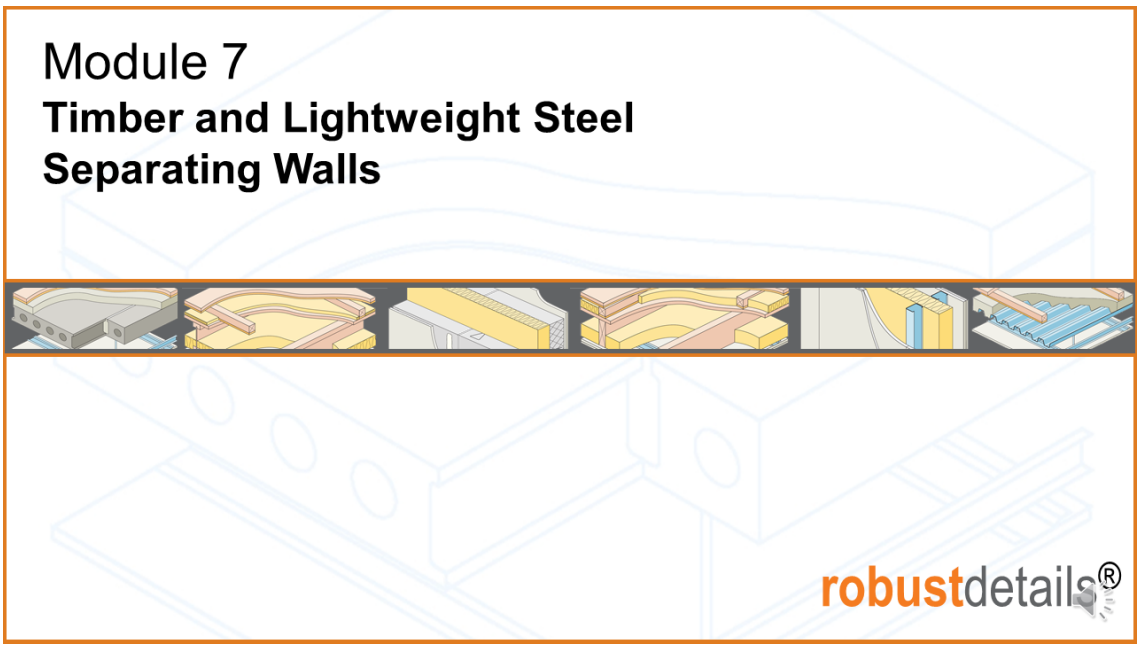
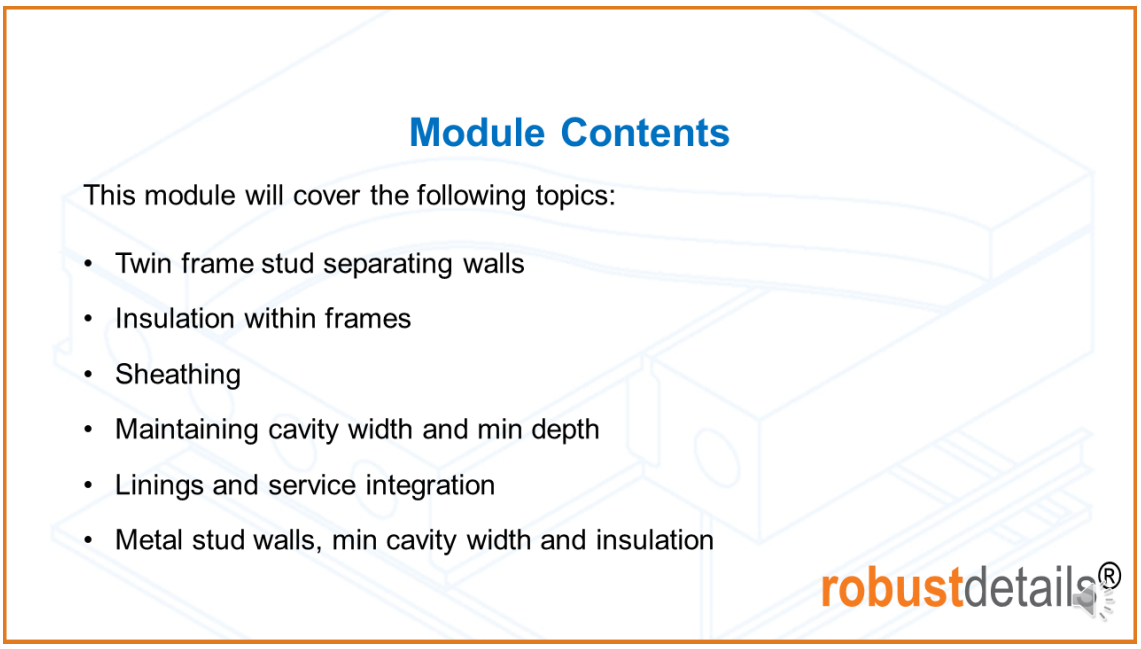
Slide 1



Welcome to Module 7 – Timber and Lightweight steel separating walls

Additional notes:

Slide 2

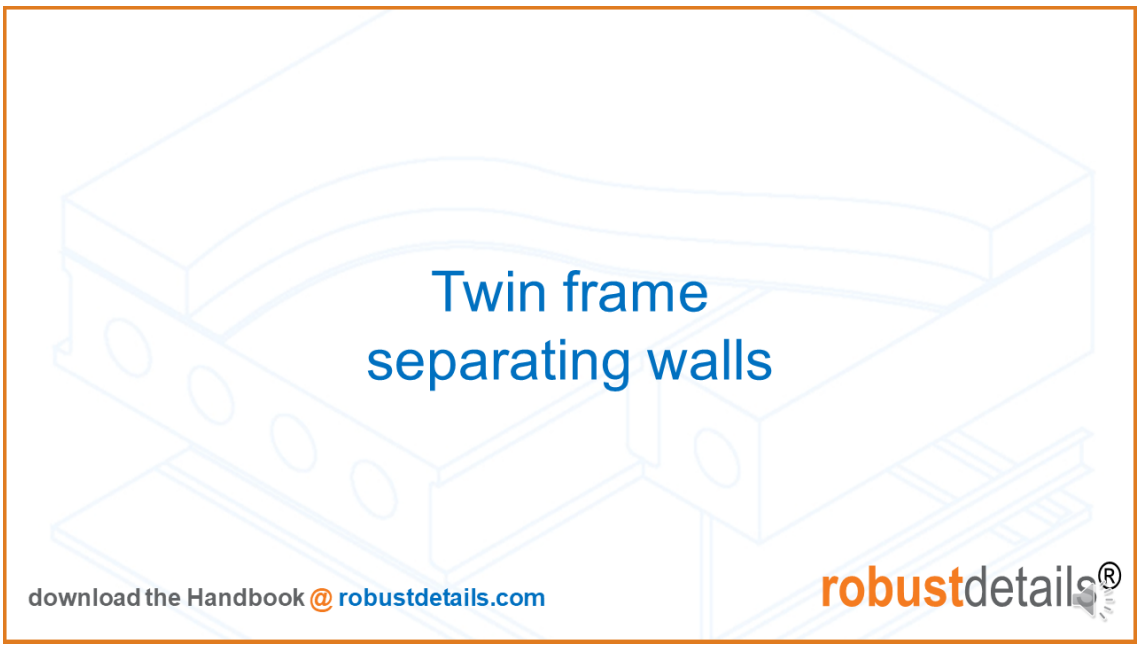


This Module will cover the following topics:

- Twin frame stud separating walls
- Insulation within frames
- Sheathing
- Maintaining cavity width and min depth
- Linings and service integration
- Metal stud walls, min cavity width and insulation

Additional notes:

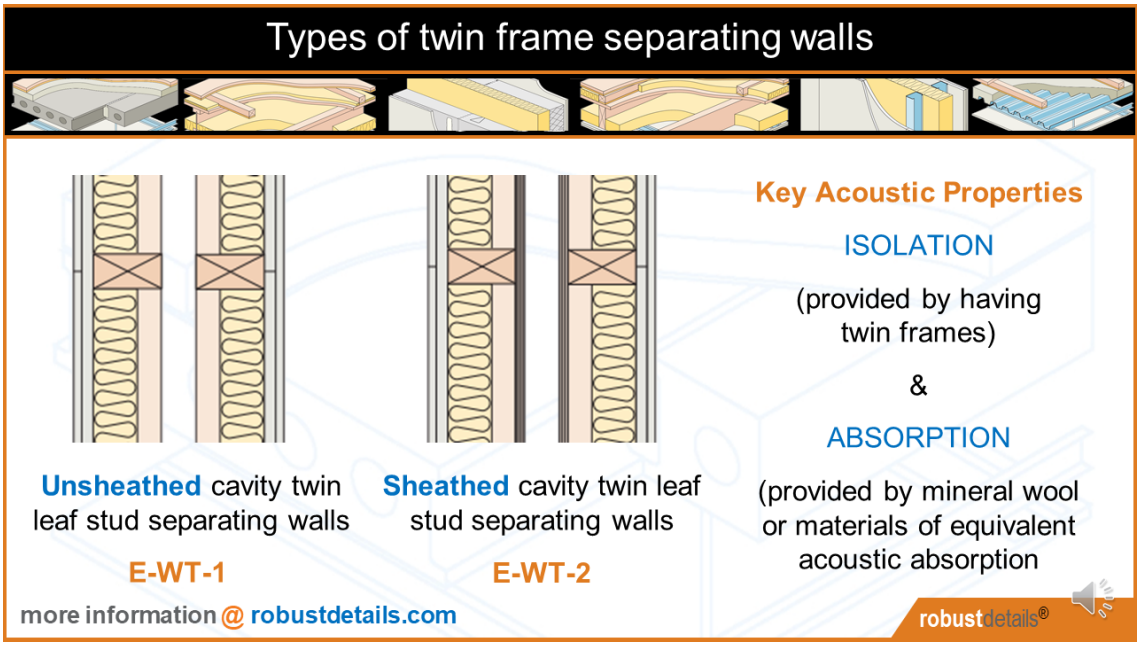
Slide 3



Read slide

Additional notes:

Slide 4



There are 2 primary types of twin timber stud separating walls, these are Unsheathed and Sheathed.

