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WALLS IN OFFICE BUILDING ENDED AGAINST CEILING PLATE – MEASURED SOUND INSULATION

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ABSTRACT

In Norway there are many experiences with office buildings with measured R'_w around 32-37 dB between offices. Such values of sound insulation are measured for situations were the walls are ended against the ceiling, and not splitting the ceiling on both sides of the wall. In office building in Kristiansand with 40 mm Thermatex Silence ($D_{n,f,w}$ 44 dB) as ceiling plate and walls ended against the ceiling, measured sound insulation between offices was R'_w 41-45 dB. The reason for these good results is due to good sealing between wall and the ceiling plate of mineral wool. Experience from other situations with low sound insulation for such solutions, seems basically to be explained by sound leakage in the connection between wall and ceiling plate. It will be possible to achieve measured sound insulation between offices with walls ended against ceiling of mineral wool of at least R'_w 40 dB or better, with good enough sealing between wall and ceiling and a good enough ceiling plate.

Keywords: *office walls, sound insulation, ceiling plate, flexible office walls*

1. INTRODUCTION

In office buildings many offices are designed for flexibility purpose with office walls ended against a ceiling plate of mineral wool. In some buildings the height between ceiling and inner roof can make it necessary to have a good solution for sound insulation when office walls are ended against ceiling. This paper summarizes experience with such solution. The intention of this paper is to describe how a good enough design has to be, for achieving sufficient sound insulation when office walls are ended against ceiling plate. Theory about this solution for walls was presented back to year 1959 [1] .

2. EXPERIENCE WITH SOUND INSULATION

From measurements in several buildings, the sound insulation R'_w was often 32-37 dB with office wall ended against ceiling plate. Different experience with known solutions will be summarized below.

2.1 Wall ended against ceiling – no sealing in connection or poor sealing with leakage

In a modern office building (Mjåvannsveien 301 in Kristiansand), an office wall of 100 mm timber stud filled with 100 mm mineral wool and with 2 layers of gypsum on each side was ended against a ceiling of 50 mm Rockfon Blanka ($D_{n,f,w}$ 46 dB) plate of mineral wool. There was a column in wall against the corridor splitting the glass in the corridor by the office wall, and the gypsum on the wall against outside was also splitted. Pictures of the situation is shown in figure 1 and 2. This wall is seen as a "lower boundary" for achieved sound insulation with wall ended against ceiling of mineral wool, when the flanking solutions are good and do not contribute to limit the measured sound insulation. It is possible to look at this situation as lowest

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achievable value with poor sealing between wall and ceiling, but with good flanking solutions.

Figure 1. Office wall ended against ceiling plate.

Figure 2. Flanking wall in corridor splitted.

With no sealing or poor sealing between wall and ceiling and good flanking solutions, the sound insulation R'$_w$ was measured to 36 dB. The detailed measurement result is shown in figure 3. When measuring sound insulation a leakage of sound from the connection between wall and ceiling plate can be clearly heard.

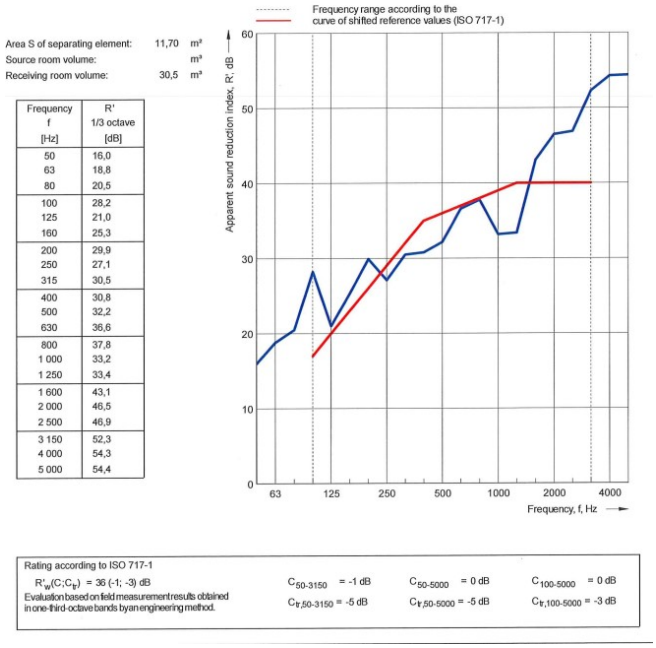

Figure 3. Measured R'$_w$ for wall ended against ceiling with no sealing between wall and ceiling plate and good flanking solutions.

