Oregon Tsunami Program:
Accomplishments:

• **Modeling & Mapping:** 2009-2013, Oregon coast tsunami inundation mapping completed (5 local scenarios, 2 distant);
• **Maximum-considered local and distant scenarios used for developing evacuation maps (entire coast covered)**
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- **Building a Culture of Awareness:** Intensive community outreach programs implemented in all coastal population centers - since ~2011;

- **TsunamiReady:** 19 communities & 5 counties;
- **Tsunami Comic Book:** *Without Warning: Tsunami* (OEM & Dark Horse Comics);

**Up and Out: Oregon Tsunami Wayfinding Research Project**
- **Up and Out Wayfinding guidance, Phase 1—Final Project Report and Guidance Document**
- **Up and Out Wayfinding guidance, Phase 2—A study in Seaside and Warrenton**
2018/19 Major Accomplishments - TsunamiSafe

Tsunami Safe: Hospitality Begins with Safety:
- Rebuilt 2018;
- Added analytics (usage tracking);
- Added ability to modify content;
- While orientated to hospitality industry, emphasis now is also for broader public (i.e. learning tool).
- Re-launched ~mid January 2019.
Manzanita’s Ocean Inn stocks emergency GoBags

- February 28, 2019

(Left to right) Linda Cook, Janice Zagata and Larry Zagata show off the emergency GoBags Manzanita’s Ocean Inn has stocked in each of its rooms. – EVCNB Photo

https://www.northcoastcitizen.com/2019/02/manzanitas-ocean-inn-stocks-emergency-gobags/
**2018/19 Major Accomplishments – Wayfinding Signage**

"Entering- and Leaving Tsunami Hazard Zone" Signs: DOGAMI and ODOT (District 7) partnering to install ~60 signs along Highway 101 & major Secondary Highways, southern Oregon coast.

**Tsunami Evacuation Wayfinding:**
$60k (FY17)/$30k (FY18). Funding new signage in 4 communities & 3 counties.

"You are Here" Evacuation Signs: Completed 63 YAH signs (Clatsop, Tillamook, Lincoln, Douglas, and Lane Counties)

It takes a village!
Tsunami Evacuation Wayfinding Guidance

https://www.oregon.gov/OEM/hazardsprep/Pages/Tsunami.aspx
Tsunami Evacuation Drill Guidebook

How to Plan a Community-Wide Tsunami Evacuation Drill

Oregon Office of Emergency Management
December 2017
2\textsuperscript{nd} Oregon Tsunami Conference: over 25 speakers presenting on tsunami topics ranging from effective public education, new science, ..... 
~150 participants attended the meeting
Tsunami Debris Workshop

May 28, 2019
Astoria, OR

Brought together speakers and stakeholders to discuss tsunami debris

Multi-state: WA, OR, CA
Corps of Eng, FEMA,

Outcomes:
Series of webinars
Debris guidance: Rick Wilson drafted rough

NEHRP funded
“Beat the Wave” (BTW) Pedestrian Evacuation Modeling: Completed BTW modeling for Warrenton and Hammond, Clatsop Plains, Rockaway Beach, Pacific City and Newport.

**Outcomes:**
1. Ideal evacuation routes
2. Minimum evacuation speeds
3. Vulnerabilities and mitigation options (primarily infrastructure)
4. Socioeconomic analysis (where are the vulnerable populations?)

**Data inputs**
- Road and trail surfaces (paved vs gravel vs sand)
- Tsunami evacuation zone (XXL)
- DEM for slope and distance (lidar)
- Tsunami wave arrival times
2. Pedestrian walking speeds
- The MINIMUM walking speed someone must travel in order to reach safety ahead of the first tsunami arrival at the start of their route
- These speeds will change depending on the scenario (i.e. bridges in versus out or adding a hypothetical vertical evacuation structure)

3. Evacuation “communities”
- “flow zones” or “watersheds”
- Zones delineating which safety destination is best for entire town
- These community boundaries will change depending on the scenario (i.e. bridges in versus out or adding a hypothetical vertical evacuation structure)

1. Evacuation routes
- Detailed information on the most efficient routes to safety (arrows)

4. Tsunami wave arrival time map
- Detailed map of the first tsunami wave arrival for the entire region

Beat The Wave Products
Investigate Vulnerabilities
Example: How does the failure of bridges affect evacuation?

