

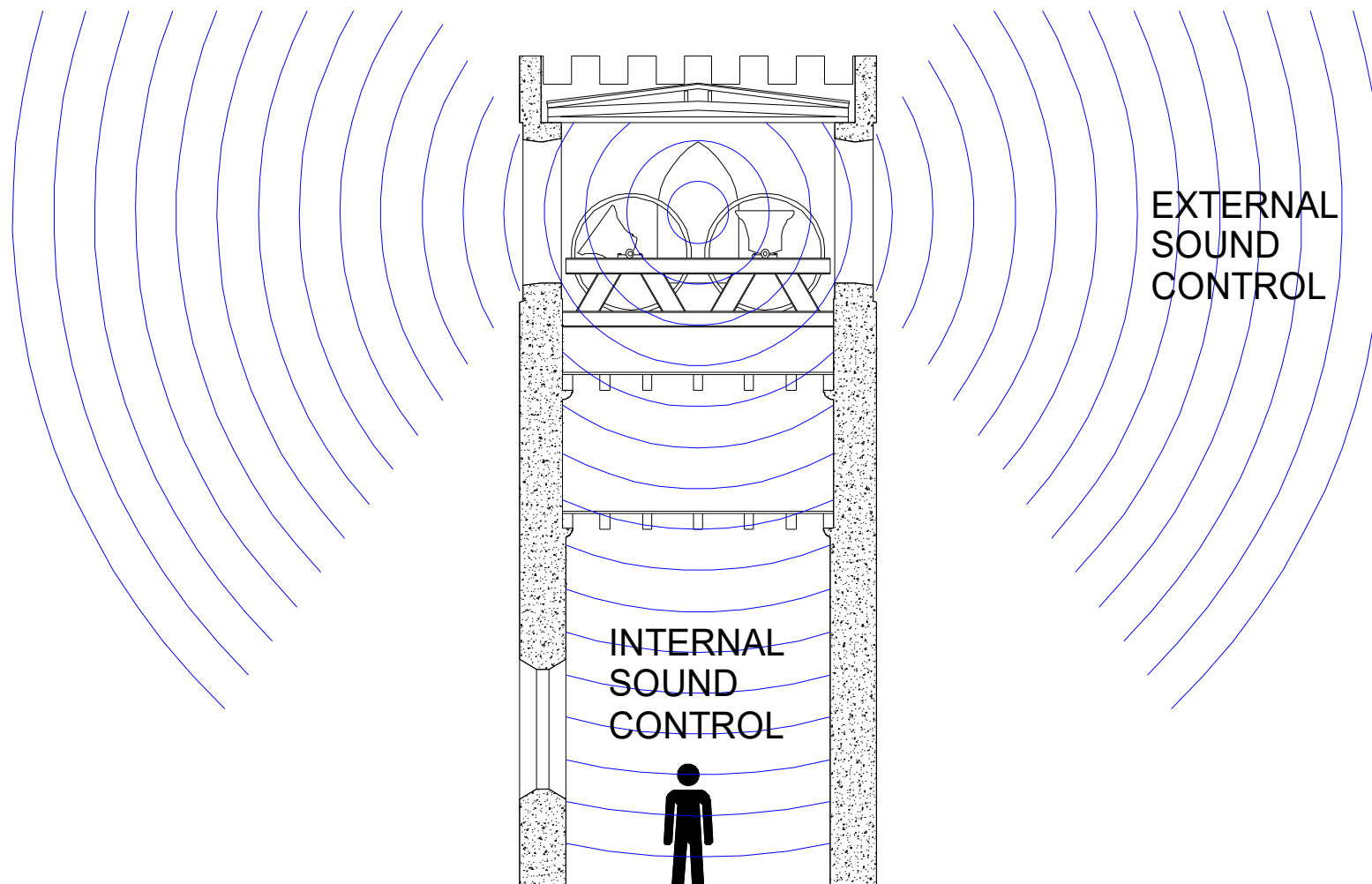
SOUND CONTROL INSIDE AND OUTSIDE OF YOUR TOWER

Mike Banks



THE CENTRAL COUNCIL OF CHURCH
BELL RINGERS

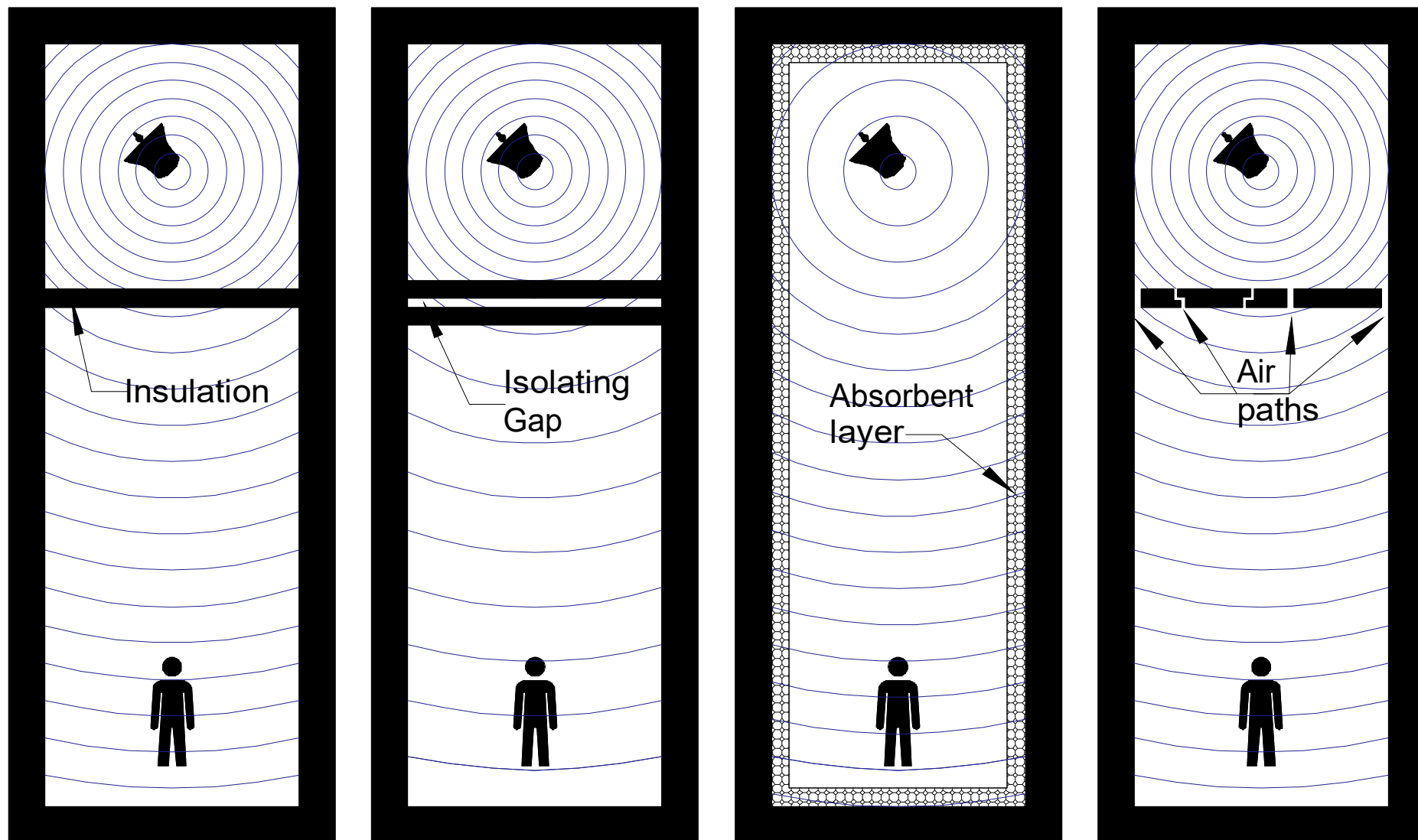
Internal & External Sound Control



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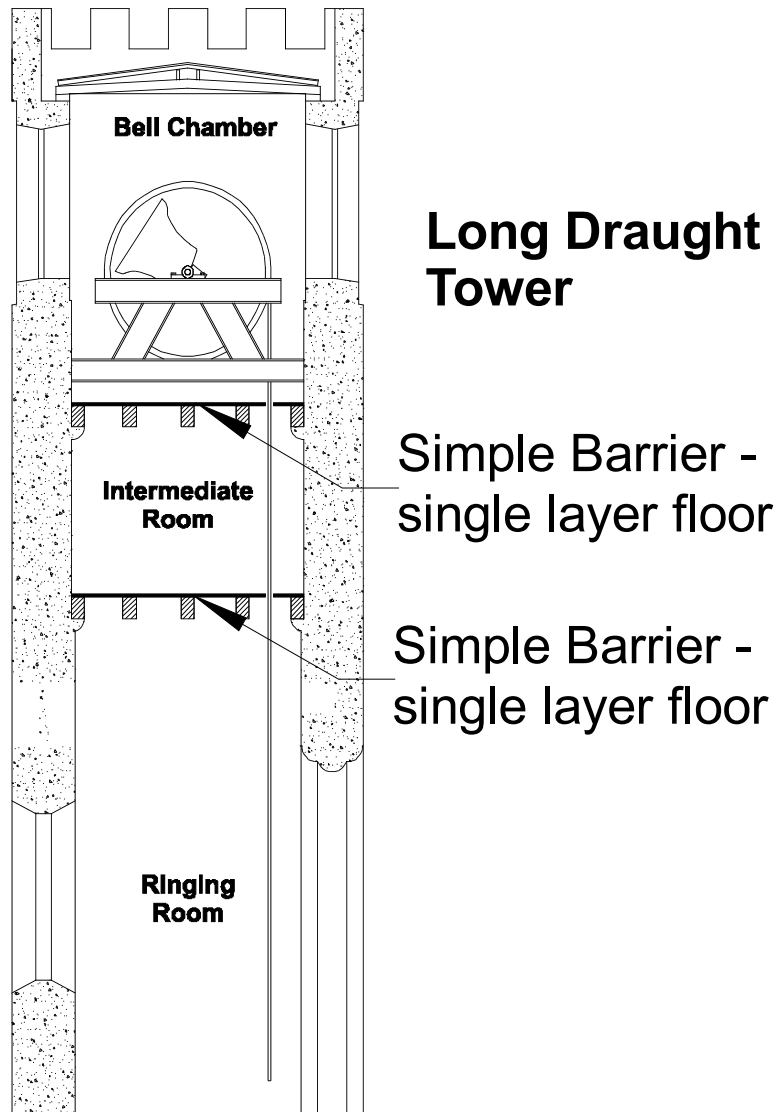
Factors Influencing Sound Control



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Types of Acoustic Barrier – Simple Barrier



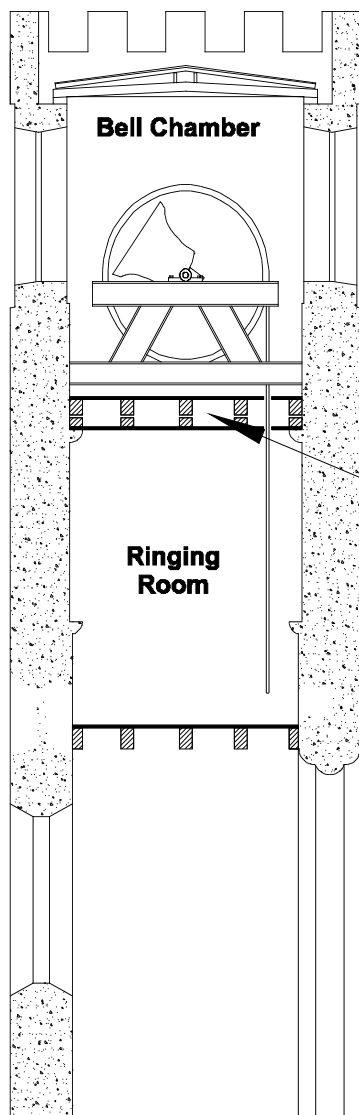
A simple barrier may comprise:

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



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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

	<ul style="list-style-type: none"> Insulation Minimal isolation Insulation 	Type 1
	<ul style="list-style-type: none"> Insulation Minimal isolation Absorption Insulation 	Type 1A
	<ul style="list-style-type: none"> Insulation Isolation Insulation 	Type 2
	<ul style="list-style-type: none"> Insulation Isolation Absorption Insulation 	Type 2A



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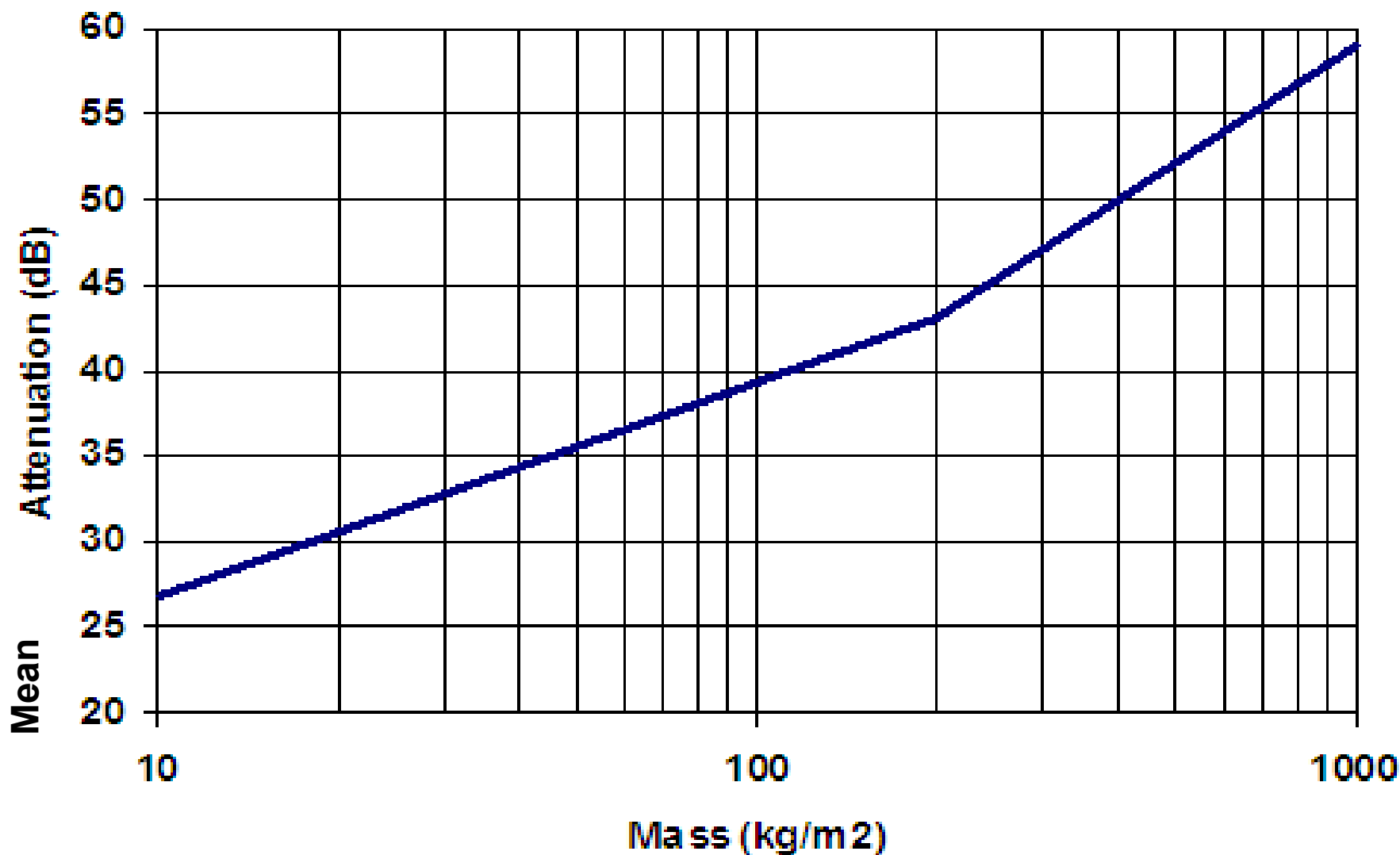
Measuring Sound Pressure Levels



- 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.



