# LiDAR Mapping

# EXECUTIVE SUMMARY

## What is Mobile LiDAR Mapping?

LiDAR stands for Light Detection and Ranging. It is an active remote sensing method that uses a laser to measure ranges (variable distances) to the surrounding environment. When the laser is combined with GPS and Inertial Navigation System (INS) data, a precise dimension, shape, and location on Earth is generated in 3D.

Mobile LiDAR is used to map corridors from the street level with high accuracy. Roads, highways, and railways can be mapped at high speed without disturbing traffic.

LiDAR is ideal for a future-proof technology which helps with planning and maintaining the utility industry. Use of LiDAR and imagery benefits multiple groups within the utility industry, including engineering, construction, encroachments, and aerial line maintenance.

Mobile LiDAR benefits include a high density, high accuracy geospatial dataset, rapid documentation of existing conditions, and it offers the ideal solution for extracting street features such as lines, polygons, and points.

## Street Level LiDAR:

- Used for general layout of blocks (street view-up)
- High density and high accuracy
- All street features are visible and can be extracted
- Best tool for corridor mapping

## How We Use Mobile LiDAR Mapping at BPG?

BPG offers a spatial GIS-centric, comprehensive yet scalable solution to survey, map and track assets and infrastructure by using a combination of general surveying, mobile LiDAR, static scanners, and UAS's to perform asset management data collection tasks. This includes everything from striping on roadways to above ground utilities, tree inventories, signs, poles, pole connections, streetlights, traffic cabinets, buildings, and facility footprints (interior and exterior) and can even assist with American Disability Act (ADA) compliance such as sidewalk slopes.

BPG has extensive experience in the collection and processing of massive amounts of geospatial information. With a fleet of two Mobile Lidar Scanners and a technical staff of engineers, surveyors, GIS specialists, and project managers, BPG can effectively manage, control, and produce the information and value-added products required from a mobile mapping system.

## How Do We Use Mobile LiDAR Mapping at BPG (continued)

Our company utilizes survey-grade laser scanners to provide exact dimensions and measurements of large-scale projects, such as roadways, sites, plants, and facilities. Project managers provide custom quotes and quickly mobilize to laser scan each site. We work closely with you to make your project successful, delivering accurate data to expedite project planning and prevent costly rework.

With the field survey data by mobile LiDAR, GPS & UAS, we offer mapping, surveying and modeling for roads, highways, and railway corridor projects. Also, we process data for irrigation & dam, industrial area, power plants, transmission, smart cities, railways, ports, and airports.

Our mobile mapping systems are the perfect solution when a massive amount of asset data must be collected in a short amount of time. By mounting a mapping system with various integrated sensors (GNSS, laser scanner, camera, IMU, wheel encoders) to a vehicle, users get all field data quickly. We drive at normal speeds and get locations and visual detail of all roadside features, with no need to revisit the field for missing points. Simple office software can then be used for viewing, processing, projecting and exporting data for GIS or CAD software.

## Benefits:

- Safety: Collection at posted highway speeds without risking personnel in traffic to collect road/rail/survey data
- Collection Efficiency: Faster by up to 50x than conventional acquisition means
- Accurate Positional Processing: Integrating survey control, GPS, and IMU data
- Product Delivery: Delivered in standard formats immediately available in CAD or other software packages
- Cost and Schedule Effective: Virtual survey means no return to the field to pick up additional features
- 3D Visualization Excellence: Accurate and complete detail capture of structures, roads, infrastructure, etc.

In addition to the automated data processing workflows listed above, it is possible for BPG to customize its algorithms and reports to extract other types of data. Please feel free to reach out if you would like to see what is possible.

With the comprehensive data collected, BPG and our partners can tailor reports to fit the specific needs of our clients. While data is crucial to the process, it is not what decisions are based on. BPG and our partners provide the report as information side by side with relevant standards. This report allows decision makers to quickly discern which attributes are not within standards, while also giving the reader a more thorough understanding of how severe any failure is. BPG goes beyond the data collected by our LiDAR systems. With the help of our partners, we can incorporate additional factors that can affect the severity of issues. Some of these additional factors can include proximity to schools, government buildings, parks, bus stops, and much more. The algorithm used to determine the overall severity of issues can be customized to fit the individuality of community's priorities.



