Area Determination for Timber Cruising

FSH 2409.12, section 50
-
TwoTrails Area Cruising Tool

Forest Management Service Center
Forest Products Measurement Group
Gary L. Boyack, FMSC, October 2009

Gary Boyack

Forest Products Measurement Group

Mathematics, B.S.
Forest Sciences, M.S.
from
Colorado State University

Survey Methods Expanded

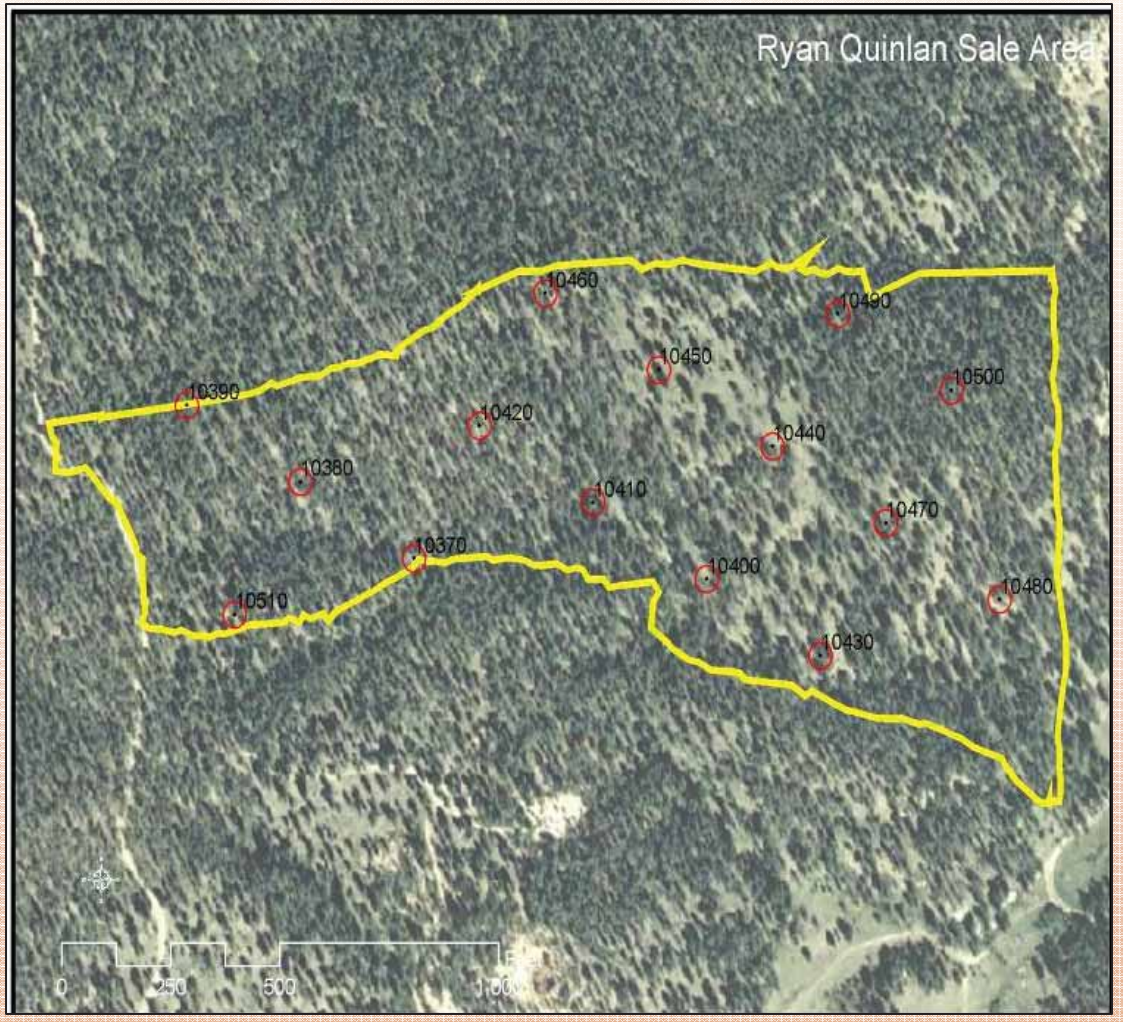
- GPS
  - Walk method (bread crumb idea)
  - Corner measurement method
- Direction – Distance method
  - Tradition around the unit
  - Between control points
- Ortho-photography
- Combined

