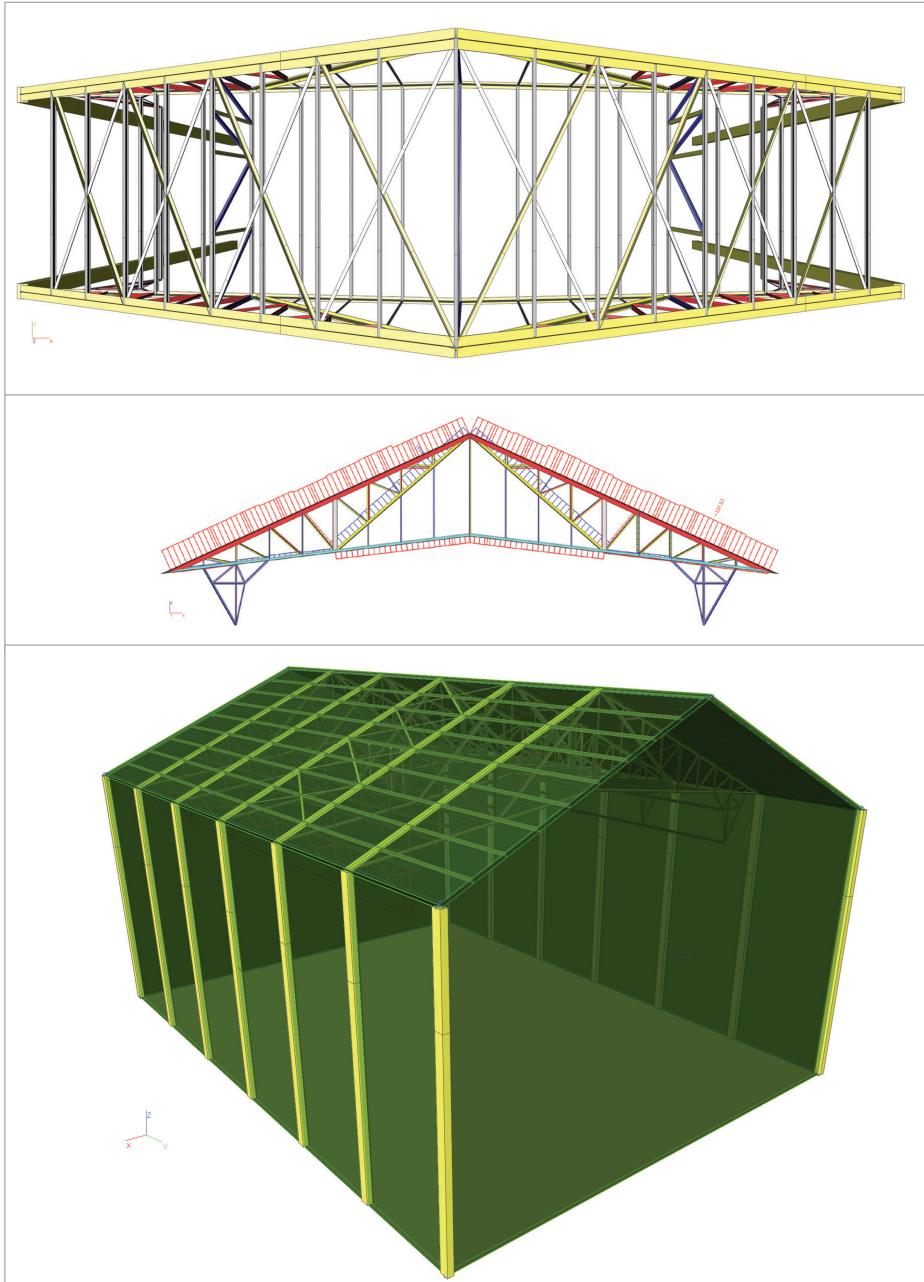


Restoration Study Roof Trusses Cinema Roma - Antwerpen, Belgium



General information

Cinema theatre 'Roma' is a social monument from 1928, constructed in a typical Art Deco style by Alfons Pauwels. Its hall has a capacity of over 2,000 seats and is suitable for multifunctional use. During the venue's first decades (1930-1955), its captivating architecture achieved great popularity and put Antwerp on the European map as 'the place to be' for film lovers. After the theatre's closure in 1982, the building became subject to decay and vandalism with the result that it became a real eyesore in the neighbourhood. In 2002, after 20 years of inactivity, local association Rataplan decided to restore the building to its former glory. Following the help and efforts of hundreds of volunteers and material support from local companies, cinema theatre Roma reopened in 2003.

