



Oregon Resilient Plan 2013

Transportation: Critical Mobility for Rescue and Recovery



Broad Participation – Transportation

- Ports: Portland, Astoria, Coos Bay
- Federal Agency: USCG
- Universities: OSU, PSU
- Consultants: Ch2M Hill, HDR, KPFF, Quincy, OBEC
- Local Governments: AOC, LOC, Western Cities and Counties
- State Agencies: Transportation, Aviation, Forestry

Resilient Oregon Plan Concepts

- Retrofit increases resiliency if done incrementally and strategically
- Secondary loss of life and long term economic losses can be significantly reduced
- Strategic planning is critical to success and will require widespread consensus

Solution: Retrofit

Phase 1 for “life safety” connects superstructure to the substructure.

Phase 2 for “serviceability” strengthens the substructure.
Design for 500-year recurrence interval.

Recurrence Interval

National Code (AASHTO) - Design for no collapse at a 1000-year recurrence interval.

Oregon Code - Design for no collapse at a 1000-year recurrence interval and design for usability within 72 hours at a 500-year recurrence interval.

Bridge Span Collapse



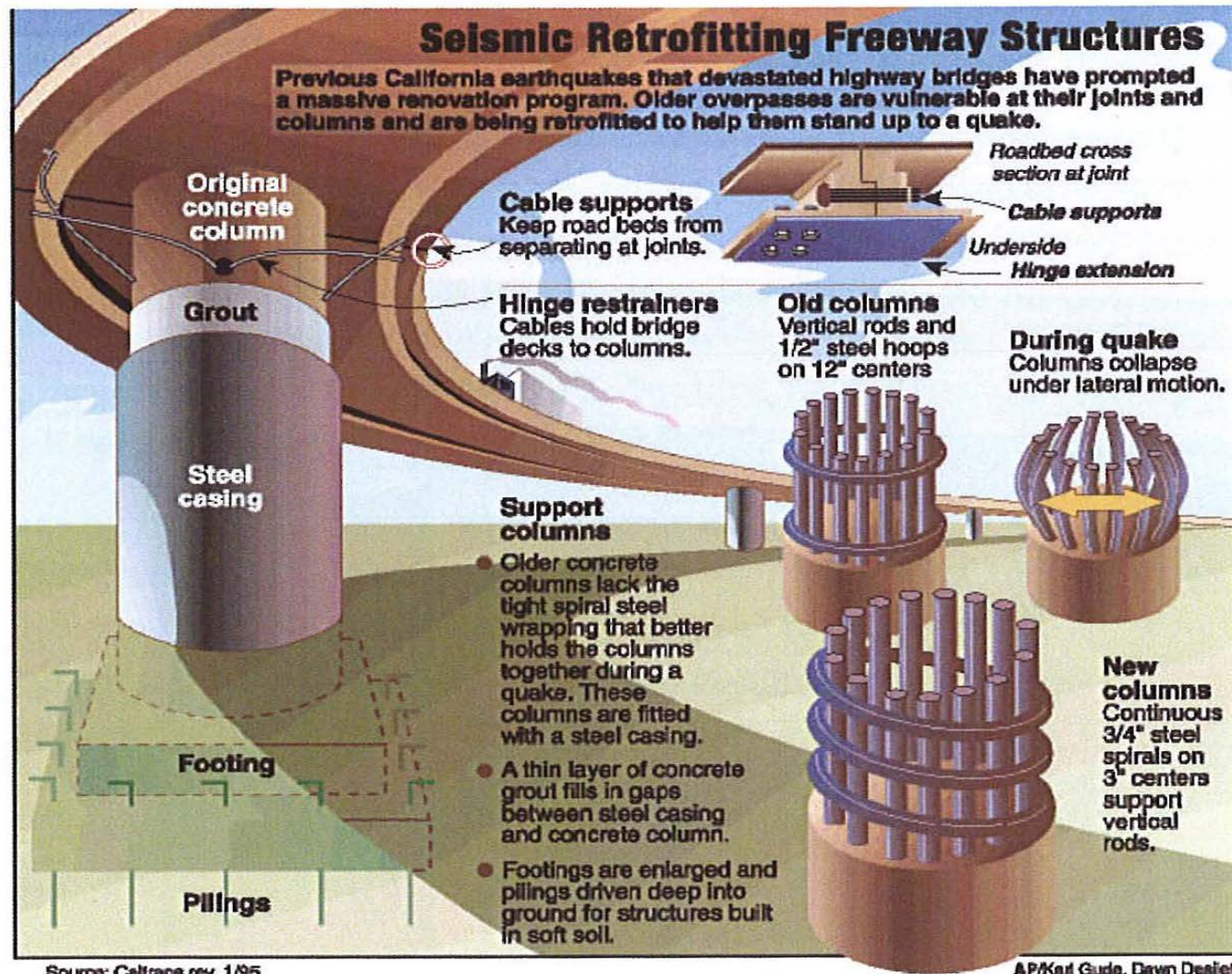
Bridge Bent Failure



Seismic Retrofit Methods

The following sketch illustrates the various substructure retrofit concepts.

