Illinois Department of Transportation, District 4, Tazewell County LiDAR Acqusition

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Description:

Abstract:

This task order is for planning, acquisition, processing, and derivative products of LiDAR data to be collected for areas of Illinois. LiDAR data, and derivative products produced in compliance with this task order are part of the data to be obtained under Job Number P-94-025-10. Specifications listed below are based on the U.S. Geological Survey National Geospatial Program Base LiDAR Specification, Version 13.

Purpose:

LiDAR data was collected for the Illinois Department of Transportation. The Illinois Department of Transportation LiDAR Acquisition project is to acquire high accuracy bare-earth processed LiDAR data; to produce vector collection of water and drainage features, DAT files and Triangulated Integrated Network (TIN) files.

The data referenced is part of Illinois District 4 and refers to Tazewell County in Illinois. Tazewell County is 1704 square kilometers (650 square miles).

The project consisted of airborne acquisition, post-processing, classification of LiDAR data, collection of water and drainage and creation of final deliverable products. All areas

are collected at a nominal pulse spacing (NPS) of 1.0 meters based on UTM16, related to the North American Datum of 1983 HARN. Vertical accuracy was to achieve a RMSE Z of 0.6 feet or better in the "Open Terrain" land cover category.
Time_Period_of_Content:
Time_Period_Information:
Range_of_Dates/Times:
Beginning_Date: 20110405
Ending_Date: 20120212
Currentness_Reference: ground condition
Status:
Progress: Complete
Maintenance_and_Update_Frequency: As needed
Spatial_Domain:
Bounding_Coordinates:
West_Bounding_Coordinate: -89.920
East_Bounding_Coordinate: -89.260
North_Bounding_Coordinate: 40.750
South_Bounding_Coordinate: 40.323
Keywords:
Theme:
Theme_Keyword_Thesaurus: None
Theme_Keyword: Light Detection and Ranging
Theme_Keyword: LiDAR
Theme_Keyword: Breaklines
Theme_Keyword: Shapefiles
Theme_Keyword: Survey Control
Theme_Keyword: Lift
Theme_Keyword: LAS
Theme_Keyword: Swath
Theme_Keyword: Project
Theme_Keyword: DAT
Theme_Keyword: TIN
Place:
Place_Keyword_Thesaurus: None
Place_Keyword: US
Place_Keyword: State
Place_Keyword: IL
Place_Keyword: Illinois
Place_Keyword: Tazewell
Place_Keyword: Tazewell County
Access_Constraints: None.
Use_Constraints:
None. However, users should be aware that temporal changes may have occurred since this data set was collected and that some parts of this data may no longer represent actual surface conditions. Users should not use this data for critical applications without a full awareness of its limitations.

Acknowledgment of the Illinois Department of Transportation, Bureau of Design and Environment, would be appreciated for products derived from these data.
Point_of_Contact:
Contact_Information:
Contact_Person_Primary:
Contact_Person: Amy Eller
Contact_Organization: Illinois Department of Transportation, Aerial Survey Section
Contact_Address:
Address_Type: mailing and physical address
Address: 2300 South Dirksen Parkway, Room 005
City: Springfield
State_or_Province: IL
Postal_Code: 62764
Country: USA
Contact_Voice_Telephone: 217-782-4748
Contact_TDD/TTY_Telephone: unknown
Contact_Facsimile_Telephone: unknown
Contact_Electronic_Mail_Address: Amy.Eller@illinois.gov
Hours_of_Service: unknown
Contact_Instructions: none
Data_Set_Credit: AeroMetric, Inc.
Native_Data_Set_Environment:
1. Scanner - Optech Gemini
2. Processing Programs and versions - Applanix POSGPS and POSProc, versions 4.4, MMS version 5.2
3. Program and version - Optech ASDA
4. Processing Programs and versions - TerraSolid TerraScan (version 012.019), TerraModeler (version 012.008) and TerraMatch (version 012.011), Geopak (version 08.01.00.07), Intergraph MicroStation (version 08.05.02.70), and GeoCue (version 2012.1.27.4) 5. Viewing Program - GlobalMapper V12.00

Data_Quality_Information:
Attribute_Accuracy:
Attribute_Accuracy_Report:
Project data was collected as one project including all counties of Illinois District 4. LiDAR data was placed into a tile layout and later divided by county boundaries. Ground survey check points were collected on a county basis by Lin Engineering, Inc for use in vertical accuracy evaluation. In vertical accuracy assessments the ground survey check points of the various ground cover categories are compared to a TIN of the LiDAR points, differences are measured to establish an RMSE.
Logical_Consistency_Report: None.
Completeness_Report: Complete
Positional_Accuracy:
Horizontal_Positional_Accuracy:
Horizontal_Positional_Accuracy_Report:

All data were acquired at or below 1600 meters above mean terrain (AMT) and have a horizontal accuracy of 0.30 meters (per manufacturers system specifications), with a nominal point spacing of 1.0 meters.
Vertical_Positional_Accuracy:
Vertical_Positional_Accuracy_Report:
The vertical accuracy of the data has a requirement to achieve a Fundamental Vertical Accuracy (FVA) of 18.2 ft at 95% confidence level based on an RSMEz x 1.960 in "open terrain" as defined by National Standards for Spatial Data Accuracy (NSSDA); assessed and reported using National Digital Elevation Program (NDEP)/ASPRS Guidelines. Further, the data requires a Consolidated Vertical Accuracy (CVA) of 1.19 ft at 95th Percentile and a target value for Supplemental Vertical Accuracy (SVA) of 1.19 ft at 95th Percentile.
The ground survey data included many points categorized as 'Cross Section'. These points were used in evaluation against the TIN. The results are included in graphs in the Vertical Accuracy Assessment Report.
Quantitative_Vertical_Positional_Accuracy_Assessment:
Vertical_Positional_Accuracy_Value: 0.163 ft RMSEz .
Vertical_Positional_Accuracy_Explanation:
Tested RMSE of the Classified Points 0.163 ft in open terrain as tested against the TIN.
Quantitative_Vertical_Positional_Accuracy_Assessment:
Vertical_Positional_Accuracy_Value: 0.320 ft FVA.
Vertical_Positional_Accuracy_Explanation:
Tested FVA of 0.320 ft at the 95% confidence level in open terrain as tested against the TIN.
Quantitative_Vertical_Positional_Accuracy_Assessment:
Vertical_Positional_Accuracy_Value: 0.319 ft
Vertical_Positional_Accuracy_Explanation:
Tested 0.319 ft SVA at the 95th Percentile in the Hard Ground category against the TIN.
Quantitative_Vertical_Positional_Accuracy_Assessment:
Vertical_Positional_Accuracy_Value: 0.313 ft.
Vertical_Positional_Accuracy_Explanation:
Tested 0.313 ft SVA at the 95th Percentile in the Short Grass category against the TIN.
Quantitative_Vertical_Positional_Accuracy_Assessment:
Vertical_Positional_Accuracy_Value: 0.490 ft.
Vertical_Positional_Accuracy_Explanation:
Tested 0.490 ft SVA at the 95th Percentile in the Tall Grass category against the TIN.
Quantitative_Vertical_Positional_Accuracy_Assessment:
Vertical_Positional_Accuracy_Value: 0.514 ft.
Vertical_Positional_Accuracy_Explanation:
Tested 0.514 ft SVA at the 95th Percentile in the Brush category against the TIN.
Quantitative_Vertical_Positional_Accuracy_Assessment:
Vertical_Positional_Accuracy_Value: 0.669 ft.
Vertical_Positional_Accuracy_Explanation:
Tested 0.669 ft SVA at the 95th Percentile in the Woods category against the TIN.
Quantitative_Vertical_Positional_Accuracy_Assessment:
Vertical_Positional_Accuracy_Value: 0.375 ft.

Vertical_Positional_Accuracy_Explanation:
Tested 0.375 ft CVA at the 95th Percentile in all ground categories against the TIN.
Lineage:
Process_Step:
Process_Description:
The LiDAR data was acquired using AeroMetric's or a vendor's twin engine fixed wing aircraft equipped with a LiDAR system. The LiDAR systems include a differential GPS unit and inertial measurement system to provide superior accuracy.

Acquisition parameters:
1. Flight Height - 1600 meters above mean terrain (AMT)
2. Swath Width - 40 degrees
3. Sidelap - 50%
4. Nominal Post Spacing - 1.0 meters

GPS and IMU processing parameters:
1. Maximum baseline length - Not greater than 100 kilometers.
2. Number of base stations during LiDAR collection - A minimum of 1.
3. Maximum positional RMS of trajectory during LiDAR collection - 0.10 meters
4. IMU processing monitored for consistency and smoothness - Yes.

Point Cloud Processing:
1. Horizontal Datum - North American_1983/HARN
2. Horizontal Coordinates - NAD 1983 HARN StatePlane Illinois West FIPS 1202 in feet.
3. Vertical Datum - North American Vertical Datum of 1988
4. Geoid Model used to reduce satellite derived elevations to orthometric heights - NGS Geoid09.