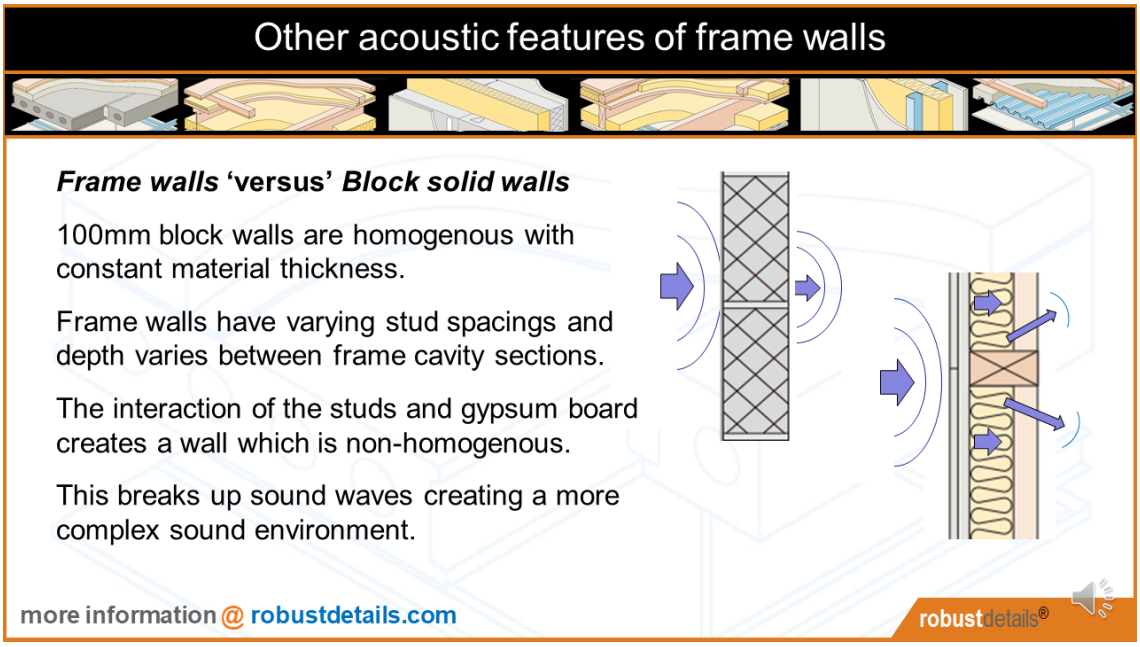
Twin stud walls whether timber or steel based rely on two key acoustic properties – these are

- ISOLATION provided by the two separate frames and
- ABSOPRTION provided by the mineral wool or equivalent acoustic absorption materials.

Other wall properties such as STIFFNESS and MASS also play a part, but the mass of such walls tends to be low.

Additional notes:

Slide 5



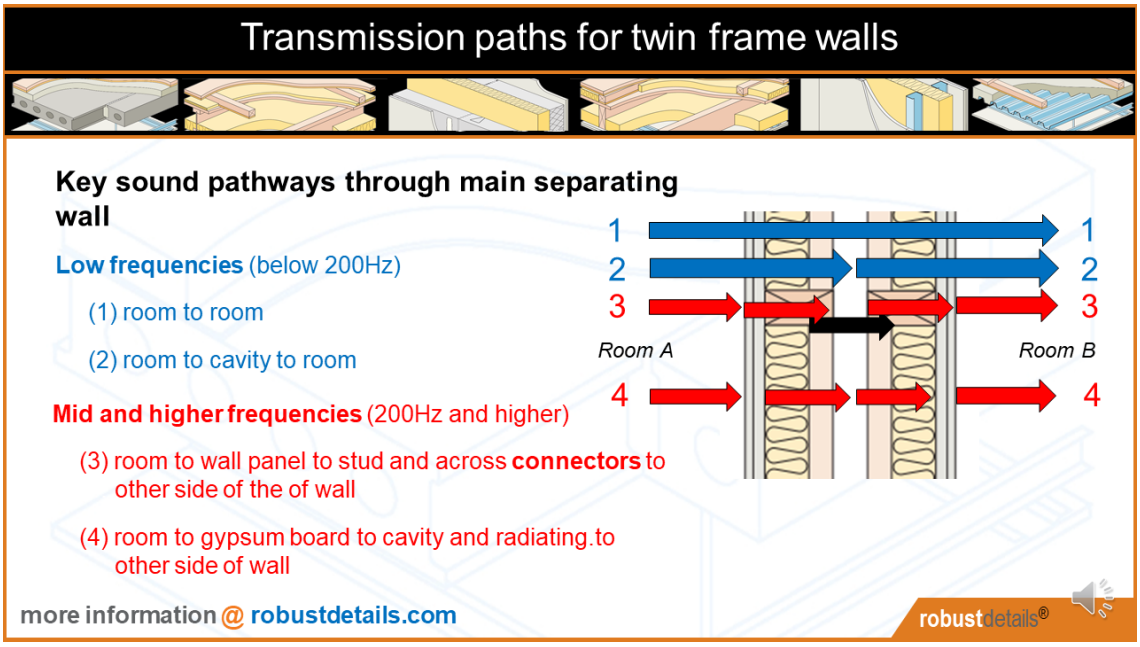
Unlike standard 100mm block walls which are quite uniform, fairly homogenous and of constant material thickness, frame walls have studs at various spacings, and the wall depth varies between the frame and cavity bay sections.

The design, shape and interaction of the studs with the gypsum board creates a 'ribbed' non-homogenous wall.

This helps break up sound waves within the wall structure and stud bays, and creates a more complex sound transmission environment.

Additional notes:

Slide 6



Sound transmission through timber or metal twin frame separating walls behaves differently at low, mid and high frequencies.

At low frequencies sound can transmit from ‘Room A’ to ‘Room B’ where the factors of isolation, mass and stiffness of the wall are important.

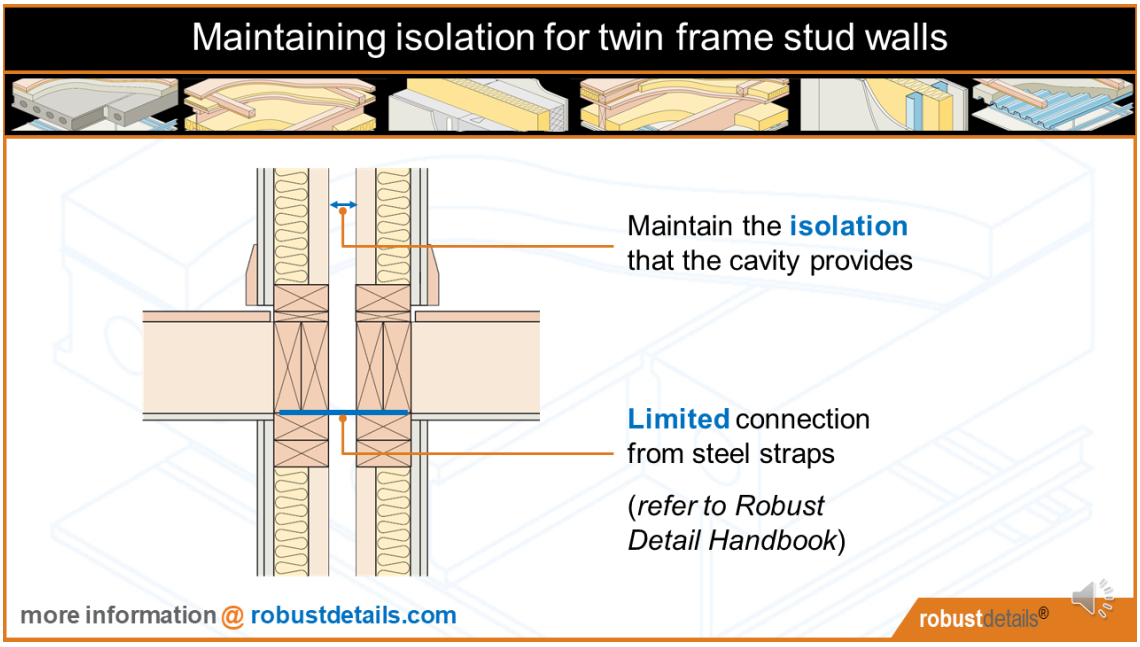
Typically below 200Hz the wall behaves acoustically as one large single wall structure. Sound transmits through the separating wall such as Pathway (1) room to room; and pathway (2) room to cavity to room.

At mid and high frequencies the whole wall divides into its component parts.

As sound frequency increases the sound wavelengths become shorter and more easily interact with the wall component parts such as the studs, gypsum boards, structural connector and cavity such as shown by pathways (3) and (4)

Additional notes:

Slide 7



The cavity of these separating walls provides the isolation, or separation between the dwellings on either side – so it's important for the isolation to be maintained.

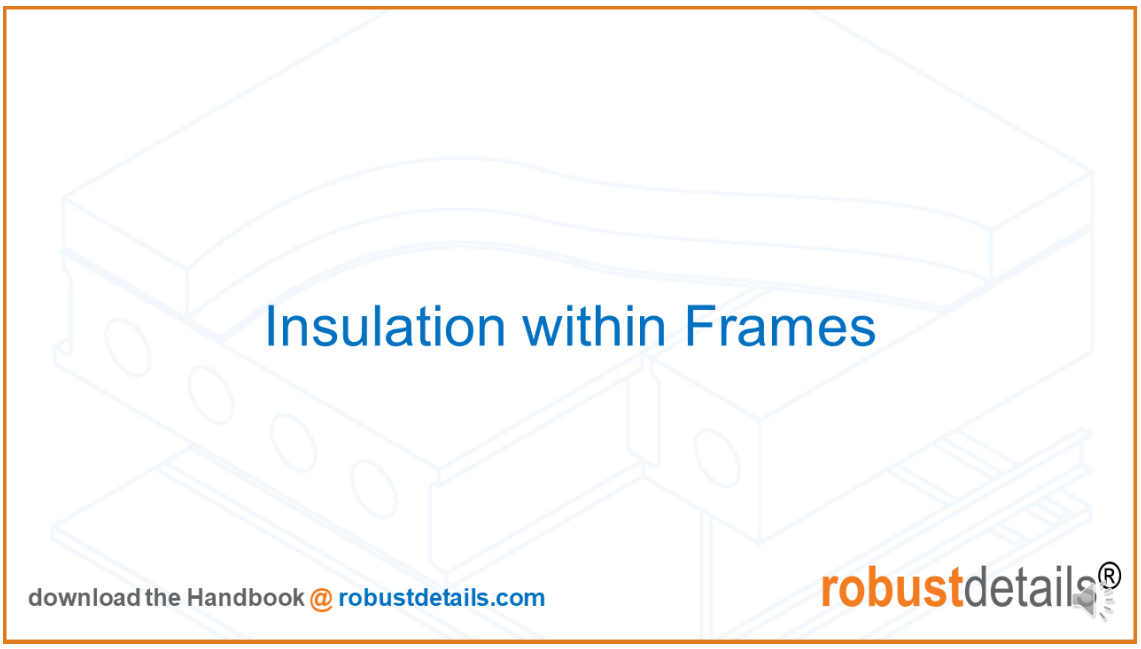
Any connection across the cavity will compromise the isolation, so this must be kept to a minimum.

