

"Lessons from Reconstruction Processes of Earthquakes in Rural Area
of the cases of Japan and Indonesia (Mid-Java)"

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Here I would like to express my condolence to the souls of Sichuan Earthquake Victims and pray for the recovery of suffered areas.

In Japan, after Great Hanshin-Awaji (Kobe) Earthquake (more than 6,000 dead) happened in 1995, many damage giving earthquakes happened mainly in rural area. Even very recent the Iwate-Miyagi-Nairiku Earthquake (M7.2) happened in 14th June, 2008. Chuetsu Earthquake in 2004 Oct. is the biggest earthquake disaster in this decade after Hanshin-Awaji. Here, introducing the Chuetsu Proposal of AIJ, reflecting the reconstruction process of the Hanshin-Awaji EQ, we will discuss about the mitigation of rural area disaster, adding the report of the several points on Mid-Java Earthquake 2006/05/27 in Indonesia.

1 The Chuetsu Proposal for rural area disaster.

2004, October 23rd Chuetsu Earthquake happened in Niigata prefecture Japan, although the dead victims were not so many as Hanshin-Awaji case but wide damage were left in infrastructures many villages were isolated because of the loss of approaches. It became a good opportunity to look over the disaster in rural area. Coincidentally it was the year of 10years memorial of the Great Hanshin Awaji Earthquake. In 2005 10 23, AIJ (Architectural Institute of Japan) presented "**Proposal for the Prevention and Mitigation of the Earthquake Disaster in (Mountainous) Rural Area.**"

This proposal was drafted by a committee with me as a chair, after the Chuetsu Earthquake of 2004 10 23. (Magnitude 6.8, Seismic Intensity 7, dead victims 65persons, 4,805 injured, House Collapsed 16,000.) , describing the necessary action for the rural area disaster from the architectural and building scientific point of view. This was also written after deliberating the reconstruction process of the Great Hanshin-Awaji (Kobe)

Earthquake of 1995 1.17 (Magnitude 7.2, Seismic Intensity 7, dead victims 6,434 persons, 43,792 injured, House Collapsed 250,000.)

This proposal consists of three major divisions and 20 chapters.

Division A is about **the Prevention and Mitigation Beforehand the Disaster Considered the Social and Spatial Characteristic of the Rural Area**. Division A consists of 5 chapters.

1) Strengthening the Seismic Resistance of Existing Houses:

*new houses are under control of new building code and rural houses was built conventionally by local carpenters.

2) Checking the disaster preparedness of each daily life territory (several hamlets) participated by local people, and build the social disaster prevention system.

* Through checking own environment and learning from **Hazard Map**, the social education (**Disaster Education**) for local people will be accomplished automatically.

3) Preparing the emergency corresponding system and logistic system for the areas (territories) with possibilities of risk of isolation at the disaster, while strengthening local self-help autonomy.

* Public Emergency Wireless Corresponding System did not functioned at Hanshin-Awaji. FM station functioned well in both cases.

4) Preparing the public building and open space with enough safe condition checked in order to be used as emergency shelter or the rescue center.

5) Preparing the suitable scale network for administration and management against disaster. :* Recently Japanese municipality in rural area is too wide to handle the community level problem comparing to the traditional province and hamlet scale.

Division B is about **the Emergent Actions after the Disaster** with 8 chapters.

B-1 from Emergent Survey to Placing Evacuation Shelter

6) Establishing Damage and Risk Survey System and let the people know its meaning. * Sometimes the danger to be lived now is confused to be the economic damage survey or fixing possibility survey.

7) Preparing Diverse Evacuation Places and if needed managing a gradual shelter system.

- 8) Building efficient **logistic and distribution system of relief and necessary resources such as food, fuel and water.** * Sometime relief gathers inequitably by many reasons.

B-2 Setting of Transitional Housing Respecting Community

- 9) Building **Transitional Houses as possible as nearby the original hamlet** respecting the livelihood, preparing the space for the community and the space
- 10) Designing the **transitional houses fitting to the local climate.** * Japan has diverse climate zones although the supply of transitional houses is to be conducted by centralized distribution. Often standardized model is provided to the disaster area which could not fit to the climate, such as snow or coldness.
- 11) Encouraging **diverse alternative ways** for the sufferers to get the transitional houses such as renting private or public stocks. * Often **in rural area there are certain numbers of non used facilities** those which could be transferred to transitional houses.

B-3 Repairing of Existing Damaged Houses, Rebuilding Lives of Sufferers.

- 12) Establishing the subsidy and system to repair and recover good housing stocks.
* In Hanshin-Awaji Earthquake the demolishing subsidy is high and many houses are lost which could be repaired.
- 13) Encouraging the sufferers **by subsidy and loan to rebuild their daily lives and livelihood.**

Division C is about the **Reconstruction Plan and Strategy** consists of 7 chapters.

