

Resilience Planning Rolling with the Punches

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What Is Resilience?



The ability to withstand and/or recover quickly from difficult conditions.

Hazards

- Storms
- Floods
- Landslides
- Earthquakes
- Tsunami
- Fires
- Drought
- Climate/Sea Level Change



Hazard Levels

- *Routine* - Hazard events are *more frequent*, less consequential events that cause *limited damage*.
- *Design* - Hazard events are used to design structures; design loads are specified in building codes for many natural hazards.
- *Extreme* - Events may also be defined in building codes for some hazards; they are less frequent and the most likely to cause *extensive damage*.

Changing Climate Change



Variations in average weather conditions that persist over multiple decades or longer that encompass increases and decreases in temperature, shifts in precipitation, and changing risk of certain types of severe weather events.

-DOD

Risks



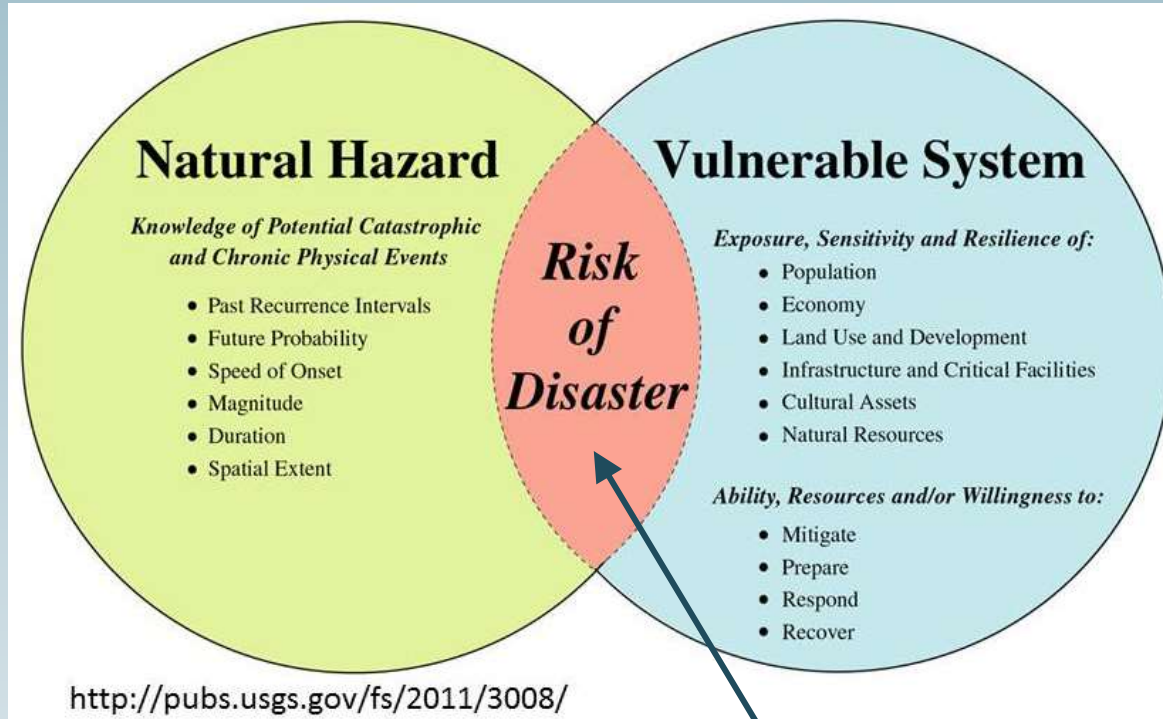
- Infrastructure Damage
- Utility Damage
- Ecological Damage
- Human Risks/Casualties
- Personnel Difficulties
- Communication Loss
- Economic/Financial Losses

Resilience Planning - Overall Goal



Mitigate Hazards and
Reduce Risks to
Decrease Response
and Recovery Times

What Makes a Hazard a Disaster?



