The application of traditional traverse control using a Terrestrial LASER scanner, a case study of the Gold Hill Scheduled Monument, Shaftesbury, Dorset UK

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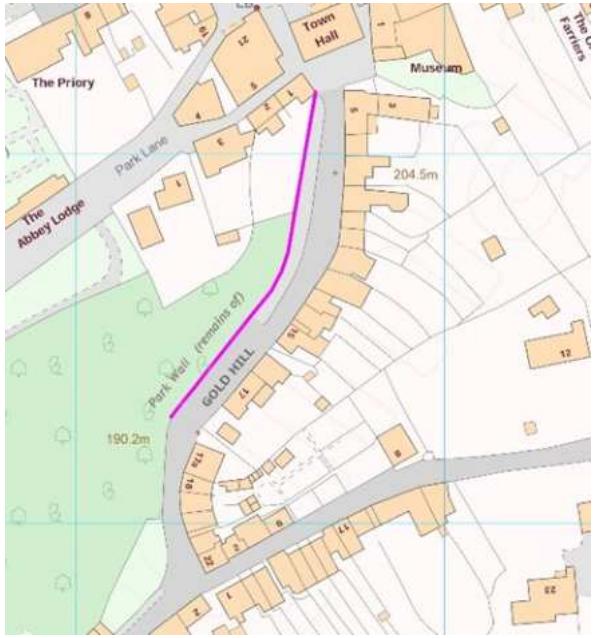
Introduction

This research develops work done over the last 2 years looking at optimising the preformance of scanning in the field.

In the last study the use of pivot fixed prisms was considered to reduce site time and allow repeatable reference points, this had several benefits saving time, manual handling and generating fixed references, on the scheduled monument at Gold Hill, Shafesbury (see opposite).

At the time investigations had begun into using the scanning points for traverse control



Past work

- The focus of the research has been in the main to introduce control and look to maximise field time and reduce post data correction work. The work manifested itself into two distinct areas of application:

1. Field operation of the instrumentation
2. Survey control utilising a variety of control targets systems (See Opposite)

Data Collection for the Traverse Control

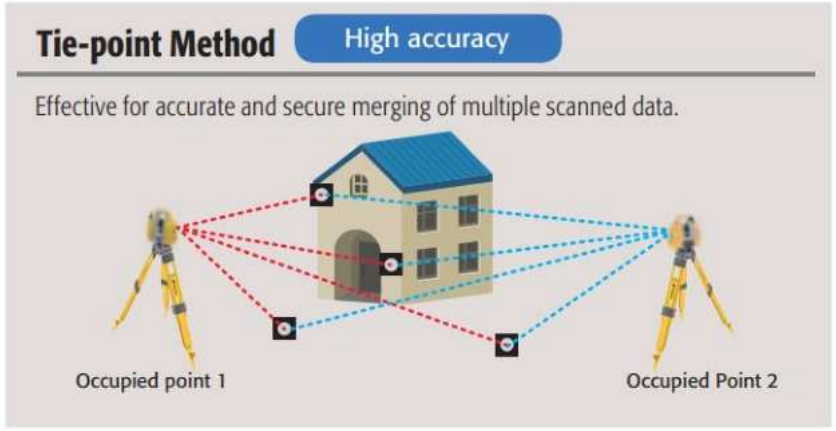
- The data was collected on 3 separate visits to the site, in each visit a further aspect was explored to advance the student learning experience. The site visits took place on:
- 4th May 2022
- 26th January 2023
- 10th September 2023
- The visits have been arranged to undertake assessment during different seasons and weather conditions, noting that the scanner is not used below freezing or in periods of heavy precipitation.