C-1 Goal of the Reconstruction in Harmony with the Regional Quality,

Rebuilding villages

- 14) Driving for the **reconstruction succeeding the village space and culture** which had been carried on traditionally.
- 15) Setting the goal of reconstruction in harmony with the **topography and vernacular characteristics**, reviving appropriate **land use and beautiful landscape.**
- 16) Forwarding the **reconstruction process elastically and gradually**, corresponding and **reviewing the regional condition and climate.** * In Chuetsu the rivers were damaged by plenty of **blockages by land slides** so at the procedure of reconstruction **the recovery of river have priority and road through the valleys follows.** **Heavy Snow** from December to March stops everything and the

construction can be planned after seeing the result of thaw flood (**melting snow flood**) of April and May. So every process is **not as linear with many reviewing processes**.

C-2 Rebuilding Houses Respecting Local Culture

17) **Improving traditional style houses to be enough resistant to earthquake and fitting to the modern life.**

* This process should be carried out with **local architects, carpenters and contractors**, sometime with **inhabitants or journalists and opinion leaders**.

18) Building the **permanent house gradually from small to big or from skeleton to filled**, fitting to necessity, building **public rental houses** (for the weak or elderly) which could be **reused for green tourism lodge** after its mission is over.

C-3 Reconstruction of the Region by the Inhabitants as the Subject and Support for Them

19) Setting of **goal by the inhabitants**, the **discussion body** for it and the advisory board of **specialists and facilitators**.

20) Participating by the **inhabitants who were grown up there and now live in distant cities**, promoting frequent **cultural interchanges of rural and urban areas**.

2 The Reflection of the Reconstruction Process of Hanshin-Awaji Earthquake and Comparison to Chuestu

On the contrary to Chuestu, Great Hanshin-Awaji (Kobe) Earthquake happened in very center of high dense urban area so the victims and damages are so big. The reconstruction process of Great Hanshin-Awaji Earthquake 1995 is full of lessons. Despite success in quick recovery of infrastructure, lifelines, public facilities and significant buildings, about the continuity of community there were many mistakes. To solve accommodation problem with big quantity of damaged houses (200,000), provisional houses and public apartments were quickly built ignoring the original community which made another suffer to weak people. City planning also made mistakes to try to introduce too gigantic change to traditional dense area by redevelopment. It took years to realize. The result is enough to kill the continuity of local industries. On the other hand in the area where government did minimum in city

planning and prepared many subsidies to private reconstructions, communities and industries going well. We will summarize several points about the reflection of the reconstruction process of Hanshin-Awaji EQ.

2-1 Evacuation Shelters (School/temple/etc) worked well.

As Kobe has a population of almost 1.5 million and is a part of several million populated conurbation. So there were diverse public or common building facilities such as schools, assembly halls, religious buildings etc. Some of such were broken but most of remained because they were built in better ground and given stronger seismic resistance than other usual buildings.

The diversity of evacuation spaces also fit to the diversity of sufferers (ethnic group, religious group and so on.)

There the management of the camp had gone well as **a kind of an autonomy which consists of community members and volunteers gathered from all Japan**. But still the severe problems remained in such as **toilet, privacy and imbalanced relief supply**, etc.

On the other hand in **Chuetsu in low dense and mountainous area**, there were **quite less public facilities** left which could be accessible and not damaged. The spaces were not enough and some people stayed in small car to avoid the coldness as a result some were died stayed in narrow space because of so called economy class syndrome.

2-2 Transitional Shelters Camps shuffled community.

There could be a possible alternative to permit self-help nearby the original neighborhood of the sufferers. But the government refused to accept this choice by the reason to avoid the slum might remain in future. The decision was made to provide 48,000units of transitional shelters quickly. Using prefabricated standardized model they were built with in 2~6months after the disaster and remained 2~4years.

This was great task but the result was terrible. Those shelters were build very distant area far from the original community of sufferers and the residents were recruited each by each camp as lottery so the community which strengthened after the disaster to have made autonomous solidarity was destroyed and shuffled. Misfortune happened frequently such as solitude death or suicide. There was few news of good episode.

In **Chuetsu, regretting the Hanshin-Awaji case, the different policy was chosen**. If possible people build their transitional shelter on their land nearby the original home.

In other case, transitional shelters were built in small scale camp in the neighborhood.

In case the original hamlet (village) is not accessible, it was build as gatherings of original hamlets in distant vacant lot.