## Example Compliance Report
### Public Rights-of-Way
### (Curb Ramps)

| Intersection ID: | 104 | Main Street: | Main St | Cross Street: | E 2nd St | Location: SW |
| ADA ID: | 5000 | Ramp Type: | Perpendicular | Overall Compliance: No | Severity Score: | 41.25 |

| Existing Access Barrier and Possible Solution | | Codes/Mitigation Info | Field Measurements/Component Compliance | | | | | | |
|---|---|---|---|---|---|---|---|---|---|

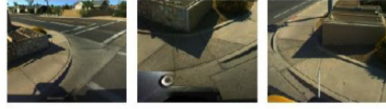Possible Solutions: Remove and replace with Mag No. 236-4

Surveyor Notes: No Landing

Street 1 Name: Main St
Stop Condition - Street 1: Signal
Street 2 Name: E 2nd St
Stop Condition - Street 2: Signal

PROW/ADA: R304.2.1, R208, R304.5.1

Total Cost: $ 2200

| Compliance | Description | Data | Standard | Compliance | Description | Data | Standard |
|---|---|---|---|---|---|---|---|
| N/A | Ramp Length LT (in) | N/A | | N/A | Ramp Length RT (in) | N/A | |
| N/A | Ramp Width LT (in) | N/A | >=48 | N/A | Ramp Width RT (in) | N/A | >=48 |
| N/A | Ramp Slope LT (%) | N/A | <=8.3 | N/A | Ramp Slope RT (%) | N/A | <=8.3 |
| N/A | Ramp X Slope LT (%) | N/A | <=2.0 | N/A | Ramp X Slope RT (%) | N/A | <=2.0 |
| N/A | Ramp Length (in) | 54.9 | | | | | |
| No | Ramp Width (in) | 47.6 | >=48 | | Grade Break? | No | |
| Yes | Ramp Slope (%) | 5.5 | <=8.3 | N/A | Grade Break Slope % | N/A | |
| Yes | Ramp X Slope (%) | 1.3 | <=2.0 | N/A | Grade Break Slope X % | N/A | |
| | Flare Type LT | | | | Flare Type RT | | |
| Yes | Flare Slope LT (%) | 5.5 | <=10.0 | Yes | Flare Slope RT (%) | 2.3 | <=10.0 |
| Yes | Flare Traversable LT? | Yes | Yes | Yes | Flare Traversable RT? | Yes | Yes |
| N/A | Landing Length (in) | N/A | >=48 | No | Domes Provided? | No | Yes |
| N/A | Landing Width (in) | N/A | >=48 | | Domes Contrast? | N/A | Yes |
| N/A | Landing Slope (%) | N/A | <=2.0 | N/A | Domes Length (in) | N/A | >=24 |
| N/A | Landing X Slope (%) | N/A | <=2.0 | N/A | Domes Full Width? | N/A | Yes |
| N/A | Landing Curb? (Y/N) | Yes | | N/A | Domes Offset (in) | N/A | 1.6-2.4 |
| N/A | Shared Landing? | No | | | | | |
| Yes | Gutter Ponding? | No | No | Yes | Counter Slope (%) | 0.7 | <=5.0 |
| Yes | Gutter Lip Ht (in) | 0 | 0 | Yes | Counter X Slope (%) | 0.6 | <=2.0 |
| N/A | Painted X Walk1? | Yes | | N/A | Painted X Walk2? | Yes | |
| | X Walk 1 Direction | N | | | X Walk 2 Direction | E | |
| Yes | X Walk 1 Width (in) | 120 | >=72 | Yes | X Walk 2 Width (in) | N/A | >=72 |
| Yes | X Walk 1 Slope (%) | 1 | <=5.0 | No | X Walk 2 Slope (%) | 6.3 | <=5.0 |
| Yes | X Walk 1 X Slope (%) | 0.4 | <=5.0 | Yes | X Walk 2 X Slope (%) | 0.5 | <=5.0 |
| Yes | Ramp inside XWalk1? | Yes | Yes | Yes | Ramp inside XWalk2? | Yes | Yes |
| | Road Slope (%) | 0.4 | | Yes | Clear Space? | Yes | Yes |
| | Road X Slope (%) | 1 | | Yes | Clear Space to XWalk (in) | 60 | |
| No | Obstruction? | Yes | No | Yes | Storm Grate/Utility Hazard? | No | No |
| | Obs. Type | SRP Well | | N/A | Storm Grate/Utility Type | | |
| Yes | Surface Condition? (G/P) | Good | Good | | | | |

