

## INTISARI

Peristiwa likuefaksi terjadi pada lapisan tanah yang secara umum materialnya didominasi oleh ukuran pasir yang belum terkonsolidasi dengan baik serta kondisinya jenuh air. Kemudian lapisan tanah tersebut terkena gaya guncangan yang sangat kuat akibat kejadian seismik maupun gaya eksternal lain yang setara. Kondisi ini dapat mengurangi tegangan efektif secara signifikan, yang mengakibatkan hilangnya daya dukung tanah hingga penyebaran lateral. Penelitian ini dilakukan untuk mengestimasi potensi likuefaksi yang terjadi di Kawasan Pembangunan Jalan Tol serta pengaruhnya pada permukaan tanah dan fondasi tiang bor.

Penelitian berlokasi di Kawasan Pembangunan Jalan Tol Solo – Yogyakarta – Kulon Progo Seksi 1.2 Simpang Susun Purwomartani, Kabupaten Sleman, D.I. Yogyakarta yang termasuk ke dalam zona kerentanan likuefaksi sedang. Lokasi penelitian ini berada di wilayah yang sering mengalami gempa bumi dan terdiri dari lapisan tanah endapan vulkanik Gunung Merapi. Metode penelitian yang digunakan meliputi analisis kegempaan, analisis potensi likuefaksi, analisis indeks kerusakan likuefaksi, analisis penurunan pasca likuefaksi, dan analisis daya dukung fondasi tiang bor. Studi potensi likuefaksi dilakukan secara empiris menggunakan data N-SPT, serta dilakukan studi peningkatan rasio tekanan air pori dan kaitannya dengan faktor keamanan likuefaksi. Selanjutnya, dilakukan analisis menggunakan indeks potensi likuefaksi, indeks keparahan likuefaksi, serta penurunan tanah pasca likuefaksi. Hasil potensi tersebut kemudian dipetakan berdasarkan tingkat potensi dan estimasi penurunan yang dapat terjadi. Dilakukan juga studi untuk mengevaluasi dampak likuefaksi pada fondasi tiang bor menggunakan pendekatan empiris.

Analisis potensi likuefaksi secara empiris menghasilkan lapisan tanah pada daerah penelitian memiliki potensi likuefaksi di kedalaman 1,5 – 20 m. Sementara itu, hasil analisis secara numeris menunjukkan hubungan antara faktor keamanan dan rasio kenaikan tekanan air pori, di mana pada perhitungan faktor keamanan secara empiris menghasilkan angka yang lebih konservatif. Penurunan vertikal permukaan tanah akibat likuefaksi berkisar antara 4,69 – 37,19 cm. Likuefaksi tanah juga menyebabkan penurunan daya dukung fondasi tiang bor sebesar 21,28 – 39,92% untuk aksial dan 5,31% untuk lateral.

**Kata kunci:** Potensi Likuefaksi, Gempa Bumi, Penurunan Pasca Likuefaksi, Tekanan Air Pori, Fondasi Tiang Bor

## ***ABSTRACT***

Liquefaction events occur in soil layers whose material is generally dominated by sand that has not been properly consolidated and is saturated with water. Then the soil layer is exposed to very strong shaking forces due to seismic events or other equivalent external forces. This condition can reduce the effective stress significantly, resulting in a loss of soil bearing capacity resulting in lateral spreading. This research was conducted to estimate the potential for liquefaction that occurs in the Toll Road Construction Area and its effect on the soil surface and bored pile foundations.

The research is located in the Solo-Yogyakarta-Kulon Progo Toll Road Development Area Section 1.2, specifically at the Purwomartani Intersection, Sleman Regency, D.I. Yogyakarta, which falls within the moderate liquefaction vulnerability zone. The study area is prone to earthquakes and consists of volcanic sediment layers from Mount Merapi. The research methods employed include seismic analysis, liquefaction potential analysis, liquefaction damage index analysis, post-liquefaction settlement analysis, and analysis of the bearing capacity of bored pile foundations. The liquefaction potential study is conducted empirically using N-SPT data, along with an investigation into the increase in pore water pressure ratio and its correlation with liquefaction safety factors. Subsequently, analyses are performed using liquefaction potential index, liquefaction severity index, and post-liquefaction soil settlement analyses. The results of this liquefaction potential are then mapped based on the level of potential and estimated settlement. Additionally, a study is conducted to assess the impact of liquefaction on bored pile foundation using an empirical approach.

Empirical analysis of liquefaction potential reveals that the soil layers in the research area have liquefaction potential at depths of 1.5 to 20 meters. Meanwhile, numerical analysis results show the relationship between safety factors and the ratio of pore water pressure increase, with empirically calculated safety factors yielding more conservative values. Vertical ground settlement due to liquefaction ranges from 4.69 to 37.19 cm. Soil liquefaction also leads to a reduction in the bearing capacity of bored pile foundations by 21.28% to 39.92% for axial loads and 5.31% for lateral loads.

**Keywords:** Liquefaction Potential, Earthquake, Post-Liquefaction Settlement, Pore Water Pressure, Bored Pile Foundation