Disaster Recovery and Rehabilitation Experience of a Centrally-Planned, Self-Constructed Village - Case Study of One Village After Sichuan Wenchuan Earthquake in 2008

Submitted by: Sichuan University (SCU)
Disaster Recovery and Rehabilitation Experience of a Centrally-Planned, Self-Constructed Village -- Case study of one village after Sichuan Wenchuan earthquake in 2008

Luo Qian, College of Architecture and Environment, Sichuan University
I. Background
II. Reconstruction Options
III. The Case of Taizi Village
IV. Results
V. Learning
VI. Talent Development
After the Sichuan Wenchuan earthquake hit, devastated villages urgently needed scientific planning for residential quarters, architectural knowledge and technical support for safe housing.

Disaster Recovery and Rehabilitation (DRR) project team of Sichuan University College of Architecture and Environment participated in rebuilding Taizi village of Xiaoyudong town, Pengzhou city, Sichuan province. The project was championed by China’s Ministry of Science and Technology and Sichuan Bureau of Science and Technology. By applying advanced and practical technologies, the project aims to provide a DRR model and technical support, build up disaster resilience and promote sustainable development.
Wenchuan earthquake
The earthquake of magnitude 8.0 $M_s$ that hit Wenchuan, Sichuan province on May 12, 2008 caused rarely seen catastrophe to local ecology, environment and human habitat. Rural houses accounted for 60-70% of all collapsed and damaged houses in Sichuan.
Effects in Pengzhou city

Damages to rural housing. Among 202,324 rural household houses,

- 25,673 were still sound (12.65%);
- 36,974 minor damages (17.07%);
- 37,909 considerable damages (16.73%);
- 85,859 severe damages (43.32%);
- 15,909 collapsed (10.22%).
3. About Taizi village

Overview
Taizi village of Xiaoyudong town is located at the northwest edge of Sichuan Basin. It is 32km and 72 km northwest of Pengzhou county and Chengdu city respectively. It is a key town on Pengzhou-Baishui road which links northern towns to the Pengzhou county center. It is also a key pass to Longmen mountain Yinchanggou national-accredited scenic area. At foot of mountains, the village is abundant in natural resources and beautiful scenery. It occupies about 2.4 hectares of land.
4. Effects in Taizi village

Effects

Most houses collapsed or were destroyed. Some households had just invested savings and borrowed money to build their houses, and now they were left with virtually nothing. Most households moved to government sponsored shelters, and a few chose to stay at remains of their original housing supported by some temporary structures.
1. Problems and challenges Taizi village faced

- Changes in landform
- Changes in private lot
- Severe damage to houses
- Government guidance and administration
- Value chain affected
- Reconstruction capital limited
- Mentality after the disaster
Reconstruction
Problems and challenges

• Changes in landform

Landslides, broken bridges and collapsed houses all contributed to changes in village landform and reduced availability of private lots for reconstruction. Landform changes affect choice of reconstruction sites.
• Changes in private lot

Changes in private lot on which to build own house and courtyard will cause primary social relationships in the village to reshuffle. The original set of social relationships based on blood and/or proximity will be replaced by a new set of relationships to be built. Such fundamental root changes could cause conflicts in the new community and affect sense of belonging among the village survivors.
• Severe damage to houses

Before the earthquake, 26% of houses in Taizi village were built of bricks and concrete, 22% of column and tie structure, and 52% of brick and wood. Most of the houses were old, and substandard in quality due to use of simplistic materials and structures. After the quake, almost all houses were damaged and no longer safe. Only a few wood structure houses survived the quake.

To what extent should we preserve the look of traditional houses? How should we balance traditional look and modern comforts, making the houses resilient and cozy at the same time? We had to address these two questions.
• Government guidance and administration

On the one hand, planning and coordination by the government and other organizations helped to introduce and allocate capital, technology and construction staff and equipment, which were fundamental to reconstruction. On the other hand, if the government takes care of everything, villagers will become dependent, their own initiatives and resilience are stifled, not conducive to future long-term economic and social development.

• Value chain affected

Before the quake, 60% of villagers were engaged in agricultural activities. After the quake, such activities were terminated, and poultry and aquatic bases destroyed. Villagers lost their livelihood. They had to make new choices and face new challenges, as previous value chain is broken.

