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A holistic approach to acoustic design of open offices – ISO 22955

Morten Roar Berg

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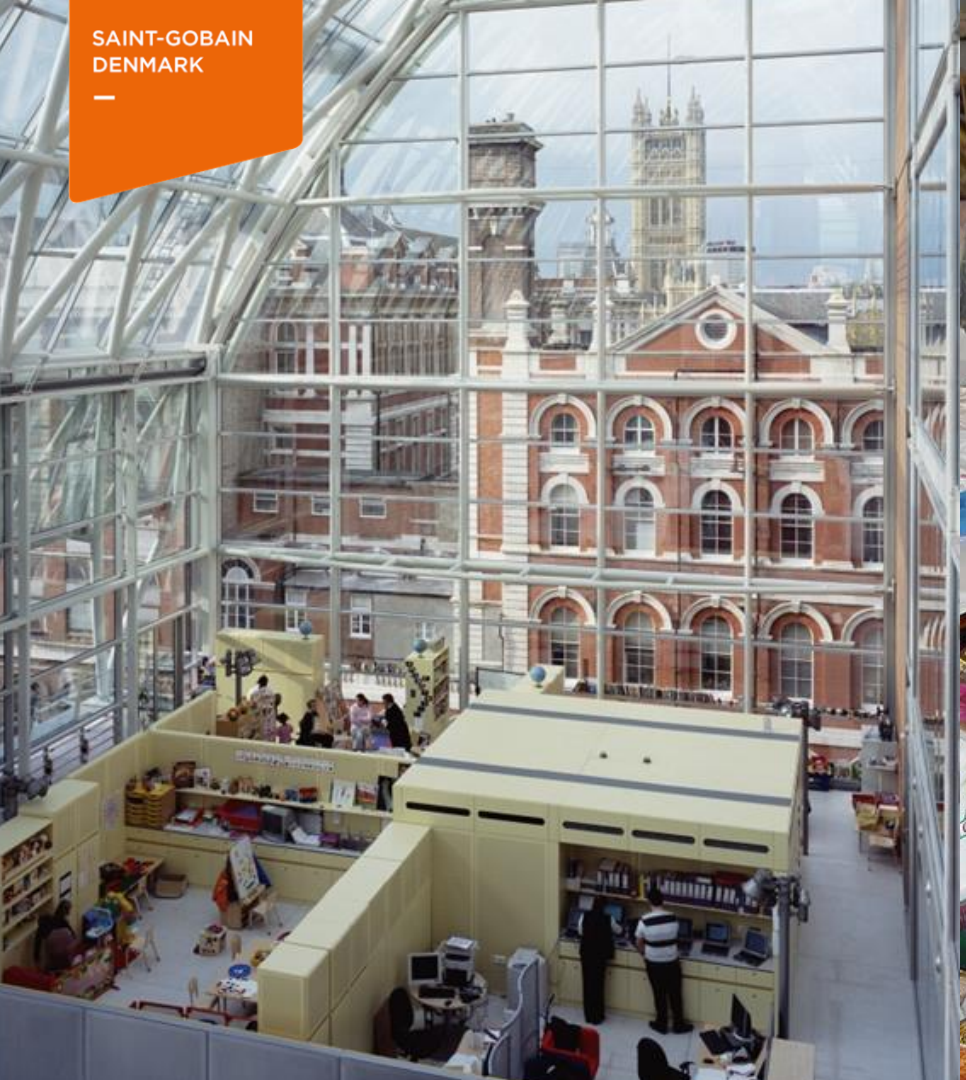

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HOW DOES OUR BUILDINGS SOUND?

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Leesman features by **importance**