Handbook Survey Methods Modified

GPS – Walk Method

Uses a continuous GPS track from walking the boundary

- Enhances existing process
- Expands use to other receivers and real-time
- Allows raw tracks to be modified in a GIS
- Adds or modifies filters such as PDOP, HDOP, SNR, Masks
- Adds area-error calculations



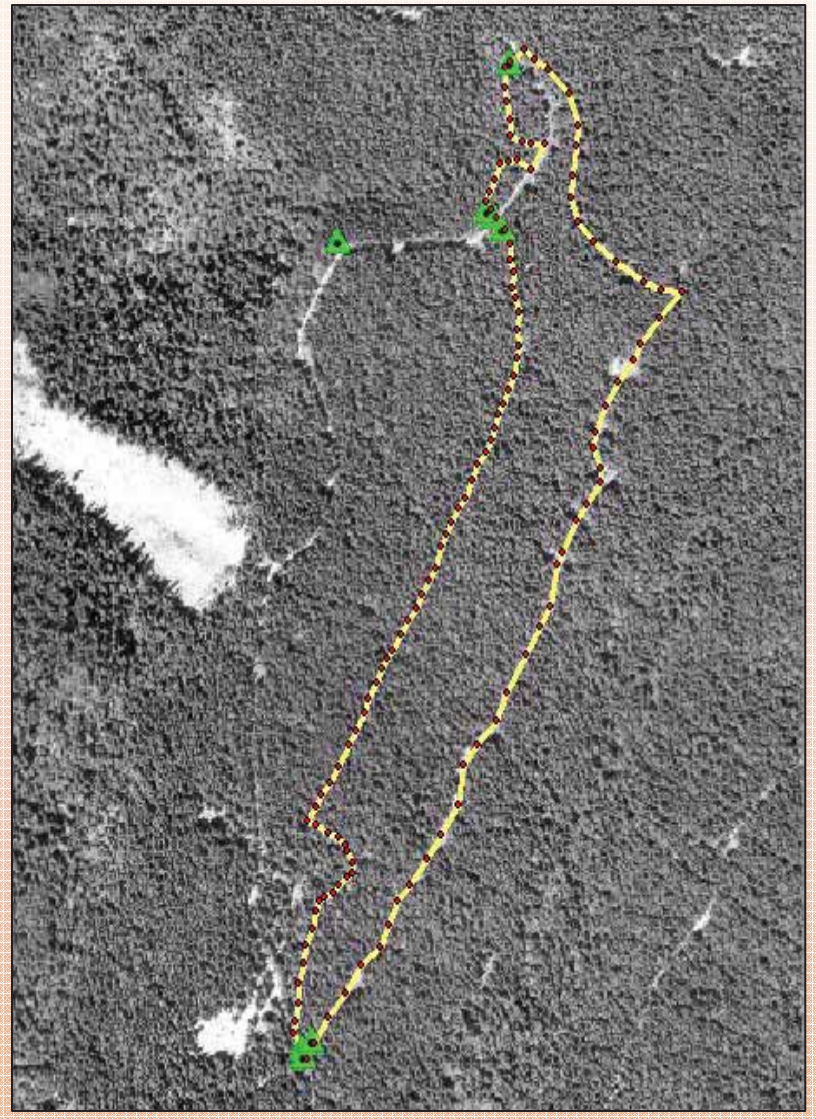
Moderate to Light Canopy – Manitou Springs

Handbook Survey Methods Modified

Direction-Distance Traverse

Uses traditional compass and chain methods

- Enhances existing methods
- Modifies method for traverse between GPS points
- Clarifies how direction is determined
- Adds area-error calculations



