Geophysical Research Abstracts
Vol. 17, EGU2015-3940, 2015
EGU General Assembly 2015

Performance of building materials under load stresses: the case of Arroyo Meaques Bridge in Madrid, Spain

David Mencías (1,2), Miguel Gomez-Heras (1,2), Laura Lopez-Gonzalez (1,2,3)

(1) ETS Arquitectura, Universidad Politecnica Madrid, Spain (dameca@gmail.com), (2) CEI Moncloa (UPM, UCM, CSIC), Madrid, Spain, (3) Instituto de Geociencias (CSIC, UCM), Madrid, Spain

In most masonry structures analyzed by limit state models, it is not possible to determine where thrust lines are located or stress fields are defined. This is because very small modifications of the geometry can modify considerably a stress situation. Moreover, structural safety of this kind of construction is mainly established by equilibrium, and structural analysis is based on this premise. However, from the point of view of a stress model, the thrust line can be approximately positioned (either graphically or by analytical methods) only from a geometrical description and material properties and, therefore, determine the amount of stresses that masonry undergoes.
This research tries to provide the relationship between geometry and thrust line analysis, applied to the 17th century Arroyo Meaques Bridge. This is a brick and stone bridge, located at the southwest edge of Casa de Campo in Madrid (Spain) and it actually sets up the limit of the municipality of Madrid. The bridge was designed by architect Francesco Sabatini as a part of a set of improvements of Madrid city center.
Starting from a geometrical surveying and photogrammetric restitution, a 3-dimension CAD model is performed, in which all geometrical conditions are collected. At the same time, elastic properties, compactness and strength of bricks were determined by means of non-destructive techniques, such as Schmidt hammer and ultrasound pulse velocity. All this information is uploaded to a GIS and 2D maps are generated.
Brick physical properties were compared to previously done thrust line analysis to understand the relationship between maximum stresses and brick performance. This technique may be a starting point for more specific analysis, once possible failure mechanisms are identified and can be a very simple method to identify how it can affect any geometrical changes.

Research funded by Geomateriales 2 S2013/MIT-2914, CEI Moncloa (UPM, UCM, CSIC) through a PICATA contract and the foundation Juanelo Turriano through a doctoral fellowship.