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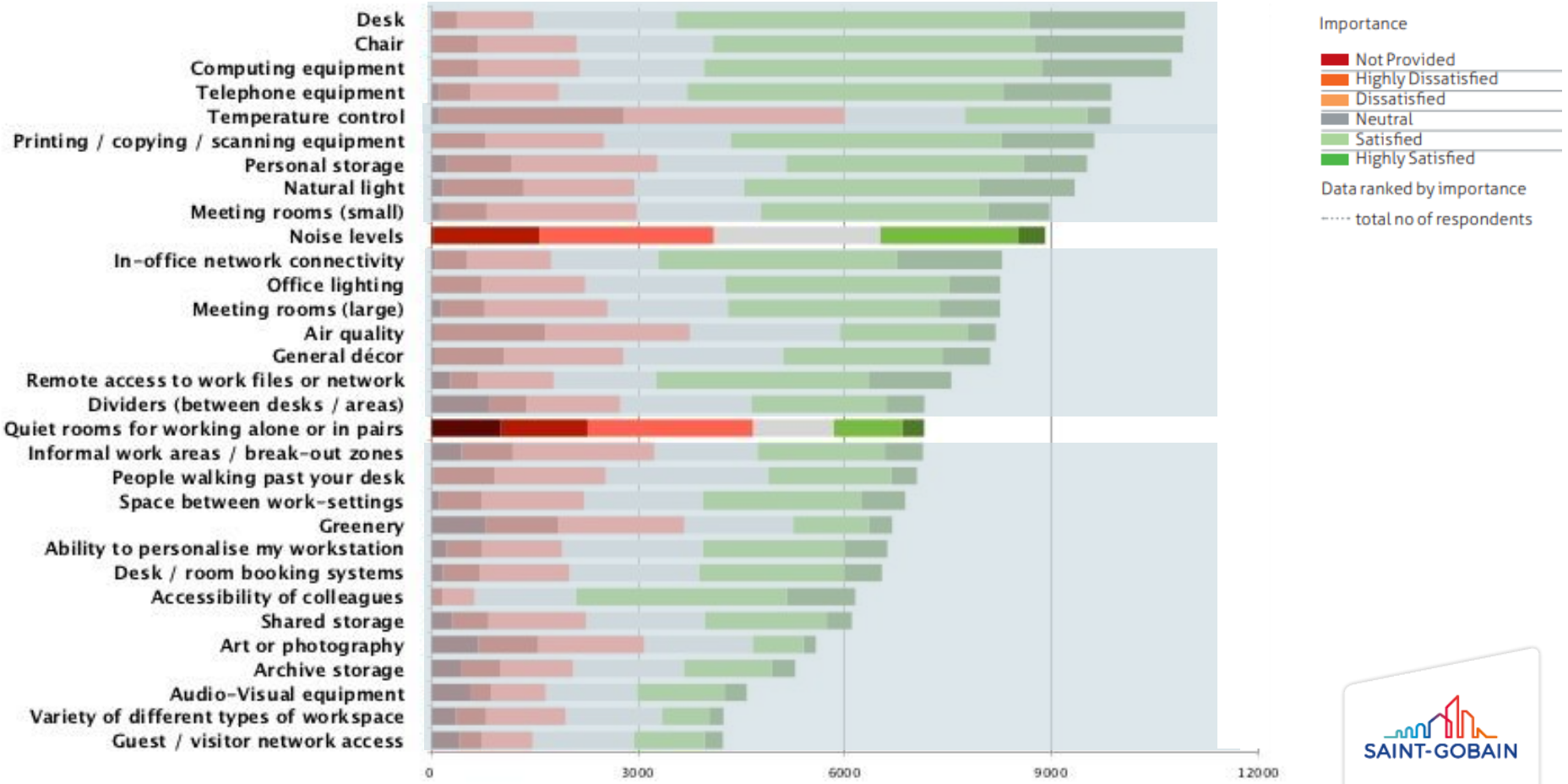

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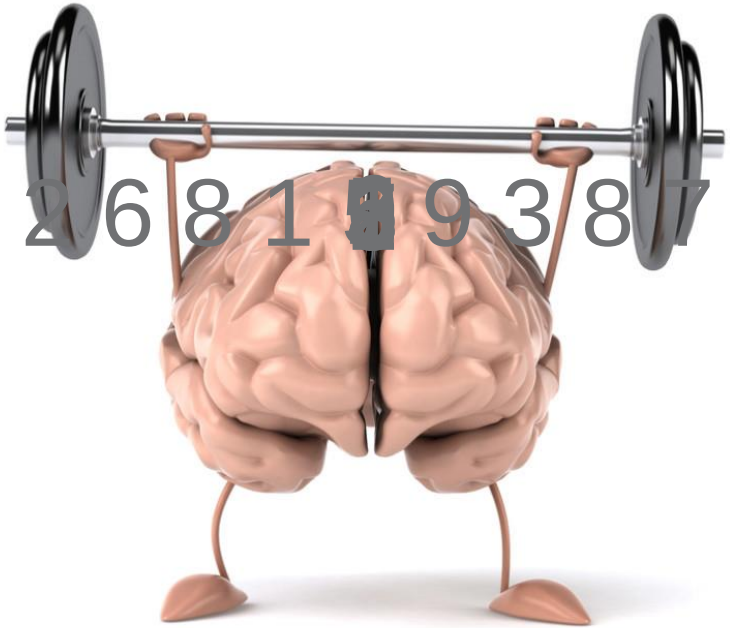
WORKING MEMORY - TEST



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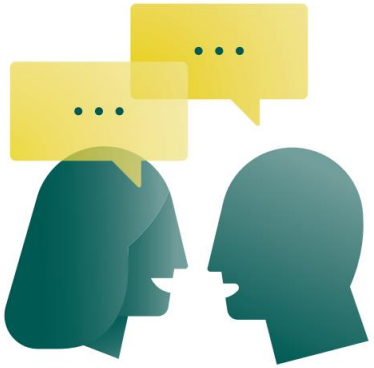
INTERNATIONAL STANDARD

ISO 22955

First edition
2021-05

Acoustics — Acoustic quality of open office spaces

Acoustique — Qualité acoustique des espaces de bureaux ouverts



This document is concerned with the acoustics of open-plan spaces and, more specifically, cognitive effects of noise, i.e. acoustic comfort and noise disturbance linked to the obligations of the activity.

