

FIELD NOTES

Bridge Scanning: Two bridges, one day, surveying made twice as easy

On May 27, 2002, Purdue University undertook a project with Optech to scan two bridges in Indianapolis, Indiana. The purpose of the project was threefold:

1. To ascertain the speed at which such a project could be completed.
2. To document the process of scanning a complex structure such as a bridge.
3. To verify that dense, accurate data could be generated within a reasonable time.

The bridges that were scanned were the Bridgeport Road bridge and the Six Points Road bridge, both over Interstate 70, immediately southwest of the Indianapolis Airport. This area is scheduled to become an entrance to new airport terminal facilities. The goal of the data collection was to provide detailed as-built information to the design team under contract to the Indiana Department of Transportation (DOT).

Scanning each bridge presented several challenges. The scans had to be done from several locations in order to ensure coverage of the entire structure, and a fine balance between data collection time and point density had to be maintained. Extreme over-sampling would increase the data collection and processing times, but the point density had to be adequate for the application.

The most difficult challenge in the project was aligning scans from the top of the bridge to scans from the sides and bottom. Since alignment requires common points to align multiple scans, several tripods were placed on the surface of the bridge. Each tripod held a different geometric object ranging from a GPS antenna to Styrofoam spheres. These worked well because they were visible on all scans and could be used for the alignment process.

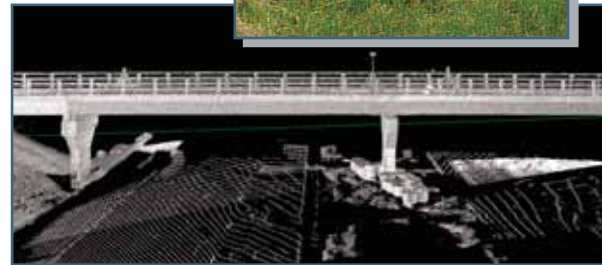
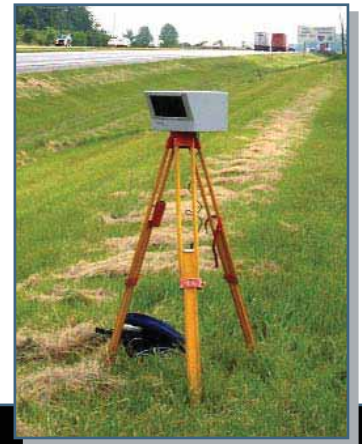
It was determined that each bridge would require 12 scans at a resolution of approximately 1 inch. This resulted in a data collection time of approximately 3 hours for each bridge, including 2 hours of scanning (10 minutes per scan) and 1 hour of setup time (5 minutes between each scan). In the end, both bridges were scanned in one business day.

Data Processing

During each scan cars were continually passing into the field of view of the scanner. As a result, each scan needed to be edited individually before the scans could be aligned together. This was accomplished in a matter of minutes for each scan using the 3D viewing ability of PolyWorks. Following that, the scans were aligned to generate a complete dataset. Using the features visible on the top of the bridge made this relatively easy (approximately 2 hours for each bridge).

The final process for this phase of the project involved the generation of solid models and cross sections from the datasets. Using PolyWorks, approximately 20 MB solid models were generated in 1 hour for each bridge.

Once the solid models were complete, the generation of cross sections was simple. Cross section intervals were decided upon and the cross sections (dxf format) of each bridge were generated in minutes.

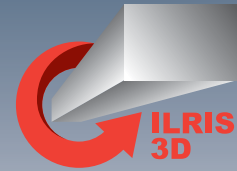


Images from top: ILRIS-3D scanning the survey scene, and a profile view point cloud. Bottom: Photo of one of the surveyed bridges.



High resolution solid models and cross sections were provided in the span of 24 hours. This project proved that a high resolution structural survey can be completed and processed at unprecedented speeds. Also, due to the high point density, the user is able to

provide products that are unavailable from conventional methods. Not only was time saved, but a better, more complete product was provided to the client.

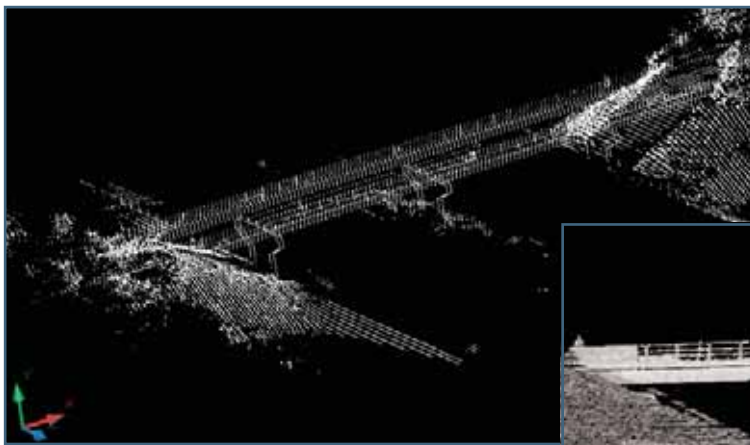


Results and Comparison

Data Collection	Bridge A	Bridge B
Setup Time	30 minutes	30 minutes
Number of Scans	12	10
Data Collection Time	3 hours	2.5 hours
Total Number of Measurements	~5,400,000	~4,500,000

Data Processing	Bridge A	Bridge B
Data Editing Time	15 minutes	15 minutes
Scan Alignment Time	2 hours	2 hours
Solid Modeling Time	1 hour	1 hour

PROJECT SUMMARY	Bridge A	Bridge B
Total Data Collection Time	3.5 hours	3 hours
Total Data Processing Time	3.25 hours	3.25 hours
Total Time per Measurement	0.0045 seconds	0.005 seconds
TOTAL TIME TO GENERATE FINAL PRODUCT	~7 hours	~6.5 hours



Images showing results of survey, from left: Cross-sections generated from the entire point cloud; solid model of a bridge.



Better data in half the time ~ **PRODUCTIVITY DOUBLED**



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