Surveying & Georeferencing Historical Buildings using Laser Scanners
Luis Landaverde\textsuperscript{1}, Mohammed Algasem\textsuperscript{2}, Ahmed Elaksher\textsuperscript{2}
\textsuperscript{1}ETSE, NMSU, \textsuperscript{2}NMSU

Generating 3D models of historical buildings and sites requires powerful techniques to capture and digitally model their fine geometric and appearance details. Recently, remote sensing technologies have been used in surveying and monitoring historical monuments. In addition, they have stimulated a great interest in their applications in documenting heritage and archaeological objects. One of the major technologies in remote sensing is laser scanning. Unlike traditional surveying techniques that often show inadequacy when presented with the challenge of producing highly accurate results, terrestrial laser scanners have been shown as being a possible solution for the growing demand of accurate 3D geometrical data.

In this article, we present the results of georeferencing point clouds generated by a terrestrial laser scanner into state plane/NAVD88 coordinates. Our test site was one building on the NMSU campus. We first designed, built, and evaluated a local traverse around the building and connected the traverse horizontally to surrounding state plane control points and vertically to NAVD88 benchmarks. Scanning targets were then placed on the building and surveyed with reference to the local traverse. We then scanned the building from different stations having enough overlapping tie points to tie the different scans together and to georeference the point cloud created by the scanner. Several 7 parameter transformations were used to tie the scans and place them in the state plane/NAVD88 coordinates. Results are reported for the accuracy of the point cloud registration. In addition, we present the benefits of the laser scanners over photogrammetry in scenario of objects with low texture, images with poor quality, shadows and occlusions arising from surface discontinuities.