It is intended for stakeholders working in the planning, design, construction or layout of open-plan offices. Its aim is to help them provide users with a good level of acoustic comfort. It is meant as a basis for discussion and dialogue between the stakeholders involved in creating office spaces. In particular, it is intended for project owners to fine-tune the drafting of the acoustic specifications and help project management companies decide upon their objectives and the resources linked to the architecture and layout of open-plan offices.

The aim of this document is to offer principles, descriptors and measurement methods to characterise acoustics, which are easy to use and correspond to the perception of the acoustical environment by the occupants of the spaces.

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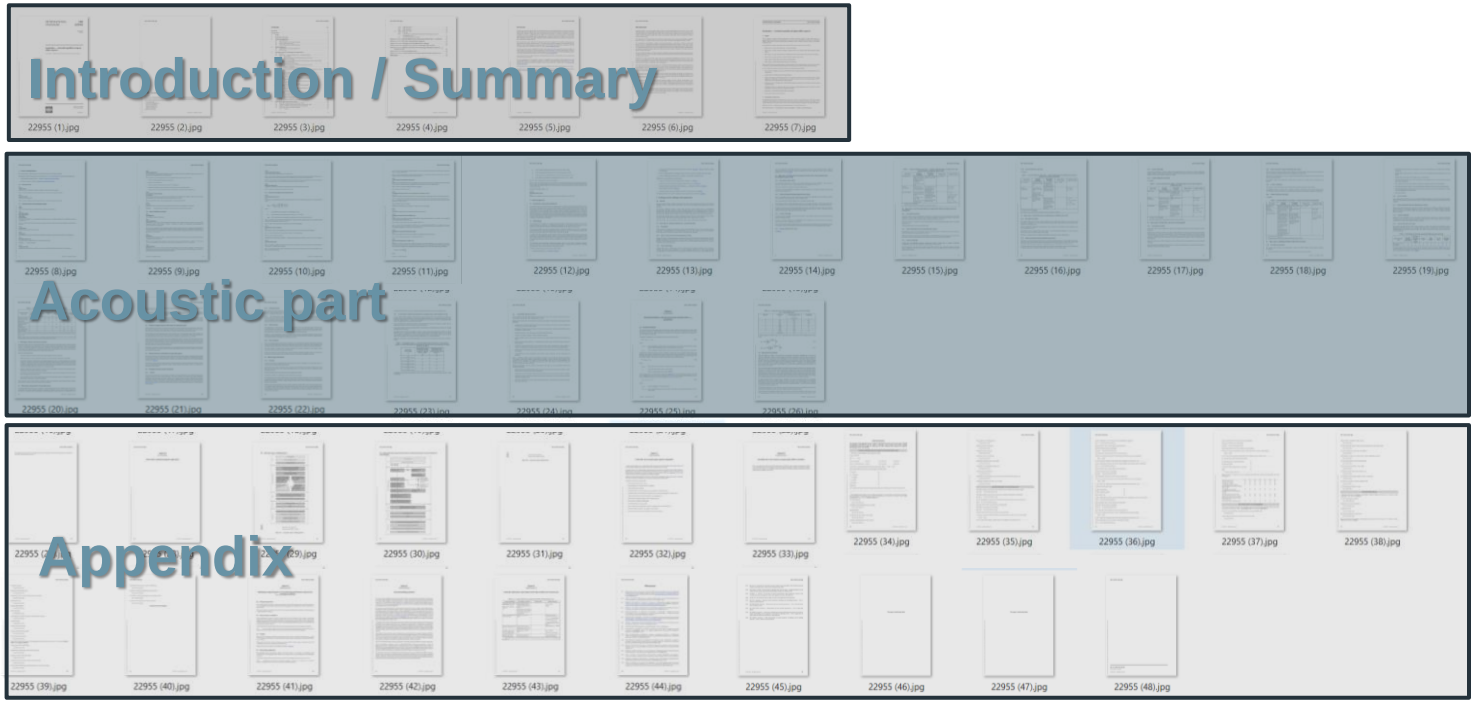
STRUCTURE ISO 22955

– What's in there?



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ISO 22955

– Methodology

Offices → two theoretically contradictory activities: oral communication and focused individual work

Intended to guide through the **acoustic planning** of open office areas

- 6 types of open areas defined
- **Goals and target values** are set for each type of activity

The standard is here to **protect workers**

- It's **outside** of the standard to **change people's behaviour** but rather to provide them the right place to work and by doing that one will influence their behaviour to be more collectively responsable
- It **cannot foresee the individual perceptions of users** associated with the working conditions and the use of the spaces. It offers a comprehensive approach to support acoustic management in OP projects

Proposed method

- Up to one how much you want to implement
- Show paths where to go in order to **avoid future dissapointments**

