2007 Planning for Post Disaster Rehabilitation and Reconstruction

Submitted by: China

Study Course on Disaster Emergency Response and Recovery
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Planning for Post Disaster Rehabilitation and Reconstruction

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Outline

Seismicity and Earthquake Disasters in the APEC Regions

Disaster reduction and Post Disaster Reconstruction Model

Post Disaster Planning and Strategies
Asia-Pacific Economic Coorperation (APEC) has 21 members:

Australia, Brunei Darussalam, Canada, Chile, People's Republic of China, Hong Kong China, Indonesia, Japan, Republic of Korea, Malaysia, Mexico, New Zealand, Papua New Guinea, Peru, Philippines, Russia, Singapore, Chinese Taipei, Thailand, United States, Viet Nam.
Representatives from 7 of 21 APEC members are invited to attend this course.
Historical earthquakes in Asia-Pacific Regions

(BC312〜, Output from EqTAP Project, T. Utsu: Table of World Historical Earthquake, 1990.)
Expected values of peak accelerations in Asia-Pacific Regions (Output from EqTAP Project)
The seismicity of member economies in the APEC regions
### Seismicity in the APEC regions

<table>
<thead>
<tr>
<th>Seismicity</th>
<th>Highly Developed</th>
<th>Developed</th>
<th>Developing</th>
</tr>
</thead>
<tbody>
<tr>
<td>High(9)</td>
<td>Japan</td>
<td>New Zealand</td>
<td>P.R.China</td>
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<tr>
<td></td>
<td>United States</td>
<td>Australia</td>
<td>Indonesia</td>
</tr>
<tr>
<td>Low(7)</td>
<td>Republic of Korea</td>
<td>Russia</td>
<td>Peru</td>
</tr>
<tr>
<td></td>
<td>Singapore</td>
<td>Canada</td>
<td>Philippines</td>
</tr>
<tr>
<td></td>
<td>China</td>
<td>Vietnam</td>
<td>Brunei Darussalam</td>
</tr>
</tbody>
</table>

- **Highly Developed** (High(9)): Japan, United States
- **Developed** (Medium(5)): New Zealand, Australia, Russia, Chinese Taipei, Chile, Mexico
- **Developing** (Low(7)): Republic of Korea, Singapore, Canada, Malaysia, Hong Kong, China, P.R.China, Indonesia, Philippines, Peru, Papua New Guinea, Viet Nam, Brunei Darussalam

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**Seismicity**

- **High(9)**: Japan, United States
- **Medium(5)**: New Zealand, Australia, Russia
- **Low(7)**: Republic of Korea, Singapore, Canada

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**Seismicity**

- **High(9)**: Japan, United States
- **Medium(5)**: New Zealand, Australia, Russia
- **Low(7)**: Republic of Korea, Singapore, Canada

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**Seismicity**

- **High(9)**: Japan, United States
- **Medium(5)**: New Zealand, Australia, Russia
- **Low(7)**: Republic of Korea, Singapore, Canada
Decade comparison of great natural disaster 1950-1999

 Thousands of people are killed, hundreds of thousands are made homeless or a country suffers substantial economic losses

Source: UN, Know Risk, 2005
Disaster losses total and as a share of GDP, in the richest and poorest nations, 1985-1999
<table>
<thead>
<tr>
<th>No</th>
<th>Economies</th>
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<th>Period</th>
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<th>Injured</th>
<th>Homeless</th>
<th>Affected</th>
<th>Damage US (000's)</th>
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<td>Viet Nam</td>
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<td>0</td>
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<td><strong>Total</strong></td>
<td><strong>403</strong></td>
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<td><strong>1,090,284</strong></td>
<td><strong>682,480</strong></td>
<td><strong>5,382,019</strong></td>
<td><strong>49,289,478</strong></td>
<td><strong>178,250,414</strong></td>
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</table>

Source: EM-DAT: The OFDA/CRED International
www.em-dat.net - Universite catholique de louvair
700-2500 killed, thousands injured
• First major urban earthquake
• The Great Fire
• First seismographic recording of major event
• Correlation between earthquakes & faults
• Effects on buildings

San Francisco
April 18, 1906
Concepcion, Chile
May 22, 1960, Ms8.5

- 5700 death, 3 billion damage
- The largest earthquake ever recorded
- City of Valdivia suffered catastrophic damage
- Severe shaking lasted for over 15 minutes
- Coastal area subsided
- A 10m tsunami was generated
- The earth ruptured for 450 miles along the Chile coast
- The area of rupture was the size of California
Hilo, Hawaii: May 23, 1960

Maximum inundation in Hilo (along the Wauioa River) exceeded half a mile.

