as do outdoor spaces used by staff and visitors of Gosford Hospital.	The health precinct comprises of many areas, offices and internal activities. It is not practicable to individually assess each of these. The report aims to assess impacts at representative locations that are fair. The Construction Noise and Vibration Management Plan will include the requirement of verification measurements at the beginning of each major construction phase. Only then, can mitigation measures be tailored to each receiver location of concern. Note that the "health" receiver type has been adopted for the overall Health Precinct. This is conservative since the ICNG sets this land use for "Hospital wards and operating theatres". There will be many general office areas that are much less sensitive to noise than hospital wards and operating theatres. Outdoor areas are a good example of an area that is much less sensitive to noise.
NSW Health #4: The health service premises C1, C2 and C3 are expected to experience construction noise sound pressure levels between 70 and 93 dBA. These levels exceed the 'commercial' project specific noise criteria and significantly exceed the 'health' classification noise criteria (45 dBA, LAeq 15 min). We request that these impacts be accurately assessed and effectively managed to as to avoid impacts on the health and wellbeing of the staff and users at these premises.	Construction is noisy by nature. The assessment is based on information that is currently known and well-established calculation methods. A more accurate assessment will involve verification measurements during construction. This can be a condition of consent. The receivers C1, C2 and C3 are neither "Hospital wards" nor "operating theatres", and so the 'Health' criterion does not apply. Furthermore, the health criterion is an internal noise objective whereas the noise levels being compared are external. This overstates the exceedance.

Noise or vibration concern raised (paraphrased)	RCA's response
NSW Health #5: The preliminary assessment considers the impacts on adjacent properties but does not appear to consider impacts on other residential and health service premises in Showground Rd and Holden St. The applicant should be required to undertake a thorough assessment of impacts for all potentially affected receivers, not only adjacent properties	The current assessment is based on current construction information available. Mitigation measures can and will be finessed once verification noise measurements have confirmed noise levels. As mentioned above, the receiver H1 represents many different internal spaces. It is not practicable to assess each individually at this time. The report assesses the most impacted receivers for the purpose of identifying the likely extent of construction noise and vibration impacts. Construction noise will be audible at other receiver locations, but these locations are further away and have limited line of sight due to intervening structures. Ultimately, mitigation measures will be confirmed based on the highest impacts (the closest receivers). Receivers further away will also benefit from these mitigation measures.
NSW Health #6: Request that premises 67-77 Holden St, 69-71 Holden St and 73-75 Holden St be noted in the Acoustic report as receiver type 'Health', and the appropriate construction noise criteria is set on this basis.	RCA contest that these receivers meet the ICNG intent of the 'Health' receiver type. Unless these premises are used as Hospital wards or operating theatres, RCA believe the current classification of 'commercial/office' is more appropriate.
NSW Health #7: Demolition and construction noise and vibration impacts on the abovementioned health services in Holden St and on all potentially affected receivers be accurately assessed prior to work commencing.	The assessment is based on typical construction plant and a worst-case scenario where plant operate at full noise for the entire 15-minute period. A more accurate assessment is not available until exact plant is known. Instead, RCA recommend that noise and vibration verification measurements are undertaken at the beginning of each major phase of construction.
NSW Health #8: Mitigation measures are to be identified based on a revised assessment, prior to works commencing.	RCA has updated the recommended mitigation measures section in this report; however, the more effective approach is to condition that a Construction Noise and Vibration Management Plan is prepared and then updated based on verification measurements at beginning of each major construction phase.
NSW Health #9: A detailed Construction Noise and Vibration Management Plan be prepared and implemented to the satisfaction of the appropriate regulatory authority.	Agreed. Additional detail will be available when a Contractor is appointed.

Noise or vibration concern raised (paraphrased)	RCA's response
NSW Health #10: The nearest receivers should be consulted rather than notified of works. The objective should be to establish demolition and construction works programs that create the least possible disruption, noting hours of work for the project will overlap with hours of occupation for surrounding non-residential premises.	Agreed. Reasonable consultation will provide better understanding of each of the land uses.
NSW Health #11: Communication and consultation with affected receivers be extended to all potentially affected receivers.	Agreed. Reasonable communication and consultation will be identified at the time of developing the Construction Noise and Vibration Management Plan, noting that no unidentified receivers are expected to receive levels above the residential "highly noise affected" level due to increased separation distance and limited line of sight.
NSW Health #12: Ongoing noise monitoring at nearby receivers is undertaken during the demolition and construction, in addition to the planned vibration monitoring.	Agreed. This is a good idea. RCA suggest that verification noise measurements are conducted at the beginning of each major construction phase, and /or upon receipt of a new noise complaint.
NSW Health #13: If additional impacts are identified by the community, control measures must be identified and implemented.	Agreed. All reasonable and feasible mitigation measures will be investigated in response to receiving a noise complaint. This will be detailed in the Construction Noise and Vibration Management Plan.
NSW Health #14: Approval should include provisions for noise and vibration monitoring.	Agreed. A monitoring plan will be detailed in the Construction Noise and Vibration Management Plan.
DPE #2: Consider the noise impacts of existing helicopter flight paths.	RCA has provided additional assessment details in **Section 4.2** and have updated design recommendations in **Table 10** to account for helicopter movements.
DPE #3: include appropriate mitigation measures which seek to minimize acoustic impacts during construction, particularly during excavation and piling.	RCA has updated the recommended mitigation measures section of this report.

