PORT OF LOS ANGELES SEISMIC ENGINEERING PROGRAM

Presented by
Tony Gioiello
Chief Harbor Engineer

INNOVATIVE APPROACHES TO PORT CHALLENGES

September 14, 2006

American Association of Port Authorities

The Port of Los Angeles Today

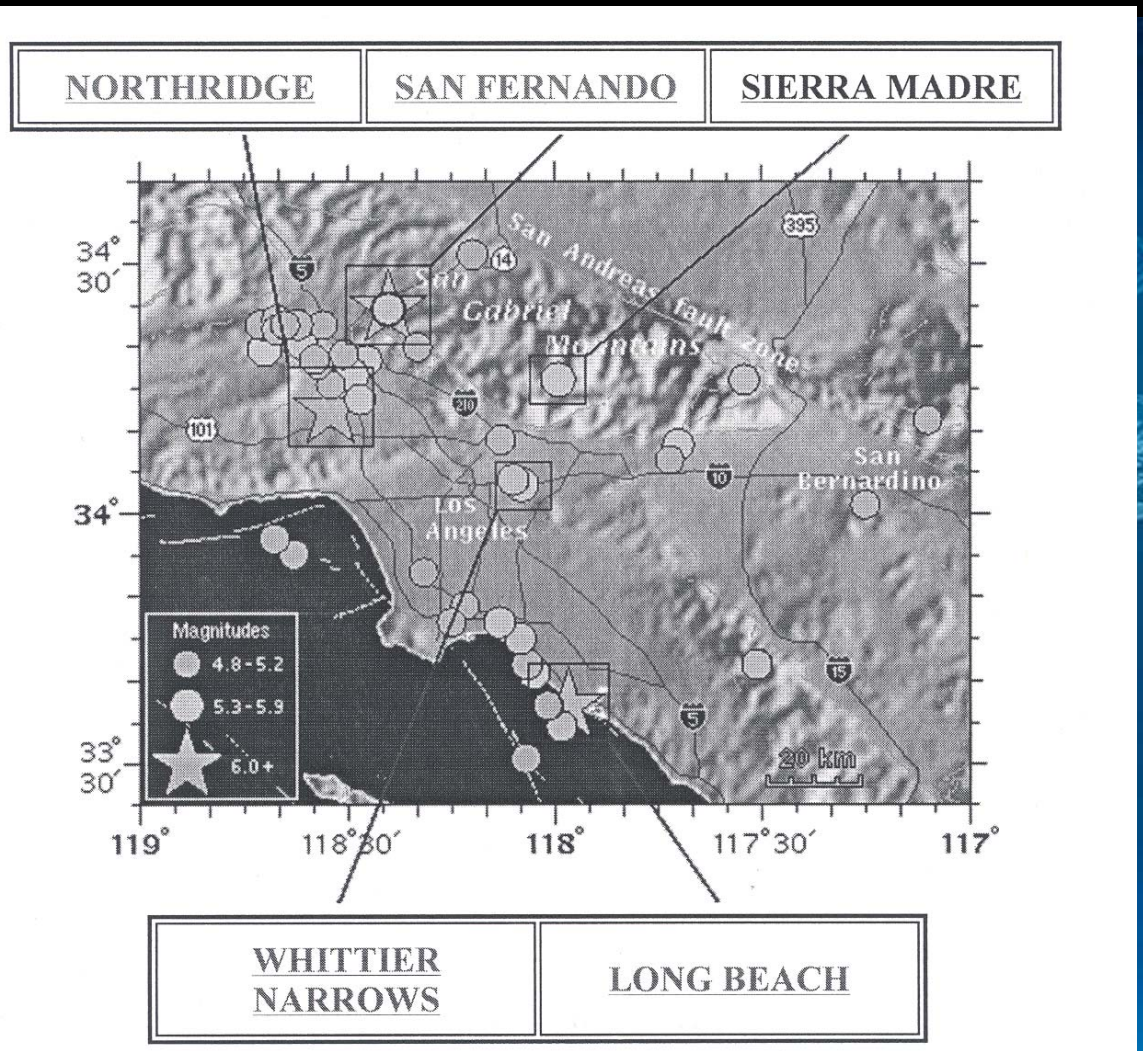
- One of the largest manmade seaports in the world
- A diverse port
  - » Containerized Cargo
  - » Automobiles, coal, liquid bulk, “walking cargo”
  - » Recreation
  - » Fishing

