LANDSLIDE TECHNOLOGY
A DIVISION OF CORNFORTH CONSULTANTS

Memo To:	Aaron Banks, C.P.G. R&M Consultants, Inc.	2925-5.2
From:	Darren Beckstrand, C.E.G. Landslide Technology	
Date:	August 26, 2021	
Subject:	**Surface Extensometer Instrumentation Installation** **Beach Road Landslide, Haines, Alaska**	

This memo describes the installation of surface displacement monitoring instruments at the Beach Road landslide in Haines, Alaska. These instruments are installed across scarp cracks, as shown on Figure 1. They represent a first phase in landslide monitoring and will be followed by subsurface drilling and instrumentation beginning in late-August 2021. The following sections describe the installation and initial datasets.

INSTALLATION

Landslide Technology's engineering and geological staff installed the components between July 12 and 20, 2021. Temsco Helicopters provided logistical support in mobilizing equipment, water (for concrete), tools, sensors, and miscellaneous equipment to the installation site. Helicopter drops were prepared at Haines airport and slung to the site in 1-cubic yard "super sacks". Other hardware, conduit, and commercial items were provided by Lutak Lumber of Haines or was purchased in Oregon prior to mobilization. Forty 60-lb bags of concrete ready mix were used for all post and anchor supports. PVC conduit containing signal cables were secured to the ground where possible with rebar bent into hooks and driven into the ground.

LAYOUT

Five extensometers are located spanning a ground surface crack extending eastward from the upper landslide headscarp, ranging from a few feet wide adjacent to the headscarp then shrinking eastward and curving north until the crack is no longer visible, are monitored with long range displacement meters (Figure 1). A sixth extensometer location is monitoring a discrete scarp and block on the upper east flank of the headscarp. Locations shown on Figure 1 are approximate and have not been surveyed.

Anchor post locations were determined as part of the spring reconnaissance carried out following complete snow melt. Extensometers 1 through 3 cross over the scarp with vertical offsets of about five feet on the west side at extensometer 1, shrinking to about three feet at extensometer 3. Extensometers 4 and 5 are positioned at the eastern flanks of the visible crack with vertical offsets of one to three inches.

EQUIPMENT

Each extensometer instrument consists of stainless steel aircraft cable that is supported between two anchor posts and tension applied by a constant force spring. The displacement meter is mounted on one of the anchor posts, which includes a cable reel/drum and sensor. If the ground downslope of the scarp crack moves, the lower anchor post would move along with the ground causing the extensometer wire cable to be pulled out relative to the upper anchor post. Ground movement, or elongation or temperature-contraction of the wire cable, rotates the reel/drum in the displacement meter box. Drum rotations are measured with a vibrating wire displacement transducer and equated to a change in distance of the extensometer cable between the two anchor posts.

The anchor posts consist of 2-inch rigid galvanized steel pipe concreted within a 1-foot diameter excavation 2 feet deep. They rise about 2 feet above the surface; the upslope anchor post is tilted downslope to be roughly perpendicular to the extension cable extending down toward the downslope anchor post. The downslope anchor post is installed vertically with a threaded cap fitted with a stainless-steel eyebolt.

Photo 1 displays a side view of extensometer locations 1 and 2. The attached Figure 2 illustrates the anchor and extensometer details.

Photo 1: Extensometer locations 1 (background) and 2 (foreground).

Extensometer Cable

The extensometer cable consists of 1/16-inch diameter, nylon-jacketed, stainless steel aircraft cable that is supported between the two anchor posts. The extensometer cable is protected within a PVC conduit supported by intermediate ground stakes. The extensometer wire cable is roughly parallel

with the ground slope, assuming the two anchor posts are nearly the same height above the ground surface.

Included is a "weak link" cable with hooks for attachment between the tensioned aircraft cable inside the sensor enclosure and the extensometer cable that stretches between the two anchor post points being monitored. The "weak link" is a breakable element intended to prevent damage to the instrument should a large animal, tree limb, or other item strike the extensometer cable. The "weak link" is designed to break at relatively low cable tension and prevent excessive force or over-range movement of the extensometer cable or instrument sensor. The "weak link" cable can be readily repaired or replaced. The extensometer cable is field finished with swage-locked loops attached to the weak link's hook and the downstream anchor post's eyebolt with a stainless-steel quick link.

Sensors

The sensors consist of Geokon Model 4427 Long Range Displacement Meters (LRDM), each with a 6.5-foot (2-meter) range. The whole mechanism is enclosed within a rainproof enclosure. The devices consist of a drum on which is wound a length of 1/16 inch, nylon-jacketed, stainless steel aircraft cable. As movement occurs, the cable reels off the drum, and the drum turns. The tension on the cable is maintained by a constant force spring inside the drum. The drum is connected to a lead screw in such a way that the rotation of the drum is converted into a linear motion of the lead screw. The lead screw is connected to a Model 4450 Vibrating Wire Displacement Transducer, which measures the linear motion. This measurement system equates approximately 40 inches movement of the aircraft cable to roughly 1 inch of transducer movement. A thermistor is integrated with the transducer so that temperature changes can be monitored. Photo 2 below illustrates the drum and lead screw mechanism. System cable tension is applied by rolling out the drum's cable approximately an inch, allowing for minor contraction between the anchor posts while providing for the rated of 6.5-foot displacement range.

Photo 2: Long range displacement meter drum, lead screw, displacement transducer, and temperature sensor.

The enclosure has a gasketed, hinged cover and is mounted on a 3-inch NPT threaded steel pipe flange, which mates with the upslope anchor post pipe.

Table 1 contains sensor serial numbers and installation specifics. Appendix A contains calibration sheets.

Table 1: Extensometer installation details, including initial readings (R0) and temperatures (T0).

Location	Length (ft)	Azimuth (°)	R0 (Digits)	T0 (°C)	Displacement Meter Serial No
Extensometer 1	33	026	2843.7	12.8	2129483
Extensometer 2	20	014	2799.9	13.1	2129482
Extensometer 3	27	353	2900.6	13.1	2129481
Extensometer 4	20	311	3055.8	13.1	2129480
Extensometer 5	25	304	3011.6	13.1	2129479
Extensometer 6	14	348	2966.1	13.1	2129478

Datalogging

All six extensometers relay the data via electrical signal cables installed within 1½-inch PVC bell-end conduit to a base station that houses the terminal box and multiplexer for automated readings and data storage. Currently, readings are programmed to be taken every 15 minutes, 24 hours per day. The readings are averaged and compiled each hour and stored until data management systems obtain the data at scheduled intervals.

The datalogging system consists of a datalogger, vibrating wire interface, a multiplexer, cellular modem and antenna powered by two 55-amp hour 12-volt batteries charged by a 100W solar panel. A 200W panel is planned for later installation. The specialized datalogging componentry was manufactured and/or supplied by Campbell Scientific, Inc. (CSI) of Logan, Utah. The datalogger was programmed by Landslide Technology using CSI's proprietary programming language, CR Basic. All datalogging components are protected in NEMA 4X weather resistant enclosures mounted on a 3-inch post secured in the ground. Photos 3 and 4 below illustrate the base station installation and datalogger enclosure, respectively. The datalogger components are specified in Table 2, below.