Steel straps can be used if needed for structural requirements, but these must be:

- No more than 40mm wide x 3mm thick in section
- Positioned no closer than 1200mm to each other
- Just one row of these per storey height – normally fixed on top of the timber frame panels.

Additional notes:

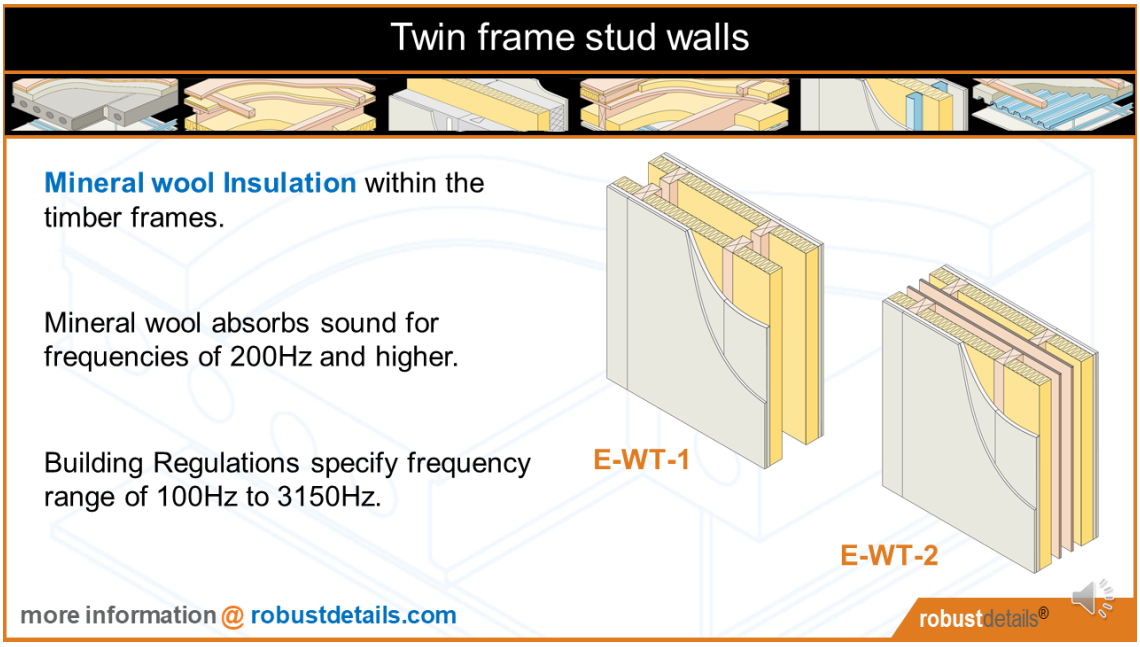
Slide 8



Read slide

Additional notes:

Slide 9



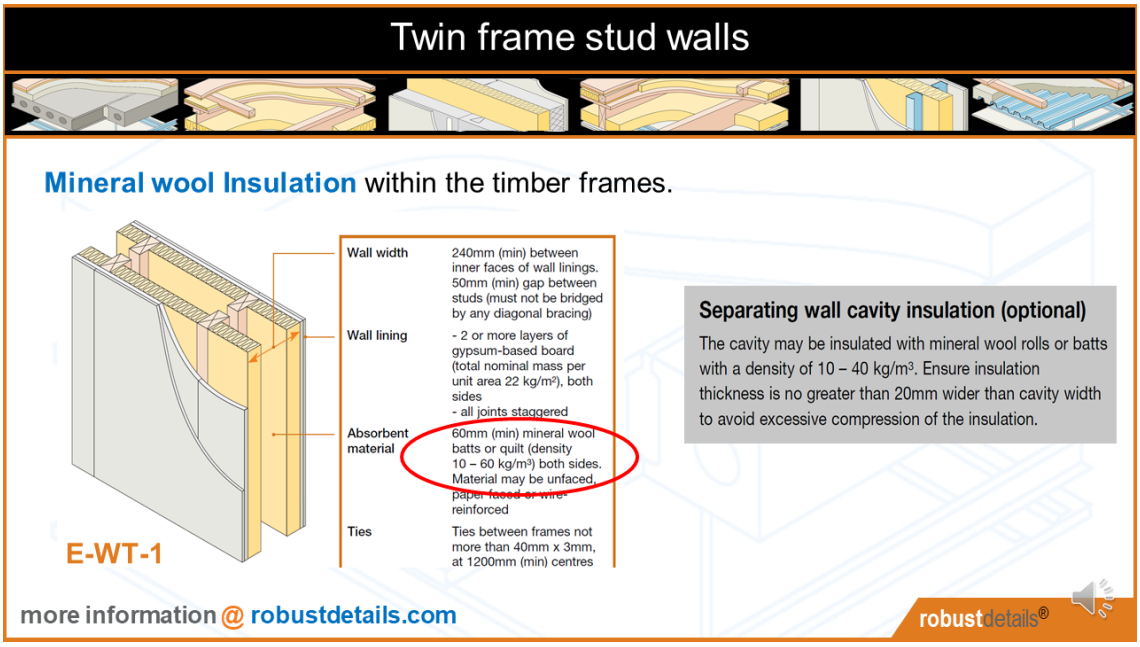
The absorption materials such as mineral wool play an important acoustic feature as the material is able to absorb sound from 200Hz onwards.

Below 200Hz it is more difficult for materials to absorb sound.

So for the building regulation acoustic frequency range of 100Hz to 3150Hz, the mineral wool absorbs sound for a large part of the regulation frequency range.

Additional notes:

Slide 10



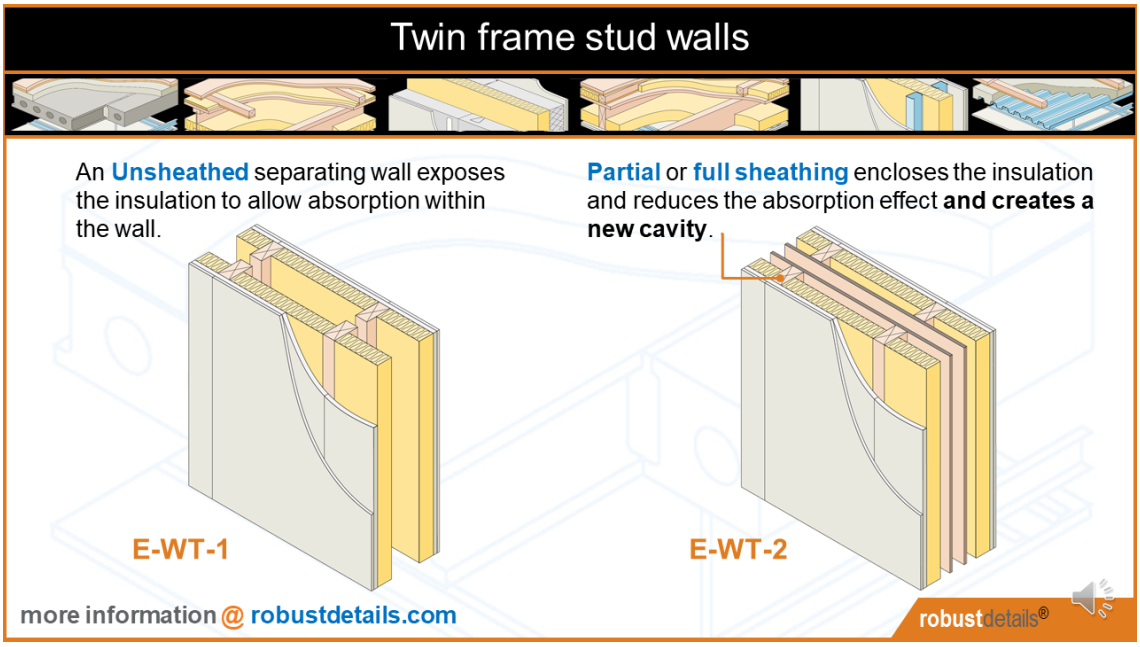
Mineral wool insulation can absorb sound that gets into the frame and eliminates reverberation.

Mineral wool in the specified density range must be used as this has the absorptive properties necessary to perform this function.

In order to comply with Part L and SAPs, it is normally required to have a fully-filled wall to address the cavity thermal bypass issues. Both of the generic timber wall types include provision for this, although the specifications do vary slightly

Additional notes:

Slide 11



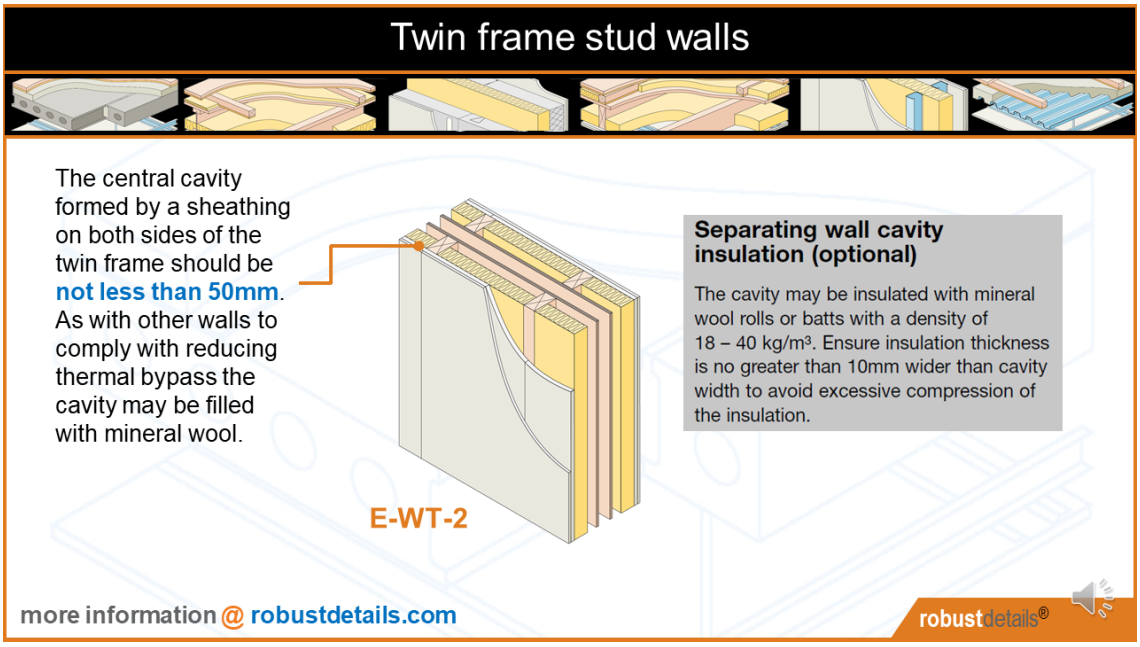
Using an **Unsheathed** separating wall exposes the insulation to allow for absorption in the main wall cavity.

