LiDAR ACCURACY REPORT

Project:	MO/AR Counties LiDAR Project
Report Area:	Shannon County, MO
Delivery Order No.:	0018
Contract No.:	W912P9-10D-0538
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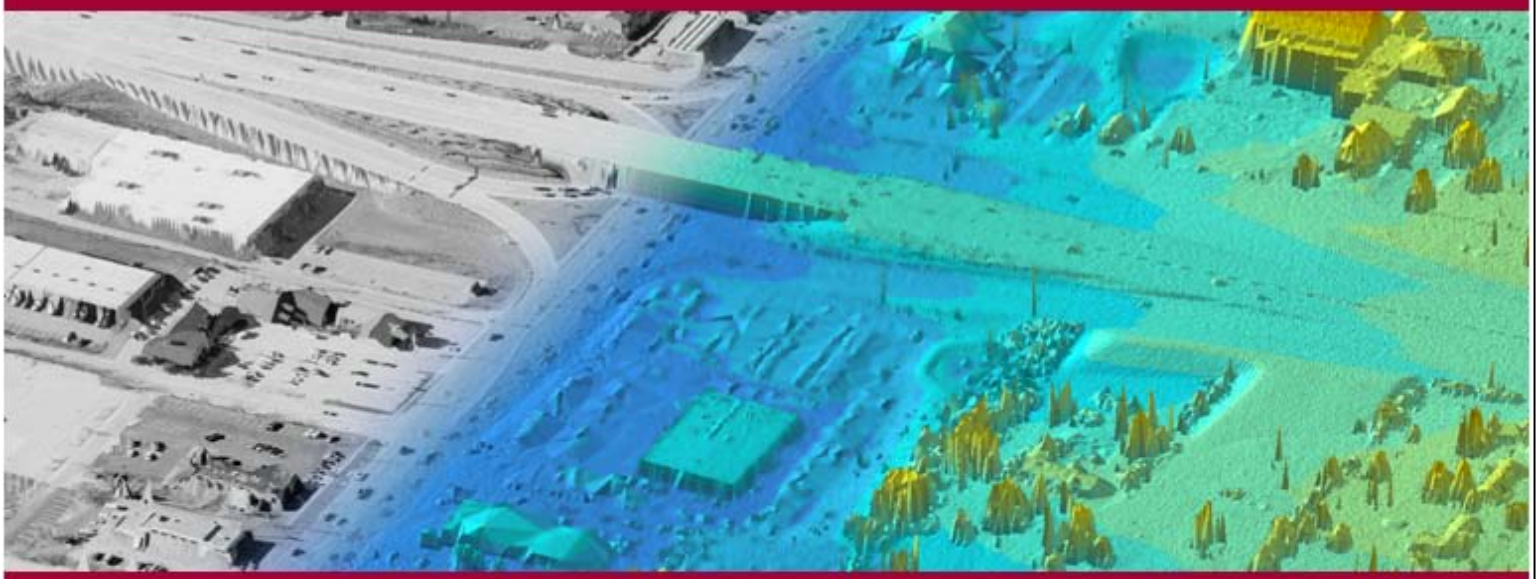
Submitted by:	Wade Williams, Project Manager



US Army Corps of Engineers, St. Louis District

Project Overview

The St. Louis District of the United States Army Corps of Engineers (USACE) contracted with Surdex Corporation in the fall of 2013 to collect high resolution LiDAR elevation data over multiple counties as part of the Missouri & Arkansas Counties Lidar Project. The project combines the varied interests of the MO-NRCS, MO-DNR, USGS, USACE and Arkansas Game & Fish totaling over 20,200 square miles of coverage. Processing of the LiDAR data and bare-earth model followed USGS Base LiDAR Specifications V1.0 standards. Surdex tested that the deliverables meet or exceed accuracy as stated in NDEP Guidelines for digital elevation data, Version 1.0 for NSSDA of 95% confidence for 2' contours and ASPRS Class I Standards. Hard surface survey control points were collected by Surdex in order to calibrate the swath LAS data, these values are listed in the table on page 3. In addition independent survey check points were collected on hard surface features, in urban areas, in grass & under trees for each delivery area as specified by the USACE. The survey check points were compared to both the Classified LAS LiDAR data & bare-earth Imagine DEM and the differences have been outlined on page 6. In order to meet the USACE project specifications the overall vertical accuracy of these points should be 15.0 centimeters RMSEz or less. The RMSEz was calculated as the square root of the average of the set of squared differences between the bare-earth and the survey points collected for the individual features (hard surface, grass & trees). Also, 95 percent of the feature types should be less than 1.96 times the RMSEz which equals 36.3 centimeters or less. The final results for this delivery area are listed on the last page of this report.

Delivery Area

This report covers the collection and processing of LiDAR elevation data over Shannon County MO. The project limits are presented in the graphics below. The project area consisted of approximately 92 square miles of elevation data.

