

INTEGRATION OF GEOTECHNICAL DATA AND 3D MODELING FOR STRATIGRAPHIC ANALYSIS IN THE BREAKWATER AREA

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ABSTRACT

The construction of marine infrastructure such as breakwaters is vulnerable to geotechnical risks arising from uncertainties in subsurface stratigraphic conditions. This study aims to integrate geotechnical data obtained from hand boring with three-dimensional (3D) modeling to analyze soil stratigraphy in the planned breakwater area of Muntai Beach, Bengkalis Regency, Riau. Data were obtained from hand boring, including spatial coordinates, depth, soil layer descriptions, and physical soil property parameters (soil type classification). Stratigraphic analysis was conducted through correlation between boring points to identify the type, thickness, and continuity of soil layers. The 3D model was constructed using spatial interpolation methods to comprehensively visualize the vertical and lateral distribution of soil layers. Cross-validation was performed by comparing the model results against actual field data. The results indicate that the integration of geotechnical data and 3D modeling produces a more accurate stratigraphic representation compared to conventional two-dimensional approaches. The resulting 3D model illustrates layer geometry and thickness variation, and identifies potential geohazard zones such as soft soil layers that affect breakwater stability. This study contributes to the development of geotechnical investigation methods in coastal areas with limited data and provides a scientific basis for the planning of safer and more sustainable coastal infrastructure.

Keyword: *geotechnical data integration, 3D modeling, stratigraphy, hand boring, breakwater, Muntai Beach.*