koikas acoustics PTY LTD
CONSULTANTS IN NOISE & VIBRATION

Commercial 1 (Unit 27)
637-645 Forest Road
Bexley NSW 2207

+612 9587 9702
office@koikasacoustics.com
www.koikasacoustics.com

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ABN: 12 058 524 771

ACOUSTICAL REPORT

PROPOSED BOARDING HOUSE

27-28 PARK AVENUE, KINGSWOOD NSW

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Approved by	Nick Koikas M.A.A.S Acoustical Consultant
Client	Nassar Matta C/- CK Design Attention: Chris Khoury Email: chris@ckdesign.net.au

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1.0 INTRODUCTION

Koikas Acoustics Pty Ltd was engaged to prepare a noise impact assessment for the proposed development at 27-28 Park Avenue, Kingswood NSW seeking approval for the construction of a new boarding house with 64 boarding rooms, a communal room & managers room over three above ground floor levels with associated basement level parking.

For the DA proposal, the acoustic adequacy of the proposed design must be assessed in terms of standard planning guidelines issued by the Council in their Local Environment Plan (LEP) and Development Control Plan (DCP), and also in terms of other standard planning guidelines related to common sources of noise.

As per Council guidelines and other standard planning instruments, Koikas Acoustics has determined the following acoustical components require an assessment at the current DA stage:

1. **Mechanical plant** noise emission from the proposed development to neighbouring dwellings (determine criteria only).
2. **Operational** noise emission from the proposed development to neighbouring dwellings.
3. **Rail** noise associated with the T1 Line and its impact on future occupants of the development.
4. **Inter-tenancy sound-insulation** requirements for shared partitions within the building.

This report presents the results and findings of an acoustic assessment for the subject proposal. In-principle acoustic treatments and noise control recommendations are included (where required) so that the premises may operate in compliance with the nominated acoustic planning levels.

2.0 THE PROPOSAL

The development is proposed to occupy the site at 27-28 Park Avenue, Kingswood NSW. The application is for a new boarding house with 64 boarding rooms, a communal room & a manager's room over three above ground floor levels with two basement level parking. The current development design can be seen in architectural drawings as prepared by CK Design, detailed in Table 1. All calculations and noise modelled scenarios conducted for this assessment are referenced to these architectural drawings.

Table 1. Design drawings used in the assessment

Drawing Title	Drawing No.	Date	Project No.
Cover page	A1-01	May 20	20016-14
Site analysis	A1-03	May 20	20016-14
Site plan	A1-04	May 20	20016-14
Basement 2 floor plan	A1-05	May 20	20016-14
Basement 1 floor plan	A1-06	May 20	20016-14
Basement 1 floor plan	A1-07	May 20	20016-14
Ground floor plan	A1-08	May 20	20016-14
First floor plan	A1-09	May 20	20016-14
Second floor plan	A1-10	May 20	20016-14
Roof plan	A1-11	May 20	20016-14
Elevations	A1-12	May 20	20016-14
Elevations	A1-13	May 20	20016-14
Sections	A1-14	May 20	20016-14
Notes 1.	Detailed above are the plans and drawings available at the time of assessment. Where design changes are made without the prior knowledge of Koikas Acoustics, the assessment results and conclusions published within this report may be incorrect.		

The development location is situated in a primarily urban residential area. The subject site is classified as R3 'Medium Residential' as per relevant land zoning maps from Penrith Local Environmental Plan 2010. Surrounding properties are also predominantly residential in classification, also located within R3 'Medium Residential' zoning.

Prevailing ambient noise conditions on-site and in the local area are generally the result of typical environmental noise such as rail, distant traffic and localised domestic noise sources.

The subject site and surrounding properties are identified on the aerial photograph included in Figure 1.

Figure 1. Aerial photo of the subject site, monitoring location and surrounding area (image source – Six maps)

3.0 RAIL NOISE AND VIBRATION SURVEYS

Rail noise and vibration surveys were conducted by Koikas Acoustics on the 7th April 2021 at the subject premises. The location of each survey can be seen in Figure 1.

The assessment procedure of AS 2377-2002 considers that a minimum of 20 rail pass-by events should be recorded to acquire reliable noise and vibration data. 20 rail pass-by events were recorded during the survey, all of which were commuter trains.

Noise measurements were taken with a Type 1 NTi XL2-TA spectrum analyser sound level meter. The instrument was field calibrated with a Larson Davis CAL200 Precision Acoustic Calibrator before and after the survey. No system drift was recorded. The Sound Exposure Level (SEL) of each pass-by event was recorded in dB(A).

Rail vibration levels were measured with a Vibrock 901 seismograph. Vibration levels were recorded in directions x, y and z as unweighted R.M.S. acceleration. The survey data was subsequently analysed as per ISO2631-2:2003 to appropriate a Vibration Dose Value (VDV) in $m/s^{1.75}$ for each measured train pass-by event.

The calculated VDV's for all 20 recorded events were separated into groups of commuter and freight trains and then averaged. The average VDV for a single commuter and freight train pass-by event was then used to calculate the total DAY and NIGHT period VDV for all rail pass-bys.

A summary of the surveyed data is included below.

Table 2. Rail noise and vibration survey results

Description	Value	Measurement result
Noise from train pass-by	SEL	81 dB(A)
Vibration from train pass-by	VDV (i)	0.046 $m/s^{1.75}$
Notes 1. 2.	SEL = Sound Exposure Level VDV (i) = Vibration Dose Value for a single pass-by event	

4.0 ACOUSTICAL REQUIREMENTS

4.1 RAIL NOISE – ISEPP/DOP

As per Clause 87 of the State Environmental Planning Policy (Infrastructure) 2007, hereafter referred to as ISEPP, development for a residential, place of public worship, hospital, educational facility or child care centre use must be designed to consider the indoor noise amenity of future occupants.

Where the development is for residential use, the consent authority must be satisfied that the following internal rail levels will not be exceeded:

- L_{Aeq} 35 dB in any bedroom in the building between the hours of 10 pm and 7 am.
- L_{Aeq} 40 dB elsewhere in the building (excluding a garage, kitchen bathroom or hallway) at any other time.

Neither the ISEPP nor DoP guidelines specifically define a target level for sleeping areas during daytime hours. To maintain a level of consistency between indoor noise amenity in living and sleeping areas during daytime hours, an $L_{Aeq, (15\ hours}$ limit of 40 dB is adopted by Koikas Acoustics. A summary of the applied rail noise planning levels is included in Table 3.

ISEPP requires that before any application is determined under which this clause applies, consideration must be given to guidelines that are issued by the Director-General. It is the understanding of Koikas Acoustics that the Director-General has issued guidelines relating to the determination of suitable indoor noise levels for development with open windows allowing natural ventilation of indoor areas. The Director-General has recommended under this condition (open windows) that indoor noise levels should not exceed:

- L_{Aeq} 45 dB in any bedroom in the building between the hours of 10 pm and 7 am.
- L_{Aeq} 50 dB elsewhere in the building (excluding a garage, kitchen bathroom or hallway) at any other time.

The NSW Department of Planning (DoP) supports the design targets of ISEPP and the Director-General guidelines within their road/rail noise guidelines (*Development near rail corridors and busy roads, Interim Guideline 2008*).

As mentioned previously, neither the ISEPP nor DoP guidelines specifically define a target level for sleeping areas during daytime hours. Koikas Acoustics has adopted for living and sleeping areas during daytime hours an $L_{Aeq,\ 15\ hours}$ 50 dB for windows and doors open.

