

The Great  
Southern California  
**Shake  
Out**

November 12–16, 2008

**ShakeOut Earthquake Surface Rupture of the San Andreas Fault:  
Impacts on Critical Lifeline Infrastructure**

Ken Hudnut, Lucy Jones, Brad Aagaard, Dan Ponti (USGS),  
Rob Graves (URS), Mike Reichle, Jerry Treiman (CGS) and  
Keith Porter (Univ. Colorado)

**12 November 2008**

**International Earthquake Conference  
Los Angeles, California**



Earthquake Country **Alliance**  
*We're all in this together.*

# Scenario Development

## USGS Multi-Hazards Demonstration Project (MHDP)

Lucy Jones, **Chief Scientist**

Dale Cox, **Project Manager**

Sue Perry, **Staff Scientist**

## Key Partnerships and a Large Collaboration

### 10 Section Leaders

#### Earth and Computer Science

Ken Hudnut, USGS

Dan Ponti, USGS

Mike Reichle, CGS

#### Engineering

Keith Porter, EERI

Hope Seligson, MMI Engineering

#### Public Health

Kim Shoaf, UCLA

#### Disaster Sociology

Dennis Mileti, Seismic Safety Commission

Jim Goltz, Governor's Office of Emergency Services

#### Disaster Economics

Anne Wein, USGS

Richard Bernknopf, USGS

More than 300 Panelists, Experts, Special Studies

Download reports at [urbanearth.usgs.gov](http://urbanearth.usgs.gov)



# Fault Rupture - Large Offsets



examples:

Landers, California M 7.3 - 1992 earthquake  
~1 meter (3 feet) offset

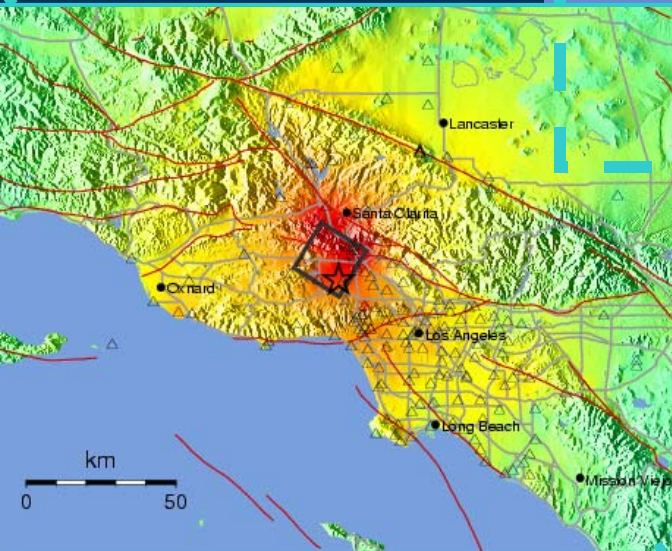
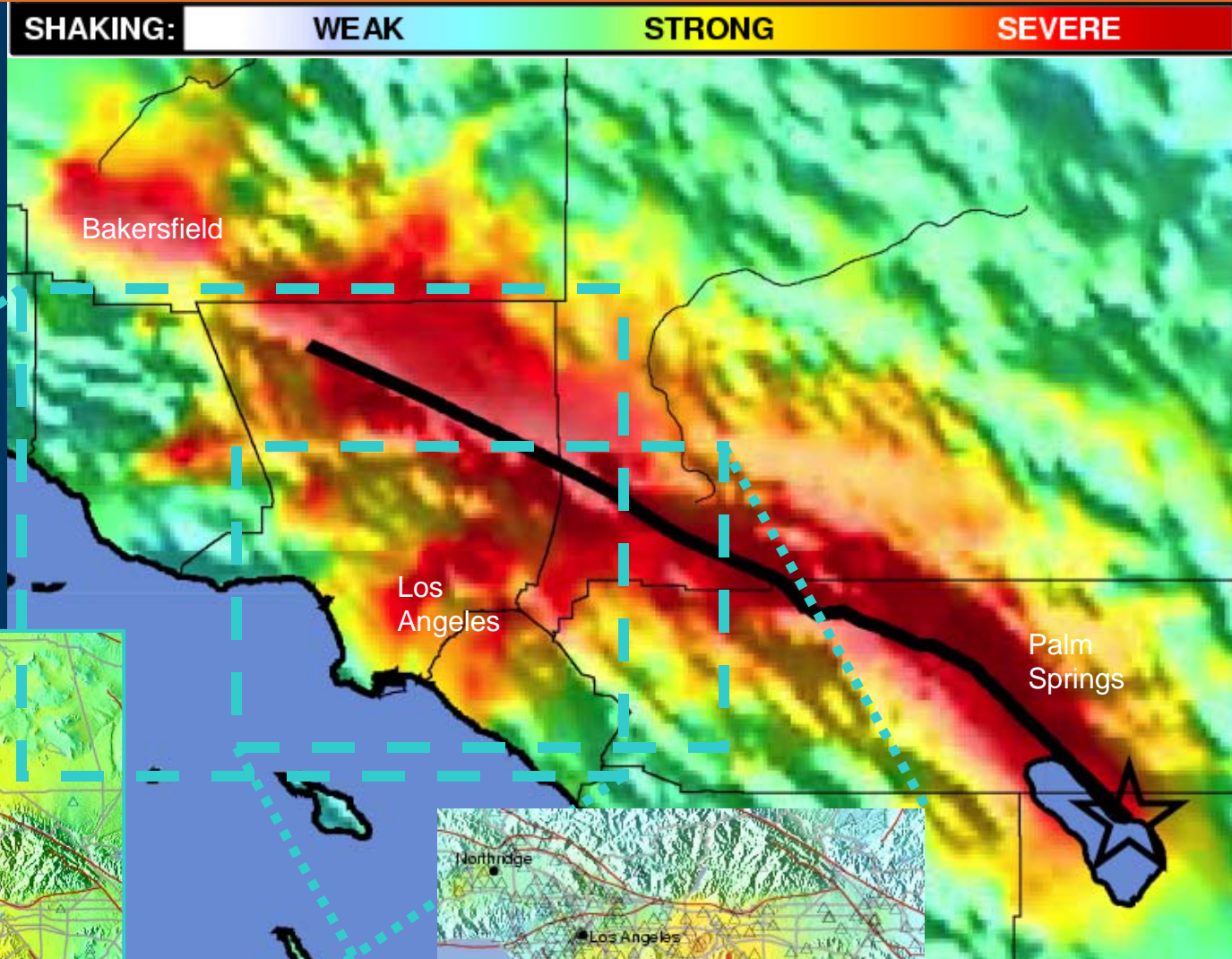


