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:	October 18, 2021	
Subject:	**Surface Extensometer Monitoring** **Beach Road Landslide, Haines, Alaska**	

This memo presents a summary of the first 3 months monitoring the surface extensometer instruments at the Beach Road Landslide. These instruments are installed across scarp cracks, as approximately shown on Figure 1.

BACKGROUND INFORMATION

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. A sixth extensometer location is monitoring a discrete scarp and block on the upper east flank of the headscarp. Extensometers 1 through 3 cross over the tension crack with vertical offsets of about 5 feet on the west side at extensometer 1, shrinking to about 3 feet at extensometer 3. Extensometers 4 and 5 are positioned at the eastern flanks of the visible crack with vertical offsets of 1 to 3 inches. Installation details are provided in the August 26, 2021 memo.

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 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. 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.

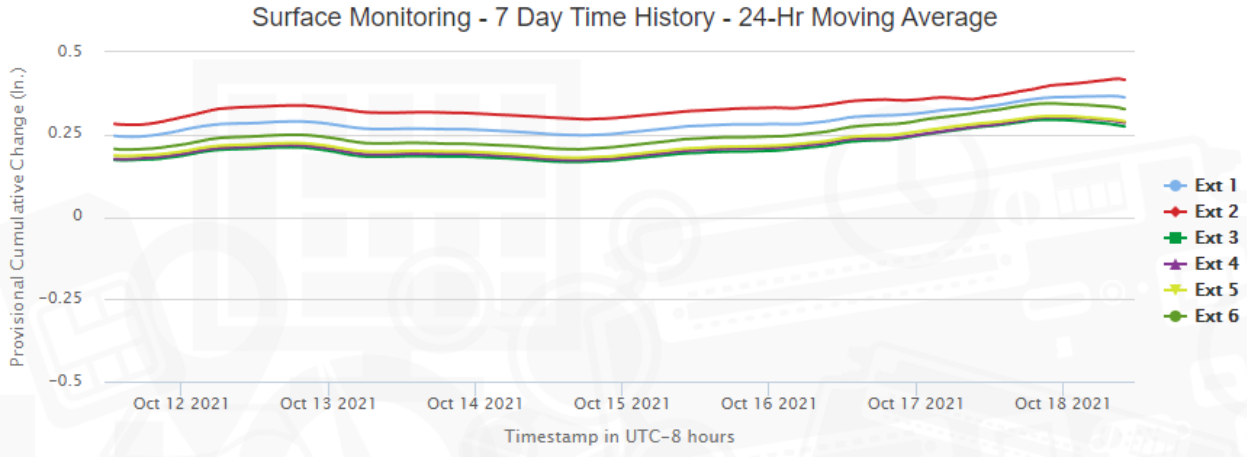
DATA

Extensometer data has successfully been obtained daily since installation. 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 the daily temperature effects.

