

CHAPTER 13

SURVEYING AND MAPPING REQUIREMENTS

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13.1 GENERAL

13.1.1 GENERAL

When surveying and mapping are performed by the Louisville District's Civil/Survey Section, topographic maps and other survey data will be provided to the A-E by government employees who are qualified and licensed in such work. When surveying and mapping are performed by the A-E as part of the contract, it must be accomplished by qualified personnel licensed in such work. A copy of the A-E survey will be provided to the Civil/Survey Section. The survey is intended to furnish general information and data for design purposes and every effort shall be made to have it thorough and not of a preliminary nature.

13.1.2 PROCEDURES

Topographic surveys shall typically be performed by total-station radial survey, differential global positioning system, photogrammetry or LIDAR which will produce a map conforming to national map accuracy standards as established by the Federal Geographic Data Committee (FGDC) unless otherwise permitted. Horizontal control for surveys are based on coordinates of NGS published monuments referenced to the National Spatial Reference Network (NSRS) unless otherwise directed and of a minimum of third order accuracy. Horizontal control will be referenced to the appropriate State Plane Coordinate system unless otherwise directed. Base lines are established throughout the survey area with a minimum of one base line with two inter-visible semi-permanent markers, iron pins with caps are acceptable. Show the location and distance between markers and markers referenced to identifiable features. Base vertical control for surveys will be referenced to the North American Vertical Datum of 1988 (NAVD88) unless otherwise directed and to a minimum third order accuracy. Identify datum and establish benchmarks for vertical control so that the distance between them does not exceed 1000 ft. These benchmarks are to be established in areas that are expected to be free from disruption due to construction activity. Identify the unit of measure, U.S. survey feet, international feet or meters. Show horizontal alignment data (curve information, equations, etc.) and benchmark elevations to the closest 0.01 ft. Show roadway elevations, used for pavement tie-ins, vertical clearance computations, and spot elevations to the closest 0.01 ft. Show all other offsets, pipe diameters, ground spot elevations, physical feature dimensions, etc. to the closest 0.1 ft. Contour intervals should be 2 ft, 1 ft, 0.5 ft, or 0.25 ft depending on map scale. Plot surveys on dimensionally stable material or in digital form, if directed. Draw line weights and symbolization compatible with map scale and consistent with accepted drafting practices as described in the AEC CADD Standards. Use scale and contour interval as specified in EM 1110-1-1005, Control and Topographic Surveying, unless otherwise directed.

- a. Conduct basic mapping control, as-built control, and cadastral surveys to 3rd Order accuracy, both horizontally and vertically, and comply with USACE EM 1110-1-1005, Control and Topographic Surveying.
- b. When surveys include legal land surveys or descriptions, accomplish the work by IAW (in accordance with) Bureau of Land Management methods and procedures, state statutes where appropriate, and by or under supervision of a professional land surveyor holding a current license issued by the state in which the work is located.
- c. All extension of survey control and mapping accomplished by photogrammetric methods and procedures shall comply with the National Map Standards of Accuracy.
- d. Inform the Government of proposed methods, procedures, and type of equipment to be used, if the work will be subject to inspection by Government personnel. However, the A-E retains responsibility for the quality of the work within the limits prescribed in Appendix A of the design contract.
- e. Obstruction surveys include a topographic survey within the prescribed limits of the easement areas, determining the evaluation of obstructions, and establishing property lines and ownership. These surveys may include placing tags on trees which are obstructions with pertinent information for clearing which shall be recorded in standard field books. These surveys are generally performed at a scale of 1:1000 or 1:300 (1"= 100' or 1"= 30').

13.2 SUBMITTAL REQUIREMENTS

As soon as practicable after completion of the survey (i.e., with the first required submittal), submit the following documents to the District:

All digital files created during the execution of the project shall be submitted to the Government. This includes the final CADD drawing in Microstation DGN format and a DTM, field data files, XYZ coordinate file with point codes and a project report.

13.2.1 PROJECT REPORT

The project report will contain a general statement of the project requirements, procedures and equipment used; all file names, any special features unique to this particular project, and a list of personnel performing the work.

13.2.2 METADATA

A metadata file describing the project will be created and submitted to the Government. If necessary, the Government will supply Corpsmet software. Corpsmet is a program that puts metadata information into the proper format so it may be submitted to the national spatial data clearinghouse.

