

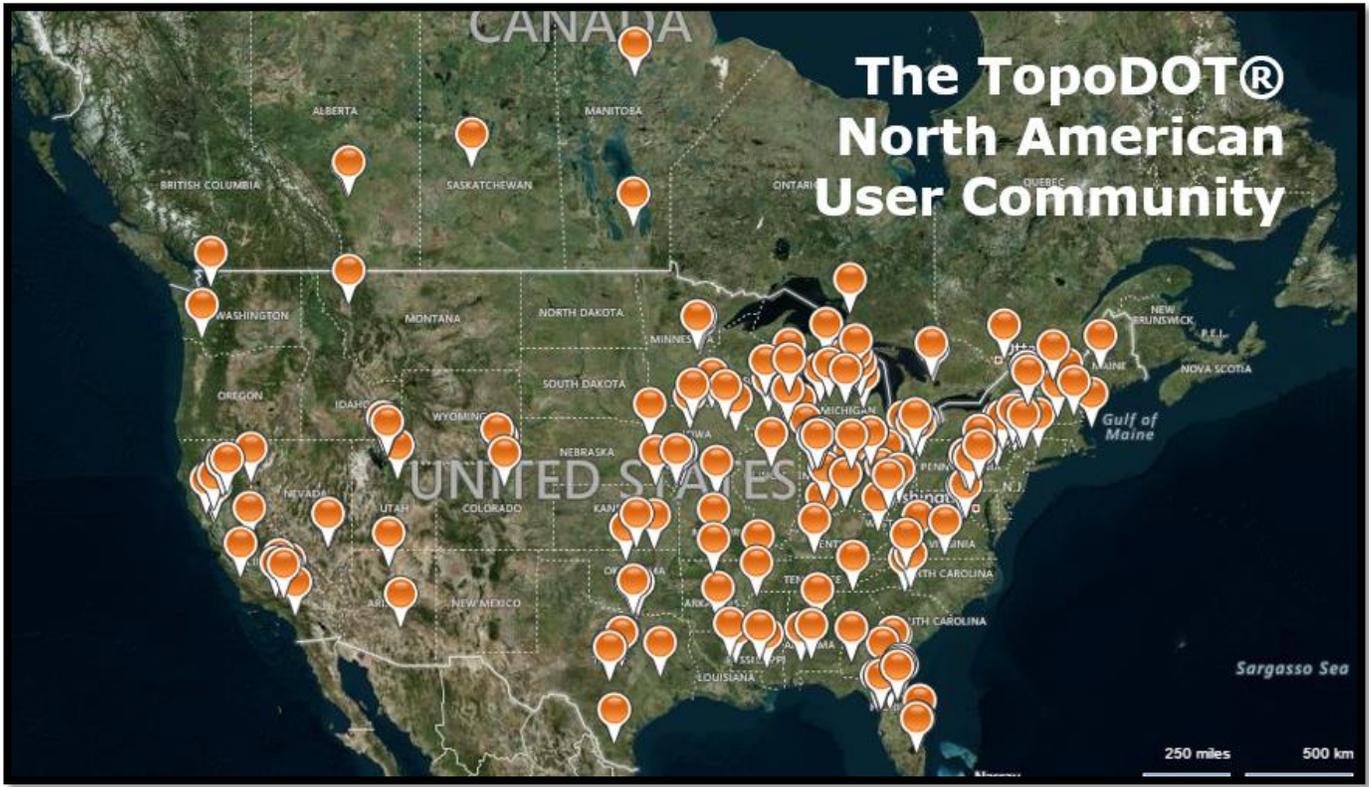


The Right Choice for **Infrastructure**

TopoDOT® is an industry leading software application for extracting high quality CAD topographies, features, and 3D models from point cloud data. These high quality CAD models meet the stringent format and quality standards required by downstream CAD applications operating in MicroStation®, AutoCAD®, ArcGIS and other industry leading software platforms. Primary application areas for TopoDOT® include:

- ✓ Road & Rail Corridors
- ✓ Bridge and Structures
- ✓ Power Transmission & Substation
- ✓ Architecture, building, campus
- ✓ General land survey

The TopoDOT® user community spans the globe with almost 300 companies and 2500 active users. TopoDOT® strongest presence is for roadway and rail transportation corridors where it dominates the processing market for mobile laser system data. TopoDOT® has a heavy presence in departments of transportation, survey/mapping, design, engineering and construction companies.



Below are just a few TopoDOT® users from around the world.



Every DOT, survey, engineering and construction firm needs a point cloud strategy – Here is why!

A new emerging technology will displace existing workflows and processes when it meets three simple criteria; **it's better, it's faster, and it's cheaper**. Point cloud producing technology such as laser scanning, terrestrial mobile LiDAR and UAV image systems have now far exceeded the economic returns of traditional surveying along transportation corridors. Reliable field to finish processes now yield higher quality topographies, features and 3D models typically 60% faster than traditional survey workflows. Actual data acquisition times are at least 90% faster. Despite the high cost of these systems, overall project costs are lower. This technology is here to stay!



