

Depth Errors

What are Depth Errors?

Slope Indicator's accuracy statements assume that the probe can be positioned repeatably within 0.25 inch (6mm). If the probe is located less precisely in the casing, an error will result.

In the graph at right, two datasets show depth errors. The error is less noticeable in straight casing and more noticeable in curved casing.

What Causes Depth Errors?

- A Change in Cable Reference

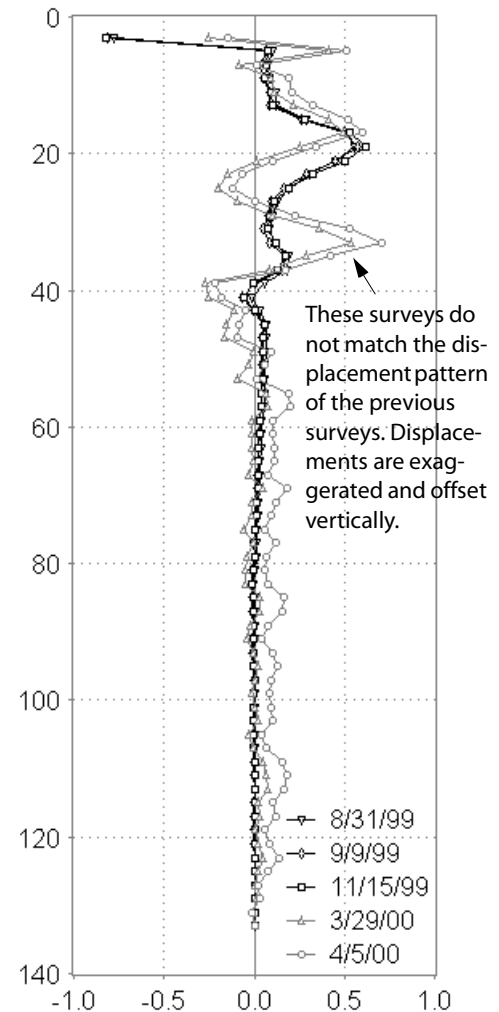
To position the probe, operators align cable marks with a reference at the top of the casing. If the elevation of the reference changes - for example, casing is cut off or a pulley assembly is not used - a depth error occurs.

- A Change in Cable Length

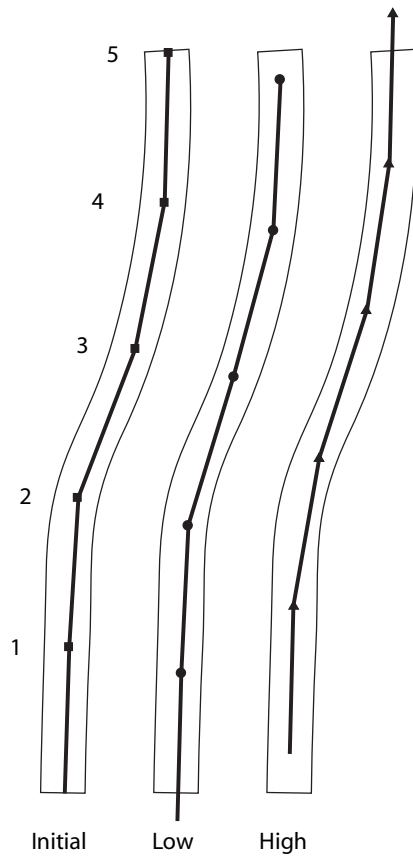
Control cables may shrink over time. Cables may be interchanged with other cables that are not the same length. Also, repairs to the cable may result in changed length.

- A Change in Casing Length

Settlement compresses the casing, reducing its length, or the survey may be started at the wrong depth by mistake, or rocks or silt may fill the bottom of the casing.