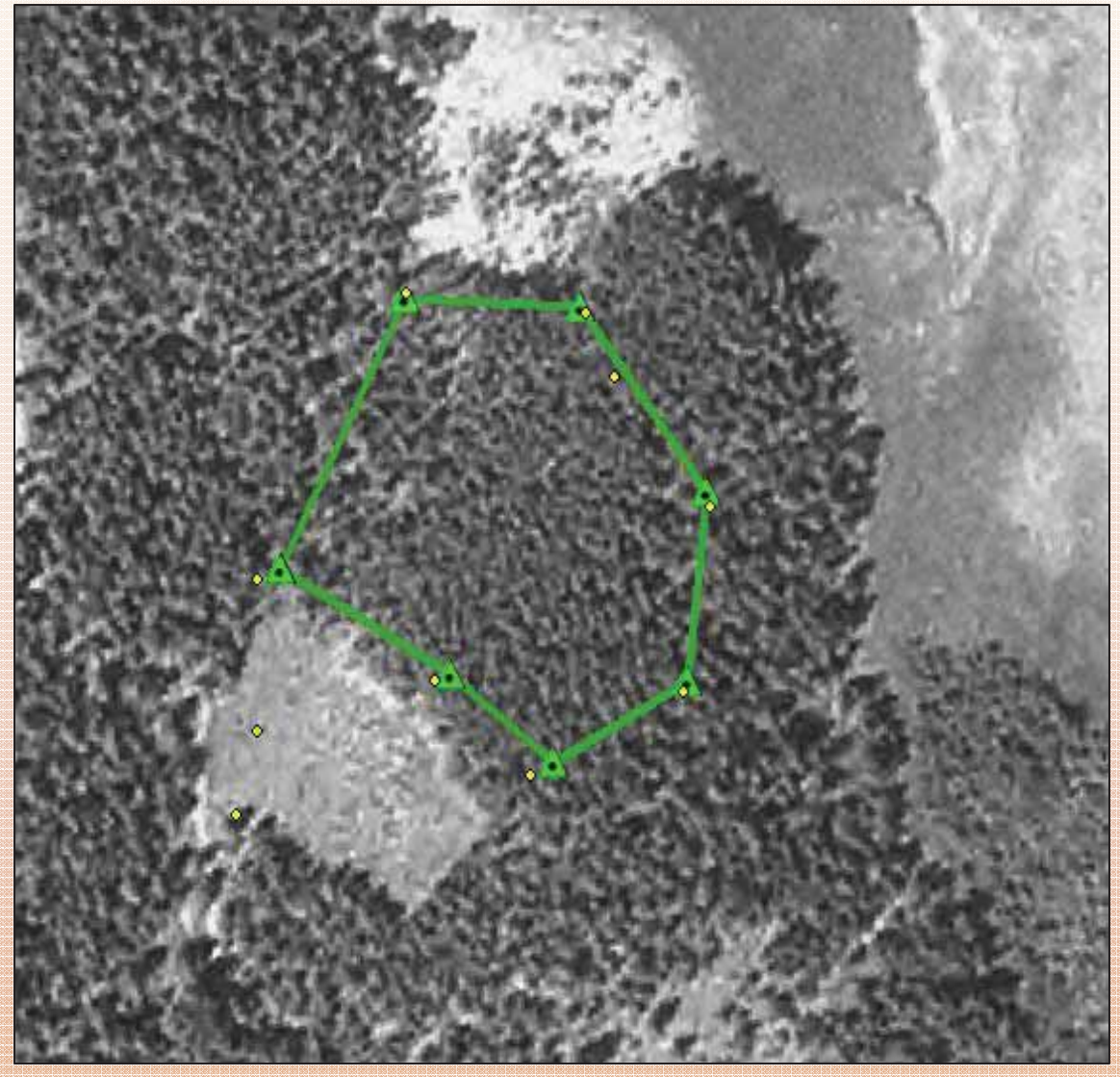
Heavy Canopy: Required Traverse Lines with GPS Geo-reference - Willamette

Handbook Survey Methods Added

GPS – Angle-Point Method

Uses static GPS locates at significant boundary changes

- Enhances existing processes
- Adds methods to use many receivers and real-time observations
- Adds area-error calculations