A summary of the applied rail noise planning levels is included in Table 3.

Table 3. Indoor design noise level [dB]

Design condition	Area	Noise metric	Day (7 am to 10 pm)	Night (10 pm to 7 am)
Windows/doors closed	Bedroom	L_{Aeq}	40	35
Windows/doors closed	Living area	L_{Aeq}	40	
Windows/doors open	Bedroom	L_{Aeq}	50	45
Windows/doors open	Living area	L_{Aeq}	50	

4.2 EPA NOISE POLICY FOR INDUSTRY

Noise emission design targets have been referenced from the NSW Environmental Protection Authority Noise Policy (EPA) for Industry (NPfI). The NPfI replaces the former Industrial Noise Policy, also prepared by the EPA.

The NPfI is designed to assess environmental noise impacts associated with scheduled activities prescribed within the Protection of the Environment Operations Act 1997, Schedule 1. It is also commonly used as a reference tool for establishing suitable planning levels for noise generated by mechanical plant and equipment and noise emission from commercial operations.

The guideline applies limits on the short-term intrusive nature of a noise or noise-generating development (project intrusive noise level), as well as applying an upper limit on cumulative industrial noise emissions from all surrounding development/industry (project amenity noise level).

The most stringent of the project intrusive noise level and project amenity noise level is applied as the **project noise trigger level**. The project noise trigger level is the point, above which noise emission from a source or development site would trigger a management response.

To be able to define the more stringent of the intrusive and amenity noise levels, the underlying noise metrics must be the same. As the intrusive noise level is defined in terms of an $L_{Aeq\ 15\ minutes}$ and the amenity noise level is defined in terms of an $L_{Aeq\ Period}$, a correction +3dB correction is applied to the project amenity noise level to equate the $L_{Aeq\ Period}$ to $L_{Aeq\ 15\ minutes}$.

4.3 PROTECTION OF THE ENVIRONMENT OPERATIONS (NOISE CONTROL) REGULATION 2017

Clause 45 of the regulation requires that air conditioning units installed on residential premises must not emit noise that is audible within a habitable room in any other residential premises between the hours of 10 pm and 7 am (Monday to Friday) or 10 pm and 8 am (Saturday, Sunday and public holidays).

4.4 INTER-TENANCY NOISE

In Class 2 or 3 buildings, the BCA acoustical Performance Requirements state that separating walls and floors must provide insulation against the transmission of airborne or impact generated sound sufficient to prevent illness or loss of amenity for the occupants.

A wall/floor partition is considered to satisfy BCA Performance Requirements where it is shown to:

- Have a laboratory tested acoustic rating that meets or exceeds the Deemed-to-Satisfy provisions of F5.4 to F5.7, or
- Complies with Specification F5.2, or
- Is tested on-site to achieve the minimum acoustic performance as defined within *Verification Methods* FV5.1 and FV5.2.

The Deemed-to-Satisfy provisions applying to this specific development are summarised below:

Table 4. BCA acoustic design requirements			
Partition	**Detail**	**Airborne sound**	**Impact sound**
Floor	Separating SOU's, or an SOU from a plant room, lift shaft, stairway, public corridor, public lobby or the like, or part of a different classification	Rw + Ctr ≥ 50	Ln,w ≤ 62
Wall *See notes 1 and 2*	Separating SOU's	Rw + Ctr ≥ 50	Not applicable
	Separating a habitable room (other than a kitchen) in one SOU from a bathroom, sanitary compartment, laundry, kitchen in another SOU	Rw + Ctr ≥ 50	Discontinuous construction
	Separating an SOU from a plant room or lift shaft	Rw ≥ 50	Discontinuous construction
	Separating an SOU from a stairway, public corridor, public lobby or the like, or part of a different classification	Rw ≥ 50	Not applicable
Door	Located in a wall separating an SOU from a stairway, public corridor, public lobby or the like	Rw ≥ 30	Not applicable
Services	Duct, soil, waste or water supply pipes located in a wall or floor cavity and serves or passes through more than one SOU (including a stormwater pipe)	Rw + Ctr ≥ 40 (habitable) Rw + Ctr ≥ 25 (other)	Not applicable
Pumps	A flexible coupling must be used at the point of connection between the service's pipes in a building and any circulating or another pump.		
Notes 1. 2. 3.	Where a wall is to achieve a sound insulation rating and has a floor above, the wall must continue to either the underside of the floor or to the ceiling which has a comparable sound insulation rating to the wall. Where a wall is to achieve a sound insulation rating and has a roof above, the wall must continue to either the underside of the roof or to the ceiling which has a comparable sound insulation rating to the wall. As defined by the BCA, a 'habitable room' means a room used for normal domestic activities such as bedroom, living room, lounge room, music room, television room, kitchen dining room, study, playroom, family room, home theatre and sunroom.		

5.0 MECHANICAL PLANT AND BUILDING USE NOISE IMPACTS

Mechanical plant and equipment on this project could include air conditioning condensers units where they are installed in the development and other ventilation plant required for basement levels and garbage rooms etc.

Outdoor common areas such as the outdoor communal area are considered to be noise generating areas associated with 'building use'.

5.1 PROJECT NOISE TARGETS

This noise is assessed as per the planning levels contained within the NPfI. Acoustic planning levels are largely determined with to the existing environmental noise levels. Noise surveys conducted for this assessment show that environmental noise levels can differ based on the location of a particular receiver and its orientation to major contributors of noise in the area, such as road corridors and commercial operations. The following NPfI planning levels apply for this project, based on logging conducted by Koikas Acoustic previously:

Table 5. NPfI planning levels

Period, T (Note 1)	Intrusive		Amenity					Project noise trigger level
	RBL	RBL + 5	Area classification	Recommended amenity noise level	High traffic area	Project amenity noise level	+3dB correction	
Day	38	43	Urban	60	No	55	58	43
Evening	37	42	Urban	50	No	45	48	42
Night	32	37	Urban	45	No	40	43	37

Notes
1. The NSW EPA Industrial Noise Policy refers to the following periods, Day – 7 am to 6 pm Monday to Saturday and 8 am to 6 pm Sunday and public holidays, Evening – 6 pm to 10 pm Monday to Sunday, Night – 10 pm to 7 am Monday to Saturday and 10 pm to 8 am Sunday and public holidays.
2. The amenity criterion is based on the area classification of the site as being 'urban' and has been corrected for an assessment in areas of high traffic and for existing industrial noise where applicable.
3. Project noise amenity level = recommended noise amenity level – 5dB, except where specific circumstances are met, such as high traffic.

Surrounding commercial properties must also not be exposed to noise that exceeds $L_{Aeq\ Period\ (business\ hours)}$ 63 dB during business hours.

At this stage, a mechanical design is yet to be completed. A detailed mechanical plant noise impact assessment is to be provided once the final mechanical design and specification have been completed.

5.2 CALCULATED RECEIVER LEVELS

Operational noise levels have been predicted to nearby residential receivers by way of preparing an acoustic model and conducting point-to-point calculations based on standard sound propagation algorithms. Reference should also be made to additional noise control recommendations included within Section 5.4 of this report, which also govern the calculated receiver noise levels.

Due to the size of the development, several potentially affected receiver locations must be assessed in terms of their respective noise exposure from 'building use' associated with the development. The most noise-sensitive receiver locations are summarised below.

