







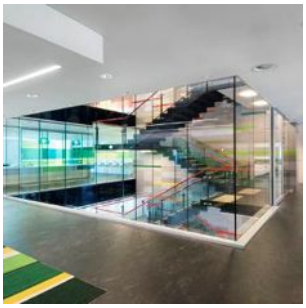


Permaform Acoustic Assessment

For: Permaform

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This report has been prepared in accordance with the scope of services described in the contract or agreement between Rudds Consulting Engineers Pty Ltd ABN 16 054 221 162 (Rudds) or Rudds Acoustics Pty Ltd ABN 41 147 203 610 and the client. The report relies upon data, surveys, measurements and results taken at or under the particular times and conditions specified herein. Any findings, conclusions or recommendations only apply to the aforementioned circumstances and no greater reliance should be assumed or drawn by the client. Furthermore, the report has been prepared solely for use by the client and Rudds accepts no responsibility for its use by other parties.

No acoustic test results have been provided in order to undertake these predictions. This being the case, Rudds recommends that prototype testing of the chosen wall system be undertaken prior to committing to large scale construction.

Contents

Section 1 - Introduction

Rudds Acoustics Pty Ltd. (Rudds) is pleased to provide a desktop assessment to determine configurations of two Permaform wall systems that will comply with Part F5 of the Building Code of Australia for acoustic performance.

These predictions are based upon a visual inspection of the product only. No test results, predictions or detailed acoustic data is currently available on the product. This being the case, Rudds recommends that prototype testing of the chosen wall system be undertaken prior to committing to large scale construction.

The product is a PVC system that acts as sacrificial formwork for concrete walls. It consists of a number of outer sides and edges with interlocking central link panels that join the faces prior to concrete core filling.

The sample provided to Rudds is the 110 mm wide product, consisting of 400 mm wide face panels linked at various intervals by 100 mm wide centre link panels. The link panels are 2 mm thick in the centre and have 60 mm diameter holes at 150 mm centres to allow for structural steel and will aid in even spreading of concrete. Rudds also expects these could be used for conduit reticulation where necessary.

The overall design creates a cavity of between 100 mm and 104 mm which is to be filled with concrete. It is understood that the concrete can be vibrated down if necessary by using a concrete vibrator.

