

PART 540 — FIELD SURVEYS

WA540.02(a)(2)

**WA540.01 Format**

The minimum requirements for field survey note-keeping are contained in this section.

**WA540.02 Precision and Accuracy**

(a) The following required precision and accuracy as outlined in the Engineering Field Handbook, (NEH Part 650), Chapter 1, Table 1-1 (see below), for engineering field surveys shall be followed:

- (1) Rough Surveys: Allowed for determining the feasibility and alternative evaluation of engineering practices as part of CTA, RMS or CMS planning.
- (2) Ordinary Surveys: Required for design and implementation of all engineering practice designs.

Table 1-1.-Accuracy standards for horizontal and vertical control

Type of survey	Ordinary surveys	Rough surveys
Triangulation:		
Maximum error of angular closure	1.0 minutes $\sqrt{N}$	1.5 minutes $\sqrt{N}$
Maximum error of horizontal closure		
By chaining	1.0/5,000	1.0/1,000
By stadia	1.0/1,000	3.0/1,000
Traverse:		
Maximum error of angular closure	1.0 minutes $\sqrt{N}$	1.5 minutes $\sqrt{N}$
Maximum error of horizontal closure		
By chaining	1.0/5,000	1.0/1,000
By stadia	1.0/1,000	3.0/1,000
Leveling:		
Maximum error of vertical closure		
By level and rod		
Metric	0.02 m $\sqrt{\text{km}}$	0.08 m $\sqrt{\text{km}}$
English	.10 ft $\sqrt{M}$	.40 ft $\sqrt{M}$
By transit and stadia		
Metric	.06 m $\sqrt{\text{km}}$	.20 m $\sqrt{\text{km}}$
English	.30 ft $\sqrt{M}$	1.0 ft $\sqrt{M}$
Topographic:	The elevation of 90 percent of all readily identifiable points shall be in error not more than one-half contour interval. No point shall be in error more than a full contour interval.	

N is the number of angles turned.  
M is the miles of levels run.  
km is the kilometers of levels run.