

DAMAGE ASSESSMENT MATRIX FOR LOW-RISE MASONRY HOUSES

G.G.T.D. Wickramathilake ¹, C. Jayasinghe ^{1,*}

¹ Department of Civil Engineering, University of Moratuwa, Moratuwa

Low-rise buildings are susceptible to damage from factors like poor design or construction quality, inadequate supervision, improper drainage, problems due to the soil condition, and adverse climatic conditions. In certain areas where expansive soil is present, especially in floodplain areas, significantly threatens lightly loaded structures due to uplift pressures. The objectives of this study were to identify the factors for the damages in low-rise masonry buildings, the level of effect of those factors for the damages, and develop a matrix to assess the damages in low-rise masonry buildings as a case study based approach. This study was based on the damaged houses which are in Higurakgoda in the North Central province of Sri Lanka and constructed with commonly available materials. Field investigation, detailed review of the reports that had been prepared after the investigation done by the National Building Research Organisation in Sri Lanka, preparation of the database, and analysis of data using Microsoft Excel and Power BI is the procedure followed in this research. All those houses have been constructed in an area that is underlain by the Minneri Oya alluvial deposit layer. Through the detailed analysis, poor construction quality and the expansiveness of the soil were identified as the major factors for damage in the houses in the case study. With the aid of literature, this study considered liquid limit, plasticity index, clay content, natural water content, and free swell index of soil as dominant parameters that describe the expansiveness of soil, as well as the quality of construction, foundation type, wall material, and floor material as the factors affecting risk due to the poor construction quality as satisfaction. After determining the level effect of each considered parameter using the Analytical Hierarchy Process and actual data from the houses in the case study, a matrix that enables the prediction of the risk level of low-rise masonry houses on expansive soil was developed by combining two matrices developed to predict soil expansiveness and the risk level due to poor construction quality. The study also categorises possible damages, proposing an equation to predict the probability of structural cracks occurring in the building and a rationale to predict critical and possible types of cracks based on the risk level of the low-rise masonry house that is predicted using the proposed matrix. Validation of the proposed matrix using actual data demonstrated their accuracy in predicting risk levels. Therefore, when the construction details of the house and soil properties are identified, the outcomes of this research can be used to predict the risk level of low-rise masonry houses, the tendency to get structural cracks, and possible types of cracks. So, these findings can help assess and mitigate potential damage to low-rise buildings in expansive soil areas, enabling better construction practices and risk management strategies.

Keywords: Low-rise masonry buildings, Expansive soil, Damage assessment, Construction quality, Structural cracks

* Correspondence: chintha@uom.lk

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