

Zeitschrift: IABSE reports = Rapports AIPC = IVBH Berichte
Band: 70 (1993)

Artikel: Testing the steeple of the Peter and Paul Cathedral in Saint Petersburg
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DOI: <https://doi.org/10.5169/seals-53306>

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Testing the Steeple of the Peter and Paul Cathedral in Saint Petersburg

Contrôle du clocher de la cathédrale de St. Pierre et Paul à Saint Petersbourg

Kontrolle des Glockenturms der St-Peter und Paul-Kathedrale in St. Petersburg

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The steel steeple with a cross of 60 m in height (from el. + 60.0 to el. 120.0) was erected in 1857 in place of a wooden one destroyed by fire. When examining the cathedral structures in 1991, cracks were found in the masonry at an el of 40.0 m in a place where the steeple anchoring beams had been built in.

The dynamic loading tests of the steeple structures were performed for experimental determination of the following:

- natural frequency of the first mode of oscillation and its comparison with the design mode;
 - decrement of oscillation for calculation of dynamic forces;
 - values of the revealed crack;
 - an oscillograph and a cinecamera started working simultaneously with the radio command.
- The tests were performed eight times.

The valute $\delta = 0.0875$ with an amplitudine of strain $\pm 9,6$ MPa is explained by the fact that the copper sheets of the steeple displace in oscillation which be clearly seen and dissipation of the oscillation energy accelerated due to dry friction.

In the cracked area at an elevation of 40.0 m, vertical displacement was recorded of the steel supporting beam relative to the brick masonry with an amplitude of ± 0.01 mm at a maximum amplitude of the steeple 70 mm at an el. of + 115.0.

The diagram of the tests is shown in Fig. 1. The results are presented in Table 1.

The tests showed coincidence of the design and the field strain characteristics of the steeple structures. The verification calculations, the results of examination and the field tests made it possible to give a complex assessment of the condition of one of the main historical structures of Saint Petersburg.

