

KAJIAN STABILITAS DAN PIPING PADA BENDUNG (STUDI KASUS BENDUNG BORENG DI KABUPATEN LUMAJANG)

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ABSTRAK

Bendung merupakan infrastruktur penting dalam pengelolaan sumber daya air, khususnya untuk irigasi. Stabilitas struktur menjadi aspek krusial untuk keselamatan konstruksi dan keberlanjutan fungsi bendung. Bendung Boreng di Kabupaten Lumajang perlu evaluasi stabilitas akibat perubahan dimensi konstruksi karena keterbatasan anggaran. Penelitian ini mengkaji keamanan struktur melalui eksperimen, survei, analisis kualitatif dan kuantitatif. Pemeriksaan meliputi stabilitas guling, geser, daya dukung tanah, dan risiko erosi bawah tanah (piping) menggunakan perhitungan manual, metode Bligh, metode Lane, serta pemodelan numerik dengan Plaxis 8.6 dan GeoStudio 2024.2.1. Hasil perhitungan menunjukkan faktor keamanan guling 5,817 (normal gempa) dan 3,438 (banjir gempa), faktor geser 1,793 dan 1,181, serta daya dukung tanah 9,270 dan 9,110. Analisis piping metode Bligh menghasilkan panjang rayapan 59,540, metode Lane memberikan creep lane 5,757 (air normal) dan 8,793 (air banjir). Solusi analisis piping Bligh diperoleh panjang rayapan 63,540, Lane creep lane 6,008 (air normal) dan 9,117 (air banjir). Analisis daya dukung tanah dengan Plaxis menunjukkan kondisi aman tanpa dan dengan mini pile. Analisis piping dengan GeoStudio untuk desain eksisting dan rekomendasi juga dinyatakan aman. Bendung aman terhadap guling, geser, dan daya dukung tanah, namun belum sepenuhnya aman terhadap piping. Solusi rekomendasi adalah penambahan apron 4 meter di sisi hulu untuk memperpanjang lintasan rembesan dan meningkatkan keamanan piping.

Kata Kunci: Bendung Boreng; Lumajang; Piping; Stabilitas Struktur.

STABILITY AND PIPING STUDY ON DAM
(CASE STUDY OF BORENG DAM IN LUMAJANG REGENCY)

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ABSTRACT

Dams are important infrastructure in water resource management, especially for irrigation. Structural stability is a crucial aspect for construction safety and the sustainability of dam function. Boreng Dam in Lumajang Regency requires stability evaluation due to changes in construction dimensions due to budget constraints. This study examines structural safety through experiments, surveys, qualitative and quantitative analysis. The examination includes overturning stability, shear, soil bearing capacity, and underground erosion risk (piping) using manual calculations, the Bligh method, the Lane method, and numerical modeling with Plaxis 8.6 and GeoStudio 2024.2.1. The calculation results show a rolling safety factor of 5.817 (normal earthquake) and 3.438 (earthquake flood), shear factors of 1.793 and 1.181, and soil bearing capacity of 9.270 and 9.110. Piping analysis using the Bligh method produces a creep length of 59.540, while the Lane method produces creep lanes of 5.757 (normal water) and 8.793 (flood water). The Bligh piping analysis solution obtained a creep length of 63,540, Lane creep lane 6,008 (normal water) and 9,117 (flood water). Analysis of soil bearing capacity with Plaxis showed safe conditions without and with mini piles. Piping analysis with GeoStudio for existing and recommended designs was also declared safe. The dam is safe against overturning, sliding, and soil bearing capacity, but not yet completely safe against piping. The recommended solution is the addition of a 4-meter apron on the upstream side to extend the seepage path and improve piping safety.

Kata Kunci: Boreng Dam; Lumajang; Piping; Structural Stability.