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Analisis Model Sistem Perkuatan Ground Anchor dan Soil Nailing Terhadap Stabilitas Lereng Batuan Menggunakan Metode Elemen Hingga (Midas GTS NX) = Analysis of the Ground Anchor and Soil Nailing Reinforcement System Model for Rock Slope Stability Using The Finite Element Method (MIDAS GTS NX)

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Abstrak

Pada tahun 2019, sebuah sistem perkuatan lereng ground anchor pada lereng batuan curam di Bogor, Jawa Barat dirancang untuk menstabilkan lereng di bawah struktur jembatan yang melintasi sungai. Dikarenakan kesulitan dalam tahap konstruksi maka desain ground anchor dievaluasi dan dilihat pengaruhnya terhadap stabilitas lereng. Penelitian ini bertujuan untuk menganalisis kondisi inisial lereng sebelum diberi perkuatan dan efek dari pemasangan perkuatan lereng ground anchor dan efek dari alternatif perkuatan lain berupa soil nailing. Selain itu, dilakukan variasi geometri pada perkuatan berupa letak, kemiringan dan panjang untuk melihat pengaruhnya terhadap stabilitas lereng dan mendapatkan konfigurasi pemasangan perkuatan yang efektif. Proses analisis dibantu menggunakan aplikasi berbasis elemen hingga (MIDAS GTS NX), menghasilkan faktor keamanan lereng dan pola keruntuhan. Hasil dari analisis yang dilakukan menunjukkan kondisi awal lereng memiliki nilai faktor keamanan yang melebihi standar (FK=2,019) dan terjadi keruntuhan kritis lereng yang terjadi di bagian atas lereng dengan tipe non-sirkular. Penambahan perkuatan ground anchor dan soil nailing meningkatkan nilai faktor keamanan lereng. Pemasangan ground anchor di area kaki lereng tidak menunjukkan nilai faktor keamanan yang memiliki pola kecenderungan pada rentang kemiringan 10o-30o dan cenderung menurun setelah melebihi 30o. Pemasangan ground anchor di puncak lereng menunjukkan peningkatan nilai faktor keamanan pada rentang kemiringan ground anchor 10o-30o namun cenderung menurun pada rentang 30o-45o. Letak anchor memiliki pengaruh besar pada perubahan permukaan keruntuhan kritis dan nilai faktor keamanan. Letak optimal ground anchor adalah pada lokasi dimana deformasi tertinggi terjadi. Pemasangan soil nailing di sepanjang permukaan meningkatkan nilai faktor keamanan secara signifikan. Hasil analisis soil nailing menunjukkan peningkatan nilai faktor keamanan seiring bertambahnya panjang dan kemiringan soil nailing.

.....In 2019, a ground anchor slope reinforcement system was designed to stabilize a steep rock slope in Bogor, West Java, Indonesia, beneath a bridge structure that crossed a river. Due to construction difficulties, the design of the ground anchor was evaluated, considering its impact on slope stability. This study aims to analyze the initial condition of the slope before reinforcement and the effects of implementing ground anchor slope reinforcement, as well as the effects of an alternative reinforcement method known as soil nailing. Additionally, variations in the geometry of the reinforcements, including their placement, inclination, and length, were examined to determine their influence on slope stability and identify effective reinforcement configurations. The analysis process was aided by a finite element-based software called MIDAS GTS NX, which yielded slope safety factors and failure patterns. The analysis results showed that the initial condition of the slope had a safety factor value exceeding the standard (SF = 2.019) and experienced critical slope failure at the upper part of the slope with a non-circular failure type. The addition of ground anchors and soil nailing increased the slope safety factor. When ground anchors were installed in

the foot area of the slope, the variations in geometry did not exhibit a consistent safety factor pattern within the slope inclination range of 10o-30o, and it tended to decrease after exceeding 30o. Installing ground anchors at the peak of the slope showed an increase in the safety factor within the ground anchor inclination range of 10o-30o, but it tended to decrease within the range of 30o-45o. The placement of anchors had a significant impact on changes in the critical failure surface and safety factor value. The optimal location for ground anchors was where the highest deformation occurred. The installation of soil nails along the surface significantly increased the safety factor value. The analysis of soil nails demonstrated an increase in the safety factor as the length and inclination of the soil nails increased.