Tsunami Evacuation Modeling

Exploring evacuation difficulty and mitigation options

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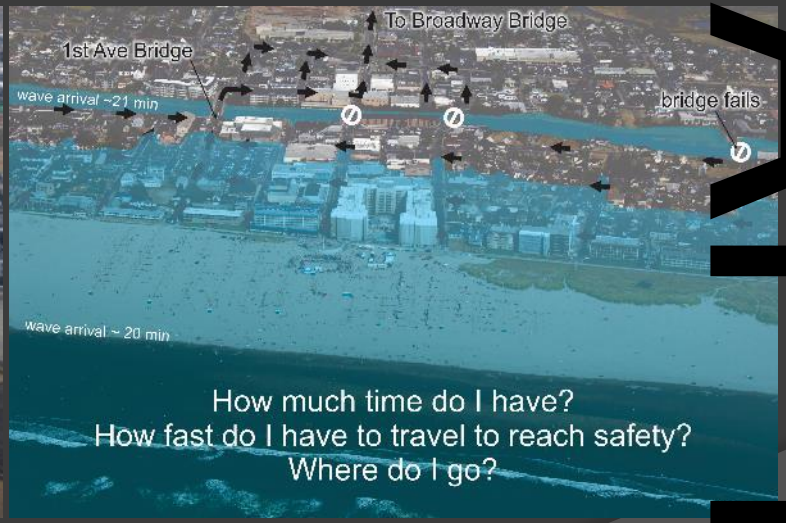
March 11, 2011 Japan tsunami, seen crashing into homes in Natori, Miyagi prefecture. *AP*



Seaside, OR during their annual beach volleyball tournament which attracts more than 20,000 people!

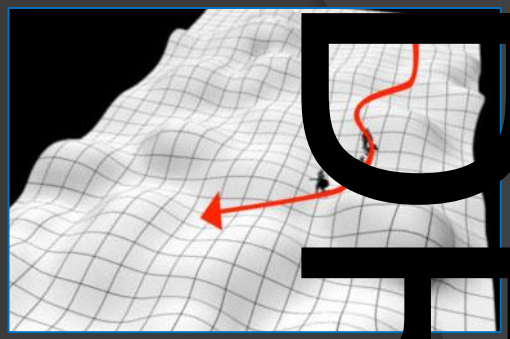
Pedestrian Tsunami Evacuation Modeling

Beat The Wave investigates:

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

…using **least cost path** modeling

GIS is used to model the most efficient path to safety for every point on the map. Safety is high ground, not necessarily an assembly area.



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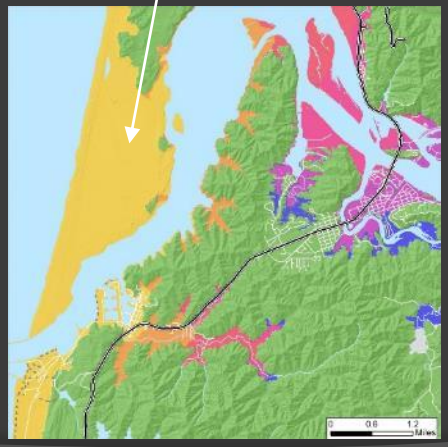
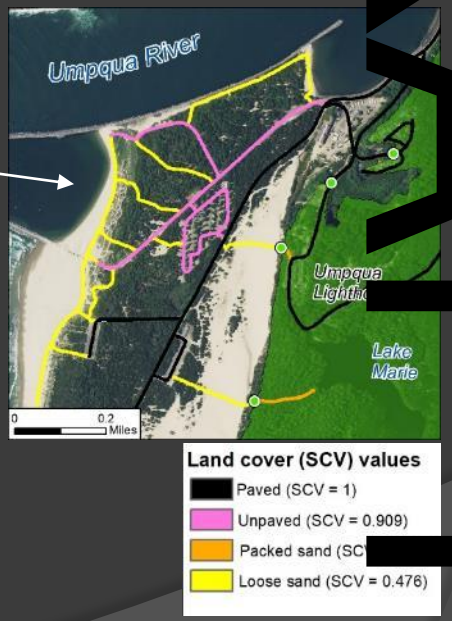
Data inputs

