Building Resilience Through Leadership and Community Engagement

Richard Steinbrugge, PE
Executive Administrator for Facilities
Beaverton School District

Kent Yu, PhD, PE, SE
SEFT Consulting Group
Presentation Outline

• Background
  • Oregon Seismic Hazard
  • Oregon Resilience Plan
  • Beaverton School District and its 2014 Bond Program
• Resilience Vision of Beaverton School District (BSD)
• Resilience Planning Approach
• South Cooper Mountain High School
• New Middle School at Timberland
• Recommendations for Future BSD Projects
• Next Steps
Background
Oregon Seismic Hazard

(OSSPAC 2013)
Oregon Seismic Hazard

(Modified from Goldfinger et al. (in press) by adding magnitude estimates and some labels)
Definition of Resilience

- The ability to prepare for and adapt to changing conditions and withstand and recover rapidly from disruptions (from PPD-21)
The Oregon Resilience Plan

50-year Comprehensive Plan

- Cascadia Earthquake Scenario
- Business/Workforce Continuity
- Coastal Communities
- Critical & Essential Buildings
- Transportation
- Energy
- Information and Communication
- Water & Wastewater

- Save Lives, protect our economy, and preserve our communities;
- 169 Expert Volunteers;
- $ Millions in donation of professional services over a year
Recovery of the Built Environment

Source: National Disaster Recovery Framework
## Target States of Recovery for Building & Infrastructure

<table>
<thead>
<tr>
<th>Phase</th>
<th>Time Frame</th>
<th>Focus of Attention</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>1 to 3 days</td>
<td>Initial response</td>
</tr>
</tbody>
</table>

*EOC’s, Hospitals, Police and Fire Stations, Emergency Shelters (Animal Shelters)*

*Lifeline Infrastructure to provide services to this group of buildings*
## Target States of Recovery for Building & Infrastructure

<table>
<thead>
<tr>
<th>Phase</th>
<th>Time Frame</th>
<th>Focus of Attention</th>
</tr>
</thead>
<tbody>
<tr>
<td>II</td>
<td>1 to 4 weeks</td>
<td>Workforce housing restored – ongoing social needs met</td>
</tr>
</tbody>
</table>

**Essential County/City Services**  
Residential Housing,  
**Schools/Daycare Centers,**  
Community retail centers,  
Financial and Banks

**Buildings** – “safe and useable during repair”  
**Lifeline infrastructure provide services to this group of buildings**
### Target States of Recovery for Building & Infrastructure

<table>
<thead>
<tr>
<th>Phase</th>
<th>Time Frame</th>
<th>Focus of Attention</th>
</tr>
</thead>
<tbody>
<tr>
<td>III</td>
<td>2 to 36 months</td>
<td>Long term reconstruction</td>
</tr>
</tbody>
</table>

**Industrial Buildings**

**Commercial buildings**

**Historic buildings**

*Building - “Safe and usable after repair” “Safe but not repairable”*

Complete 100% reconstruction of lifeline infrastructure within less than 3 years
Four Zones
State Response/Recover Strategy

1st tier
2nd tier
3rd tier
Business and Work Force Task Group

- Oregon is a small business state, 50% ~60% of our work force is employed by small businesses
- Business can only tolerate two to four weeks of disruption of essential services
Key Findings

• Oregon is far from resilient to the impact of a great Cascadia earthquake today
  • Casualties (a few thousand to more than 10,000)
  • Economic Loss (at least 20% state GDP)
  • More than one million truck loads of debris