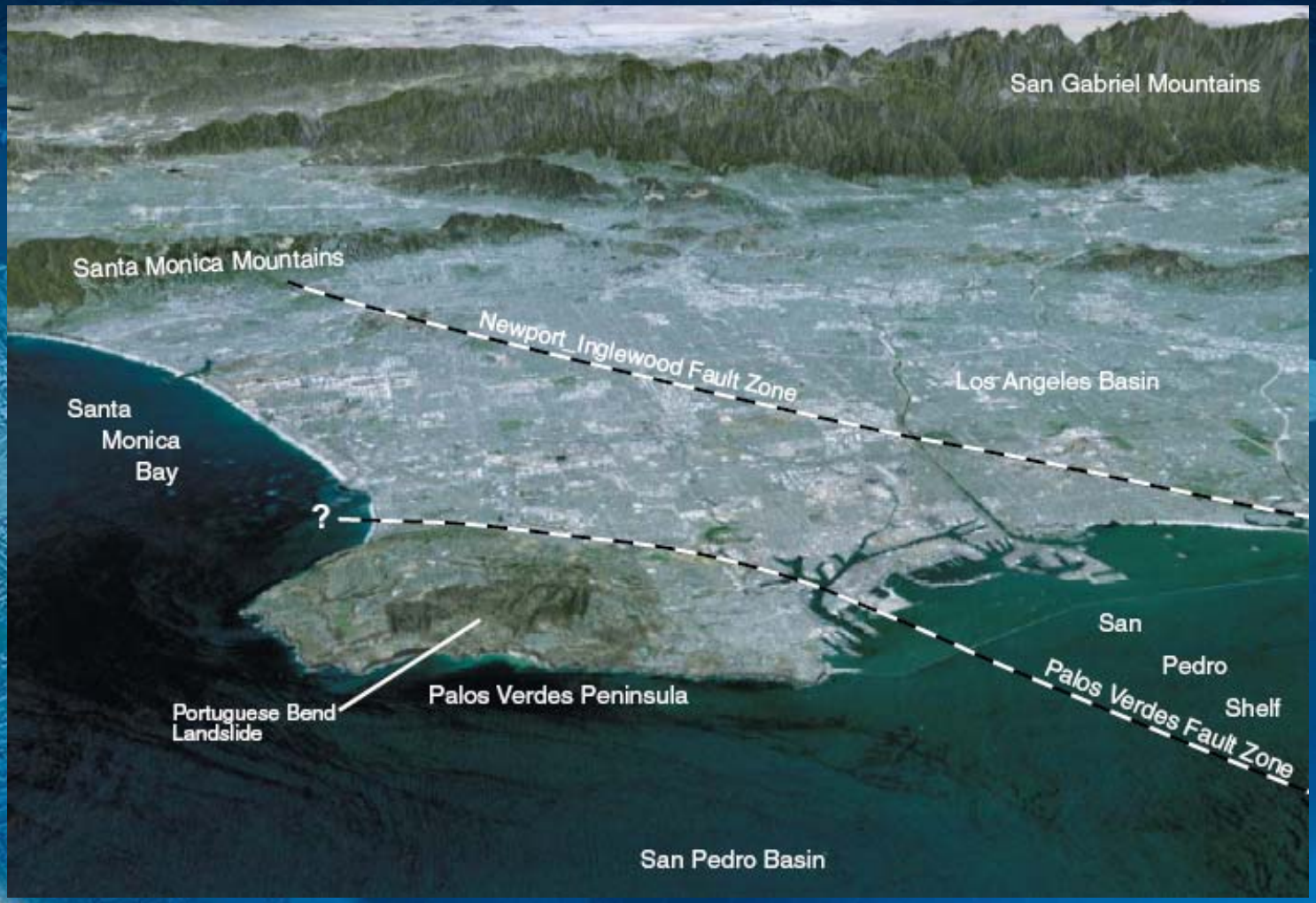
The Port of Los Angeles

- 7,500 Acres
  - » Land (4,200)
  - » Water (3,300)
- 43 Miles of Waterfront
- 8 Major Container Terminals (Approximately 1,600 Acres)
- 33,000 LF of Container Wharf
- 10,000 LF of Recently Constructed State-of-the-art Wharves

