ANALYSIS OF LATERAL BEARING CAPACITY OF PILE FOUNDATIONS USING ANALYTICAL AND FINITE ELEMEN METHODES WITH VALIDATION FROM LATERAL LOAD TEST RESULTS

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ABSTRACT

Foundation Piles on bridges must be able to withstand lateral loads from water pressure, wind, and dynamic loads. This study aims to analyze and compare the lateral bearing capacity and deflection of single piles using three approaches: the analytical method (Broms and Meyerhof), the 2D finite element method, and direct validation with lateral load test results on SP piles 13. The study was conducted using a case study on pile foundations in the Sodongkopo Bridge Project. Soil data from BH-02 was interpreted to obtain geotechnical parameters through empirical correlation. The research results show that at a permissible deflection of 10 mm based on SNI 8460:2017, the lateral bearing capacity values obtained from each method differ. The Broms method yields the lowest bearing capacity of 97.227 kN, the Meyerhof method yields 190.650 kN, and the 2D finite element method 209.635 kN. Field test results showed a bearing capacity of 265.831 kN. Thus, the finite element method is the closest with a deviation of 21.14% from the field test results, followed by Meyerhof at 28.28% and Broms at 63.43%. It is concluded that the finite element method provides results that are closest to actual field conditions because it can better model the interaction between soil and pile materials. The Broms and Meyerhof analytical methods can be used for conservative initial estimates. This study recommends the use of the finite element method for detailed analysis and final planning of pile foundations, as well as the importance of lateral load testing as the primary validation method.

Keywords: Broms' Method, Finite Element Method (FEM), Lateral Bearing Capacity, Meyerhof's Method, Pile Foundation.