

## 2024 NDOT IMPERIAL MAPPING GUIDELINES

AUGUST 2024

### I. DESCRIPTION OF SERVICES FOR AERIAL MAPPING

#### A. INTRODUCTION

These specifications set forth the minimum standards and general procedures to be followed for NDOT aerial mapping products.

#### B. COMPILATION EQUIPMENT

Consultant must use MicroStation and a ZI softcopy photogrammetric production system (ImageStation) to compile planimetric and DTM maps.

#### C. MAPPING FILE REQUIREMENTS

1) Refer to "NDOT Schedule of Services" for project specifics, which may deviate from the following. Generally, the corridor width for the project is 1,000' (500' LEFT and 500' RIGHT of the highway centerline). The corridor length will extend 1,000' beyond the project Beginning and Ending reference posts. Corridor width for county road/intersection coverage (cross flights), is 400' (200' LEFT and 200' RIGHT of road centerline). Corridor length for cross flights will be the entire cross flight. Corridor width for other perpendicular roads will be 400' (200' LEFT and 200' RIGHT of road centerline), and will extend 500' from either side of the designated corridor.

2) Files must be compiled with coordinate values to the nearest hundredth (1/100) of a foot. The working units must be:

Master Unit: International Feet  
Sub Unit: Inches  
1000 Per Distance International Foot

3) The entire mapping for each project must be in one continuous file.

4) The MicroStation file must be named with the NDOT control number and have the "DGN" extension.

EXAMPLE: Use Control Number plus extension (121390pp\_xxxx.dgn) (xxxx = the year the survey was flown)

PLANIMETRIC & DTM

Use NDOT\_3D\_Seed\_Int\_FT.dgn file located at the following website link:  
<http://roads.nebraska.gov/business-center/design-consultant/>

#### D. MAP PRODUCTION TECHNIQUES

1) All features to be labeled and the labels to be used must be as described on the Preliminary Survey CADD Levels (PCL). Included for each feature will be the corresponding MicroStation level, feature description and line styles.

- 2) Labels must be oriented along linear features or parallel to the roadway or survey baseline, as appropriate. Cells and labels must be placed reading left to right, progressing from the lower control point (CP) number to the higher CP number.

#### E. MAP CONTENT

The following list applies to all scales of mapping.

##### 1) Planimetric Details

- a) Mapping must be continuous with model limit lines separating stereomodels.
- b) The principal point or nadir (photo center) point of each photograph used in the mapping must be shown and labeled in the mapping file.
- c) The maps must contain all planimetric features listed in PCL which are visible or identifiable on, or are interpretable from the aerial photograph, including land use features, buildings, irrigation pivots and swing arm lengths, and any utility service to the center pivots, canals, irrigation reuse pits, ditches, reservoirs, trails, roads, highways, railroads, ferry slips, fords, quarries, borrow pits, cemeteries, orchards, boundaries of logged-off areas and wooded areas, and individual large trees that can be recognized as such, and telephone, telegraph, electric power poles and towers, underground cables, pipe lines and sewers, fence lines, billboards, rock and other walls, and similar details of land use. Structures such as bridges, trestles, tunnels, piers, retaining walls, dams, power plants, transformer and other substations, transportation terminals and airfields, oil, water and other storage tanks, and the like must also be shown. In addition to all other required land use features, curbs/gutter, foundations, steps, building entrances, sidewalks, driveways, hydrants, manholes, lampposts, and similar features, if visible or identifiable on the photography, must be shown. All line-like features, such as highways, railroads, fence, curb/gutter and sidewalk lines, and so forth, must be drawn with the guidance of the straight line or curve capabilities of the Intergraph digital mapping software. In areas of abundant brush and timber, a note such as "Scattered brush and timber" etc. may be used providing the area is properly delineated.

Building and similar measurable objects must be correctly outlined and oriented, and must be to actual size, except that building dimensions smaller than representable by two tenths of an inch at map scale must be symbolized two tenths of an inch in size. Minor irregularities in building outlines not representable by one tenth of an inch at map scales must be ignored.

The names of cities, towns, villages, rivers, streams, railroads, and other features of importance shall be obtained by the Consultant and must be neatly and correctly lettered on the maps.

- d) Features must be compiled and labeled as prescribed on the PCL. Features not specifically included on the PCL must also be shown and symbolized using the most equivalent symbol and associated descriptor indicated on the cell list.
- e) Features that are visible but not readily identified must be outlined with dashed lines and placed on the most appropriate level. See PCL.

