



A view of Changning County, Yibin City, Sichuan Province after a 6.0 magnitude earthquake occurred in 2016

Post-disaster housing solutions

Beyond tents and prefab houses:

New thinking on post-disaster settlement
from the perspective of an architect

Project Partners |



by **Chen Huanyu**

Master of Architecture, Tsinghua University. Grade 1 registered architect & registered urban and rural planner, PRC
Supervisor of Team BJTU+ in 2021 Solar Decathlon China, providing advice in architectural design

Note from the Editor: Natural disasters have occurred frequently across the world in recent years. Beyond the physical and emotional toll imposed on the affected population, they also lead to displacement and a settlement period that can go on for a long time. Therefore, housing solutions that can provide a comfortable living environment in the immediate aftermath of disasters become an urgent demand. After the field research in the earthquake-affected region with his team, Mr Chen Huanyu, an architect, comes up with some new thinking on post-disaster settlement and proposes plans in improving post-disaster housing solutions.

A magnitude 7.0 earthquake hit Lushan County, Ya'an City, Sichuan Province at 8:02 a.m. on April 20, 2013. It was one of the most intense quakes the province had experienced since the Great Wenchuan Earthquake of 2008. All nine villages and towns of the county were damaged to varying degrees while more than 20,000 buildings collapsed. The local government faced a formidable task in the post-disaster settlement. Thanks to the experience gained from the Wenchuan earthquake, however, local authorities and government departments had put more effort into disaster preparedness and better responded to the Lushan earthquake.



When natural disasters occur, we prioritise rescue operations to save people's lives as much as possible. And then, great efforts are needed to ensure temporary accommodation for the affected population. This transitional period, neither a race against time like the search and rescue phase nor a focus of public attention and investment like

post-disaster constructions, is pivotal to survivors and cannot be shortened regardless of receiving attention. It is a subject before us and rarely studied previously to provide survivors with a comfortable living environment during this period that could be up to three to five years.

In view of this, we carried out the field research in Lushan and came up with some new idea.

A close look at disaster victims' living environment

Lushan County Stadium Settlement is the biggest transitional settlement site for quake victims. After the emergency settlement phase, an efficient and professional construction team completed the prefab house zone of the transitional settlement site in just one week. The site is capable of 218 households, totalling over 800 people. It consists of four subzones, with communal facilities like kitchens and toilets located at the edge.

Walking on the concrete path between prefab houses and looking up, one could see the rectangle sky framed by the houses' eaves. Despite the clothes hanging under eaves suggesting a lively community, the path seemed a bit quiet. We stopped and knocked on the door of a household.

We visited the home of Mr Li, one of the subzone leaders. The Li family of three lived in a room of 24 square metres, which looked clean and full, with a bed, a cupboard, a table, and appliances taking much of the space. And the daily necessities on the bed and table made the room seemed even more packed.

Mr Li told us that the whole family living together in a compact space without separation led to some inconvenience. On top of that, other residents also reported poor sound insulation and long distance between their rooms and communal kitchens. For some of them, the kitchens could be as far as six rows of prefab houses away.



■ settlement houses
■ communal kitchen
■ service facilities
■ management
■ toilet/shower
芦山县体育馆 Lushan County Stadium
游泳馆 indoor swimming pool

According to our interviews with residents, it is noticed that, besides sound planning and efficient construction, many design details can affect their quality of life throughout the settlement period.



Inspired from local life and rethink for the solution

We then headed to our next station—the settlement site of Lingguan County, Ya'an, where we saw a scene slightly different from that of the Lushan Stadium Settlement.

The site also adopted prefab houses as its housing solution. But the passages between houses were sheltered by elevated roofs or connected eaves. It was thought that the covered areas might not be popular among residents as the design blocked sunshine and impeded ventilation. Surprisingly, what we saw was a vivid picture with a full flavour of life: furniture like tables, chairs, sofas, and tea tables was placed in the passages for residents to sit together and enjoy their leisure time by chatting, tasting tea, and playing mahjong—the most popular game in Sichuan. The covered areas thus turned toward semi-outdoor living rooms shared by neighbours.



In addition, the exterior walls of the houses here looked different from the neat and white ones seen at the Lushan Stadium Settlement: besides the state-distributed colour steel boards, buildings at the Lingguan settlement site also used other materials, such as old doors and windows, waterproof cloth, and bamboos. It turned out that the two settlements adopted different construction methods. The transitional houses at the Lingguan settlement site were mainly built by villagers, collectively, instead of professional construction teams.