Systems producing point cloud and image data

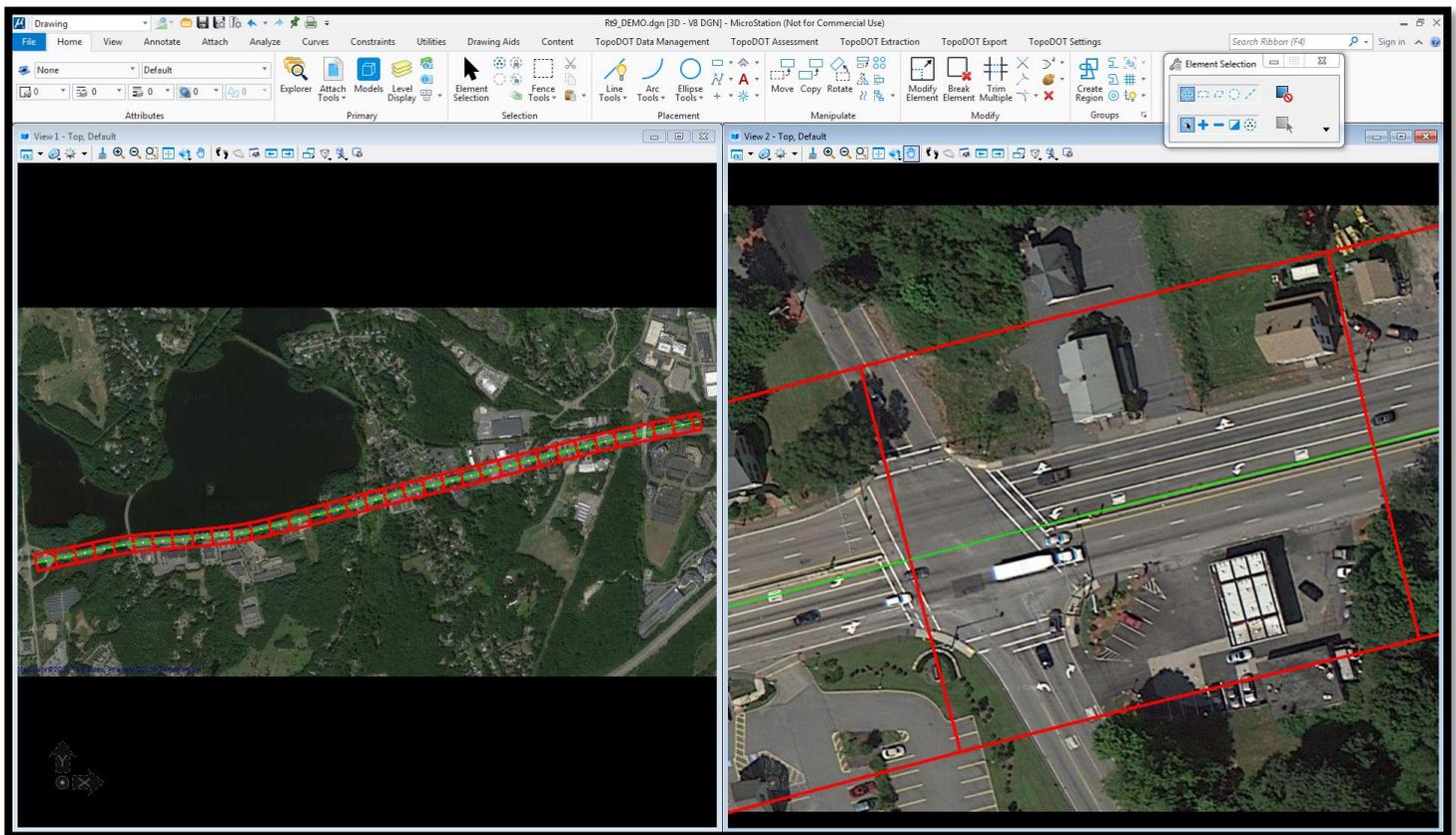
Given the productivity and economics, Departments of Transportation (DOTs) are quickly adopting the technology. For example, the Florida Department of Transportation (FDOT), a TopoDOT user, has invested years reorganizing their operational and procurement processes around laser scanning technology. Other DOTs using TopoDOT® are pursuing their own initiatives. In the near future, geospatial information supporting almost every transportation corridor project will be acquired using mobile LiDAR data. Therefore any company using geospatial information in support of design, engineering or construction processes will be required to work with point cloud and related data. Specifically, they must develop a comprehensive strategy to manage data, assess data quality and extract topographies, features and 3D models from the data.

TopoDOT® Offers a Comprehensive Solution

While TopoDOT offers hundreds of tools for extracting high quality CAD deliverables from point cloud data, it actually offers much more. In one product, TopoDOT offers a complete workflow solution to the challenges of point cloud data. The fundamental components of the TopoDOT workflow are:



Manage Data



Point Cloud Data Tiling

TopoDOT® offers a complete tool suite to quickly organize and apportion large point cloud files into optimal sized tiles complete with geospatially located links for quick and easy access.

The TopoCloud™ feature included with TopoDOT® allows users to store, administer and share these large data sets efficiently and cost effectively over a private FTP server, a mapped network or public data cloud storage service such as Amazon® Simple Storage Service (Amazon® S3). TopoDOT® customers as well as agencies like the Florida Department of Transportation are storing terabytes of corridor project data on Amazon S3 or private networks.

TopoCloud™ is elegantly simple to use. Just 3 steps:

1. After a project is organized in TopoDOT®, an administrator uploads a corridor project along with related files, i.e. survey, CAD, GIS, etc. to the cloud storage medium of his choice.
2. From there he provides access to any TopoDOT® user worldwide.
3. At the other side, a user will see he has been given access to certain project(s) by the administrator(s), download the project map file indicating tile location along the corridor and download data and other files with a simple mouse click.

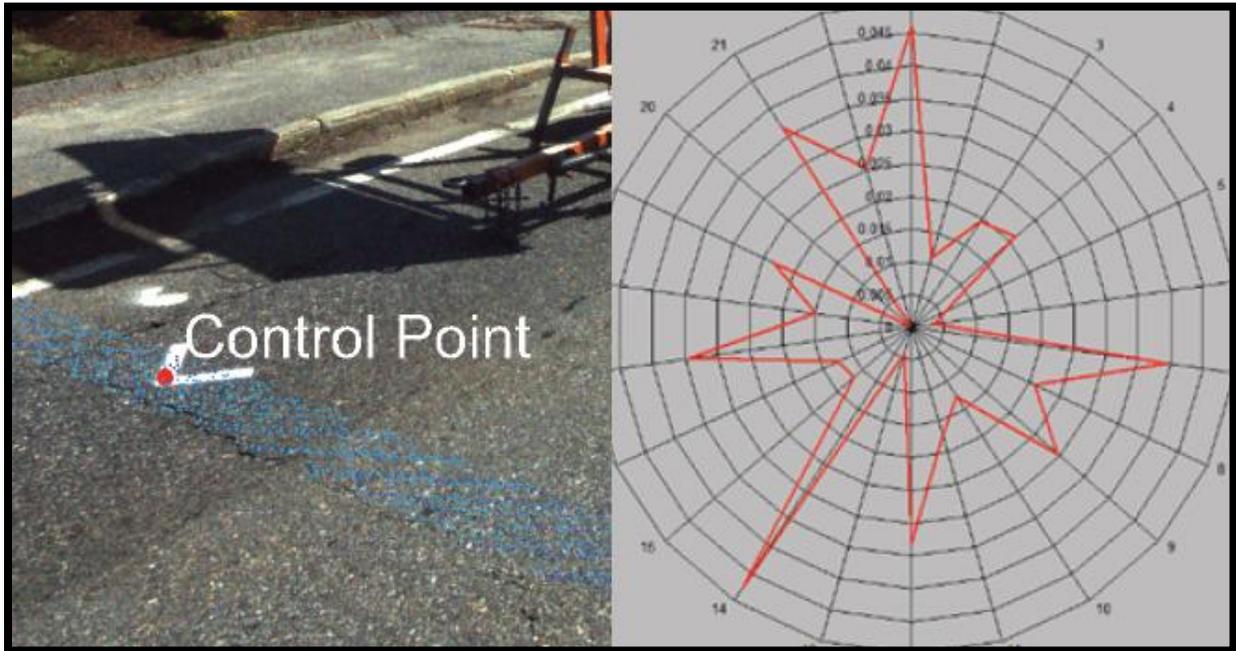


Assuring that everyone across the user network is accessing “the same data” is key to effective quality control of the process. Note that TopoCloud™ inherently provides control of the data. Only the administrator may upload data to the cloud storage site. Whenever a user clicks a GUI icon to request data, TopoCloud™ automatically checks if the data is on the user’s hard drive “and” if that data has been updated on the cloud. If the data on the user’s hard drive is current, it loads quickly from the user’s hard drive. If the administrator has updated the data, TopoCloud™ will detect this and download the latest data to the user. Therefore TopoCloud™ assures that all users across the network are sharing and using a consistent source of geospatial data.

