

Mobile Mapping System Workflow for Roadway Asset Inventories

SUMMARY

This document describes the workflow for quickly mapping an existing roadway corridor; analyzing and extracting pertinent features; and exporting mapped features to GIS and CAD software for asset inventory, maintenance planning, and design purposes.

Topcon's IP-S2 3D Mobile Mapping System is used to quickly map an existing roadway. Collected data is processed with Geoclean software. Using specialized Spatial Factory software, the engineer, GIS technician, or planner can view existing conditions in 360° spherical images, and map the geospatial position of features from a high-accuracy LiDAR point cloud. Once the features are mapped, they can be exported to GIS and CAD software programs for further analysis and utilization.

This workflow is demonstrated by a study of a major intersection that is experiencing heavy traffic flow and congestion.

INTRODUCTION

Planning improvements and maintenance to existing developed roadways within transportation corridors requires intensive study and analysis. An accurate inventory of existing assets and pertinent data is needed to successfully schedule maintenance operations or plan, design, and estimate the cost of improvements.

These assets include traffic signals and control boxes; light poles and fixtures; street and traffic control signs; street trees, landscaping, and irrigation; above-ground utility installations such as water meters, fire hydrants, etc.; and site amenities such as benches and bollards. Off-site features that may have an impact on planned improvements are also important. Essential information that must be obtained about surface assets includes feature type, geospatial location, and condition.

Prior to the introduction of mobile mapping systems, the inventory of existing assets was typically accomplished on foot. This labor intensive and costly process requires personnel to walk within vehicular traffic areas carrying a GPS data collector, camera, measuring tape, and notebook. Extensive back-office work is required to correlate information, enter data into analysis, planning, and design software, and create an inventory database. Frequently items were missed during the field work or project requirements expand, requiring the technician to return to the site.

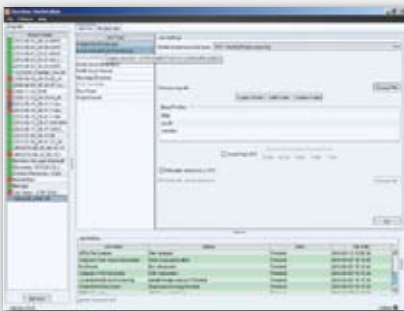
Mobile mapping systems eliminate many of the drawbacks of conventional methods for asset collection and inventory. One person can travel the corridor at normal roadway speeds from a safe location inside a vehicle. All necessary information is collected in one pass, eliminating return trips to the field. Back-office work is substantially reduced. All data and information is collected, stored, and transmitted in digital format, eliminating the need for paper documents. The result is an exponential increase in productivity and decrease in costs.

