Potential Role of S&T for ERM in Nepal

Innovative technique for promoting earthquake safety in Nepal

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National Society for Earthquake Technology – Nepal (NSET)
The Context and Problems
India-Eurasia convergence rate $\sim$ 40-50 mm y\(^{-1}\)
Rate of contraction across the Himalaya $\sim$ 17.52 ± 2 mm y\(^{-1}\)
Consequent upward lift of Himalayas $\sim$ 5 mm y\(^{-1}\)
Need of Earthquake Risk Reduction

Sources of Earthquake Risk

- Building Collapse
- Medical Care Problem
- Emergency Response Problems
- Others (Fire, Landslide)
Approach for promoting earthquake safety

- **Orientation to House Owner**
- **Mason Training**
- **Demonstration Projects**
- **Training on Basic Earthquake Resistant Design and Construction Training**
- **Training on Earthquake Resistant Design of Buildings**
- **Sharing Visits to Municipalities and other institutions**
- **Earthquake Scenario and Action Plan Workshops**
- **Strategic Planning**
- **Awareness Campaign**
- **Earthquake Safety**
- **House Owners**
- **Masons**
- **Contractor & Consultant Engineers**
- **Freelancing Engineers**
- **Municipal Engineers**
- **Local Champions**
- **Government Officers**
- **Political Leaders**
Need and potential is huge, require innovative approaches

Social Mobilization Experts

Social Mobilization Training

Information workers

Social Mobilizers / Community Motivators

Social Mobilization

United people

Aware people

Information Campaign

Search for knowledge & Info.

Technical orientation

Demand / Monitor

Owner-Builders

Several Hundred Thousands

Several Hundred Thousands

Safer behavior, safer Construction

Capable Practitioners

Technical Skill upgrading

Several Thousands

S & T Innovators

Less than Hundreds

S & T Experts

Training

Continuous Knowledge and Capacity Enhancement

Social Mobilization Experts

Technical Training Teams

Social Mobilizers / Community Motivators

Aware people

Safer behavior, safer Construction

Culture of Prevention / Safety

Common / unaware people

Information workers

S & T Innovators

S & T Experts

Less than Hundreds

Continuous Knowledge and Capacity Enhancement

Training

Training

Technical Skill upgrading

Several Thousands
Some tools used for understanding and disseminating hazard, vulnerability and risk
Accelerometer network

- Measures the acceleration due to earthquake
- Data is used to understand how the earthquake affects the buildings and other infrastructures
- These data help to revise the building codes
- Nepal does not have much wider network, hence poor database
Quake Catcher Network (QCN)

- Digitally transmit “triggers” to QCN's servers whenever strong new motions are observed
- Low-cost
- Internet telemetry
- Aftershock data
M6.6, 49km East of Lamjung, Nepal

QCN Station NSET-SNS (PGA 5%g)
N-SHAKE: Now

16 QCNs already installed including 1 in Bhimeshawr Municipality
Problems??

- **Internet connection to communicate with central server at Caltech**
  - Possibility of storing data and uploading letter on server

- **Power back up**
  - Use of low cost, low power consumption devices- Raspberry Pi
Future work

- Expansion of N-SHAKE network
- Dense array, Kathmandu Valley → ShakeMap
- 30 Municipality where NSET/BCIPN is working
- Use data for development of GMPE and microzonation
Recent Effort on Building Damage Assessment

- Detail building damage assessment survey
  - Under the leadership of Central Bureau of Statistics (CBS)
  - Use of real-time spatial data collection tool
  - Use of OpenStreetMap
  - For knowing damage and fragility of different building types
  - Use of IC Tools for data capturing and sharing
Objectives of Assessment

- Identify damaged buildings which are possible to repair, retrofit or which need demolition
- Provide references for reconstruction planning based on the results gained from the assessments
Target Area, Building and Time Frame

- 14 Severe Affected Districts
- 20 Municipalities
- 2,50,000 Buildings
- Jun-Dec 2015

