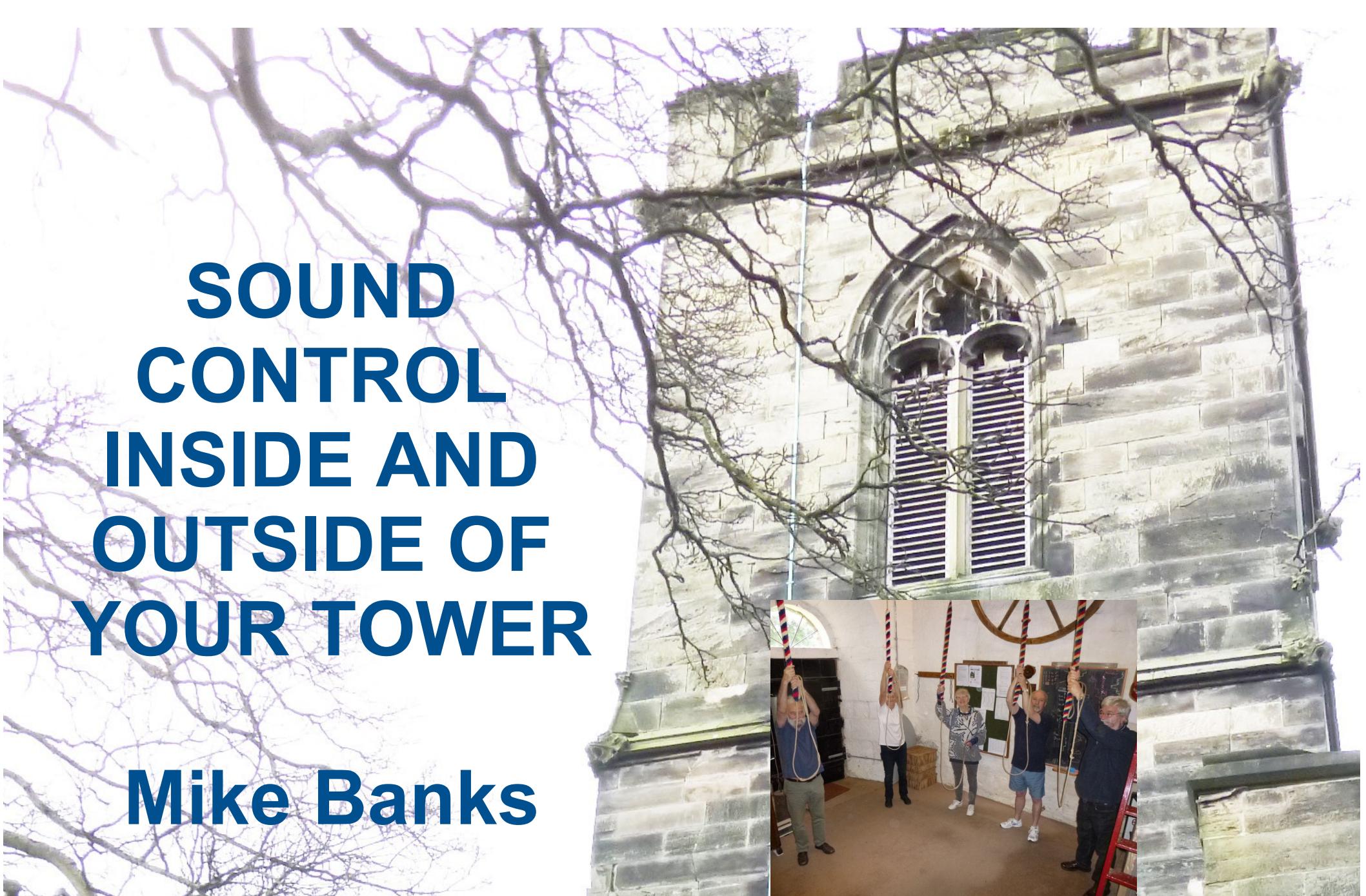
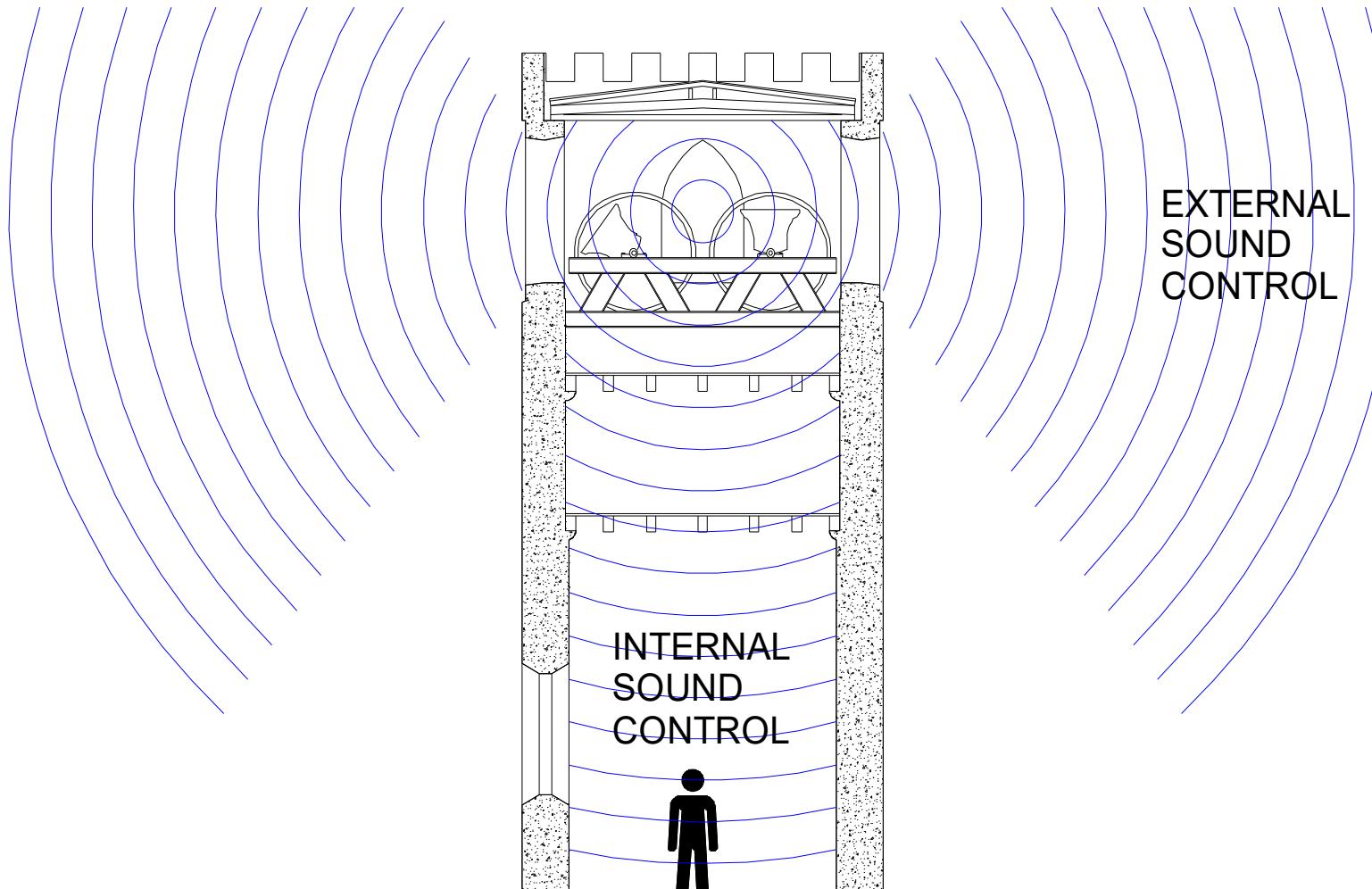


SOUND CONTROL INSIDE AND OUTSIDE OF YOUR TOWER

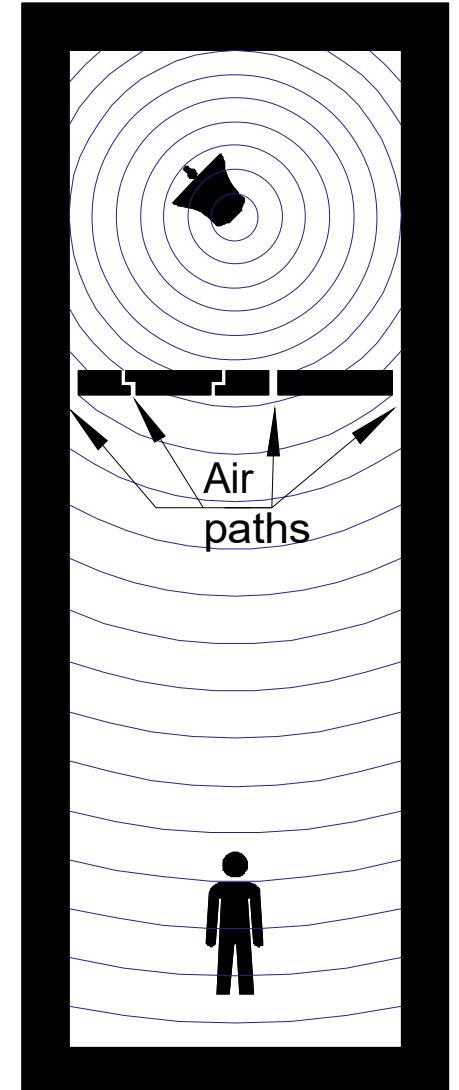
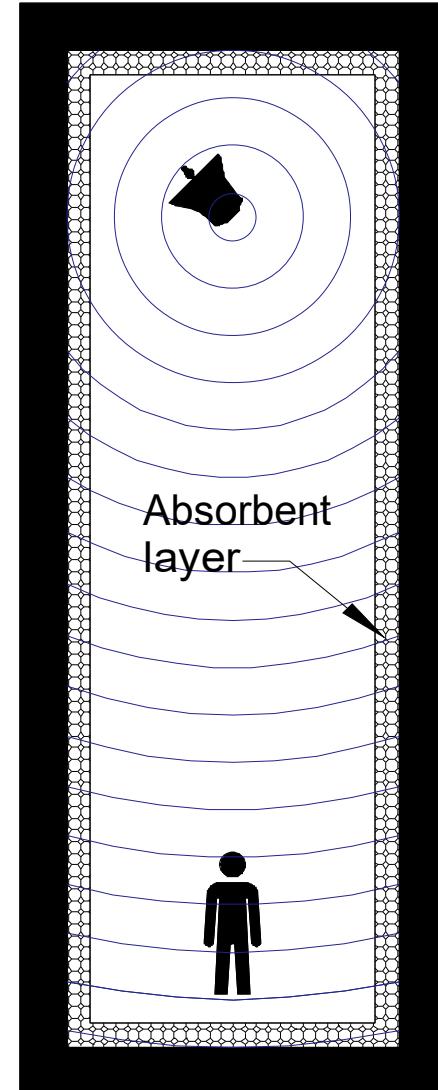
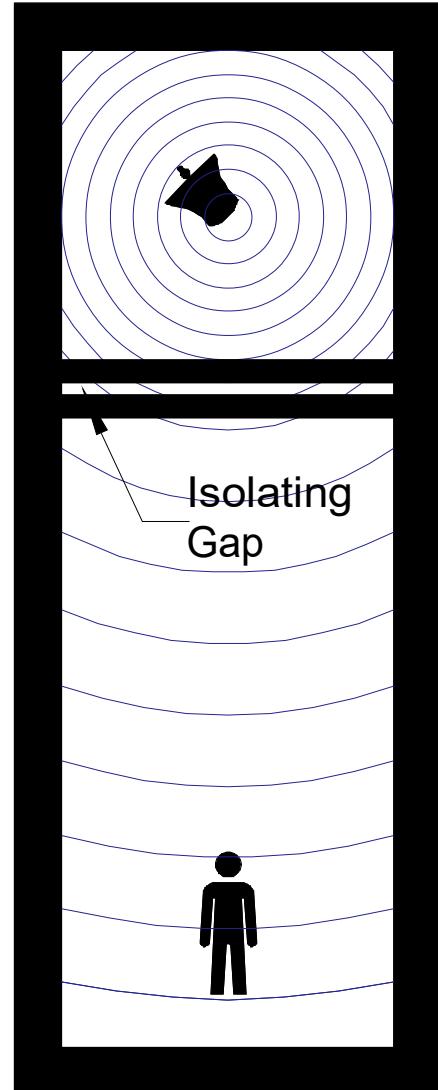
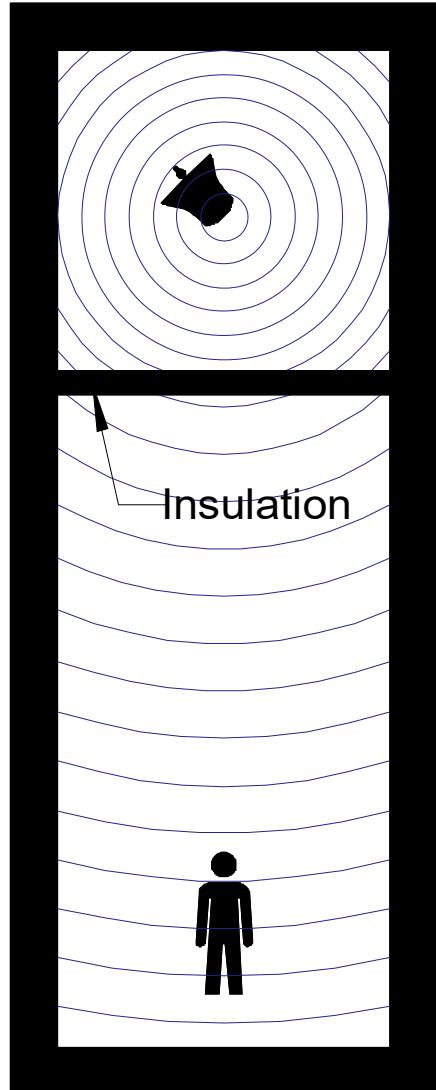
Mike Banks



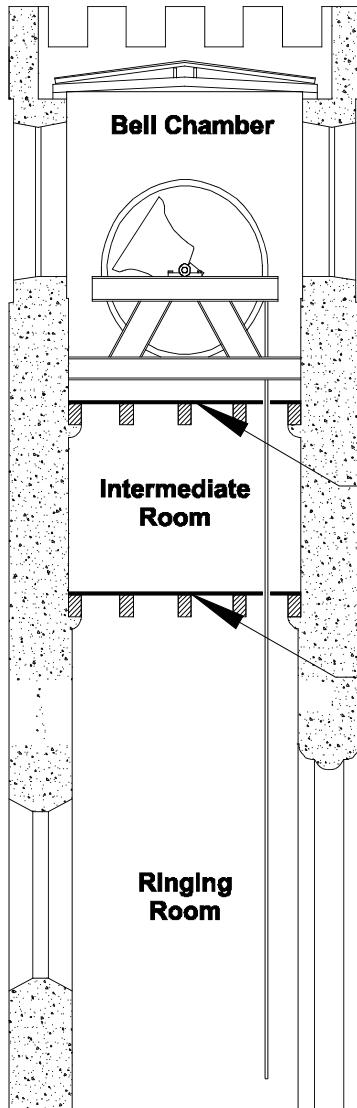
Internal & External Sound Control



Factors Influencing Sound Control



Types of Acoustic Barrier – Simple Barrier



**Long Draught
Tower**

Simple Barrier -
single layer floor

Simple Barrier -
single layer floor

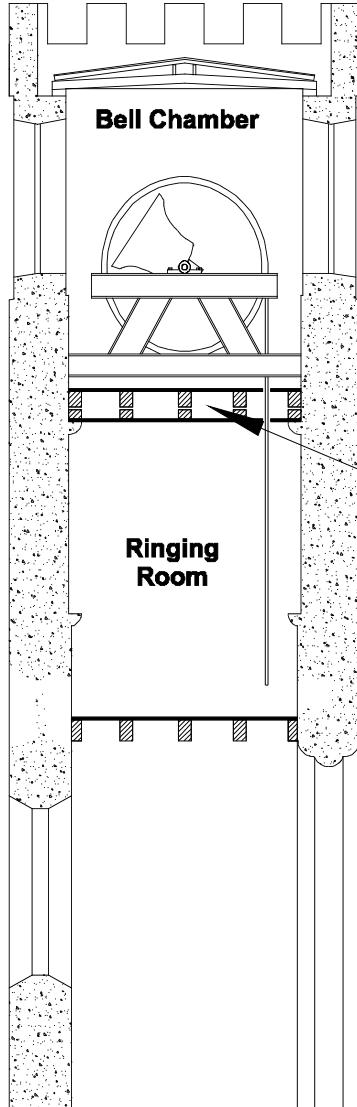
A simple barrier may comprise:

- a wooden floor resting on joists
- a reinforced concrete floor.