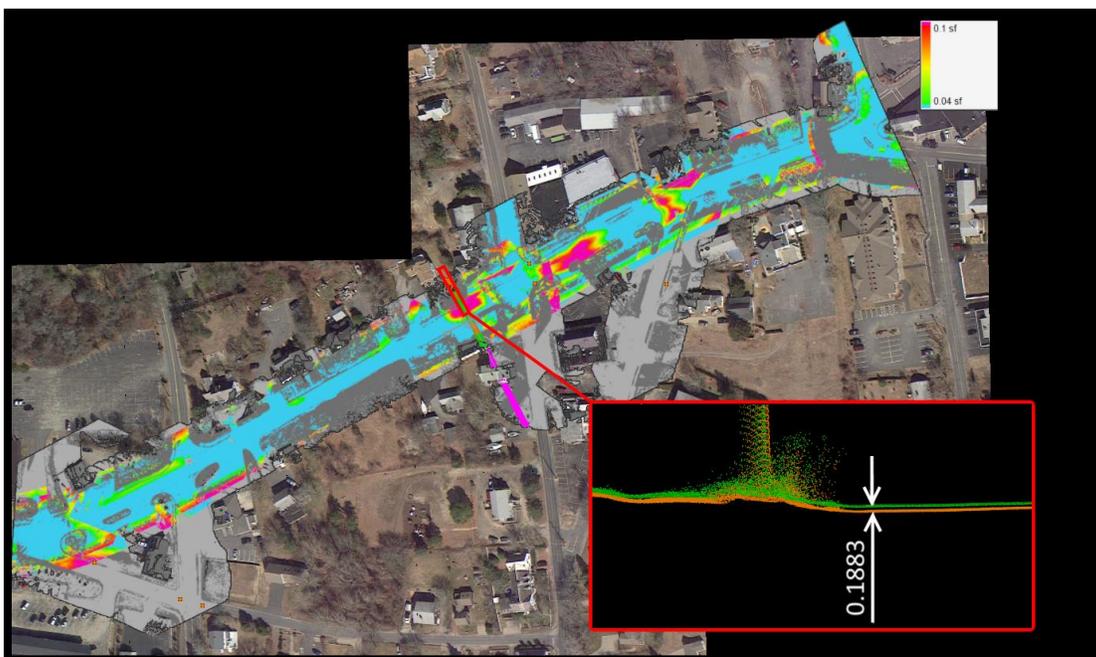
Note also that the TopoCloud™ solution implicitly optimizes data bandwidth and storage requirements. Prior to using TopoCloud™, customers shared data by physically passing around a hard drive amongst the processing team. Aforementioned issues of version control aside, this approach also assures that the entire project data set will be installed on each workstation. TopoCloud™’s unique geospatial GUI interface makes it easy for the user to download data where and when it is needed, inherently optimizing memory and transfer bandwidth.

Assess Quality

TopoDOT® includes a complete suite of tools to automatically assess the quality of point cloud and image data along the project corridor. A well-documented and comprehensive workflow has been developed to assess the relative and geospatial alignment of the data. The ultimate result of this process is a clear lineage from the point cloud data back to any geospatial control reference coordinates along the corridor. For more details reference [TechNote #1021: Establishing Requirements, Extracting Metrics and Evaluating Quality of LiDAR Data](#) found on the C3D University page of the Certainty 3D website at www.certainty3d.com.



Control to point-cloud data analysis and report



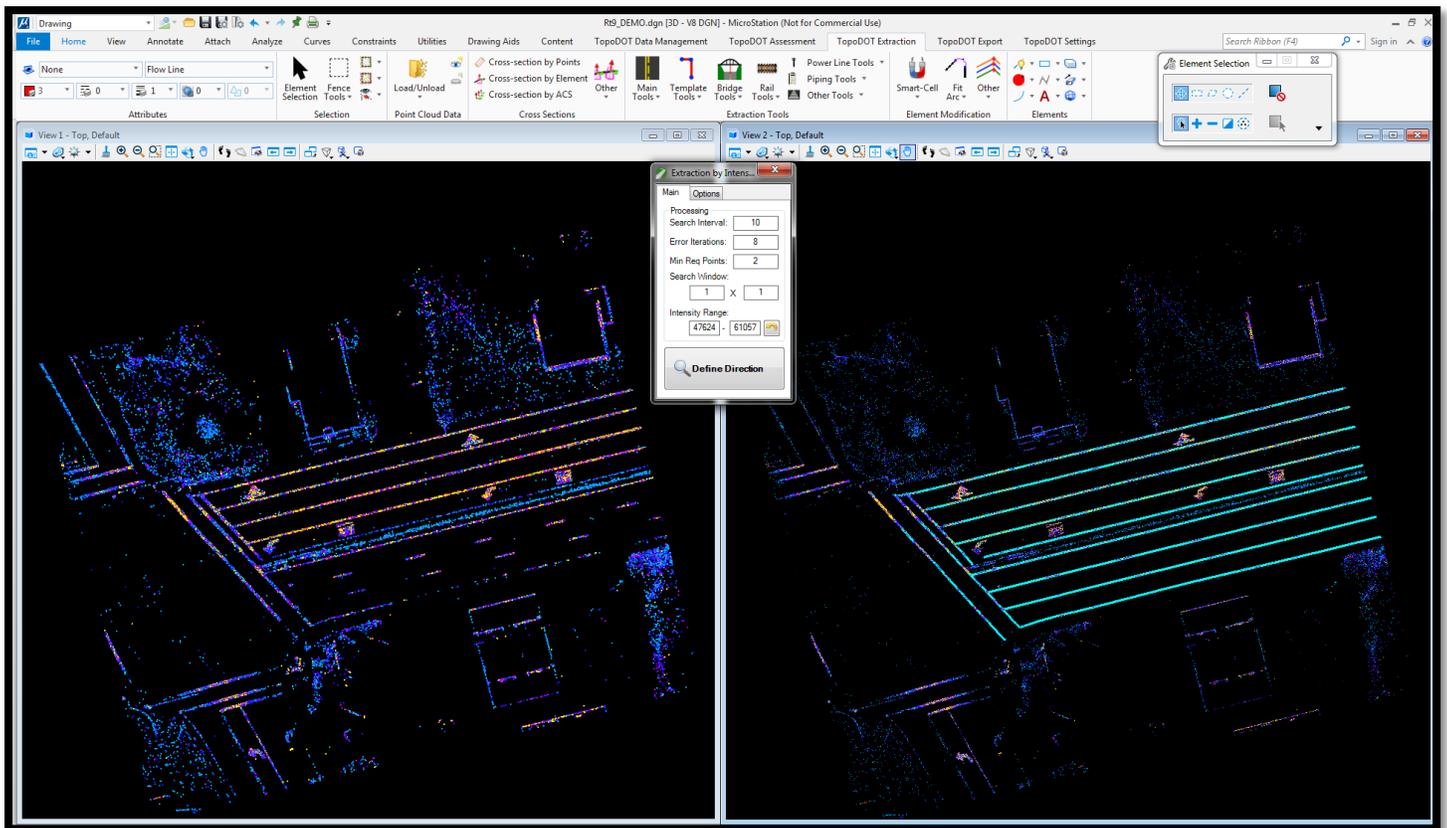
Point-cloud deviation analysis

Extract Topographies, Metrics, Assets and 3D Models

TopoDOT® offers the industry's most productive tools for extracting information and models from mobile LiDAR data. Employing Bentley's MicroStation® as a CAD engine fully exploits the full potential of Bentley CAD product capabilities within TopoDOT®. In the following examples, one notes how effectively TopoDOT® exploits the synergy between the point cloud and calibrated image data produced by the mobile LiDAR system. Every workflow balances the highest levels of automation with the requirements for reliability and quality. A subset of TopoDOT®'s extensive extraction tool suite focused on transportation corridors are provided in the following.