WORKFLOW

1. Map an existing corridor



2. Process Data



3. Analyze Data and Extract Features

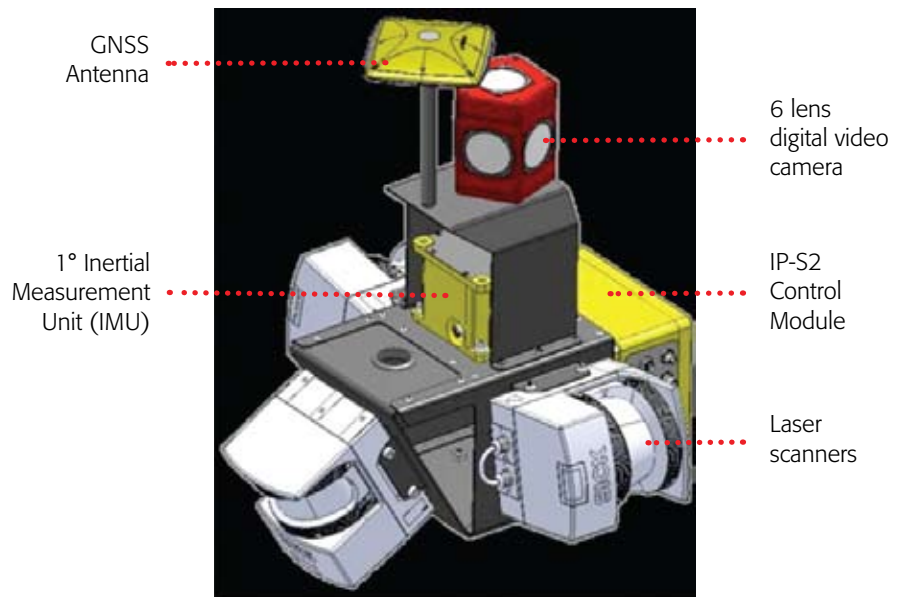


4. Inventory, plan & design in GIS & CAD



1. MAPPING AN EXISTING ROADWAY CORRIDOR

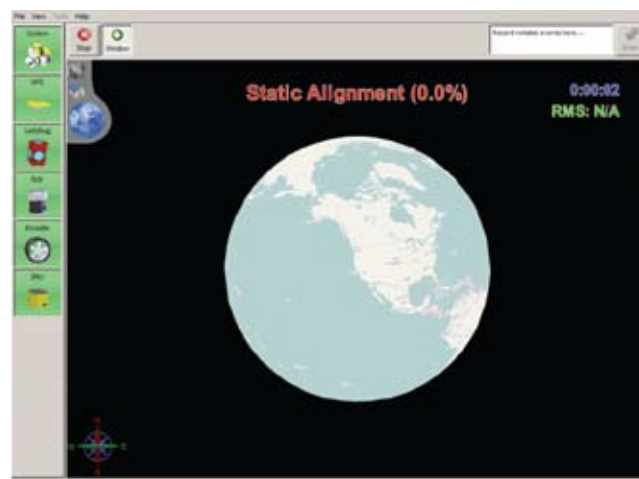
Topcon's IP-S2 3D Mobile Mapping System is designed to collect 360° images and LiDAR point clouds accurately geospatially referenced to the vehicle trajectory.



IP-S2 Components

The IP-S2 has mounting options for cars and trucks. Data can be collected safely from the inside of a vehicle at normal roadway speeds up to 65 mph.

The IP-S2 system includes Spatial Collect software. This software is designed for ease of operation, indicates status of each sensor, and provides a geographic map of the data collection run.



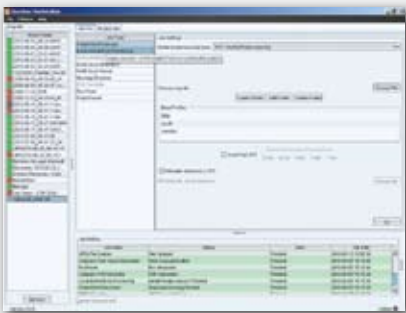
Spatial Collect Software

WORKFLOW

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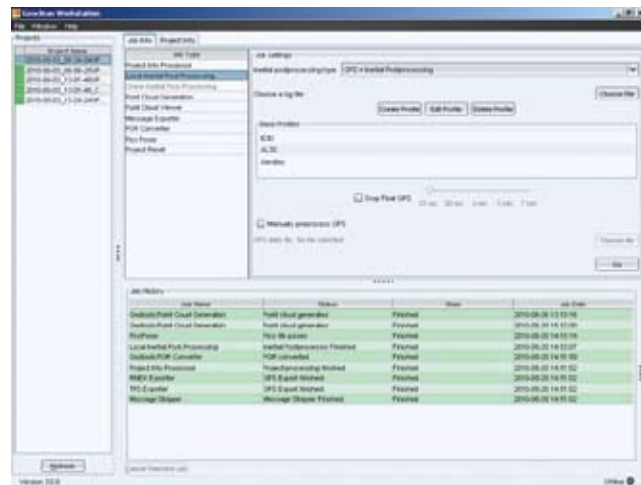


4. Inventory, plan & design in GIS & CAD



2. PROCESS DATA

Geoclean processing software is provided with the IP-S2 system to convert the output files generated during data collection into data that can be viewed and utilized in other software applications. Post-processing of GNSS data can be performed by obtaining observation log files from a GNSS receiver set up near the site or from a GNSS reference station site. Point clouds from the laser scanners can be viewed and exported from Geoclean for use with GIS and CAD software programs.