• Liquid Fuel vulnerability
## Current Resilience Gap

<table>
<thead>
<tr>
<th>Critical Services</th>
<th>Zone</th>
<th>Estimated Average Recovery Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electricity</td>
<td>Valley</td>
<td>1 to 3 months</td>
</tr>
<tr>
<td>Electricity</td>
<td>Coastal</td>
<td>3 to 6 months</td>
</tr>
<tr>
<td>Drinking Water</td>
<td>Valley</td>
<td>6 months to 1 year</td>
</tr>
<tr>
<td>Drinking Water</td>
<td>Coastal</td>
<td>1 to 3 years +</td>
</tr>
<tr>
<td>Sewer</td>
<td>Valley</td>
<td>1 to 3 years +</td>
</tr>
<tr>
<td>Sewer</td>
<td>Coastal</td>
<td>1 to 3 years +</td>
</tr>
<tr>
<td>Top-priority highways (partial restoration)</td>
<td>Valley</td>
<td>6 to 12 months</td>
</tr>
</tbody>
</table>
### Expected and Targeted Building Performance

<table>
<thead>
<tr>
<th>Critical Building Category</th>
<th>Zone</th>
<th>Estimated Average Recovery Time</th>
<th>Resilience Target</th>
</tr>
</thead>
<tbody>
<tr>
<td>Healthcare Facilities</td>
<td>Valley</td>
<td>18 months</td>
<td>Immediate</td>
</tr>
<tr>
<td>Police and Fire Stations</td>
<td>Valley</td>
<td>2 to 4 months</td>
<td>Immediate</td>
</tr>
<tr>
<td>Emergency Sheltering</td>
<td>Valley</td>
<td>18 months</td>
<td>72 hours</td>
</tr>
<tr>
<td>K-8</td>
<td>Valley</td>
<td>18 months</td>
<td>30 days (60 days*)</td>
</tr>
<tr>
<td>High Schools</td>
<td>Valley</td>
<td>18 months</td>
<td>30 days (60 days)</td>
</tr>
<tr>
<td>Housing</td>
<td>Valley</td>
<td>3 days**</td>
<td>72 hours</td>
</tr>
</tbody>
</table>

* A 30-day timeframe is preferred but a 60-day is also acceptable.
** Underestimates recovery for older construction
Beaverton School District

- 3rd Largest School District in OR
  - ~40,000 students
  - 51 schools
  - Increase 2,600 students since 2006
  - Additional 5,400 students by 2025
- 4/5 high schools at/over 100% capacity
- 2 middle schools over 100% capacity
- 14 elementary schools over 100% capacity
- Repairs & Modernization/ Technology/Safety & Security Needs
Beaverton School District Bond Program

• $680 Million Bond Program - Think Big!
  • Passed in May 2014
  • Largest bond program in the State
  • No property tax increase

• New Capacity Construction
  • A high School
  • A Middle School - (used as a temporary school during school replacement)
  • An Elementary School

• Replace four outdated Schools
  • Hazeldale, Vose and William Walker elementaries
  • The Arts & Communication Magnet Academy
Resilience Vision of Beaverton School District
US and International Examples

Sumatra (2004)  
Japan (2011)  
Nepal (2015)  
Sandy Storm (2012)  
Anchorage District with 72-hour supply
Resilience Goals

• Schools function as emergency shelter within 72 hours
• Education resumes within 30 days
• Realistic and flexible
  • Not possible to be completely self-sufficient emergency shelter
  • Adaptable with ability to add more systems as resources become available
• Shelter pre-designation likely leads to prioritized, resilient upgrade of infrastructure systems supporting the schools
• Groundbreaking project with a focus on two schools
  • South Cooper Mountain High School
  • New Middle School at Timberland Development
• Report out $ associated with resilience improvements
Resilience Planning Approach
Issues and Challenges

• Community Development
  • Silo mentality, without coordination
  • Lack of consideration of dependencies

• Current approach to address emergency shelter needs
  • Pre-designated shelters with seismic performance undetermined
  • Ad hoc
  • Lack of reliable lifeline support to make shelters functional

• Lack of public funding for resilience building
  • Public funding available to address legacy projects (FEMA, SRGP)
  • No incentive funding for new construction

• Project Schedule/Budget Constraint
Resilience Investment - Uncertainty

Steady Resilience Investment

Delayed Resilience Investment
Strategies for Shelter Needs

• Short-Term
  • School building is safe to use as a shelter
  • EM agencies to provide utility services