Automatic Paint Line Extraction and Road Center Line

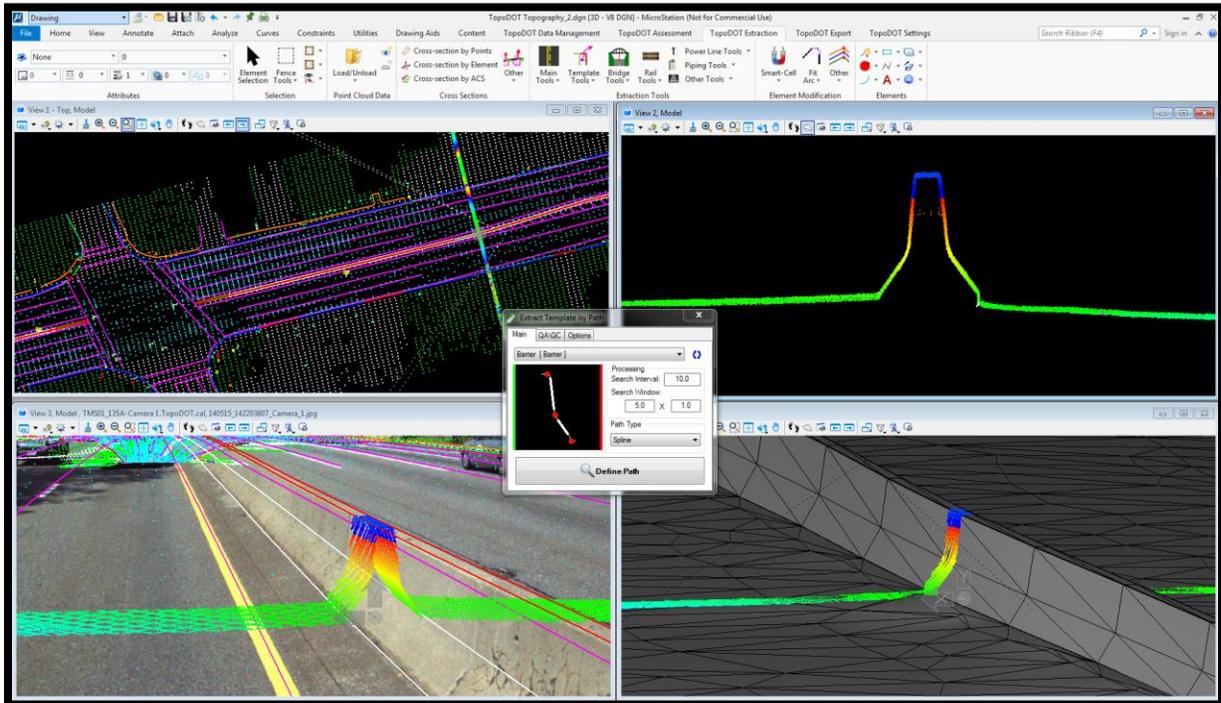
A typical first step in extracting a transportation corridor topography is to identify and extract a center line or road alignment. Lane stripe reflectivity make lines easy to identify within Lidar and serve as representation of the road alignment. TopoDOT® provides very intuitive tools for isolating and filtering pointcloud data by reflectivity. Extraction by intensity tools automatically locate the data and place CAD linear elements along the painted stripes.



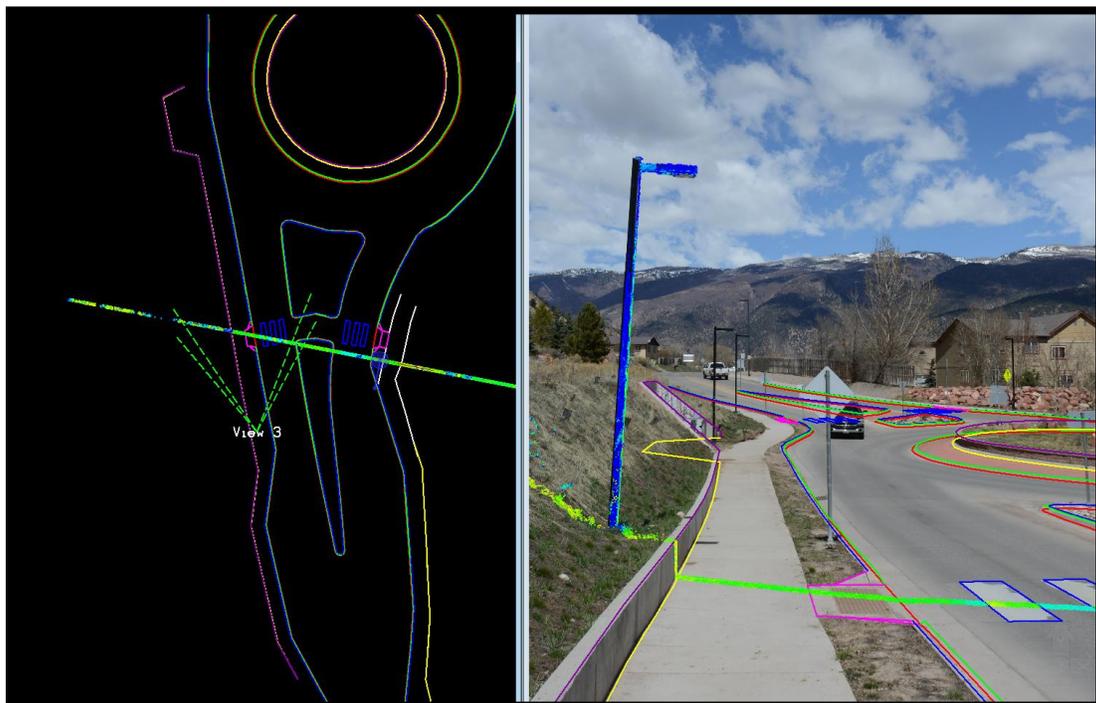
Extraction by intensity to create lane line stripes

Automatic Break-line Extraction

TopoDOT® offers the latest in automated break-line extraction tools typically used to model curb lines, barrier walls, etc. A unique template matching tool allows the user to define any type of profile to be extracted and store it as a cell. The user can just select that specific cell and extract the break lines defined by that profile automatically.