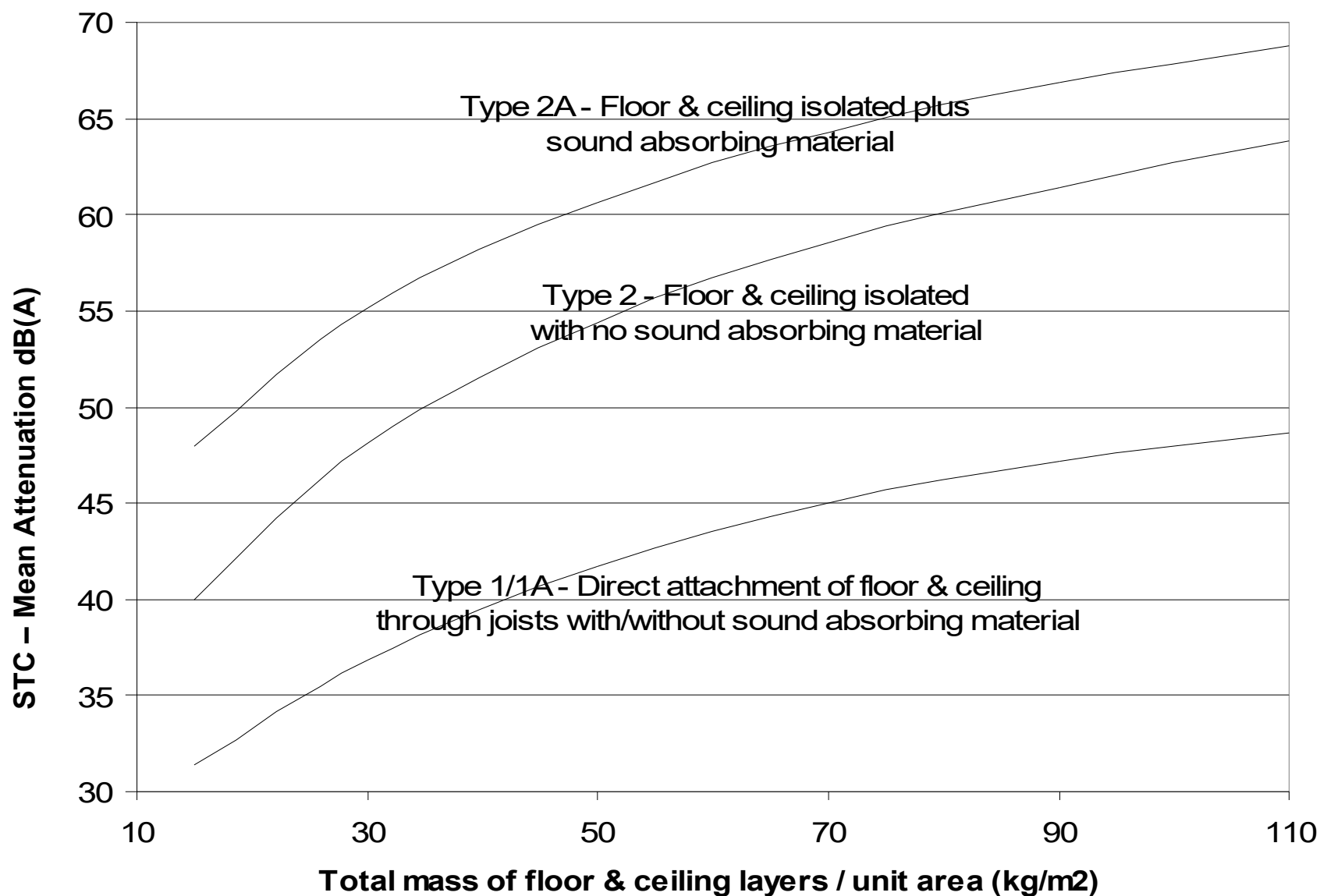
Estimated Sound Attenuation for Simple Barriers



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Estimated Attenuation - Composite Barriers



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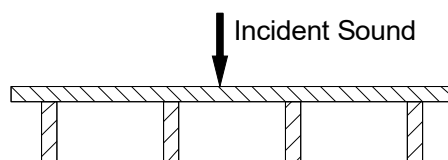
BELL RINGERS

Estimated Sound Attenuation for Various Wooden Barrier Configurations

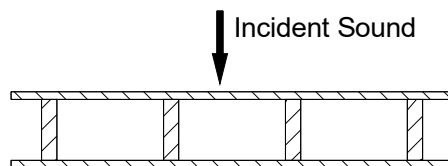
Assumptions:

- 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)

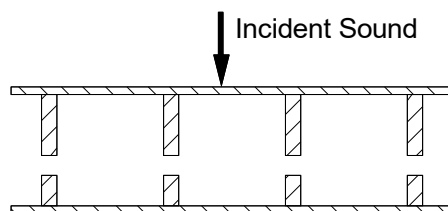


(Type 1) 35 dB(A)



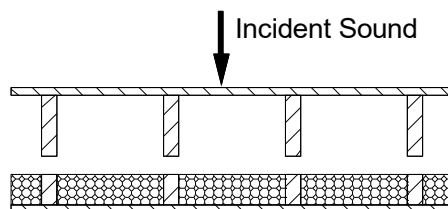
Floor and ceiling acoustically connected through joists

(Type 2) 46 dB(A)



Floor & ceiling acoustically isolated

(Type 2A) 53 dB(A)



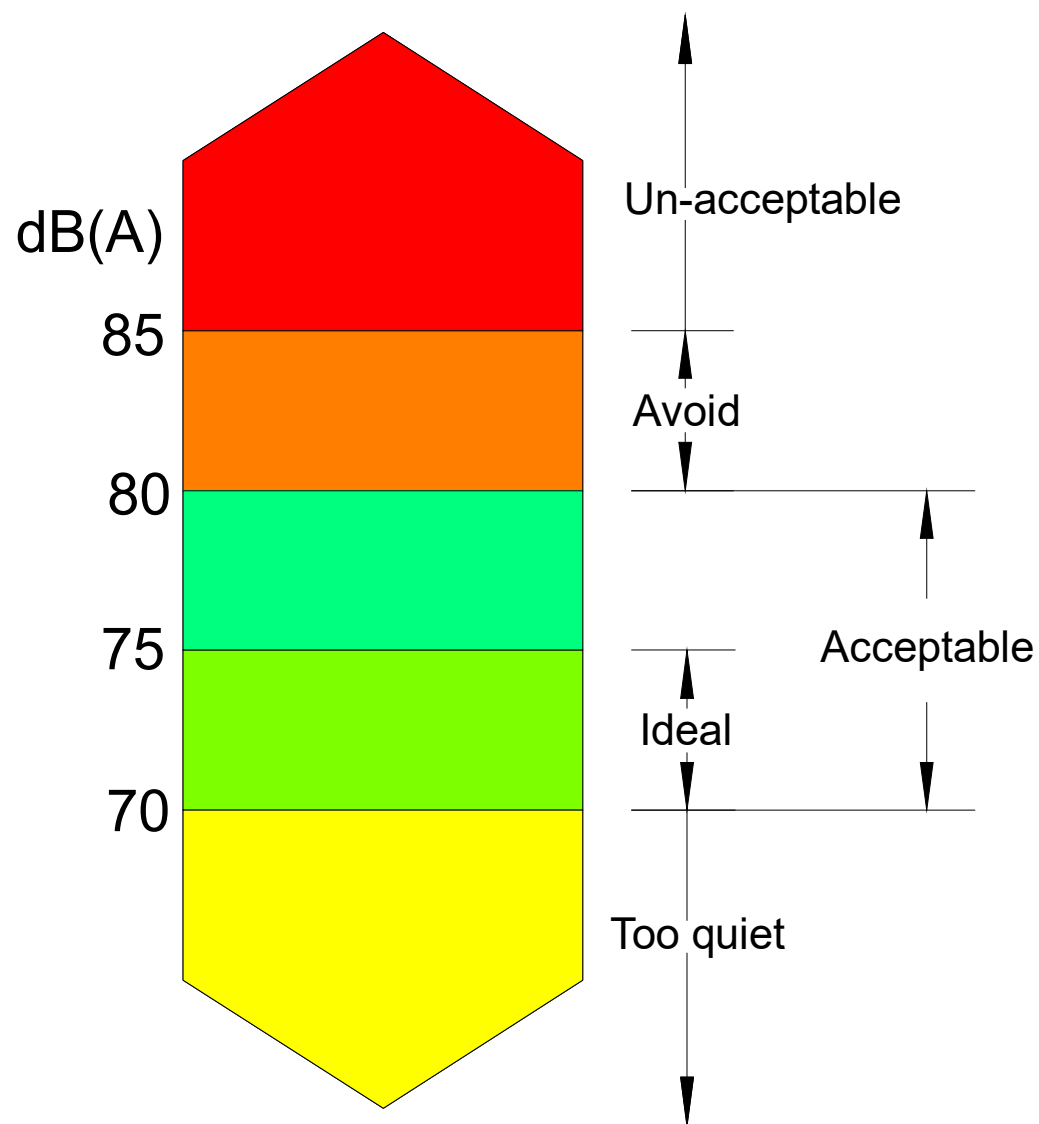
Floor & ceiling acoustically isolated plus sound absorbing material



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Target Sound Levels For Ringing Room



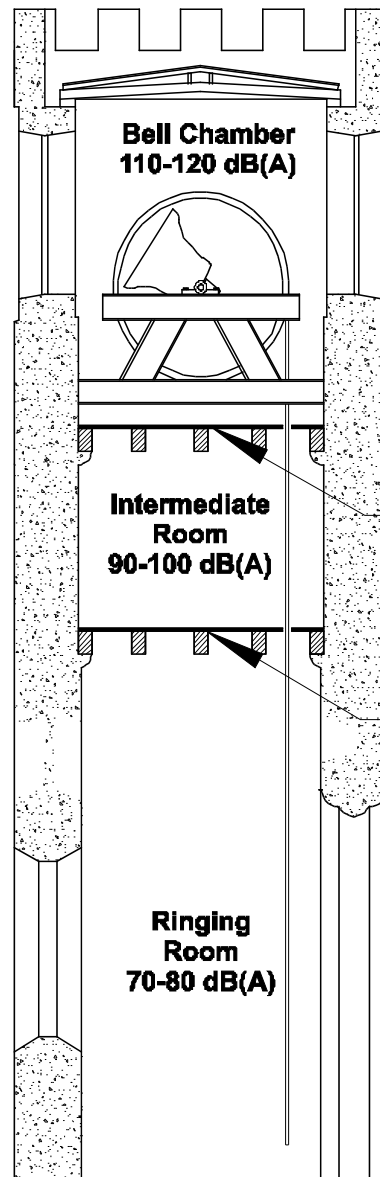
- **Sufficiently loud** for ringers to clearly hear their own and the other bells to ensure good striking.
- **Not too loud** since ease of verbal communication is essential for ringers to clearly hear commands from the conductor or from a tutor.



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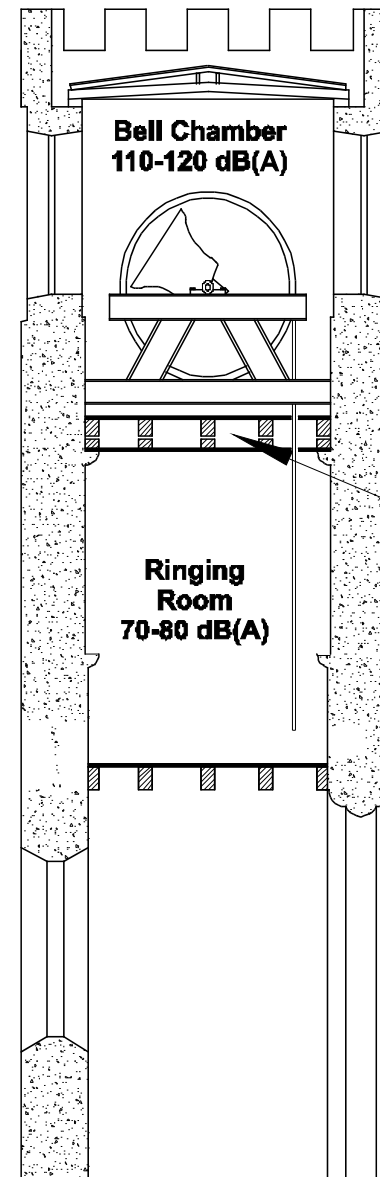
Sound Barriers Inside Tower Must Give 35-45 dB(A) Attenuation For Ringing Room



Long Draught Tower

Simple Barrier -
single layer floor

Simple Barrier -
single layer floor



Short Draught Tower

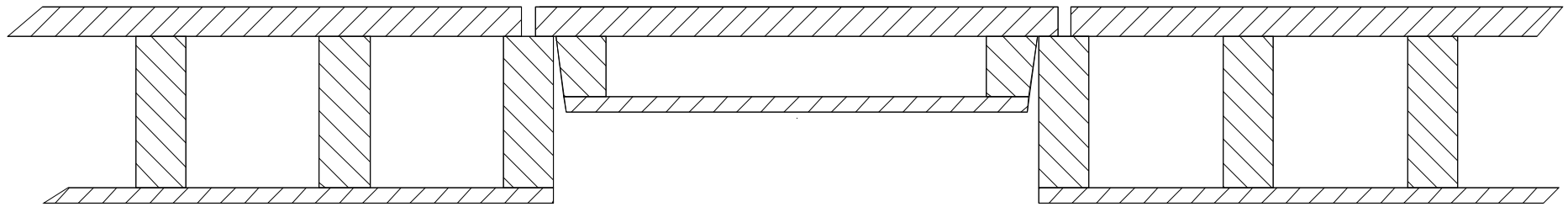
Composite Barrier -
floor/joist/ceiling



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All Trap Doors are an Integral Part of the Acoustic Barrier

