

Earthquake Early Warning

*Presented at:
BOMA Earthquake Preparedness, Business
Continuity & Survival Seminar
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Systems Engineering for the Resource and Transportation Industries

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Experience — Over 45 Years. More Than 55 Countries



Integrated Monitoring Systems for Dams (Portugal)



Monitoring of CO₂ Injection Sites (West Texas)



RockFall Detection Systems Slopes (White Canyon)



Remote Pipeline Integrity Monitoring Systems (N. Canada)



Total Structural Monitoring Systems on Offshore Rigs



One of 75 Seismic Monitoring Stations in Argentina



Qualification and Testing of Accelerometers



Production of Precision Accelerometers for the F-117



Integrity Monitoring for the Skytrain in Vancouver



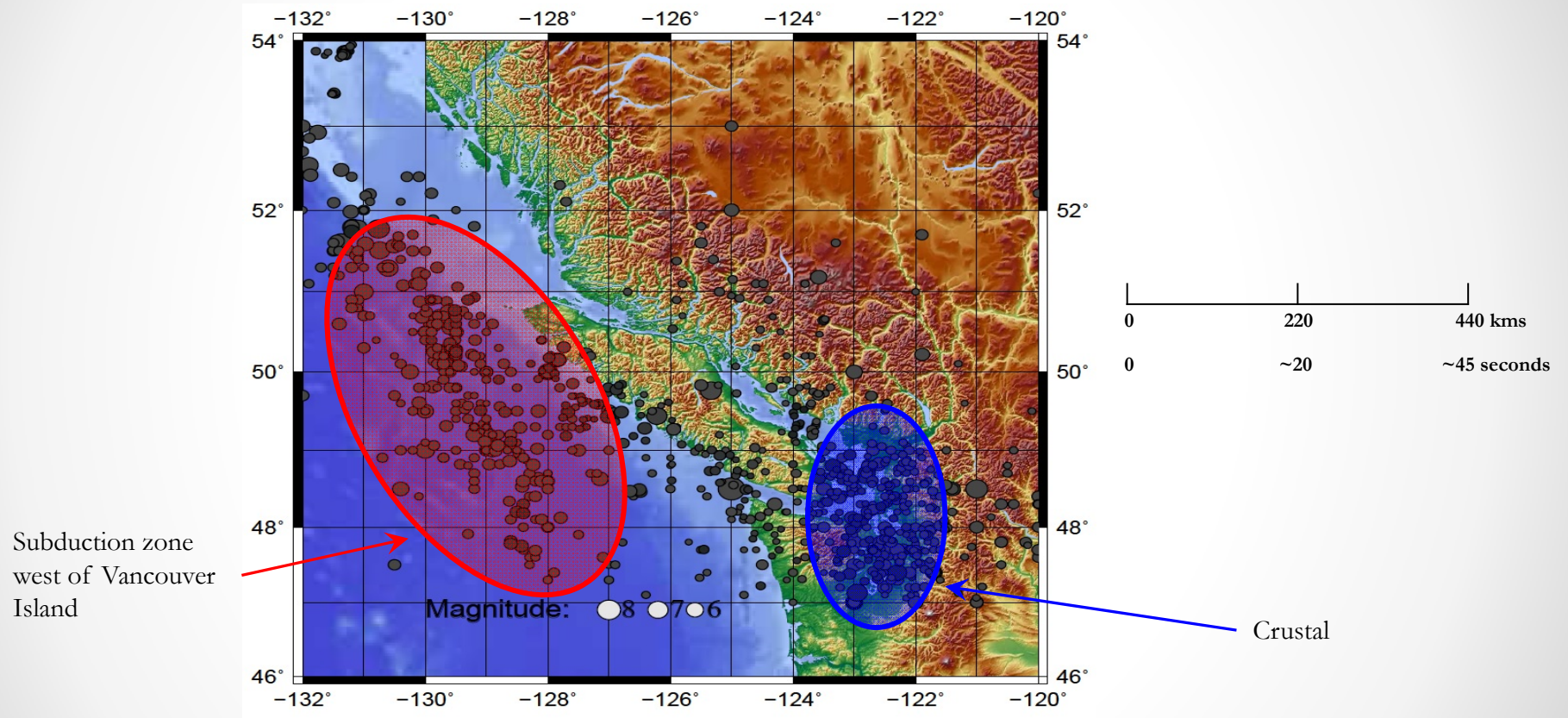
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History

