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Conquering mass asset inventory for aging infrastructure with custom AI workflows

From impossible to in-demand

By LInda Duffy

Embracing geospatial technology enables companies to solve problems faster and more efficiently, and deliver better results for clients. A leading geomatics firm in Canada is integrating mobile mapping with AI to transform how infrastructure assets are identified, extracted and managed. The result: sharper data, safer crews and speedier project delivery times.

▲ *Trimble mobile mapping systems capture images and point clouds while driving at normal traffic speeds. (Image courtesy: GeoVerra)*

When aging infrastructure meets shrinking budgets, it usually means a slowdown both for traffic and for investment in technology. But at GeoVerra, Canada's largest geomatics firm, they hit fast-forward, training artificial intelligence (AI) to inventory entire corridors in hours, not weeks.

By training AI models within Trimble Business Center (TBC) to automatically recognize and extract diverse asset types, from railway signals to highway signs, GeoVerra processes vast amounts of data in a fraction of the time compared to traditional manual methods. This approach helps the company meet the growing demands of government agencies and private companies that need accelerated project delivery, reduced costs and more comprehensive data. For field crews and executives alike, success means removing workers from dangerous roadway and rail environments while providing clients with detailed asset information to manage infrastructure effectively.

Critical data for crumbling infrastructure

Asset management is transitioning from a back-office function to a strategic priority to make the best use of taxpayers' money. Faced with deteriorating infrastructure and reduced budgets, municipalities and government agencies must understand exactly what assets they own, where they are located and what condition they are in.

The convergence of mobile mapping technology and AI-driven asset extraction makes monitoring and tracking assets possible at larger scale and higher accuracy. Where agencies once lacked quantitative data on their infrastructure, they can now efficiently map and track asset conditions across hundreds of kilometres of corridors without disrupting traffic or deploying workers into hazardous environments. Government agencies use this knowledge to prioritize spending, schedule repairs

proactively and replace infrastructure before failures occur.

Saving costs and time

Mobile mapping combined with AI-driven asset extraction offers a powerful solution for reducing both costs and time in large-scale infrastructure projects. Consider a typical 10km urban corridor survey that requires detailed topographic mapping and a full inventory of street assets such as poles, signs, manholes, traffic lights, signs, kerbs and so on. When compared to traditional field survey methods using total stations or RTK GPS, mobile mapping systems deliver significant efficiencies.

By integrating AI-based feature extraction into the workflow, project teams achieve even greater benefits. This dual approach streamlines both field data collection and office processing, resulting in substantial savings across the board. Overall project expenses are reduced by approximately 40-50%, while the total project schedule is shortened by roughly 30-40%.

Processing power and precision

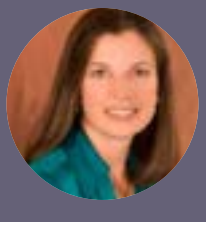
GeoVerra's geospatial group executes its own projects and supports other internal teams with advanced data collection and analysis tools for land surveying, forestry and environment, and line locating applications. Mobile mapping is essential for these operations. Using Trimble MX90, MX50 and MX9 mobile mapping systems, the team captures imagery and point clouds with vehicles traveling at normal traffic speeds, eliminating the need to close lanes or disrupt communities.

The real transformation happens after data collection, when the raw point clouds are converted into actionable asset inventories. Traditional methods require technicians to identify and extract each asset from point cloud data manually. A project covering hundreds of kilometres with dozens of asset types could take weeks or months of tedious work. The extended duration often makes these projects unfeasible, forcing clients to seek alternatives.

The software used by GeoVerra includes pre-trained AI models that identify common infrastructure elements like poles, signs and barriers. These integrated capabilities for AI-driven asset extraction change the project timeline, cutting processing time from weeks to days. Moreover, these models can be customized for specific client needs and regional variations. After all, assets vary across regions. A utility pole in Ontario may differ in design from one in British Columbia, and road signs vary by jurisdiction. Rail infrastructure has subtle differences depending on the operating company and era of construction.

To address these deviations, custom AI models are trained within TBC. This process starts with technicians providing sample assets from the collected data and then identifying representative examples of each asset type that the client needs tracked.

