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Seismic Analysis for Low-Rise Buildings Based on Different Types of Soil Consideration

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Abstract

The earthquakes around the neighboring country caused Malaysia to experience small tremors from the quake. One of the distant earthquakes is the West Sumatra earthquake that affected several tremors felt in Peninsular Malaysia, causing vibrations in some areas and causing damage to buildings and injuries to people. The earthquake disaster that hit Ranau, Sabah on the 5th of June, 2015, increased the awareness of Malaysians on the matter of considering seismic design for the building. Consequently, the engineers in Malaysia should have to consider the seismic design and construction even though Malaysia has not encountered an active seismic fault zone. This undertaking will impact construction costs, specifically in terms of materials. As a result, this research analyses the cost of steel tonnage for structural work on a double-storey house with a seismic design. Because this study focuses on seismic design buildings in Malaysia, we applied the Malaysia National Annex to Eurocode 8. In this study, three steps involved which is the design of a primary model, structural analysis and seismic design, and finally, the take-off procedure. As a starting point, a double-storey house was constructed. The model considered all soil types. The reference peak ground acceleration, αg_R 0.07g applied for DCL. According to the simulation data, the expenditure of steel tonnage for the soil types A and B structure reduces the cost of steel reinforcement by approximately 0% to 3%, against a non-seismic model, and, the expenditure of steel tonnage for the other soil types which are C, D and E structure increase the cost of steel reinforcement by approximately 4%, against a non-seismic model. By this means, the non-seismic models in this study required more steel reinforcement than the soil types A and B models due to the domination of wind load on the structure that produces a bigger force, and for the soil types C, D, and E models required more steel reinforcement than the non-seismic models because the soil softer compared to soil types A and B. In this study, the softer soil required more steel reinforcement compared to the stiff soil and the cost of steel reinforcement is anticipated to rise depending on the type of soil and the level of seismicity.

Keywords: Seismic design; Steel tonnage; Soil type.; Seismicity; Civil engineering; Eurocode 8.