Taizi village has ecological natural environment, post-quake new village look, and visible earthquake impacts, which are unique resources for tourism. The challenge is how to monetize them to benefit the villagers.
• Reconstruction capital limited

About half of households make RMB4,000-5,000, 25% make RMB10,000 and the rest 25% make more than RMB10,000 annually. A household has 53.09 sq. meters in living area and 250 sq. meters of courtyard, on average. More than 70% of households borrow (from others or banks) to build new houses.

• Mentality after the disaster

The villagers have a strong desire to build houses anew on their original private lot. Government sponsored shelters were small for them, and temperatures fluctuate with outside. In summer it could be 40 degrees Celsius and in winter very cold. Most villagers want to make a living by entertaining tourists in their house.
2. To identify options,

- Respect villagers desires;
- Consider overall land availability and usage;
- Consider original social network;
- Remember options are affected by portfolio of livelihoods.
Three main options were identified based on post-quake statistics.

### Main features

<table>
<thead>
<tr>
<th>Options</th>
<th>Centrally designed and built</th>
<th>Centrally designed and self built</th>
<th>Self built on old site</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Definition</strong></td>
<td>Centrally plan and construct new rural communities and residential quarters</td>
<td>Centrally plan and farmers self construct new rural communities and residential quarters</td>
<td>Residential quarters that comply with reconstruction and disaster mitigation plans can be rebuilt on old site</td>
</tr>
<tr>
<td><strong>Changes in private lot</strong></td>
<td>Return private lot to be used for farm</td>
<td>Return private lot to be used for farm</td>
<td>No changes</td>
</tr>
<tr>
<td><strong>Availability of land</strong></td>
<td>Not dependent on land availability</td>
<td>Not fully dependent on land availability; but need some space</td>
<td>Dependent on land availability; land reserved for future development</td>
</tr>
<tr>
<td><strong>Portfolio of livelihoods</strong></td>
<td>Secondary and tertiary industries</td>
<td>Combination of primary industry (farming, forestry, animal husbandry and aquaculture) and tourism and catering industry</td>
<td>Mainly traditional farming, forestry, animal husbandry and aquaculture; supplemented by tourism</td>
</tr>
</tbody>
</table>
Hence, an approach that is

- appropriate for disaster recovery and rehabilitation in remote regions populated by poor farmers,

- and a technology that is appropriate for DRR requiring little cost and technical input yet safe, environmental and cozy.

Centrally planned and self built

New wood structure houses
<table>
<thead>
<tr>
<th>DRR</th>
<th>The Taizi village example</th>
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<tbody>
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<td>1. Scientific planning</td>
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<td>2. New wood structure house</td>
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<td>3. Government’s role in organization</td>
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<td>4. Community’s participation</td>
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</tbody>
</table>
1. Scientific planning

Layout design

Stick to Diversity, Compatibility, Sharing and Development principles in designing rural residential quarters that exhibit local Sichuan styles.
Village layout design that conforms to local customs and lifestyles
Final design was based on both traditional column and tie structure and modern wood structure, and the resulting new design is more resilient to disasters, cozy, environmental and low cost.
# 2. New wood structure house

## Comparisons

<table>
<thead>
<tr>
<th>Types</th>
<th>Traditional column and tie structure</th>
<th>Modern wood structure</th>
<th>New wood structure</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Price</strong></td>
<td>Low (RMB500-600/m²)</td>
<td>High (RMB&gt;3,000/m²)</td>
<td>Low (RMB700/m² incl. basic interior decorations)</td>
</tr>
<tr>
<td><strong>Processes</strong></td>
<td>Low requirement on timber (log), all manual, slow</td>
<td>High requirement on timber (imported converted timber), mass produced, easy to assemble</td>
<td>Introducing modern wood structure, and simplifying and improving the traditional column and tie structure</td>
</tr>
<tr>
<td><strong>Look</strong></td>
<td>Shabby</td>
<td>Elegant</td>
<td>Elegant</td>
</tr>
<tr>
<td><strong>Durability</strong></td>
<td>Poor in insulation, noise absorption, prevention of fire, humidity, decay and bugs.</td>
<td>Good performance in prevention of fire, humidity and ants</td>
<td>Good performance in insulation, noise absorption, and fire prevention</td>
</tr>
<tr>
<td><strong>Anti-shock</strong></td>
<td>Good</td>
<td>Excellent</td>
<td>Good</td>
</tr>
<tr>
<td><strong>Applicability</strong></td>
<td>Farmers are familiar with the processes</td>
<td>Extensively used in developed countries</td>
<td>Good value for money, suitable for farmers to build on their own</td>
</tr>
</tbody>
</table>
New house features

