

# Turkish historical arch bridges and their deteriorations and failures

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## Abstract

Preservation and conservation of historical structures are the major points for the continuity of history. Therefore, in order to develop suitable restoration projects without neglecting any of the unique cultural values, it is very important to determine the present conditions of these structures. In this paper, it is aimed to present architectural and engineering properties of Turkish historical arch bridges. For this purpose, deteriorations in construction materials, damage and failure patterns occurred in the masonry arch bridges are classified and discussed using some illustrated photos. Some restoration practices for the bridges have been carried out by Turkish General Directorate of Highways are briefly discussed.

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## 1. Introduction

Historical structures are the most invaluable reflections of cultural heritage and cultural identity, both of which have significant roles to create a strong link between the past and the present. Without them, it is not possible to understand, interpret and retrace the period of civilization. Historical arch bridges constructed in many countries from different regions of the World are main examples of these structures. The first examples of arches were seen in the underground tombs of the Sumerians in Mesopotamia around the years 3000BC [1]. The ancient Romans used stone arches for large bridges and aqueducts, and the tradition of building bridges in stone continued in medieval and Renaissance Europe. Turkey (Anatolia) is also one of the most important regions about historical construction and also stone masonry arch bridges due to the geographical location and rich cultural heritage. Unfortunately, although the Turkish stone arch bridges have been widely

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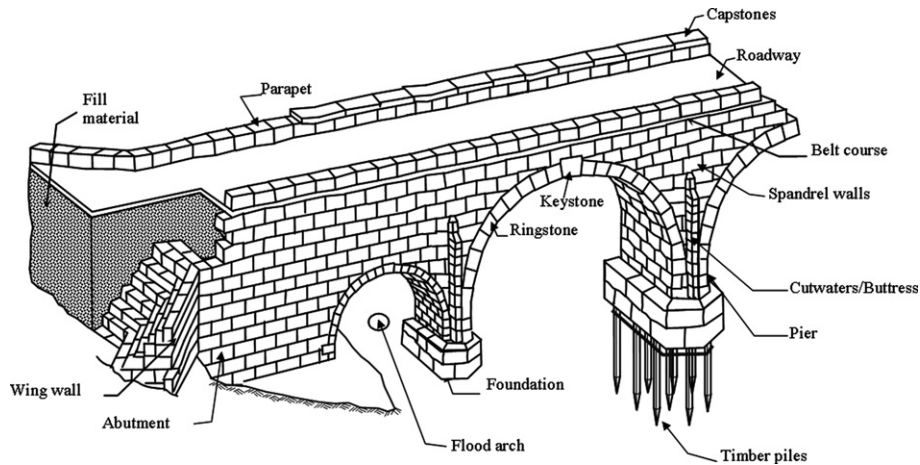


Fig. 1. Some definitions used for stone arch bridge.

sprouted in Turkey and surroundings, studies related to these structures have been rare. The main study was been carried out by Çulpan [2]. Almost no studies in which engineering properties and structural analyses were discussed have been carried out.

Being fairly convenient to span large distances, arch form is generally subjected to compressive forces because of its geometric shape. Therefore arch is among the most commonly utilized structural forms in masonry buildings. Materials such as stone and brick have been the basic materials for the construction of arches since they have excessive compressive strength. Turkish arch bridges, built in various periods, occupy an important place among historic engineering items. These bridges were built as a result of local funding and by the labors of the local inhabitants.

There are so many masonry arch bridges of different periods, which are protected by the state and have the status of “Cultural Heritage”. The Cender Suyu Bridge, Karamagara Bridge and the Justinianus Bridge are the examples of Roman bridges in Turkey. The perfect workmanship in the construction of the cut stones put the beauty of the Seljuks Bridges forward; however, the best examples of bridge architecture



Fig. 2a. Uzunköprü Bridge in Edirne [3].

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