LiDAR ACCURACY REPORT

Project:	Elk Horn River LiDAR Project
Report Area:	Elk Horn River Nebraska
Delivery Order No.:	0005
Contract No.:	W912P9-10D-0538
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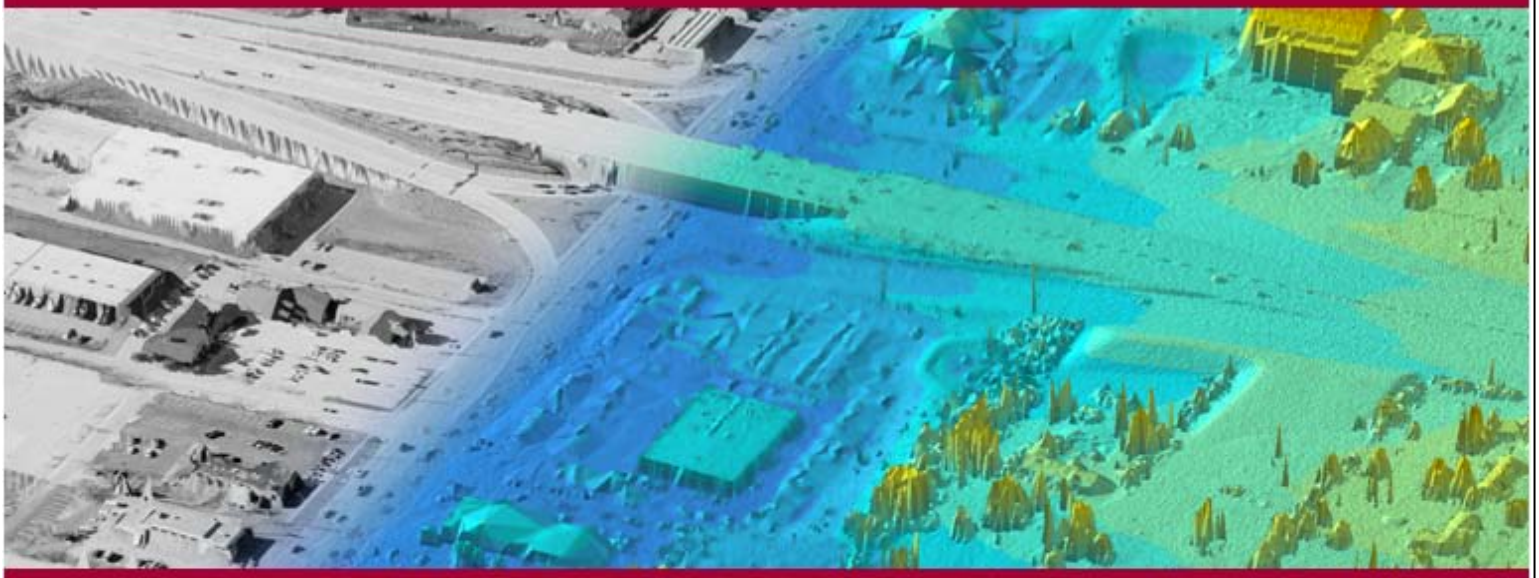
Submitted by:	Wade Williams, Project Manager



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 2011 to collect high resolution LiDAR elevation data over the Elk Horn River in Nebraska. The project covers approximately 694 square miles over two areas. The southern area is a 177 square miles at the confluence of the Elk Horn & Platte Rivers. The northern area follows the Elk Horn River about 125 miles to the northwest. Processing of the LiDAR data and bare-earth model followed USGS Base LiDAR Specifications V13 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. Survey points were collected on hard surface and grass surfaces as specified by the USACE. The survey ground truth points were compared to both the LAS LiDAR data & bare-earth ESRI Grid DEM and the differences have been outlined in this report. In order to meet project specifications the overall vertical accuracy of these points should be 18.5 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% confidence level & 95th percentile of the feature types have been reported as well. The final results for this delivery area are listed on the last page of this report.

Project Area

This report covers the collection and processing of LiDAR elevation data over the Elk Horn River in Nebraska. The project limits are presented in the graphics below. The project area consisted of approximately 694 square miles of elevation data.

Figure 1 Elk Horn River Project Area

LiDAR Data Collection Scenario

The LiDAR elevation data for this project was collected with a Leica ALS-50II MPIA aerial LiDAR sensor system. The project design called for acquisition of LiDAR data with lines flown north-south. The nominal collection scenario called for the acquisition of nominal point spacing of 1.4 meter on the ground.