Seismic Hazard in British Columbia



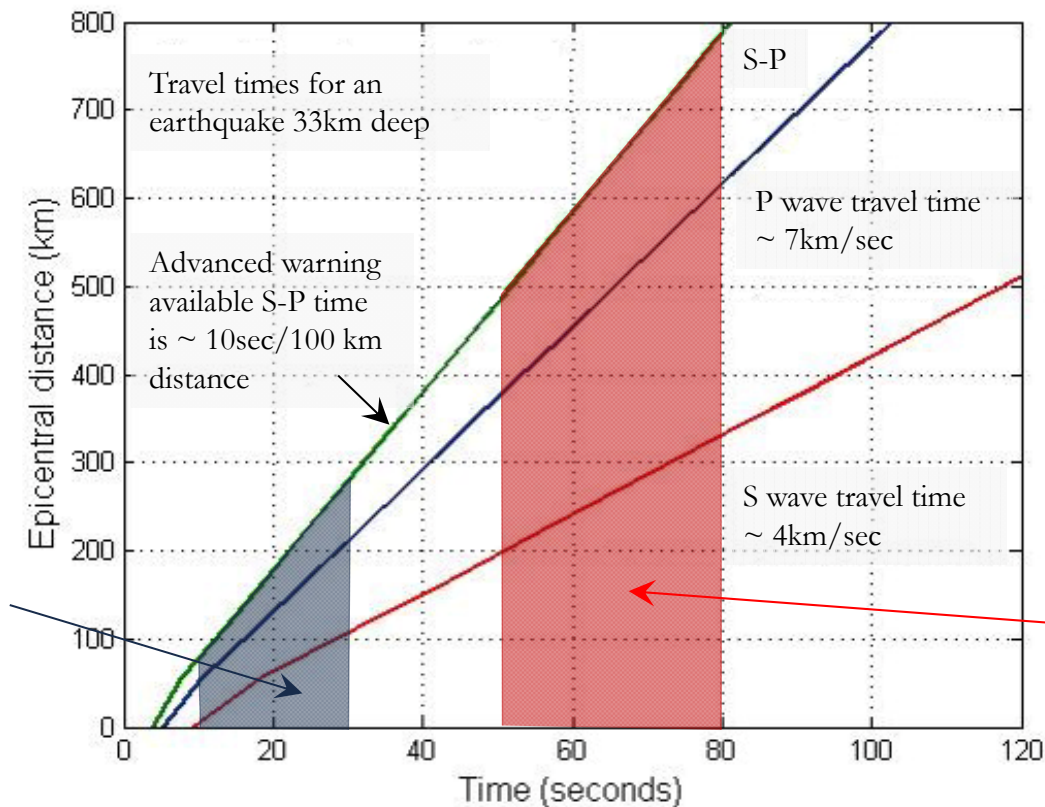
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The Science of Early Warning

P and S travel time curves (example for earthquake in California)



Near surface crustal earthquake possibly in the Vancouver-Seatac corridor 100-300 kms from Vancouver



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Earthquake Early Warning: Fundamentals

Earthquake Early Warning Systems “EEWS” protect life and property by:

- Notifying Emergency Services (Civil Authorities).
- Providing an advance warning to personnel on site, evacuation if feasible.
- Controlled shut down of facility operations.
- Infrastructure Closures, Roads, Tunnels, Bridge Closures, Rapid Transit.
- Safety measures for public safety and critical facilities.
- Post event evaluation, Operating Basis Earthquake for NPPs & HPP.
- Assessment of structural integrity after the event.