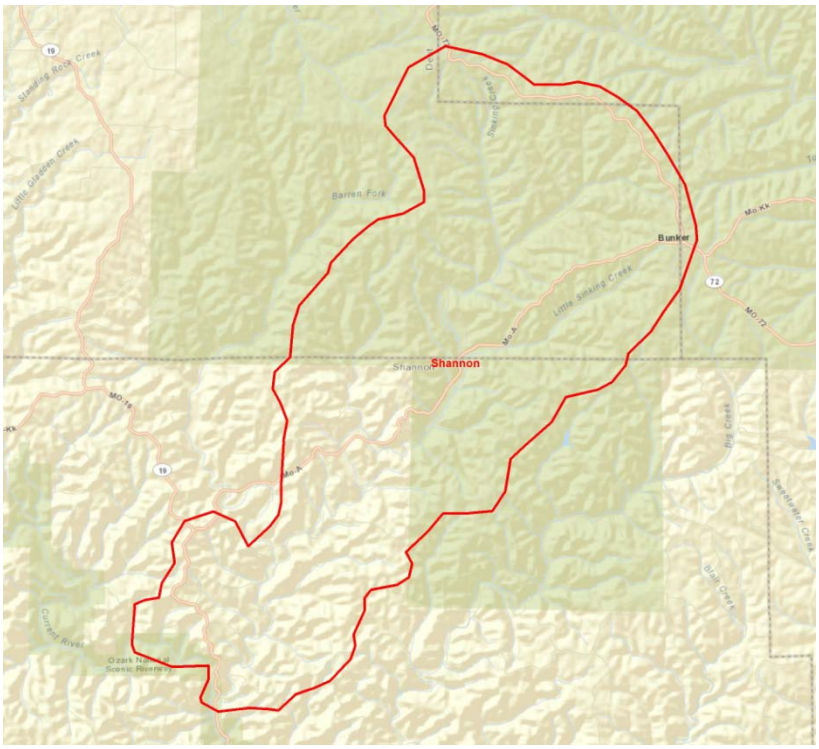


Figure 1 Shannon Co. Project Area

LiDAR Data Collection

The LiDAR elevation data for this project was collected with an Optech Orion Aerial LiDAR sensor system. The project design called for acquisition of LiDAR data with lines flown diagonally. The nominal collection scenario called for the acquisition of nominal point spacing of 1 meter on the ground.

Shannon Co. Swath LiDAR Control

The field survey control for this delivery consisted of 13 hard surface (HS) **open-terrain** control points used for calibrating the unclassified LiDAR swath data. The graphic below presents these control points on the delivery area map.

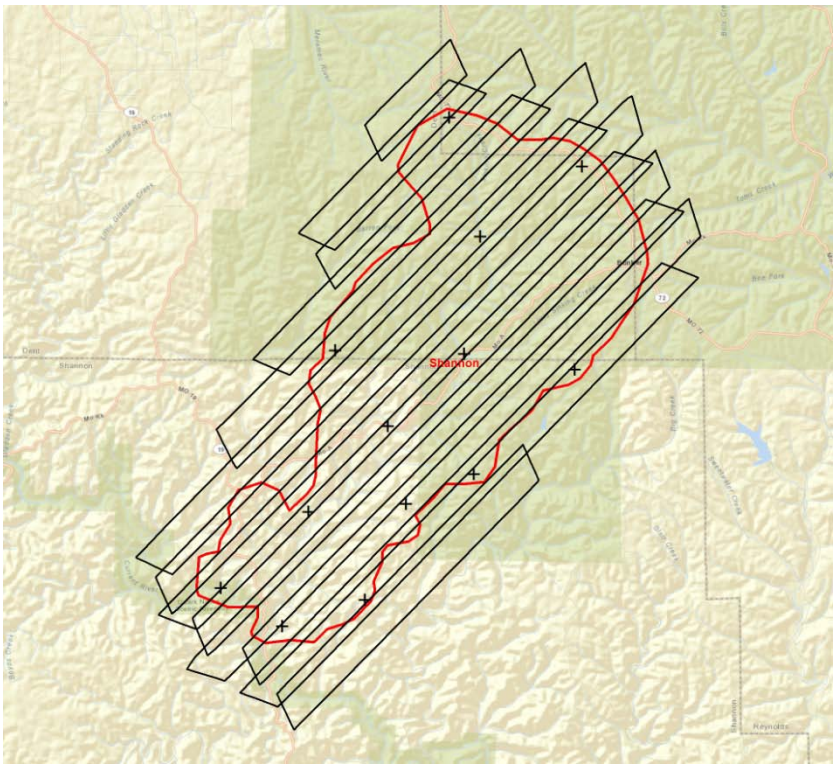


Figure 2 Shannon Co. Swath LiDAR Control

Swath LiDAR Control Accuracy Results

The table below presents the results of the control accuracy analysis for the Shannon Co., MO unclassified swath LAS data. All values are in meters.

