



# CGSIC 2017

## Oregon Real-time GNSS Network

### Critical Infrastructure for Emergency Response

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OREGON  
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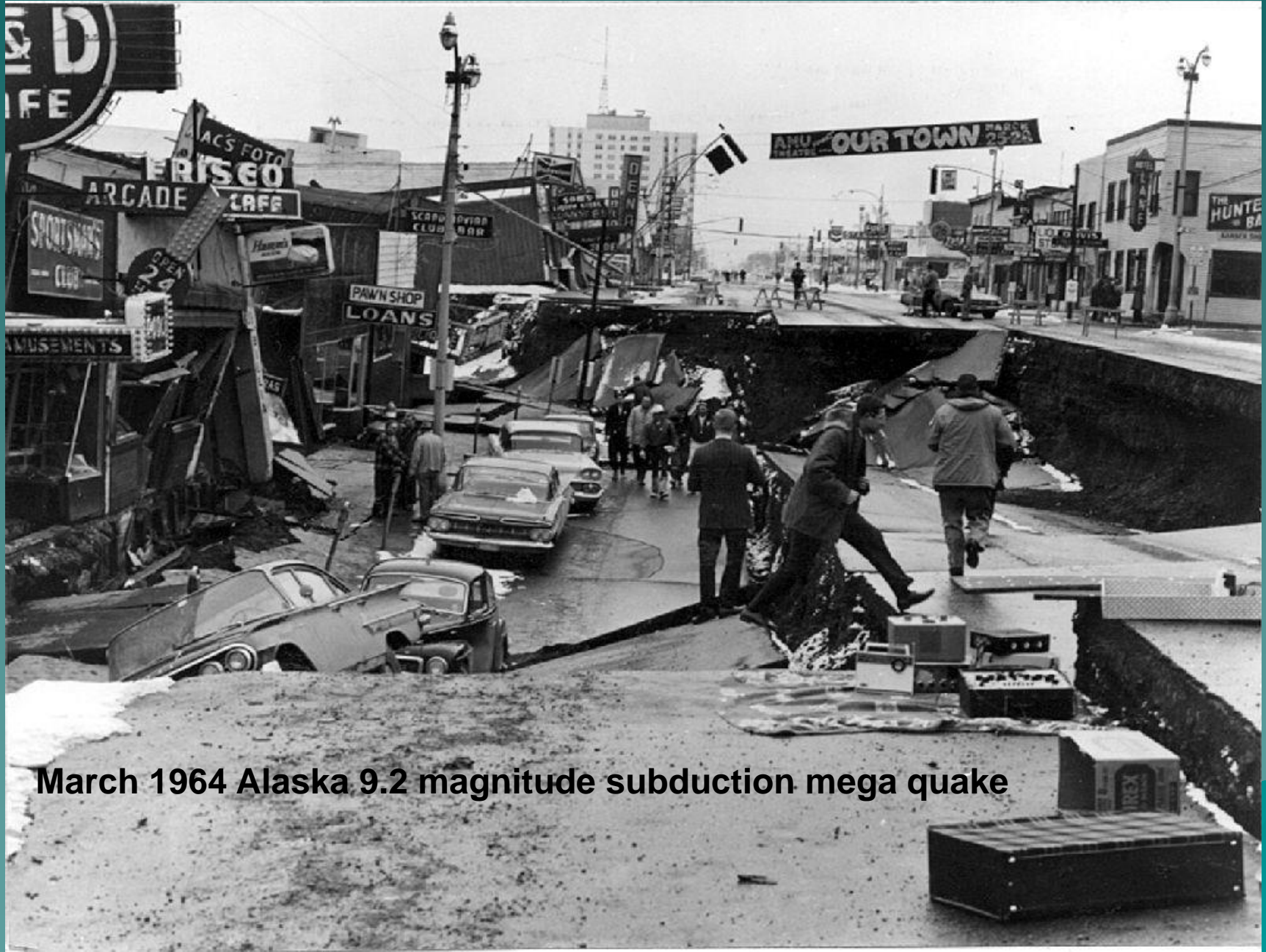
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## Oregon Real-time GNSS Network: Critical Infrastructure For Emergency Response