Unprepared = Disaster

Rare but High Impact Events

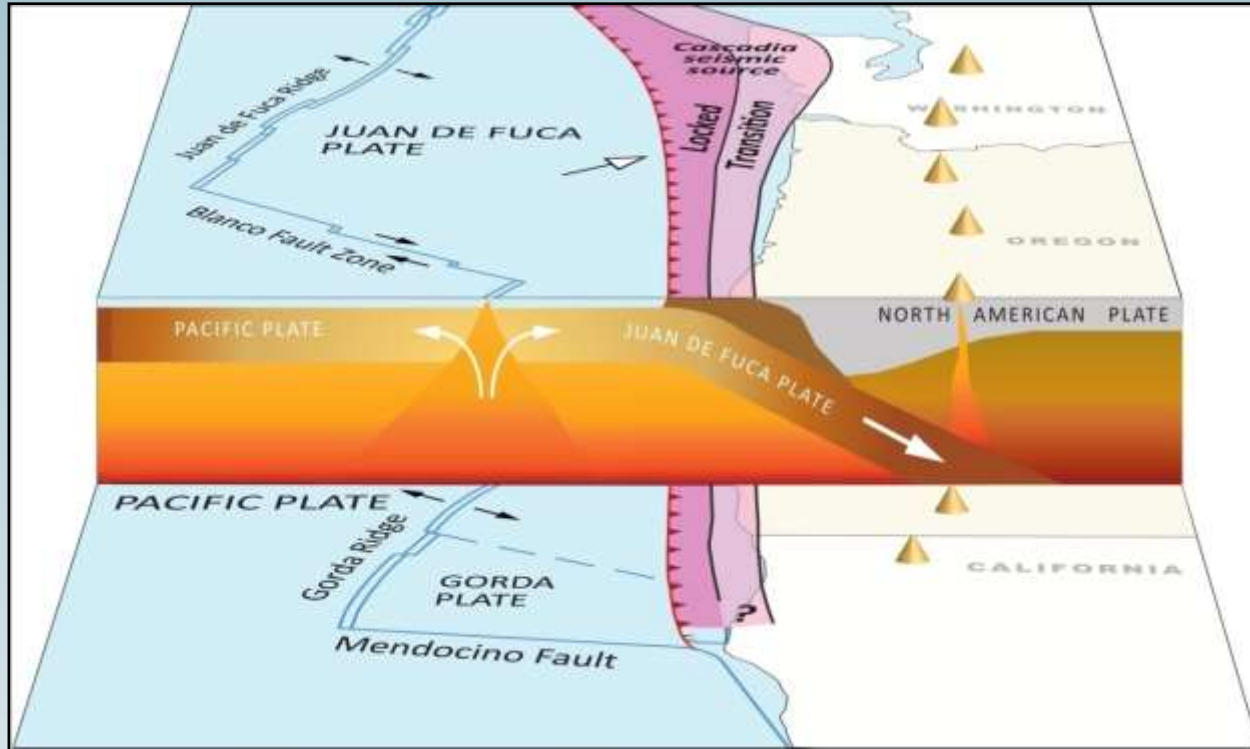
- High Consequence
- Difficulty Understanding Risk
- Responsibility to Plan for

