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SOUND INSULATION OF WINDOW– AND FAÇADE PROFILES

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ABSTRACT

Within the scope of a R&D- project to determine the sound insulation of facades, ift Rosenheim developed a procedure for determination of the sound insulation of profiles for windows and facades. This procedure is to be integrated in the test standard for laboratory measurements, EN ISO 10140.
The procedure, in short profile sound insulation, serves as a means of comparison and assessment in order to be able to evaluate the effect of variations in profile geometry, material changes or even improvement measures in relation to complete building components, when it cannot be measured in situ or in a test facility for building elements. The data of the profile sound insulation can also be used as input data for calculation models according to ISO 12354-1 or ISO 12354-3, Annex B.
The procedure distinguishes two sound transmission paths, first perpendicular sound transmission against sound from outside and second parallel sound transmission to evaluate flanking sound transmission from room to room when a facade is a flanking element. With relative low effort, measurements on small elements can be done to compare profiles or to develop improvements.
The article introduces the Procedure and describes possibilities and boundary conditions which result from measurements of profile sound insulation.

Keywords: *profile sound insulation, test procedure, laboratory measurement, perpendicular sound transmission, parallel sound.*

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1. INTRODUCTION

The test standard EN ISO 10140 gives no special rules or procedures for testing profiles for windows or glazed facades as a small element; usually the sound insulation of windows and facades will be measured on a complete element.
Many years ago, ift Rosenheim developed a guideline to test the sound insulation of profiles to evaluate details of improvement or changes in geometry on sound insulation. The test results may be used as basis of expert statements. During the work on a Research project on sound insulation of facades the sound insulation of profiles was used to evaluate a calculation procedure for flanking sound insulation of facades[1]. Meanwhile this calculation procedure has been included in German standard for requirements of sound insulation DIN 4109.
During this work the questions came up to transform the procedure for testing profile sound insulation in the international test standard EN ISO 10140 to define a method as state of the art. Additional to the test procedure it is important to describe mounting and boundary conditions to realize comparable results for such special test arrangements.

2. TEST PROCEDURE

The quantity to be determined is the normalized sound level difference of small technical elements $D_{n,e}$. In addition, the sound reduction index R, related to the clear size of the profile, can be evaluated and indicated informatively. The definition of $D_{n,e}$ and R is given in ISO 10140-2
The exact description of the test setup and especially the transmission paths is important. In principle, a distinction must be made between sound transmission from outside to inside and sound transmission between rooms. The following terms are used to differentiate the sound transmission paths:

2.1 Perpendicular sound transmission:

Sound transmission perpendicular to the filling plane; in the case of facades and windows this is the sound transmission from outside to inside: see Fig. 1.

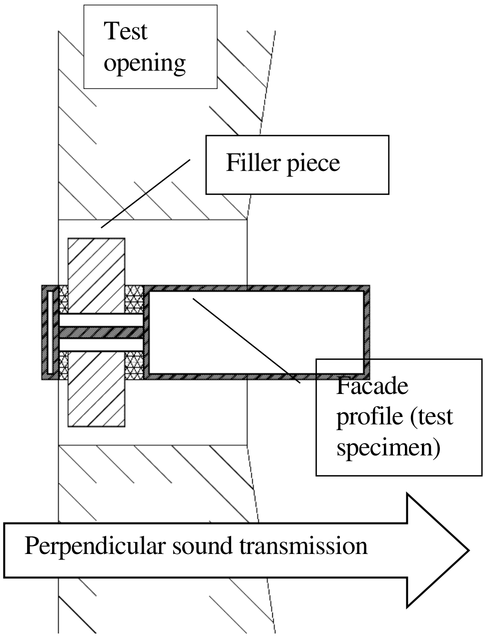

Figure 1. Principle illustration for installation of a facade mullion profile with perpendicular sound transmission

2.2 Parallel sound transmission:

Sound transmission parallel to the filling plane; for facades this is the sound transmission from room to room, whereby the frame profile is connected to the partition wall: see Fig. 2.

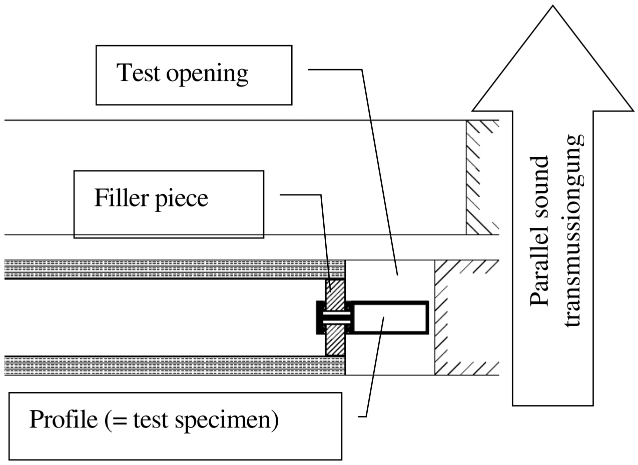

Figure 2. Principle illustration for installation of a facade mullion with parallel sound transmission

2.3 Boundary and mounting conditions

A differentiation between perpendicular and parallel sound transmission has to be done to choose the right way of mounting.
The opening intended for testing (e.g. the window test facility according to ISO 10140-5) is converted in such a way that a residual opening with the required dimensions of the test elements remains, sufficient maximum sound insulation is required. This can be done with a dual shell structure with flexible cover shells and with a mineral wool filling, sealed against joint sound transmission.

