

**PRELIMINARY PROGRAM**  
**Tsunami Evacuation Buildings**  
**9/28/09 Coastal Field Trip and 9/29/09 Portland Workshop**

**Cannon Beach/Seaside Field Trip September 28, 2009**

**Description:** Visit community leaders and residents in Cannon Beach and Seaside to better understand local issues. Discuss the possibility of constructing tsunami evacuation buildings with coastal community members.

7:00-8:30	Drive to Cannon Beach (CB)
8:30 – 9:00	Coffee and OEM April earthquake and tsunami month preparedness display (Althea Turner, moderator)
9:00-10:30	Presentation of Cannon Beach City/Tsunami Refuge, CB Tsunami efforts, Group Discussion Rich Mays, City manager, to be invited (Jay Raskin moderator)
10:30-11:00	Break
11:00-12:00	Tour of Cannon Beach (Jay Raskin, leader)
12:00-1:00	Lunch
1:00-2:00	Drive to Seaside with tour of Seaside
2:00-3:30	Seaside School District, Seaside Tsunami Refuge & Tsunami efforts, Group Discussion Doug Dougherty and Tom Horning, to be invited (Bob Frietag, moderator)
3:30-5:00	Return to Portland

**Portland Workshop September 29, 2009**

**Description:** Foster a productive dialog among CREW members and others from northern CA, OR, WA, and BC and elsewhere on tsunami evacuation buildings (TEB). This will involve discussions on:

1. FEMA P646 publication series on vertical evacuation design guidelines
2. FEMA P646A State and Local Guide for implementation
3. Risk management strategies needed as supported by increased risk hazards shown in the new Cannon Beach Tsunami Inundation study.
4. Different types of tsunami refuges: berms, structures, and buildings.
5. Lessons learned from Japan, which has built tsunami refuges.
6. Other implementation issues: funding opportunities, feasibility, building codes, education, design, cost.

8:30-10:00	TEB Policy Session: Mike Mahoney, FEMA HQ NOAA, legislators, governor's office, media (to be invited) (Yumei Wang and Jay Raskin, moderators)
10:00-10:15	Break
10:15 - 10:30	Group Introductions (everyone), framework and goals of workshop (Yumei Wang and Jay Raskin, moderators)
10:30-11:30	Experienced Designer of Tsunami Evacuation Building (Japan or HI, TBD) (Harry Yeh, moderator)
11:30-12:00	Fema P646 and P646A, Mike Mahoney
12:00-12:15	Space issues, Althea Turner

12:15-1:00	Lunch (provided)
1:00 - 2:00	OR Cannon Beach maps, DOGAMI/Yumei Wang CB Tsunami Refuge, design team members
	<ul style="list-style-type: none"> <li>• Jay Raskin, Ecola Architects, Co-leader and architect</li> <li>• Yumei Wang, DOGAMI, Co-leader and risk engineer</li> <li>• Harry Yeh, Coastal and Ocean Engineering, OSU; Tsunami expert</li> <li>• Kent Yu, Degenkolb, Structural Engineer, structural design</li> <li>• Javier Moncada, Berger Abam, engineer, wave deflection structures</li> <li>• Marcy Boyer, Chinook Geoservices, geotechnical engineer</li> <li>• Tim Fiez, Gartrell Group, software architect, tsunami evacuation modeling</li> </ul>
2:00-2:30	WA, TBD
2:30-3:00	CA, Jim Goltz, CA Office of Emergency Services
3:00-3:30	Break
3:30-4:00	British Columbia, Maiclaire Bolton, Seismologist, BC Emergency Program
4:00-5:00	Group discussion
6:00 -7:30	Dinner suggestion

**Sponsors:** Cascadia Region Earthquake Workgroup (CREW) and the City of Cannon Beach

**Contacts:** Yumei Wang 971-673-1551, Jay Raskin 503- 436-2162; Bob Freitag (206) 328-2533

**Current Planning Team** (subject to change)

- Yumei Wang, DOGAMI (with assistance from Rob Witter & James Roddey)
- Jay Raskin, City of Cannon Beach
- Bob Freitag, CREW
- Althea Turner, OEM
- Tim Walsh, DNR
- John Schelling, EMD
- Tamra Biasco, FEMA Region X
- Prof. Harry Yeh, OSU