2-3 City Planning destroyed the continuity of the neighborhood

After 2 months of the earthquake, the local government and ministry of construction of the national government decided to designate the **Intensive Reconstruction Areas** at **heavily damaged disaster areas** in order to build new urban areas with high standard quality. But at this decision the citizen and sufferers had almost no chance to participate in it, moreover the scheme itself had many problems. For the redevelopment area the **high-rise buildings** are proposed, those are very different from the original low rise communities. As to **the economical feasibility there was uncertainty** as the trend of land price had been going down, so it might not be sold as the scheme. To realize this scheme many **undamaged buildings should be destroyed**. It was considered to **take a long term to accomplish** them. All those fear proved it right after 13 years. The projects are **still on the way** and suffering with the **economic mismatch**. The **long process was enough to break the social and economic continuity of those quarters**.

In Chuetsu Earthquake Disaster Area (2004) or Fukuoka-Seibu-Okai Disaster Area (2005), those gigantic and community relocating projects were not selected.

2-4 Self-Help Reconstruction Areas with Subsidies Menu worked well for house owners, but not for house renters.

For the usual damaged disaster areas it is prepared **a diverse menu of subsidies and public loans including interest subsidies** for private loans were prepared. Those worked well for the reconstruction of single family houses (self owning), condominiums and small commercial buildings. The combination of subsidy, long term public loan and subsidy of private loan interest was successful to the ownership.

For renter and tenant, two ways were prepared, to subsidize private rentals and to provide public rentals.

In the area of Kobe City 25,100 public rental houses were built newly for the sufferers. Most of them are rather high-rise and separated from the old neighborhood as the case of transitional shelters. So the lively vitality is lacking and many elderly are living complaining about the solitude.

About the improvement of neighborhood environment, at the district where some **discussion before the earthquake was done and the residents and stakeholders**

knew what kind of problems including danger at disaster they had, the reconstruction program not only saving the sufferers but also build a more safe neighborhood were agreed easily.

2-5 Non-designated Cultural Heritages were disappeared from townscape.

What we confronted is the problem that on one hand **designated cultural properties could have been conserved or rehabilitated sufficiently**, on the other hand, it was realized that **vast of undesignated historical buildings in the damaged areas have been demolished**. Especially first 3~4months most of the non-designated historical buildings were demolished as the owners had no idea to repair and rehabilitate them because of cost, lack of know-how and no legal constraints. After the **subsidy for the restoration of non-designated building** announced it decreased.

Now as the management program of historical buildings the **listing and designation of wider concept of heritages for not only historical monument but also the buildings and elements which contributing to composing townscape are prepared**. We should develop **preservation engineering**. The administrative board should prepare more firmly the **urgent checking system just after the disaster**.

2-6 Earthquake Resistant Buildings and Strategy for Retrofitting of Existing Stocks

Seismic provision has been revised almost simultaneously to big seismic disasters, for taking account of the findings from the disaster. The change of the **seismic provision in 1981 was drastic one**, which is called **“New seismic provision”**. Statistics about the damaged buildings at Hanshin –Awaji EQ showed, **the buildings that were constructed before 1981 are experienced more severe damage than the buildings that was designed by “New seismic provision”**. Now, the most important issues in Japan became clear how to upgrade seismic performance of the buildings that is designed before 1981. So the seismic retrofitting of every existing old structures became a big issue and especially school buildings which should guard our children, and might become evacuation shelters were pointed as in a category of priority to retrofit.

3 View Points about the Mid-Java Earthquake

3-1 Reconstruction Process is based on the original communities.

The Mid-Java Earthquake (Magnitude 6.2~6.3) happened in 2006/05/27. By reports, the power is not so big as other damage given earthquake but the damage is so big

as 156,000 houses were heavily damaged and 5,716 persons were died. Kobe University is making support by the School of Medicines Immediate Teams first followed by Civil Engineers of Urban Safety Center. COE Team by Architects, Planners and Structural Engineers entered July and August.

All the process is going well, respecting original communities. This idea is based on the lessons and reflection of the reconstruction processes of Aceh (Great Sumatra EQ 2004) and Japan. Here the evacuation centers or provisional houses (T-shelters are built in the original neighborhood by local people and government and I-NGOs are aiding them by finance ,materials and logistics. Permanent houses have been being built in the same way at the original sites. Local industry is gradually recovering.

3-2 The largeness of the damage compared to the seismic power.

Most of the dead were killed by the fall of brick walls and roof structures. Brick masonry buildings were broken and the vernacular timber and bamboo houses relatively safe. We doubted the adequacy of the brick usage as it is so heavy. But we realized brick is very realistic material because it is very affordable and easy to build by people without special skill. It can be made by local soil by easy way. Clay can be made to adobe and burned to brick. Even it can be recycled so the fallen bricks were reused to new structure. On the other hand timber is expensive. Bamboo is very strong but considered to be material that is used by low economy or primitive people.