However, Structural engineers may request that sheathing is added to the separating wall leafs to help with anti-racking in relation to wind loads.

But Partial sheathing of a separating wall near the junction with the external wall, or a fully sheathed separating wall encloses the insulation and reduces the absorption effect – it also creates a new cavity.

Additional notes:

Slide 12

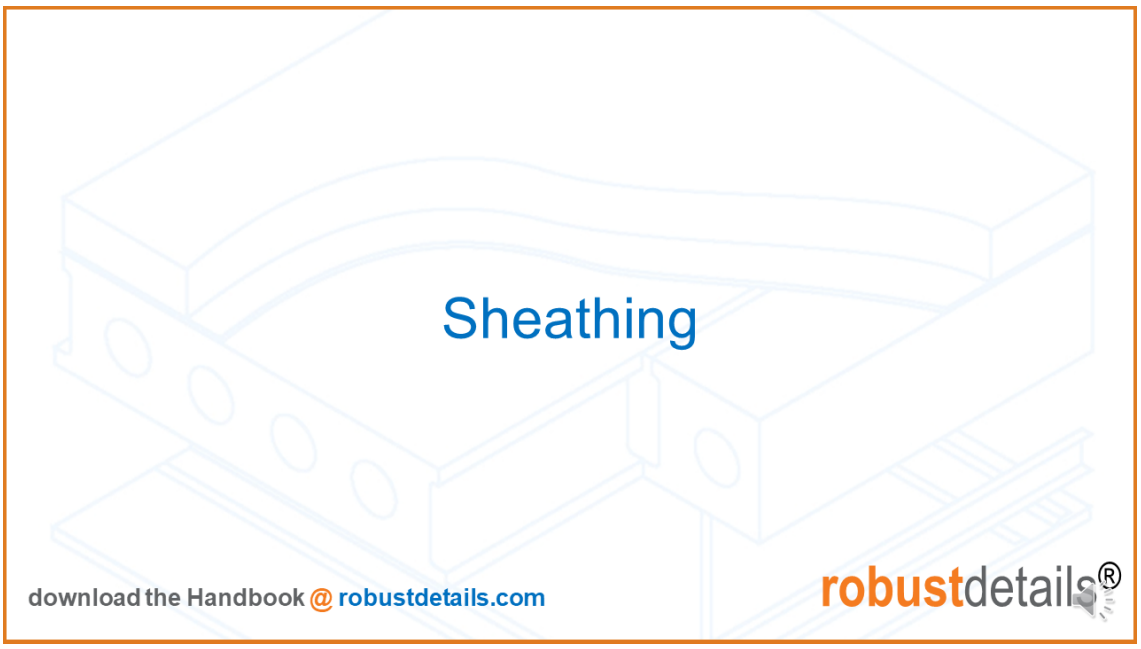


The central cavity formed by a sheathing on both sides of the twin frame should be not less than 50mm.

As with other walls to comply with reducing thermal bypass the cavity may be filled with mineral wool.

Additional notes:

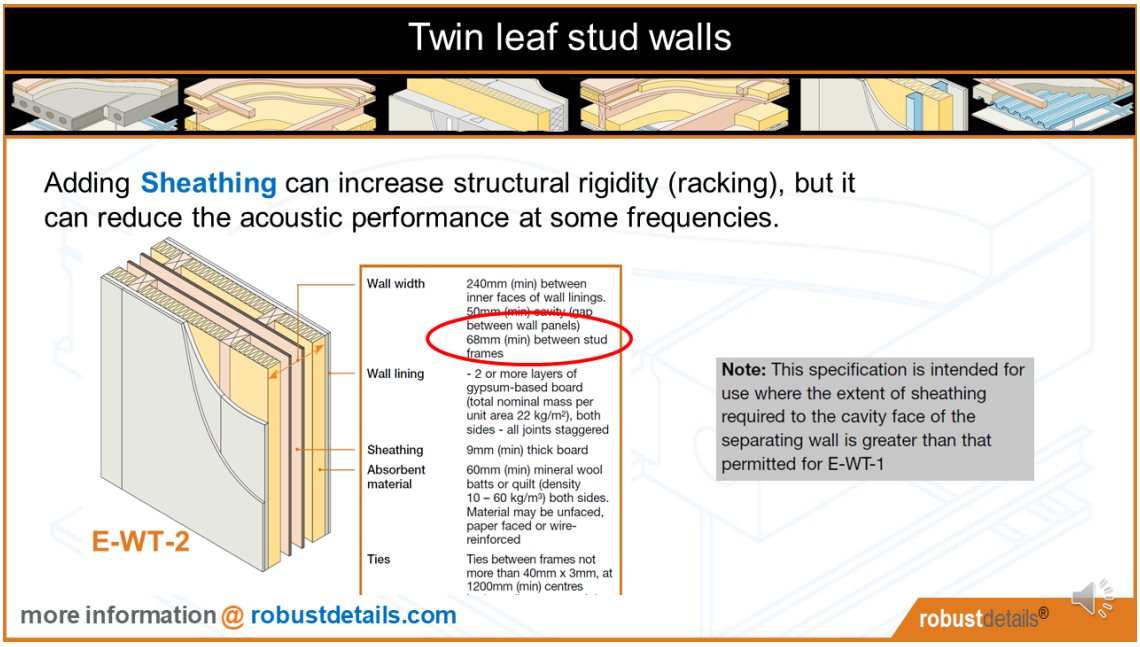
Slide 13



Read slide

Additional notes:

Slide 14



If more sheathing is required, including the panels being fully sheathed, then E-WT-2 needs to be used.

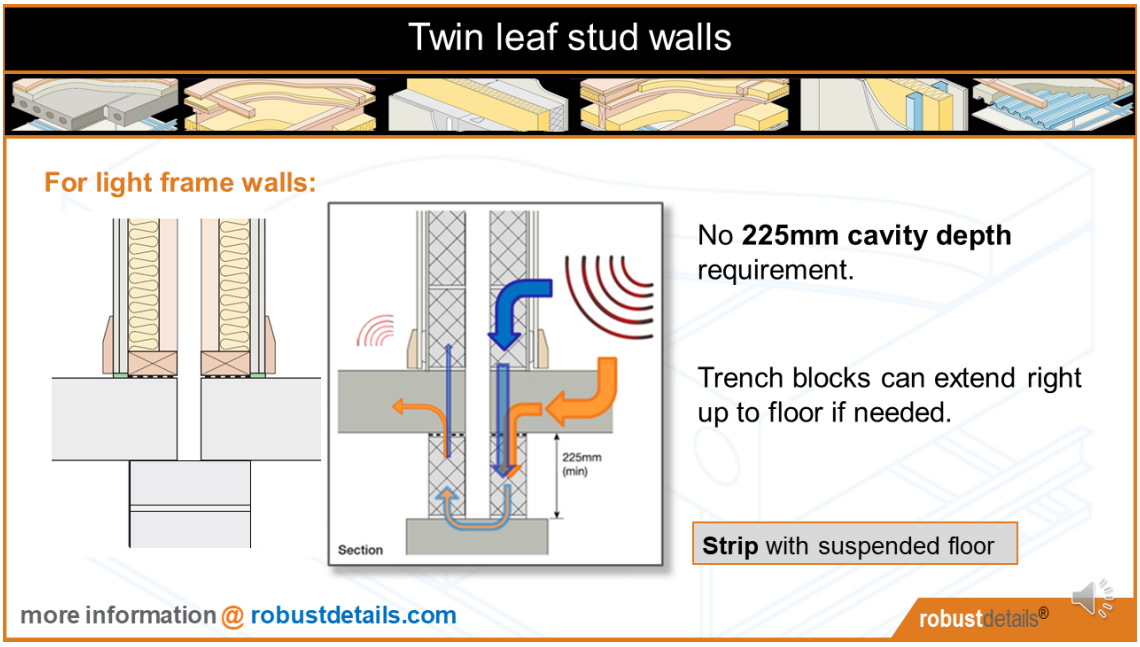
However, the frames need to be 68mm apart as a minimum, so that there is a MINIMUM 50mm cavity between the sheathing faces when fully-sheathed.

Care should be taken that sheathing is not exposed to high quantities of rain or moisture as this can cause the sheathing to warp.

If the sheathing warps this reduces the 50mm cavity and can lead to acoustic resonance issues in the narrow cavity and a reduction in sound insulation performance.

Additional notes:

Slide 15



As we have dissimilar materials there's less tendency for structure-borne transmission.

In crude terms, each material has its own natural frequency and resonance response, so they start vibrating in response to specific frequencies.

If we consider masonry walls, the wall and floor components or elements can have similar material density properties. When components or building elements that physically connect to each other have similar materials properties, such as material density, sound is more able to easily transfer from one component or element to the next.

