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## **Contribution of the glass cladding to the overall structural behaviour of 19th century iron and glass roofs**

In the 19th century architecture, the use of iron and glass roofs made it possible to bring daylight to the core of the buildings. Together with the social context of the industrial revolution and the improvements in heating techniques, the creation of a "Garden of Eden" became popular. Building typologies like railway stations, market halls, fabrication halls, exhibition halls and greenhouses exploited this possibility at full extend.

When renovating 19th century glass roofs, discussions are rising whether to replace the single glass and whether to strengthen the iron frame. The requirements formulated by the present-day building codes are much sterner compared to those of the 19th century.

*This research will develop a methodology to assess the 19<sup>th</sup> century iron and glass roofs by using combined calculation models which take in account the mechanical properties of glass and iron.*

To make the glass cladding and the iron frame structurally work together, an insight in the connections and building techniques of these two materials is desirable. By means of an extensive literature study of 19th century course books and manuals, the evolution in these construction details during the 19th century is investigated.

When establishing the connection between the iron and the glass during a renovation, a choice must be made between traditional putty and modern structural adhesives. Lab experiments are carried out to determine the mechanical properties of putty and a structural adhesive.

The structural assessment of the glass roofs is carried out in finite element model software. The thickness of the glass plates (single vs. laminated vs. double vs. double laminated glass), the load conditions (in- and out-of-plane loads), the geometry of the iron glazing bar and the stiffness of the iron-glass connection (putty or adhesive connection) are selected for a parameter study.

The results of the research are formulated in guidelines to give architects and engineers an insight in the strengthening rates that can be reached when the structural behaviour of the glass components is taken in account. Depending on the monumental value of the glass roof, decisions have to be taken about which glass and adhesive varieties can be used and how the connections are designed.

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