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BELL RINGERS

Types of Acoustic Barrier – Composite Barrier



**Short Draught
Tower**

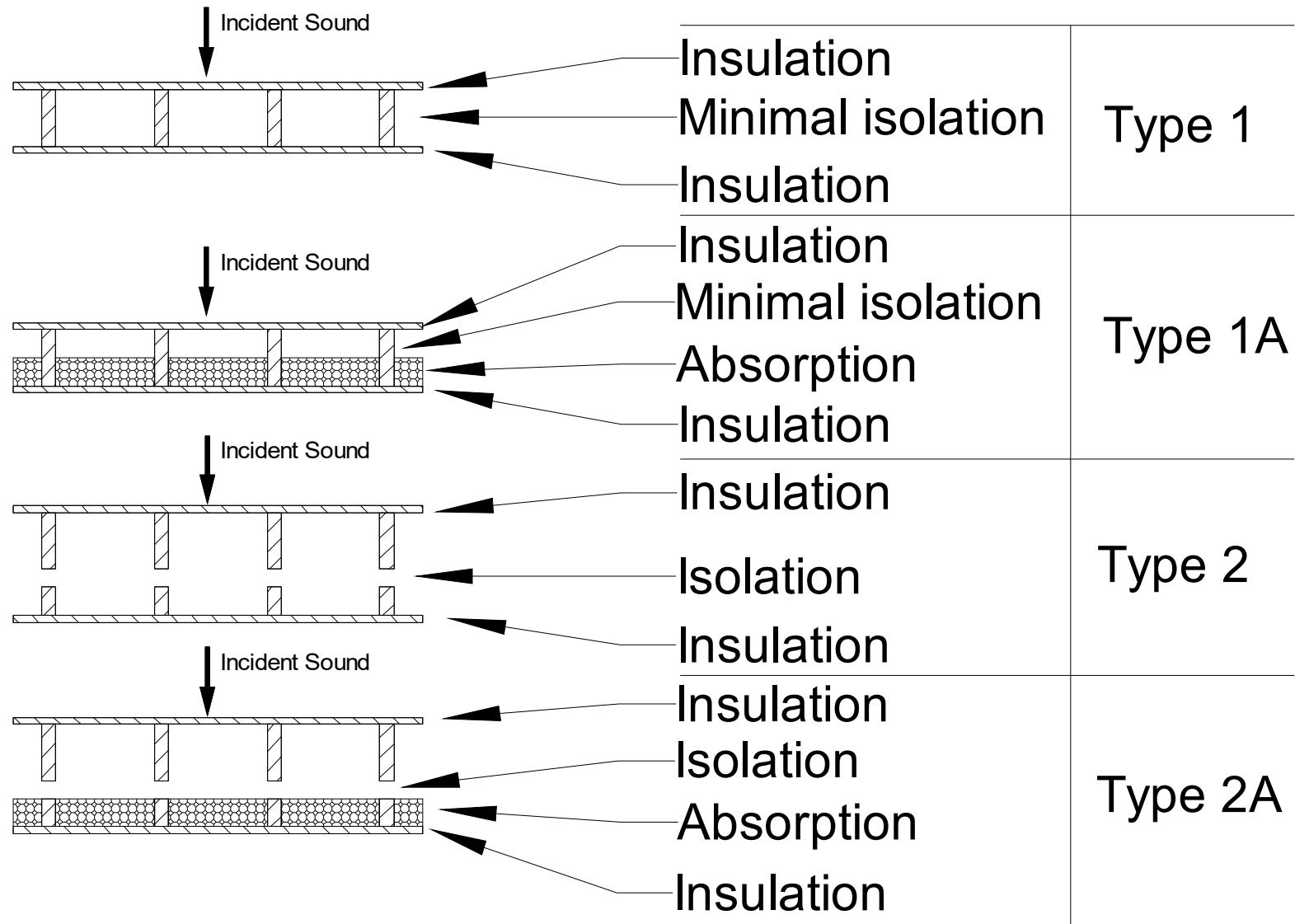
Composite Barrier -
floor/ joist/ ceiling

A composite barrier typically comprises a wooden floor resting on joists, with a ceiling below either attached to the underside of the joists or structurally independent.



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Types of Composite Sound Barrier



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Measuring Sound Pressure Levels

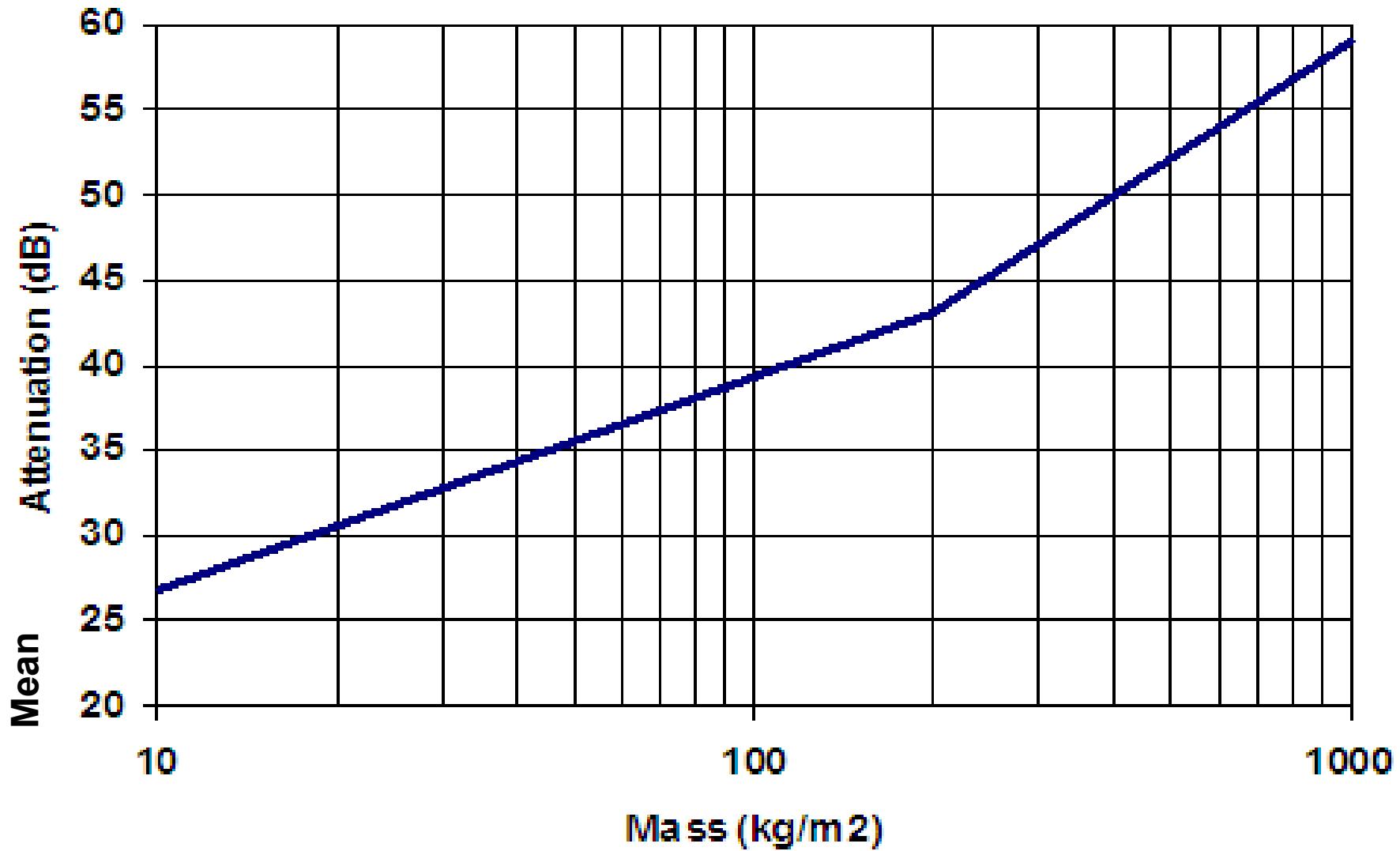


- To correspond with the sensitivity of the human ear, sound level meters incorporate electronic filtering called A-weighting – the measured sound levels are signified as dB(A).
- The FAST setting attempts to catch peaks of sound whereas the SLOW setting averages sound levels over a longer time period.
- Ringers' perceptions of bell sound levels correlate well with use of dB(A) and a SLOW setting.



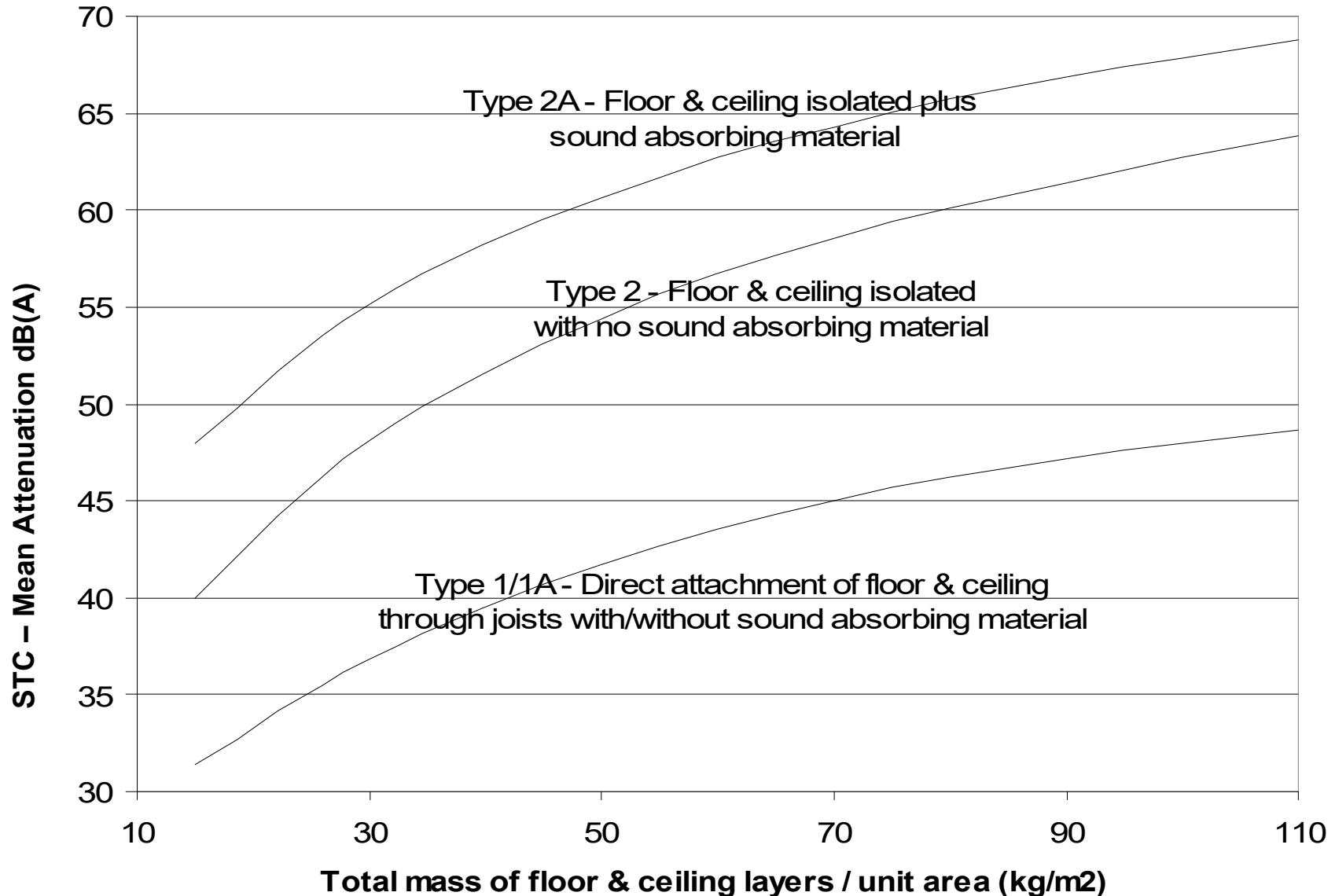
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Estimated Sound Attenuation for Simple Barriers



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Estimated Attenuation - Composite Barriers



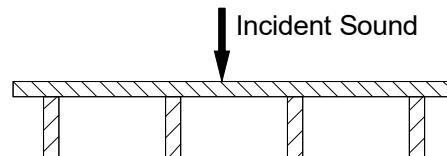
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BELL RINGERS

Estimated Sound Attenuation for Various Wooden Barrier Configurations

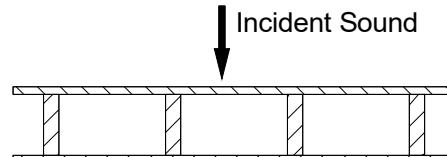
Assumptions:

- simple barrier comprises 50 mm T&G timber boards,
- composite barrier floors and ceilings each comprise 25 mm T&G timber,
- the mass of each floor plus ceiling is 24 kg/m² (ignoring mass of joists).