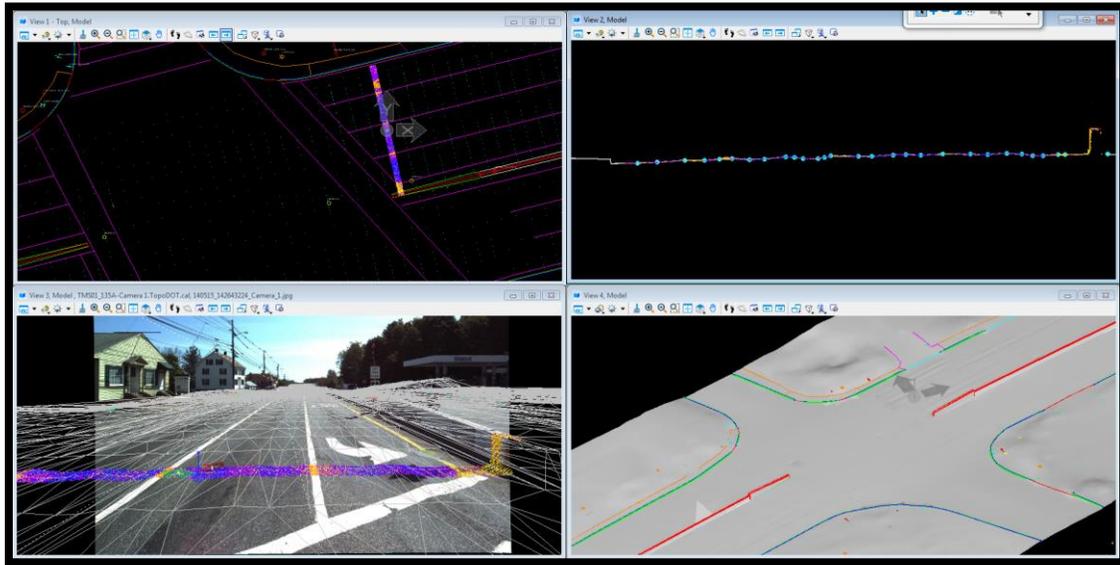
Automatic break-line extraction



Smart Cell Insertion

Automatic Road Surface Extraction

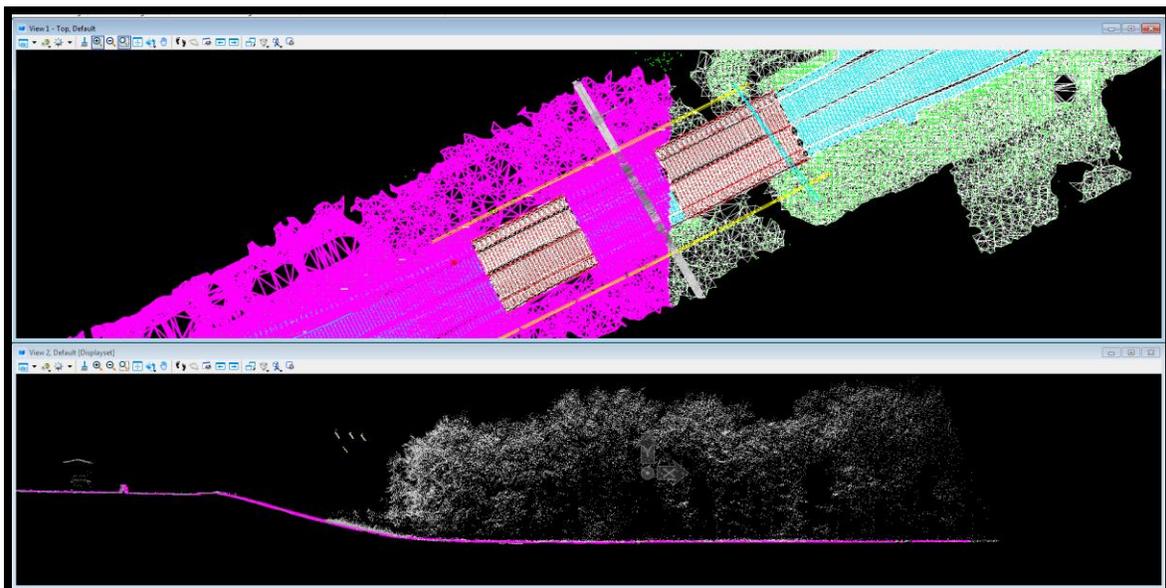
The TopoDOT® road extraction tool produces high quality cross sections along the roadway surface elements using a stripe or imported roadway alignment as a reference. This totally automatic tool is extremely fast and accurate. Cross sections along the reference alignment or road stripe are extracted at specified intervals. If specified, the cross-section can be extracted such that vertices are located at each grade break. This yields a highly accurate digital terrain mesh. **As is the case with all TopoDOT® tools, no pre-cleaning and/or classification of the point cloud data is required!**



Surface extraction and DTM production

Bare Earth Surface Extraction

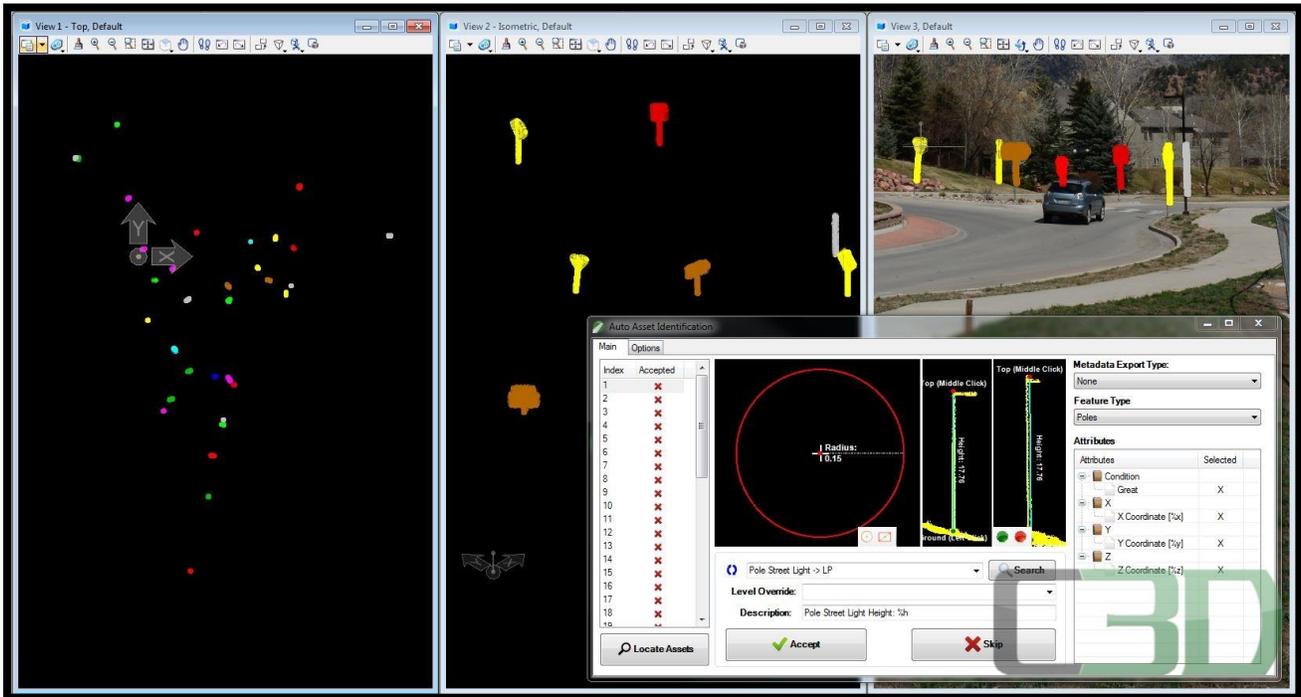
Heavily wooded areas, grass, trees, people, debris or any type of noise are never a problem for TopoDOT®. Use the grid elevation tool to extract elements representing bare earth models in seconds. Once again, no classification or pre-cleaning of the point cloud required!



