Use of LiDAR Technology in Local Government

Background

Local government uses elevation data for many engineering programs, including utilities, road and bridge design and floodplain development. In 2006, Johnson, Jefferson, and Shawnee Counties acquired LiDAR data as part of a multi-jurisdictional project along the Kansas River. Sedgwick County also recently acquired LiDAR. Some of the local government uses of the data are described here.

Purpose

Johnson County utilized LiDAR data to generate average, minimum and maximum building heights, a bare earth DEM, 2 foot contours, hillshade and aspect. LiDAR has been used to assign elevations to manholes and locations of trails. The Planning Department has used the contour data to address floodplain-related inquiries including the amount of fill that would be needed for new construction in floodplains. The LiDAR data is available in a website viewer, and anyone with internet access can hover on the map and read elevations of LiDAR points.

Recently a citizen was able to determine the elevations in an area and suggest alternative higher locations for a proposed cell tower.

Jefferson County Emergency Management has used LiDAR to predict flood areas. The LiDAR data was also provided to FEMA to produce a highly accurate Digital Flood Insurance Rate Map (DFIRM). Jefferson County regularly supplies elevation maps to internal departments and public citizens. The Road and Bridge Department requests maps with contour data during the planning stages of bridge and culvert repair. Depiction of slope and drainage areas is particularly helpful for these applications. Cities have requested elevation maps for water/sewer repairs, and an architect generated a 3D model of a forty-acre land parcel from LiDAR data in order to site a house for maximum energy efficiency.

LiDAR is an acronym for Light Detection And Ranging. LiDAR is an aircraft-based remote sensing technology that uses laser pulses of light to measure height or elevation points on the landscape.
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Shawnee County has used both point cloud and bare earth LiDAR data for hydraulic analysis in preparation for replacing culverts. The U.S. Army Corps of Engineers requires a detailed cross-section analysis along the channel corridor prior to certifying that the new culvert is large enough to accommodate flood waters. The County also used LiDAR data in the development of new floodplain maps; preliminary maps were released for public comment in February 2010.

The City of Wichita and Sedgwick County are using LiDAR, aerial imagery and stormwater structure data to recertify levees as mandated by Congress. Future uses include drainage basin delineation and flood inundation analyses.

Results

Prior to the availability of LiDAR data, highly accurate elevation measurements involved employing a survey crew at an average cost of about $200 an hour (Shawnee County estimate). Survey costs can add up quickly, especially during warm months in highly vegetated areas, as the land must be cleared prior to survey. LiDAR data significantly reduces the cost of the project and allows the inclusion of a much larger area for analysis than can be effectively surveyed.

With the integration of LiDAR, aerial imagery and stormwater data into a geospatial database, Wichita and Sedgwick County improved the engineering hydrologic and hydraulic results of their analyses and met the aggressive schedule created by the Federal Emergency Management Agency (FEMA) for levee recertification. The new procedures will reduce levee failures, protect property values and the local economy, and save lives.

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Wichita Levee Recertification Project. Images Courtesy of Merrick & Company.