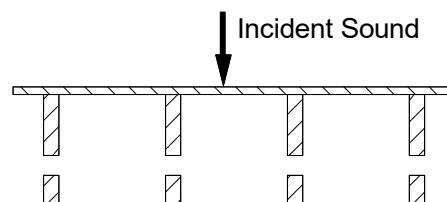
(Simple) 32 dB(A)



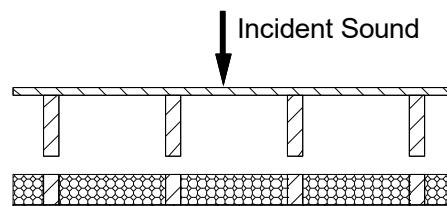
(Type 1) 35 dB(A)



(Type 2) 46 dB(A)



(Type 2A) 53 dB(A)



Floor and ceiling acoustically connected through joists

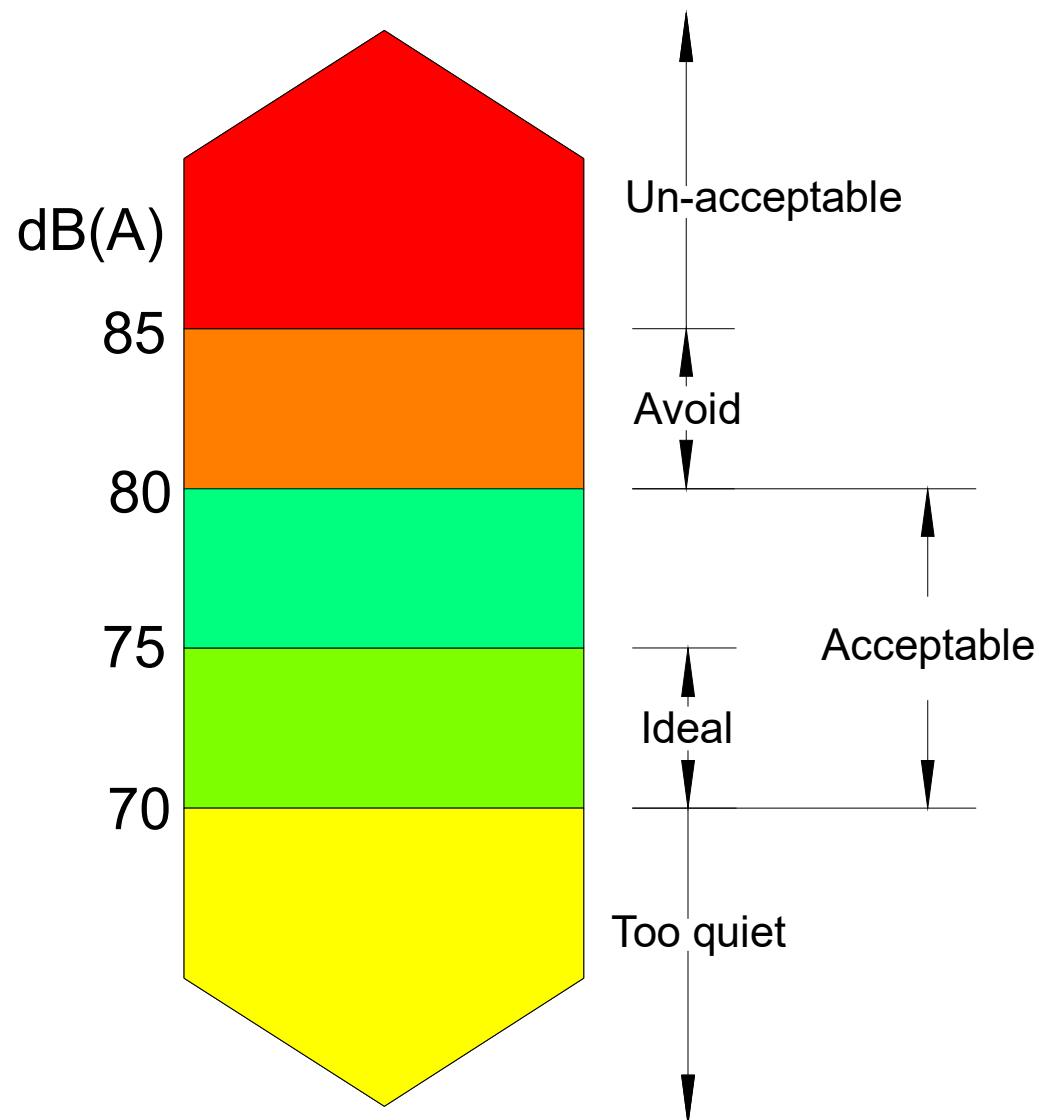
Floor & ceiling acoustically isolated

Floor & ceiling acoustically isolated plus sound absorbing material



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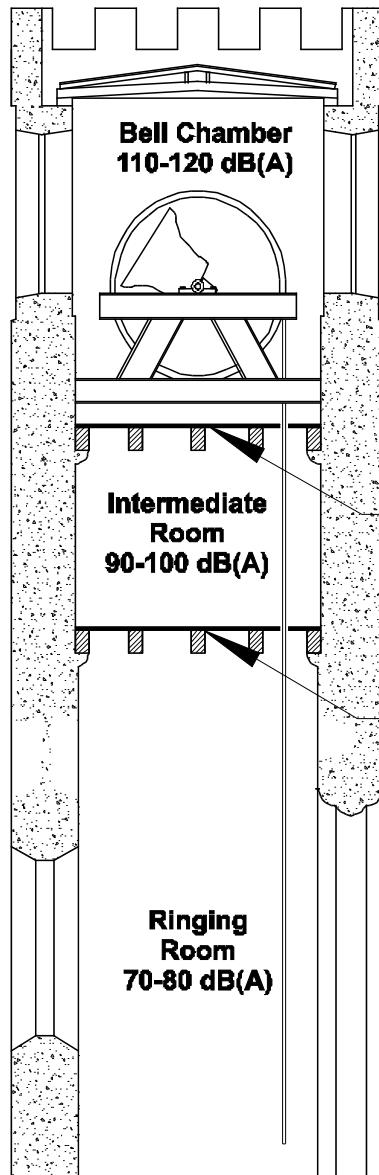
Target Sound Levels For Ringing Room



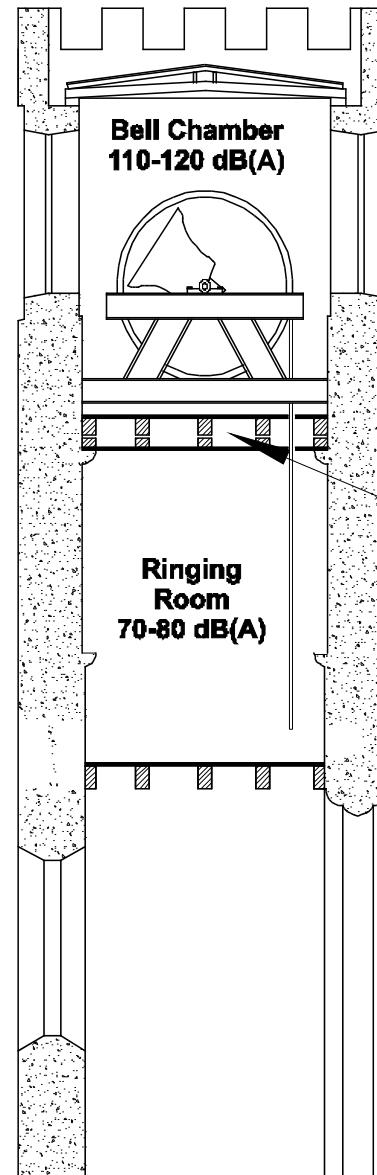
- **Sufficiently loud** for ringers to clearly hear their own and the other bells to ensure good striking.
- **Not too loud** since ease of verbal communication is essential for ringers to clearly hear commands from the conductor or from a tutor.



Sound Barriers Inside Tower Must Give 35-45 dB(A) Attenuation For Ringing Room



Long Draught
Tower



Short Draught
Tower

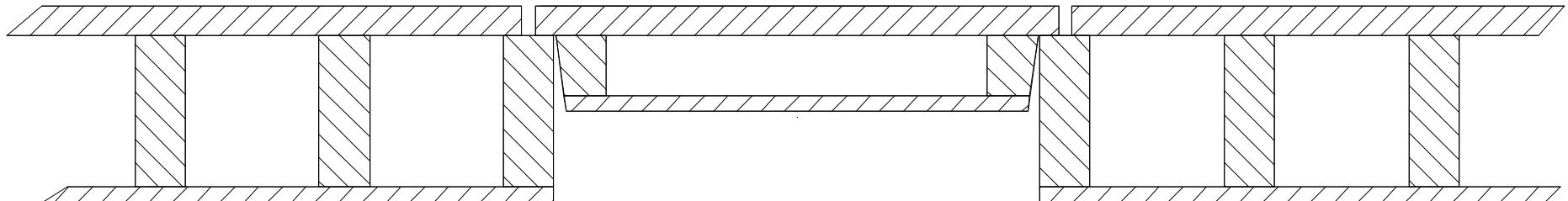
Simple Barrier -
single layer floor

Simple Barrier -
single layer floor

Composite Barrier -
floor/joist/ceiling

All Trap Doors are an Integral Part of the Acoustic Barrier

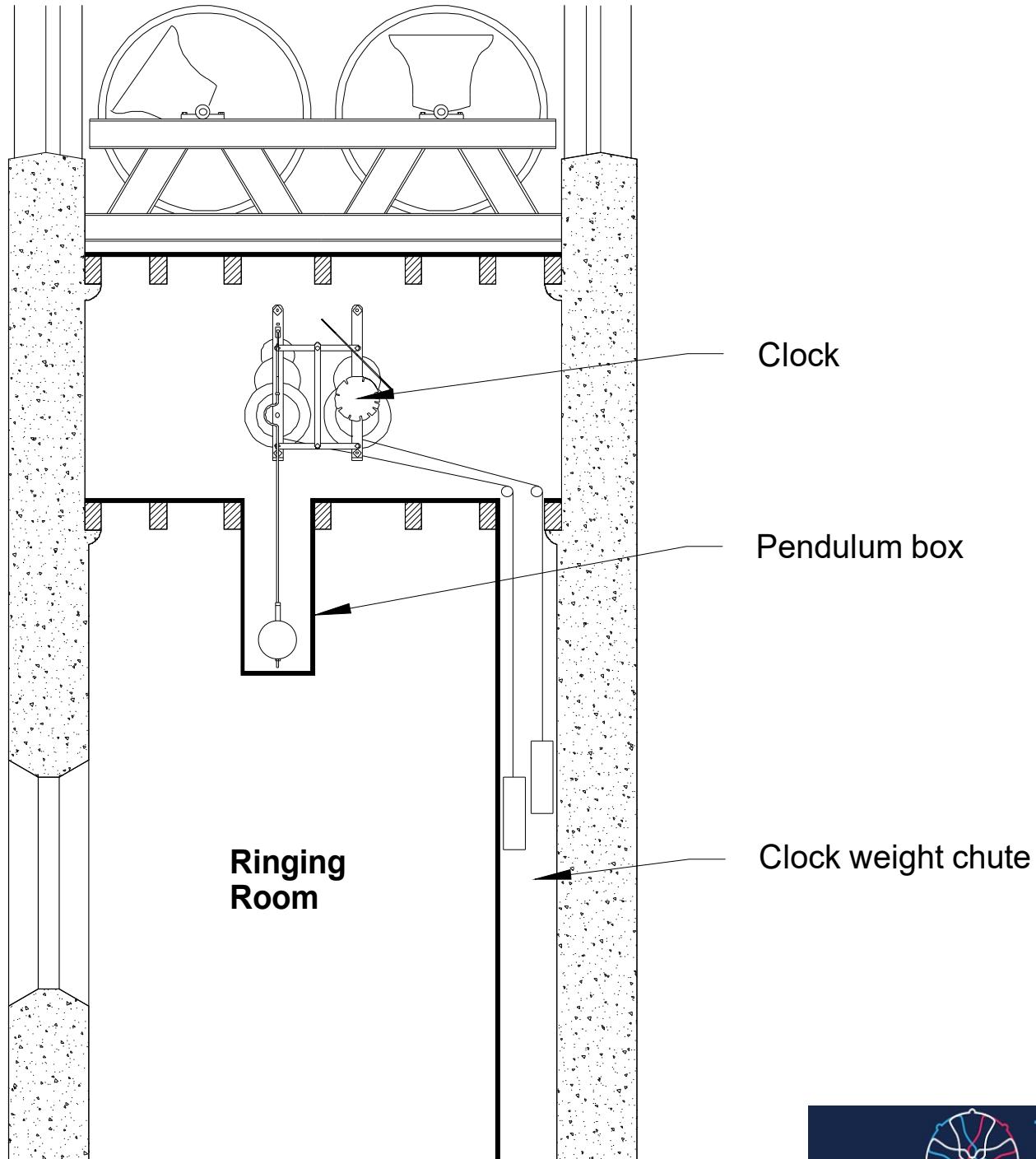
Trap Door



- Trap door must comprise same type of construction as rest of acoustic barrier and be sealed around edges.
- Composite construction trap door will be heavy – if used for access it may need to be counterbalanced.



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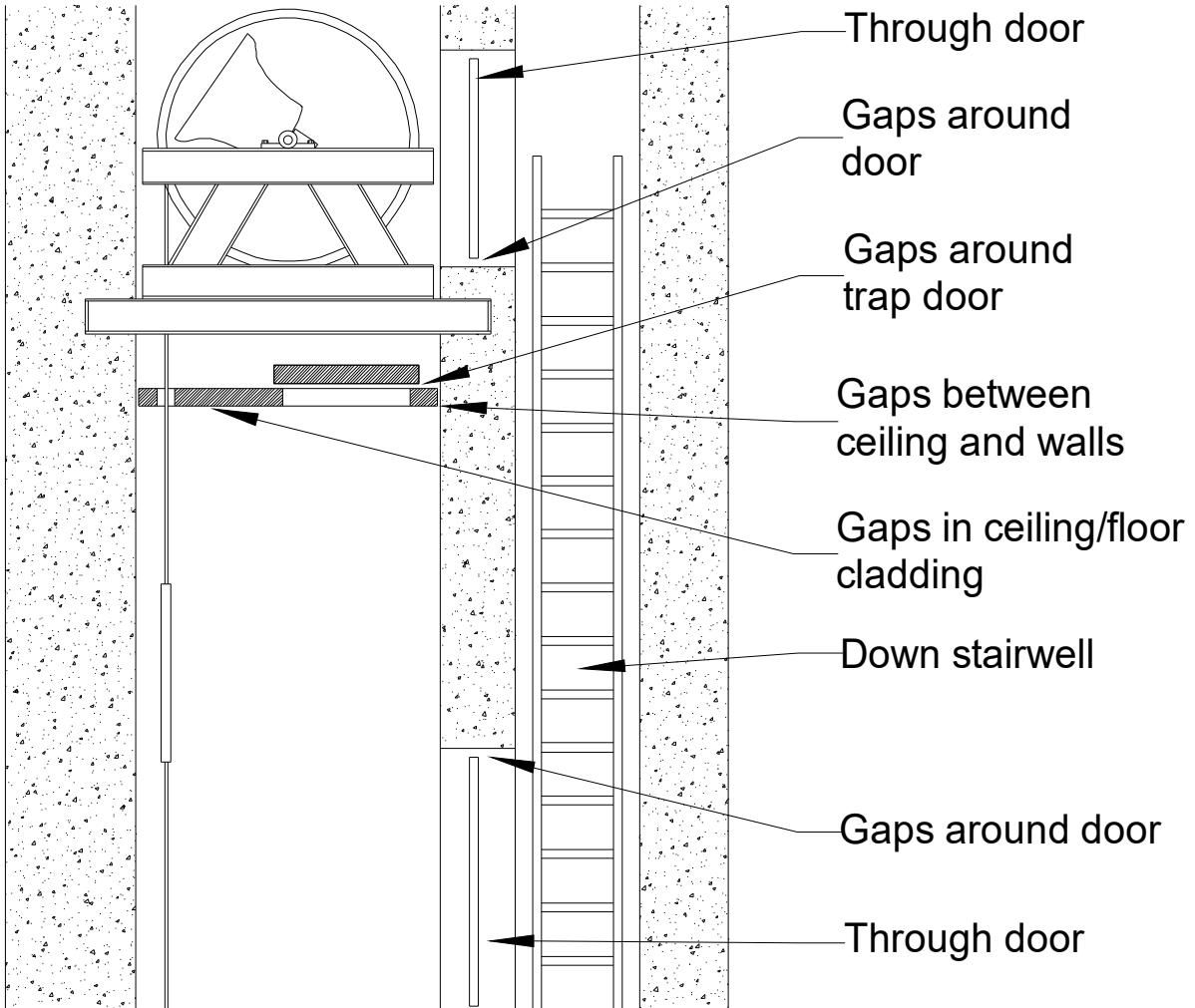


**Clock Weight
Chutes and
Pendulum
Boxes are
Extended
Surfaces
of the
Acoustic
Barrier**



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All Flanking Sound Must be Eliminated!



