WELCOME!
Interactive Workshop 7B
Challenges and Opportunities to Scale-up Actions that Reduce Risk and Build Resilience in Existing Buildings

March 5-8, 2019 EERI 2019 ANNUAL MEETING Vancouver, BC, Canada
PLEASE SIT AT TABLES ACCORDING TO ELEMENTS YOU WOULD LIKE TO DISCUSS

- **Table 1**: Mandatory inventory, evaluation and retrofit
- **Table 2**: Market driven via rating systems (like a resilience rating), time of sale disclosure, and placarding
- **Table 3**: Codes & integrating seismic considerations with other code objectives
- **Table 4**: Funding/finance for retrofits
- **Table 5**: Cost-benefit calculations for resilience payback
- **Tables 6/7**: Other/repeats
PURPOSE OF SESSION

- EXPLORE THE CHALLENGES AND OPPORTUNITIES IN IMPROVING SEISMIC PERFORMANCE OF EXISTING BUILDINGS

- BUILDING FROM/OFF OF THE TECHNICAL SESSION CONTENT AND EXPERIENCE AND EXPERTISE OF PANELISTS AND GAIN THE INPUT OF ALL OF YOUR VOICES
PANELISTS

- NANCY DEVINE, CITY OF SEATTLE, Senior Structural Plans Engineer
- CARLOS MOLINA HUTT, UNIVERSITY OF BRITISH COLUMBIA, Assistant Professor | Structural Engineering
- DANIELLE HUTCHINGS MIELER, Principal Resilience Analyst, City and County of San Francisco - Office of Resilience and Capital Planning
- JANIELE MAFFEI, Chief Mitigation Officer at California Earthquake Authority
- IBBI ALMUFTI, Risk and Resilience Leader, Arup San Francisco
- ANDREW PAPE SALMON, GOVERNMENT OF BC, BUILDING SAFETY STANDARDS BRANCH
- MICAH HILT, CITY OF VANCOUVER, SEISMIC POLICY PLANNER
SEATTLE PROPOSED URM POLICY

- Require retrofit all URMUs
- Bolts Plus minimum standard
- 7-13 years depending on “risk category”
- Incentives like transfer of development rights, SDCI ombudsman
- Penalties for noncompliance
- Financing options
- One- and two-family dwellings exempt
RACE AND SOCIAL ASPECTS OF INVENTORY

- Government funded affordable housing
- Naturally occurring affordable housing
- Locally-owned, small businesses
- Historically under-represented communities

Challenges
- Displacement
- Communication in world languages
- Mitigation and financial tools
- Make city process accessible to all
SEISMIC RETROFIT OF EXISTING TALL BUILDINGS

- San Francisco’s Pre-Northridge Steel Buildings:
  - 1960s through the early 1990s
  - 50 to 65 welded moment-frames

- Challenges:
  - High cost
  - Occupant disruption
  - Lack of incentives (rent, insurance, etc.)
  - Lack of knowledge

- Opportunities:
  - Innovative solutions
  - Staggered retrofits
  - Making resilience count (link performance to rent costs)
  - Acting before it is too late
SAN FRANCISCO’S NON-DUCTILE CONCRETE BUILDINGS

- ~3,400 pre-1980 concrete buildings citywide
  - 12 tall buildings
  - 116 city-owned buildings
  - How many are non-ductile concrete?

- Ordinances in LA and Santa Monica
- ESIP Task C.2.a: retrofit beginning in 2020

- Challenges:
  - Expensive
  - Untested evaluation methodology (ATC-78)
  - Many buildings, few truly risky ones

- Opportunities: City can lead by example
  - Validate evaluation methodologies (ATC-78)
  - Develop screening, evaluation tools
  - Develop retrofit standards
  - Work out the kinks before rolling out private building program
WHEN NORTH RIDGE EARTHQUAKE STRUCK IN 1994

• One of the costliest natural disasters in U.S. history
• Caused $20 billion in residential damage
• Destroyed or severely damaged thousands of single-family homes
• Displaced about 22,000 people
• Most insurance companies stopped writing Homeowners insurance; prompted creation of CEA
PUBLICLY MANAGED • PRIVATELY FINANCED

A not-for-profit provider of residential earthquake insurance

GOVERNING BOARD:  
Governor
Insurance Commissioner
State Treasurer

Non Voting:  
Assembly Speaker and Senate Rules Chair

PRIVATELY FINANCED:  
1,050,000 Policyholders

MISSION:  
Educate
Mitigate
Insure
Welcome to the Arup Resilience Payback Calculator, a tool that enables building owners and developers to explore the benefits of investing in resilience. Please answer the following questions to discover whether extra investment in resilience can yield positive returns. Use of this tool should not take the place of detailed structural analyses and financial calculations.

1. Where is the building located?
Earthquake hazard varies depending on location. Please select a location from the list below so we can more accurately determine the expected earthquake losses and downtime for the building.

   - Vancouver

2. What is the building occupancy?
Please select the building’s primary occupancy from the list below. We will use this information to determine the value of the building and the cost of downtime. If desired, these values can be adjusted later.

