

# Appendix I

# Post-Earthquake Data Collection Workshop

Anchorage, Alaska

July 20-21, 2014

## Background:

The world has experienced unprecedented losses from earthquakes in recent years. For example, in Christchurch, New Zealand, the impacts of the February 2011 M6.3 earthquake include an estimated \$40 billion in losses (equivalent to 20% of New Zealand's GDP), demolition of ~70% of downtown buildings, including loss of more than 50% of heritage structures, expropriation of hundreds of homes in liquefied suburban regions, closure of the core business district for over 2 years, and outmigration of thousands of residents. Over the past five years, earthquakes have also impacted urban regions in Italy, Chile, and Japan, among many others. While devastating for the communities struck by the earthquakes, these events and their impacts present the international research and policy-development communities with unparalleled opportunities. This proposal aims to harness these opportunities through the development of an international workshop on post-earthquake data collection.

Empirical evidence from past earthquakes is essential to understanding and improving community resilience to earthquake disasters; however, we currently lack consensus on what data to collect, how to collect the data, and how to most effectively use it. Recent earthquakes around the world provide us with an opportunity to review data collected internationally, critically evaluate current data collection approaches, and initiate collaborative international research efforts to maximize the knowledge gained from recent devastating events and arrive at international consensus on data collection protocols for future events.

## Workshop objectives:

The objectives of the workshop are:

- To report on data collection practices from recent earthquakes: What data were collected? How were the data collected? What worked? What did not work? What data were lost?
- Initial development of consensus-based data collection protocols.

To achieve a manageable scope, this workshop will focus on building-related data. Lifelines such as roadways, power distribution systems, etc. are clearly essential for resilience but such data is generally collected in a systematic manner already since lifelines are typically managed by a single entity. Data collection for private buildings is considerably more challenging. Data of interest to this workshop include building performance, business interruptions, housing impacts and post-earthquake decisions (repair vs demolish).

It is also anticipated that the workshop may lead to the development of international collaborative projects using empirical data from recent earthquakes to assess and improve community resilience in the event of major earthquakes.

## Participants:

This unique multi-disciplinary workshop will include participants from six different countries: Canada, United States, New Zealand, Italy, Chile, and Japan. Notably, the latter four countries have all experienced devastating earthquakes in the past five years, thus the workshop will provide the

opportunity to share recent experiences and develop new partnership with international colleagues with common interests.

All international participants bring direct experience in data collection after recent earthquakes in their respective countries. Data have been collected by both government agencies and academic institutions, and hence both will be represented at the workshop. Notably, a representative from the insurance and reinsurance industry has been asked to contribute some remarks that will share the industry's perspective and assist in identifying potential sources of funding for collaborative research proposals from this important industry.

In order to keep the workshop effective, the number of participants will be limited to approximately 30, with the majority of participants bringing first-hand recent experience with data collection in Chile, Italy, Japan, and New Zealand.

### **Recent Earthquakes:**

A critical portion of the workshop will be reports from Italy, Chile, New Zealand, and Japan on data collection experiences after recent earthquakes. Each country's participants will work together to develop a 75 min presentation (followed by 15 minutes of questions) to be given on Day 1 of the workshop. This presentation should be coordinated by one representative from each country but can be delivered by multiple participants if this format is preferred. To provide consistency in the reporting and valuable information for the Day 2 breakouts, we ask that the country reports address the following questions:

1. **What forms of data were collected after the earthquake?** Data of interest to this workshop include building performance (physical damage), business interruptions, housing impacts, and post-earthquake decisions (repair vs demolish). We are interested in data at both the detailed building level as well as at the broader community level. What data were used to assess building residual capacity and how were these data used in reconstruction decisions? What should be implemented in data collection protocols to make the assessment of residual capacity more reliable?
2. **Have any relationships between the different forms of data been explored?** For example, what is the relationship between the physical damage and business interruption? Are there other factors influencing the socio-economic impacts, suggesting other forms of data that should be collected?
3. **What organizations were involved in collecting data and for what purpose?** Such organizations may include city government, insurance companies, university researchers, etc. Although the goal of data collection may be different for each organization, the data may be similar and synergistic efforts should be identified.
4. **What barriers are there to sharing data across different organizations?** What experience do you have in finding ways to share data across government and non-government entities?
5. **How were the data collected?** Were any advanced technologies used to collect data or were all data collected manually? What training was provided for data surveyors?
6. **What data were lost?** Were there specific data that were not collected, or not collected in a coordinated manner, such that the data may not be available for future research studies?

