Final Technical Report

Modernization of Anza Seismic Network Equipment

Term covered by the award:	9/18/2009 – 8/31/2010
Cooperative Agreement Number:	G09AC00488
Seismic Network Web Site:	http://eqinfo.ucsd.edu
Network Code:	AZ
Network Name:	ANZA Seismic Network
ANSS Region:	California
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Abstract

In 2009 the ANZA Seismic Network (http://eqinfo.ucsd.edu) utilized broadband and strong motion sensors with 24-bit (Reftek RT72A, Quanterra Q4120, and Quanterra Q330) dataloggers combined with real-time telemetry to monitor local and regional seismicity in southernmost California. The goal of the ANZA project is to provide continuous on-scale digital recording of high-resolution three-component seismic data for earthquakes occurring in southern California, provide real-time data to the California Integrated Seismic Network (CISN), other regional networks, and the Advanced National Seismic System (ANSS), as well as to provide near real-time information and monitoring to the greater San Diego community. Twelve high dynamic range broadband and strong motion sensors adjacent to the San Jacinto Fault zone contribute data for earthquake source studies to the National Earthquake Reduction Program (NEHRP) and continue the real-time monitoring of the seismic activity of the San Jacinto fault initiated 24 years ago.

The ARRA funds provided to the ANZA network were used to support the modernization and standardization of the network to minimize long term maintenance costs, improve network robustness by eliminating all single points of failure, and improve data quality.

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The critical element of this project was the replacement of all Reftek RT72A and Quanterra Q4120 data acquisition systems and any associated wireless telemetry. The location of the ANZA stations are shown in Figure 1. The pre-existing data acquisition and communications systems were close to the end of their life expectancy since they were designed and deployed 10 to 15 years ago. We installed US Government Furnished Equipment (GFE) state-of-the-art digitizers such as the Q330 with on-site storage (such as the Slate) to record and facilitate data recovery after communication outages. We also installed IP based radios that allow full use of the remote command and control capability of the Q330 dataloggers. These IP radios are non-GFE equipment since we are coordinating with other existing equipment on Toro Peak on a non-interference basis. Since the current sensors (Streckeisen STS-2s (with one exception) and Kinemetrics Episensors) already meet the ANSS standards, we only needed to ensure proper cables are available for the datalogger replacement.

The work supported the purpose of the American Recovery and Reinvestment Act and make progress towards attaining the ANSS performance standards in two ways. First, it helped sustain full-time employment for a field engineer and field technician. These jobs could have been forced into part-time positions if enough funding had not been secured through normal funding channels. Second, these upgrades provide a significantly more robust and easier to maintain network by finally providing onsite backup data storage while modernizing the data acquisition and communications infrastructure.

