

Scope of Services for Traditional Ground Surveys

Surveying work for topographic and track expansion projects will follow these guidelines:

Surveying long, narrow areas such as railroad rights of way requires extra care. Whenever possible alternate the control points from one side of the tracks to the other. The optimum angle when traversing is between 60 & 120 degrees (back site to foresight). This will provide an accurately balanced control loop. Run a closed traverse and adjust using least squares. Ground control shall meet the following criteria: Horizontal control shall be 1 part in 120,000. Vertical control is to be NAVD88. The use of GPS with State Plane coordinates to establish control is preferable. All surveys will use US Survey Feet. Vertical tolerance on top of rail shots will be plus or minus 0.05 foot and plus or minus 0.1 foot on ground shots.

Set control points 500 feet to 800 feet apart, along base alignment with sufficient ties to allow UPRR construction crews to re-establish, when construction begins. The consultant will provide field notes sufficient to recover control points. Control points will be rebar, 5/8" of an inch in diameter and 24 inches long with colored ribbon tied to the rebar and marked with surveyor's lath.

Surveys shall be taken in direction of increasing engineering stations. The railroad will provide an alignment print for establishment of stationing. One hundred stations shall be measured at centerline of track and marked on the outside of the rail, with "Paintstik" (or similar permanent marking device) on the construction side of the project, throughout the survey project. **Monument point used to establish chaining and note it in the coordinate file.**

When collecting topographic data, the primary objective is to provide an accurate representation of ground terrain. The terrain model will be defined by break lines and topography shots. Shots will be taken at the left and right ends of ties, toes of ballast, shoulders, and toes of subgrade. Break lines will also be taken at any other discontinuity of terrain such as creeks, canals, bridges, bridge backwalls, retaining walls, etc. Break lines and drain lines running parallel to the baseline track will be shot on the even 100 foot stations and at other locations to fully describe the terrain. Break lines and drain lines must not cross. In large areas, where additional terrain data is needed to increase the accuracy of the digital terrain model (DTM), spot elevations will be taken on a grid not to exceed 100 feet in spacing.

To determine the width of topographic data to obtain: Assume the new track construction to be at 20 foot track centers, with a 26.5 foot shoulder from proposed centerline, a 3 foot deep, 10 foot flat bottomed ditch in cut sections, with 2:1 side slopes (3:1 in sandy soils). Take shots at least 50 feet beyond the estimated catch point. If shots are to be taken off Railroad's right of way, permission must be obtained from landowner before work commences.

Shoot the centerline of track every 500 feet on tangent, every 50 feet on spiral curves and 50 feet to 100 feet in circular curves. Sharper circular curves will require shorter spacing of shots. If a switch falls in a curve, shoot a POC (point of curve) within the limits of the switch, in each track. Each section of tangent should have at least 2 shots (Feature Code – POT - point on tangent) in addition to the PS (point of spiral), PC (point of curve), and PT (point of tangent) shots, each curve should have at least 3 shots (Feature Code POC). Between tangents and curves a shot should be taken at the best guess location of PS, PSC (point of spiral to curve), PCS (point of curve to spiral), and PT. At least 1 additional shot should be taken on each spiral (Feature Code – POS – point on spiral). **DO NOT END THE SURVEY IN THE MIDDLE OF A CURVE- HORIZONTAL OR VERTICAL.** Shoot 500 feet into tangent beyond the end of curve to establish proper line and a good grade. Shoot top of rail at each 100 foot station and opposite every shot taken on the centerline of track (PSW – point of switch, PF – point of frog, PS, POT, etc.). On curves, the top of rail is always taken on the grade rail (low rail). On tangents the top of rail is taken on the north rail (East - West running track), or the west rail (North - South running track). Top of rail shots may cross from side to side only when necessary to keep them on the grade rail. Top of rail & centerline shots will extend 1000 feet beyond the proposed construction limits.

Indicate the weight of rail at the beginning and end of the survey project, including any changes in rail weight within the survey limits (i.e. compromise joints, compromise welds, taper rails, etc.).

Shoot the centerline of track, opposite the point of switch (PSW) and opposite the point of frog (PF), indicating the weight of rail, type of switch (hand thrown, power operated, electric lock, etc.), note the size and type of frog (self guarded, bolted, peg-leg spring, rail bound manganese or movable).

In addition to break line and topographic features, shoot vertical clearances on all existing wire line crossings (Indicate the voltage) and overhead structures. High water marks (where applicable) should be shot as well. All road crossings and roadways will be shot as you would shoot track (including edges, crowns and centerline) at least 300 feet in each direction at an interval necessary to fully define grade breaks and vertical curves. Enough data must be gathered in order to design approach run-off if necessary. Include the road name, when known. If a building is within the limits of the DTM, it will be shot as a break line (feature code BLDB). If outside the limits of the DTM, it will be shot as a topography point (BLD). Shoot signals and poles for elevation at the existing ground and angle offset for their true location.

Locate culverts with a shot at each invert for elevation and direction of flow. Indicate the size in inches and type of pipe. Shoot the inside face of each bridge backwall at centerline (EBW, WBW, SBW or NBW), for location. Locate the backwall itself by shooting a break line along the top and bottom. Locate the stream channel under the bridge from "off" side to the construction side. Signal houses and signal cases will be shot at the first face, nearest to the rail. A length (along the rail) followed by a depth (perpendicular to rail) will be entered in a field note. If not relatively square to the baseline rail, shoot as many sides as necessary to fully define size and orientation. Extra care should be taken when shooting bridge columns or piers. Enough shots need to be taken to fully outline the structure. Enter as many field notes as necessary to describe the general shape and layout of piers, columns and crash walls (including wall height).

Consultant will make a utility "one-call" to mark any utilities prior to survey, so all pertinent locations of any these facilities will be shown in the drawing.

Files submitted to the Railroad's office will include the coordinate file, preferably in a Sokkia SDR transfer file or an ASCII file (comma delimited), a MicroStation V8 3D design file, and a GPS Data sheet outlining the vertical datum used, the coordinate system used, and the scale factor. The Railroad will provide necessary seed files, resource files, cell libraries, feature code list and color tables. File names will adhere to the following naming convention.

filename.sdr (SDR transfer file) or filename.txt (ASCII file)
filename.dgn (3d MicroStation design file)
"project name"_Adjustment_Report.txt (Adjustment Report file)

Before submitting to the railroad office, check the coordinate file and design file for proper coding to ensure the DTM data will be processed on the proper levels. Look for missing symbols or line work in the design file and check for any crossing break lines.

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