

Bendungan Surumana berlokasi di Desa Ongulara dan Desa Malino, Kecamatan Banawa Selatan, Kabupaten Donggala, Provinsi Sulawesi Tengah yang direncanakan memiliki saluran pengelak menggunakan terowongan dengan tipe tapal kuda dengan ukuran panjang 525,78 m dan diameter 7 m. Penelitian ini bertujuan untuk mengkaji kondisi geologi teknik area sekitar terowongan dan menganalisis stabilitas lereng portal outlet terowongan serta menentukan rekomendasi metode penggalian dan sistem penyangga terowongan. Metode penelitian ini meliputi pemetaan geologi permukaan, analisis data pengeboran inti, pengujian laboratorium, dan klasifikasi kualitas massa batuan menggunakan metode *Q-System* dan *Geological Strength Index* (GSI). Analisis stabilitas lereng dilakukan dengan Limit Equilibrium Method (LEM) menggunakan pendekatan Morgenstern-Price dan Spencer pada kondisi statis dan pseudostatis. Hasil penelitian menunjukkan bahwa kondisi geomorfologi daerah penelitian terbagi menjadi tiga satuan geomorfologi yaitu satuan dataran denudasional berlereng landai, satuan perbukitan kuesta berlereng agak curam – curam, satuan perbukitan homoklin berlereng curam – sangat curam. Area penelitian tersusun atas tiga satuan litologi dengan urutan dari yang paling tua hingga yang paling muda yaitu satuan breksi polimik, satuan konglomerat andesit, dan satuan batupasir dengan struktur geologi yang berkembang berupa kekar, lipatan, dan sesar. Kualitas massa batuan di sepanjang jalur terowongan berdasarkan *Q-System* menunjukkan kualitas sangat buruk hingga buruk, sedangkan berdasarkan GSI menunjukkan kualitas buruk hingga sedang. Hasil analisis stabilitas lereng portal outlet, desain lereng menunjukkan kondisi stabil baik pada kondisi statis maupun gempa dengan nilai faktor keamanan melebihi standar yang disyaratkan dalam SNI 8460:2017. Rekomendasi metode penggalian terowongan berdasarkan klasifikasi GSI adalah ripping pada kualitas massa batuan sedang serta digging pada kualitas massa batuan buruk. Sistem penyangga terowongan yang direkomendasikan berdasarkan *Q-System* berupa pemasangan rock bolt sepanjang 2,4 m dengan spasi 1,7–2,1 m dan fibre-reinforced sprayed concrete setebal 5–6 cm untuk kualitas massa batuan buruk, serta spasi 1,5–1,7 m dan ketebalan shotcrete 6–9 cm untuk kualitas massa batuan sangat buruk. Hasil penelitian ini diharapkan dapat menjadi acuan dalam perencanaan dan pelaksanaan konstruksi terowongan pengelak Bendungan Surumana agar lebih aman, efektif, dan sesuai dengan kondisi geologi teknik setempat.

Kata kunci: terowongan pengelak, Bendungan Surumana, geologi teknik, *Q-System*, GSI, stabilitas lereng, sistem penyangga terowongan, metode penggalian terowongan.

ABSTRACT

Surumana Dam is located in Ongulara Village and Malino Village, Banawa Selatan District, Donggala Regency, Central Sulawesi Province, and is planned to be equipped with a diversion channel in the form of a horseshoe-shaped tunnel with a length of 525.78 m and a diameter of 7 m. This study aims to assess the engineering geological conditions around the tunnel area, analyze the stability of the outlet portal slope, and determine appropriate excavation methods and tunnel support system recommendations. The research methods include surface geological mapping, core drilling data analysis, laboratory testing, and rock mass quality classification using the Q-System and Geological Strength Index (GSI) methods. Slope stability analysis was conducted using the Limit Equilibrium Method (LEM) with the Morgenstern–Price and Spencer approaches under static and pseudostatic conditions. The results indicate that the geomorphological conditions of the study area are divided into three geomorphological units, namely gently sloping denudational plains, moderately steep to steep cuesta hills, and steep to very steep homoclinal hills. The study area is composed of three lithological units, from oldest to youngest: polymict breccia, andesitic conglomerate, and sandstone units, with geological structures including joints, folds, and faults. Rock mass quality along the tunnel alignment based on the Q-System ranges from very poor to poor, while GSI classification indicates poor to moderate quality. The outlet portal slope stability analysis shows that the slope design is stable under both static and seismic conditions, with safety factor values exceeding the standards specified in SNI 8460:2017. The recommended tunnel excavation methods based on GSI classification are ripping for moderate-quality rock masses and digging for poor-quality rock masses. The recommended tunnel support system based on the Q-System consists of 2.4 m long rock bolts with spacing of 1.7–2.1 m and fibre-reinforced sprayed concrete with a thickness of 5–6 cm for poor-quality rock masses, as well as bolt spacing of 1.5–1.7 m and shotcrete thickness of 6–9 cm for very poor-quality rock masses. The results of this study are expected to serve as a reference for the planning and implementation of the Surumana Dam diversion tunnel construction to ensure safer, more effective, and engineering-geology-based design.

Keywords: diversion tunnel, Surumana Dam, engineering geology, Q-System, GSI, slope stability, tunnel support system, tunnel excavation method.