About the author



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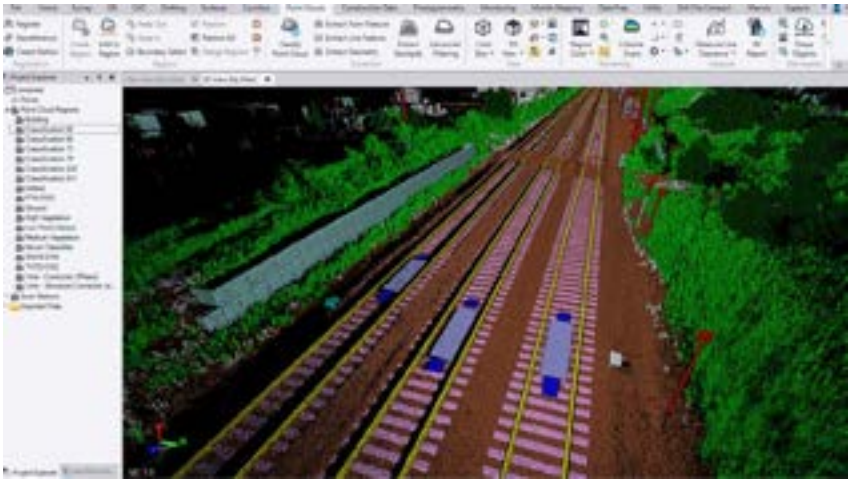
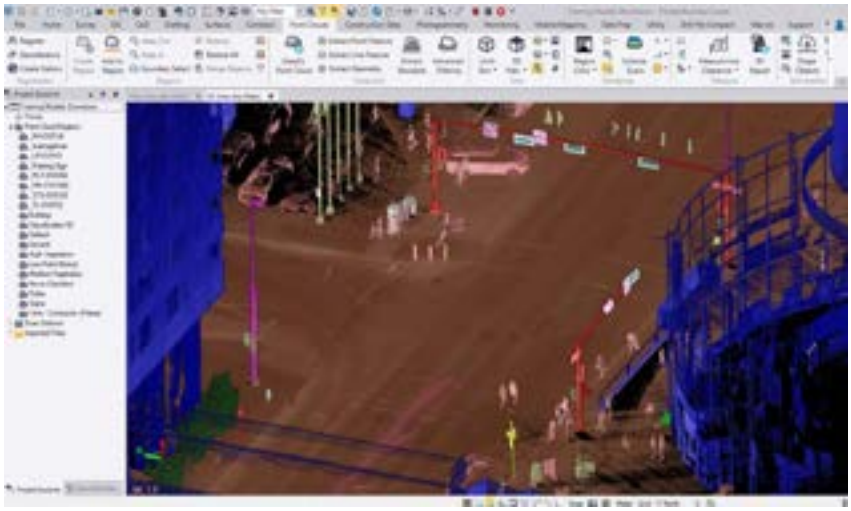
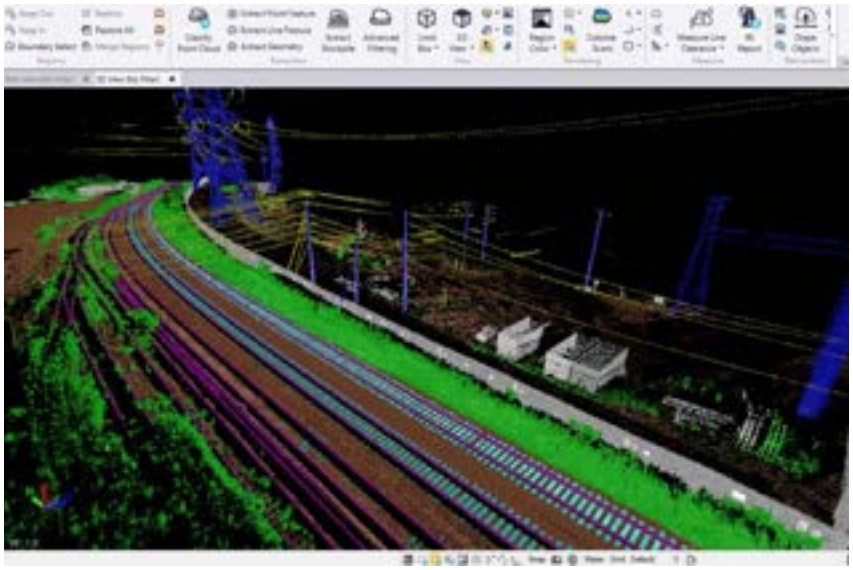


