Advanced Highway Maintenance and Construction Technology

3D Laser Scanning for Construction and Maintenance

What is the innovation, and why it is innovative

The innovation uses advanced 3D laser scanning for registration and localization of construction features in highway structures. It is innovative since it allows coordinate measurements from locations on the construction site remote from the construction feature being measured.

Where and when it originated, has been used, and is expected to be used in the future

The innovation originated in a research project performed by the Advanced Highway Maintenance and Construction Technology Research Center at the University of California – Davis. In this project, AHMCT researchers developed guidelines for 3D Laser Scanning that will enable large-scale deployment of this technology into Caltrans day-to-day survey operations. The research project included detailed vendor-neutral hardware and software evaluation of systems from major LIDAR vendors. This evaluation focused on issues that are of significant concern to Caltrans applications, workflows, and data flows.

The project included real-world case studies and applications, including 3D laser scan of the under-span of the SF-Oakland Bay Bridge. The key deliverable in this project was to find out the exact coordinates of the four bolts holding the connector-truss that leads into the Yerba Buena Island tunnel. The detailed point cloud allows modeling of the bolts and the determination of their coordinates and orientation. An addition deliverable was the axis line of symmetry of the stiffening beam that spans across the width of the bridge. The postprocessed CAD model data was exported to MicroStation (current Caltrans CAD software).

What it changed or replaced

It replaced having to position construction workers at dangerous locations and heights to perform measurements. It also eliminated the need for use of cranes or scaffolding.

If the nomination is for an innovative project, specifically identify each of its innovations

The innovation is to use 3D laser scanning as a method for metrology of construction features, such as bolt locations and alignments of bridge stiffening beams, in construction and maintenance of highway structures. It is innovative in that:

(a) It does not use traditional measurement techniques;

(b) Measurements can be made from a location on the construction site which is remote from the location where the measurement is taken;

(c) It eliminates the need for construction workers to have proximity to the construction feature for measurement, therefore greatly enhancing worker safety.

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Figure 1: Scan setup

Figure 2: Bolt pattern on the south side of the Bay Bridge

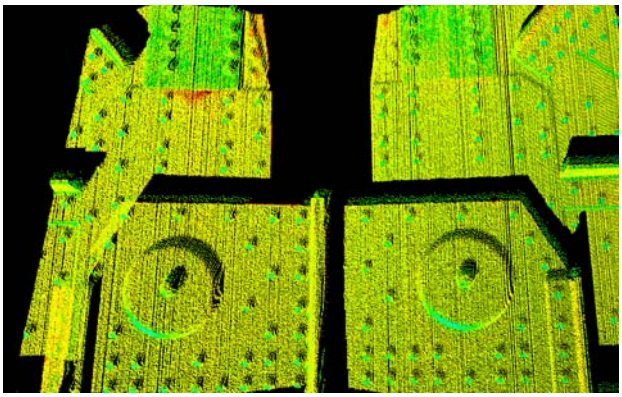

Figure 3: Snapshot of laser point cloud showing fine detail of the bolt pattern on the south side of the Bay Bridge

Figure 4: The stiffening beam across the Bay Bridge span

Figure 5: Registration control points overlaid on laser point cloud data – North side scan of Bay Bridge

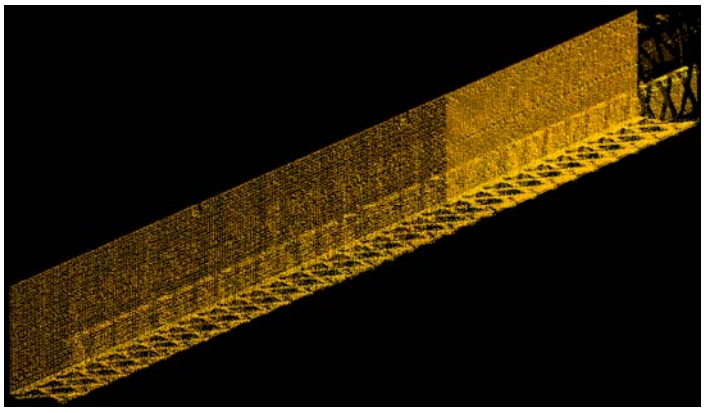

Figure 6: Laser point cloud data as an end-result of merged scans of the stiffening beam, with almost zero noise