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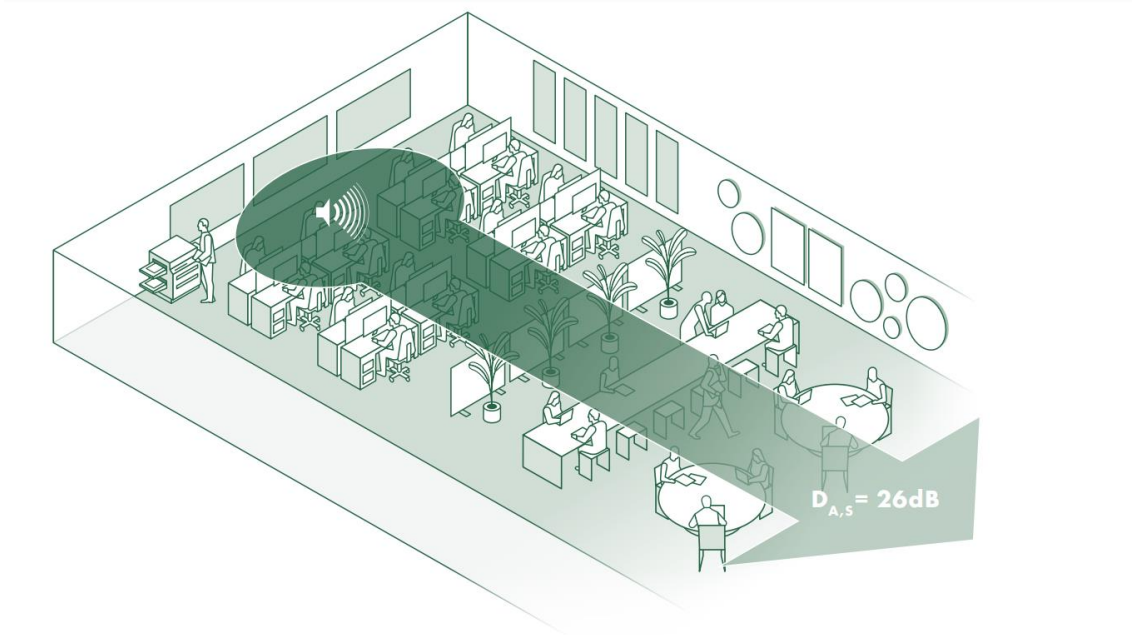
ISO 22955 – SECTION 3.4

– Acoustic Descriptors

$D_{A,S}$: in situ acoustic attenuation of speech

Difference, in decibels, between an A-weighted speech source spectrum at 1 m from an omni-directional source in the free field and the A-weighted sound pressure level at a reception point



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ISO 22955 – “CHAPTER 1”

– Types of activities

1) Vacant floor – activity still unknown

2) Tele- and video communication – mainly focusing on external communication

3) Mainly collaborative work – often verbal communication with nearby colleagues

4) Small amount of collaborative work – sporadic verbal communication with nearby colleagues

5) Welcoming areas – receiving the public

6) Mixed spaces – combining two or more activities in the same space

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1) VACANT FLOOR

– activity still unknown

Table G.1 — Acoustic indicators and values when the activity isn't known yet

Acoustic challenges	Description, criterion	Target values	Required values
Minimising effect of many simultaneous sources Preventing "Lombard" effect	This parameter should only be assessed if a suspended ceiling has been installed. Attenuation of the amplification of the room as much as possible by reducing reverberation.		$\frac{A}{S_{\text{Floor}}} \geq 0,9$

90% of the surface of the ceiling with α_w=1

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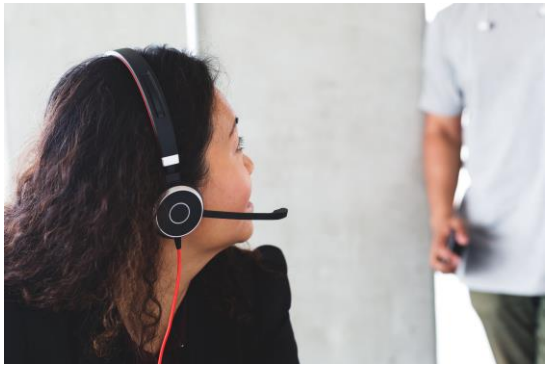
SPACE 2-3

- telecommunication, collaboration and little collaboration

Table 1 — Acoustic indicators and values — Activity mainly focusing on outside of the room communication (by telephone/audio/video)

Interaction	Acoustic challenges	Description, criterion	Target values	Required values
[illegible]	[illegible]	[illegible]	[illegible]	
[illegible]	[illegible]	[illegible]	[illegible]	Attenuation $D_{A,S} \geq 6$ dB
[illegible]	[illegible]	[illegible]	[illegible]	$T_r \leq 0{,}5$ s [b] $T_r \leq 0{,}8$ s at 125 Hz Noise reduction inside room $D_{2,S} \geq 7$ dB $L_{p,A,S,4\,m} \leq 47$ dB
[illegible]				



High absorption (short reverberation time)

Sound propagation control requires screens

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5) WELCOMING AREAS

Table 4 — Acoustic indicators and values — Activity can involve receiving public

Interaction	Acoustic challenges	Description, criterion	Target values	Required values
				Attenuation $D_{A,S} \geq 6$ dB
				$T_r \leq 0{,}8$ s [b] $T_r \leq 1{,}0$ s at 125 Hz $L_{Aeq,1hr} \leq 50$ dB - un-occupied

Absorption must be present

Sound levels should not be too high on average.