   - Academic

3. How large is the building?
Please provide the approximate gross area of the building in square feet.

   - 20000 sq ft
   - 800000 sq ft

The extra investment in resilience will pay for itself within

23 years

Cost of standard building vs. resilient building over time
(in $millions)

Standard building
Resilient building
# MONETARY VALUATION OF DOWNTIME

<table>
<thead>
<tr>
<th>Occupancy</th>
<th>Downtime Cost (per sqm per day)</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Research</td>
<td>$4.63</td>
<td>Annual revenues from government grants and contracts*</td>
</tr>
<tr>
<td>Administrative</td>
<td>$1.84</td>
<td>Overhead from government grants and contracts (25%)</td>
</tr>
<tr>
<td>Residential</td>
<td>$0.92</td>
<td>Business interruption values from insurance policies; rental information published online</td>
</tr>
</tbody>
</table>

| Academic      | $73.49 (per seat per day)        | Annual revenues from tuition and student fees**                        |

* $1.06B (Consolidated Financial Statements for Year Ended March 31, 2016)
** $560M (Consolidated Financial Statements for Year Ended March 31, 2016)
LEGISLATION & CODES FOR BUILDINGS

- BC Building Regulatory System
  - BC Building Code, substantively based on the National Building Code of Canada
  - Objectives: Health, safety, fire and structural protection, accessibility, energy and water efficiency
  - Triggers: Construction of new buildings, or the alteration, repair or demolition of existing buildings
  - Enforcement: Local governments, via building officials
  - Compliance enhancement: Letters of assurance from registered professionals (engineers and architects)
  - Warranty: Mandatory home warranty insurance for new construction and building envelope renovations
MARKET TRANSFORMATION

- **Data Analysis**
- **Benchmarking, Education**
- **Strategic Planning**
- **Coordination**
- **R&D, Demonstration, Commercialization, Deployment**
- **Government Leadership**
- **Training and Capacity Building**
- **Equipment standards**
- **Financing**
- **Market stimulus (revitalization incentives, EfficiencyBC, utilities)**
- **Local Authority Regulations**
- **BC Building Code**

The diagram illustrates the progression from **Early Adoption** to **Mass Uptake** through steps including:

1. Data Analysis
2. Demonstration
3. Deployment
4. Standard Practice

Each step is influenced by various factors such as government leadership, data analysis, strategic planning, coordination, benchmarking, education, R&D, demonstration, commercialization, deployment, training and capacity building, equipment standards, financing, market stimulus (revitalization incentives), and local authority regulations.
**PROJECT SNAPSHOT**

**Emerging Understanding, Challenge of Priority**
1994 - Delcan Report
2001 - Scawthorn Fire Following Study

**Seismic Risk Reduction for Buildings / Resilient Buildings Project**

<table>
<thead>
<tr>
<th>Year</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>1700</td>
<td>Cascadia EQ</td>
</tr>
<tr>
<td>1989</td>
<td>Loma Prieta</td>
</tr>
<tr>
<td>2001</td>
<td>Nisqually EQ</td>
</tr>
<tr>
<td>2011</td>
<td>Christchurch EQ</td>
</tr>
<tr>
<td>2011</td>
<td>Tohoku EQ</td>
</tr>
</tbody>
</table>

2013 **Earthquake Preparedness Strategy**

Seismic Mitigation Program for High-Risk Buildings

**Phase 1**
2018 **Program Launch, Inventory, Analysis + Seismic Policy Advisory Committee**

**Phase 2a – Assessment, Policy Matrix**
2019 Resilient Vancouver

Outcome: **Risk Assessment + Policy Options**

**Phase 2b — Policy Selection**
Fall 2019

Stakeholder, Public Engagement
OVERVIEW OF TASK

- 5 TOPICS TO FOCUS ON (SOME MAY HAVE MORE THAN 1 TABLE)
- EXPLORE ASSOCIATED CHALLENGES AND OPPORTUNITIES ASSOCIATED WITH EACH
- EXAMPLE: RATING SYSTEMS CAN DRIVE RISK REDUCTION VIA ENHANCED AWARENESS AND MARKET DRIVE BUT CAN AMPLIFY INEQUALITY
- FINAL 5 MINS: ID THE MOST IMPORTANT IDEAS FROM YOUR DISCUSSION
DISCUSS

- WHAT ARE THE CHALLENGES AND OPPORTUNITIES FOR ENHANCING PERFORMANCE OF EXISTING BUILDINGS AS RELATED TO:
  - **Table 1**: Mandatory inventory, evaluation and retrofit
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REPORT BACK

- EACH TABLE TO SUMMARIZE KEY FINDINGS/INSIGHTS FROM THEIR DISCUSSION
- 2 MINS PER TABLE
- ARE THERE PRIORITY ACTIONS OR ACTIONABLE STRATEGIES YOU THINK CAN AND SHOULD BE PURSUED?
<table>
<thead>
<tr>
<th>Approach</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Incentivization (via insurance, mortgage rates, etc.)</td>
<td>51%</td>
</tr>
<tr>
<td>Existing building code</td>
<td>27%</td>
</tr>
<tr>
<td>Ratings systems</td>
<td>16%</td>
</tr>
<tr>
<td>Real estate disclosure</td>
<td>3%</td>
</tr>
<tr>
<td>Other</td>
<td>3%</td>
</tr>
</tbody>
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POLLING

- JOIN AT SLIDO.COM