

Structural behavior of the old masonry bridge in the Gulf of Castellammare



O. Bergamo^a, G. Campione^{b,*}, C. Cucchiara^b, G. Russo^a

^a Dept. of Civil Engineering and Architecture, Univ. of Udine, Via delle Scienze 206, 33100 Udine, Italy

^b Dept. of Civil, Environmental, Aerospaziale and Materials Engineering, Univ. of Palermo, Viale delle Scienze, 90128 Palermo, Italy

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ABSTRACT

Masonry arch bridges represent a very significant part of the heritage of road and railway artworks all over the world and especially in the Mediterranean area, both in terms of: numbers; reduced environmental impact; and static efficiency. In these cases, the cost of maintenance is often limited to the content and channeling of surface water and control of vegetation, which can eventually take root on the joints of the masonry at the shoulders. In masonry bridges, there are no expansion joints or hinges with support equipment or trolleys, as in metal bridges and reinforced concrete ones, or paint, or resin surface protection, all items that affect the cost of maintenance. The permanent weight of these bridges is very high and, together with the mechanical characteristics of the structure, results in very high strength and stiffness against moving loads. This is one of the most valuable aspects of masonry arch bridges, making it possible to keep open to traffic safely, without repair actions, bridges that are centuries old and which are now subject to vehicular traffic and trains producing actions that are considerably higher than those for which they were originally designed.

The purpose of this work was a static check on the old Gate Bridge, a road bridge in masonry which links Corso Garibaldi and Via Giacomo Puccini in the town of Castellammare del Golfo (Trapani province). An extensive experimental research was carried out for in situ mechanical characterization of the constituent materials and static tests were also carried out to study the structural response (load–deflection curves) of the arch bridge. Finally, analytical and numerical analyses were carried out for safety verification of the arch stone and for verification of the serviceability condition.

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1. Introduction

Arch bridges, as shown in Fig. 1, are characterized by a supporting structure consisting in a main arch or a set of arches on which the deck rests, which are mainly stressed by compression actions. The absence of traction actions makes it possible to build arches with materials that are not resistant to traction, which is the case of masonry structures with ashlar (brick masonry or coarsely squared-off stone). In general the shape of the arch does not fit that of the road platform, and therefore requires a superstructure for the underpinning (abutment, hood and filling). Masonry arch bridges from the Roman period until the nineteenth century were made with semicircular arches and had support pylons with a width of between 1/3 and 1/5 of the light.

Masonry arch bridges are a very significant part of the heritage of road and railway artworks all over the world and especially in the Mediterranean area [1–3], both in terms of: numbers; quality of their inclusion and environmental; and static efficiency. In these cases, the cost of maintenance is often limited to the content and channeling of surface water and control of vegetation, which can eventually take root on the joints of the masonry at the shoulders or hat rostrum of the batteries. In masonry bridges,

* Corresponding author.

E-mail address: giuseppe.campione@unipa.it (G. Campione).

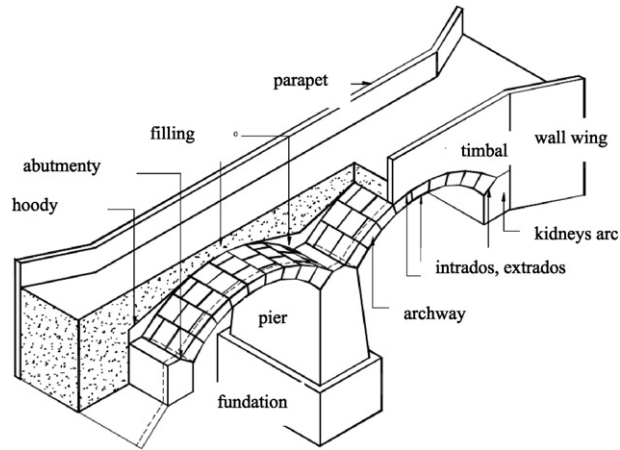


Fig. 1. Constructive element of arch bridge.

there are no expansion joints or hinges with support equipment or trolleys, as in metal bridges and reinforced concrete, or paint, or resin surface protection, all items that affect the cost of maintenance. The permanent weight of these bridges is very high and, together with their mechanical characteristics of the structure, results in a very high strength and stiffness of the work against the moving loads. This is one of the most valuable aspects of masonry arch bridges, allowing you to keep a static exercise safely and without intervention, bridges that are too old for centuries and which are now subject to vehicular traffic and trains with action calculation considerably higher than those for which they were originally designed.

Some of the existing masonry bridges in Sicily of the arch type are shown in Fig. 2; these bridges are also mentioned in Santagati [4].

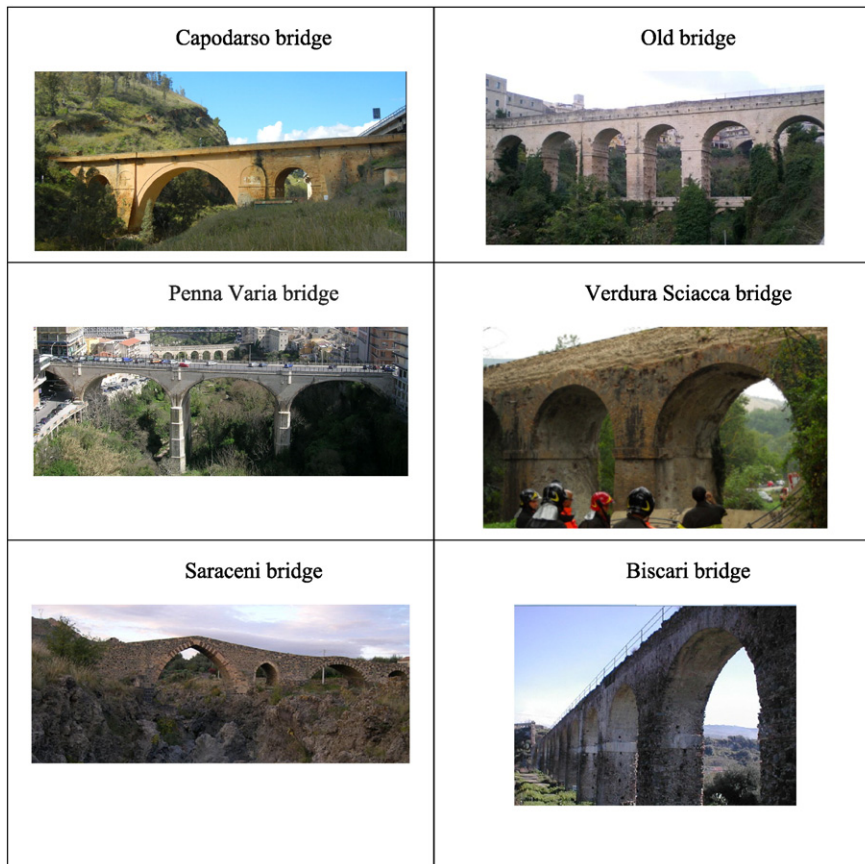


Fig. 2. Typical examples of an arch masonry bridge in Sicily.

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