Maximum wave height at Hilo was 11m (36 feet), 61 people died, US$23 million damage.

May 23, 1960 tsunami. Damage behind the Hilo Theater.
Japan: May 24, 1960

22 hours after the earthquake and 7 hours after the Hilo, Hawaii tragedy
The tsunami killed 200 people in Japan
• 800 km-long rupture
• Largest earthquake in history of US
• Landslide, tsunami, uplift/subsidence
• 120 deaths due to tsunami
• Initiation of US earthquake hazard program

Anchorage
March 27, 1964, M8.6

Coastal uplift/subsidence
• 242,769 deaths, 164,851 injured,
• 32.2 million building rooms collapsed
• $5 billion damage
• Most costly natural disaster in China’s history
• Effects of ‘blind’ faults
• Impacts of major urban earthquake

Tangshan
July 28, 1976, M7.8
Lunan District, Tannahshan

The Epicenter was reduced to ruins
Soldiers digging for survivals
Slab overlapping of the five story building
• 9,500 deaths, 30,000 injured, 50,000 homeless
• $4 billion damage
• Severe impacts in center of city (amplification)
• Impacts of major urban earthquake
• Severe effects on Mexican economy
- 63 killed, 3,757 injured,
- 2600 buildings, 18,000 homes damaged
- 12,000 displaced
- $16.8 billion damage
- Most costly natural disaster in US history

Loma Prieta
Oct 17, 1989, M7.1
• 61 deaths, 1,500 injured,
• 24,000 buildings
damaged
• $44 billion damage
• Most costly natural
disaster in US history
• Effects of ‘blind’ faults
• Impacts of major urban
earthquake

Northridge
Jan 17, 1994, M6.8
• 6,348 deaths, 43,177 injuries
• $112 billion damage
• Most expensive natural disaster in history!
• Major earthquake located in urban center
• Effects on transportation system
• Amplification in filled la

Kobe
Jan 17, 1995  M7.3
Ji-Ji, Taiwan, China
Sept 21, 1999, M7.5

• 2,321 deaths, 8,737 injured,
• $9.3 billion damage, 3.3% of GDP
• Most costly natural disaster in China’s history
• Ground surface deformed
Izmit, Kocaeli, Turkey
Aug 17, 1999, M7.4

- 15,851 deaths, 43,953 injured
- $16 billion damage, 7.0% of GDP
- Most costly earthquake disaster in Turkey’s history
• 265,000 killed and missed
• 500,000 injured
• 350,000 houses & facilities damaged
• 514,150 displaced
• $10 billion damage
• One of the deadliest disasters in modern history

Earthquake was detected to give 3 hours of tsunami notice. Such warning system is available across the Pacific Ocean but not in the Indian Ocean.

Coastal dwellers are educated in the Pacific littoral to get to high ground quickly following tremors and waves but not in the Indian Ocean.

Tsunamis are rarer in the Indian Ocean as the seismicity is less than in the Pacific. Tsunamis are not entirely unknown in the Indian Ocean.