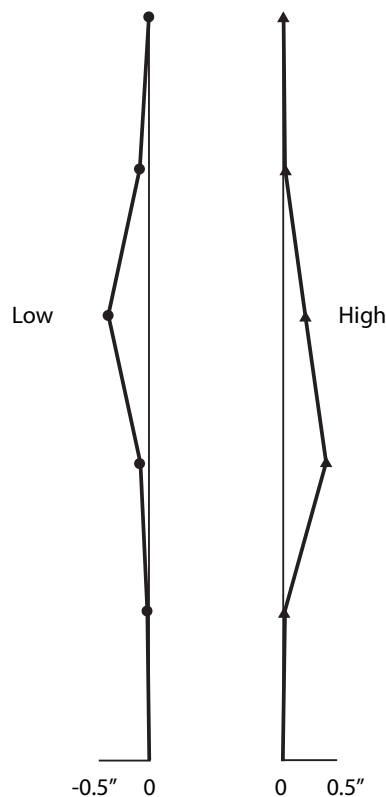


Depth Errors in S-Shaped Casing



The diagram at left shows how the probe was positioned for three surveys of the same casing. The cable reference is normal for the first survey, low for the second survey, and high for the third survey.

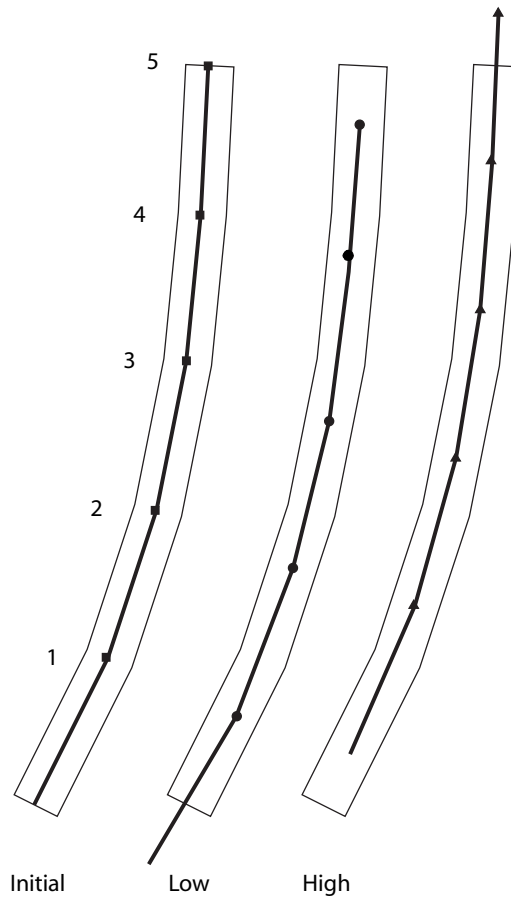
Readings			
Interval	Initial	Low	High
5	100	180	90
4	800	110	600
3	1500	1200	1300
2	300	230	700
1	100	90	110



Now look at the effect of plotting displacement (the change in readings). Depth errors are responsible for the apparent displacements.

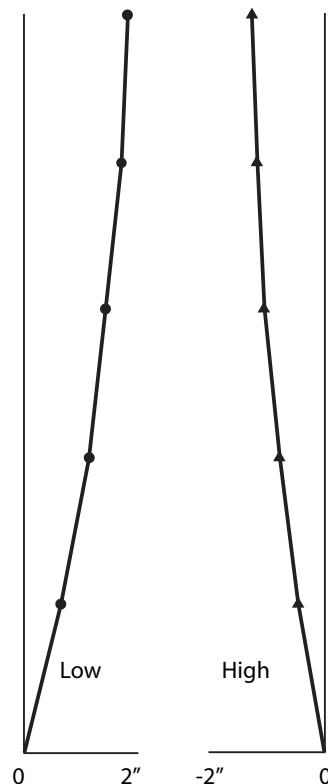
		Change from Initial	
		Initial	Higher
5	100	80	-10
4	800	300	-200
3	1500	-300	-200
2	300	-70	400
1	100	-10	10

Depth Errors in J-Shaped Casing



The diagram at left shows how the probe was positioned for three surveys of the same casing. The cable reference is normal for the first survey, low for the second survey, and high for the third survey.

