State Of California

ALFRED E. ALQUIST
SEISMIC SAFETY COMMISSION

Governor Edmund G. Brown Jr.

WORKSHOP AGENDA
October 7, 2015
Council Chambers, Eureka City Hall 400-530
531 K Street, Eureka CA 95501
Greg Sparks, City Manager (707) 441-4144

Time	Item	WORKSHOP AGENDA	Action
4:00	**I.**	**Call to Order** **Roll Call**	Roll Call
	II.	• **Review Commission Budget** • **FI$CAL/State Leadership Accountability Act(SLAA) Review** • **Review of Recommendations to Modify the Alquist Priolo Earthquake Fault Zoning Act**	Discussion & Possible Action
	III.	**Legislation**	Discussion & Possible Action
	IV.	**Research Projects**	Discussion & Possible Action
5:30	**XII.**	**Adjourn**	Discussion & Possible Action

AGENDA
October 8, 2015
D Street Neighborhood Center
1304 D Street, Arcata CA 95521
Karen Diemer, City Manager (707) 822-5953

Time	Item	AGENDA	Action
9:00	**I.**	**Call to Order** **Roll Call**	Roll Call
9:05	**II.**	**Chairman's Remarks** *Commissioner Timothy Strack*	Discussion & Possible Action
9:10	**III.**	**Approval of August 13, 2015 Meeting Minutes**	Discussion & Possible Action
9:15	**IV.**	**Opening Comments** *Commissioner Wheetley* *Mayor Mike Winkler (invited)* *Dr. Lisa Rossbacher, President, Humboldt State University*	Discussion & Possible Action
9:30	**V.**	**The Redwood Coast Tsunami Work Group: 20 Years of Addressing the Cascadia Earthquake Threat** *Dr. Lori Dengler, Department of Geology, Humboldt State University*	Discussion & Possible Action
9:50	**VI.**	**Seismic Risk & Recovery: Critical Town/Gown partnerships** *Mr. Mark Andre, Director of Environmental Services, City of Arcata* *Mr. Michael, Fisher, Associate Director Planning & Design, Humboldt State University*	Discussion & Possible Action
10:10	**VII.**	**Last Chance Grade, Highway 101: History, Geology, Challenges, Alternatives, & Education** *Ms. Talitha Hodgson, Project Manager, CalTrans*	Discussion & Possible Action

10:30	**VIII.**	**Guide to Identify and Manage Seismic Risks of Buildings for Local Governments** *Commissioner Goodwin* *Mr. Fred Turner, Staff Structural Engineer, Seismic Safety Commission*	Discussion & Possible Action
10:50	**IX.**	**California Small Business Continuity Training** *Ms. Kristi Johnson, Chair, Small Business Development Centers' Leadership Council*	Discussion & Possible Action
11:10	**X.**	**Public Comment** *(Please complete a "Request to Speak" Form)*	Discussion & Possible Action
11:20	**XI.**	**Miscellaneous & Good of the Meeting**	Discussion & Possible Action
11:30	**XII.**	**Adjourn to Crescent City**	Discussion & Possible Action

October 8, 2015
Crescent City Harbor District
101 Citizens Dock Road
Crescent City CA 95531
Charlie Helms, Harbor Master (707) 464-6174

Time	Item	WORKSHOP AGENDA	Action
3:00	**I.**	**Call to Order** **Roll Call**	Roll Call
	II.	**Crescent City Harbor: Tsunami Risks & Lessons Learned** *Mr. Lane Tavasci, Deputy Harbor Master, Crexcent City Harbor District* *Mr. Eugene Palazzo, City Manager, Crescent City*	Discussion & Possible Action
5:00	**III.**	**Adjourn**	Discussion & Possible Action

October 9, 2015
Yurok Tribe Headquarters
190 Klamath Blvd, Klamath CA 95548
Troy Fletcher, Executive Director (707) 482-1350

Time	Item	WORKSHOP AGENDA	Action
9:00	**I.**	**Call to Order** **Roll Call**	Roll Call
	II.	**Welcome/Opening Remarks** *Mr. Thomas O'Rourke, Chairman, Yurok Tribal Council* *Mr. Tim Strack, Chairman, Seismic Safety Commission* *Mr. Richard McCarthy, Executive Director, Seismic Safety Commission* *Mr. Michael Kleeman, Seismic Safety Commission Tribal Consultant* *California Office of Emergency Services (Invited)*	Discussion & Possible Action
	III.	**General Discussion**	Discussion & Possible Action
11:00	**IV.**	**Adjourn**	Discussion & Possible Action

Next Meeting: December 10, 2015, State Capitol

* * *

MEETING NOTICES

SIGN-UP & TIME LIMITS: If you wish to speak on an item, please fill out a “Request to Speak” form and give it to a staff person before the public hearing. The forms are available near the door to the meeting room. Time limits are indicated on the speaker sign-up forms and in case of questions or disputes the Chairman will determine the time limits for each speaker at the beginning of the public hearing.

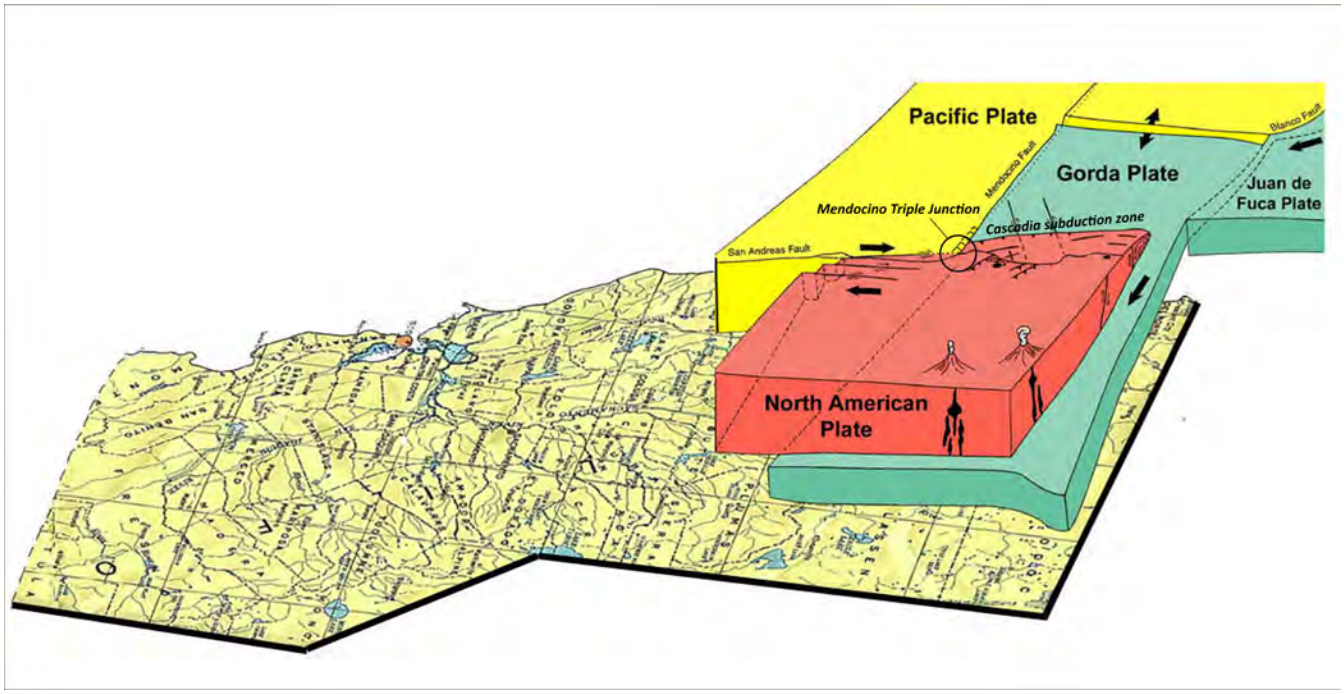
SUGGESTIONS FOR SUBMISSION OF WRITTEN MATERIALS. It is requested that written materials be submitted to the Commission staff prior to the meeting. If this is not possible it is requested that at least 30 copies be submitted to the Commission. This material will be distributed to the Commission members. Applicants are responsible for presenting their projects at the public hearing. NO FAXES will be accepted at the meeting site. You may be able to make prior arrangements with staff or a Commissioner to send a fax but you will be responsible for paying the hotel or meeting site for its receipt.

CLOSED SESSION: The Commission may meet to consider possible and pending litigation in a session closed to the public pursuant to attorney-client privilege and statutory exception to the Open Meeting Act (Government Code §11126e).

ACCESS TO HEARING: Meeting facilities are accessible to persons with disabilities. If you require special assistance, please contact any staff member prior to the meeting. An interpreter for the deaf will also be made available upon request to the staff at least five days prior to the meeting.

7th Item II

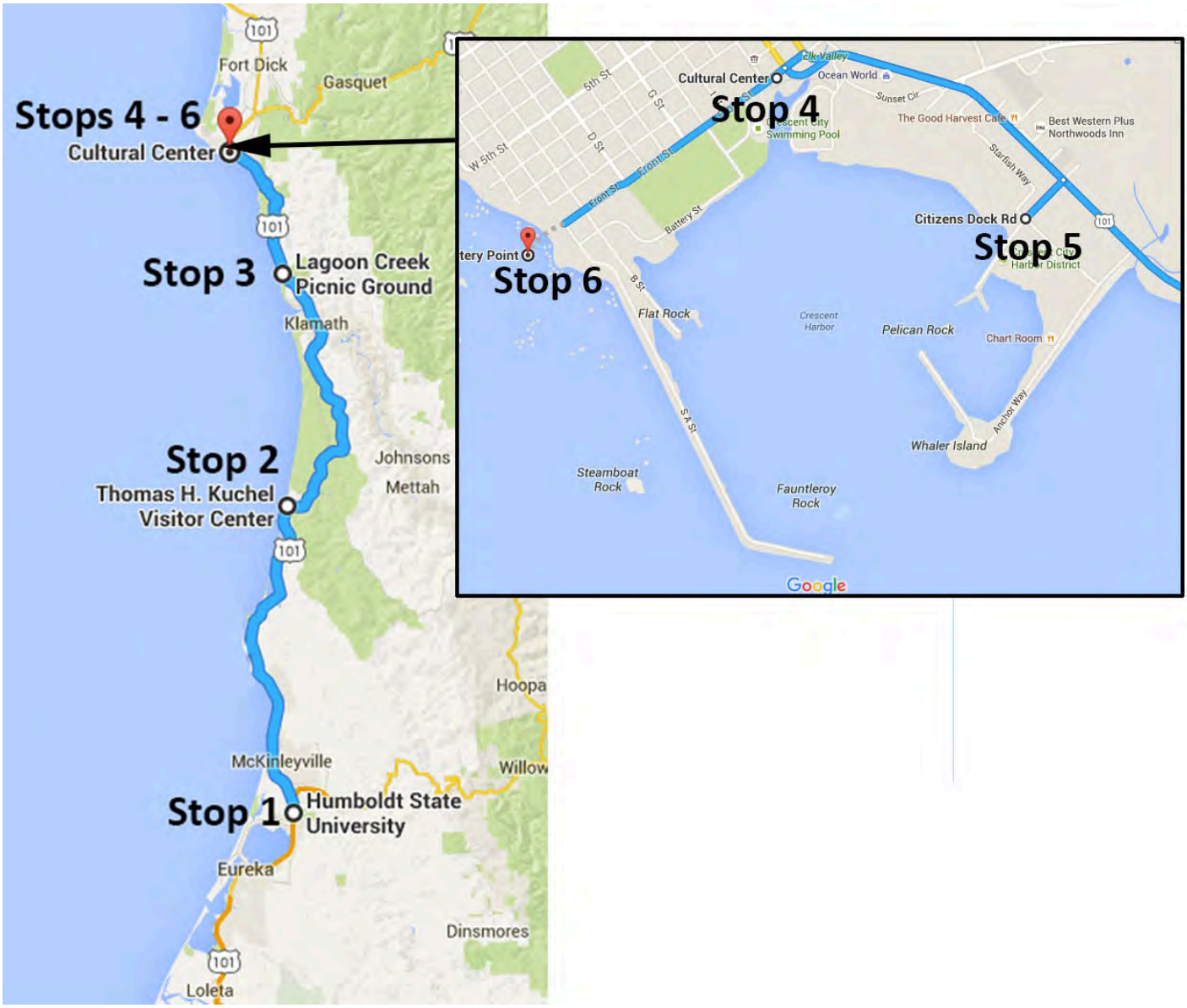
CEETEP Field Trip Guide
October 10, 2015



Cascadia EarthScope Earthquake and Tsunami Education Program (CEETEP)

October 9 - 12, 2015

Field Trip Stops



CEETEP Convener cell phone numbers
Bob Butler: 503-313-3908
Lori Dengler: 707-845-4960
Beth Pratt-Sitaula: 509-899-3480
Kerry Sherin: 707-845-4891

Field Trip Schedule

Stops	Location	arrive	leave	topics covered	guidebook page
	Van Matre Hall - Breakfast	7:30	8:00	Orientation to Humboldt Bay plate tectonic setting	4
1	HSU GPS station	8:00	8:45	Geometry of the southern Cascadia margin, monitoring earth movements, coseismic/interseismic deformation, complexities of the accretionary fold and thrust belt.	5
	Driving 8:45 - 9:30				
2	Redwood National Park Information Center (restrooms)	9:30	10:15	Native peoples of the area, oral history, reconstructing the last Cascadia earthquake & tsunami from oral history, correlating oral history with scientific data, using oral history to constrain tsunami maps, Orick TsunamiReady, multi hazard beach signs and folding tsunami preparedness into an all-hazards approach.	7
	Driving 10:15 - 10:45				
3	Lagoon Creek (restrooms)	10:45	11:15	Paleotsunami stratigraphy, not all Cascadia tsunamis (and earthquakes) are the same, tools of paleoseismology, Value of high and low coastal wetlands in recording paleo- tsunami history. Only large tsunamis captured at Lagoon Creek. Compare to Crescent City gouge core.	10
	Driving 11:15 - 11:45				
	Lunch - Crescent City Community Center	11:45	12:30		
4	Crescent City Tsunami Walk	12:30	1:30	What happened in 1964, the tsunami warning system and what would happen if the 1964 tsunami happened today, how a Cascadia tsunami would differ from 1964, evacuation and inundation maps - how they differ.	14
	Driving 1:30 - 1:45				
5	Crescent City Harbor	1:45	2:15	Marigrams and past tsunamis in Crescent City. What is so special about Crescent City and tsunami amplification, what happened in 2006 and 2011, harbor retrofit.	18
	Driving 2:15 - 2:30				
6	Battery Point Lighthouse	2:30	3:00	What happened in 1964, the complexities of the Cascadia fold and thrust belt (difference in sea mount density to the north and south), the big picture.	22
	Return to Arcata	3:00	4:30		

Introduction and Orientation

The Cascadia margin along the Northern California is unique because of the close proximity of the fold and thrust belt to the coast. In most of the world's subduction zones and the Cascadia margin offshore of Oregon and Washington, the highly deformed edge of the North American plate is far offshore. Onshore mapping and offshore marine reconnaissance studies reveal a complex series of Holocene folds and faults (Figure 1).

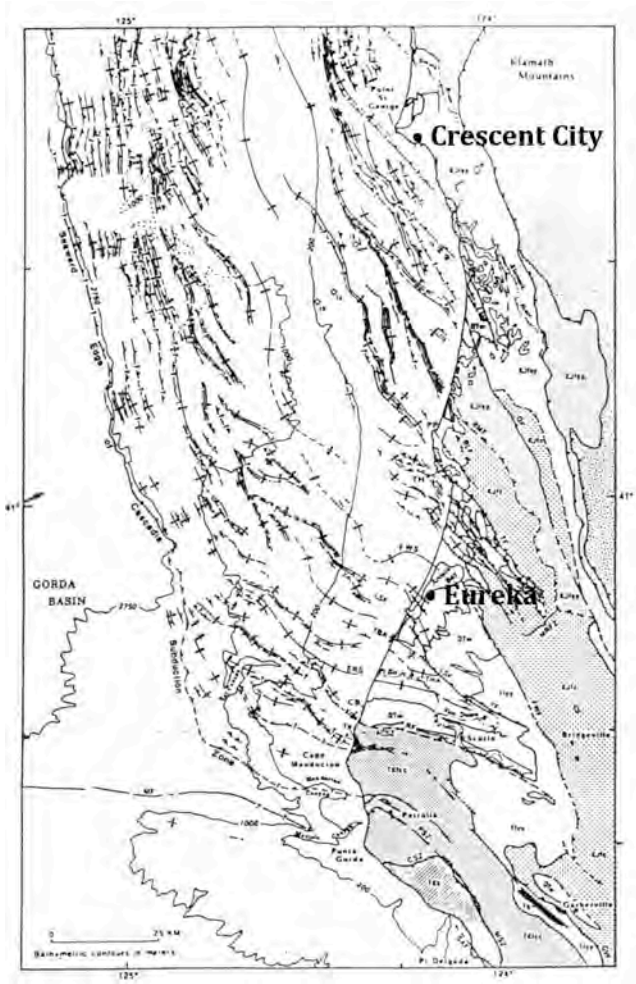


Figure 1: Mapped offshore and onshore faults part of the Cascadia fold and thrust belt..

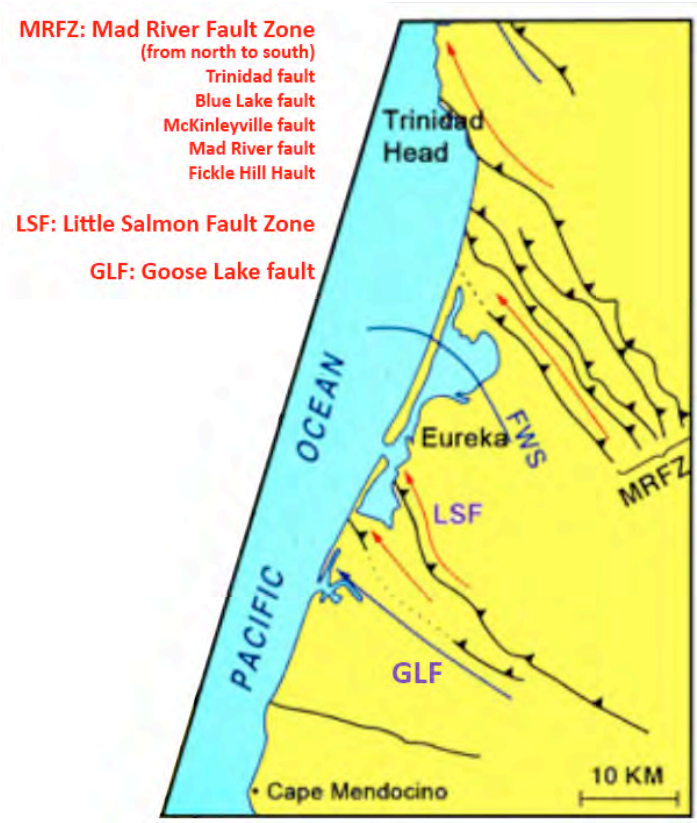


Figure 2: Mapped active faults in the Humboldt Bay region.