Continued Overleaf

Additional notes:

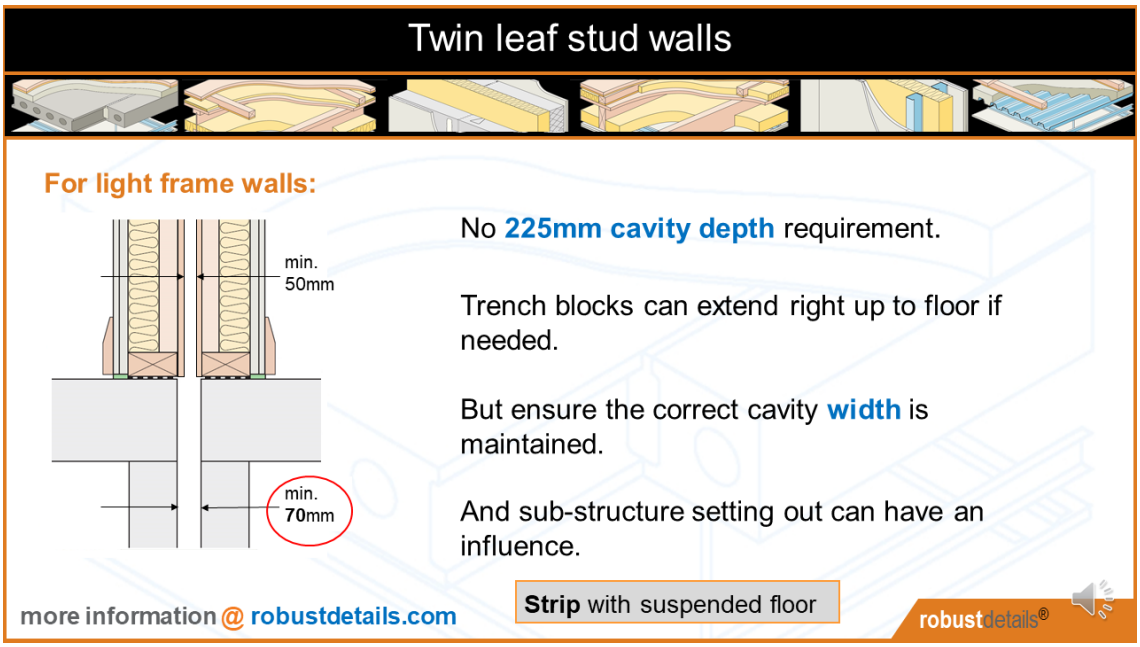
However, in the case of timber frame walls the timber sole plates have much lower material density than concrete blocks or raft foundations, so the sound transmission between these components or elements is much weaker.

This means there is no specified minimum depth, but it must extend at least through the thickness of the suspended floor. This gap between suspended floor slabs provides isolation and reduces the potential for flanking sound transmission via the slabs.

Trench blocks or solid substructure walls can extend right to the underside of the structural floor – but the deeper the cavity, the better.

Additional notes:

Slide 16

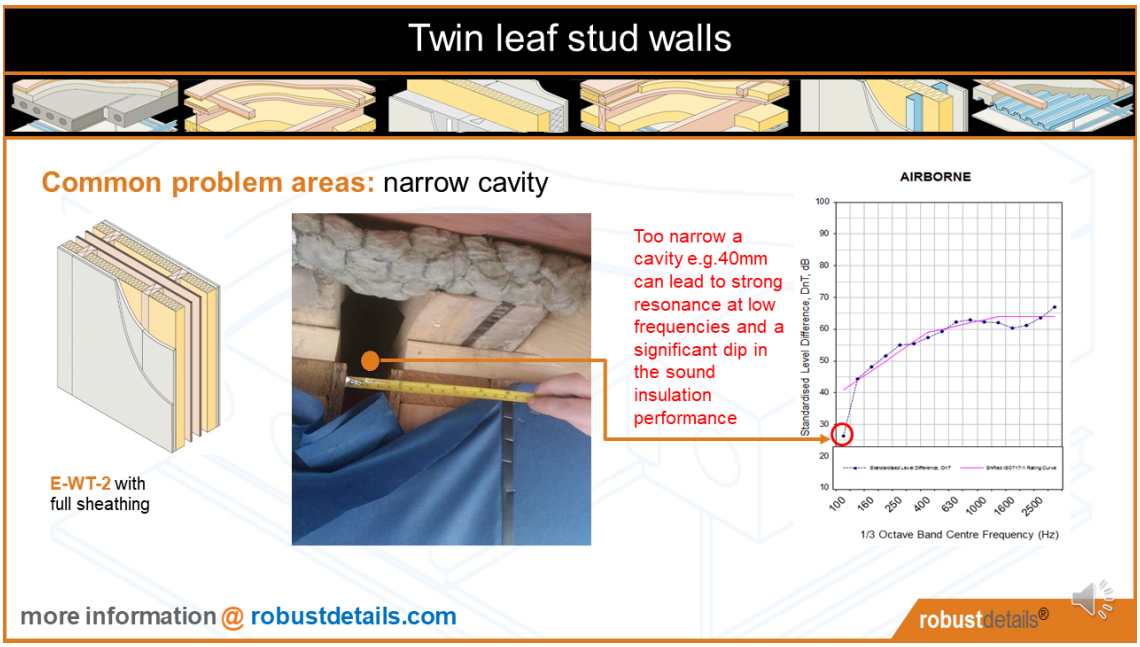


So even though there's no depth requirement, we still need the right width.
It is possible to use the substructure as a setting out guide for the timber frames.
EWT1 requires 50mm between frames, so substructure is drawn up with a corresponding 50mm.
EWT2 sheathed wall requires min 50mm between sheathing so this means 70mm between supporting base walls.

If your design starts as a non sheathed wall (EWT1) however, after doing this, the structural engineer decides that racking resistance is needed and adds sheathing boards to the design specification (e.g. wall spec changed to EWT2) – this needs 50mm between sheathing – so groundworks drawings will need adjusting to 70mm to allow for the minimum 50mm cavity between sheathing boards width to be retained.

Additional notes:

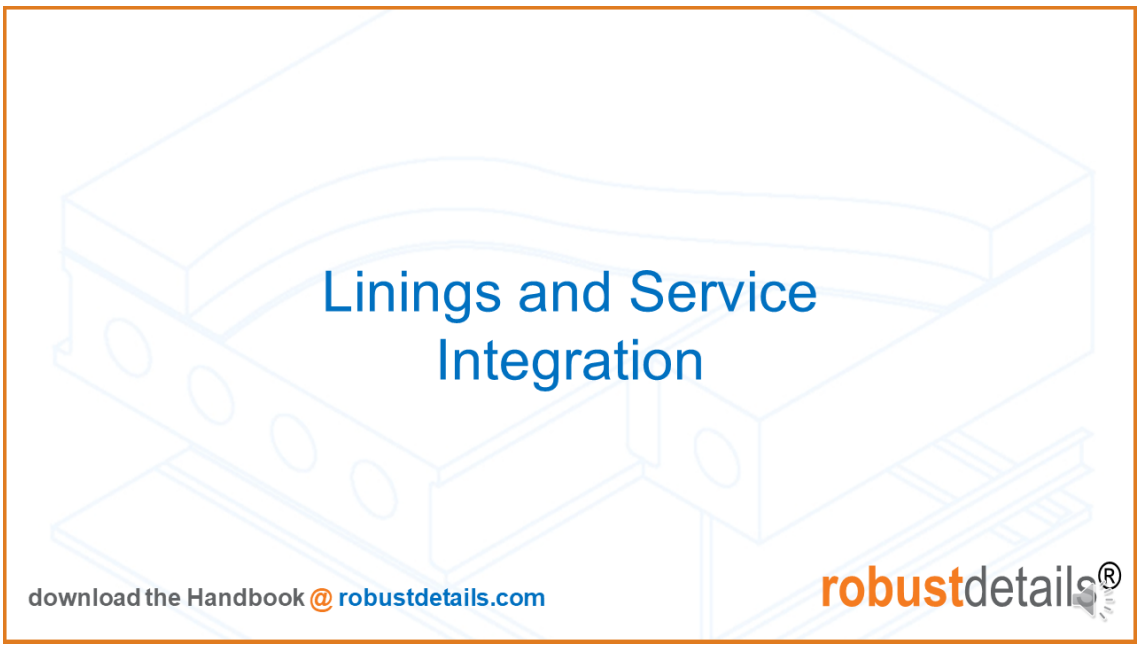
Slide 17



If the cavity is too small – this example shown measures 40mm, there will invariably be a dip at 125hz, as panel resonance starts up – and this could lead to test failure.

Additional notes:

Slide 18



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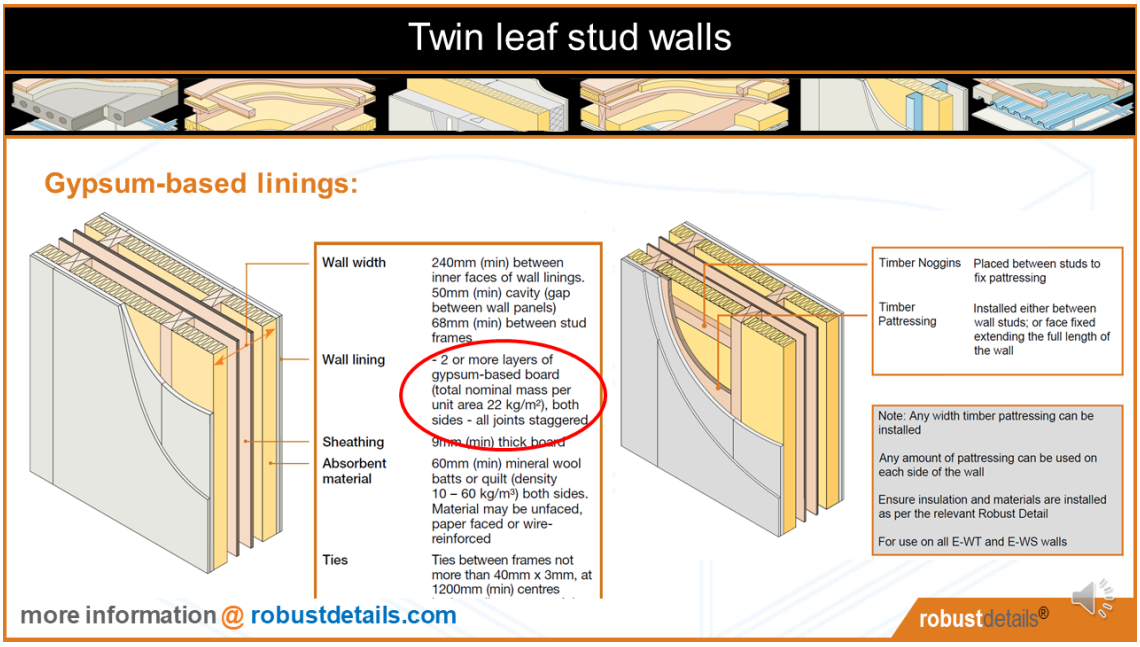
Additional notes:

Slide 19



For all light frame separating wall Robust Details specify a minimum of 2 layers to give a minimum mass per unit area of 22kg/m^2 on both sides. And it's critical this is followed.

The light frame separating walls, by definition, have no inherent mass in order to deal with the mid to low frequencies – so this has to be introduced via the boards.