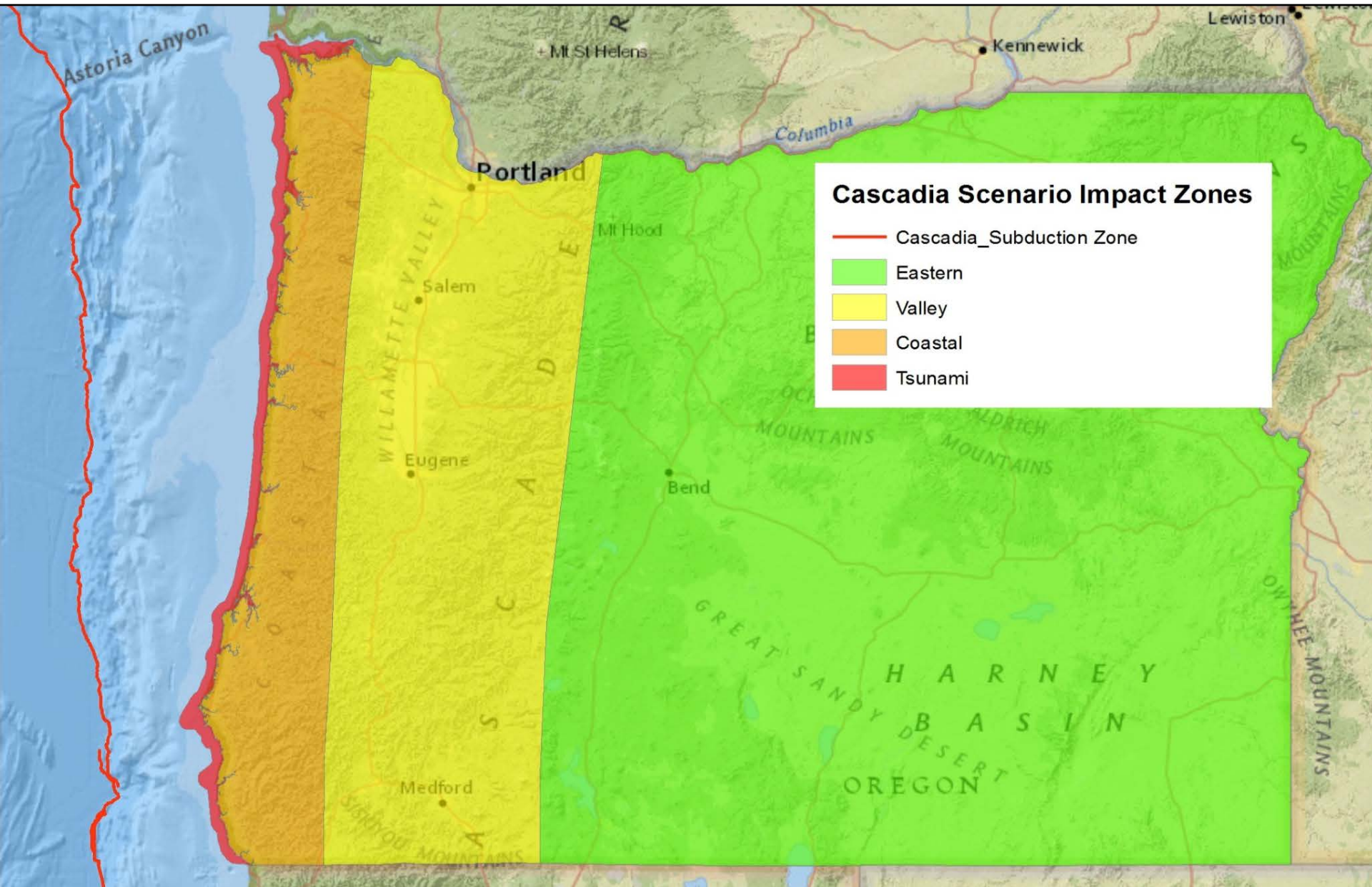
Figure 3.8 : Seismic Retrofit Concepts



Landslide



Four Study Zones

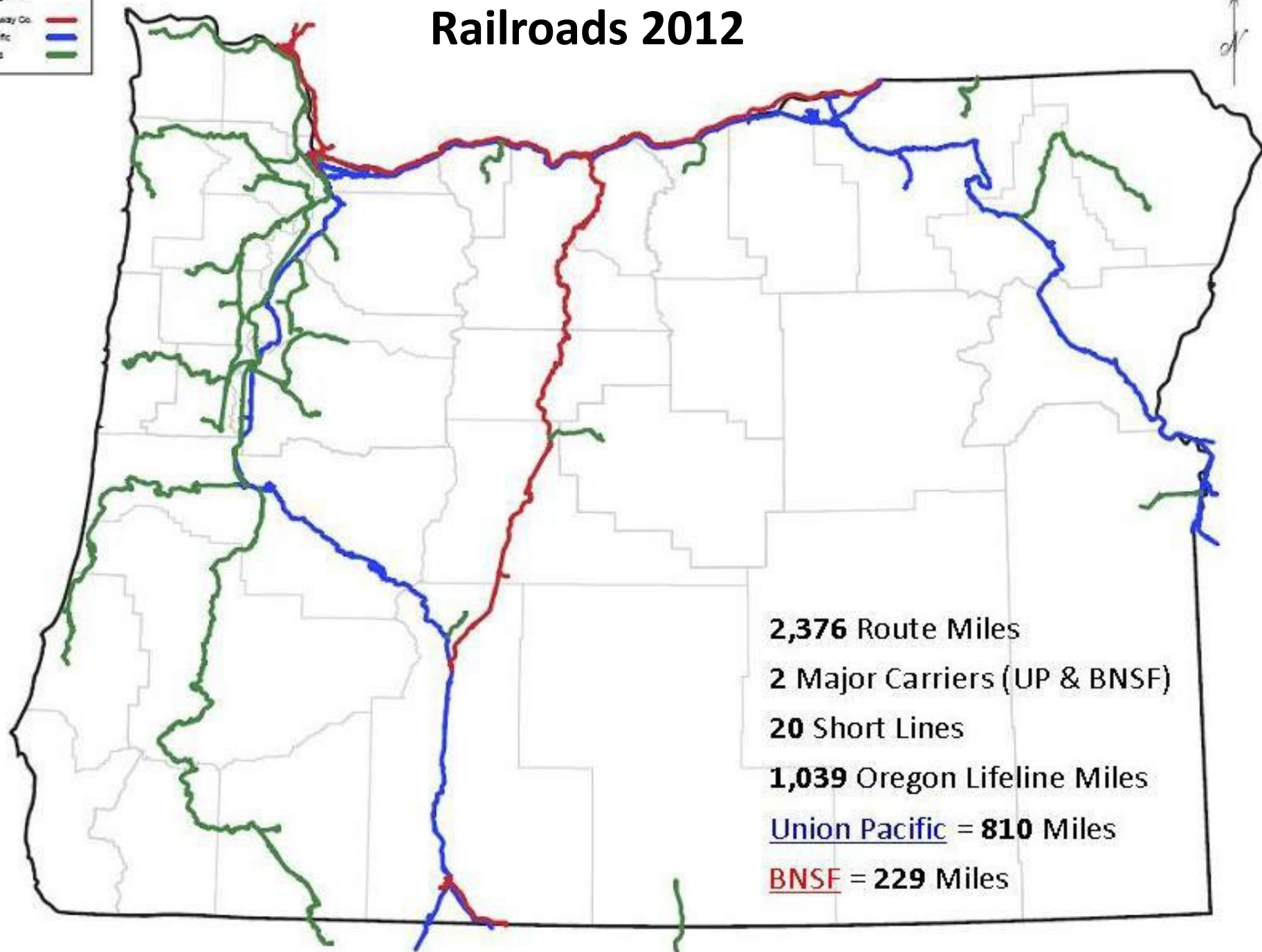


Railroads 2012

Railroads 2012

Legend

- BNSF Railway Co.