Table 2: Datalogging components.

Component	Model
Datalogger	Campbell Scientific CR1000X
Vibrating Wire Interface	Campbell Scientific AVW200 2-channels
Multiplexer	Campbell Scientific AM16/32B
Cellular Modem	Sierra Wireless RV50, AT&T service
Cellular Antenna	Yagi directional
Solar Regulator	Morningstar SunSaver 20L (12 Volt, 20 amp load capacity)
Solar Panel	100W, 12 Volt Monocrystalline
Batteries	Duracell 12V, 55 ampHr x 2, connected in parallel for combined 110 ampHrs
Battery Enclosure	Mild steel 12x20x8", Hammond 1418, continuous hinge, clamped cover
Datalogger Enclosure	Polycarbonate 18x16x10", Adalet Elite HFLL Series, hinged, locking latch

Photo 3: Datalogger post, enclosures, solar panel, and cellular antenna.

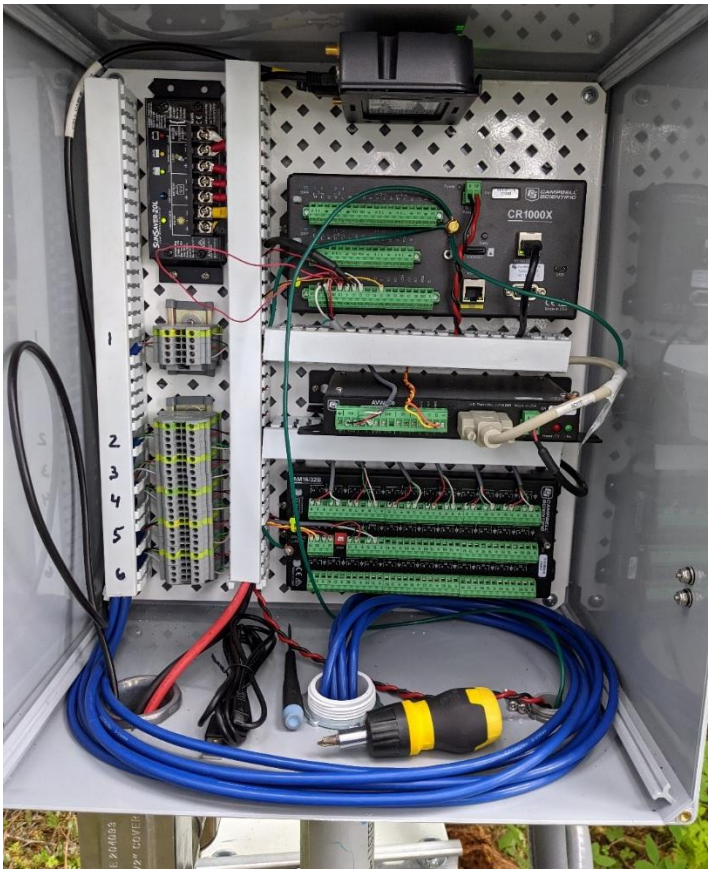


Photo 4: Components listed left to right, top to bottom: solar controller, cellular modem, CR1000X datalogger, terminal blocks, AVW200, and multiplexer. Solar panel cables (black and red) and attenna cable enter from the bottom left, and extensometer cables (blue) enter from the center entry. Batteries stored in a separate, lower enclosure.

The datalogger is currently programmed to turn on its modem at 6:45am and turn it off at 10:15am (Alaska local time) to conserve power. Program updates can be sent remotely via the cellular connection. While the modem is on and connected, the cloud-based data processing and plotting service 'Konect' communicates with the datalogger and obtains all readings since its last communication. Landslide Technology's servers also connect daily to download and archive hourly readings. Configured websites allow our geotechnical staff to view data as it is collected.

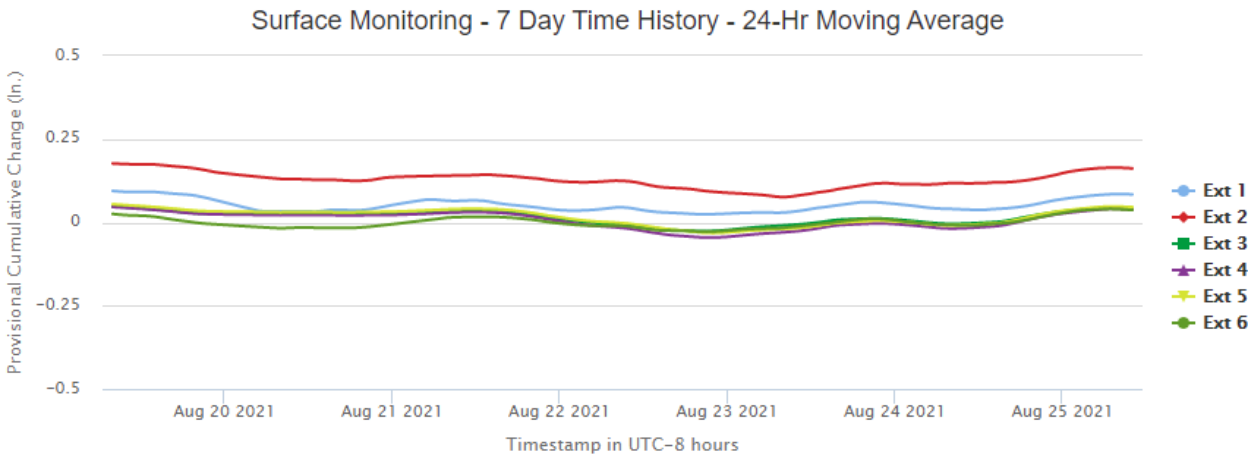
INITIAL DATA

Extensometer data has successfully been obtained daily since installation. Minor programming related troubleshooting occurred between July 19 and 21, 2021. Since July 21, data has been populating the project's Konect data portal. Temperature affects the length of the measurement cable (expands as the temperature increases), causing changes in the extensometer readings deviating from the actual distance between the two anchor posts. To account for daily temperature fluctuations, plotting a 24-hour running average helps mute daily temperature effects. Note that seasonal effects will remain. Temperature corrections to the data results are being considered.