This reporting is one of the greatest benefits of partnering with BPG. The knowledge gained from this reporting allows leaders to make informed decisions quickly and accurately. Time, money, and resources can be directed to where they will provide the greatest benefit to the community based on a fair and transparent process.

Another benefit of the technology and software used by BPG is that our analysts can compare the LiDAR cloud side-by-side with panoramic images taken during collection. The allows our analysts to work in the best environment for their task.



Side by side view of point cloud and images

**BPG's Mobile LiDAR System**

### Scanner – TopCon IP-S3

This mobile mapping system offers high-density, high-precision point clouds, combined with high-resolution panoramas from a smaller, lighter system that is easier to handle.

The IP-S3 positioning system integrates an Inertial Measurement Unit (IMU), GNSS receiver (GPS and GLONASS), and a vehicle odometer. It provides precise positioning and attitude in a dynamic environment.

The rotating LiDAR sensor captures the environment with a rate of 700,000 pulses per second. During each rotation, the 32 internal lasers cover the full 360 degrees around the system, each from a slightly different viewing angle. This minimizes gaps in the point cloud which arise from obstacles or dead angles and removes the need for multiple scanners.

With a six-lens digital camera system the IP-S3 provides 360-degree, high-resolution spherical images that allow easy feature recognition. Mobile Master Office software handles all post-processing trajectories and georeferencing scans and images.

- Ultra-compact design
- Minimized scanning shades from multiple lasers
- Unparalleled ease of use
- Factory calibrated
- Full integration of clouds and images

### Processing Software – MAGNET Collage

Process, combine and analyze multi-source point cloud data from traditional survey instruments as well as reality-capture laser scanners, mobile mapping systems and UAVs. Easily export to industry-standard modeling or CAD software or directly publish online with MAGNET Collage Web for improved collaboration among stakeholders. Leverage survey control points or known geographical coordinates to further accelerate dataset processing.

- Combine mobile and static scan data into one immersive 3D environment
- Faster point-cloud processing and reality capture data handling
- Combine civil, mapping, BIM and survey data
- Advanced matching and ground-control functionality for a variety of sensors
- Extensive projections and geoid exports
- Segment and reduce point clouds to export to third-party software

### Feature Extraction Software – Orbit GT

Complete mapping unit for Image, LiDAR and DSM mapping process features and results in semi- or full automated mode document assets, centralize data management roles and permissions for teamwork.

The 3DM Feature Extraction product has no parallel anywhere in the world: a smart set of displaying and measuring tools combined with a dedicated user interface for every type of 3D mapping

data allows every user to browse efficiently through all types and sizes of mobile, indoor, oblique, uas, and terrestrial mapping content in very little time.