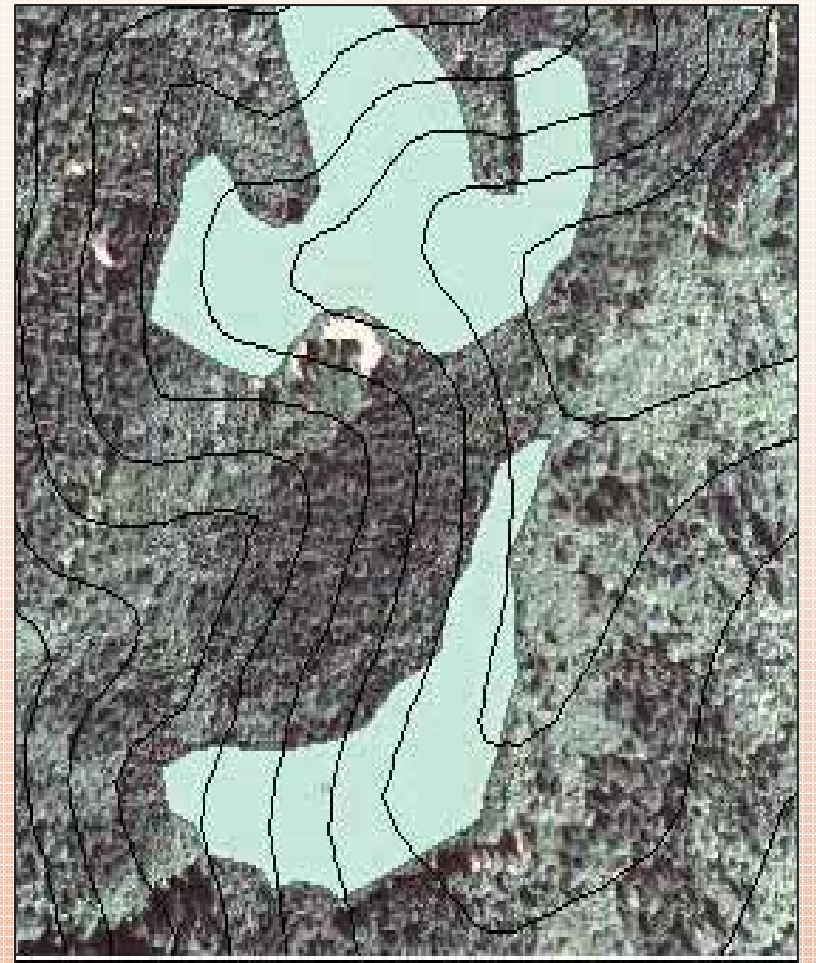
Heavy Canopy with Openings - Lubrecht

Handbook Survey Methods Added

Ortho-photography Survey

Uses digitized photo points for boundary or control points

- Capitalizes on new and available remote sensing products such as NAIP
- Shows methods to estimate accuracy of images
- Shows procedures to estimate accuracy of image points
- Adds area-error calculations
- Adds adjustments for using points not on the ground



100 foot contours

Steep Slopes and Heavy Canopy - Siuslaw

Survey Methods Mixed

Diagram illustrates traverse through heavy trees between GPS or ortho-photo points.

Survey Methods Mixed

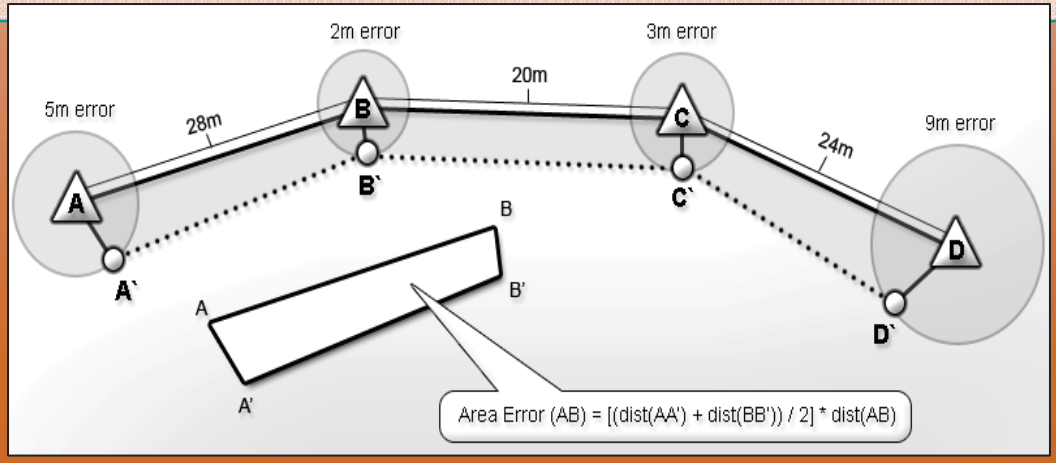
Ft Collins Test Survey combines : Ortho or GPS Angle Point
GPS real-time walk – Direction/Distance Traverses