The faults and folds are best studied in Humboldt County where seven thrust faults have been classified as active under California's Alquist-Priolo Special Studies fault zone identification legislation (Figure 2). The closest mapped fault to the HSU campus is the Fickle Hill fault, one strand of which cuts through campus and surfaces about 320 meters (1050 ft)) WSW of Van Matre Hall.

None of these faults have produced slip in the last 165 years of written history, although all show paleoseismic evidence of rupture within the last 10,000 years. Slip measurements suggest earthquakes as large as 7.8, if they occurred independently.

In addition to the close proximity of the Cascadia margin to the coast, Northern California tectonics are further complicated by the Mendocino triple junction (see front cover) 62 km (38 miles) SSW of Van Matre Hall, and faulting within the Gorda plate.

STOP 1: HSU GPS Station

The Humboldt State University Global Positioning Satellite (GPS) Station is located just east of the Lumberjack stadium, a short walk from Van Matre Hall (Figure 3). It is one of 11 stations operated by UNAVCO to monitor deformations at the southern end of the Cascadia subduction zone and the Mendocino triple junction.

Continuous GPS stations are able to track very small movements of a site relative to both horizontal and vertical axes.

Figure 3. HSU GPS site.

The instrument was installed in late 2005. The plot to the left (Figure 4) shows the record of movement since it was installed. Note the jump in the eastward movement on March 10, 2014 at the time of the magnitude 6.8 offshore earthquake.

The figures below show the network response during the 1994 and 2010 earthquakes. In both cases, land moved primarily to the east.

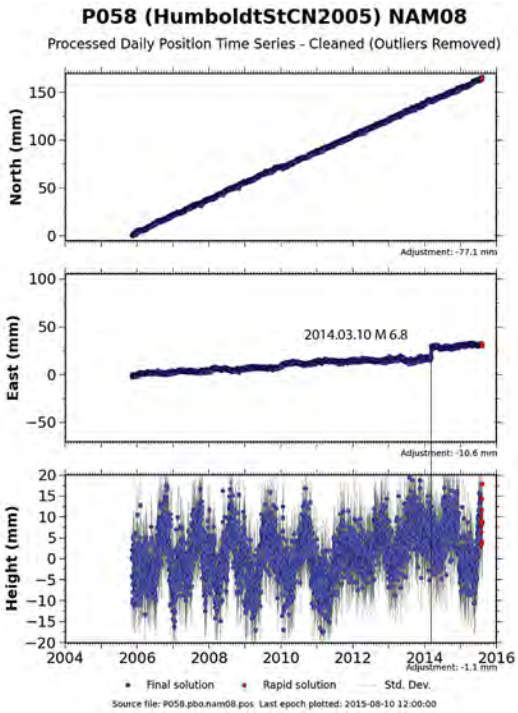


Figure 4. HSU GPS data.

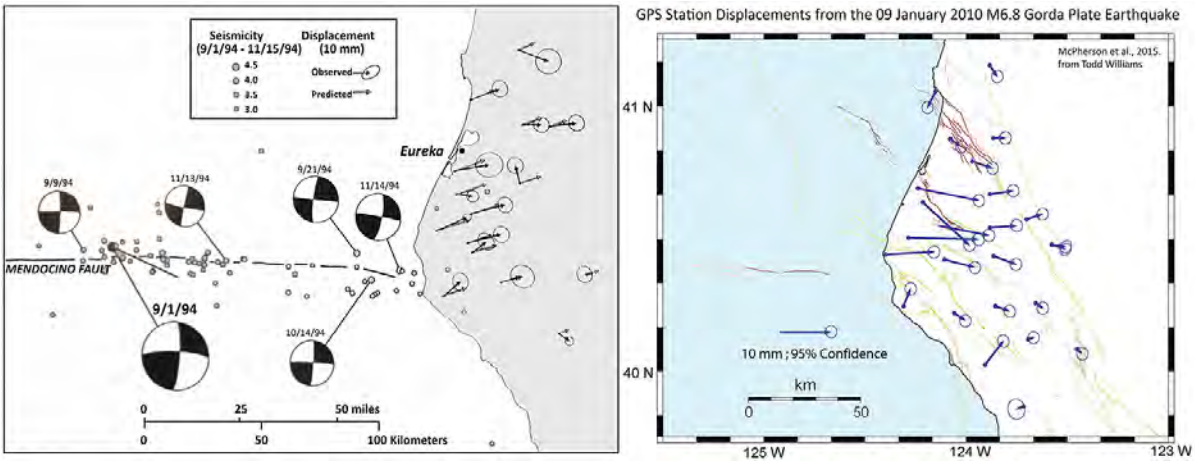
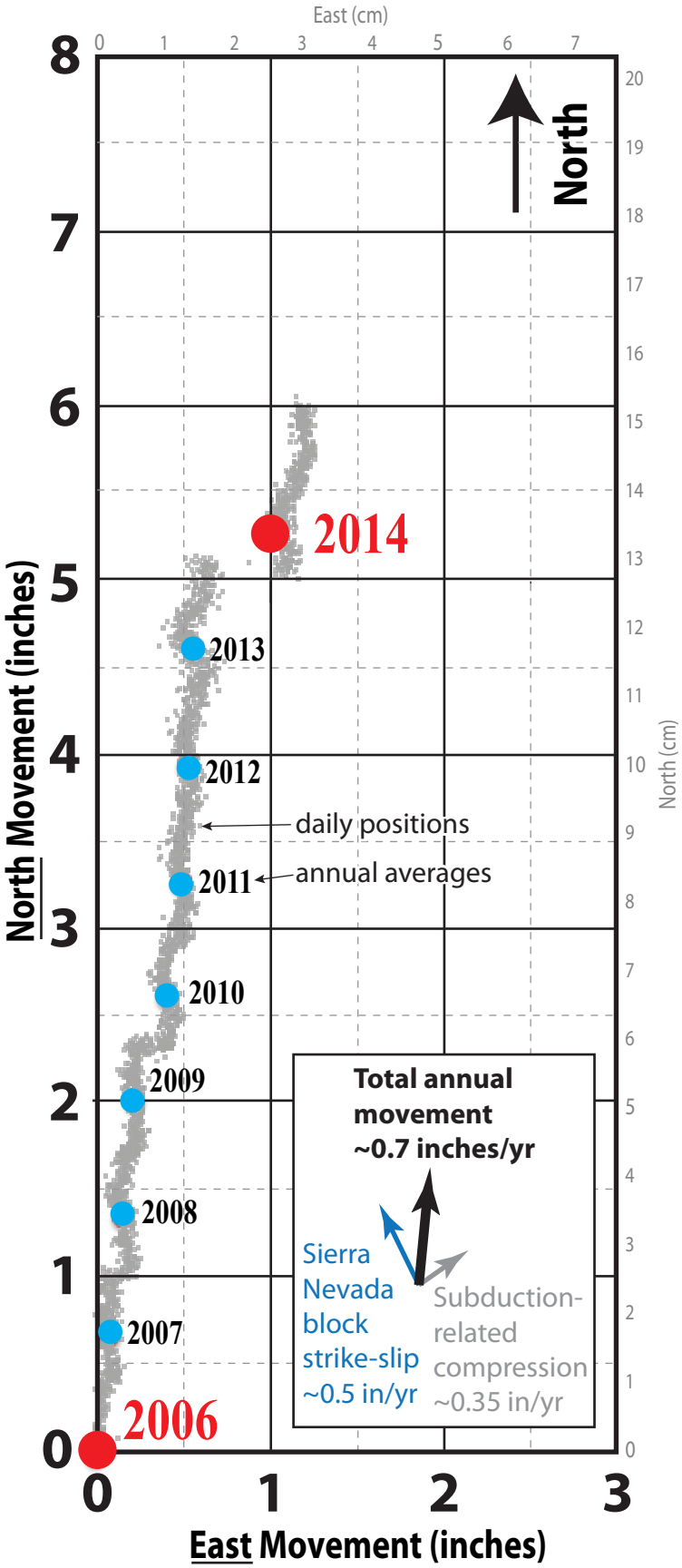


Figure 5. GPS array data comparing positions before and after the September 1, 1994 M 6.9 Mendocino fault earthquake and the March 10, 2010 M 6.8 offshore Gorda plate earthquake.

Arcata, California GPS Station

Yearly Movement, 2006 - 2014

(Referenced to North America's stable east)



Cut Here

The dots on this card show motion of the Arcata GPS station since 2006. Because the station is anchored into hard rock beneath the soil, the large dots represent the year-to-year movement of the Arcata region toward the north-northeast.

Orient this graph toward the north, tape it to the floor, and think about the questions below.

1. How far has the Arcata region moved since the year 2006? At what rate (inches per year) is the region moving in total? How much of this movement is due to Sierra Nevada block strike-slip motion?

2. How much of this movement (inches per year) is due to subduction-related compression? The last Cascadia subduction-zone earthquake occurred in the year 1700. **What will happen to the Arcata region when the next big subduction earthquake occurs?**

3. Why do the daily timeseries have a sudden offset in early 2014? How much movement was measured? What direction was the movement?

Station P058 from the EarthScope Plate Boundary Observatory (**http://pbo.unavco.org**). GPS time series data provided by UNAVCO (**http://www.unavco.org**). Data as of August 14, 2015. Position offset -0.06 inches east and -0.5 inches north from the NAM08 P058 .cvs file to bring 2006 average to zero.

Card developed by the Cascadia EarthScope Earthquake and Tsunami Education Program (CEETEP; **http://ceetep.oregonstate.edu**) and UNAVCO. CEETEP is sponsored by a grant from the EarthScope Program (**http://www.earthscope.org**) of the National Science Foundation to Oregon State University, the University of Portland, and Central Washington University.

From the HSU campus, we drive north on U.S. Highway 101 to the Redwood National Park Information Center at the mouth of Redwood Creek.

STOP 2: Redwood National & State Parks Information Center

The Native peoples of the Pacific Northwest have a long oral history tradition. Some of the accounts provide vivid descriptions of earthquakes and tsunamis. Although many accounts were lost after European settlement, some were recorded by anthropologists at the turn of the century and others are still told today.

Figure 6. Tskerkr (center left) at the fishing village of Sigwetz near the present day location of the Information Center.

Three stories of the Yurok people who lived at or near this location are excerpted below.

How Prairie Became Ocean: "Where shall we make water to be? How will they live if we leave prairie there?" said Thunder. He said to Earthquake, "What do you think? I want water to be there, so that people may live." Then he (earthquake) started and arrived there, it will be easy for me to do that, to sink this prairie." so he ran about a little and the ground sank. So they (two) went south with one another. He kept sinking it: every little while there would be an earthquake, then another earthquake: that is what he was doing. And then the water would fill those (depressed) places. Then they went north together and did the same: they kept sinking the ground. The earth would quake and quake again and quake again. And the water was flowing all over.

And that is why it is thus, that everything is in the ocean that (lies) in front of us. The land sank where they had run about, (where) Earthquake had run about, Thunder had run about. One can see now that the water is deep-of course we do not know how deep it is-because it was a prairie.

Yurok legend told by Ann of Espeu, recorded by Kroeber

Earthquake and Thunder: Then Earthquake thought: "How will it be about the earth?" Thunder came and said, "It will be best if I help you when you shake." Earthquake said, "Well, I shall tear up the earth." Thunder said, "That's why I say we will be companions, because I shall go over the whole world and scare them" Earthquake said, "If I see the earth tilt, I can level it again" So he (Thunder) began to run, and leaped on trees and broke them down. Earthquake stayed still to listen to his running. Then he said to him, "Now you listen: I shall begin to run." He started. He shook the ground. He tore it and broke it to pieces. All the trees shook; some fell

Now that is the reason Earthquake goes to different places because in the beginning he did that, and did not encompass the world in one day. It is thus with him now: He cannot go entirely around in a day, so he goes part way, and as it were spends the night. In some places he shakes the earth hard, in some he shakes it a little. For he did that in the beginning and does it now."

Yurok legend told by Tskerkr of Espeu, recorded by Kroeber

The Flood: There used to be a settlement at Sigwets just north of Orekw. Then it happened that there almost came to be no people (left in the world) on account of (what happened at) this settlement. For an old man and his brother went into the sweathouse to sleep. But a man was outside, and when they slept, he went in and tied their hair together. Then he went out and shouted, "They have come! Somebody will be killed! They are going to fight!

Figure 7. Traditional Woodpecker-crest headbands.

Then the ocean began to turn rough (from the anger of the old men). A breaker came over the settlement (of Sigwets), washed the whole of it away, and drowned everyone. Then all the people of Orekw ran off to the top of the hill, wearing their woodpecker-crest headbands: they were afraid.

Then he at Orekw who knew the formula for the sacred sweathouse there ran to Oketo, for now the water was already all around Orekw. He looked into the sweathouse at Oketo. There was the one who knew that formula. He spoke to him, but that one did not answer. Four times he spoke to him. Then he said. "Were they drowned?" "Yes, I saw them drown," said he of Orekw, "but I am afraid the water will cover the whole land."

And now the breakers were already dashing against one side of that sweathouse (at Oketo). Then that one began to speak his formula in that sweathouse. He had to do it hastily; therefore he used old boards to make the fire. Then the ocean went down. *Yurok legend told by Tskerkr of Espeu, recorded by Kroeber*

This site is unique not only for its oral history of earthquakes and tsunamis but also for the close correlation of story and physical evidence of past tsunamis. In the 1980s, Deborah Carver began compiling North Coast Native American oral histories related to earthquakes and tsunamis. A careful analysis of Tskerkr's story suggested that the water height above Sigwets was about 19 m (62 ft). Ida's story from just north of Redwood Creek suggested a water height of 18 m (59 ft). At the same time, her husband HSU Geology Professor Gary Carver was conducting paleoseismology research looking for physical evidence of past earthquakes and tsunamis. Cores taken at the mouth of the Orick Valley record tsunami sand deposits.

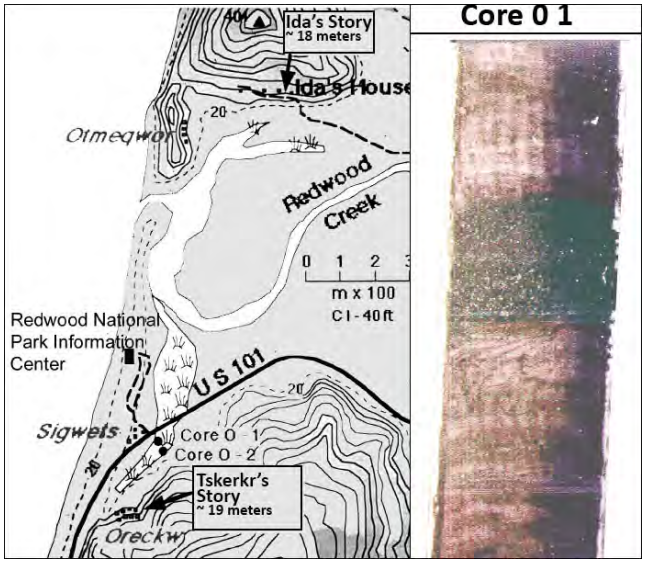


Figure 8. Left map shows location of Tskerkr's and Ida's stories and core sites. Core on the right shows tsunami sand deposit.

From the Redwood National Park Information Center, we drive north on U.S. Highway 101 to Lagoon Creek in the park.

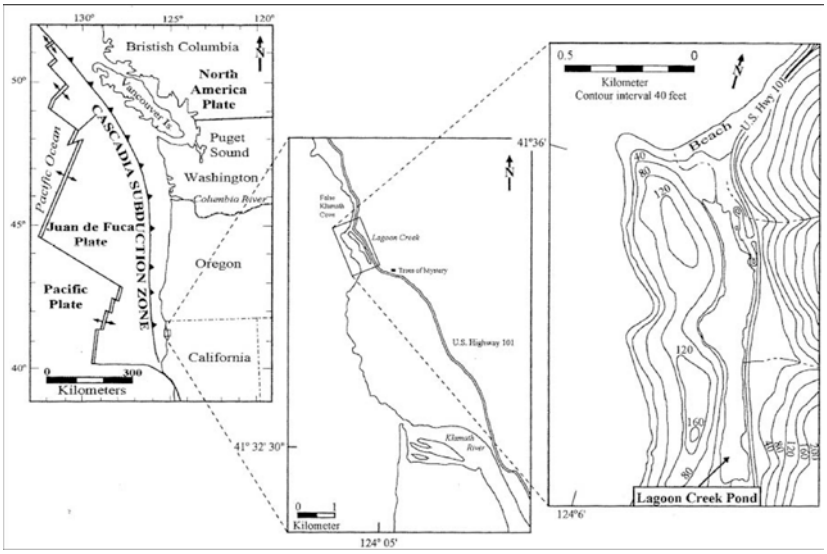
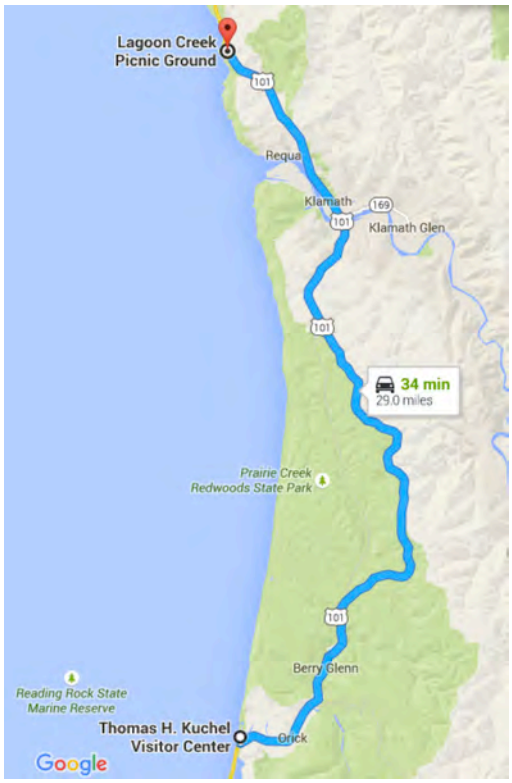


Figure 11. Location of Lagoon Creek.