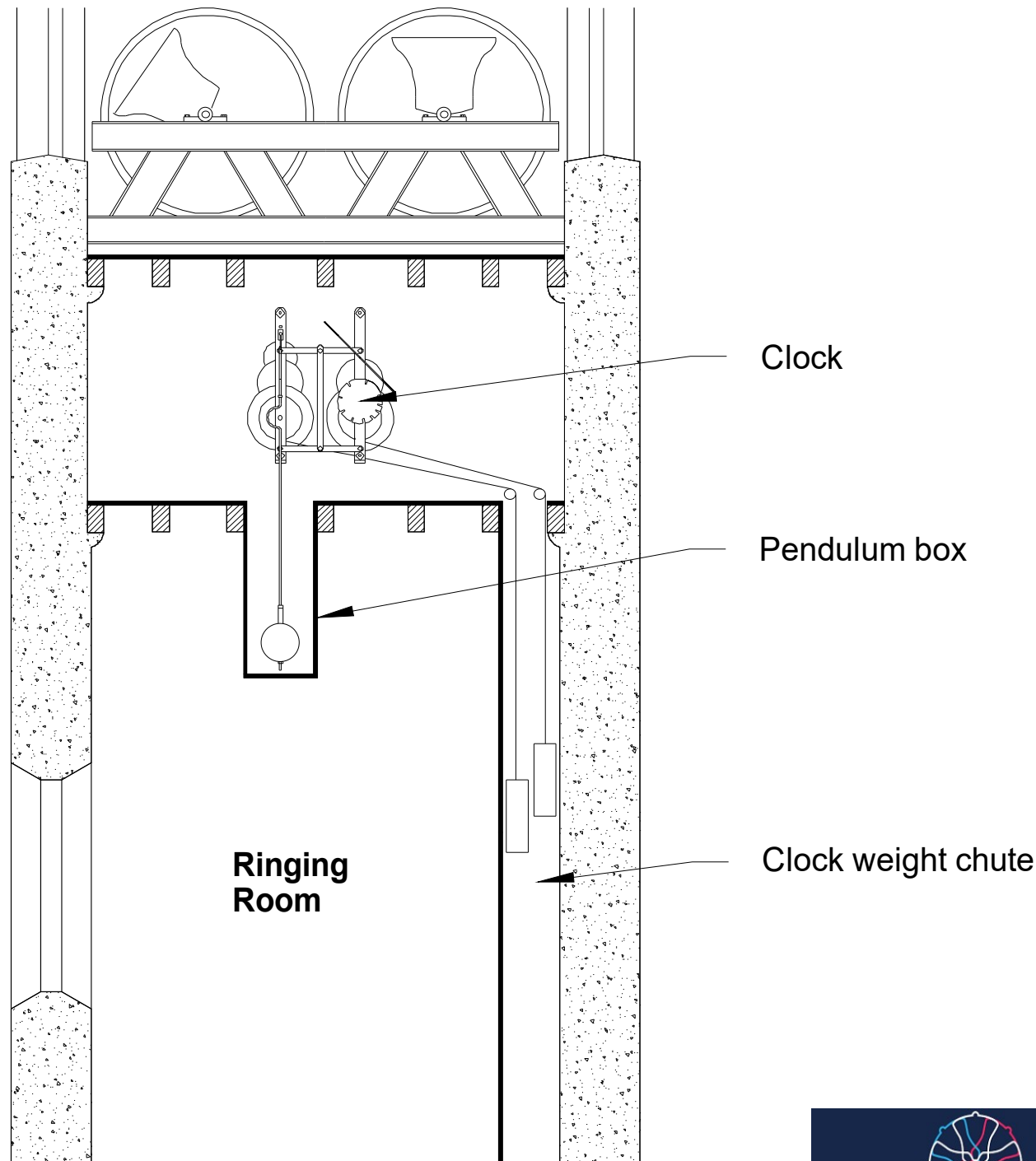
Trap Door



- 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.

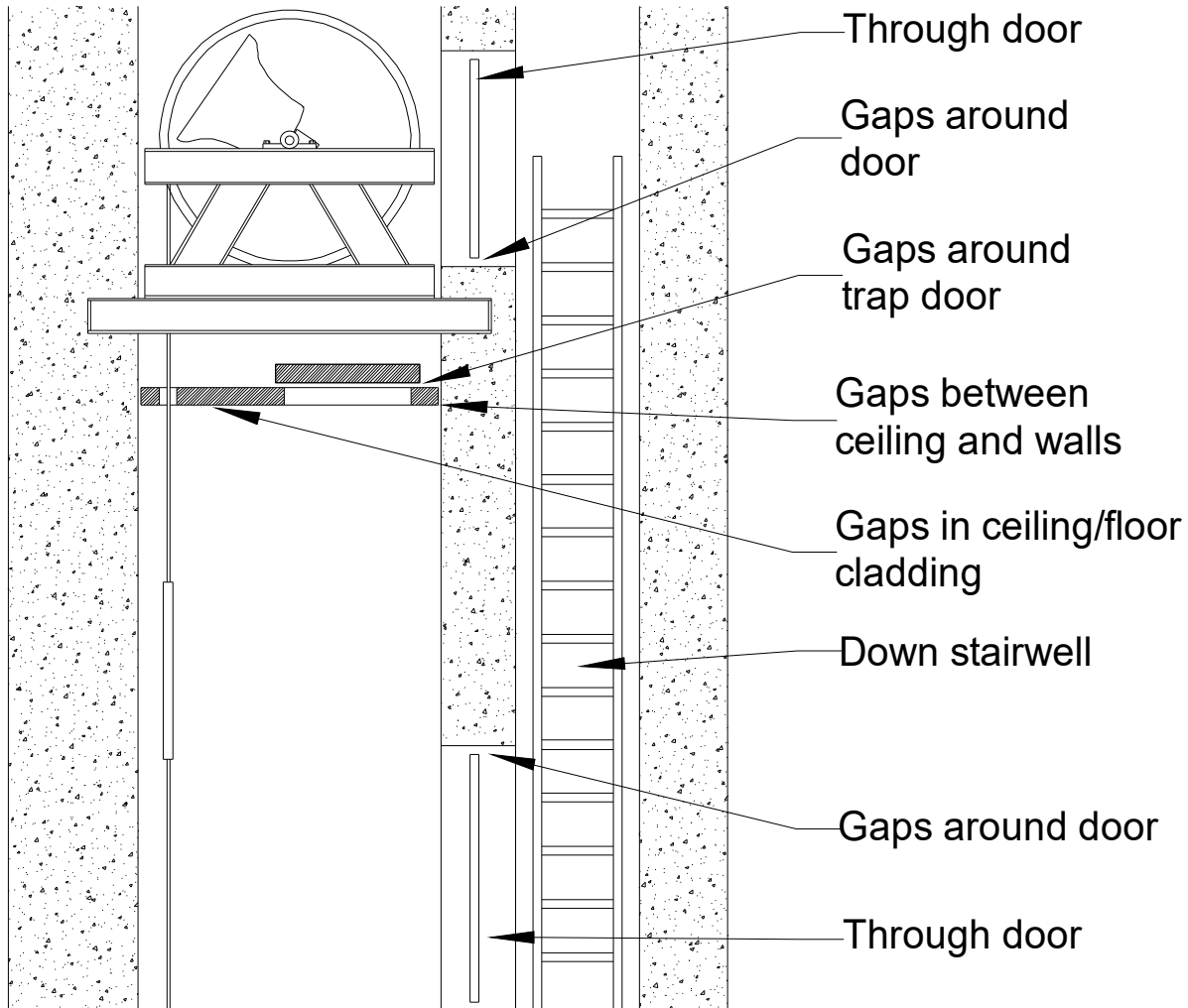


Clock Weight Chutes and Pendulum Boxes are Extended Surfaces of the Acoustic Barrier



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All Flanking Sound Must be Eliminated!



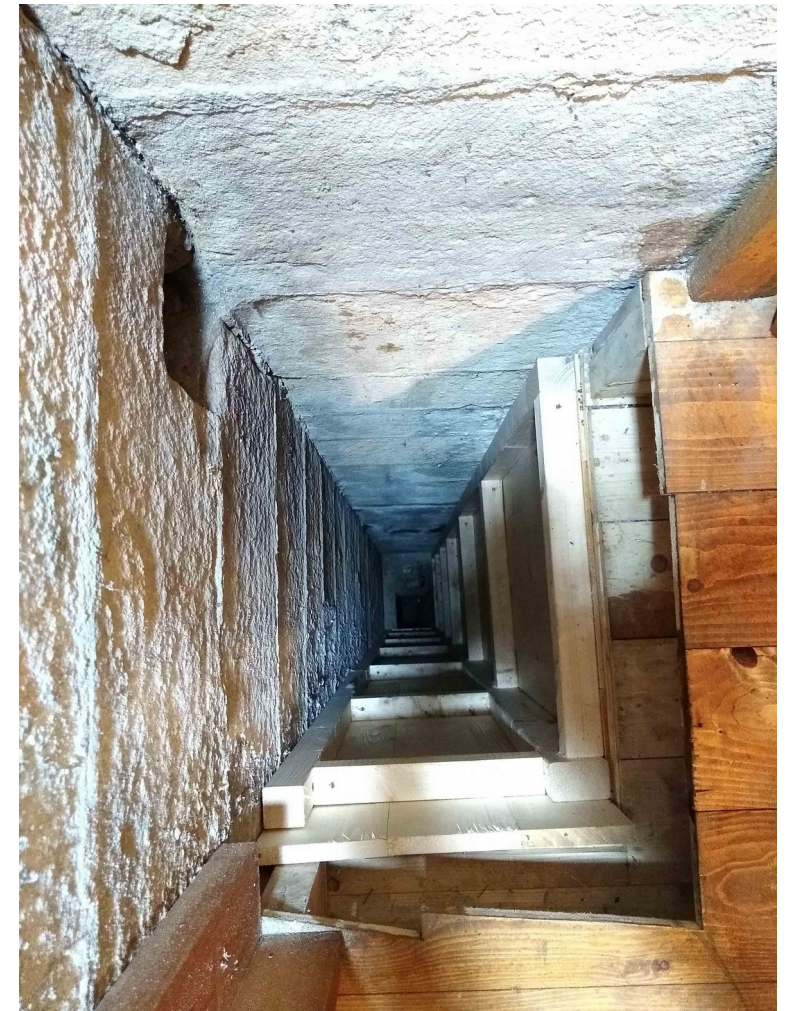
Other sources of flanking sound are:

- 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.



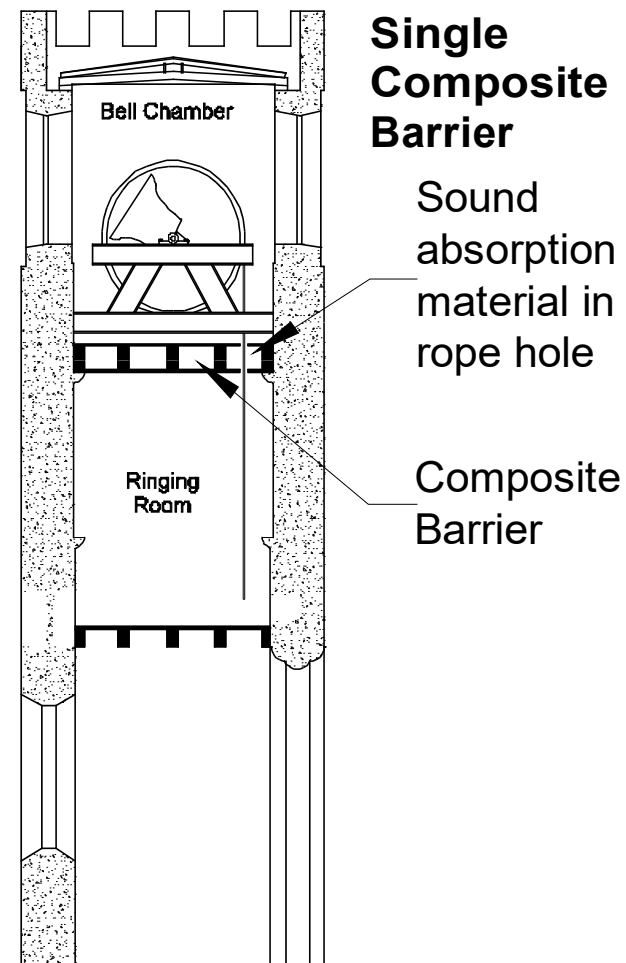
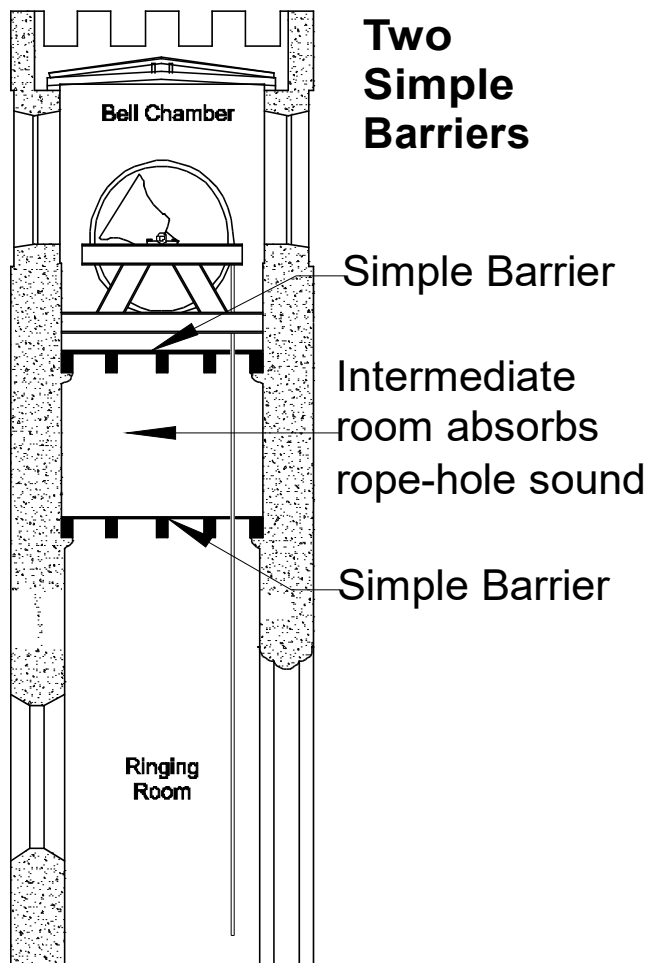
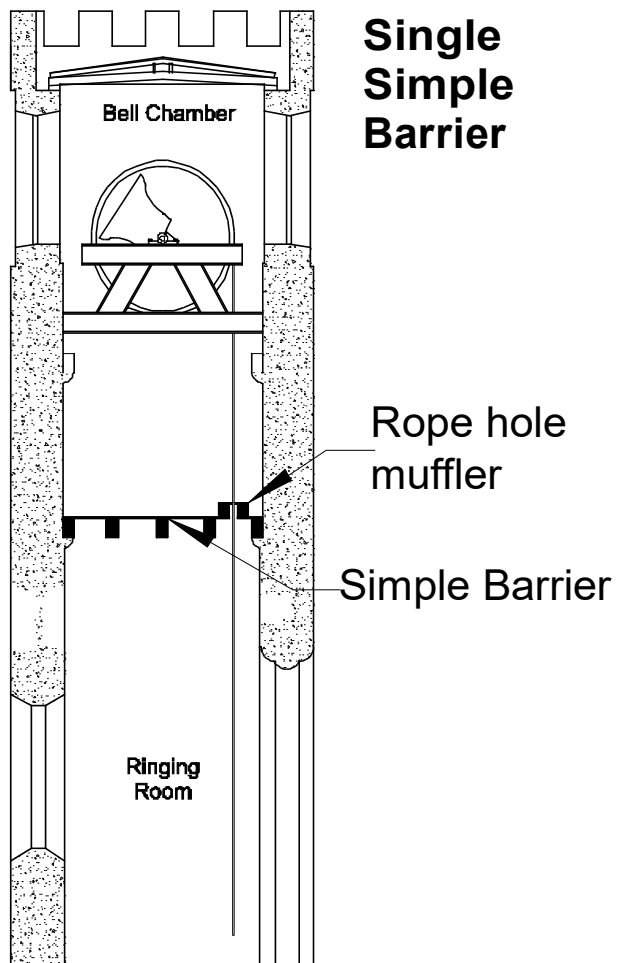
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Rebuilt Clock Weight Chute – All Saints Glossop Derbyshire