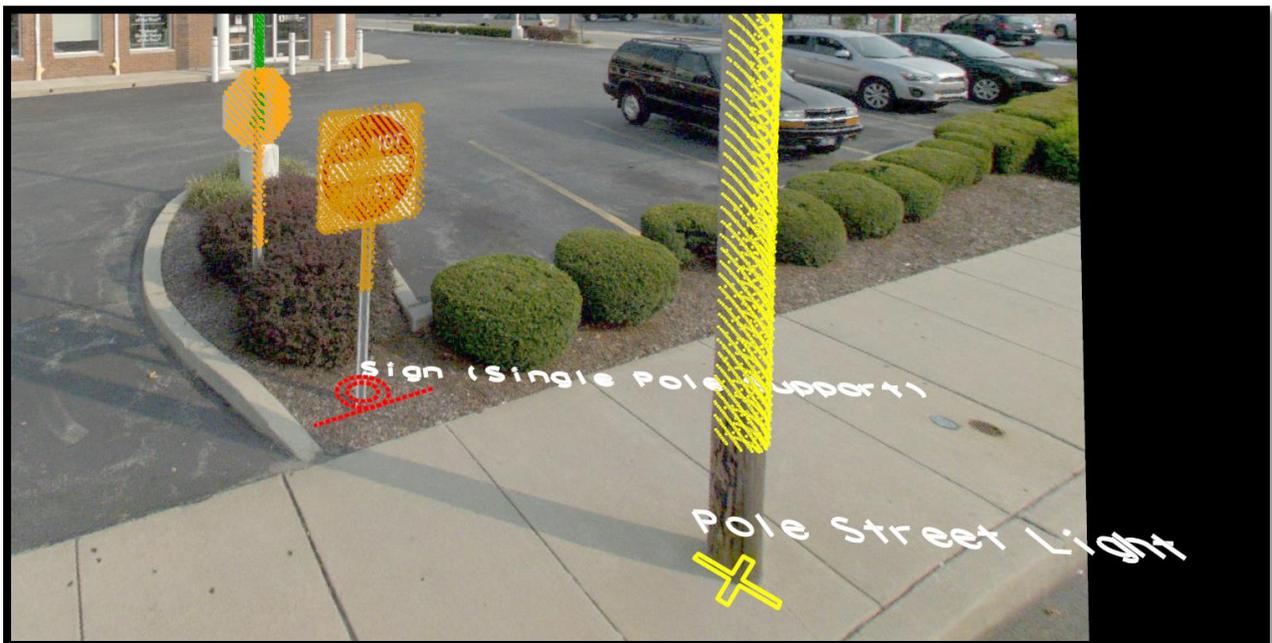
Automatic surface extraction without noise removal

GIS Asset Extraction

TopoDOT® offers the industry's most productive tools and workflow for extracting GIS assets from point cloud and calibrated image data. Potential assets along the transportation corridor are located and **uniquely indexed automatically**. The user then just moves through an indexed list where the location, corresponding point cloud, closest image and presented automatically. The user just quality controls the selection, adds any metadata from the predefined custom schema, and accepts the asset. Once all the assets have been identified, the tagged CAD symbols can be exported as a standard GIS formatted file for import into ArcGIS or any other asset management software.