Area study next

Area-Error Determination

The maximum area error for a timber unit is estimated in this fashion:

- The estimated accuracy of the boundary point is used as input.
- This accuracy comes from the Accuracy Matrix maintained by MTDC/FMSC for different GPS configurations and timber canopy conditions or similar operations.
- The maximum error for each leg of a traverse is estimated by using the mean of the inaccuracy distances of the endpoints, offset perpendicularly to one side of the boundary line, times the length of the boundary line.
- In general, the calculations are simple. The sticky issues of corners, overlaps, and other problems are managed.



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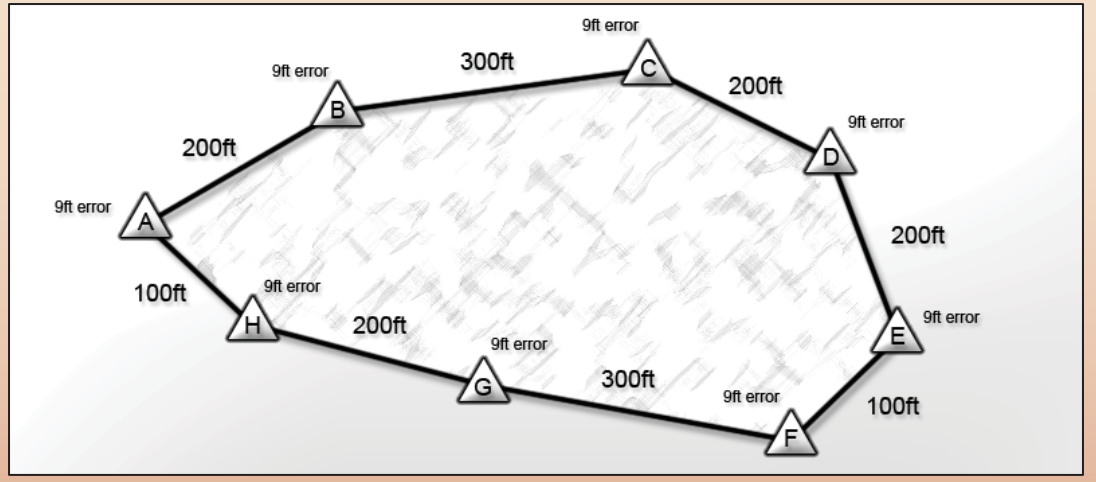
MTDC Accuracy Matrix