STOP 3: Lagoon Creek

Lagoon Creek is likely the remnant channel of Wilson Creek that flowed to the south and drained into the Klamath River before coastal erosion cut off this reach and isolated it. The placid pond is blocked from the ocean by a 5 meter (over 16 ft) sand berm that was a mill site in the early 20th century (Figure 10). It provides an ideal sediment trap to collect deposits from tsunamis large enough to overtop the berm. Two HSU geology masters students Carrie Garrison-Laney and Hans Abramson Ward working under Dr. Gary Carver examined the stratigraphy and micropaleontology from 27 cores retrieved from the pond in 1987 (Figure 11).

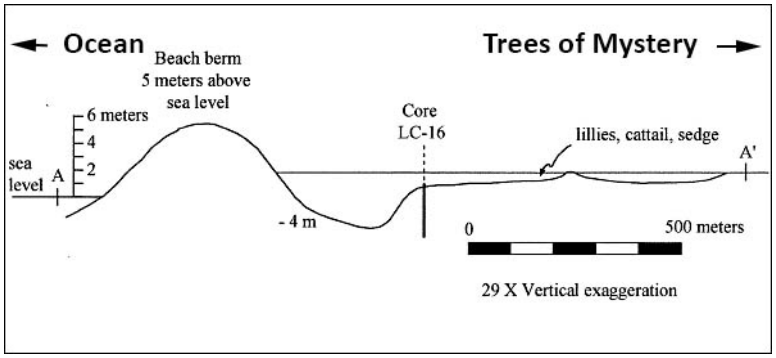


Figure 10. Profile of the Lagoon Creek channel, note vertical exaggeration. Core LC-16 was the site of the most detailed micropaleontology analysis. After C. Garrison-Laney, 1989

They found evidence for six tsunami events in the past 3500 years:

Event	Age	Inland extent (meters)
Y	315 BP* (1700)	870
W	~1100 years BP	1130
U	~ 1300 years BP	1060
S	~ 1600 years BP	1130
N	~ 2500 years BP	1100
L	~ 3200 years BP	>625

**Before Present*

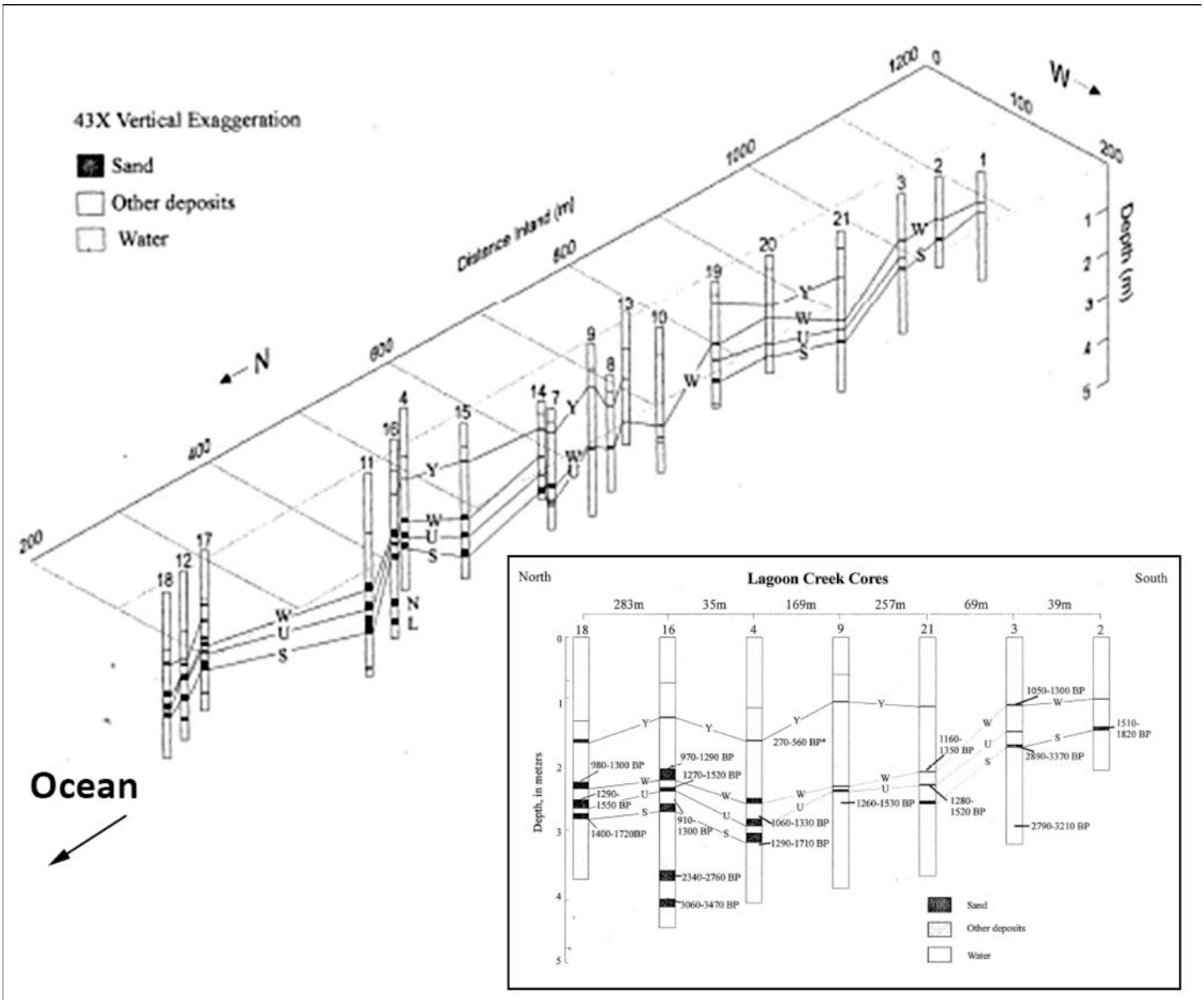


Figure 11. Core locations in Lagoon Creek. The coast is to the left. The black units are identified tsunami sand units and the letters correspond to the age of the unit inferred from stratigraphic position and radiocarbon dating. Three sand units (W, U, S) are observed in almost every core and are interpreted as more robust tsunamis than units only observed closer to the coast. After H. Abramson 1989.

The 5-meter berm appears to effectively protect Lagoon Creek from large tsunamis generated by distant tsunamis as there is no evidence of the 1964 tsunami in this location and all of the sand units correlate with identified Cascadia tsunamis from Oregon, Washington and British Columbia. One of the conclusions of the studies at this site is that not all Cascadia tsunamis are equal in size. The most recent Cascadia event corresponds to unit Y. It can be traced about midway through the lagoon but is not as extensive as units W, U, and S (1100, 1300, 1600 B.P.). Paleoseismology studies in Oregon also support this interpretation.

We also examine a gouge core pulled from a site near the open coast just south of Crescent City. This is near the location of the core you examined on campus. Unlike Lagoon Creek, the Crescent Beach site is exposed to the coast and has been impacted by large distant tsunamis as well as local tsunamis from the Cascadia subduction zone (Figure 12).

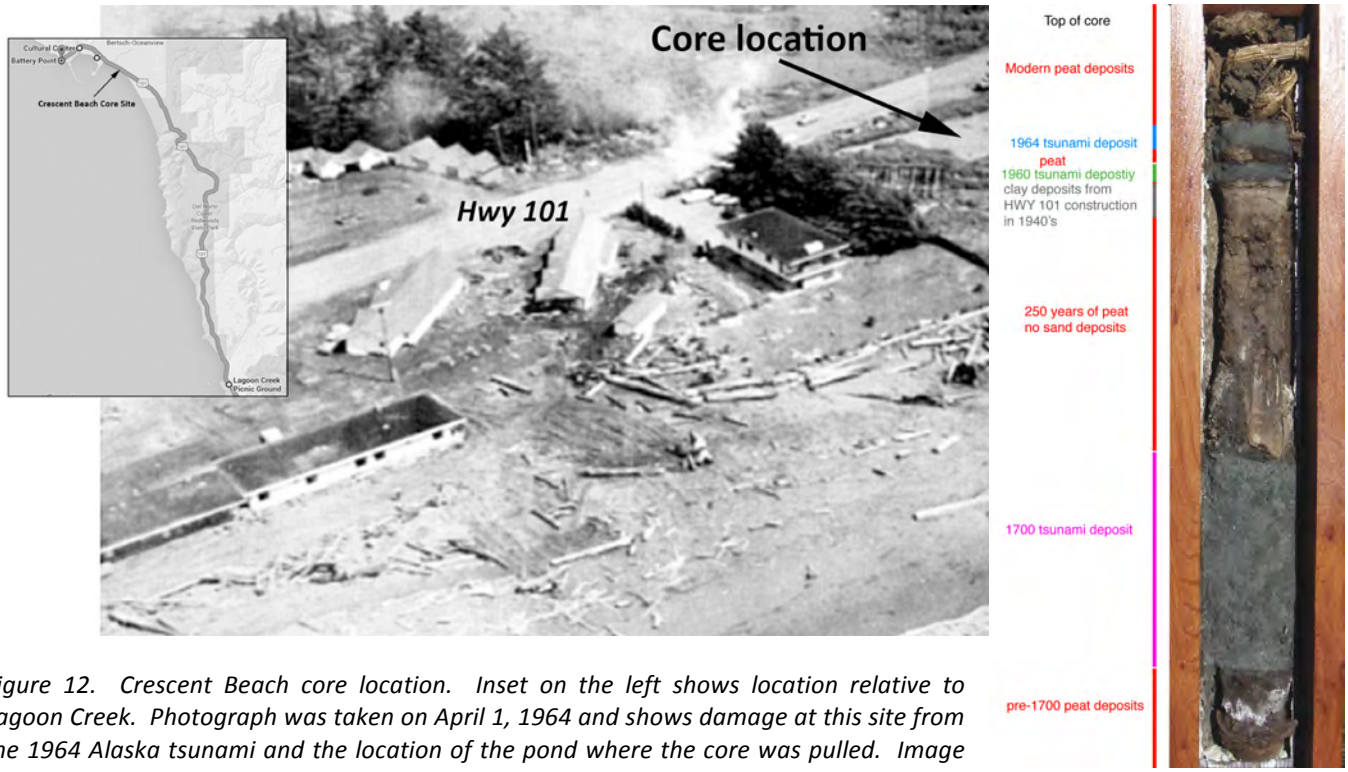
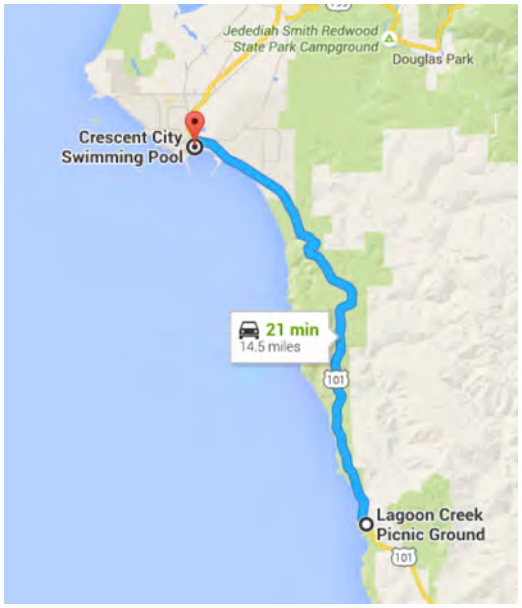


Figure 12. Crescent Beach core location. Inset on the left shows location relative to Lagoon Creek. Photograph was taken on April 1, 1964 and shows damage at this site from the 1964 Alaska tsunami and the location of the pond where the core was pulled. Image on the right shows the core you looked at on campus.

From Lagoon Creek, we continue north on U.S. Highway 101 to Crescent City. Turn left at Front Street to Crescent City's Beach Front Park and Swimming Pool next to the Crescent City Cultural Center for our lunch stop.

The Beach Front Park was part of the Army Corps of Engineers post 1964 tsunami reconstruction. The entire beach area south of Front Street was elevated about seven feet. There are no residences now permitted in this area now – it is zoned for recreational use only.



Stop 4: Crescent City Tsunami Walk

The 1964 tsunami is the most significant historic tsunami event to impact the west coast of the United States and Canada in the past 200 years of European settlement. On March 27, 1964 a magnitude 9.2 earthquake struck the Prince William Sound area of Alaska at 5:36 PM Alaska Standard Time (7:36 PM PST). This was the second largest earthquake ever recorded with modern seismic instruments; only the 1960 M 9.5 Chilean earthquake was larger. The fault rupture extended about 500 miles in length and 150 miles in width and uplifted some regions over 30 feet while other areas sank as much as 7 feet. Tsunamis were generated both by the fault rupture and also by numerous large submarine landslides. Impacts were greatest in Alaska where the highest tsunami water levels exceeded 200 feet in Shoup Bay in the Valdez inlet. Of the 115 deaths in Alaska attributed to the earthquake, over 90% (106) were caused by the tsunami.

The tsunami traveled outward from the source region at speed of about 415 miles per hour causing damage along the Southeast Alaska, British Colombia, Washington and Oregon Coasts. At 11:08 PM PST, about 3 1/2 hours after the earthquake, the California Disaster Office issued an emergency bulletin to all coastal police and local disaster office officials stating that a "tidal wave" was probable but not confirmed. At 11:50 PM a similar bulletin issued by the State Civil Defense Office estimated the arrival time of the first wave as 12:00 AM. These bulletins were received by the Del Norte County Sheriff's Department and the sheriff sent deputies to the low waterfront areas to tell people that a wave was expected. He did not order an evacuation and the deputies had not completed the door-to-door notification when the first wave arrived at 11:52 PM. Anecdotal reports suggest that most people had left the waterfront area before the first wave arrived.

The first wave caused modest flooding and deposited some debris on the beach and Front Street in the Downtown Crescent City area and near Citizens Dock. Its elevation is estimated at 14.5 feet above Mean Lower Low Water (MLLW) or about 8 feet above the ambient tide level (a high tide of about 6 feet at the time of the first wave arrival). After the first wave, the harbor emptied completely before the arrival of a second, smaller wave at 12:20 AM on March 28. This wave crested at 4 to 6 feet above the ambient tide and did not reach Front Street. Some people reentered the waterfront area, assuming the worst of the event had past. Others, hearing about the wave damage, came to sightsee.

There is some discrepancy about the arrival time and size of the later waves as the tide gage in the Crescent City harbor ceased recording a little after 1 AM. Eyewitnesses generally agreed that the third and fourth waves were both larger than the first wave, the third arriving at about 1:20 AM and the fourth and largest at 1:45 AM. From measurements of high water marks on land, it reached a height of about 22 feet above MLLW or nearly 16 feet above the ambient tide. By the time of the 4th wave, the sheriff had decided to close off the entire waterfront district to keep out sightseers and potential looters, but a general alarm was not issued until after the largest wave struck. Almost all of the damage was caused by this wave – 10 deaths, 54 homes destroyed and an additional 37 damaged forcing 150 people to seek shelter elsewhere. One hundred seventy nine businesses in a 29-block area were affected, 42 of which were totally destroyed. The cost (in 1964 dollars) is estimated at about $15 million. A contributing factor to the high loss of structures was that most buildings not secured to foundations and were highly vulnerable to being lifted by the water and displaced.

Elsewhere along the Northern California Coast, the impacts were not as great. One death was reported in the Klamath River and there was $4,000 in damage to piers and docks. The tsunami was observed at least 1.5 miles upstream of the Klamath mouth. In Humboldt County, the tsunami caused water to breach a ten-foot seawall at the Eureka Boat Basin and rise eight feet into the street.

Humboldt Bay was filled with logs and debris and nine changes in tidal height were reported over the night causing high current velocities within the bay. Fourteen-knot currents were reported in the channel opposite the Coast Guard Stations. At Trinidad, water was reported to have reached 16 feet above MLLW or 10 feet above the tidal height at the time of the tsunami. Eyewitness accounts reported significant flooding in Fairhaven on the Samoa Peninsula. In Mendocino County, the tsunami reached heights of at least 6 feet and damaged or sank over 120 boats on the Noyo River. One death was attributed to the tsunami in Bodega Bay over 13 hours after the first wave arrived. The tsunami caused seiching (oscillations) in San Francisco Bay and caused damage to boats and docks estimated at $1 million. Some damage to boats and docks was reported as far south as Santa Monica and Los Angeles.

Lessons from the 1964 tsunami

The most important lesson from the 1964 tsunami was that failure to evacuate kills people. People who were out of the inundation zone survived while many of those in the area of flooding did not. Impacts were exacerbated by later waves being much larger than the first. A study conducted by the Disaster Research Center at Ohio State University in 1964 examined the problems with the warning notification and evacuation and concluded:

- The first tsunami warning bulletins was received in Crescent City only 50 minutes before the expected arrival of the first wave. The time was insufficient for a controlled evacuation.
- The wording of the tsunami bulletins may have confused local officials. The bulletins warned of a "probable" but "unconfirmed" wave.
- In 1957, the Sheriff's Office had evacuated the downtown area and no significant wave had occurred. There were many recriminations that may have affected the response in 1964.
- The Del Norte Sheriff's Office only sent deputies to the water after the second bulletin arrived. They did not order an evacuation, but rather informed people that waves were possible. Past tsunami experiences may have also contributed to the losses. Tsunamis were not a new experience for Crescent City and the city had experienced some flooding from tsunamis in 1946, 1952, 1957 and 1960. The tsunami in 1960 was the most damaging in Crescent City's history and at the time may have set the standard for the "worst-case" event. The first waves in 1964 were very similar in impacts to 1960 and the second wave was smaller. It is not surprising that some people returned to the downtown area based on their previous experience.
- Wood-frame structures in the inundation zone were particularly vulnerable to damage because very few were secured to foundations and were easily floated by the water. Much of the damage was the result of floating debris – cars, logs, damaged structures – colliding with buildings.