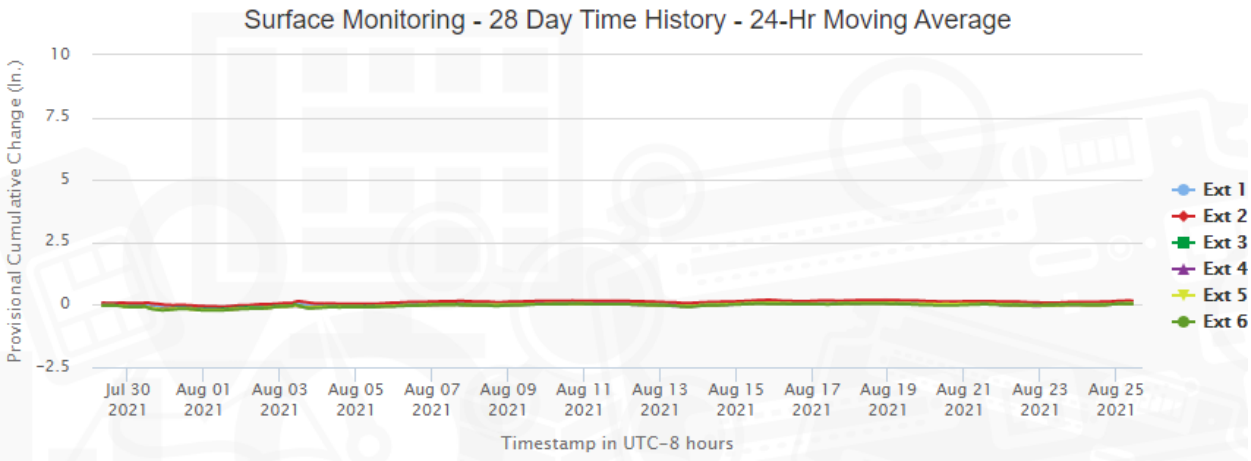
Plots have been configured to illustrate the 24-hour running average over the latest 7-day time history with a display range of 1 inch (Plot 1, below), and a 24-hour running average over the latest 28-day time history and a 12.5-inch display range (Plot 2). The 1-inch display scale is an exaggerated scale that is used to enable evaluation of minor data fluctuations, whereas the 12.5-inch display scale is used to present a more realistic representation of trends. Based on the data so far, no displacement attributed to potential crack enlargement is interpreted from these plots.

Plots of the 24-hour running average over a 90-day time history will be populated as data accumulates (Plot 3). The display scale ranges for all of the plots can be adjusted over time. Sensor temperature fluctuations over time are shown on Plot 4.

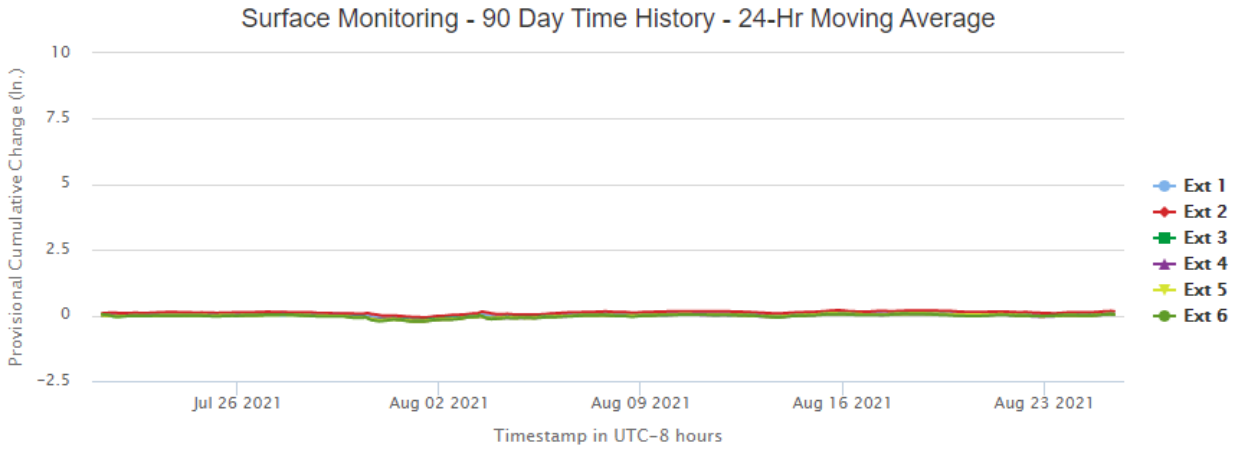
Battery voltage over time is shown on Plot 5. The data is frequently reviewed to verify that there is no significant loss of power and that the solar panel is sufficiently recharging the batteries. A switch from the currently installed 100W solar panel to a 200W solar panel is planned.



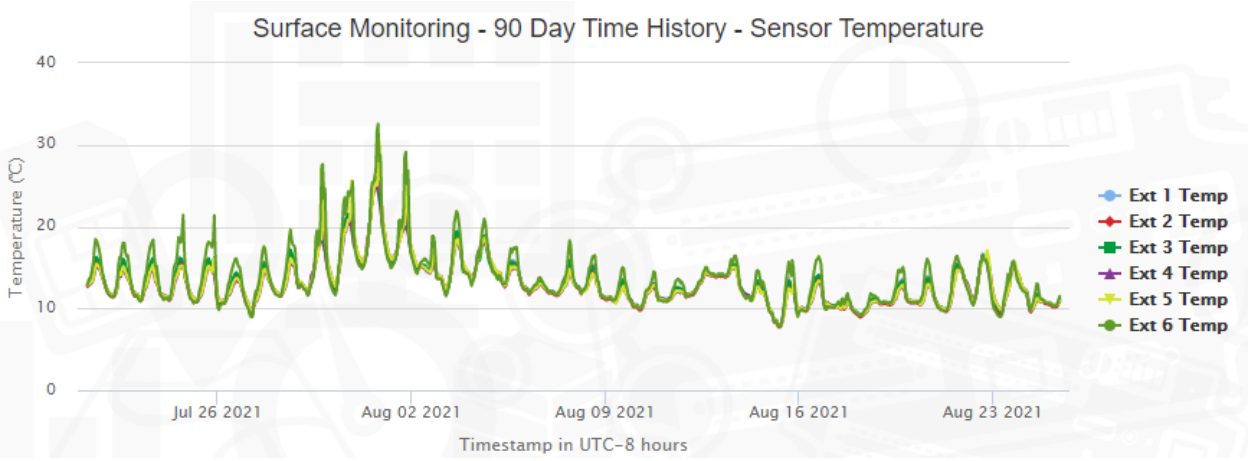
Plot 1: Extensometer data, 7-day time history with a 1-inch scale range.



