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ACOUSTICAL REPORT

PROPOSED BOARDING HOUSE

27-28 PARK AVENUE, KINGSWOOD NSW

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ACOUSTICAL REPORT

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27-28 PARK AVENUE, KINGSWOOD NSW

CONTENTS

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. Rail noise associated with the T1 Line and its impact on future occupants of the development.
2. Operational noise emission from the proposed development to neighbouring dwellings (determine criteria only).
3. Mechanical plant noise emission from the proposed development to neighbouring dwellings (determine criteria only).
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 & 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 as Figure 1.

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

3.0 ACOUSTICAL REQUIREMENTS

3.1 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} 35dB in any bedroom in the building between the hours of 10 pm and 7 am.
- L_{Aeq} 40dB elsewhere in the building (excluding a garage, kitchen bathroom or hallway) at any other time.

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*). The DoP guideline further defines the duration under which noise levels are assessed, being $L_{Aeq\ 9\ hours\ (10\ pm\ to\ 7\ am)}$ for bedrooms and $L_{Aeq\ 15\ hours\ (7\ am\ to\ 10\ pm)}$ elsewhere.

A summary of the applied rail noise planning levels is included in Table 2.

Table 2. Design criteria for internal spaces			
Description	**Area**	**Period**	**L_{Aeq} (Period) [dB]**
Windows and doors closed	Bedrooms	10 pm to 7 am	35
	Living areas	At any time	40
Windows & doors open (natural ventilation)	Bedrooms	10 pm to 7 am	45
	Living areas	At any time	50

3.2 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 a $L_{Aeq\ 15\ minutes}$ and the amenity noise level is defined in terms of a $L_{Aeq\ Period}$, a correction +3dB correction is applied to the project amenity noise level to equate the $L_{Aeq\ Period}$ to $L_{Aeq\ 15\ minutes}$.

3.3 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 10pm and 7am (Monday to Friday) or 10pm and 8am (Saturday, Sunday and public holidays).

3.4 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 or 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 3. 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.		

4.0 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 terrace/balconies are considered to be noise generating areas of the 'building use'.

4.1 PROJECT NOISE CRITERIA

Mechanical plant noise is assessed as per the planning levels contained within the NPfI. Acoustic planning levels are largely determined in relation to the existing environmental noise levels. The following NPfI planning levels apply for this project:

Table 4. NPfI planning levels [dB]

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[3]	43	Urban	60	No	55	58	43
Evening	37[3]	42	Urban	50	No	45	48	42
Night	32[3]	37	Urban	45	No	40	43	37

Notes
1. EPA defines the following time periods, Day – 7am to 6pm Mon to Sat and 8am to 6pm Sun and public holidays, Evening – 6pm to 10pm Mon to Sun, Night – 10pm to 7am Mon to Sat and 10pm to 8am Sun and public holidays.
2. Project noise amenity level = recommended noise amenity level – 5dB, except where specific circumstances are met, such as high traffic.
3. Koikas Acoustics has utilised noise levels conducted in the surrounding area. Site specific noise levels are to be confirmed once noise monitoring is completed onsite.

Mechanical plant noise levels assessed to nearby commercial properties are not to exceed a recommended project amenity noise level of $L_{Aeq\ Period}$ 63dB during business hours.

For residential air conditioning units to comply with the POEO (Noise Control) Regulation 2017 night-time inaudibility requirement, the predicted level should be 5-10dB lower than the existing night-time background noise level. The adopted inaudibility threshold is $L_{Aeq\ 15\ minutes}$ 22-27 dB.

4.2 DESIGN SCENARIOS

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.

4.3 RECOMMENDATIONS

For the mechanical plant noise level not to be intrusive at the adjoining/surrounding residential premises, noise mitigation measures are required to attenuate the noise levels generated by the mechanical plant. The following noise mitigation measure may be required (this is to be verified once the design details becoming available at a later stage):

Table 5. Recommended Noise Mitigation Measures to Mechanical Plant

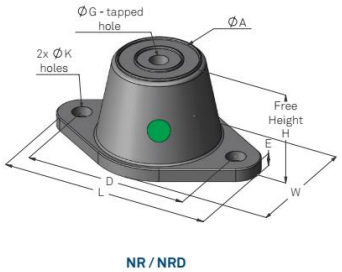
Mechanical Plant	Noise Mitigation Measures

