

Modal and structural identification of a multi-span masonry arch bridge

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ABSTRACT

The Olla bridge is a multi-span masonry arch bridge dating back to the second half of the 19th century. The structure, 117 m long, includes five arches of different span and crosses the Stura river close to the small town of Gaiola, about 16 km far from Cuneo (Piedmont, Northern Italy). The central span of the bridge was destroyed during the 2nd World War and rebuilt in 1945. Recently, damages (i.e., the opening of some cracks) have been reported on two arches and the structural assessment of the bridge is ongoing.

The structural assessment procedure is similar to the one adopted for historical constructions and involves several tasks, according to a multidisciplinary approach [1].

In the case of Olla bridge, the documentary research in the archives did not lead to any results, making the identification of the construction details particularly difficult. In order to retrieve the missing information on the bridge geometry, a geomatic survey was carried out, whereas the unknown structural details have been assumed according to the well-known manual of Curioni [2], published in 1873 and illustrating examples of masonry bridge design and the related details. The reference to the manual [2] is motivated by both the time of its publication and the geographical proximity, suggesting a remarkable affinity with the Olla bridge. In addition, limited material samples were taken, mainly in order to help solving typical uncertainties, such as the effective thickness of the arches, the morphology of internal spandrels, and the backfill type and material. Subsequently, ambient vibration tests were performed and different output-only techniques were applied to the acquired time series with the two-fold objective of identifying the dynamic characteristics of the bridge and verifying the time invariance of the identified modal parameters. Finally, all the available information were summarized in a Finite Element model, that – after an appropriate vibration-based tuning of the uncertain structural parameters – turned out to be capable of accurately reproducing the identified dynamic characteristics of the structure.

REFERENCES

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- [2] G. Curioni, *The art of building: roads, civil and hydraulic constructions* (in Italian), Augusto Federico Negro Editore, 1873.