DEVELOPMENT OF A CUT-SLOPE STABILITY ASSESSMENT SYSTEM FOR PENINSULAR MALAYSIA

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By

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The purpose of this research is to evaluate the accuracy of four existing slope assessment systems (SAS) in Malaysia in predicting landslides on granitic and sediment/metasediment formation slopes. The four existing SAS in Malaysia are namely Slope Management System (SMS), Slope Priority Ranking System (SPRS), Slope Information and Management System (SIMS), and Slope Management and Risk Tracking System (SMART).

Assessment on 139 slopes underlain by granitic formation from the Gunung Raya Road, the East-West Highway and the Kuala Kubu Baru – Gap Road showed that none of the existing SAS is satisfactory for predicting landslide. The most accurate prediction was made by SMART System with only 61% accuracy. For the assessment of 47 slopes underlain by sediment/metasediment formation from the Gunung Raya Road and the East-West Highway, the results showed that the accuracy produced by the SMART System was 90%, which was considered as very good prediction. None of the other three SAS gave satisfactory prediction.

Based on the accuracy evaluation above, two new SAS models were developed for the slopes in granitic formation. Using the slope database (139 cut-slopes) from the Gunung Raya Road, the East-West Highway and the Kuala Kubu Baru – Gap Road, twenty five slope parameters was analysed for development of the new SAS. Development of Model 1 using stepwise discriminate analysis found that ten slope parameters, namely; slope angle, feature area, distance to ridge, slope shape, percentage of feature uncovered, presence of rock exposure, rock condition profile, presence of bench drain, horizontal drain and sign of erosion were significant in predicting landslides occurrences. However, development of Model 2 using stepwise linear regression analysis found that only nine of the parameters (same parameters as Model 1 except without rock condition profile) were significant. The overall correct classification for Model 1 and Model 2 were 77% and 73% respectively.

In order to validate the accuracy of these two newly developed SAS, slope assessment was carried out on two sites which were different from the ones used in the development of the new SAS models. The assessment on 36 slopes underlain by granitic formation from the Kuala Lumpur – Bentung Old Road and the Tapah – Cameron Highland Road, found that the accuracy in predicting landslides by Model 1 and Model 2 is 88% and 84% respectively. Hence the degree of accuracy by the 2 newly developed models is within the accuracy produced by other previous researchers.

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan untuk ijazah Sarjana Sains.

PEMBANGUNAN SISTEM PENILAIAN KESTABILAN CERUN POTONGAN BAGI SEMENANJUNG MALAYSIA

Oleh

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Tujuan kajian in adalah untuk menilai ketepatan empat sistem penilian cerun (SAS) di Malaysia; Sistem Pengurusan Cerun (SMS), Sistem Turutan Keutamaan Cerun (SPRS), Sistem Maklumat dan Pengurusan Cerun (SIMS), dan Sistem Pengurusan dan Penjejakan Risiko Cerun (SMART) dalam meramal kejadian tanah runtuh di cerun potongan yang di dasari batuan granit dan *sediment/metasediment.*

Hasil penilaian terhadap 139 cerun potongan didasari batuan granit dari Jalan Gunung Raya, Lebuhraya Timur – Barat dan Jalanraya Kuala Kubu Baru – Gap menunjukkan tiada sebarang SAS sedia ada memuaskan dalam meramal kejadian tanah runtuh, dengan ketepatan tertinggi dihasilkan oleh SMART iaitu hanya 61%. Bagi penilaian terhadap 47 cerun potongan di dasari batuan *sediment/metasediment* dari Jalan Gunung Raya dan Lebuhraya Timur – Barat menunjukkan ketepatan yang dihasilkan oleh SMART adalah sangat baik dengan ketepatan 90%, tetapi baki tiga SAS lain tiada yang memuaskan.

Berdasarkan hasil penilaian ketepatan di atas, dua SAS baru telah dibangunkan bagi cerun potongan didasari batuan granit. Menggunakan pengkalan data cerun (139 cerun potongan) daripada Jalan Gunung Raya, Lebuhraya Timur – Barat dan Jalanraya Kuala Kubu Baru – Gap, dua puluh lima parameter cerun telah dianalisa dalam pembangunan model baru ini. Pembangunan Model 1 menggunakan analisa *stepwise discriminant* mendapati sepuluh parameter cerun (sudut cerun, luas muka cerun, jarak ke rabung, bentuk cerun, peratusan muka cerun yang terdedah, keujudan dedahan batu, profil keadaan batuan, keujudan saliran batas, keujudan saliran datar dan keujudan hakisan) memberi makna dalam meramal tanah runtuh. Walaubagaimanapun, pembangunan Model 2 berdasarkan analisa *stepwise linear regression* mendapati sembilan parameter cerun (parameter yang sama kecuali tanpa profil keadaan batuan) memberi makna dalam meramal tanah runtuh. Peratus pengkelasan betul bagi keseluruhan cerun gagal dan tidak gagal ialah 77% bagi Model 1 dan 73% bagi Model 2.

Bagi mengesahkan ketepatan SAS baru ini, penilaian cerun telah dijalankan di dua tapak berlainan dari yang digunakan untuk membangunkan dua SAS baru. Hasil penilaian ke atas 36 cerun potongan didasari batuan granit dari Jalan Lama Kuala Lumpur – Bentung dan Jalanraya Tapah – Cameron Highland, mendapati ketepatan dalam meramal kejadian tanah runtuh yang dihasilkan oleh Model 1 dan Model 2 ialah masing-masing 88% dan 84%, dalam lingkungan ketepatan yang dihasilkan oleh penyelidik terdahulu.