

**STATE OF OKLAHOMA
DEPARTMENT OF TRANSPORTATION
SURVEY DIVISION**

Aerial LIDAR Acquisition & Mapping Specifications

July 2023

NOTE: The Specifications, and all forms noted in this document can be downloaded from the ODOT Website at: <https://www.odot.org/survey/surveyInternet/consurveyspecs.htm>

PREFACE

These Specifications are written for utilizing the English system of measurement. The Consultant is to provide the completed survey using the English system (**U.S. Survey Foot**) of measurement.

For each specific project, additional requirements and/or amendments to these Specifications may be provided by the Oklahoma Department of Transportation, Survey Division (ODOT, SD), and shall be covered by **Survey Special Provisions** written at the time of contract negotiation and/or during the survey scope definition.

I. GENERAL

- A. The intent of these Specifications, and associated documentation is to prescribe details for the performance and completion of work that the Consultant shall undertake in accordance with the terms of the Contract.
- B. In addition to these Specifications, Survey Division may provide the consultant with Survey Special Provisions, as necessary, to define the project specific extents and requirements.
- C. Unless otherwise specified, the Consultant shall provide all labor, materials, tools, equipment, and incidentals, and to do all work involved in executing said Contract.

II. SCOPE

- A. The scope of work consists of providing Aerial LiDAR (Light Detection and Ranging) and Color Aerial Photography collected with a large or medium format digital mapping camera (large format preferred) utilizing Sensor Inertial Motion Unit (IMU), Global Positioning System (GPS) Receivers, and other supplemental equipment and techniques, to ensure compliance with the ODOT Standard for Spatial Data Accuracy, (OSSDA).
- B. The scope may also include design mapping of specific projects, delivered in Open Roads Designer format (.dgn).
 - 1. OSSDA Testing is derived from the National Standard for Spatial Data Accuracy (NSSDA), which has been refined to better meet the accuracy requirements of the Oklahoma Department of Transportation and will be conducted on projects requiring the Consultant to perform mapping services, (0.4 foot vertically at 95% Confidence Level). Note: A horizontal pass/fail threshold has yet to be determined, but because of displacement of vertical objects, planimetric collection from a traditional orthophoto image alone will not be accepted.
 - 2. The Testing will be conducted by ODOT personnel upon receipt of the deliverables, prior to payment of the final invoice.

III. DELIVERABLES FOR AERIAL LIDAR ACQUISITION

1. Raw LiDAR Files adjusted to the specified Geoid and Datum, as requested. LiDAR files shall have a point density of at least 40 points per square meter, higher in overlapping areas and be delivered in LAS format.
2. Trajectory file: SBET.OUT format of the trajectory accompanying the LiDAR flight mission.
3. Aerial Photography: Photography shall be obtained at an altitude suitable for design mapping and to ensure a ground sample distance of less than 2 inches. Image files are to be delivered in tiled tiff format and shall be compatible with Imagestation Photogrammetric software with accompanying ABGPS text file. (See Specifications for Aerial Photography_2022).
4. Flight Planning Maps of Aerial LiDAR and Aerial Photography Acquisition: Delivered in KMZ/KML format.
5. Ground Control File: (For consultants contracted for Target placement and survey) The file shall contain Target #, X, Y, Z coordinates in .txt or .xls format, along with a KMZ file of the numbered target locations. Aerial Targets and Vertical check points should be in separate files. Any approved means for setting Aerial Targets will be acceptable as long as the point has been collected and accurately verified by a second reading. This may be accomplished utilizing any combination of the acceptable means of collecting photo control.

1. **Differential Leveling**
2. **Total Station**
3. **RTK**

(Note: If RTK alone is used, shots from 2 distinct setups, from 2 different control points, will be required.)

IV. DELIVERABLES FOR CONSULTANT MAPPING IN ADDITION TO LIDAR AERIAL ACQUISITION

- A. Deliverables will include one or more of the following, (See Request for Task Order). All Design Files, (.DGN), will be in Open Roads Designer format.
 1. An Open Roads Designer file (.dgn) that contains all terrain and topographical data within the ORD field book to include but not limited to ground points, break lines, graphical lines, points, symbols, and text, as necessary to accurately depict and describe all surface and topographical features within the limits of the project. **Note: Areas of obscurity smaller than 20 feet shall not be shown.**
 2. The final ground point/bare earth file in LAS format shall be delivered and written to the design file. The LiDAR project and/or classified LiDAR block files containing all point classes shall also be delivered in LAS format.
 3. Digital orthophotography of the area shall also be delivered, preferably in ECW or TIFF format, with a ground pixel resolution of .25 or less.
 4. AT files: Includes the camera, control, model, photo, and project files.

B. SUPPORTING DATA

1. Complete descriptive data, including source of hard monuments, virtual monuments, Horizontal and Vertical Datum, and equipment used to compile data for the project, including Oklahoma State Plane Coordinates and Elevations for all points used to control the project, (.txt or .xls File Format).
 - a. Horizontal Datum will be NAD83 (2011).
 - b. Vertical Datum will be NAVD88 using Published National Geodetic Survey (NGS) Benchmarks, or from particular monuments specified in the Survey Special Provisions.

C. All digital files will be in digital format and submitted electronically or other acceptable digital media, as approved by Survey Division Administration.

D. Symbology (Color, Line Weight, Line Style, Level (Layer), and Cell (Block) information to be used in compiling the data, can be downloaded from the Consultant Pack on the ODOT Website. <https://www.odot.org/survey/surveyInternet/cpexamples.htm>. If symbology provided do not properly depict a particular topographic feature, the consultant shall select an appropriate symbol as long as the feature is labeled accordingly.

E. Topography/Planimetrics to be delineated by CADD lines or symbols, and/or descriptive text includes, but is not limited to the following:

1. Utilities (power lines, poles, guy wires, and light poles only, rotated to properly define their direction.) Note: Overhead Crossings are no longer required
2. Drainage features (drainage ditches, ponds, rivers, streams, etc.) All bodies of water that are shown as edge of water will need to be closed shapes.
Note: Culverts and headwalls shall not be shown, (except for a breakline behind the headwall).
3. Fences, walls, barriers, and any identifiable lines of occupation.
4. Paved and unpaved streets/roads, front/back of curb and gutter/concrete if one exists, guardrails, railroads, bridges, parking lots, drives, etc.
5. Buildings, sidewalks, privately-owned signs collected to scale if not a single post sign (not traffic signs) or other improvements.
6. Vegetation of any type is no longer required In rural settings. Trees will need to be located in urban settings within 100' of the centerline of the subject highway.

Note: If collecting features using traditional orthophotos, vertical features, (buildings, etc.), must agree horizontally with the lidar point cloud rather than the orthophotography.