

Scope of Services for Aerial Photogrammetry Surveys with Supplemental Ground Topography

The Horizontal Control will be tied to the appropriate State Plane Coordinate System, NAD 88, *with the correct Zone for the state (i.e. Kansas North Zone)* and modified to project ground datum. The crew will recover published National Geodetic System monuments and setup a control network to provide control points along the project for the Survey as well as provide reference ties to project control that can be recovered for future purposes. All surveys will use US Survey Feet. Project limits should be maintained within 25 miles or less for containing possible errors.

Control points will be supplied in a separate data sheet with the project limits defined for retracing or amending to the project surveys at a future date.

Supplemental ground surveys shall be taken in direction of increasing engineering stations. The railroad will provide an alignment print for establishment of stationing. One hundred foot 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.**

The supplemental ground survey will include centerline of existing main track, top of "grade" rail elevations, locations of drainage structures, overhead structures, overhead wire lines (noting type and height above top of rail) and locations of any utilities within the Digital Terrain Model corridor. Vertical tolerance for top of rail elevations will be within plus or minus 0.05 foot. Also include center line and top of rail of any track emanating from the main track, for a distance of 1000 feet along the track.

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.

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).

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.).

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 back wall at centerline (EBW, WBW, SBW or NBW), for location. 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.

Mapping, within the survey drawing, should include lines drawn between signal poles, electrical poles, telephone poles, etc., with the appropriate line codes. The mile marker symbol will be placed at the mile marker location, labeling the appropriate mile post. Roads noted as paved or unpaved, trails, etc. with names included.

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) and MicroStation V8 3D design files. 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)

contours.dgn (3D MicroStation design file) Contour file to be delivered with 1 foot contours

dtm.dgn (3D MicroStation design file) Vertical tolerance equivalent to plus or minus 0.25 foot.

Black and white ortho-rectified photographs to accompany files, with .tif or equivalent format and corresponding world files, unless color photographs are specifically requested.

Please note all digital terrain model files and mapping will be reduced to ground elevations.

May 3, 2011