Although the resident-engaged construction took a longer time than professional construction, it allowed these quake victims to customise their living space, thus enhancing their sense of

belonging to the community. The combination of the elevated roof and the houses on both sides of the passage created a semi-open space, which, compared to an open path without shelter, provided residents with a more comfortable space for activities and interactions. And the use of recycled materials reflects the sustainability of the buildings.

The post-disaster settlement involves two critical stages. One is the emergency settlement phase, referring to the one to two months in the wake of a disaster. The focus of this phase is rapidly evacuating people to reduce injuries and deaths. Tents are widely used in this period as they are not only easy to build and disassemble but portable. However, the flexible materials of tents lead to poor insulation that cannot meet the need for long-term residence.

The other is the transitional settlement phase starting from three months after a disaster until the completion of permanent housing and usually lasting three to five years. The population composition of disaster-affected

1	2
3	4
5	6

1. Despite the clothes hanging under eaves suggesting a lively community, the passage seemed a bit quiet.
2. According to residents, the whole family living together in a compact space without separation led to some inconvenience.
- 3-4. Vivid scenes with a full flavour of life could be seen in roof-covered common areas.
- 5-6. Besides colour steel boards, other materials, such as old doors and windows, waterproof cloth, and bamboos, were also used for the exterior walls of the buildings at the Lingguan settlement site.

New thinking on post-disaster settlement from the perspective of an architect

areas evolves¹ in this phase; the widely adopted housing solution is prefab houses—the buildings mainly used at the two settlements we visited. Like tents, prefab houses are not only easy to assemble and disassemble but also portable. What's more, being more stable and durable, they can better resist subsequent disasters like aftershocks to meet the need for long term residence. However, after visiting the settlement sites, it was noticed that the existing form and combination of prefab house system is short of variation and flexibility, leading to a lack of privacy among households, interference between family members, and inconvenience in the use of communal facilities.

Therefore, beyond tents and prefab houses, could we find a better post-disaster settlement solution for survivors to improve their living environment?



Explore a sustainable modular design strategy to create a better living environment

After the field research, we started to explore the new concept of sustainable and modular settlement housing solution.

Sustainability is reflected in two aspects: master plan and building unit.

For master plans, functional elements can be dynamic in response to the needs in different phases to save space and increase efficiency. For example, the storage space reserved for steel boards in the emergency settlement phase can serve as a communal zone with facilities like toilets, refuse collection points, and solar collectors in the transitional period.

For building units, some spaces (e.g., 4*6 metres) can be reserved in between units as buff areas for further expansion to meet the evolving needs of each family. Such spaces, for instance, can store large furniture salvaged from old houses in the early stage of the settlement period. Then, in the middle or late stage, they can be transformed into bedrooms or rooms used for other purposes to ensure the personal living



space of family members or satisfy the residential needs of new family members or relatives who return home.

Modularity refers to the free arrangement of layout on a fixed grid with prefabricated components.

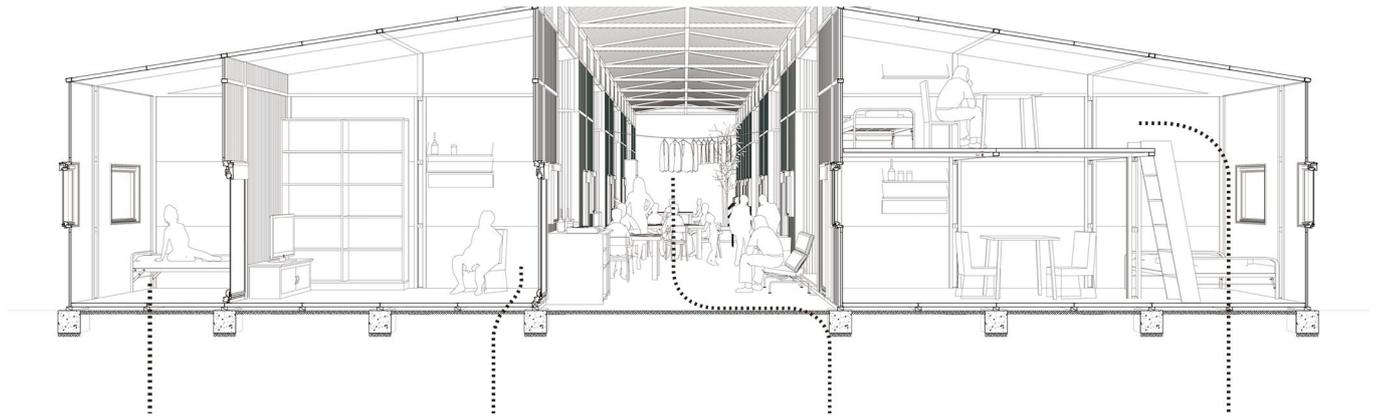
In addition to a flexible floor plan, modularity brings about safe and low-cost construction which is faster, less affected by weather, more acceptable for residents, and easier for workers or even locals

