

Analysis of the Behaviour of Improved Soil under Shallow Concrete Foundations

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As a step towards sustainability and environmental protection, use of waste material and by-products in construction activities is becoming a trend. Quarry dust is a waste product of stone crushing process, which can be effectively used as a shallow ground stabilizer. This research investigates the behaviour of improved soil under a shallow foundation, by adding various mix proportions of quarry dust to the natural weak soil. Further, based on the foundation stability analysis, determining an optimum proportion of soil + quarry dust mix is studied. This is done by numerically analysing the displacement, shear strength, stresses, strains, and safety factors of stabilized soil underneath a shallow foundation. The study confirms that mixing quarry dust with natural weak soil - layered under a shallow foundation can significantly improve the stability of the respective foundation. This is due to the improvement of soil shear strength parameters, i.e. cohesion and friction angles, which are used for the stability analysis in the numerical model – incorporating the Mohr-Coulomb failure criterion. Further, it can be concluded that the optimum quarry dust mix proportion that yields the highest factor of safety of the foundation is around 60% - 80%, in which further increase in quarry dust % can cause reduction in the stability, due to unbalanced effect of cohesion and friction angle of mixed soil. Overall, the study concludes that mixing quarry dust with natural weak soil can be considered as a better ground improvement technique; however, the optimum mix proportion has to be determined after a careful analysis of the specific soil types, ground conditions and the applied loads.

Keywords: *ground stabilization, quarry dust, shear strength, shallow foundation*