

Mitigation “Triage” Workshop: School Pilot Project Case Study

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Washington Military Department
Emergency Management Division



WASHINGTON STATE DEPARTMENT OF
Natural Resources
Peter Goldmark • Commissioner of Public Lands

WASHINGTON STATE SCHOOL SEISMIC SAFETY PILOT PROJECT— Providing Safe Schools for Our Students



by the Washington State Seismic Safety Committee



Project Background

- Led by WA State Seismic Safety Committee
 - John Schelling, WA EMD
 - Tim Walsh, WA DNR
- Structural Evaluations Completed by SEAW (Structural Engineers Association of Washington) Volunteers
 - Stacy Bartoletti, Degenkolb Engineers (Project Lead)
 - Wes Neeley, PCS Structural Solutions (Aberdeen Lead)
 - Cale Ash, Degenkolb Engineers (Walla Walla Lead)
- FEMA Grant to Support Volunteer Travel
- OSPI Support



Washington Military Department
Emergency Management Division

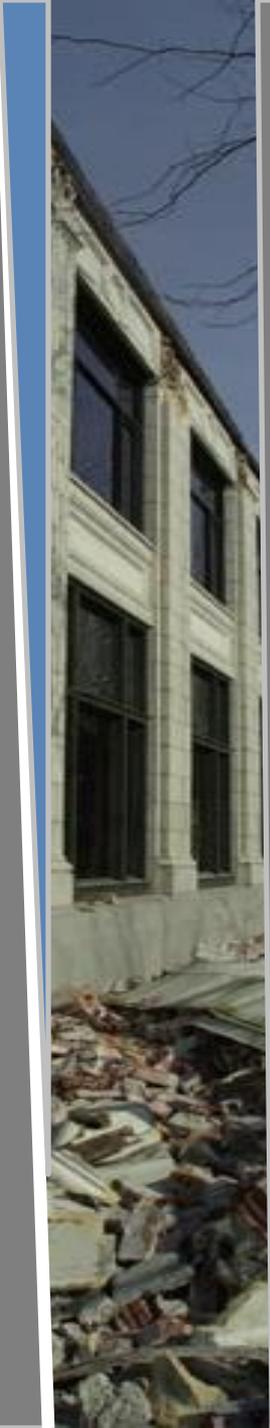


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FEMA





Why Assess School Buildings?

- Do YOU know how many schools in Washington State are vulnerable to damage or collapse in an earthquake?
- Do YOU know how many kids are at risk in these buildings?
- Do YOU know which districts have retrofitted buildings?
- **Well, you might be surprised to know that neither does anyone else.**

Washington Schools have been Damaged in Earthquakes

1949, a large earthquake collapsed the gymnasium roof at Puyallup High School. The earthquake occurred at 11:58 a.m., and the gym had just been vacated by students for lunch.

At Castle Rock High School, however, falling masonry killed the student body president as he tried to escape from the building .

Another student was killed by falling bricks at Lowell Grammar School in Tacoma

In all, thirty schools were damaged in this Nisqually-type earthquake

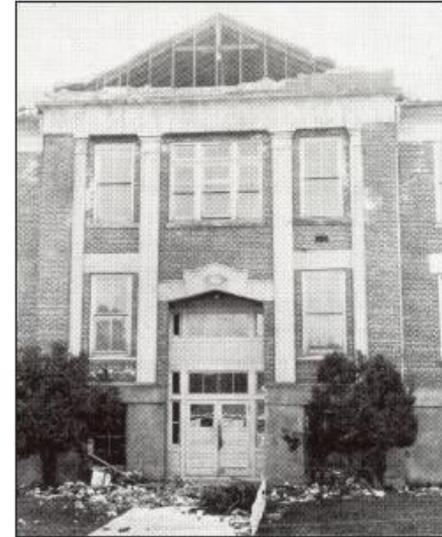


Figure 2. At Castle Rock, a high school student was killed as unanchored gable masonry cascaded to the walk outside the entrance. There could have been more casualties. (From Edwards, 1951.)



Figure 1. Open air theatre—Three members of the stage crew at Puyallup High School survey the wreckage of the stage, which was caved in by the earthquake just as they were leaving for lunch. Under the debris are a ping-pong table and a grand piano. Seattle Times staff photo by Larry Dion (from Ulrich, 1949).