- Road and trail surfaces (paved vs gravel vs sand)
- Tsunami evacuation zone (**XXL**)
- DEM for slope and distance (lidar)
- **Tsunami wave arrival times**

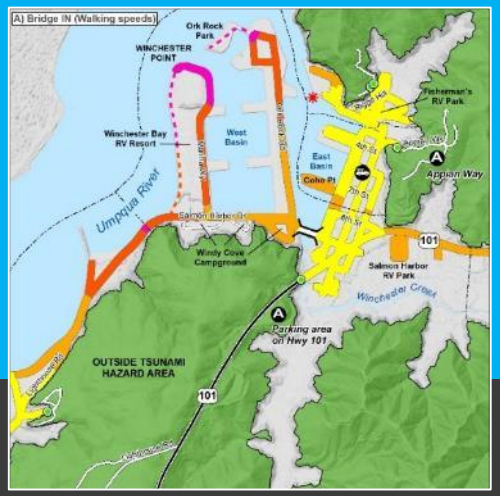




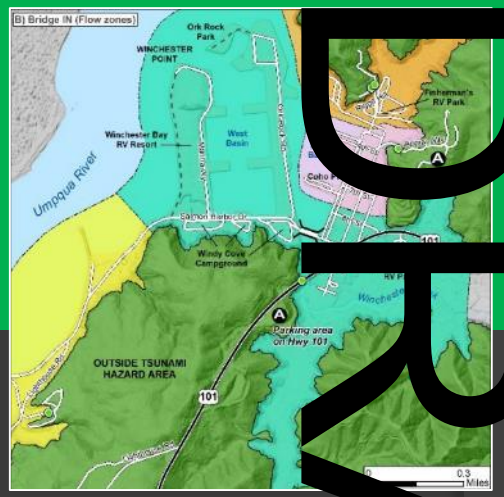
Beat The Wave Products

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

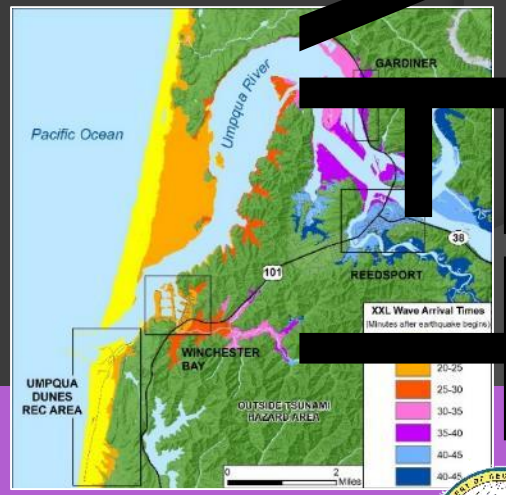
2. Pedestrian walking speeds
- The MINIMUM walking speed someone must travel in order to reach safety ahead of the first tsunami arrival at the start of their route
- These speeds will change depending on the scenario (i.e. bridges in versus out or adding a hypothetical vertical evacuation structure)



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)