**Cooperating Organizations** (Others to be determined)

State and Provincial Agencies:

- a. DOGAMI
  - i. Yumei Wang, Geohazards Team Leader
  - ii. Rob Witter, Regional Coast Geologist
  - iii. James Roddey, Earth Sciences Information Officer
- b. Oregon Emergency Management
  - i. Althea Turner, Earthquake, Tsunami, and Volcano Program Coordinator
- c. OSSPAC
- d. California Governor's Office of Emergency Services
  - i. Jim Goltz, Earthquake and Tsunami Program
- e. British Columbia
  - i. MaiClaire Bolton, Seismologist, Emergency Program Seismic Safety
- f. Washington State Agencies (proposed, not confirmed)
  - i. John Schelling, Emergency Management Dept, Earthquake Prog. Manager
  - ii. Timothy Walsh, Chief Geologist, Hazards Section, Washington Geological Survey

Coastal Communities

- g. City of Cannon Beach
  - h. City of Seaside
- FEMA Region X and FEMA Headquarters
- i. Tamra Biasco, Region X
  - j. Mike Mahoney, Headquarters
- NOAA Portland and Headquarters
- k. Tyree Wilde

***Tsunami Evacuation Buildings (TEBs)***  
***A new risk management approach to Cascadia earthquakes and tsunamis***  
*Yumei Wang*

Low lying coastal communities along the Pacific Northwest are at-risk of near-field (local) tsunami inundation generated by Cascadia Subduction Zone (CSZ) earthquakes. Certain communities were developed long before scientists understood the existing tsunami hazards. As such, about 100,000 people are in the tsunami inundation hazard zone each day in Oregon. Some of these 100,000 people are in the high hazard portion of the inundation zone nearest to ocean and river channels with long travel distances to safe, higher elevation land.

In 2009, new generation tsunami inundation maps will be issued for Cannon Beach, Oregon (CB). Using improved scientific data and methods (ie. post 2004 Sumatra), the tsunami hazard maps will show greater risk hazards from Cascadia generated tsunamis than previous maps. The 2008 CB evacuation map shows much of the downtown, the elementary school, fire station, police station and city hall at risk from distant and local tsunamis (Figure 1a and 1b)

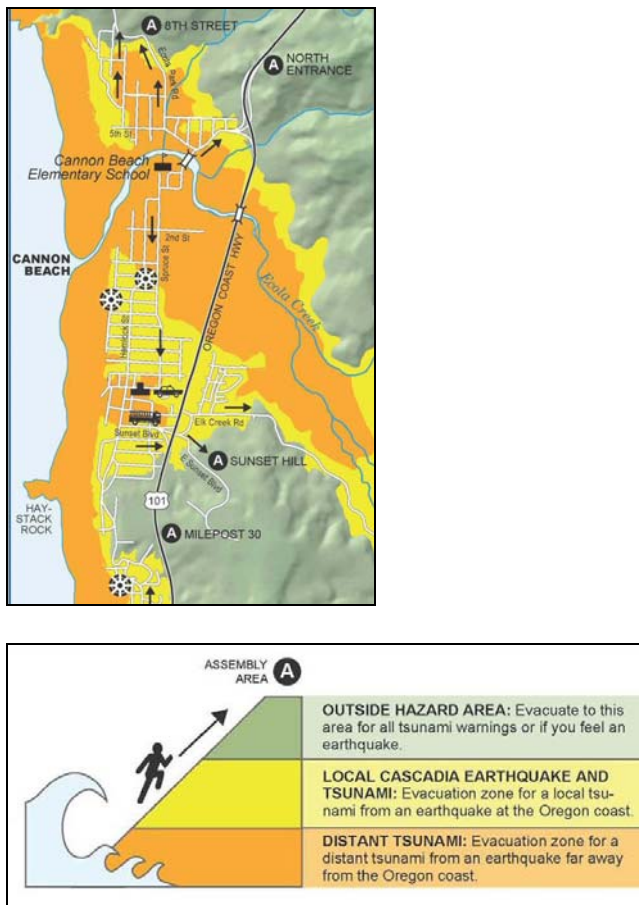


Figure 1: Portion of Cannon Beach tsunami evacuation map and index (DOGAMI, 2008)