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6) MIXED SPACES

– Potential $D_{A,S}$ target values

Table 6 — Potential $D_{A,S}$ ratings between different types of spaces[6]

Source/receiver space type	Informal meetings (open plan)	Outside of the room communication (phone)	Collaborative	Non-collaborative	[illegible]	Focused individual work
[illegible]	15	15	18	24	27	32
Informal meetings (open plan)	15	12	15	21	24	29
Outside of the room communication (phone)			12	18	21	29
Collaborative				18	21	26
Non-collaborative					18	23
Focused phone					21	26

NOTE 1 In order to keep the noise level within the social and welfare space under control and avoid Lombard effect, a certain amount of absorption is needed. It is recommended to have an absorption area of at least 90 % of the floor surface. $A/S_{Floor} = 0{,}9$.

NOTE 2 These values are derived based on assumptions regarding background sound levels, source vocal effort, and proposed signal to noise ratios. These values may vary depending on the context.

Noise emission

“Distraction sensitivity“

The greater the difference in activity and sensitivity to noise, the greater the attenuation that is appropriate between activities.

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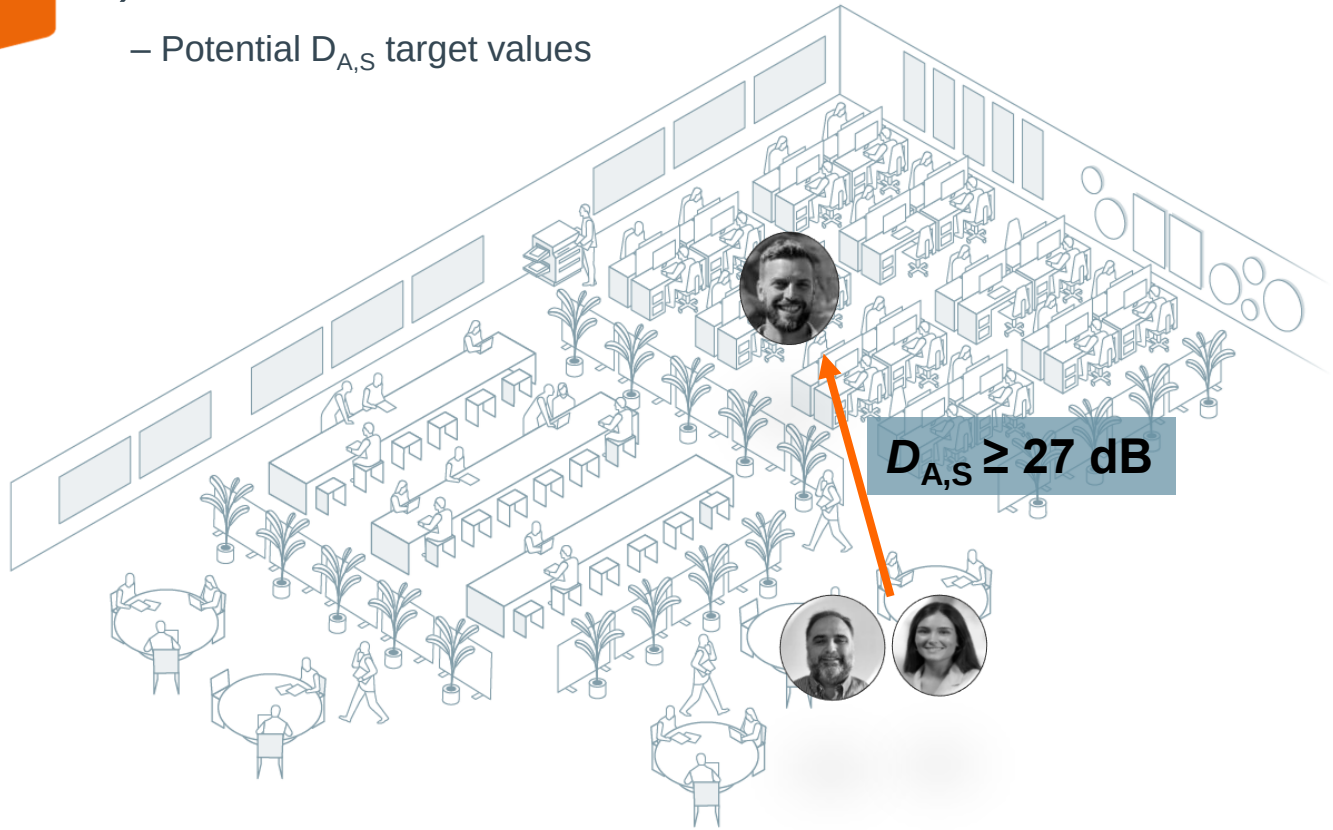
6) MIXED SPACES