Readings			
Interval	Initial	Low	High
5	200	270	150
4	400	550	330
3	800	970	650
2	1300	1550	1130
1	2000	2350	1750

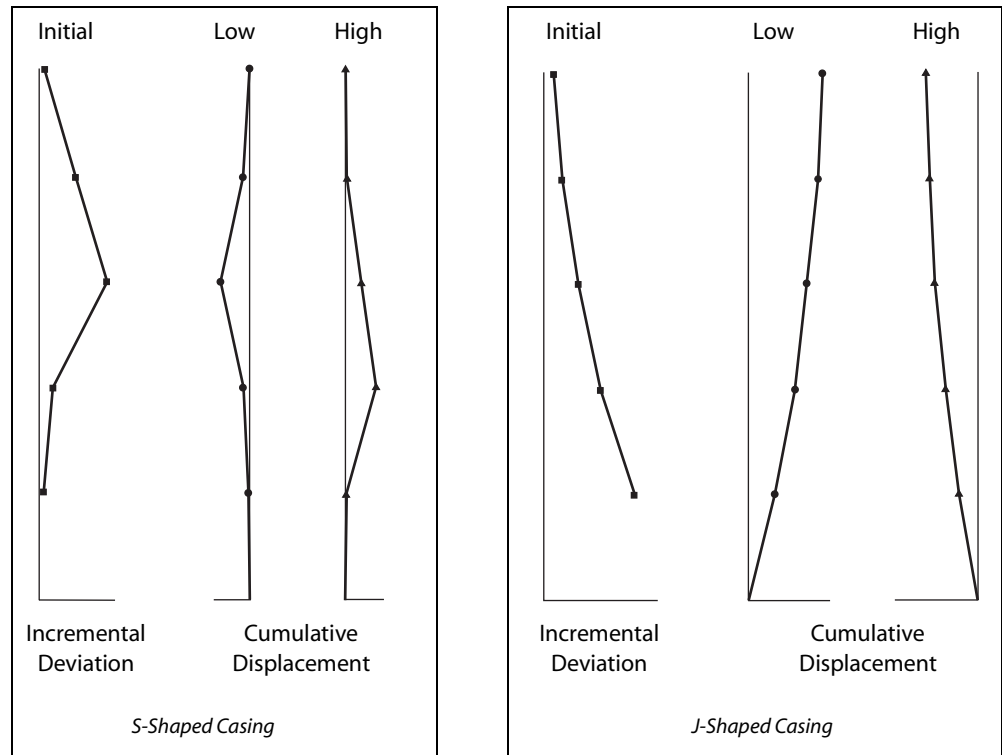


Now look at the effect of plotting the change in readings. Depth errors are responsible for the apparent displacements.

Interval	Change from Initial		
	Initial	Low	Higher
5	200	70	-50
4	400	150	-70
3	800	170	-150
2	1300	250	-170
1	2000	350	-250

Identifying Depth Errors

Systematic depth errors can be identified by comparing displacement plots of questionable surveys to an incremental deviation plot of the initial survey. The error is systematic if you can see a similar shape.



Correcting Depth Errors

Calculating corrections is not difficult if the depth error is known. You may wish to save your original data and construct a new dataset of corrected readings:

For each depth:

$$\text{Corrected Reading} = \text{Current Reading} + \text{Correction}$$

$$\text{Correction} = \text{Curvature} \times \frac{\text{Depth Error}}{\text{Interval}}$$

$$\text{Curvature} = \text{Reading Above} - \text{Current Reading, probe too deep}$$