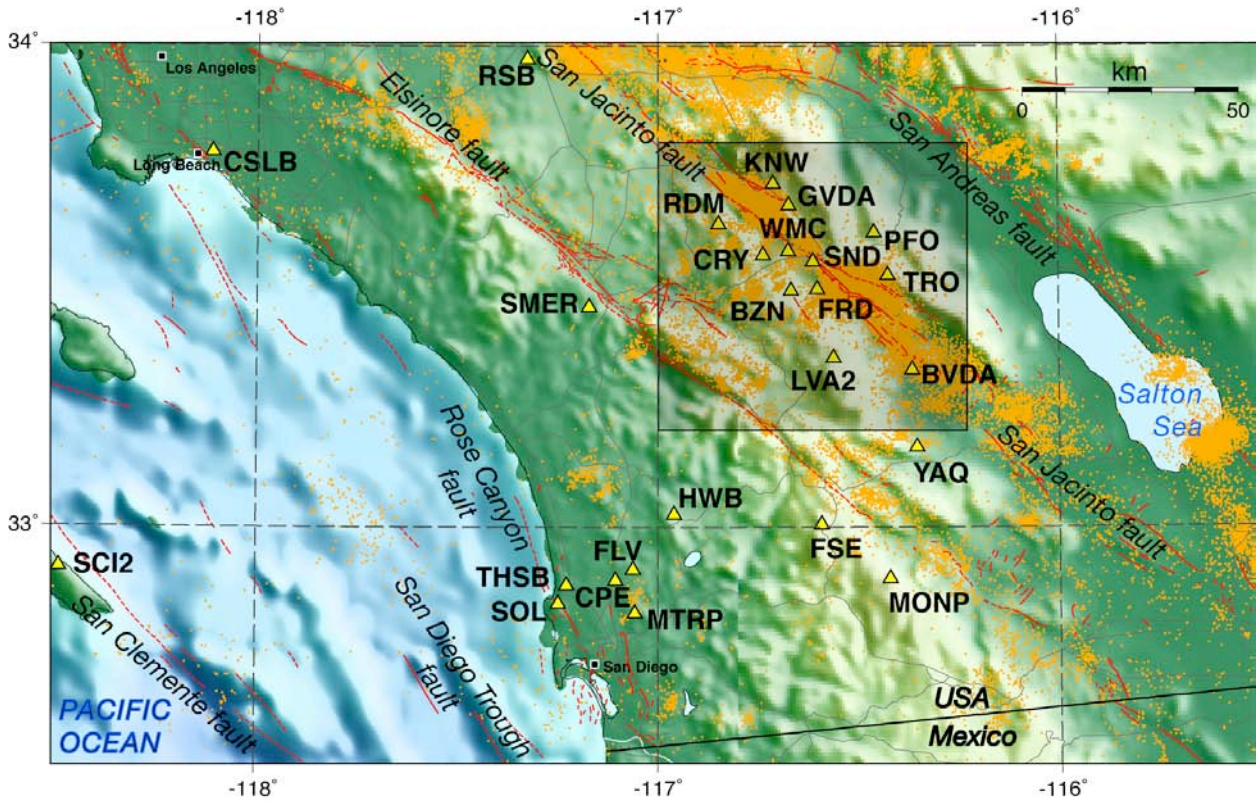

Figure 1. Topography and bathymetry of Southern California, with major roads (gray) and cities (white box) plotted. Fault lines in red and labeled. Background seismicity are orange dots. The twenty-one real-time ANZA stations are yellow triangles, eighteen of which are the broadband and strong motion stations discussed in this technical review.

The specific operational objective of this project was the replacement of the data acquisition systems at all ANZA non-Q330 equipped stations. The components of this work were:

1. Upgrade of existing Toro Peak Telemetry
2. Upgrade of existing Typical RT72A+FreeWave Stations
3. Upgrade of existing RT72A+FreeWave Station "TRO"
4. Upgrade of existing Q330+WiLAN Stations "BZN" and "KNW"
5. Upgrade of existing Q4120 stations "SMER" and "HWB"
6. Upgrade of existing Q330 HPWREN stations. “CPE”, “SOL”, “MONP2”

Upgrade of existing Toro Peak Telemetry

We replaced existing remote station to Toro Peak telemetry with a product built in the US known as the Afar AR-24027. The Afar system has been tested thoroughly in the GPS and seismic field environment. This communication module has a 2-Mbit through put rate, can support multiple remote sites, is robust in field environments, and using directional antennas can sustain communications to over 50 miles. We used four Afar radios on Toro Peak to handle the currently deployed twelve remote stations and their associated distances and azimuths. If needed in the future, the Toro Peak Afar radio hub can support additional remotely deployed seismic stations. There are multiple users of the RF spectrum on Toro Peak and we have verified that these radios will not cause any interference with other users, and will also survive the severe winter environment.

Figure 2 – Photos Toro antenna array installed in this project. Left photo is unshrouded antennas, Right photo shows protective shroud in place.

Upgrade of existing Typical RT72A+FreeWave Stations

By converting all ANZA stations to GFE provided dataloggers with Q330-like capabilities, we needed to replace the wireless communication infrastructure of each Reftek RT72A seismic station. We replaced all cables and power systems.

Figure 3) Examples of equipment upgrades under ARRA funding. Station SND is shown

Upgrade of existing RT72A+FreeWave Station "TRO"

One ANZA RT72A station exists on Toro Peak a short distance from the telemetry building in a quieter site. It still uses wireless telemetry, but does not need solar power. We replaced all cables and power systems.

Figure 4) TRO ARRA seismic equipment installation.

Upgrade of existing Q330+WiLAN Stations "BZN" and "KNW"

Two ANZA Toro based telemetry stations used Q330 dataloggers. Stations BZN and KNW used Q330s and Wilan IP wireless telemetry. The Wilan infrastructure was replaced with Afar radios. We replaced all cables and power systems.

Figure 5) BZN and KNW ARRA seismic equipment installation.

Upgrade of existing Q4120 stations "SMER" and "HWB" to Q330s

Two ANZA non-Toro based telemetry stations used Quanterra Q4120 dataloggers. Stations SMER and HWB used Q4120s connect to HPWREN directly. In addition to replacing the Q4120s with Q330s, appropriate cabling was replaced at these stations.

Upgrade of existing Q330 HPWREN Stations "CPE", "SOL", and "MONP2"

Three ANZA HPRWEN based telemetry stations use Q330 dataloggers. Stations CPE, SOL, and MONP2 use Q330s and connect to HPWREN directly. The only change at these stations was to add on-site local storage.