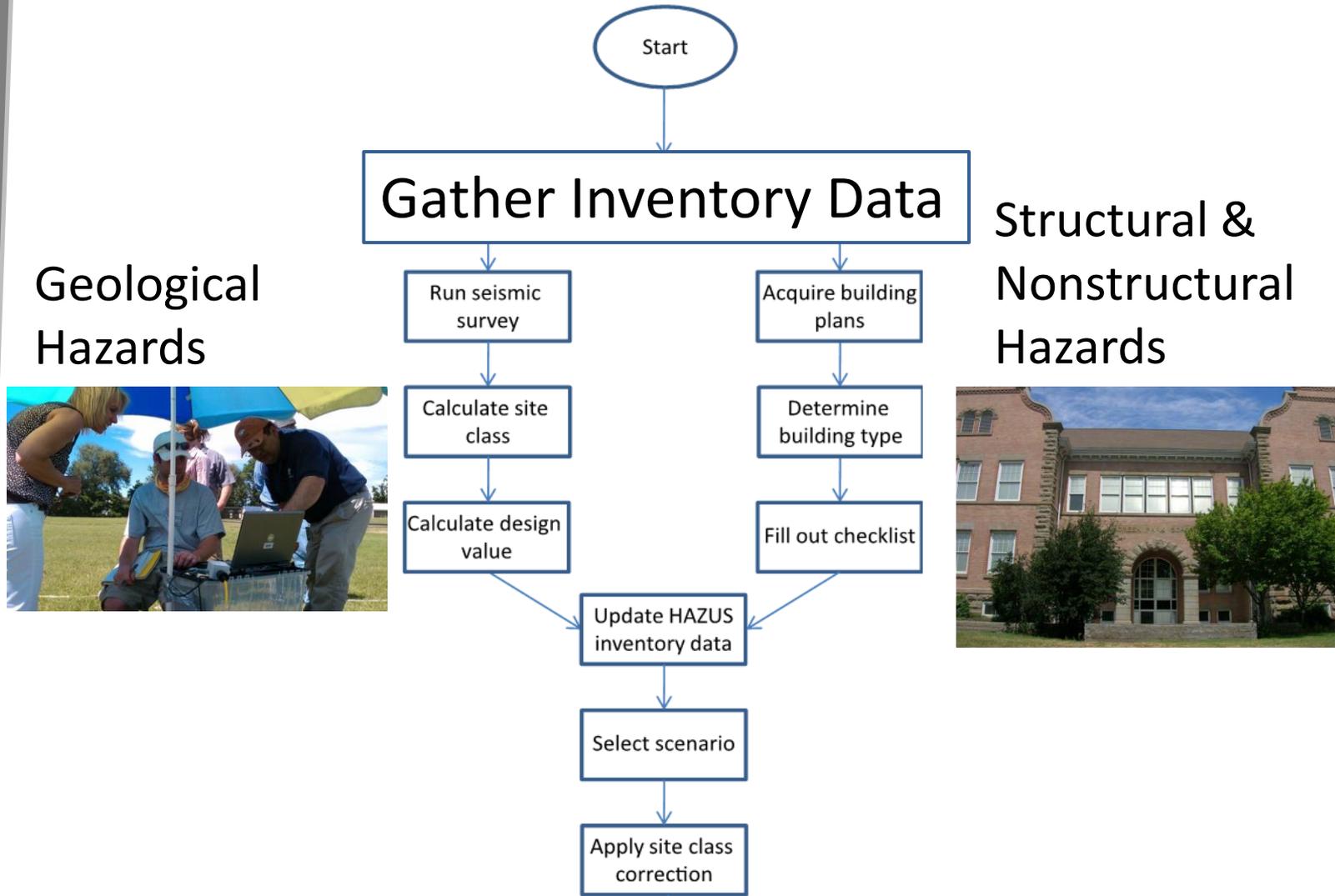


Seismic Evaluation Pilot Project

- Pilot Project for possible statewide implementation
- Walla Walla and Aberdeen
- Volunteers from SEAW and WABO (Washington Association of Building Officials) complete ASCE 31 Tier 1 evaluations
- FEMA Hazus Modeling



Screening Process



FEMA Hazus

- Loss and impact estimation for earthquake, wind, and flood hazards
- Convert ASCE 31 results into damage state probabilities
- Useful for mitigation planning & FEMA grant applications

Damage state		Description
	Slight	Small plaster cracks at corners of door and window openings and wall–ceiling intersections; small cracks in masonry chimneys and masonry veneers. Small cracks are assumed to be visible with a maximum width of less than 1/8 inch (cracks wider than 1/8 inch are referred to as “large” cracks).
	Moderate	Large plaster or gypsum-board cracks at corners of door and window openings; small diagonal cracks across shear-wall panels exhibited by small cracks in stucco and gypsum wall panels; large cracks in brick chimneys; toppling of tall masonry chimneys.
	Extensive	Large diagonal cracks across shear-wall panels or large cracks at plywood joints; permanent lateral movement of floors and roof; toppling of most brick chimneys; cracks in foundations; splitting of wood sill plates and/or slippage of structure over foundations.
	Complete	Structure may have large permanent lateral displacement or be in imminent danger of collapse due to cripple-wall failure or failure of the lateral-load-resisting system; some structures may slip and fall off the foundation; large foundation cracks. Three percent of the total area of buildings with Complete damage is expected to be collapsed, on average.