- Union Pacific
- Short Lines



2,376 Route Miles

2 Major Carriers (UP & BNSF)

20 Short Lines

1,039 Oregon Lifeline Miles

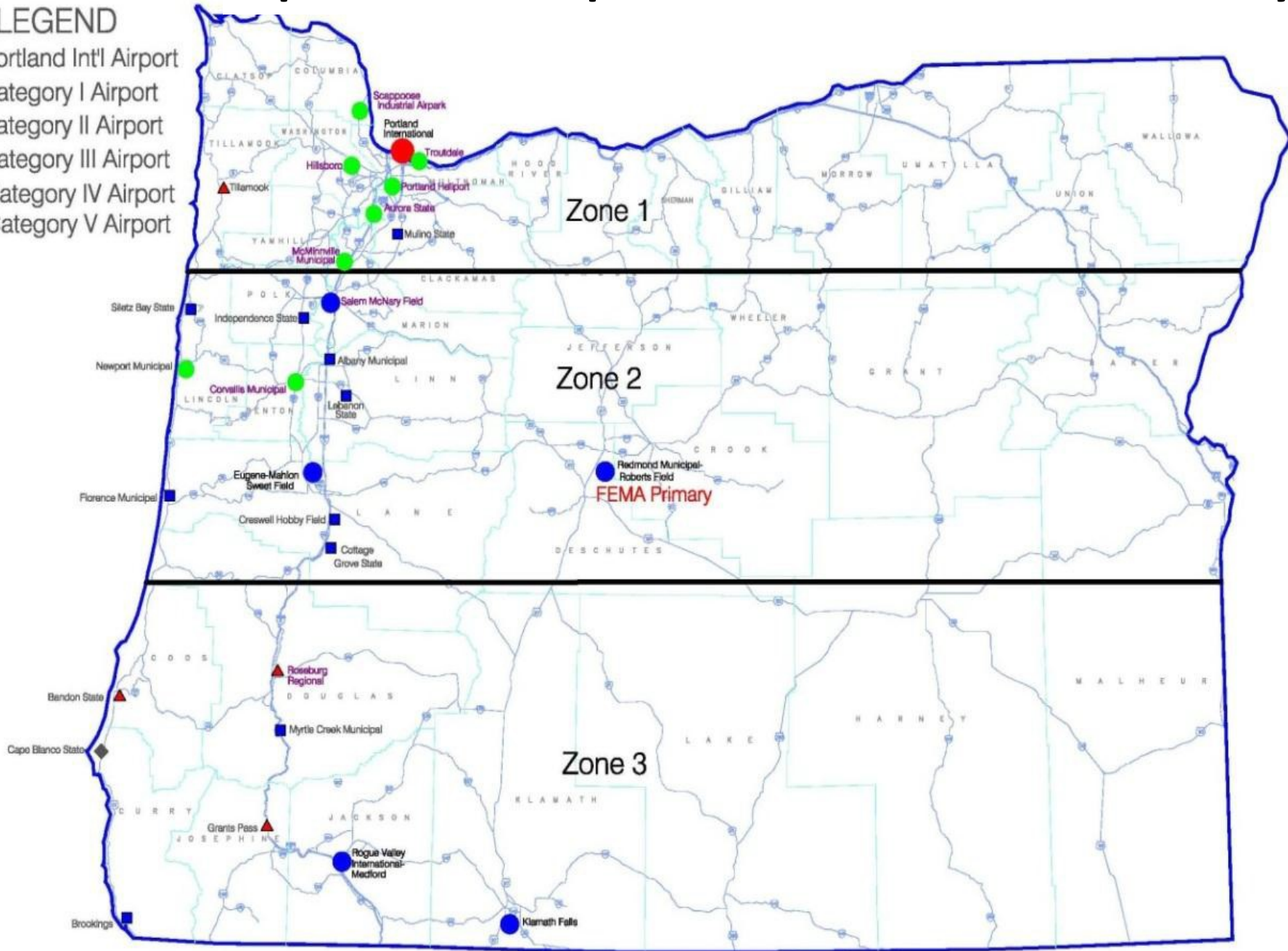
Union Pacific = **810** Miles

BNSF = **229** Miles

Operational Airports After EQ-Tsunami – Valley

LEGEND

- Portland Int'l Airport
- Category I Airport
- Category II Airport
- ▲ Category III Airport
- Category IV Airport
- ◆ Category V Airport