LiDAR Processing:
1. Point Cloud data is imported to TerraScan in a Microstation V8 (V) CAD environment on a specified 2000 feet by 2000 feet tiling scheme.
2. Analyze the data for overall completeness and consistency. This is to ensure that there are no voids in the data collection.
3. Inspect for calibration errors in the dataset using the TerraMatch software by sampling the data collected across all flight lines and classifying the individual lines to ground. The software will use the ground-classified lines to compute corrections (Heading, Pitch, Roll, and Scale).
4. Orientation corrections (i.e. Calibration corrections) are then applied (if needed) to the entire dataset.
5. Automatic ground classification is performed using algorithms with customized parameters to best fit the project area. Several areas of varying relief and planimetric features were inspected to verify the final ground surface.
6. AeroMetric, Inc. performed Quality Assurance and Quality Control (QA/QC) for this project by comparing field observed points in 'open terrain' land cover category to LiDAR data set points. TerraScan's Output Control Report (OCR) was used to compare

the QA/QC data to the LiDAR data. This routine searches the LiDAR dataset by X and Y coordinates finding the closest LiDAR point and comparing the vertical (Z) values to the known data collected in the field. Based on the QA/QC data, a bias adjustment was determined, and the results were applied (if necessary) to the LiDAR data.
7. After the LiDAR data is finalized for vertical placement, a macro is run via TerraScan to output a dataset generated on a per swath basis as part of the final deliverables. All points of the swath are reclassified to class 0 during this step.
8. Each tile is reviewed for accuracy and consistency of the macro ground classification. During this phase, MicroStation is used to generate line work representing water bodies and rivers. Separate line work is also placed in instances where overpasses have blocked enough valid ground returns or water gave too few ground returns to reasonably portray the ground surface. A proprietary in-house software program is then run to drape the river line work in a flowing fashion. Contours are generated on the river breaklines to review monotonicity of the draped line work.
9. Once the automatic processing and the testing of LiDAR is complete, AeroMetric meticulously reviews the generated bare-earth surface data to ensure that proper classification was achieved as part of a Quality Control process. Point classification follows the standard established by The American Society for Photogrammetry and Remote Sensing (ASPRS) for LAS data:
Code 1 Processed, but unclassified / non-ground
Code 2 Ground
Code 7 Noise / Low Points
Code 9 Water
Code 10 Ignored Ground (Breakline proximity)

10. Final deliverables are generated and output to a client specified 2000 feet by 2000 feet tiling scheme.
11. On a per tile basis, data files and Triangulated Integrated Network (TIN) files are generated by processing the finalized line work along with bare earth LiDAR points through a Geopak macro. Subsequent files are reviewed for adherence and completeness to the data and tile layout used during the creation process.
Process_Date: 201210
Cloud_Cover: Unknown

Spatial_Data_Organization_Information:
Direct_Spatial_Reference_Method: Point

Spatial_Reference_Information:
Horizontal_Coordinate_System_Definition:
Planar:
Grid_Coordinate_System:
Grid_Coordinate_System_Name: State Plane Coordinate System 1983
State_Plane_Coordinate_System:
SPCS_Zone_Identifier: 1202 Illinois State Plane West
Transverse_Mercator:
Scale_Factor_at_Central_Meridian: 0.999941

Longitude_of_Central_Meridian: 90.1666
Latitude_of_Projection_Origin: 36.66666
False_Easting: 2296583.333
False_Northing: 0
Planar_Coordinate_Information:
Planar_Coordinate_Encoding_Method: coordinate pair
Coordinate_Representation:
Abscissa_Resolution: 0.01
Ordinate_Resolution: 0.01
Planar_Distance_Units: survey feet
Geodetic_Model:
Horizontal_Datum_Name: North American Datum of 1983/HARN
Ellipsoid_Name: Geodetic Reference System 80
Semi-major_Axis: 6378137
Denominator_of_Flattening_Ratio: 298.257222101
Vertical_Coordinate_System_Definition:
Altitude_System_Definition:
Altitude_Datum_Name: North American Vertical Datum of 1988
Altitude_Resolution: 0.1
Altitude_Distance_Units: feet
Altitude_Encoding_Method:
Explicit elevation coordinate included with horizontal coordinates

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Metadata_Reference_Information:
Metadata_Date: 20130325
Metadata_Contact:
Contact_Information:
Contact_Organization_Primary:
Contact_Organization: AeroMetric, Inc.
Contact_Address:
Address_Type: Mailing and physical address
Address: 4020 Technology Parkway
City: Sheboygan
State_or_Province: WI
Postal_Code: 53083-6049
Country: US
Contact_Voice_Telephone: 1-920-457-3631
Contact_Facsimile_Telephone: 1-920-457-0410
Contact_Electronic_Mail_Address: cguy@aerometric.com
Hours_of_Service: Monday through Friday 8:00 AM to 5:00 PM (Central Time)
Metadata_Standard_Name: FGDC Content Standard for Digital Geospatial Metadata
Metadata_Standard_Version: FGDC-STD-001-1998

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