Zeitschrift: IABSE reports = Rapports AIPC = IVBH Berichte
Band: 77 (1998)

Artikel: Roof structure renewal of the St. Peter and Paul church in Osijek
Autor: Takac, Stjepan / Zagar, Zvonimir
DOI: https://doi.org/10.5169/seals-58258

Roof Structure Renewal of the St. Peter and Paul Church in Osijek

Stjepan TAKAC
Civil Engineer,
University of Osijek
Osijek, Croatia

Stjepan Takac, born 1941, received his civil engineering degree from Univ. of. Sarajevo, BiH in 1967 and Phd in 1992 from Univ. of. Zagreb, Croatia.

Zvonimir ZAGAR
Prof. Dr
University of Zagreb
Zagreb, Croatia

Zvonimir Zagar,
Born, 1931, Ph.D. in 1984
from CEF, Zagreb University

Summary:

Described is the timber roof structure of the St. Peter and Paul parish church in Osijek as well as the damage this building suffered from missile attacks during war operations in 1991/92. The consequences of rain penetration into vital parts of the wooden roof structure are presented. It is emphasized that such penetration and leakage was caused to the impossibilities of proper maintenance of the church in the war period and after the damage done. Results of the technical evaluation of the damage to the main load bearing structural element, as well most significant repair solutions are presented.

Keywords: timber roof structure, church, Osijek, reconstruction

1. INTRODUCTION

The parish church of Peter and Paul was built in 1898. German constructor Franz Langenberg conceived it as a three-nave basilica with a transept of a ground-plan formed like a Latin cross in neogotic style. Its dominated accent is the 90 m high tower dominate the Osijeks panoramic view. The church is a registered monument of culture, situated in the urban center of Osijek, which is entirely also registered as historical monument too. During the war in 1991/92 the church was severely damaged in missile attacks on Osijek. The parish church was hit by more then hundred mortar and rocket shells. Damages are scattered all over the building: from stained-glass windows (vitrages), stone figures and reliefs, to the roofing tiles and the roof timber structure. Estimated total damage to the object, caused by direct and indirect hits, amounts to about 4,500,000.00 DEM. To protect the object from atmospheric agents as well as to prevent further damages of the interior the roof structure has to be repaired. Therefore a through repair and restoration was planned. Professional expertise has been done to get acquired with the real conditions

of the object. On the bases of professional expertise blueprints and design of the repairs are planed and successfully performed.
Beside the roof cover tiles damaged by the shells explosions the damage was done to the wooden structure. The deformations of the vital structural elements have been observed too. Some of the damages are caused by deterioration of wood, and long lasting loads.

2. The main nave, small towers and the north and south transepts

The bearing roof structure is a timber frame made of the first class fir. The static conception is based on a set of compound three level main triangular attic-formed timber frames with steel tie rods above the first level of tie beams. The distances of the main structural frames are unusually spacious and different from field to field: the largest about 10.43 m on the touching point of the nave and the transept. Long lasting dead load has caused excessive deformation of the not adequately designed structural elements.
The principal structure is in the statically sense a compound manifold triangular frame - truss of very clear outline. The bond beams of the roof frames (trusses) are bent and settled on the brick arches of the main nave therefore causing additional loading of the brick arches. The most damaged are the bond beams of the frame - trusses alongside gable walls. The bearings of the structure show a previous intervention done with cleats which have been slacken owing to vibration caused by shell explosions.
The wooden roof rafters are continued girders across three spans accomplished from one piece of timber. They are connected at the ridge by bolts. Some of the rafter are destroyed by the bombings, and most of rafters in the vicinity of gable walls are destroyed by rot.
The purlines are accomplished as Gerber beams across few fields, with spans ranging from 7.10 to 10.43 meters. In the vertical direction they are supported by hands that considerably lessen the static spans. The vertical deflections are in the range of 3.5 cm to 4.3 cm. The horizontal deflections developed due to insufficient stiffness of the purlines and due to the effect of the long lasting loads are in the range of 3.0 to 5.5 cm. The biggest total deflection measured is 6.98 cm which is L/111 considerably larger than permissible. Due to the value of the total deflection several supporting hands slipped out from joints. Owing to the eccentric connection of the rafters to purlines rotation of sections and longitudinal cracks occurred due to torsion.

2. Repair work done

All of the repairs were done successfully without any accidents, according to detail design and all of the damaged parts were replaced by parts of original dimensions.
The sanation of the roof structure was coordinated with the exchange of roof slates slabs. In this way the repairing of the timber structures and elements could be accomplished with the gross reduction of the load for more than 45%, which contributes, among other things, to the security in the phase of repair work execution. To protect the church's interior from atmospheric agents during the works it was necessary to erect a movable lightweight prefab protective cover construction.
The repair work of the bearing structure assembly commenced with the sanation of the main structure and continued with the exchange of bearing plates, rafters and other secondary elements.