What are the odds of another 1964 tsunami event?

Thirty-eight tsunamis have been observed or recorded on California's North Coast since 1855. All but four were distant tsunamis (the source was far away). Crescent City in Del Norte County has suffered more tsunami damage in the past 150 years than any other area of the US West coast outside of Alaska. Major damage occurred in the 1960 and 1964 distant tsunamis and significant wave activity was observed in 1946, 1952, and 1957. Looking only at the record from 1940 – 1970, one might conclude we are long overdue for another damaging distant tsunami. However our historic record is not long enough to make good probability estimates and distant tsunami studies from Oregon and California suggest that 1960 and 1964 type tsunamis might be uncommon events. So the short answer is that we do not know, but the potential damage is great enough that we need to be prepared.

Are we better prepared today?

There is no question that the US Tsunami Warning system has significantly improved since 1964. Local emergency managers and public safety officials routinely receive bulletins from potentially tsunami-producing earthquakes in the Pacific Ocean within 15 minutes of their occurrence. For earthquakes originating in Alaska, the time is even shorter. This information is rapidly disseminated on NOAA Weather Radio and through the Emergency Alert Radio system. In 1996, Congress provided funding for the National Tsunami Hazard Mitigation Program. As a result of this program, about 40 deep ocean sensors (the DART system) have been deployed within the Pacific to record tsunamis in real time and provide information on the damage potential of a tsunami. The program has also supported tsunami inundation modeling and mitigation programs in all coastal states and territories. Inundation maps are now available for most coastal communities, and tsunami signs are posted in many west coast tsunami zones. The bottom line? We should be in much better shape for the next distant tsunami like 1964. But we have got much work to do to prepare for the next local tsunami from the Cascadia subduction zone.

Crescent City Tsunami Walk and 1964 tsunami impacts

In 2014, as part of the 50-year commemoration of the 1964 tsunami, Crescent City developed a tsunami walk with kiosks explaining what had happened during the tsunami. We will visit most of the kiosks on a short walk around the Crescent City downtown area that was most impacted by the tsunamis (next page).

The Army Corps of Engineers was responsible for the redevelopment of the downtown area after the tsunami. Most of the structures within the 29-block area devastated by the tsunami were removed. Figure 13 is a snapshot of the changes wrought by the tsunami and post event rebuilding from the perspective looking east at 2nd and H Streets.

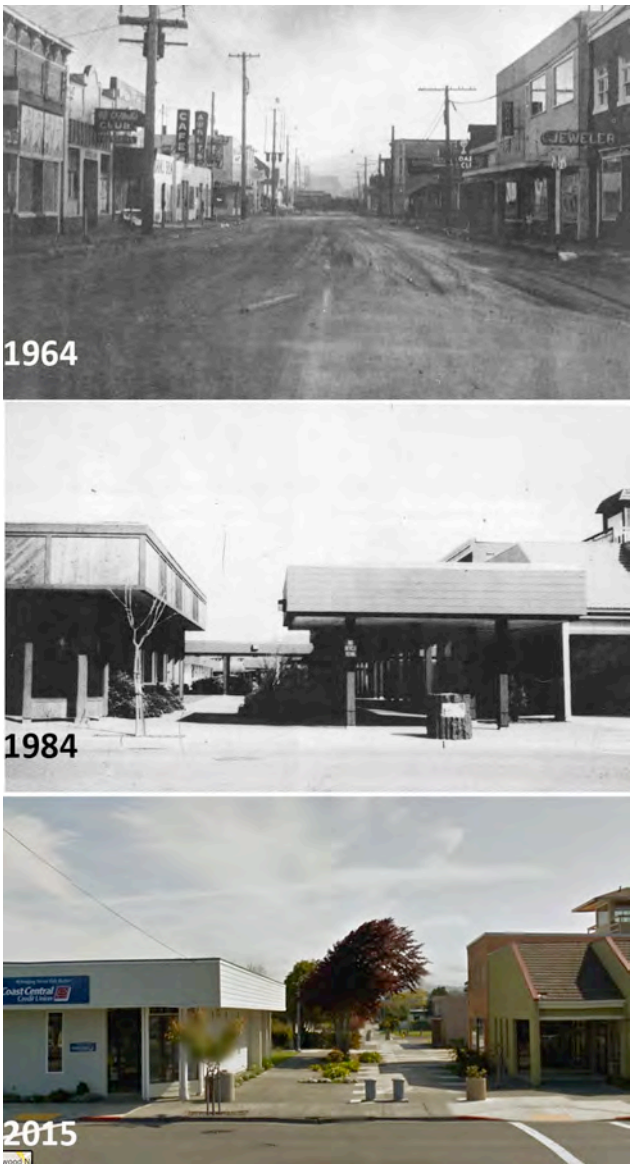


Figure 13. 2nd and H Street looking east. Top photo taken a few days after the tsunami shows the through going 2nd Street and the mixed commercial neighborhood before the tsunami. Twenty years later (in 1984) 2nd Street had been replaced by the Tsunami Landing promenade walk was nearly void of businesses. The promenade was removed in 2013.

1 Jetty Dolos and Tetrapod
Front Street, Below J Street

You'll find this behemoth located just east of the Cultural Center on Front Street.

These 40-ton "jacks" were built on-site to bolster the harbor breakwaters. A 25-ton Tetrapod was pushed off its display pad during the '64 Tsunami.

2 Elk Creek Bridge
Just East of Dolos on Coastal Trail

Walk southeast on the paved path to the newly built Elk Creek foot bridge.

This is where the worst loss of life happened when five people drowned while receding tsunami waters pulled their boat under the highway trapping them.

3 Tsunami History Kiosk
Second & K Streets

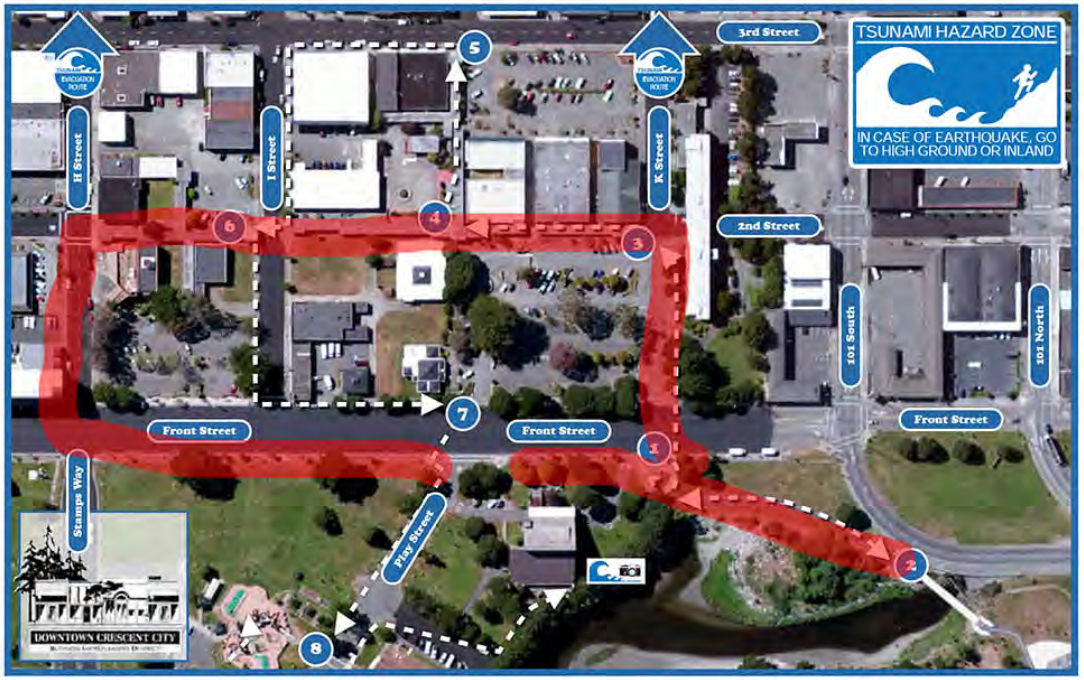
Head back west, then north up K Street to Second Street.

You'll learn how the offshore topography makes this area a tsunami magnet that over the years has ravaged both the Downtown and Harbor, which was heavily damaged in 2011.

4 Memorial Fountain
Tsunami Plaza

Take a short walk east along what used to be 2nd Street to Tsunami Plaza, one of the new wide-open spaces built after the 1964 tsunami.

This fountain was erected by the citizens of Crescent City as a remembrance to the eleven people who lost their lives. You'll learn the story of how citizens rebuilt their town and will never forget those they lost.



5 Historical Downtown
Third & J Streets

Head north through modern Downtown, on what used to be J Street, up to 3rd & J Streets for this kiosk.

Before the 1964 tsunami, Downtown Crescent City was a thriving area of over 250 shops, motels, cafes and bars that catered to fishermen and lumberjacks. Today's views are very different because nearly 29 blocks were wiped away that night by the tsunami.

6 Mural & KPOD Building
Second & I Streets

Head west on Third Street and down I Street to see buildings that survived the '64 Tsunami and a mural that immortalizes it.

Bill Stamps broadcast on KPOD radio that night until power was knocked out and he barely escaped with his life.

7 A Tsunami Resistant Town
Front Street and J Street

Head south down to Front Street and head east to the kiosk.

The Downtown architecture after the '64 tsunami reflects the ideas for minimizing damage of any future tsunami debris with deflecting sea walls and wide open spaces to slow surges.

8 Beachfront Park Buffer Zone
Kids Town, Beachfront Park, Pool

Crossing south across Front Street, take the sidewalk south to the Kids Town entrance across from Fred Endert Municipal Pool.

While rebuilding, tsunami debris was used to fill in the park to raise it 10 feet higher and build the surrounding sea walls 16 feet high.

Coming Soon! - The life-size 1964 Crescent City Tsunami Wave Mural on the east wall of the Cultural Center, which was officially 20.7 feet high!

After the Crescent City Tsunami Walk, we take the short drive to Crescent Harbor. Time permitting, we will briefly look at the famous tetrapod displaced by the 1964 tsunami.

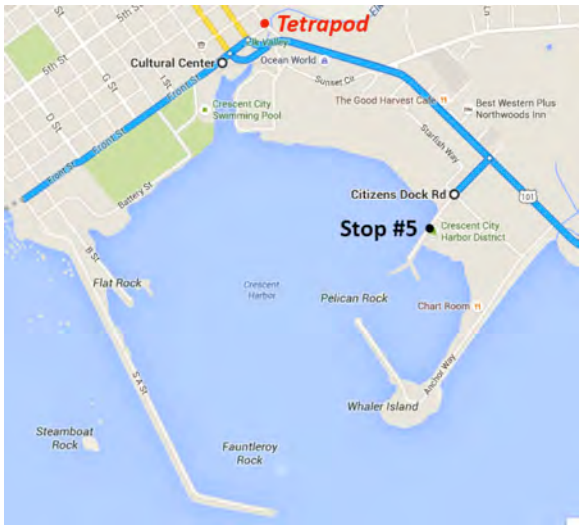


Figure 14. The tetrapod at the corner of N and Front Street was displaced about 3.5 meters in the 1964 tsunami. The photo of the right was taken the day after the tsunami and shows the culprit – the log whose impact provided the necessary force to move the 25-ton object.

Stop #5: Citizen's Dock and Crescent Harbor

This area bore the brunt of the 1964 tsunami. It also experienced moderate to major damage in four other tsunamis.

Damaging Tsunamis in the Crescent City Area

November 4, 1952 Source: Kamchatka, Russia, strong currents in harbor capsized 4 boats

May 23, 1960 Source: Southern Chile, flooding at Citizens Dock and to second street. $30,000 in damages.

March 28, 1964 Source: Prince William Sound, Alaska; 29 blocks in Crescent City flooded, 11 deaths in Del Norte County, $17 million in damages.

November 15, 2006 Source: Kuril Island north of Japan, strong currents destroyed/damaged docks in boat basin, ~$20 million in replacement costs.

March 11, 2011 Source: Japan, strong currents destroyed what remained of the boat basin ~ an additional $15 - $20 million in damages

Crescent City is well known in the tsunami world as a site that amplifies the tsunami – at least for tsunamis coming from far away. There are five reasons why Crescent City is a "tsunami magnet":

1. Location on the coast. Crescent City juts out into the Pacific Ocean. It is the second most western point in California, losing to Cape Mendocino by only 19 km (12 mi). Unlike Cape Mendocino, Crescent City is low-lying and the only relatively populated exposed community north of Mendocino County. The populated areas of Humboldt County are protected by the spits and Humboldt Bay.

2. The shape of the Pacific sea floor offshore of Humboldt and Del Norte Counties. Look at a Google Earth image showing Humboldt and Del Norte Counties. You should be struck by the unusual sea floor bathymetry (depth to the sea floor) off of our coast. Zoom out a bit more and you will see a giant scar

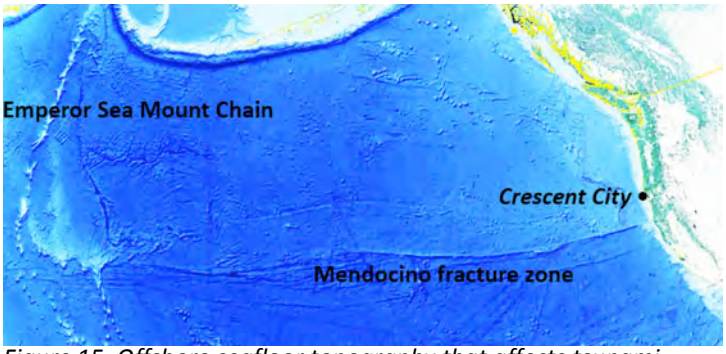


Figure 15. Offshore seafloor topography that affects tsunami amplitudes on California's North Coast.

stretching west from Cape Mendocino over 4000 km (2500 mi) into the Pacific Ocean. This is the Mendocino Fracture Zone - created by millennia of plate motions.

The result is that the Pacific Ocean to the north of the fracture zone is a little bit shallower than to the south. This difference becomes most extreme just off Cape Mendocino, where the escarpment (known as the Gorda Escarpment) reaches more than 1000 m (3000 ft). Tsunami speed is related to the depth of the sea floor. Tsunamis travel faster in deep water. A tsunami traveling to the south of the fracture zone is moving faster and to the north more slowly. Along the Humboldt and Del Norte coasts, the shallow water slows the tsunami, which causes more water to build up behind the wave front. By the time a tsunami hits the US west coast, it will be a little bit larger along the north coasts than to the south. The effect is probably not large - but even a 5 or 10% difference can be significant in large tsunamis. The effect is likely larger on the Humboldt than on the Del Norte coast - but Humboldt does not have the Crescent City's exposure (reason 1).

There is a second effect of the sea floor shape - Going a little further west from the end of the Mendocino fracture zone, you can see a chain of sea mounts extending to the north. This is the Emperor Sea Mount Chain and its orientation and shape tends to focus tsunami energy from the northwestern Pacific Ocean (Japan, Kuril Islands, Kamchatka) toward our coast.

3. The shape of the continental shelf and the coast off the Humboldt and Del Norte coast. If you look at a map of California's North Coast, note the curvature of the Humboldt and Del Norte coast line and the relatively flat, smooth appearance of the shelf. The shelf is actually slightly bowl shaped. Tsunami energy hitting this coast excites secondary oscillations in this large gentle "bowl" - rattling around for days when a large tsunami strikes. These secondary waves add to the continuing wave train of the primary tsunami resulting in constructive interference. The result is that the largest surges at Crescent City always arrive at least a few hours after the first and the signal lasts a long time. The 2011 tsunami could be clearly seen on the Crescent City tide gauge for at least 6 days. The same effect occurs on the Humboldt coast too - but the only tide gauge is inside Humboldt Bay, which is very shallow and dampens tsunami energy quickly.

4. The shape of Crescent Harbor. The gentle, relatively open south-facing harbor also traps tsunami energy. Half Moon Bay has a similar behavior - but does not get the added oomph of points 1 - 3 above. The bay does two things: it focuses the tsunami into the bay and sets up another set of secondary oscillations which further interferes with the primary tsunami and the shelf oscillations.

5. The design of the Small Boat Basin. The small boat basin to the north of us was built as part of the Crescent City renovations after the 1964 tsunami. It was intended to protect the fishing fleet from storm waves which can become quite large in the relatively unsheltered open bay. It does a good job of protecting boats from the relatively short period wind waves and swells caused by storms. But long period tsunami waves are first focused into the natural harbor and then further squeezed into the narrow entrance of the basin. Tsunami modeling has demonstrated a six-fold increase in the water speed inside the boat basin

Figure 16. Citizens Dock on April 1, 1964 after the tsunami. The tide gauge was located near the end of the badly damaged Lumber Dock.

compared to the larger outer bay. In addition, the relatively solid walls of the boat basin means that wave energy is reflected with little dissipation in the basin.

A tide gauge was installed on Citizens Dock in 1933 (Figure 16). The original instrument sat near the end of the Lumber dock – the northern fork of the dock. Tide gauges provide a record of water level in as a function of time. In addition to measuring the tidal fluctuation, they also record tsunamis and storm surges. Since 1933, the gauge at Crescent City has recorded 38 tsunamis. Figure 17 shows four Crescent City marigrams. All four show typical characteristics of Crescent City tsunamis – long duration and the largest amplitude signal occurring hours after the initial wave.