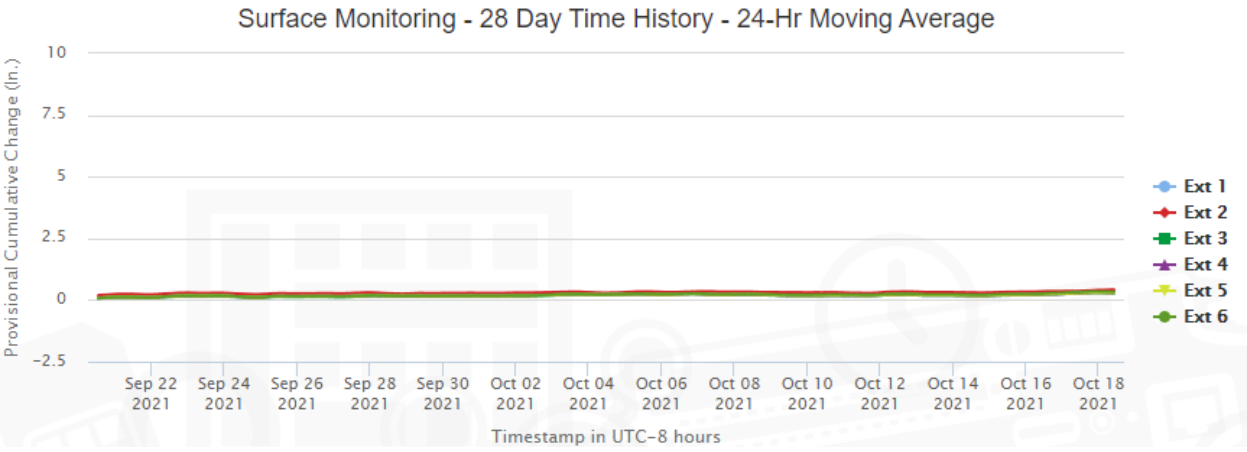
Plots have been configured to illustrate the 24-hour running average over the latest 7-day time history with a display range of 1 inch (Plot 1, below), and a 24-hour running average over the latest 28-day time history with a 12.5-inch display range (Plot 2). The 1-inch display scale is an exaggerated 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. Trends observed to date track seasonal temperature changes, with the onset of fall cold weather corresponding to increasing cumulative change.

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. Note that the splice at extensometer 6 was allowing water to influence temperature readings and was removed from the plot for clarity. It was repaired October 6 and has since returned reliable data.

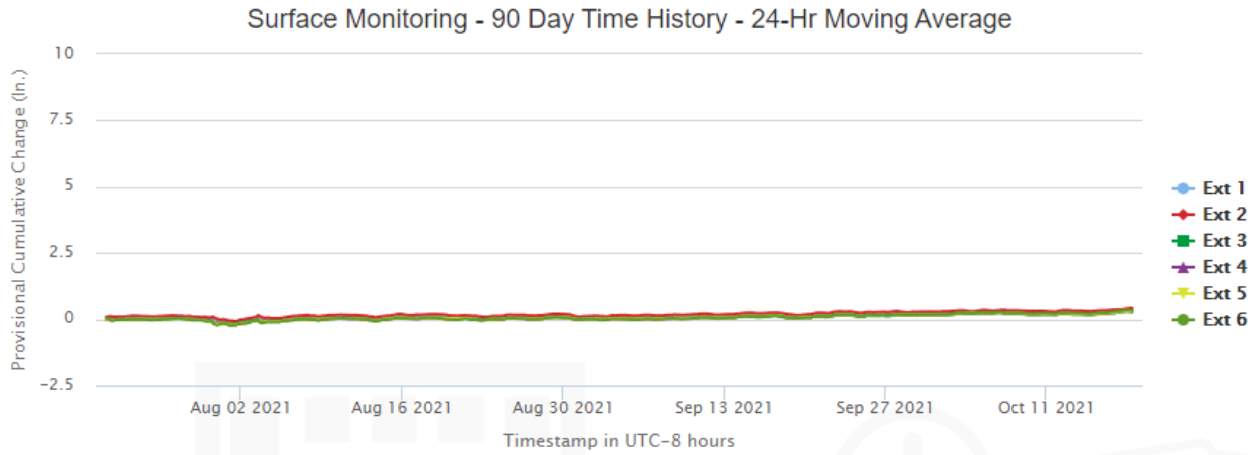
Battery voltage over time is shown on Plot 5. The data is frequently reviewed to verify that there is no significant loss of power and that the solar panel is sufficiently recharging the batteries. A switch from a 100W to a 200W solar panel was completed August 31 and has resulted in better battery life.



