Masonry arch bridges are the oldest structures made for crossing that have more economic repercussion at present. More than of 30% of the Spanish road bridges and a 40% of rail network bridges are made of masonry. With this data, the functional value of these structures is shown clearly, but moreover the majority of them are part of our historical, artistic and engineering heritage. In spite of this, with passing of the time, the quantity and the traffic weight that these bridges must resist has increased tremendously since the moment of their construction. In spite of that, the great quantity of these bridges are functional today and this is a proof of the long-life materials which are used, their right structural skeleton and the correct builder's design.

So, after some centuries in service, the majority of these bridges show some deterioration and new necessities of load, due to the present service demands. For this reason, the old rules of good practise can not be generally applied and are incomplete now and out of their valid field. It has been necessary, therefore, to arrange improved analysis, analytics and experimental methods, which let us know and predict the behaviour of this structural typology with enough accuracy and exactness.

Is for this that the investigation about the structural behaviour of masonry arch bridges is very active at present. In the Technological Laboratory of Structures of the UPC, an experimental programme about different masonry arch bridges on real scale is being carried out and this work talks about its formulation, realization and interpretation. To be exact, it shows the study of the experiment until the breaking of a masonry depressed arch bridge with 3.2 m span. This bridge was already tested previously, but the embedded springs failed and did not collapse according to the expected fail mode. For this reason the results could not be compared with other analytic nor experimental methods. This time the bridge has been reinforced and the embedding has been fixed by means of a rotation coercion system with UPN girders.

Before the experiment, the structural working of masonry bridges is analized, describing the different structural elements and studying their work inside the resistant mechanism of the bridge. Likewise, the experimental antecedents about masonry arch bridges are identified, paying more attention to the tests that, like the studied, have been carried out on a real scale model built in a laboratory. All this must let us establish the fail mode of the typology studied and predict and control the fail form expected for the type of bridge tested, according with the particular load conditions.

Later, the design, reinforcement and preparation of the bridge is going to be described, as well as its instruments used for scoring and test until breaking. The results obtained are interpreted and checked with analytical and experimental predictions about the bridge's answer, the fail mode and the critical load. Finally, the conclusions of the experiment are set out and, basing on the won experience and the mistakes made, some recommendations for future experimental workings with this structural typology are done.
Title: TEST UNTIL BREAKING OF A MASONRY ARCH BRIDGE BUILT IN A LABORATORY

Author: Germán de Marco Ibáñez

Tutor: Pere Roca Fabregat

Abstract:

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