R1	Residential townhouse (1st floor level)	30 Park Avenue
R2	Residential townhouse (1st floor level)	30 Park Avenue
R3	Residential townhouse (1st floor level)	30 Park Avenue
R4	Residential dwelling (ground floor level)	20 Joesph Street
R5	Residential dwelling (ground floor level)	18 Joesph Street
R6	Residential dwelling (ground floor level)	16 Joesph Street
R7	Residential dwelling (ground floor level)	26 Park Avenue
R8	Residential dwelling (ground floor level)	26 Park Avenue

Where noise levels are shown to comply at the above most noise affected properties, compliance is implied at other less sensitive properties.

5.3 CALCULATED NOISE LEVELS

The external common area is identified on the ground floor of the site neighbouring the internal community room, as well as a seating area occupying the southern boundary of the ground floor. Noise from the internal communal living area will be confined to indoor areas where windows and doors are closed. In this regard, the primary focus of the noise emission assessment is attributed to persons talking in the outdoor common area, especially during nighttime hours.

When predicting noise emission, conservatively 24 people are assumed to occupy the ground floor communal outdoor area with 50% talking with a normal vocal effort. Sound power levels attributed to a normal conversational voice are 68 dB L_{wAeq}.

Based on that there are 32 car parking spaces within the proposed car park area of the development site, a maximum of 20 vehicle movements into the car park is predicted at the peak

arrival/departure during the busiest 15-minute period. Noise from car engines igniting and doors slamming will be confined to internal areas within the garage and therefore have not been considered for this assessment.

Noise source levels are shown below:

Table 6. Noise Source and noise levels

Noise Source	Descriptor	Noise level [dB]	Location
A person talking with normal vocal effort	L_{WAeq}	68	Communal Open Spaces
Car entering/leaving the car park	L_{WAeq}	78	Carpark/Driveway

Calculated cumulative receiver noise levels are as follows:

Table 7. Predicted noise levels to residential and commercial receiver locations [dB] - $L_{Aeq\ 15\text{-}minutes}$

Receiver	Location Height	Predicted receiver noise levels	Night-time Criteria	Exceedance
R1	First Floor	13	**37**	-
R2	First Floor	17		-
R3	First Floor	39[1]		-
R4	Ground Floor	35		-
R5	Ground Floor	35		-
R6	Ground Floor	37		-
R7	Ground Floor	34		-
R8	Ground Floor	16		-
Notes 1.	Receiver locations are outside neighbouring windows. Noise reduction over a balustrade and through an open window with a non-direct line of sight is expected to be approximately 5-10 dB, therefore compliance with the limiting EPA NPfI criteria.			

Cadna/A noise contour diagrams are attached as **Appendix B.**

The noise impact from people talking in the outdoor spaces and cars traversing to the car park area is predicted to not exceed the night-time project noise trigger levels at any residential properties surrounding the proposed development site provided the recommendations outlined in Section 5.4 of this report are implemented. As the noise is predicted to comply with night-time NPfI guidelines, it is expected to also comply with the less stringent daytime and evening criteria.

5.4 RECOMMENDATIONS

- Boundary fences should be a minimum of 1.8 m high. Boundary fences should utilise the following construction:
    - Double lapped 15mm thick timber fence palings offset so that there are no air gaps. This equates to a total barrier thickness of 30 mm; OR
    - 15mm compressed fibre cement panels with no air gaps at the joins; OR
    - 6mm compressed fibre cement panels on either side of a 50 mm steel frame with fibre-glass insulation batts (14 kg/m^3) to the cavity, or
    - the equivalent in sound transmission loss.
- The outdoor communal area should not be occupied by more than 24 people at any one time during the night-time period.
- Doors to the indoor communal areas should be kept shut during the night-time period.

6.0 RAIL NOISE AND VIBRATION ASSESSMENT

6.1 NOISE

Calculating the resulting level of noise that is transmitted through a façade and into a room is dependent upon the external façade noise level, the sound insulation performance of the building façade (inclusive of all building components), and the level of acoustic absorption that is present within the subject room.

A calibrated CadnaA noise model was used to predict external façade rail noise levels. The calibrated model considered:

- Commuter trains generating an average SEL for each pass-by of 81 dB(A).
- 259 commuter trains passing by the site during daytime hours (7 am to 10 pm) – as per Sydney Trains timetables.
- 60 commuter trains passing by the site during night hours (10 pm to 7 am) – as per Sydney Trains timetables.

Maximum external façade traffic noise levels are expected to be:

Daytime $L_{Aeq,\ 15\ hours}$ 58 dB and

Night time $L_{Aeq,\ 9\ hours}$ 53 dB

at the upper floor level and along the southern façade of the building exposed to the rail corridor.

Reduced noise exposure along the sides of the building will result from the limited field of view of the rail corridor and partial noise shielding from adjacent buildings.

The least noise-exposed façade of the building will be along the northern boundary where a high level of noise shielding is generated by the subject building and surrounding buildings.

Indoor noise levels were calculated to certify the acoustic performance of the proposed building facade. The noise modelling and subsequent analysis conclude the following:

6.1.1 External walls

Table 8. External walls recommendations	
Recommended construction	**Area to which the recommendation applies**
AFS150 wall system	All external walls

6.1.2 Ceiling/roof

Table 9. Ceiling/roof recommendations	
Recommended construction	**Area to which the recommendation applies**
• 0.6mm metal clad • One layer of 18mm plywood • 150 mm timber joist with 100 mm Earthwool ceiling insulation (14 kg/m^3) • One layer of 13 mm standard plasterboard **OR** • 100 mm thick concrete slab	All ceiling/roof areas

6.1.3 Windows and doors

Table 10. Glazing recommendations		
Room	**Glass recommendation**	**Seals**
All areas	6.38 mm laminated glass	Q-lon and fin

In addition to the minimum glass recommendation, the installed window/glazed door systems (inclusive or framing and seals) must achieve a minimum acoustic rating of Rw 31 for 6.38mm thick laminated glass and comply with Notes 1 to 4 below.

Notes

1. Window frames should be tightly fitted to the external wall minimising any air gaps. Any air gaps present should be packed with timber and an appropriate acrylic sealant such as Knauf Bindex (or approved equivalent).
2. All open-able windows and glazed door systems should be airtight when closed.
3. Q-lon type seals or the equivalent should be fitted along the perimeter of all glazing systems to minimise air gaps. For sliding glass systems that cannot incorporate Q-lon seals, heavy-duty fin-type seals such as Schlegel SilentFin could be used. If the windows/doors are not designed to be air-tight when closed, the reduced performance of the windows/doors could compromise the acoustic integrity of the building facade.
4. Recommended glass systems are calculated based on current architectural drawings as established within this report.

Koikas Acoustics notes that the recommendations provided in this report are for the minimum required glazing that is predicted to achieve satisfactory acoustic performance. No consideration has been given to other factors such as safety, thermal or energy efficiency that may render the recommended glazing not compliant with other standards or guidelines. It is, therefore, the responsibility of the client to ensure all glazed windows and sliding doors installed on-site to meet all building design requirements.

6.1.4 Ventilation

In some cases where external rail traffic noise levels are high, it is not a viable option to naturally ventilate rooms through the opening of windows and/or doors. This is due to the level of traffic noise being transmitted through the open doors resulting in a breach of the applied noise criterion.

As a general rule, where windows or doors opened sufficiently to provide natural ventilation to a room, the indoor noise level is 10dB below the outside noise level. Therefore, a window or sliding door to a room may be opened to provide natural ventilation where the outdoor noise level does not exceed 10dB above the "Windows open" criteria as detailed within this report.