Wairarapa fault, New Zealand - M 8.2 1855 earthquake  
18.7 meter (~61 feet) right-lateral offset

# Calculate Wave Propagation

Compare with  
1994 Northridge  
earthquake:

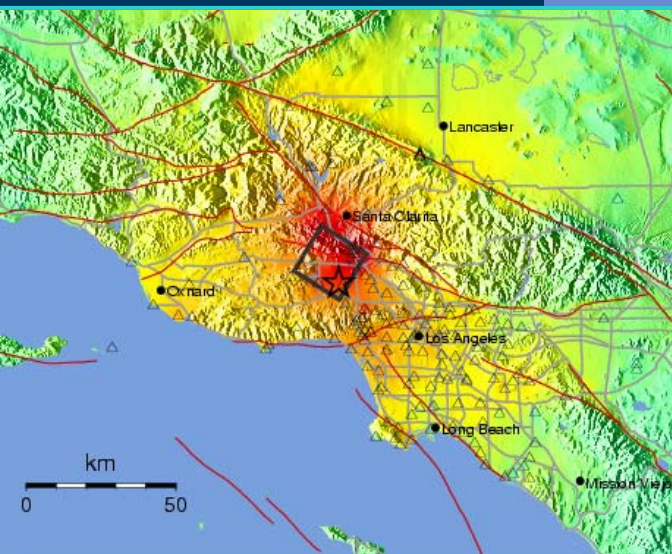
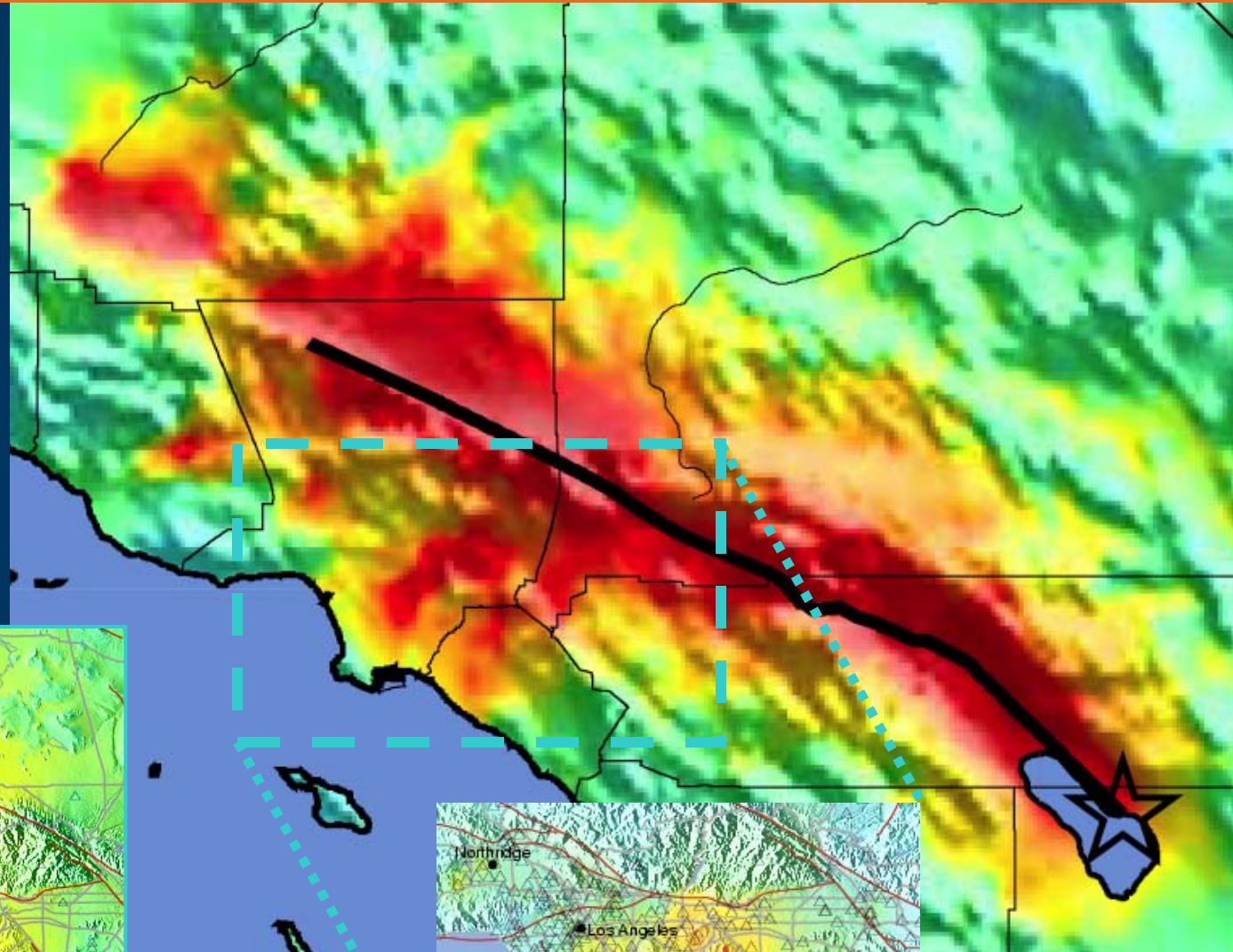
- 50x smaller
- *Magnitude 6.7*
- *57 deaths*
- *\$40 billion*



# Calculate Wave Propagation

Compare with  
2008 Chino Hills  
earthquake:

- 5000x smaller!
- Magnitude 5.4
- 0 deaths
- Minimal damage



QuickTime™ and a  
Cinepak decompressor  
are needed to see this picture.