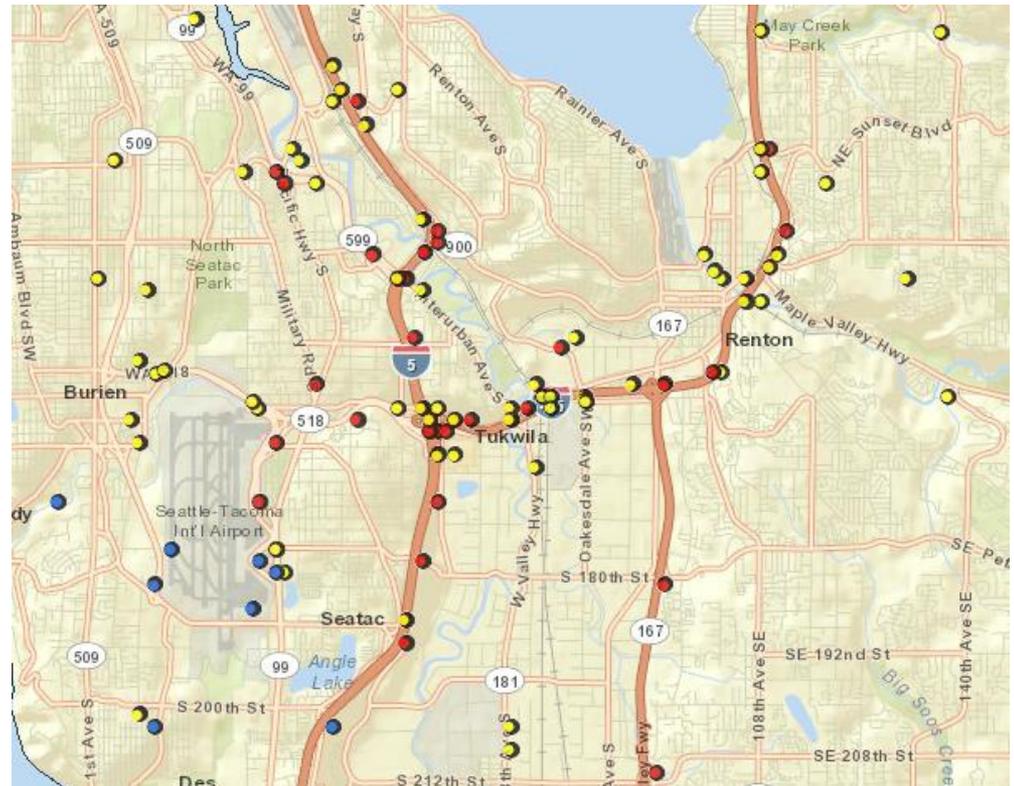


FEMA Hazus

- OSHPD uses for hospital building screening in CA
- Scenario-Based Planning
 - WA State Seismic Hazards Catalog



