COMMENTS FOR THE NSF TSUNAMI WORKSHOP AT HILO, HAWAII, 26-28 DECEMBER 2006

By
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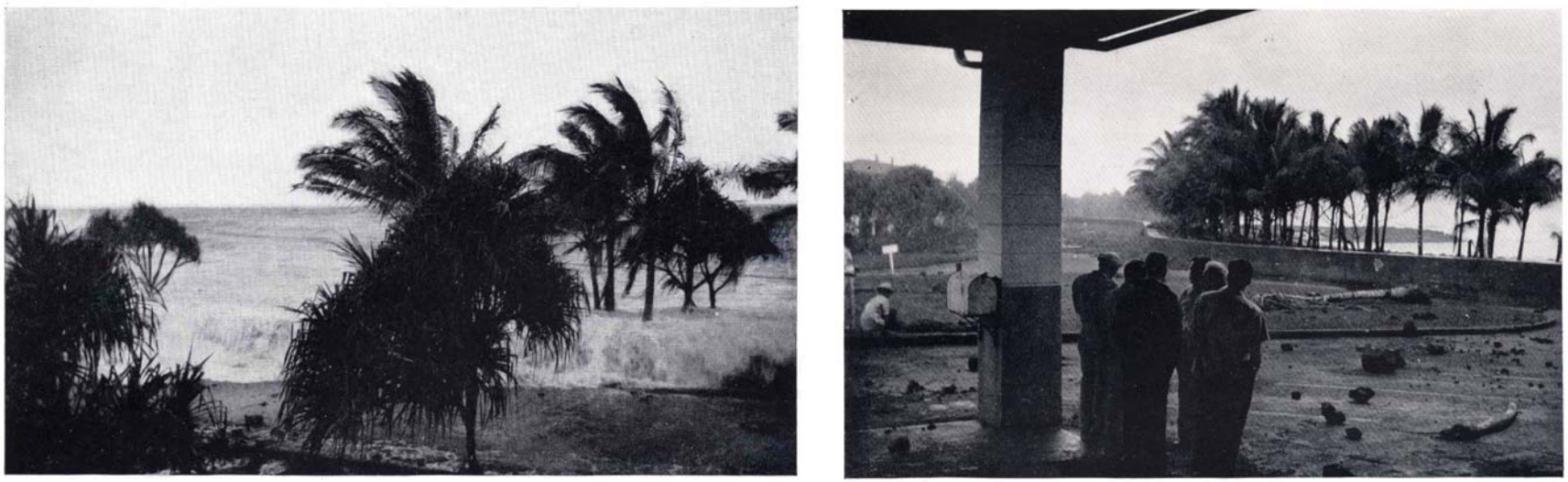
1. Introduction

- Seawalls during tsunamis?



A tsunami flooding over the sea wall at the Puu Maile Hospital near Hilo, 1 April 1946

3. Hilo Hawaii

- 1 April 1946: the Aleutians; 96 people killed.
- 4 Nov. 1952: Kamchatka
- 9-10 May 1957: the Aleutians
- 23 May 1960: Chile: 61 people killed
- 27 March 1964: the Gulf of Alaska
- The two largest locally generated tsunamis
  - 2 April 1868 (estimated earthquake Richter magnitude 7.25 to 7.75)
  - 29 Nov. 1975 (earthquake Richter magnitude 7.2)

- ***Tsunami Ready Award*** -- the state had taken several steps to be better prepared for the next tsunami, including having emergency operations center in every county, a statewide siren system, evacuation maps in phone books, regular drills and public education programs. Its long-term tsunami mitigation program is the result of studies and plans that started shortly after the Chile tsunami of 23 May 1960.

3. Hilo Hawaii

Figure 4. Wave in form of a bore, approaching Wailuku River;
looking toward the sugar mill, 1 April 1946 tsunami.
It appears to be moving along the seacliff as a **Mach-stem.**

4. Designing for Tsunamis: Seven Principles for Planning and Designing for Tsunami Hazards

1. Know your community's tsunami risk: hazard, vulnerability, and exposure
2. Avoid new development in tsunami run-up areas to minimize future tsunami losses
3. Locate and configure new development that occurs in tsunami run-up areas to minimize future tsunami losses
4. Design and construct new buildings to minimize tsunami damage
5. Protect existing development from tsunami losses through redevelopment, retrofit, and land reuse plans and projects
6. Take special precautions in locating and designing infrastructure and critical facilities to minimize tsunami damage
7. Plan for evacuation

- "Sound reinforced-concrete construction with deep embedded foundations or solid raft foundations (foundation mats) capable of resisting scour; shear walls are desirable."
  - What has been the experience, and what is the judgment about this of the present workshop participants?

5. Tsunami Runup and Inundation; and Worst Case Scenario

- What type of tsunami is likely to occur?
- Will the tsunami move onto shore like a fast rising tide, a surge, or a bore?
- Do we know enough to decide this reliably?
- Are sufficient data available at a particular site to judge this?
- Or, if the local authorities must make a decision for adopting or upgrading a building code, or the issuance of a building permit, do they have to assume the "worst case scenario"?

6. Wave-induced Forces by a "Bore" on a Vertical Circular Cylinder

- Snodgrass, Rice, and Hall, 1951: a ***foam line*** (i.e., the wave progressing shoreward just after breaking, similar to a bore) moving past the pile exerted a larger horizontal force on the test pile than a wave that broke at the pile.
- The peak force is inertial, with a sharp spike in addition to the expected drag force.

- This was also observed in a wave tank experiment by Hall (1957).
- This has been described, and explained by Wiegel (1983), by Goda, Haranaka and Masahata (1966) and Watanabe and Horikawa (1974).
- Additional studies have been made in the Large Wave Flume of the Coastal Research Center in Hannover, Germany, by K. Irschik, U. Sparboom, and H. Oumeraci (2005), and by Wienke and Oumeraci, (2005).

7. Scour on a Fringing Reef; Request for Information

- During one or more drawdowns of a tsunami, much of the reef, and on one occasion the entire fringing reef was observed to become bare. The currents on the reef would have been strong, and much sediment scoured from the reef flat, carried seaward over the reef edge during the drawdown, and lost to the littoral. I think this is an important factor in the fact that there is a relatively small amount of sand at Waikiki; but I have no data. While making the study I made a search for data about tsunamis on reefs, but found little information.

8. Ports and Harbors

- It is generally recognized that the best procedure in the case of a tsunami, if adequate warning time is available, is to move the ships and boats out of a port, to sea
- As the tsunami approached the shoreline and entered shallow waters, it created high water levels and strong currents. These caused mooring lines to break and ships to capsize.