2.2 Wall ended against ceiling – sealing and mineral wool between ceiling plate and inner roof

The same wall as given above (in the building Mjåvannsveien 301) was later measured with both sealing between wall and ceiling plate, and mineral wool in the gap between ceiling plate and inner roof. The result was then R'$_w$ 48 dB (shown in figure 4), which shows the potential of good sound insulation with sufficient solutions for the connection between wall and ceiling plate. This value of sound insulation is seen as an upper limit for the case with office wall ended against ceiling plate.

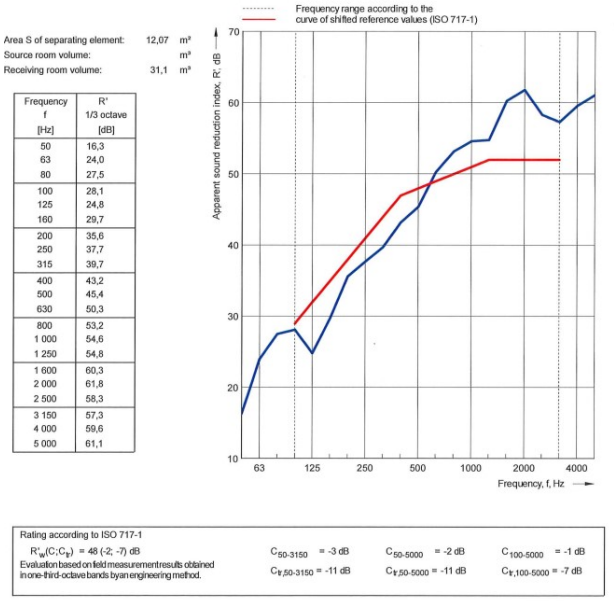

Figure 4. Measured R'$_w$ for wall ended against ceiling with sealing between wall and ceiling plate, and vertical mineral wool between ceiling plate and inner roof.

2.3 Wall ended against ceiling – sealing in connection

Measurements were done in office building to Drevelin Ortopedi Sør wih address Kongsgård allé 53 in Kristiansand in Norway. In this case the wall of 100 mm timber stud was filled with 100 mm mineral wool with 2 layers of gypsum on each side and was ended against a ceiling of 40 mm Thermatex Silence ($D_{n,f,w}$ 44 dB). The sealing used is normally applied for facades.

The result of these two measurements were R'$_w$ of 41-45 dB, and the detailed results are shown in figure 5 and 7.

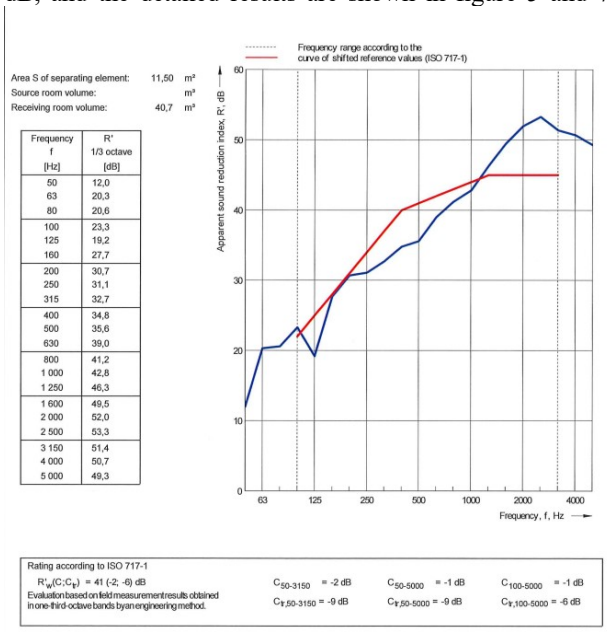

Figure 5. Measured R'$_w$ of 41 dB for wall ended against ceiling with sealing between wall and ceiling plate. Ceiling of 40 mm Thermatex Silence ($D_{n,f,w}$ 44 dB). The sealing used is normally for facades, and a piece of wood was mounted afterwards to hide the sealing.

The light fixture in the ceiling is not seen to be a weak point regarding sound insulation. Figure 6 shows the solution for lights in the ceiling.

Figure 6. Light fixture in the ceiling in office building to Drevelin Ortopedi Sør.