Tested Accuracies 1/17/2007		(NSSDA = horiz RMS x 1.7308) Some results are an average of more than 1 test run				
RECEIVER TYPE	COMMENTS	Open Open NSSDA MTDC Pt (meters)	Medium Canopy NSSDA Lubrecht (meters)	Heavy Canopy NSSDA Powell (meters)	Heavy Canopy NSSDA Clakamas (meters)	Heavy Canopy NSSDA Hardwoods (meters)
Garmin V - Autonomous, Ext Ant	1 Position Reading		5.54	12.21		
Garmin V - WAAS, Int Ant	1 Position Reading	3.71				
Garmin V - Autonomous, Ext Ant	5 Position Ave		11.31	12.19		
Garmin V - WAAS, Int Ant	5 Position Ave	5.33				
Garmin V - Autonomous, Ext Ant	60 Position Ave		5.14	11.96		
Garmin V - Autonomous, Beacon, Ext Ant	60 Position Ave		5.30	12.25		
Garmin V - Autonomous, Int Ant	60 Position Ave		19.30	9.83		
Garmin V - Autonomous, Beacon	60 Position Ave		5.30			
Garmin V - WAAS, Int Ant	60 Position Ave	4.28				
Trimble Pro XT - Autonomous, Int Ant	60 Position Ave		7.83	6.39		
Trimble Pro XT - Post-Processed, Int Ant	60 Position Ave		3.36	6.13		
Trimble Pro XT - Hurricane Ext Ant, Autonomous	60 Position Ave		5.39	6.26		
Trimble Pro XT - Hurricane Ext Ant, Post-Processed	60 Position Ave		2.34	4.68		
Trimble Pro XT - Beacon, Autonomous	60 Position Ave		16.57			
Trimble Pro XT - Beacon, Post-Processed	60 Position Ave		2.91			
Trimble Pro XT - Hurricane Ext Ant, Beacon (Polson), Autonomous	60 Position Ave		4.90	8.21		
Trimble Pro XT - Hurricane Ext Ant, Beacon (Polson), Post-Processed	60 Position Ave		4.43	9.39		
Trimble Pro XT - Zephr Ext Ant, Autonomous	60 Position Ave			6.92		
Trimble Pro XT - Zephr Ext Ant, Post-Processed	60 Position Ave			5.13		
Trimble Pro XT - Zephr Ext Ant, Post-Processed w/ filters	60 Position Ave			6.24		
Trimble XB - Autonomous, Int Ant	1 Position Reading		10.16	4.66		
Trimble XB - Post-Processed, Int Ant	1 Position Reading		8.03			
Trimble XB - Autonomous, Int Ant	5 Position Ave	1.25	8.59	8.82		
Trimble XB - Post-Processed, Int Ant	5 Position Ave		6.65			
Trimble XB - Autonomous, Int Ant	60 Position Ave	1.85	6.42	9.72		
Trimble XB - Post-Processed, Int Ant	60 Position Ave		6.08			
Trimble XB - WAAS, Int Ant	60 Position Ave	1.90				
Trimble XB - WAAS, Int Ant	5 Position Ave	1.99				
Trimble XB - Post-Processed, WAAS, Int Ant	60 Position Ave	1.86				
Trimble XB - Ext Ant	1 Position Reading			19.22		
Trimble XB - Ext Ant	5 Position Ave			23.28		
Geneq SXBlue - WAAS, Ext Ant, ArcPad7	1 Position Reading			8.97		
Geneq SXBlue - WAAS, Ext Ant, ArcPad7 (a-firmware update 1-7-07)	5 Position Ave	2.87	2.674a	9.66		
Geneq SXBlue - WAAS, Ext Ant, ArcPad7 (a-firmware update 1-7-07)	60 Position Ave	2.15	3.433a	6.54		

GPS_ChallengeTeam_ForestService_Savannah8_7wNotes.ppt

Area-Error Determination

- In a even stand, you can use one value for all GPS vertices
- In an uneven stand, you can either use different values relative to each site canopy condition --- or you can estimate the relative value for the unit and use one value as before. (Metadata required !)



Given the top figure where the unit size is 10 acres and the error at each point is 10 feet (not 9 as shown): “What is the area-error?” Let’s practice it together now.

Perimeter is 1600 feet

Area of maximum error is 10x1600 = 16000 sq feet

10 acres is 435600 sq.ft.

16,000 / 435,600 ~ 0.0367 ~ 3.7% less than 4%

Does it matter if you measure by walk method (bread crumb) or if you take static observations at each corner?

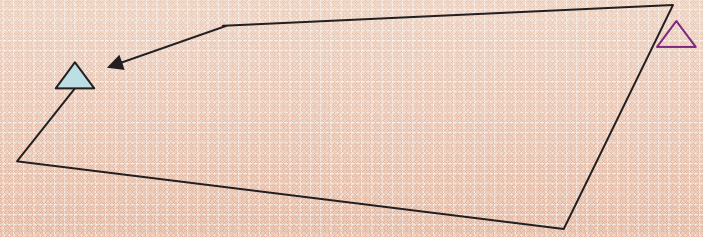
TwoTrails calcs all this, however, all that is needed is:

shapefile or route measuring the boundary; correct protocol; GPS corner point accuracy

Handbook Limits

Direction-Distance Traverse Around the Unit

1:50 < 20 acres 1:100 > 20 acres (original limit)



