



#7 – Sound in Office Environments

Acoustic comfort plays a crucial role in the overall well-being and productivity of employees in office environments. When we look at the challenges within an office space, they can typically be divided into several different types:

- **Noise pollution** - which is sound from external sources, whether it is office equipment (printers, etc.), HVAC sound, or that originating from outside like traffic or building construction.
- **Echoes** (ie: extended Reverberation times) - due to the presence of hard surfaces throughout the space (concrete or tile, walls, and floors).
- **Poor speech intelligibility** - due to a lack of or ineffective sound absorption throughout the space.
- **Maintaining privacy** – due to sound leakage between workspaces, desks, and between rooms.
- **Elevated sound levels** – can make it difficult to concentrate, diminishing effective productivity.



Acoustic comfort is important in office spaces because it can have a significant impact on the overall well-being and productivity of employees. Poor acoustic conditions, caused by those elements referenced above, can lead to a number of negative effects, such as:

- **Distraction:** Excessive noise and poor speech intelligibility can make it difficult for employees to focus on their work, leading to increased distraction and reduced productivity. A Journal of Building Acoustics - found that office workers who were exposed to a comfortable acoustic environment reported improved concentration, communication, and overall well-being (Banbury et al., 2008).
- **Fatigue:** Uncomfortable levels of noise can cause mental and physical fatigue, leading to decreased energy and motivation. A Journal of Occupational Health Psychology - found that employees who worked in environments with poor acoustic comfort reported lower job satisfaction, higher levels of stress, and an increased likelihood of taking sick leave (Banbury and Berry, 2002).
- **Stress:** Constant exposure to high levels of noise can cause stress and increase the risk of burnout. A Journal of Environmental Psychology - found that employees who worked in environments with high levels of noise experienced increased stress and reduced job satisfaction (Banbury and Berry, 2005).

- **Health problems:** Prolonged exposure to poor acoustic conditions can lead to hearing loss, headaches, and other health problems. A World Health Organization (WHO) study - found that exposure to excessive noise can have a number of negative effects on health, including sleep disturbances, cardiovascular disease, and cognitive impairment (WHO, 2011).
- **Reduced communication:** Poor speech intelligibility and echoes can make it difficult for employees to communicate effectively, leading to misunderstandings and reduced collaboration. A Journal of Acoustical Society of America - found that employees who worked in environments with poor speech intelligibility experienced reduced productivity and increased error rates (Banbury and Berry, 1998).
- **Privacy:** Poor sound isolation can make it difficult to maintain privacy and confidentiality in the office.

To effectively design around these challenges, with the goal being to reduce these negative effects and promote a positive work environment, there are multiple strategies that can be employed. Though all are helpful, based on the specific site conditions, some strategies should be prioritized and/or combined with others for the greatest results. Here are the top considerations:

- **Sound absorption:** Incorporating materials such as acoustic panels, carpet, and fabric-covered and/or acoustic furniture can absorb sound and reduce echo and reverberation.
- **Sound isolation:** Using acoustic barriers like heavy walls and sound-isolating doors, and soundproofing techniques can help to reduce the transmission of sound between rooms and spaces (Note: this should ideally be done in the initial design stage of the space planning, as retrofitting tends to be more difficult and expensive).
- **Noise reduction:** Implementing measures such as sound-masking systems and using acoustically rated windows and doors can help to reduce noise pollution whether it originates from within space, or from the outside.
- **Room layout and design:** The layout of the office space and the design of the acoustical elements can also play a critical role in the sound quality of an office. For example, using angled walls, curved surfaces, or reflecting surfaces can help to scatter sound and reduce standing waves.
- **HVAC system:** Properly designing and operating the HVAC system can help to control the acoustical environment of the office. For example, by selecting equipment with low noise levels and isolating the equipment from the interior of the building, it's possible to reduce the level of unwanted noise.



For retrofit applications, where it is typically more cost-effective to employ sound absorption methods rather than focusing on the other strategies discussed above, the placement of acoustical panels becomes quite important (and critical for success in the effort). Typically, you want to consider all the surfaces you have access to. Here is a summary of considerations:

- **Wall placement:** To effectively reduce the Reverberation time (Rt60), acoustic panels should be placed on the walls that are the most parallel to each other, as this will help to scatter sound and reduce standing sound waves. Additionally, it's important to consider the main source of the sound, for example, if the speakers are at the front of the room, the panel should be placed behind the speakers.
- **Ceiling placement:** Acoustic panel placement on the ceiling when the room allows for it, is a great option, as it is often a large swath of unobstructed space. All things considered, the best placement for the panels would be on the ceiling directly above the area where the most sound is generated, such as the area where the speakers are located. This will help to reduce the amount of sound that is reflected back into the room, improving the sound quality of the space.
- **Corner placement:** In a rectangular conference room, it's also important to consider placing acoustic panels in the corners of the room, as sound tends to collect in corners and create standing waves.
- **Side walls:** The side walls, if the space design or room allows (ie: not all glass), is also important in reducing reverberation and improving speech intelligibility.

It's worth noting that the number, size and positioning of the acoustic panels will depend on the size of the room, the specific acoustical requirements of the space, and the design of the room. Though the American National Standards Institute (ANSI) S12.60-2010 Acoustical Performance Criteria, Design Requirements, and Guidelines for Conference Rooms recommends that at least 20-40% of the wall area be covered with sound-absorbing materials, it is always best to conduct acoustical analysis of the space with an acoustic engineer or similarly accredited professional.

In summary, providing a comfortable acoustic environment can help to reduce negative effects such as stress, fatigue, health problems, reduced communication and increased errors, and promote positive effects such as concentration, communication, and overall well-being. Acoustic comfort is vital for the well-being and productivity of employees and should be considered in the design of office spaces.

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