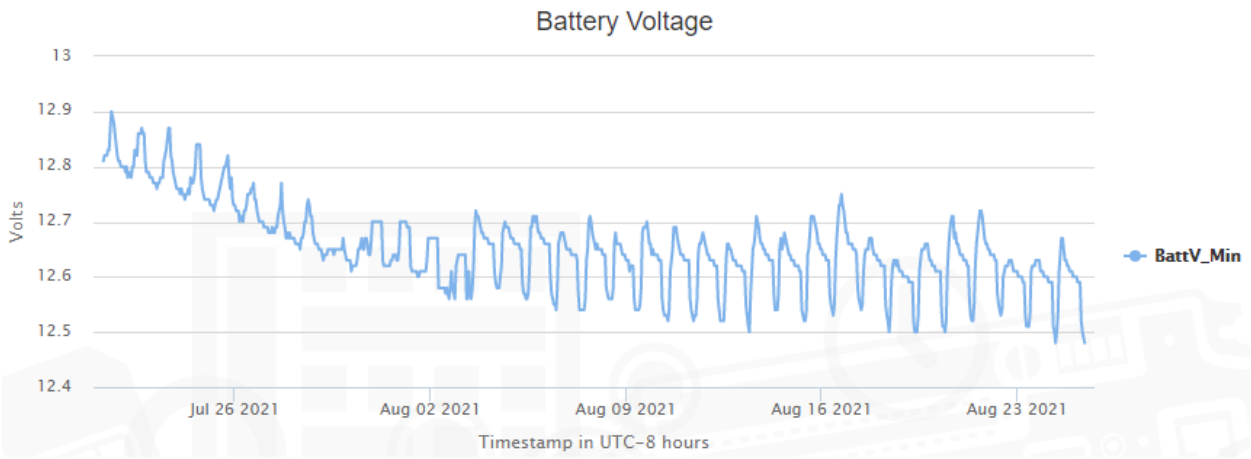
Plot 2: Extensometer data, 28-day time history with a 12.5-inch scale range.



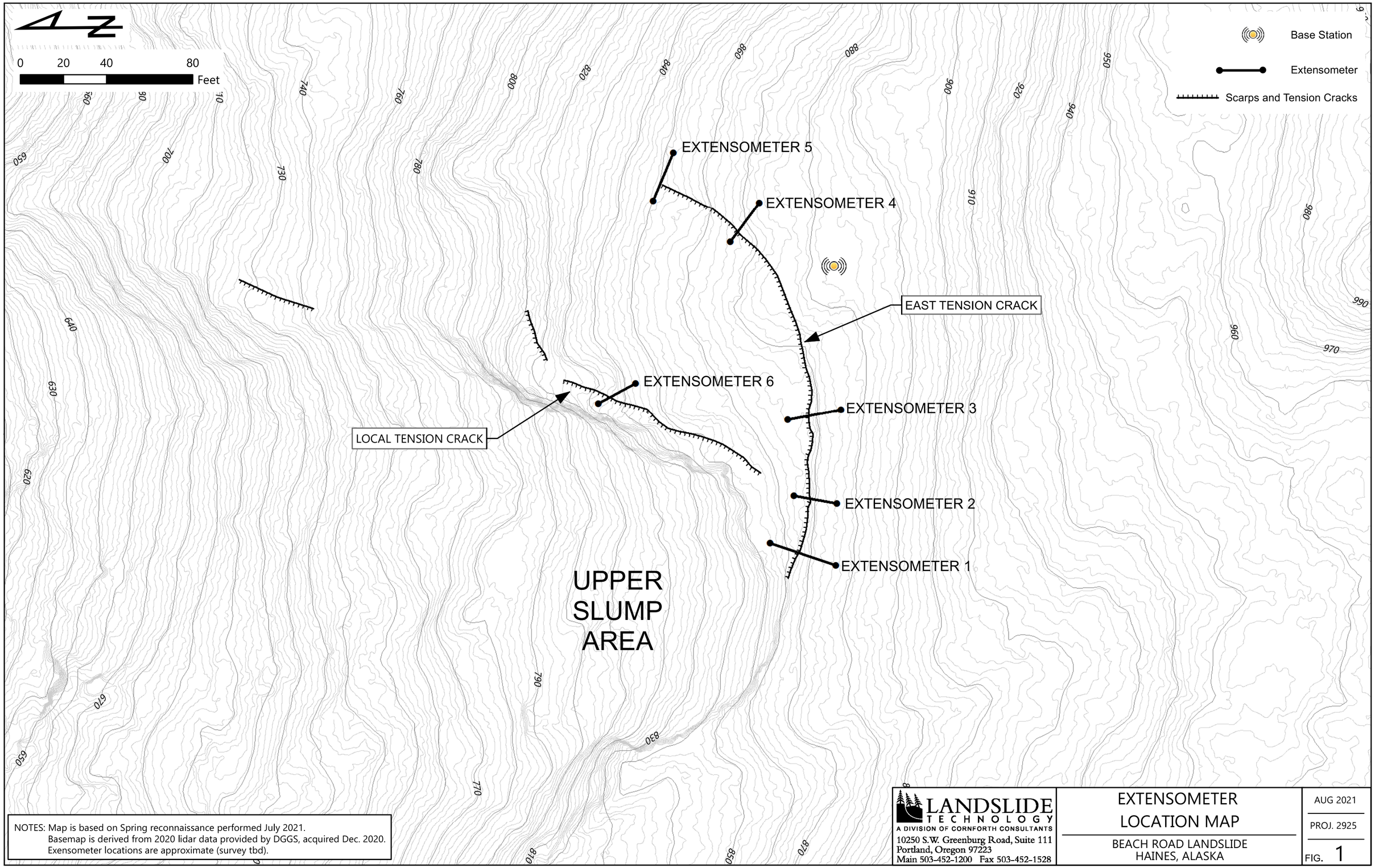
Plot 3: Extensometer, 35 of 90 days with a 12.5-inch scale range.



Plot 4: Senor temperature data, 35 of 90 days with automatic y-axis scaling.



Plot 5: Base station battery voltage. Modem on time was switched from always on July 29, reduced on August 3 and then again August 13.



NOTES: Map is based on Spring reconnaissance performed July 2021.
Basemap is derived from 2020 lidar data provided by DGGS, acquired Dec. 2020.
Exensometer locations are approximate (survey tbd).