Other sources of flanking sound are:

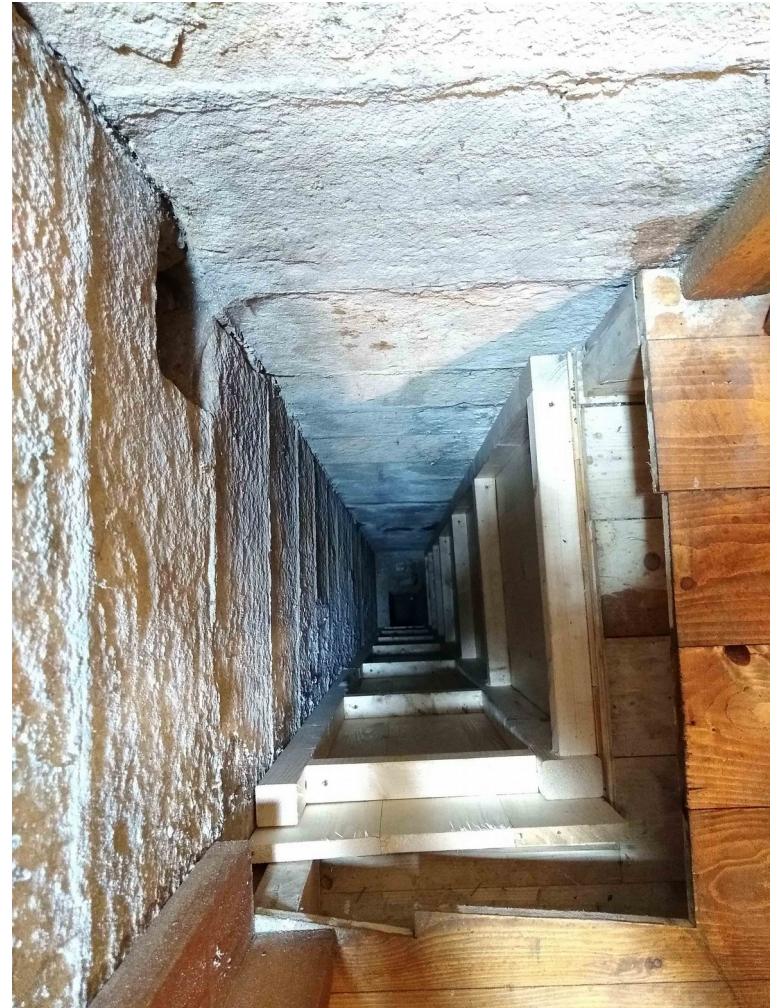
- clock weight chutes made from lightweight materials and with unsealed joints
- clock pendulum box made from lightweight materials and unsealed
- holes for clock drive shafts, chiming wires etc.
- ringing room window.



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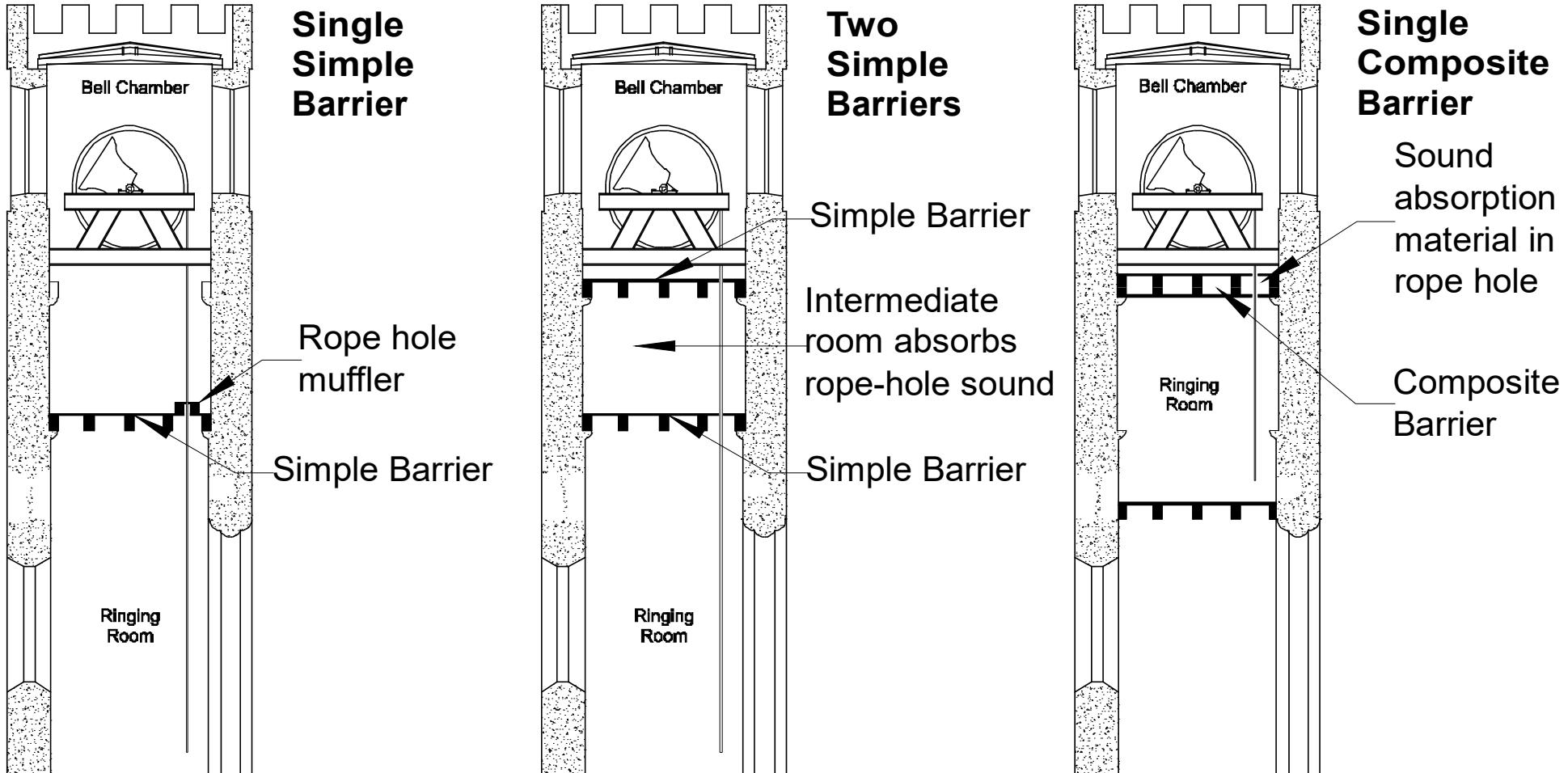


Rebuilt Clock Weight Chute – All Saints Glossop Derbyshire



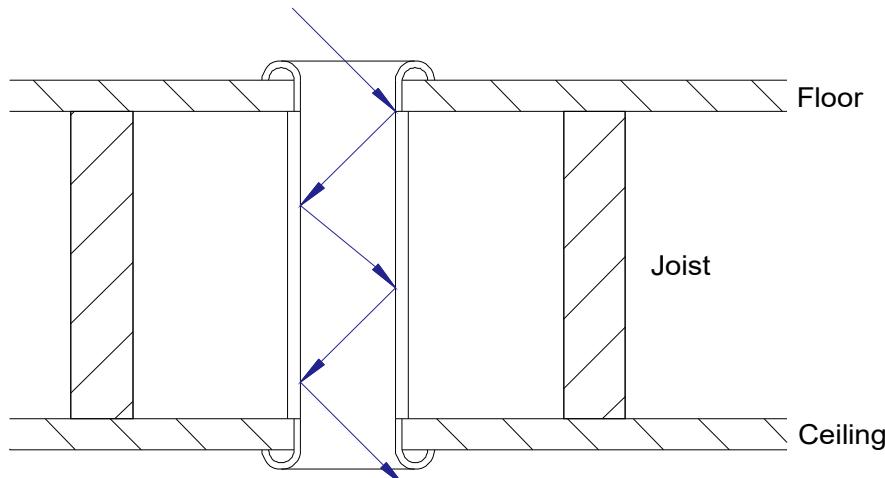
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BELL RINGERS

Rope Hole Sound Control



Rope Holes in Composite Barriers – Effect of Tube

Rope hole
with tube



Sound reflected
down tube giving
little attenuation of
rope hole sound

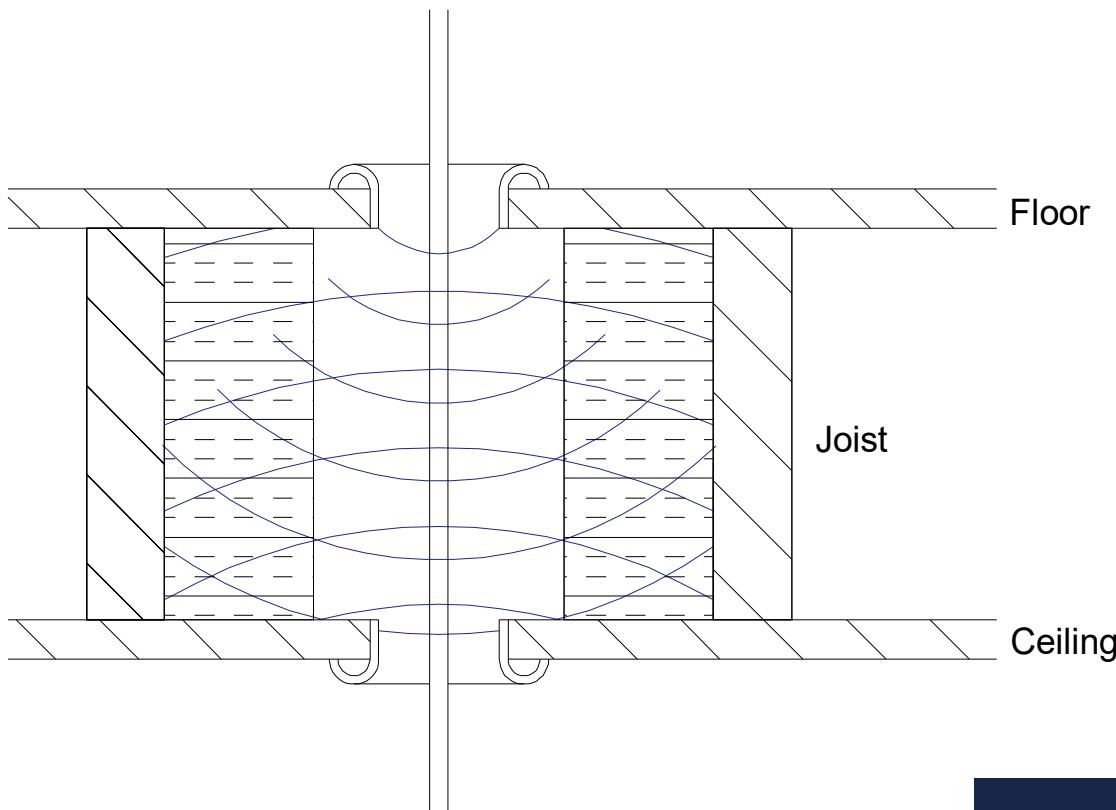
- Use of plain rope-hole tubes or boxes through composite floors causes maximum rope hole sound transmission.
- Where the rope is drawn above the barrier, tubes **are necessary** to ensure free rope movement through the barrier.



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BELL RINGERS

Rope Holes in Composite Barriers – Preferred Design

Rope hole with sound absorbent material in cavity and no tube



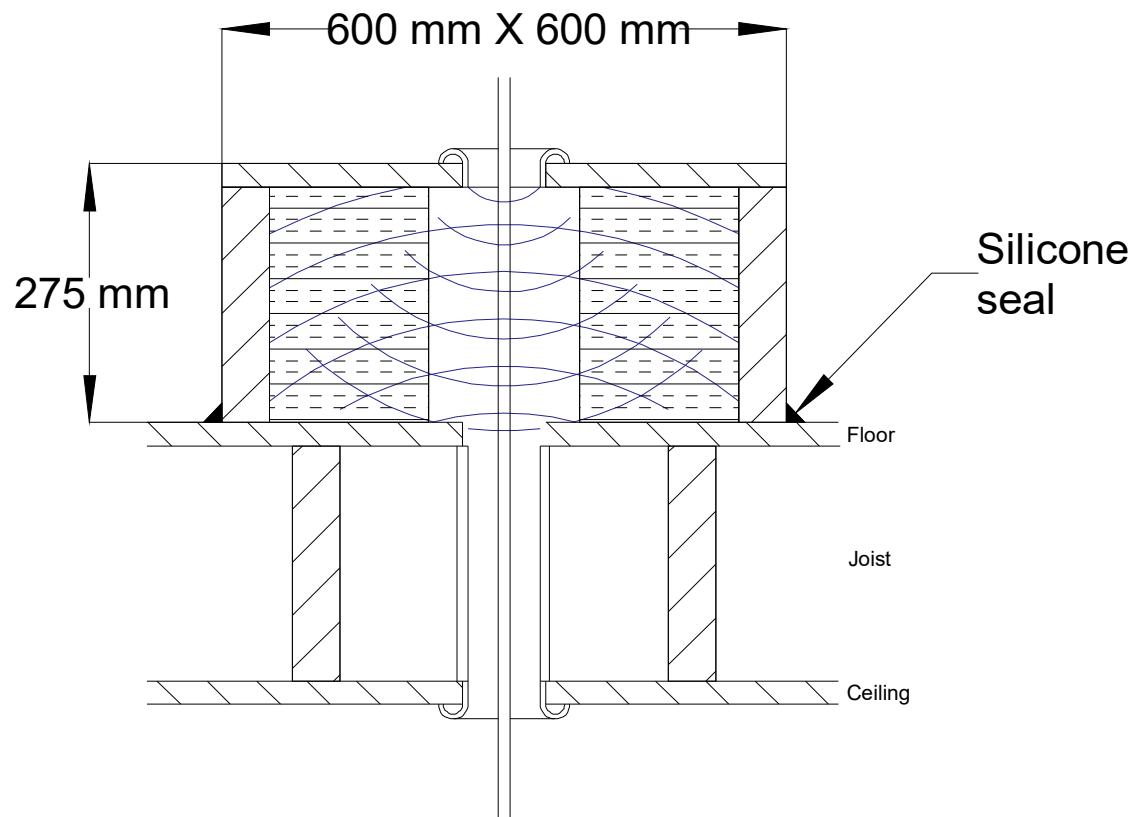
Use in all situations where the rope falls vertically and maximum sound attenuation is required.