8 CONCLUSION

RCA has been engaged to conduct an acoustic assessment for a proposed development at 60, 62 and 64 Showground Road, Gosford. This assessment included a combination of taking noise measurements on site as well as preparing a 3D computer noise model to determine worst case external design noise levels. Internal noise targets have been set for the SDA units on the fifth floor in accordance with the SEPP 2007 Infrastructure and sleep disturbance research, and indicative internal noise targets were set for commercial / medical tenancies based on advice from AS2107. In both cases, noise treatment construction categories have been identified from the Department of Planning document *Development Near Rail Corridors and Busy Roads - Interim Guideline,* to achieve the internal noise targets. Examples of each noise treatment category has been taken from this guideline and is attached in **Appendix C** of this report. Individual tenants within the commercial and medical tenancies will need to consider if the general advice presented in this report is suitable for their specific room use and layout.

A construction noise and vibration assessment has also been prepared for the project which found all construction activities are likely to create periods of noise above the highly noise affected level of 75 dBA at the nearest residential receiver. Construction noise impacts are also expected at the nearest commercial/office receivers but not within the educational or health buildings. Vibration generating plant can be chosen to avoid causing cosmetic damage to any nearby receivers, however, human comfort vibration impacts likely cannot be avoided. Community consultation will be an important mitigation measure.

Yours faithfully

RCA Acoustics

A. Rees

Alex Rees
Senior Acoustic Consultant

Terminology

dB(A) ..... Unit of sound pressure level, modified by the A-weighting network to represent the sensitivity of the human ear.

SPL..... Sound Pressure Level (SPL), the incremental variation of sound pressure from the reference pressure level, 20 µPa, expressed in decibels.

L_{eq}..... Equivalent continuous noise level averaged over time on an equivalent energy basis.

Rw ..... Stands for weighted reduction. This is a single number rating of the airborne sound insulation of a partition. The spectrum adaption +Ctr is a penalty for poorer performance at low frequencies.

Appendix A

Proposed Architectural Plans

Integrated Medical Office Building and Specialist Disability Accommodation

Development Numbers

Street Address: 60, 62 and 64 Showground Road, Gosford
Property Description: Lots 1-4 on SP 20095 and Lots 1-6 on SP 20058

Site Area: 2437sqm

Proposal Description: Mixed use development consisting of an integrated health hub facility and disability accommodation. Retail and medical land uses such as GP clinic, pharmacy, radiology, pathology on the ground level; with 4 levels of medical suites above. Level 5 will provide seven specialist disability accommodation units

Carparking Numbers

Basement 1
45 Car spaces
2 Accessible Car spaces
1 SDA Drop off space
2 Van spaces
1 Motorcycle Bay

Basement 2
68 Car spaces
2 Accessible Car spaces
1 Motorcycle Bay

Basement 3
68 Car spaces
2 Accessible Car spaces
1 Motorcycle Bay

Basement 4
35 Car spaces

Total Carparking Numbers
216 Car spaces
6 Accessible Car spaces
3 Motorcycle Bays
1 SDA Drop off space
2 Van spaces

Drawing List

Drawing No.	Drawing Name
00.01	Context & Locality Plans
01.01	Site Plan
01.02	Existing Survey
01.03	Demolition Plan
01.04	Excavation Plan
03.01	Floor Plan - Basement 4
03.02	Floor Plan - Basement 3
03.03	Floor Plan - Basement 2
03.04	Floor Plan - Basement 1
03.05	Floor Plan - Ground Floor
03.06	Floor Plan - First Floor
03.07	Floor Plan - Second Floor
03.08	Floor Plan - Third Floor
03.09	Floor Plan - Fourth Floor
03.10	Floor Plan - Fifth Floor
04.01	Roof Plan
09.01	Elevations - North
09.02	Elevations - East
09.03	Elevations - South
09.04	Elevations - West
09.05	Showground Road Site Elevation
10.01	Section A
10.02	Section B
10.03	Section C
22.01	North-Eastern Perspective
22.02	Showground Rd Perspective
22.03	South-Eastern Perspective
22.04	Showground Road Context