In this case, rail noise levels are not significant and naturally ventilated rooms are expected to still result in the 'open windows' noise criteria being achieved.

6.2 VIBRATION

Vibration levels (VDV) for individual pass-by events have been calculated from site survey results and are included in Table 3 of this report. Where the individual VDV values for commuter train pass-bys are corrected for the cumulative impact throughout the day and night periods based on the expected rail movements summarised above in Section 6.1, the total VDV for the day and night periods calculated for the future development are:

- Daytime total VDV (commuter and freight trains): 0.095m/s$^{1.75}$
- Nighttime total VDV (commuter and freight trains): 0.066m/s$^{1.75}$

These values are significantly below the human comfort thresholds recommended in the DEC guideline. As such, Koikas Acoustics expects a low probability of adverse comment.

7.0 INTER-TENANCY NOISE

The following recommendations are expected to satisfy the relevant provisions of the BCA sound insulation requirements between tenancies. Options have been provided in all cases that consider a range of standard constructions.

All wall systems should be installed as per general installation guidelines included in the BCA and as per relevant manufacturer installation guidelines/requirements.

Alternate systems and design may be considered to those recommended within this report provided that they are approved by an appropriately qualified acoustical engineer/consultant.

7.1 RECOMMENDED PARTITION WALLS

Table 11 recommends several partition wall systems that are capable of achieving the required acoustic performance.

Table 11. Recommended partition wall systems		
Wall type	**BCA design standard**	**Construction**
Inter-tenancy wall	Rw + Ctr ≥ 50 Discontinuous	*Partition wall between sole-occupancy units – Separating a habitable room (other than a kitchen) in one unit from a bathroom, sanitary compartment, laundry or kitchen in an adjoining unit* **[AFS]** AFS 162 Logicwall, 20mm cavity, 64mm steel studs with 75mm thick Tontine TSB4 insulation within the stud cavity, 10mm Soundcheck. **[Masonry]** Two leaves of 110mm clay brick masonry, 50mm cavity between the leaves (where brick ties are used they are to be of the resilient type), 13mm cement render to each side. *BCA D.T.S.* **[Concrete]** 125mm concrete panel, 20mm cavity, 64mm steel studs, 70mm polyester insulation (9kg/m^3) between the studs, 13mm plasterboard fixed to studs. *BCA D.T.S.* **[Hebel]** 13mm Fyrchek, 75mm Hebel Powerpanel, 35mm cavity, 64mm steel studs with 100mm S6 polyester insulation, 13mm Fyrchek/Aquachek. **[Lightweight]** 2x64mm steel studs, 20mm cavity, 60mm polyester insulation (11kg/m3) positioned between one row of studs, 2x13mm fire resistant plasterboard each side.
	Rw + Ctr ≥ 50	*Partition wall between sole-occupancy units* **[AFS]** AFS 162 Logicwall panel, paint or render finish. **[AFS]** AFS 162 Logicwall panel, 28mm furring channel, Tontine TSB2 insulation within the framing cavity, 13mm plasterboard. **[Masonry / Hebel / Lightweight]** As above. **[Concrete]** 200mm concrete panel, 13mm cement render of each face. *BCA D.T.S.*
Common wall	Rw ≥ 50 Discontinuous	*Partition wall between sole-occupancy unit and plant room or lift shaft* As above for inter-tenancy wall partitions that satisfy discontinuous construction
	Rw ≥ 50	*Partition wall between sole-occupancy unit and stairway, public corridor, public lobby or the like or part of a different classification* **[AFS]** AFS 150 Logicwall panel, paint or render finish. **[AFS]** AFS 162 Logicwall panel, paint or render finish. **[Masonry]** Single leaf 150mm brick masonry with 13mm cement render on each face. **[Concrete]** 125mm thick concrete panel. **[Hebel]** 13mm Gyprock CD, 75mm Hebel Powerpanel, minimum 20mm cavity, 64mm steel framing with 50mm glasswool insulation, 13mm Gyprock CD. **[Lightweight]** 92mm steel studs, 60mm polyester insulation (11kg/m3) positioned between the studs, 2x13mm fire-resistant plasterboard each side.
Services shaft wall	Rw+Ctr ≥40	*Services shaft wall to habitable room within unit* **[Masonry]** 110mm brick masonry with 13mm cement render on each face. *BCA D.T.S.* **[Concrete]** 100mm thick concrete panel. *BCA D.T.S.* **[Lightweight]** 2x13mm plasterboard, pipe lagging (Soundlag 4525C, Acoustilag 45)
	Rw+Ctr ≥25	*Services shaft wall to non-habitable room within unit* **[Lightweight]** 2 layers of 13mm plasterboard
Notes:1.	Recommendations within the above table are based on published acoustic data obtained from the manufacturer's website.	
2.	Laboratory tests of the AFS 162 Logicwall on its own showed non-compliance with the BCA requirement of Rw + Ctr 50. However, an investigation by PKA Consulting concludes that the poor acoustic performance was due to factors not related to the wall system, but rather the test facility. It is expected that the acoustic performance will satisfy the BCA condition. This conclusion is supported by numerous field tests that indicate compliance with the BCA verification methods rating.	
3.	All installation of proprietary type wall systems must be as per the relevant installation guidelines and manuals.	
4.	*BCA D.T.S.* =BCA Deemed-to-Satisfy construction. These wall systems are to be installed as per "Construction Deemed-to-Satisfy" notes included within Specification F5.2 of Volume One of the BCA. Where these systems are installed correctly as per the BCA they do not require compliance testing to verify acoustic performance.	

7.2 RECOMMENDED PARTITION FLOOR/CEILING

The following floor/ceiling assemblies are recommended to achieve the BCA minimum acoustic rating requirements.

Table 18. Typical acoustical performance achieved with Uniroll underlays that would achieve or better the BCA & Council's requirements	
Floor-type	**Construction details or underlay type**
Carpet	Carpet over carpet underlay over ≥ 150 mm concrete slab will typically achieve L'nTw ≤ 40
Direct Stick Tiles	- 9 or 10 mm ceramic tiles over - 5 mm adhesive over a composite underlay **RFC**750 (4.5 mm) **RF**700 (4- 5- 10 mm)RF700 over - 200 mm thick concrete slab over - 100 mm ceiling cavity and - 13 mm plasterboard ceiling will typically achieve L'nTw ≤ 50
Under Screed Tiles	- 9 or 10 mm ceramic tiles over_ - 5 mm glue over - 30 mm screed over RFC750 (4.5mm) or RF700 (5mm) over - 200 mm concrete slab over - 100 mm ceiling cavity and - 13 mm plasterboard ceiling will typically achieve L'nTw ≤ 50
Direct Stick Or	***- 19 mm strip timber*** over - adhesive over - 15 mm ply + RFC700 (4, 5 or 10 mm) over - 200 mm concrete slab over - 100 mm ceiling cavity and - 13 mm plasterboard ceiling will typically achieve L'nTw ≤ 50
Floating Floor	***- Engineered floating floor*** over - 2 mm foam slip layer + RF700 (4, 5mm) - 200 mm concrete slab over - 100 mm ceiling cavity and 13 mm plasterboard ceiling will typically achieve L'nTw ≤ 50
Direct Stick Vinyl Flooring	- Vinyl flooring over - RF700 (3, 4, 5 or 10 mm) over - 200 mm concrete slab over - 100 mm ceiling cavity and - 13 mm plasterboard ceiling will typically achieve L'nTw ≤ 55

Notes

RF Rubber foam composite

RFC Rubber foam cork composite

Alternative underlay suppliers could also be considered.