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Rope Hole Sound Control

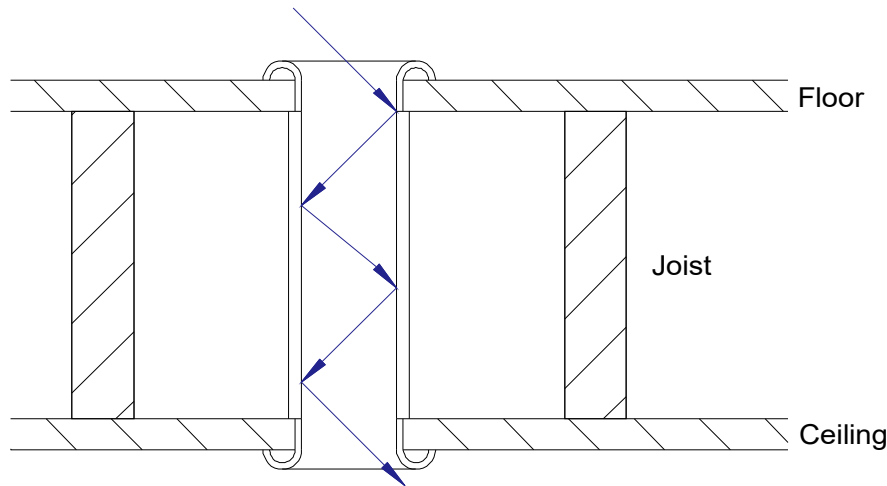


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Rope Holes in Composite Barriers – Effect of Tube

Rope hole
with tube



Sound reflected
down tube giving
little attenuation of
rope hole sound

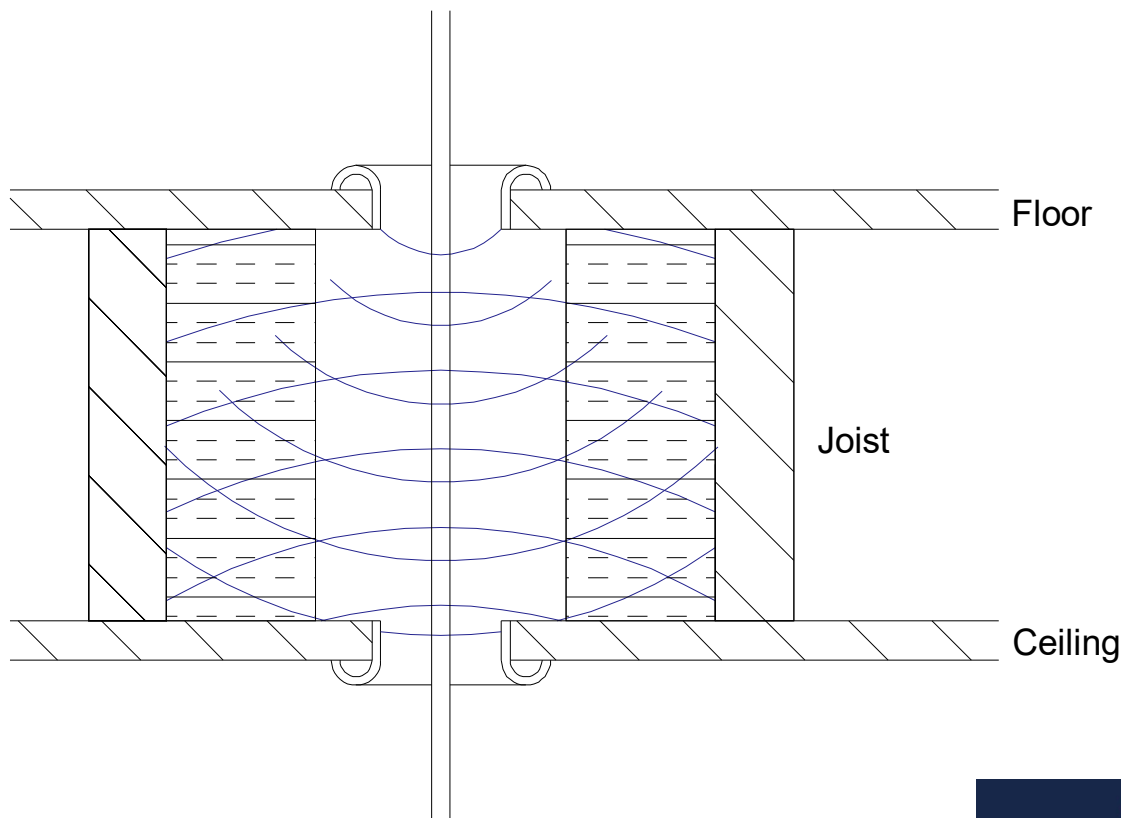
- Use of plain rope-hole tubes or boxes through composite floors causes maximum rope hole sound transmission.
- Where the rope is drawn above the barrier, tubes **are necessary** to ensure free rope movement through the barrier.



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Rope Holes in Composite Barriers – Preferred Design

Rope hole with sound absorbent material in cavity and no tube



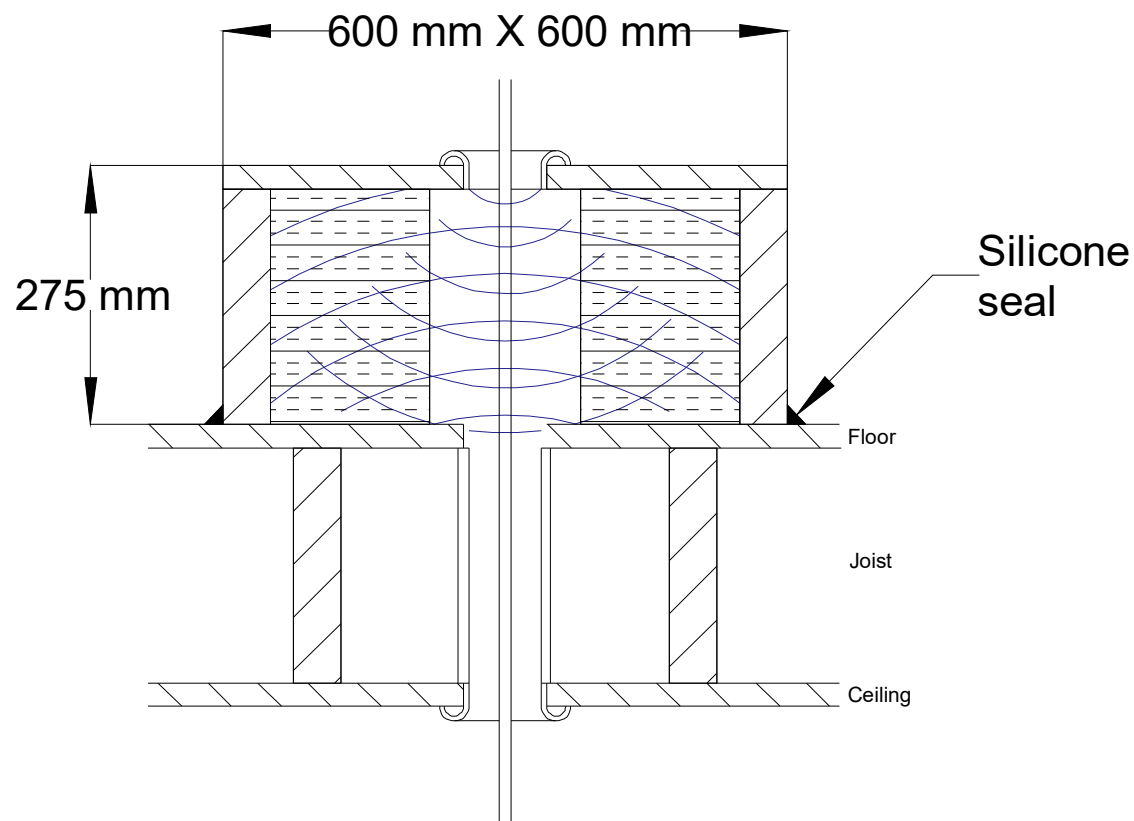
Use in all situations where the rope falls vertically and maximum sound attenuation is required.

Attenuation up to 10dB(A)



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Rope Holes in Composite Barriers – Muffler Box



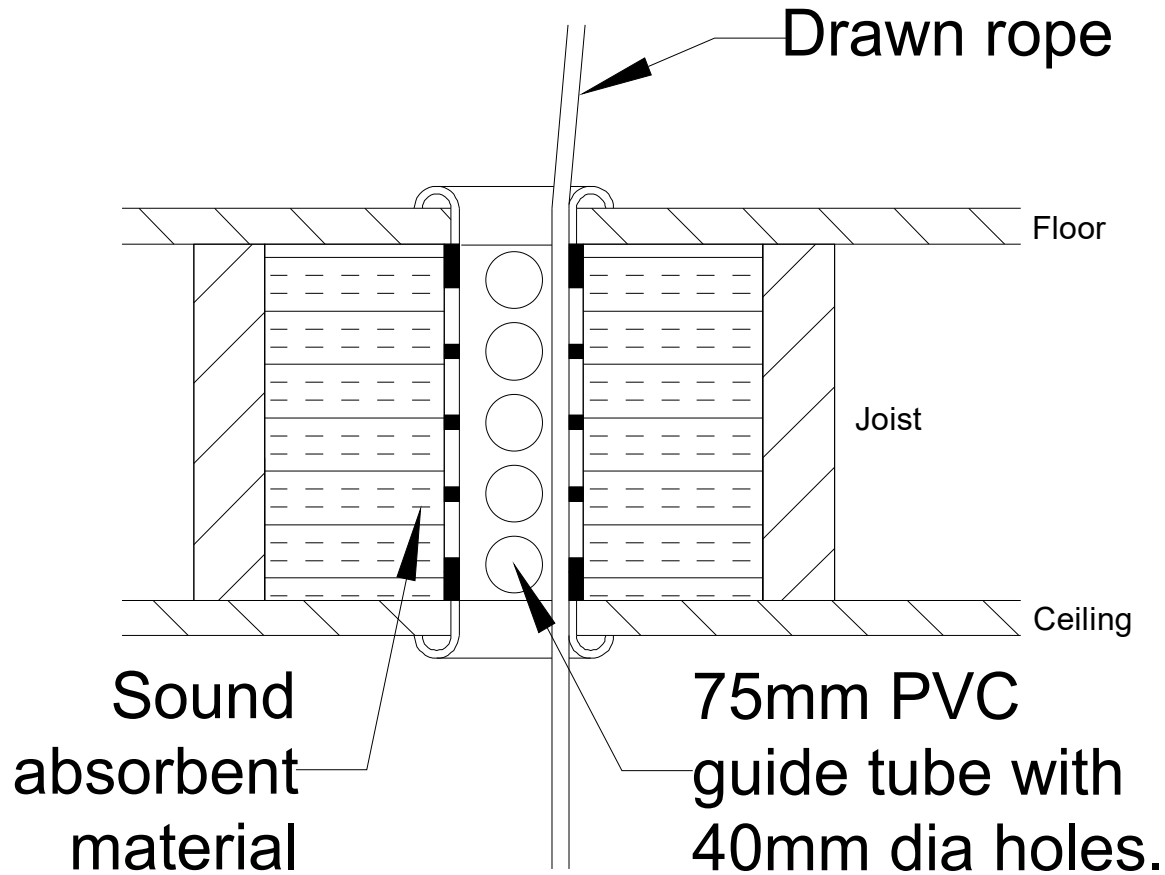
- Use where the rope falls vertically and where there is already a rope-hole tube or box.
- Great care is needed to seal all joints in the box or it will be ineffective!
- Can also be used with simple barriers.
- Attenuation up to 10dB(A)



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Rope Holes in Composite Barriers – Tube Modified to Attenuate Sound