Shake  
Out

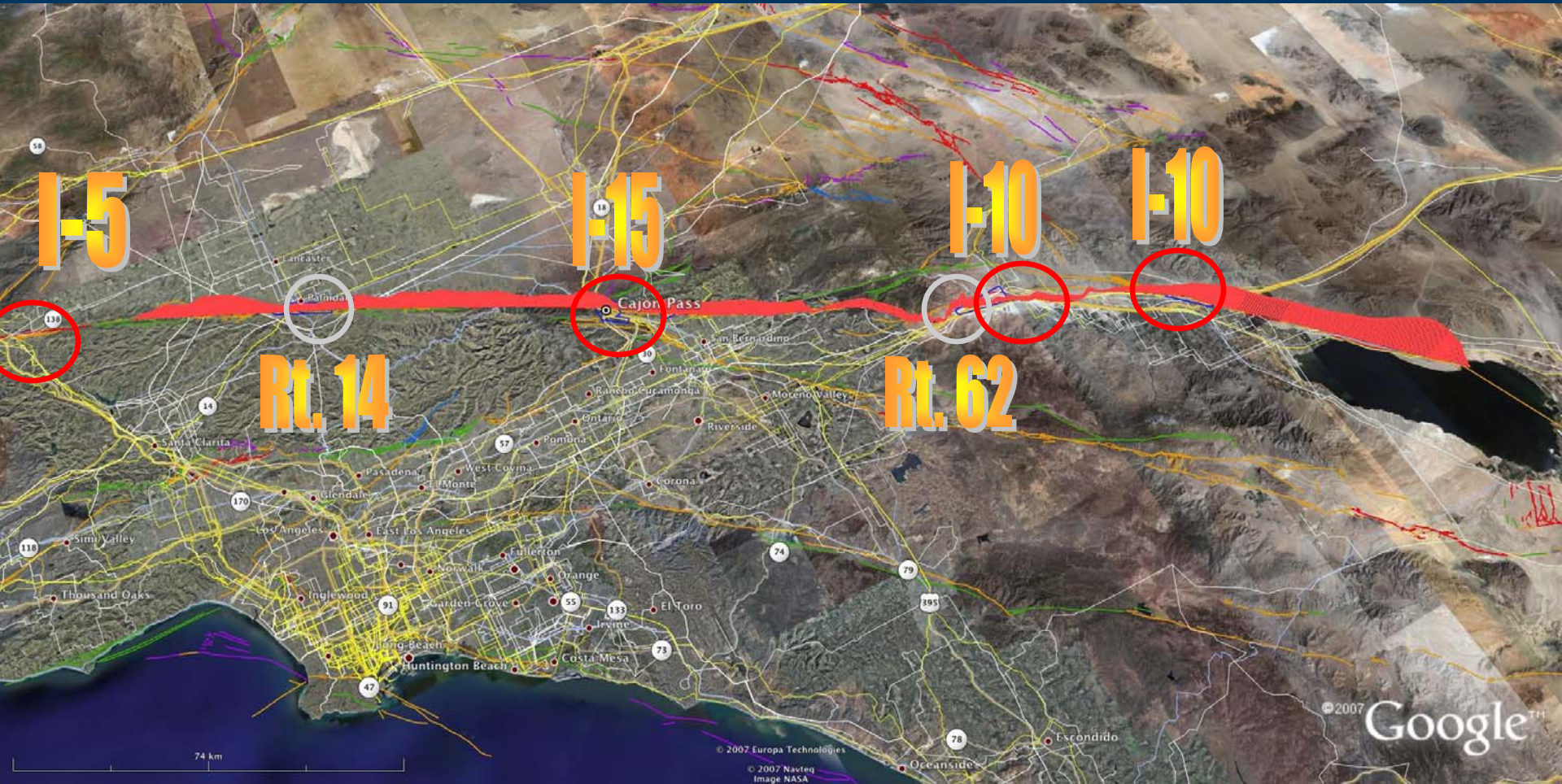
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