or

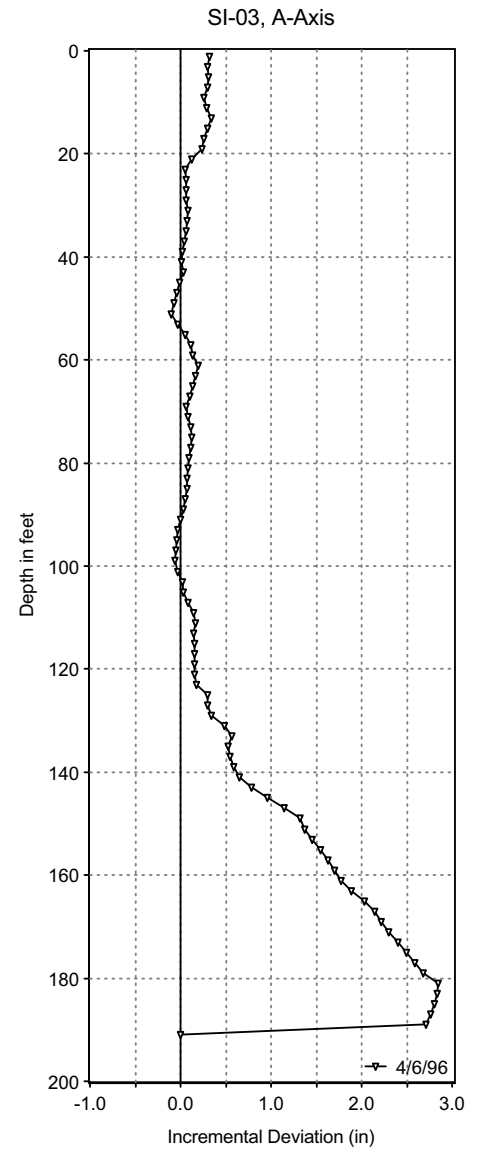
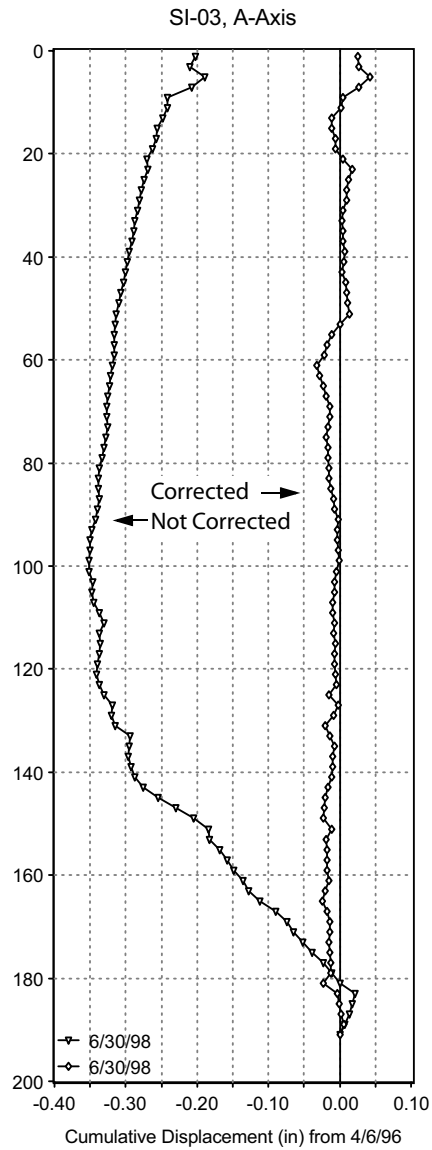
$$\text{Curvature} = \text{Reading Below} - \text{Current Reading, probe too shallow}$$

$$\text{Depth Error} = |\text{Distance from correct depth}|$$

$$\text{Interval} = \text{The reading interval used, typically 2 feet or 0.5 m}$$

Depth Error Example 1

The graph below shows corrected and uncorrected versions of the same dataset. The depth error was about 0.3 feet. Note how closely the uncorrected dataset matches the incremental deviation plot on the right.



Depth Error Sample 2

The graph below shows corrected and uncorrected versions of the same dataset. The cause of the depth error was unknown. The average depth error was about 0.75 feet, so the source of the error may have been use and non-use of a pulley assembly. The casing was not very straight, as shown in the incremental deviation plot at right.