Minimum walking speeds necessary for survival increase significantly if bridges are not available for evacuation.

Investigate Mitigation Options
Example: How helpful would a vertical evacuation structure be when facing the possibility of bridge failures?

Minimum walking speeds necessary for survival decrease significantly if a vertical evacuation structure is present.
coming soon...

BTW evacuation maps
2018/19 Major Accomplishments – HAZUS

Tsunami Building Damage and Casualty Estimation – Clatsop/Tillamook Counties

Goals:
1) Determine casualties for a Cascadia earthquake and tsunami (XXL1/L1/M1);
2) Assess building losses (includes debris)
3) Assess economic impact.

Two scenarios:
1) Summertime weekend (2 AM)
2) Wintertime mid-week (2 AM)

<table>
<thead>
<tr>
<th>Community</th>
<th>Buildings No.</th>
<th>Replace Cost. ($ Millions)</th>
<th>Losses &amp; Debris $ Millions</th>
<th>Tons (*1000)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Warrenton</td>
<td>2469</td>
<td>793</td>
<td>673</td>
<td>204</td>
</tr>
<tr>
<td>Camp Rilea</td>
<td>1807</td>
<td>464</td>
<td>422</td>
<td>116</td>
</tr>
<tr>
<td>Gearhart</td>
<td>1769</td>
<td>500</td>
<td>499</td>
<td>139</td>
</tr>
<tr>
<td>Seaside</td>
<td>3900</td>
<td>1342</td>
<td>1327</td>
<td>352</td>
</tr>
<tr>
<td>Cannon Beach</td>
<td>1688</td>
<td>498</td>
<td>461</td>
<td>111</td>
</tr>
<tr>
<td>Arch Cape</td>
<td>391</td>
<td>87</td>
<td>65</td>
<td>17</td>
</tr>
<tr>
<td>Clatsop County Total</td>
<td>12024</td>
<td>3683</td>
<td>3448</td>
<td>939</td>
</tr>
</tbody>
</table>

Notes:
Assumes 10 min departure delay; % relative to pop of that scenario in tsunami zone

Earthquake losses ~ 1/3 of total losses.
Leave ASAP!  Walk AFAP!

Average Walk Rate:
4 feet/sec

Average Walk Rate:
6 feet/sec

Casualties (Injuries + Fatalities)

Departure Time (minutes since earthquake commencement)
Mobile Phone App
NVS-TsunamiEvac (Released Jan 2019)
Tsunami influence

Table 5. Maritime evacuation times to nearest offshore* (where currents fall below 4 knots) and upriver staging destinations for a DISTANT tsunami®. Evacuation times assume an average vessel speed of 6 knots.

<table>
<thead>
<tr>
<th>Location</th>
<th>Distance to Offshore Safety* (km / NM)</th>
<th>Time to Safety (min)</th>
<th>Distance to Upriver Safety® (km / NM)</th>
<th>Time to Safety (min)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ilwaco, WA</td>
<td>17 / 9.2</td>
<td>1 hour 31 min</td>
<td>47 / 25.4</td>
<td>4 hours 14 min</td>
</tr>
<tr>
<td>Chinook, WA</td>
<td>18 / 9.7</td>
<td>1 hour 37 min</td>
<td>41 / 22</td>
<td>3 hours 41 min</td>
</tr>
<tr>
<td>Hammond, OR</td>
<td>20 / 10.8</td>
<td>1 hour 48 min</td>
<td>33 / 17.8</td>
<td>2 hours 58 min</td>
</tr>
<tr>
<td>Warrenton, OR</td>
<td>25 / 13.5</td>
<td>2 hours 15 min</td>
<td>31 / 16.7</td>
<td>2 hours 47 min</td>
</tr>
<tr>
<td>Astoria, OR</td>
<td>26 / 14</td>
<td>2 hours 22 min</td>
<td>25 / 13.5</td>
<td>2 hours 15 min</td>
</tr>
<tr>
<td>Tongue Point, OR</td>
<td>36 / 22.4</td>
<td>3 hours 14 min</td>
<td>16 / 8.6</td>
<td>1 hour 26 min</td>
</tr>
</tbody>
</table>

km = kilometers. NM = nautical miles.
Thank You

Leaving Tsunami Zone