Attenuation up to 10dB(A)



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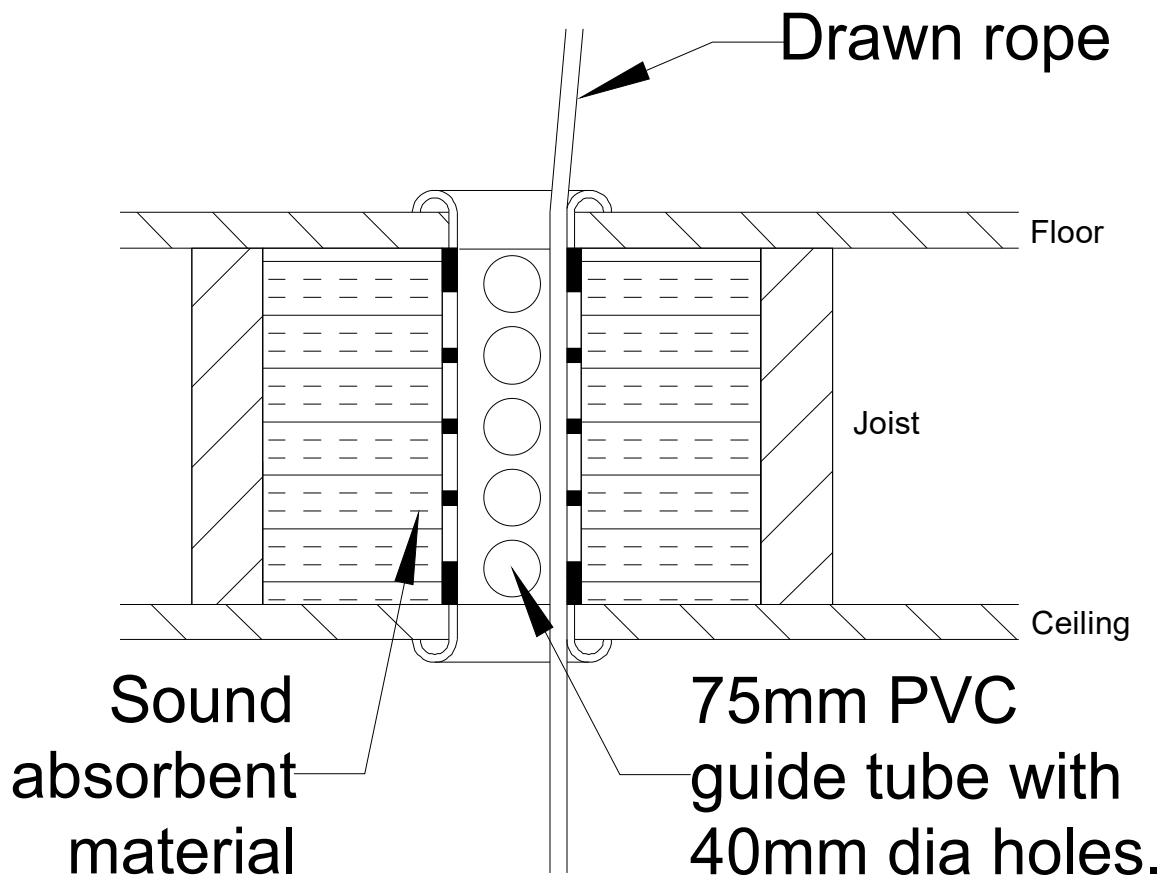
Rope Holes in Composite Barriers – Muffler Box



- Use where the rope falls vertically and where there is already a rope-hole tube or box.
- Great care is needed to seal all joints in the box or it will be ineffective!
- Can also be used with simple barriers.
- Attenuation up to 10dB(A)



Rope Holes in Composite Barriers – Tube Modified to Attenuate Sound



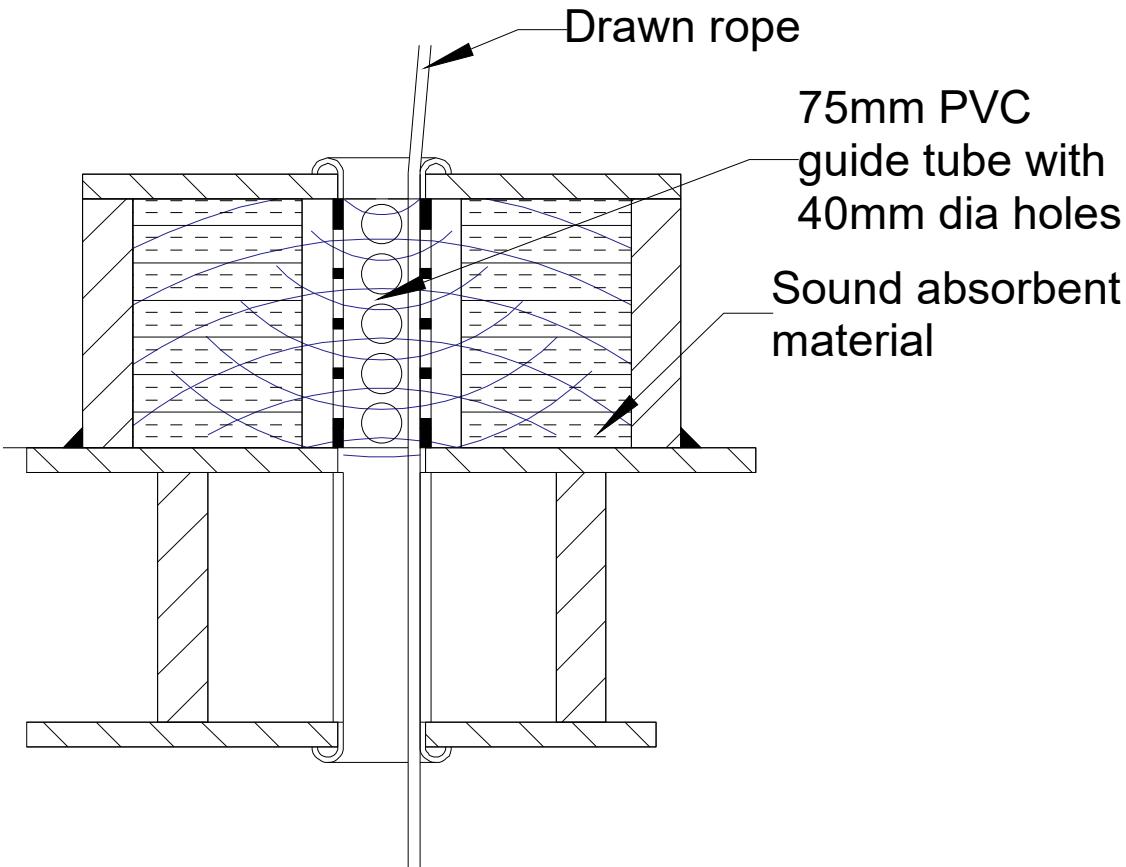
Where the rope is drawn above the barrier and the cavity depth permits, incorporate 40 mm diameter perforations in the walls of the tube and surround with sound absorbent material.

Attenuation up to 8dB(A)



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Rope Holes in Composite Barriers – Rope Guide Muffle



Where there is already a rope-hole tube or box and the rope is drawn above the barrier, use a muffled rope guide above the barrier **firmly attached to the floor**.

Great care is needed to seal all joints in the box or it will be ineffective!

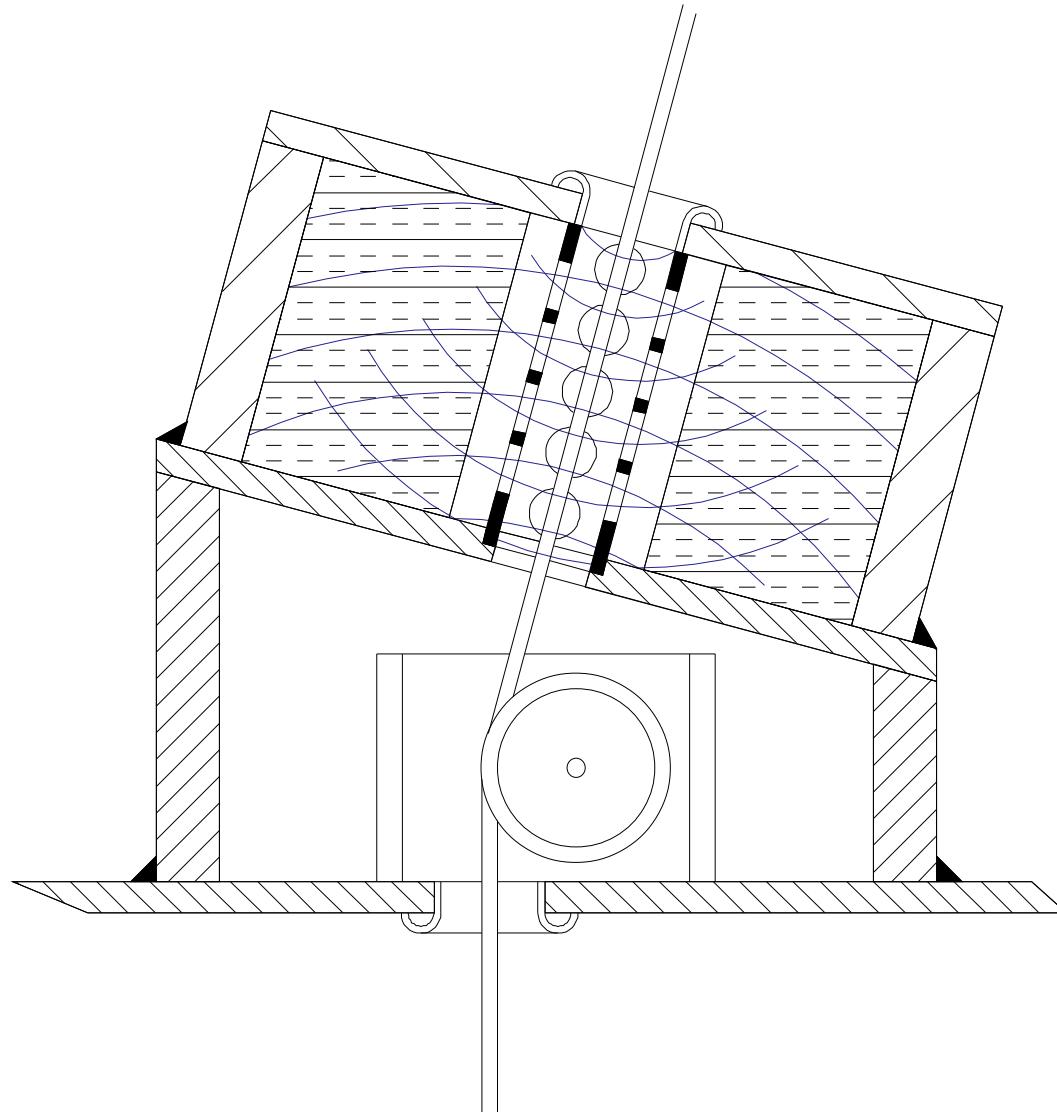
Can also be used with simple barriers.

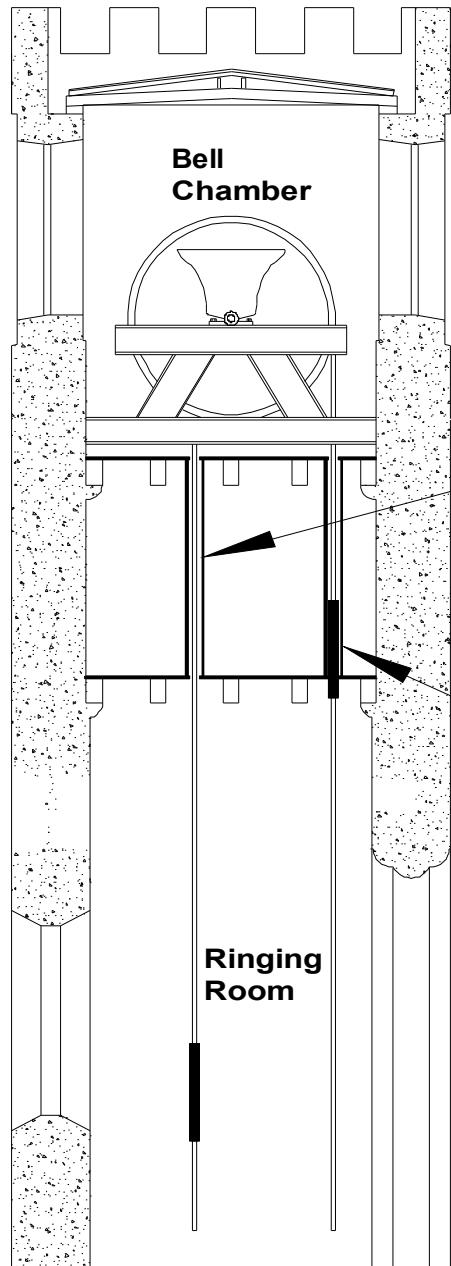
Attenuation up to 8dB(A)



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BELL RINGERS

Rope Holes in Simple or Composite Barriers – Rope Guide Muffle and Floor Pulley





Conventional Rope Guides (i.e. without Sound Attenuation Incorporated)

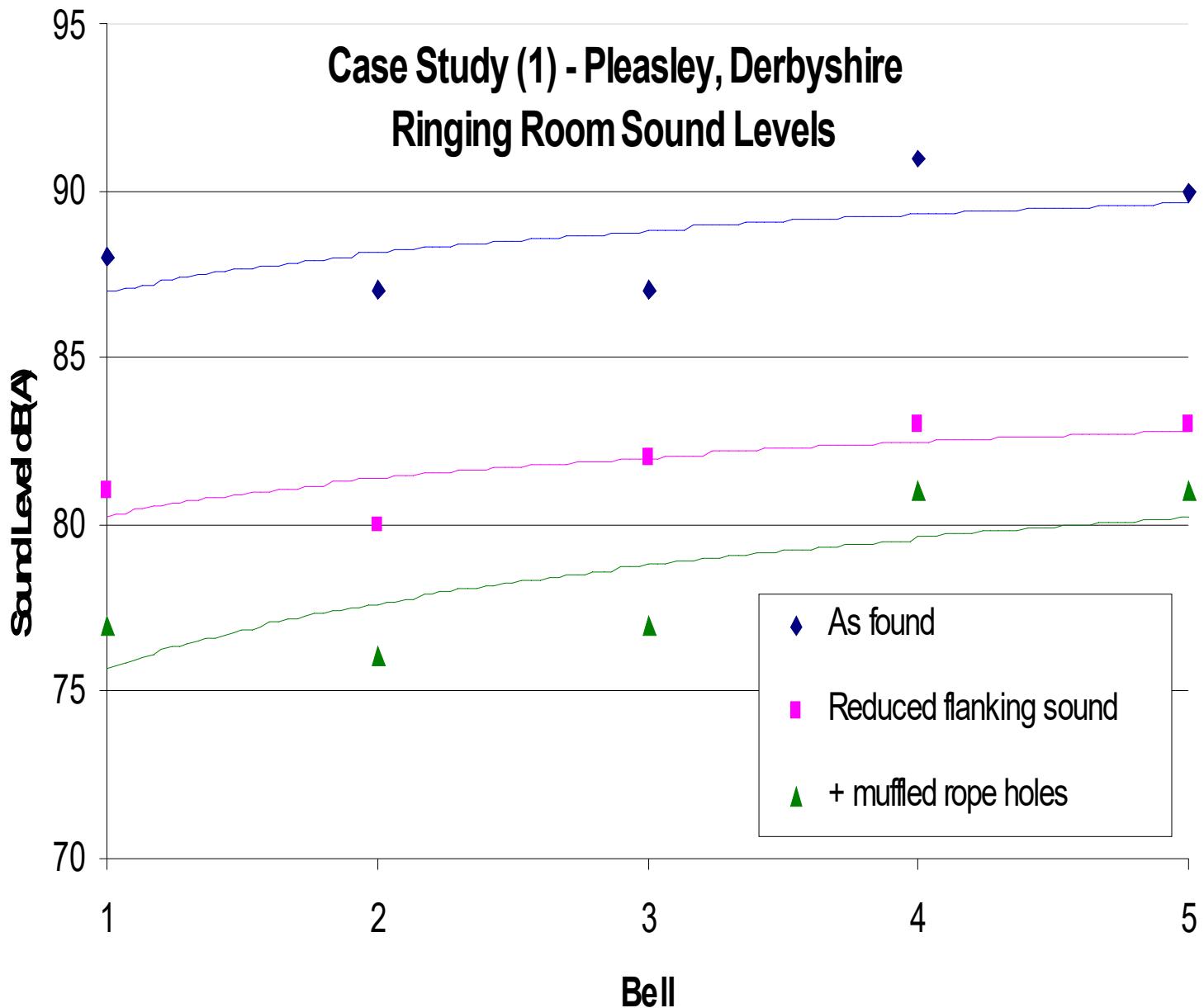
Fully enclosed rope guides act as sound conduits between bell chamber and ringing room

If sally enters fully enclosed rope guide, it mutes the sound following a hand stroke.