POLA Container Terminals

Seismic Risk





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POLA Risk Strategies – History

1933 - Long Beach Earthquake

1962 – Start of Containerization

1971 – San Fernando Earthquake

1981 - POLA State-of-the-art Container Berthing Study

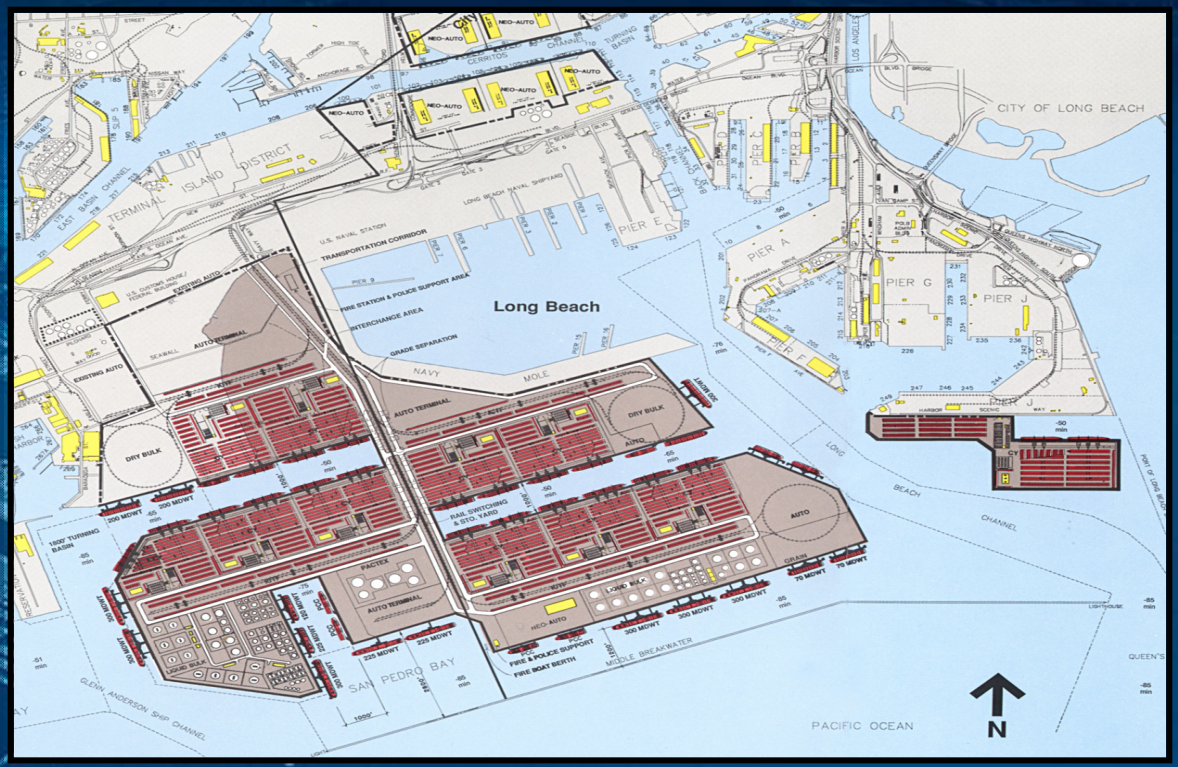
1983 - Development of Risk Management Policy – Hazardous Cargoes.