Stat	Hard Surface (HS)
Count	13
RMSEz (FVA)	0.038
95% Confidence Level (FVA)	0.075

Shannon Co. LiDAR QC Check

An additional set of survey check points were collected for an independent QC of the Classified LAS & Imagine DEM deliverable tiles. The points were collected over the following feature types: 11 hard surface (HS), 4 grass (G) points & 7 tree (TR) points for a total of 22 qc check points. No points were collected over urban features due to the rural AOI. The graphic below presents these QC check points on the delivery area map.

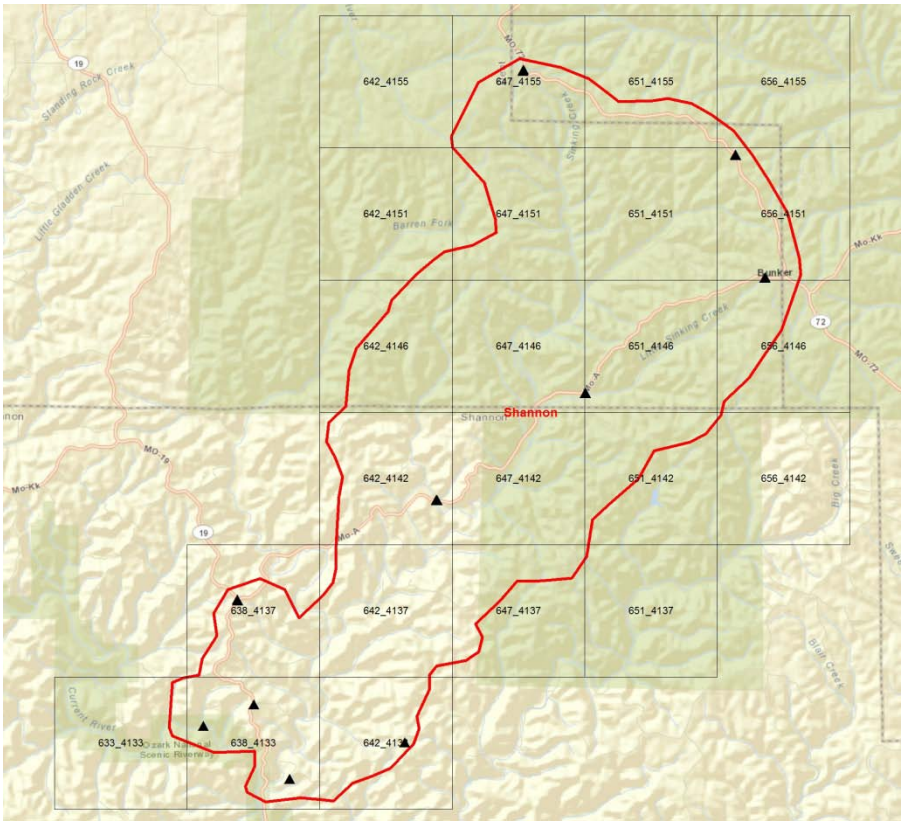


Figure 3 Shannon Co. LiDAR QC Check

These points consisted of various types of ground cover including asphalt, gravel, short grass, tall grass and trees. Examples to the types of points surveyed are included below.






The required LiDAR elevation data values were derived within ArcGIS from the bare earth LAS files. For each control point location a LiDAR elevation value was derived and exported and the surface value subtracted from the survey elevation. These derived values were imported into Excel and comparisons were performed to generate statistics by ground cover type and for the overall dataset.

Classified LAS QC Accuracy Results

The table below presents the results of the QC accuracy analysis for the Shannon Co., MO classified LAS tile data. All values are in meters.

Stat	Overall	Hard Surface (HS)	Grass (G)	Trees (TR)
Count	22	11	4	7
RMSEz (FVA)	0.095	0.086	0.080	0.114
95% Confidence Level (FVA)	0.187	0.169	0.157	0.224
95th Percentile (CVA & SVA)	0.175	0.164	0.106	0.189

As indicated above the LAS LiDAR surface meets hard surface Fundamental Vertical Accuracy (FVA) project specifications of RMSEz less than or equal to 15.0 cm, with an RMSEz of 8.6 cm. The FVA 95% confidence level of 29.4 cm or less was also meet with a value of 16.9 cm.

DEM QC Accuracy Results

The table below presents the results of the QC accuracy analysis for the Shannon Co., MO derived bare-earth Imagine DEM tile data. All values are in meters.

Stat	Overall	Hard Surface (HS)	Grass (G)	Trees (TR)
Count	22	11	4	7
RMSEz (FVA)	0.104	0.095	0.084	0.125
95% Confidence Level (FVA)	0.203	0.186	0.164	0.245
95th Percentile (CVA & SVA)	0.179	0.167	0.114	0.190

As indicated above the derived DEM LiDAR surface meets both Supplemental & Consolidated Vertical Accuracy (SVA & CVA) project specifications of 95th Percentile less than or equal to 36.3 cm.