Tsunami in 1883 generated by the Volcanoes at Krakatoa led to a surge of at least 1 m in Sri Lanka.
Summary of the Human Impact of the Earthquake and Tsunami of December 26, 2004

<table>
<thead>
<tr>
<th></th>
<th>Casualties</th>
<th>Health Problems (Number of Cases)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Dead</td>
<td>Missing</td>
</tr>
<tr>
<td>Sri Lanka</td>
<td>30,718</td>
<td>3,858</td>
</tr>
<tr>
<td>Indonesia</td>
<td>113,306</td>
<td>7,191</td>
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<tr>
<td>Maldives</td>
<td>82</td>
<td>26</td>
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<tr>
<td>Thailand</td>
<td>5,265</td>
<td>4,499</td>
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<tr>
<td>India</td>
<td>15,693</td>
<td>5,900</td>
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<td>Malaysia</td>
<td>74</td>
<td>6</td>
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<tr>
<td>Myanmar</td>
<td>90</td>
<td>na</td>
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<tr>
<td>Bangladesh</td>
<td>2</td>
<td>na</td>
</tr>
<tr>
<td>TOTAL</td>
<td>165,230</td>
<td></td>
</tr>
</tbody>
</table>

*a As of 9 January 2005; sourced from the UN Office for the Coordination of Humanitarian Affairs, CNN, and Reuters News.

Storm lashes Bangladesh coast

November 19, 2007

DEATH, LOSS
Primary official estimate

Death toll : 2,299
Death feared: 10,000
Affected families: 8.87 lakh
Livestock death: 2.42 lakh
Crops fully damaged: 23,000 acres
Beijing Rainstorm, July 10, 2004, Road hydrocele, Traffic paralysis

Drainage system is designed on 5 years of return period (100-300 years for developed countries).

Diameter of drainage pipelines only 1M (3-5 times more in developed countries).

Less daily maintenance, some outfalls were jamed.
Jinan
Shangdong

Rainstorm, July 18, 2007
34 died
6 disappeared
142 injured
Chongqing
Rainstorm, July 16, 2007

Depth of Water was more than 1M on the road, hundreds of vehicles were submerged

10 died, 5 missing, 128 injured
10,000 housing rooms were collapsed
2.72 million population effected
Some infrastructures were damaged
Xingtai, Hebei

Rainstorm, July 18, 2007

Depth of Water was more than 1M on the road.
Yantai airport
Shangdong

Rainstorm, July 12, 2007

Depth of water was 15-45 cm in parking apron area, 45 scheduled flights were suspended.
Outline

Seismicity and Earthquake Disasters in the APEC Regions

Disaster reduction and post disaster reconstruction model

Post disaster planning and strategies
Pre-disaster phase

1. Insurance & reinsurance
2. Financial market Instruments
3. Privatization of public services with safety regulation
4. Calamity Funds

Risk identification

1. structural mitigation works
2. Land-use planning and Building codes
3. Economic incentives for Pro-mitigation behavior
4. Education, training and Awareness about risks and prevention

Preparedness

Risk transfer

Mitigation

Emergency response

1. Rehabilitation & reconstruction of damaged structures
2. Macroeconomic and budget management
3. Revitalization for affected sectors
4. Incorporation of disaster mitigation components in reconstruction activities

Rehabilitation

Reconstruction

Post-disaster phase

1 Early warning and communication systems
2 Contingency planning
3 Networks of emergency responders
4 Shelter facilities and evacuation plans

Risk transfer

Disaster impact

1. Humanitarian assistance
2. Clean-up, temporary repairs, and restoration of services
3. Damage assessment
4. Mobilization of recovery resources

1. hazard assessment
2. vulnerability assessment
3. risk assessment
4. hazard monitoring & forecasting
The focus of disaster risk reduction

Risk Factors
- Vulnerability
- Social
- Economic
- Physical
- Environmental

Hazards
- Geological
- Hydrometeorological
- Biological
- Technological
- Environmental

Vulnerability/Capacity analysis

Hazard Analysis & monitoring

Risk Identification & Impact assessment

Awareness Raising for Change in behavior

Knowledge Development
- Information
- Education & Training
- Research

Political Commitment
- International, regional, national, local levels
- Institutional framework (governance)
  - Policy development
  - Legislation & Codes
  - Organizational development
- Community actions

Application of Risk Reduction measures
- Environment management
- Social and economic development practices (including poverty alleviation, livelihoods, financial mechanisms, health, agriculture, etc.)
- Physical and technical measures
  - Land-use/urban planning
  - Protection of critical facilities
- Networking and partnerships

Emergency Management

Preparedness

Early Warning

Recovery

UN, 2005, Know Risk, pp. 29
**Hazard**
Frequency and severity of a threat inflicting losses on people, property, systems or functions.