7. **Lessons from the data collection process.** What aspects of the data collection process seemed to work well? What could be improved upon?
8. **How are data stored after collection and what are access policies for this data?**
9. **Suggestions for the development of consensus-based data collection protocols?** One of the primary goals of the workshop is the initial development of consensus-based data collection protocols for application after future earthquakes around the world. What experiences from the events in your country could inform the development of these data collection protocols?

**Expected outcomes:**

The workshop is expected to provide the impetus for the development of two types of joint international research proposals: (1) focused on the development of consensus-based data collection protocols; and (2) focused on using empirical data from recent earthquakes to assess and improve community resilience.

For proposal type #1, funding will be sought from public-private partnerships between government agencies responsible for collecting data for the recovery process and the insurance industry interested in rich data to refine natural hazard risk models. This effort is urgently needed to ensure improved and consistent data collection protocols are available prior to the next major earthquake such that valuable data are not lost in the future. Application of the proposed procedures in future earthquakes will provide an excellent opportunity to continue collaborative efforts initiated at the workshop.

For proposal type #2, joint funding will be sought from several national research agencies. Such proposals will build on a US National Science Foundation grant held by the Earthquake Engineering Research Institute to create a Seismic Observatory for Community Resilience with the goal of documenting and understanding the factors influencing the ability of communities to recover after devastating earthquakes. Linkages with new proposals to other national research agencies will be explored to enable international workshop participants to contribute to future joint research projects.

**Timing and venue:**

The workshop will be held over 1.5 days immediately prior to the 10th US National Conference in Earthquake Engineering in Anchorage, Alaska, in July 2014. This international conference draws participants from around the globe, and hence provides the perfect opportunity to host the proposed workshop. Travel costs will be covered by the participants as it is expected that they will be attending the conference regardless of the workshop. The workshop will be held in the NCEE conference hotel, the Anchorage Hilton.

**Proposed Agenda:**

The first day will focus on experiences from recent earthquakes, while the second day will provide an opportunity to discuss the development of post-earthquake data collection protocols and future collaborative activities.

**Sunday, July 20, 2014**

8:00 am – 8:30 am	Breakfast
8:30 am – 8:50 am	Welcome and objectives of the workshop
8:50 am – 10:20 am	Italy experience (group organized presentation)
10:20 am – 10:40 pm	Break
10:40 am – 12:10 pm	Chile experience (group organized presentation)
12:10 pm – 1:00 pm	Lunch
1:00 pm – 2:30 pm	Japan experience (group organized presentation)
2:30 pm – 2:45 pm	Break
2:45 pm – 4:15 pm	New Zealand experience (group organized presentation)
4:15 pm – 4:35 pm	Resilience Observatory (Scott Miles)
4:35 pm – 4:50 pm	Break
4:50 pm – 5:10 pm	Data collection tools (EERI)
5:10 pm – 5:30 pm	Data collection and collaboration with (re)insurance industry (tentative)
5:30 pm – 6:00 pm	Discussion and plans for Day 2
6:00 pm – 7:00 pm	Reception

**Monday, July 21, 2014**

7:30 am – 8:00 am	Breakfast		
8:00 am – 9:30 am	Data Collection Protocols Discussion: (moderators)		
	Breakout 1: Physical Damage Data (Santiago Pujol )	Breakout 2: Impact Data (Mary Comerio)	Breakout 3: Reconstruction and Recovery Data (Stephanie Chang)
9:30 am – 9:50 pm	Break		
9:50 am - 11:30 am	Breakout 1 cont.	Breakout 2 cont.	Breakout 3 cont.
11:30 am – 12:00 pm	Box lunch and planning for evening meeting		

**Tuesday, July 22, Evening meeting:**

5:00 pm – 7:00 pm	Workshop resolutions and action items for collaborative proposals (with hors d'oeuvres)
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**Participant List:**