▲ *GeoVerra combines pre-built asset classification and extraction functionalities with customization of AI models. (Image courtesy: GeoVerra)*



▲ *3D deep learning models are trained to extract features using Trimble Business Center. (Image courtesy: GeoVerra)*



▲ *GeoVerra customizes AI models for specific client needs and regional variations in railroad and highway infrastructure. (Image courtesy: GeoVerra)*

TBC's AI then learns to recognize these specific features and extracts them from the entire dataset. The team customized nearly all features for their rail projects beyond standard poles and tracks. For highway projects, they differentiate various sign types and adapt models to new specifications within a couple of days. This foundation ensures GeoVerra does not need to start the training process from scratch for every project, so each subsequent project becomes more cost effective.

Benefits beyond the baseline

The value of these detailed asset inventories extends well beyond initial project deliverables. Government agencies unlock rich datasets that support multiple use cases over extended periods. Images and point clouds allow staff to conduct virtual site visits from the office, examining assets without the need to travel to remote locations or coordinate field access. During stakeholder meetings, project teams provide clear visual context for proposed changes or maintenance priorities. Everyone gains a better understanding of conditions and constraints.

Many clients utilize the extracted asset data within GIS systems, typically as shapefiles or in database formats. GeoVerra has developed custom GIS dashboards for some clients, providing intuitive interfaces for exploring and analysing their infrastructure. On one rail project, the rail company made the collected data widely accessible through an online portal, allowing employees across the organization to access information relevant to their roles.

Since mobile mapping captures comprehensive information about the entire corridor, agencies often discover additional uses for data that were not part of the original project scope. The existing dataset maintains long-term value over time by providing answers without incurring new data collection costs.

Streamlined process

Before this integration, advanced asset extraction required purchasing separate expensive software licences and managing data transfers between multiple applications. Teams would process mobile mapping data in one system, classify point clouds in another and extract assets using yet another tool. Now, TBC consolidates these workflows into a single platform, streamlining the process and reducing training requirements.

Working closely with Trimble's development team provides additional benefits, such as enabling GeoVerra to explain client challenges to technical staff and influence software development priorities. When issues arise, responsive technical support helps the team maintain project momentum.

Scalable solutions, sustainable success

Interest in asset lifecycle management continues to grow, so mobile mapping expertise and custom AI models developed by early adopters will be applicable in the future. Beyond railroads and highways, the latest AI capabilities show potential for tackling citywide projects and airport initiatives, both of which could benefit from TBC's comprehensive asset extraction and pavement analysis algorithms, according to GeoVerra. Building a library of trained models, combined with proven workflows on diverse projects, can enable geomatics firms to create a valuable competitive advantage. ■

Real-world results

One project that demonstrates the scale and efficiency made possible by this technology is a rail project in the Greater Toronto Area. Using mobile mapping systems, the team collected 970km of rail corridor. A trained AI model reviewed the point cloud and extracted 33 different types of assets at the rate of 15km of track in just 25 minutes. The project needed high feature-extraction accuracy to ensure every asset was captured and correctly classified. Manual extraction at this scale would have been financially and practically impossible. With AI tools in TBC, GeoVerra delivered comprehensive results that met the client's timeline and budget.

Meanwhile, a highway project in Ontario showcases how trained models create compounding benefits. Along 125km of highway, the team extracted more than 8,000 individual features across 21 different asset categories. Moreover, because highway assets remain consistent across the province, established models will work efficiently on fresh datasets. This means that the same trained AI model can be applied to new data collections when Ontario expands or upgrades its highway network in the future.