• Long-Term
  • School building is safe to use as a shelter
  • Utility services quickly restored to the shelter

• Strike a balance between current and future shelter needs and limited economic resource for resilience improvements
Resilience Planning Process

• Work with BSD
  • Determine appropriate performance goals and functional recovery for school building

• Coordinate with the County and surrounding cities
  • Determine shelter needs

• Explore potential funding sources to cover financial gap

• Coordinate with lifeline service providers
  • Understand their resilience plan
  • Assist BSD to develop a long-term and interim solutions
Stakeholder Workshop

• Local Emergency Response
  • American Red Cross
  • Washington County Emergency Management
  • TVFR, City of Beaverton

• Lifeline Service Providers
  • Electricity (PGE) and Gas (NW Natural)
  • Water (City of Beaverton, TVWD) & Wastewater (Clean Water Services)

• Beaverton School District
  • District Administration and Project Managers
  • Design team for High School (Boora Architects)
  • Design team for Middle School (Mahlum Architects)

• State Agencies
  • Oregon Emergency Management
  • Portland Metro Regional Solutions
# Stakeholder Workshop

Workshop at TVFR Command & Business Operations Center on February 10th, 2015

<table>
<thead>
<tr>
<th>Name</th>
<th>Participant's Affiliation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jerry Abdie</td>
<td>KPFF Consulting Engineers</td>
</tr>
<tr>
<td>Bruce Barney</td>
<td>Portland General Electric</td>
</tr>
<tr>
<td>Aaron Boyle</td>
<td>Beaverton School District</td>
</tr>
<tr>
<td>Mike Britch</td>
<td>Tualatin Valley Water District</td>
</tr>
<tr>
<td>Brian Butler</td>
<td>Interface Engineering</td>
</tr>
<tr>
<td>David Chesley</td>
<td>Interface Engineering</td>
</tr>
<tr>
<td>Nate Cullen</td>
<td>Clean Water Services</td>
</tr>
<tr>
<td>Tiffany Delgado</td>
<td>Portland General Electric</td>
</tr>
<tr>
<td>David Etchart</td>
<td>Beaverton School District</td>
</tr>
<tr>
<td>Clint Fella</td>
<td>Oregon Office of Emergency Management</td>
</tr>
<tr>
<td>Karl Granlund</td>
<td>Beaverton School District</td>
</tr>
<tr>
<td>Jim Harold</td>
<td>Boora Architects</td>
</tr>
<tr>
<td>Scott Holum</td>
<td>Interface Engineering</td>
</tr>
<tr>
<td>Leslie Imes</td>
<td>Beaverton School District</td>
</tr>
<tr>
<td>Ruwan Jayaweera</td>
<td>PAE Engineers</td>
</tr>
<tr>
<td>Scott Johnson</td>
<td>Beaverton School District</td>
</tr>
<tr>
<td>Siobhan Kirk</td>
<td>Tualatin Valley Fire &amp; Rescue</td>
</tr>
<tr>
<td>Michael Kummerman</td>
<td>NW Natural</td>
</tr>
<tr>
<td>Bobby Lee</td>
<td>Portland Metro Regional Solutions</td>
</tr>
<tr>
<td>Steve Muir</td>
<td>Washington County Emergency Management Cooperative</td>
</tr>
<tr>
<td>Michael Mumaw</td>
<td>City of Beaverton</td>
</tr>
<tr>
<td>Patrick O’Harrow</td>
<td>Beaverton School District</td>
</tr>
<tr>
<td>Curtis Peetz</td>
<td>American Red Cross</td>
</tr>
<tr>
<td>Scott Porter</td>
<td>Washington County Emergency Management Cooperative</td>
</tr>
<tr>
<td>Jeff Rubin</td>
<td>Tualatin Valley Fire &amp; Rescue</td>
</tr>
<tr>
<td>Dick Steinbrugge</td>
<td>Beaverton School District</td>
</tr>
<tr>
<td>Brandon Watt</td>
<td>PAE Engineers</td>
</tr>
<tr>
<td>Dave Winship</td>
<td>City of Beaverton</td>
</tr>
<tr>
<td>Kurt Zenner</td>
<td>Mahlum Architects</td>
</tr>
</tbody>
</table>
Stakeholder Workshop