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



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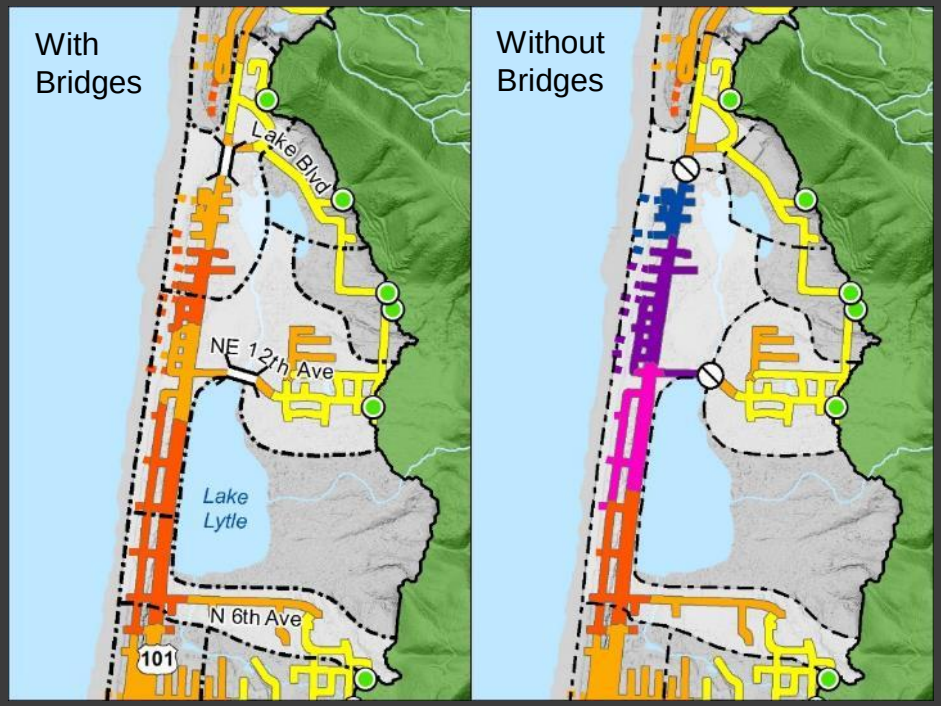
Investigate Vulnerabilities

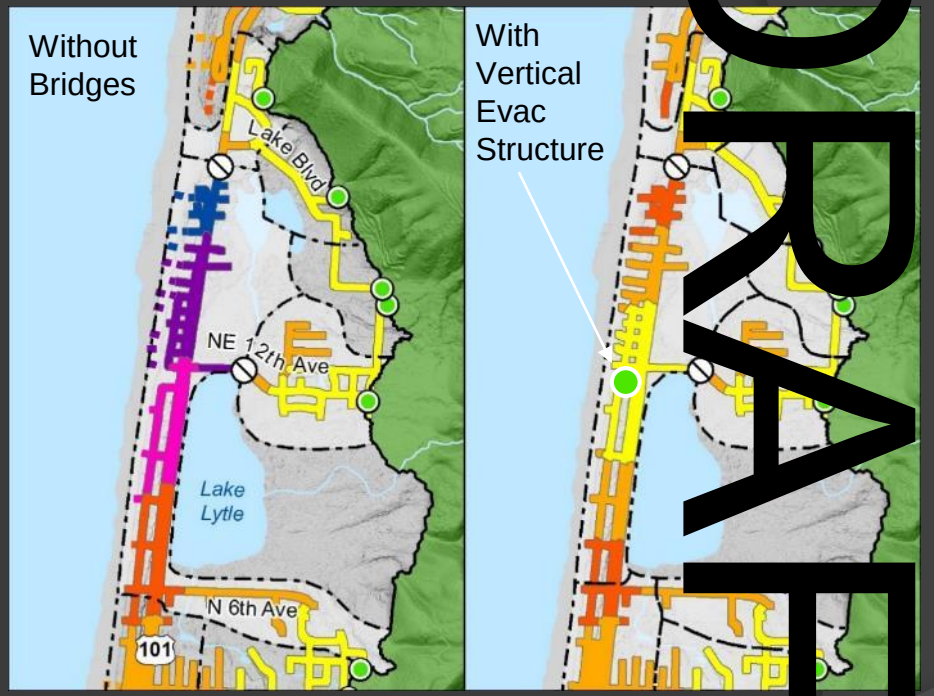
Example: How does the failure of bridges affect evacuation?



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

Investigate Mitigation Options

Example: How helpful would a vertical evacuati[illegible] when facing the possibility of bridge fa[illegible]res?



Minimum walking speeds necessary for survival **decrease** significantly if a vertical evacuation structure is present

- Slow walk (0-1.4 mph)
- Walk (1.4-2.7 mph)
- Fast walk (2.7-4.1 mph)
- Slow jog (4.1-5.5 mph)
- Run (5.5-6.8 mph)
- Sprint (6.8-10 mph)

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What can you do with these data?

Vertical Evacuation Structures

OSU @ HMSC Marine Studies Building, est completion 2020

Ocosta School (Westport, WA) completed 2016

Improvements to existing infrastructure

Safehaven Hill

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Wayfinding