Residential Outdoor AC Condenser Unit	• It is assumed that the Daikin FTXM46QVMA outdoor AC condensing unit is used. The sound power level is not to exceed L_{WAeq} 60 dB.
	• The distance between the outdoor AC unit and the nearest residential boundary is not to be less than 3 metres, alternatively, a noise barrier between the outdoor AC unit and the noise-affected residential may be required (to be verified).
	• "Night-time Quiet Mode" operation may require to be activated if any AC is to operate during the night-time period. This will reduce the overall noise level by up to 3 dB.
	• Footings/supports of outdoor AC units must be vibration isolated to minimise structure-borne vibrations transmitting into floor slabs/walls which will manifest as airborne noise.
	• Boundary fences should be a minimum 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 either side of a 50 mm steel frame with fibre-glass insulation batts (14 kg/m^3) to the cavity.

Carpark exhaust fan	• The first 3 m of the car park exhaust fan internal ducting should be lined with 50 mm thick fibreglass duct lining material that has a density of no less than 32 kg/m^3.

Furthermore, ductwork in risers adjacent to habitable spaces (if any) must be vibration isolated to minimise structure-borne vibrations transmitting into walls which would otherwise manifest as airborne noise in those spaces.

Rubber mounts for air-conditioning units that could be used are as follows:



NR / NRD

Embelton Rubber Mounts Type NR/NRD.

5.0 EXTERNAL NOISE INTRUSION ASSESSMENT

Calculating the level of traffic 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.

As per *AS3671-1989 Acoustics – Road traffic noise intrusion*, the prediction of façade traffic noise levels considers a forecast increase in traffic volumes over a 10 year planning period. In the absence of RMS traffic volume data for the specific road corridor, Koikas Acoustics has adopted a forecast 2% p.a. increase in traffic volumes over 10-years.

5.1 FAÇADE TRAFFIC NOISE LEVELS

Koikas Acoustics has conducted noise monitoring in the area is expect external façade rail noise to be $L_{Aeq\ 15\ hour}$ 63-68 dB / $L_{Aeq\ 9\ hour}$ 58-63 dB along the southern façade of the building fronting the T2 train line. Reduced noise exposure along the sides of the building will result from the limited field of view of traffic and partial noise shielding from adjacent buildings. The least noise-exposed façade of the building is at the rear of the proposed building where a high level of noise shielding is generated by the subject building and surrounding buildings. Noise levels are to be confirmed once noise monitoring is completed onsite.

5.2 RECOMMENDED CONSTRUCTION MATERIALS

Indoor noise levels were calculated to determine the acoustic performance of the proposed building facade. All recommendations are to be confirmed once noise monitoring is completed onsite. The noise modelling and subsequent analysis conclude the following:

5.2.1 External walls

Table 6. External walls recommendations

Recommended construction	Area to which the recommendation applies
AFS150 wall system	All external walls

5.2.2 Ceiling/roof

Table 7. Ceiling/roof recommendations	
Recommended construction	**Area to which the recommendation applies**
Proposed metal roof consisting of: • Sheet metal roof; • 18mm plywood; • 150mm joist with 100mm insulation (14kg/m3), and • 13mm standard plasterboard. Alternatively, a 100mm thick concrete slab.	All ceiling/roof areas

5.2.3 Glass windows and doors

Recommendations for glass windows and doors are included in Table 8.

Table 8. Glazing recommendations		
Room	**Glass recommendation**	**Seals**
U01-04 & U22-27	10.38mm laminated glass, or 6.38mm laminated + 46 mm air gap + 8.38 mm laminated	Q-lon and fin
All other areas	6.38mm 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 laminated glass;
- Rw 34 for 10.38mm laminated glass;
- Rw 45 for 6.38mm laminated + 46 mm air gap + 8.38 mm laminated;
- and comply with Notes 1 to 5 below.

Koikas Acoustics notes that the recommendations provided in this report are for the minimum required glazing predicted to achieve satisfactory acoustic performance. Design factors such as safety, thermal or energy efficiency are outside the scope of this report and should be assessed accordingly. It is the Client's responsibility to ensure all glazed windows and sliding doors installed on-site to meet all building design requirements.

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.