Examples: Cascadia and Climate Change

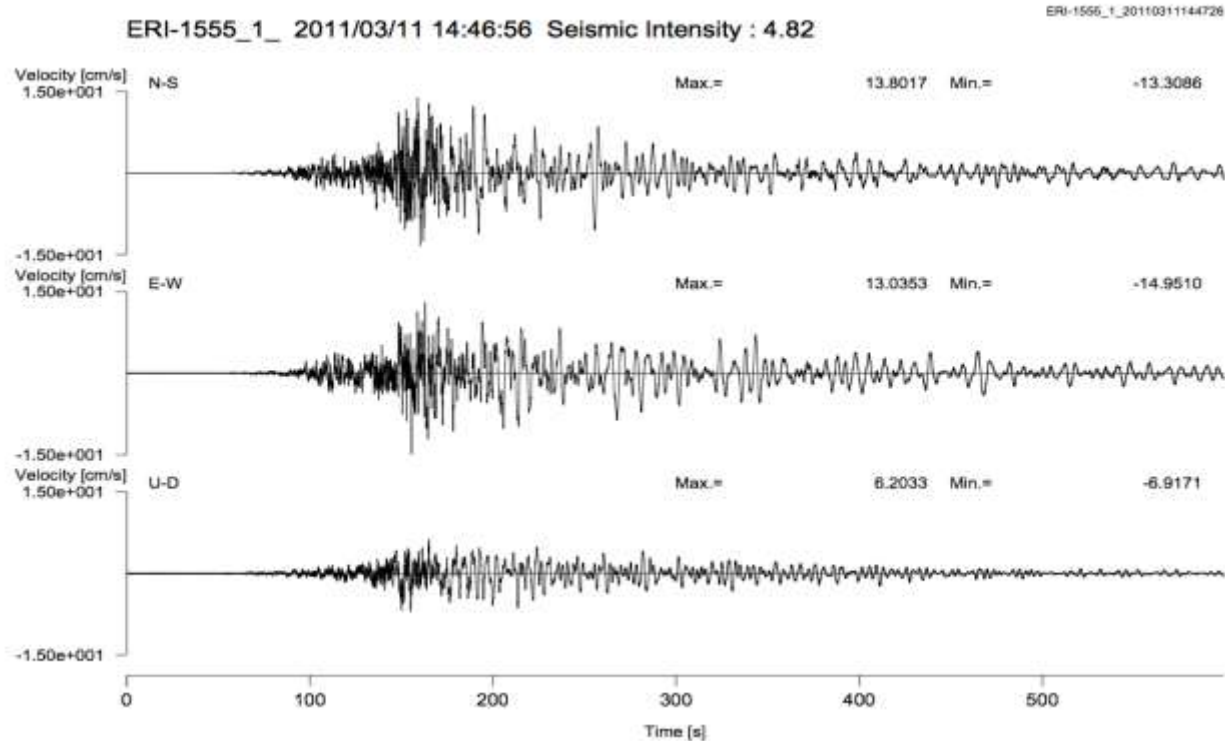




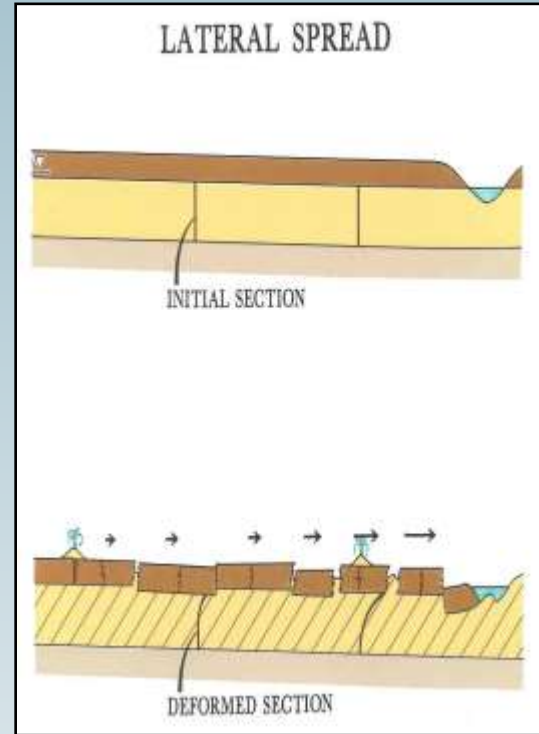
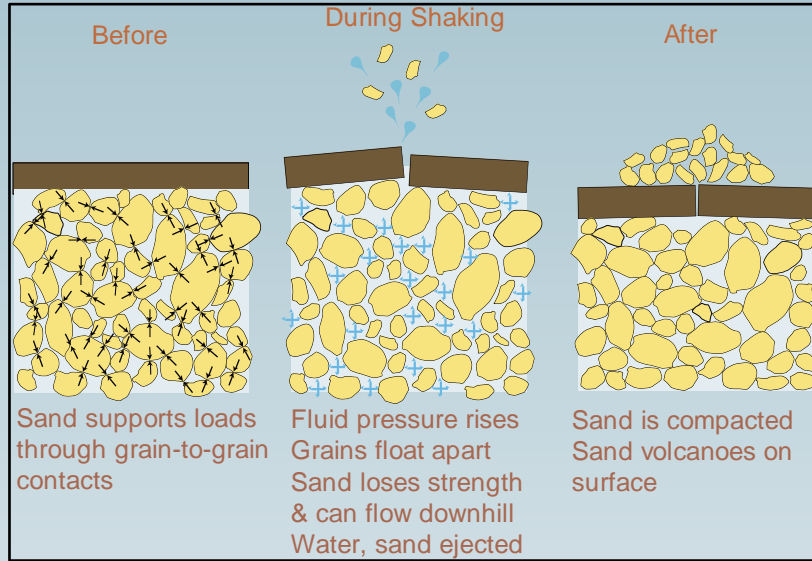
Subduction Zone Geometry



