

WISCONSIN CONSTRUCTION SPECIFICATION

24. CONSTRUCTION SURVEYS

1. Scope

The work consists of performing all layout, construction control, and documentation required by the project.

2. Equipment and Material

Conventional and Global Positioning System (GPS) survey equipment shall be of a quality and condition to provide the required accuracy. The equipment shall be maintained in good working order and in proper adjustment at all times. Equipment shall be checked, tested, and adjusted in conformance with manufacturer's recommendations.

3. Quality of Work

All work shall follow professional practice and the standards of the industry. The work shall be performed to the tolerances in Table 1. Notes, sketches, and other data shall be complete, legible, reproducible, organized to facilitate review, and allow reproduction of copies for job documentation.

Table 1 - Positional Accuracy and Allowable Tolerances (+/- ft)

	Elevation	Location by Distance¹	Location by Given Coordinate²
Control Points (PT, PC, etc)	0.01	0.1	0.1
Concrete works and pipe inverts	0.01	0.1	0.1
Earth work	0.1	0.3	0.5

¹ Location relative to known baseline station or offset station (profile or cross section)

² Location relative to known coordinates (GPS or Total station)

Point Closure Ratio Accuracy

The closure error on a benchmark shall be 1:2,500 horizontally and $0.10 * \sqrt{M}$ vertically.

The horizontal point closure is determined by dividing the linear distance misclosure of the survey by the overall circuit length of a traverse, loop, or network line/circuit (Sum of FS and BS distance). In cases where GPS vectors are measured in geocentric coordinates, the three-dimensional positional misclosure is assessed.

The vertical accuracy of a survey is determined by the elevation misclosure (feet) within a level section or level loop, where the line or circuit length (M) is measured in miles. (M = sum of FS and BS distance in miles)

4. Primary Control

Primary controls, which include items such as baselines, control points, and bench marks, necessary to establish lines, grades, and locations are shown on the drawings and have

been established on the job site.

These baselines, control points, bench marks, and GPS coordinates shall be used as the origin of all surveys, layouts, and measurements to establish construction lines, grades, and locations. The Contractor shall take precautions to prevent the loss or damage of primary control points. Stakes or control points lost or damaged by construction activity will be reestablished by the Contractor or at the Contractor expense.

5. Construction Surveys

Electronic GPS coordinates and elevation files, used as primary control and for design, will be provided to the Contractor. No work shall take place without approval of field layout by the Technician.

The Contractor is responsible for the following items by use of conventional or GPS survey equipment.

- a. Establishing centerline for location and alignment.
- b. Establishing location and elevation of additional control points.
- c. Setting slope stakes and reference stakes.
- d. Intermittent checking and any supplemental or interim staking.
- e. Establishing final grade stakes.
- f. Providing final constructed locations and grades for the work.
- g. Recording survey documentation.

6. Records

Survey data shall be recorded in fully identified standard hard-bound engineering survey field notebooks with consecutively numbered pages. All field notes and printed data shall include the purpose or description of the work, the date the work was performed, sketches, and the personnel who performed and checked the work.

Electronically generated survey data shall be cross referenced in the bound field notebook containing the index for all survey activities.

The construction survey records shall be available at all times during the progress of the work for examination and use by the Technician and when requested, copies shall be made available.

The original field notebooks and other records shall be provided to the Government for acceptance of all work. The records will become the property of the owner.

7. Acceptance

The job will not be accepted until all surveys are complete and required documentation has been determined complete. The Technician shall conduct quality assurance checking. Checking shall include the visual review of survey markings, notes, and random surveys to check for accuracy.