**Vulnerability**
Susceptibility to losses to exposure hazard.

**Exposure**
People, property, systems or functions at risk of partial or total losses exposed to hazard.

**RISK** - Convolution of hazard, vulnerability and exposure

**DISASTER**

**Losses**

**Personal**

**Direct economic**

**Indirect economic**

**Environmental**
Typical Post-earthquake Reconstruction Activity Model

Phase: Emergency | Rehabilitation | Reconstruction I | Reconstruction II

Property: Damage | Restoration | Reconstruction | Large scale reconstr.

Normal activity: Suspend or change & operation

Counter Activity

Max

Min.

0.5 1 2 5 10 20 50 100 300 500

Impact

- End of search and rescue
- Provision of emergency food, shelter and medical assistance
- Clearance of ruins on the main roads
- Restoration of essential services and repairable buildings and structures
- Provision of temporary housing
- Clearance of ruins
- Returning to level of functioning prior to disaster
- Replacement of buildings and infrastructures
- Introducing improved and advanced building systems and programs
- Applying experiences learned from the disaster in future research and development programs
- Utilizing international assistance optimum effect
Post-earthquake Reconstruction Activity Model for 1975 Haicheng, China, Earthquake

Phase: Emergency Recovery Reconstruction I Reconstruction II
Counter Activity

Max

Min.

Impact
- End of search
- Provision of shelter
- Restoration of production
- Returning to level of functioning prior to disaster

Number of weeks

0.5 1 2 5 10 20 50 100 300 500
Post-earthquake Reconstruction Activity Model for 1976 Tangshan, China, Earthquake

Rehabilitation

Phase: Emergency Recovery Reconstruction I Reconstruction II

Max.

Min.

Impact

1 End of search and rescue and start of clearance of dead body
2 Start to build temporary housing
3 Shops restored
4 Completion of temporary housing construction
5 End of epidemic prevention and clearance of dead body
6 Total industrial output reached to the level prior to the event
7 Start of large scale housing construction projects
8 Completion of housing construction projects

Number of weeks

1 2 3 4 5 6 7 8
Rehabilitation

Pressures faced immediately after a disaster

- Economical, social, psychological and political pressures foster rehabilitation and reconstruction as rapidly as possible. The overriding concern is with immediate needs, not with future disasters.
- The immediately passed bitter experience and the concern in significant reduction in future risk foster improving safety in rehabilitation and reconstruction. The survivors hope to build and repair buildings and structures much better to withstand damage from future disasters.

The correct and rational decision making for rehabilitation and reconstruction including **land-use planning, housing construction, priority of recovery of economic sectors and resources arrangement**, are the key to solve the pressures faced immediately after a disaster.
Rehabilitation

Actions taken in the aftermath of a disaster to enable basic services to resume functioning, assist victims self-help efforts to repair physical damage and community facilities, revive economic activities and provide support for the psychological and social well-being of the survivors. It focuses on enabling the affected population to resume more-or-less normal (pre-disaster) patterns of life. It may be considered as a transitional phase between immediate relief and more major, long-term development.

Source: UNDP/UNDRO module Overview of Disaster Management
chair  disaster  rehabilitation
Reconstruction

Full restoration of all services, and local infrastructure, replacement of damaged physical structures, the revitalization of economy and the restoration of social and cultural life.

Reconstruction must be fully integrated into long-term development plans, taking into account future disaster risks and possibilities to reduce such risks by incorporating appropriate measures. Damaged structures and services may not necessarily be restored in their previous form or location. It may include the replacement of any temporary arrangements established as part of emergency response or rehabilitation.

Source: UNDP/UNDRO module Overview of Disaster Management
1  chair

2  disaster

3  reconstruction
Recovery

Actions taken during the period following the emergency phase, which encompasses both rehabilitation and reconstruction.

