HELICOPTER-MOUNTED LASER SURVEY FOR I-69

With the designation of I-69 (the proposed interstate connecting Canada and Mexico) the ultimate outcome of the master plan for the 42-mile long segment through Angelina and Nacogdoches counties, Texas, shifted from conceptual design to full schematic design. To meet the original schedule, the Texas Department of Transportation (TxDOT) and planners and designers from Parsons Brinckerhoff (PB), selected, tested, and implemented the first-time use of a helicopter-mounted laser survey for a highway in Texas. The survey, using light detecting and ranging (LiDAR) technology, resulted in a monumental cost savings, a significant time savings, better public relations, and a better image for TxDOT. John Chance Land Surveys, Inc. (JCLS) performed the survey.

The type of terrain and vegetative covering was a key factor in determining what kind of survey to use to create a digital terrain model (DTM). Since much of the study area is covered with thick evergreen pine forests, a ground survey would have required extensive rights-of-entry, brush cutting, and scarring of tree farms. Furthermore, due to the heavy tree canopy, a DTM from conventional airborne photography would not cover the entire corridor.

The pressure to maintain the original 23-month schedule presented an opportunity to investigate and implement the new LiDAR technology. The challenge to the project team to break traditional boundaries began with the review of available technologies for performing the surveying work. The technologies evaluated to obtain a DTM and complete the project on time included: traditional ground surveyed cross-sections, standard aerial photogrammetry, and photogrammetry using airborne Global Positioning Satellites (GPS).

The team had decided to use a combination of aerial GPS photogrammetry and ground survey when information came in about LiDAR technology that had been used in other disciplines such as power transmission lines, pipelines, and railroads, but not for highway design in Texas.

With the cooperation of the team and the LiDAR provider, TxDOT decided to test the new laser survey technique. The LiDAR surveying technology uses a low flying helicopter, airborne GPS, and 2 GPS base units to obtain the data.

To ensure TxDOT about the accuracy of the technology, JCLS agreed to perform a test flight and evaluation at no cost - as long as they would receive the work if LiDAR's accuracy proved to match their claims.

Engineers and a local surveyor selected a test site within the preferred corridor. The selected site, located on the Winston Land & Cattle tree farm, was approximately one-half mile long by 1500 feet wide. The site had dense forestation on one side and an open area with heavy grass or vegetative cover on the other. The test obtained data by both LiDAR with airborne GPS and by ground survey. Both sets of raw data were transmitted to PB for evaluation. Using GEOPAK® software, a DITM was created from each set of data. Then a grid of 36,418 points (10 foot on center) was draped across both DTM's to obtain common x,y coordinates so that the z values could be compared. This data was imported into Microsoft® EXCEL and sorted by x,y values. Approximately 76 percent of the points were within the plus or minus six-inch requirement. Approximately 94 percent of the points were ± one foot

The test proved LiDAR was accurate enough to develop a DTM for schematic design and TxDOT decided to implement LIDAR on the project for the initial survey work. As a result of using this method and "breaking the mold" of traditional wisdom, over $1.5 million and 9 months were saved on the project. Rights-of-entry were not required, public opinion of TxDOT and the project soared, and a potential tool for other similar projects was introduced to Texas.

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Helicopter-Mounted Laser Survey for I-69

Angelina and Nacogdoches Counties, Texas

Unprecedented testing and use of LiDAR (light detecting and ranging) technology for a Texas corridor represents a new standard for obtaining data for designing highways through thickly vegetated areas.

Benefits included:

- Savings of 9 Months & Over $1.5 Million
- DTM (Digital Terrain Model) for Over 12,000 Acres Completed in Under 6 Weeks
- No Rights-of-Entry Required
- Non Intrusive
- Non Destructive
- Safer For Survey Crews