March 1964 Alaska 9.2 magnitude subduction mega quake



# Background ORGN





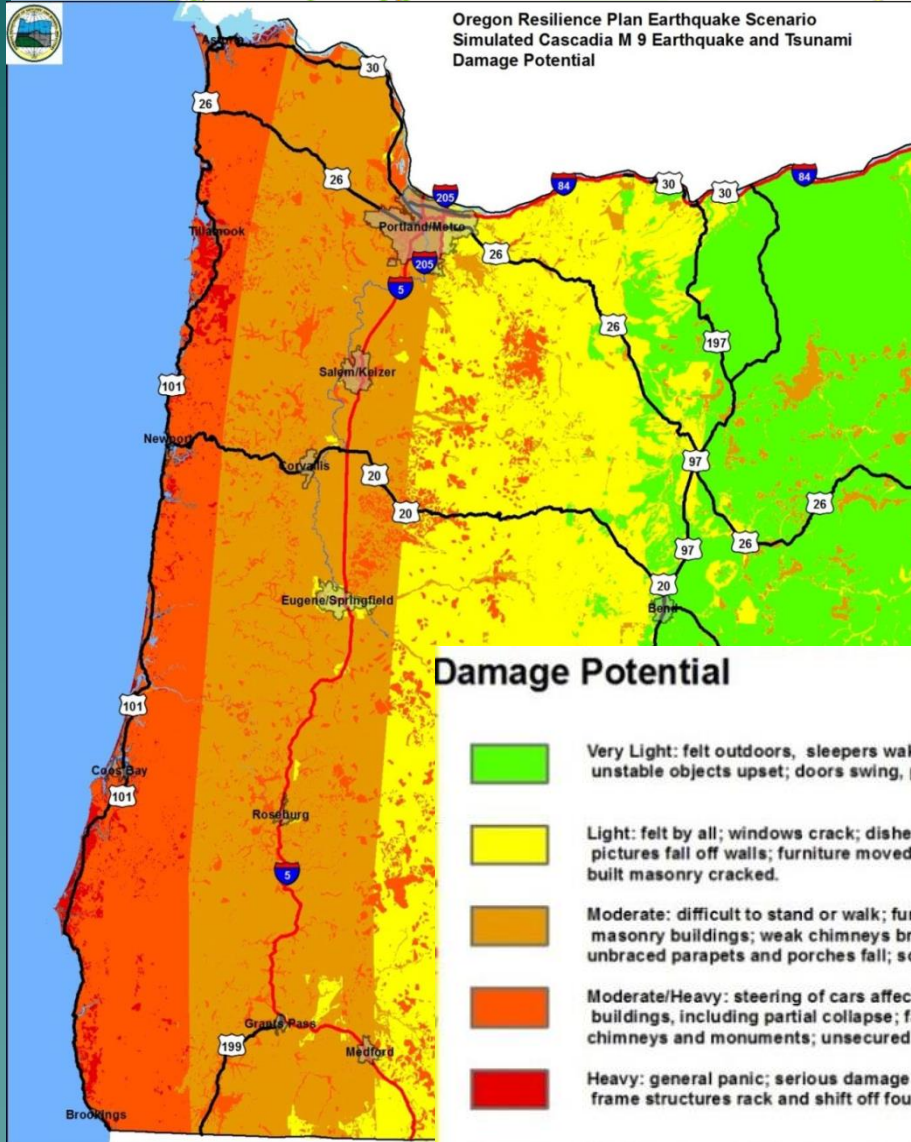
## ORGN Overview

A Cooperative Network getting data from many sources





- ◆ 100 stations total (96% GPS and GLONASS)
- ◆ 41 station are ODOT Owned and Operated
- ◆ 59 Stations from partners
  - Plate Boundary Observatory (PBO)
  - Washington State Reference Network (WSRN)
  - Counties
  - Cities
  - Private Business

