Building Scientific and Technical Capacity in Developing Countries to Support Disaster Risk Reduction

Tuna Onur\textsuperscript{1} and Rengin Gök\textsuperscript{2}

\textsuperscript{1}Onur Seemann Consulting, Inc.
\textsuperscript{2}Lawrence Livermore National Laboratory

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Earthquake Resilience: From Science to Policy

Research → Decision Making

Data → Knowledge → Policy

Big Gaps in Each of These in Developing Countries
Seismic Cooperation Program (SCP)

- Seismic Cooperation Program of the Lawrence Livermore National Laboratory (LLNL)
- Long-Term Support for Local Seismologists and Engineers (Middle East, Central Asia, Caucasus)
- All Elements of Building Code Development
Building Code Development – Challenges

**Developing Countries**
- Coordination
  - Government
  - Private Sector
- Modernization
  - Science and research
  - Code updates
- Enforcement
  - Responsibility
  - Consequences

**Developed Countries**
- Overarching Policy
  - Consistency among construction codes
- Expectations
  - Code developers
  - Public
- Performance-based codes
  - Explicit criteria
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Coordination of Building Codes

Building codes are typically developed at the national level but enforced at the local level.

- Formal process
  - Broad-based code committee (national and local governments, researchers, practicing engineers, ...)
  - Clear performance goals for the code; tied to public-safety policy
  - Development lifecycle and public review process
Earthquake Resilience: From Science to Policy

Big Gaps in Each of These in Developing Countries
SCP PSHA Project Regions

Central Asia

Caucasus

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Example Project 1: Iraq (Completed)

- Probabilistic seismic hazard studies conducted over a three-year period
- Intensive training program: One in Erbil, Iraq (2014) and two in the US (2015, 2016)
- Resulting hazard maps used in Iraq’s building code update
- Through continuing collaboration and support, locals have taken over the work
Example Project 1: Iraq (Completed)
Example Project 2: Caucasus (In Progress)

- Overview of PSHA in a workshop in Georgia (2016) with attendees from Georgia, Armenia, Azerbaijan and Turkey.
- A non-technical half-day symposium attracted interest of government officials in downstream uses of PSHA results.
- First in-depth hands-on workshop next month in Georgia.
Seismic Source Characterization

- **Earthquake catalogue**
  - Reliable *earthquake location and Mw* calculations
- **Active fault database**
  - Fault geometry & activity rates
Ground Motion Characterization

- Strong ground shaking characterization
  - Compilation of recorded strong motion data
  - Regional attenuation characteristics
  - Empirical and/or simulation-based ground motion models

Source: Pasyanos et al. (2009)
Example Project 3: Central Asia (In Planning)

- Planning meeting in Kazakhstan (2016) with participants from Kazakhstan, Kyrgyzstan, Tajikistan and Uzbekistan.
- Earthquake bulletin/catalogue digitization, revision and unification and their use in PSHA
- Local interest in downstream benefits:
  1. Modernization and possibly harmonization of building codes in the region, and
  2. Understanding risk in the region
Computational Framework

• Probability and statistics
  – Return periods, exceedance probabilities, Poisson distribution, etc.

• Software tools
  – Signal processing, calculation of response spectra
  – Development of PSHA components, running analyses

• GIS capability
  – Source characterization, mapping hazard
Outcomes for the Countries

Data

- Weak- and strong-motion instrument deployment, data collection and processing
- Robust earthquake catalogue including earthquake relocations & newly calculated Mw
Outcomes for the Countries

Knowledge

- Long-term training, capacity building and support for local seismologists and engineers → local ownership
- Probabilistic assessment of seismic hazard with local input

Enabling building code modernization
Road to Disaster Resilience...

• Risk mitigation through retrofitting buildings and infrastructure...
• Build back better...
• Risk resilient infrastructure...
• **First step: Robust building codes!**
Thank you!

Questions/Comments?

tuna@onurseemann.com