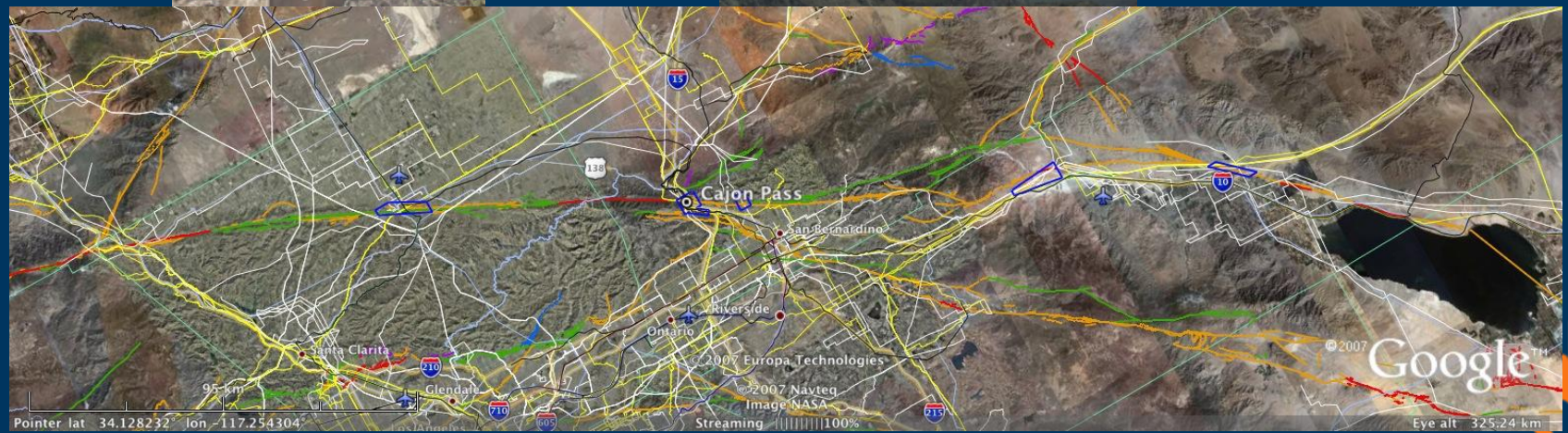
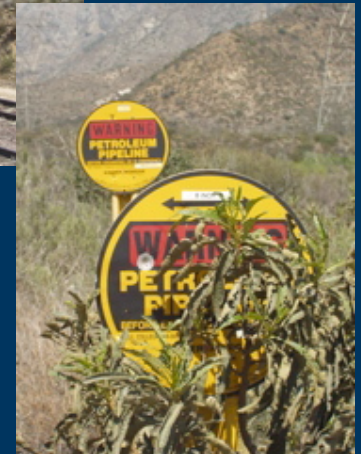
Courtesy of Rob Graves (SCEC-URS) and Brad Aagaard, USGS