M9.0 Tohoku Japan



Liquefaction & Lateral Spreading



Observed Damage Patterns

- Shaking Damage
 - Weak Soils
 - Weak Infrastructure
- Tsunami Damage



Water and Wastewater Systems



Ground Shaking Damage

Structure Damage



Ground Shaking Damage

Landslides



Electrical Systems



Transportation

Weak Infrastructure



Transportation

Poor Soils – Embankment Failures



Overall Performance

Successes

- Utilities Generally Operational within 1 week
- Relatively Quick Transportation Recovery

Failures

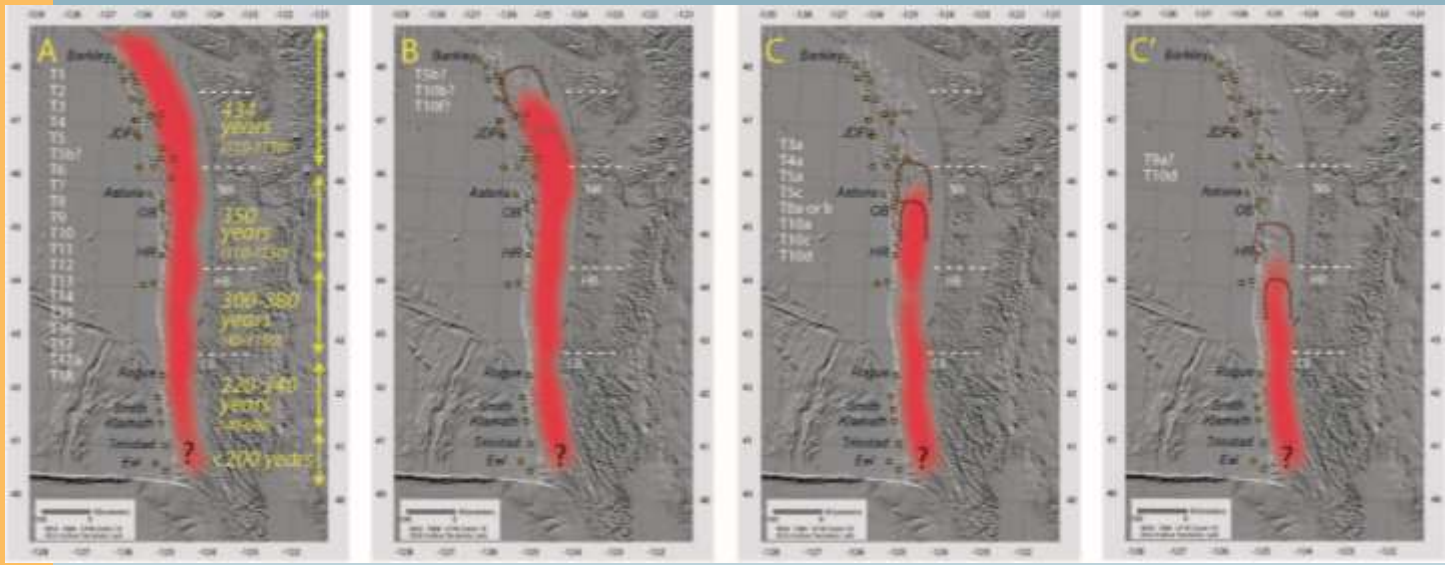
- Public Communication
- Large Numbers of Tsunami Deaths (Japan)
- Tsunami Areas and Industry
- Electrical Systems
- Fuel Shortages