Source: UNDP/UNDRO module Overview of Disaster Management
Outline

Seismicity and Earthquake Disasters in the APEC Regions

Disaster Reduction and Post Disaster Reconstruction Model

Post Disaster Planning and Strategies
Personal Loss
Injuries, death, diseases

Direct economic Loss
Buildings, infrastructures, contents, vehicles

Indirect economic Loss
Financial loss, business interruption, consequential loss

Environmental Loss
Ground failure; damage to flora, fauna, biodiversity

Short term

Long term

Earthquake risks
<table>
<thead>
<tr>
<th>Topic</th>
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<tbody>
<tr>
<td>Shelter and housing</td>
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<tr>
<td>Evaluation and rehabilitation of damaged buildings and structures</td>
</tr>
<tr>
<td>Industrial sector recovery</td>
</tr>
<tr>
<td>Land use</td>
</tr>
<tr>
<td>Building an informed, trained and prepared community</td>
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<td>Resource balancing</td>
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</table>
1 Shelter and housing
1976 Tangshan Earthquake

Phase 1 Temporary shack
Phase 2 Simply constructed house
  352,000 rooms were
  completed before Nov 15, 1976
Phase 3 Semi-permanent house
Phase 4 Permanent house
  - 5 years postponed due to increase of scale caused by population increase, rise of housing costs and limitation of budget.
  - 11.22 million m² of building floor area were completed in July of 1986, which consists of 144% of the planned, and accommodated 222,500 households (It was 157,960 before disaster).
Permanent house

Interior wall and slab: Cast in place
Exterior wall: Brick masonry

Interior wall and slab: Cast in place
Exterior wall: Prefabricated
Brick Masonry multi-story building with constructive R/C columns and ring beams
Permanent Housing in Tangshan city
Housing reconstruction in Kobe

• Three-year Housing Reconstruction Plan was formulated in August 1995

• Rent reduction for lower-income households and special care for the needs of the elderly

• For low/middle-income households, a new measure, which lessens the initial burden of rent payments on renters for private-sector housing, was put into effect in October 1996.

• Low-interest loan by the Housing Loan Corporation is offered to those who wish to rebuild their own houses.
Lessons learned

• Ignorance of potential households.
• Unpracticed technical requirements, 10 million Yuan RMB were lost in response to use advanced technology.
• Reconstruction plan was revised timely.
• Establish a powerful headquarters to control all of the rehabilitation and reconstruction process.
1975 Haicheng Earthquake

- severe winter time
- shelters were made of wood & rice straw
- no any heating devices

Total deaths 1328
713 after earthquake 53.7%

Total injured 16,980
After quake 7558 44.5%
Typical temporary housing units consist of stacked box-like structures. Residents share kitchen and bathroom facilities.
2 Evaluation and rehabilitation

HAZARD, IMPORTANCE
ECONOMICS

• Geological hazard
  - Basic intensity map
  - Medium-term prediction
• Importance
  - Political
  - Economic
  - Population

1st cut
List of critical cities/regions

• Political
• Economical
• Historical
• Occupancy
• Earthquake effect
  - Secondary disaster potential
  - Social impact
  - Post earthquake rescue, recovery and
  • reconstruction needs
  - Emergency services
  - Life line system

2nd cut
List of critical institutions/buildings

• Structure type
• Construction quality
• Design code followed
• Seismic capacity
  (Analytical evaluation)
• Constructive measures
  (Constructive evaluation)

3rd cut
List of critical Struct./Bldgs needed to be Strengthened

“Three cuts” Retrofitting process

Strengthening Design
Retrofitting following 1976 Tangshan Earthquake
Retrofitting must consider

- their life span
- Increasing resistant capacity for whole building
- should never just strengthen damaged items or even only strengthen the building without comprehensive analysis
Factors impeded implementation of retrofitting program

1 Absence of damaging disaster and the memory of bitter life happened in the past disaster faded from people’s mind.

2 Low credibility of disaster threat and inability to define the threat in precise enough terms so that people believe that they will be affected.

3 Ignorance of relevant authoritative regarding the nature and magnitude of the disaster due to lack of awareness.
4 Fear of disturbance of productive activities.  
5 Fear of disturbance of housing activities.  
6 Costs of retrofitting buildings are still unknown, but generally are much higher than incorporating disaster resistant requirements into new construction and retrofits offer little in the way of near-term market benefits.  
7 Difficulties in determining the appropriate safety level.  
8 Difficulties in analyzing the buildings to be retrofitted, because for many old buildings the original and modified drawings are not available.  
9 Limitation of financial resources.
3 Priority of Industrial Sector Recovery

It is necessary to identify priority for recovery of economic sectors because financial resources are limited.