– Potential $D_{A,S}$ target values



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6) MIXED SPACES

- Assumed noise levels

Table 5 — Workstation noise levels assumed for different types of activity

Receiver space type	Informal meetings (open plan)	Outside of the room communica-tion (phone)	Collabora-tive	Non-collabora-tive	Focused phone	Focused individual work
Workstation noise level (dBA)	48	48	45	42	42	40

If suitable workstation noise levels are assumed for each type of space, as noted in Table 5 above, the in situ level difference $D_{A,S}$ can be determined between different types of spaces based on an A-weighted source speech level of 57 dB at 1 m. See Table 6.

Combining two or more activities in the same space

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CLEAR INSTRUCTIONS FOR ACOUSTIC DESIGN

- Room acoustic design

General:

Acoustic design of rooms fundamentally involves covering room surfaces exposed to sound with sound absorptive materials to limit sound reflections. The more sound absorbing a given material is (e.g. higher sound absorption coefficient), the better.

p. 15 – s. 6.4.1

Ceiling treatment

The ceiling is the most important room surface to treat in open offices and should be as sound absorbing as possible. A wall-to-wall sound absorbing ceiling is preferable.

p. 16 – s. 6.4.2

NOTE The ceiling surface cannot be fully treated, when trying to take advantage of the building thermal inertia. In this case, treatment methods using suspended absorptive elements covering approximately 50 % to 60 % of the open-plan space ceiling surface is preferred. To increase spatial decay, treatment elements are placed as low as ergonomic requirements permit because floating island solutions of this type are all the more effective when their top surfaces are exposed to the sound field.

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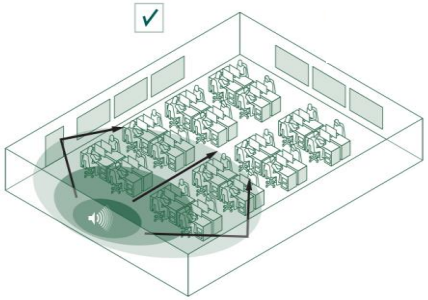
CLEAR INSTRUCTIONS FOR ACOUSTIC DESIGN

- Room acoustic treatment

Walls treatment

Wall absorbers is a good way of reducing reverberation time if the open office is sparsely furnished (lacking diffusion). They likewise minimize flutter echoes as well as sound reflections for workstations located close to walls, particularly in corners of open offices. Wall absorbers should be installed in the ear height of the users of the room.

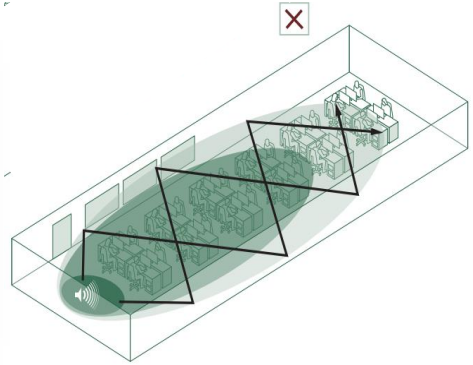
p. 16 – s. 6.4.3



Floor treatment

In general, the effect of acoustic treatment on floor surfaces in open offices is not significant. Unless highly specialized solutions like perforated cavity flooring is installed. Soft floorings only contribute slight absorption in the higher frequency ranges. Main room acoustic benefit of soft flooring is to minimize impact noise from steps and furniture.

p. 16 – s. 6.4.4.



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CLEAR INSTRUCTIONS FOR ACOUSTIC DESIGN

- Room acoustic treatment

Acoustic Screens

Acoustic screens improve speech privacy through an open office. They do this by minimizing the distance sound spreads. The effect of acoustic screens depends on the quality of room acoustic design. The less reflective surfaces present, the better the effect. Furthermore, acoustic screens extending both above and below desks provides better acoustic effect.

p. 17 s. 6.5.2

Furniture

As a rule of thumb, furniture will not be sufficient to meet the acoustic needs of an open office space. Instead design priority for acoustic treatment should be given to treating room surfaces.