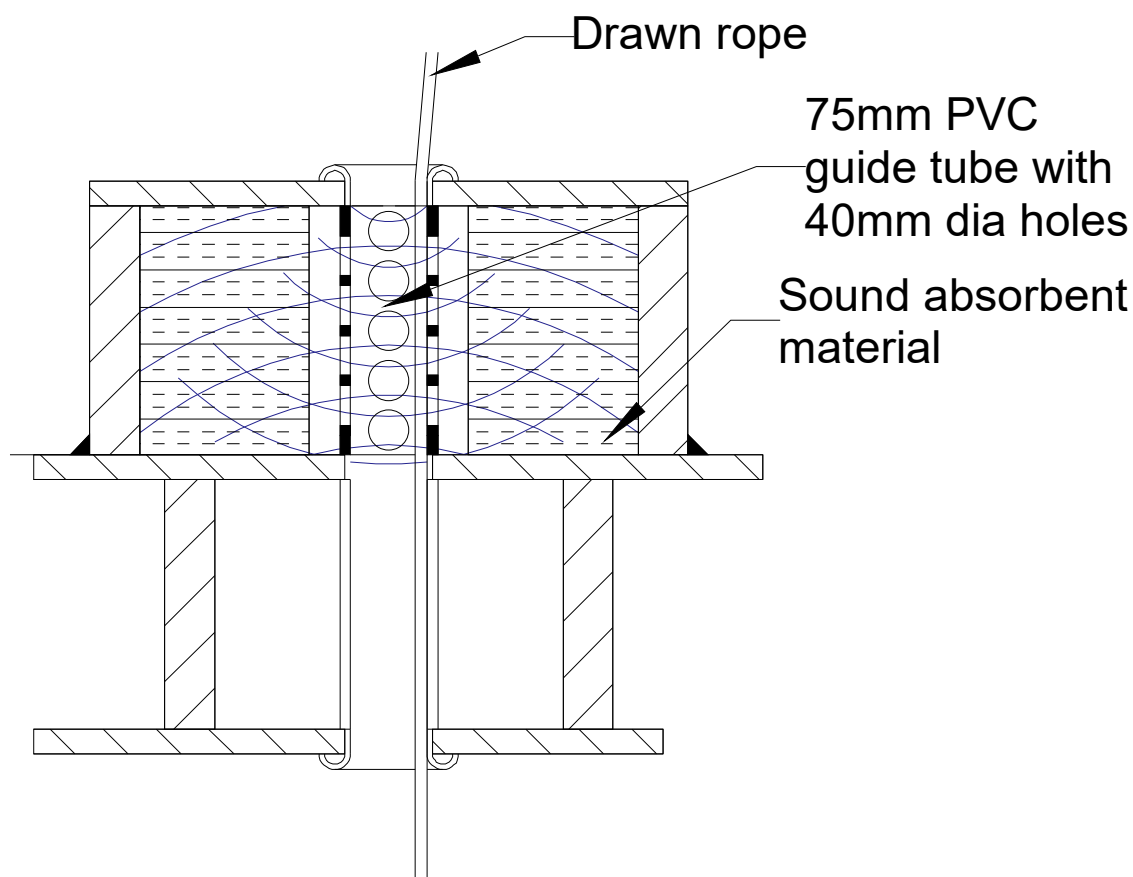
Where the rope is drawn above the barrier and the cavity depth permits, incorporate 40 mm diameter perforations in the walls of the tube and surround with sound absorbent material.

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.

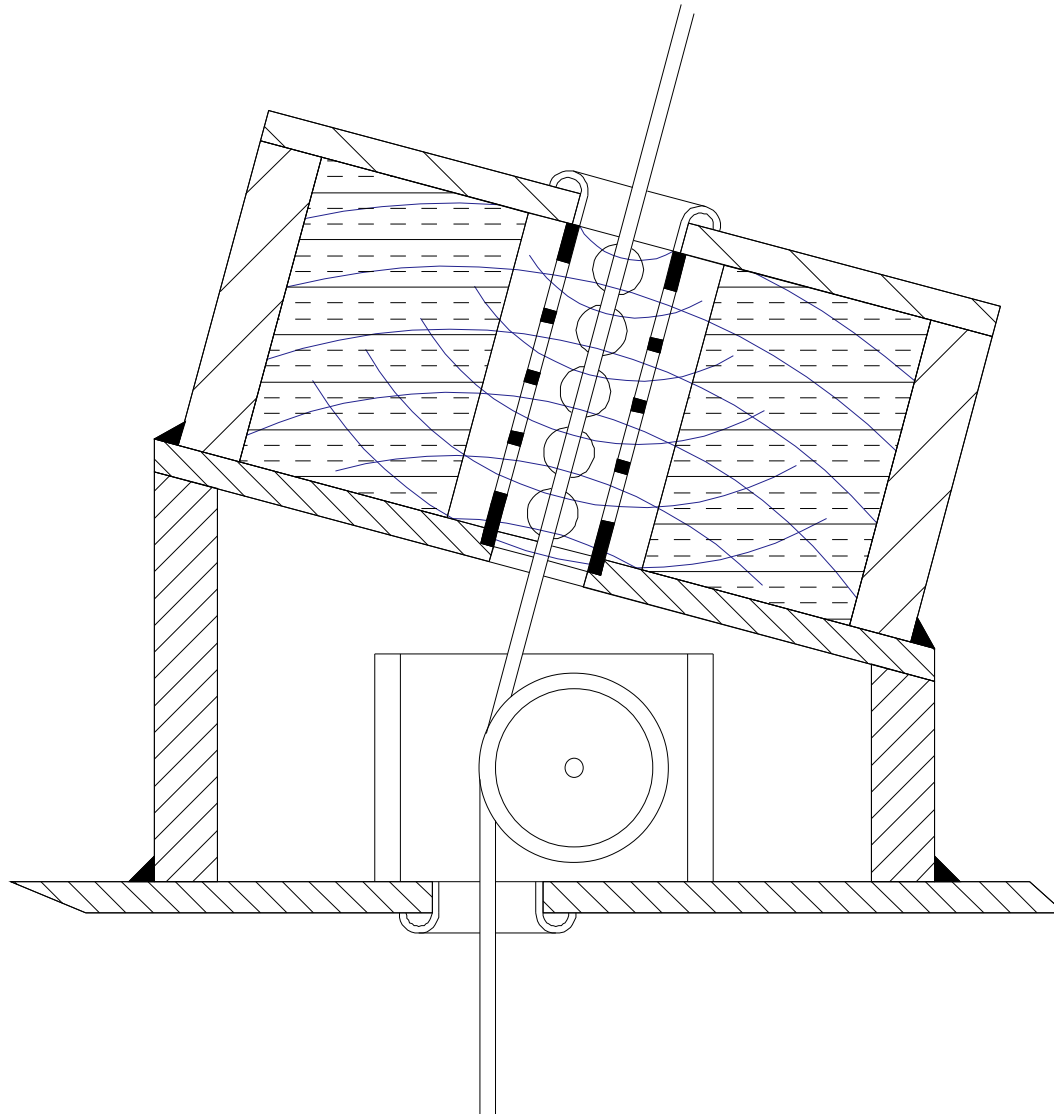
Attenuation up to 8dB(A)



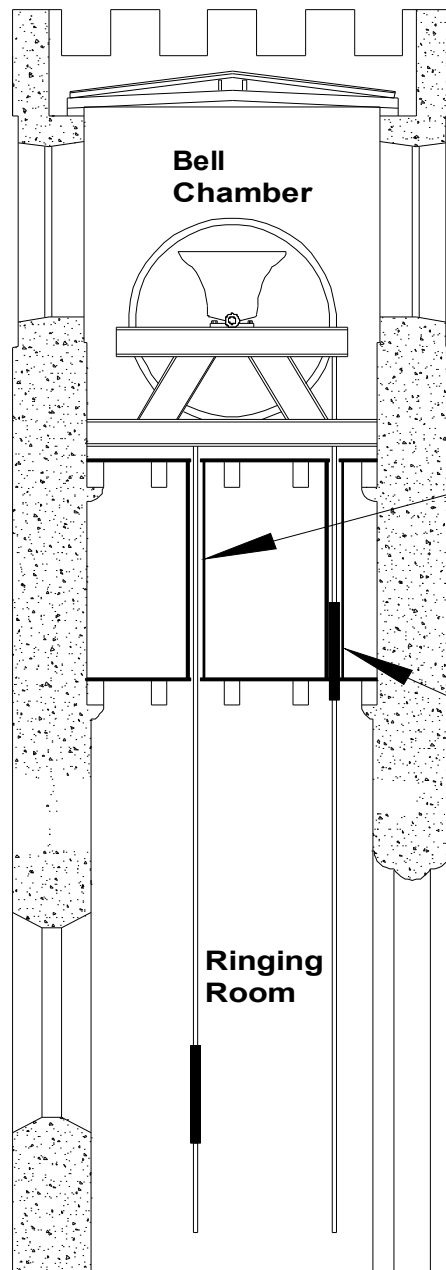
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Rope Holes in Simple or Composite Barriers – Rope Guide Muffle and Floor Pulley



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

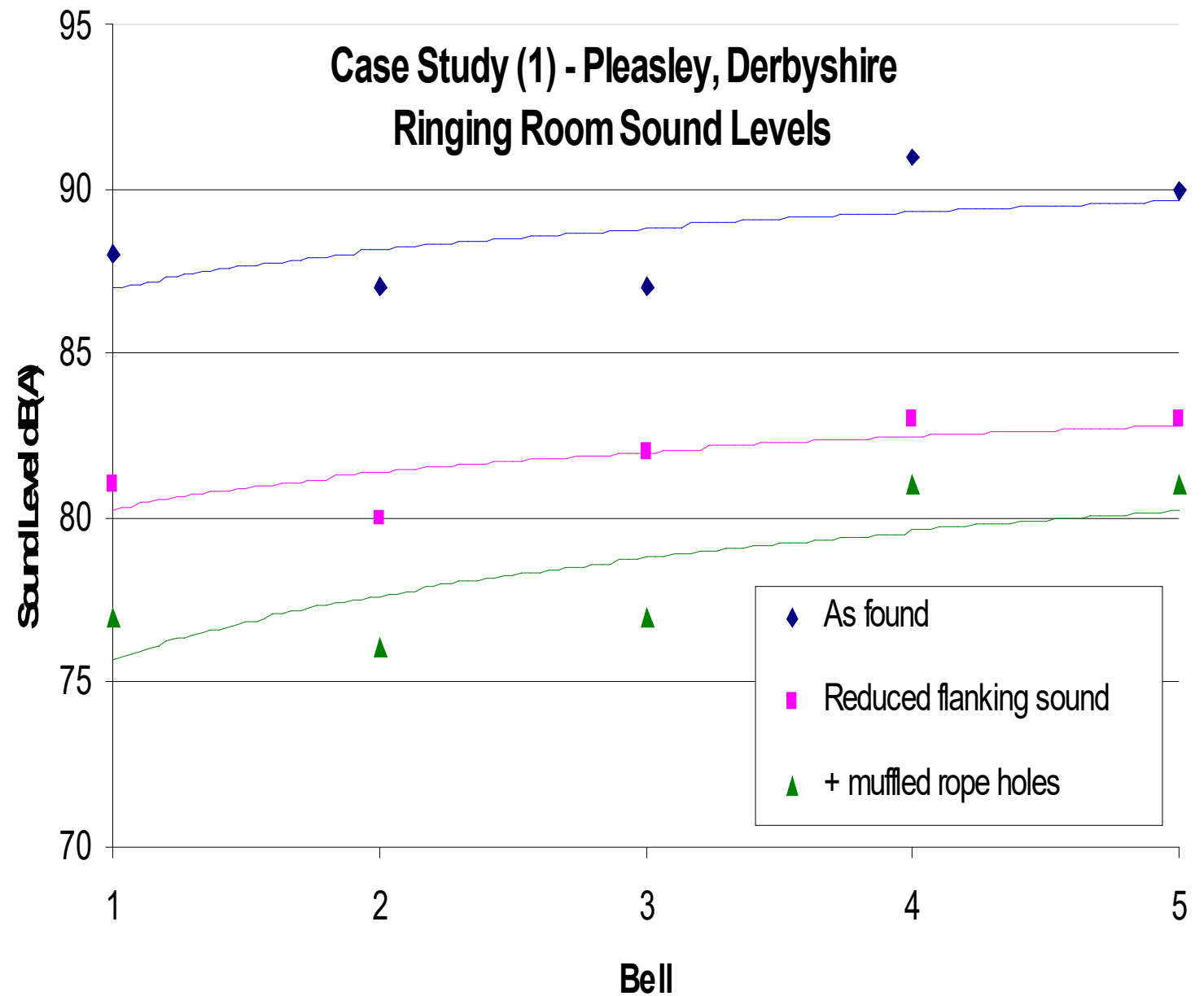
Fully enclosed rope guides act as sound conduits between bell chamber and ringing room

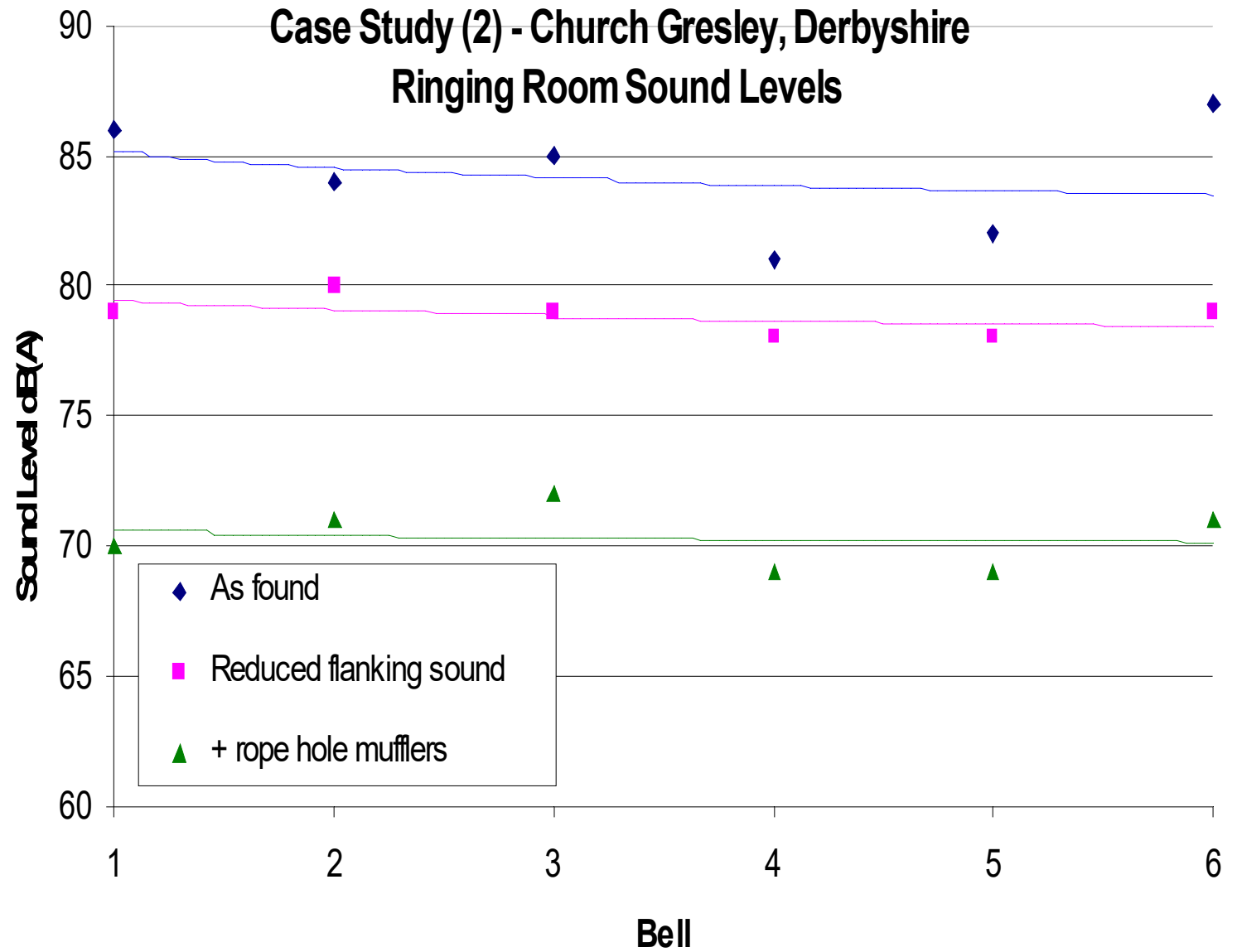
If sally enters fully enclosed rope guide, it mutes the sound following a hand stroke.