DA
NOT FOR CONSTRUCTION

elevation ARCHITECTURE
(07) 3251 6900 info@elevationarchitecture.com.au

Revision		
A	Updated Drawing Set	27/01/2022
B	DA Drawings	4/03/2022
C	DA RFI Amendments	9/12/2022

Project
Integrated Medical Office Building and Specialist Disability Accommodation
60, 62 & 64 Showground Road Gosford NSW

Client
CHP

Architect
GA

Drawn
DS

Stage
Concept

Status
DA (NOT FOR CONSTRUCTION)

Project No.
1174-03

Scale
at A3

Context & Locality Plans

A-DA-00.01

Revision
C

P:\Data 1\1174-03 Showground Road Integrated Medical Office Building\5.2 Development Application\5.2.1 ArchiCAD\1174-03_Master DA 24 UniIConfig.pln

NSTRUCTION

elevation ARCHITECTURE

(07) 3251 6900 info@elevationarchitecture.com.au

Revision		
A	Updated Site Plan	23/09/2021
B	Updated Drawing Set	27/01/2022
C	DA Drawings	4/03/2022

Project
Integrated Medical Office Building and Specialist Disability Accommodation
60, 62 & 64 Showground Road Gosford NSW

Client
CHP

Architect
GA

Drawn
DS

Stage
Concept

Status
DA (NOT FOR CONSTRUCTION)

Project No.
1174-03

Scale
at A3

Site Plan

A-DA-01.01

Revision
C

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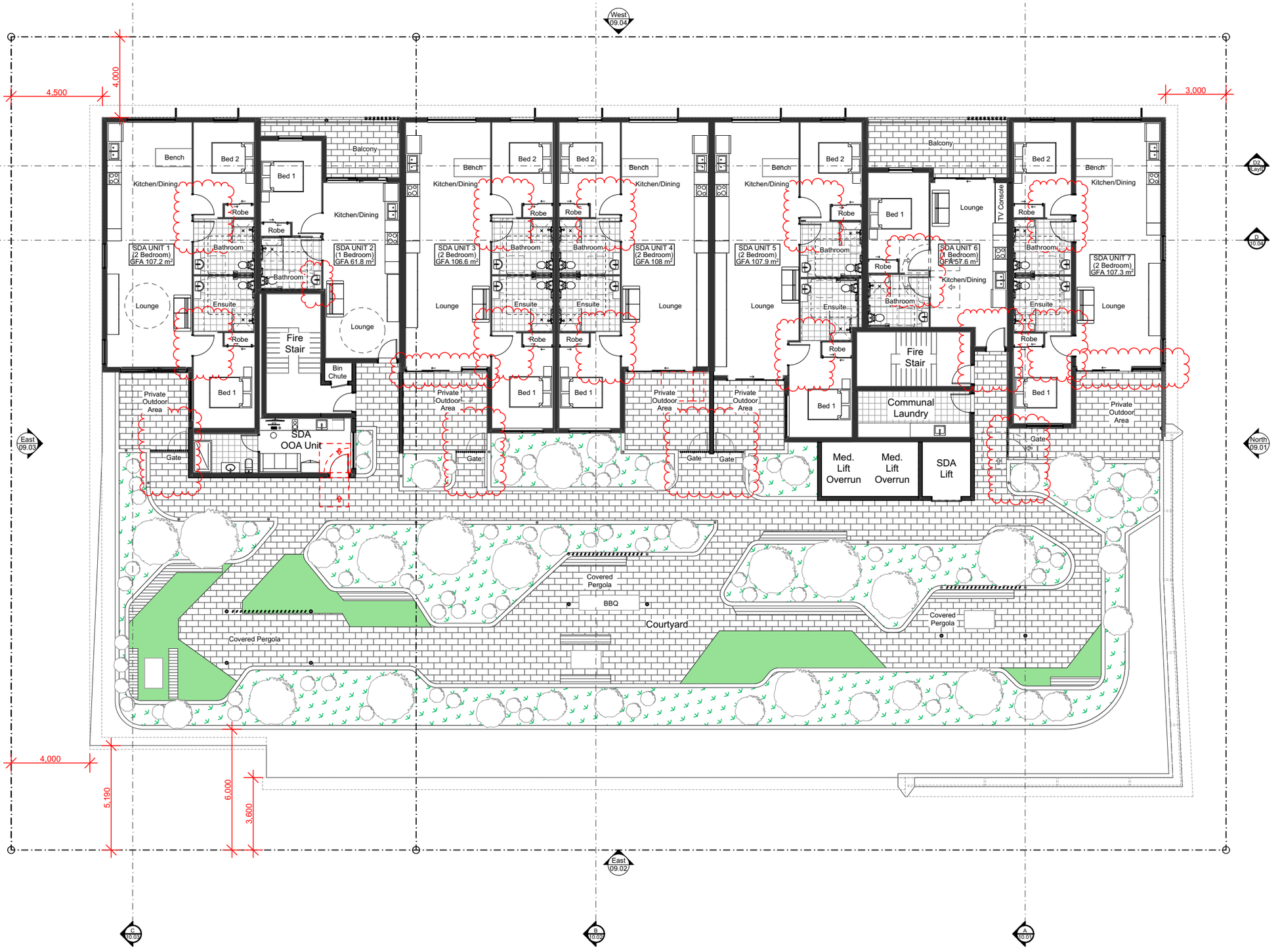