• Vision for new BSD schools and 2014 bond program

• Emergency Shelter: Current Practice (Capacity, duration, and Level of human services)
  • American Red Cross
  • Washington County Emergency Management

• New, Integrated approach: building Resilience into School Design
  • Identify shelter needs: capacity, duration, and level of human services
  • Categorize support for human services into three categories: Brought in, design flexibility, and hard construction
  • Built-in facility features
  • Utility services required
  • Resources, challenges, and champion
Shelter Needs

• A safe and usable building

• Minimum Requirements
  • Thermal Comfort: a wide temperature range is acceptable
  • Natural Ventilation: Bring in fresh air
  • Lighting: battery lanterns and flash light

• Desirable shelter features
  • Emergency Power: lighting, powering medical devices and personal devices
  • Water Supply: drinking and personal hygiene
  • Wastewater: holding tank or operating wastewater system
Power

• BSD is required to provide 2-hour emergency power
  • Smoke control systems
  • Exit signs
  • Egress lighting
  • Emergency voice/alarm communications

• Generator size: 150 KW

• Shelter Emergency Power
  • Illumination of common areas and the gym for shelter use
  • Exhaust and ventilation fans
  • Power the kitchen
  • Fuel supply adequate for 96 hours of operation of emergency power
Water

- TVWD is starting to incorporate resilience into its planning, with long-term goal below
  - Water available within 24 hours for schools near new backbone
  - Water available from 1-3 days to 2-4 wks for schools not close to backbone
  - Tanker trucks to provide water
- City of Beaverton
  - ASR near high school may be used as a component of emergency supply
  - Water quality will need to be reviewed
- Resilient Pipes & Connections b'twn school and utility water main
Wastewater

• CWS is working to develop resilience plan, with preliminary intention below
  • Create a backbone system that would strengthen main trunk lines, major pumps stations, and treatment plants
  • Provide priority services for essential facilities and emergency shelters
• Resilient Pipes & Connections btwn school and sewer main
South Cooper Mountain High School

- 3-story plus partial Basement
- 330,000 SF
- 2,200 Students
- $98 M
Site Layout

Two circulation systems provide on-site distribution of supplies and services.
High School Resilience Feature - Seismic

• Risk Category IV – Structural/Seismic Design
• Non-structural Component
  • Equipment (required to operate after EQ) Seismically Certified
  • Components required for use as shelter: Category IV seismic bracing
  • Others: Category III seismic bracing

<table>
<thead>
<tr>
<th>Area</th>
<th>Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Main Gym</td>
<td>160</td>
</tr>
<tr>
<td>Auxiliary Gym</td>
<td>80</td>
</tr>
<tr>
<td>Aerobics/Dance Room</td>
<td>30</td>
</tr>
<tr>
<td>Commons</td>
<td>90</td>
</tr>
<tr>
<td>Classrooms (50 rooms @10 people/room)</td>
<td>500</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>860</strong></td>
</tr>
</tbody>
</table>
High School Resilience Feature – HVAC & Power

• Heating
  • Likely acceptable, supplemented with jackets or blankets as needed.

• Ventilation and Cooling
  • Hot weather: indoor temperature = outside temperature
  • Natural ventilation thru doors and windows, and exhaust fans

• Emergency Power
  • 500 KW emergency generator, with 96-hour run time fuel storage
  • Power lighting and ventilation fans in common areas and gym (plus two outlets in kitchen for water boiling)
  • Equipment Seismically Certified: Generator, ATS, ventilation fans
  • Components required for use as shelter: Category IV seismic bracing
High School Resilience Feature – Water