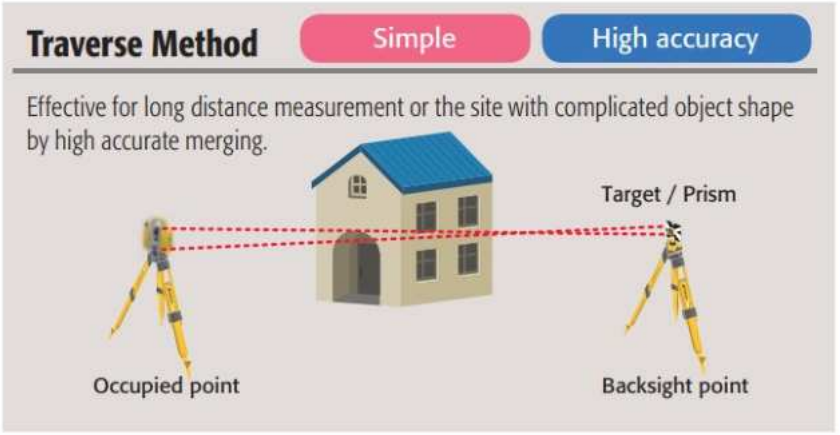
Equipment

- The LiDAR scanner used was a Topcon GLS-2000
- Scanner can operate at 135,000 points a second with up to 350m
- Tie points established using elevating targets with circular flat reflective target faces
- Traverse measurements taken with a circular retro-reflective prism
- Total station used to perform check measurements on-site, providing validation of the results

On-site Data Collection Processes

- Walk around of site and position of setups determined
- Targets and tripod setups installed at identified locations
- Scanner installed on top of tripods and point cloud data collected
- Target data measured
- Prism measurements recorded and checked against coordinates provided by the total station
- Scanner position moved and process repeated until all data was collected

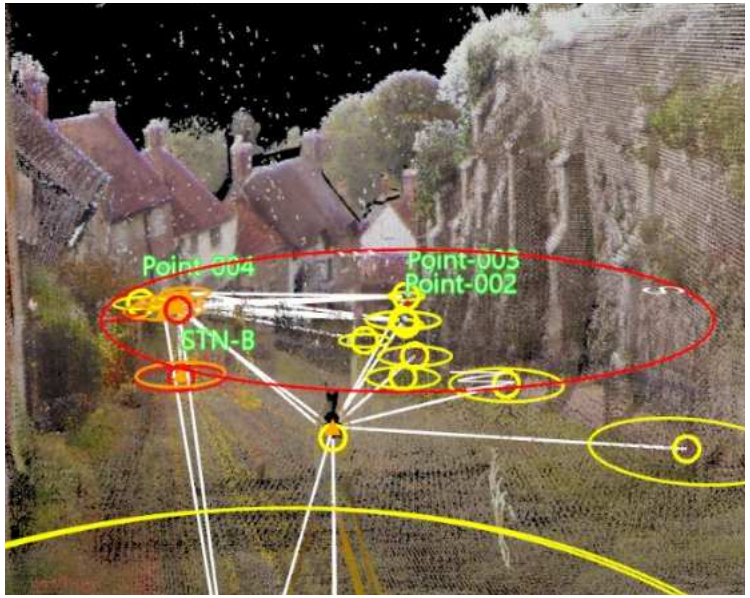


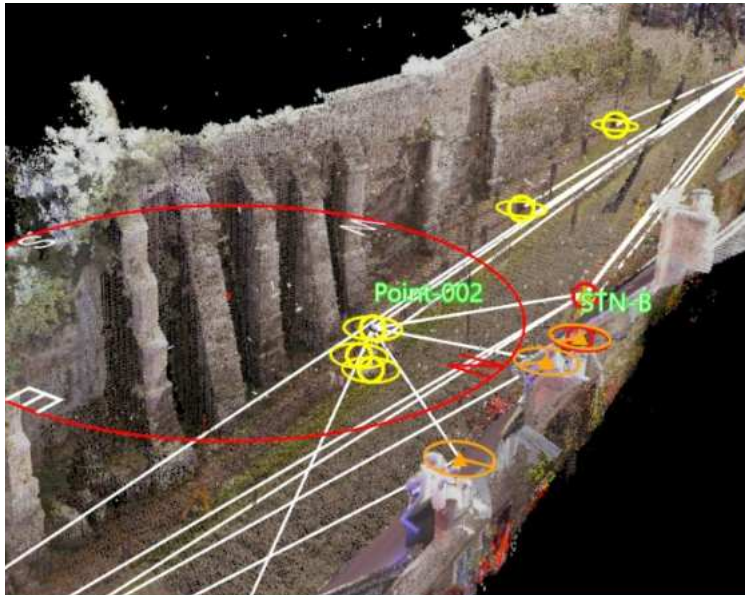


(Topcon, 2015)