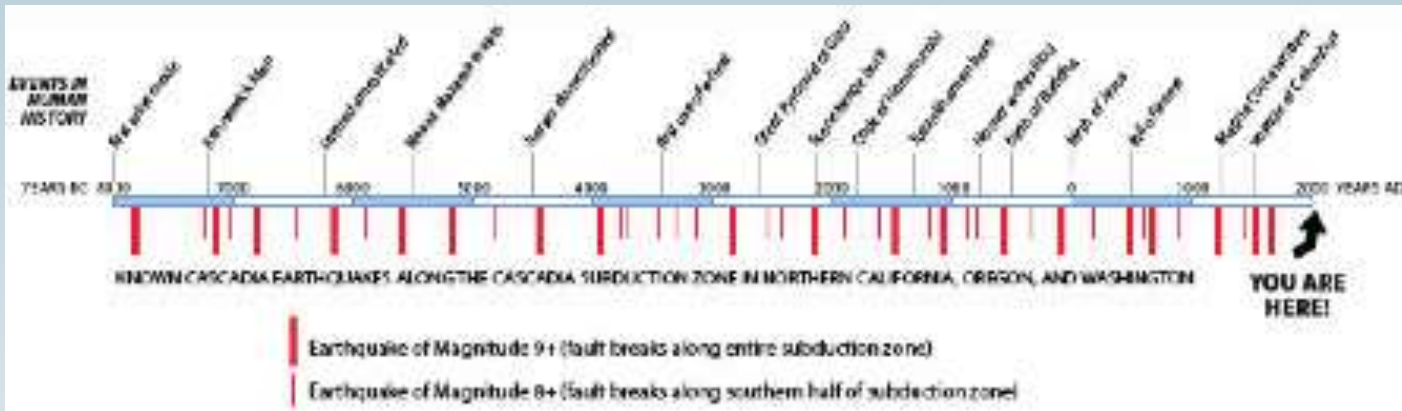


Pacific Northwest

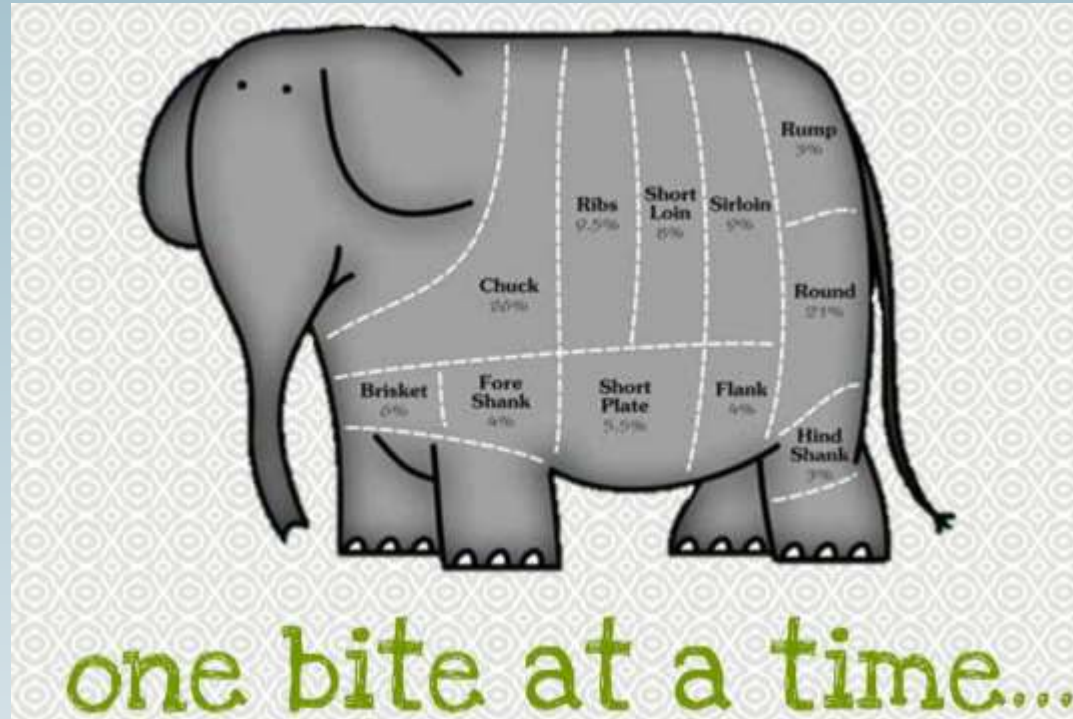
- 1994 – Oregon Building Code w/Seismic Design Provisions
- Inherited community infrastructure at-risk



Chris Goldfinger
 Oregon State
 University



Overwhelming Problem



Resilience Planning



- Define Hazard
- Define Timelines
- Assess Risks
- Develop Cost/Benefit Analysis
- Prioritize
- Develop a Plan
- Incorporate Plan into Long Term Plans and Budgets

Pertinent Players

- Engineers
- Architects/Planners
- Maintenance & Operations
- Emergency Planning/Operations
- Financial/Business Development
- Public Health/Social Services
- Human Resources
- Education
- Private Organizations



