An Analysis Model for Partially Grouted Shear Walls Using Macro-Modelling: Importance of Reporting Joint Shear Strength

Amr Ba Rahima[1], Clayton Pettit [2], Carlos Cruz Noguez[3], and Jeffrey Hung [4]

Abstract:

Partially grouted (PG) masonry shear walls are widely used as lateral force resisting systems in North America due to their economic value and practicality. Only cells containing reinforcing steel are grouted in PG walls, leaving the remaining cells hollow. The in-plane lateral behavior of PG walls is complex due to the different materials in the assembly (masonry block, mortar, grout and reinforcing steel), and discontinuities formed by the voids in the ungrouted cells. To characterize and understand better the in-plane response of PG walls, finite element (FE) methods have been used, based on micro- and macro-modelling formulations. Micro-modelling involves the definition of each material present in the masonry assemblage (i.e. masonry block, mortar, grout and reinforcing steel) separately as well as the interfaces between them. Although accurate, this process is both time-consuming and computationally expensive. Thus, more efficient analysis models are preferred, such as macro-modeling (i.e. treating the masonry assemblage as a region with averaged properties). In this paper, a macromodeling approach was presented to investigate the inplane shear behavior of PG walls, using a finite-element software that implements the modified compression field theory originally developed for reinforced-concrete members. The approach was validated with nine PG walls experimentally tested from the literature. These walls covered a wide range of design parameters, including compressive strength, aspect ratio, axial stress, and reinforcement ratio, which add more credibility to the defined model. The defined model simulated the response of the experimental satisfactorily up to the peak strength. The validation process revealed the necessity of reporting the joint shear strength in the literature, which was found to have a significant influence on the model results.

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[1] University of Alberta, Edmonton, AB, Canada, abarahim@ualberta.ca
[2] University of Alberta, Edmonton, AB, Canada
[3] University of Alberta, Edmonton, AB, Canada
[4] University of Alberta, Edmonton, AB, Canada