Studies on the Strength of Thin Glass

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1. Introduction

In architecture the term “thin glass” is normally used for glass with a thickness less than 3 mm. Loading very thin glasses, especially when it is pre-stressed, causes large deformations which lead to additional horizontal reaction forces and a nonlinear approach has to be used. The main gain for using thin glass in architecture is a reduced weight, which leads to the possibility to produce laminated safety glass (LSG) with lower dead weight.

EN 1288-3 [2] describes the four point bending test for determining the bending strength of flat glass. This test is based on the linear beam theory and is not suitable for very thin glass. Loading very thin glass leads to very large deformations and by this an additional horizontal reaction force. A nonlinear approach becomes necessary.

In the context of current research two modified testing methods for determining the bending strength of thin glass were developed. The goal was to illustrate an approach about experimental, numerical and analytical investigations. A final comparison will show the pros and cons for both developed methods.

2. Analytical, Experimental and Numerical Investigations

2.1 Four-Point-Bending-Test

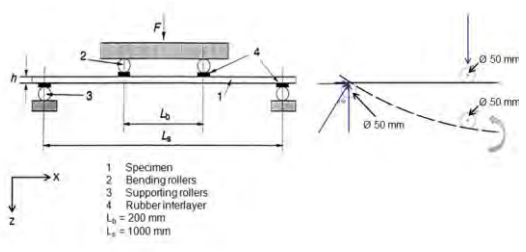

Fig. 1: Basic test arrangement for Four-Point-Bending test (left) [2], [3] and static module (right) [10]

The basic set up of the experimental arrangement is shown in Figure 1. The dimension of the specimen should have L = 1100 mm ± 5 mm and B = 360 mm ± 5 mm. The thickness of the specimen is not limited. However it is assumed that the deflections are small and a constant bending moment occurs between the two bending rollers which results in a constant bending stress [2], [3], [4], [5]. Loading the specimen of less thickness can lead to significant deflections because in case of large deflections the Kirchhoff plate theory cannot be applied anymore.

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