

坡地社區智慧防災系統研發驗證－推估社區整合型監測儀器安全管理值大尺寸試驗模型建置

Validation of Slope Community Intelligent Disaster Prevention System - Estimation of Community Integrated Monitoring Instrument Safety Management Value Large Size Test Model Construction

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摘要

台灣地區因為地狹人稠，居住用地不斷往山坡地擴展。既有之坡地社區開發時間已久，當時之擋土工法與材料不見得能夠適應目前之極端氣候，其設計之服務生命週期恐怕比預期短很多；加上並無相關之檢測工作與監測設備，居民只能透過自主目視巡檢方式自保，然而隱藏在結構物或地層中之變化，實在無法透過人力觀測得到，因此進行週期性檢測與監測勢在必行。本所多年來不斷針對「山坡地社區智慧防災系統可行性研究」進行一系列研究，硬體開發之成果相當豐碩。然而實務操作上，受限於近年來因示範場址無遭受較大之降雨或地震等天災事件，且示範場址皆位於社區，無法進行大尺度之破壞型實驗，相關之破壞參數無法取得，成為本系列研究面臨之最大課題之一。另一方面由於市面既有之監測設備成本高，自行開發之監測設備耐候性亦須檢驗，因此進行用於推估社區監測儀器安全管理值之大尺寸試驗相當重要。結果顯示，於明新科大校園建置一座 2M 寬、4M 長、3M 高之土槽，於內回填現地夯實土壤，模擬自然邊坡與人工擋土邊坡，並進行降雨模擬與相關邊坡安全數據監測，包括降雨量、地下水位、地層變位、擋土牆傾斜度、裂縫變化等。結果顯示，在模擬降雨過程中，地下水位會不斷蓄積至一個程度後，邊坡才開始滑動，相當符合實際狀況，這個時間差可以做為未來應變預警的一個參考。另外本實驗採用相高紀錄頻率監測邊坡與擋土設施變化，皆可完整記錄，顯示儀器之穩定度相當高。

關鍵詞：坡地社區、邊坡安全監測、大尺寸模型試驗、坡地安全管理

Abstract

In Taiwan, because of the small area and dense population, the residential land has been expanding to the hillside. The existing hillside communities have been developed for a long time, and the retaining method and material at that time may not be able to adapt to the

current extreme climate, and the service life cycle of the design may be much shorter than expected; in addition, there is no relevant inspection work and monitoring equipment, and the residents can only protect themselves by independent visual inspection, but the hidden changes in the structures or strata cannot be detected by human observation, so periodic inspection. Therefore, it is imperative to conduct periodic inspection and monitoring. For many years, the Institute has been conducting a series of studies on the feasibility study of hillside community intelligent disaster prevention system, and the results of hardware development are very fruitful. However, the practical operation is limited by the fact that in recent years, the demonstration sites have not been subjected to major natural disasters such as rainfall or earthquakes, and the demonstration sites are all located in the community, so large-scale damage experiments cannot be conducted, and the relevant damage parameters cannot be obtained, which is one of the biggest problems faced by this series of studies. On the other hand, due to the high cost of existing monitoring equipment in the market, the weather resistance of self-developed monitoring equipment must also be tested, so it is important to conduct large scale tests for estimating the safety management value of community monitoring equipment. The results showed that a 2M-wide, 4M-long, 3M-high soil tank was built on the campus of Ming Shin University of Science and Technology and backfilled with compacted soil in situ to simulate natural slopes and artificial retaining slopes, and rainfall simulation and related slope safety data monitoring were conducted, including rainfall, groundwater level, ground level change, retaining wall slope, and crack change. The results show that during the rainfall simulation, the groundwater level will accumulate to a certain level before the slope starts to slide, which is quite in line with the actual situation, and this time difference can be used as a reference for future contingency warning. In addition, the experiment used a high recording frequency to monitor the changes of the slope and retaining facilities, and all of them can be recorded completely, which shows that the stability of the instrument is very high.

Keywords : Hillside Residential Communities, Monitoring, Large-scale Model Test