1984 - 2020 Plan

POLA Risk Strategies – 2020 Plan

POLA 2020 Plan:

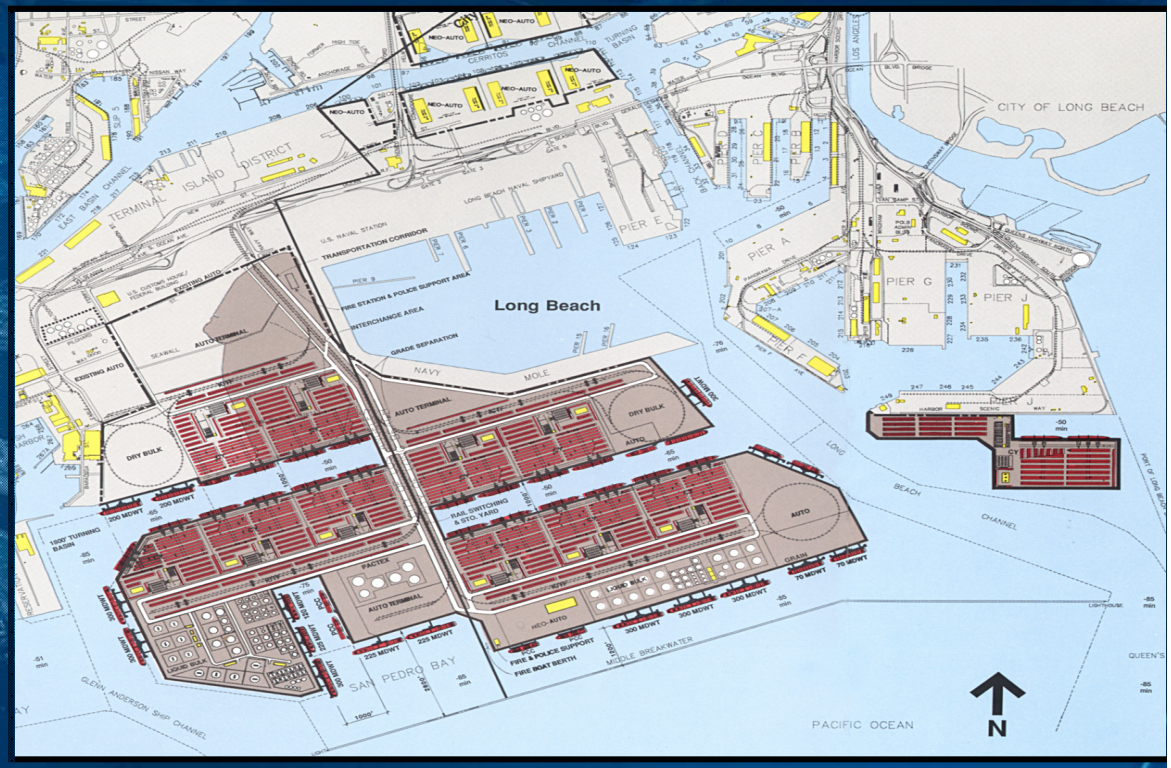
- Large increase in container traffic was predicted over the next 30 years
- Major port expansion is planned
- Needs deeper water and larger wharves to accommodate the growth



POLA Risk Strategies – 2020 Plan

2020 Plan Resolution:

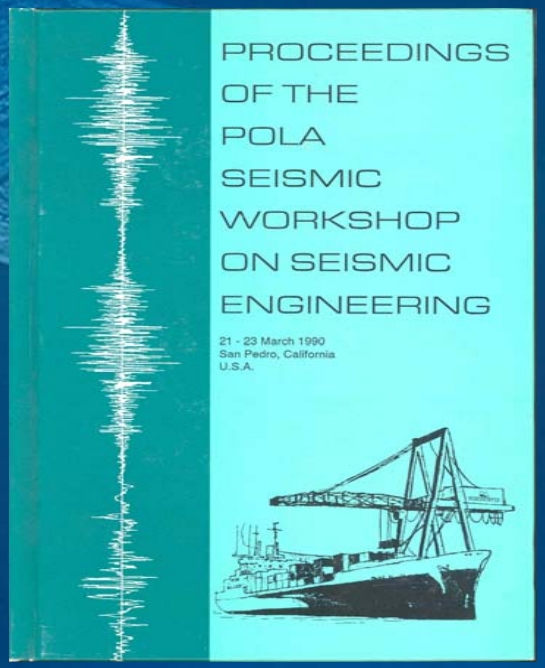
- A seismic design guideline with uniformed approach was necessary
- The call for a seismic workshop to establish such criteria



