

Bendungan Rongkong merupakan bendungan serbaguna yang direncanakan dibangun di Desa Tandung, Kecamatan Sabbang, Kabupaten Luwu Utara, Provinsi Sulawesi Selatan, dengan fungsi utama untuk irigasi, penyediaan air bersih, pembangkit listrik tenaga air, dan pengendalian banjir. Perencanaan bendungan telah dilakukan oleh konsultan perencana, namun kajian geologi teknik dan kestabilan terowongan pengelak bendungan (panjang ± 570 m dan diameter 10 m) masih belum komprehensif. Sementara itu, penelitian terdahulu telah dilakukan secara komprehensif, namun terbatas pada lingkup analisis kestabilan lereng portal terowongan. Penelitian ini bertujuan untuk mengevaluasi kembali kondisi geologi teknik serta menentukan sistem penyangga dan metode penggalian terowongan secara empiris berdasarkan *Rock Mass Rating* (RMR), *Q-system*, dan *Geological Strength Index* (GSI), yang selanjutnya diuji kestabilannya melalui analisis numerik metode elemen hingga (FEM) menggunakan perangkat lunak RS2 (*Rocscience*). Daerah penelitian tersusun dari batuan beku intrusif (didominasi granodiorit dan dasit) serta batuan metamorf sekis yang terinterpretasi sebagai xenolit, dengan struktur geologi utama berupa kekar, foliasi, dan sesar geser. Sesar utama tidak memotong lintasan terowongan, namun area bukit rencana terowongan didominasi oleh batuan metamorf sekis yang memiliki foliasi sebagai bidang lemah potensial. Penilaian kualitas massa batuan membagi lintasan terowongan ke dalam tiga zona utama, yaitu Zona 1 (*inlet*) dengan kualitas sedang, serta Zona 2 (tengah) dan Zona 3 (*outlet*) dengan kualitas massa batuan cenderung baik. Berdasarkan RMR, Zona 1 direkomendasikan menggunakan sistem penyangga kelas *Fair* dengan metode penggalian *top heading and bench*, sedangkan Zona 2 dan Zona 3 menggunakan sistem penyangga kelas *Good* dengan metode penggalian *full face*. Berdasarkan GSI, metode penggalian pada seluruh zona dapat dikombinasikan dengan *blasting* karena karakteristik batuan yang relatif keras. Sistem penyangga yang direkomendasikan merupakan kombinasi *rock bolt* dan *shotcrete*, tanpa penggunaan *steel set*. Berdasarkan *Q-system*, ketiga zona direkomendasikan menggunakan perkuatan kategori 3 dengan penyesuaian perkuatan dinding berdasarkan nilai Q. Batuan pada bukit rencana terowongan bersifat akuiklud–akuifug dengan permeabilitas rendah, sehingga potensi *inflow* diperkirakan terbatas pada rembesan atau *dripping* jika dilakukan penggalian terowongan. Analisis numerik mempertimbangkan kondisi massa batuan buruk–sedang pada Zona 1, serta pengaruh *overburden* tebal dan beban tambahan tubuh bendungan pada Zona 2. Hasil analisis menunjukkan bahwa regangan dan *displacement* pada Zona 1 berada pada kisaran 1 - 2,5% terhadap diameter terowongan dengan kategori *minor squeezing problem*, sedangkan pada Zona 2 berada di bawah 1% dengan kategori *few squeezing problem*, meskipun terdapat beban tambahan dari tubuh bendungan.

Kata kunci: Terowongan pengelak, RMR, *Q-system*, GSI, metode elemen hingga, *inflow*, kestabilan terowongan.

Rongkong Dam is a multipurpose dam planned to be constructed in Tandung Village, Sabbang District, North Luwu Regency, South Sulawesi Province, with primary functions including irrigation, domestic water supply, hydropower generation, and flood control. Dam planning has been carried out by the design consultant; however, the engineering geological assessment and stability analysis of the diversion tunnel (570 m in length and 10 m in diameter) have not yet been comprehensively addressed. Previous studies have been conducted comprehensively but were limited to the analysis of portal slope stability. This study aims to re-evaluate the engineering geological conditions and to empirically determine the tunnel support system and excavation method based on the Rock Mass Rating (RMR), Q -system, and Geological Strength Index (GSI), which are subsequently evaluated through numerical stability analysis using the Finite Element Method (FEM) with the RS2 (Rocscience) software. The study area is composed of intrusive igneous rocks, dominated by granodiorite and dacite, as well as metamorphic schist interpreted as xenoliths, with major geological structures including joints, foliation, and strike-slip faults. The main fault does not intersect the tunnel alignment; however, the planned tunnel hill area is dominated by metamorphic schist exhibiting foliation that may act as potential weakness planes. Rock mass quality assessment divides the tunnel alignment into three main zones: Zone 1 (inlet) with moderate rock mass quality, and Zone 2 (middle) and Zone 3 (outlet) with both generally good rock mass quality. Based on the RMR system, Zone 1 is recommended to use a Fair-class support system with a top heading and bench excavation method, while Zones 2 and 3 are recommended to use a Good-class support system with a full-face excavation method. According to the GSI, excavation methods in all zones may be combined with blasting due to the relatively hard rock characteristics. The recommended support systems consist of combinations of rock bolts and shotcrete, without the use of steel sets. Based on the Q -system, all three zones are recommended to apply Category 3 support, with adjustments to wall support based on the Q value. The rocks at the planned tunnel hill are classified as aquiclude-aquifuge with low permeability; therefore, groundwater inflow during tunneling is expected to be limited to seepage or dripping. The numerical analysis considers poor-to-moderate rock mass conditions in Zone 1, as well as the effects of thick overburden and additional loading from the main dam embankment in Zone 2. The results indicate that tunnel strain and displacement in Zone 1 range from 1 to 2.5% of the tunnel diameter, corresponding to a minor squeezing problem, whereas in Zone 2 they remain below 1%, corresponding to a few squeezing problems, despite the presence of additional loading from the main dam embankment.

Keywords: Diversion tunnel, RMR, Q -system, GSI, finite element method, inflow, tunnel stability.