	<b>Name</b>	<b>email</b>	<b>Country</b>	<b>Organization</b>
1	Andrew King	A.King@gns.cri.nz	NZ (coord)	GNS
2	Peter Wood	srlnprw@gmail.com	NZ	Min of Civil Defence
3	David Johnston	David.Johnston@gns.cri.nz	NZ	GNS
4	Mike Stannard	Mike.Stannard@mbie.govt.nz	NZ	MBIE
5	Quincy Ma	q.ma@auckland.ac.nz	NZ	Univ. of Auckland
6	Stefano Pampanin	stefano.pampanin@canterbury.ac.nz	NZ	Univ. of Canterbury
7	John Hare	JohnH@holmesgroup.com	NZ	Holmes Consulting Group
8	Andrea Prota	andrea.prota@unina.it	Italy (coord)	UNINA
9	Maria Polese	mapolese@unina.it	Italy	UNINA
10	Marco Di Ludovico	diludovi@unina.it	Italy	UNINA
11	Gian Paolo Cimellaro	gianpaolo.cimellaro@polito.it	Italy	Torino
12	Paolo Bazzurro	pbazzurro@gmail.com	Italy	IUSS
13	Juan Carlos de la Llera	jcllera@ing.puc.cl	Chile (coord)	PUC
14	Rene Lagos	rlagos@renelagos.com	Chile	Rene Lagos Engineers
15	Matias Hube	mhube@ing.puc.cl	Chile	PUC
16	Judy Mitrani-Reiser	jmitrani@jhu.edu	US (collaboration with Chile)	John Hopkins
17	Toshimi Kabeyasawa	kabe@eri.u-tokyo.ac.jp	Japan (coord)	Univ. of Tokyo
18	Tomohisa Mukai	t_mukai@kenken.go.jp	Japan	BRI
19	Masaki Maeda	maeda@archi.tohoku.ac.jp	Japan	Tohoku Univ.
20	Satoshi Tanaka	tanaka_s@fuji-tokoha-u.ac.jp	Japan	Tokoha Univ.
21	Sam Kono	kono@serc.titech.ac.jp	Japan	Tokyo Tech
22	Koichi Kusunoki	kusunoki@eri.u-tokyo.ac.jp	Japan	Univ. of Tokyo
23	Toshikazu Kabeyasawa	kabeyasawa-t92ta@nilim.go.jp	Japan	MLIT
24	Scott Miles	scott.miles@wwu.edu	US	Western Washington Univ.
25	Mary Comerio	mcomerio@berkeley.edu	US	UC Berkeley
26	Steve Mahin	mahin@berkeley.edu	US	PEER
27	Vesna Terzic	vesna@berkeley.edu	US	PEER
28	Santiago Pujol	spujol@purdue.edu	US	Purdue
29	Ken Elwood	elwood@civil.ubc.ca	Canada	UBC
30	Stephanie Chang	stephanie.chang@ubc.ca	Canada	UBC
31	Sean Wilkinson	Sean.wilkinson@ncl.ac.uk	UK	Newcastle Univ.
	<b>Students</b>			
32	Frederic Marquis	frederic.marquis@usherbrooke.ca	Canada	UBC
33	Jenna Kim	jenna.jh.kim@gmail.com	Canada	UBC
34	Panos Galanis	pgalan@berkeley.edu	US	UC Berkeley
	<b>Staff</b>			
35	Marjorie Greene	mgreene@eeri.org	US	EERI
36	Heidi Tremayne	heidi@eeri.org	US	EERI
37	Maggie Ortiz	maggie@eeri.org	US	EERI
38	Alex Julius	alex@eeri.org	US	EERI
39	Eddie Vega	ejevega@eeri.org	US	EERI
40	Erik McAdams	emcadams@eeri.org	US	EERI

**Appendix II:  
Sunday July 20 Presentations**

# International Post- Earthquake Data Collection Workshop

Sponsored by

EERI

UBC

MBIE - NZ



# Thank you

- Co-Organizer, Stephanie Chang
- Marjorie Greene, Heidi Tremayne, Maggie Ortiz @ EERI
- Student and intern support
  - Panagiotis Galanis
  - Jenna Kim
  - Frederic Marquis
- **All of you!**

# Workshop motivation

- Empirical evidence from past earthquakes is essential to understanding and improving community resilience to earthquake disasters.
  - However, we currently lack consensus on what data to collect, how to collect the data, and how to most effectively use it.
- 10NCEE provides opportunity to consider lessons from recent earthquakes regarding post-earthquake data collection.
  - Italy, Chile, New Zealand, Japan

# Workshop objectives

- To report on data collection practices from recent earthquakes:
  - What data were collected?
  - How were the data collected?
  - What worked?
  - What did not work?
  - What data were lost?
- Initial development of **consensus-based data collection protocols** and strategizing about what data matters.
- Initiate discussions on joint international research proposals on related topics.