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EXTENSOMETER LOCATION MAP

BEACH ROAD LANDSLIDE
HAINES, ALASKA

AUG 2021

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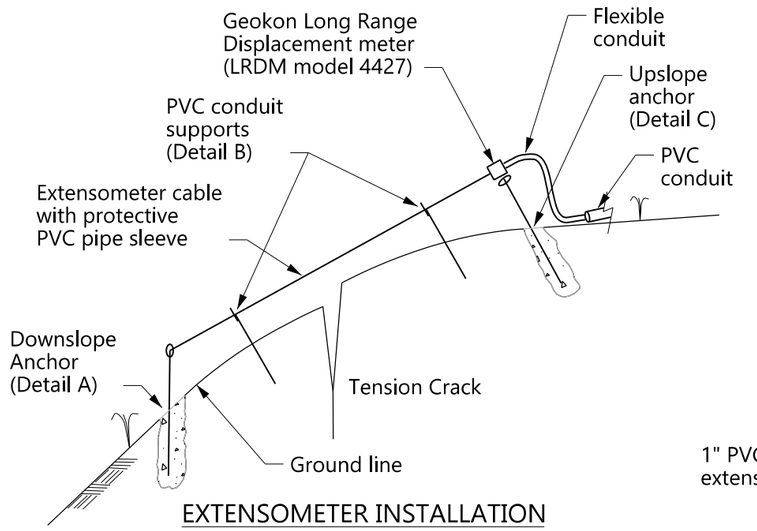
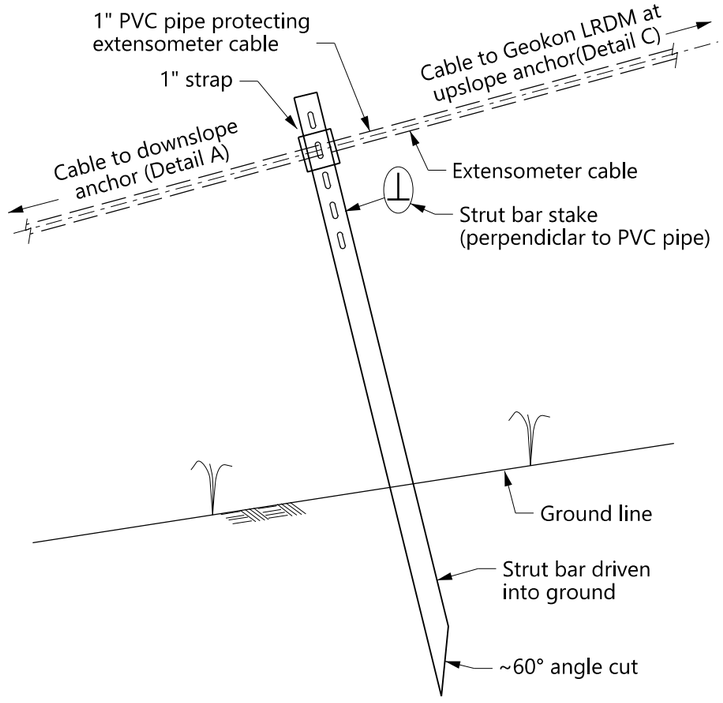
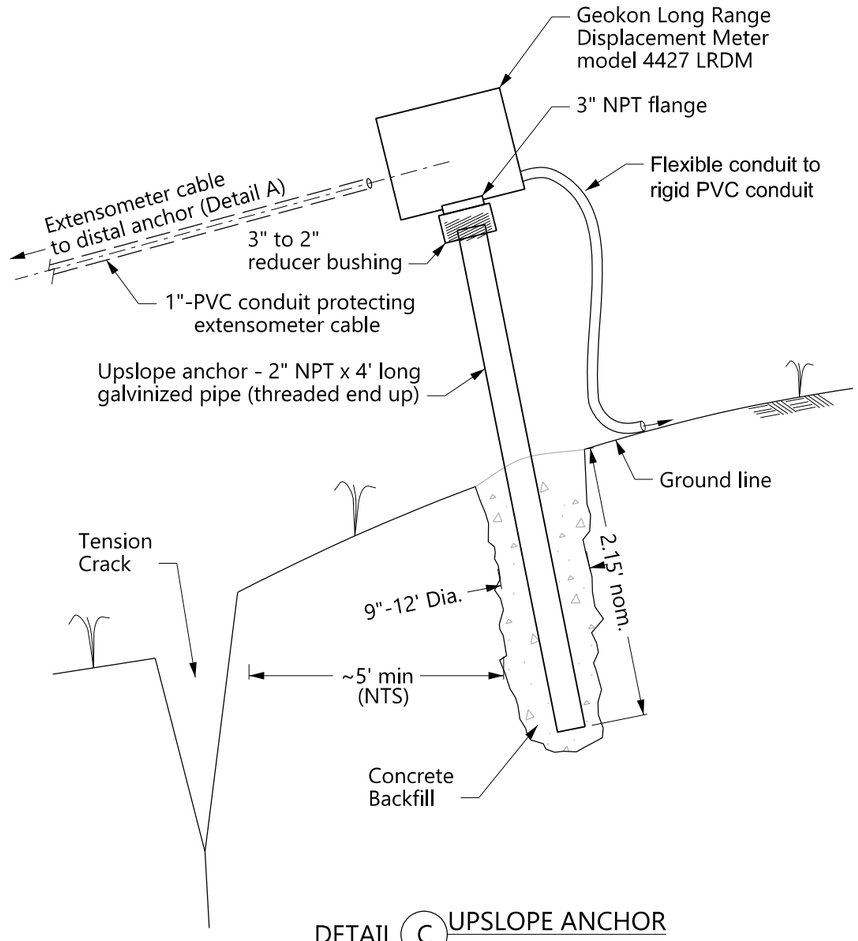
FIG. 1



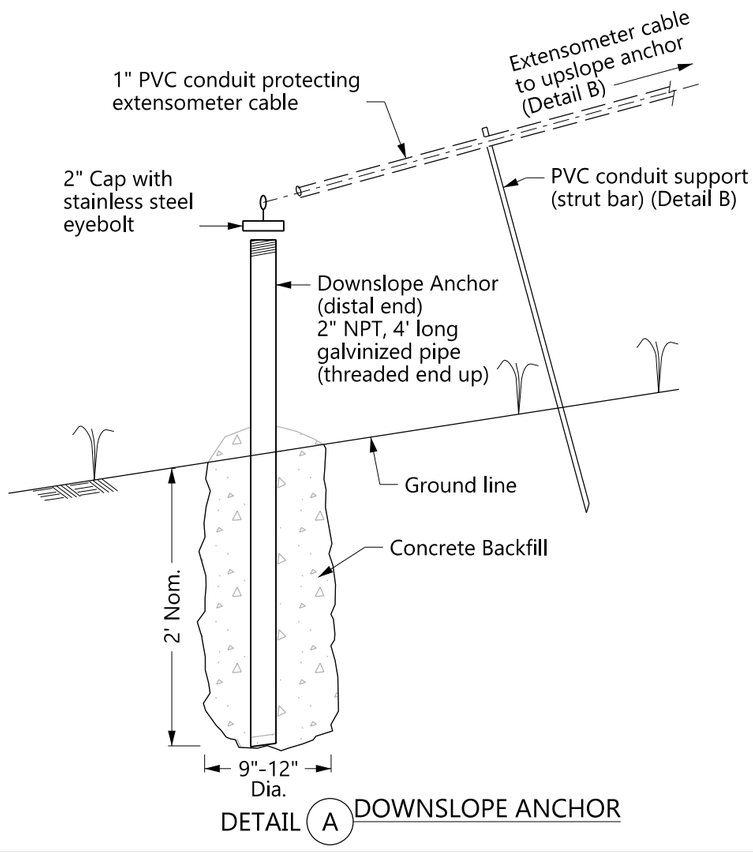
EXTENSOMETER INSTALLATION



DETAIL (B) PVC CONDUIT SUPPORT



DETAIL (C) UPSLOPE ANCHOR



DETAIL (A) DOWNSLOPE ANCHOR

LANDSLIDE TECHNOLOGY
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Main 503-452-1200 Fax 503-452-1528