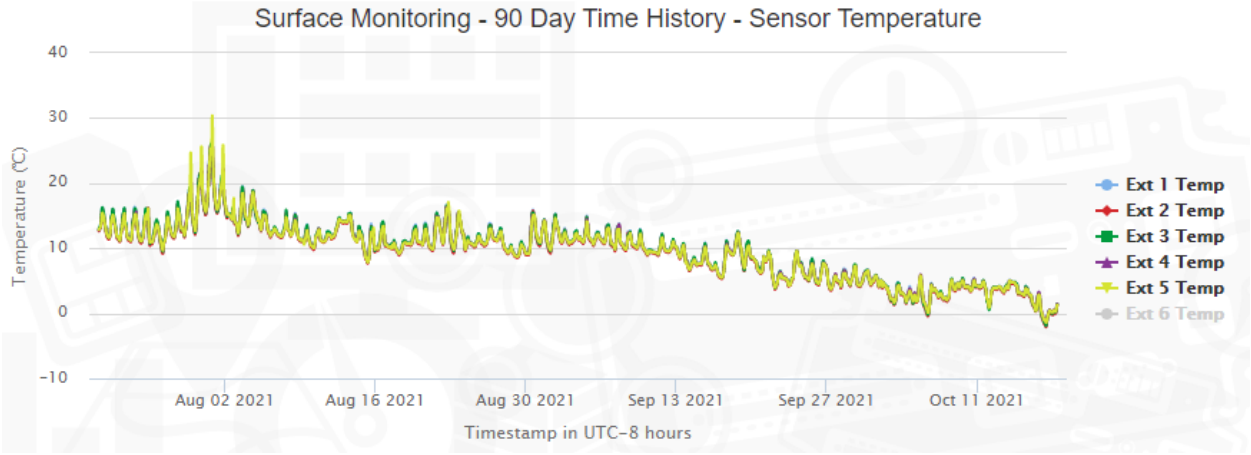
Plot 1: Extensometer data, 7-day time history with a 1-inch scale range.



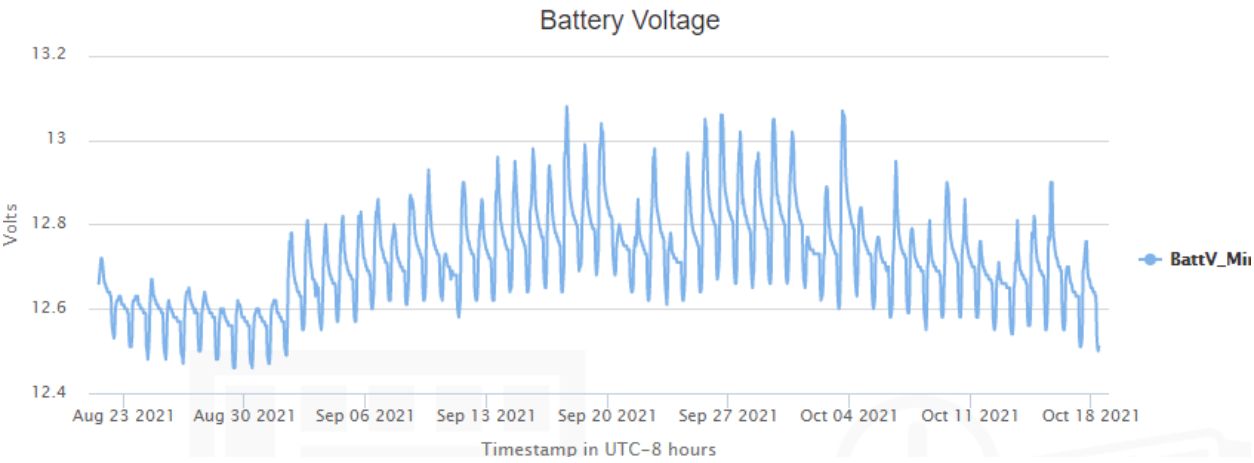
Plot 2: Extensometer data, 28-day time history with a 12.5-inch scale range.



