

## 應用三維雷射掃描與 GIS 於邊坡穩定分析之研究

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**摘要** 本研究介紹應用三維雷射掃描獲取邊坡三維地形資訊，以及在地理資訊系統架構下進行邊坡穩定分析的方法。經由邊坡實測經驗，證實三維雷射掃描安全且快速的測量方式，可改善傳統測量上操作繁複且耗費人力的缺點，減少作業時間與簡化作業流程。掃描資料可建置成數值高程模型展示於地理資訊系統中，其結果顯示掃描所得之高精度的「點雲」資料，能有效掌握原始的邊坡坡型。在邊坡穩定分析上，本研究於 GIS 架構下，開發了「三維邊坡穩定分析模組」，能計算邊坡三維安全係數。本研究以實測邊坡進行三維與二維的邊坡穩定分析以進行比較與驗證，其成果顯示三維計算所得之安全係數均大於二維分析結果，且搜尋之崩塌滑動面位置大都相當接近。分析結果也顯示崩塌寬度也會影響計算的結果，增加滑動面寬度將使安全係數降低。

**關鍵詞：**三維雷射掃描、地理資訊系統、邊坡穩定分析。

## An Application of Three-dimensional Laser Scanning and GIS on Slope Stability Analysis

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**ABSTRACT** This study introduces the application of 3D laser scanning on topography surveying for slopes, and the method of GIS-based 3D slope stability analysis. Operating the 3D laser scanning is both quick and safe. Compared to conventional surveying work, it can reduce surveying time and total workforce. The DEM data of slopes can be established in GIS from the high resolution “point cloud” data obtained by 3D laser scanning. Therefore, landforms of slopes can be effectively captured for further slope analyses in GIS. This study developed a GIS-based 3D slope stability analysis program, called “3D slope stability analysis modulus”. The modulus can compute a factor of safety for given slopes in GIS. After analysis of a scanned slope, the results of the factor of safety show the factor of safety for 3D analysis are larger than those of 2-D analysis and most of the 3D sliding surfaces searched by the modulus are close to those of the 2-D slide surfaces. It is also found that the selection of the width of a sliding surface for 3D analysis will influence the factor of safety in that increasing the width of a sliding surface will result in decreasing the factor of safety.

**Key Words:** 3D laser scanning, geographical information system, slope stability analysis.

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