



Managing temperature effect on readings of vibrating wire sensors

By
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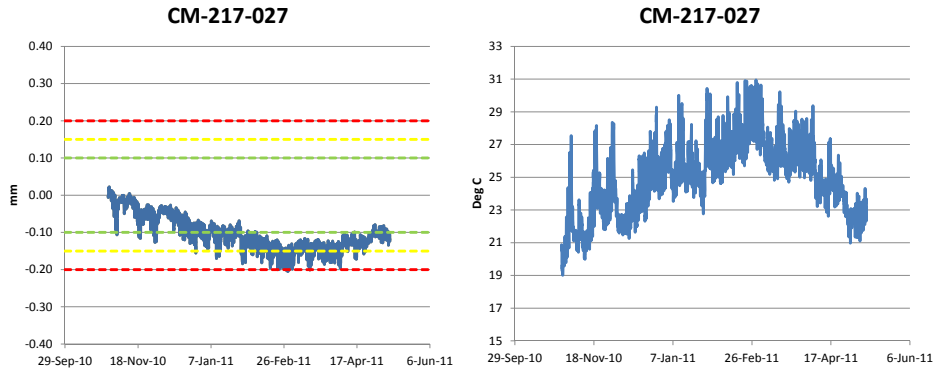


The Instrumentation Setup

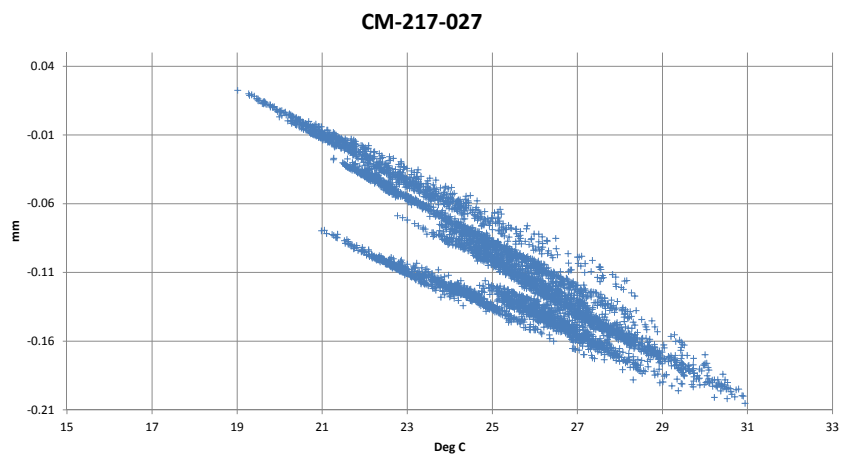
- 16 VW crackmeters installed in tunnels
- Sensors read with CR800 based data logger
- Readings include frequency in Hz and temperature in deg C

The Problem

- Readings are very temperature dependent
- Actual movements masked by temperature effects
- Alert thresholds un-usable