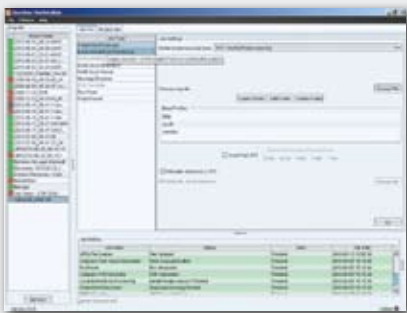
Geoclean Processing Software

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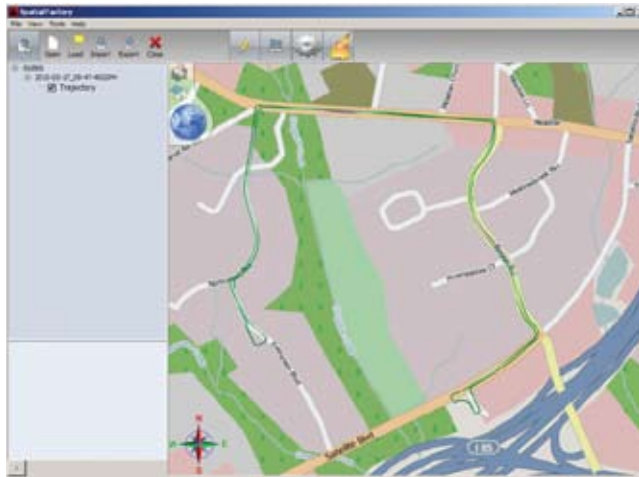
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3. ANALYZE DATA AND EXTRACT FEATURES

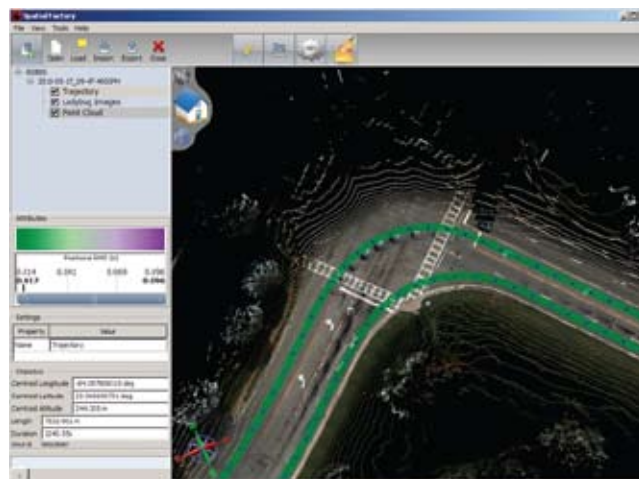
Topcon's Spatial Factory software is a unique powerful tool for viewing, analyzing, and extracting features from processed IP-S2 datasets. Geoclean creates 360° image sets and 3D colorized LiDAR point clouds that are geospatially referenced to the vehicle trajectory. Spatial Factory enables the simultaneous viewing of images for measurement and feature extraction. Spherical images provide instant visual recognition of features to be mapped and the 3D point cloud provides accurate geospatial feature locations.

When a data set in Spatial Factory is loaded, a geographic map opens to show the trajectory of IP-S2 data run.



Geographic Map of Vehicle Trajectory

Spherical images and 3D point cloud of the area of interest are loaded by selecting points along the vehicle trajectory. Blue dots are spherical image sets.



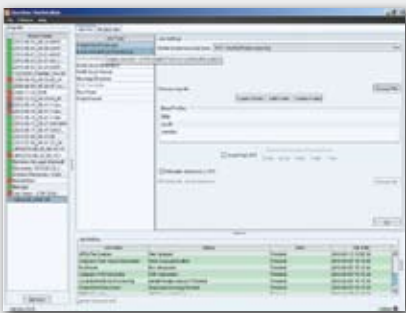
Point Cloud and Images in Area of Interest

WORKFLOW

1. Map an existing corridor



2. Process Data



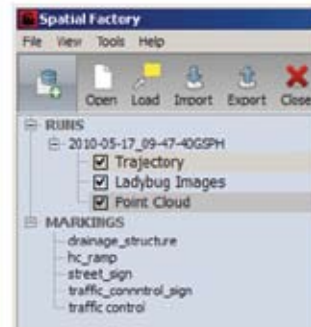
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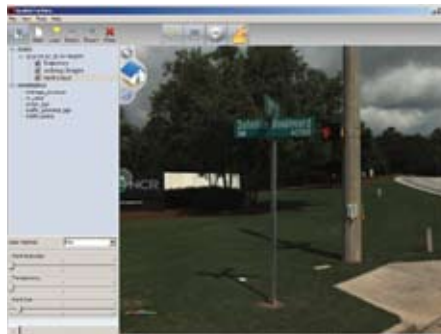


GIS features and attributes of objects to be mapped are imported in shapefile format. Point, line, and polygon features are supported.



