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Development of technologies for prediction, risk assessment and countermeasures of landslides in Korea

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Korea Institute of Geoscience and Mineral Resources (KIGAM) commenced a five-year research project titled as "Development of technologies for prediction and damage mitigation of landslides" supported by National Emergency Management Agency (NEMA), Korea since 2006. Major objectives of the project are to construct prediction map and risk map of landslides and to develop pertinent real time monitoring system and countermeasures of landslides. The previous 8-year project performed by KIGAM proposed logistic regression models for landslide prediction dependent upon lithology. The models were produced by a logistic regression analysis using data over 1,600 landslides acquired from field survey, laboratory soil tests. The logistic regression analysis selected seven landslide triggering factors that were assigned weighting values and established a formula for predicting the probability of landslide. On the other hands, the project developed a method to assess the runout distance of debris flows through natural terrain. The runout distance of debris flows in three pilot sites underlain by different lithologies were measured in the field. Only debris flows that were not interfered by other nearby debris flows were selected for the study in order to accurately qualify the distance of travel of a single landslide. Based on the results of field survey and the laboratory test, artificial intelligence methods were used to develop models for assessment of runout distance of debris flows. Because the influential factors of run-out distance are too complex to analyze one by one in a deterministic manner, a back propagation algorithm was used to characterize runout distance relative to topographic and geologic properties.

Based on the results of the previous research project, the current research project constructs landslide prediction map over five regional provinces in Korea in each year.

When the prediction maps are accomplished, risk assessment of landslides will be conducted over high susceptible areas. The results of risk assessment are presented as risk maps on a computer system. Based on the prediction map and risk map, the research team installs countermeasures based on a flexibility concept from 2008. Several types of countermeasures based on a flexibility concept will be developed considered with geological and geotechnical characteristics in Korea. They will be applied to some pilot sites of high risk. The project also develops an optimal real time monitoring system for debris flows. A wireless network based system measures pore water pressure and behavior of soils, rainfall intensity, and displacement of debris flows through natural terrain.

All the results of research are managed by an integrated system for landslide risk management which will be connected to the National Disaster Management System (NDMS) operated by NEMA. The developed results of projects will contribute to systematic and comprehensive steps to mitigate damage due to landslides in Korea.