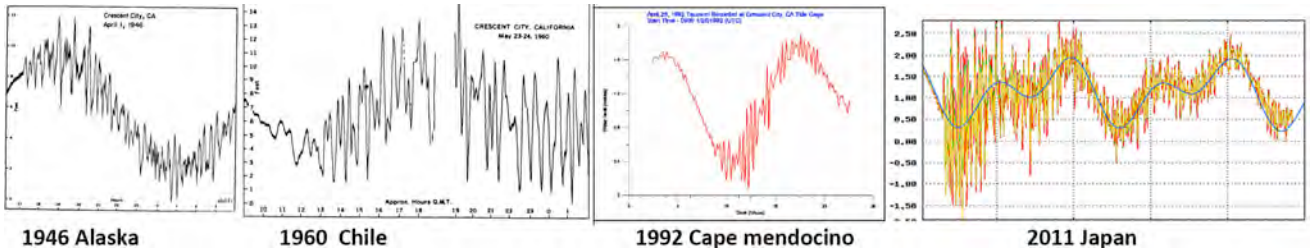


Figure 17. Marigrams recorded at Crescent City. Only the 1992 tsunami was produced by a nearby earthquake.

The largest tsunami ever recorded at Crescent City was from the 1964 Alaska tsunami. The first tsunami wave arrived at 11:50 p.m. PST and arrived at high tide, with the water height reaching 15.5 feet above Mean Lower Low Water (MLLW). This first surge caused flooding as far as Front Street – nearly the same as the peak inundation produced only four years earlier from the 1960 Chilean tsunami. The second wave arrived a half hour later and was smaller. Water heights were low for over a half hour and many residents thought the tsunami was over and returned to the flooded area. Unfortunately, the third surge was larger than the previous waves and overtopped the dock, knocking over the tide gauge instrument housing. Eyewitness accounts agree that there were four significant waves and that the third and fourth were the largest. The maximum water, inferred from the peak debris line, is about 6.7 m (22 ft) above MLLW.

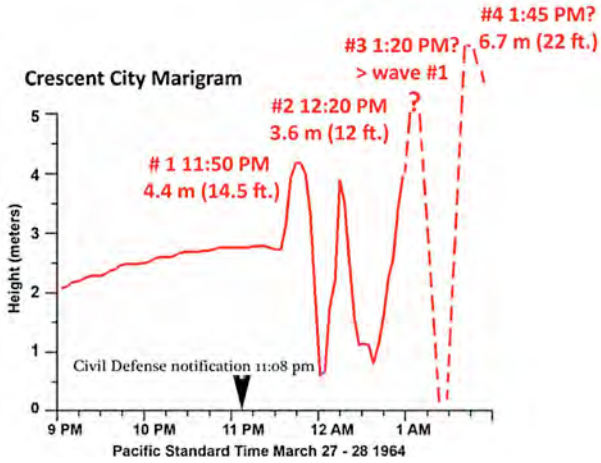
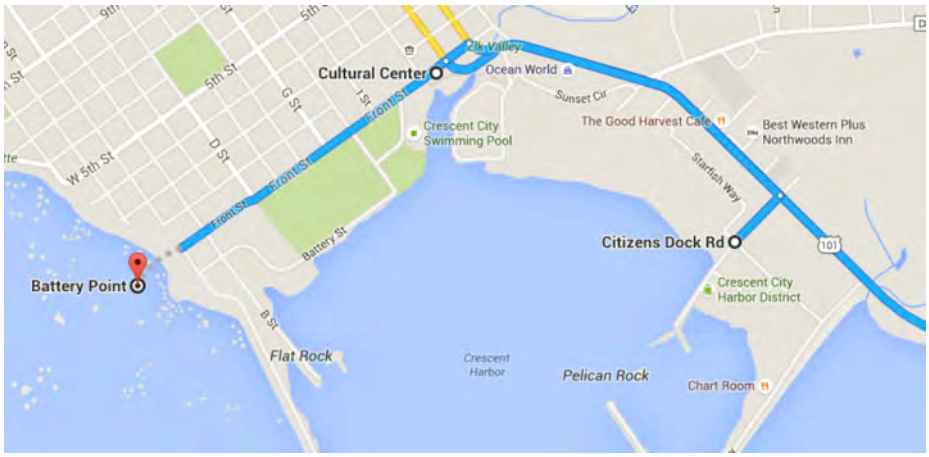


Figure 18. Crescent City marigram for the 1964 Alaska tsunami. Solid lines are the actual recording. The instrument was knocked over as the third surge arrived. The dashed lines are estimates based on eyewitness accounts.

From Crescent Harbor, we drive along Front Street to the parking lot next to Battery Point Lighthouse and walk the short distance across the isthmus to the island. Access to the lighthouse is only possible at low to moderately low tides.



Stop #6: Battery Point Lighthouse

Figure 19. Battery Point Lighthouse.

Battery Point Lighthouse, built in 1856, is located just west of the Crescent City breakwater. Battery Point Island, elevation 32 feet, got its name from a "battery" of guns–three brass cannons salvaged from the 1855 wreck of the America–which were place on a point of land near the island. The parking area across from the island was a Tolowa village. Before the Crescent City pier was built, the Point was on a peninsula, connected to the mainland by sand. Passengers and freight were ferried between ships and the shore in small boats. The lighthouse was built to guide navigation through the dangerous, rocky entrance to the harbor. After the outer breakwater was built, sand no longer replenished the connection and the Point became an island at all times except low tide. The lighthouse beacon, 75 feet above sea level, can be seen 14 miles offshore. It remained in service until 1965 when the Coast Guard ceased to use the station. In 1982, the lighthouse was reactivated as a Private Aid to Navigation, and is supported by the Del Norte Historical Society.

In March, 1964, Peggy and Clarence Coons were the resident curators of the lighthouse. Peggy Coons wrote the following description of the tsunami.

CRESCENT CITY'S DESTRUCTIVE HORROR OF 1964 (THE VIEW OF THE TIDAL WAVE FROM THE LIGHTHOUSE AS DESCRIBED BY PEGGY COONS, CURATOR OF BATTERY POINT LIGHT HOUSE IN 1964)

-from the Del Norte Historical Society files.

Good Friday, March 27th, 1964, the morning was mild. The tradewinds that prevail along the Pacific Coast had subsided. Little did I realize, as my husband Roxey and I went about our chores at the lighthouse, that before the next day had dawned high on Battery Island, we would watch four waves play havoc with the town and its people. Smashing the city's business center along with some of the beach front homes in Crescent City, CA, and we would have a spectacular view of the whole performance. And as curators here

at the lighthouse we would be called on by friends and tourists alike to relive this one night of horror almost everyday since.

Perhaps I should stop to explain Battery Island, three hundred yards from the mainland, is solid rock at the base and about three quarters of an acre, fifty-eight feet at the highest point near the flagpole. The lighthouse, completed in 1856, is 74 feet above mean sea level. The only access to this Historical Monument is walking across the ocean floor at low tide.

We spent the early part of the day planting a garden. Friday was our shore leave, so we crossed to the mainland at three o'clock to shop for Easter. Late that evening we struggled back across the rocky ocean floor with our supplies and stopped to rest before climbing another two hundred yards to the lighthouse. Exhausted, we turned in shortly after nine o'clock unaware an earthquake and tidal wave had devastated Alaska. We might have slept through the whole thing if I hadn't gotten up to go to the bathroom a little before midnight. I stood at the window, a full moon shining on the water below me. Somehow the first moment I saw the ocean I sensed something was wrong, for all the rocks around the island had disappeared. They were covered with water. I realized it was almost time for high tide, but the rocks are always visible even in the severest of storms. Suddenly I became alarmed and called Roxey. We quickly slipped on some clothes, rushed down the stairs, and grabbed our jackets as we ran outside.

The air was still, the sky had an unusual brightness about it. It was light as day. The water shimmering in the moonlight was high over the outer breakwater. We headed for the highest point overlooking the town. The first wave was just reaching the town. Giant logs, trees and other debris were pitching and churning high on the crest of the water as it raced into the city. "My God, no!" I cried, "It will flood the town." As the impact began, the loud blast of breaking glass and splintering wood reached us, buildings crumpled, cars overturned, some smashed through plate glass windows, while the water plowed down the streets. Within minutes the water came back just as fast as it had gone in, bringing all manner of things with it. It drained away with terrific speed. The whole beach front was strewn with logs, cars, buildings, trash of every description. Some of the fishing boats were tossed high on the land, others drifted to sea. A few cars and two small buildings that were swept off Citizen's Dock floated away with the water. The water was gone. We could see it piling up a half mile or more beyond the end of the outer breakwater, higher and higher as the minutes passed.

We stood there stunned with fright for we knew there was no way out of here if the water came this high. The light house, serene in the moonlight, had been battered with severe storms for over a century: could it protect us now? We have lived on the island since 1962 and watched the storms come and go, but this was unlike anything we had ever experienced. The light flashed in the tower. We knew we would have to notify the Coast Guard if there was any failure or discrepancy in it. I don't know how long we stood there for we were just too frightened to move, when the second wave churned swiftly by us, gobbling everything in its wake. It picked up all the ruins along the beachfront and shoved them right back into town. It didn't seem as large as the first one to us, but it caused considerable damage. Some of the lights faded out along Front Street. As the backflow began we raced frantically around the place, watching the water drain from the bay. We glanced at the tower: the light was still flashing.

We watched the Coast Guard Cutter, a big lumber tug, and some of the fishing boats that had received warning and left the harbor riding the tides a good three miles or more off shore. We were getting more frightened now, for the water had receded farther out than before. We knew it had to come back, but when? We screamed at one another in our fright, wondering if it would ever stop, for there was an ominous stillness about it, warning us of more to come.

As the third wave raced swiftly by us, it was much larger than the second, a horrifying thing, crushing everything in it's path. When it reached the south end of town, sparks started flying in the air, igniting a

fire. It spread rapidly, lighting up the water and sky around the bay. All of the lights faded out along the 101 highway.

The water withdrew suddenly, as though someone had pulled the plug out of the basin. The water was here, then gone. We ran around the lighthouse again wondering if we were safe. We kept anticipating something more violent would happen, for the water had receded far out, three fourths of a mile or more beyond the end of the outer breakwater. We were looking down as though from a high mountain into a black abyss of rock, reefs, and shoals, never exposed even at the lowest of tides. A vast labyrinth of caves, basins and pits undreamed of in the wildest of fantasy. In the distance a dark wall of water was building up rapidly, so the Coast Guard cutter, the lumber tug, and small craft appeared to be riding high above it, with a constant flashing of white at the edge, as the water kept boiling and seething, caught in the rays of the moonlight.

The basin was dry. At Citizen's Dock the large lumber barge, loaded with millions of board feet of lumber, was sucked down in the bay. The fishing boats still in the small craft harbor, were pulled down on the floor of the ocean. We clung to one another, asking God to have mercy on us. We prayed for the town and its people. We realized the water would return with more destruction to follow. We kept straining ourselves trying to visualize what would happen next, while the water piled higher and higher in the distance.

Suddenly there it was, a mammoth wall of water barreling in toward us, a terrifying mass of destruction, stretching from the floor of the ocean upwards: it looked much higher than the island, black in the moonlight. Roxey shouted, "Let's head for the tower." It was too late. As we turned toward the tower, he yelled, "Look out!" We both ducked. It struck, split and swirled around both sides of the island with such speed we felt like we were sailing right along with it. It took several minutes for us to realize the island hadn't moved. It crashed the shore, picking up the driftwood logs and other debris lodged in our roadway and along the beachfront. It looked as though it would push them on the pavement at the end of A street leading past the Seaside Hospital. Instead it shoved them around the bank and over the end of the outer breakwater through Dutton's Lumber Yard it tossed big bundles of lumber, some splitting up with planks like matchsticks flying in the air, while others sailed gracefully away. The water overflowing Dutton's Dock was high above it. At Citizen's Dock, the large lumber barge, loaded with lumber came up and sat on top of the dock. The dock humped up, then relaxed right off its pilings. The fish storage houses, on the fish wing, were dancing around in the fury. The fishing boats still at their moorings were bobbing around like corks. Some sank right where they were while others flew onto the beach, while others came out, careened about and flew on the other side of the bay. One boat took off Elk Creek at the end of town as though someone was at the helm.

When the Tsunami assaulted the town it was like a violent explosion, a thunderous roar mingled with all the confusion. Everywhere we looked buildings, boats, lumber, everything was shifting around like crazy. The whole front of town moved, changing before our eyes. By this time the fire had raced across the water to the ruptured Texaco Bulk tanks: they started exploding one after the other. The whole sky lit up. It was fantastic.

As the tide turned it was sucking everything back with it: cars, buildings were moving seawards. The old covered bridge, from Sause Fish Dock, that had floated high on the land, came back to drop almost in place. Furniture, beds, mattresses, TVs, radios, clothing, bedding, and other objects were moving by us so fast we could barely discern what some of it was. A siren was blowing. There were lights now in the front of town or along Highway 101. The light in the tower continued to burn. The block on this end of town near the Seaside Hospital was unharmed. Across the bay the fire was till raging higher and higher as each tank exploded. Time passed quickly, for everywhere we looked was a shambles; houses, buildings, lumber, boats, all smashed or moved blocks from where they had been by the onrush of water.

The fifth wave rushed swiftly by us back into town. It just pushed things around. We could observe no noticeable damage this time, but off and on the rest of the night the water kept surging in and out and slopping around in the harbor. At daybreak we made coffee and fixed our breakfast, but we kept checking each change of the tide. We had never seen so many in our knowledge of the sea. The boats continue to ride the surf off shore, waiting for another big one. A fishing craft careening around in the harbor finally sank. The boat up Elk Creek had settled among the ruins of the new Olympic Pool. The cars along with the two small buildings, that were swept off the dock had faded from sight. Logs, boats, furniture along with the buildings all tossed helter skelter. The lumber from three big yards was tossed high on the land or floating in the water. Some of the landing and small craft floats were sailing away in a dizzy pattern.

Isolated on the island we watched the search begin along Elk Creek for the bodies of the victims. The demolition crews started clearing the streets and burning the debris along the beachfront and the 101 highway. The silent killer had left after taking its toll of life and property, but the vacant lots, the broken fish docks, along with abandoned fishing boat hulls still reminds us of the gruesome night the Tsunami destroyed 56 blocks of Crescent City, CA.

It still seems hard to believe that with all the salvage that floated by us out to sea, the only bit to reach the island was one spool of lavender thread.

Tsunami Walk Sponsors

Businesses & Organizations

This Self-Guided Tsunami Walking Tour Couldn't Have Happened Without Generous Support From:

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Rural Human Services
Sutter Coast Hospital
Uncharted Shores Academy

Special thanks for providing photos and research goes to the

Del Norte Historical Society

Visit them at 577 H Street for more on Tsunamis and Local History!

TSUNAMI EVACUATION ROUTE

Know Your Zone!

Tsunami Evacuation Maps & Information

Since 1933, 32 tsunamis have been observed in Crescent City. Five of those caused damage, and one of them, in March 1964, remains the "largest and most destructive recorded tsunami to ever strike the United States Pacific Coast," according to the University of Southern California's Tsunami Research Center.

This is why it is important to "Know Your Zone," while you are visiting. A tsunami could happen at anytime and most of Downtown Crescent City is in the tsunami run-up zone. If an near-shore earthquake occurred, you would only have minutes to get to safety!

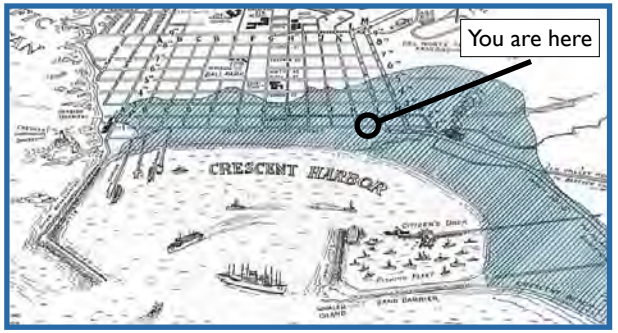
The main "rule of thumb" is when you feel a sizable earthquake, head north for high ground at 9th Street. Leave your car and walk briskly, because many of the roads could be clogged with cars or building debris. Do the same if you hear the tsunami sirens go off! There will be no mistaking when they do. Don't panic and follow the "Tsunami Evacuation Route" signs to safe ground.

The map below is from a Tsunami Safety brochure that you can download from the Del Norte County Office of Emergency Services website along with other helpful tips for a worry-free stay. Just scan the QR Code in the top right corner to open it up on your smartphone. Be Tsunami Safe and Know Your Zone!

Downtown Business Improvement District's

Tsunami Walking Tour

It started with a 9.2 magnitude earthquake in Alaska that sent tsunami waves surging towards Crescent City. In less than five hours, during the early morning hours of March 28th, 1964, three smaller waves pushed into storefronts and businesses causing little damage and a sense of calm in the people trying to clean up. Then the big wave, cresting at nearly 21feet, slammed into the Downtown, killing eleven people and devastating 29 city blocks.



This was the worst tsunami disaster recorded in the U.S., causing millions of dollars in damage and shaping what Crescent City's Downtown looks like today. Over 289 buildings and homes were destroyed after being pushed off their foundations or damaged by rising waters, resulting in most of the Downtown being rebuilt.

But many relics and improvements from the 1964 Tsunami remain ready for you to discover on this short historical tsunami walking tour through Downtown Crescent City, also known as "Comeback Town, U.S.A.

You'll see high-water marks posted on buildings that survived the onslaught, huge objects pushed around from the power of the surges and memorials to the people who lost their lives during this tragic event.

Start at the huge, white Jetty Dolos on Front Street and follow the map inside to find the informational kiosks along the way. Scan Quick Read (QR) Codes at each point to get a more immersive experience with interactive audio, video and pictures on your smartphone or internet-connected tablet.

OPEN UP TO BEGIN YOUR WALK INTO HISTORY

1 Jetty Dolos and Tetrapod
Front Street, Below J Street

You'll find this behemoth located just east of the Cultural Center on Front Street.

These 40-ton "jacks" were built on-site to bolster the harbor breakwaters. A 25-ton Tetrapod was pushed off its display pad during the '64 Tsunami.

2 Elk Creek Bridge
Just East of Dolos on Coastal Trail

Walk southeast on the paved path to the newly built Elk Creek foot bridge.

This is where the worst loss of life happened when five people drowned while receding tsunami waters pulled their boat under the highway trapping them.

3 Tsunami History Kiosk
Second & K Streets

Head back west, then north up K Street to Second Street.

You'll learn how the offshore topography makes this area a tsunami magnet that over the years has ravaged both the Downtown and Harbor, which was heavily damaged in 2011.