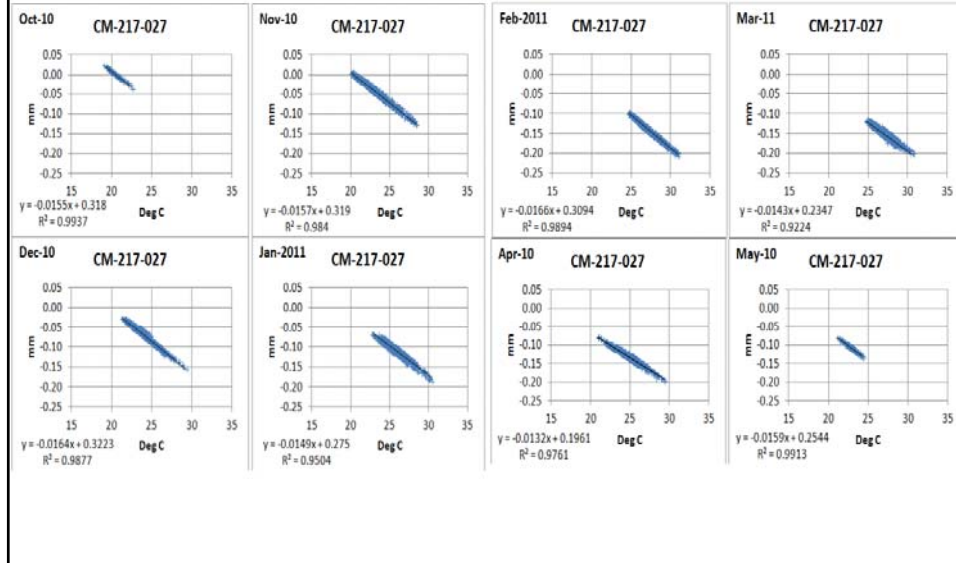


Data Patterns



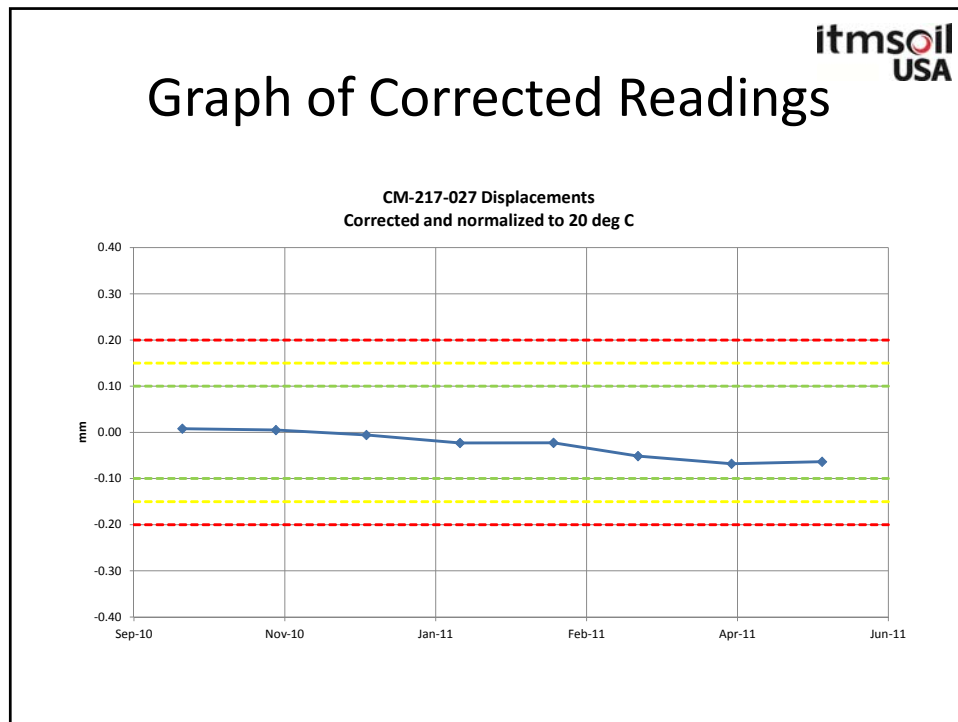


Data Patterns



Data Patterns in Numbers

Month	Slope	Intercept	R squared	Corrected and normalized displacement (at 20 deg C)
Oct-10	-0.0155	0.3180	0.9937	20 x Slope + Intercept = 0.0080
Nov-10	-0.0157	0.3190	0.9840	20 x Slope + Intercept = 0.0050
Dec-10	-0.0164	0.3223	0.9877	20 x Slope + Intercept = -0.0057
Jan-11	-0.0149	0.2750	0.9504	20 x Slope + Intercept = -0.0230
Feb-11	-0.0166	0.3094	0.9894	20 x Slope + Intercept = -0.0226
Mar-11	-0.0143	0.2347	0.9224	20 x Slope + Intercept = -0.0513
Apr-11	-0.0132	0.1961	0.9761	20 x Slope + Intercept = -0.0679
May-11	-0.0159	0.2544	0.9913	20 x Slope + Intercept = -0.0636