Define Goals



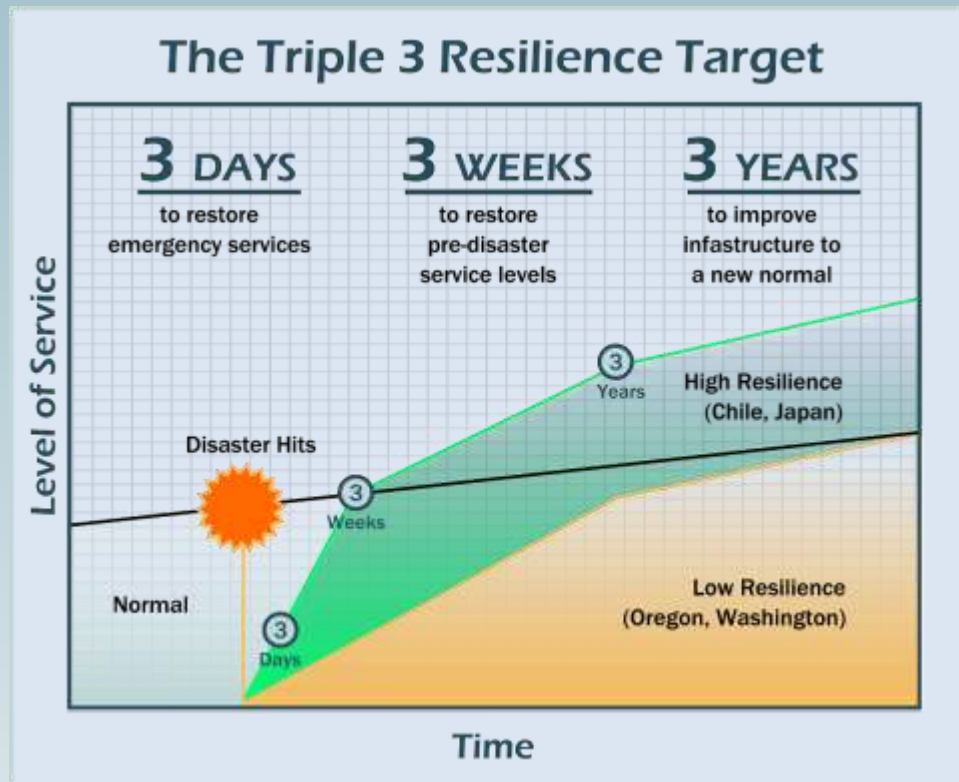
Define the Hazard(s) of Concern

- Return Interval and Likelihood

Develop Ideal Timeline for Recovery

- Define Specific Goals
- Response vs. Recovery

Specific Resilience Goals



Assets/Vulnerabilities

- Facilities
 - Structural
 - Non Structural
 - Equipment
- Material Resources
- Human/Personnel Resources
- Financial Resources
- External and Internal Relationships
- Public



Interdependencies

- Internal Systems
- External (utilities/infrastructure)
- Outside Coordination
(other agencies)



Cost/Benefit

Cost

- Emergency Response
- Replacement and Repair
- Now vs. After
- Loss of Use
- Human/Personnel
- Public Perception
- Lost business investment

Value

- Resilient Infrastructure
- Availability for
Emergency Response
- Continuity of Service
- Public Perception
- Value to Client/Other
Agencies



Returns on Resiliency Investments

- FEMA average \$4 benefit for each \$1 spent
- UN Office of Disaster Risk Reduction 10:1
- Multi-hazard Mitigation Council 4:1
- American Society of Civil Engineers 6:1 for levees, 3:1 for other flood controls
- Rockefeller Institute: it costs 50% more to rebuild in wake of disaster than build resiliently

Prioritize



- Critical Facilities
- Personnel Resources
- Service Loads

Prioritize



Develop a Plan

- Hazard/Timeline Defined
- Infrastructure Improvements
- Employee Prep – Home and Work
- Office/Facility Prep
- Business Continuity
- Emergency Response
- Long-term Recovery

Incorporation into Existing Efforts

- Sustainability
- Transportation Planning
- Land Use Planning
- Master Planning
- Capital Improvement Plans
- Long-term budgeting
- Localized and Overall Emergency Plans
- Operations and Maintenance Plans

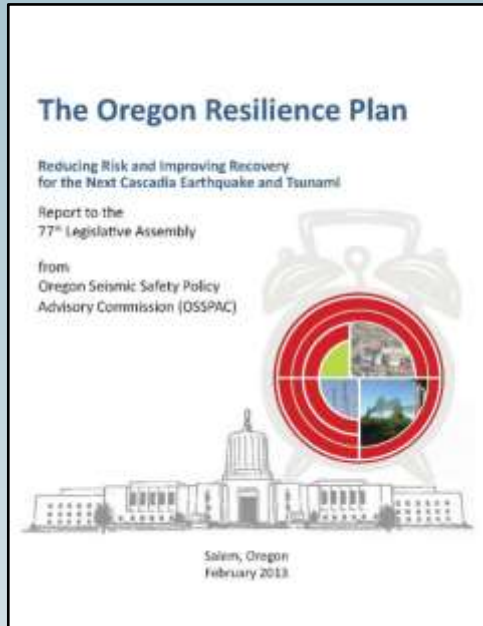


Long-term Funding for Improvements

- Consider carrying capacity of community
- Incremental Increases/Bonds
- Low Interest Loads – W/WW
- Dedicate 1-5% of budget to resiliency investments