4 Memorial Fountain
Tsunami Plaza

Take a short walk east along what used to be 2nd Street to Tsunami Plaza, one of the new wide-open spaces built after the 1964 tsunami.

This fountain was erected by the citizens of Crescent City as a remembrance to the eleven people who lost their lives. You'll learn the story of how citizens rebuilt their town and will never forget those they lost.

5 Historical Downtown
Third & J Streets

Head north through modern Downtown, on what used to be J Street, up to 3rd & J Streets for this kiosk.

Before the 1964 tsunami, Downtown Crescent City was a thriving area of over 250 shops, motels, cafes and bars that catered to fishermen and lumberjacks. Today's views are very different because nearly 29 blocks were wiped away that night by the tsunami.

6 Mural & KPOD Building
Second & I Streets

Head west on Third Street and down I Street to see buildings that survived the '64 Tsunami and a mural that immortalizes it.

Bill Stamps broadcast on KPOD radio that night until power was knocked out and he barely escaped with his life.

7 A Tsunami Resistant Town
Front Street and J Street

Head south down to Front Street and head east to the kiosk.

The Downtown architecture after the '64 tsunami reflects the ideas for minimizing damage of any future tsunami debris with deflecting sea walls and wide open spaces to slow surges.

8 Beachfront Park Buffer Zone
Kids Town, Beachfront Park, Pool

Crossing south across Front Street, take the sidewalk south to the Kids Town entrance across from Fred Endert Municipal Pool.

While rebuilding, tsunami debris was used to fill in the park to raise it 10 feet higher and build the surrounding sea walls 16 feet high.

Coming Soon! - The life-size 1964 Crescent City Tsunami Wave Mural on the east wall of the Cultural Center, which was officially 20.7 feet high!

8th Item III

State Of California

ALFRED E. ALQUIST SEISMIC SAFETY COMMISSION

Governor Edmund G. Brown Jr.

State Capitol, Room 437, Sacramento, California
Minutes of Regular Meeting
August 13, 2015

Members Present

Timothy Strack, Chairman
Tracy Johnson, Vice Chair
Greg Beroza
Michael Gardner
Mark Ghilarducci
Randall Goodwin (arrived at 10:10 a.m.)
Elizabeth Hess (for Ken Cooley)
Mark Johnson (for Mark Ghilarducci)
Helen Knudson
Jim McGowan
Kit Miyamoto (arrived at 10:56 a.m.)
Ian Parkinson
David Rabbitt (arrived at 10:80 a.m.)
Fuad Sweiss (arrived at 10:20 a.m.)
Mark Wheetley

Members Absent

Anthony Cannella
Peggy Hellweg

Staff Present

Richard McCarthy, Executive Director
Robert Anderson, Engineering Geologist
Henry Reyes, Special Projects Manager
Fred Turner, Structural Engineer
Salina Valencia, Legislative Director

I. CALL TO ORDER AND ROLL CALL

Commission Chairman Timothy Strack called the meeting to order at 10:04 a.m. and welcomed all participants. Legislative Director Salina Valencia called the roll and confirmed the presence of a quorum.

II. CHAIRMAN'S REMARKS

Chairman Strack announced that Senator Anthony Cannella had been appointed to the Commission, and he welcomed Commissioner Cannella. He noted that Commissioner Cannella hoped to attend the next meeting.

III. APPROVAL OF JUNE 11, 2015 MEETING MINUTES

ACTION: Commissioner Michael Gardner made a motion, seconded by Commissioner Helen Knudson, that:

The Commission approve the minutes of the June 11, 2015 meeting as presented.

* Motion carried, 11 - 0 (Commissioners Randall Goodwin, Kit Miyamoto, David Rabbitt, and Fuad Sweiss absent during voting).

Chairman Strack advised that Item VIII on the agenda would be taken before Item VII.

IV. MULTI-HAZARD SENSOR NETWORK AT LAKE TAHOE AND CENTRAL NEVADA

Executive Director Richard McCarthy noted that the Commission is interested in partnering with the Nevada Earthquake Safety Council on projects of mutual interest. He said Nevada is working on an early warning network too, and he introduced Mr. Graham Kent, Nevada Earthquake Safety Council, and invited him to discuss that effort.

Mr. Kent said Nevada is building a multi-hazard early warning network based on sensor stations and high-resolution HD cameras that transmit data through microwave and fiber-based systems that are not as likely to fail in catastrophic events as cellular service. He noted that the network is scalable and user-tailored, and it will provide warnings of fires, earthquakes, and extreme weather. He displayed a map of sensor stations in Nevada and California. Mr. Kent identified earthquakes that occurred along the California-Nevada border in 2015, including many larger than a 4 magnitude, and some swarm sequences.

Mr. Kent showed videos of fires spotted by the fire cameras. He said spotting fires results in smaller fires that are controlled earlier. He showed examples of time-lapse videos of fires from the vantage points of various cameras, and he talked about crowd-sourcing funds for additional fire cameras.

Mr. Kent discussed the Alert Tahoe project, a system created to provide emergency information in real time for earthquakes, fires, and floods that will improve business and community resiliency. He said Alert Tahoe will cost about $2 million to build and run for ten years. He displayed a coverage map.

Mr. Kent stated that the federal Bureau of Land Management (BLM) also has a fire camera network in northern Nevada that it plans to expand statewide, and he showed a photo of a BLM tower with antenna. He observed that Nevada and California face similar hazards with respect to wildfires, so it would benefit both states to work together. He suggested joint consideration of putting cameras on old fire towers throughout both states.

Mr. Kent said Nevada is working with the University of California at San Diego to develop an integrated unified interface for a microwave-based multi-hazard network rather than one focused on earthquakes only. He remarked that cellular technologies are still unproven and unreliable in large events, and microwave provides greater reliability and capability. He remarked that there will be 12K fire cameras available soon, and cellular transmission will not be able to keep up. Mr. Kent showed a map of the cellular outage affecting a large section of the U.S. on August 4, 2015.

Commissioner Greg Beroza said California's early warning system is focused on urban areas, which require greater density of sensors than wildfires would require. He asked how Nevada balances that mixture of needs. Mr. Kent stated that Nevada has many unpopulated areas in the center of the state that provide an excellent line of sight for miles around, but cameras on towers in urban areas would have a much more limited range. He recommended investing in the best equipment available to ensure maximum coverage.

Engineering Geologist Robert Anderson said the Commission staff is watching Nevada's progress with great interest. He noted that having cameras could help spot fires and likely areas of damage after earthquakes.

Commissioner Tracy Johnson commented that the redundancy features and reliable microwave-based technology would make this kind of network attractive to investors.

Mr. Kent noted that public communication networks tend to become overwhelmed after earthquakes and other large events, so this system will provide access to a private network.

Chairman Strack thanked Mr. Kent for his presentation.

V. PROGRESS REPORT ON SOUTH NAPA EARTHQUAKE PROJECT

Mr. McCarthy said the Commission is funding research by the Pacific Earthquake Engineering Research (PEER) Center on lessons learned from the South Napa earthquake, with a final report due by the end of this year. He introduced Dr. Laurie Johnson, PEER, and invited her to provide an update on this project.

Dr. Johnson reported that the contract was restarted in July because of long delays in PEER's contract approval process. She stated that the report features lessons learned, success stories and best practices, issues with existing policies that were not successful, research needs, and recommendations for new policies.

Dr. Johnson reported that PEER researchers met with the staff to develop a work plan. She said researchers are gathering resources, and scheduling interviews with local officials and key state agencies, and the next step will be identifying policy implications and prioritizing recommendations. She advised that a draft report will be ready in November, and it will include some ideas for 2016 legislation.

Dr. Johnson noted that a great deal has changed over the past couple decades in terms of technology and economic conditions. She said the researchers are looking at lessons learned from other events, including recent earthquakes in New Zealand, Japan, Chile, Mexico, and the 2003 event in San Simeon, California. She reported that a title and outline have been developed, and findings will be divided by topic. She noted that topics will cover a broad range of disciplines, such as geoscience, structural engineering, infrastructure, people and business impacts, government, and others.

Commissioner Knudson asked how many people in the Napa area were still in temporary housing and how social services and infrastructure needs were being provided. She said these were issues in the 2010 Baja earthquake as well. Dr. Johnson replied that she would look at these issues.

Commissioner Rabbitt reported that the Napa city council had just approved a demolition permit for a historic stone structure, and the county council had replaced a bridge. He remarked that the Napa earthquake seems to have alerted local wineries to the need for secure barrel storage systems.

Commissioner Sweiss asked if the report will look at earthquake impacts on lifelines, and Dr. Johnson responded that infrastructure will be one of the topics. She said the gas system was replaced in the Browns Valley subdivision. She added that there had been some negative comments about the lifeline providers and mutual aid, and a series of meetings was held over the past year to resolve these issues.

Chairman Strack thanked Dr. Johnson for the update and said the Commission looked forward to receiving the report.

VI. PROGRESS REPORT ON RECOVERY MODELING WITHIN THE GLOBAL EARTHQUAKE MODEL

Mr. McCarthy said the Commission is providing funding for two Global Earthquake Model (GEM) projects, one that identifies underlying assumptions in existing damage models, and another to develop simulation tools that will identify policies and practices that tend to facilitate post-earthquake recovery. He introduced Dr. Chris Burton, GEM, and invited him to provide an update on the recovery modeling project.

Dr. Burton provided a brief background on GEM, a global nonprofit public-private organization created to help worldwide communities better understand their risks, identify specific vulnerabilities, estimate losses and damage, mitigate hazards, and speed up recovery. He said GEM is developing open-source tools for its OpenQuake Web platform that shares data with a wide variety of users.

Dr. Burton displayed photos of buildings damaged in the Napa earthquake and some of the recovery and rebuilding efforts since then. He said GEM's tools take into account a community's built environment, population, policies, and existing programs and resources. He noted that shaking can be linked to damage, and then various external factors are incorporated to plot recovery trajectories and predict recovery time. Dr. Burton reported that GEM researchers are studying the drivers of recovery by identifying and incorporating the appropriate externalities into the calculations.

Dr. Burton showed examples of color-coded maps used to portray rates of recovery from a Mississippi hurricane at six-month intervals for four years for different affected communities. He showed damage maps and recovery trajectory graphs. He noted that this kind of quantifiable data can be used to identify drivers of recovery in terms of environmental, social, community, economic, institutional, and infrastructure-related factors, and then regression models can be developed to understand the predictive values of various factors.

Dr. Burton outlined next steps, included ongoing data collection and in-depth analysis of recovery drivers. He said researchers have been able to incorporate lessons learned from other earthquakes and externalities for Southern California, and a software tool is being developed that will expand this capability.

Mr. McCarthy expressed concern about the potential impact of a large earthquake in California now, given current economic conditions and the growing economic stress imposed by the drought.

Commissioner Miyamoto commended GEM for going beyond just scientific data and looking at social factors too, noting that this kind of analysis is often the most difficult. He asked how confident GEM was of its forecasting ability. He noted that GEM's modeling efforts can help spot trends, and tools must be flexible enough to accommodate the needs of many users. Commissioner Miyamoto emphasized the importance of social and psychological components in influencing government policies. He recommended that GEM work with local building departments and first responders to make them aware of how the software and tools can enhance their understanding and ability to recover.

Dr. Burton indicated that GEM used census data and was confident of its statistical models, and other GEM tools will be incorporated in the recovery model as well. He advised that GEM plans to invite community leaders to review the tool and provide their feedback. He added that the model was tested in Katmandu twice, as well as in Quito, Addis Ababa, and 30 cities in Nepal, and the Napa earthquake provides a great opportunity to demonstrate its benefits.

Commissioner Knudson recommended considering earthquake insurance as an additional external feature. Dr. Burton agreed that insurance coverage was an importance variable, and he said the researchers will need to obtain data on that issue. Commissioner Mark Ghilarducci offered his assistance in working with the California Earthquake Authority to obtain the information, and Dr. Burton thanked him for his help.

Chairman Strack thanked Dr. Burton for the update.

VIII. EARTHQUAKE EDUCATION/OUTREACH RESEARCH PROJECT FOR SMALL BUSINESSES (PHASE II)

Mr. McCarthy noted that the Small Business Development Centers (SBDC) had completed Phase I of its Commission-sponsored project, which entailed surveying business owners about their preparedness needs, and then developing preparedness guidelines for small businesses. He introduced Mr. Joel Ayala, SBDC, and invited him to discuss Phase II of the work. He added that a proposal will be coming to the Commission for approval at the October meeting.

Mr. Ayala reported that the survey of small business revealed that not many are prepared or have plans for coping with major disasters. He said many respondents identified restoration of utilities as their biggest concern. He advised that Phase II of the project will involve outreach and finding the best ways to reach small business owners. Mr. Ayala clarified that SBDC can play an important role in helping organizations like the Commission disseminate their messages and access small businesses.

Mr. McCarthy indicated that the staff was waiting for feedback from GoBIZ. He added that a number of small business owners had already expressed interest in the early earthquake warning system.

Commissioner Chester Widom stated that the Division of the State Architect created a certified access specialist program to help small businesses improve their understanding of access requirements. He encouraged SBDC and DSA to find ways to work together. Mr. McCarthy said he would arrange a meeting before the October Commission meeting.

Commissioner Ghilarducci observed that keeping small businesses going after a disaster is critical to recovery. He noted that 80 percent of small businesses close after major events, and the same impacts and results have been observed after disasters for many years. He emphasized the need to change these conditions, and he supported a goal of working in partnership to help small businesses become key cornerstones of resiliency.

Mr. Ayala said SBDC is working with GoBIZ, the Department of General Services, and other state organizations to help them reach small businesses at their conferences and summits. He encouraged the Commission to attend future small business summits.

Chairman Strack thanked Mr. Ayala for his presentation. He added that keeping small businesses functioning after a disaster is a high priority for California.

VII. PROPOSAL: "THE VALUE OF A CALIFORNIA EARTHQUAKE EARLY WARNING SYSTEM"

Update on SB 494

Commissioner Ghilarducci stated that SB 494 (Hill), creates an overarching set of earthquake programs and would entail moving the Commission away from the Business, Consumer Services, and Housing (BCSH) Agency where it is currently housed, to the California Office of Emergency Services (OES).

Commissioner Ghilarducci noted that the Commission's chief role is to provide important multi-disciplinary advice to the state on earthquake preparedness issues, post-earthquake impacts, research needs, and government policies. He pointed out that many of the Commission's useful products and resources have ended up on a shelf because interest in earthquake safety predominately spikes immediately after a large earthquake but fades after that. He expressed his hope that having the Commission with CalOES will give the Commission greater access to key decision-makers and more influence on state policies.

Commissioner Ghilarducci expressed his opinion that working with CalOES can provide some important benefits for the Commission, such as the ability to improve on projects and earthquake efforts rather than administrative tasks, and making decisions and recommendations that can have an immediate impact on state operations. He advised that the legislative goal is to pass SB 494 this session, and then roll in implementation in the new year.

Update on Early Warning System

Commissioner Ghilarducci said SB 135 created a process for developing an earthquake early warning system for California. He noted the intent of the legislation is to combine and integrate public and private resources to leverage funds and develop a statewide network. He clarified that the goal is not earthquake prediction, but rather to provide an advance alert based on detection of "P" waves before an earthquake's "S" waves are felt. He stressed that the network needs to be reliable, systematically implemented, and cost-effective; otherwise, its development will waste unnecessary time and money and undermine public confidence.

Commissioner Ghilarducci advised the SB 135 established a multi-disciplinary working group of public and private stakeholders to define the standards for inclusion in the network, identify funding sources, and convincing potential private-sector sponsors of the system's benefits. He remarked that a number of major utilities, transportation businesses, and telecommunications companies are on board, but other industries still need to be engaged. He advocated performing a cost-benefit analysis to provide more concrete support of the potential benefits.

Commissioner Ghilarducci agreed with Dr. Burton of GEM that transmission of signals through Internet channels is often impossible after a major disaster, and he underscored the need to work with other systems to leverage public and private resources. He indicated that the working group has already identified potential funding sources and is recommending a stronger governance model to consolidate efforts and coordinate with other organizations.

Commissioner Ghilarducci said the working group is also crafting a proposal for a new board to identify research and development needs, set standards, and gather input from stakeholders, then supervise operations of the early warning/seismic network in coordination with tsunami programs, the Strong Motion Instrumentation Program, California Geological Survey, and public education programs; as well leveraging and managing funding, ongoing administration, and maintaining the system in future years.

Discussion of SB 494

Commissioner Beroza asked if funding issues would be resolved by January of 2016, and Commissioner Ghilarducci responded that funding sources have already been identified, and passage of SB 494 will accelerate that process.

Commissioner Goodwin noted that from a local government perspective, the Seismic Safety Commission does great work and has an excellent reputation. He observed that the Commission has always been transparent as a state government entity, and he asked if moving the Commission to CalOES would change that. Commissioner Ghilarducci expressed his opinion that the change will enhance the Commission's abilities and provide a more integrated collaboration with all disciplines. He said public involvement strengthens California's preparedness level, so the Commission can continue and enhance its current capabilities and engage more sectors.

Commissioner Gardner commented that SB 494 is an interesting and sweeping proposal that commissioners need to think through and digest. He said he could see benefits of moving to CalOES, but he also expressed concern about the makeup of the oversight board, and he suggested including the chairman of the Seismic Safety Commission and a public safety representative. He expressed support for having three cabinet-level state officials and local government representatives from north and south. Commissioner Ghilarducci thanked Commissioner Gardner for his suggestions.

Commissioner Parkinson said he spoke with Mr. McCarthy about the proposed change, and it seems that transferring administrative functions elsewhere would help the Commission focus on its work. He acknowledged that many details still need to be worked out.

Commissioner Ghilarducci said California needs to do something different and soon. He emphasized that another big earthquake will happen, perhaps on the Hayward or San Andreas fault. He noted the focus of disaster preparedness changed in the U.S. and California after 9/11, shifting from natural disasters to terrorism; after Hurricane Katrina, the focus shifted again to an all-risk approach.

Commissioner Ghilarducci observed that much has changed over the past decade in California as technological capabilities have exploded. He mentioned that San Francisco and Los Angeles have both enacting groundbreaking ordinances to deal with hazardous buildings in their jurisdictions, and the California Earthquake Authority is offering new programs. He advised that there has been considerable private-sector interest in California's earthquake early warning system, and California can springboard on these efforts for the next ten or twenty years. He said the state can bring all this together, and also work with Nevada, Oregon, and Washington, and other states.