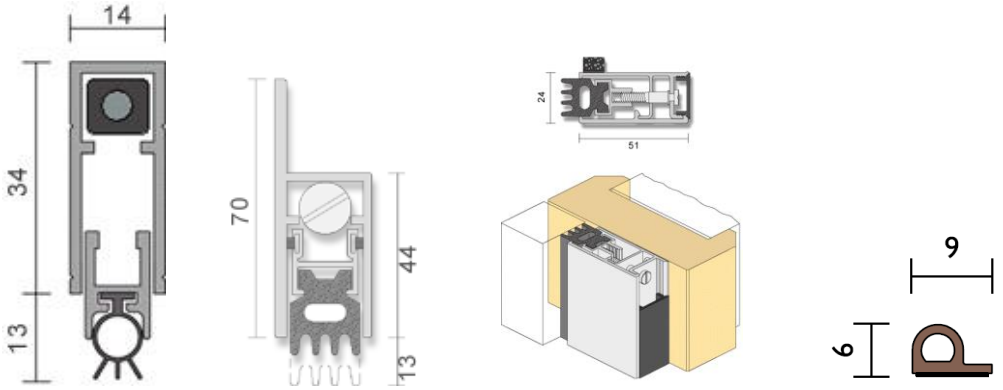
3. Q-lon type seals or the equivalent should be fitted along the perimeter of all glazing systems to minimise air gaps. For sliding glass systems that cannot incorporate Q-lon seals, heavy-duty fin-type seals such as Schlegel SilentFin could be used. If the windows/doors are not designed to be air-tight when closed, the reduced performance of the windows/doors could compromise the acoustic integrity of the building facade.
4. Recommended glass systems have been calculated based on current architectural drawings as established within this report.

High performing glazed window/door systems can be supplied and installed by Eco Aluminium. Mob 0475 770 272. Web: www.ecoaluminium.com.au. Other reputable suppliers can also be considered.

5.2.4 Timber entry doors

The entry door to the boarding rooms and the Communal Room should be a minimum 35-40mm thick solid-core timber with acoustic perimeter and door bottom seals. Suitable acoustic seals could be Raven type RP10/RP10si door frame/perimeter seals and RP8si door bottom seals, or an approved equivalent from another manufacturer.

For timber doors incorporated into a partition separating a sole-occupancy unit from a common area, hallway or lobby area, that door is required to provide an Rw of not less than 30. A suitable door system for this purpose would be a 40 mm solid core timber door with Raven type acoustic perimeter and drop seals.



RP8Si RP38 RP24 RP48

The Schlegel type equivalent is also recommended as an alternative door seal.

Any glass inserts in external doors should be a minimum 10.38 mm laminated glass.

5.2.5 Ventilation

In the event of high external traffic noise levels, naturally ventilating rooms through the opening of

windows and/or doors may not be suitable. 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.

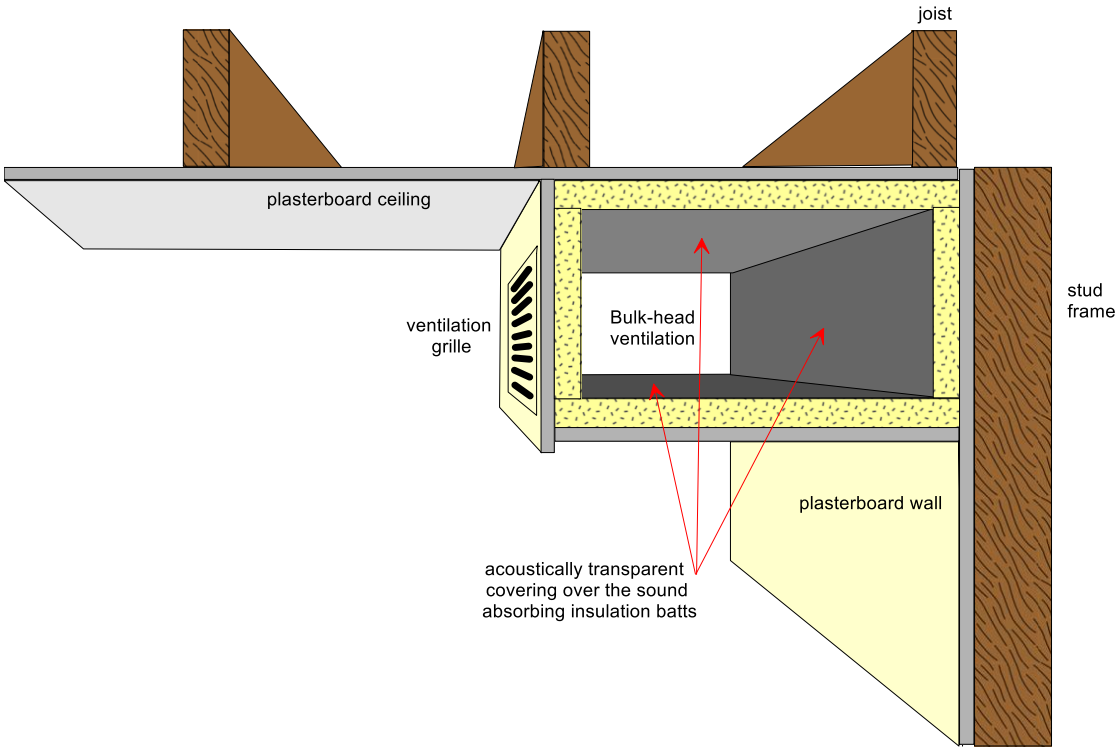
For this development, the U01-04 & U22-27 are all not suitable for natural ventilation through open windows/doors. Therefore, windows and doors will need to be closed in order to achieve the acoustic criteria. The design of the ventilation to these rooms is to consider windows and doors being closed.

