

KAJIAN POTENSI LIKUEFAKSI DI WILAYAH SEKITAR SESAR OPAK

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Intisari

Daerah Istimewa Yogyakarta merupakan wilayah dengan tingkat aktivitas seismik tinggi di Indonesia, disebabkan oleh letaknya yang dekat dengan zona subduksi antara Lempeng Indo-Australia dan Lempeng Eurasia. Kondisi tektonik ini membentuk struktur geologi kompleks, termasuk keberadaan Sesar Opak, yang meningkatkan kerentanan wilayah terhadap gempa bumi dan dampak ikutan seperti likuefaksi. Gempa bumi Yogyakarta tahun 2006 merupakan salah satu gempa bumi merusak yang memicu terjadinya fenomena likuefaksi di wilayah sekitar zona sesar. Fenomena tersebut berupa *sand boils*, retakan tanah, amblesan permukaan, serta naiknya air ke permukaan tanah, terutama pada zona kurang dari 6 km dari Sesar Opak. Penelitian ini bertujuan: (1) memetakan potensi likuefaksi akibat gempa bumi di wilayah sekitar Sesar Opak (2) menganalisis secara umum tingkat kerawanan likuefaksi terkait dampaknya terhadap Rencana Tata Ruang Wilayah (RTRW) di wilayah penelitian. Variabel yang digunakan meliputi kejadian likuefaksi gempa bumi 2006, kecepatan gelombang geser rata-rata hingga kedalaman 30 meter (V_{s30}), nilai *Peak Ground Velocity* (PGV), jarak terhadap badan air terdekat, curah hujan, dan kedalaman muka air tanah. Analisis potensi likuefaksi menggunakan metode regresi logistik. Hasil penelitian disajikan dalam peta potensi likuefaksi dari kategori sangat rendah hingga tinggi. Verifikasi menggunakan data bor menunjukkan kesesuaian tinggi dengan litologi di lapangan. Uji akurasi menggunakan kurva *Area Under the Curve* (AUC) sebesar 0,677 mengindikasikan performa klasifikasi cukup baik. Kerawanan likuefaksi tinggi terkonsentrasi di dataran aluvial dekat sungai besar, sementara potensi rendah hingga sangat rendah dominan di perbukitan dengan litologi batuan keras yang relatif stabil terhadap guncangan seismik. Hasil *overlay* dengan RTRW menunjukkan bahwa sebagian besar kawasan permukiman dan pariwisata berada dalam zona potensi likuefaksi sedang hingga tinggi. Kedua kawasan ini memiliki aktivitas sosial dan ekonomi yang tinggi, sehingga perlu mendapat prioritas dalam perencanaan ruang dan mitigasi bencana. Rekomendasi mitigasi meliputi penyesuaian tata ruang, desain fondasi adaptif terhadap likuefaksi, penguatan sistem drainase, dan edukasi masyarakat.

Kata kunci : Sesar Opak, Likuefaksi, Regresi Logistik, Perencanaan Tata Ruang

STUDY OF LIQUEFACTION POTENTIAL IN THE SURROUNDING AREA OF OPAK FAULT

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Abstract

The Special Region of Yogyakarta is a region in Indonesia with high seismic activity, caused by its close to the subduction zone between the Indo-Australian Plate and the Eurasian Plate. This tectonic setting has resulted in a complex geological structure, including the presence of the Opak Fault, which increases the region's vulnerability to earthquakes and associated secondary hazards such as liquefaction. The 2006 Yogyakarta earthquake was one of the destructive events that triggered liquefaction phenomena in the area around the fault zone. This phenomenon manifested as sand boils, ground fissures, surface subsidence, and the emergence of groundwater, particularly within a 6 km radius of the Opak Fault. This study aims to: (1) map the liquefaction potential induced by earthquakes in the area surrounding the Opak Fault, and (2) analyze the general level of liquefaction susceptibility in relation to its implications for the Regional Spatial Planning (RTRW) in the study area. Variables used include the 2006 liquefaction occurrence, average shear wave velocity up to 30 meters depth (V_{s30}), Peak Ground Velocity (PGV), proximity to nearby water bodies, rainfall, and groundwater table depth. The liquefaction potential was analyzed using a logistic regression method. The results are presented in a liquefaction potential map classified from very low to high. Verification using borehole data shows a high degree of consistency with field lithology. Accuracy testing using the Area Under the Curve (AUC) yielded a value of 0.677, indicating a fairly good classification performance. High liquefaction susceptibility is concentrated in alluvial plains near major rivers, whereas low to very low potential is dominant in hilly areas with hard rock lithology, which is relatively stable against seismic shaking. The overlay results with the Spatial Plan (RTRW) indicate that most residential and tourism areas are located within moderate to high liquefaction potential zones. These two areas exhibit high levels of social and economic activity, and therefore should be prioritized in spatial planning and disaster risk mitigation efforts. Mitigation recommendations include spatial planning adjustments, adaptive foundation design for liquefaction, strengthening of the drainage system, and public education.

Keywords: Opak Fault, Liquefaction, Logistic Regression, Spatial Planning