Kansas Department of Transportation

TECHNICAL SUMMARY

Assessing LiDAR Elevation Data for KDOT Applications

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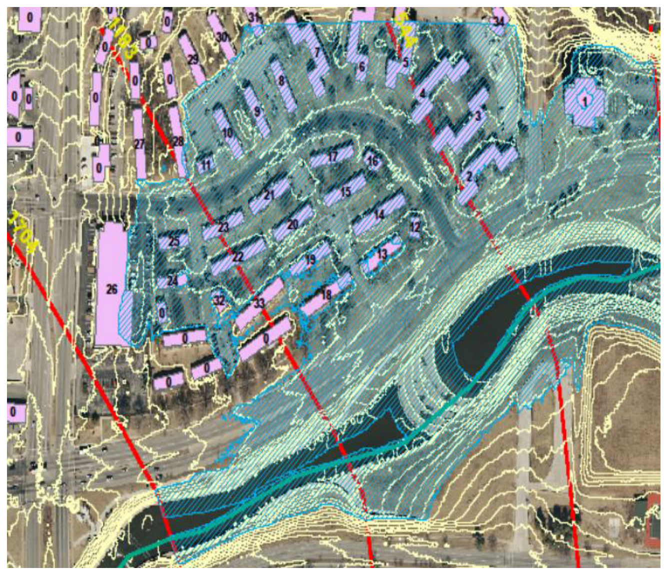
Introduction

LiDAR-based elevation surveys are a cost-effective means for mapping topography over large areas. LiDAR surveys use an airplane-mounted or ground-based laser radar unit to scan terrain. Post-processing techniques are applied to remove vegetation and reveal the bare-earth elevations. In recent years, LiDAR hardware and processing technologies have improved greatly. LiDAR surveys are now cost-competitive with traditional aerial topographic surveys and offer the capability to produce very high resolutions (potentially over 50 points per m2 with <10 cm vertical accuracy for airborne systems).



(Image courtesy of PhotoScience, Inc.)

LiDAR Used for Floodplain Modeling and Mapping

Project Description

LiDAR survey data may not replace traditional ground-based survey for applications that require centimeter or sub-centimeter accuracy, but the data available from these surveys may be perfect for many engineering applications. One such application is hydraulic modeling with HEC-RAS. Hydraulic models, used for flood-plain mapping and the evaluation of bridge backwater effects, require detailed elevation maps for the stream channel and floodplain. These data are difficult to obtain using traditional aerial survey techniques due to riparian vegetation that obstructs the view of the stream channel. Another potential application for LiDAR data is earthwork calculations (cut/fill analysis) for preliminary route planning purposes. Because LiDAR surveys are fairly new, the applications and limitations of these data have not been explored. This report presents an overview of LiDAR technology, applications, and error characteristics. Over fifty research papers and reports were reviewed.

Project Results

LiDAR data acquisition and analysis have the potential to revolutionize highway design, construction, and maintenance. ALS surveys may be suitable to replace or supplement traditional survey and photogrammetric mapping for a variety of applications, including highway planning and hydrologic / hydraulic studies. ALS has demonstrated potential for the development of highway inventories, sight distance studies, intersection line-of-sight studies, and the mapping of road breaklines (edge-of-curb for planimetric mapping). Currently, the accuracy of ALS is at or near 15 cm vertical RMSE, suitable for generating 2-ft contours. Recent studies have produced lower vertical RMSE; even below 10 cm. ALS is currently capable of routinely producing DEMs suitable for floodplain mapping according to FEMA standards.

MLS technology could be integrated with a current DOT's highway video collection system for documentation of road conditions. MLS has the potential to generate extremely high resolution maps of the highway surface and adjacent corridor. These MLS data can be used for as-built documentation, development of sign inventories, or to collect preliminary elevations for design work.

TLS has tremendous potential for DOT applications, particularly when integrated with traditional survey techniques. TLS has been demonstrated to be useful for bridge clearance measurement and damage detection. An archive of bridge scans would be useful for rapid damage analysis. TLS can be used to supplement traditional survey to collect detailed elevate on maps of areas that are difficult or unsafe to survey. For example, some surveying companies use LiDAR to survey intersections. MLS should be considered carefully as an alternative to TLS, as the accuracy of the two methods are similar for areas where multiple TLS scanner positions are required.

Project Information

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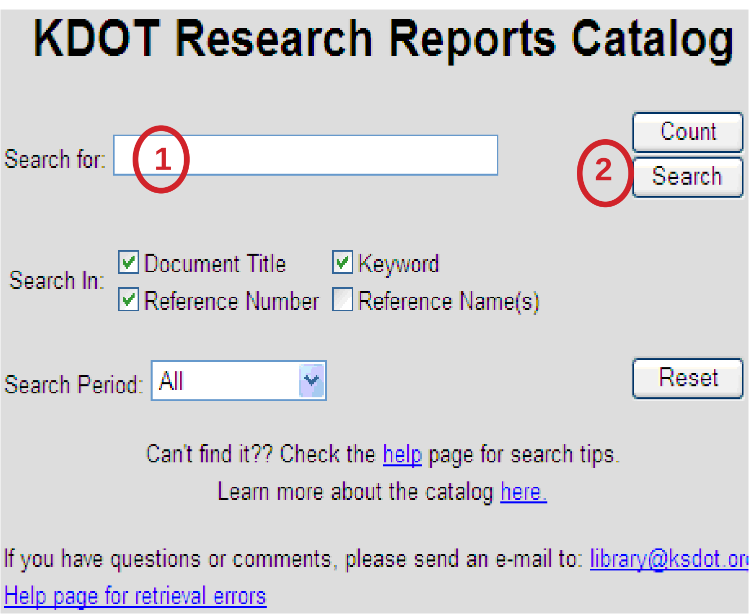

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