



U.S. Department of Transportation
Federal Highway Administration

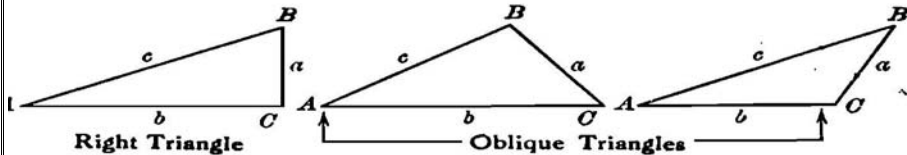
Central Federal Lands Highway Division

Field Point Coding and Numbering



March 17, 2009

TRIGONOMETRIC FORMULAS



Solution of Right Triangles

For Angle A . $\sin = \frac{a}{c}$, $\cos = \frac{b}{c}$, $\tan = \frac{a}{b}$, $\cot = \frac{b}{a}$, $\sec = \frac{c}{b}$, $\operatorname{cosec} = \frac{c}{a}$

Given a, b	Required A, B, c	$\tan A = \frac{a}{b} = \cot B, c = \sqrt{a^2 + b^2} = a \sqrt{1 + \frac{b^2}{a^2}}$
a, c	A, B, b	$\sin A = \frac{a}{c} = \cos B, b = \sqrt{(c+a)(c-a)} = c \sqrt{1 - \frac{a^2}{c^2}}$
A, a	B, b, c	$B = 90^\circ - A, b = a \cot A, c = \frac{a}{\sin A}$
A, b	B, a, c	$B = 90^\circ - A, a = b \tan A, c = \frac{b}{\cos A}$
A, c	B, a, b	$B = 90^\circ - A, a = c \sin A, b = c \cos A$

Solution of Oblique Triangles

Given A, B, a	Required b, c, C	$b = \frac{a \sin B}{\sin A}, C = 180^\circ - (A + B), c = \frac{a \sin C}{\sin A}$
A, a, b	B, c, C	$\sin B = \frac{b \sin A}{a}, C = 180^\circ - (A + B), c = \frac{a \sin C}{\sin A}$
a, b, C	A, B, c	$A + B = 180^\circ - C, \tan \frac{1}{2}(A - B) = \frac{(a - b) \tan \frac{1}{2}(A + B)}{a + b},$ $c = \frac{a \sin C}{\sin A}$
a, b, c	A, B, C	$s = \frac{a + b + c}{2}, \sin \frac{1}{2}A = \sqrt{\frac{(s - b)(s - c)}{bc}},$ $\sin \frac{1}{2}B = \sqrt{\frac{(s - a)(s - c)}{ac}}, C = 180^\circ - (A + B)$
a, b, c	Area	$s = \frac{a + b + c}{2}, \text{area} = \sqrt{s(s - a)(s - b)(s - c)}$
A, b, c	Area	$\text{area} = \frac{bc \sin A}{2}$
A, B, C, a	Area	$\text{area} = \frac{a^2 \sin B \sin C}{2 \sin A}$

POINT NUMBERING

<u>PT. NUMBERS</u>	<u>DESCRIPTION</u>
1 - 999	Level Runs
1000 - 1999	Existing Primary Control
2000 - 2999	GPS Control Monuments
3000 - 3999	Control Monuments w/Differential Levels
4000 - 4999	Auxiliary Control Monuments
5000 - 5999	Supplemental Control
6000 - 6999	Boundary Control Points
7000 - 7999	Benchmarks
8000 - 8999	Panel Points
9000 - 9999	Surveyor Discretion
10000 +	Mapping / Topographic Points

•To identify multiple features, use the third number field.
If more than one edge of road, identify with a different third character,
i.e.421 = 1st edge of pavement, 422 = 2nd edge of pavement, and so on.

Begin continuous features with a "BL "
End line with "EL*" Close line with "CL "
denote Start of Curve with "PC "
Denote End of Curve with "PT "

POINT NUMBERING GUIDELINES AND NOTES

Area, Length, and Volume Conversion Factors

Quantity	From Inch-Pound Units	To Metric Units	Multiply By
Length	* mile (U.S. Statute)	m	1609.347
	mile (international)	km	<u>1.609344</u>
	yard	m	<u>0.9144</u>
	foot	m	<u>0.3048</u>
	* foot (U.S. Survey)	m	0.30480061
	inch	mm	<u>25.4</u>
Area	* square mile (U.S. Statute)	km ²	2.589998
	* acre	m ²	4046.873
		ha (10,000 m ²)	0.4046873
	square yard	m ²	<u>0.83612736</u>
	square foot	m ²	<u>0.09290304</u>
	square inch	mm ²	<u>645.16</u>
Volume	acre foot	m ³	1233.4894
	cubic yard	m ³	0.7645549
	cubic foot	cm ³	<u>28316.85</u>
	cubic foot	L (1000 cm ³)	<u>28,31685</u>
	cubic foot	m ³	<u>0.02831685</u>
	100 board feet	L (1000 cm ³)	0.235974
	gallon	kL (1000 L)	3.785412 x 10 ⁻³
	1000 gallons	cm ³	<u>3785412.</u>
	cubic inch	mm ³	<u>16387.064</u>

Note: Underline denotes exact number.

* Any data, in feet, derived from and published as a result of geodetic surveys will remain with the U.S. Survey foot including all stationing, land measure, and coordinate conversions.