Funded by: USAID/OFDA
Implementing by: National Society for Earthquake Technology- Nepal
Use IT Tools

- Android App to Collect Building Information
- Uploading Data by Local Server
- Monitoring Data
- Web Map & Report Application
### Damage Levels

<table>
<thead>
<tr>
<th>Damage Levels</th>
<th>&gt;2/3</th>
<th>1/3-2</th>
<th>&lt;1/3</th>
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<tr>
<td><strong>Columns</strong></td>
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<td>Extreme</td>
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<tr>
<td>Moderate-Heavy</td>
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<tr>
<td>Insignificant-Light</td>
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<tr>
<td><strong>Beams</strong></td>
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<tr>
<td>Extreme</td>
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<tr>
<td>Insignificant-Light</td>
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<td>[ ]</td>
</tr>
<tr>
<td><strong>None</strong></td>
<td>[ ]</td>
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</tbody>
</table>

**Comments**

- Hairline Cracks

**Beams comments**

- None
Report Application
Report Application

Building Damage Assessment - V4

Report of Detail Damage Assessment of Residential Buildings
(Gorkha Earthquake 2015)

Inspection

Inspector ID: JF
Inspection Time: 11:40:00
Organization: NSET
Inspection Date: 2015/6/2

Building Description

Building ID: JF1235093
District: Dolakha
Building Name: Chamarey Sherpa
Municipality/VDC: JIR
Tel.: Kuthemai
Ward No.: 3

OK
Damage Report on Map
<table>
<thead>
<tr>
<th>Out Kathmandu Valley</th>
<th>Inside Kathmandu Valley</th>
</tr>
</thead>
<tbody>
<tr>
<td>Besisahar: 5597</td>
<td>Lalitpur: 6630</td>
</tr>
<tr>
<td>Bhimeshor: 6035</td>
<td>Kathmandu: 8216</td>
</tr>
<tr>
<td>Chautar: 4308</td>
<td>Budhanilkhantha: 1272</td>
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<tr>
<td>Jiri: 3997</td>
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</tr>
<tr>
<td>Kamalamai: 8575</td>
<td></td>
</tr>
<tr>
<td>Panauti: 6928</td>
<td></td>
</tr>
<tr>
<td>Thosey: 754</td>
<td></td>
</tr>
<tr>
<td>Manthali: 8295</td>
<td></td>
</tr>
<tr>
<td>Bidur: 6760</td>
<td></td>
</tr>
</tbody>
</table>

**Total:** 78918

Now, 200,000 Buildings are Surveyed
Profile of Number of Storey

Total Buildings: 78,918

Number of Storey:
- 1: 18%
- 2: 46%
- 3: 28%
- 4: 6%
- 5: 1%
- >5: 0.3%

Building Materials:
- Adobe: 1%
- Bamboo: 0.1%
- BrickBlockInCement: 9%
- BrickBlockInMud: 4%
- Mix: 1%
- Others: 0.3%
- RCFrame: 4%
- StoneInCement: 11%
- StoneInMud: 20%
- TimberFrame: 11%

Number of Stories:
- 1: 4%
- 2: 29%
- 3: 9%
- 4: 3%
- 5: 2%
- 6: 1%
- 7: 0.5%
- 8: 1%
- 9: 0.2%
- 10: 0.2%
- 11: 0.1%
- 12: 0.2%
- 13: 0.1%
- 14: 0.2%
Damage Grade Distribution

[Diagram showing the distribution of damage grades for different materials and structures, with bars indicating percentages for Grades 1 to 5, and specific materials like Adobe, Bamboo, BrickBlockInCe, etc.]