If there is no suspended ceiling beneath the concrete slab, the acoustical impact noise rating would reduce by up to 8 rating points.

The above recommendations also apply to balconies/terraces situated above indoor areas of apartments below.

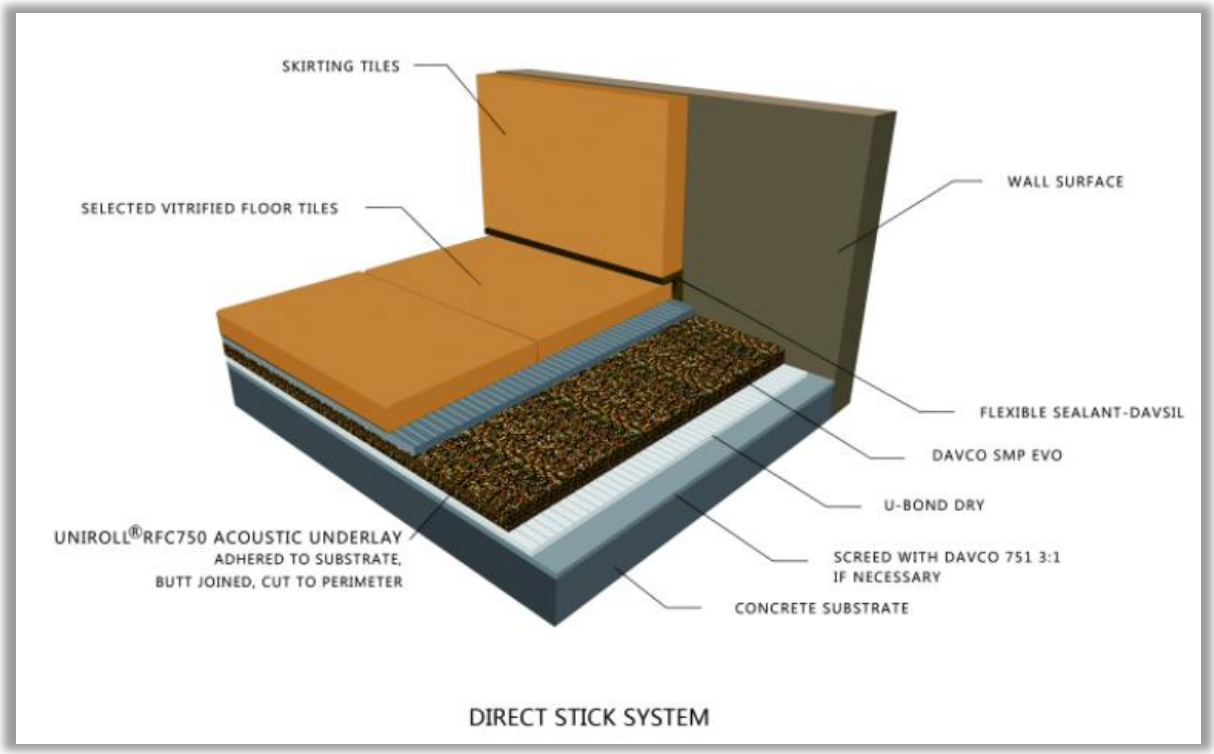
7.2.1 Installation requirements

All flooring and acoustic underlays should be installed as per relevant manufacturers installation and design guides.

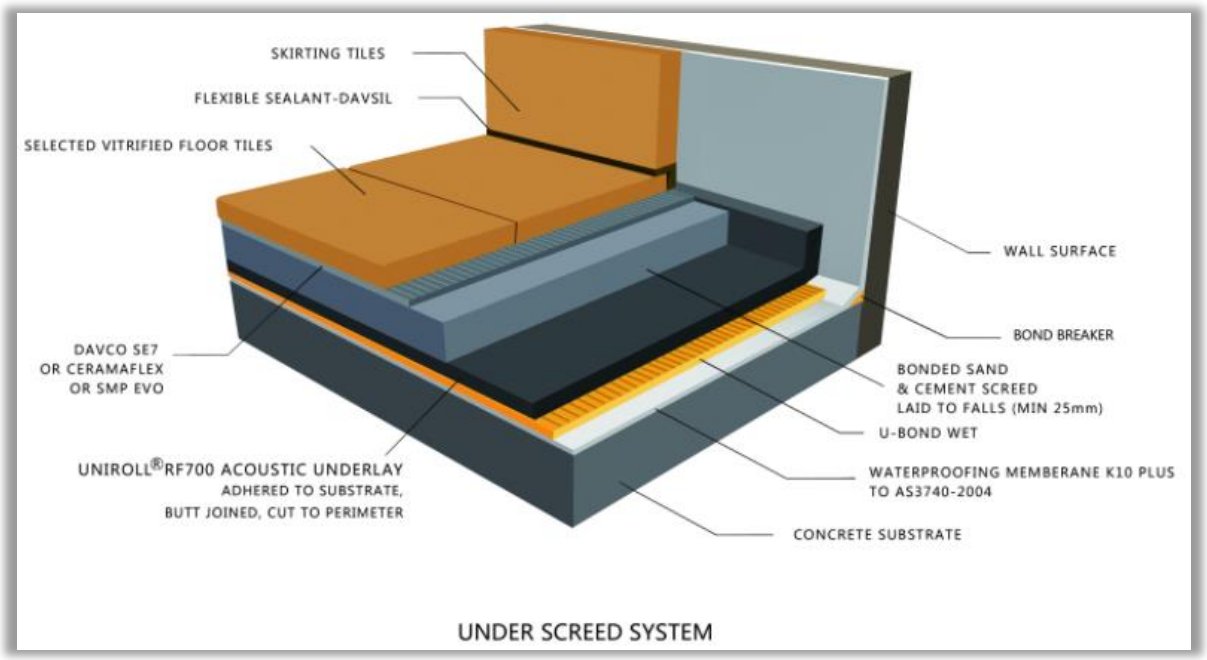
Hard floor coverings such as tiles must not make contact with any walls or joinery such as kitchen benches, cupboards etc.

During the installation of hard floor coverings, temporary spacers of 5 - 10 mm should be used to isolate the floor covering from walls and/or joinery with the resulting gaps filled with a suitable mastic type sealant or off-cut of rubber-underlay material. Most acoustic underlay manufacturers include a construction detail in this regard that involves an upturn of the rubber underlay material at the wall/floor junction.