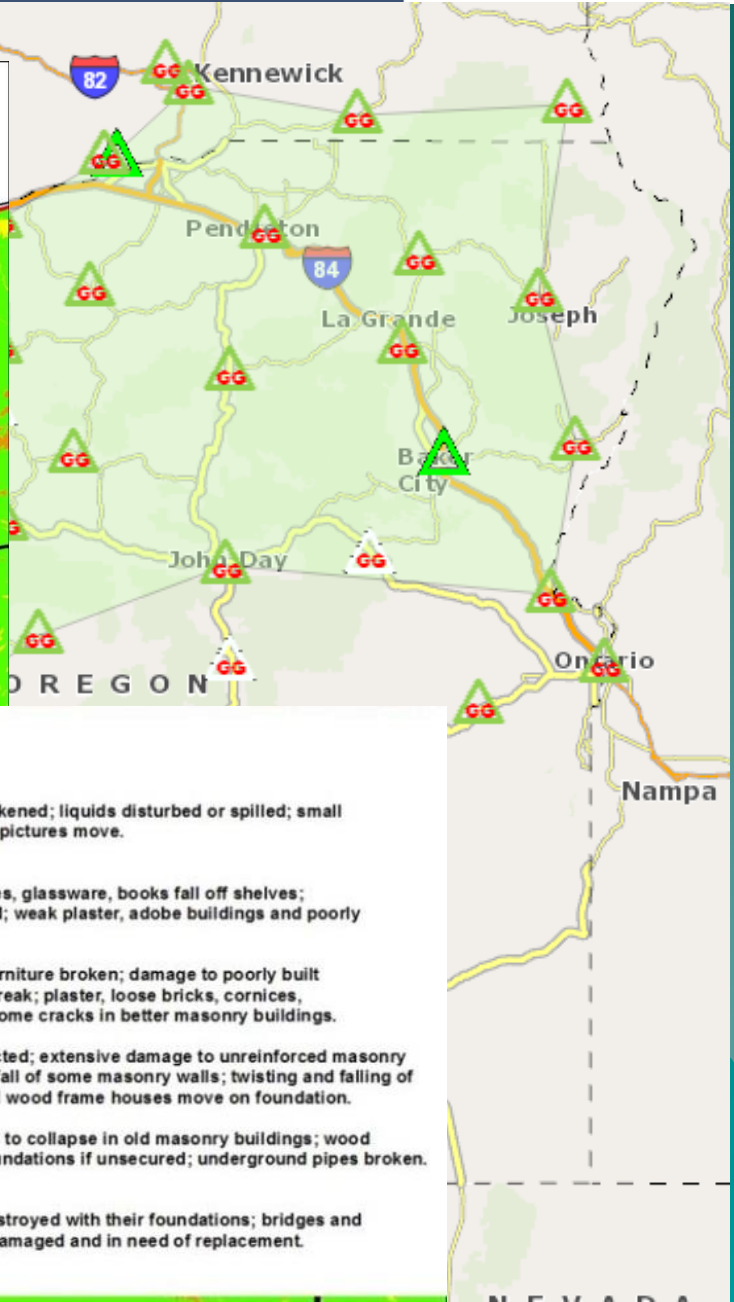


Oregon Resilience Plan Earthquake Scenario  
Simulated Cascadia M 9 Earthquake and Tsunami  
Damage Potential



## Damage Potential

-  **Very Light:** felt outdoors, sleepers wakened; liquids disturbed or spilled; small unstable objects upset; doors swing, pictures move.
-  **Light:** felt by all; windows crack; dishes, glassware, books fall off shelves; pictures fall off walls; furniture moved; weak plaster, adobe buildings and poorly built masonry cracked.
-  **Moderate:** difficult to stand or walk; furniture broken; damage to poorly built masonry buildings; weak chimneys break; plaster, loose bricks, cornices, unbraced parapets and porches fall; some cracks in better masonry buildings.
-  **Moderate/Heavy:** steering of cars affected; extensive damage to unreinforced masonry buildings, including partial collapse; fall of some masonry walls; twisting and falling of chimneys and monuments; unsecured wood frame houses move on foundation.
-  **Heavy:** general panic; serious damage to collapse in old masonry buildings; wood frame structures rack and shift off foundations if unsecured; underground pipes broken.
-  **Very Heavy:** poorly built structures destroyed with their foundations; bridges and well-built wooden structures heavily damaged and in need of replacement.