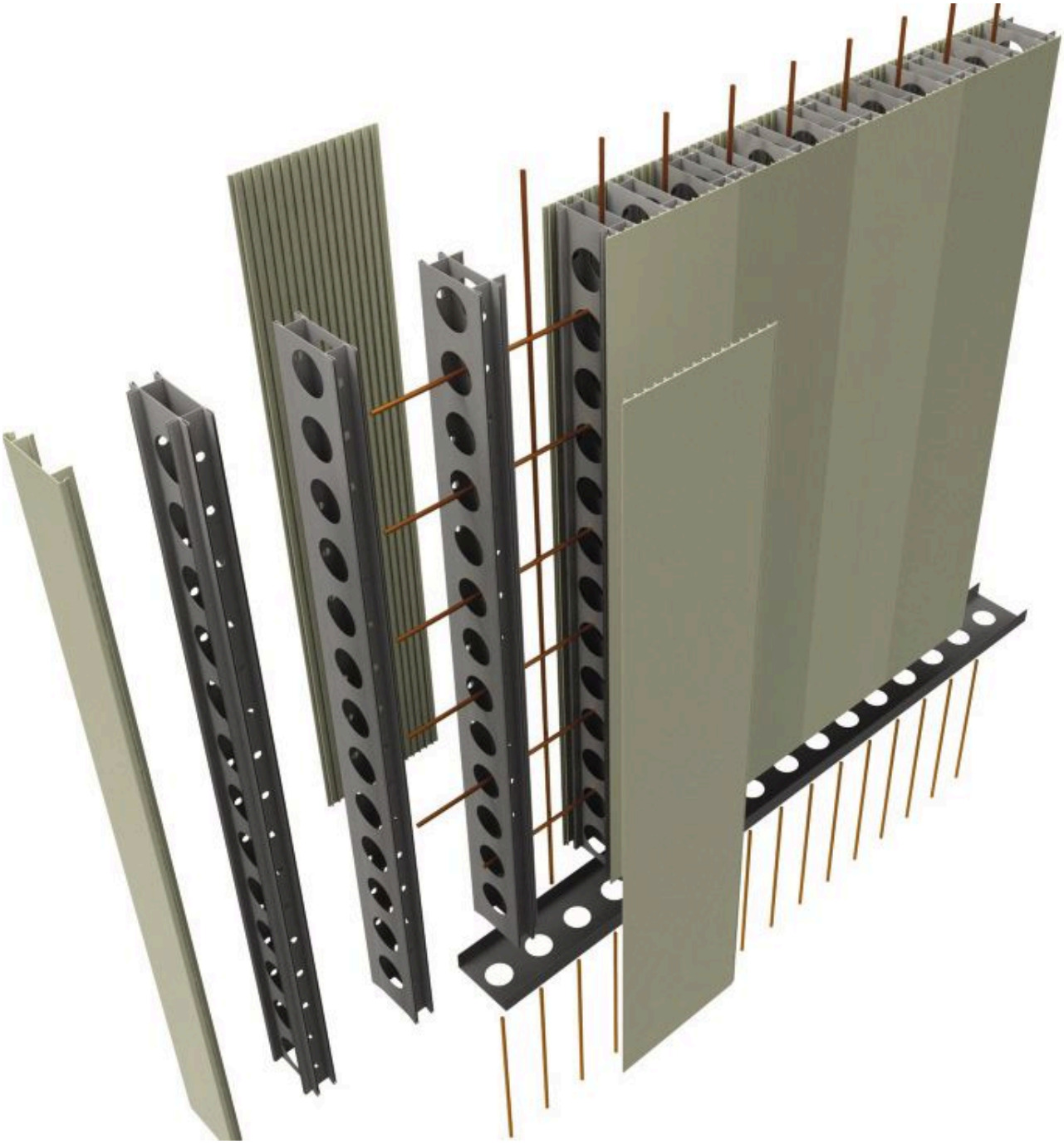
Permaform also provides 150 mm and 200 mm thick systems. Information is available in the brochures and on the website, but Rudds has not been provided with a sample of the 150 mm or 200 mm wide system. On the understanding that the face panels are the same as for the 110 mm system and the link panels are the only change, Rudds expects a total concrete thickness of not less than 140 mm for the 150 mm system and 190 mm for the 200 mm system when the panels are filled.

Figure 1 contains a picture from the Permaform website and brochure detailing the construction of the 200 mm thick system. It shows double bracing panels between the faces.

Actual link panel spacing is variable and will depend upon the final system requirements for each particular project. Rudds has assumed typical link panel spacing of 100 mm.

Rudds has undertaken this assessment assuming that the concrete will bond to the PVC structure and will not shrink away from the plastic. Rudds has also assumed that the final system, when constructed, will contain no substantial air voids or the like. Acceptable air voids include the small V shaped section behind the linking clips.

FIGURE 1 PERMAFORM CONSTRUCTION



Source: www.permaform.com.au

Section 2 - BCA Requirements for Party Wall Systems

Acoustic design and construction requirements are prescribed in the Building Code of Australia (BCA).

In each case, the goal of the BCA is to protect the acoustic amenity of the occupants of the building through appropriate design and construction materials and methods. Building elements must provide insulation against the transmission of airborne and impact generated sound sufficient to prevent illness or loss of amenity to the occupants.

There are similar airborne and impact noise requirements depending upon the classification of the buildings, with the following being the relevant sections of the BCA 2014 for particular building classifications:

1. Part F5 of Volume 1 details requirements for Class 2 and Class 3 residential buildings and Class 9c aged care buildings.
2. Part 3.8.6 of Volume 2 details requirements for Class 1 residential buildings.

In each case, the requirements include acoustic requirements for the interface between the appropriate classification and parts of a different classification.

Table 1 contains the airborne and impact noise requirements for a party wall in a Class 2 or Class 3 residential development.