Commissioner Widom proposed a minor amendment; citing the description of the advisory committee on page 2, he recommended specifying a structural engineer, and including a mechanical-electrical-plumbing engineer and an architect as well.

Commissioner Wheetley remarked that Cascadia is a huge dilemma for the north coast. He agreed that CalOES could enhance the Commission's abilities, and it could be good for local governments as well. He noted there are existing networks for vetting policies, such as CSAC and the League of California Cities, and the business community, and he suggested working closely with those organizations.

Commissioner Ghilarducci advised there is a saying that "All disasters are local," and community resiliency is a critical factor in disaster recovery. He expressed interest in how local governments use their networks, and he noted that communications could help reduce fires and power outages in some circumstances. He said the City of Los Angeles has encountered resistance from businesses when trying to enforce aggressive hazard mitigation objectives, so building stronger community partnerships would be very beneficial.

Commissioner Johnson expressed her opinion that moving the Commission into CalOES makes sense, and she recommended clarifying the Commission's role. She said she envisioned the Commission as developing partnering relationships, fostering broad thinking, providing a forum for ideas, and initiating outreach to a range of populations. She noted the Commission has formed ties with Nevada and is working in partnership with small businesses and other groups.

Commissioner Ghilarducci said he had the same view of the Commission's role. He noted that working under CalOES will likely create more work for the Commission in terms of review and advice.

Commissioner Miyamoto said CalOES seems a natural fit for the Commission. He pointed out that there were also benefits to being outside CalOES, and he asked how independent the Commission would be and what checks and balances would exist.

Commissioner Ghilarducci responded that the Commission's role now is to make recommendations and provide advice to CalOES and the Governor's Office, and that role would continue. He said the Commission will continue to be transparent and independent, but also more collaborative, and in a better position for checks and balances as a result. He noted that CalOES can streamline the Commission's access to top decision-makers in the state, so the Commission will have more influence on policy development, implementation, operations, and strategy.

Commissioner Miyamoto said he was excited to be part of CalOES because implementation of seismic safety policies is a critical step in making a change. He acknowledged that there might be some loss of independence, and noted that California does need an independent voice. He recommended creating some kind of system within CalOES to fill that need. Commissioner Ghilarducci thanked Commissioner Miyamoto for his recommendation and said CalOES will consider this point.

Commissioner Rabbitt commented that streamlining administrative tasks for the Commission would be a wonderful idea. He expressed concern about the effects on local governments of the change in Commission governance. He said local governments are overwhelmed and need help, especially with implementation. Commissioner Ghilarducci clarified that CalOES is a coordinating agency, not a regulatory agency, but CalOES can work with regulatory agencies on behalf of local governments, and the Commission can act as a forum for gathering input from local governments.

Chairman Strack thanked Commissioner Ghilarducci for his remarks. He noted that the lack of cohesiveness with respect to earthquake policies in different local jurisdictions has been frustrating to commissioners for many years, so it is encouraging to hear about opportunities for the Commission to work within CalOES to expand outreach, and to keep the value of the Commission intact.

Update on Earthquake Early Warning System

Mr. Mark Johnson, CalOES, provided an update on the progress in developing an earthquake early warning system for California. He said the state has been working with private- and public-sector representatives since 2013 to develop a strategy, and the next task is completion of a cost-benefit analysis. He explained that because the early warning system is a complex initiative and represents a sizable investment for the state, a study is needed to validate and identify the benefits for utilities, telecommunications, lifeline providers, and other industries in California. Mr. Johnson referred to the draft scope of work in the meeting packet. He explained that the proposal is for a consultant to interview representatives of the financial sector, water companies, utilities, telecom industries, technology experts, managers, hospitals, and other sectors to identify the specific benefits to them of the earthquake early warning system, and then to produce a written report to CalOES and the Commission. He recommended that the Commission authorize CalOES to proceed with the contractor selection process and authorize the funding for this work.

Chairman Strack noted the Commission's next meeting is in October, and action is required before then. He suggested that two commissioners volunteer to assist CalOES with finalizing the contract so they can proceed with the work.

Commissioner Beroza noted that Task 3 is a summary of other countries' systems. He suggested finding out if data is available on impacts and benefits and incorporating that as well.

Commissioner Johnson observed that the focus of the study is the benefits of the system. Mr. Johnson clarified that cost savings would be considered a benefit. Commissioner Gardner recommended identifying the benefits that will be the most important driving forces in attracting funding. Commissioner Johnson suggested acknowledging costs when interviewing people, and she agreed that completing the cost-benefit analysis was a critical step. Commissioner Ghilarducci said a better estimate of costs is also needed.

Commissioner Ghilarducci advised that the working group has been able to get utilities to support the proposal, but they need to present the idea to their shareholders using independent data. He noted that utilities already provide a credit for hazard mitigation each year.

Commissioner Wheeler pointed out that California's ports also face tremendous environmental and economic risks, and he suggested working with them as well. Mr. Johnson stated that CalOES has contacts with ports, and he said this language can be added to the scope of work.

ACTION: Commissioner Gardner made a motion, seconded by Commissioner Wheetley, that:

The Commission authorize CalOES to proceed with contractor selection as proposed and move forward with the work.

* Motion carried, 13 – 0 (Commissioners Parkinson and Widom absent during voting).

Commissioners Wheeler and Gardner volunteered to work with CalOES to finalize the contract.

IX. LEGISLATIVE UPDATE

Legislative Director Salina Valencia stated that the Legislature was currently on its summer recess, due to return to the Capitol the following Monday. She noted that Commissioner Ghilarducci had already covered SB 494, and she said she would have more to report at the October meeting.

X. EXECUTIVE DIRECTOR'S REPORT

Budget

Mr. McCarthy said the Commission ended the 2014-15 fiscal year in satisfactory shape, having billed for overhead costs on research projects. He estimated there was still a reserve in the research fund and a small amount in unbilled overhead. He indicated he would have better projections available at the October meeting. Mr. McCarthy added that he would send fiscal year recap figures to commissioners as soon as they become available.

Filling Vacant Staff Services Manager I (Specialist) Position

Mr. McCarthy reported that about twenty applications had been received for the vacant staff services manager position, and he said he would be contacting one or two commissioners to participate with Agency and CalOES representatives in interviews.

October Meeting

Mr. McCarthy noted that Commissioner Mark Wheetley will be hosting the Commission's October meeting in Arcata. He added that a three-day Cascadia workshop will take place following the Commission meeting, so some commissioner may want to attend that event as well.

Mr. McCarthy said the staff will be working with Commissioner Wheetley to develop a draft agenda and field trip options for the Commission to consider. He indicated that the Commission will be hearing presentations from local government agencies and people from Humboldt State University, and he invited commissioners to contact him if they had suggestions for other agenda items.

Co-Sponsorship of "User Needs Workshop for the National Seismic Hazard Mapping Project"

Mr. McCarthy advised that the Commission will be co-sponsoring and upcoming user needs workshop with the U.S. Geological Service (USGS) and others, and he noted that Commissioner Beroza and Engineering Geologist Robert Anderson planned to attend.

Shake Table Demonstration at State Fair

Mr. McCarthy reported that the Commission worked with the Pacific Earthquake Engineering Research Center to provide a shake table for demonstrations at the state fair. He said this exhibit was well attended and popular.

XI. PUBLIC COMMENT

There were no members of the public who wished to address the Commission.

XII. MISCELLANEOUS AND GOOD OF THE MEETING

There were no other matters brought to the attention of the Commission.

XIII. ADJOURN

There being no further business, the meeting was adjourned at 12:49 p.m.

_____
Sue Celli
Office Manager

Approved by:

_____
Richard McCarthy
Executive Director

8th Item VIII

State of California
Seismic Safety Commission

Memo

To: Seismic Safety Commission

From: Fred Turner, Staff Structural Engineer
California Seismic Safety Commission
1755 Creekside Oaks Drive, Suite 100
Sacramento, CA 95833
Phone: (916) 263-0582 Fax: (916)263-0594 Email: Turner@StateSeismic.com

Date: 9-29-2015

Subject: **Draft 1.6 of the Guide to Identify & Manage Seismic Risks of Buildings for Local Governments**

Since our last hearing on this guide's Executive Summary in June, the Commission's Committee comprised of Randy Goodwin, Kit Miyamoto, and Fuad Sweiss met twice by phone. The staff also hired an editor, Andrew Alden. He helped produce the attached draft that was reviewed and further refined by the Commission's Committee during two rounds of reviews in September. The Committee has also agreed to engage Andrew Alden to help edit the Appendix.

The major changes since the last draft include increasing its reliance on the Appendix, moving key sections of the Appendix into the attached Executive Summary, adding a Table of Contents and efforts to reorganize the Appendix, and increasing its length by about two pages.

Staff Recommendation: The staff asks that Commissioners read the attached draft Version 1.6 and provide suggestions and concerns at the October 8th hearing in Arcata.

Guide to Identify & Manage Seismic Risks of Buildings for Local Governments

Presentation Draft Version 1.6

September 30, 2015

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Overview

California has some of the most modern and earthquake-resistant buildings in the world. However, most of our older buildings could be damaged by severe shaking in a major earthquake, and some of them could partially or completely collapse. Many Californians live, work, go to school, shop and worship in these buildings. “Collapse risk” buildings present the greatest risk of death and injury from earthquakes. They can also cause fires, damage and disrupt surrounding properties, and threaten neighborhoods and public rights of way. Together, these social and economic disruptions may amount to hundreds of billions of dollars after the largest foreseeable earthquakes. Mitigation of this risk is an expensive project, but much cheaper than the costs of collapse.

The California Seismic Safety Commission considers these buildings a top priority in seismic risk mitigation efforts across the state. Given sufficient time, effort and luck, many collapse risk buildings can be retrofitted or replaced before they cause harm in the next damaging earthquake. The Commission encourages a long-term outlook and commitment, because even under the best conditions it will take generations to achieve the ultimate goal of an earthquake-resilient society.

Every jurisdiction has an obligation to determine its degree of exposure to risk from building collapses, but there is more than one way for a jurisdiction to handle the threat. This guidebook presents a broad four-step process, with many different options, to help local governments identify and reduce the risks presented by these buildings. It also summarizes California’s relevant laws and regulations. Along the way, it presents examples of successful approaches that have been taken by different California cities to address collapse risk buildings. Because each jurisdiction faces its own unique circumstances, each summary section of this guide is expanded in the Appendixes.

The advice in the Appendixes can be considered a toolbox from which local governments can draw and adapt to their community’s unique circumstances. Checklists, success stories, financial incentives, and references for more detailed information might prove useful to local governments when designing initiatives to manage collapse risks.

The California Seismic Safety Commission has drawn from the experiences of hundreds of local governments to generate this Guide and Appendixes. Your feedback is welcome and essential for the Commission to make periodic improvements and corrections. Please send your comments to feedback@stateseismic.com

See **Appendix 1** for more detail on this topic.

What Are Collapse Risk Buildings?

No building is without any risk of collapse during a very strong earthquake, but some have much greater risk than others. Buildings may be vulnerable to collapse because they were:

- Not constructed to comply with codes and standards, or
- Constructed before earthquake resistance was required in the 1930s, or
- Built to codes that were later found to be inadequate, or
- Poorly maintained or improperly altered, repaired or retrofitted.

Experience in California near active earthquake faults has shown that the following types of buildings generally pose exceptionally high risks of collapse:

- Pre-1940s unreinforced masonry, primarily brick, buildings
- Pre-1980s concrete frame buildings
- Pre-1980s buildings with soft or open lower stories, unbraced crawl space walls below first floors, or irregular shapes, including those on steep hillsides
- Pre-2000s buildings with precast concrete tilt-up walls or masonry walls, and precast concrete parking structures.

Other types of buildings pose risks that are significant, but generally lower or harder to identify:

- Pre-2000s steel buildings
- Buildings of all ages that are inadequately constructed, repaired or maintained
- Buildings on sites subject to fault displacement, landslides, or soil liquefaction

Smaller, residential buildings and various specific building components have their own sets of vulnerabilities, but they present a relatively low risk of death and injury and are not considered further here.

In setting priorities among their collapse risk buildings, jurisdictions may choose from three basic approaches. The first focuses on the specific building category that poses the greatest risk. The second addresses vulnerable buildings in order of their size. The third prioritizes buildings by their importance. Many jurisdictions combine two or more of these in a hybrid approach.

See **Appendix 2** for more detail on this topic.

The Most Effective Method of Managing Collapse Risk Buildings

The best defense against building collapse during earthquakes is strong standards and professional practices. Ensuring that building construction and alterations are properly designed by licensed professionals, using plan reviews and inspections by qualified regulators, is the most effective way for governments to identify and reduce the risks of collapse.

Nearly all of this responsibility falls upon local governments. They review construction plans, issue building permits and inspect construction for most buildings, including local essential service facilities such as fire and police facilities. State agencies check plans for and inspect public schools, hospitals and other essential services buildings. Federal agencies regulate building safety for federal buildings and support research to improve building standards. Regulatory permits are required from all appropriate agencies for new buildings as well as alterations and seismic retrofits of existing buildings.

See **Appendix 3** for more detail on this topic.

Who Is Responsible?

The responsibility for collapse risk buildings is generally well defined, but not always widely understood. For effective cooperation, building owners and regulators need to be aware of each other's obligations and concerns.

Building owners are responsible for ensuring their buildings are safe and are responsible for disclosing a building's vulnerabilities to occupants. Regulators leave certain matters to the discretion of building owners (tenant alterations, minor repairs and so on) that may affect the collapse risk of buildings. Owners are not obliged by law to go beyond the ordinary care exercised by a reasonable person; however, there are many extra options that prudent owners can take in their own self-interest. These include obtaining earthquake insurance, storing construction records securely, arranging professional seismic evaluations, and creating a Building Occupancy Resumption Plan to ease disruption after a disaster.

Government agencies can set examples of prudence in managing their own buildings. They can also devise policies that acknowledge those factors that most commonly discourage building owners from doing the right thing.

Because decisions made by building owners usually affect others, many circumstances associated with buildings may involve government regulators in their role of ensuring public safety. For example:

- A building at risk of collapse may endanger neighboring structures and rights of way, blocking emergency response efforts.
- Owners might not inform building users—or not even know—about the vulnerable condition of their buildings.
- The public may assume that the existence of regulations ensures the safety of a building even if its owners are negligent.
- Local government policies aimed at population growth, preservation, redevelopment or revitalization of neighborhoods may affect the public's exposure to seismic risks in ways that should be considered during decision-making.

These circumstances tend to accumulate with time, increasing levels of risk, unless they are addressed through proactive intervention by regulators and effective action by policy-makers.

The public is a stakeholder in questions of collapse risk buildings. Collapsed buildings cause major disruptions that affect the whole community. Retrofitting policies should focus on speeding improvements, reducing their costs, and minimizing their disruption to all parties: owners, occupants and surrounding neighborhoods. The best initiatives go beyond technical feasibility by respecting owners' knowledge and experience, selecting cost-effective alternatives, and demonstrating that local governments are serious about ensuring their success.

Because California's jurisdictions vary so greatly, a uniform statewide approach is not optimal. In deciding the appropriate levels of investment in retrofit programs and the urgency with which to pursue them, local governments have difficult choices to make in balancing the risks against their resources. Internal factors within government affect these choices, such as the confidence of leadership, funding priorities, relationships with other stakeholders, staff costs and expertise, and time horizons. Governments should acknowledge these factors as they work to best ensure safe buildings.

See **Appendix 4** for more detail on this topic.

Nexus for Public/Private Partnerships to Manage Collapse Risks

Most buildings are privately owned, but their risk of collapse affects the public. Both building owners and government agencies therefore have a stake in managing earthquake risks. It is in everyone's best interests for governments and building owners to collaborate in identifying vulnerable buildings and improving their earthquake resistance. After several decades of witnessing such collaborations, the Seismic Safety Commission has observed that fostering active dialogues, mutual understanding, and commitment are key to helping these efforts succeed.

See **Appendix 5** for more detail on this topic.

Four Steps to Managing Collapse Risk Buildings

There are many options for governments to manage the risk presented by buildings that are prone to collapse. They range from passive approaches that may gradually reduce collapse risk for some buildings over decades to active approaches that require seismic evaluations and retrofits within a few years. This guidebook summarizes knowledge gained from monitoring hundreds of local government efforts.

The public often assumes, incorrectly, that government agencies require existing buildings to be earthquake resistant. Many people are surprised to learn that some earthquake safety regulations only apply to existing buildings when they undergo major alterations, additions, or repairs.

Owners may not know or may be reluctant to find out about the earthquake resistance of their buildings. As a result, many buildings have never been seismically evaluated or upgraded. Pre-1930s buildings were likely constructed without considering earthquake resistance since California's building codes did not include earthquake safety requirements until 1933.

There may be only a few key opportunities to address the collapse risk of a building during its useful life, such as major alterations or changes in use. These opportunities set the baseline pace for risk reduction in a jurisdiction. In dealing with collapse risk buildings, policymakers should

Success Story

St. Helena's Unreinforced Masonry Building Program

St. Helena has 33 buildings in its inventory, and the owners have retrofitted all of them. The city provided numerous incentives including building permit fee waivers, creation of a historic district to take advantage of a 20% federal tax credit, use of the state's Mills Act to preserve facades and reduce costs, and a streamlined design review process.

decide whether to speed up this pace and how much to do so. This section outlines ways to organize that decision-making process.

When buildings are sold, the California Seismic Safety Commission's *Commercial Property Owner's Guide to Earthquake Safety* and the *Homeowner's Guide to Earthquake Safety* encourage or require sellers to disclose typical earthquake weaknesses to buyers. When major buildings are refinanced, lenders and insurers may require seismic evaluations as a precondition. When buildings undergo major alterations, additions or repairs, local governments may require seismic evaluations or retrofits when issuing construction permits.

If a community relies on building owners to manage their own risks, conscientious owners who have long-term interests in their community and are aware of earthquake risks may eventually replace or retrofit their vulnerable buildings when they find it convenient. But risk reduction progress is expensive and will typically be slow and uneven. In the meantime, those who occupy collapse risk buildings and rely on streets and sidewalks nearby are exposed to their risks while facing the prospect of years of disruption after a major earthquake.