• Be included in the BWD’s backbone system to receive water within 24 hours (after the system is upgrade to its resilience goals)
• Resilient design of piping between water main and the school
• Provide Stub-outs to allow use of portable water tank to supply water to kitchen, locker rooms & showers, drinking fountains in common spaces, and restroom serving Dining Commons
• Seismic bracing of water pipes per Category IV requirements
• ARC or others provide portable shower units
• ARC or others provide appropriate fire watch
High School Resilience Feature – Wastewater

• Long term: Be included in the CWS’s wastewater backbone system to restore services within 1-2 weeks (after the system is upgrade to its resilience goals)
• Short Term: ARC or others provide portable toilets
• Resilient design of piping between sewer main and the school
• Seismic bracing of plumbing system components per Category IV requirements
High School Resilience Feature – Gas & Telecom

• Natural Gas
  • Emergency shelter not dependent on natural gas
  • Install seismic shutoff valve to reduce potential fire hazard

• Telecommunication
  • EM agencies to bring in portable communication systems (COLTs or COWs)
  • BSD has its own radio system, which may be operational
## High School Resilience Feature - Cost

<table>
<thead>
<tr>
<th>Resilience Feature</th>
<th>Cost Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) Design building structure’s lateral-force resisting system for seismic Risk Category IV</td>
<td>$500,000</td>
</tr>
<tr>
<td>2) Provide 500 kW emergency generator with 96-hour run time fuel storage. Emergency generator, switch gear, ventilation fans, and other equipment that is expected to be operational after an earthquake should satisfy the special certification requirements of ASCE 7-10, which is referenced by the OSSC</td>
<td>$330,000</td>
</tr>
<tr>
<td>3) Provide electrical service to power lighting and ventilation fans in common areas and gymnasium on emergency power; does not provide heated or conditioned air</td>
<td>$8,000</td>
</tr>
<tr>
<td>4) Provide stub-outs at building exterior to allow use of portable water tank and associated pump to supply water to key building areas: kitchen, locker rooms &amp; showers, drinking fountains in common spaces and restrooms serving the Dining Commons</td>
<td>$15,000</td>
</tr>
<tr>
<td>5) Provide two electrical outlets in kitchen on emergency power to allow hot plates for water boiling, etc.</td>
<td>$5,000</td>
</tr>
<tr>
<td>6) Provide natural gas seismic shutoff valve at meter</td>
<td>Negligible</td>
</tr>
<tr>
<td>7) Provide hardened water service line from BWD water line to building</td>
<td>TBD</td>
</tr>
<tr>
<td>8) Provide hardened sanitary sewer service line from CWS sewer line to building</td>
<td>TBD</td>
</tr>
<tr>
<td>9) Provide seismic bracing/anchorage design of nonstructural components based on Risk Category III requirements except that those components required for use of the school as emergency shelter (as specified in Sections 5.5 and 5.6) satisfy Risk Category IV requirements</td>
<td>Negligible</td>
</tr>
<tr>
<td>Approximate Total</td>
<td>$900,000</td>
</tr>
</tbody>
</table>
New Middle School at Timberland

- 2-story
- 165,000 SF
- 1,100 Students
- $43 M
Site Layout

Two circulation systems provide on-site distribution of supplies and services.
1st Floor Plan

- Commons @ Lower Level (Seating Capacity Approx. 360)
- Multi Purpose
- Choir Room
- Band Room
- Auxiliary Gym
- Main Gym
- Kitchen @ Lower Level
- Space for Generator

Plan North
Middle School Resilience Feature - Seismic

• Risk Category IV – Structural/Seismic Design
• Non-structural Component
  • Equipment (required to operate after EQ) Seismically Certified
  • Components required for use as shelter: Category IV seismic bracing
  • Others: Category III seismic bracing

<table>
<thead>
<tr>
<th>Area</th>
<th>Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Main Gym</td>
<td>160</td>
</tr>
<tr>
<td>Auxiliary Gym</td>
<td>80</td>
</tr>
<tr>
<td>Aerobics/Dance Room</td>
<td>30</td>
</tr>
<tr>
<td>Commons</td>
<td>90</td>
</tr>
<tr>
<td>Classrooms</td>
<td>500</td>
</tr>
<tr>
<td>(50 rooms @10 people/room)</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>860</strong></td>
</tr>
</tbody>
</table>
Middle School Resilience Feature – HVAC & Power

• Heating
  • Likely acceptable, supplemented with jackets or blankets as needed.