Existing Efforts

Oregon Resilience Plan



- 50 Year Plan for State
- Assessment of Current State
 - Coastal Communities
 - Business
 - Critical Buildings
 - Transportation
 - Energy
 - Communications
 - Water/Wastewater
- Months to Years of Recovery
- 1/5 of Oregon GDP Lost
- 10,000's Displaced

Oregon Resilience Plan

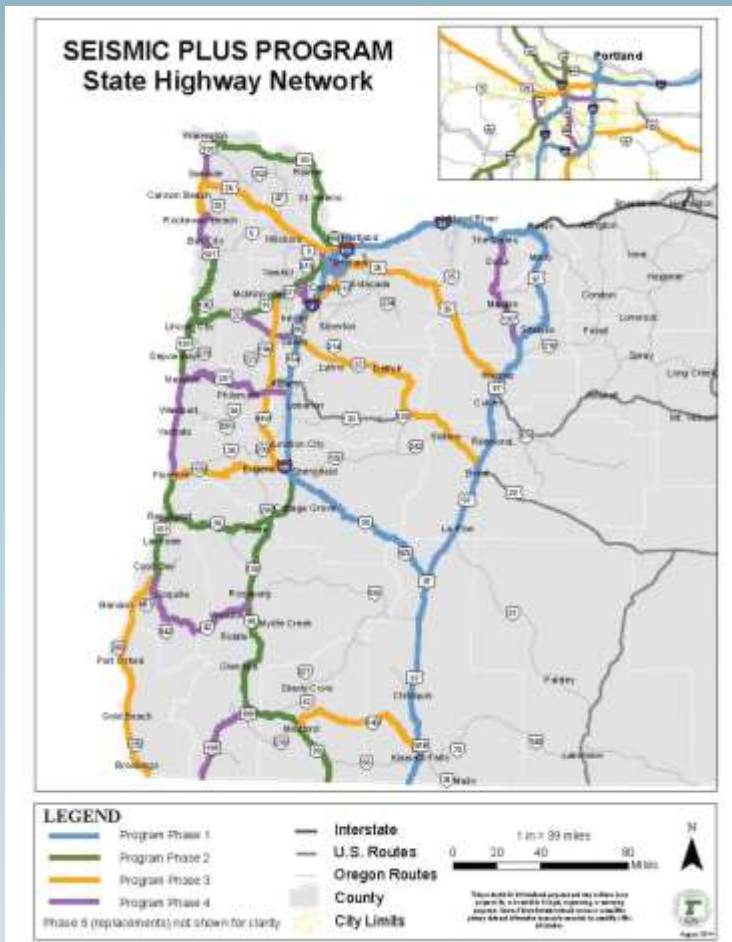
Critical Service	Zone	Estimated Time to Restore Service
Electricity	Valley	1 to 3 months
Electricity	Coast	3 to 6 months
Police and fire stations	Valley	2 to 4 months
Drinking water and sewer	Valley	1 month to 1 year
Drinking water and sewer	Coast	1 to 3 years
Top-priority highways (partial restoration)	Valley	6 to 12 months
Healthcare facilities	Valley	18 months
Healthcare facilities	Coast	3 years

Oregon Resilience Taskforce

- Recommendations
 - Resiliency Policy Advisor to Governor
 - Provide Revenue and Support for ODOT
 - Land Use – Tsunami Planning
 - Energy
 - Fund Critical Facilities/School Grants
 - Resilience Research
 - Training and Education
 - Water/Wastewater
 - Recovery goal of 2-3 weeks

Plan and Prioritize

- Tier 1: Backbone system
Restored within Hours to 3 Days
- Tier 2: Secondary system
Restored with Days to Weeks
- Tier 3: Tertiary systems
Restored with Weeks to Months





NIST Community Resilience Planning Guide

Better New Structures

- US Resiliency Building Rating System
 - Safety
 - Cost of Repairs
 - Time to regain functionality
- Similar criteria can be adopted for infrastructure



