

HOVERMAP ACCURACY EVALUATION



ACCURACY | POSTS & POLES

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ACCURACY EVALUATION

Lightweight, easy to use, and deploy, the versatile Emesent Hovermap mobile LiDAR scanner is changing the way that people think about the collection of high-resolution 3D data.

In this study, we utilize Hovermap in a close-range walking scan to examine point cloud accuracy across a several rectangular (posts) and cylindrical (poles) targets in effort to better understand potential system performance in such environments.

These results confirm that Hovermap is capable of achieving high-resolution and millimeter accuracy on both rectangular and cylindrical targets when deployed in a close-range walking scan.

METHODS

Direct measures and a single, close-range, walking scan was conducted on three post and three cylindrical targets (Figure 1).



Figure 1

The six targets imaged in this study including (a) Post1 and DrainPipe, (b) Post2, (c) Post3, (d) PowerPole1 and (e) PowerPole2.

Direct measurements of posts and a DrainPipe were achieved using calipers with PowerPoles measured using a tape measure (Figure 2). To facilitate accurate comparisons, care was taken to record the vertical position of each measure.



Figure 2

Direct measures of (a) posts and drainpipe with calipers and (b) poles with a tape measure.

Hovermap was then deployed across the study area to perform a close-range walking scan (Figure 3). The acquired point cloud is shown as Figure 4.

The point cloud was then 'cleaned' using CloudCompare, and a comparative analysis with Cyclone 3DReshaper software was performed.

Specifically, planar cross-sections of each target were sampled at 1.5m intervals (Figure 5a), and a 'best-fit' rectangle, or circle, was applied (Figure 5b).



Figure 3
Hovermap LiDAR was utilized in a close-range walking scan.

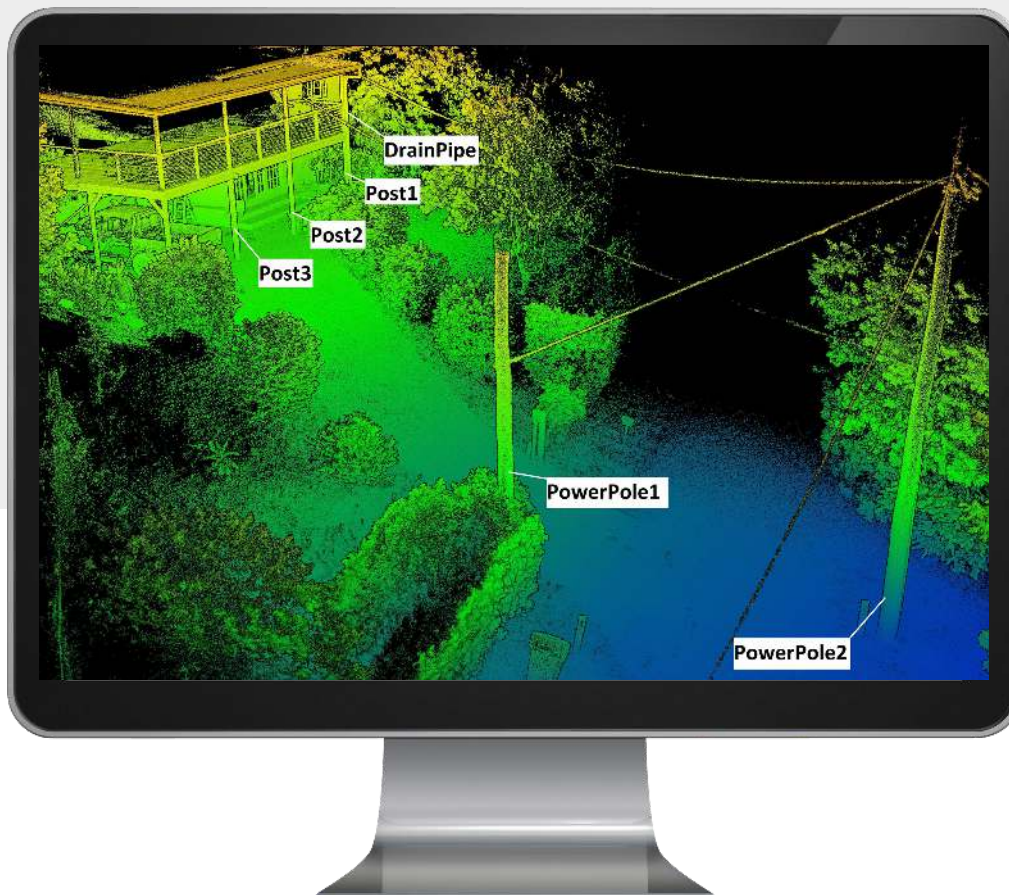


Figure 4
Hovermap point cloud obtained.

