

Pembangunan jalan tol Yogyakarta-Bawen, khususnya pada seksi 5 Temanggung-Ambarawa, melibatkan konstruksi terowongan jalur B di Dusun Kragan, Desa Losari, Kabupaten Magelang. Terowongan ini dengan panjang 510 meter pada sisi barat, menjadi fokus penelitian. Evaluasi kondisi geologi teknik dan hidrogeologi menjadi penting untuk mengidentifikasi potensi dampak negatif dan memahami kondisi lingkungan sekitarnya. Metodologi penelitian melibatkan analisis geomorfologi, karakteristik batuan, struktur geologi, dan kondisi air tanah untuk mengevaluasi kondisi geologi teknik. Evaluasi agresivitas air tanah dilakukan berdasarkan nilai pH, konsentrasi ion magnesium, dan sulfat. Pemodelan air tanah dilakukan untuk memprediksi perubahan elevasi serta pola aliran air tanah sebelum, selama, dan setelah konstruksi terowongan menggunakan perangkat lunak Visual Modflow. Penelitian mengungkapkan karakteristik geologi teknik mencakup satuan kondisi geomorfologi, yaitu satuan lembah vulkanik berlereng landai-miring dan satuan perbukitan tinggi vulkanik berlereng agak curam. Litologi terdiri dari satuan tuf dan satuan breksi tuf dengan tingkat pelapukan tinggi sampai sangat tinggi, serta struktur geologi berupa kekar ekstensi dengan orientasi bidang tenggara-barat laut dan timur laut-barat daya. Kedalaman air tanah bervariasi antara 13-40 m dari permukaan. Agresivitas air tanah tergolong rendah terhadap pengikisan struktur beton. Pemodelan menunjukkan perubahan pola aliran air tanah yang signifikan sepanjang tahap konstruksi terowongan. Hasil evaluasi geologi teknik dan hidrogeologi memberikan pemahaman mendalam terkait kondisi lingkungan sekitar proyek terowongan jalan tol Yogyakarta-Bawen. Informasi ini diharapkan dapat membantu pemangku kepentingan dalam mengatasi potensi tantangan dan berkontribusi pada kelangsungan operasional proyek infrastruktur yang berkelanjutan.

Kata kunci: jalan tol Yogyakarta-Bawen, terowongan jalur B, geologi teknik, hidrogeologi, agresivitas air tanah, model air tanah

ABSTRACT

The development of the Yogyakarta-Bawen toll road, specifically in section 5 Temanggung-Ambarawa, involves the construction of the B-line tunnel in Kragan Hamlet, Losari Village, Magelang Regency. This 510-meter-long tunnel on the west side is the focus of the research. The evaluation of geological and hydrogeological conditions assumes paramount importance for the identification of potential deleterious impacts and comprehension of the proximate environmental milieu. The research methodology encompasses a comprehensive analysis of geomorphology, rock characteristics, geological structures, and groundwater conditions, with the aim of evaluating the geological engineering conditions. The assessment of groundwater aggressiveness is conducted based on pertinent parameters such as pH values, magnesium ion concentration, and sulphate levels. Groundwater modelling, employing Visual Modflow software, is executed to prognosticate elevation alterations and groundwater flow dynamics pre-, intra-, and post-tunnel construction. The study unveils salient geological engineering characteristics, delineating distinct geomorphological units, namely the gentle sloping volcanic valley unit and the steep volcanic highland unit. Lithologically, the area comprises the tuff unit and tuff breccia unit with highly to completely weathering levels. Geological structures manifest as extensional faults with orientations along the southeast-northwest and northeast-southwest axes. The depth of groundwater fluctuates within the range of 13–40 meters from the surface. The assessed aggressiveness of groundwater towards concrete structures is deemed to be low. Groundwater modelling substantiates consequential alterations in flow patterns throughout various phases of tunnel construction. The outcomes of geological engineering and hydrogeological evaluations engender a profound understanding of the environmental context enveloping the Yogyakarta-Bawen toll road tunnel project. This corpus of information is anticipated to furnish stakeholders with valuable insights for mitigating potential challenges and contributing to the enduring operability of the infrastructure project.

Keywords: Yogyakarta-Bawen toll road, B-line tunnel, geological engineering, hydrogeology, groundwater aggressiveness, groundwater modeling.