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Mobile laser scanning

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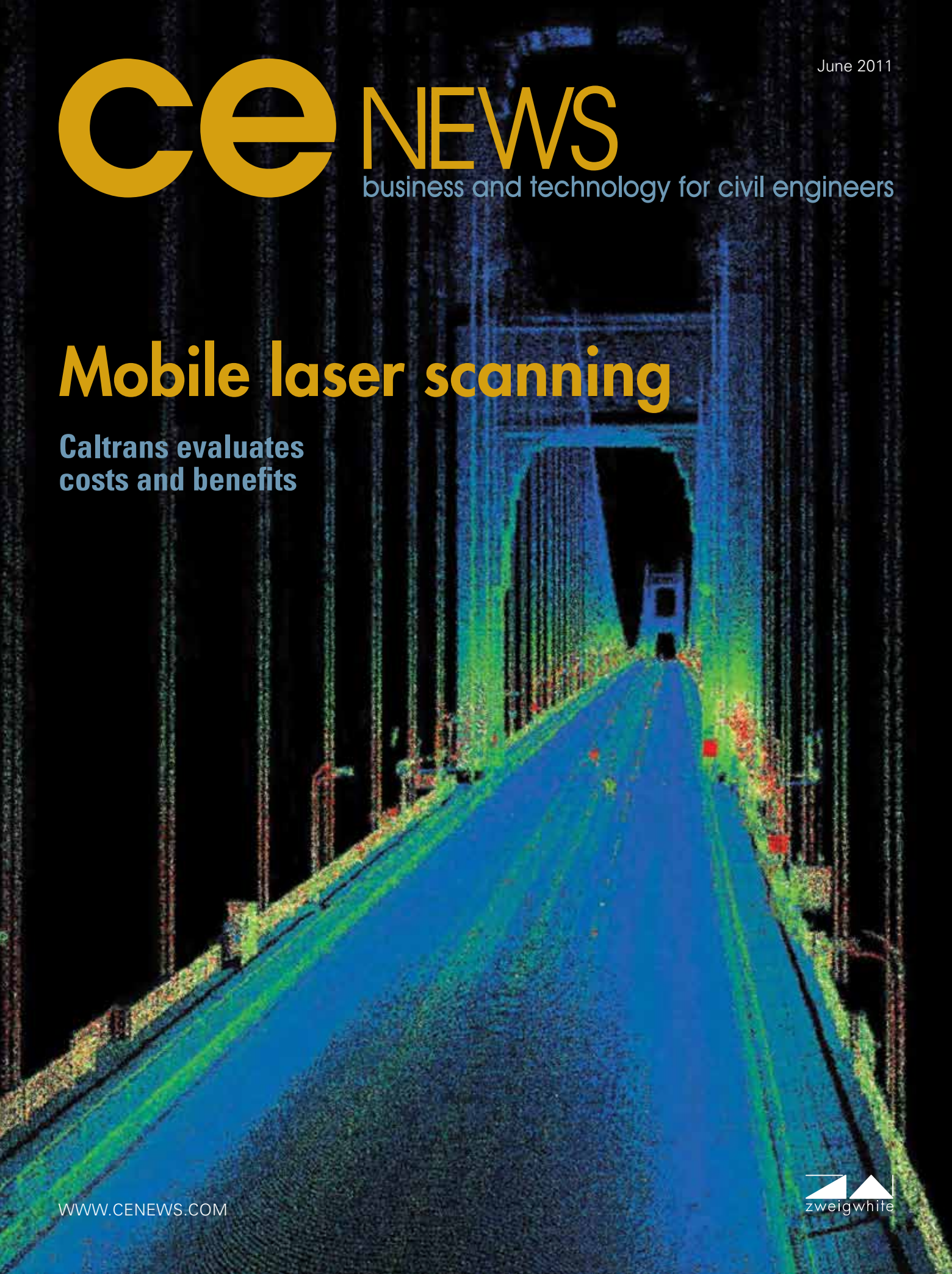

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project case study

Mobile laser scanning

Caltrans evaluates the technology's costs and benefits.

By Steve Mendenhall, P.L.S.