1. Improved structure
   Even simpler, easier to mass produce and connect, more secure
2. Improved space layout

Better natural lighting, air exchange and sanitary conditions, meeting modern lifestyle needs.
New house features

3. Improved walls

Mass produced, environmental wall filings that improve insulation and comforts.
4. Different look options

New house features
5. Can go for high-end interior, depending on affordability and preference
3. Government’s role in organization

- Government takes charge of planning, thus ensuring scientific and rational approach in DRR through technology and organization.
## DRR

### 4. Community’s participation

- **Community takes part in DRR**

1) Villagers join in choosing village site and discussing village layout. Their opinions were collected and coordinated.

2) Villagers help each other to build own homes. They established teams to identify construction staff, negotiate price, supervise process to optimize cost and quality.
Response
Moving to new life
Dissemination – Coverage by Science Channel, Sichuan TV Station
New wood structure houses in Qingchuan and Pingwu counties
What we learned from DRR post Wenchuan-earthquake:

DRR is not simply rebuilding everything tangible. It should be combined with Building New Rural China Initiative. Change lagged lifestyles and livelihoods in rural areas, and reconstruct physical and spiritual homes on a higher level.
1. Government assumes leadership role, experts provide guidance, and people take part. This helps to ensure quality and efficiency of DRR.

The government provides central planning and coordinates urban and rural development. This is fundamental to ensure scientific and rational approach of DRR through technology and organization deployed. It is crucial to make villagers understand community involvement protects their own interests. Their participation helps to foster sense of value and contribution to community development, thus to build stronger communities.

Centrally planned and self built, it is a good house when it fits you. When temperature falls, our body needs warmer clothes. No housing, no peace of mind.

Self funding, government contribution, donations, financial resources from banks and market, all help to build home better and sooner.
Most disaster-affected areas are remote mountainous regions. Because of lagged economic development, low income, and little affordability, scientific support (design and construction) was not available to the farmers. They copied design of neighbor’s houses, structures were simple, and anti-shock was not a considered. This time, government assumes leadership role, experts provide guidance, and people take part. Lifestyle, livelihood and ecology can exist in harmony, and economic, social and environment development are all considered.
<table>
<thead>
<tr>
<th>Learning</th>
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</thead>
<tbody>
<tr>
<td>2. Appropriate technology boosts sustainable development</td>
</tr>
</tbody>
</table>

Farmers’ values, wish-list and aesthetic preferences are shaped by urban apartment buildings. They think brick and concrete buildings are more modern. Government guidance is needed to change their beliefs. Rebuilt houses need to be safe and environmental at the same time.

Applying appropriate construction technology is important in reducing building energy consumption, impact on the environment as well as cost while improving living comforts. DRR strategies that are energy-efficient and environmental through appropriate construction technologies can better facilitate sustainable development of rural housing.
Learning

3. Centrally planned and self-built housing facilitates creation of rural harmonious society

1) When people take initiative to build their new homes, they develop a stronger sense of ownership, as well as acknowledgement, acceptance, tolerance and care behavior and attitude for others and for the new house in the new place.

