STATIC ANALYSIS OF A MASONRY ARCHED AND BUTTRESSED RETAINING WALL

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ABSTRACT

The paper presents the geometrical survey and the analyses that were carried out to assess the stability of a masonry arched and buttressed retaining wall. Mur Casa Salvans, which was built in 1909 and located in Terrassa, Catalonia, contains a series of 11 arches of unique shapes, dimensions and inclinations supported on buttresses.

The stability of the wall was analyzed using modern retaining wall design principles. As the stability of a retaining wall is contingent upon the weight and the geometry, accurate geometrical representation is of vital importance. Self- produced photogrammetry survey enabled creating accurate three-dimensional models of the front of the wall that were later combined with the available information from the topographic survey to construct cross sections of the wall at different locations. These were used to assess the variability of the geometry and to produce representative unit sections that could be used to evaluate the stability of the entire wall. Due to the complex geometry of the structure, unit sections were defined between the vertical axis of each buttress and the key of the adjacent arch.

The stability of the retaining wall was analyzed in terms of overturning, sliding and base pressures. As a consequence of the uncertainties related to the soil parameters and the buried elements of the wall, the stability factors varied in a range that could not comply with modern design criterion. Then, a sensitivity analysis was carried out on the shear strength parameters of the backfill namely, the soil friction angle, φ, and the friction angle of the wall and the soil, δ. It was found out that slight increases in both values enhance the factors defining stability significantly and decrease the base pressures.

Finally, the stability of the arches was verified according to the Lower Bound Theorem by applying graphic statics on the arch series. Successive thrust lines were located within the boundaries of each arch by considering their actions against each other.