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Timber-Glass Composite in Structural Glazing

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Summary

In the normal application of glass in buildings, glass panels are mounted in frames and designed to carry their self-weight, wind and snow load, which are then transmitted to the supporting structure. The timber-glass concept is a mixed structure of glass and wood, with both components acting as the supporting structure. This paper aims to present the problems related to such structures, and the solutions proposed by our research.

Introduction

More and more architects and engineers are looking for an ecological way of construction. Glass is an ecological material in the sense that we can economise energy for heating and for light, if used in construction. In the same way wood is an ecological material because it is the only renewable raw material that stores carbondioxide which is necessary for wood growth. Less energy is needed to fabricate a timber beam compared to metal, aluminium or concrete. Therefore, timber and glass are often used in combination for construction like for greenhouses or facades.
In the traditional (not composite) timber and glass construction, the beam-sections are often so important, that it causes problems with aesthetic and natural lighting. So a timber-glass composite element has been developed, where the wooden frame is directly glued to the glass-plate (fig.I).

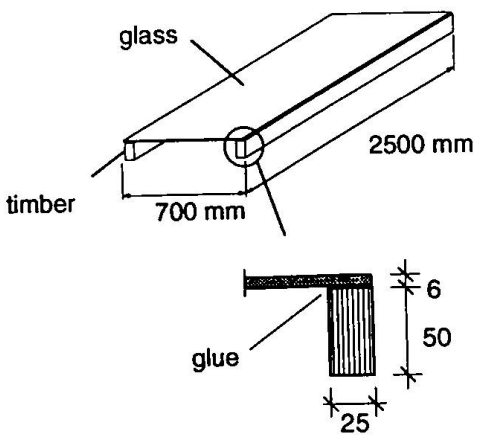

fig.I: composite element timber-glass

A comparison between the traditional and the composite structure shows that the wooden sections are much smaller with timber-glass composite structures (fig.II, next page).

This kind of composite structure has the following advantages:

- prefabricated sections
- minimal cold bridges
- optimised energetic profit
- light structure
- ecological
- economical

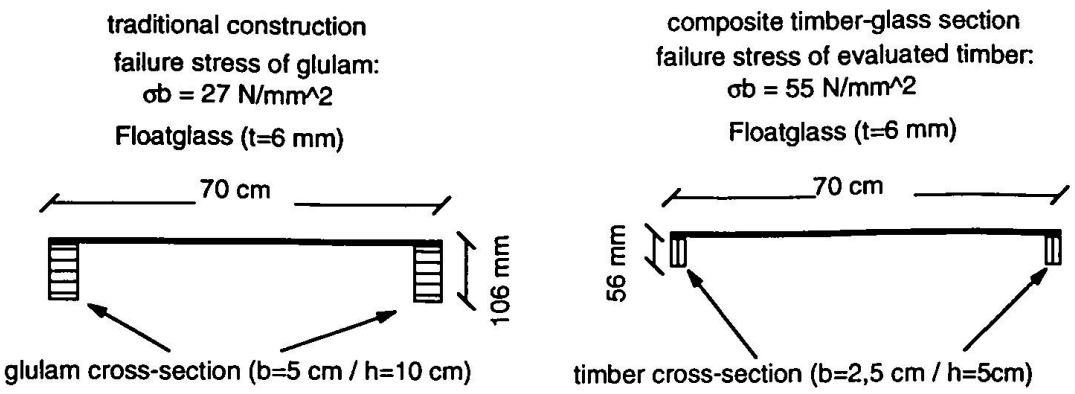

fig.II: comparison between the traditional and the composite structure

Tests

To find the right glue for the timber-glass composite structure, several small specimens have been tested under shear compression loading. Because the composite elements are under climatic variations the test specimens were submitted to several cycles. One cycle consisted of 4 hours at -30°C, 4 hours at +70°C, 16 hours at +30°C and 80% humidity. This cycle was repeated up to seven times and specimens were tested after 0-cycle, 2-cycles, 5-cycles and 7-cycles to evaluate the possible degradation. Of the four glues which were tested, only one resisted to the stress-test.
After the right glue was found, 4-point loading tests on timber-glass composite plates were executed. The results of these tests showed that the efficiency of the glueing was nearly 100%. The rupture of these elements was due to the excess of the tensile-bending stress in the wood (in average: 66,24 N/mm^2).

Conclusion

The goal of this research is to develop composite timber-glass elements for structural glazing. A glue has been found and tested by shear compression loading after several climatic cycles. It was proven, that composite elements which are loaded perpendicular to its plane has a high rigidity and resistance. The research-team of timber-glass composite for structural glazing is now testing composite elements as shear-walls to stabilise greenhouses and facades. Also composite timber-glass beams will be tested.

References

Savoy, Eric; Traité technique du verre;
Imprimerie André Demierre SA (1989)

Couvrat, Patrice; Le collage structural moderne- théorie & pratique;
TEC & DOC - LA VOISIER (1992)

Kollmann, F.F.P; Principles of Wood Science and Technology;
Volume I, Springer-Verlag, Berlin (1984)