# Caltrans freeways (and major highways) fault crossings



# Cajon Pass lifelines



QuickTime™ and a  
Cinepak decompressor  
are needed to see this picture.



Courtesy of Rob Graves (SCEC-URS) and Brad Aagaard, USGS



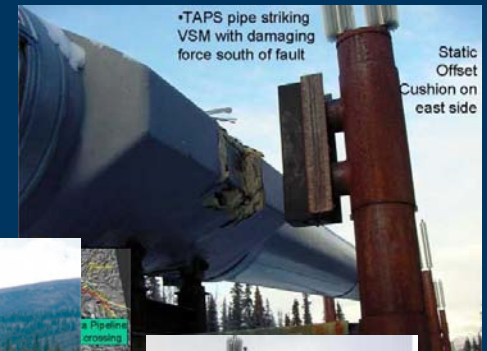
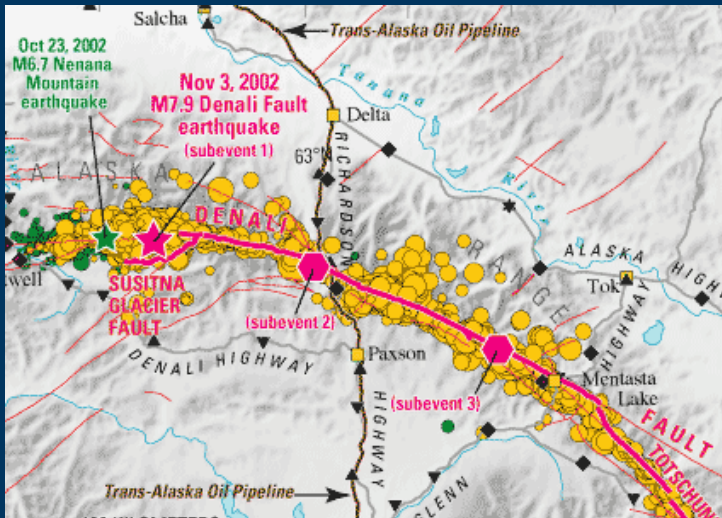
"Good science, when applied in the way that the people of Alaska have done, made the difference between an emergency and a tragedy."