EEWS In BC: *ShakeAlarm*[®] at George Massey Tunnel



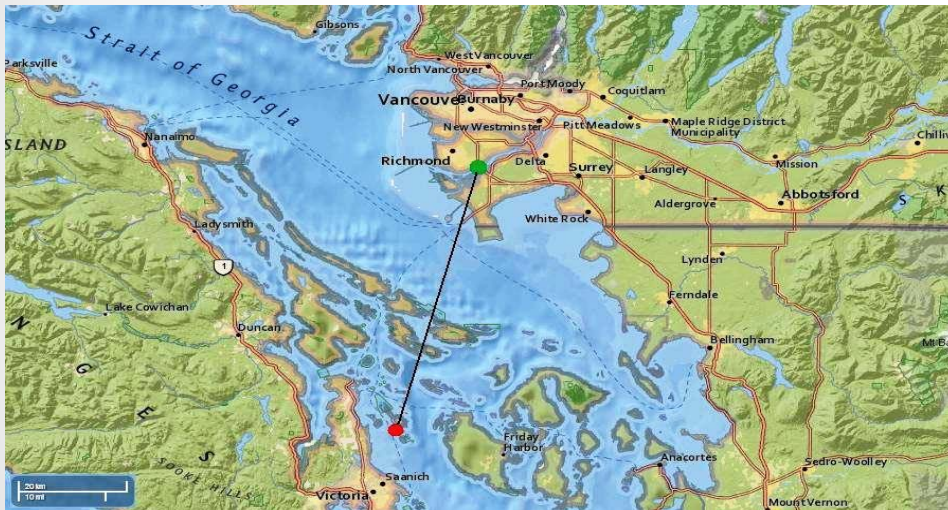
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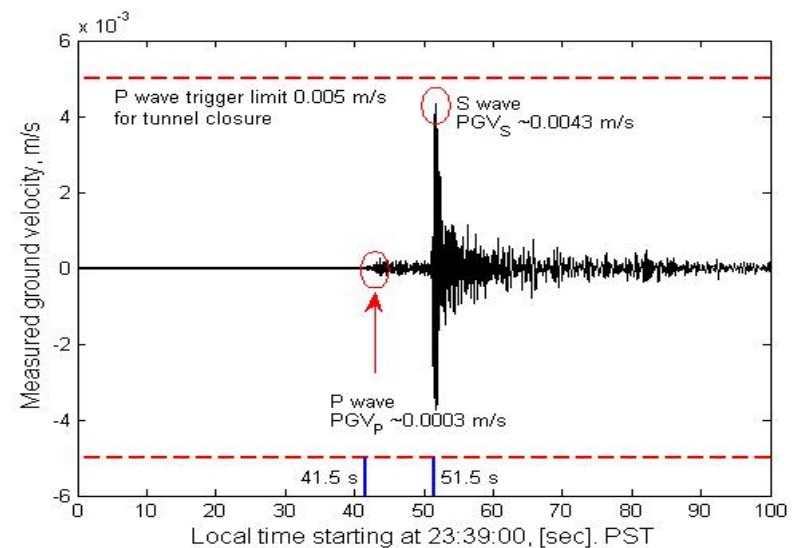
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ShakeAlarm[®]: In Action

P and S Travel Time -Dec 29, 2015 Magnitude 4.8 Earthquake
Recorded at the George Massey Tunnel.



This P-Wave event was ~6% of the level required to activate closure of the George Massey Tunnel



Time: 2015-12-29 23:39:29 (local time)

Location: 48.587N 123.300W, ~20km from Victoria

Depth: ~51 km

Magnitude: 4.8

Epicentral distance: ~62km.

P-S time difference at the GMT site: 10sec.