A single heavy-weight board cannot be used in place of the 2 layers, as having the two layers allows the joints to be staggered (with overlapped joints), meaning there is no straight-through path for sound leakage at board joints;

Continued Overleaf

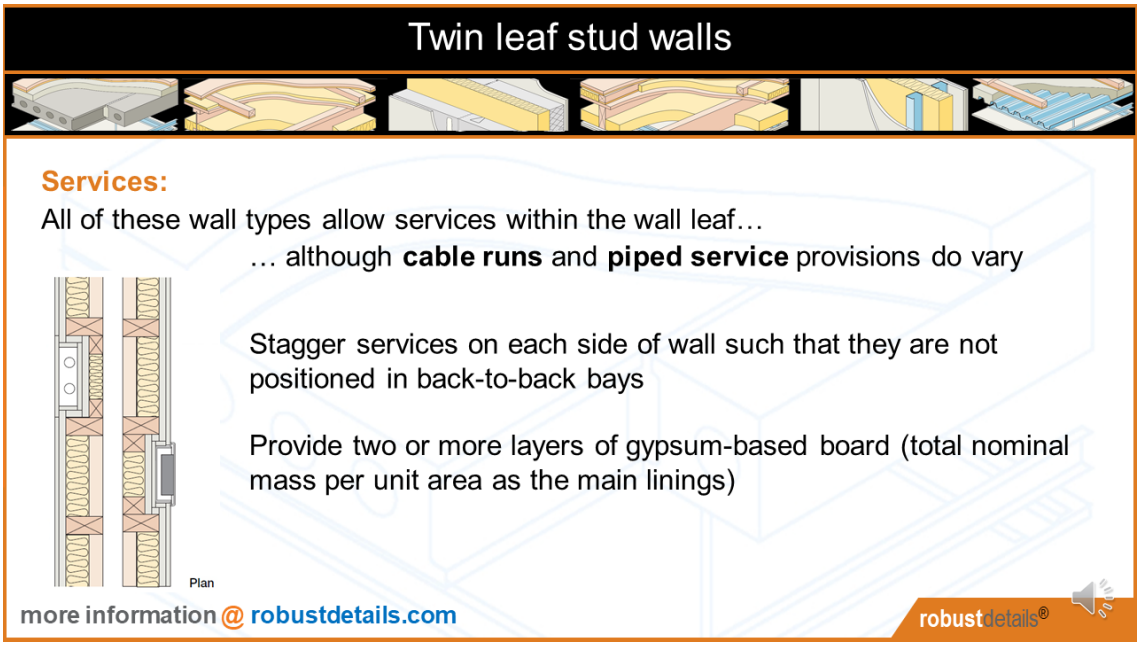
Additional notes:

Having more than one board lining also impedes sound due to having to try and move through different layers.

Gypsum-based board (also known as plasterboard) has specific acoustic properties, so this cannot be replaced with any other material such as plywood although the ply can be used in addition to the gypsum board for pattressing etc.

Additional notes:

Slide 20



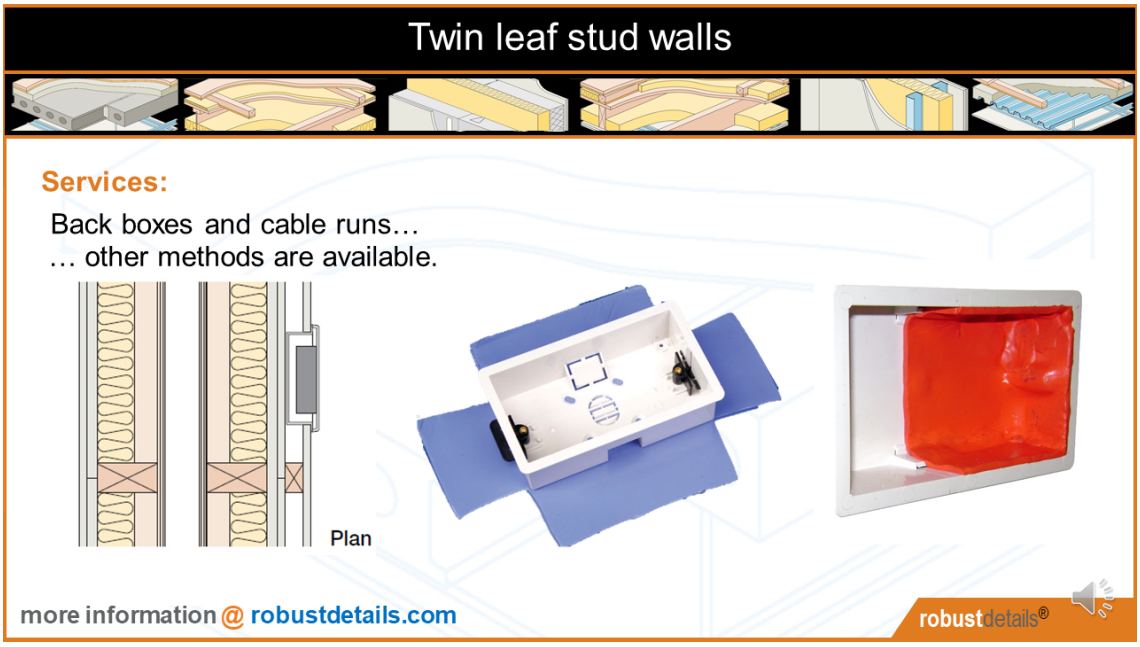
You should always look to avoid placing services in the separating walls. If this is not possible, they can be incorporated, but a lot of care is needed.

Regardless of it being electrical or piped services, ensure they are staggered, so the primary wall lining is not cut into on both sides of the wall within the same stud bay

The services then need to be enclosed with 2 layers of gypsum board giving 22 kg/m^2 … piped services need boxing-in for the full height of the run

Additional notes:

Slide 21



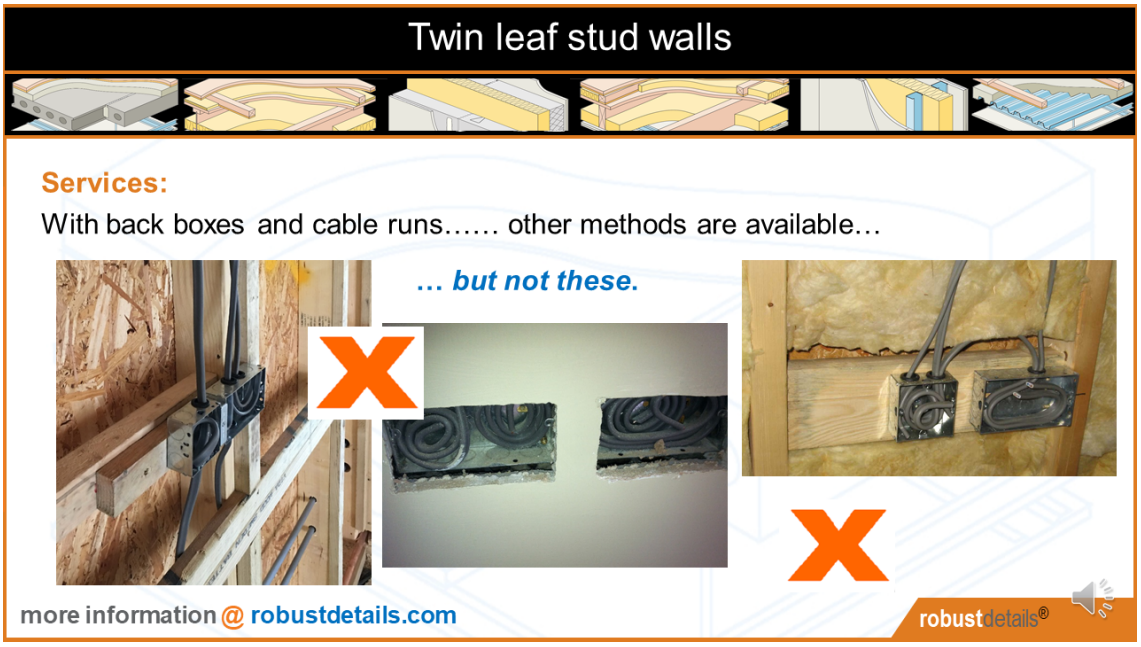
Creating the double boarding around a back-box is not the easiest thing to do on site, so you could consider:

Service zones – keeps primary lining intact for sound and fire – this enables services to be positioned directly back-to-back, as the primary lining on just one side of the wall has been cut into

Alternatively, putty pads and other proprietary enclosures can be used – but these are not all the same, so ensure the manufacturer has tested them to meet our Appendix H.

Additional notes:

Slide 22

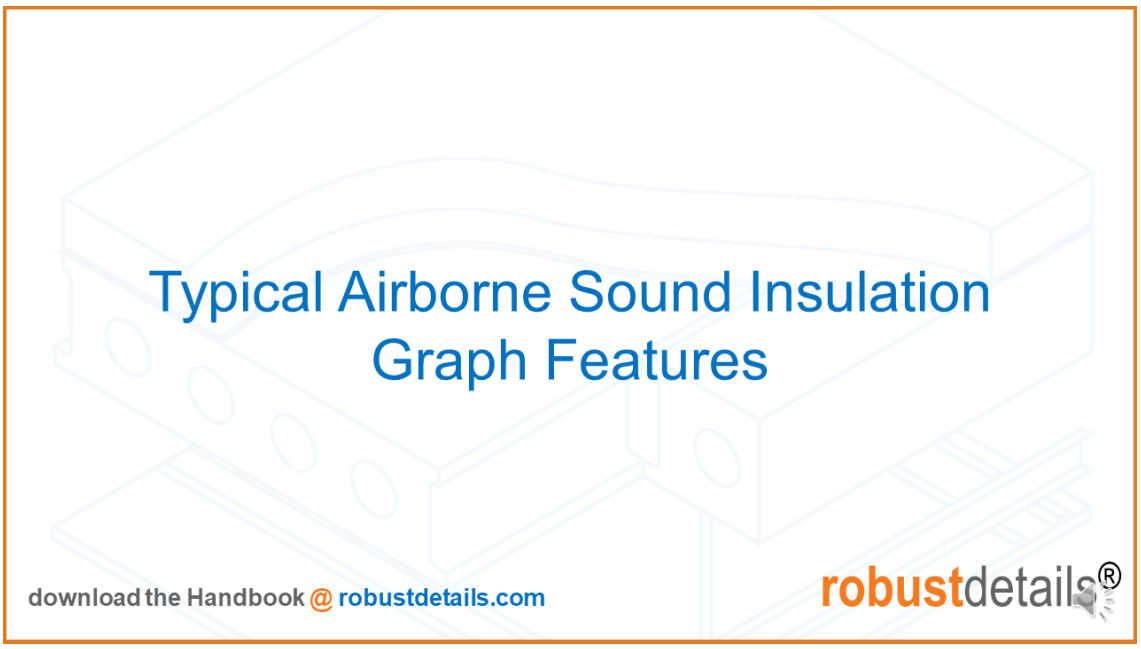


When we say other methods are available, we don't mean these…

… as we can see, no enclosures provided, so sound and potentially fire can readily pass through.