p. 16 – s. 6.5.1

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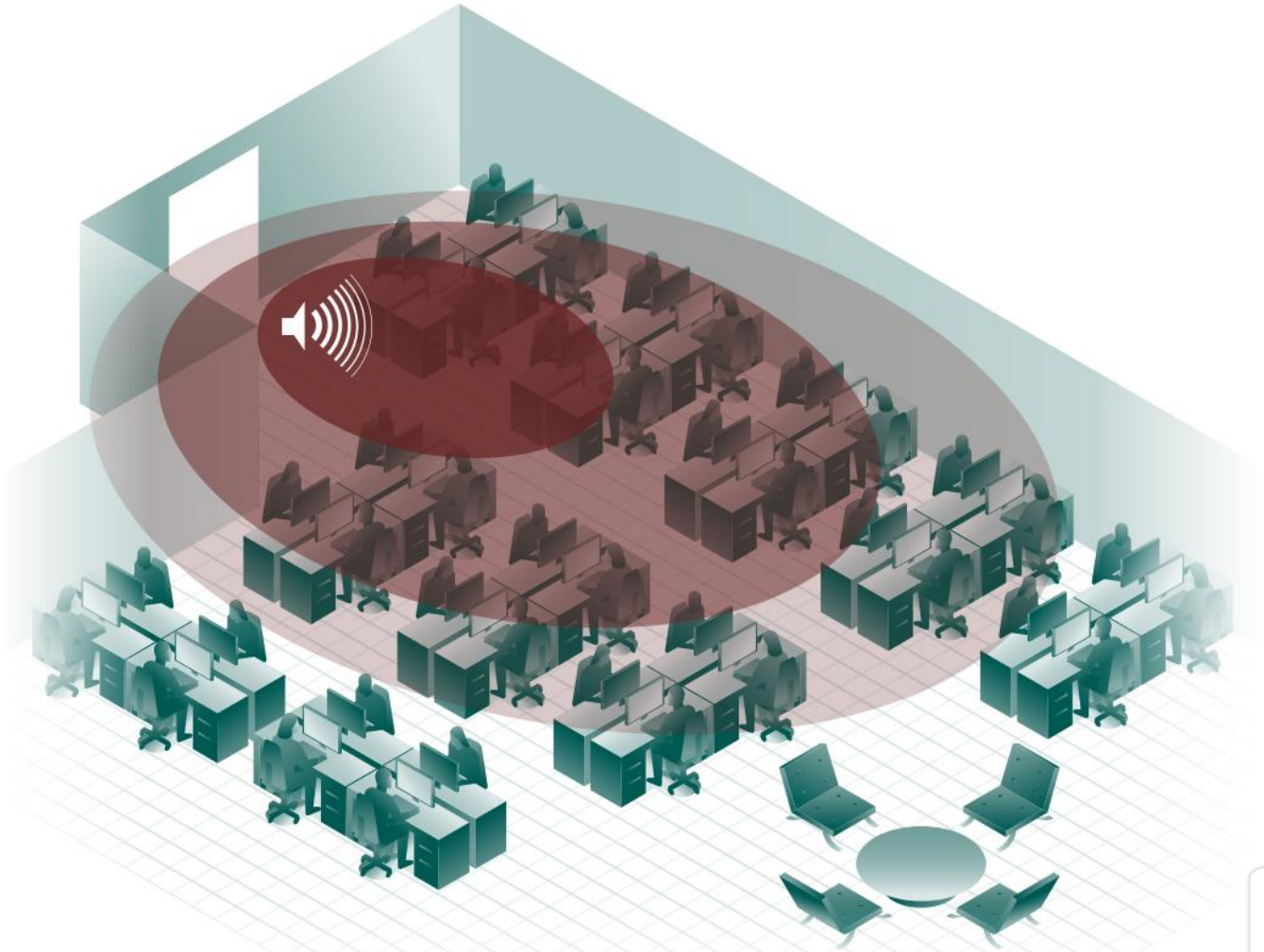