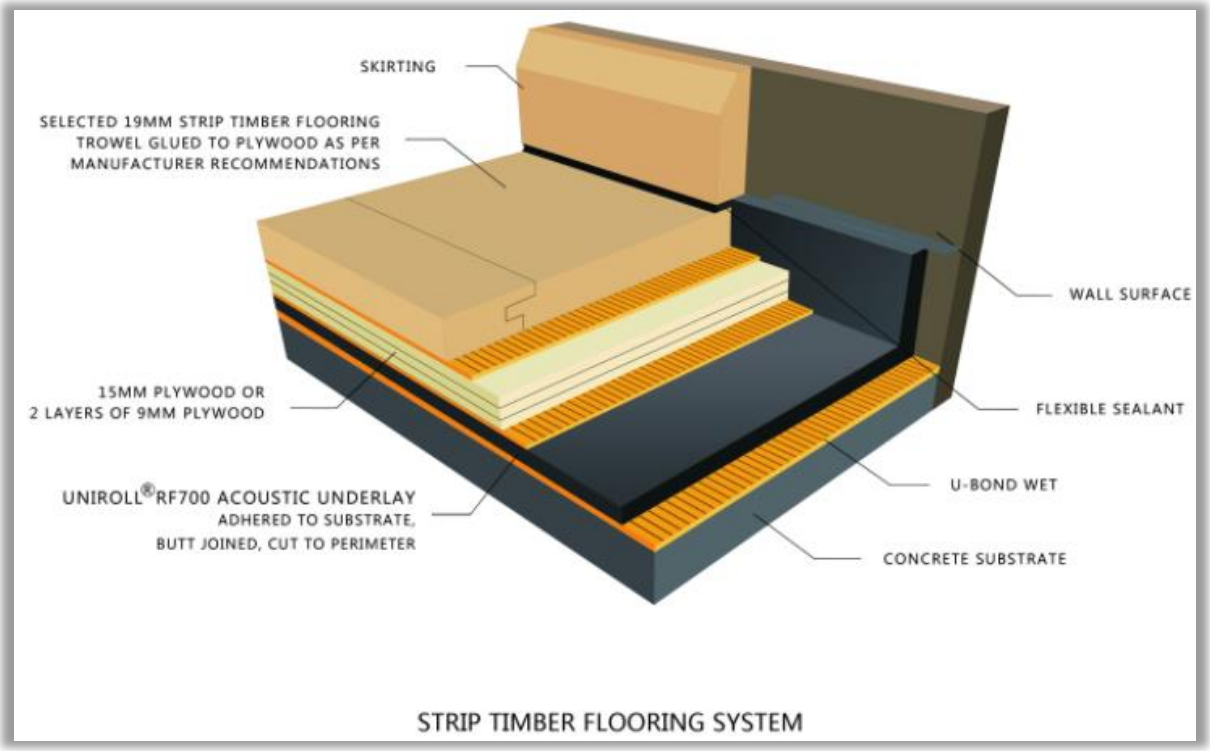
The following diagrams show detailed installation requirements of different flooring systems in conjunction with underlays.



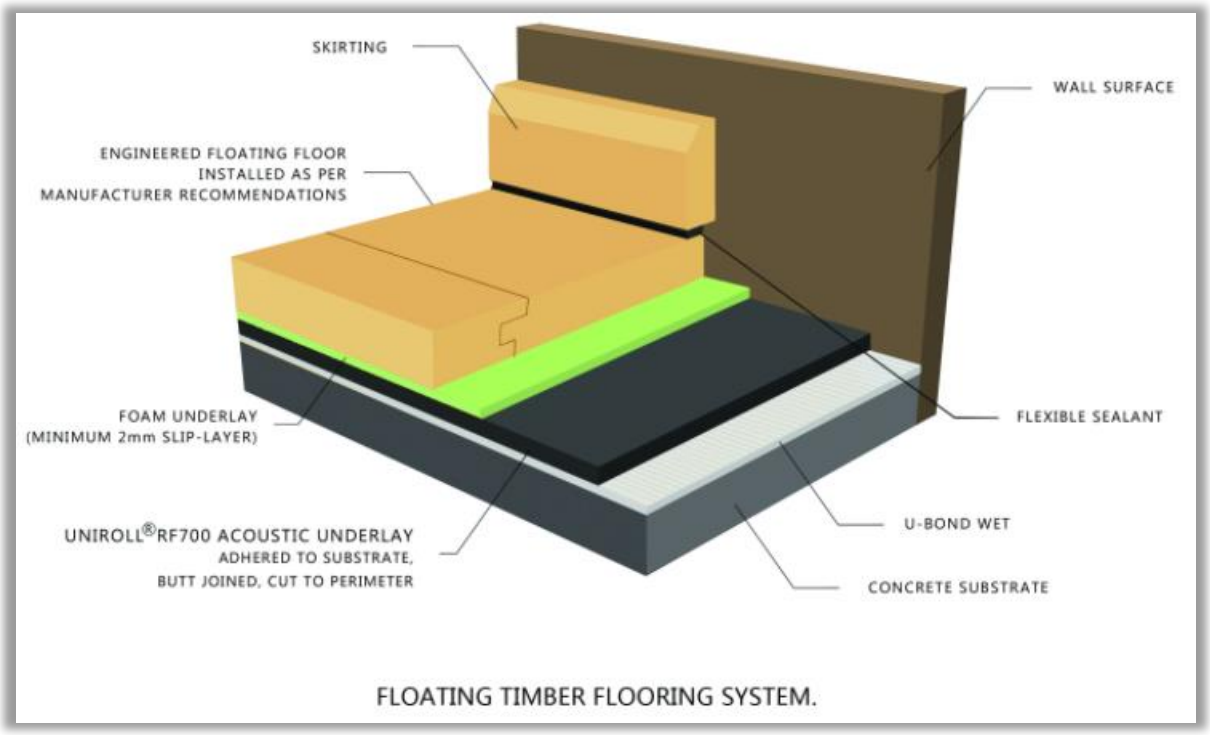
DIRECT STICK SYSTEM



UNDER SCREED SYSTEM



STRIP TIMBER FLOORING SYSTEM



FLOATING TIMBER FLOORING SYSTEM.

7.2.2 Alternative ceiling/floor systems

Alternative floor/ceiling systems can be considered provided that the acoustic performance is tested or assessed by a consulting acoustical engineer as being compliant with the sound insulation performance requirements of the BCA.

Verification of installed acoustic performance should be determined following the recommendation of Section 5.5 of this report.

7.2.3 NATA certified ceiling/floor systems

Flooring systems tested in a NATA or an equivalent International Laboratory Accreditation Cooperation Mutual Recognition Arrangement (ILAC MRA) certified laboratory and complying with the acoustical performance requirements of the BCA do not require that they be tested in-situ for verification of installed acoustic performance.

Flooring systems not tested by a NATA or ILAC MRA certified laboratory should be tested before any flooring is installed to ensure that the flooring systems comply with the BCA's impact-noise rating requirements.

7.2.4 Impact-noise rating performance

Impact-noise ratings derived from in-situ testing can vary from site to site and between different

space within the same building constructed of the same building materials.

Impact-noise rating differences can arise from:

- the type of flooring installed
- whether the flooring is touching the walls creating bridging,
- whether the flooring is in contact with the skirting boards creating bridging,
- the thickness of floor slabs,
- the air gap between the plasterboard ceiling and the concrete slab,
- the sealing between the plasterboard and the walls,
- the thickness and density of the plasterboard ceiling,
- the degree of sealing between the plasterboard ceiling and the down-lights,
- the connections of the suspended ceiling grid to the concrete slab,
- the insulation installed or not installed in the cavity,
- the surface area of the floor,
- the geometry of the floor surface,
- flanking paths between the concrete slab and the wall types, and
- the junctions between the slab and the walls.

7.2.5 Verification of Acoustic Performance

The recommendations for partition construction details included in this report are not BCA certifications of acoustic compliance. The recommendations are based on our professional opinion of acoustic performance ratings. Due to the number of variables that can exist between development sites, it is not possible to confirm acoustical compliance without conducting in-situ testing.

Koikas Acoustics recommends that in-situ testing is conducted on representative and fully installed partition assemblies to ensure adequate acoustic insulation and isolation is achieved before installation throughout the development.