LiDAR Evaluation

The field survey for this delivery consisted of 28 hard surface points & 35 grass points for a total of 63 check points. The graphic below presents these points on the delivery area map.

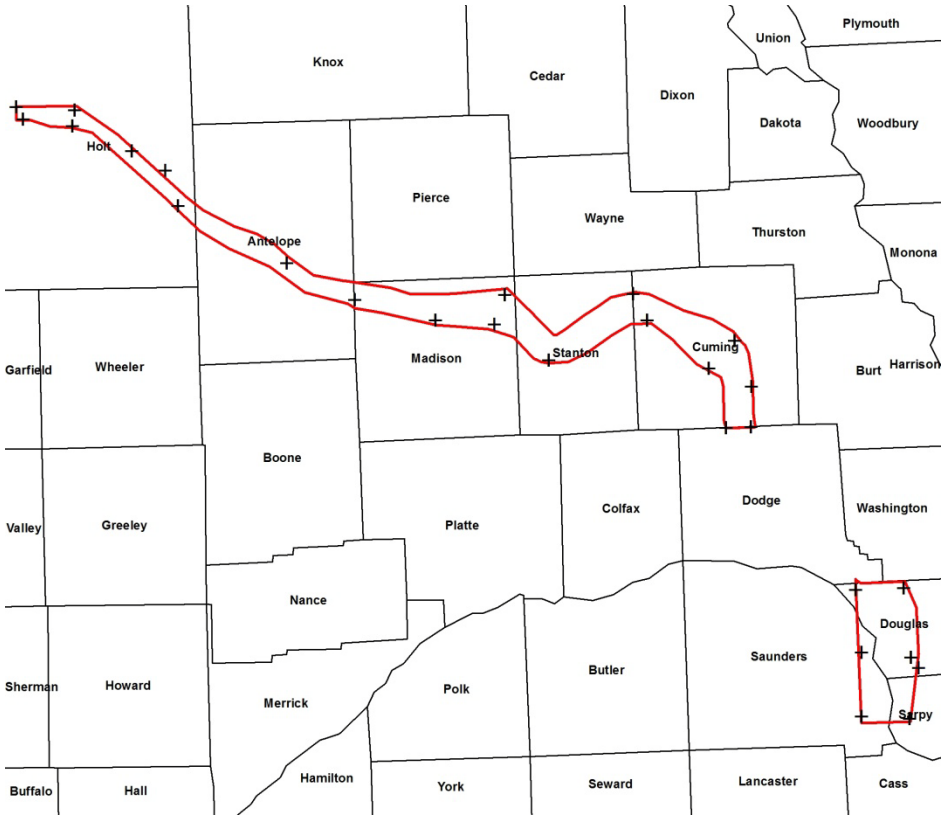


Figure 2 Elk Horn River Control

These points consisted of various types of ground cover including asphalt, gravel, short grass & tall grass. 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 Elk Horn River Nebraska Classified LAS data. All values are in feet.

Stat	Overall	Hard Surface	Grass
Count	63	28	35
Average	-0.022	0.021	-0.057
RMSEz (FVA)	0.401	0.354	0.435
95% Confidence Level (FVA)	0.786	0.694	0.853
95th Percentile (SVA & CVA)	0.755	0.600	0.834

As indicated above the Classified LAS LiDAR surface meets hard surface Fundamental Vertical Accuracy (FVA) project specifications of RMSEz less than or equal to 18.5 cm, with an RMSEz of 10.78 cm. The FVA 95% confidence level of 24.5 cm or less was also meet with a value of 21.15 cm. The 95th percentile of 36.3cm for both CVA & SVA were also met.

DEM QC Accuracy Results

The table below presents the results of the QC accuracy analysis for Elk Horn River Nebraska DEM data. All values are in feet.

Stat	Overall	Hard Surface	Grass
Count	63	28	35
Average	-0.106	-0.053	-0.149
RMSEz (FVA)	0.424	0.375	0.460
95% Confidence Level (FVA)	0.831	0.735	0.901
95th Percentile (SVA & CVA)	0.816	0.654	0.880

As indicated above the Classified LAS LiDAR surface meets hard surface Fundamental Vertical Accuracy (FVA) project specifications of RMSEz less than or equal to 18.5 cm, with an RMSEz of 11.43 cm. The FVA 95% confidence level of 24.5 cm or less was also meet with a value of 22.4 cm. The 95th percentile of 36.3cm for both CVA & SVA were also met.