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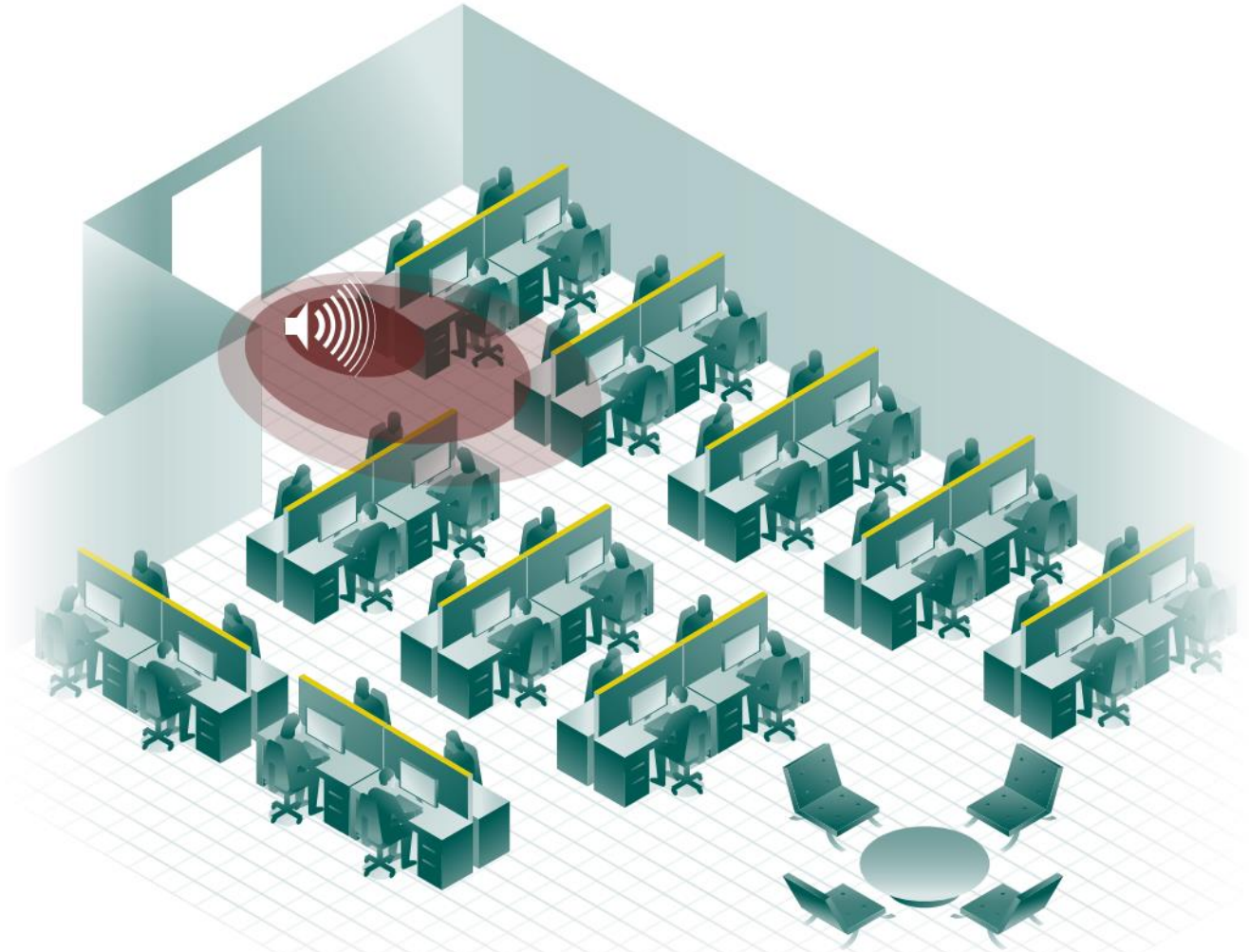

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CLEAR INSTRUCTIONS FOR ACOUSTIC DESIGN

- Workplace layout

General recommendations:

— all cooperating workstations should be grouped together (teams, projects);

— different teams or services should be separate, even if occasional cooperation is possible;

— movements between workstations and supporting spaces such as a photocopying area, meeting rooms, etc. should be optimized. Distinction should be made between supporting spaces directly available to open-plan space users (nearby supporting areas including break areas and meeting rooms) and supporting spaces that do not need to be directly associated or on the same floor as the relevant open-plan space (e.g. cafeterias or training rooms);

— adjacent supporting spaces should be used as much as possible to structure the open-plan space. Separations may be used, if distance is lacking;

— movement areas should be delimited visually (marked) to separate the workspaces from movement flows through the open-plan space;

— doors should be used to isolate supporting areas from the open-plan space are designed not to cause disturbance (clearance or acoustic insulation).

These measures can be taken while in compliance with usual regulations governing workspace design, particularly in relation to personal safety and accessibility.

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Annex B
(normative)

Flow chart summarising the approach

Annex C
(informative)

Collective use of open-plan spaces: etiquette

Annex D
(informative)

Example of a user survey on open-plan office acoustics

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ANNEX F

Annex F
(informative)

Sound masking systems

The use of sound masking systems in open plan offices is controversial, and attitudes towards this technology differ widely. For some people there is an expectation for the technology to be incorporated in all new office buildings; others have found it counter-productive and have switched it off. The controversy is centred around the potential for masking sound to be effective (at masking intrusive sounds), without becoming annoying itself, due to the level of the sound (potentially leading to fatigue) or any qualities that attract attention[2].

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FIND MORE HERE:

ISO 22955 brochure

Acoustic design with screens

Acoustic design video conferencing

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UNRELEASED STUDY ON INSITU ACOUSTIC ATENUATION OF SPEECH – WRITE ME

inter.noise 2022

Insitu attenuation of speech in offices with mixed activities according to ISO 22955

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ABSTRACT

In the new international standard "ISO 22955: Acoustics – Acoustic quality of open offices" a number of different space types are described in terms of acoustic characteristics and target values. Space type 6 describes open offices for mixed activities which arguably encompasses the vast majority of open office spaces. As the standard prescribes general acoustic target values depending on activity for the remainder of the space types, space type 6 instead prescribes target values for the descriptor insitu acoustic attenuation of speech ($D_{2,S}$) between different types of workspaces in its table 6. As this approach is quite novel in terms of prescribing acoustic target values, further investigation is warranted to explore and support this approach. The present paper details measurements of $D_{2,S}$ values in three offices with varying degrees of acoustic treatment and either activity based layout or division of activity types in the same office space. None of the measured offices live up to the standardized target values. Acoustic design measures and findings related to the theoretical background for ISO 22955's table 6 along with opportunities for further research are discussed. It is concluded that certain principles should be followed when evaluating open offices through ISO 22955's table 6.

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