# Examples of ORGN Sites

Seaside



Roseburg



Seal Rock



Florence

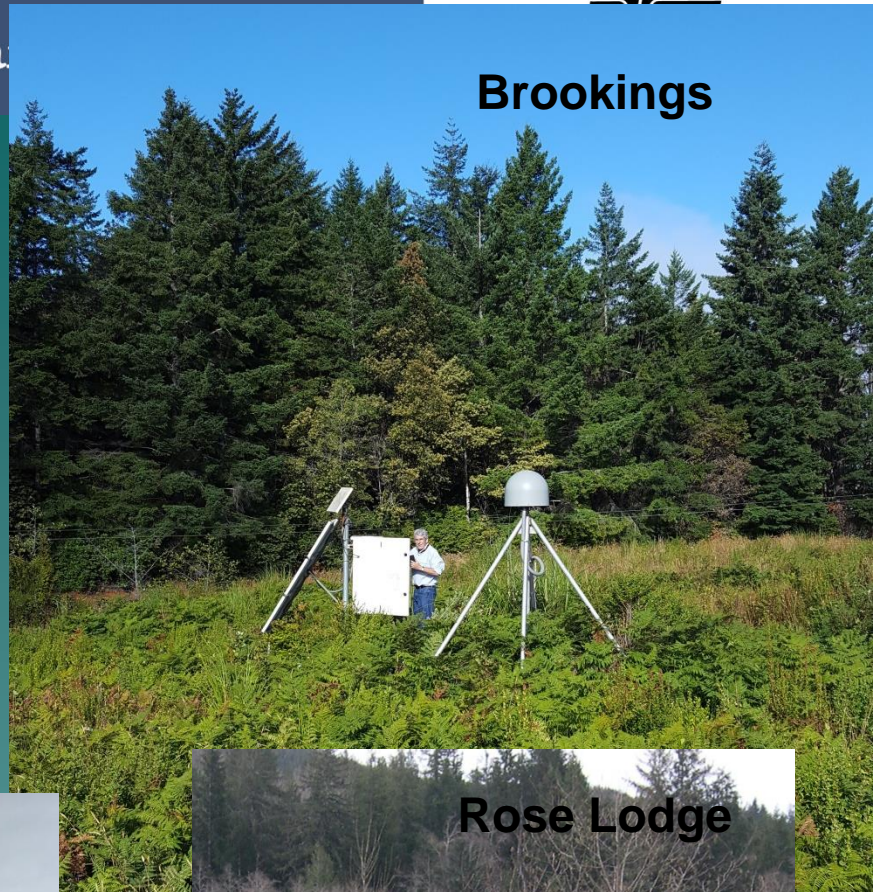


Tillamook





Gold Beach



Cape Blanco



Rose Lodge









# SOPAC

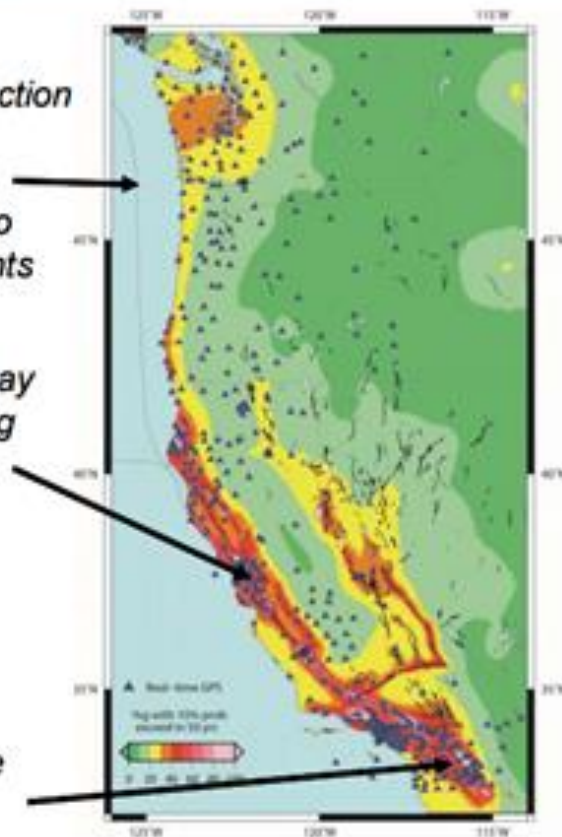
## READI Network Western U.S.

READI network in Western U.S. – Utilizing 600+ real-time high-rate GPS stations spanning areas of high seismic and tsunami risk

*Cascadia Subduction Zone – Mw 9.0 earthquake & tsunami similar to 2011 Japan events*

*San Francisco Bay Area – Increasing risk of large earthquake on Hayward fault*

*Southern San Andreas fault – overdue for large earthquake*



- **Real-Time Earthquake Analysis for Disaster mItigation network (READI):** ~600 GPS stations, a NASA driven project
- Super set of GPS networks maintained by (sorted according to largest to smallest number of stations):
  - UNAVCO/PBO
  - CWU/PANGA
  - USGS/Pasadena-SCIGN & Menlo Park
  - UC Berkeley/BARD
  - Scripps Institution of Oceanography/SCIGN
  - California Department of Transportation/CVSRN

