



research bridges railways tunnelling monitoring technology management international

Mariinsky Theatre

The forces of the hanger rods of the stairs 5 & 7 at Mariinsky-2, St Petersburg had to be measured by the vibration (harmonics) method. A check of the top rods of the oval and the scissor stairs was required to provide the actual forces in the ties under full dead load.

The evaluation of the hanger forces was done directly through the measurements of the fundamental vibration frequencies, as well as of the interval between the frequencies of consecutive modes.

For the calculation of the exact hanger force the determination of the basic and higher vibration frequencies is necessary. A linear relation between the basic and higher order of natural frequencies is only valid for a wire without sag and bending stiffness. This theoretical case is called "string wire". In such a string wire there is a harmonic succession of every mode shape starting from the first up to the very high natural frequencies.

A real hanger brings up a deviation from this ideal case in the higher modes, since the bending stiffness causes an increase of natural frequencies in the higher modes. For an accurate cable force measurement, this effect must be considered.

From the measurement data the actual hanger force can be calculated by the BRIMOS® Software. The only input needed for this analysis is the hanger geometry and the hanger properties. The determination of the natural frequencies, the bending stiffness and the hanger forces is done fully automatically by the BRIMOS® Software.

- Client: Mageba SA
- Location: St. Petersburg, Russia
- Checking Period: 2013



BRIMOS® Services conducted:

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| Lifecycle Management: | <input checked="" type="checkbox"/> <u>Condition Assessment</u> | <input type="checkbox"/> Condition Monitoring | <input type="checkbox"/> Rehabilitation Planning | <input checked="" type="checkbox"/> <u>Quality Control</u> |
| | <input type="checkbox"/> Lifetime Assessment | <input type="checkbox"/> Traffic Analysis | <input type="checkbox"/> Environmental Influences | <input type="checkbox"/> Risk Assessment |
| Special Measurements: | <input type="checkbox"/> Attendant Monitoring | <input type="checkbox"/> Noise and Vibrancy | <input type="checkbox"/> Deflection Measurements | <input type="checkbox"/> Seismics |