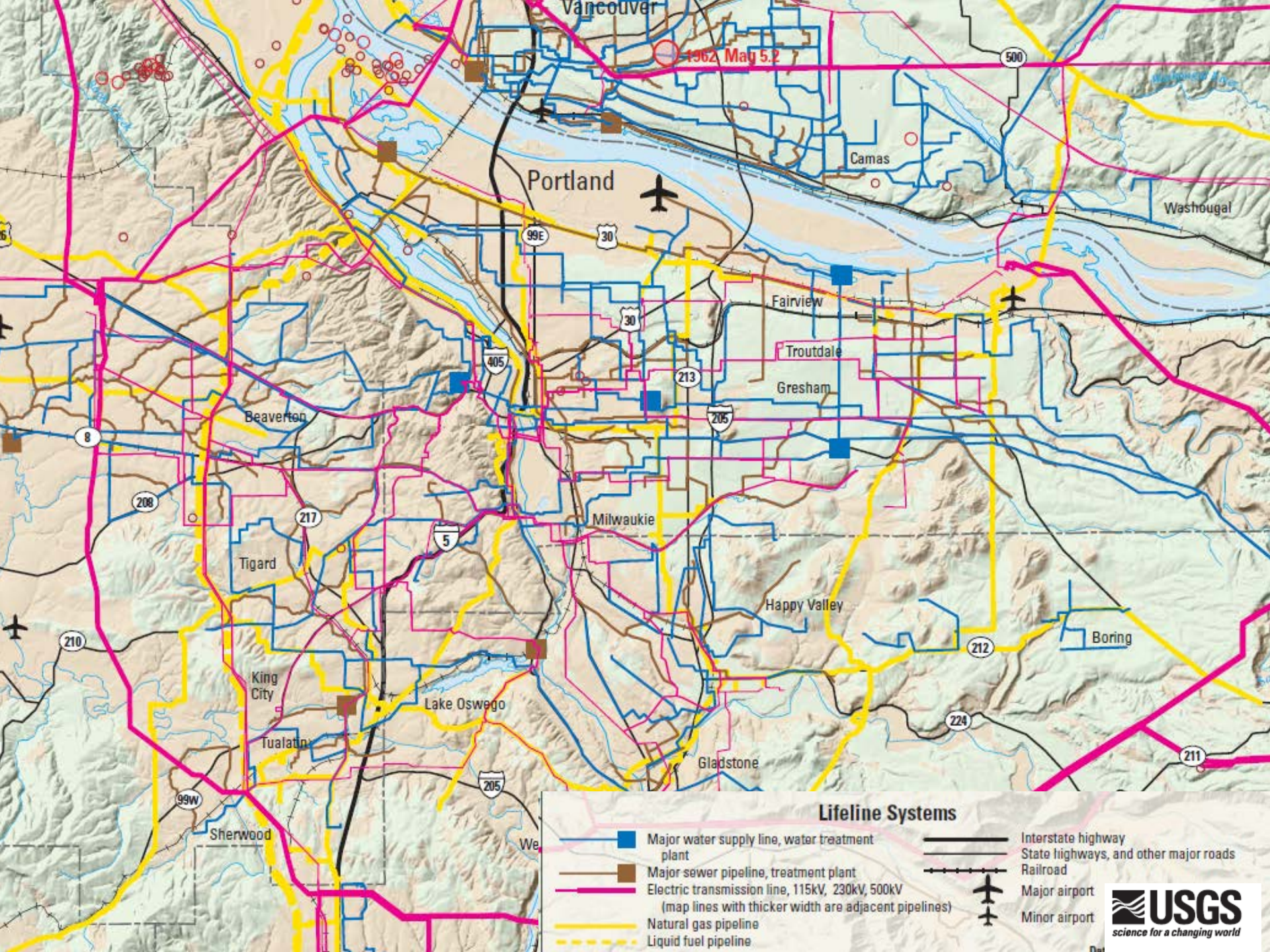


Columbia River Ports



Port of Portland Facilities





Lifeline Systems

	Major water supply line, water treatment plant
	Major sewer pipeline, treatment plant
	Electric transmission line, 115kV, 230kV, 