<http://sopac.ucsd.edu/projects/realtime/READI/>



# USGS Earthquakes Hazards Program



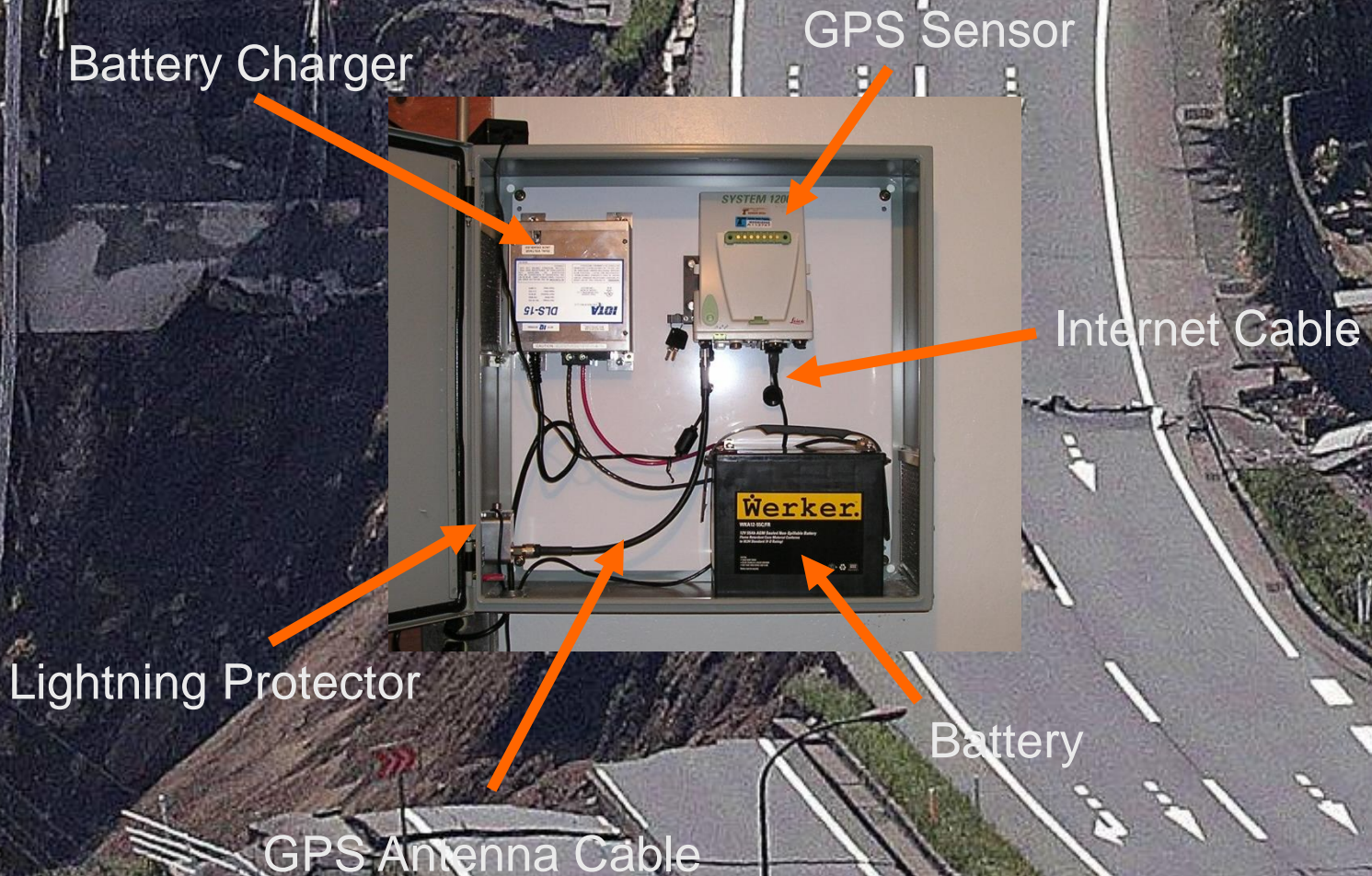


# Steps Needed to Prepare the ORGN for Emergency Response

- ◆ Power
- ◆ Communications
- ◆ Back Up Servers for Operating Software
- ◆ Quick Mobilization to Repair ORGN Sites
- ◆ Structural Monitoring

The ORGN provides **active** geodetic control stations that can be monitored for movement and readjusted quickly, as opposed to conventional **passive** control that will take years to replace once displaced or destroyed.