TABLE 1 BCA 2014 REQUIREMENTS FOR CLASS 2 AND CLASS 3 BUILDINGS

Item	Airborne Noise Requirement	Impact Noise Requirement
Walls		
Separating sole occupancy units	**Design Rating** Not less than $R_w + C_{tr}$ 50 **Field Rating** Not less than $D_{nT,w} + C_{tr}$ 45	Discontinuous construction is required if the wall is separating a bathroom, sanitary compartment, laundry or kitchen in one sole occupancy unit from a habitable room (other than a kitchen) in an adjoining unit.
Separating sole occupancy units from a plant room, lift shaft, stairway, public corridor, public lobby or the like, or parts of a different classification	**Design Rating** Not less than R_w 50 **Field Rating** Not less than $D_{nT,w}$ 45	Discontinuous construction is required if the wall is separating a sole occupancy unit from a plant room or lift shaft.

Discontinuous construction is defined by the BCA as a wall having a minimum 20 mm cavity between 2 separate leaves and:

1. For masonry, where wall ties are required to connect the leaves, the ties are of the resilient type
2. For other than masonry, there is no mechanical linkage between leaves except at the periphery.

In addition to the requirements contained in Table 1, the BCA 2014 sets minimum construction and detailing standards for acoustically rated partitions so as to minimise any weaknesses or degradation of the partitions during construction. Refer to the BCA for these requirements.

Section 3 - BCA Compliant Permaform Wall Systems

Rudds has undertaken a desktop assessment of the Permaform wall systems at 110 mm, 150 mm and 200 mm thickness. The following wall systems are predicted to comply with the minimum requirements under the Building Code of Australia 2014 for acoustic performance. Three options for each wall system have been provided and are shown in Table 2, Table 3 and Table 4. These include:

1. Wall achieving minimum Rw 50 (Suitable for use as a wall between a sole occupancy unit and a public corridor).
2. Wall achieving minimum Rw +Ctr 50.
3. Wall achieving minimum Rw +Ctr 50 and discontinuous construction.

It is important to understand that triple wall systems (systems containing a central element with linings either side) are particularly vulnerable to minor changes in design and construction. Under no circumstances should it be assumed that adding or changing a lining where it is not shown is acceptable. In many cases, changing the lining will reduce the acoustic performance of the wall and can have a detrimental effect on the Ctr value. Put simply, the Ctr value is a negative number that is applied to show the low frequency performance of the wall. The more negative the number, the poorer the acoustic performance in the low frequency range.

Rudds has also found that 51 mm steel studs may require bracing where walls are high. With modern apartment construction, it is not uncommon to have ceiling heights exceeding 2.4 metres. If the stud is braced back to the Permaform, this means the wall is no longer of discontinuous construction, and acoustic performance will be reduced. Therefore, we recommend using 64 mm steel studs for discontinuous wall systems.

TABLE 2 110 MM PERMAFORM CORE WALL SYSTEMS

One Side	Other Side	Rw 50	Rw+Ctr 50	Discon-tinuous
Paint, render or 13 mm thick direct stick plasterboard.	13 mm thick plasterboard on 16 mm furring channel mounted on furring channel clips to create a minimum cavity of 25 mm. Minimum 25 mm thick, 24kg/m^3 polyester or glasswool acoustic insulation in cavity.[4]	✓	X	X
Paint or render.	13 mm thick plasterboard on 16 mm furring channels mounted using resilient mounts to create a cavity not less than 45 mm. Minimum 50 mm thick, 14kg/m^3 polyester or glasswool acoustic insulation in cavity[4].	✓	✓	X
13 mm plasterboard on 64 mm steel stud spaced minimum 20 mm clear of Permaform. No connection to the Permaform at any point. Minimum 75 mm thick, 14kg/m^3 polyester or glasswool acoustic insulation in cavity.	13 mm thick plasterboard on 16 mm furring channel mounted on furring channel clips to create a minimum cavity of 25 mm. Minimum 25 mm thick, 24kg/m^3 polyester or glasswool acoustic insulation in cavity[4].	✓	✓	✓

TABLE 3 150 MM PERMAFORM CORE WALL SYSTEMS

One Side	Other Side	Rw 50	Rw+Ctr 50	Discon-tinuous
Paint or render.	Paint or render.	✓	X	X
Paint or render.	13 mm thick plasterboard on 16 mm furring channels mounted using resilient mounts to create a cavity not less than 45 mm. Minimum 50 mm thick, 14kg/m^3 polyester or glasswool acoustic insulation in cavity[4].	✓	✓	X
13 mm plasterboard on 64 mm steel stud spaced minimum 20 mm clear of Permaform. No connection to the Permaform at any point. Minimum 75 mm thick, 14kg/m^3 polyester or glasswool acoustic insulation in cavity.	13 mm thick plasterboard on 16 mm furring channel mounted on furring channel clips to create a minimum cavity of 25 mm. Minimum 25 mm thick, 24kg/m^3 polyester or glasswool acoustic insulation in cavity[4].	✓	✓	✓

