

ABSTRAK

PEMODELAN GEOLOGI TEKNIK 3D DENGAN KLASIFIKASI MASSA BATUAN *Q-SYSTEM*, RMR, DAN RQD TERHADAP KESTABILAN LUBANG BUKAAN BAWAH TANAH DAERAH MURUNG RAYA, KALIMANTAN TENGAH

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Kabupaten Murung Raya, Kalimantan Tengah, memiliki kondisi geologi kompleks akibat alterasi dan struktur geologi seperti sesar dan kekar, yang menurunkan kondisi massa batuan dan meningkatkan risiko keruntuhan pada lubang bukaan bawah tanah. Sesar mayor di daerah penelitian berpengaruh terhadap turunnya kualitas massa batuan, khususnya pada zona yang dilaluinya. Litologi utama terdiri dari tuff, andesit basaltik, basalt, breksi vulkanik, dan vein kuarsa yang memiliki kondisi massa batuan yang berbeda. Penelitian ini bertujuan menganalisis kondisi massa batuan tiap litologi menggunakan *Rock Mass Rating* (RMR), *Geological Strength Index* (GSI), dan *Q-system* melalui *geotechnical domain*, menentukan *Stand-Up Time* dan *span* yang aman, serta memberikan rekomendasi perkuatan bukaan bawah tanah. Data diperoleh melalui *geotechnical logging* inti bor, serta data topografi berupa pemboran, dan uji laboratorium. Hasil menunjukkan dua *geotechnical domain*. Domain 1 (vein kuarsa dan andesit basaltik) dengan kualitas sangat baik, serta Domain 2 yang meliputi tuff (RMR 45, RQD 77, Q 9,66), basalt (RMR 49, RQD 78, Q 8,37), dan breksi vulkanik (RMR 52, RQD 75, Q 8,6). Analisis *Finite Element Method* (FEM) merekomendasikan perkuatan bervariasi, dari *rock bolt*, beton tembak dan *wire mesh* pada batuan kuat hingga kombinasi perkuatan kompleks pada batuan lemah, untuk memastikan stabilitas lubang bukaan.

Kata kunci: FEM, GSI, *Q-system*, Rekomendasi perkuatan, RMR

ABSTRACT

3D Geotechnical Modeling With Rock Mass Classification Using Q-System, RMR, and GSI for the Stability of Underground Openings in Murung Raya, Central Kalimantan

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Murung Raya Regency, Central Kalimantan, has complex geological conditions due to geological changes and structures such as faults and joints, which degrade the quality of the rock mass and increase the risk of collapse during tunnel opening. The mayor fault in the study area contributes significantly to the weakening of the rock mass, especially in the zone it passes through. The main lithology consists of tuff, andesit basaltik, basalt, breksi vulkanik, and quartz veins that have different geomechanical properties. This study aims to analyze the rock mass conditions of each lithology using Rock Mass Rating (RMR), Geological Strength Index (GSI), and Q-system through the geotechnical domain, determine the Stand-Up Time and safe span, and provide recommendations for underground excavation reinforcement. Data were obtained through geotechnical core logging, as well as topographic data, drilling, and laboratory tests. The results show two geotechnical domains: Domain 1 (vein quartz and basaltic andesite) with very good quality, and Domain 2 which includes andesite tuff (RMR 45, RQD 77, Q 9.66), basaltic andesite (RMR 49, RQD 78, Q 8.37), and volcanic breccia (RMR 52, RQD 75, Q 8.6). Finite Element Method (FEM) analysis recommends various reinforcements, from rock bolts at strong strength to complex reinforcement combinations at weak strength, to ensure the stability and safety of the tunnel.

Keywords: FEM, GSI, Q-system, RMR, support recommendation