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ABSTRACT: Numerical Solution for Problematic Photogrammetrically-Derived Digital Elevation Models and the Consequences for Slope Stability Analysis

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Heavy rainfall in February 2019 resulted in a shallow landslide along the outboard edge of Old La Honda Road in San Mateo County, California. Stormwater flowed across the gently sloping road towards the shoulder, saturated the downslope soils, and led to the slope failure of the fill prism and uppermost weathered bedrock. CE&G collected Unmanned Aerial System photos along the densely-canopied road and landslide on two occasions: 1. shortly after the slide with two county-provided control points (CPT) (M1); and 2. three weeks after initial collection to collect six new CPTs (M2). Establishing GNSS control under a canopy can be difficult. M1's two CPTs are located on the road above the slide leaving the downslope of the photogrammetric model to be solved by geometric algorithms. The resulting model contained a nonexistent 15-foot elevation differential over ~55 feet along the road. M2 used six new CPTs solving a model with a more realistic 2-foot elevation difference between the original two CPT locations. If M1's structure was "correctly" solved in the horizontal directions, then a horizontal-axis rotation brings the CPT-location elevations within given error. As the model rotates, the embankment slope angle changes, potentially contaminating slope stability analyses. The resulting M1 slope angle is compared to that of M2 and determines the threshold at which a rotation invalidates the derived slope. This study uses a deterministic limit equilibrium method with both results to evaluate slope stability and determines the magnitude of influence the horizontal-axis rotation has on the slope stability analysis.