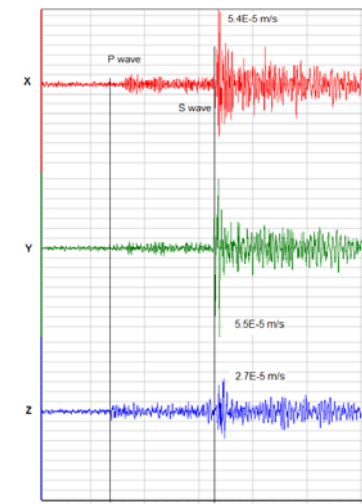
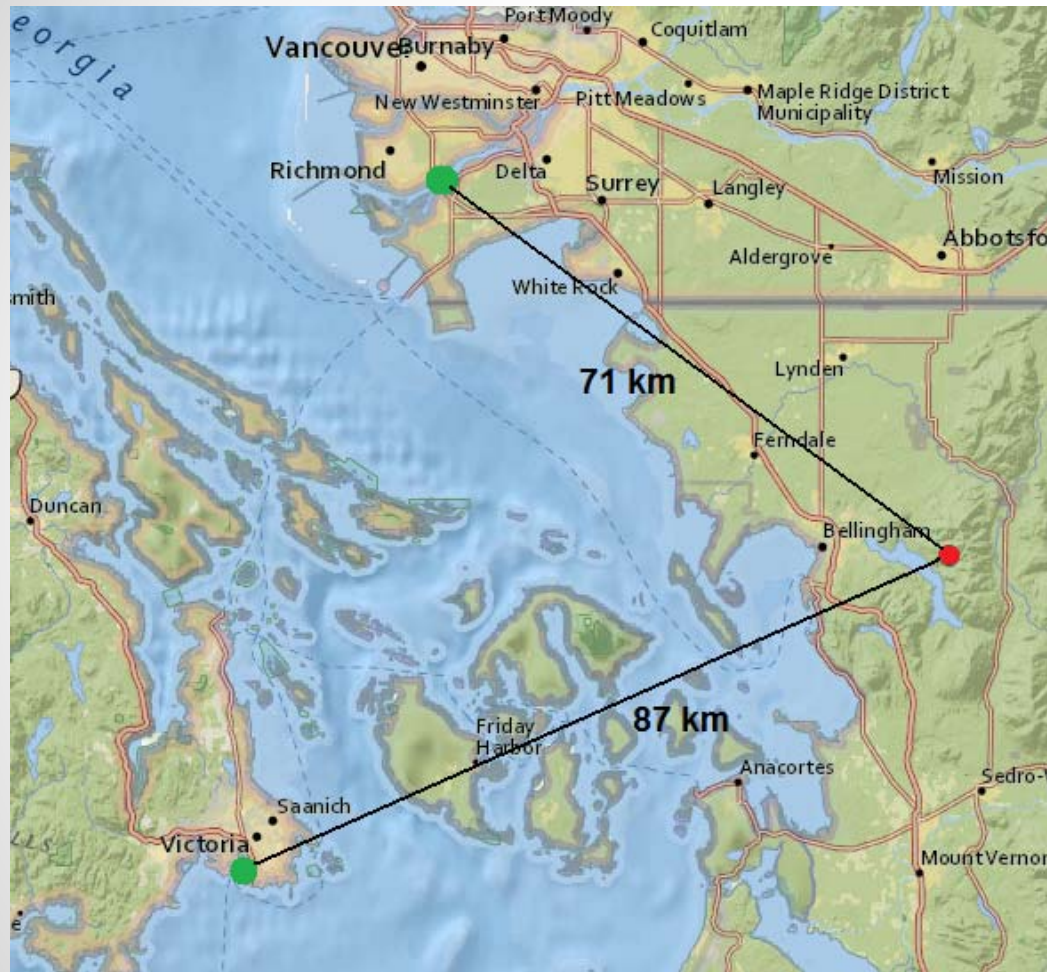


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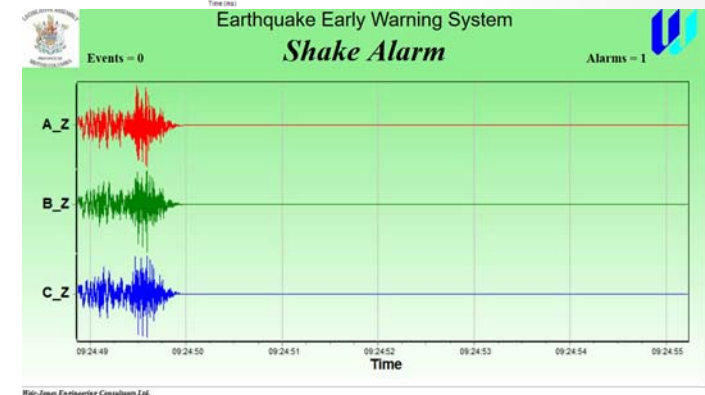
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Records at the George Massey Tunnel and Victoria on September 6, 2016



George Massey Tunnel:
~ 9 seconds warning



Victoria: ~ 10 seconds warning

Thank-you,
Please visit our display and ask questions.



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