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



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St Giles – Sandiacre Derbyshire

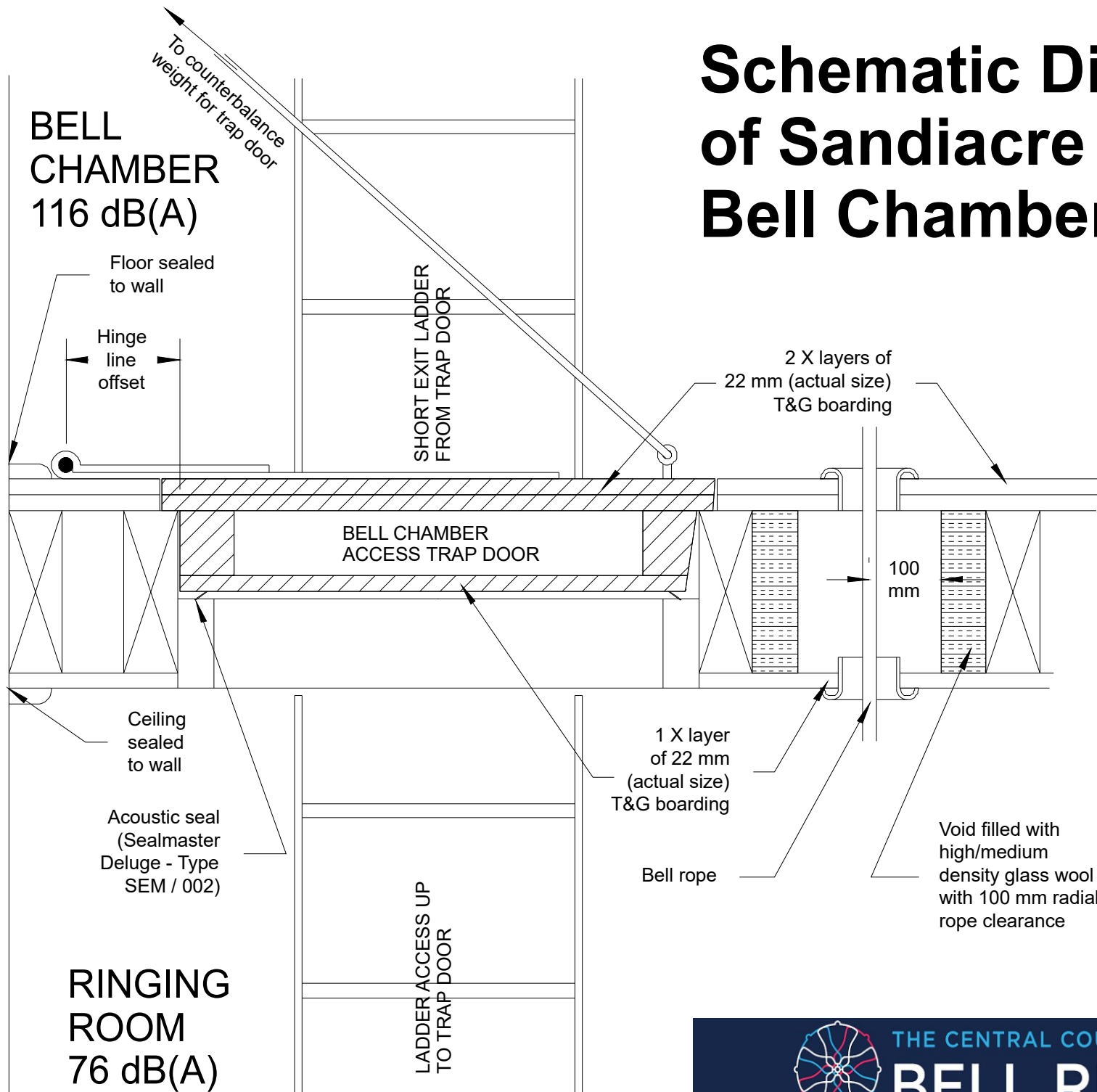
Bells re-installed lower
in tower with no
intermediate room and
new type 1 composite
bell chamber floor.

derbyda.org.uk



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Schematic Diagram of Sandiacre Bell Chamber Floor



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Sandiacre Counter-balanced Entry Trap Door to Bell Chamber



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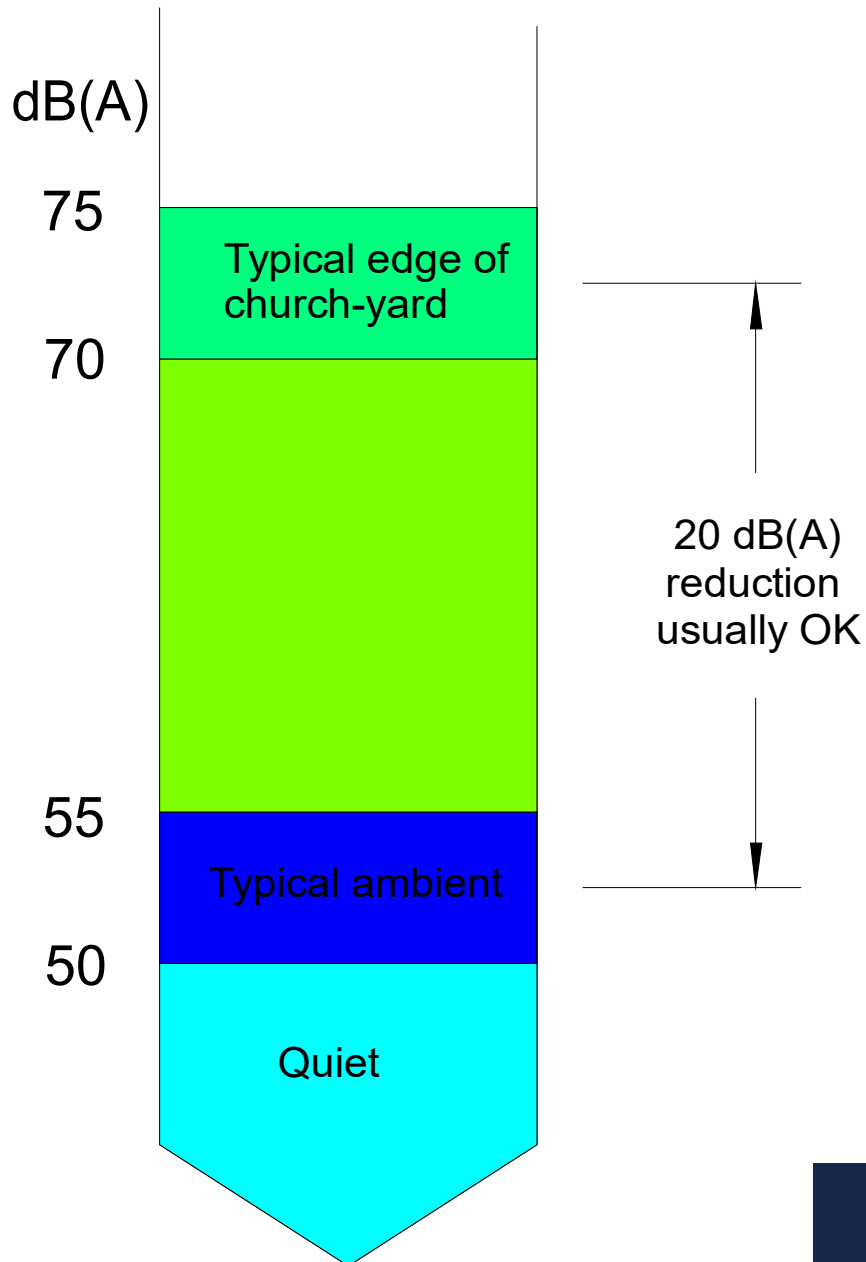
External Sound - Tips on How to Avoid Complaints

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.

Control of Sound Levels Outside the Tower

- Sound Levels too High

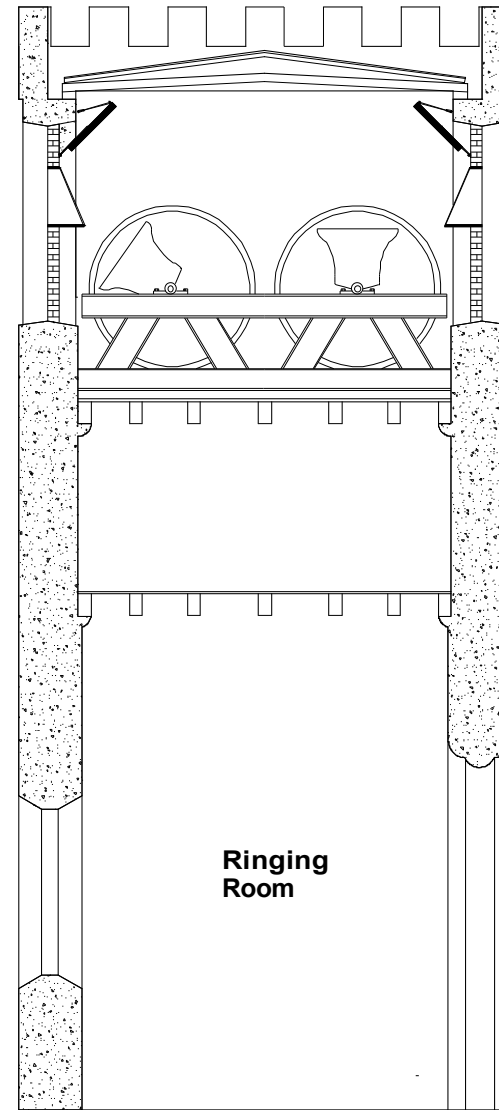
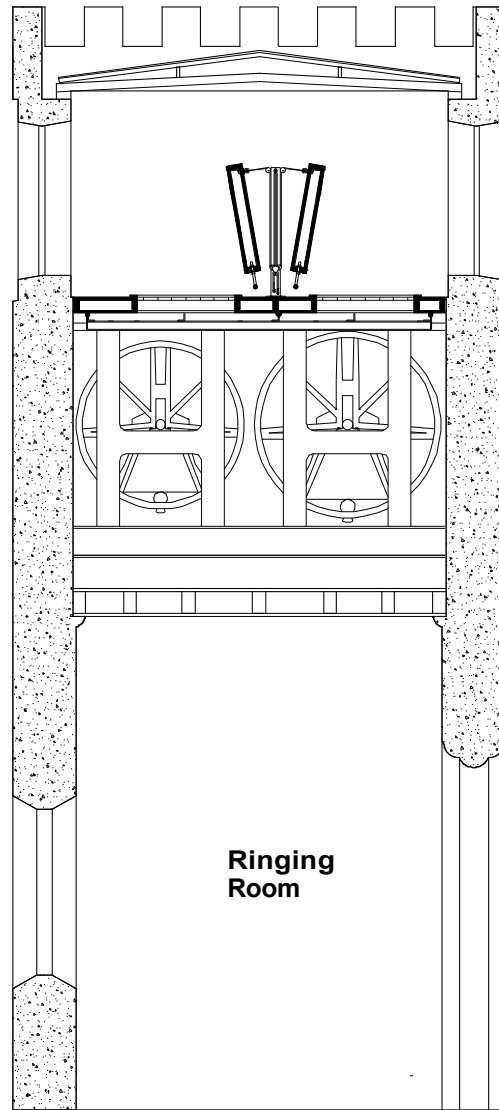


Sound levels will be unobtrusive if no higher than ambient noise levels.