# Workshop scope

- Buildings
  - Lessons may come from lifeline data collection
- Data types:
  - building performance,
  - business interruptions,
  - housing impacts,
  - post-earthquake decisions (eg repair vs demolish)

# Workshop questions

- **What forms of data were collected after the earthquake?**
- **Have any relationships between the different forms of data been explored?**
- **What organizations were involved in collecting data and for what purpose?**
- **What barriers are there to sharing data across different organizations?**
- **How were the data collected?**
- **What data were lost?**
- **Lessons from the data collection process.**
- **How are data stored after collection and what are access policies for this data?**
- **Suggestions for the development of consensus-based data collection protocols?**

# Additional points to frame discussions

- What are the decisions that need to be made (on buildings) post-EQ and how will data help this decision making?
  - e.g. data for deciding fate of building (demolition), data for zoning?
- What data is needed for evaluating and adapting technical decisions?
- Need to identify two forms of links:
  - "links" that allow interoperability between data collected by different entities
  - "links" between physical damage, impact, and recovery data → to inform reconstruction policy.
- Bear in mind time frames
  - What is the minimum data to collect in the first weeks following, vs comprehensive collection later, vs data to assess residual capacity for decisions on demolitions.
- Recommendations coming out of this workshop could:
  - benefit decision-makers in earthquake-struck communities in the future, and
  - advance knowledge about earthquake disasters/recovery

# Sunday Agenda

8:00 am – 8:30 am	Breakfast	
8:30 am – 8:50 am	Welcome and objectives of the workshop	
8:50 am – 10:20 am	Italy experience (group organized presentation)	
10:20 am – 10:40 am	Break	
10:40 am – 12:10 pm	Chile experience (group organized presentation)	
12:10 pm – 1:00 pm	Lunch (Bristol Bay Ballroom--Katmai room)	
1:00 pm – 2:30 pm	<i>New Zealand experience (group organized presentation)</i>	} Shuffled presentations!
2:30 pm – 2:50 pm	<i>Resilience Observatory (Scott Miles)</i>	
2:50 pm – 3:10 pm	<i>Break</i>	
3:10 pm – 3:30 pm	<i>Data collection tools (EERI)</i>	
3:30 pm – 5:00 pm	<i>Japan experience (group organized presentation)</i>	
5:00 pm – 5:15 pm	<i>Break</i>	
5:15 pm – 5:35 pm	Data collection and collaboration with (re)insurance industry (Paolo Bazzurro)	
5:35 pm – 6:00 pm	Discussion and plans for Day 2	
6:00 pm – 7:00 pm	Reception (Bristol Bay Ballroom--Katmai room)	

- Time will be made for discussion
- Keep notes for further discussion in breakouts tomorrow.

# Monday Agenda

Breakouts: Alaska Ballroom - Aleutian, 2fl; Lupine, 1fl; Chartroom, 15fl

7:30 am – 8:00 am	Breakfast		
8:00 am – 9:30 am	Data Collection Protocols Discussion: (moderators)		
	Breakout 1: Physical Damage Data (Santiago Pujol )	Breakout 2: Impact Data (Mary Comerio)	Breakout 3: Reconstruction and Recovery Data (Stephanie Chang)
9:30 am – 9:50 pm	Break		
9:50 am - 11:30 am	Breakout 1 cont.	Breakout 2 cont.	Breakout 3 cont.
11:30 am – 12:00 pm	Box lunch and planning for evening meeting		

- Please assist in an even distribution in the breakouts
- EQ Country participants: at least one person to each breakout please

# Tuesday evening

Boardroom, 2fl; **Dena'ina Convention Center**

5:00 pm – 7:00 pm	Workshop resolutions and action items for collaborative proposals (with hors d'oeuvres)
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Thank you!

# Sunday Agenda

8:00 am – 8:30 am	Breakfast	
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6:00 pm – 7:00 pm	Reception (Bristol Bay Ballroom--Katmai room)	

- Time will be made for discussion
- Keep notes for further discussion in breakouts tomorrow.

# Additional questions to frame discussions

- What are the decisions that need to be made (on buildings) post-EQ and how will data help this decision making?
  - e.g. data for deciding fate of building (demolition), data for zoning?
- What data is needed for evaluating and adapting technical decisions?
- Towns vs Cities - different data needed?
- Need to identify two forms of links:
  - "links" that allow interoperability between data collected by different entities
  - "links" between physical damage, impact, and recovery data → to inform reconstruction policy.
- Bear in mind time frames
  - What data is available (needed) at what times after event?
  - What is the minimum data to collect in the first weeks following, vs comprehensive collection later, vs data to assess residual capacity for decisions on demolitions.