All other rooms may be naturally ventilated through open windows/doors.

For rooms requiring an alternate source of ventilation other than open windows/doors, the following may be considered (subject to review by a ventilation expert):

- Borrowed air from elsewhere in the dwelling/unit.
- Incorporating a component of fresh air into a ducted air conditioning system
- Installing a small air supply fan and acoustically treated duct. This could include:
    - Round or square ceiling mounted ventilation duct fan incorporating a minimum of 3 metres of sound-absorbing to the inner surfaces of the ductwork
    - DuctTech Phone: (02) 9674 157
    - Email: salesnsw@ducttech.com.au

- Installing a small air supply fan and acoustically treated duct into a ceiling bulkhead



- Installing a wall-mounted ventilator such as the Acoustica Aeropac or similar

It is important to note that any proposed ventilation solution should be reviewed by a suitably qualified ventilation expert.

Any penetrations in the walls or roof to accommodate ventilation system/s should not impact the acoustic integrity of the building façade. An acoustical engineer should review any proposed ventilation solution that proposes a penetration of the building façade.

6.0 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.

6.1 RECOMMENDED PARTITION WALLS

Table 9 recommends several partition wall systems that are capable of achieving the required acoustic performance.

Table 9. 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.

6.2 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.

The above floor systems have been assessed to comply with the BCA airborne and impact sound insulation requirements. **The 'for construction' floor systems should be re-assessed at the detailed design stage.**

Verification of installed acoustic performance should also be determined as per the recommendations of Section 7.5 of this report.