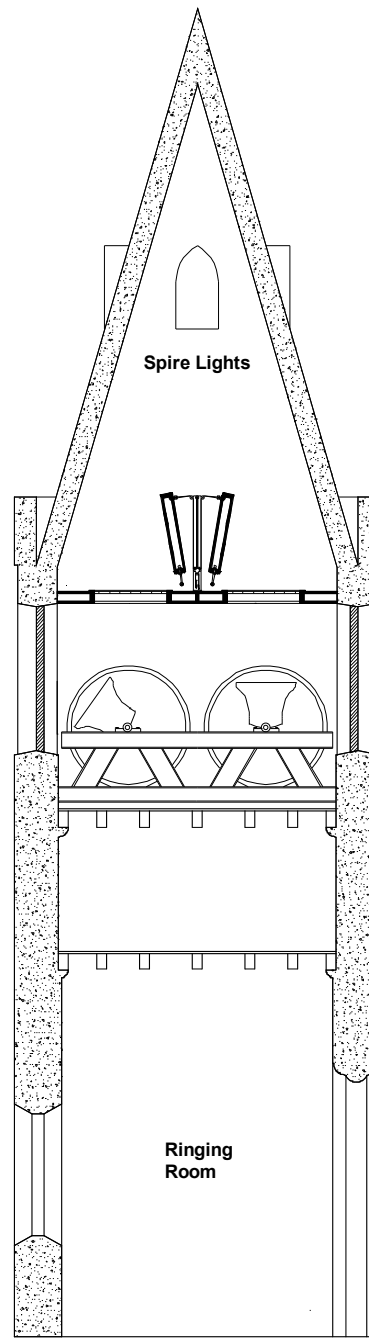
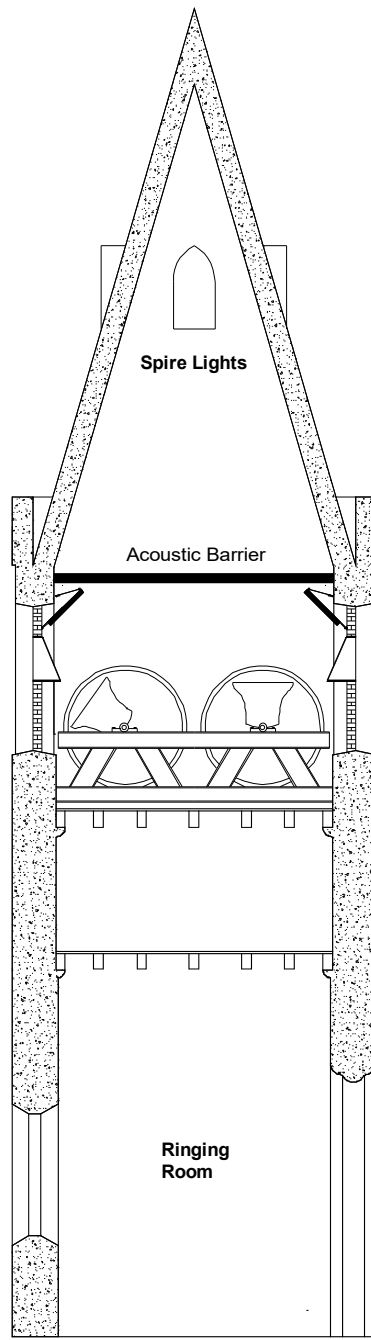
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External Sound Control – Doors Held Shut by Own Weight



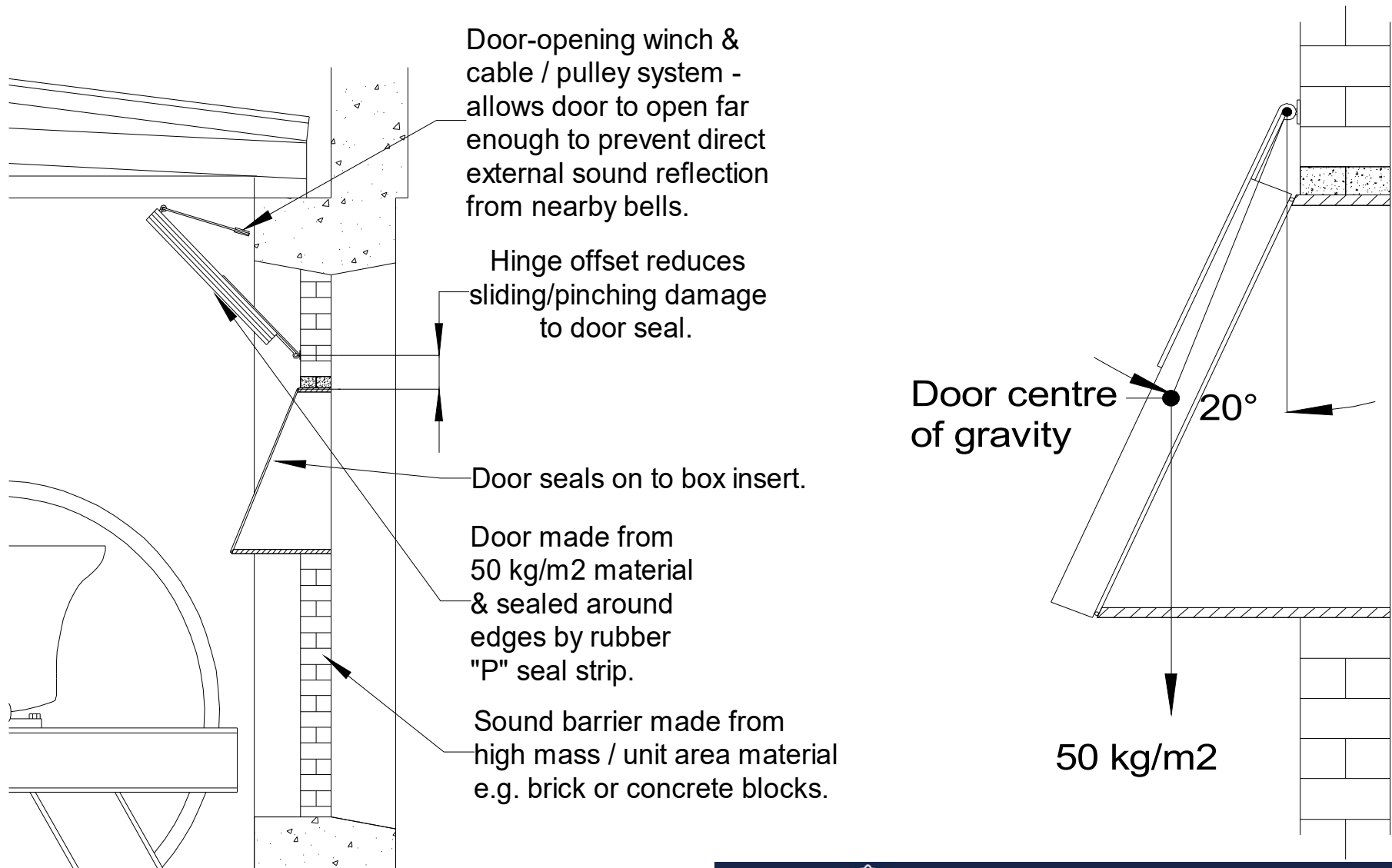
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External Sound Control – Steeple with Spire Lights



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Variable Sound Control in Sound Windows





Variable Sound Control - Saint Alkmund's Duffield

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



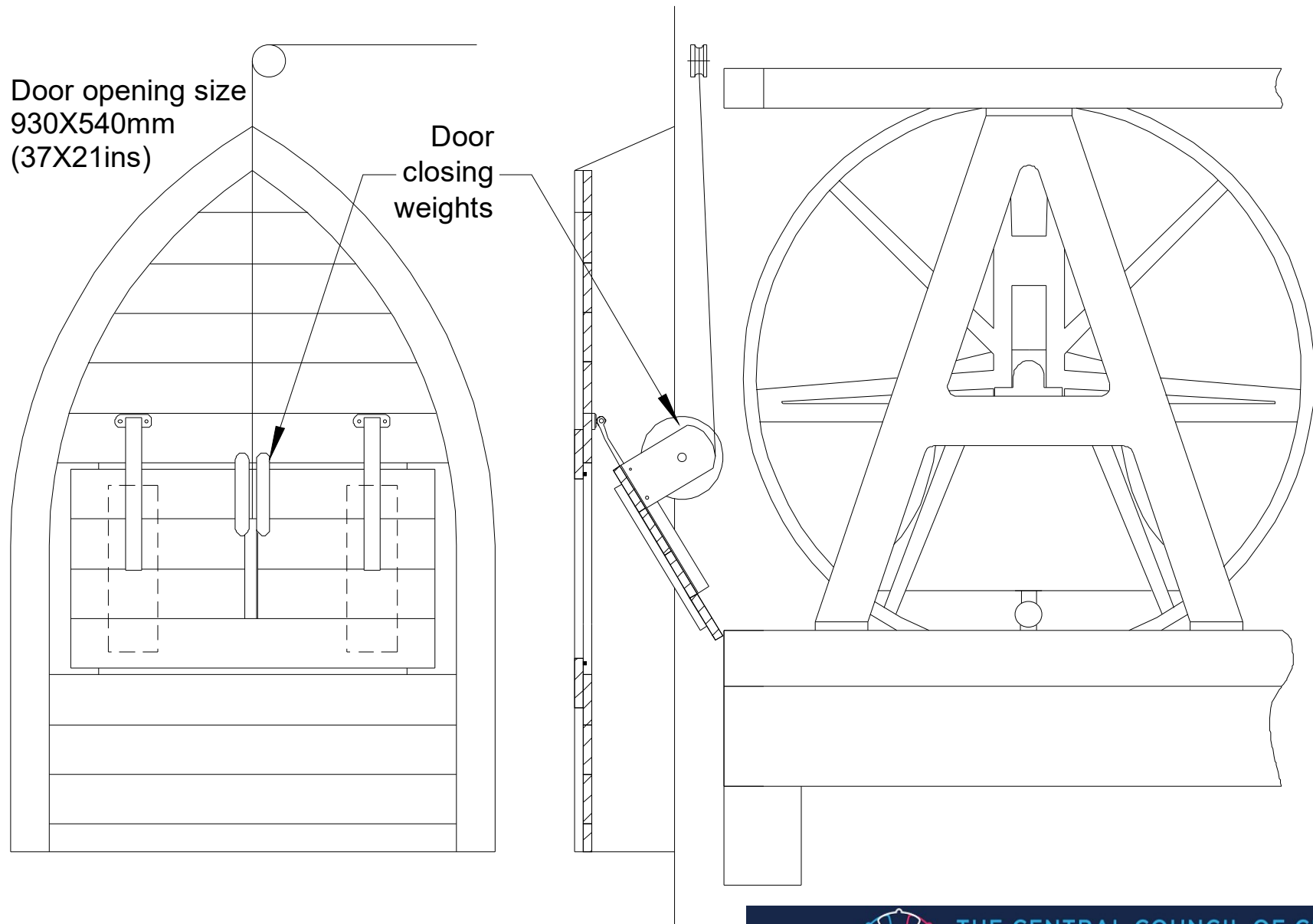
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Duffield with Sound Control - sound levels at south east corner of the churchyard



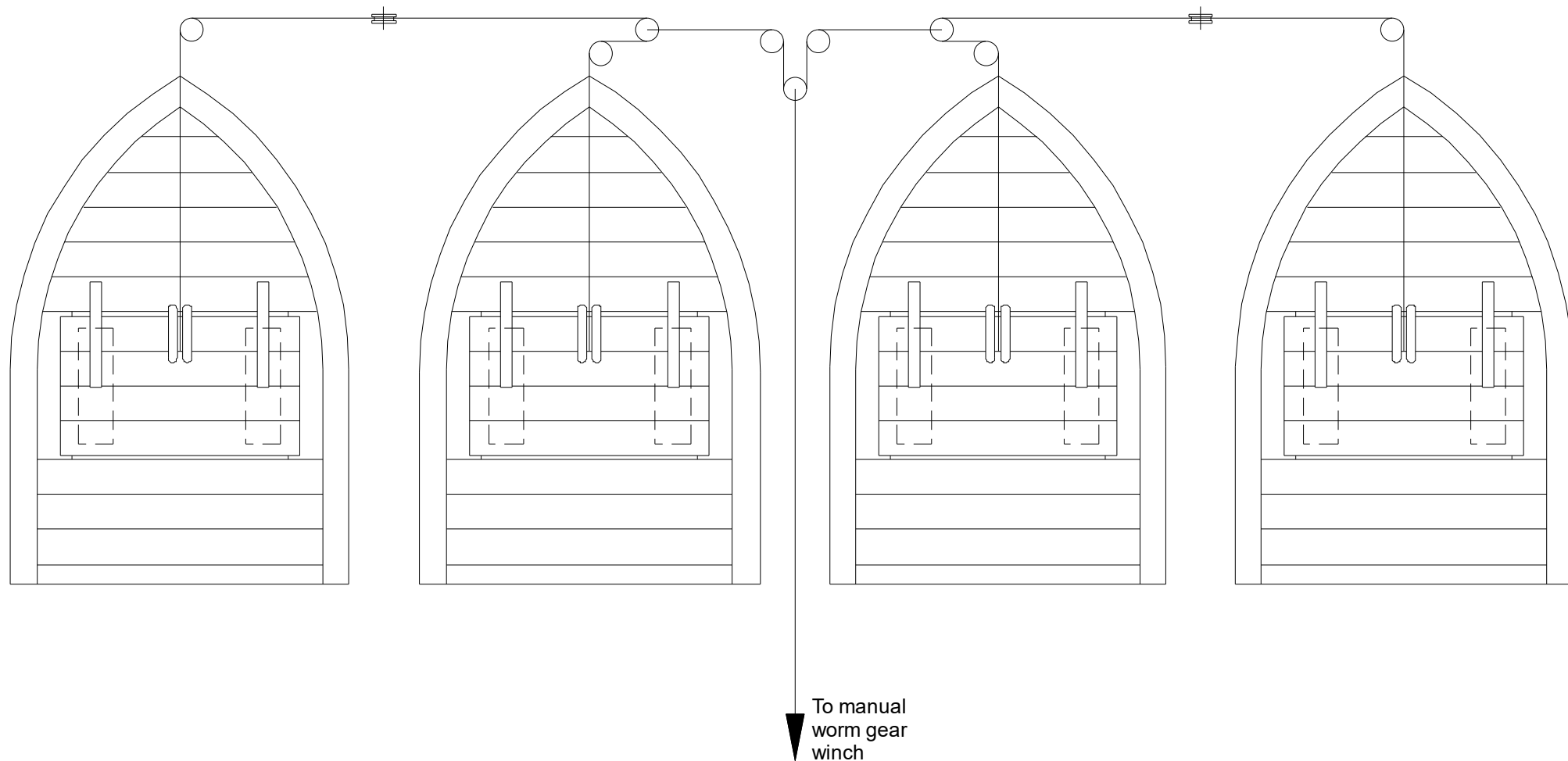
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Variable Sound Control in Confined Space - Doors Held Shut by Counterbalance Weights



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Suggested Layout of Winch Cables