3-3 The Adequacy of Confined Masonry

We are impressed by the eager effort of the academicians of Gadjamada University to spread the right structure system of Confined Masonry. But that was very different from our Reinforced Brick Masonry System, so after return to Japan we checked the academic document of AIJ about this structure. We found a report by Mr. H. Mizuno (BRI) on an experiment of confined masonry and realized this structure is enough resistant to earthquake. As this is build by mainly not so well trained people, still we are anxious about whether the adequate construction could be done. So the specialists helping the reconstruction of Mid-Java area are making teams and making campaign to spread right knowledge by the mean of posters, meetings, workshops and direct teaching at the building sites. Those efforts by architects and civil engineers are very respectful.

3-4 **Sub Structure Problems like Roof Tile etc.**

So if this Confined Masonry System is introduced in appropriate manner we can trust it. But still we should be careful about the fall of **heavy materials from the high position**. Through the hearing survey we learned most of the victims were killed by the fall of bricks and tiles inside or outside nearby the house. So the high brick wall or brick filled roof truss is not suitable. **The biggest problem is the detail of the roof tile hanged by small tongue to fix it to rafter. This roof tile detail should be improved to the detail using nails or strings.** The old roof tiles which we saw in Bantul area were rather thin and tongue had more depth (1cm). In old structure the bamboo finish under rafter were keeping safety but this was forgotten. So the new roof tile should have deeper tongue and holes for binding and under rafter finish by timber should be recovered.

3-5 **The collapse of Pendopo** (Historical Folk House Style and Seismic Retrofitting)

Even humble timber structure remained in the country side, it is pity that in old capitol district of Kotakede, many beautiful historical house, “Joglo” were broken especially “Pendopo” were found fallen down. These structure timber open frame structure with no brace is considered to be weak against horizontal power. Japan also has such historical buildings, recently **adhesive dumpers** are adopted and proving the good performance. So some devices as braces, adhesive dumpers or timber grids as resistant walls should be introduced.

3-6 **Bamboo has many possibilities**

Bamboo is **strong material and easy to get and reproduce**. To get more **endurance** there are many measures such as **boiling, soaking, smoking , half-carbonization and Boric treatment** etc. We should develop more **diverse usage and building devices**. It will be hopeful to organize the bamboo used **architecture competition** for bamboo so that the peoples may evaluate them for more **fashionable and trendy method** of construction and exchange the broad international usages. In Mid-Java, except the rare cases of obtaining permanent houses, most of the villages built Temporary-Shelters by bamboo before the rainy season start from early October. We, Kobe University, COE Team also designed a bamboo model in order the people will build by themselves with the support of the supply of materials by NPOs. We should develop and propose more experimental, fitting to contemporary life and fashionable houses. Because the bamboo is a

material which is **most sustainable, light, strong and very affordable in Java.**

3-7 Seismic Education in Peace Time, and Communication System in Emergency

In countries with many natural disasters like Japan or Indonesia, we should enhance the people's awareness of risk and support for their decision-making processes by risk communication in order to realize mitigation of natural disaster. In my case my late **mother's repetitive oral story of the Great Kanto Earthquake, 1923** lead me to behave right in Hanshin-Awaji 1995.

To talk, to read or to see about the experience of the process of happened disaster is very important. **Picture Book, Movie, even Wayang Kulit (shadow theater)** could be a good mean to succeed the experience to next generation.

The **role of radio is big** because even after the electricity fell down, people may have portable radio. Even **mobile phone often became un-available** in emergency, because of the lack of electricity, damage of antenna and **congestion of emergent calls**. So the usual coordination with broadcasting specialist and the administrators for the disaster is very important in daily life. In Hanshin-Awaji Earthquake many small FM station began **minority language broadcasting** and worked well.

4 Conclusion:

We should build well preparedness for disaster in rural area. Considering the situation of isolation, strong public facilities such as government, hospital and school are important as emergency or evacuation centers. Logistics, correspondence means, emergency stock and medical care systems for the isolated villages must be considered. At the reconstruction process we should respect the original community or hamlet as the base of the recovery and continuity of the society. We should consider the continuity of environment for the reconstruction plan as sustainability of society, local industry and livelihood of the suffered people are very related to the environment. The reconstruction process should be done carefully to the regional and cultural features of environment.

The safety of regional space is obtained through symbiosis. We call it Symbiotic Safety. We can make tough (resilient) regional space against natural and social disaster, pursuing ecological city/village that co-exists with nature, creating universal environment where people can live together. Only through this way we can contribute to realize sustainable society and environment.