500kV (map lines with thicker width are adjacent pipelines)
	Natural gas pipeline
	Liquid fuel pipeline

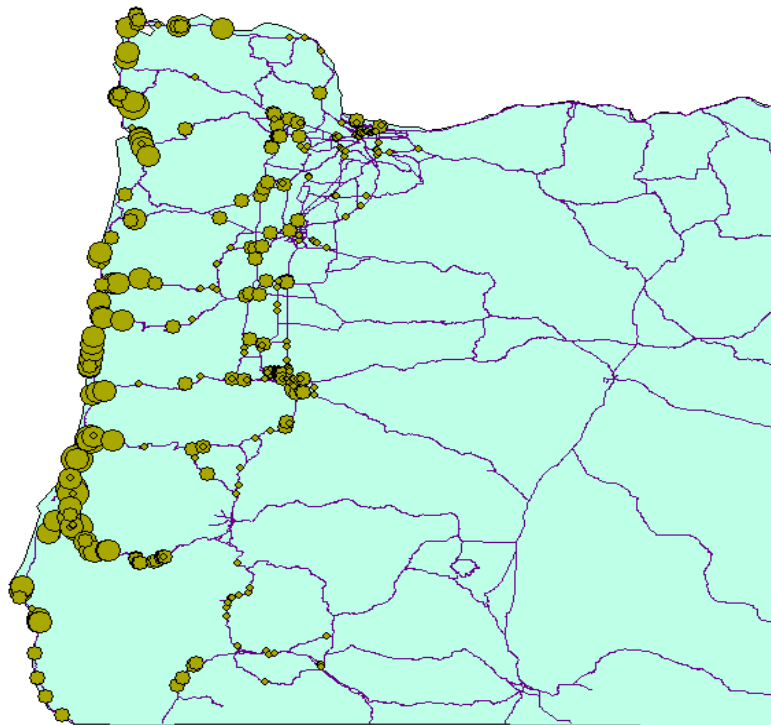
	Interstate highway
	State highways, and other major roads
	Railroad
	Major airport
	Minor airport