1990 POLA Seismic Workshop

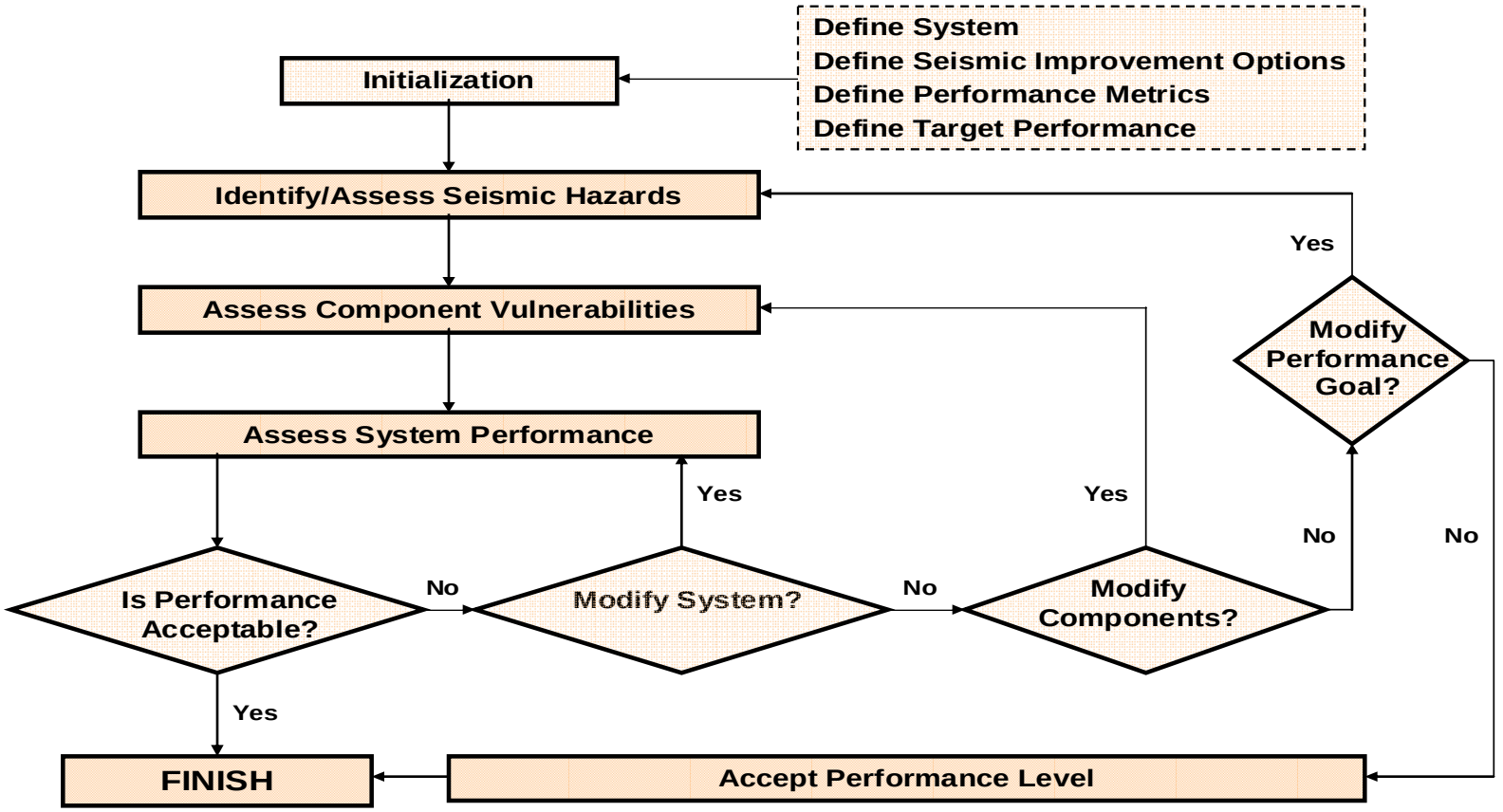
In The Workshop:

