EDM Slope Distance to Horizontal and Sea-Level Distance

Horizontal distance and height difference from an EDM slope distance and zenith angle, with curvature and refraction and reduction to sea level.

Method: Slope reduction; curvature and refraction; ...

Input parameters

Unit system: SI

Parameter	Value	Unit
Measured slope distance	1,250.0	m
Zenith angle	87.500	°
Instrument height	1.5500	m
Target (reflector) height	1.8000	m
Mean elevation of the line	450.00	m
Refraction coefficient	0.13000	
Earth radius	6,371.0	km

Calculated results

Parameter	Value	Unit
Horizontal distance	1,248.8	m
Height difference (target ground − station ground)	54.381	m
Curvature and refraction correction	106.48	mm
Distance reduced to sea level	1,248.7	m
Sea-level reduction	88.200	mm

Notes for this case

• H = S·sin Z; Δh = S·cos Z + h_i − h_t + (1 − k)H²/2R, the last term adding curvature and refraction for long sights. Sea-level (geoidal) distance H_0 = H·R/(R + h_m) shrinks lines measured at altitude; a grid scale factor for the map projection is a further step. EDM distances should already carry the instrument's atmospheric (ppm) correction.

Formula and method

$$H = S\sin Z, \quad \Delta h = S\cos Z + h_i - h_t + \frac{(1-k)H^2}{2R}, \quad H_0 = H\frac{R}{R+h_m}$$

Variables

S	Measured slope distance	m
Z	Zenith angle	rad
h_i	Instrument height	m
h_t	Target (reflector) height	m
h_m	Mean elevation of the line	m
k	Refraction coefficient	-
R	Earth radius	m
H	Horizontal distance	m
Δh	Height difference (target ground − station ground)	m
c_r	Curvature and refraction correction	m
H_0	Distance reduced to sea level	m
$H - H_0$	Sea-level reduction	m

Method and standards

Slope reduction.

Assumptions and limits

- Spherical earth; uniform refraction; atmospheric correction already applied.

References

Slope reduction, curvature and refraction, sea-level reduction

Report details

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Release checks	3 reference cases of this calculator, computed independently, are checked on every release

Results are for engineering estimation. Verify critical designs against the referenced standards and your own data.

This calculator online

https://calc.firecad.com/civil/surveying/edm-slope-distance-reduction

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.