Tools
- System dynamics method
- Analytical hierarchy process method
System Dynamics Method

• Problem identification

• Making causality feedback drawings and set up model frame

• Making system flow chart by using system dynamics symbols

• Setting up DYNAMO equations, compiling system program by using DYNAMO language and testing on the computer

• Drawing up possible solutions

Rehabilitation options following 1976 Tangshan, China, earthquake

<table>
<thead>
<tr>
<th>Option</th>
<th>Metallurgic</th>
<th>Electric</th>
<th>Coal</th>
<th>Chemical</th>
<th>Mechanical</th>
<th>Bldg. material</th>
<th>Forest</th>
<th>Food</th>
<th>Textile</th>
<th>Paper making</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>5.0</td>
<td>37.2</td>
<td>37.3</td>
<td>2.7</td>
<td>5.9</td>
<td>3.1</td>
<td>0.4</td>
<td>1.6</td>
<td>4.0</td>
<td>0.6</td>
<td>2.2</td>
</tr>
<tr>
<td>2</td>
<td>6.0</td>
<td>30.0</td>
<td>30.0</td>
<td>3.0</td>
<td>6.0</td>
<td>3.0</td>
<td>0.5</td>
<td>7.0</td>
<td>10.0</td>
<td>2.3</td>
<td>2.2</td>
</tr>
<tr>
<td>3</td>
<td>10.0</td>
<td>26.5</td>
<td>26.5</td>
<td>8.0</td>
<td>10.0</td>
<td>3.0</td>
<td>0.5</td>
<td>7.0</td>
<td>10.0</td>
<td>2.3</td>
<td>2.2</td>
</tr>
</tbody>
</table>

1 similar to practical one after earthquake
2 investment in light industry ↑, in heavy industry ↓
3 investment in light industry ↑, properly ↑ in mechanical, metallurgic, chemical

<table>
<thead>
<tr>
<th>Option</th>
<th>Total output value, TOV</th>
<th>Recovery percentage, RP</th>
<th>Tax &amp; Profit, TP</th>
<th>TP/TOV</th>
<th>TOV/Real estate value</th>
<th>Water consumption</th>
<th>Electricity and land consumption</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>311.8e3</td>
<td>132.4</td>
<td>58.52e3</td>
<td>18.77</td>
<td>7.42</td>
<td>&lt;1.0</td>
<td>&lt;1.0</td>
</tr>
<tr>
<td>2</td>
<td>409.8e3</td>
<td>174.0</td>
<td>72.36e3</td>
<td>17.66</td>
<td>9.76</td>
<td>&gt;1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>3</td>
<td>469.2e3</td>
<td>199.2</td>
<td>81.12e3</td>
<td>18.14</td>
<td>10.54</td>
<td>1.2</td>
<td>&gt;1.2</td>
</tr>
</tbody>
</table>
Analytical hierarchy process method

- Problem identification
- Structuring judgment Matrix

\[
\begin{array}{c|ccc}
A_k & B_1 & B_2 & \ldots & B_n \\
B_1 & B_{11} & B_{12} & \ldots & B_{1n} \\
B_2 & B_{21} & B_{22} & \ldots & B_{2n} \\
\vdots & \vdots & \vdots & \ddots & \vdots \\
B_n & B_{n1} & B_{n2} & \ldots & B_{nn} \\
\end{array}
\]

- Arrange in importance order for hierarchy

\[
BW = \lambda_{\text{max}} W
\]

- General arrange in importance order for hierarchy
- Checking consistency

Results from Analytical hierarchy process method for Tangshan case

• Rehabilitation and reconstruction of life line systems, such as water supply, power supply, communications etc., shall be put in the first place.
• More attention shall be paid to job generation and housing construction
• Attention shall be paid to recover most effective industrial sectors.
4 Land Use

