Rehabilitation of the Library of the University of Würzburg

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Summary

The University of Würzburg is situated in the beautiful and hilly German town of Würzburg. In the library there is a skylight with a very special architecture, the so called "Grabenoberlicht".

Due to broken glass panes there were more and more problems in the past years to make the roof watertight. Furthermore thermal bridges occurred. To meet the actual requirements another issue was to reduce the CO2-emission.

Therefore a new roof is necessary without thermal bridges to mach the actual requirements for safety, energy reduction and to improve the comfort for the users with maximum natural lightning.

In this paper the problems of static analysis, design, reinforcement of the construction and pictures of the renovated building are presented.

Keywords: glass constructions, rehabilitation (refurbishment), safety aspects, overhead glazing, Finite-Element-Analysis, residual resistance.

Introduction

At the library of the University of Würzburg a 30 year old glass roof had to be replaced (see Fig. 1 and 2). The original glass roof with the dimensions 7,2m x 26,4m was built in the year 1974.

Many glass panes of the roof were damaged in the last years because peaces of shivers from the neighbouring façade fell on the roof. A consequence was also that infiltrated water damaged the wired glass.

The overhead glazing has an inclination of 30° to the horizontal and consists of 104 double glazed units, 12 of them can be open as natural smoke and heat exhaust ventilators.

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Fig. 1 Glass roof "Grabenoberlicht"

Fig. 2 View from inside

Static calculation and design

The glass roof is designed for dead-, wind and snow loads.

Since July 2006 there is a new design standard in Germany for snow loads. There the snow, which is blown from an upper roof, must be considered. In this case the standard snow load is 0,52kN/m² and 1,3kN/m² for the load case “snow blown from the upper roof”.

As an additional requirement the glass roof shall be accessible for cleaning and maintenance work. The design load for this requirement is a single load of 1,5kN on a load area of 100 mm x 100 mm. Further verification had to be performed by experimental studies.

Glazing

The size of the new double glazed units is 0,84m x 3,90m, the glass is linear supported along its edges.

The design of the glazing is according to the TRLV [5].

Steel construction

The original steel construction has not been changed. In the static design a check of the steel construction for the new loads was performed.

For the load case “snow blown from the upper roof” (s = 1,3kN/m²) the deflection of the rafter was greater than L / 200. To avoid the exchange of the steel rafter, new glass profiles with a negative deflection of 10mm were welded on the existing rafter.

Conclusion

Many glass constructions from the last decades like facades or roofs must be replaced because the security of the glazing does not correspond with the actual requirements of safety. Also the thermal insulation is not sufficient in most cases.

References

See full paper