• Ventilation and Cooling
  • Hot weather: indoor temperature = outside temperature
  • Natural ventilation thru doors and windows, and exhaust fans

• Emergency Power
  • 500 KW emergency generator, with 96-hour run time fuel storage
  • Power lighting and ventilation fans in common areas and gym (plus two outlets in kitchen for water boiling)
  • Equipment Seismically Certified: Generator, ATS, ventilation fans
  • Components required for use as shelter: Category IV seismic bracing
Middle School Resilience Feature – Water

• Be included in the TVWD’s backbone system to receive water within 24 hours (after the system is upgrade to its resilience goals)
• Resilient design of piping between water main and the school
• Provide Stub-outs to allow use of portable water tank to supply water to kitchen, locker rooms & showers, drinking fountains in common spaces, and restroom serving Dining Commons
• Seismic bracing of water pipes per Category IV requirements
• ARC or others provide portable shower units
• ARC or others provide appropriate fire watch
Middle School Resilience Feature – Wastewater

- Long term: Be included in the CWS’s wastewater backbone system to restore services within 1-2 weeks (after the system is upgrade to its resilience goals)
- Short Term: ARC or others provide portable toilets
- Resilient design of piping between sewer main and the school
- Seismic bracing of plumbing system components per Category IV requirements
Middle School Resilience Feature – Gas & Telecom

- Natural Gas
  - Emergency shelter not dependent on natural gas
  - Install seismic shutoff valve to reduce potential fire hazard

- Telecommunication
  - EM agencies to bring in portable communication systems (COLTs or COWs)
  - BSD has its own radio system, which may be operational
## Middle School Resilience Feature - Cost

<table>
<thead>
<tr>
<th>Resilience Feature</th>
<th>Cost Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) Design building structure’s lateral-force resisting system for seismic Risk Category IV</td>
<td>$310,000</td>
</tr>
<tr>
<td>2) Provide 450 kW emergency generator with 96-hour run time fuel storage. Emergency generator, switch gear, ventilation fans, and other equipment that is expected to be operational after an earthquake should satisfy the special certification requirements of ASCE 7-10, which is referenced by the OSSC</td>
<td>$400,000</td>
</tr>
<tr>
<td>3) Provide electrical service to power lighting and ventilation fans in common areas and gymnasium on emergency power; heating is only provided for the commons, gymnasium, administrative wing and locker room area, does not provide conditioned air</td>
<td>Included in Total</td>
</tr>
<tr>
<td>4) Provide quick-connect stub-outs at building exterior to allow use of portable water tank and associated pump to supply water to key building areas: kitchen, locker rooms &amp; showers, and drinking fountains in common spaces</td>
<td>$20,000</td>
</tr>
<tr>
<td>5) Provide two electrical outlets in kitchen on emergency power to allow hot plates for water boiling, etc.</td>
<td>$5,000</td>
</tr>
<tr>
<td>6) Provide natural gas seismic shutoff valve at meter</td>
<td>Negligible</td>
</tr>
<tr>
<td>7) Provide hardened water service line from TVWD water line to building</td>
<td>TBD</td>
</tr>
<tr>
<td>8) Provide hardened sanitary sewer service line from CWS sewer line to building</td>
<td>TBD</td>
</tr>
<tr>
<td>9) Provide seismic bracing/anchorage design of nonstructural components based on Risk Category III requirements except that those components required for use of the school as emergency shelter (as specified in Sections 6.5 and 6.6) satisfy Risk Category IV requirements</td>
<td>Negligible</td>
</tr>
<tr>
<td><strong>Approximate Total</strong></td>
<td><strong>$750,000</strong></td>
</tr>
</tbody>
</table>
Oregon ASCE Members Make Resiliency a Priority in School District

by Ben Walpole

September 17, 2013

Infrastructure Resilience discreet Oregon resilience

It’s not easy to face up to the frightening prospect of a major earthquake and tsunami striking your community.

