Foreword-1

Kazuo Iwamura and IWAMURA Atelier started developing so entitled “Environmentally Symbiotic Housing (Iwamura et al., 2000, 2009)” as a national initiative of Japan in collaboration with academia and industry in the year of 1990. The trigger was the Japanese cabinet’s project coping with the Global Warming (1990). In between to date, Japan has experienced a number of tragic natural disasters.

Learning from those experiences, it should be recognized that the sustainability of housing and community be holistically elaborated within a sequence of time, 1) Disaster 2) Aftermath 3) Ordinary Time only that we usually tend to take into consideration.
Foreword-2

Dr. Sadako OGATA, former United Nations High Commissioner for Refugees, organized and led a committee for Human Security (Oagata, 2002, 2005), which must be placed as the top priority beyond anything.

The author, inspired by her thought that should be considered also as the very basis for our any initiatives related to housing and community development, is now being committed to achieving “Resiliently Sustainable Housing for Human Security (Iwamura, 2012).”
Major Natural Disasters around the World since 1990 (as of Aug. 31st, 2011)

**Earthquake (M 6.1)**
- 1998.2.4: AFGHANISTAN
  - 17,127 dead

**Earthquake (M 7.6)**
- 1999.8.17: Turkey
  - Ca. 35,000 dead
- 2000.12: VENEZUELA
  - Downpour & Flood
  - Ca. 30,000 dead

**Earthquake (M 6.9)**
- 2010.7-9: PAKISTAN
  - Northern Region
  - 84,537 dead or more
- 2001.1.26: INDIA
  - Gujarat Region
  - 30,000 dead or more

**Earthquake (M 6.5)**
- 1997.5.10: IRAN
  - Various Regions
  - Ca. 9,000 dead or missing
- 2002.12: INDIA
  - Earthquake (M 6.5)
  - Ca. 30,000 dead or more

**Cyclone**
- 2005.10.9: PAKISTAN
  - Kashmir Region
  - Earthquake (M 7.6)
  - 74,651 dead or more
- 2007.6-9: INDIA
  - Various Regions
  - Monsoon Heavy rain & flood
  - 2,744 dead
- 2010.1.12: HAITI
  - Southern Hyogo Region
  - Earthquake (M 7.0)
  - Ca. 2,000 dead or more
- 2011.3.11: JAPAN
  - Eastern Region
  - Earthquake (M 9.0)
  - Tsunami
  - Ca. 16,447 dead or more
- 2011.2.22: NEW ZEALAND
  - Canterbury Region
  - Earthquake (M 7.3)
  - Ca. 120,000 people affected
- 1991.1.11: PHILIPPINES
  - Typhoon
  - Ca. 6,300 dead

**Tsunami**
- 2004.12.26: INDONESIA
  - Off Sumatra Island
  - Earthquake & Tsunami
  - Ca. 220,000 dead
- 2005.3.28: INDONESIA
  - Padang coast
  - Ca. 1,700 dead

**Cyclone**
- 2005.12.26: INDONESIA
  - Java Island Central Region
  - Earthquake (M 6.3)
  - Ca. 5,776 dead
- 2006.5.27: INDONESIA
  - Ca. 5,776 dead

**Number of Fatalities**
- 200,000 or more
- 100,000~200,000
- 50,000~100,000
- 10,000~50,000
- 5,000~10,000
- 1,000~5,000

**Richter Scale of Earthquake**
- M6.0
- M7.0
- M9.0

Major Natural Disasters in Asia & Oceania since 1990 (as of August 30th, 2011)

**Earthquake (M 6.1)**
- 1999.8.17: Turkey
  - Izumit Region
  - Ca. 35,000 dead
- 2001.8.17: JAPAN
  - Southern Hyogo Region
  - Earthquake (M 7.3)
  - 6,434 dead

**Earthquake (M 7.6)**
- 2008.5.12: CHINA
  - Sichuan Region
  - Earthquake (M 7.9)
  - Ca. 2,000 dead or more

**Earthquake (M 6.9)**
- 1993.8.17: TURKEY
  - Zanjan Region
  - Earthquake (M 6.9)
  - Ca. 9,000 dead or missing
- 2008.4.27: MYANMER
  - Cyclone
  - Ca. 5,000 dead or more

**Earthquake (M 6.5)**
- 1997.5.10: IRAN
  - Qayen
  - Ca. 1,568 dead
- 2001.5.10: IRAN
  - Baguio Region
  - 1,621 dead

**Cyclone**
- 2010.7-9: PAKISTAN
  - Northern Region
  - Heavy rain & flood
  - 1,568 dead
- 2007.6-9: INDIA
  - Gujarat Region
  - Heavy rain & flood
  - 1,568 dead

**Number of Fatalities**
- 200,000 or more
- 100,000~200,000
- 50,000~100,000
- 10,000~50,000
- 5,000~10,000
- 1,000~5,000

**Richter Scale of Earthquake**
- M6.0
- M7.0
- M8.0

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Life Continuity Plan (LCP)

Given the above, it must be recognized that we are always confronted with disasters, both “Natural” and “Daily.” Taking this into consideration, how should we plan and design sustainable housing and community?

Related to this query, Business Continuity Plan (BCP) gives us a hint, which means the following:

“When business is disrupted, it can cost money. Lost revenues plus extra expenses means reduced profits. Insurance does not cover all costs and cannot replace customers that defect to the competition. A business continuity plan to continue business is essential”.

The author proposes similar initiative, replacing “Business” by “Life,” namely “Life Continuity Plan (LCP)” to take care of the holistic planning and design of resiently sustainable housing.

