Science Application for Risk Reduction

ADVANCES IN TSUNAMI RISK ASSESSMENT AND MITIGATION

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Mission: innovate and apply hazard science for the safety, security, and economic well-being of the nation
SAFRR scenarios

Large, not-very-rare events worth planning for
Science & engineering consensus
For planning & mitigation
Crafted with stakeholders
Scenarios help avoid streetlight effect
Scenarios

Major societal interests, societal 3D’s
Systems, interaction & time
Human behavior
Info for planning, mitigation, response, recovery

Codes, PSRAs

Isolated facility, context-blind, time-blind
Deep math, narrow model
Codewriter interests
Pass/no pass or benefit-cost ratio
"We don't THINK that a large tsunami would cause docks to float off the top of pilings, we KNOW that it will happen." -- Morro Bay Harbor Director
Marinas and harbors

Piling height database (how big is the problem?)

Fragility functions with more than 2 data points

![Graph showing the relationship between maximum current and fraction of boats or docks damaged. The graph includes lines for dock damage, boat damage, and boat sinks.](image)

- **Dock damage**
- **Boat damage**
- **Boat sinks**
15% of boats sink, 20% damaged, $700M

+ sediment transport, hazmat, nav hazards
Ports of Los Angeles and Long Beach
Ports of Los Angeles and Long Beach

3½ hr warning
30-40 large vessels
Pilots remove 5-8 per hr
11-page dispersal plan
  - No specific triggers
  - Not exercised
POLA & LB: moorings, warehouses, equipment
They generally don’t sink

MV Rena, Astrolabe Reef, Oct 2011

Norfolk Express, Weser Estuary, Wremen Germany, Apr 2013
Ports of Los Angeles & Long Beach

$100 million
2-3 days of downtime
6 months repair
Highway and bridge scour

Bridge Scour and Stream Instability Countermeasures: Experience, Selection, and Design Guidance-Third Edition

Volume 2

NATIONAL HIGHWAY INSTITUTE
U.S. Department of Transportation
Federal Highway Administration

CA1 bridge at Malibu Lagoon
CA1 bridge at Costa Mesa
I-5 bridge at Camp Pendleton
I-5 Camp Pendleton
US101 bridge at Cardiff

Data: DDEO, Columbia, NSF, NOAA
Image Landsea: Data: SIO, NOAA, U.S. Navy, NGA, GEBCO
13 highway bridges w/ embankment scour
Highways and bridges: Bay Bridge toll plaza
20 lane-miles on 8 stretches of highway
Highways & bridges

$100 million in repair costs
2-3 days for some repairs
3 months for others
Coastal homes & businesses

13 counties
Coastal homes & businesses

1,800 census blocks
Coastal homes & businesses

103 million sq ft
≈ 70,000 dwellings
Coastal homes & businesses

$31 billion
Coastal homes & businesses

40% of Cal OES max inundation zone
Coastal homes & businesses

$2.6 billion in repairs, mostly contents
Tunnels
Repair cost across CA: $4,500,000,000 (76,000 CO family’s incomes for 1 year)

Other costs that I haven’t talk about could add $1,000,000,000+

Business interruption adds $1-5 billion
The Bottom Line

$5-10 billion statewide loss

– $4-5B marinas, ports, buildings, roads, bridges
– $1-5B business interruption
– Loss depends on actions and preparation

Advanced risk assessment for marinas, ports, roads & bridges, agriculture