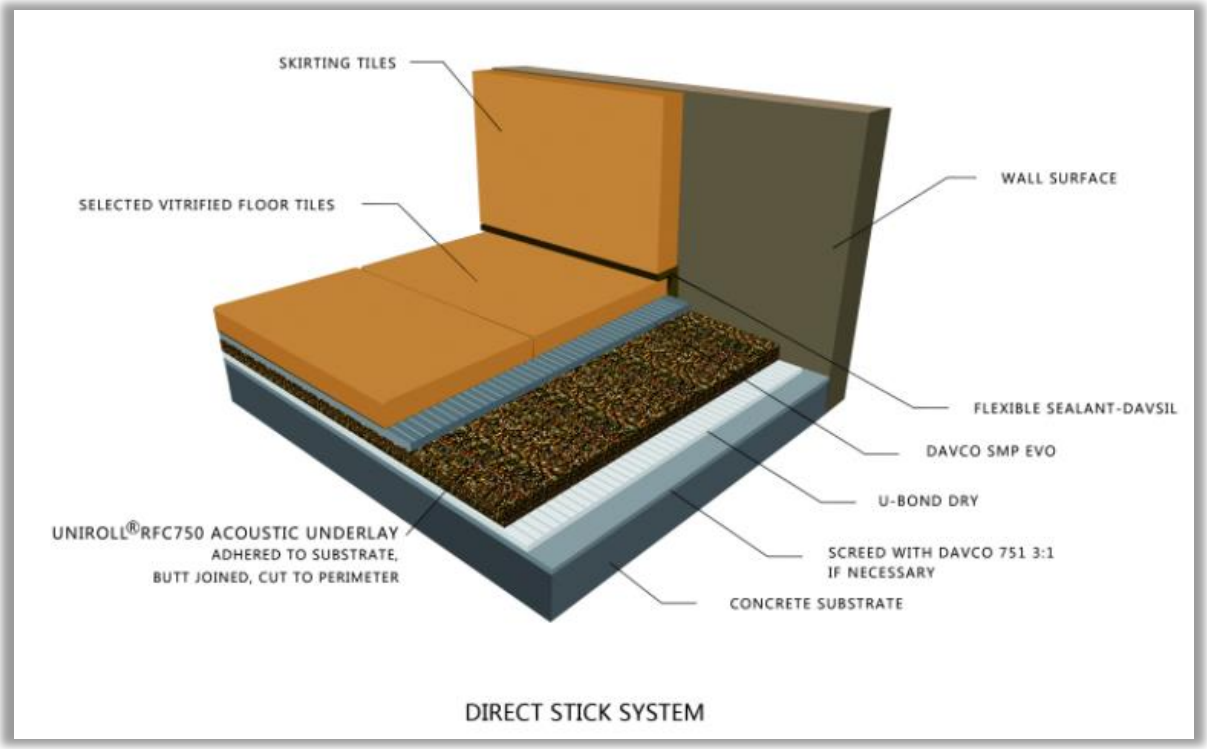
6.2.1 Installation requirements

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

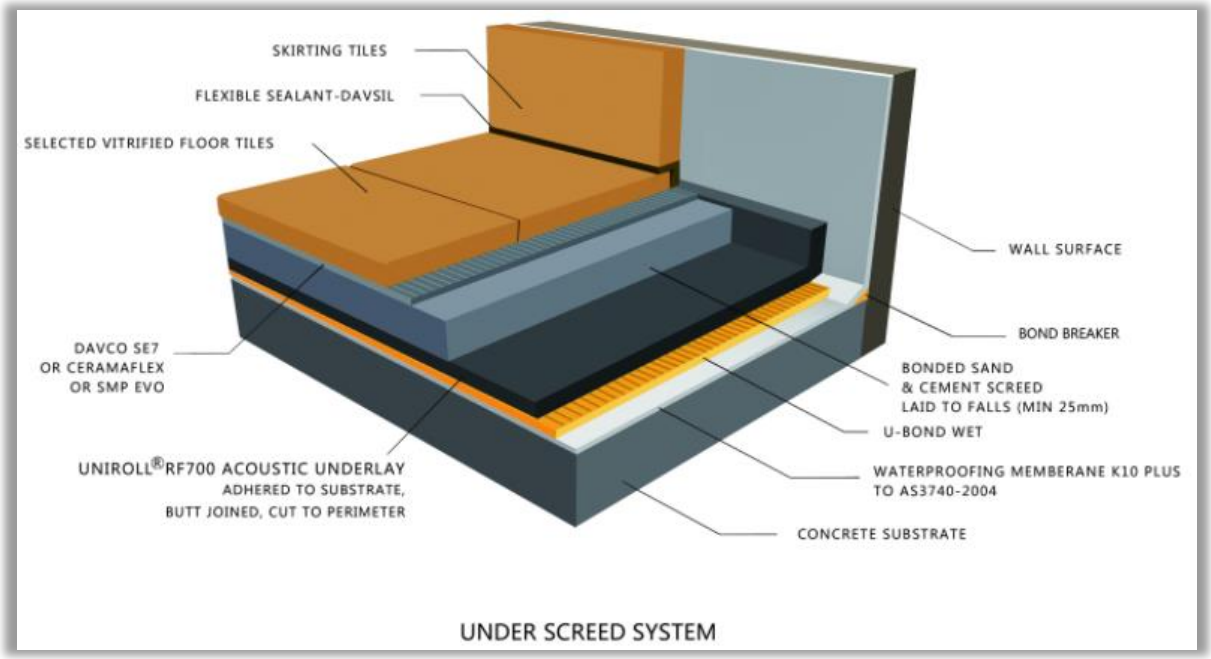
Hard floor coverings such as tiles must not make contact with any walls or joinery such as kitchen benches, cupboards etc.

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.