- None/Grade1: 41%
- Grade2: 16%
- Grade3: 14%
- Grade4: 15%
- Grade5: 15%

[Legend: Green bar for Grade1/None, Blue bar for Grade2, Red bar for Grade3, Yellow bar for Grade4, Blue bar for Grade5]
<table>
<thead>
<tr>
<th>Recommendation</th>
<th>Bidur</th>
<th>Kamalai</th>
<th>NSET</th>
<th>NPC</th>
<th>Bhimeshwar</th>
<th>Karyabinayak</th>
<th>Panauti</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>NSET</td>
<td>NPC</td>
<td>NSET</td>
<td>NPC</td>
<td>NSET</td>
<td>NPC</td>
<td>NSET</td>
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<tr>
<td>None</td>
<td>554</td>
<td>8%</td>
<td>0</td>
<td>0%</td>
<td>1169</td>
<td>14%</td>
<td>0</td>
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<tr>
<td>Repair/Minor Damage</td>
<td>1727</td>
<td>25%</td>
<td>1213</td>
<td>13%</td>
<td>5157</td>
<td>60%</td>
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<tr>
<td>Retrofit/Partial Damage</td>
<td>1147</td>
<td>17%</td>
<td>1464</td>
<td>16%</td>
<td>975</td>
<td>11%</td>
<td>7833</td>
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<tr>
<td>Demolish/Complete Damage</td>
<td>3363</td>
<td>50%</td>
<td>6749</td>
<td>72%</td>
<td>1274</td>
<td>15%</td>
<td>2636</td>
</tr>
<tr>
<td>Total</td>
<td>6791</td>
<td>100%</td>
<td>9426</td>
<td>100%</td>
<td>8575</td>
<td>100%</td>
<td>10469</td>
</tr>
</tbody>
</table>

**Kamalai/NSET Pie Chart:**
- None: 11%
- Repair/Minor Damage: 60%
- Retrofit/Partial Damage: 14%
- Demolish/Complete Damage: 15%

**Kamalai/NPC Pie Chart:**
- None: 75%
- Repair/Minor Damage: 25%
- Retrofit/Partial Damage: 0%
- Demolish/Complete Damage: 0%
More than 100 HAM Operators in Nepal
Used HF Radio for communication during recent Gorkha Earthquake
Enhancing capacity of HAM operators going on
Advancing Emergency Communication through HAM in Nepal

Repeater and Handheld radios provided by CAN-USA

Amateur Radio for Emergency Communication in Nepal
Amateur Radio for Emergency Communication in Nepal

Advancing Emergency Communication through HAM in Nepal

Emergency Communication Drill from Hospitals:
- Bir Hospital
- Teaching Hospital (TUTH)
- Civil Hospital
- Army Hospital
- Chhetrapati Free Clinic

Net Control: NSET
NSET building, with Repeater Antenna faintly visible atop building, to the left

Still need to do a lot

Source: http://9n7ak.wordpress.com/
Training sessions by Remote Presence

- Develop as many instructors as possible in the municipalities
  - develop system for conducting trainings by them
- Use innovative approach such as IT tools
  - To get maximum beneficiaries out from each training
  - Use IT tools – multiplier effect
- Online Training Courses
Satellite ISP Hub in Kathmandu

Optical Fiber Link

Conduct trainings using remote presence

VSAT for internet

Eastern Region

Western Region

Central Region

NSET-Head Office

USAID
FROM THE AMERICAN PEOPLE

NSET
Benefit of IT Tools

- Optimum use of expert time (by saving travelling time and conducting parallel training session)
- Can conduct training on remote part of Nepal
- Reduce the program cost.
Challenges

• Cost of technology – still high, need ways to reduce the cost

• Increasing reliability

• Continuous upgrading of communication technology: Enhance Resolution/speed, reduce costs

• Simplification of the tools so that local professionals can also use it
Some issues

- **Minimum standards for hazard, vulnerability and risk assessments, studies**
  - Such as the simplified RADIUS tool
- **Need more transparency**
  - Protocols, standards, and assurance
- **Networking among similar disaster prone countries in the region, particularly for earthquakes**
  - lessons learned, data sharing
Thank You!