Additional notes:

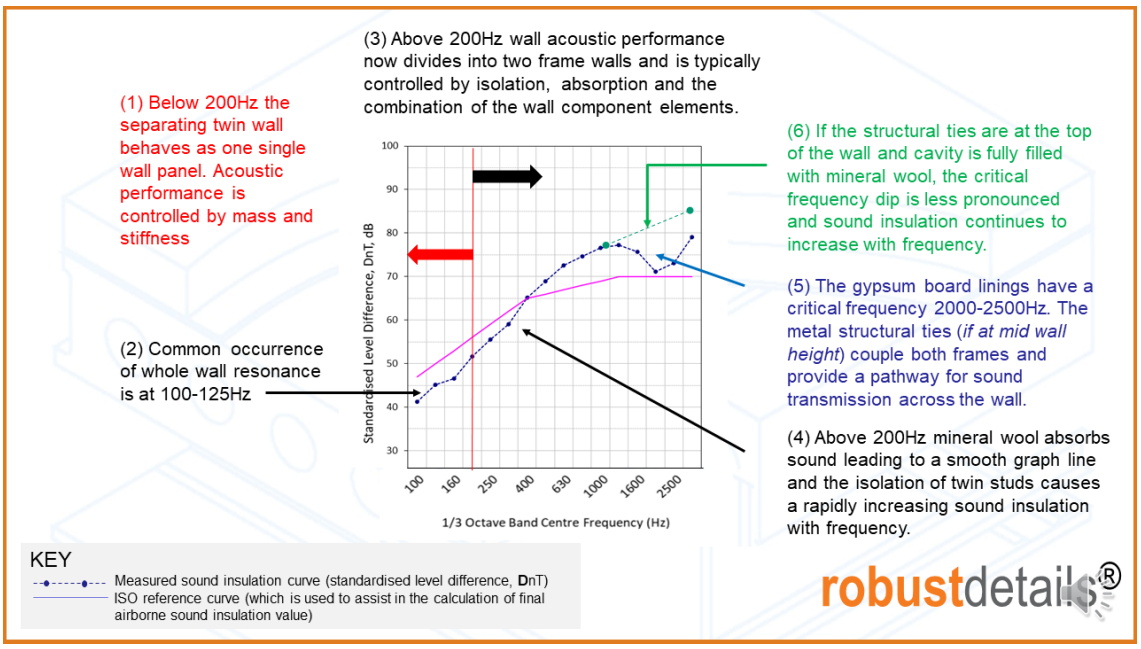
Slide 23



Read slide

Additional notes:

Slide 24



Typical airborne sound insulation graph features are shown in this slide.

(1) Below 200Hz the separating twin wall behaves as one single wall panel. Acoustic performance is controlled by mass and stiffness

(2) Common occurrence of whole wall resonance is at 100-125Hz

(3) Above 200Hz the wall acoustic performance, now divides into two twin frame walls and is typically controlled by isolation, absorption and the combination of the wall component elements

Continued Overleaf

Additional notes:

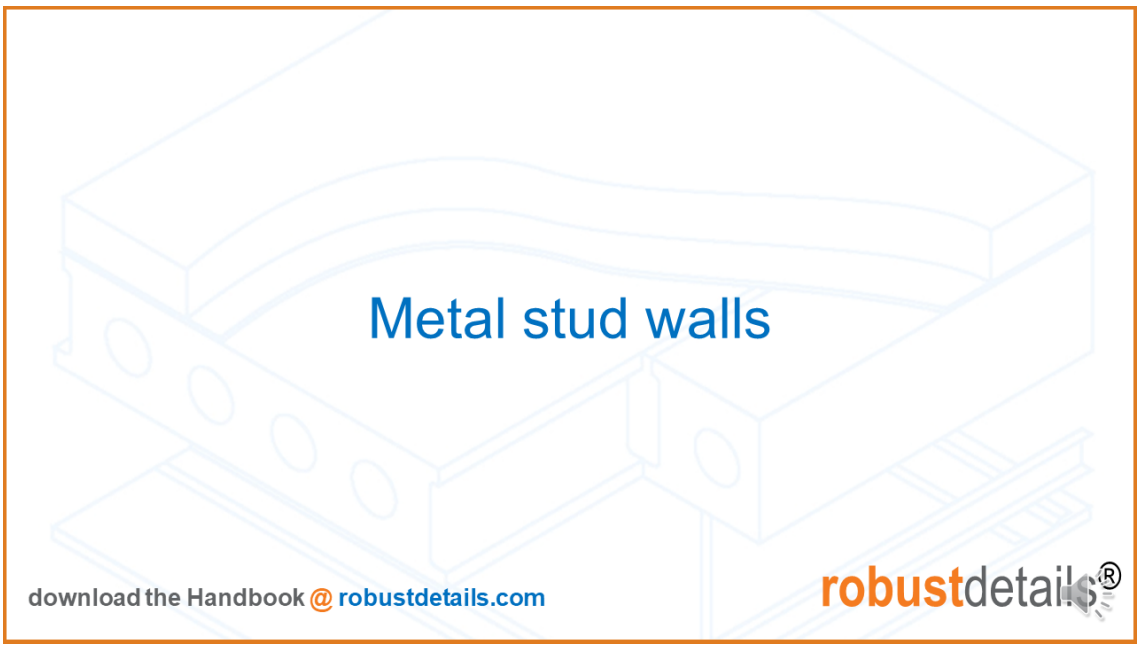
(4) Above 200Hz the mineral wool absorb sounds leading to a smooth graph line and the isolation of twin studs causes a rapidly increasing sound insulation with frequency.

(5) The gypsum board linings have a critical frequency 2000-2500Hz – this is where the gypsum boards vibration couples with the air very effectively and results in increased sound transmission. The metal structural ties (*if at mid wall height*) also couple both frames and provide a pathway for sound transmission across the wall.

(6) If the structural ties are at the top of the wall and the main central cavity is fully filled with mineral wool, the critical frequency dip is less pronounced and sound insulation continues to increase with frequency.

Additional notes:

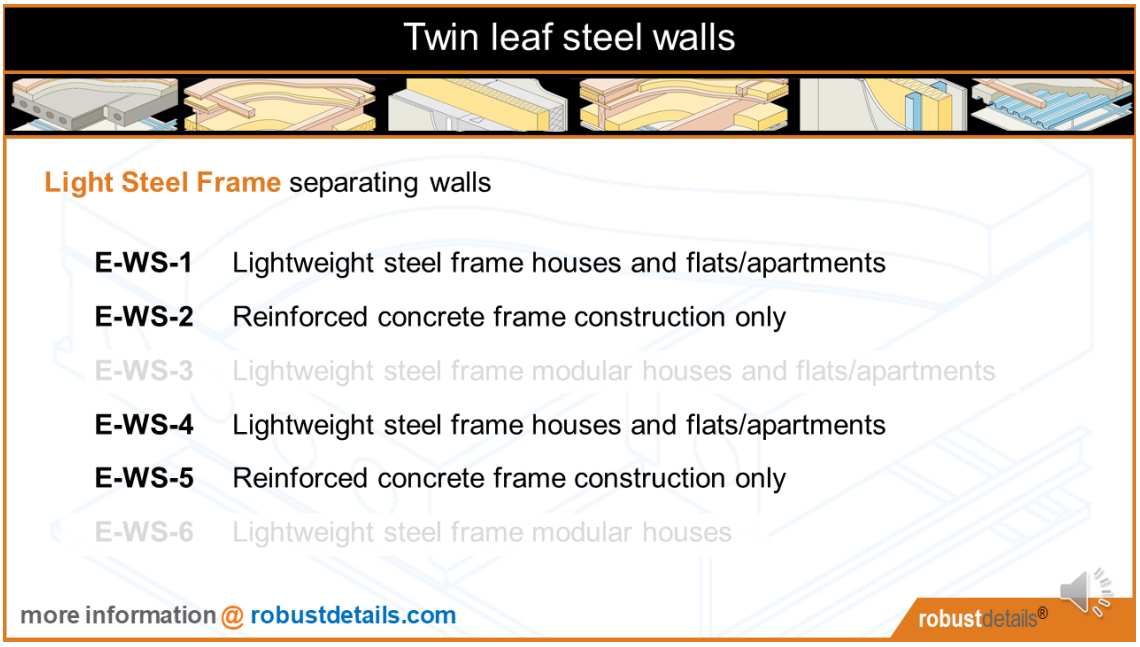
Slide 25



Read slide

Additional notes:

Slide 26



There are currently 6 light-steel frame Robust Details

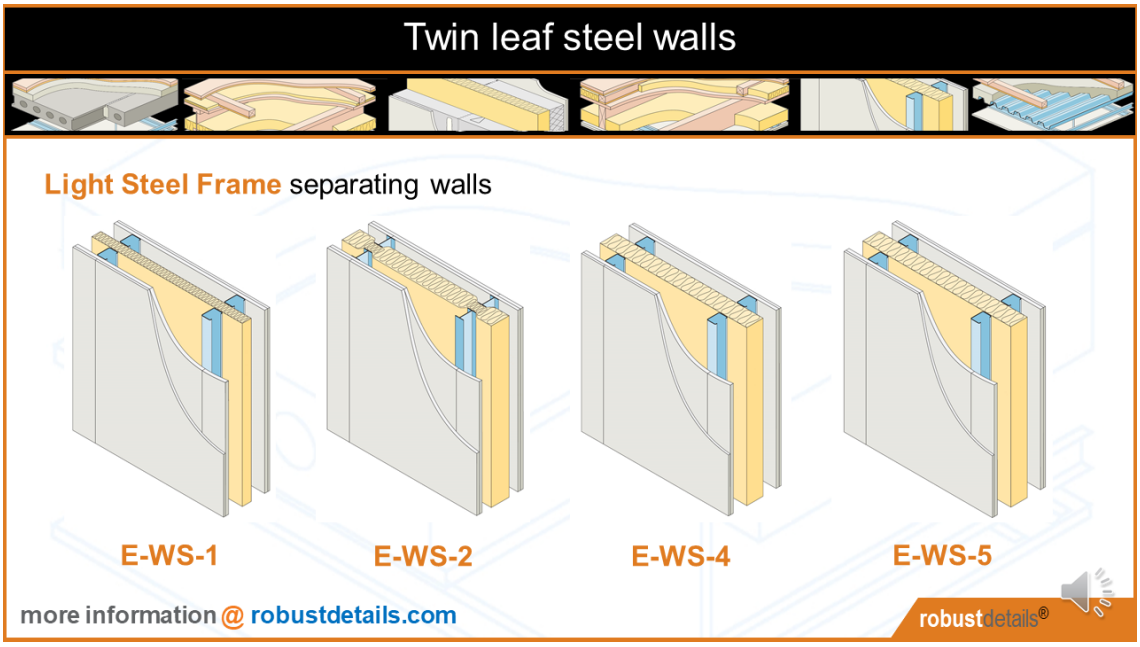
Unlike timber frame, the steel walls have specified forms of construction where they can be used. This is shown at the top of p.1 of each of the Details.