Cascadia Subduction Zone Earthquake (Magnitude 9.0)

6 complete collapses
64 extensive
106 major
164 slight

Estimates Loss:

- **\$1,080** million for bridge repair and replacement
- **Significant Economic losses** (travel time related losses)



Legend

- Slight
- Moderate
- Extensive
- Collapse
- NHPN

Route	Damage States			
	Slight	Moderate	Extensive	Complete
I-5 (MWC)	4	1	0	0
I-5 (MLL)	16	3	1	0
I-5 (DJJ)	27	0	0	0
I-84	13	1	0	0
US-101	7	14	36	5
US-26	7	5	0	0
I-205	8	2	0	0
I-405	7	0	0	0
US-30	4	2	2	0
US-20	5	3	5	0
OR-38	3	2	1	0
OR-42	4	13	13	1
Others	59	60	6	0
Total	164	106	64	6

Retrofitting Progress

First 16 Years Since Vulnerability was Identified

Years	Actions
1994/1997	CH2M Hill prioritization includes all state and local bridges. Priority state bridges 1155
1985-2012	<ul style="list-style-type: none">Phase 1 retrofit added to repair projects 143Other bridges resolved (replacements or retrofits added to repair/widening contracts in the STIP & OTIA III program) <u>212</u>Total number of bridges addressed 355
Future	Bridges still needing retrofitting 800 (About 200 years at average 4 bridges retrofitted per year in the STIP, much longer for Phase 2 and much longer to Pay OTIA III bonds)

METRO Bridges

• Bridge Name	Expected Performance	Notes
• I-5 Boone Bridge	Slight Damage	Retrofitted Ph 1
• I-5 Marquam	Moderate	Retrofitted Ph 1
• I-5 Oregon Slough	Moderate	Poor girder connections
• I-205 Abernethy	Moderate	Poor column confinement
• US30 Bypass St. Johns	Extensive	Poor column details
• I-405 Fremont	Moderate	Poor column details
• I-405 Fremont approach	Collapse	Poor column details
• US26 Ross Island	Collapse	Poor column details
• Sellwood, Hawthorne	Collapse	
• Steel, Broadway	Collapse	
• Morrison, Burnside	Extensive	

• Columbia River Bridges

• US 101 Astoria-Megler Bridge	Collapse	Truss, Steel Columns, foundations
• US30C Longview-Ranier Bridge	Collapse	Retrofitted Ph 1, columns, foundations
• I-5 Interstate	Collapse	Poor details, counterweight
• I-5 Oregon Slough	Moderate	Poor girder connections, liquefaction
• I-205 Glen Jackson	Slight to moderate	Column reinforcement
• I-205 South Channel	Slight	Column reinforcement

Key Findings - Transportation

- Update Transportation Inventory
- Complete Statewide Transportation Resilience Assessment and Gap Analysis

Key Findings - Transportation

- Develop Mitigation Policy and Retrofit Plan
- Identify Key Transportation Links
 - Redmond Municipal Airport (Roberts Field)
 - Coastal and River Ports or heliports
 - The Columbia River

Key Findings – Long Term

- Enhanced Design and Maintenance Standards
- Temporary Bridge Policy and Program
- Research on retrofit strategies

Resilience in Action – Transportation



Tsunami Resistant Bridge: US 101
Spencer Creek Bridge



1947 original and 1999 detour

<http://www.slayden.com/us-101-spencer-creek-bridge/>



Thank you!

**Bruce Johnson, State Bridge Engineer
ODOT Bridge Engineering Section**