



ABSTRACT

A landslide is a geological disaster often occurring in the tropics, including Indonesia. In Indonesia, for example, during the last ten years, landslide events have resulted, either directly or indirectly, in more than 537 deaths and economic losses of about US\$ 10 million annually (Tohari, 2018). A prone area for landslide was identified on the Central Java railway line which could cause damage to the double-track railway as a transportation infrastructure. To protect its railway, the identification of landslide trigger factors must be carried out and the protection work needs to be planned. This study aimed to identify landslide trigger factors, predict landslide potential, and plan protection work against landslides using geosynthetics and sheet piles.

Information was collected through field investigations and measurements based on field investigation at 3 points, geophysical surveys at 5 lines, and laboratory testing of several soil samples. Geological and geotechnical settings, topography, lithology, hydrogeology, and rainfall data of the area were analyzed to determine the factors that trigger landslides. The landslide potential is studied analytically by considering the infiltration process using the Green-Ampt equation. Meanwhile, the geosynthetics reinforced slope design is evaluated using existing equations and using the limit equilibrium method (LEM) and finite element method (FEM).

Based on the analysis results, the landslide that occurred was triggered by several factors, including the slope material dominated by clay, low intensity-long duration rainfall, and external loads from trains passing on the slope. The slope stability in the research area is influenced greatly by two types of rainfall - light rain and normal rain. The slopes around the main landslide location are predicted to fail due to continuous rain that has occurred for several days to months. To mitigate landslides, a geosynthetic reinforced slope was designed with a vertical spacing of 0.5 m and equipped with several other components, such as gabions, rip-rap, surface drainage, and surface protection. Apart from that, landslide mitigation using sheet piles was also designed as an alternative, which uses CCSP W-450 type sheet piles with an embedded length of 14 m and a free-standing length of 2 m.

Keywords: mass movement; landslide prediction; Green-Ampt; infiltration; mitigation measure