Reference photo credit: https://orbitgt.com/products/3dm-feature-extraction/
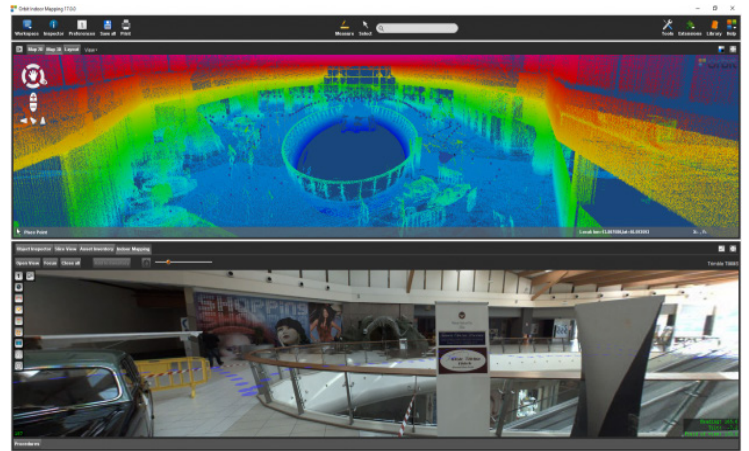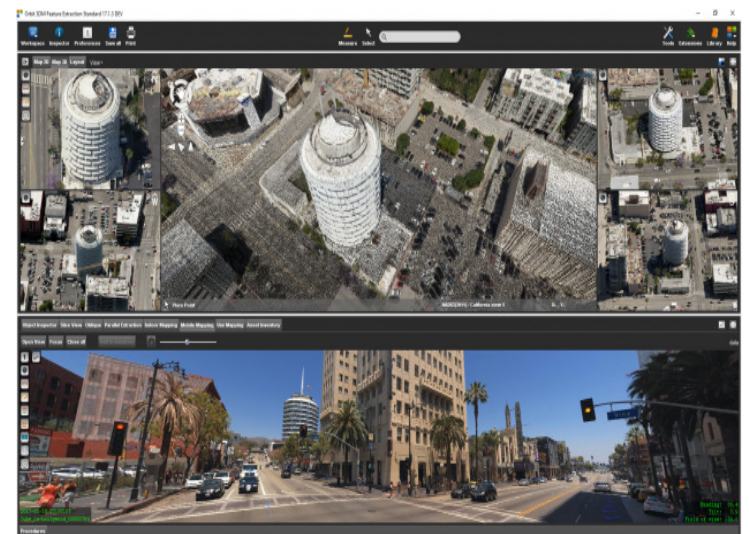


Along with assisting procedures to define the perfect set of parameters, as well as a complete verification procedure to QC afterward, the 3DM Feature Extraction Pro product comes with full automated detection tools for poles, traffic signs and shapes. Results are stored in your database with all required metadata such as ground position, height, snapshot, the shape of the sign, etc.
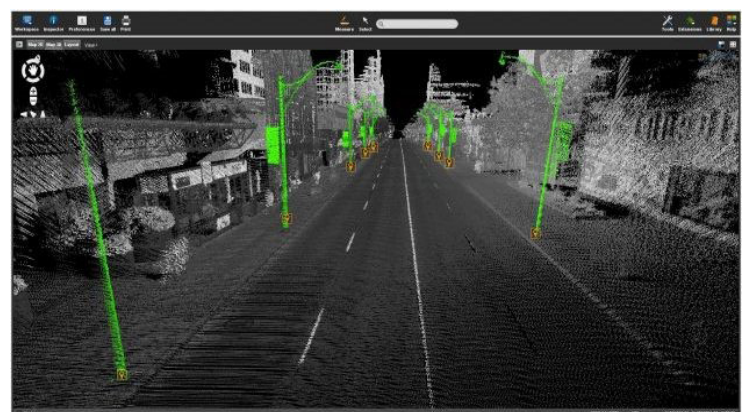
# Contact Us

BPG offers a spatial GIS-centric, comprehensive yet scalable solution to survey, map and track assets and infrastructure by using a combination of general surveying, mobile LiDAR, static scanners, and UAS's to perform asset management data collection tasks. This includes everything from striping on roadways to above-ground utilities, tree inventories, signs, poles, pole connections, streetlights, traffic cabinets, buildings, and facility footprints (interior and exterior). Let us assist you in building your Smart City.

We also have many years of experience assisting cities with better fiber optics network documentation and tracking to provide risk assessments, predictive analysis, planning, and action-oriented decision-making abilities. Feel free to contact BPG at info@BPGdesigns.com or contact one of our experts directly with any questions you might have.