The U.S. Survey foot, as established in the U.S. Metric Law of 1886, is based on the relationship of 1 m = 39.37 inches or 1 foot = 1200/3937 m. All conversion factors for units of land measure in this table referenced to this footnote (*) are based on the U.S. Survey foot.

CODE		DESCRIPTION			CODE		DESCRIPTION		
16	Archeological Site	L			32	Tree (Generic)			A
72	Bench Mark			A	18	Trench Scar	L		
99	Berm	L	D		13	Wall (type)	L	D	A
09	Bore Hole				07	Water Elevation (w date)			A
11	Bottom of Bank	L	D		04	Wet Area (Outline)	L	D	
31	Boulder (solitary rock)								
24	Break Line (w/description)	L	D	A					
34	Brush Line	L							
02	Dam	L	D						
01	Dike	L	D						
21	Ditch (man made, Irrigation)	L	D						
20	Drainage Flow Line	L	D						
23	Edge of Water	L	D						
05	Grave	L							
27	Ground Shot		D						
29	High or Low Point		D						
08	Overhang (plan only)								
25	Ridge Line	L	D						
30	RipRap	L	D						
28	Rock (point feature)		D						
26	Rock Outcrop	L	D						
03	Spring, Seep		D						
19	Stream	L	D						
73	Temp Bench Mark (w/description)			A					
12	Top of Bank	L	D						
06	Trail	L	D						

**Topo & Vegetation
(Alpha)**

L = connect lines

D = incl. in DTM

A = Attribute

CODE		DESCRIPTION			CODE		DESCRIPTION		
01	Dike	L	D		32	Tree (Generic)			A
02	Dam	L	D		34	Brush Line	L		
03	Spring, Seep		D		72	Bench Mark			A
04	Wet Area (Outline)	L	D		73	Temp Bench Mark (w/description)			A
05	Grave	L			99	Berm	L	D	
06	Trail	L	D						
07	Water Elevation (w date)			A					
08	Overhang (plan only)								
09	Bore Hole								
11	Bottom of Bank	L	D						
12	Top of Bank	L	D						
13	Wall (type)	L	D	A					
16	Archeological Site	L							
18	Trench Scar	L							
19	Stream	L	D						
20	Drainage Flow Line	L	D						
21	Ditch (man made, Irrigation)	L	D						
23	Edge of Water	L	D						
24	Break Line (w/description)	L	D	A					
25	Ridge Line	L	D						
26	Rock Outcrop	L	D						
27	Ground Shot		D						
28	Rock (point feature)		D						
29	High or Low Point		D						
30	RipRap	L	D						
31	Boulder (solitary rock)								

**Topo & Vegetation
(Numeric)**

CODE		DESCRIPTION			CODE		DESCRIPTION		
79	Antenna				50	Utility Pedestal (type)			A
80	CATV Line (OH)	L			39	Utility Pole (w/description)			A
81	CATV Line (UG)	L			100	Valve, Gas			
95	Culvert (type, size)	L		A	101	Valve, Water			
21	Ditch (man made, Irrigation)	L	D		105	Vault	L		A
20	Drainage Flow Line	L	D		106	Vent			A
96	Drop Inlet (4 shots)	L			103	Water Faucet			
82	Electric Line (OH)	L			88	Water Line (UG)	L		
83	Electric Line (UG)	L			56	Well			
84	Fiber Optic Line (OH)	L							
85	Fiber Optic Line (UG)	L							
102	Fire Hydrant								
89	Gas Line (UG)								
22	Guy Anchor								
104	Invert	L		A					
97	Light Pole								
98	Manhole (type)			A					
94	Pipe Line (w/description)	L		A		L = connect lines			
14	Sanitary Sewer Invert					D = incl. in DTM			
35	Septic Tank (extents?)	L				A = Attributes			
15	Storm Sewer Invert								
36	Street Light (gantry type)					(UG)=Underground			
86	Telephone Line (OH)	L				(OH)=Overhead			
87	Telephone Line (UG)	L							
37	Traffic Signal (w/description)			A					
38	Utility Meter (w/description)			A					
					Utilities (Alpha)				

CODE		DESCRIPTION		CODE		DESCRIPTION	
14	Sanitary Sewer Invert			97	Light Pole		
15	Storm Sewer Invert			98	Manhole (type)		A
20	Drainage Flow Line	L	D	100	Valve, Gas		
21	Ditch (man made, Irrigation)	L	D	101	Valve, Water		
22	Guy Anchor			102	Fire Hydrant		
35	Septic Tank (extents?)	L		103	Water Faucet		
36	Street Light (gantry type)			104	Invert	L	A
37	Traffic Signal (w/description)		A	105	Vault	L	A
38	Utility Meter (w/description)		A	106	Vent		A
39	Utility Pole (w/description)		A				
50	Utility Pedestal (type)		A				
56	Well						
79	Antenna						
80	CATV Line (OH)	L					
81	CATV Line (UG)	L					
82	Electric Line (OH)	L			L = connect lines		
83	Electric Line (UG)	L			D = incl. in DTM		
84	Fiber Optic Line (OH)	L			A = Attributes		
85	Fiber Optic Line (UG)	L					
86	Telephone Line (OH)	L			(UG)=Underground		
87	Telephone Line (UG)	L			(OH)=Overhead		
88	Water Line (UG)	L					
89	Gas Line (UG)						
94	Pipe Line (w/description)	L	A				
95	Culvert (type, size)	L	A				
96	Drop Inlet (4 shots)	L					
Utilities (Numeric)							