**Appendix III:  
Monday July 21 Discussion  
Summary Presentations & Notes**

# International Post-Earthquake Data Collection Workshop: Wrap-up

## Agenda

- Breakout summaries (<45 min with discussion)
  - Five slides each breakout
  - Discussion after all three have been presented
- Next Steps (<1 hour)
  - Resolutions
  - Action items

# Damage

PHYSICAL

# WHY

- Identify Knowledge Gaps
- Conduct Forensic Studies
- Produce Damage Statistics
- Guide Response

# WHAT

CATEGORY	DATA	DEFINITION



# EARTHQUAKE

CATEGORY	DATA	DEFINITION
Earthquake	Name	
	<b>Date</b>	
	Ground Record(s)	
	Response Record(s)	

# STRUCTURE

CATEGORY	DATA	DEFINITION
Structure	ID	
	<b>Coordinates</b>	
	<b>Address</b>	
	<b>Number of Stories</b>	
	Occupancy	
	Number of Occupants	
	Number of Housing Units	
	Force-Resisting System(s)	
	Seismic Isolation	
	Mechanical Protection Device	
	Strengthening	
	<b>Nonstructural Elements</b>	

# STRUCTURE

CATEGORY	DATA	DEFINITION
Structure	ID	
	<b>Coordinates</b>	
	<b>Address</b>	
	<b>Number of Stories</b>	
	<b>Nonstructural Elements</b>	

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# CONSEQUENCES

<b>CATEGORY</b>	<b>DATA</b>	<b>DEFINITION</b>
Consequences	Survey Date	
	Tag	
	In Use or Not in Use	
	Damage Level	
	Damage Description	
	Cause of Damage	
	Tsunami Run-up Height	
	Crack / Damage Maps	
	Site / Soil Damage	
	Photos, Video, Media	

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# HOW

- Representative samples
- Narratives with standard terms or keywords instead of or in addition to pull-down menus and check boxes?
- Explicit references to standards and ranking systems

# Research Needs

- Define an index to quantify residual capacity
- Produce better simulation tools and models
- Identify factors contributing to resilience
- Develop better methods to estimate regional vulnerability



# Summary of Impact Data Breakout Discussion


Mary Comerio, Moderator

With help from Judith Mitrani-Reiser

# What are Critical Impact Sectors

- Housing
- Health
- Education
- Economy (Jobs)
- Environment
- Communication
- Lifeline operability
- Safety of Civil Society

↑ All are interconnected



Holistic Overview:  
Social  
Economic  
Natural Environment

# What are Minimum Parameters for Baseline and Post-Event

Population impacted area (make up by census)

Urbanized vs non-urbanized

# Dwelling Units (+ types)

# Hospitals/beds (+types)

# Schools (+types)

# Government buildings

# Industrial/commercial buildings

Productivity

Ground Surface Changes

Lifeline Status

Non-Structural Damage

# Data Collection Procedures and Use of International Protocols

- Data Protocols are critical
  - GEM consequence protocols, WHO reports, Sphere Standards, UNDAC other existing models
- Link Damage Survey to operational effectiveness –to define building functions by structure type and link loss/damage with disruption of service
- Engineering community needs to take ownership of functionality requirements to improve Performance Based Design

# Value of Data

## Time Sensitivity of Data

- Overcome barriers to sharing by demonstrating community benefits
  - Examples NZ Geotech/ACC data, Hur. Sandy NYC hospitals shared beds avail daily
- Base Line (pre-event) AND Change in event
- Timeframe for data vary by sector
- Note what is perishable. Because of relation to functioning vs recovery

# Recovery and Reconstruction

## Participants

David Johnston (NZ)

Mike Stannard (NZ)

Marco Di Ludovico (IT)

Juan Carlos de la Llera (CHILE)

Tomohisa Mukai (JP)

Scott Miles (US)

Vesna Terzic (US)

Ayhan Irfanoglu (US)

Ken Elwood (U. Auckland)

## Moderator

Stephanie Chang

## Student/recorder

Frederic Marquis

## Why collect data? (value)

\* “How is the recovery going?” (informing decision-makers)