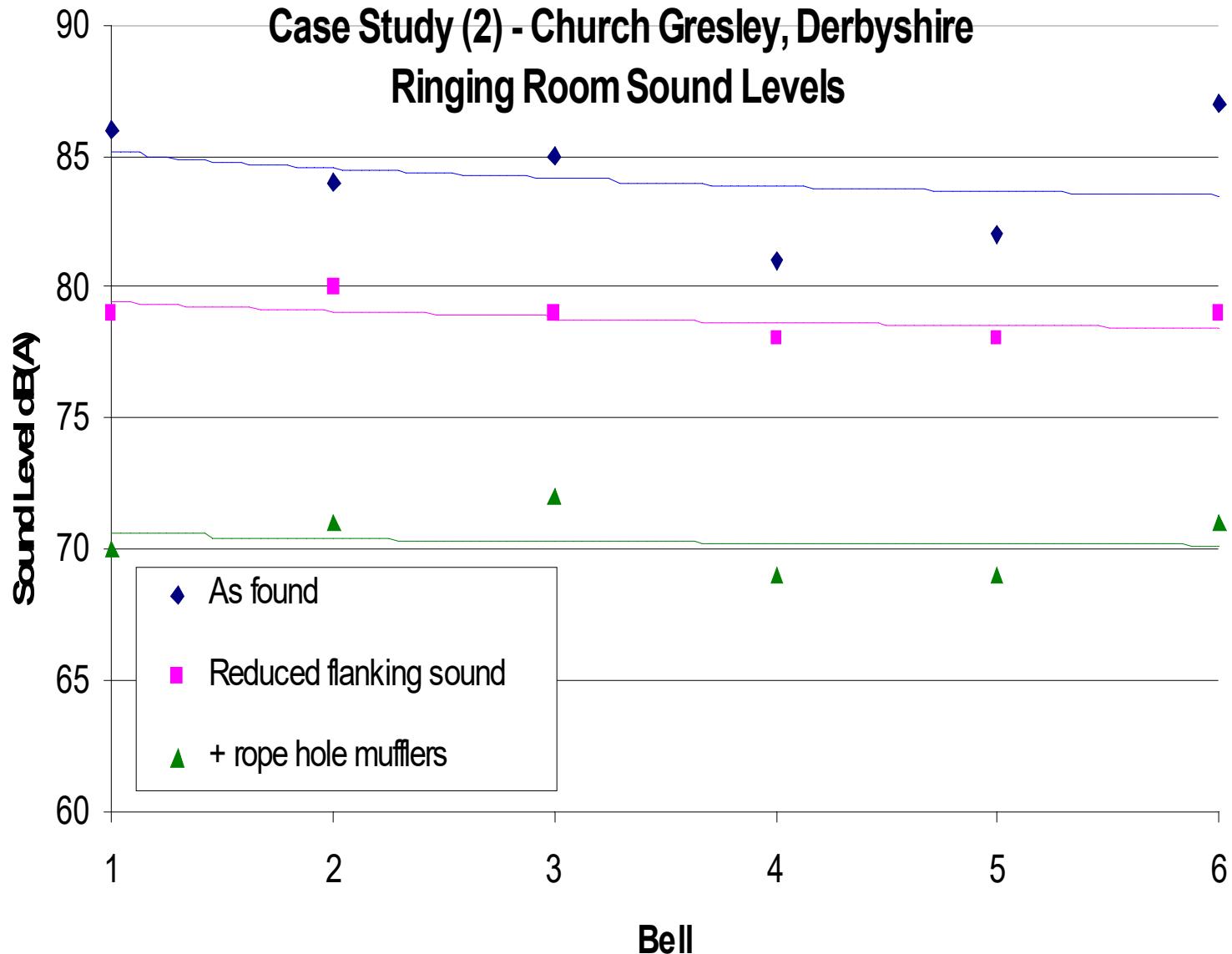
**Avoid fully enclosed
rope guides unless there
is a need to increase
ringing room sound levels.**



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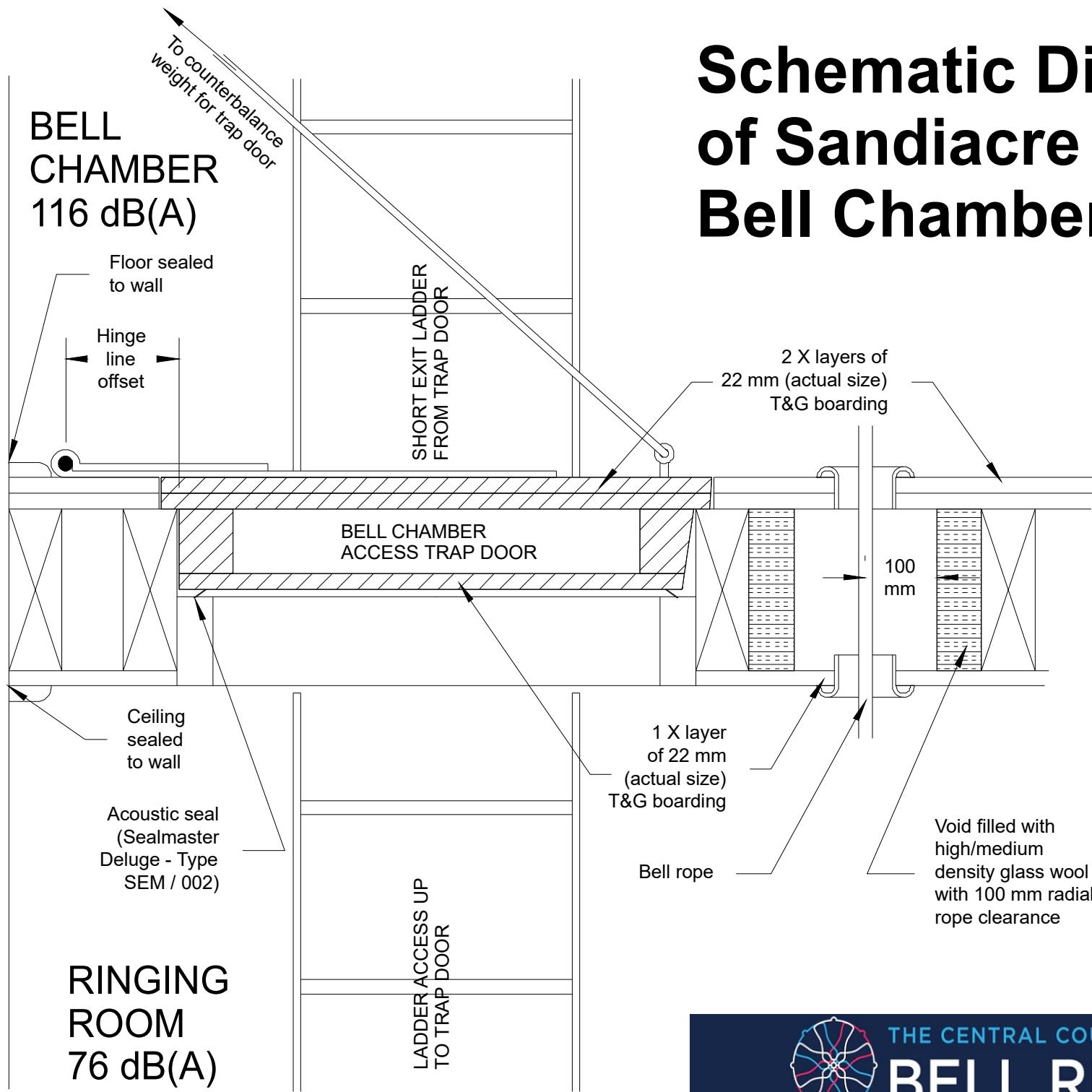
St Giles – Sandiacre Derbyshire

Bells re-installed lower in tower with no intermediate room and new type 1 composite bell chamber floor.



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Schematic Diagram of Sandiacre Bell Chamber Floor



Sandiacre Counter-balanced Entry Trap Door to Bell Chamber



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External Sound - Tips on How to Avoid Complaints

Avoid complaints in first place rather than drift into a confrontation where external sound control becomes unavoidable.

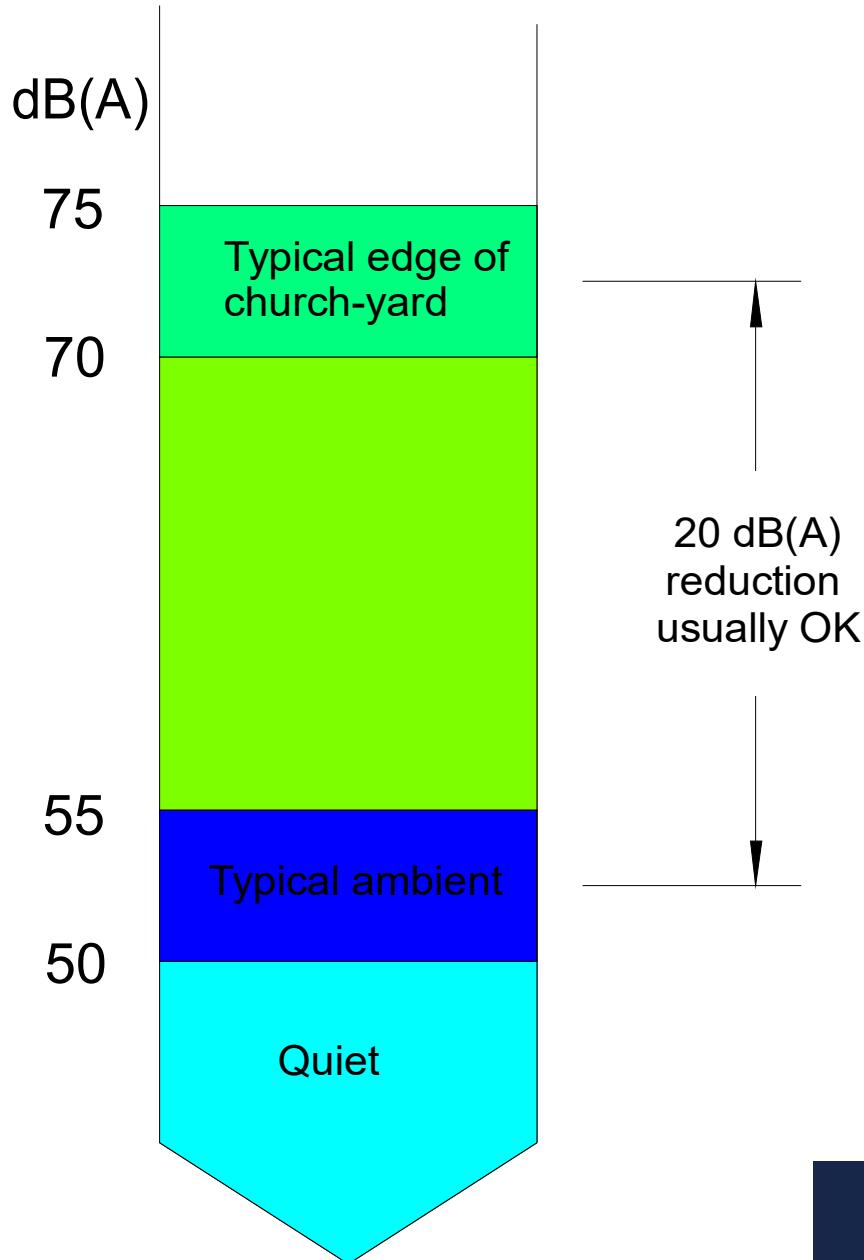
- Ring bells regularly and at fixed times.
- People can tell good ringing from bad and are more likely to complain about the latter. Poor quality ringing often occurs when too many novices ring at the same time – consider installing a simulator for practices.
- When special ringing is necessary, ensure local residents are forewarned.
- If your bells are noisy, restrict ringing at unsocial times or during hot weather when neighbours have open windows.
- Complaints sometimes arise after new houses are built close to a bell tower. Make the local authority planning department aware of the church bells at an early stage in the planning process.
- Advice can be obtained from the CCCBR.