Low lying tsunami-prone coastal communities require proactive implementation programs, such as aggressive education, tsunami evacuation buildings (TEB) and reliable near-field tsunami warning systems. TEBs can be an important element to insuring that schools, essential facilities, and government buildings are able to meet their everyday purposes, and continue to function after the earthquake and tsunami.

People who cannot safely evacuate the tsunami inundation zone should be able to evacuate to a TEB within 500 to 1,000 m. An estimated dozen or more TEBs should be available in Oregon alone. TEBs must be able to withstand prolonged strong earthquake shaking and may be reinforced concrete structures with deep scour-resistant foundations and a minimum of two stories (Figure 2). The lowest story should be open space on the ground floor to allow for water and debris passage. Or, the lowest floor should be designed to be sacrificial, such as with break away walls. The elevation of the bottom of the second story should be higher than the anticipated tsunami inundation elevation. The roof may be designed for general purposes, such as for parking or recreation space. It may also be designed for emergency purposes, such as for evacuees, heliport, emergency storage of food or medical supplies, emergency generator, emergency vehicles and so on. TEBs may be designed with energy dissipation or wave deflection structures facing the ocean to allow water to flow past the structure. In addition, TEB design should accommodate rapid ingress by foot traffic during tsunamis and be readily identifiable to evacuees. TEBs should allow for a minimum of 0.5 sq m per evacuee. Because tsunamis are rare, TEBs should serve a daily purpose.

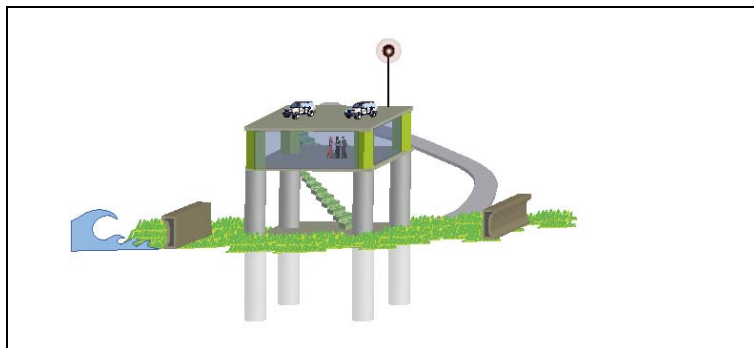


Figure 2. Schematic Design of Tsunami Evacuation Building (TEB)

Figure 2 is a schematic design of a hypothetical two story concrete TEB with rooftop parking on deep foundations. Floor 1 includes a tsunami education center and other community functions, which would be sacrificed during a tsunami. Floor 2 includes office space and is elevated above the tsunami inundation elevation. The top floor is for parking, emergency supply storage, and has a readily identifiable TEB beacon and siren for evacuees. Vehicular ramps and staircases, which are located away from the ocean, allow for mass emergency ingress including wheelchair access.

#### **Ad-hoc Design Team for Cannon Beach Tsunami Refuge**

Replacing the existing Cannon Beach City Hall with a TEB could serve as a demonstration project for other coastal communities with high tsunami risks. An ad hoc design team has developed a conceptual design for the City of Cannon Beach. Team members include:

Jay Raskin, Ecola Architects, Co-leader and architect  
Yumei Wang, DOGAMI, Co-leader and risk engineer  
Harry Yeh, Coastal and Ocean Engineering, OSU; Tsunami expert  
Kent Yu, Degenkolb, Structural Engineer, structural design  
Javier Moncada, Berger Abam, engineer, wave deflection structures  
Marcy Boyer, Chinook Geoservices, geotechnical engineer  
Tim Fiez, Gartrell Group, software architect and tsunami evacuation modeling