

The finite element analysis of collapse loads of single-spanned historic masonry arch bridges (Ordu, Sarpdere Bridge)



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ABSTRACT

The current methods used in estimating the collapse loads of masonry arch bridges have been examined, and a study has been made aiming the calculation of the behaviors of the single-spanned masonry arch bridges shows under certain loads with the method of static analysis.

The model used for the study was 3D formed with the ANSYS package program, and the results of the analysis were achieved using this program, as well. The model that was created was obtained by using the original dimensions of the historical Sarpdere Bridge located within the province of Ordu. The results obtained have shown compliance with the existing studies in the literature.

In addition, the effects of the loads on the bridge that were applied to the different places on the system were examined, and the behaviors of the single-span masonry arch bridges under the loads applied were evaluated. The filler and sidewalls on left and right sides of the arch bridge were differentiated the loading about 10%.

1. Introduction

Historical structures are one of the most essential parts of the cultural heritage. Historical monuments are the witnesses of our old traditions and the symbols of the cultural identity. It is not possible to understand, interpret and retrace the period of civilization, without them. They represent the details related with the technology in design, material characteristics, workmanship, architectural features and spiritual value of their periods. Actually, there exist only two basic ways to bring the past into today's world; literature and historical structures. These are remarked as the living history, on which human beings past is reflected, it will not be wrong to say that they are the proofs showing the spirit and charm of the heritage.

Conservation and restoration of historical structures require a sensitive systematic study in order to achieve proper results. In addition to a deep knowledge of the ethics of conservation, one should have good technical skills and sufficient information related to the structure and material. This means that specialized people who take the necessary education should perform the conservation of historical structures. As well, conservation requires not only a multidisciplinary work, including history, but also architecture and engineering as the basic sciences. For proper intervention, understanding of the structural behavior and good engineering judgment with sufficient experience of the old construction techniques and concepts and correct interpretation of the analysis results of comprehensive structural analyses are needed. The master historical structures was designed not only for complex load carrying system and continuous interaction of domes, vaults, arches, minarets and pillars, but also for architectural concepts and for enough light and proper acoustics. [3,9,25].

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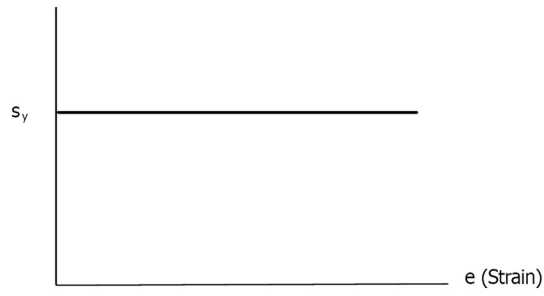
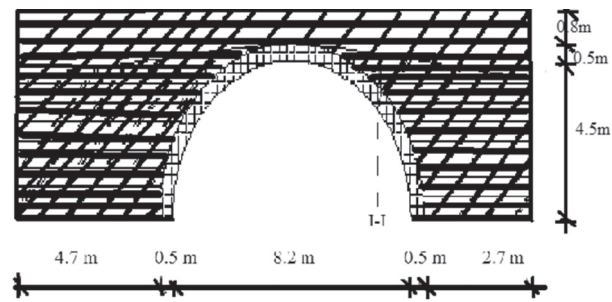


Fig. 1. Plastic stress-strain diagram.



Fig. 2. Sarpdere Bridge [1].



Side walls

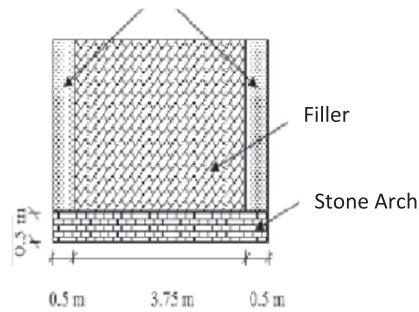


Fig. 3. Longitudinal and transverse appearances of the Sarpdere Bridge.

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