GIS Features Loaded

Images are viewed by clicking on a blue dot along the vehicle trajectory. From the camera center, the 360° image can be rotated, panned, and zoomed to obtain the best view of the object to be mapped. Changing the transparency of the point cloud reveals that the image is registered with the point cloud.



Point Cloud Hidden

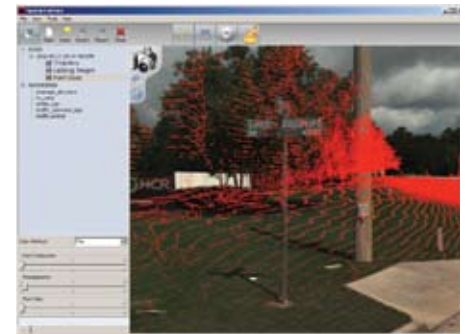
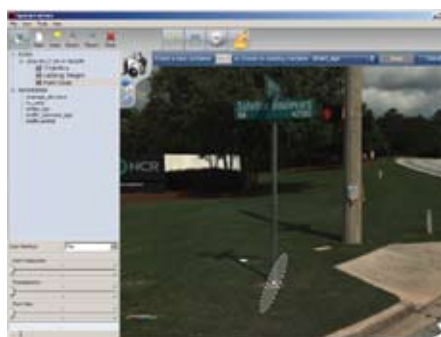


Image with Point Cloud

Features are mapped by selecting the type (point, line or polygon) and the desired layer. The cursor snaps to the point cloud to obtain the geospatial location of the feature. After a feature is mapped and saved, attributes associated with the shapefile can be entered.