# Typical ORGN GPS Sensor Cabinet





# Rebuilding?

1. Check on ORGN Bases Stations
  - Operational
  - Stability
2. Compute and publish coordinates ORGN stations (Temporary CORS)
  - GNSS Base Radio Operations
  - Drone and Scanner use
  - Provide data for post process
3. With communication reestablished, ORGN network RTK will become available again.
  - Communication with ORGN base stations
  - Communication with ORGN users (Rovers)





# Why LiDAR?

Post-accident analysis – North Bend, OR







# Why LiDAR?

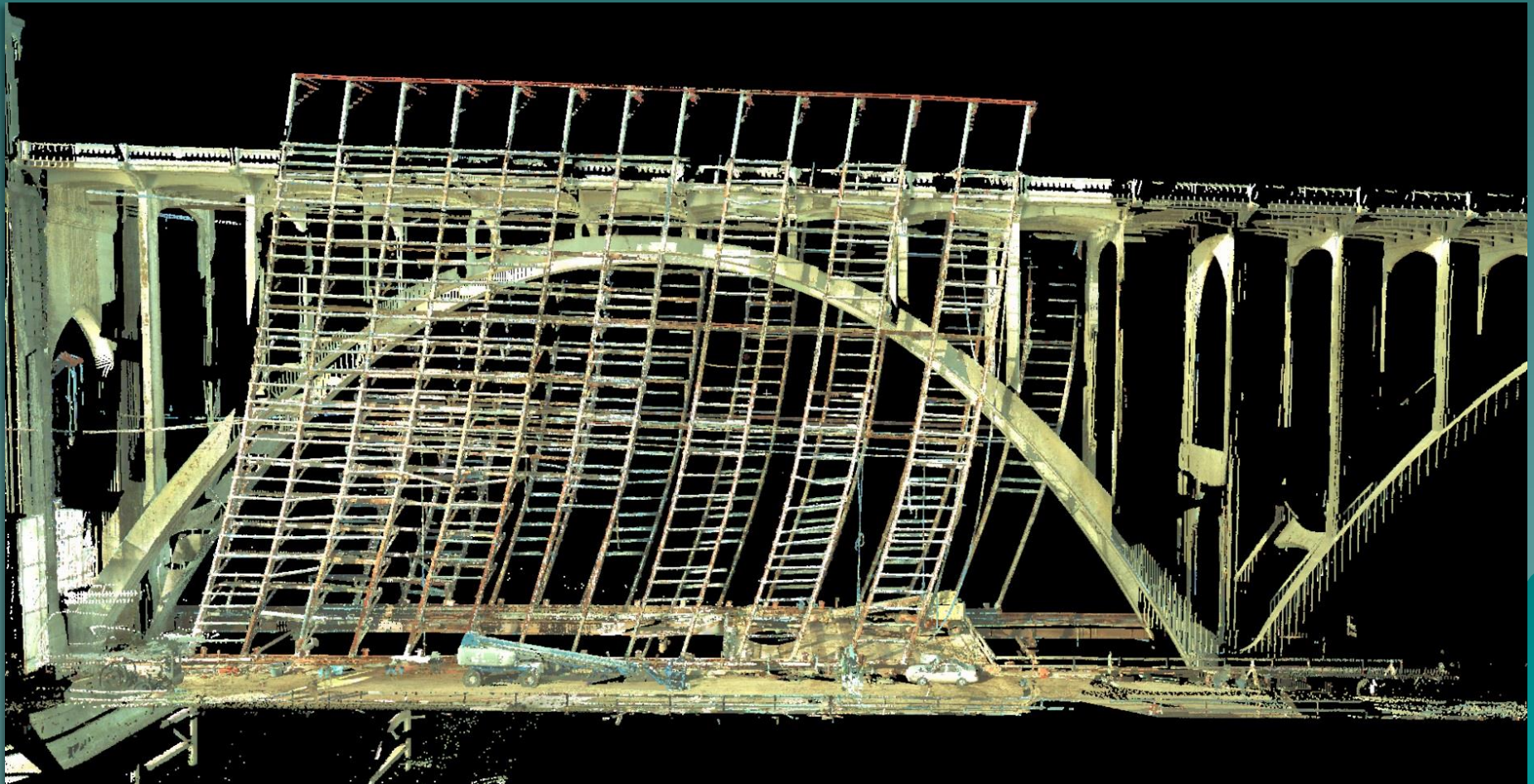
Post-accident analysis – North Bend, OR





## Why LiDAR?

- ◆ Post-accident analysis – North Bend, OR





Questions?





Oregon Department of Transportation



The beach at Bandon, Oregon

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