*Charles Groat, Director, United States Geological Survey*

Each day, the Trans-Alaska oil pipeline carries one million barrels of oil, about 17% of the domestic oil supply for the United States, valued at about \$25 million. If the pipeline had ruptured during the 2002 Denali earthquake, the lost revenue and cost of repair and environmental cleanup would have been incalculable.

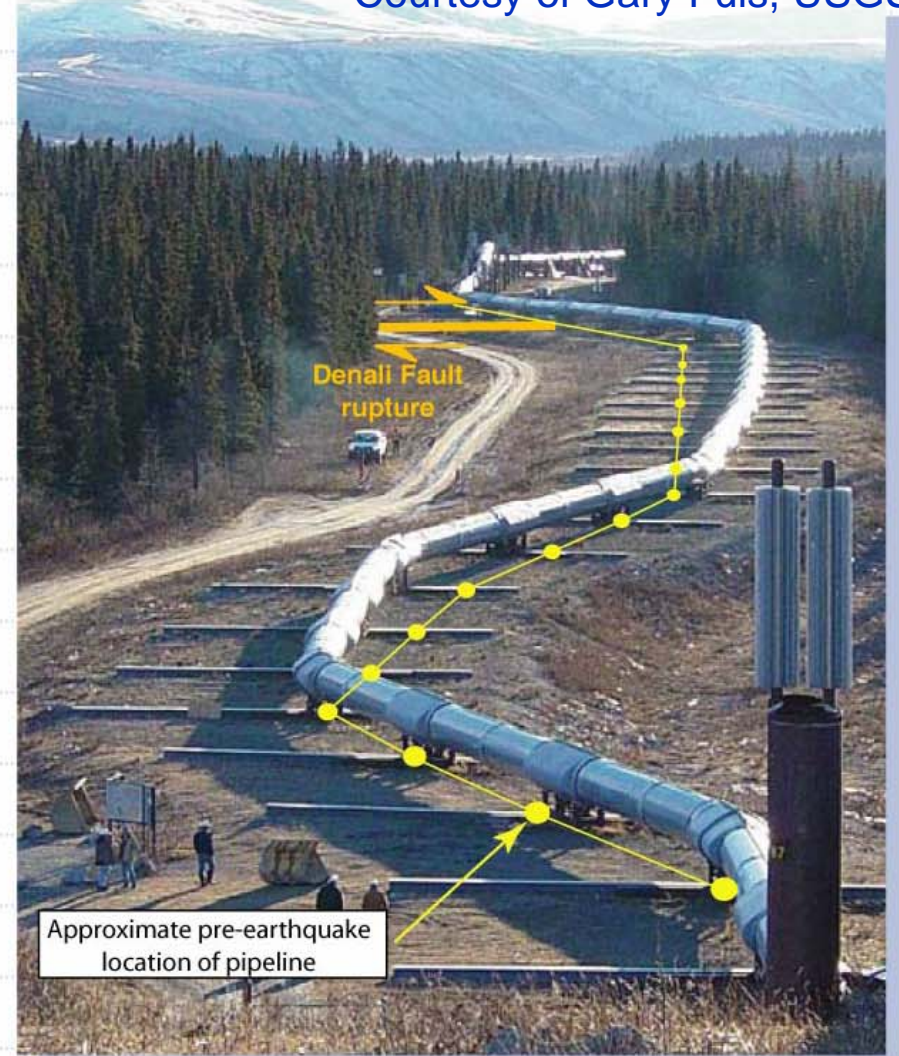


## M 7.9 - similar to the anticipated San Andreas fault 'Big One'

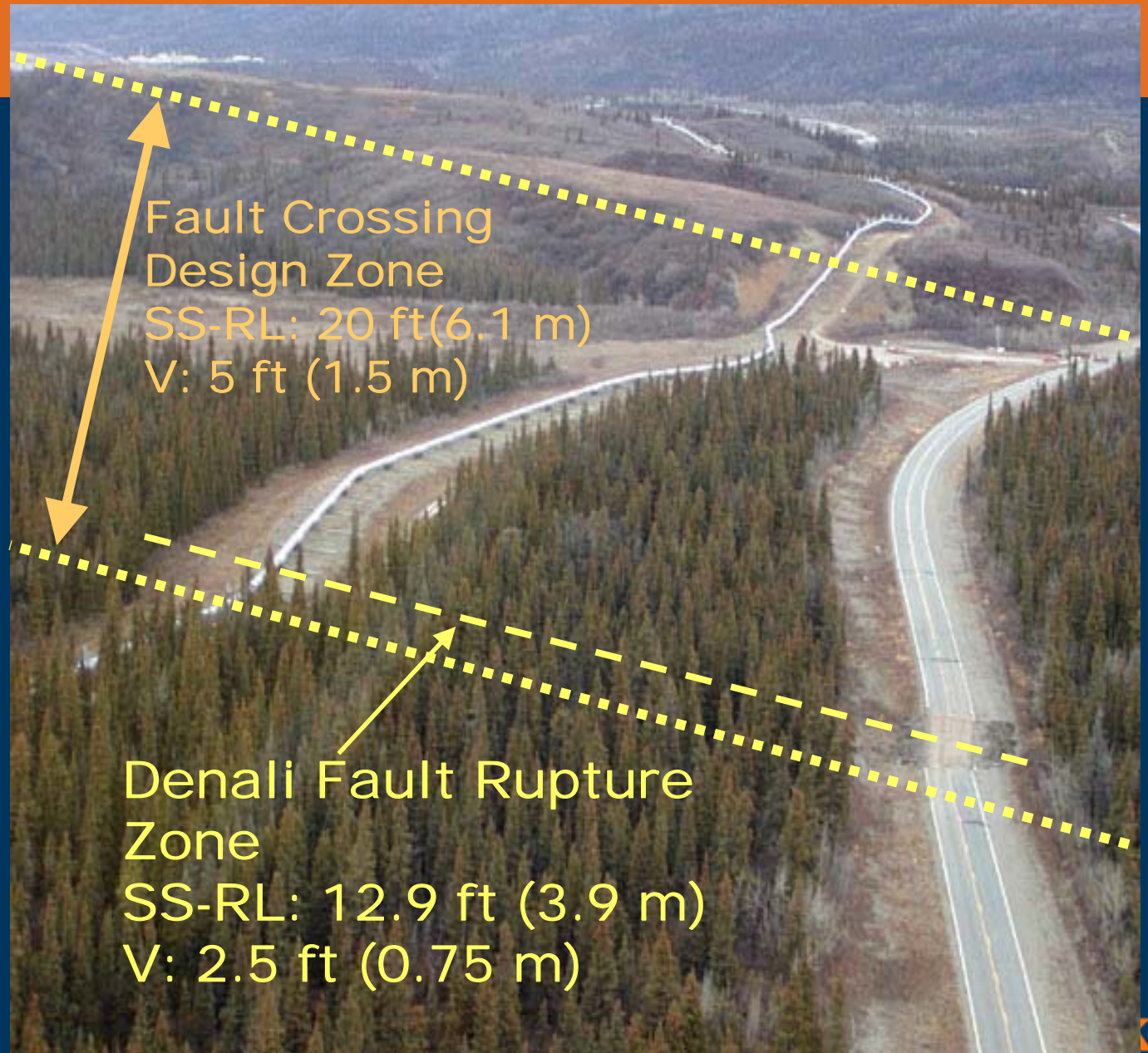


# Denali Fault Crossing (Before and After)

Courtesy of Gary Fuis, USGS



**TAPS  
Pipeline  
Denali  
Fault  
Crossing  
and  
Richardson  
Highway**



Courtesy of Cluff & Slemmons

# Policy points

ShakeOut long-term economic impact is strongly influenced by efficient restoration of lifelines

Aging co-located critical lifeline infrastructure is a recognized seismic vulnerability, but retrofitting to current standards is not required... so it's not done

Assess seismic threat to existing critical lifelines

Review existing codes and best practice in design

Explore cost-effective retrofit options

Plan and prioritize, then retrofit existing lines where necessary... with how much regulation?