

SAWG Hawaii Civil Defense July 2006 Meeting













SWAN Model for Hawaii Kai Click above for Movie

- On CD-ROM in Numerical Modeling of Water Waves CRC Press (2004)
- A train of 3 meter high, 1500 second tsunami waves. 30 DeChezy Friction.
- Modeled 15 years ago.
- Topography of bay from Sea Engineering depth measurements for Ferry Feasibility Study.
- Floods up to 5 meters inside front of bay and a min of 2 meters in back of bay by third wave.

Hambantota, Sri Lanka

- Dr. Hermann Fritz surveyed after December 26, 2004 Indian Ocean Tsunami
- Noted that it was similar to Hawaii Kai with reef outside with a channel under a road along the sea shore into a large shallow lake.



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Hambantota Tsunami

- Wave arrived a little over 2 hours after earthquake. The first wave was about 1 meter high and the second wave was up to 10 meters high about 10 minutes later.
- Houses over 1 kilometer inland were demolished.

Tsunami Effects

- Little of the town was left standing with no water, electricity or communications.
- One thousand houses along the Hambantota-Tissa road, town-council residences, shops and other buildings destroyed. Many homes located near the Hambantona harbor were completely washed away.

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Loss of Life

- When the tsunami hit, hundreds of local people were visiting Sunday markets.
- Two to three thousand people were promenading along Hambantota harbor when the tsunami wave struck.
- The overwhelming majority of these died.
- Over 4500 died in low-lying coastal strip





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HAMBANTOTA, SRI LANKA December 26, 2006 Tsunami

DEATH ZONE WAS AREA BELOW 10 METERS and LESS THAN 1 KILOMETER FROM SHORE.

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Multiple Tsunami Waves

 Often populated areas along coasts are located in low-lying and flat regions that together with natural and man made obstacles make retreat of the flood caused by first tsunami wave to be slow.
 Subsequent waves ride over a region already flooded resulting in higher and faster waves.

Sri Lanka Multiple Tsunami Waves

- The multiple wave phenomenon was observed throughout the Sri Lanka coast.
- http://www.asce.org/page/?id=53
- "It wasn't one wave, it came in great surges, each one deeper than the last and pushing the water that had come in before it in front of it.

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Sri Lanka Multiple Tsunami Waves

- Most witnesses described 3 main waves.
- The first knocked them off their feet, the second picked them up and carried them, often up to 50 km/hr, and the third bore them up to 15 meters high or sucked them under.

Fritz Indian Ocean Tsunami Survey Conclusions

- Evacuate all areas below 15 meters above sea level and within 0.25 mile of shoreline or along rivers.
- Evacuate all areas below 10 meters above sea level and within 1.0 mile of shoreline or along rivers.
- Evacuate all areas below 5 meters above sea level and within 3 miles of shoreline.

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HAWAII KAI

- MINIMUM Evacuation zone should include all area below 5 meters above sea level.
- <u>3 Meter Tsunami Flooding Graphic</u>

Sandy Beach and Queens Gate CLICK ABOVE FOR MOVIE 3 meter, 1500 sec Tsunami 10 meter, 1500 sec Tsunami From Numerical Modeling of Water Waves

- CD-ROM, CRC Press (2004).
- All of Queens Gate up to Hawaii Kai Drive should be in evacuation zone.