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Control of Sound Levels Outside the Tower

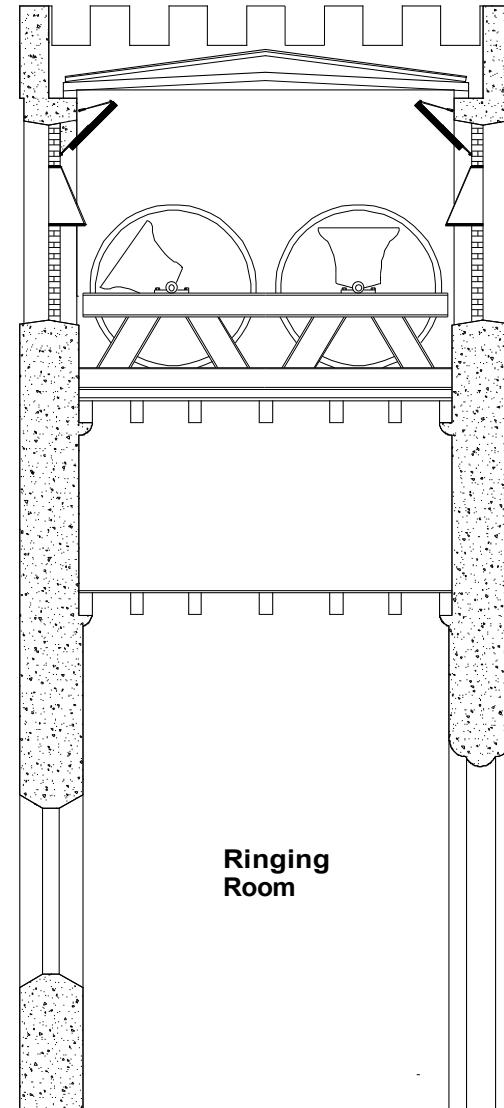
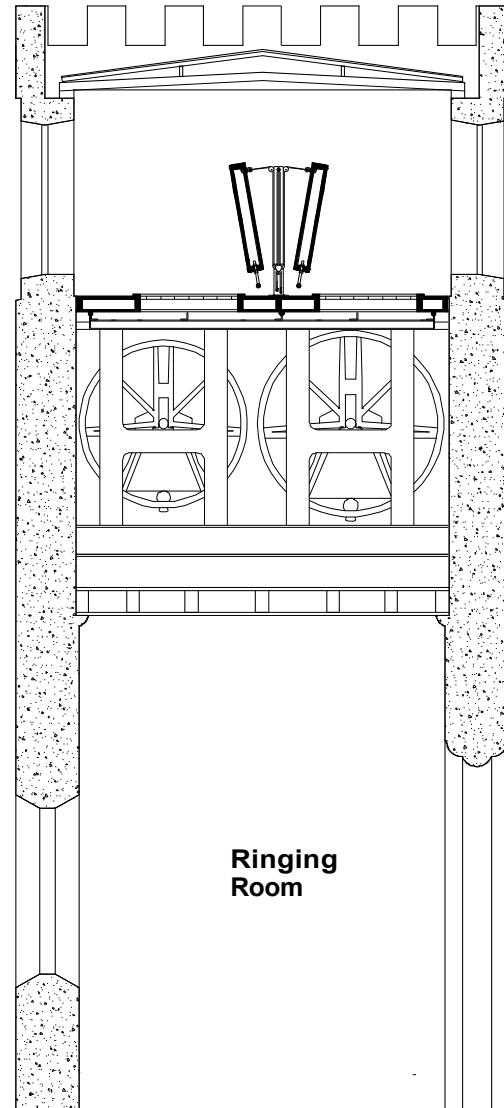
- Sound Levels too High



Sound levels will be unobtrusive if no higher than ambient noise levels.

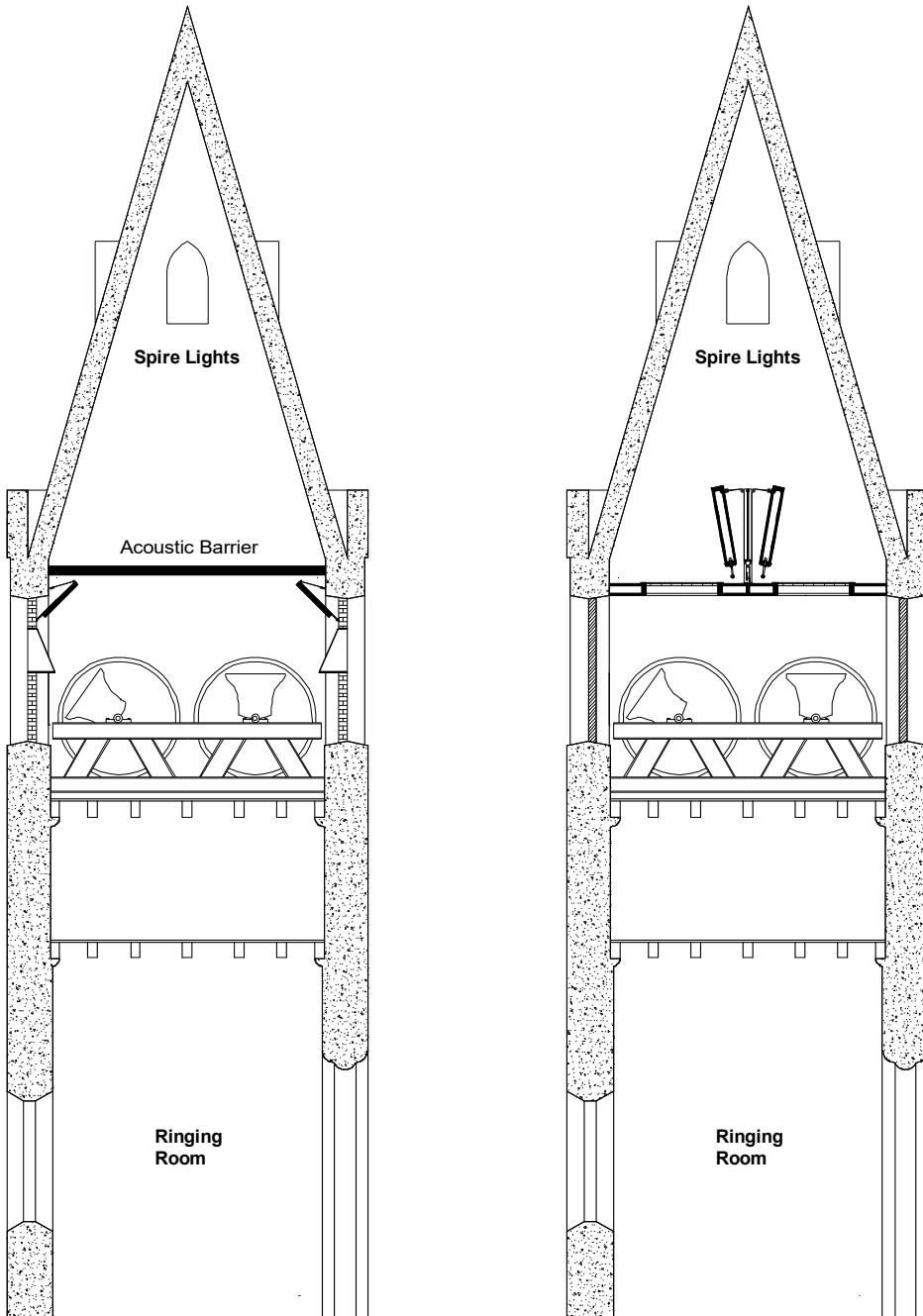


External Sound Control – Doors Held Shut by Own Weight



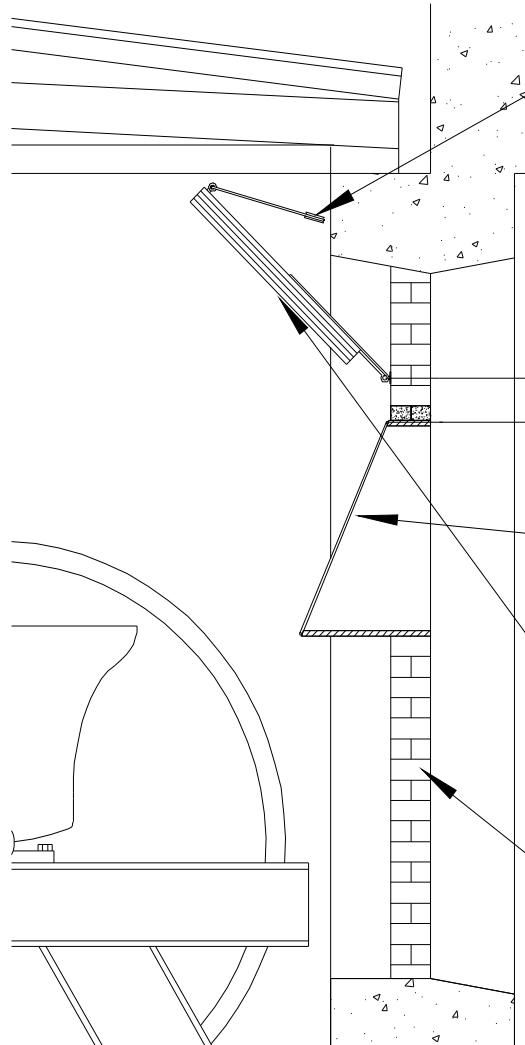
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External Sound Control – Steeple with Spire Lights



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Variable Sound Control in Sound Windows



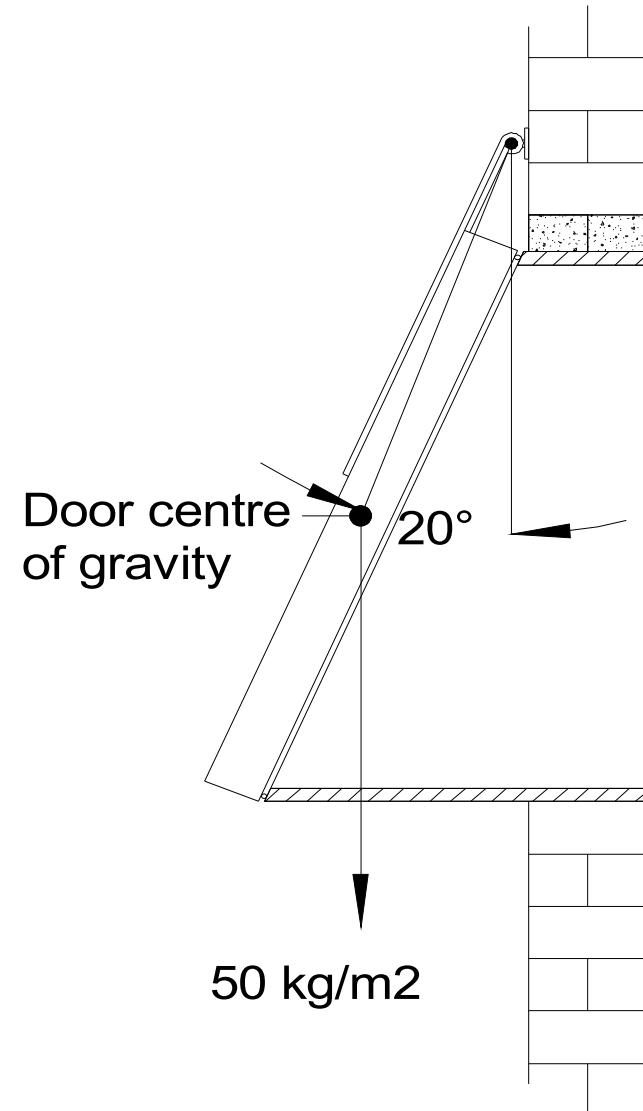
Door-opening winch & cable / pulley system - allows door to open far enough to prevent direct external sound reflection from nearby bells.

Hinge offset reduces sliding/pinch damage to door seal.

Door seals on to box insert.

Door made from 50 kg/m² material & sealed around edges by rubber "P" seal strip.

Sound barrier made from high mass / unit area material e.g. brick or concrete blocks.



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Variable Sound Control - Saint Alkmund's Duffield

**Opening Size
860X570mm
(34X20ins)**



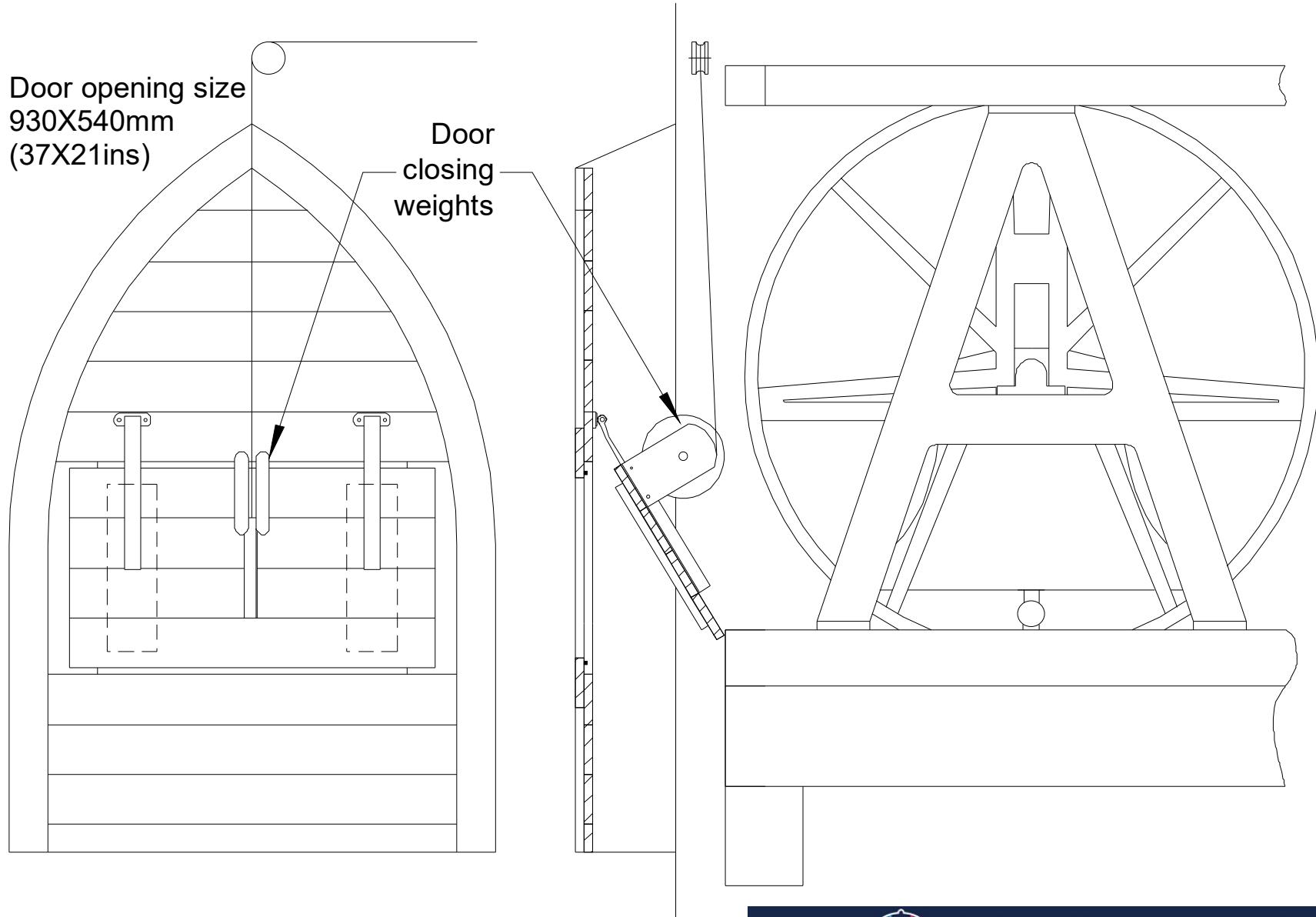
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Duffield with Sound Control - sound levels at south east corner of the churchyard

