

Earthquake

Overview

Explanation This document describes VTS mission objectives (policies, procedures, and decision-making guidance) related to VTS action during and immediately after an earthquake.

Living Document As with all emergency documents, this is a living document.
Post-incident lessons learned will prompt changes to this document and all associated job-aids.
VTS's goal is to optimize emergency procedures as needs change and lessons are learned.

Contents In this document, the following topics are discussed.

Topic	See Page
Mission Objectives and Methods	2
Real-time Risk Assessment – B ³ L ³ Principle	3

Mission Objectives and Methods

Policy Goal During and after an earthquake traffic managers shall take measures to mitigate further injury or damage which may be caused by underway vessels. Traffic managers shall also enlist the services of vessels to aid with damage assessment and with rescue around bridges and waterfront facilities.

VTS shall act swiftly. If command and control communications are impaired VTS shall act independently.

Strategy Traffic managers' strategy will depend on the nature of the damage and the availability of VTS systems.

- Use VHF radio to advise mariners of the quake and alert mariners as to the severity/magnitude of the quake.
- Use the Real-time Risk Assessment – B³L³ Principle (see pg. 2) when collecting damage reports and when warning mariners of likely risks.
- Assist in mitigating further damage possibly caused by underway vessels encroaching on damaged bridges, an uplifted seabed, marine pollution, or obstructed waterways.
- Determine and report usability of occupied waterways and destination routes and docks. Consider damage to navigation aids and direct traffic based on determinations.
- Assist with emergency communications.
- Give waterway priority to passenger vessels since they may be called on to assist with rescue and evacuation.

Measures of Success Traffic Managers are successful if the following are true.

- Moored vessels remain moored unless remaining moored is dangerous.
- At-sea vessels remain at sea.
- Underway vessels either have a viable plan to reach a safe intermediate destination or they are safely holding position while waterway and destination dock usability is determined.
- Passenger vessels have the clearest possible route to offload passengers.
- Sector Command Center is aware of reported injuries, damage, and pollution.

Real-time Risk Assessment – B³L³ Principle

Explanation The B3L3 Principle is a rule of thumb (memory aid) for assessing the most likely risks following a San Francisco Bay Region earthquake.

- B³ refers to Bridges, Bottoms, and Berths.
- L³ refers to Lines, Liquids, and Levees.

Bridges Consider these bridge-related risks.

1. Bridge obstructs the waterway due to full or partial collapse.
2. People, vehicles, or dangerous cargo falling or fallen from the bridge.
3. Drawbridge unable to open due to power failure or structure damage.
4. Tsunami wave surge dramatically reduces vertical bridge clearance.

Bottoms Consider these seabed and waterway related risks.

1. The bottom of the waterway rose due to seismic uplifting forces.
2. Dredged channel walls collapsed filling channels with sediment.
3. Seismic seichesⁱ slammed vessels into the seabed.

Berths Consider these likely berth and mooring-related risks.

1. Seismic waves tore mooring lines leaving vessels adrift or slammed vessels into docks.
2. Cranes tipped or collapsed obstructing the waterway.
3. Berth structures collapsed or burned leaving no mooring facilities.
4. Landslides deposited dockside sediment reducing water depth.
5. Massive shore side or facility fire necessitates vessel evacuation.
6. Loss of power renders berths unusable.

Lines Consider these risks related to power and pipe lines crossing waterways.

1. Live high-voltage lines reducing vertical waterway clearance.
2. High-voltage tower structures collapsed and obstructing waterways.
3. Live high-voltage lines in contact with underway or anchored vessels.
4. Emergency anchoring damaging underwater power or pipelines.

Liquids Consider these risks related to dangerous liquids or other cargo spilling into the waterway or onto shore side facilities.

1. Severed ship-to-shore transfer lines spilling oil into the water.
2. Severed underwater pipes releasing polluting liquid into the water.
3. Severed x-bridge pipes spilling unknown liquids from above.
4. Refineries spilling volatile or polluting substances on the dock or in the water.
5. Anhydrous ammonia facilities releasing deadly gas over the waterway.
6. Overturned tank trucks or rail cars spilling substances from bridges or from the shoreline.

Levees Consider these risks related to the levees in the River/Delta Region.

1. Ruptured levee causing water current to surge or reversing current flow.
2. Wake from a passing underway vessel causing a weakened levee to fail.

ⁱ Seismic seiches are standing waves set up on rivers, reservoirs, ponds, and lakes when seismic waves from an earthquake pass through the area. They are in direct contrast to tsunamis which are giant sea waves created by the sudden uplift of the sea floor. *From USGS Earthquake Hazards Program* <http://earthquake.usgs.gov/learn/topics/seiche.php>