7.2.6 Ceiling lining

Standard 13 mm plasterboard ceiling lining is satisfactory. Where a fire-rated ceiling is required, 13 mm or 16 mm fire-rated plasterboard may be used instead of standard plasterboard.

7.2.7 Insulation in ceiling cavities

Acoustic insulation in the ceiling cavities is not required provided that the depth of the ceiling cavity is no less than 100mm and that the suspended ceiling system used is a light steel grid type system such as Rondo Key-lock or similar.

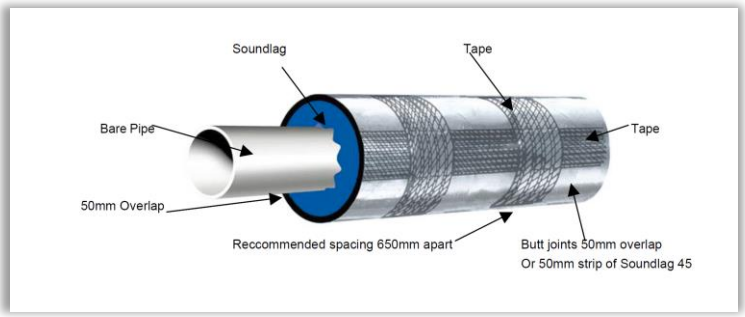
Where ceiling cavities are less than 100 mm in-depth, 50 mm fibreglass insulation (11kg/m^3 density) is recommended.

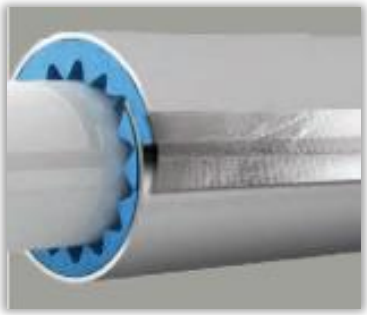
7.3 SOIL, WASTE, WATER SUPPLY PIPES

Where a duct, soil, waste or water supply pipe is located within a wall or ceiling cavity and serves or passes through one or more SOU's, the following separation details may be used to comply with the required acoustic rating:

Table 9. Services in cavity wall or ceiling

Option	Rating	Documented source	System detail
1	Rw + Ctr 25	CSR Red Book, KA opinion	2 layers of 10 mm plasterboard
2	Rw + Ctr 25	CSR Red Book	Acoustilag 45 and 13 mm plasterboard wall/ceiling lining
3	Rw + Ctr 25	CSR Red Book	Unlagged pipes and 13 mm Soundchek wall/ceiling lining. Alternatively, 2 layers of 16mm Fychek may be used as wall/ceiling lining
4	Rw + Ctr 40	CSR Red Book	Acoustilag 45 and 13 mm Soundchek wall/ceiling lining. Alternatively, 2 layers of 16 mm Fychek may be used as wall/ceiling lining
5	Rw + Ctr 40	Pyrotech Soundlag 4525C brochure	Soundlag 4525C and minimum 10 mm plasterboard wall/ceiling lining
Notes: 1. 2. 3.	The acoustic lagging material may be excluded by using Rehau Raupiano Plus pipe system. All installations are to be as per relevant manufacturers' specifications and requirements. Incorporating downlights into ceilings will impact the acoustic rating of the partition system. Consultation should be made with an acoustic consultant in the event of downlights being proposed in the ceiling. The CSR Red Book provides some guidance on downlights being installed in a services partition system.		





Photos by Pyrotek

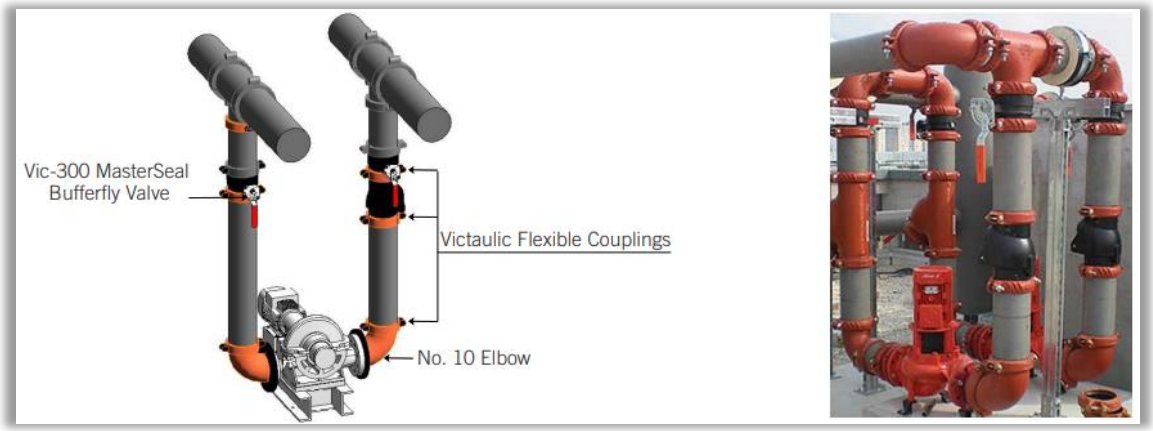
7.3.1 Additional BCA requirements

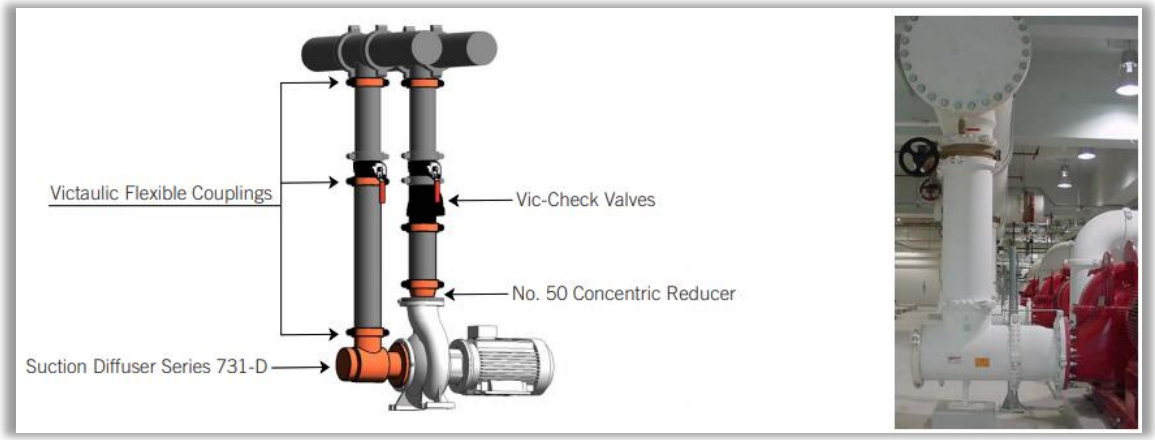
The BCA further qualifies the acoustic requirements of services partitions with the following:

- Services must not be chased into concrete or masonry elements,
- An access door or panel must be firmly fixed to overlap the frame or rebate the frame by not less than 10 mm and be fitted with proper sealing gasket along all edges and constructed of:
- Wood, particle board or block board not less than 38 mm thick; or
- Compressed fibre reinforced cement sheeting not less than 9 mm thick; or
- Other suitable material with a mass per unit area not less than 24 kg/m^2.
- A water supply pipe must only be installed in the cavity of discontinuous construction, and in the case of a pipe that serves only one SOU, must not be fixed to the wall leaf on the side adjoining any other SOU and have a clearance not less than 10 mm to the other wall leaf.

