

# A limit analysis approach to the assessment of masonry arch structures under the influence of fundamental parameters

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**Abstract.** The majority of buildings in the world are made of masonry, and some of these buildings are historical constructions with heritage values. It is commonly known that masonry can withstand significant compressive stresses, but since it lacks tensile strength, it is more susceptible to dynamic actions. In this aspect a curvature was introduced in masonry constructions in order to reduce the tensile stresses and exploit their compressive strength. This innovative structural element in the past enabled crossing large spans without intermediate supports at the cost of a horizontal thrust transmitted to the supports. The structural condition of the supports constructed of masonry is of crucial importance to resist this horizontal force that varies in intensity based on the type of curvature of the arch. Additionally, a non-standard approach including joint friction has shown to be important in such structures and therefore sliding mechanisms are investigated. Research on critical parameters affecting the safety levels of piers under the thrust of arches is carried out using an in-house code (ALMA) that uses limit analysis as a rigid block approach to modeling masonry with frictional joints. Under two cases of vertical live load, symmetric and asymmetric, the different pier textures, levels of joint friction and arch shallowness, were examined. The main outcomes of the study demonstrate that even before initiating any expensive testing campaign, complex structural analysis, the investigation of these parameters in the structure itself present the most important features of its safety level and vulnerability.

**Keywords:** joint friction, masonry arches, limit analysis, dry-joints, shallowness, texture