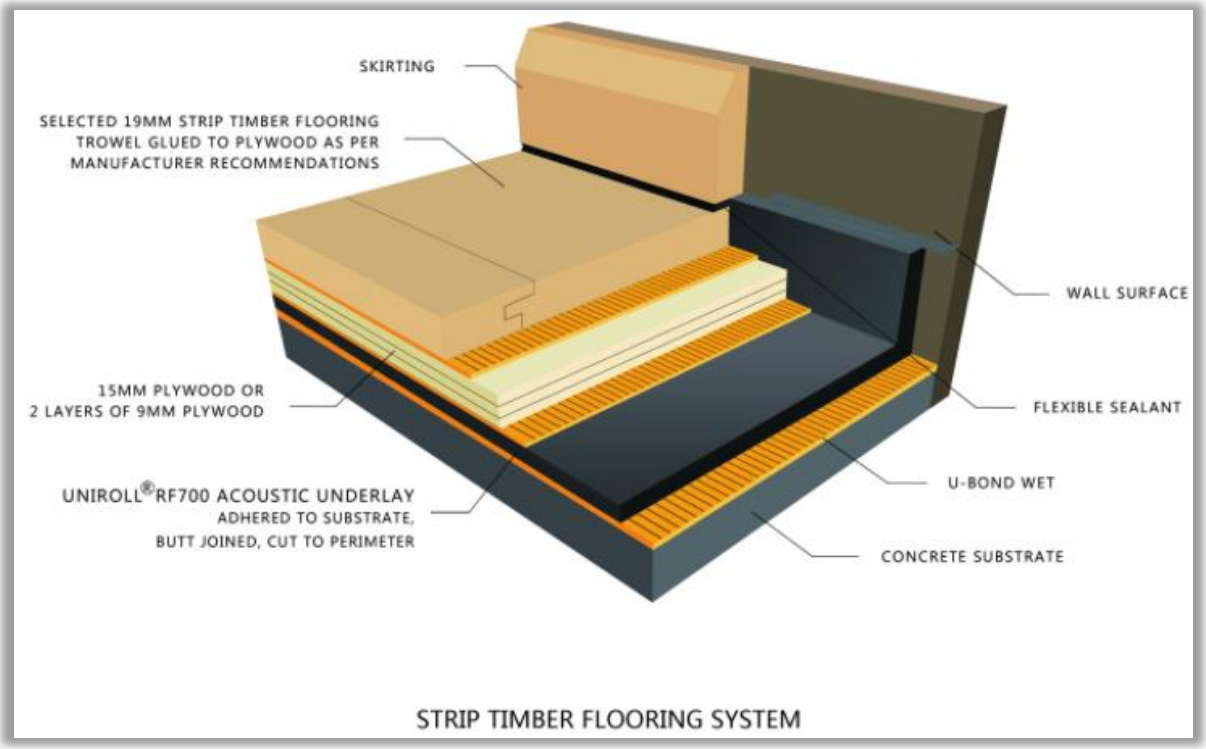
The following diagrams show detailed installation requirements of different flooring systems in conjunction with underlays.