E-WS-3 and E-WS-6 are factory-built volumetric, so these walls cannot be selected for on-site construction, and you will have no control over the specification or design.

So let's look at the others.

Additional notes:

Slide 27

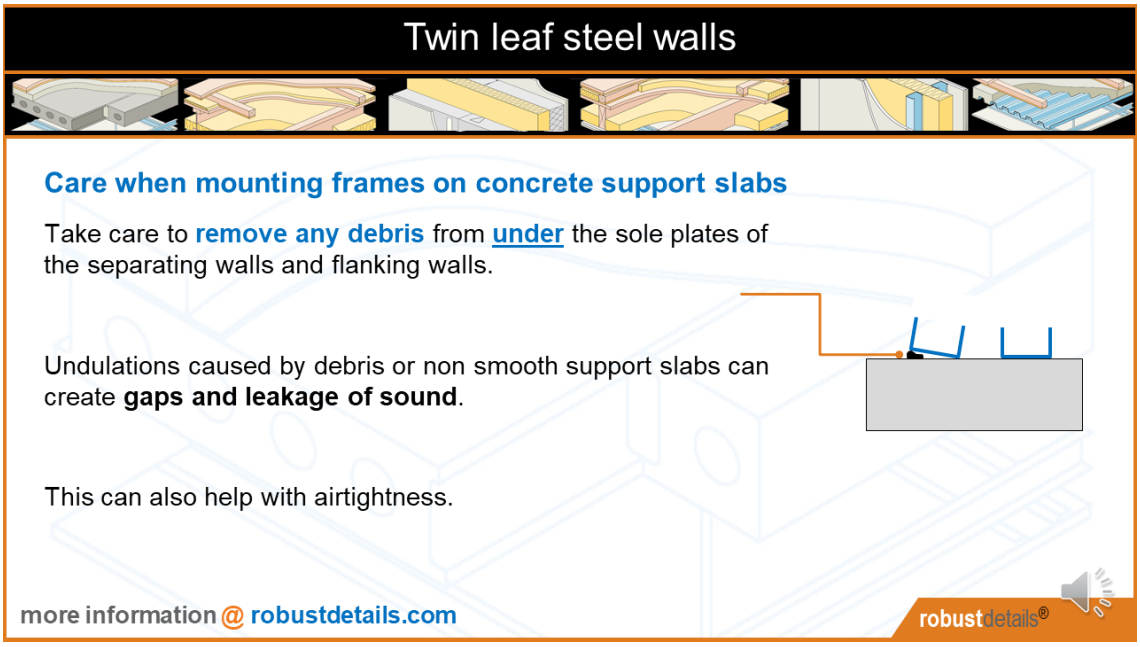


As can be seen, the steel walls are all very similar in design, albeit the specifications of the insulation and gypsum board does vary from one Detail to the next.

However, the only wall type that can be fully-filled to address the cavity thermal bypass issues, is E-WS-5 – the others do not allow full-fill.

Additional notes:

Slide 28



Care should be taken when mounting frames on concrete support slabs

When mounting steel frame sole plates for twin separating walls and flanking walls it is **important that debris** is **not under** the sole plates. The same applies to timber sole plates.

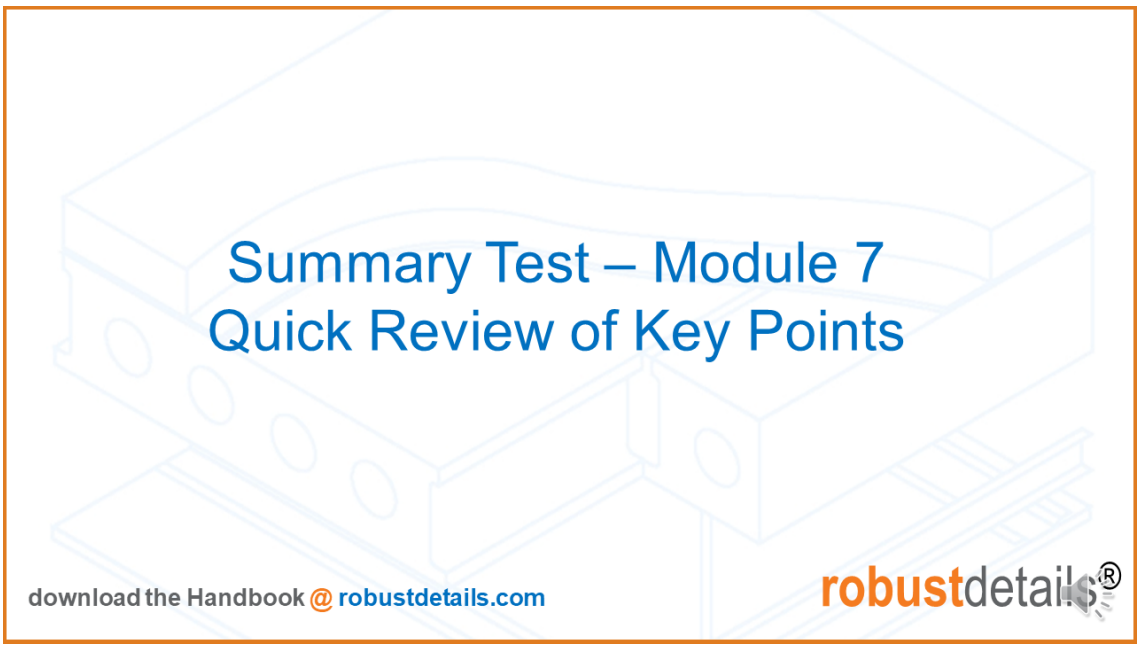
However, as metal sole plates are more flexible, any undulations caused by debris or non-smooth support slabs can create **gaps and leakage of sound**.

Also ensuring such sole plates are not twisted helps reduce sound leakage.

This can also help with the airtightness of a building.

Additional notes:

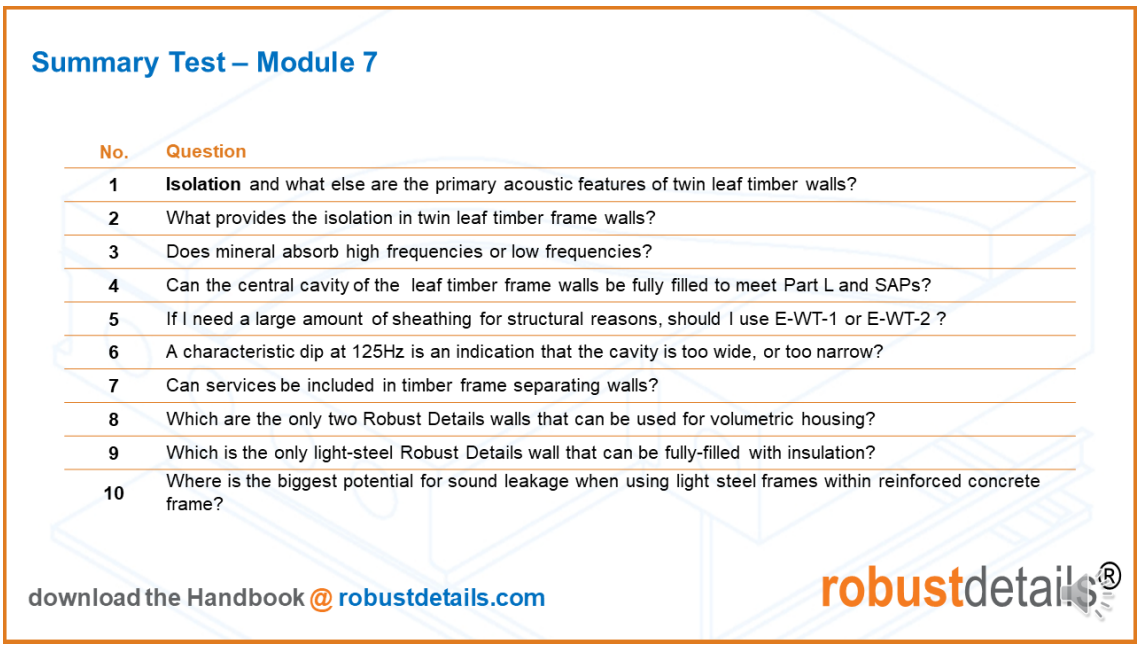
Slide 29



Now for a quick TEST to recap on Module 7

Additional notes:

Slide 30



Here are 10 questions – you may wish to PAUSE the recording and test yourself against these questions.

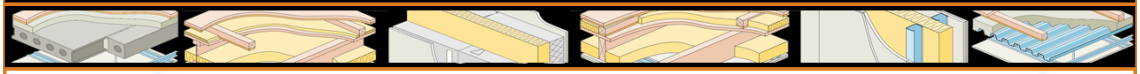
Once you have answered all of them – the next slide provides the answers.
In 10 seconds the slide will change so press pause now if you want to test yourself first.

Thank you for following Module 7

Additional notes:

Slide 31

Summary Test – Answers



No.	Answer
1	Absorption
2	The cavity
3	Higher frequencies of 200Hz and above
4	Yes, provided the correct density is used
5	E-WT-2, as this allows anything up to full sheathing of both panels.
6	Too narrow. This is an indicator of strong panel resonance.
7	Yes, provided they are not positioned back-to-back; and they are shielded by gypsum board or putty pads.
8	E-WS-3 and E-WS-6
9	E-WS-5
10	At the base, where any undulations caused by debris or non smooth support slabs can create gaps and leakage of sound.

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Here are the answer to Module 7's quick test.
How did you do?

Thank you for following Module 7

Additional notes:

Slide 32

This completes the end of Module 7 – Timber and lightweight steel separating walls

Additional notes:

Slide 33

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Additional notes: