

3D Geological Modeling and Engineering Geological Characterization of Shallow Subsurface Soil and Rock of Addis Ababa, Ethiopia

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Abstract : A comprehensive three-dimensional (3D) geological modeling and engineering geological characterization of shallow subsurface soils and rocks are essential for a wide range of geotechnical and seismological engineering applications, particularly in urban environments. The spatial distribution and geological variation of the shallow subsurface of Addis Ababa city have not been studied so far in terms of geological and geotechnical modeling. This study aims at the construction of a 3D geological model, as well as provides awareness into the engineering geological characteristics of shallow subsurface soil and rock of Addis Ababa city. The 3D geological model was constructed by using more than 1500 geotechnical boreholes, well-drilling data, and geological maps. A well-known geostatistical kriging 3D interpolation algorithm was applied to visualize the spatial distribution and geological variation of the shallow subsurface. Due to the complex nature of geological formations, vertical and lateral variation of the geological profiles horizons-solid command has been selected via the Groundwater Modelling System (GMS) graphical user interface software. For the engineering geological characterization of typical soils and rocks, both index and engineering laboratory tests have been used. The geotechnical properties of soil and rocks vary from place to place due to the uneven nature of subsurface formations observed in the study areas. The constructed model ascertains the thickness, extent, and 3D distribution of the important geological units of the city. This study is the first comprehensive research work on 3D geological modeling and subsurface characterization of soils and rocks in Addis Ababa city, and the outcomes will be important for further future research on subsurface conditions in the city. Furthermore, these findings provide a reference for developing a geo-database for the city.

Keywords : 3d geological modeling, addis ababa, engineering geology, geostatistics, horizons-solid

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