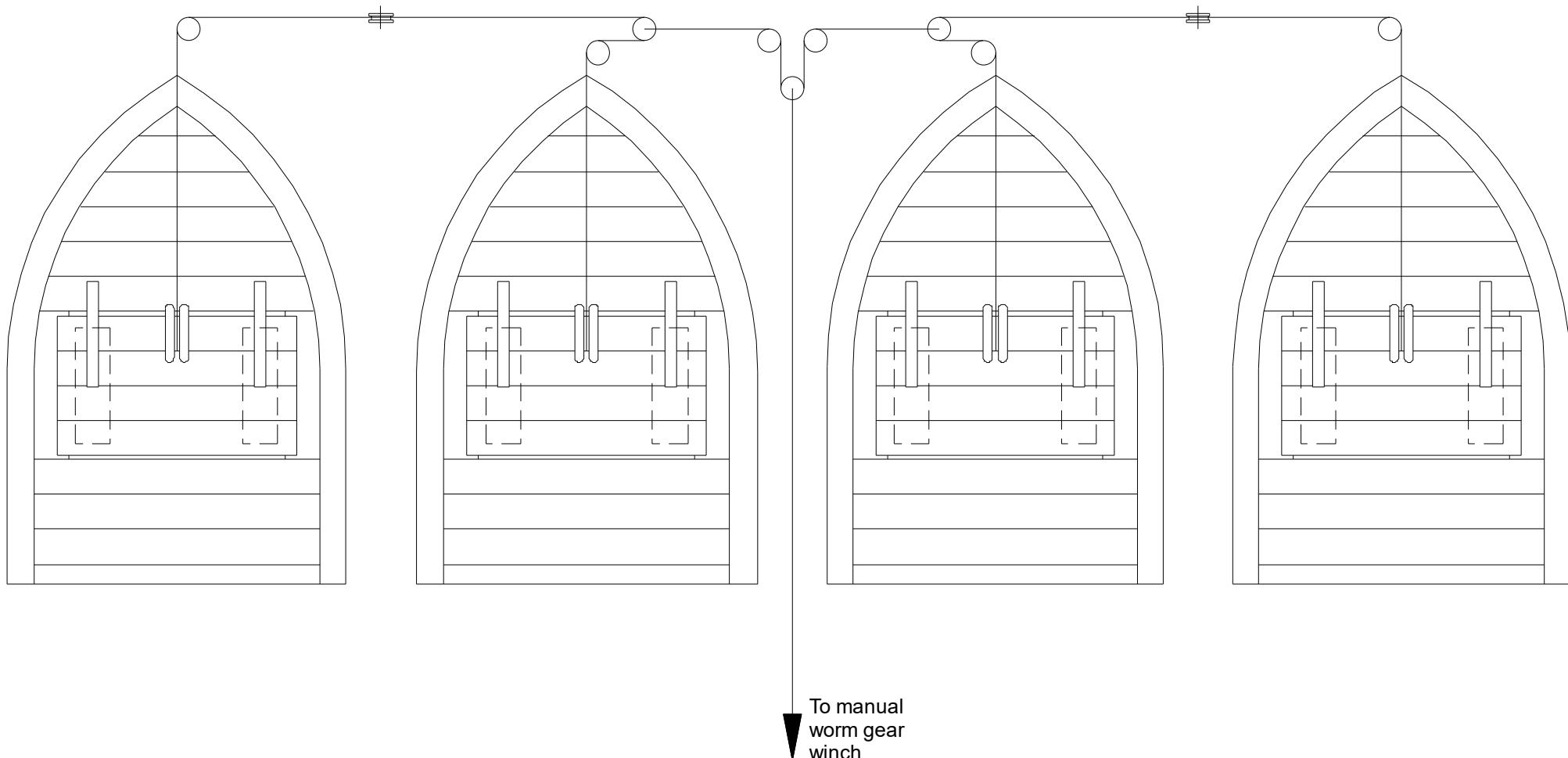


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Variable Sound Control in Confined Space - Doors Held Shut by Counterbalance Weights



Suggested Layout of Winch Cables



To manual
worm gear
winch

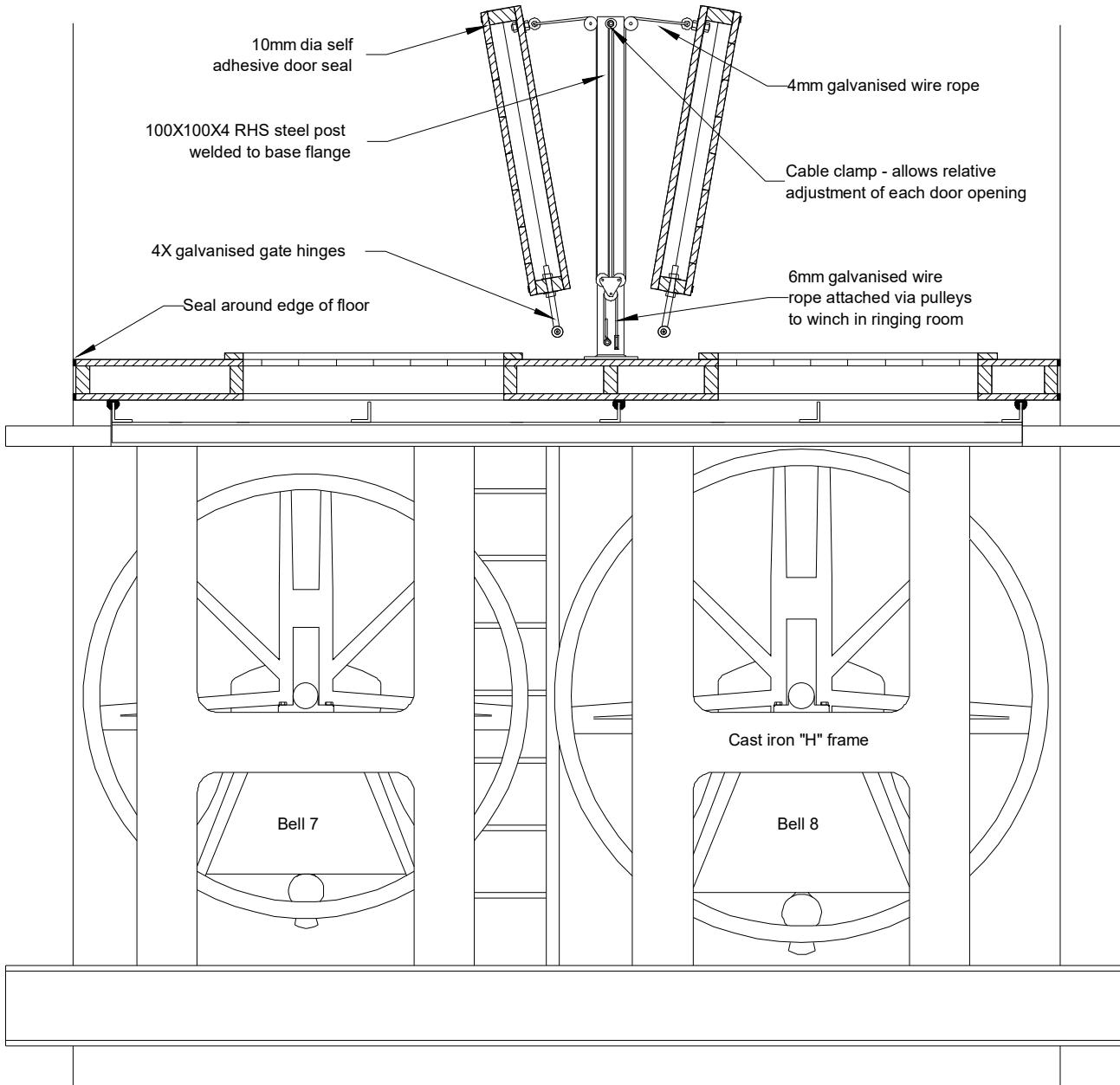


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Variable Sound Control in very Confined Space - Use of Remotely Controlled Linear Actuators



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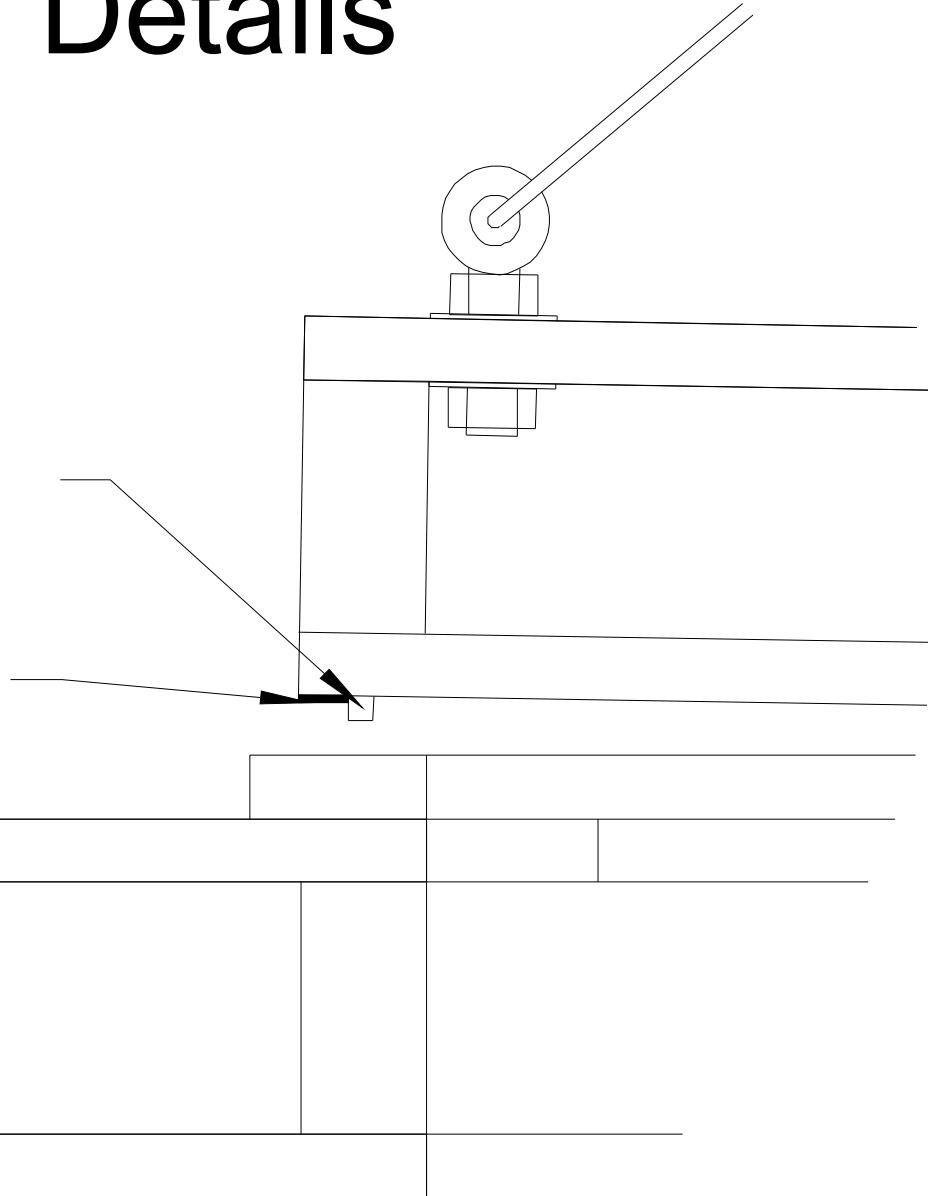
Horizontal Variable Sound Control Above Bell Frame

**Door opening
area as big as
possible**



Door Sealing Details

10X10 mm self adhesive sealing strip
20X3 mm steel strip
screwed to door sealing face to prevent excessive crushing of seal



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Horizontal Variable Sound Control - St Peter's Belper Derbyshire



St Peter's Belper with Sound Control - sound levels to north of church



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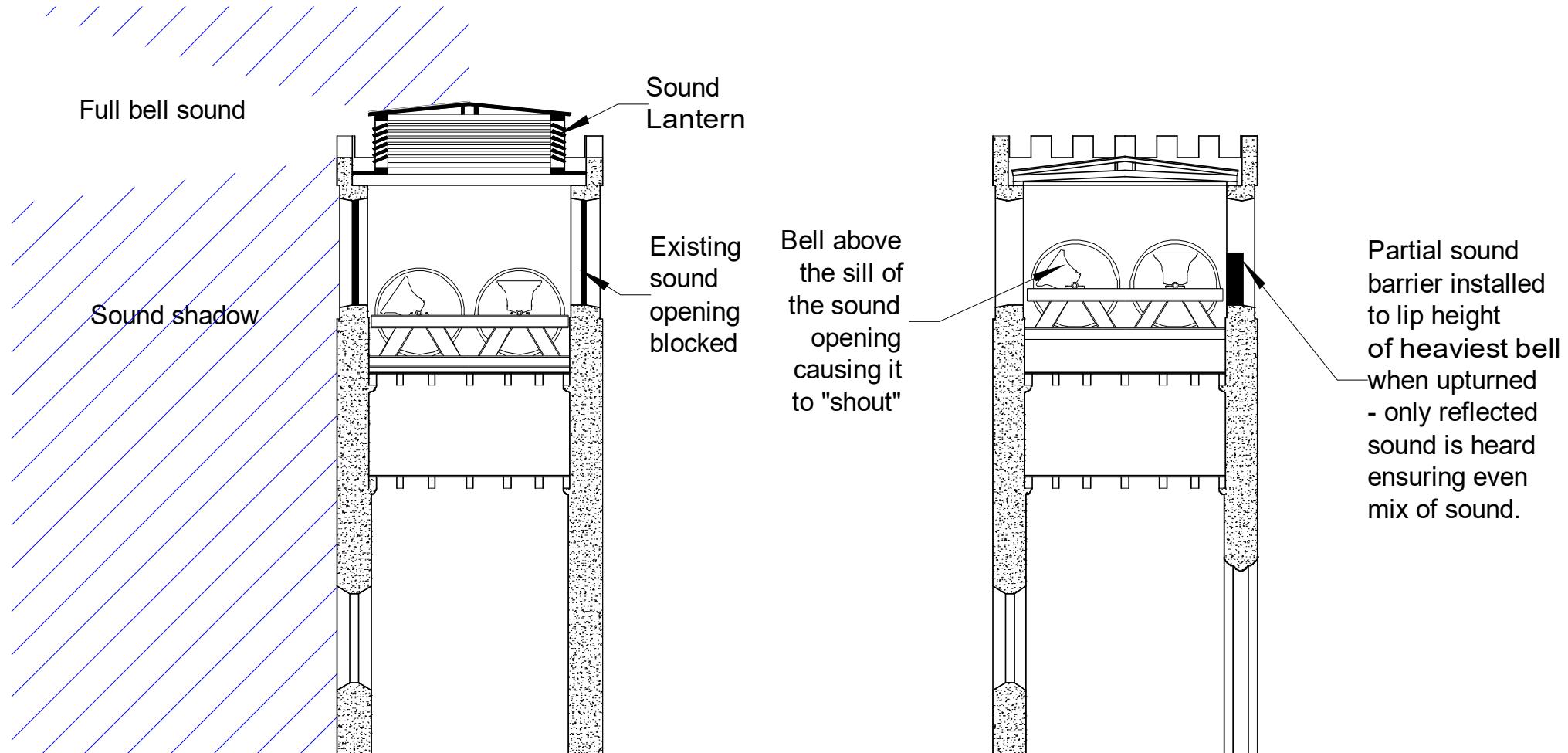
Lifting Winch



Use a worm drive lifting winch which cannot be back-driven by the load



Partial Sound Barrier and Sound Shadow



In Summary

Remember three things:

- ***Mass/unit area*** – choose correct value for facing your acoustic barrier.
- ***Sound absorption*** to control rope hole noise.
- ***Seal ALL other gaps.***



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