Limits apply to area-expanded cruise methods

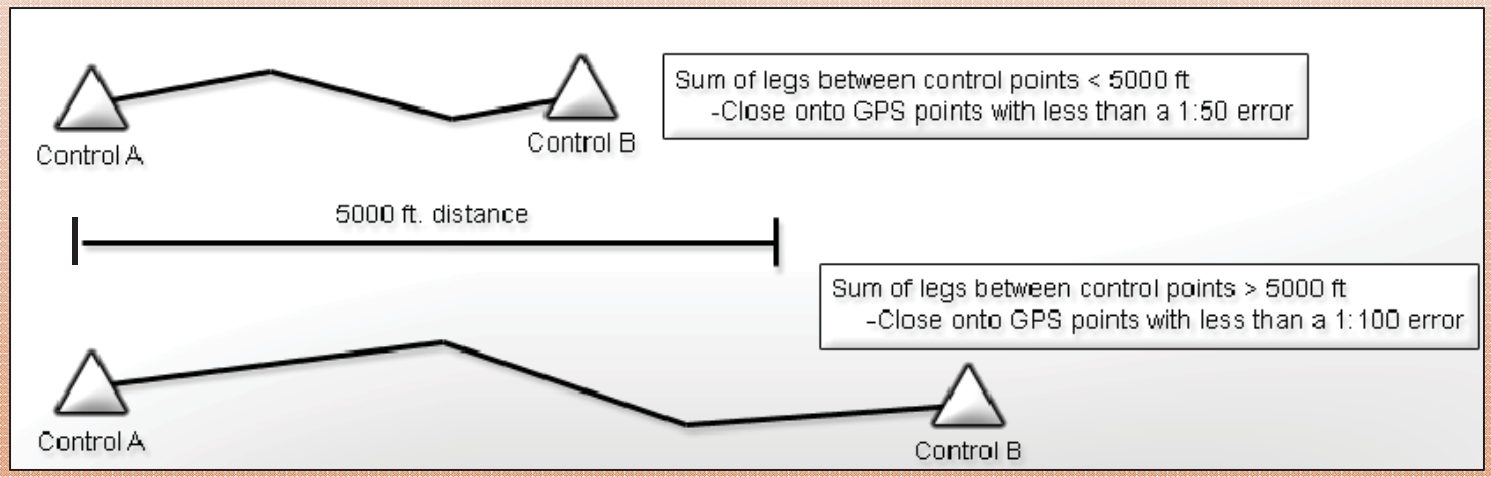
Additional control point - Checks azimuth and scale and helps with error discovery

Traverse closing distance (closing error, mis-closure, error of closure) takes precedence over area limiting standards

Handbook Limits

Direction-Distance Traverse Between Control

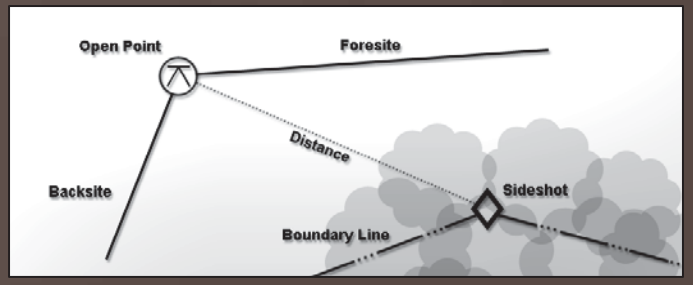
1:50 < 5000 ft 1:100 > 5000 ft



Traverse Comments

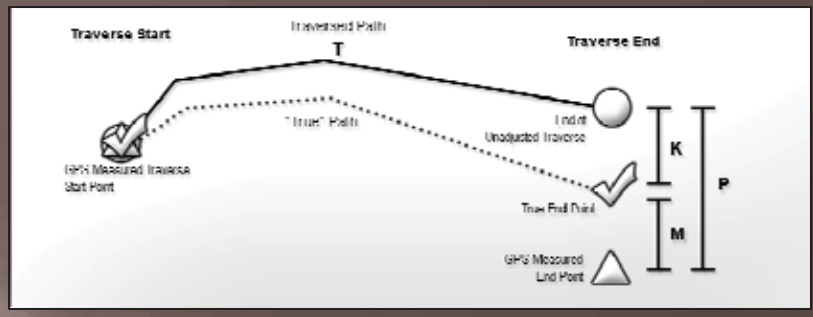
- Points in a traverse are dependent (GPS points are autonomous)
- Lasers and sighting compasses are better
- Better for small areas