Feature Selection



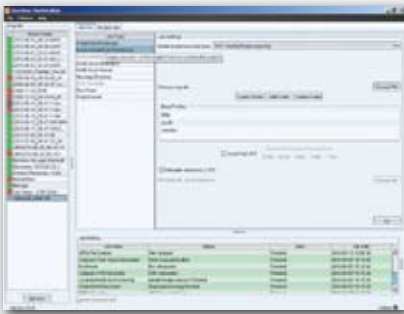
Attribute Entry

WORKFLOW

1. Map an existing corridor



2. Process Data



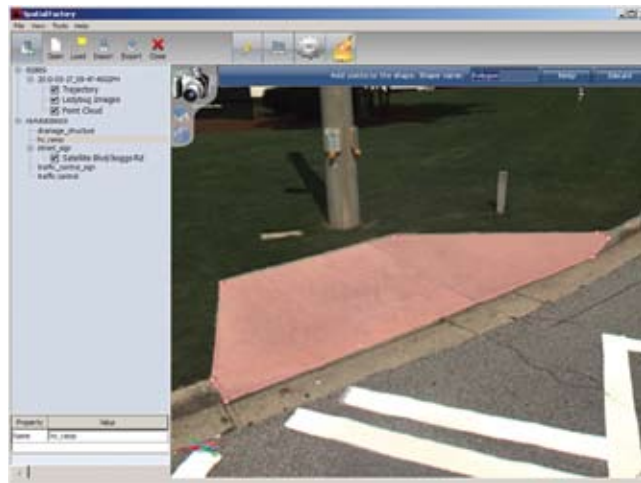
3. Analyze Data and Extract Features



4. Inventory, plan & design in GIS & CAD

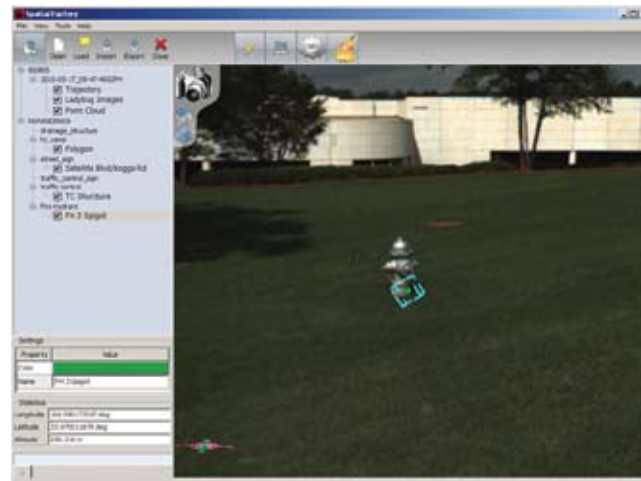


Area features are mapped using the polygon tool and selecting the appropriate layer. Linear features are mapped by using the polyline tool.



Mapping a Polygon Feature

If a feature is encountered that was not included in the shapefile import, a new layer can be created and the object can be mapped using the point, line, or polygon tools.



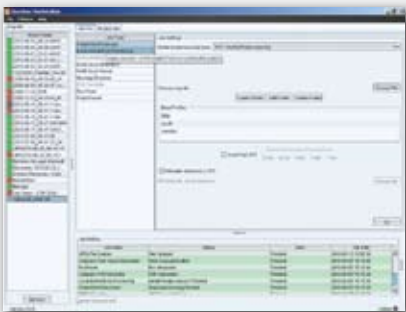
Adding a New Feature Layer

WORKFLOW

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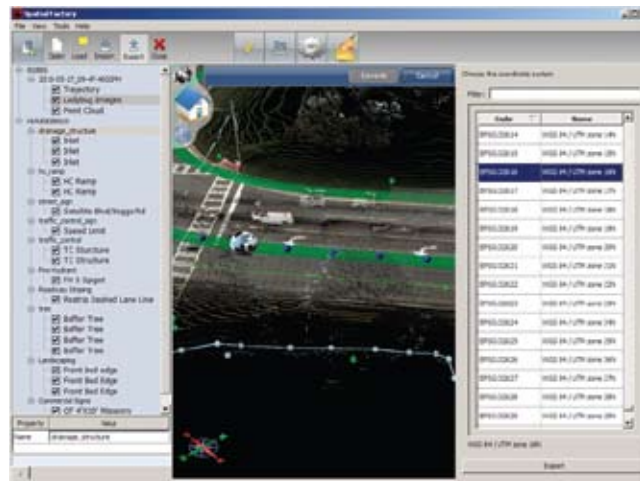
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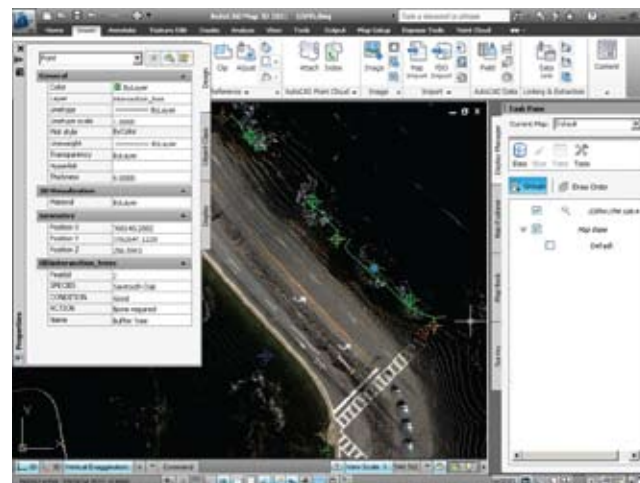


Once all features are mapped, they are exported from Spatial Factory. Export options include shapefile, kml, gml, and ascii file formats. A coordinate projection to match a particular database can be selected at the time of export.



Selecting Projection on Feature Export

Point cloud, features, and attributes can be imported to GIS or CAD software applications for asset inventory, planning, or design purposes. For this particular workflow AutoCAD Map 3D® was used.



Point Cloud, Features and Attributes in GIS Software

Additional information about the IP-S2 Mobile Mapping system can be obtained from Topcon Positioning Systems website: www.topconpositioning.com/products/mapping-and-gis/mobile-mapping/ip-s2.html These resources include: Detailed description of the IP-S2 system; Downloadable product brochure; Link to schedule a web conference or demonstration; View or download video case studies.