Transportation

Greg MacRae, PhD, P.E.
University of Washington
## Transportation Team

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<th>Engineer</th>
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<tr>
<td>David Arndt, PE, SE</td>
<td>Airports</td>
<td>KPFF Consulting Engineers</td>
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<td>Don Ballantyne, PE</td>
<td>Network</td>
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<td>William Byers, PE</td>
<td>Railways</td>
<td>Formerly with BNSF Railroad</td>
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<td>Greg MacRae, Ph.D., PE</td>
<td>Coordinator/Editor</td>
<td>University of Washington</td>
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<td>Dan Mageau, PE</td>
<td>Waterfront Ports</td>
<td>GeoEngineers</td>
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<td>Lee Marsh, Ph.D., PE</td>
<td>Road and Bridges</td>
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Transportation Network

Roads and Bridges
Rail
Airports
Ports
Ferries

Interdependent
Roads and Bridges

Major arterial roads near fault region:

- I-5 > 240,000 vpd
- I-90 (Seattle east) > 148,000 vpd
- I-405 (N-S through Bellevue) > 200,000 vpd
- I-520 (Seattle east) > 100,000 vpd
- SR-99 > 110,000 vpd

Local roads

Highway 101 near Olympia
2001 M6.8 Nisqually Earthquake
Washington State Highway Bridges Years Constructed

- Inadequate Seismic Design Codes
- Transition
- Modern Seismic Design Codes

1971 San Fernando Earthquake

Figure Courtesy WSDOT/EQE/ABS Consulting
WSDOT Bridge Seismic Retrofit

Phase 1
Superstructure

Phase 2
Major Bridges & Single Columns

Phase 3 Multiple Columns

Note: All foundation retrofit, all bridges with hollow core piles, and the Alaskan Way Viaduct are excluded.

Current Funding
$4.7 Million/Year

WSDOT Bridge Seismic Retrofit Timeline
12/2004 (Courtesy of WSDOT)
Multicolumn Bents  (Courtesy: WSDOT)
Alaskan Way Viaduct

Typical Crack Locations

Cypress Viaduct
(Loma Prieta, 1989)

E.Q. Effects on Highways

Likely Scenario
- I-5, I-90 and I-405, and SR 99, 167 and 520 have major damage or collapse.
- Moveable bridges will be jammed open or shut
- Other local bridges may experience damage
- Landslides/slips and liquefaction will affect local roads

Impacts - Immediate
- Severe traffic congestion
- Emergency services will be limited

Recovery Issues
- Surface streets cannot carry increased traffic volumes.
- Single bridges on some major routes may be replaced within a year
- Probably take > 6 years to replace Alaskan Way Viaduct on SR-99

Impacts – Long term
- Severe traffic congestion will occur for at least a year
- Commutes to work that took 30 minutes could take hours
- Movement of goods to final destinations – manufacturers, retail outlets, and hospitals, for example – will be much slower.
- Businesses will move from Seattle
BNSF and UP handle about 200,000 tons/day share a line south of Seattle. Equipment for realigning track is available after floods, etc.

**Expected damage:**
- Distortion over the fault
- Track settlement due to liquefaction
- Slumping, landslides
- Some damage to cars and facilities
- Jamming of moveable bridges
- Slumping at bridge abutments
- NOT expected to fixed bridges or tunnels

Inspection will require 6+ hours. Depending on damage extent, full restoration may take much more than one week. Loss of revenue is likely to exceed repair cost.
Airports

SeaTac International Airport
(26 million passengers/year)
- Structural damage
  - potentially even to retrofitted structures
- Non-structural damage

King County Int. Airport/Boeing Field and Renton Municipal Airport
(contributing $1.43 billion and $17 million to the economy/year respectively)
- Significant damage to:
  - liquefaction and runway damage
  - structures, older ones may collapse

Boeing Field and Renton closed immediately
Possibly more than a month to open to full operation at some airports
Ports

Second largest regional employer (after Boeing)
7% of U.S. trade through Seattle and Tacoma ports
Seattle is 5th largest container port in US
Seattle cargo terminal revenue > $1.58 billion (1999)

Damage is expected due to:
- pier and wharf deformations due to > 1 ~ 5ft soil movement
- seawalls
- cranes
- structures
- buried structures/pipes
- containers yards (liquefaction)

Recovery:
- full economic recovery may take several years (Kobe)

This will have a multibillion $ effect on local economy
Ferries

Susceptible Terminals
- Seattle: Pier 50 Terminal – Vashon (walk-on)
- Seattle: Pier 52 Terminal - Bremerton/Bainbridge Island
- Fauntleroy: Vashon/Southworth

Planning
- WS Ferries (WSF) with 26 million passengers/year has contingency plans for other disasters. Other ports will be used with more frequent trips.
- Ferries may be used as alternative transportation

Major Concerns
- Piers and Terminal Structures
- Liquefaction/Spreading ~ similar to port damage
Transportation Summary

The system is essential:
- For daily life and the regional economy
- To protect life during an earthquake
- To provide emergency response
- To provide long-term recovery

Many elements of the system are vulnerable

The rate of preparing the interdependent system for earthquake should be increased.
Seattle Fault
Earthquake Scenario

Conference

February 28, 2005