Solutions for Post Disaster Reconstruction Planning

Rebuild at original place

Satellite town

Relocation
Land use solutions

1. Rebuild at original place should be put in the first priority

2. Partially rebuild at the original place, partially move to close neighbouring place

3. Renounce the original place and move to a new place is a more expensive and more difficult solution. It can be adopted on the following conditions:
   - It is very difficult to take measures to mitigate future disasters
   - Inhabitants are willing to relocate
   - Economically feasible
Tangshan • 1980

Planned Population: 100,000
79,000 in 1988

Fengrun new district

25km

Only 9 enterprises (12% of the planned) were relocated from Lunan old district to Fengrun new district in 1988

Planned Population: 300,000

N

Planned Population: 250,000

530,000 in 1987

Lunan old district

25km

Original east coal mine district
Jingjiang Detention Basin in China

The detention basins are effectively used to direct the excessive flow over the design flood. During the 1954 great flood of 100-years frequency occurred in the Yangtze River, it prevented about 30,000 of fatalities.
The areas along the rivers have always been flooded, but now they are inhabited by hundreds of thousands of people, many of them even living in specially designed polders.
5 Building an informed, trained and prepared community

Cases in damage information management

(1) Damage information was not available at all and even experts did not know anything about the disaster, such as in the case of 1976 Tangshan China Earthquake and 1999 Izmit Turkey earthquake;

(2) Damage information is available at least partially, but it did not reach the right decision makers and stakeholders promptly. The 1995 Hanshin-Awaji Earthquake was precisely the case.

(3) Damage information was available and it reached the respective personnel promptly, such as the case of the 1999 Ji-Ji Taiwan China Earthquake.
Damage information available: 1.7, 30, 43, 29
Headquarters established: 498, 738, 1438, 2174
Military forces mobilized to disaster area: 1976 Tangshan, China; 1995 Hanshin-Awaji, Japan; 1999 Ji-Ji Taiwan, China
Difference between 100 seconds and 100 minutes can be the difference between life and death!

July 28, 1976 Tangshan China earthquake
Survival and extricated rate (Tangshan, 1976)
### Extricated and surviving numbers by rescue time for 1976 Tangshan and 1995 Hanshin-Awaji earthquakes

<table>
<thead>
<tr>
<th>Rescue time</th>
<th>Extricated number</th>
<th>Surviving number</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 day</td>
<td>7849</td>
<td>604</td>
</tr>
<tr>
<td>2 day</td>
<td>1638</td>
<td>452</td>
</tr>
<tr>
<td>3 day</td>
<td>348</td>
<td>408</td>
</tr>
<tr>
<td>4 day</td>
<td>399</td>
<td>238</td>
</tr>
<tr>
<td>5 day</td>
<td>459</td>
<td>121</td>
</tr>
<tr>
<td>Total</td>
<td>10693</td>
<td>1823</td>
</tr>
</tbody>
</table>
(a) Extricated rate (%)  
(b) Surviving rate (%)  

Extricated rate (%) and surviving rate (%) vs. rescue time for 1976 Tangshan and 1995 Hanshin-Awaji earthquakes
1976 Tangshan

- Local self-rescue
- Informed, trained & prepared community

- 600,000 people that consist of 86% of the city’s total urban population of 700,000 were trapped

- Among them 22% were rescued by themselves and 58% by local residents and troops stationed at Tangshan city

- Troops in Tangshan city, which consist of 20% of the total rescue troops, extricated 96% of the total rescue number by troops
6 Resources Management

Balancing needs with resources available is critical at stages of post-disaster rehabilitation and reconstruction. While the relief period may attract large national and international inputs, rehabilitation and reconstruction may not benefit from such attention.
Reconstruction was in the period with central planning economy. The national economy was on the verge of collapse. The whole China was in an isolated society. After the earthquake, the UN and many countries expressed their willing to aid, however, the Chinese government didn’t accept any international and foreign aid because they determined to follow the principles of “Rebuild one’s homeland through self-reliance”.

1976 Tangshan, China, earthquake
In October of 1976, the residents in Tangshan city were not allowed to build houses by themselves, which means building private houses was prohibited.