DA
NOT FOR CONSTRUCTION

elevation ARCHITECTURE
(07) 3251 6900 info@elevationarchitecture.com.au

Revision		
D	Updated Drawing Set	1/12/2021
E	Updated Drawing Set	14/01/2022
F	Updated Drawing Set	18/01/2022
G	DA Drawings	4/03/2022
H	DA RFI Amendments	9/12/2022

Project
Integrated Medical Office Building and Specialist Disability Accommodation
60, 62 & 64 Showground Road Gosford NSW

Client
CHP

Architect
GA

Drawn
DS

Stage
Concept

Status
DA (NOT FOR CONSTRUCTION)

Project No.
1174-03

Scale
1:200 at A3

Floor Plan - Fifth Floor

A-DA-03.10

Revision
H

P:\Data 1\1174-03 Showground Road Integrated Medical Office Building\5.2 Development Application\5.2.1 ArchiCAD\1174-03_Master DA 24 UnitConfig.pln

Appendix B

Noise model predictions for SDA units


345680
345700
345720
345740
345760
345780
345800
345820
345840
345860
6300840
6300820
6300800
6300780
6300760
6300740
6300720
Showground Rd
Freight train
MV LWA 100 dBA
59
50
63.5

Appendix C

Appendix C of Department of Planning Guideline

Appendix C – Acoustic Treatment of Residences

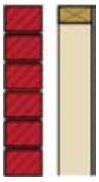
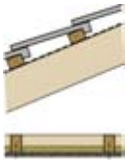
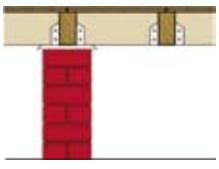
The following table sets out standard (or deemed-to-satisfy) constructions for each category of noise control treatment for the sleeping areas and other habitable areas of single / dual occupancy residential developments only. The assumptions made in the noise modelling are as follows:

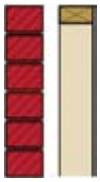
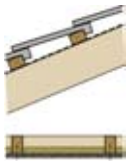
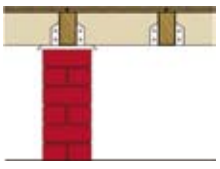
- Typical layout of a modern dwelling taken from a recent large residential development in an outer Sydney suburb
- Bedrooms and other habitable rooms are exposed to road noise

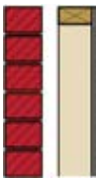
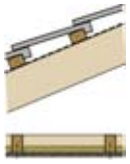
ACOUSTIC PERFORMANCE OF BUILDING ELEMENTS

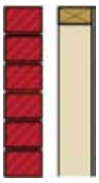
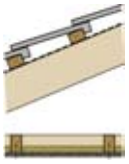
The acoustic performances assumed of each building element in deriving the Standard Constructions for each category of noise control treatment presented in the preceding Table, are presented below in terms of Weighted Sound Reduction Index (Rw) values, which can be used to find alternatives to the standard constructions presented in this Appendix:

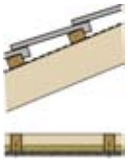
Category of Noise Control Treatment	R_w of Building Elements (minimum assumed)				
	Windows/Sliding Doors	Frontage Facade	Roof	Entry Door	Floor
Category 1	24	38	40	28	29
Category 2	27	45	43	30	29
Category 3	32	52	48	33	50
Category 4	35	55	52	33	50
Category 5	43	55	55	40	50