Extensometer - Installation and Details

Beach Road Landslide Recon & Prelim Investigation - Haines, AK

AUG 2021

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FIG. 2

GEOKON
48 Spencer Street
Lebanon, New Hampshire
03766 · USA

www.geokon.com
p: +1·603·448·1562
f: +1·603·448·3216

CERTIFICATE OF QUALITY, CONFORMITY & CALIBRATION

WE HEREBY CERTIFY that the manufactured materials listed below (SCHEDULE A)
Furnished to: R&M Consultants, Inc.
Reference Geokon Job No.: 20079054

order no.: Phone 6/9/21, contract no.: N/A in all aspects
In the amount specified in Schedule A, identified by our label "GEOKON"
Complies/Conforms to, or exceeds the requirements and specifications of your purchase order no: contract no: N/A in all aspects.
Country(s) of Origin: United States of America

WE FURTHER CERTIFY that the product supplied has been inspected, tested and calibrated as applicable, in conformance to the relevant specifications and drawings of the GEOKON registered ISO 9001:2015 Quality Management System, Revision 19. Calibration and testing standards are calibrated by ISO 17025 Accredited Laboratories, are maintained per ANSI/NCSL Z540-1 and are traceable to the N.I.S.T.

SCHEDULE A

MODEL NO.	QUANTITY	TYPE OF INSTRUMENT	SERIAL NO.
4427-1X-2M	6	Modified: VW Long Range Displacement Meter	2129478~2129483
02-250V6-E	60ft	Blue PVC Cable, 0.250", 2 twisted pairs	N/A
02-250V6-E	800ft	Blue PVC Cable, 0.250", 2 twisted pairs	N/A
07-062SS-E	60ft	Stainless Steel Aircraft Cable, 1/16", Specify lengths required	N/A
ORDER NOTES	1		N/A

Signed by:

Date: July 13, 2021

Kevin Locke

Quality Assurance Manager

Ref: 20079054

GEOKON

Model 4427 Long Range Displacement Meter Calibration Report

This Calibration has been Verified/ Validated as of: July 13, 2021

Model Number: 4427-1X-2M

Calibration Date: July 13, 2021

Serial Number: 2129478

Temperature: 23.4 °C

Calibration Instruction: CI-VW 4427 LRD

Technician:

GK-401 Reading Position B

Actual Displacement (mm)	Gauge Reading 1st Cycle	Gauge Reading 2nd Cycle	Average Gauge Reading	Calculated Displacement (Linear)	Error Linear (%FS)	Calculated Displacement (Polynomial)	Error Polynomial (%FS)
0	2800	2800	2800	-3	-0.17	0	0.02
400	3418	3417	3418	400	0.00	399	-0.04
800	4035	4035	4035	803	0.17	800	0.02
1200	4647	4647	4647	1203	0.16	1200	0.01
1600	5255	5255	5255	1600	0.02	1600	-0.01
2000	5861	5861	5861	1996	-0.18	2000	0.00

(mm) Linear Gauge Factor (F): 0.6533 (mm/ digit) **Regression Zero: 2805**

Polynomial Gauge Factors: **A: 2.9723E-06** **B: 0.6276** **C:**

Calculate C by setting D = 0 and R_1 = initial field zero reading into the polynomial equation

(inches) Linear Gauge Factor (F): 0.025720 (inches/ digit)

Polynomial Gauge Factors: **A: 1.1702E-07** **B: 0.024707** **C:**

Calculate C by setting D = 0 and R_1 = initial field zero reading into the polynomial equation

Calculated Displacement: **Linear, $D = F(R_t - R_0)$**

Refer to manual for temperature correction information.

GEOKON®

Model 4427 Long Range Displacement Meter Calibration Report

This Calibration has been Verified/ Validated as of: July 13, 2021

Model Number: 4427-1X-2M

Calibration Date: July 13, 2021

Serial Number: 2129479

Temperature: 23.4 °C

Calibration Instruction: CI-VW 4427 LRD

Technician:

GK-401 Reading Position B

Actual Displacement (mm)	Gauge Reading 1st Cycle	Gauge Reading 2nd Cycle	Average Gauge Reading	Calculated Displacement (Linear)	Error Linear (%FS)	Calculated Displacement (Polynomial)	Error Polynomial (%FS)
0	2820	2819	2820	-1	-0.06	0	0.00
400	3432	3432	3432	400	0.01	400	0.00
800	4044	4044	4044	801	0.06	800	0.01
1200	4653	4654	4654	1200	0.02	1200	-0.02
1600	5264	5264	5264	1600	0.02	1600	0.01
2000	5872	5872	5872	1999	-0.06	2000	0.00

(mm) Linear Gauge Factor (F): 0.6552 **(mm/ digit)** **Regression Zero:** 2821

Polynomial Gauge Factors: **A:** 8.9454E-07 **B:** 0.6474 **C:**

Calculate C by setting D = 0 and R_1 = initial field zero reading into the polynomial equation

(inches) Linear Gauge Factor (F): 0.025795 **(inches/ digit)**

Polynomial Gauge Factors: **A:** 3.5218E-08 **B:** 0.025489 **C:**

Calculate C by setting D = 0 and R_1 = initial field zero reading into the polynomial equation

Calculated Displacement: **Linear, $D = F(R_t - R_0)$**

Refer to manual for temperature correction information.

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Model 4427 Long Range Displacement Meter Calibration Report

This Calibration has been Verified/ Validated as of: July 13, 2021

Model Number: 4427-1X-2M

Calibration Date: July 13, 2021

Serial Number: 2129480

Temperature: 23.4 °C

Calibration Instruction: CI-VW 4427 LRD

Technician:

GK-401 Reading Position B

Actual Displacement (mm)	Gauge Reading 1st Cycle	Gauge Reading 2nd Cycle	Average Gauge Reading	Calculated Displacement (Linear)	Error Linear (%FS)	Calculated Displacement (Polynomial)	Error Polynomial (%FS)
0	2810	2811	2811	-3	-0.14	0	0.00
400	3433	3435	3434	401	0.03	400	0.00
800	4054	4055	4055	802	0.11	800	-0.01
1200	4673	4673	4673	1202	0.12	1200	0.01
1600	5288	5288	5288	1600	0.02	1600	-0.01
2000	5901	5901	5901	1997	-0.14	2000	0.00

(mm) Linear Gauge Factor (F): 0.6472 **(mm/ digit)** **Regression Zero:** 2815

Polynomial Gauge Factors: **A:** 2.2536E-06 **B:** 0.6275 **C:**

Calculate C by setting D = 0 and R_1 = initial field zero reading into the polynomial equation

(inches) Linear Gauge Factor (F): 0.025478 **(inches/ digit)**

Polynomial Gauge Factors: **A:** 8.8724E-08 **B:** 0.024706 **C:**

Calculate C by setting D = 0 and R_1 = initial field zero reading into the polynomial equation

Calculated Displacement: **Linear, $D = F(R_t - R_0)$**

Refer to manual for temperature correction information.