- f) The widths of roads and streets must be shown as the separation between back of curb or hard surface edges. See PCL
- g) Drainage ditches must be individually symbolized. Drainage must be shown spot elevations by a beginning, ending and change of slope, whether or not water is visible in them on the aerial photography.
- h) Spot Elevations.
  - 1. Spot elevations must be shown on topographic and planimetric only mapping for drainage.
  - 2. All spot elevations must be labeled with decimal values giving their elevation to the nearest one-tenth of a foot. Labels must be positioned so that they do not obscure other map detail, and placed reading left to right, bottom to top progressing from the lower CP number to the higher CP number.
- i) The edge of shoulder on both inside and outside shall be shown by the correct symbology from the NDOR Pull-Down Menu.
- j) All drives, gravel or hard surface shall be shown by the correct NDOR Preliminary Survey Menu symbology.

#### F. DIGITAL TERRAIN MODELS

- 1. Digital terrain models consist of elevation data compiled using a regular RANDOM SPOTS of elevation points as well as intermediate or random spots, where appropriate, to accurately define the general terrain and BREAK LINES of elevation points used to define unique features of grade or change in grade.
  - a) RANDOM SPOTS data shall consist of elevations taken at regularly spaced intervals in two horizontal coordinate directions coinciding with the easting and northing (X, Y) of the project coordinate system. The MAXIMUM grid spacing allowable for this project shall be defined at 35'. RANDOM SPOTS data shall not be placed on top of break lines.
  - b) BREAK LINE data shall consist of a line of elevations taken at unique elevation breaks such as drainage, centerline of roads, edge of roads, edge of shoulder, toe of slopes, bottom of ditches, ridge lines, saddles and other features. In addition, break line data that defines the terrain at the project perimeter and at the internal stereomodel boundaries shall be provided. The MAXIMUM break line point spacing allowable for this project shall be defined at 35'. Curved break lines will require closer spacing so as not to distort the feature or the program computations related to the discontinuity. Break lines must not cross.
  - c) OBSCURE/VOID AREAS BREAK LINES any object that cannot be seen through shall have an obscure break line drawn around it.

- d) Accuracy of the RANDOM SPOTS and BREAK LINE points will be equal to that of spot elevations for contour mapping in accordance with of United States National Map Accuracy Standards.
  - e) RANDOM SPOTS and BREAK LINE data shall be compiled at intervals such that when contours or cross-sections are generated by an accurate software program the contours or cross-sections will meet United States National Map Accuracy Standards.
2. STREAM CROSSING - Give flow line elevations and meander at least to the route band limits upstream and downstream. Meander requirements will vary depending upon size and nature of the stream. The survey should be extensive enough to include all bends or other characteristics that may affect the stream crossing.

G. DIGITAL ORTHOPHOTOS (Refer to “NDOR Schedule of Services” for specifications.)

H. ACCURACY OF MAPPING

1. Analytical Triangulation

The error tolerances for digital camera imagery will be established by its provider based on the sensor footprint used. For digital camera imagery analytical triangulation, the horizontal position (x and y) and elevation (z) of all control points required shall not be in error by more than the tolerances listed below.

Absolute Error Tolerance according to Ground Scale Distance (GSD)

Ground Scale Distance	Horizontal		Elevation
	X	Y	Z
14CM.	0.92 ft	0.92 ft	0.46 ft.
7CM.	0.46 ft	0.46 ft.	0.23 ft.
5CM.	0.32 ft	0.32 ft.	0.16 ft.

- 2. Planimetric Features—Ninety-five percent of all planimetric features which are well defined on the photographs must be plotted. Their position on the finished maps must be accurate to within at least 2 tenths of a foot of their true coordinate position, as determined by the test surveys. None of the features tested must be misplaced on the finished map by more than 4 tenths of a foot from their true coordinate position. The true coordinate position must be determined by making accurate measurements originating and closing on station markers of the project basic control survey, which must have a closure accuracy conforming to the requirements for the basic control.
  - 3. The depth index for each model must be checked by map compilers against elevations from the 3D Control Point dgn provided.
- I. TESTS BY NDOR FOR QUALITY CONTROL OF MAPS AND THEIR COMPLETION BY THE CONSULTANT

NDOR will do whatever testing, editing, and checking deemed necessary and may, at any time, inspect any or all phases of the work being done by the Consultant. Whenever inaccuracies occur, and adjustments and corrections are necessary, the Consultant shall make those corrections, and/or adjustments when requested to do so by the Prime Consultant.

J. OWNERSHIP OF MATERIALS AND RESPONSIBILITY

At the conclusion of the work, the Consultant shall deliver to NDOR all original materials on DVD or portable hard disk. While any resultant items of work are in the possession of the Consultant, either before or after completion of the work, the Consultant is responsible for their preservation. If they are lost, damaged, or destroyed while in the Consultant's possession, the Consultant shall replace them in the same quantity and quality as specified in the agreement at no cost to the State.