

## INTISARI

*Yogyakarta International Airport* di Kabupaten Kulon Progo terletak dekat pertemuan lempeng tektonik yaitu Lempeng Eurasia dan Lempeng Indo-Australia. Badan Geologi Kementerian ESDM menjelaskan bahwa lokasi proyek memiliki kerentanan terhadap likuefaksi secara merata. *Stone column* merupakan metode perbaikan tanah yang dipilih berdasarkan SNI 8460:2017. Peta potensi likuefaksi diperlukan untuk memberikan pemahaman atas kondisi lapangan, sedangkan optimasi perbaikan dengan bahasa pemrograman Python diperlukan untuk menghindari *overcost* desain.

Penelitian dilakukan berdasarkan 84 data uji bor sedalam 12 – 16 meter dan 6 data uji laboratorium. Interpretasi lapisan tanah kawasan YIA dibuat menggunakan perangkat lunak *Rockworks*. Analisis potensi likuefaksi menggunakan metode *simplified procedure*, sedangkan derajat kerusakan akibat likuefaksi menggunakan *Liquefaction Severity Index*. Sementara itu, perbaikan tanah menggunakan *stone column* berdasarkan pada metode Priebe (1995) yang dioptimasi menggunakan bahasa pemrograman Python. Kemudian peta potensi likuefaksi dan peta perbaikan dibuat menggunakan perangkat lunak QGIS.

Kawasan YIA dibagi menjadi 3 zona dengan interpretasi lapisan tanah berupa pasir sedang pada kedalaman 2 - 4 meter dan muka air tanah dangkal sedalam 2,96 meter. Hasil analisis distribusi tanah menunjukkan bahwa kawasan YIA rentan terhadap likuefaksi akibat gradasi yang seragam serta nilai *finer content* dibawah 5%. Analisis likuefaksi menunjukkan terdapat 77 titik rawan likuefaksi dengan rata-rata nilai LSI sebesar 24,3 berderajat kerusakan rendah. Perbaikan tanah menggunakan *stone column* dengan 7 variasi jarak (*s*) serta 3 variasi kedalaman (*d*) menyebabkan kawasan YIA aman terhadap potensi likuefaksi serta menurunkan nilai LSI rata-rata menjadi 8,8 yang tergolong berderajat kerusakan sangat rendah. Bagaimanapun juga diperlukan analisis lebih lanjut mengenai kemampuan *stone column* sebagai drainase dan pengaruhnya terhadap kepadatan tanah sekitarnya.

Kata kunci : Likuefaksi, *Stone Column*, QGIS, *Rockworks*, Python

## ABSTRACT

*Yogyakarta International Airport in Kulon Progo Regency is located near the confluence of the Eurasian and the Indo-Australian tectonic plates. The Geological Agency of the Ministry of Energy and Mineral Resources concludes that the project location has vulnerability to be liquefied. Stone column is a soil improvement method chosen based on SNI 8460: 2017. A liquefaction susceptibility map is necessitated to provide an insight of field conditions, while soil improvement plan ought to be optimized using Python to avoid design overcosts.*

*This research was conducted based on 84 drill test data as deep as 12-16 meters and 6 laboratory soil test data. The YIA soil interpretation was generated by using the Rockworks software. Analysis of liquefaction susceptibility was calculated by using simplified procedure method, while the Liquefaction Severity Index was used to predict the severity of a liquefiable layer. Moreover, soil improvement was conducted using a stone column based on the Priebe (1995) method which was optimized using Python. Afterwards, a potential liquefaction map and an improvement map were generated using the QGIS software.*

*The YIA area which has divided into 3 zones is underlain by medium sand soils with 2 - 4 meters depth and a shallow groundwater level of 2.96 meters. The results of soil distribution analysis indicate that the YIA area is susceptible to liquefaction due to uniformly graded sand and fines content values below 5%. The liquefaction analysis showed that there were 77 liquefaction vulnerable points with an average LSI value of 24.3 classified as a low severity class. Soil improvement using a stone column with 7 distance variations (s) and 3 depth variations (d) causes the YIA area to be safe against liquefaction and reduces the average LSI value to 8.8 which is classified as having a very low degree of damage. However, further analysis is needed regarding the ability of the stone column as drainage and its effect on the density of the surrounding soil.*

*Keywords: Liquefaction, Stone Column, QGIS, Rockworks, Python*