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Model 4427 Long Range Displacement Meter Calibration Report

This Calibration has been Verified/ Validated as of: July 13, 2021

Model Number: 4427-1X-2M

Calibration Date: July 13, 2021

Serial Number: 2129481

Temperature: 23.4 °C

Calibration Instruction: CI-VW 4427 LRD

Technician:

GK-401 Reading Position B

Actual Displacement (mm)	Gauge Reading 1st Cycle	Gauge Reading 2nd Cycle	Average Gauge Reading	Calculated Displacement (Linear)	Error Linear (%FS)	Calculated Displacement (Polynomial)	Error Polynomial (%FS)
0	2769	2769	2769	1	0.04	1	0.04
400	3376	3374	3375	399	-0.04	399	-0.04
800	3983	3983	3983	799	-0.06	799	-0.06
1200	4595	4595	4595	1201	0.05	1201	0.05
1600	5204	5203	5204	1601	0.05	1601	0.05
2000	5809	5809	5809	1999	-0.04	1999	-0.04

(mm) Linear Gauge Factor (F): 0.6574 (mm/ digit) **Regression Zero: 2768**

Polynomial Gauge Factors: **A: 1.5577E-08** **B: 0.6572** **C:**

Calculate C by setting D = 0 and R_1 = initial field zero reading into the polynomial equation

(inches) Linear Gauge Factor (F): 0.025880 (inches/ digit)

Polynomial Gauge Factors: **A: 6.1328E-10** **B: 0.025875** **C:**

Calculate C by setting D = 0 and R_1 = initial field zero reading into the polynomial equation

Calculated Displacement: **Linear, $D = F(R_t - R_0)$**

Refer to manual for temperature correction information.

GEOKON

Model 4427 Long Range Displacement Meter Calibration Report

This Calibration has been Verified/ Validated as of: July 13, 2021

Model Number: 4427-1X-2M

Calibration Date: July 13, 2021

Serial Number: 2129482

Temperature: 23.4 °C

Calibration Instruction: CI-VW 4427 LRD

Technician:

GK-401 Reading Position B

Actual Displacement (mm)	Gauge Reading 1st Cycle	Gauge Reading 2nd Cycle	Average Gauge Reading	Calculated Displacement (Linear)	Error Linear (%FS)	Calculated Displacement (Polynomial)	Error Polynomial (%FS)
0	2951	2951	2951	-1	-0.07	0	-0.02
400	3564	3563	3564	401	0.03	400	0.02
800	4174	4174	4174	801	0.07	801	0.03
1200	4782	4782	4782	1200	0.02	1200	-0.02
1600	5390	5390	5390	1600	-0.02	1599	-0.03
2000	5999	5999	5999	1999	-0.03	2000	0.02

(mm) Linear Gauge Factor (F): 0.6564 (mm/ digit) **Regression Zero: 2953**

Polynomial Gauge Factors: **A: 8.6799E-07** **B: 0.6487** **C:**

Calculate C by setting D = 0 and R_1 = initial field zero reading into the polynomial equation

(inches) Linear Gauge Factor (F): 0.025844 (inches/ digit)

Polynomial Gauge Factors: **A: 3.4173E-08** **B: 0.025538** **C:**

Calculate C by setting D = 0 and R_1 = initial field zero reading into the polynomial equation

Calculated Displacement: **Linear, $D = F(R_t - R_0)$**

Refer to manual for temperature correction information.

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Model 4427 Long Range Displacement Meter Calibration Report

This Calibration has been Verified/ Validated as of: July 13, 2021

Model Number: 4427-1X-2M

Calibration Date: July 13, 2021

Serial Number: 2129483

Temperature: 23.4 °C

Calibration Instruction: CI-VW 4427 LRD

Technician:

GK-401 Reading Position B

Actual Displacement (mm)	Gauge Reading 1st Cycle	Gauge Reading 2nd Cycle	Average Gauge Reading	Calculated Displacement (Linear)	Error Linear (%FS)	Calculated Displacement (Polynomial)	Error Polynomial (%FS)
0	2772	2772	2772	1	0.06	1	0.06
400	3375	3374	3375	398	-0.12	398	-0.11
800	3987	3987	3987	801	0.03	801	0.04
1200	4594	4595	4595	1200	0.02	1200	0.02
1600	5202	5203	5203	1600	0.02	1600	0.02
2000	5810	5809	5810	2000	-0.01	2000	-0.02

(mm) Linear Gauge Factor (F): 0.6579 **(mm/ digit)** **Regression Zero:** 2770

Polynomial Gauge Factors: **A:** -1.3927E-07 **B:** 0.6591 **C:**

Calculate C by setting D = 0 and R_1 = initial field zero reading into the polynomial equation

(inches) Linear Gauge Factor (F): 0.025903 **(inches/ digit)**

Polynomial Gauge Factors: **A:** -5.4829E-09 **B:** 0.025950 **C:**

Calculate C by setting D = 0 and R_1 = initial field zero reading into the polynomial equation

Calculated Displacement: **Linear, $D = F(R_t - R_0)$**

Refer to manual for temperature correction information.

GEOKON

Vibrating Wire Displacement Transducer Calibration Report

This Calibration has been Verified/ Validated as of: July 13, 2021

Range: 50 mm

Calibration Date: June 16, 2021

Serial Number: 2129478

Temperature: 24.3 °C

Calibration Instruction: CI-4400

Technician:

GK-401 Reading Position B

Actual Displacement (mm)	Gauge Reading 1st Cycle	Gauge Reading 2nd Cycle	Average Gauge Reading	Calculated Displacement (Linear)	Error Linear (%FS)	Calculated Displacement (Polynomial)	Error Polynomial (%FS)
0.0	2210	2209	2210	-0.116	-0.23	-0.014	-0.03
10.0	3037	3037	3037	10.045	0.09	10.024	0.05
20.0	3855	3854	3855	20.08	0.17	20.00	0.00
30.0	4668	4668	4668	30.07	0.14	29.99	-0.02
40.0	5477	5477	5477	40.01	0.01	39.99	-0.03
50.0	6284	6283	6284	49.91	-0.18	50.01	0.02

(mm) Linear Gauge Factor (G): 0.012279 (mm/ digit)

(inches) Linear Gauge Factor (G): 0.0004834 (inches/ digit)

Refer to manual for temperature correction information.

The above instrument was found to be in tolerance in all operating ranges.

The above named instrument has been calibrated by comparison with standards traceable to the NIST, in compliance with ANSI Z540-1.