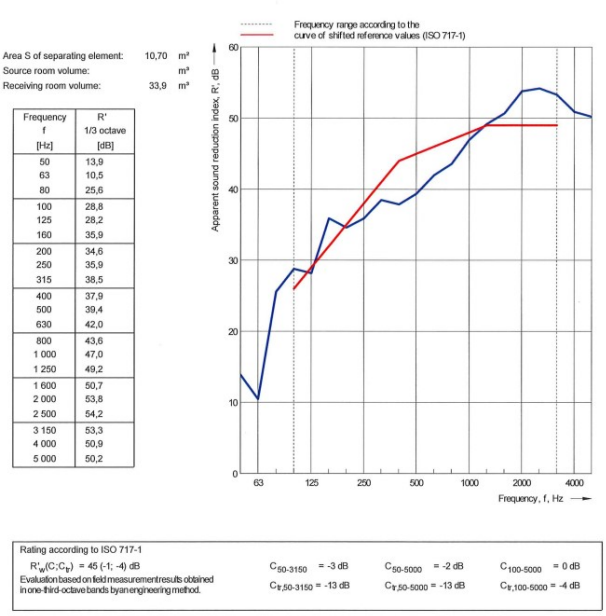

Figure 7. Measured R'_w of 45 dB for wall ended against ceiling with sealing between wall and ceiling plate. Ceiling of 40 mm Thermatex Silence ($D_{n,f,w}$ 44 dB). The sealing used is normally for facades, and a piece of wood was mounted afterwards to hide the sealing.

3. EXPECTED SOUND INSULATION

In guideline 524.331 "Lydisolering i kontorlokaler" [2] the following is said by SINTEF about sound insulation between offices when wall is ended against ceiling plate:

- R'_w 35-40 dB when office wall is ended against profile system and a ceiling plate with gypsum behind
- R'_w 36-42 dB when office wall is breaking the ceiling plates and the ceiling plate with gypsum behind

The achieved sound insulation will in all cases be dependent on all flanking transmissions. With good flanking transmissions and good sealing in the connection between wall and ceiling, it will be possible to achieve R'_w of 41-45 dB. This value seems to be higher than 35-40 dB which is predicted by SINTEF. The conclusions regarding wall ended against ceiling have to be linked with both the solution itself and corresponding flanking and sealing solutions for all connections. For the situations measured in figure 3, 4, 5 and 7 and referred above, the wall was fastened in the profile system of the ceiling.

4. SOUND INSULATION AND QUALITY OF OFFICE

In guideline 722.524 "Forbedring av lydisolasjonen i tunge etasjeskillere" [3] the following is said by SINTEF about sound insulation between offices:

- R'_w 38 dB, normal speech from neighbor office will be understood
- R'_w 43 dB, normal speech from neighbor office may barely be understood
- R'_w 48 dB, loud speech from neighbor office may barely be understood

Multiconsult has meant that R'_w 37 dB is enough to prevent normal speech to be understood between offices, and that R'_w 48 dB is necessary to prevent loud speech from being understood between offices. The company Drevelin Ortopedi Sør gives feedback that R'_w of 41-45 dB between their offices prevent normal and somewhat loud conversation from being understood in neighbor office.

If the quality of sound insulation should prevent speech in neighbor office from being understood, the solution with wall ended against ceiling has to be carefully designed. Many office buildings with this kind of solution have a

quality where normal speech in neighbor office freely can be heard and understood.

5. CONCLUSION

Measurements in office building belonging to the company Drevelin Ortopedi Sør with address Kongsgård allé 53 in Kristiansand show that R'_w of 41-45 dB may be achieved for office walls ended against ceiling plate, with the wall fastened in the profile system of the ceiling. In order to achieve such sound insulation, a ceiling plate of mineral wool with $D_{n.f.w}$ of 44 dB or better is needed. The connection between wall and ceiling has to be with a good sealing. There is also a need for good enough connection to flanking walls, with splitted flanking plates.

6. REFERENCES

[1] T. Mariner (1959), «Theory of sound transmission through suspended ceilings over partitions". Noise Control, 5, 13-18

[2] SINTEF, Tor Erik Vigran, "524.331 Lydisolering i kontorlokaler"

[3] SINTEF, Sigurd Hveem, "722.524 Forbedring av lydisolasjonen i tunge etasjeskillere"