Two years ago, the state of Oregon adopted a resilience plan with a 50-year strategy to address the threat posed by the Cascadia Subduction Zone. The plan takes a “non-hubris” approach to the next disaster, and it can make for scary reading.

But the Beaverton School District — led by several ASCE members — is not intimidated, seeing the state plan as a means to build a more resilient community. Seven new schools to be built over the next several years will all apply the resilience plan’s recommendations.

“It was evident to the school district that we had this special opportunity at a key moment in time with the construction of these seven schools,” said Dick Steinbrugge, P.E., ASCE, executive administrator for facilities at Beaverton. “It was sort of a call to action with regard to the Oregon Resilience Plan.”
Recommendations for Future Beaverton School Projects
Recommendations for Future BSD Projects

**New Construction**
- Carry out this style of resilience planning for all new schools
- Design team selection criteria include consideration of the design team’s
  - Resilience experience
  - Desire to embrace resilient design
  - Ability to implement fresh and improved resilient solutions

**Existing Schools** undergoing seismic retrofit and infrastructure modernization
- Use ASCE 41-13 to retrofit buildings to Immediate Occupancy at BSE-1N and Life-safety at BSE-2N
- Apply for the Oregon Seismic Rehabilitation Program to upgrade existing school buildings
Next Steps
Next Steps

• Create a Memorandum of Understanding between stakeholders
  • MOU between BSD, local EM agencies, and ARC
  • Separate MOU between BSD and BDW, TVWD, CWS, PGE, and NW Natural

• Resilience Implementation
  • Detailed review and Plan check during design
  • Comprehensive inspection during construction
  • Comprehensive maintenance program for generator and fuel

• Post-event Inspection Program
  • Perform seismic evaluation of building using ASCE 41-13 Tier 1
  • Develop a Building Occupancy Resumption Program
Next Steps

- Annual Ongoing Dialogue between stakeholders
  - Annual dialogue between BSD, local EM agencies, ARC, and utility provider to monitor resilience planning and implementation progress

- 10-year Review
  - Examine existing conditions of school
  - Emergency planning of the County and City Emergency Management
  - Status of service providers’ systems
  - Status of all stakeholders’ resilience plans
  - Review existing technology for economic Implementation

- Resilience and Sustainability Integration
Next Steps

• Document process for Education Materials
  • Document the planning, design and construction process
  • Educate students on the importance of enhancing resilience at all levels

• Resilience Funding
  • Very limited funding for disaster resilience improvements
  • Only available for seismic retrofit of existing buildings
  • Legislation needed to develop incentive-based resilience program for new and existing schools

Go to BSD Bond Information website to download this report

https://www.beaverton.k12.or.us/district/bond-measure-information
Acknowledgement

- Chris Poland, Chris D Poland Consulting Engineer, Canyon Lake, California
- Jay Raskin, Jay Raskin Architect, Portland, Oregon
- Jim Newell, SEFT Consulting Group, Beaverton, Oregon
- Darren Beyer, SEFT Consulting Group, Beaverton, Oregon
- Support from Dustin Morrow, Deputy Chief of TVF&R, Don Bohn, Assistant Administrator of Washington County, and Representative Tobias Read
The Iceberg Illusion

Success is an iceberg

Success!

WHAT PEOPLE SEE

Persistence

Failure

Sacrifice

WHAT PEOPLE DON'T SEE

Dedication

Hard work

Discipline

Disappointment

@sylviaduckworth
Questions?

Richard Steinbrugge, PE
Email: Richard_Steinbrugge@beaverton.k12.or.us
Phone: (503)356-4449

Kent Yu, PhD, PE, SE
Email: kentyu@seftconsulting.com
Phone: (503)702-2065