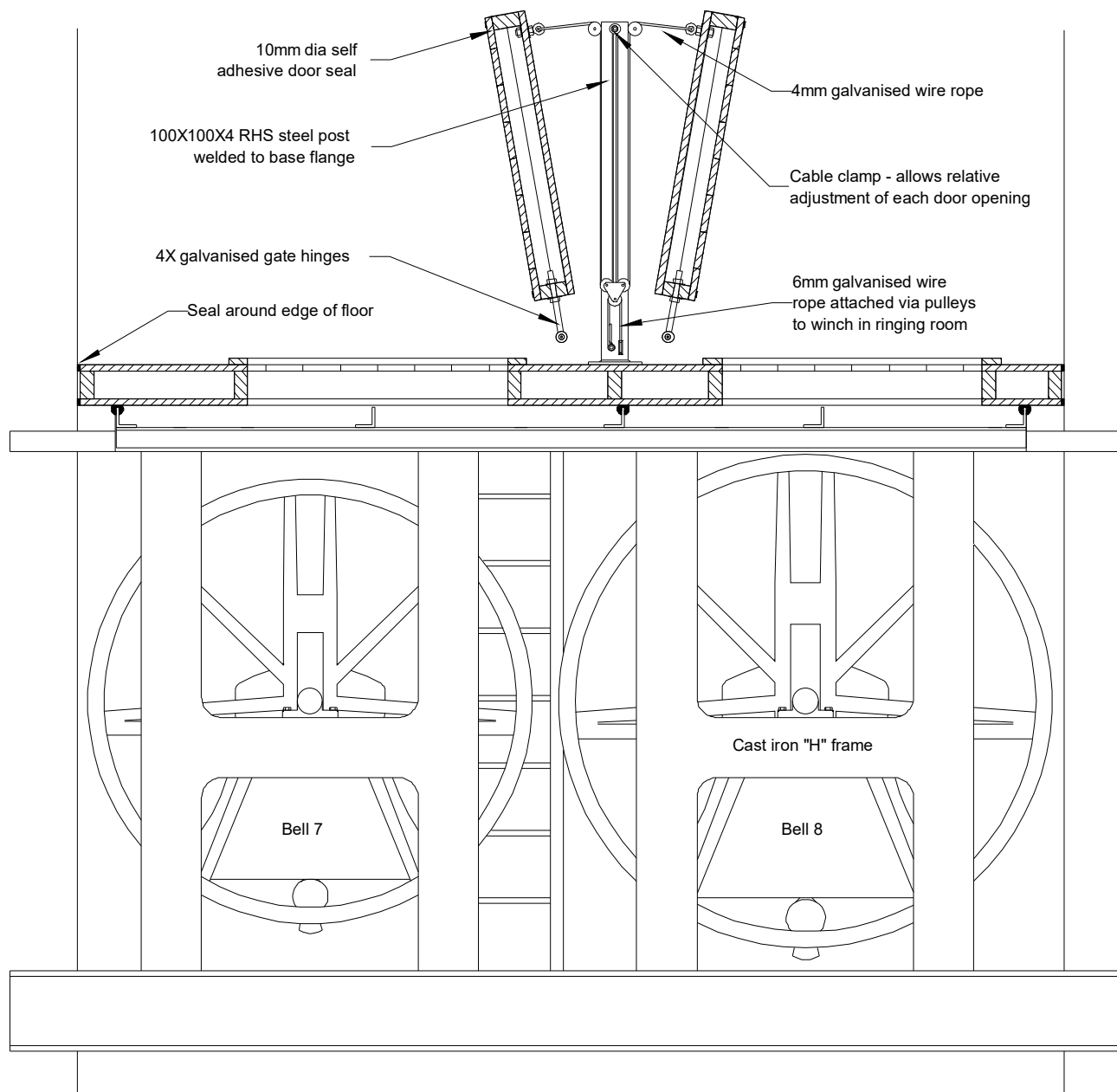
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Variable Sound Control in very Confined Space - Use of Remotely Controlled Linear Actuators



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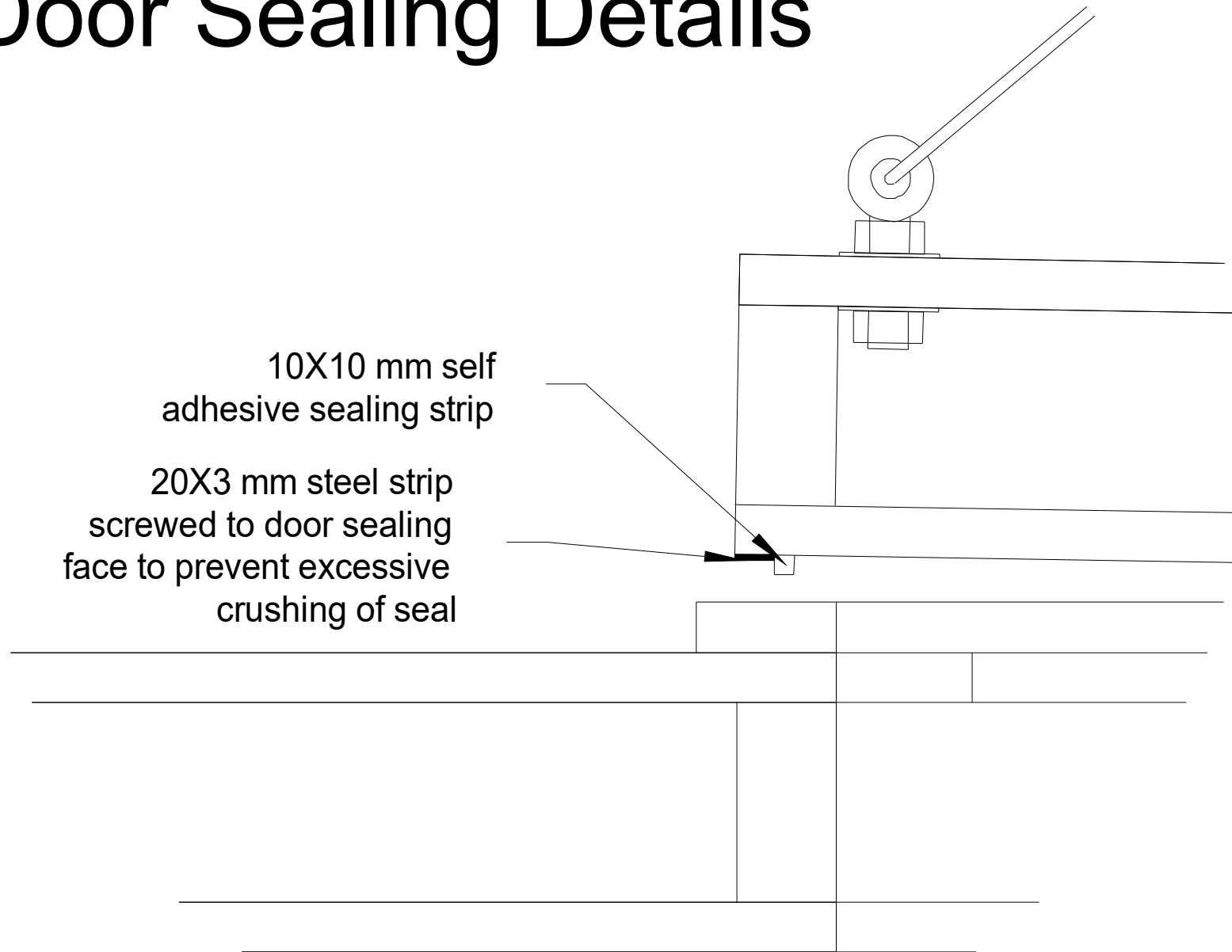
Horizontal Variable Sound Control Above Bell Frame

**Door opening
area as big as
possible**

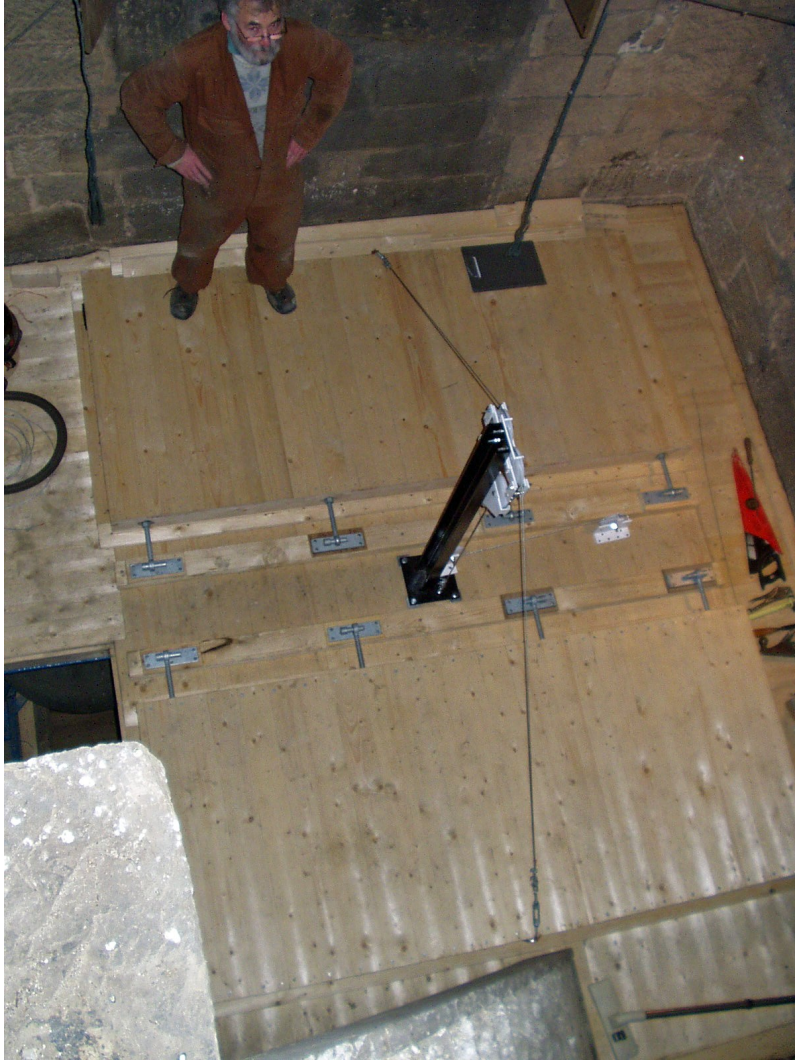


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Door Sealing Details



Horizontal Variable Sound Control - St Peter's Belper Derbyshire



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St Peter's Belper with Sound Control

- sound levels to north of church



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Lifting Winch

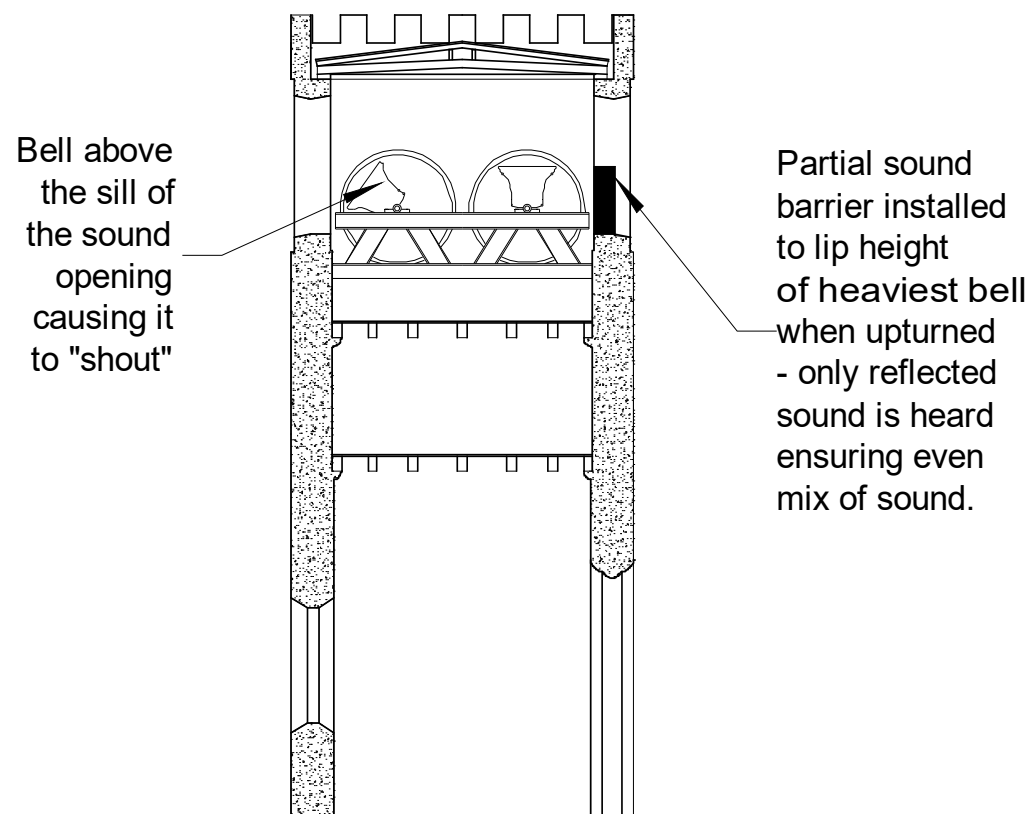
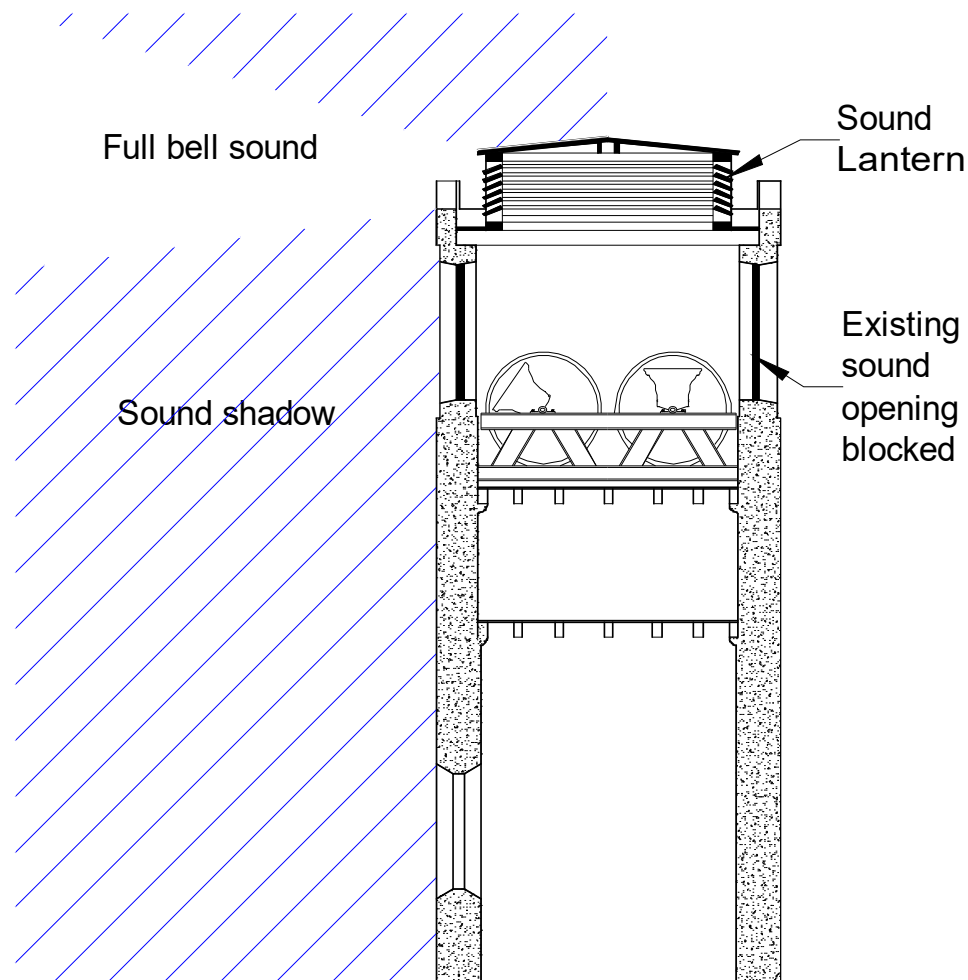


Use a worm drive lifting winch which cannot be back-driven by the load



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Partial Sound Barrier and Sound Shadow



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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.***