13.2.3 QUALITY CONTROL

A quality control plan will be developed and submitted. The quality control plan will describe activities taken to ensure the overall quality of the project. The accuracy of all products delivered will meet or exceed ASPRS map accuracy class 2

13.2.4 FIELD NOTES AND SURVEY CONTROL

Original field notes and/or topographic sheets appropriately marked and dated will be submitted. For original field data, separate horizontal and vertical control from other data to the maximum extent that is practical. Complete horizontal and vertical control sheets (furnished by the Government) for all permanent and semi-permanent points that are established by the survey. Provide a summary of the amount of mis-closure and approximate length of traverse for each horizontal and vertical circuit.

13.3 TECHNICAL REQUIREMENTS

13.3.1 TYPICAL DATA

a. Topographic Survey All planimetric features within the survey limits shall be collected and displayed. This includes, but is not limited to buildings, sidewalks, roadways, parking areas (including type such as gravel, paved, concrete, etc.), trees, road culverts, fences, manholes (inverts), inlets, catch basins, fire hydrants and water valves, all visible utility lines, boxes and signs including electric, phone, cable, gas, water etc. Inverts and pipe sizes shall be collected for all manholes and shown in the DGN file. Utility lines shall also be displayed as 3D line strings in the DGN file. A detailed list of specific features to collect is as follows:

- a. Survey of area (show property lines and ownership, and location(s), elevation(s) and descriptions of BM's/TBM's).
- b. Limits beyond area, as required (see special instructions).
- c. Building corners
- d. Finished floor elevations of building(s) on or adjoining project site.
- e. Heights, type, and characteristics of existing structures, including building numbers.
- f. Roads, streets, and trails; sidewalks; and paved areas.
 1. Typical roadway section(s).
 2. Profile of roadway (C/L).
 3. Limits of right-of-way (R/W).
 4. Type of construction (gravel, asphalt, etc.).
 5. Condition of surface (cracked, pothole, etc.).
 6. Street names: township, county, state and federal highway numbers.
 7. Culverts: size, type, invert elevations, and condition.
 8. Bridges: size, type, material, and condition.
 9. Guardrail: location, and type of material.
 10. Distance from storm drain inlets to trunk line.

11. Sidewalks, w/spot elevations.
 12. Trails.
 13. Curbs: type, spot elevations along gutter line and top of curb.
 14. Joint layout of airfield and hardstand pavements with spot elevations at joints.
- g. Railroads:
1. Alignment of track and location of road crossings.
 2. Number of tracks & weight of steel rail.
 3. Elevations along base of rail.
 4. Locations of turnouts and sidings (Station point of switch and turnout no.).
 5. Drainage structures: size, type, invert elevation and condition.
 6. Width of right-of-way (R/W).
 7. Name of serving company (L&N, Chessie Systems, etc.).
 8. Distance to nearest station(s) or milepost.
- h. Utilities:
1. Water:
 - i. Alignment of pipeline(s) within the project area.
 - ii. Type and size of pipe.
 - iii. Depth below existing ground line.
 - iv. Storage capacity of tank(s).
 - v. Location of fire hydrants.
 - vi. Valve Locations.
 2. Sanitary Sewer Collection:
 - i. Alignment of pipeline(s) within the project area.
 - ii. Type and size of pipe (RCP, DIP, etc.).
 - iii. Depth below existing ground line.
 - iv. Manholes: size and top & invert elevations.
 3. Sewage Disposal Facilities:
 - i. Location and size.
 - ii. Elevations at top and bottom of structure(s).
 - iii. Elevations of inlet and outlet pipes.
 4. Storm Drainage:
 - i. Alignment of pipelines within the project area.
 - ii. Type and size of pipe (CMP, RCP, etc.).
 - iii. Depth below existing ground line.
 - iv. Manholes: Size and top & invert elevations.
 - v. Profile of open ditches above and below culverts and surface inlets.
 - vi. Inlets and catch basins: top and invert elevations, and number and size of grates. For curb type inlets with no grate, give length of opening, invert elevation at throat (gutter line), and top elevation of structure directly over the opening.
 - vii. Dimensions of inlet structure(s).
 - viii. Delineate extent of drainage areas (For drainage area map in design analysis).
 - ix. Headwalls: give type, dimensions, pipe diameter(s) and invert elevations(s) at end(s) of pipe.
 - x. Where pipe terminates in ditch without a headwall, indicate if flared end section (FES) or end of pipe is in good condition or damaged. Also indicate if ditch is stabilized or eroded.
 - xi. Where storm drainage pipe extends beyond survey limits, secure length and invert elevation of pipe at next structure upstream or downstream to determine percent slope of pipe.
 5. Fuel Dispensing & Storage:
 - i. Type, source and capacity of tanks, if available.
 - ii. Alignment of fuel lines, depth, type, pipe size and pressure.
 - iii. Name of serving company.
 6. Electrical Power, Phone, Cable:
 - i. Alignment of power lines (aerial or underground within the project area).
 - ii. Pole locations and heights.