7.4 SOUND ISOLATION OF PUMPS

A flexible coupling must be used at the point of connection between the service's pipes in a building and any circulation or another pump.





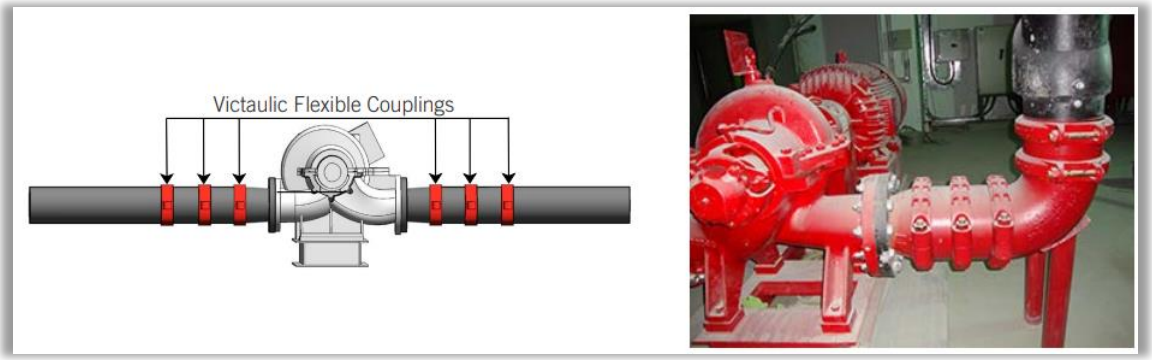
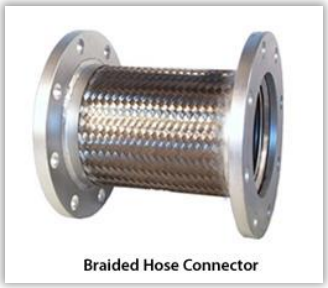


Photo by Victaulic

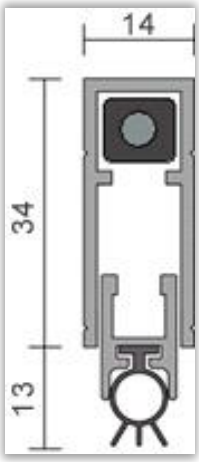


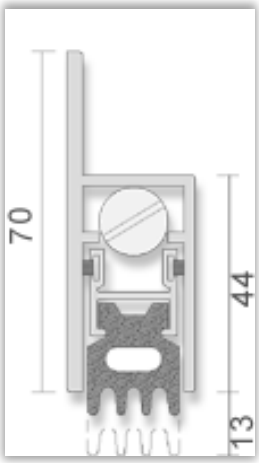
Photos by Empowering Pumps & Equipment

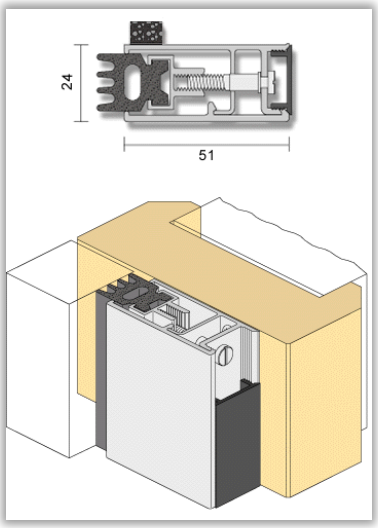
Photo by Plumbers Mate Ltd

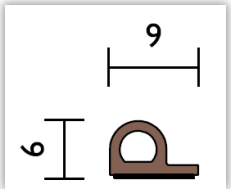
7.5 UNIT ENTRY DOORS

Where an entry door is incorporated into a wall that separates a tenancy from a common area such as a Lobby/Foyer, that door must achieve an acoustic rating of no less than R_w 30. A suitable door system to achieve this would be a 40 mm solid core timber door with Raven type RP10/RP10si door frame/perimeter seals and RP8si door bottom seals.









RP8Si RP38 RP24 RP48

The Schlegel type or other equivalent door seals can be considered provided that they provide comparable acoustical sound transmission loss performance.

7.6 VERIFICATION OF ACOUSTIC PERFORMANCE

It is common for comparable floor/ceiling systems designs to achieve varying acoustic insulation and isolation ratings between buildings. This can be due to the quality of workmanship, attention to detail in sealing any penetrations, and the emergence of flanking sound transmission paths within a building. For this reason, one cannot categorically state that any partition will achieve a specific acoustic rating without conducting in-situ testing.

Koikas Acoustics recommends that in-situ testing is conducted on a representative, and fully installed floor/ceiling assembly (for all types of floor coverings – timber, tiles, carpet) to ensure adequate acoustic insulation and isolation is achieved, before installing all floors on all floor levels of the building.

8.0 CONCLUSION

Koikas Acoustics was requested to prepare an acoustic report for the proposed boarding house at 27-28 Park Avenue, Kingswood NSW. The acoustic report is to accompany a development application being submitted to Penrith City Council.

The assessment considers potential noise impacts to future occupants of the development, and to surrounding residents such that acceptable acoustic amenity for the area is maintained.

Acoustic planning levels have been referenced from current ISEPP, NSW DoP, EPA, and BCA acoustic planning guidelines and requirements.

The included recommendations are based on designs prepared by CK Design.

The conclusions reached in this report should assist Council in making their determination of the proposal in terms of compliance with the necessary acoustic design requirements. A further detailed acoustic report may be required for the CC submission should the building design be amended, or as required by Council.

Of the assessed components of noise, the following conclusions have been reached:

1. Building noise is not expected to exceed the nominated criteria provided the recommendations outlined in section 5.4 of this report are properly implemented.
2. A detailed assessment of mechanical plant noise should be prepared for the subject development before construction. Where air conditioning and other mechanical ventilation systems not be proposed, the recommendations provided in this report would be voided.
3. The building can be sufficiently insulated against existing external sources of noise in the area such as rail traffic through the use of acoustic glazing. Recommended glazing systems are provided in this report. These recommendations should be verified before construction.
4. Acoustic treatment options for the common floors and services partitions included within this report would be adequate for satisfying the sound insulation provisions of the BCA.

In our professional opinion, there is sufficient scope within the proposed building design to achieve the applied acoustic planning guidelines.

APPENDIX A

APPENDIX A

APPENDIX A

**** Cadna/A ****
(Scenario 1 - Operational Noise)

Noise Sources:

~ 24 x People in the outdoor communal area 50% speaking with a normal vocal effort
~ Cars traversing the driveway

Note:

- LAeq15min noise level contours and receiver points R4 - R8 are 1.5 m above the natural floor level.

- Receiver points R1- R3 are 1.5 m above the first floor level

- The maximum reading at the nearest resident is 39 dB

PRINT DATE: 08/04/21

Point Source
Line Source
Building
Barrier
Contour Line
Receiver
Calculation Area

> 35.0 dB
> 40.0 dB
> 45.0 dB
> 50.0 dB
> 55.0 dB
> 60.0 dB
> 65.0 dB
> 70.0 dB
> 75.0 dB
> 80.0 dB
> 85.0 dB

koikas acoustics PTY LTD
CONSULTANTS IN NOISE & VIBRATION

JOB NUMBER: 4661
CLIENT: Nassar Matta
SITE ADDRESS: 27-28 Park Avenue, Kingswood
ASSESSED TO: EPA's Noise Policy for Industry
LIMITING CRITERIA: 37 dB(A) - Residential (Night)

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