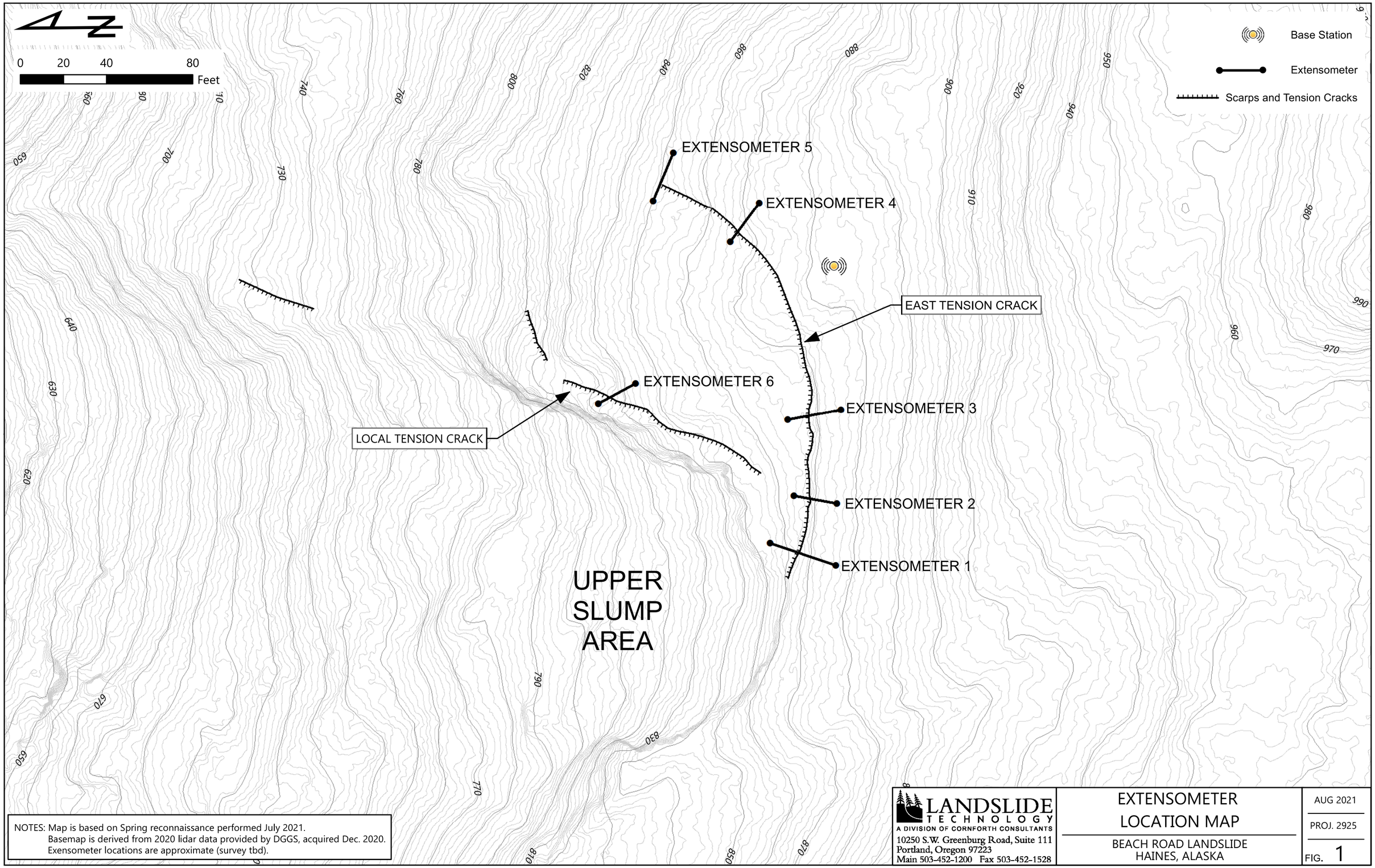
Plot 3: Extensometer, 89 of 90 days with a 12.5-inch scale range.



Plot 4: Senor temperature data, 89 of 90 days with automatic y-axis scaling.



Plot 5: Base station battery voltage. 200W solar panel installed on August 31, 2021.



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

PROJ. 2925

FIG. 1