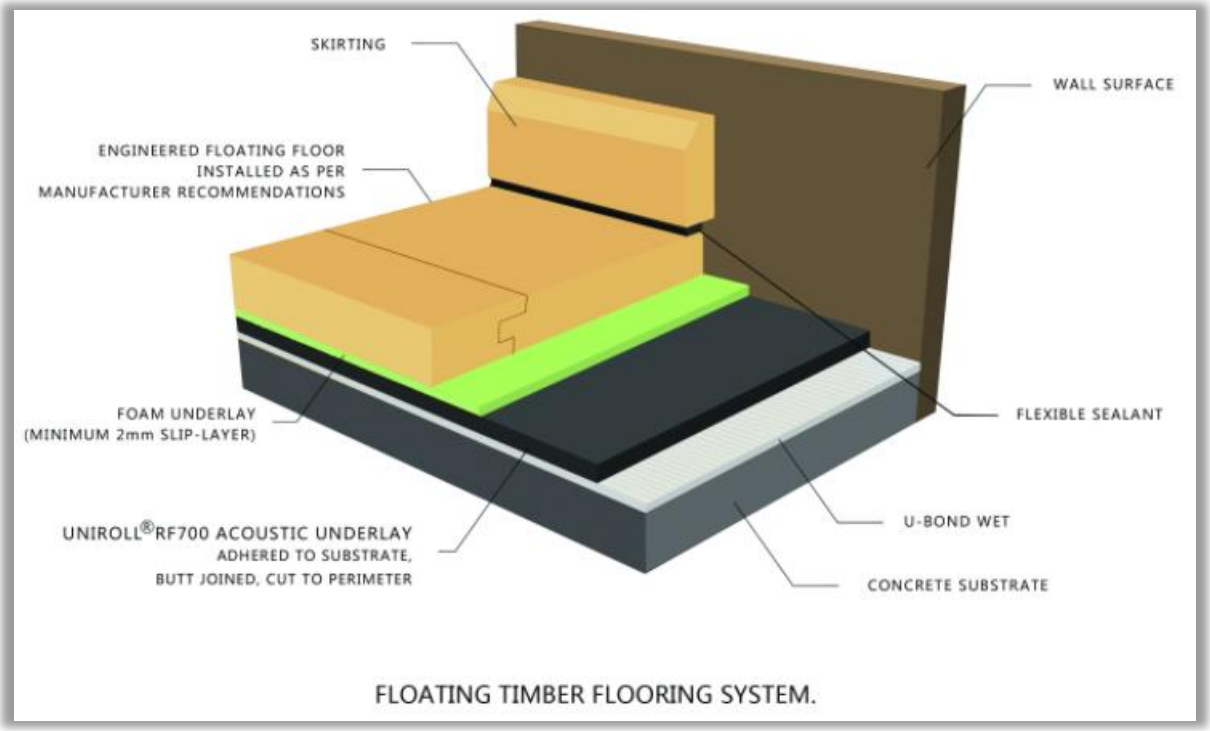
DIRECT STICK SYSTEM



UNDER SCREED SYSTEM



STRIP TIMBER FLOORING SYSTEM



FLOATING TIMBER FLOORING SYSTEM.

6.2.2 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.

6.2.3 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.

6.2.4 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.

6.2.5 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.

6.2.6 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.

6.2.7 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.

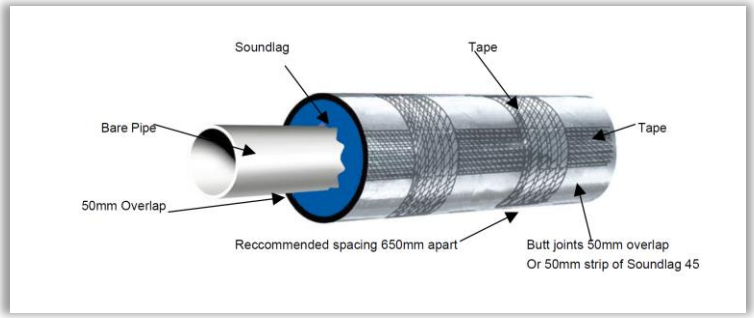
Where ceiling cavities are less than 100 mm in-depth, 50 mm fibreglass insulation (11kg/m^3 density) is recommended.

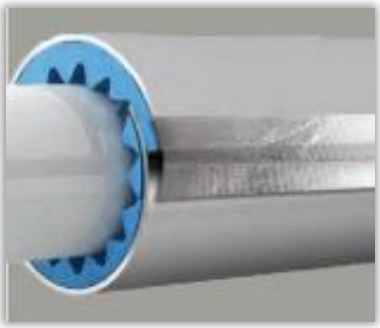
6.3 SOIL, WASTE, WATER SUPPLY PIPES

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

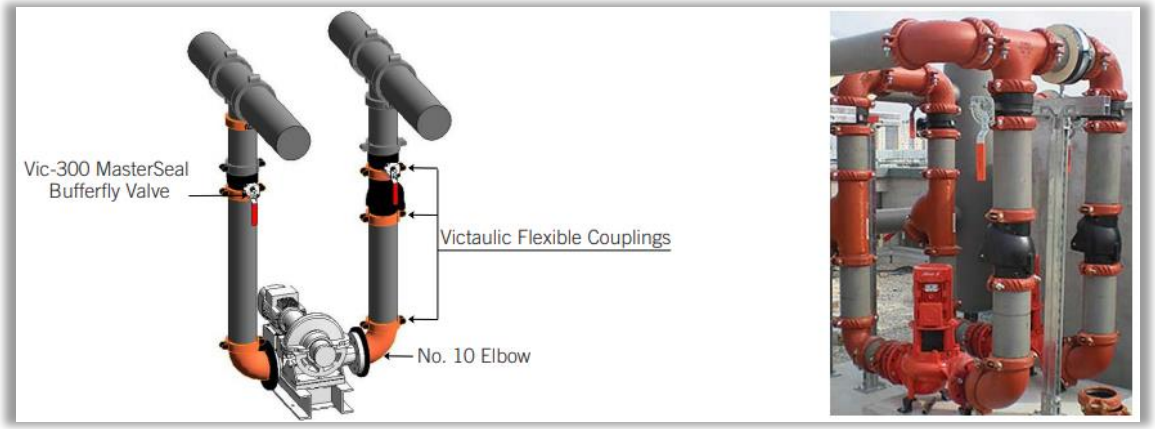
The BCA further qualifies the acoustic requirements of services partitions with the following:

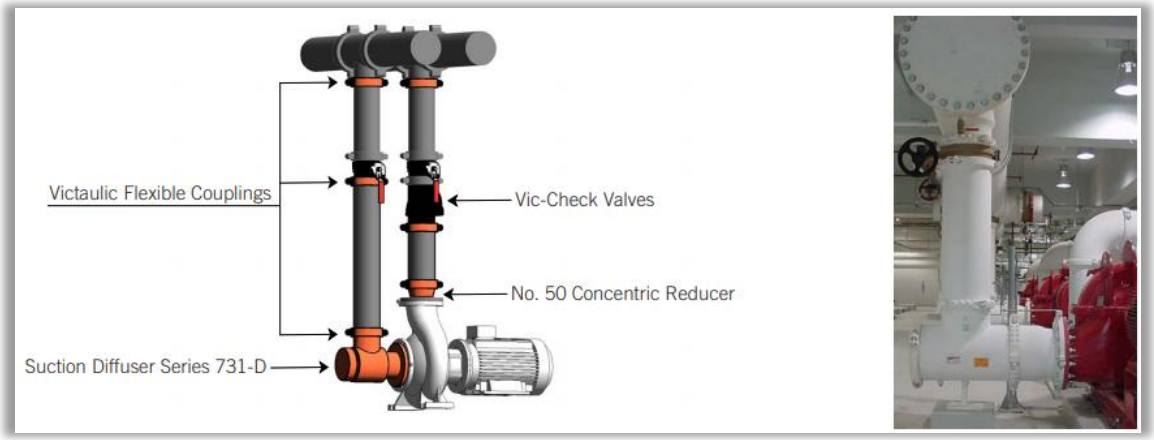
- Services must not be chased into concrete or masonry elements,
- An access door or panel must be firmly fixed to overlap the frame or rebate the frame by not less than 10mm and be fitted with proper sealing gasket along all edges and constructed of:
- Wood, particle board or block board not less than 38mm thick; or
- Compressed fibre reinforced cement sheeting not less than 9mm thick; or

- Other suitable material with a mass per unit area not less than 24kg/m2.
- 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 10mm to the other wall leaf.

6.4 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.





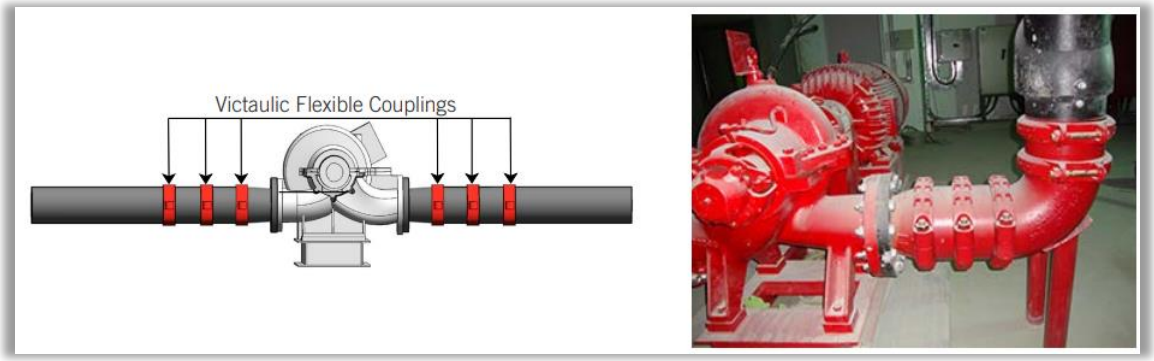
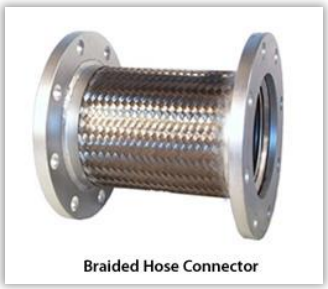


Photo by Victaulic



Photos by Empowering Pumps & Equipment

Photo by Plumbers Mate Ltd

6.5 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.

7.0 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 will be submitted for the DA submission once the noise monitoring has been completed on-site.

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

1. The building can be sufficiently insulated against existing external sources of noise in the area such as rail noise provided the recommendations in this report is implemented. These recommendations should be verified once noise monitoring is completed onsite.
2. A detailed assessment of operational and mechanical plant noise should be prepared for the subject development before construction.
3. Acoustic treatment options for the common wall/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.