Type of Data	Social	Basic services	Wellbeing, risk perception	
	Physical	Can the building be used?	What do you do with the building? (demolition decision)	Code changes
	Hard			
		Emergency	Reconstruction - Recovery	

Time

# What minimum types of data are required?

## Categories

1. Damage
2. Rebuilding
3. Functionality
4. Decisions
5. Economics
6. Behavior
7. Population
8. Perceptions

## 2. Rebuilding

- % buildings... (by type, loc., T)
  - Assessed
  - Permitted
  - Repaired
  - Retrofitted
  - Demolished
  - Rebuilt
  - Occupied
- Trends (multiple/proxy/simplified)
- Community changes



# How to Collect and Share Data (principles, ideas)

- Balance data for informing decision-makers with data for research
- Interviews with staff (as well as population)
- Multiple sources, triangulation (e.g., rebuilding)
- Build in links (e.g., buildings with owners/tenants; business actions/time/impact)
- Data has to be made public and available

## **Breakout Session – Recovery and Reconstruction (Theme #3)**

Post-Earthquake Data Collection Workshop

Anchorage, Alaska

July 20-21, 2014

**Moderator:** Stephanie Chang (UBC)

**Student:** Frederic Marquis (UBC)

**Participants:** David Johnston (NZ), Mike Stannard (NZ), Marco Di Ludovico(IT), Juan Carlos de la Liera (CHILE), Scott Miles (US), Vesna Terzic (US), Tomohisa Mukai (JP), Ayhan Irfanoglu (US), Ken Elwood (U. Auckland)

## **What minimum types of data are required?**

### **Categories**

#### **1. Damage**

- a. Detailed building geometry, materials, soils properties and damage data to fill gaps of building performance with the level of shaking experienced by the building.
- b. Amount of damage for members and damaged building by experimental tests
- c. Repair costs (structural members, non-structural members, damage location in the building) (individual building or community)
- d. Effectiveness of mitigation

#### **2. Rebuilding**

- a. % buildings
  - i. Assessed
  - ii. Permitted
  - iii. Repaired
  - iv. Retrofitted
  - v. Demolished
  - vi. Rebuilt
  - vii. Occupied
- b. Trends (multiple indicators, proxy indicators, simplified information)
- c. Community changes (e.g. spatial differences)

#### **3. Functionality**

- a. Post-EQ functionality not to shut down after EQ
- b. Occupancy of public buildings (e.g. hospitals)
- c. Lifelines recovery (different indices) and lifeline interdependencies. How the system works (lifelines, healthcare system, etc.)

#### **4. Decisions**

- a. Government (Policies, Legislation, Recovery Authority, Building Codes, Coding System, Communication to Population)
- b. Building Owners
- c. Impacts (including code changes and retrofits)

## **5. Economics**

- a. Business database: type of business, downtime, timeline of inspection, type of data collected, time to initiate repair, time to repair, sequence of actions and their durations prior to repair of the buildings, tags, business interruption losses.
- b. Data to link types of businesses to dependency on their buildings to inform the need for relative reconstruction speed versus alternative work arrangements
- c. Data to link tenants to buildings to building owners and then track during recovery
- d. Businesses by place and time (number, open/close, % functional, \$/% output, jobs)
- e. Total jobs (new, lost)

## **6. Behavior**

- a. CCTV footage inside buildings during earthquakes and along sidewalks/streets

## **7. Population**

- a. Population by place and time (and movements)
- b. School enrolment

## **8. Perceptions**

- a. Detailed data on the response of people at different levels (individuals, communities, etc.) and their risk perception and how it has evolved in time.
- b. Psycho-social data of people's perception of loss and reconstruction of their built environment (e.g. "How much change is too much?")
- c. Comfort level, wellbeing, acceptable damage level and comprehension of risks at the community level.
- d. Effectiveness of mitigation

## Value of the data

- How's the recovery going? (informing decision-makers)
- Matrix

Social	<i>Basic services</i>	<i>Wellbeing, risk perception</i>	
Physical	<i>Can the building be used?</i>	<i>What do you do with the building? (demolition decision)</i>	<i>Code changes</i>
Hard			
	Emergency	Reconstruction -	Recovery

- Balance between research and decision-making needs
- Decision-making in future events

## How to collect and share data

- Interviews with local staff, returnees, etc.
- Data has to be public and available
- Multiple sources, triangulation (e.g. rebuilding)