2) Self initiative and mutual assistance reduce their dependence on the government. They develop stronger sense of their value. They also help build stronger ties with neighbors and sense of belonging to the new community.
3) Self-built houses incorporate farmers’ own adaptations and preferences in room layout, exterior decorations and wall materials to suit their own needs and lifestyles, as long as the houses are safe and well structured. It also produces a variety of looks. Using local building materials helps to restore local damaged views and preserve local traditional culture.
Central planning and guidance draws people together to work and inadvertently return to normal life. Huge potential social and political costs are averted. People begin to collaborate and enjoy each other. Using local building materials they know of help to calm and cure the shock and pain they experienced.
● Our faculty and students

● Grassroots level village cadres

● Professionals (Disaster Recovery and Rehabilitation Institute)
### Receives gold medal for design of Taizi village

** Eighth届中国环境艺术设计学年奖获奖结果**

**Our faculty and students**

<table>
<thead>
<tr>
<th>金牌</th>
<th>秦川大学建筑学院</th>
<th>塔里木盐湖公园</th>
<th>薄瀚</th>
<th>马锐</th>
<th>罗谦</th>
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<tbody>
<tr>
<td>银奖</td>
<td>合肥工业大学建筑学院与艺术学院</td>
<td>东北大学公园</td>
<td>王立</td>
<td>王涛</td>
<td>王伟</td>
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<tr>
<td>铜奖</td>
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<td>长春市公园</td>
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<td>周鹏</td>
<td>周辉</td>
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<td>张明</td>
<td>张胜</td>
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<td>广州海事文化公园</td>
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<td>陈强</td>
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<td>江苏省博物馆</td>
<td>李明</td>
<td>李涛</td>
<td>李强</td>
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<td>陈强</td>
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<td>李强</td>
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**Talent Development**

Our faculty and students have been awarded the gold medal for the design of Taizi village in the Eighth China Environmental Art Design Annual Award.
Grassroots level village cadres

The DRR project was supported financially by USAid, and a collaboration with The Asia Foundation.

1) DRR training and disaster mitigation education for rural cadres.
Compiled Guide on safe reconstruction of villages

- PPT file and DVD for training
- Guide and Posters
Villagers

- Training on safely building houses
Talent Development

- PPT presentation

- On-site instructions
The Sichuan Wenchuan mega earthquake on May 12, 2008 caused huge casualties and damages. Sichuan University and Hong Kong Polytechnic University partnered in June 2008 to create Sichuan Post-earthquake Recovery and Rehabilitation Assistance and Research Center, an effort by two public universities dedicated to serving the people and country. Our goal is to mobilize and coordinate professionals of different disciplines at both universities to join hands to contribute high-quality science and technology assistance, research and service to disaster relief, recovery and rehabilitation, and long-term community development in the disaster-hit areas.
Annex I: Disaster Recovery and Rehabilitation Institute (research entity)

- **Purpose:** To train professionals in disaster mitigation, recovery and rehabilitation, and to provide scientific research and social service, so as to improve scientific level and management expertise in disaster resilience, thus minimizing human casualties and property loss and facilitating sustainable development.

- **Goal:** Build an open, multi-disciplinary, international and sustainable disaster recovery, rehabilitation and management school that integrates scientific research, talent development and social service.
Departments and centers

- Disaster humanity sciences
  - Disaster social work dept.
  - Disaster economics and management dept.
  - Disaster area corporate development dept.
  - Disaster crisis management & preparedness research center
  - Disaster mitigation law research center
  - Sino-Japan disaster preparedness institute
  - Int’l social work practices center

- Disaster medicine
  - Disaster emergency medicine dept.
  - Disaster care dept.
  - Disaster rehabilitation dept.
  - Disaster care lab
  - Prosthetics and Orthotics lab
  - Physical therapy lab
  - Occupational therapy lab
Annex II

Departments and centers

Disaster science and engineering

- Disaster environment and planning dept.
- Hong Kong Polo Club disaster science research center
  Sichuan earthquake recovery, rehabilitation and assistance center
- National science innovation platform

Sino-Japanese urban disaster preparedness institute

Disaster geographic information center

Disaster literature resource center

West China earthquake resilience and disaster mitigation centre

Dam earthquakes research center

Rock-soil mechanics lab, Recruitment Program of Global Experts
Soil mechanics disaster lab, Recruitment Program of Global Experts
Energy project safety and disaster mechanics lab, a Key Ministry of Education Lab
In remote regions with less household income, using centrally-planned and self-construction organizational approach, and low-cost yet safe, environmental and comfortable disaster recovery and rehabilitation technology can effectively reduce energy consumption and house building cost, providing a good example of housing construction for rural residents. The resulting model represents a good approach for village recovery and rehabilitation and safe rural construction.
Thank you!