- **Look at the Port as a system and perform a seismic risk analysis.**
- **Define the seismic hazard.**
- **Develop engineering procedures for the seismic design and retrofit of port facilities.**



Look at the Port as a system and perform a seismic risk analysis

Seismic Risk Analysis



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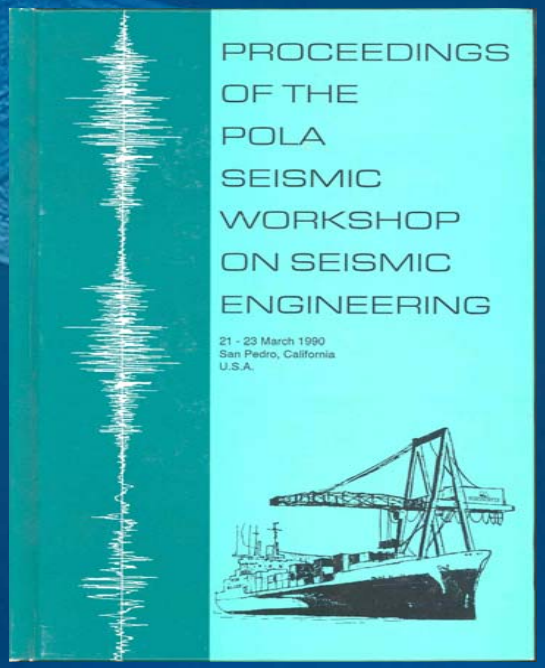
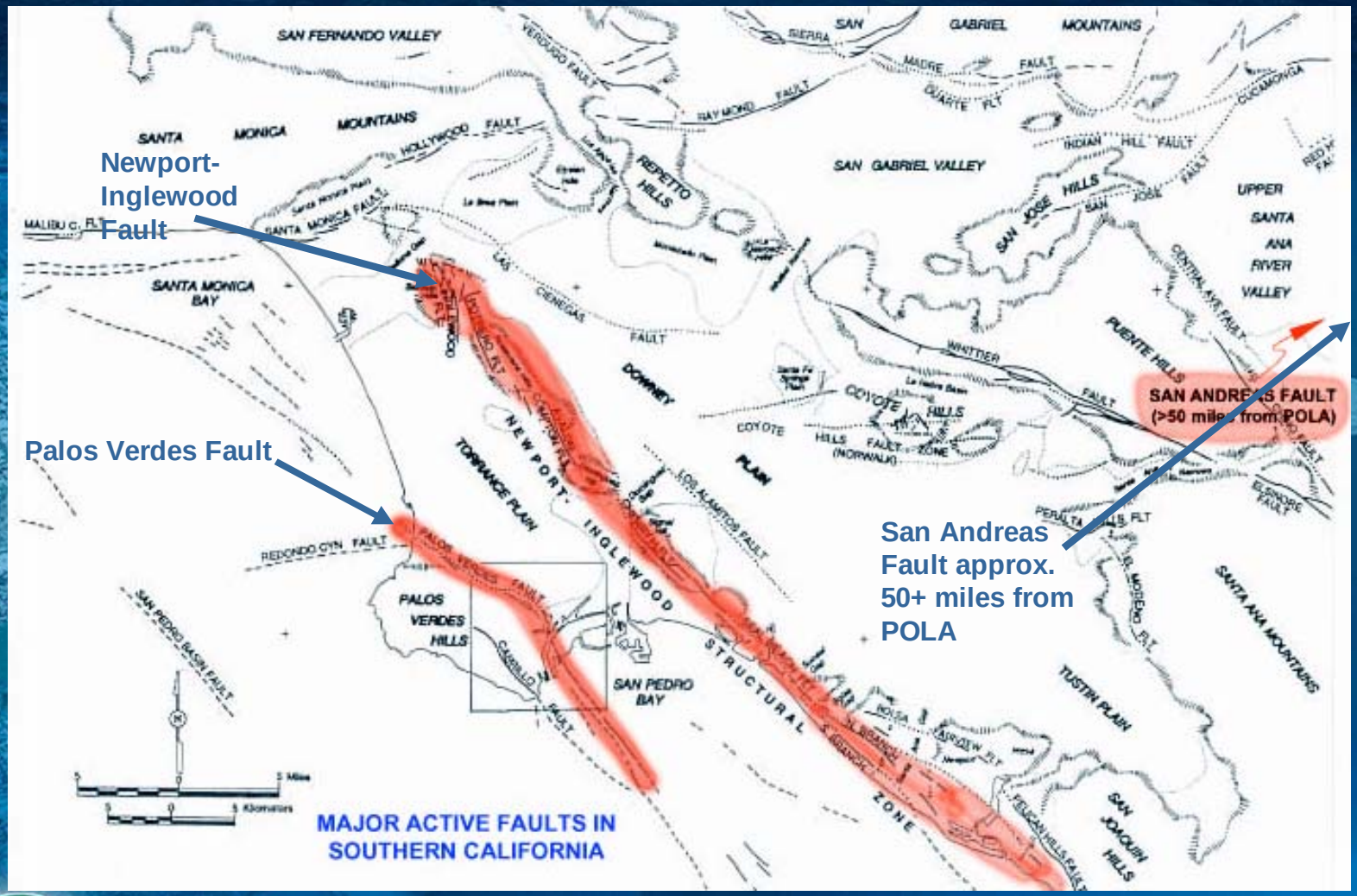


