

## INTISARI

Struktur jalan rel kereta cepat Jakarta-Bandung terletak pada elevasi yang beragam. Terdapat area transisi antara struktur rel melayang dengan struktur rel bawah tanah pada DK 2+450 hingga DK 2+540. Struktur penahan tanah tipe *diaphragm wall* digunakan untuk melindungi pekerjaan galian dan struktur jalan rel pada area transisi tersebut. Penelitian ini bertujuan untuk mengetahui stabilitas *diaphragm wall* hingga kedalaman 33 m pada titik tinjauan DK 2+500.

Data tanah dan struktur *diaphragm wall* dalam penelitian ini diperoleh dari kontraktor pelaksana. Penelitian dilakukan secara analitis menggunakan diagram distribusi tekanan tanah, dengan pemodelan numerik menggunakan Plaxis v8.6. Analisis tahapan pekerjaan galian dilakukan pada kondisi statis secara berturut-turut kedalaman -5,5 m; -9,5 m; dan -11,1 m dari elevasi muka tanah. Pekerjaan galian diikuti dengan pemasangan *strut* baja profil secara bertahap pada kedalaman 0 m; -4 m; dan -8 m dari permukaan tanah. Pada kondisi statis, struktur bekerja akibat beban tanah, beban konstruksi, serta beban kereta api yang didekati secara pseudostatis. Data *time history* gempa *benioff* Jakarta digunakan sebagai beban dinamis pada penelitian ini. Analisis bahaya *piping* pada dasar galian ditentukan berdasarkan rasio panjang lintasan air dengan perbedaan kedalaman muka air tanah pada kedua sisi galian.

Setelah dilakukan pemodelan, struktur sudah aman terhadap bahaya guling dengan syarat kedalaman minimum 15,55 m. Berdasarkan nilai *Weighted Creep Distance Ratio* (WCR) sebesar 5,70 dengan syarat minimum 5 untuk jenis tanah pasir, struktur galian sudah aman terhadap bahaya *piping*. Perpindahan yang terjadi pada elevasi dasar *diaphragm wall* menunjukkan struktur belum aman terhadap bahaya penggeseran. Momen lentur sebesar 580,14 kNm pada galian tahap 2 dan 554,99 kNm tahap 3 melebihi kapasitas struktur sebesar 533,10 kNm sehingga struktur memiliki risiko kerusakan akibat lentur. Struktur aman terhadap bahaya kerusakan akibat geser pada semua kondisi dengan kapasitas sebesar 771,69 kN. Hasil simulasi gempa selama 45 detik diperoleh momen lentur maksimum 645,74 kNm; gaya geser maksimum 687,03 kN; dan defleksi maksimum 19,98 cm.

**Kata kunci:** *diaphragm wall*; kereta cepat; tekanan tanah; analisis dinamis gempa; simulasi numeris

## ABSTRACT

*Jakarta-Bandung high-speed railway structures are divided into various elevations. The transitional area between the elevated railway and underground railway is located in DK 2+450 until DK 2+540. Diaphragm wall was built as an earth retaining system to shield the excavation site and railway structures in the transition area. The purpose of this research is to acknowledge 33 m deep diaphragm wall stability at DK 2+500.*

*The data given in this study were collected from the contractor. Analytical analysis was conducted by using earth pressure diagrams, along with numerical analysis using Plaxis v8.6. Excavation stages were consecutively calculated on static condition until -5,5 m; -9,5 m; and -11,1 m from the ground elevation. Following each excavation stage, steel struts were sequentially installed as temporal reinforcement at 0 m; -4 m; and -8 m from the ground elevation. On static condition, the structure was stressed as the impact of earth pressure, construction load, and pseudo-static approach of high-speed railway traffic load. Jakarta Benioff earthquake time history was used as earthquake load in this study. Piping hazard was analyzed based on the ratio of flow path length and difference in groundwater level.*

*As conclusion, the structure is safe against overturning based on the 15,55 m minimum depth requirement. According to the Weighted Creep Distance Ratio (WCR) of 5,7 and the required number for sandy soil is 5, excavated area is safe against the piping hazard. Displacement at the foundation of the diaphragm wall suggest the structure is unsafe against sliding. Bending moment of 580,14 kNm on the second excavation stage and 554,99 kNm on the third excavation stage exceeded structure's capacity of 533,10 kNm, therefore structures at risk of damage due to bending. Structures meet safe conditions against shear force at every stage with the capacity amount of 771,69 kN. Earthquake simulation for 45 seconds resulted in 645,74 kNm of bending moment, 687,03 kN of maximum shear force, and 19,98 cm of maximum displacement.*

**Keywords:** *diaphragm wall; high speed railway; earth pressure; earthquake dynamic analysis; numerical simulation*