USRC Building Ratings: Dimensions and Definitions	
SAFETY: The potential for people in the building to get lost after a disaster and/or locate themselves or the building during a disaster is a building evaluation.	
★★★★	High level of safety: Expected performance results in conditions associated with evacuation or being stuck during the building.
★★★★	Below average safety: Expected performance results in conditions that are unlikely to cause serious issues.
★★★	Low level of safety: Expected performance results in conditions that are unlikely to cause loss of life.
★★	Low level of safety in individual locations: Expected performance results in conditions associated with partial collapse or falling objects, which have a potential to cause loss of life at some locations within or around the building.
★	Low level of safety in the building: Expected performance results in conditions associated with building collapse, which could be detrimental to cause death within or around the building.
REPAIR COST: Damage as a percentage of the building's overall replacement cost including structural, interior finish, mechanical, electrical and plumbing systems. Does not include damage caused by liquids, fuels, gases, and gas pipes or systems. Damage.	
★★★★	Minimal damage: Repair Cost less than 10% of building replacement cost.
★★★★	Minor damage: Repair Cost less than 20% of building replacement cost.
★★★	Significant damage: Repair Cost less than 30% of building replacement cost.
★★	Substantial damage: Repair Cost less than 40% of building replacement cost.
★	Severe damage: Repair Cost greater than 40% of building replacement cost.
TIME TO REGAIN BASIC FUNCTION: An estimate of the number of days, or weeks, for a building to return to its normal level of operation after a disaster. This is based on the building's condition, the nature of the disaster, and the availability of resources.	
★★★★	Within hours to days: The expected performance will likely result in people being able to quickly re-enter and resume work in the building from immediately to a few days, depending on the factors.
★★★★	Within days to weeks: The expected performance required in days of minimal operational use for days to weeks, including external factors.
★★★	Within weeks to months: The expected performance may result in days of minimal operational use for weeks to months, including external factors.
★★	Within months to a year: Expected performance may result in days of minimal operational use for months to a year.
★	More than one year: Expected performance may result in days of minimal operational use for at least one year or more.

Develop Public-Private Partnerships

- Private sector Can Contribute:
 - significant assets
 - employment and wages
 - relevant knowledge, skills and resources
- Approach as long-term partner at beginning of process
- Make the business case for PW resilient investments

\$\$ Funding \$\$

- Federal grants and low-interest loans
- State programs
- Dedicated funds supporting infrastructure investments
- A PW resiliency plan can help support requests for tax revenues
- Identify no- or low-cost first steps

Foster Resilient Culture



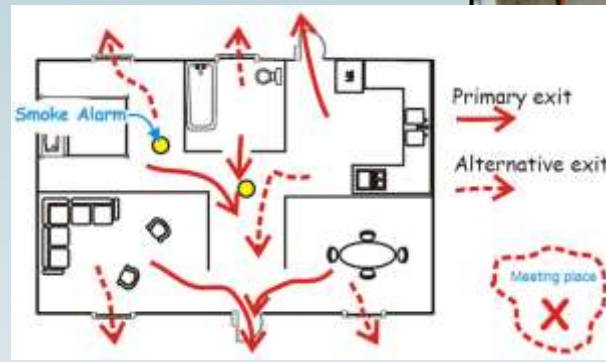
Public Works



to the Rescue!

Personal Prep First!

- Emergency Family Plans
 - Children
 - Older Family Members
 - Meeting Place
- Home Structural Improvements
- Out of State Contact
- Supplies!



Vehicles

- Life Straws
- Easily Portable Supplies
- First Aid and Safety Equipment/Tools
- Cash



In Your Facilities

- Operations and Maintenance Procedures
 - What is needed for
 - Everyday Operations – Critical Systems
 - Response
 - Recovery



In Your Facilities

- **Emergency supplies**
 - Alternative water sources
 - Food
 - Cash
- **Consider temporary housing**
 - Short Term – until they can get home
 - Long Term – when they come back to work
 - Families and Pets

Incentives

- **Educate!**
 - Hazards/Risks
 - PW Importance
- **Provide Materials**
- **Look for Deals/Offers**
- **Workshops**
- **Public/Agency/Private Education**

Incentives

- Make it a Priority
- Walk the Walk (Lead by Example)
- Include all Levels in Planning
- Encourage Input
- Assign Responsibility
- Develop Regular Reminders
 - Include incentives
 - Contests/games
 - Checklists

Questions?



Salus
RESILIENCE



HARTCROWSER