Project

Doyle Drive replacement, San Francisco

Participants

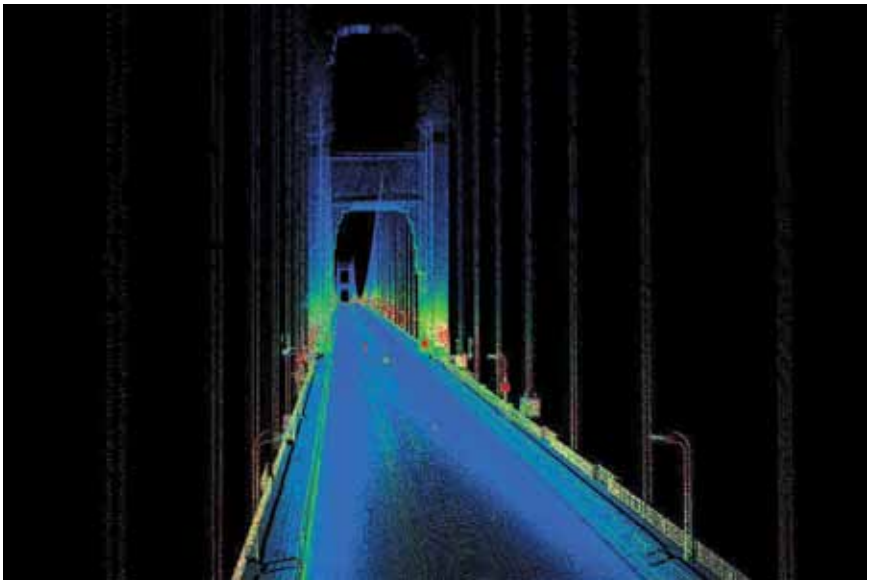
Caltrans

Psomas

WHPacific

Product application

LYNX Mobile Mapper from Optech reduces costs, increases safety, and expedites surveying of a 15-mile-long parkway.



The comprehensive data that resides in each point cloud — including this scan of the Golden Gate Bridge — means that a single deliverable can be used by a wide variety of end users for a broad spectrum of applications.

As visitors come off of the Golden Gate Bridge, the Presidio welcomes them. A unique and stunning resource, the Presidio is a national park within the boundaries of San Francisco and serves as a gateway to this world-class city. Yet, the parkway through the Presidio is in serious disrepair.

Because of the ravages of time and extensive use, the existing access road from the Golden Gate Bridge — Doyle Drive — is structurally and seismically unsafe and needs replacement. Built in 1936, Doyle Drive has reached the end of its useful life. Replacing this aging roadway not only is critical for seismic and traffic safety, but also provides an opportunity for major design improvements.

Doyle Drive has been re-envisioned as the Presidio Parkway — a roadway tucked into the natural contours of the Presidio of San Francisco and the Golden Gate National Recreation Area, one of the nation's largest urban parks. The Presidio Parkway will create a spectacular entrance from the iconic Golden Gate Bridge into the city of San Francisco. Phase one construction is under way through late 2011.

Mobile laser scanning

The state of California Department of Transportation (Caltrans District 4, San Francisco) has been interested in evaluating the costs and benefits of new mobile laser scanning technology, and the opportunity finally presented itself on the Doyle Drive project. The project required the acquisition of design-grade survey data over 15 highly restricted lane miles from the Golden Gate Bridge to the Palace of Fine Arts in San Francisco. Several factors made it difficult to perform conventional surveying on Doyle Drive, including restricted raised corridor access, impacts on the traveling public, worker safety, lane closures, limited work hours, and costs. With these concerns in mind, Caltrans focused on finding new ways to perform the surveys that would increase employee safety, decrease cost, and expedite project delivery. Caltrans turned to Psomas to help implement the use of mobile laser scanning for the survey work.

Mobile terrestrial laser scanning is an emerging technology that combines the use of a laser scanner, a global navigation satellite system, and an inertial measurement unit (adjusts input data for vehicle movements and motion) on a mobile platform to produce accurate and precise geospatial data.