Hospitals

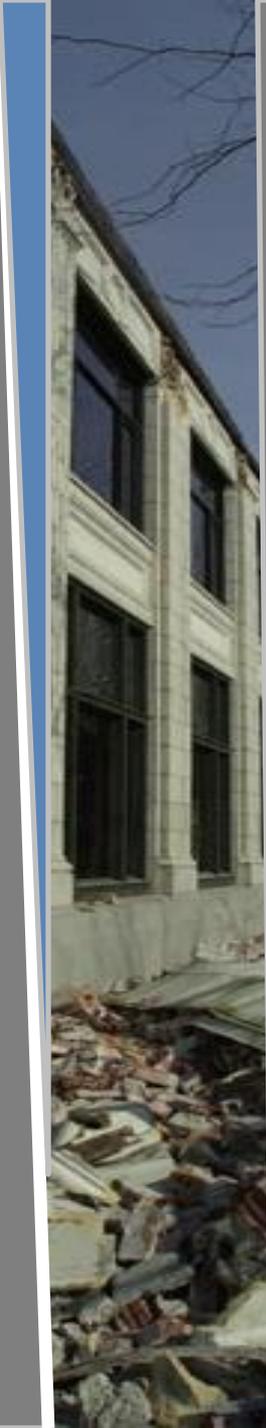


Bridges

Aberdeen Results

Hazus Damage Probabilities for Aberdeen Schools						
Name	None	Slight	Moderate	Extensive	Complete	Extensive + Complete
A J West Elementary	14.8%	56.1%	28.4%	0.7%	0.0%	0.7%
Aberdeen S Dist Admin Bldg	0.0%	0.0%	0.1%	2.1%	97.9%	99.9%
Alexander Young Elementary	0.0%	0.0%	0.2%	7.6%	92.2%	99.8%
Central Park Elementary	0.0%	0.5%	27.6%	54.4%	17.4%	71.8%
Harbor High School	0.0%	0.0%	0.2%	7.6%	92.2%	99.8%
Hopkins Elementary	0.0%	0.0%	0.2%	7.6%	92.2%	99.8%
J M Weatherwax – Aberdeen HS	41.4%	45.4%	13.0%	0.2%	0.0%	0.2%
McDermoth Elementary	44.7%	42.3%	12.7%	0.4%	0.0%	0.4%
Miller Junior High	0.0%	0.0%	4.6%	42.4%	53.0%	95.3%
Robert Gray Elementary	54.1%	41.0%	4.8%	0.0%	0.0%	0.0%
Sam Benn Gym (Aberdeen HS)	34.1%	53.7%	12.1%	0.1%	0.0%	0.1%
Stevens Elementary	0.0%	0.0%	4.6%	42.4%	53.0%	95.3%
Stewart Bldg – Robert Gray Elm	0.0%	0.0%	2.6%	31.6%	65.8%	97.3%

Results based on current code ground shaking intensity



Walla Walla Results

Hazus Damage Probabilities for Walla Walla Schools						
Name	None	Slight	Moderate	Extensive	Complete	Extensive + Complete
Berney Elementary	52.8%	22.1%	20.2%	4.4%	0.6%	5.0%
Berney Elementary Gym	52.8%	22.1%	20.2%	4.4%	0.6%	5.0%
Blue Ridge Elementary	61.7%	23.7%	12.2%	2.4%	0.0%	2.4%
Edison Elementary	60.9%	20.1%	16.4%	2.5%	0.2%	2.7%
Garrison Middle School	64.4%	26.3%	8.8%	0.6%	0.0%	0.6%
Green Park Elementary (additional)	64.4%	26.3%	8.8%	0.6%	0.0%	0.6%
Green Park Elementary (original)	39.3%	25.9%	23.7%	8.9%	2.2%	11.1%
Lincoln Alternative HS	39.3%	25.9%	23.7%	8.9%	2.2%	11.1%
Lincoln Alternative HS Annex	61.8%	27.3%	9.7%	1.1%	0.1%	1.2%
Pioneer Middle School	64.4%	26.3%	8.8%	0.6%	0.0%	0.6%
Prospect Point Elementary	28.5%	15.4%	31.4%	21.9%	2.8%	24.7%
Sharpstein Elementary (gym and lunchroom)	68.9%	15.8%	12.5%	2.7%	0.1%	2.8%
Sharpstein Elementary	51.2%	28.4%	19.2%	0.9%	0.3%	1.2%
Walla Walla HS (academic)	60.8%	18.4%	16.5%	4.1%	0.1%	4.2%
Walla Walla HS (auditorium)	41.6%	26.1%	28.0%	4.0%	0.3%	4.3%
Walla Walla HS (commons)	28.5%	15.4%	31.4%	21.9%	2.8%	24.7%
Walla Walla HS (large gym)	60.8%	18.4%	16.5%	4.1%	0.1%	4.2%
Walla Walla HS (library)	47.7%	22.8%	24.0%	5.1%	0.5%	5.6%
Walla Walla HS (music)	31.8%	21.0%	36.4%	8.9%	2.0%	10.9%
Walla Walla HS (science)	28.5%	15.4%	31.4%	21.9%	2.8%	24.7%
Walla Walla HS (small gym)	28.5%	15.4%	31.4%	21.9%	2.8%	24.7%
Walla Walla HS (vocational)	47.7%	22.8%	24.0%	5.1%	0.5%	5.6%



Current Status

- Final report has been briefed to local jurisdictions & school districts and publicly released.
- Aberdeen and Walla Walla have used this information in their local strategic planning processes.
 - Aberdeen used grant funding to complete Tier 2 evaluation & develop retrofit concepts.
- OSPI developing statewide mitigation toolkit.



Next Steps

- Integrate seismic strengthening into capital improvement plans.
- Identify synergies with other maintenance / renovation projects.
- Find small wins.
- Engage Stakeholders!



Relevant Links

- Pilot Project Report:
http://www.dnr.wa.gov/Publications/ger_ofr2011-7_school_pilot_project.pdf
- FEMA Hazus: <https://www.fema.gov/hazus>
- WA State Seismic Hazards Catalog:
<https://fortress.wa.gov/dnr/seismicscenarios/>