1. For instance, when an impacted region has achieved relative stability, its population will temporarily increase due to family visits or the reconstruction demand for labour. As the recovery phase is getting done, the number of residents will gradually return to the initial while rebound for a short time during holidays.

1
2

1. Tents are widely used in the emergency settlement phase as they are not only easy to build and disassemble but portable.
2. Building units floor plan: some spaces (e.g., 4*6 metres) can be reserved in between units as buff areas for further expansion to meet the evolving needs of each family.

New thinking on post-disaster settlement from the perspective of an architect



The room on the outside is away from the central passage and quiet. With better ventilation and lighting, it is suitable as a bedroom.

The room on the outside—suitable as a bedroom with good privacy

The room on the inside is next to the passage. With relatively poor lighting, it usually serves as a living room with a storage function. The central passage can be considered the extension of each household's living space that meets the family's further needs.

The room on the inside—next to the passage and suitable as a living room

The central passage—the communal living room of the neighbourhood

Residents spend their leisure time here, gaining comfort from each other's company to get through the tough time.

With a roof, the central passage becomes the main area for residents to conduct daily routine, enjoy leisure activities, and interact with neighbours. It serves as the outdoor kitchen, chess room, and reading room of each household. Some residents placed large pieces of furniture, such as sofas and televisions, in the passage.

The clear height of the room and its structural design allow villagers to add a mezzanine level as their children's bedroom or a storage room at a modest cost.

Mezzanine conversion—Space expansion

Neighbouring units: An elevated roof is set up above the central passage to create a common area for residents to conduct daily routine, interact with neighbours, and enjoy leisure activities, thus getting through a tough time together.

to conduct. Furthermore, compared to traditional construction, modular construction has better sustainability, generating less construction waste, while its materials are suitable for recycling and reuse.

It is also our goal to ensure a better living environment and social space for residents. Inspired by the communal "living room" created by villagers, we propose setting up an elevated roof above the central passage to create a common area. Here, residents can conduct daily routine, interact with neighbours, and enjoy leisure activities, thus getting through a tough time together.

Above is our preliminary thinking on post-disaster settlement solutions based on the field research at the Lushan post-quake temporary settlement site ([detailed plans see here](#)), of which there are many aspects worth studying. Given this, we have continued to focus on and look into post-disaster settlement solutions since 2013, hoping to find a solution that is as efficient as existing ones while providing a more comfortable living environment for disaster survivors.

With a vast territory, China is one of the most natural hazard-prone countries in the world. We, therefore, have a long way to go in post-disaster settlement

solutions. Despite the considerably increased efficiency in settlement efforts, the living environment and the sustainability of post-disaster settlement site still need improvement. Based on our preliminary exploration of a sustainable and modular housing solution, we could have further discussions on other issues, such as improving cost savings and resource allocation, increasing the sustainability of buildings by using local materials, and appropriately integrating co-building and self-building construction methods to strengthen community cohesion after a disaster.

Unless otherwise stated, all images are provided by the author.

*Information compiled by Zhao Ruyue | Reviewed by Li Junjie | Edited by Emily Li | Designed by Tracy Ying
Translated by Eppie Wang from the original version 《灾后建筑不只帐篷和板房——建筑师的灾后安置新思考》*



Together we bring hopes,
enrich lives and build for the future

Chan Cheung Mun Chung Charitable Fund

Address: 19/F, Railway Plaza, 39 Chatham Road South, Tsim Sha Tsui, Kowloon, Hong Kong

Email: info@ccmccf.org.hk Tel: +852 2756 0828

Fax: +852 2753 8434 Web: www.ccmccf.org.hk