

Recommended Minimum Classification Requirements for Vertical Control

TYPE OF SURVEY	CLASSIFICATION		
	Second-Order Class I ¹	Third-Order ¹	Project Order
Wisconsin Height Modernization Geodetic Bench Mark	X		
Engineering (Project) Bench Mark		X	
Temporary Bench Mark			X
Aerial Photogrammetry Target			X
Alignment/Profile	Classification, standards, and specifications for a vertical control survey in these categories are generally classified as engineering (project), but can vary by project and/or region. Contact the region survey coordinator for specific details.		
Structure			
Cross Section/DTM			
Topography			
Construction			

¹ Standards and specifications for establishing vertical control of this classification detailed in the Federal Geodetic Control Committee publication, "Standards and Specifications for Geodetic Control Networks," as reprinted in October 1990, or subsequent revisions.

STANDARDS & SPECIFICATIONS FOR VERTICAL CONTROL

Network Geometry

<i>Classification</i>	<i>Third-Order</i>	<i>Project Order</i>
Existing network BM ties (min).....	4	2
Maximum distance between new bench marks	1.8 mi (3 km)	1500 ft (450 m)
Maximum length of line between BM's	15 Miles (25 km) (Double-Run) 6 Miles (10 km) (Single-Run)	N/A

Instrumentation

<i>Classification</i>	<i>Third-Order</i>	<i>Project Order</i>
Accuracy		
Standard deviation in 0.6 mile (1.0 km) of double run leveling	+/-0.003 ft. (1.0 mm)	+/- 0.006 ft. (2.0 mm¹)
Leveling rod construction	Invar, Metal or Wood	Fiberglass, Metal or Wood

¹An electronic total station may be used in lieu of a spirit or electronic level.

Field Procedures

<i>Classification</i>	<i>Third-Order</i>	<i>Project Order</i>
Minimal observation method	DR or 3WR	SR
Maximum sight length	300 ft (90 m)	300 ft (90 m¹)
Maximum difference between backsight and foresight lengths		
per setup	30 ft (10 m)	30 ft (10 m)
per section	30 ft (10 m)	30 ft (10 m)
Minimum ground clearance of line of sight ²	1.6 ft (0.5 m)	0.7 ft (0.2 m)
3-wire method		
Maximum 3-wire stadia difference	0.008 ft (2.5 mm)	N/A
Maximum section misclosure	0.05√M ft (12 √K mm)	0.06√M ft (14√K mm)
Maximum loop misclosure	0.05√M ft (12 √K mm)	0.06√M ft (14√K mm)

- DR -- Double-Run with single wire observation method or with digital level instrument
- 3WR -- Single-Run with 3-wire observation method
- SR -- Single-run with single-wire observation method
- K -- Shortest length of section (one-way) in km or perimeter of loop in km.
- M -- Shortest length of section (one-way) in miles or perimeter of loop in miles.

¹ Maximum sight length of 1000 ft (**300 m**) with electronic total station provided two position vertical angles are measured.

² For 3- wire leveling, the minimum ground clearance of the lower wire line of sight.