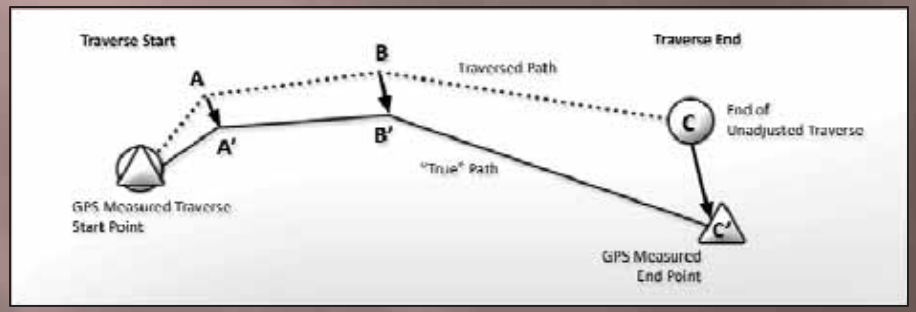
- West Coast's forests are "tough"

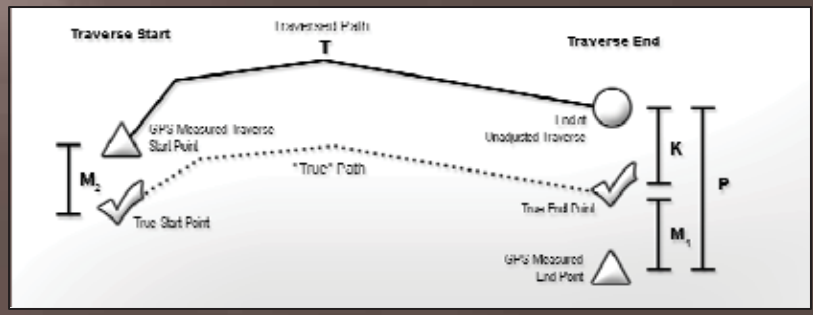


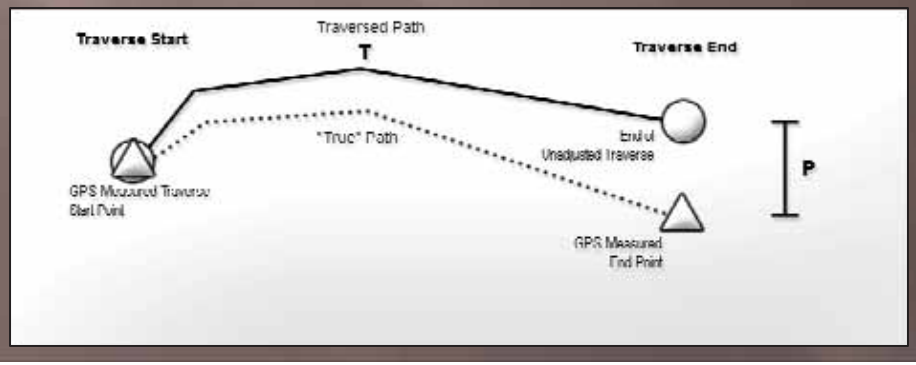
Traverse Comments

- The traverse accuracy may be as good or better than GPS accuracy









- The best way to solve the problem is to have good GPS observations
  - Observed in the open
  - Use sideshot from open sites

Handbook Limits

GPS

- Receiver configuration and method is limited and defined
  - by handbook sections
  - and the MTDC/FMSC Accuracy Matrix
- Area-error < 10%

Limits apply to area-expanded cruise methods

Results from Rewriting the Handbook

- Conflicting or confusing issues are removed
- Quantitative area measurements can be made
- Field operations are more flexible but defendable
- Additional equipment is allowed
- Advancing technology is utilized
- Present practices are affirmed
- Methods to keep current are included
- Cruiser can more efficiently use resources

Done with this
--- but just getting started ---
Happy TwoTrails to You