RESULTS

With a mean scanning range of $2.9 \pm 0.5\text{m}$, a very high resolution point cloud was obtained on each target by Hovermap and resulted in an overall point sample distance (i.e. average distance between points) of $0.004 \pm 0.001\text{m}$ (Table 1). This facilitated accurate comparisons between the direct and Hovermap measures and resulted in a total mean variance of $0.002 \pm 0.002\text{m}$ (Table 2).

These results indicate that Hovermap is capable of achieving high resolution and accuracy on both rectangular and cylindrical targets when deployed in a close-range walking scan.

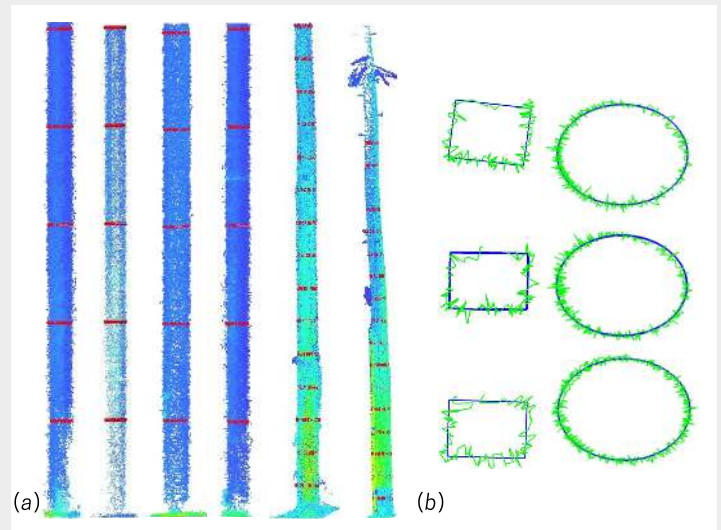


Figure 5 Point clouds of the (a) six targets imaged in this study with 1.5m planar cross-sections (red) and (b) example best-fit rectangles and circles at heights corresponding to the direct measure of each target. Images not to scale.

Table 1 Descriptive point cloud statistics for each target

TARGET	MEAN RANGE	POINT CLOUD DENSITY	POINT SAMPLE DISTANCE
POST1	$2.790 \pm 1.590\text{m}$	$76,006\text{pts}\cdot\text{m}^{-2}$	$0.004\text{m}\cdot\text{pt}^{-1}$
POST2	$2.549 \pm 1.302\text{m}$	$35,425\text{pts}\cdot\text{m}^{-2}$	$0.005\text{m}\cdot\text{pt}^{-1}$
POST3	$2.471 \pm 0.993\text{m}$	$43,831\text{pts}\cdot\text{m}^{-2}$	$0.005\text{m}\cdot\text{pt}^{-1}$
DRAINPIPE	$2.754 \pm 1.555\text{m}$	$87,890\text{pts}\cdot\text{m}^{-2}$	$0.003\text{m}\cdot\text{pt}^{-1}$
POWERPOLE1	$3.866 \pm 1.244\text{m}$	$36,565\text{pts}\cdot\text{m}^{-2}$	$0.005\text{m}\cdot\text{pt}^{-1}$
POWERPOLE2	$3.000 \pm 1.392\text{m}$	$80,951\text{pts}\cdot\text{m}^{-2}$	$0.004\text{m}\cdot\text{pt}^{-1}$
Mean	$2.905 \pm 0.507\text{m}$	$80,951 \pm 24,031\text{pts}\cdot\text{m}^{-2}$	$0.004 \pm 0.001\text{m}\cdot\text{pt}^{-1}$

Table 2 Comparison of *Direct* and *Hovermap (HVM)* measures with observed variance

TARGET	DIRECT-1	HVM-1	VARIANCE-1	DIRECT-2	HVM-2	VARIANCE-2
POST1	0.087m	0.081m	0.006m	0.087m	0.084m	0.003m
POST2	0.087m	0.079m	0.008m	0.087m	0.083m	0.004m
POST3	0.108m	0.100m	0.008m	0.091m	0.079m	0.012m
DRAINPIPE	0.045m	0.043m	0.002m			
POWERPOLE1	0.133m	0.129m	0.004m			
POWERPOLE2	0.169m	0.170m	0.001m			

Total Variance Rectangles: $0.005 \pm 0.004\text{m}$

Total Variance Cylinders: $0.007 \pm 0.003\text{m}$

Total Mean Variance: $0.002 \pm 0.002\text{m}$