GEOKON

Vibrating Wire Displacement Transducer Calibration Report

This Calibration has been Verified/ Validated as of: July 13, 2021

Range: 50 mm

Calibration Date: June 16, 2021

Serial Number: 2129479

Temperature: 24.3 °C

Calibration Instruction: CI-4400

Technician:

GK-401 Reading Position B

Actual Displacement (mm)	Gauge Reading 1st Cycle	Gauge Reading 2nd Cycle	Average Gauge Reading	Calculated Displacement (Linear)	Error Linear (%FS)	Calculated Displacement (Polynomial)	Error Polynomial (%FS)
0.0	2215	2214	2215	-0.111	-0.22	-0.012	-0.02
10.0	3040	3040	3040	10.039	0.08	10.019	0.04
20.0	3857	3857	3857	20.08	0.17	20.01	0.01
30.0	4669	4669	4669	30.07	0.14	29.99	-0.02
40.0	5477	5477	5477	40.00	0.01	39.98	-0.03
50.0	6283	6283	6283	49.91	-0.17	50.01	0.02

(mm) Linear Gauge Factor (G): 0.012295 (mm/ digit)

(inches) Linear Gauge Factor (G): 0.0004841 (inches/ digit)

Refer to manual for temperature correction information.

The above instrument was found to be in tolerance in all operating ranges.

The above named instrument has been calibrated by comparison with standards traceable to the NIST, in compliance with ANSI Z540-1.

GEOKON

Vibrating Wire Displacement Transducer Calibration Report

This Calibration has been Verified/ Validated as of: July 13, 2021

Range: 50 mm

Calibration Date: June 16, 2021

Serial Number: 2129480

Temperature: 24.3 °C

Calibration Instruction: CI-4400

Technician:

GK-401 Reading Position B

Actual Displacement (mm)	Gauge Reading 1st Cycle	Gauge Reading 2nd Cycle	Average Gauge Reading	Calculated Displacement (Linear)	Error Linear (%FS)	Calculated Displacement (Polynomial)	Error Polynomial (%FS)
0.0	2445	2444	2445	-0.092	-0.18	-0.003	-0.01
10.0	3273	3272	3273	10.016	0.03	9.998	0.00
20.0	4098	4097	4098	20.09	0.18	20.02	0.03
30.0	4915	4914	4915	30.06	0.12	29.99	-0.02
40.0	5729	5729	5729	40.01	0.01	39.99	-0.02
50.0	6541	6541	6541	49.92	-0.16	50.01	0.02

(mm) Linear Gauge Factor (G): 0.012208 (mm/ digit)

(inches) Linear Gauge Factor (G): 0.0004806 (inches/ digit)

Refer to manual for temperature correction information.

The above instrument was found to be in tolerance in all operating ranges.

The above named instrument has been calibrated by comparison with standards traceable to the NIST, in compliance with ANSI Z540-1.

GEOKON

Vibrating Wire Displacement Transducer Calibration Report

This Calibration has been Verified/ Validated as of: July 13, 2021

Range: 50 mm

Calibration Date: June 16, 2021

Serial Number: 2129481

Temperature: 24.3 °C

Calibration Instruction: CI-4400

Technician:

GK-401 Reading Position B

Actual Displacement (mm)	Gauge Reading 1st Cycle	Gauge Reading 2nd Cycle	Average Gauge Reading	Calculated Displacement (Linear)	Error Linear (%FS)	Calculated Displacement (Polynomial)	Error Polynomial (%FS)
0.0	2519	2519	2519	-0.095	-0.19	-0.006	-0.01
10.0	3335	3335	3335	10.028	0.06	10.009	0.02
20.0	4145	4145	4145	20.08	0.15	20.01	0.01
30.0	4950	4950	4950	30.06	0.12	29.99	-0.02
40.0	5752	5752	5752	40.01	0.02	39.99	-0.01
50.0	6551	6550	6551	49.92	-0.17	50.01	0.01

(mm) Linear Gauge Factor (G): 0.012405 (mm/ digit)

(inches) Linear Gauge Factor (G): 0.0004884 (inches/ digit)

Refer to manual for temperature correction information.

The above instrument was found to be in tolerance in all operating ranges.

The above named instrument has been calibrated by comparison with standards traceable to the NIST, in compliance with ANSI Z540-1.

GEOKON

Vibrating Wire Displacement Transducer Calibration Report

This Calibration has been Verified/ Validated as of: July 13, 2021

Range: 50 mm

Calibration Date: June 16, 2021

Serial Number: 2129482

Temperature: 24.3 °C

Calibration Instruction: CI-4400

Technician:

GK-401 Reading Position B

Actual Displacement (mm)	Gauge Reading 1st Cycle	Gauge Reading 2nd Cycle	Average Gauge Reading	Calculated Displacement (Linear)	Error Linear (%FS)	Calculated Displacement (Polynomial)	Error Polynomial (%FS)
0.0	2115	2114	2115	-0.133	-0.27	-0.009	-0.02
10.0	2944	2944	2944	10.037	0.07	10.012	0.02
20.0	3766	3765	3766	20.11	0.22	20.01	0.02
30.0	4579	4579	4579	30.08	0.17	29.99	-0.03
40.0	5389	5389	5389	40.01	0.03	39.99	-0.02
50.0	6194	6194	6194	49.88	-0.23	50.01	0.02

(mm) Linear Gauge Factor (G): 0.012261 (mm/ digit)

(inches) Linear Gauge Factor (G): 0.0004827 (inches/ digit)

Refer to manual for temperature correction information.

The above instrument was found to be in tolerance in all operating ranges.

The above named instrument has been calibrated by comparison with standards traceable to the NIST, in compliance with ANSI Z540-1.

GEOKON

Vibrating Wire Displacement Transducer Calibration Report

This Calibration has been Verified/ Validated as of: July 13, 2021

Range: 50 mm

Calibration Date: June 16, 2021

Serial Number: 2129483

Temperature: 24.3 °C

Calibration Instruction: CI-4400

Technician:

GK-401 Reading Position B

Actual Displacement (mm)	Gauge Reading 1st Cycle	Gauge Reading 2nd Cycle	Average Gauge Reading	Calculated Displacement (Linear)	Error Linear (%FS)	Calculated Displacement (Polynomial)	Error Polynomial (%FS)
0.0	2209	2209	2209	0.004	0.01	0.015	0.03
10.0	3013	3012	3013	9.978	-0.04	9.976	-0.05
20.0	3821	3820	3821	20.01	0.02	20.00	0.00
30.0	4624	4628	4626	30.01	0.01	30.00	0.00
40.0	5434	5433	5434	40.03	0.06	40.03	0.06
50.0	6235	6234	6235	49.97	-0.05	49.98	-0.03

(mm) Linear Gauge Factor (G): 0.012413 (mm/ digit)

(inches) Linear Gauge Factor (G): 0.0004887 (inches/ digit)

Refer to manual for temperature correction information.

The above instrument was found to be in tolerance in all operating ranges.

The above named instrument has been calibrated by comparison with standards traceable to the NIST, in compliance with ANSI Z540-1.