- iii. Number of wires, size and material; height above existing ground line at pole.
- iv. Name of serving company.
- 7. Ground Covers:
 - i. Type of Crop, where applicable.
 - ii. Grass.
 - iii. Brush.
 - iv. Trees: Species, diameter, height, condition, location of all hardwood and other trees 100 mm (4in) and larger in diameter to be retained on the project site.
- 8. Fencing:
 - i. Type and location (alignment), including location(s) and size of gates.
 - ii. Number of barbed wires on extension arm, where applicable.
 - iii. Height and type of fabric.
 - iv. Kind of posts and condition.
 - v. General condition of fence as a whole.
- 9. Maps and Drawings: Copies of all existing and pertinent maps and "as-built" drawings, requested from and furnished by the using activity (DPW or BCE).
- b. Obstruction Survey
 - 1. Topographic map of prescribed area
 - 2. Elevations of all structures and topographic features
 - 3. Show all property lines and ownership
 - 4. Place tags on trees which are obstructions with the following information; recorded in standard field book and submit:
 - i. Species of tree and diameter at breast high
 - ii. Ground elevation at base of tree
 - iii. Elevation of top of tree
 - iv. Obstruction number
- c. Boundary and Easement Surveys
 - 1. Monuments for control
 - 2. Ties to existing base lines, land corners, and installation or state coordinate system
 - 3. Property lines with metes and bounds
- d. Safety Requirements, All Surveys Locate and describe all features, and describe to the extent appropriate the existence of all features, constructed work, etc., which might constitute a hazard to construction contractor personnel who will work in the area. Every safety measure feasible will be taken to insure the safety of the field personnel involved in this survey. All requirements of the U.S. Army Corps of Engineers EM 385-1-1, titled SAFETY AND HEALTH REQUIREMENTS MANUAL will be maintained.
- e. Special Requirement for Utility Information on Topographic Surveys The chief of the party shall coordinate with the DPW/BCE concerning all utilities shown on the map sheets to insure that every effort has been made to obtain correct information. This is of prime importance in the case of underground primary and secondary utilities.
- f. Field Check of Topographic Survey When required by specific instructions during the completion of final design, conduct a field survey to determine the accuracy of the topographic sheets. Take sections where indicated on the drawings, marked in red, and the ground levels recorded at 30 m (100-foot) intervals and major break points. Take these cross sections at approximately 60 m (200-foot) intervals unless otherwise shown, with a minimum of two cross sections to each topographic survey. Submit the original cross section check level notes with the survey data.

For photogrammetric projects, 20 independent check points will be collected in the field and checked against the coordinates of the same points as determined by the photogrammetric mapping.

13.3.2 PREPARATION OF DRAWINGS

13.3.2.1 Topographic Drawings

If hard copy drawings are required, plot topographic and planimetric data to prescribed scale and contour interval as described in the AEC CADD standard.

CHAPTER 13 – SURVEYING AND MAPPING REQUIREMENTS

- a. Orient maps and drawings so oriented that north is toward top of sheet, when practicable, or toward the left of the sheet if top orientation is impractical.
- b. Items to appear on all completed topographic drawings are as follows:
 1. North arrow.
 2. Grid ticks and values.
 3. Scale and graphic scale.
 4. Grid system, projection, and vertical datum with latter referenced to National Geodetic Vertical Datum (NGVD 1929 or 1988).
 5. Date of ground survey.
 6. Survey control points, identification, and elevations where appropriate.
- c. Use contour interval of 1 ft unless otherwise directed.

---END OF SECTION---