TABLE 4 200 MM CORE PERMAFORM WALL SYSTEMS

One Side	Other Side	Rw 50	Rw+Ctr 50	Discon-tinuous
Paint or render.	Paint, render or 13 mm thick direct stick plasterboard	✓	X	X
Paint or render.	Paint or render or 13 mm thick plasterboard on 16 mm furring channels mounted using resilient mounts to create a cavity not less than 45 mm. Minimum 50 mm thick, 14kg/m^3 polyester or glasswool acoustic insulation in cavity[4].	✓	✓	X
13 mm plasterboard on 64 mm steel stud spaced minimum 20 mm clear of Permaform. No connection to the Permaform at any point. Minimum 75 mm thick, 14kg/m^3 polyester or glasswool acoustic insulation in cavity.	13 mm thick plasterboard on 16 mm furring channel mounted on furring channel clips to create a minimum cavity of 25 mm. Minimum 25 mm thick, 24kg/m^3 polyester or glasswool acoustic insulation in cavity[4].	✓	✓	✓

Notes:

1. Green tick (✓) means the proposed construction is predicted to comply with the prescribed acoustic rating in the relevant column. The red cross (X) means that it does not comply with the prescribed acoustic rating in the relevant column.
2. In all cases the 13 mm plasterboard can be substituted for 9 mm FC sheet, 10 mm CSR Soundchek plasterboard, 13 mm CSR Aquachek plasterboard or 16 mm thick fire rated plasterboard.
3. All furring channels and framing are 0.55 BMT steel.
4. The 25 mm insulation specified herein is suitable for a 25 mm cavity. For different cavity depths, consult your acoustic engineer for suitable construction.
5. Where polyester insulation is to be used it must be a high quality acoustic polyester insulation with acoustic absorption properties equal to the equivalent thickness of glasswool insulation.

Section 4 - Glossary of Terms

dB	Decibel. This is the unit measurement of sound.
dBA	A weighted decibel is the most commonly used descriptor. The A weighting is an adjustment to the raw sound level to approximate what the a verage human ear can hear, which is less sensitive at very low and very high frequencies.
Lw or SWL	Sound power level. This is the total radiated sound energy.
Lp or SPL	Sound pressure level. This is the measurable sound level at a given distance from an item.
L_{max}	The RMS maximum noise level of a measurement
L_{10}	90^{th} percentile sound level of a measurement. Often called the average maximum noise level
L_{eq}	The energy average noise level of a measurement.
L_{90}	10^{th} percentile sound level of a measurement. Often called the average background noise level
L_{min}	The minimum noise level of a measurement
$L_{eq(T)}$	The time (T) equivalent energy noise level. The time interval is often in blocks of 10 or 15 minutes for short term measurements, or hours for long-term measurements. Common increments for long term measurements are 1 hour, day, night, 18 hours and 24 hours.
$L_{eq(8h)}$	The 8 hour equivalent energy noise level. Primarily used for occupational noise assessments
LC_{peak}	The C weighted peak noise level. Primarily used for occupational noise assessments
Dw	The Weighted Level Difference as defined in AS/NZS ISO 717.1:2004. This is the single number rating describing the ability of a partition to reduce noise as measured in the field with no standardisation or normalisation.
Rw	The Weighted Sound Reduction Index. This is the single number rating describing the ability of a building element to reduce noise as measured in a laboratory. Assessed in accordance with AS/NZS ISO 717.1:2004.
NRC	Noise Reduction Coefficient. The NRC defines how much sound is absorbed by a surface. An NRC of 0 means it absorbs no sound while an NRC of 1 means it will absorb most sound.
CAC	Ceiling Attenuation Class. The CAC determines how much cross-talk will occur between one room and another through the ceiling cavity where both rooms have the tested ceiling tile. This is an ideal situation, with no wall head leaks and no services penetrations in the ceiling. Therefore, it defines the ideal, best possible result as tested in a laboratory.