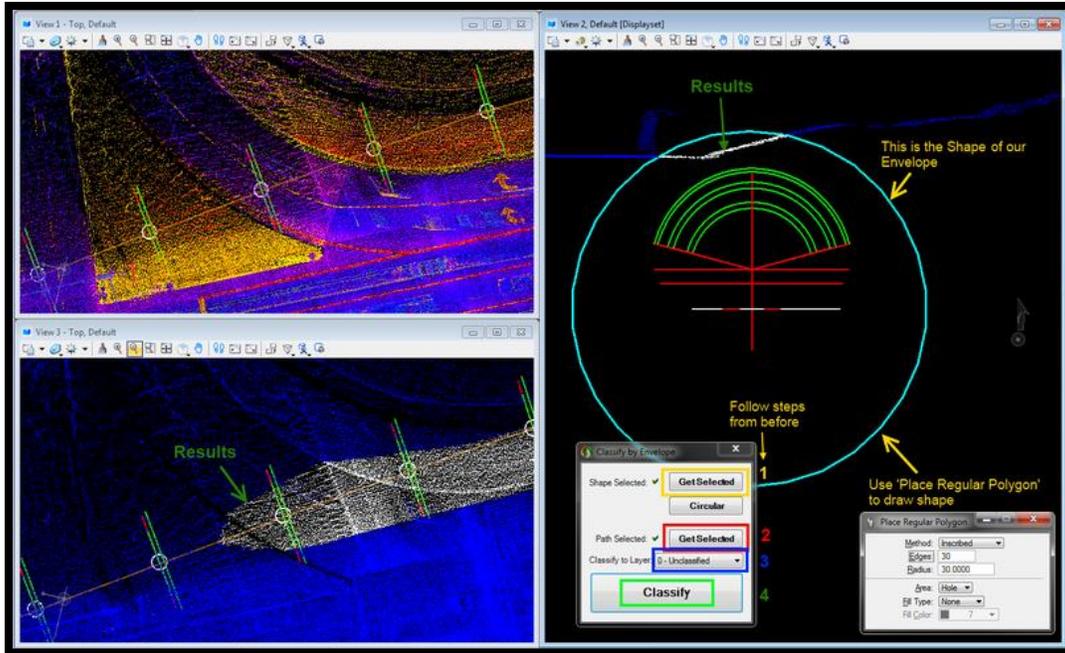
Automatic asset identification



GIS inventory

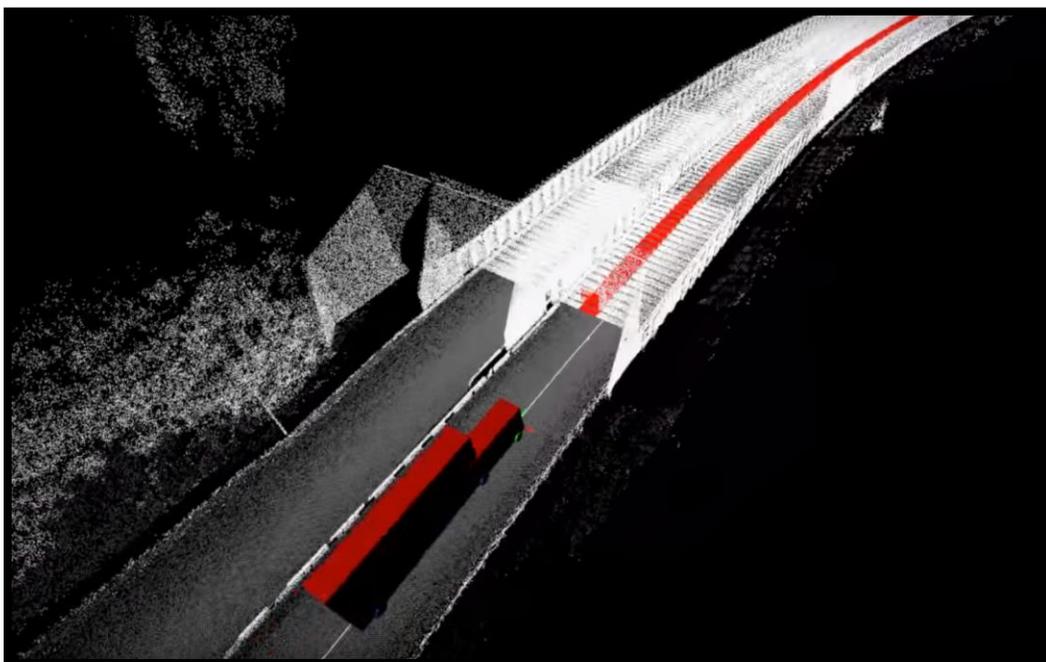
Full Simulation and Clash Detection Capability

TopoDOT® enables the users to quickly identify the clash of any points within a user defined 2D profile extruded along an arbitrary path. This tool is excellent for checking clearances through tunnels, under bridges, through vegetated areas, etc.



Tunnel model encroachment analysis

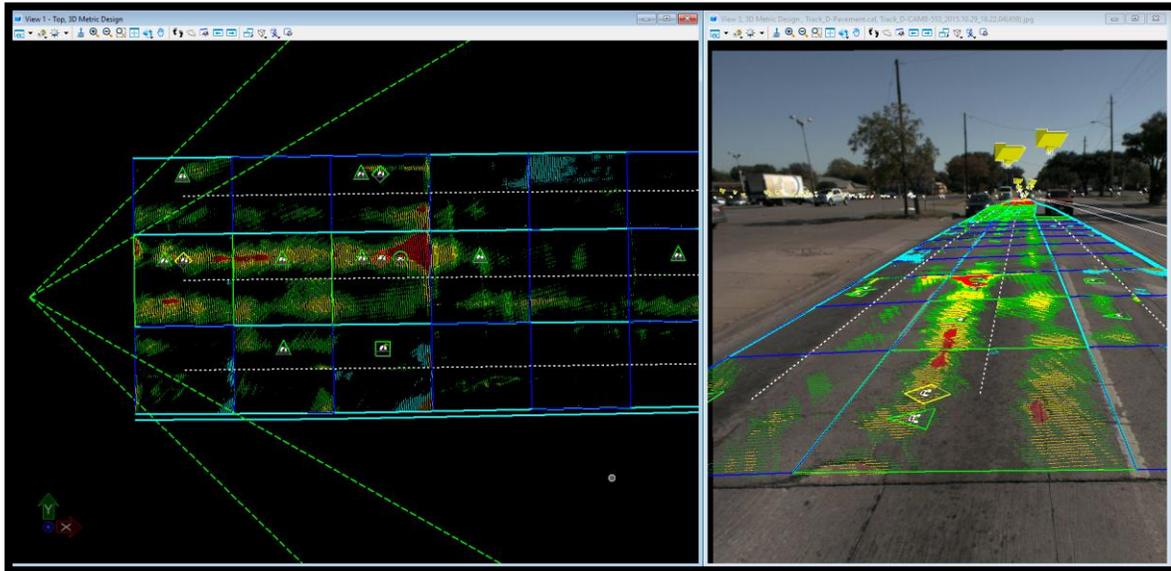
TopoDOT® also offers advanced vehicle simulation capability. The user may define a single vehicle or tractor trailer. The vehicle will actually ride through the point cloud along the vehicle swept path while locating and mapping any points which may clash with the vehicle.



Vehicle simulation encroachment analysis

Pavement Condition Analysis to ASTM Standards

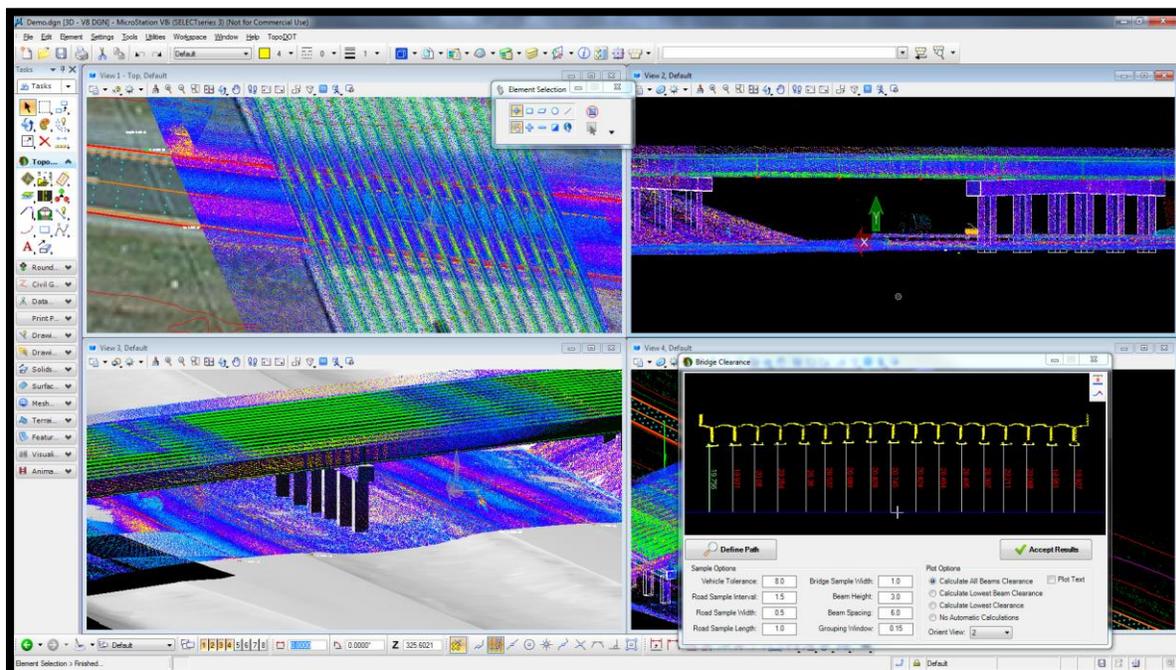
Scheduled for late 2016 general release is TopoDOT®'s new pavement condition analysis tool suite. TopoDOT® tools will automatically assess pavement condition between lane boundaries to ASTM 6433 (default) or user specified standards, export the assessment metadata to a GIS formatted file and issue a spreadsheet report—all in one mouse click.



