

Spatial Interpolation of Intermediate Soil Properties to Enhance Geotechnical Surveying for Foundation Design

Authors : Yelbek B. Utepov, Assel T. Mukhamejanova, Aliya K. Aldungarova, Aida G. Nazarova, Sabit A. Karaulov, Nurgul T. Alibekova, Aigul K. Kozhas, Dias Kazhimkanuly, Akmaral K. Tleubayeva

Abstract : This research focuses on enhancing geotechnical surveying for foundation design through the spatial interpolation of intermediate soil properties. Traditional geotechnical practices rely on discrete data from borehole drilling, soil sampling, and laboratory analyses, often neglecting the continuous nature of soil properties and disregarding values in intermediate locations. This study challenges these omissions by emphasizing interpolation techniques such as Kriging, Inverse Distance Weighting, and Spline interpolation to capture the nuanced spatial variations in soil properties. The methodology is applied to geotechnical survey data from two construction sites in Astana, Kazakhstan, revealing continuous representations of Young's Modulus, Cohesion, and Friction Angle. The spatial heatmaps generated through interpolation offered valuable insights into the subsurface environment, highlighting heterogeneity and aiding in more informed foundation design decisions for considered sites. Moreover, intriguing patterns of heterogeneity, as well as visual clusters and transitions between soil classes, were explored within seemingly uniform layers. The study bridges the gap between discrete borehole samples and the continuous subsurface, contributing to the evolution of geotechnical engineering practices. The proposed approach, utilizing open-source software geographic information systems, provides a practical tool for visualizing soil characteristics and may pave the way for future advancements in geotechnical surveying and foundation design.

Keywords : soil mechanical properties, spatial interpolation, inverse distance weighting, heatmaps

Conference Title : ICCEGE 2024 : International Conference on Civil, Environmental and Geological Engineering

Conference Location : Venice, Italy

Conference Dates : August 15-16, 2024