However, in order to meet the current standards and comfort requirements of a modern cinema theatre, it has become necessary to make a few adjustments. The roof covering has to be renewed with the integration of heavier safety glass, while the stucco ceiling needs an insulation layer, and a theatre bridge (for fixing spotlights) has to be positioned beneath the truss structure. Moreover, there is an interesting challenge where the use of renewable energy sources, in particular the installation of solar panels, is concerned. The adjustments will require additional loads on the historic roof structure.

Based upon the outcome of the recalculation, it will be clear if the original truss structure is suitable to bear the increased load. If this is not the case, an appropriate renovation proposal will be necessary.

Structural concept

The building is designed as a reinforced concrete skeleton structure with bracing brick masonry. The span of the hall (25 m) is realised with a series of steel trusses, which are embedded with their endpoints in the concrete columns. With a length of about 27.5 m, this steel structure consists of 5 Polonceau trusses with a distance between each truss of approximately 5.5 m. Each single truss is composed of combined profiles (rectangular, L or I-section) which are interconnected

with bolts or rivets. One single rivet connection can be considered as an internal hinge, but whenever multiple rivets are applied in one node, they are modelled as a rigid connection. In the longitudinal direction, I-beams are embedded into a brick wall. It is hard to tell whether the support is a hinge or a fixed connection. We chose a hinge as boundary condition because this is a safe assumption.

Loading scheme

Eurocode 1 determines the permanent loads:

- Self weight of the steel structure
- Self weight of roof finishes
- Self weight of windows
- Self weight of the white stucco ceiling
- Self weight of theatre bridges

Eurocode 1 was used to determine the variable loads:

- Snow
- Wind
- Service loads

The complete analysis was carried out according to current European standards: Eurocodes EN1990, EN1991 and EN1993.

Results

Using the most unfavourable load combination, the compression forces in the upper and lower rafters become too large, with buckling as a result. As a consequence, the steel structure will fail. However, the roof trusses remain intact. Presumably, this is due to the strict safety factors of Eurocode 1 or the fact that the most unfavourable load combination has never occurred.

After a recalculation of the additional loads, it is obvious that the structure has to be reinforced. According to our restoration philosophy, it is essential to preserve the maximum amount of authentic material and to maintain the original geometry. By adding mass to the intermediate sections, the outer rafters will no longer be subject to buckling.

Master Thesis student: Yves Govaerts

Contact Johan Blom
Address Pleinlaan 2
1050 Brussel, Belgium
Phone +32 2 629 29 55
Email johan.blom@vub.ac.be
Website www.vub.ac.be

Vrije Universiteit Brussel is a dynamic and modern university with two parkland campuses in the Brussels Capital Region. We offer a quality education to more than 11,000 students.

Thanks to the expertise of more than 150 research teams and its strategic location, VUB is your ideal partner for prestigious research and education with an outlook on Europe and the world.

In the Architectural Engineering (ARCH) department, the research is focused on "the use of engineering tools to create architecture". This approach is applied in three topics that ask for interdisciplinary studies: the design of lightweight structures, the issue of re-use, and the incorporation of 4D design.

Within the Re-Use group, the main objective is to reconcile the authenticity of the architectural heritage with the modern standards that require more comfort and safety.

Project information

Owner	Maurice De Busser
Architect	Alfons Pauwels
Location	Borgerhout, Antwerpen, Belgium
Construction Period	11/1927 to 11/1928

Short description | Restoration Study Roof Trusses Cinema Roma

This project concerns a structural restoration study of the roof trusses of cinema theatre 'Roma' (1928) in Antwerp, Belgium. This extract is derived from a student report which was prepared for the course 'Stability of structures 3: finite elements'. A 3-dimensional computational structural analysis is carried out which allows for the verification of the current structural state.

Moreover, in order to meet the current standards and comfort requirements of a modern cinema theatre, it is necessary to place additional loads on the historic structure.

The study includes the determination of the symmetrical and asymmetrical load cases and the evaluation of efficiency under all load combinations. The complete analysis is carried out according to current European standards: Eurocodes EN1990, EN1991 and EN1993.