Define the Seismic Hazard

Seismic Hazard Evaluation



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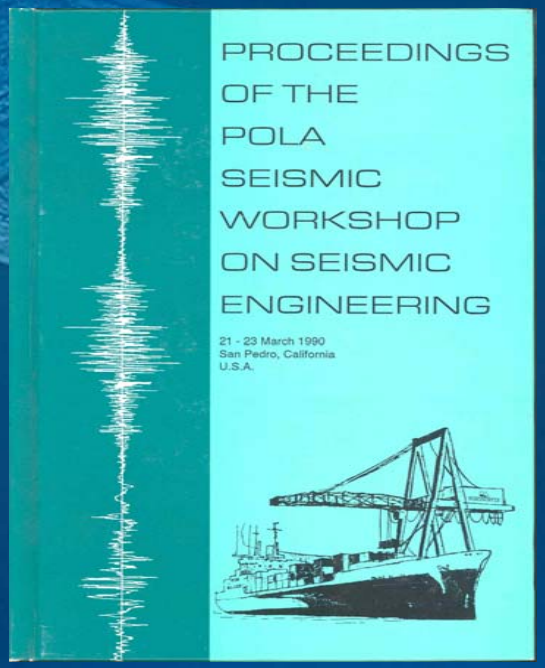

Current Design Criteria

- Operating Level Earthquake **(OLE)**
  - Hazard criteria 50% probability of exceedance in 50 years (72-year recurrence interval)
  - Insignificant damage

- Contingency Level Earthquake **(CLE)**
  - Hazard criteria 10% probability of exceedance in 50 years (475-year recurrence interval).
  - No collapse of wharf

Develop Engineering Procedures for the Seismic Design and Retrofit of Port Facilities

Categorization of Existing Facilities

- **Category 1 – Wharves with full seismic strength**
- **Category 2 - Wharves with near full seismic strength**
- **Category 3 – Post 1980's wharves with partial seismic strength**
- **Category 4 – Wharves prior to 1980's with little or no seismic strength**

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Develop Engineering Procedures for the Seismic Design and Retrofit of Port Facilities

Seismic Code Objectives

- Use as guideline for design and construction of container wharves at POLA
- FEMA recognized code for post disaster recovery reimbursement

Develop Engineering Procedures for the Seismic Design and Retrofit of Port Facilities

Seismic Code Development

- Technical Advisory Board
- Port funded experimental program at UCSD
- POLA/COPRI co-sponsored seismic workshop to present first version of code
- Port-wide ground motion study
- Code revision currently in process

Develop Engineering Procedures for the Seismic Design and Retrofit of Port Facilities

Seismic Code Publication

- Latest version of code and commentary
- Background information on theory behind the code
- Design examples
- Experimental program findings


Thank You
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