Category No.	Building Element	Standard Constructions	sample
1	**Windows/Sliding Doors**	Openable with minimum 4mm monolithic glass and standard weather seals	
	Frontage Facade	**Timber Frame or Cladding:** 6mm fibre cement sheeting or weatherboards or plank cladding externally, 90mm deep timber stud or 92mm metal stud, 13mm standard plasterboard internally	
		Brick Veneer: 110mm brick, 90mm timber stud or 92mm metal stud, minimum 50mm clearance between masonry and stud frame, 10mm standard plasterboard internally	
		Double Brick Cavity: 2 leaves of 110mm brickwork separated by 50mm gap	
	Roof	Pitched concrete or terracotta tile or metal sheet roof with sarking, 10mm plasterboard ceiling fixed to ceiling joists, R1.5 insulation batts in roof cavity.	
	Entry Door	35mm solid core timber door fitted with full perimeter acoustic seals	
	Floor	1 layer of 19mm structural floor boards, timber joist on piers	
		Concrete slab floor on ground	

Category No.	Building Element	Standard Constructions	sample
2	**Windows/Sliding Doors**	Openable with minimum 6mm monolithic glass and full perimeter acoustic seals	
	Frontage Facade	**Timber Frame or Cladding Construction:** 6mm fibre cement sheeting or weatherboards or plank cladding externally, 90mm deep timber stud or 92mm metal stud, 13mm standard plasterboard internally with R2 insulation in wall cavity.	
		Brick Veneer Construction: 110mm brick, 90mm timber stud frame or 92mm metal stud, minimum 50mm clearance between masonry and stud frame, 10mm standard plasterboard internally.	
		Double Brick Cavity Construction: 2 leaves of 110mm brickwork separated by 50mm gap	
	Roof	Pitched concrete or terracotta tile or metal sheet roof with sarking, 10mm plasterboard ceiling fixed to ceiling joists, R2 insulation batts in roof cavity.	
	Entry Door	40mm solid core timber door fitted with full perimeter acoustic seals	
	Floor	1 layer of 19mm structural floor boards, timber joist on piers	
		Concrete slab floor on ground	

Category No.	Building Element	Standard Constructions	sample
3	**Windows/Sliding Doors**	Openable with minimum 6.38mm laminated glass and full perimeter acoustic seals	
	Frontage Facade	**Brick Veneer Construction:** 110mm brick, 90mm timber stud or 92mm metal stud, minimum 50mm clearance between masonry and stud frame, 10mm standard plasterboard internally.	
		Double Brick Cavity Construction: 2 leaves of 110mm brickwork separated by 50mm gap	
	Roof	Pitched concrete or terracotta tile or sheet metal roof with sarking, 1 layer of 13mm sound-rated plasterboard fixed to ceiling joists, R2 insulation batts in roof cavity.	
	Entry Door	45mm solid core timber door fitted with full perimeter acoustic seals	
	Floor	Concrete slab floor on ground	

Category No.	Building Element	Standard Constructions	sample
4	**Windows/Sliding Doors**	Openable with minimum 10.38mm laminated glass and full perimeter acoustic seals	
	Frontage Facade	**Brick Veneer Construction:** 110mm brick, 90mm timber stud or 92mm metal stud, minimum 50mm clearance between masonry and stud frame, R2 insulation batts in wall cavity, 10mm standard plasterboard internally.	
		Double Brick Cavity Construction: 2 leaves of 110mm brickwork separated by 50mm gap	
	Roof	Pitched concrete or terracotta tile or sheet metal roof with sarking, 2 layers of 10mm sound-rated plasterboard fixed to ceiling joists, R2 insulation batts in roof cavity.	
	Entry Door	45mm solid core timber door fitted with full perimeter acoustic seals	
	Floor	Concrete slab floor on ground	

Category No.	Building Element	Standard Constructions	sample
5	**Windows/Sliding Doors**	Openable Double Glazing with separate panes: 5mm monolithic glass, 100mm air gap, 5mm monolithic glass with full perimeter acoustic seals.	
	Frontage Facade	**Double Brick Cavity Construction:** 2 leaves of 110mm brickwork separated by 50mm gap with cement render to the external face of the wall and cement render or 13mm plasterboard direct fixed to internal faces of the wall.	
	Roof	Pitched concrete or terracotta tile or sheet metal roof with sarking, 2 layers of 10mm sound-rated plasterboard fixed to ceiling joist using resilient mounts, R2 insulation batts in roof cavity	
	Entry Door	Special high performance acoustic door required - Consult an Acoustic Engineer	*Door to acoustic consultant's specifications*
	Floor	Concrete slab floor on ground	
6	**All**	Consult an Acoustic Engineer	