Data Editing and Results

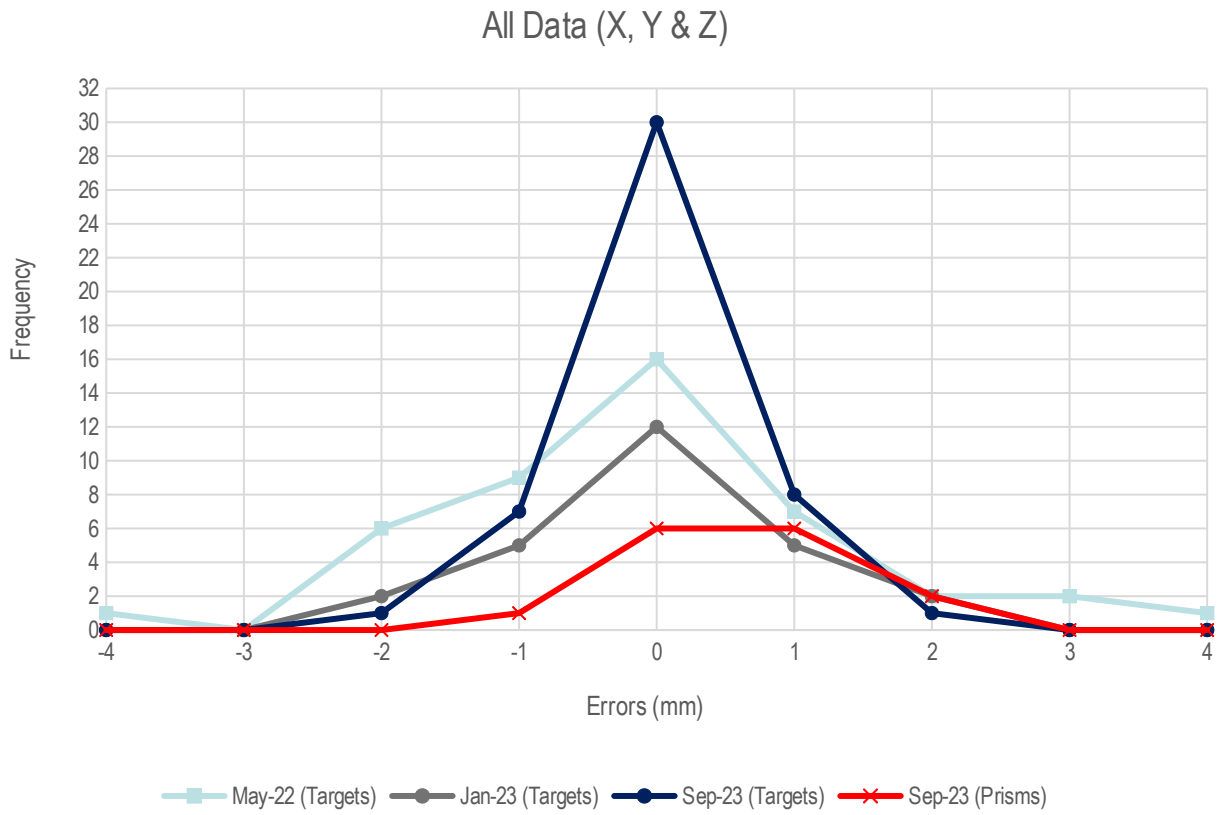
- Data extracted and edited using Magnet Collage
- Targets were registered using the software
- Traverse measurements were imported and registered separately
- Registration processes for both traverse and prisms produced accuracy reports which provide the raw results
- Results imported into graphs to provide a better visual representation of trends





Data Analysis

- Majority of target-based errors were recorded in X and Y
- This could be due to limited horizontal displacement of targets on-site
- Prism-based method was significantly more accurate than target-based in X and Y but less accurate in Z
- Vertical errors could be due to manual measurements of station heights
- Target-based method takes longer and requires more equipment than traverse method
- Target-based provides more redundant data



Conclusion & Further Research

- With the limited data clear advantages can be seen in adopting a traverse approach with the LASER Scanners.
- The validation using a Monitoring Station confirms that working tolerances are easily achieved
- The are significant time savings both in the field and the post processing
- The need to position numerous targets and undertake manual handling is significantly lowered

- Further work should consider “geotagging “ the scan positions and further stations should be included to provide for bracing and additional redundancy

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Any Questions?

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