Pavement condition analysis

Clearance Measurements

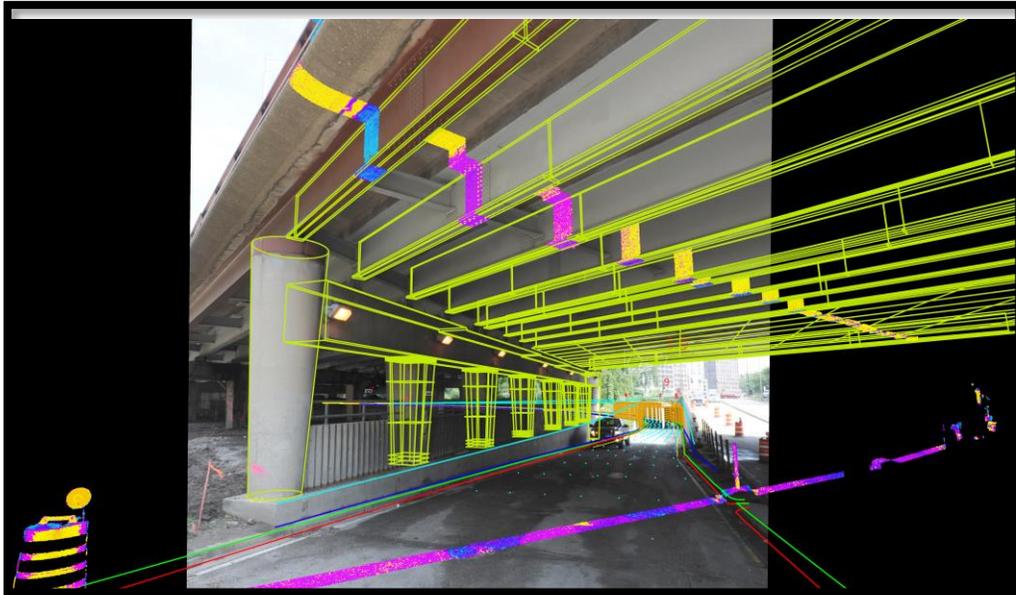
TopoDOT® offers several tools for quickly extracting clearance measurements directly from the point cloud. Minimum and maximum clearances are processed and automatically extracted from the point cloud itself thereby eliminating the need for modeling.



Bridge 3D modeling and clearance analysis

3D Modeling

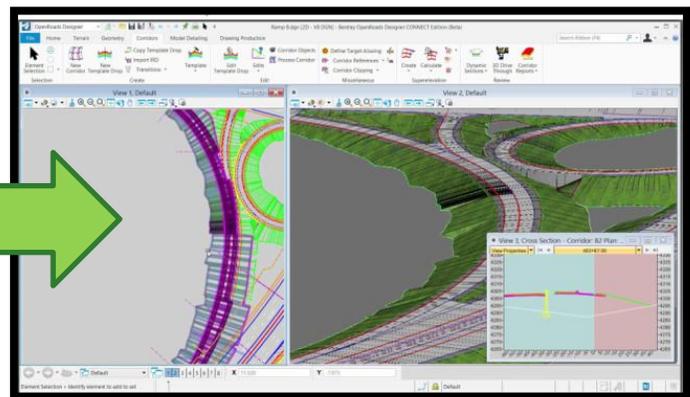
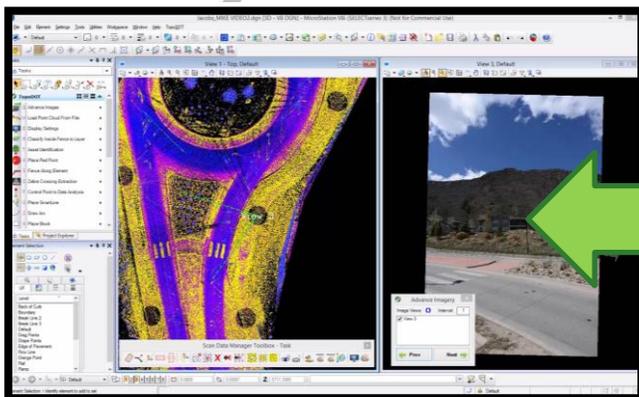
The synergy between TopoDOT® and the MicroStation® (or GeoPAK, MX, InRoads, OpenRoads®) CAD environment is unrivaled for quickly extracting detailed models from point cloud and image data.



TopoDOT® Offers a Seamless Workflow with Downstream Design Applications

The TopoDOT® application uses Bentley products as its CAD engine. That means it can run directly within MicroStation®, GeoPACK®, MX®, InRoads®, OpenRoads®, and others. Thus every CAD element extracted within TopoDOT® is already formatted correctly for MicroStation® and are often readily available for operations. Of course all import and export capabilities supported by Bentley products are inherently supported within TopoDOT®.

Note that working within a common Bentley® environment provides added synergy to planning, design and engineering operations. CAD design files can be opened in TopoDOT® and compared to point cloud data, extracted vectors, features, assets, etc. TopoDOT® customers find capabilities and reports comparing design alignments against extracted road alignments, simulate vehicle travel along a roadway for clash detection, precise cut/fill volumes, and many more to be invaluable in design decision support.



Of course since Bentley® products support dozens of data formats, exporting extracted models, assets and features from TopoDOT® to AutoCAD, ArcGIS and any other software platform is inherently supported.

TopoDOT® Price & License Programs

TopoDOT® license programs are extremely innovative, versatile and fair. Initial and annual recurring costs are based on usage. As such the number of licenses is continuously optimized to match the daily extraction workload.

The TopoDOT® web-based license server monitors daily usage of TopoDOT®. Customers purchase perpetual licenses based on annual usage. Installations on workstations are unlimited at no cost. The annual number of user-days purchased are reset each year into perpetuity.

- Prices start as low as \$7,500 for 300 annual user-days to \$17,500 for 1,000 user-days.
- Installations are unlimited.
- Annual maintenance cost is based on the total number of annual monitored user-days.
- Annual maintenance fee includes upgrades, support and continuous access to the online TopoDOT® personal training program.
- C3D University page offers customers detailed videos for self-teaching.
- Each customer may access a full usage report at any time. These reports will contain workstation ID, number of days per workstation, and if desired, the number of user-days per project ID.

We refer the reader to the quote page of the Certainty 3D website, <http://www.certainty3d.com/purchase/> for further details along with the actual license agreement. Below the program list a Cost Estimate tool is located to project the expected cost of each license program against estimated usage over two years.

Please contact Certainty 3D for additional information on licensing and/or TopoDOT® capabilities. We would be happy to schedule an online demonstration at your convenience.

Questions and/or Comments

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