Psomas, with subconsultant WHPacific, used an Optech LYNX Mobile Mapper survey solution on the project. This solution featured a tight-bundled compact Lidar laser sensor and control system with a mounting platform

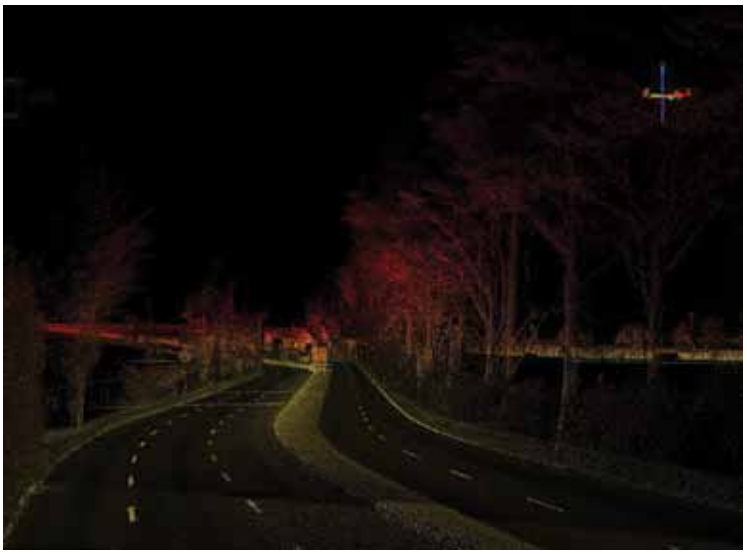
housing components to maintain alignment of sensor and navigation equipment. Able to deliver survey grade data, the Lidar sensor can collect data at more than 400,000 measurements per second with a 360-degree field of view, while maintaining a maximum eye safety rating. Not just for use on street vehicles, the mounting platform allows for mounting on all-terrain vehicles, rail vehicles, or marine craft.

Saving time and money and enhancing safety

By using mobile laser scanning on the Doyle Drive project, Caltrans "realized its goals of achieving substantial cost savings in an expedited timeframe, while at the same time enhancing worker safety," according to Nelson Aguilar, Caltrans District 4 office chief, surveys.

Reducing costs — Utilizing mobile laser scanning rather than traditional survey methods resulted in an estimated cost savings in excess of $200,000 to $300,000 to Caltrans and the city of San Francisco. This substantial cost savings was the result of a vast amount of data being acquired in a minimal amount of time with less manpower. Other factors contributing to the cost savings included reduced equipment needs, increased safety protection, the vast amount of data acquired, and the potential of multiple future uses of the data by other end users.

Increasing safety — Because mobile laser scanning eliminated the need for lane closures and the need for field crews to collect the site terrestrial topography on the ground, the risk to the field crew, as well as the traveling public, was reduced. Data collection time was limited to only a few hours in the low-risk (low-travel) periods. The only traffic safety need was a highway patrol unit for a few hours to follow the data acquisition vehicle during the low-risk hours.



Mobile laser scanning collects hundreds of thousands of field scan points per second while traveling at traffic speeds.

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Other safety benefits emanating from the use of mobile scanning include minimal to no interruption of site operations and reduced exposure to hazardous site conditions such as traffic equipment, open trenches, confined spaces, and chemical vapors.

Expediting the project — As noted before, the use of mobile scanning dramatically reduced the data collection time frame. With the ability to collect hundreds of thousands of field scan points per second while traveling at traffic speeds, data collection time was reduced from six to eight weeks for a traditional survey method to only a few hours using mobile laser scanning. The data was collected in fewer than eight hours during two nights without lane closures. In addition, management time was reduced by four weeks.

Mobile and static scanning technology has been put to use in many other instances where there is need for site data acquisition in a very short time frame, including transportation incidence scenes, sites needing immediate or emergency field survey services, forensic investigations, power and fuel processing plants, disaster response, and homeland security needs.

Wide variety of end uses

Mobile scanning deliverables have a wide variety of end uses. Deliverables can range from raw point clouds, sanitized and translated point clouds, and 2D plans to digital terrain models, 3D existing site conditions, and as-built models for building information modeling (BIM) projects. The final products can be provided in most major formats.

The comprehensive acquisition of data that resides in each point cloud means that a single deliverable can be used by a wide variety of end users for a broad spectrum of applications. In the case of the Doyle Drive project, the point cloud was used for a BIM deliverable, design studies, facilities reviews, and public outreach materials, among other uses. The full 360-degree field of view extends out 100-plus meters from the scan head, providing data that can be retrieved by other agencies or groups to meet their needs.

As the Doyle Drive project illustrates, mobile laser scanning technology is proving to be a major asset in a variety of applications. The ability of this technology to acquire a vast amount of survey data, while expediting project timeframes and reducing costs, is of significant benefit. The contribution to worker safety is invaluable.

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