In the face of this situation, three public policy questions warrant consideration by governments, building owners and the public:

1) How effective are our current policies regarding earthquake safety?

2) How many years will these policies take to significantly reduce collapse risks in our community?

3) What alternative policies might we consider?

Communities assume that their government officials will take initiatives in long-term planning and place earthquake safety priorities into context with other competing priorities. And California has many examples of government agencies that have undertaken earthquake risk management initiatives.

Here are the four necessary steps of a successful initiative to manage earthquake risks associated with buildings most likely to collapse.

Success Story

Fremont's Soft Story Apartment Building Program

In 2007, Fremont required owners of 30 apartment complexes to retrofit. The city designed its ordinance to result in no occupants being relocated from their units during construction. Fremont also reimbursed owners for all plan check and permit fees once the retrofits were completed. Owners could apply for time extensions due to financial hardship. Fremont demonstrated remarkable success, albeit for a relatively small portion of its apartment building stock.

Step 1: Create Opportunities for Education, Dialogue, and Public/ Private Participation in Decisions about Buildings

Before anything else, governments should make a commitment to ensure sound decision-making. The right process will avoid surprises and minimize delays, complaints and lawsuits after a course of action has been set. Considering issues deliberately, incrementally and from a variety of perspectives is a proven, effective management technique.

It is important at the start for departments within local governments to work together to generate effective changes. At the right time, a lead agency should be named to communicate issues in a timely manner to the public. Messages can be crafted that evoke confidence in carrying out risk reduction rather than provoke anxiety and fatalism.

Along with the private sector, government building officials, emergency managers, city councils, and boards of supervisors should actively engage and inform the public about the issues related to collapse risk buildings and the alternatives for managing their risks.

Stakeholders should be kept informed about who makes decisions, when, and how they can participate and influence policymaking. Building owners should be informed about the variety of seismic upgrade options available to building design professionals. Stakeholders can respond well to specific approaches pitched to their interests and allies.

Success Story

San Diego's Downtown Parapet Bracing Program

The City of San Diego includes parapet bracing as a key part of their downtown redevelopment effort. In light of their somewhat lower risk than in other parts of California, they considered the risks posed by other vulnerable aspects of brick buildings to be too costly to address. Bracing was accomplished with historic preservation in mind so that the aesthetics of the brickwork was not adversely impacted by the installation of new wall anchors.

See **Appendix 6** for more detail about this topic.

Step 2: Estimate the Size and Nature of Collapse Risk

Buildings offer different levels of collapse risk, depending on their construction type, age, and occupancy. Inventories of buildings thus can provide detailed insights into a community's vulnerability. A jurisdiction can make a useful beginning with indirect surveys based on agency records, online street views, Sanborn maps, other archives and similar resources. There are several more robust approaches that can be considered as part of

Step 3. Agencies may benefit from comparing efforts in other similar communities that have conducted such studies.

Learning basic information about the ages, occupancies, sizes, locations, and states of repair of the buildings in the jurisdiction will help quantify the potential for deaths, injuries, downtime, economic and social losses from damaging earthquakes. Reviewing long-term plans for economic improvement, historic preservation, transportation, and redevelopment will help identify opportunities and constraints for reducing earthquake risks while accomplishing other objectives. Inventories will also help identify buildings that have already been retrofitted or replaced and the rate at which changes are already taking place.

Even if no further steps are contemplated, community leaders, emergency managers, and building officials will gain a better sense of what to expect and how to respond to future earthquakes.

Appendix 7 has much more detail on this topic.

Step 3: Develop and Consider Options for Identifying and Mitigating Collapse Risks

In this section we present seven options to manage collapse risks. These range from implementing existing regulations to enacting mandatory retrofit programs. They are ranked below from lowest to highest according to their difficulty to implement and their potential for resistance from building owners. **Appendix 8** treats each of these options in more detail.

Option 1: Rely on Attrition and Current Triggers for Alterations in the Building Code

Older buildings are periodically replaced by newer, typically more earthquake-resistant buildings as communities grow. This attrition typically occurs at rates of less than 2 percent of the building stock per year. Most California jurisdictions rely on attrition as a risk reduction strategy. It offers owners the most discretion, is the least confrontational, is market-driven, and is consistent with the policies of neighboring jurisdictions. However, most jurisdictions are not making use of the information coming in from attrition-related activity.

Chapter 34 of the California Building Code requires owners to consider seismic safety in existing buildings when major alterations, additions, and repairs are contemplated. However, these regulations tend to discourage owners because they can cause

uncertainties and triggered costs like fire safety and accessibility upgrades. The cumulative effects of prior alterations are required to be considered when altering or constructing additions to existing buildings. Voluntary seismic improvements are encouraged by the building code, which allows owners discretion when proposing improvements.

State laws require disclosures of typical earthquake weaknesses at the time of sale for certain dwellings and encourage disclosures for certain commercial buildings. These disclosures can trigger voluntary retrofits.

This option is consistent with policies in most jurisdictions except for unreinforced masonry buildings in regions of high seismicity. A community's building official will have more information and a sense of how effectively and at what rate attrition and voluntary seismic improvements are taking place.

Option 2: Develop Reliable, Detailed Inventories of Collapse Risk Buildings

Any risk reduction program that goes beyond attrition will require detailed inventories as a foundation. Starting from information gathered in **Step 2**, these inventories can rely on:

- Samplings of buildings to infer characteristics of a larger inventory
- Records of building permits for past seismic evaluations as well as triggered and voluntary seismic retrofits
- Online street views and other geographic information systems
- Sanborn maps that depict construction types
- Building permit and tax assessor data
- Archives of architectural, civil, and structural engineering firms
- Redevelopment plans or transportation corridor studies
- Maps of liquefaction zones and areas with landslide potential
- Registers of historical buildings and surveys of historic districts
- Adopted versions of the building code in effect when buildings were constructed or retrofitted

Success Story

Los Angeles's Unreinforced Masonry Building Retrofit Program

The City of Los Angeles spent over a decade requiring owners to retrofit or replace over 8000 unreinforced masonry buildings. At the time of the Northridge earthquake in 1994, over 6000 had been retrofitted and 2000 replaced. Fortunately, no one was killed in these buildings during the earthquake. While not all retrofits were entirely successful and lives could have been lost if the earthquake had occurred at another time of the day, the city's recovery efforts were accelerated by reduced damage and disruption in these buildings.

These can help determine construction types, sizes, heights, and occupancy classifications and overall vulnerability to earthquakes. Software is available that can help analyze building inventories and make preliminary estimates of possible earthquake losses. **Appendix 8** presents this option as an eight-step checklist.

Option 3: Develop Seismic Performance Options

Governments and other stakeholders can consider a variety of alternatives for describing how buildings can be expected to perform in earthquakes. These seismic performance objectives, which are issued separately for structural and nonstructural parts of buildings, can then be used for retrofits or replacements.

The process of considering seismic performance objectives will enable a dialogue in the community about acceptable levels of risk, recovery costs, and durations of social and economic interruption. Discussions can highlight the differences between the expected performance of newer buildings compared with the performance of existing buildings.

Typical structural performance descriptions or objectives are:

- **Not Considered or Unknown**
- **Immediately Dangerous** – and not safe to occupy
- **Significant Collapse Risk** – considered safe enough to occupy
- **Collapse Prevention** – with little or no margin of safety
- **Life Safety** – with larger margins of safety beyond collapse although buildings may not be occupiable after damaging earthquakes
- **Immediate Occupancy** – although not necessarily operational due to damage to building contents, nonstructural systems, or lifelines

Typical performance objectives for nonstructural portions of buildings such as equipment, electrical, plumbing and ventilation systems, ceilings, partitions, and cladding are:

- **Not Considered or Unknown**
- **Life Safety** – to avoid death and injury, but not necessarily keep systems in place

Success Story

San Luis Obispo's Downtown Revitalization Program

The City of San Luis Obispo requires that all of its 126 unreinforced masonry buildings be retrofitted by 2017. The city provided free downtown parking for contractors, $5000 incentives for each owner that retrofits, grants for up to $25,000 for some owners, and permit fee waivers. Most importantly, the downtown business community is experiencing a major revitalization with enhanced foot traffic, retail and restaurant activity partly as a result of the improvements.

- **Position Retention** – to keep systems in place during shaking, but not necessarily operational
- **Operational**

Detailed advice about seismic performance options is in the Appendices.

Option 4: Undertake Seismic Screenings

Selective screening of collapse risk buildings will be informative for setting priorities for other options and aiding public understanding of the risks. This option doesn't necessarily involve formal quality assurance or public disclosure of screening results.

Two standard techniques for screenings are available:

- *Rapid Visual Screening of Buildings for Potential Seismic Hazards* (FEMA 154, a national guideline) is a simple procedure that can be accomplished with smartphones from the sidewalk and no access to interiors.
- *Seismic Evaluation and Retrofit of Existing Buildings – Tier 1 Seismic Screening* (from ASCE 41-13, a national standard) is a somewhat more in-depth procedure that can be accomplished in less than a day for most buildings with interior access.

The results of these screening techniques can be incorporated into community-specific vulnerability databases for more reliable loss estimates for large cities and counties. Loss estimates can also help generate what-if scenarios for an expected range of earthquakes as well as annualized losses based on screening data unique to each community.

Option 5: Require Seismic Evaluations and Ratings of Buildings

More stringent ASCE 41-13 Tier 2 or 3 evaluations of buildings that have a particular type of exceptionally high risk construction will provide comprehensive insights into vulnerabilities. These are typically done for buildings that face retrofits. This information can help scope retrofit costs and disruptions to occupants and neighbors. The results of ASCE 41 evaluations can also be used to generate safety ratings and compare them with the performance provided by standards for new construction.

A number of jurisdictions have opted to subsidize owners' costs of these evaluations.

Option 6: Encourage Voluntary Retrofits or Replacements

Communities can take steps to accelerate the baseline rate of attrition through programs that make retrofits or replacements more attractive to building owners. The success of these programs will be influenced by:

- Real estate market conditions including property values, rents, and vacancy rates
- Frequencies of changes in occupancy
- Code-based triggers of seismic evaluations and retrofits including those for alterations, additions, or repairs
- Changes in stakeholder awareness when ratings and disclosures become known pursuant to previous options
- Ordinances that require owner notification of exceptionally high risk buildings and specify seismic performance objectives
- Redevelopment and intensification of properties
- Incentives such as reducing building permit fees, or reduction of disincentives such as waiving parking requirements

An important part of such programs is asking owners to commit to a self-defined time frame for action. It may be more politically acceptable and less confrontational to start a voluntary retrofit program first, but typically a large percentage of owners will not retrofit or replace their buildings until they are required to do so.

Success Story

San Francisco's Earthquake Safety Implementation Program

San Francisco engaged its citizens in collaborative ways to develop a Community Action Plan for Seismic Safety to reduce vulnerabilities with priorities tailored to the City's unique building stock and socio-economic conditions. The plan's recommendations are now being managed through a new 30-year Earthquake Safety Implementation Program. First steps include addressing the most vulnerable soft story apartment buildings. Next in line are older private schools and with plans to address non-ductile concrete buildings later.

Option 7: Require Retrofits or Replacements

Mandatory retrofit ordinances will generally require retrofits by owners within time frames of multiple years. Ordinances will typically include:

- Notification of owners of exceptionally high risk buildings near active earthquake faults
- Minimum seismic performance objectives and retrofit requirements
- Financial incentives and removal of disincentives
- Procedures for regulators to record certificates of collapse risk and compliance on property deeds
- Ways to ensure effective enforcement of evaluations, retrofits or replacements within prescribed time frames
- Procedures to accommodate changing economic conditions, respond to unexpected construction costs and delays, and allow time for buildings to be sold to others more willing to retrofit
- Guidelines for preserving qualified historical resources

- Language specifying demolition and replacement of high risk buildings as a last resort when retrofit alternatives are infeasible
- Requirements to monitor and report progress to policymakers

California jurisdictions have enacted successful ordinances of this type for unreinforced masonry structures. In extending them to other building types, flexibility and creativity are essential for success. Communities considering this option should closely study existing programs in this state and elsewhere.

Step 4: Other Key Management Considerations

Only rarely can collapse risk buildings be dealt with in isolation. Other issues always complicate the process of seismic risk reduction, but the specifics are unique to each jurisdiction. To help avoid unforeseen difficulties, the following issues should be evaluated as part of the planning checklist for each of the three previous steps.

- Hazards arise from nearby active faults, including the extent and expected rate of occurrence of damaging ground motions, landslides, liquefaction, tsunamis, and other geological effects. The exact mixture of these hazards is unique to each community.
- Fire protection needs, electrical and communications networks, and infrastructure of regional significance each require special attention.
- Earthquakes induce major secondary effects such as water damage, nonstructural damage and damage to building contents.
- Costs are always significant. It is imperative to balance them against realistic estimates of benefits, affordability and the time needed to reduce collapse risks effectively.
- Financial, zoning and use incentives can make a significant difference in helping owners invest in building safety.
- Seismic safety objectives should mesh with other planning, zoning, economic, social development, and historic preservation initiatives.
- Seismic retrofits can trigger other requirements such as disabled access compliance, fire resistance and repairs that can substantially increase project costs and discourage building owners from taking action.
- The community's tax base will be affected, both by altering the building stock and by damaging earthquakes.
- Post-earthquake recovery times, and the extent to which they might be reduced by pre-earthquake risk reduction, should be carefully considered.

A final challenge to communities is reconciling the human and geological timescales. Damaging earthquakes may occur at any time and cannot be predicted. But they are relatively rare, so communities may have the advantage of many years, possibly decades, before the next one. But retrofits and replacements of collapse risk buildings are quite costly, so they can't be readily accomplished in the short term. Therefore, adopting a long-term perspective is typically sound practice. These are the essential elements:

- Building safety regulatory oversight by well-trained and qualified professional inspectors and plan reviewers, who are generally licensed or certified, to ensure that new buildings are earthquake resistant and every opportunity is taken to effectively reduce the risks posed by older buildings
- Preparedness, public education, and emergency management measures including barricading, stabilization and having repair ordinances in place to address the anticipated risks that damaged buildings can pose
- Management by metrics, using periodic progress reports to keep the public and policymakers abreast of the size and nature of the collapse risks posed by buildings, what has been done about them over time, how soon will such risks be significantly reduced to manageable levels, and how the rate of retrofit and replacement progress compares with the expected rate of occurrence of future earthquakes
- Incorporation of retrofit and replacement initiatives into a community's multi-hazard mitigation plans and coordination with other long-term planning and growth objectives
- Periodically reevaluating progress and revising priorities and strategies, especially after damaging earthquakes

8th Item IX

State of California
Seismic Safety Commission

Memo

To: Commissioners

From: Richard McCarthy
Seismic Safety Commission
1755 Creekside Oaks Drive, Suite 100
Sacramento, CA 95833
(916) 263-5506

Date: 9/29/15

Subject: Proposal: "Small Business Continuity Training" by California Small Business Development Center Network (Phase II)

Background

Under a Phase I Commission study, the California Small Business Development Centers (SBDC) developed a "California Small Business Development Centers Disaster Resource Guide." At the August Commission meeting, SBDC's Mr. Joel Ayala presented the Phase II concept on how to use the Guide to reach out to small businesses throughout California. Mr. Ayala requested feedback from the commission and its staff. The attached proposal describes how SBDC plans to have the disaster continuity training module delivered 420 times to an audience of over 10,500 individuals during a twelve month timeframe.

This proposal has been reviewed by the Governor's Office of Business and Economic Development (GoBiz). GoBiz will provide guidance to the Commission and SBDC during the duration of this Phase II project.

Recommendation

Staff recommends that commissioners review the attached proposal and listen to Ms. Kristi Johnson's (Chair, Small Business Development Centers Leadership Council) presentation. After the presentation and discussion, staff requests that the Commission approve the Phase II contract with SBDC.

About the California SBDC Network

California's Small Business Development Center (SBDC) Network is one of the state's primary partners for small business development. Our consortium of 42 service centers and 6 administrative lead centers play a leading role in driving the state economy. The SBDC provides small businesses and entrepreneurs with confidential no-cost advising and expert training in over 100 locations. Our wide-reaching infrastructure of technical assistance provides the state "touch points" with thousands of small businesses every month.

The SBDC network is equipped to help business owners access capital, develop business and financial models, create and implement marketing strategies, connect to global markets, and grow their business online. We also deliver important information from state agencies direct to California business owners.

California SBDC network works closely with 65,000 businesses and entrepreneurs each year. Through these efforts, the California SBDC annually assists entrepreneurs to:

- Create 920 new businesses
- Create 5,435 new jobs
- Increase taxable revenue by $343,664,562
- Raise over $535,540,000 in new capital

California Small Business Disaster Continuity Training

California SBDC network proposes to incorporate disaster continuity training modules into statewide small business workshops targeting business owners and entrepreneurs. The purpose of these educational modules would be to provide new and existing business owners with the information they need to be prepared for disruption caused by major earthquakes or other natural disasters[1]. The focus of these workshops would be planning for business continuity during and after a large earthquake. Topics to cover would include:

- Preparation of an Earthquake Plan
- Staff training to support the plan
- Power backup and restoration
- Data backup and restoration
- Restoring business operations
- Preparing staff for recovery (training and drills)
- Conducting business in an economy without communications (e.g. potentially no electronic transactions)
- Secure Supplier Network? (How quickly can you be resupplied?)

[1] Businesses disrupted by non-natural caused would also benefit from this business continuity training.

We propose to have the disaster continuity training module delivered 420 times to an audience of over 10,500 individuals during a twelve month timeframe. Trainings will be coordinated with Go-BIZ to maximize reach and collaboration.

COSTS

Development of Curriculum		$5,000.00
Production of Training Video		$12,000.00
Training of 42 Regional Trainers		$8,400.00
Production of Course Materials and Handouts		$22,500.00
	Subtotal	$47,900.00
Underwriting for 420 Trainings ($400/event)		$168,000.00
	Total	$215,900.00

PARTNERS TO WORK WITH

Governor's Office of Business and Economic Development (Go-BIZ)
Office of Emergency Services (Statewide & Local)
The Great American Shakeout