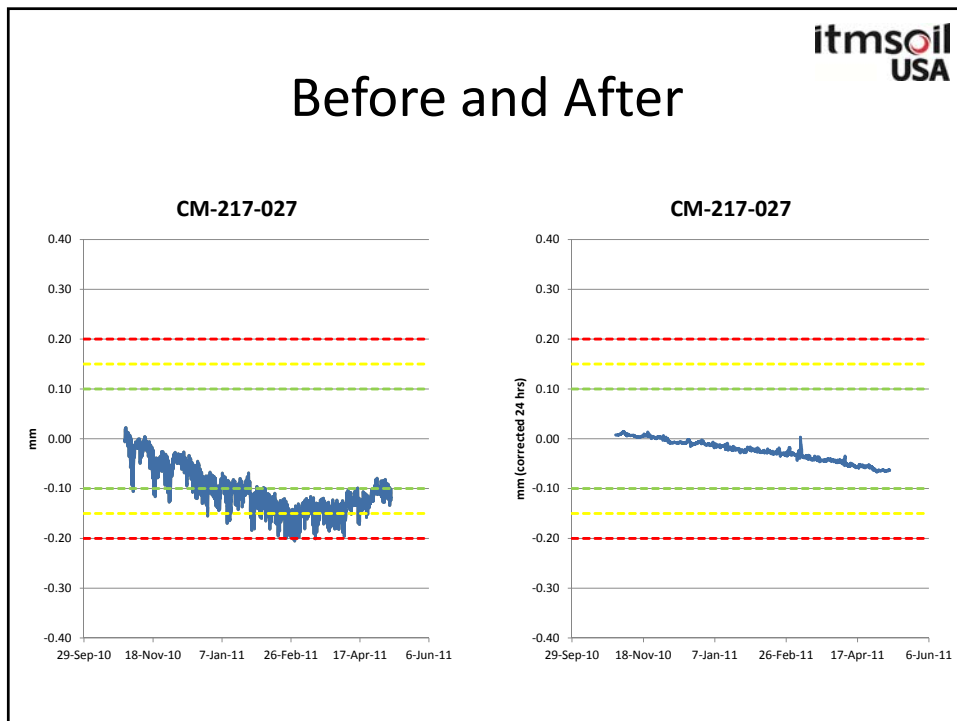
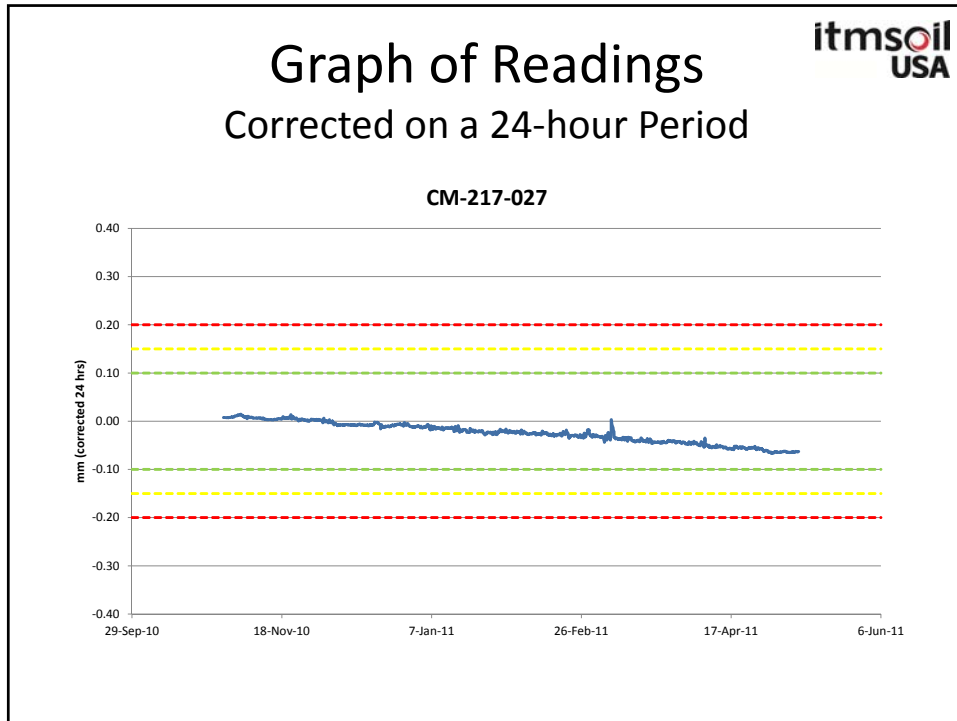


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Detailed and Realtime Correction

1. Collect the Hz readings and temperature readings.
2. Convert the Hz readings into mm values by applying the calibration factors.
3. Calculate "Slope", "Intersect" and "R squared" of all the readings taken during a time window between now and 24 hours ago – "running linear correlation".
4. Normalize the displacement reading to 20 degrees C by using the equation:

$$20 \times \text{Slope} + \text{Intersect.}$$
5. Time stamp the normalize reading with the latest date/time
6. Obtain another set of reading from the datalogger
7. Repeat the procedure from step 2



Application

- VW crackmeters
- VW strain gauges
- Other non-VW sensors