2.3.1 Installation for perpendicular sound transmission

Instead of the glass, filler pieces with high sound insulation must be installed in the glass rebate of the profile, installed according to the glazing system of the profile. The thickness of this filler piece has to be adjusted to the intended glass thickness of the profile.
The profile is placed in a test opening, which is tapered in the area of the opening, according to the principle shown in EN ISO 10140-1, Annex E. One possibility to taper the test opening is the test facility according to EN ISO 10140-1, Annex J, Figure J.3, for determining the joint sound insulation. Since the test opening varies, a statement on the test opening is informatively and depends on the profile geometry.

2.3.2 Installation for parallel sound transmission from room to room

Instead of the glass, filler pieces are installed in the glass rebate as well. The filler pieces should have the length of the profile and the thickness of the glass. They are installed according to the glazing system of the profile.
The profile prepared in this way is placed centrally in a prepared test opening, which is tapered in the area of the opening, in accordance with the principle described in EN ISO 10140-1, Annex E. Since the test opening is predetermined by the profile geometry, a statement on the test opening is also informatively and depends on the profile geometry.

3. EXAMPLES FOR TEST RESULTS

In this chapter examples for profile sound insulation shows the connection to flanking sound insulation of facade elements. The diagrams in figure 3 and 4 shows 2 examples for testing of profile sound insulation (normalized sound level difference $D_{n,e}$), tested with parallel sound transmission, and flanking sound level difference $D_{n,f}$ of a façade element in horizontal sound transmission, see also [1].

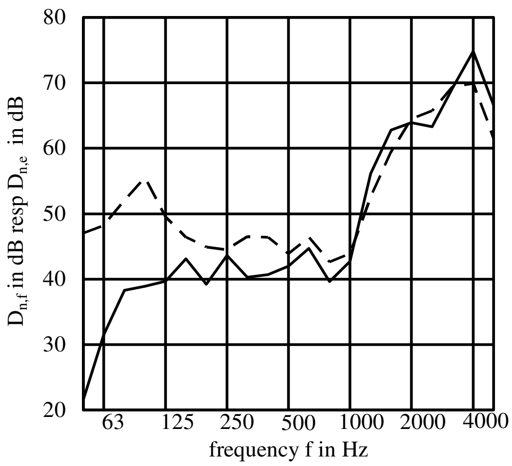

Figure 3. Profile sound insulation and flanking sound insulation of a façade element, same profile of a element façade system, depth of Profile150 mm.

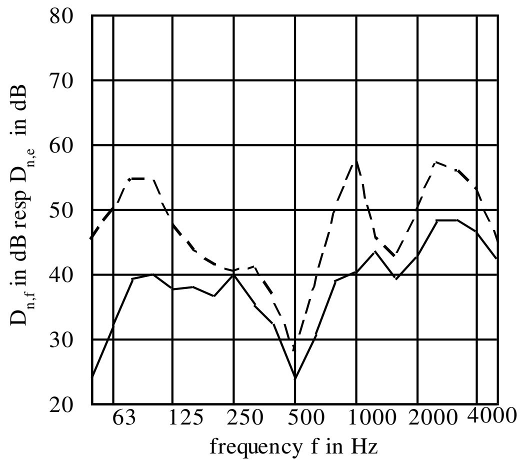

Figure 4. Profile sound insulation and flanking sound insulation of a façade element, dame mullion profile, depth of Profile150 mm.

Comparison shows common spectral characteristics, especially the resonance frequency of the profile sound insulation is also represented in the element testing of a complete façade element. Differences results by different length of the test specimen and must be adjusted by calculation.
A Calculation model is described for horizontal flanking sound transmission based on test of profile sound insulation, depending on the type of Glass filling used in the façade element. Meanwhile this procedure became part of German Standard for acoustic requirements DIN 4109 Part 35 [1], [2].

4. CONCLUSIONS

The procedure for testing profile sound insulation is a economic way to compare variants of profile dimensions and to validate improvements. Without testing complete façade element variants can be estimated.
Another application is a preliminary test of profiles to choose adequate samples which represents a product family, e.g. for mock-up testing.

5. REFERENCES

[1] Saß, B, R&D-report "Erarbeitung eines Bauteilkatalogs zur Ermittlung der

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