Building houses by individuals were allowed in 1981. In addition, the residents were allowed to buy completed residential buildings. In this way, a financial resource insufficiency for housing construction was solved.
Rehabilitation and reconstruction funds mainly came from the State, and the remaining from local government, collective institutions and individuals.
Allocated and completed reconstruction funds for Tangshan rehabilitation and reconstruction in 1978-1980 in million Yuan RMB
Delay in use of allocated funds before 1980

- Too much change in the planning of old urban district
- Delaying in development of the planning for new district—the Fengrun District which was not integrated with the original County Town
- Difficulty in development of the East Coal Mine District due to lack of basic data for planning, such as there was no topographic map, and the number, scale and location of public buildings were not identified
- Surveying work was not well organized

Reconstruction funds were pretty tight at later years due to reducing state reconstruction funds allocation.
The World Bank loan following the 1989 Datong-Yangyuan earthquake in the boundary of Shanxi and Hebei Provinces powerfully accelerated the post-earthquake reconstruction. It follows that accepting international assistance and foreign aid are a good way for acceleration of post-earthquake reconstruction.
1995 Hanshin-Awaji, Japan Earthquake

- Ten-year Kobe Revival Plan (KRP) was established by the city in June 1995 and the aim of the KRP is to revive the city by fostering communities, and strengthening the economy and culture by using a multi-stakeholder decision making process.

- Significant participation of residents in community building. Strategically adopted communities as the driving units of the KRP because after a disaster, community groups can respond much more effectively to immediate needs than a central government can.
• Established **Disaster-preventive and Welfare Communities (DWCs)** to implement the disaster management plan. Units are divided by elementary school districts, which generally hold about 10,000 people. Formulation of the community Building Basic Ordinance. Units are expected to collect public comments, check durability of structures and host disaster simulation events.
Accumulation of risks and vulnerabilities → Unsustainable development → Increasing disaster occurrence and loss → Growing demand for humanitarian assistance → Reducing demand for humanitarian assistance → Decreasing disaster occurrence and loss → Reduction risks and vulnerabilities → Sustainable development
## Duration of some activities following the earthquakes

<table>
<thead>
<tr>
<th>Activity</th>
<th>Duration (week)</th>
<th>1976 Tangshan Earthquake</th>
<th>1995 Hanshin-Awaji Earthquake</th>
</tr>
</thead>
<tbody>
<tr>
<td>Search and rescue</td>
<td>1</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Completion of temporal housing</td>
<td>18</td>
<td></td>
<td>5</td>
</tr>
<tr>
<td>Power supply</td>
<td>5 - 2 years + 2</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Communication</td>
<td>5</td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>Water supply</td>
<td>16</td>
<td></td>
<td>1 year + 13</td>
</tr>
<tr>
<td>Train</td>
<td>12</td>
<td></td>
<td>31</td>
</tr>
<tr>
<td>Highway</td>
<td>16</td>
<td></td>
<td>37</td>
</tr>
<tr>
<td>Start of construction of public apartment house</td>
<td>100</td>
<td></td>
<td>100</td>
</tr>
<tr>
<td>Completion of public housie built</td>
<td>480</td>
<td></td>
<td>400</td>
</tr>
<tr>
<td>Completion of reconstruction</td>
<td>500</td>
<td></td>
<td>400</td>
</tr>
</tbody>
</table>
More effective prevention strategies would not only save tens of billions of dollars, but hundreds of thousands of lives as well. Funds currently spent on intervention and relief could be devoted to enhancing equitable and sustainable development instead, which would further reduce the risks of disaster.

**Building a culture of prevention** is not easy, however. While the costs of prevention have to be paid in the present, its benefits lie in the distant future. Moreover, the benefits are not tangible; they are the disasters that do not happen. So we should not be surprised that preventive policies receive support that is more often rhetorical than substantive.

Koffie Annan, Report of the Secretary-General on the work of the Organization, General Assembly Official Records Fifty-fourth Session Supplement No. 1 (A/54/1
Thank you, どうもありがとうございます, 様子です, 謝謝, СПАСИБ, Grazie, Jaspajara, Danke, obrigada, Mahalo, Khawp khun