### Basic Frame of Housing for Human Security

<table>
<thead>
<tr>
<th>Phase</th>
<th>Items</th>
<th>Detached</th>
<th>Collective</th>
<th>Neighborhood</th>
<th>Region</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. At Disaster</td>
<td>Earthquake</td>
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<td></td>
<td>Tsunami</td>
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<td></td>
<td>Fire</td>
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<td>Storm</td>
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<td>Flood</td>
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<td></td>
<td>Landslide</td>
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<td></td>
<td>Evacuation</td>
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<tr>
<td>2. Aftermath</td>
<td>Place of Refuge</td>
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<td></td>
<td>Energy Sources</td>
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<tr>
<td></td>
<td>Energy Supply</td>
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<td></td>
<td>Tap Water</td>
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<td></td>
<td>Sewerage System</td>
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<td></td>
<td>Toilet</td>
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<tr>
<td></td>
<td>Traffic</td>
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<tr>
<td></td>
<td>ICT</td>
<td></td>
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<td></td>
</tr>
<tr>
<td></td>
<td>Provisions</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Ordinary Time</td>
<td>Physical Health</td>
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<tr>
<td></td>
<td>Physical Security</td>
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<tr>
<td></td>
<td>Mental Health</td>
<td></td>
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<tr>
<td></td>
<td>Peace of mind</td>
<td></td>
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<td></td>
<td>Crime Prevention</td>
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<tr>
<td></td>
<td>Maintenance</td>
<td></td>
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<tr>
<td></td>
<td>Periodic Inspection</td>
<td></td>
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</tr>
</tbody>
</table>

First, a basic frame has been developed to grasp at a glance overall relevant engagements in terms of the time-line and scale. The objects of measures are sorted horizontally according to the scale (from a detached-house, an apartment, a neighborhood, to a region), and vertically to the time-line (from at a disaster, aftermath, to a ordinary period, which are always cyclically repeated).
# 1. Measures as disaster preparedness

<table>
<thead>
<tr>
<th>Housing Level Measures</th>
<th>Community Level Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Detached</td>
<td>Neighborhood</td>
</tr>
<tr>
<td>Collective</td>
<td>Region</td>
</tr>
<tr>
<td><strong>Earthquake</strong></td>
<td>Ground stability, Ground improvement</td>
</tr>
<tr>
<td><strong>Tsunami</strong></td>
<td>Highland relocation, <em>Learning from the past</em></td>
</tr>
<tr>
<td><strong>Fire</strong></td>
<td>Firebreak forest, Open space, Water reservoir</td>
</tr>
<tr>
<td><strong>Storm</strong></td>
<td>Windbreak, <em>Weather forecast</em></td>
</tr>
<tr>
<td><strong>Flood</strong></td>
<td>High water measures, <em>Building code, Weather forecast</em></td>
</tr>
<tr>
<td><strong>Landslide</strong></td>
<td><em>Site diagnosis, Building code, Hazard map</em></td>
</tr>
<tr>
<td><strong>Evacuation</strong></td>
<td>Evacuation site, <em>Drill</em></td>
</tr>
</tbody>
</table>

*In italic: non-physical measures*

# 2. Measures for aftermath of disaster

<table>
<thead>
<tr>
<th>Housing Level Measures</th>
<th>Community Level Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Detached</td>
<td>Neighborhood</td>
</tr>
<tr>
<td>Collective</td>
<td>Region</td>
</tr>
<tr>
<td><strong>Place of refuge</strong></td>
<td>Temporary or replaced housing</td>
</tr>
<tr>
<td><strong>Energy sources</strong></td>
<td>Micro grid</td>
</tr>
<tr>
<td><strong>Energy supply</strong></td>
<td><strong>Smart grid</strong></td>
</tr>
<tr>
<td><strong>Tap water</strong></td>
<td><strong>Stock shelter</strong></td>
</tr>
<tr>
<td><strong>Sewage</strong></td>
<td><strong>District’s independent purification system</strong></td>
</tr>
<tr>
<td><strong>Toilet</strong></td>
<td><strong>Stock shelter</strong></td>
</tr>
<tr>
<td><strong>Traffic</strong></td>
<td><strong>Logistics of requirements, Car sharing, Community bus</strong></td>
</tr>
<tr>
<td><strong>ICT</strong></td>
<td><strong>Social network, Cloud computing</strong></td>
</tr>
<tr>
<td><strong>Provisions</strong></td>
<td><strong>Stock shelter</strong></td>
</tr>
</tbody>
</table>

*In italic: non-physical measures*
3. Measures for ordinary time

In italic: non-physical measures

<table>
<thead>
<tr>
<th>Housing Level Measures</th>
<th>Community Level Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Detached</td>
<td>Neighborhood</td>
</tr>
<tr>
<td>Collective</td>
<td>Region</td>
</tr>
<tr>
<td>Physical health</td>
<td>Greening, Heat island effect relaxation</td>
</tr>
<tr>
<td>Indoor thermal environment, IAQ, Lifestyle</td>
<td>Universal design, Accessibility</td>
</tr>
<tr>
<td>Physical security</td>
<td>Universal design, Accessibility</td>
</tr>
<tr>
<td>Barrier free, Accessibility</td>
<td>Universal design, Accessibility</td>
</tr>
<tr>
<td>Mental health</td>
<td>Community</td>
</tr>
<tr>
<td>Inter-generation exchange, Residents' exchange</td>
<td>Administrative support</td>
</tr>
<tr>
<td>Peace of mind</td>
<td>Town-scaping</td>
</tr>
<tr>
<td>Comfort, Greenery, Biotope, Lifestyle</td>
<td>Regional landscaping</td>
</tr>
<tr>
<td>Crime prevention</td>
<td>Neighborhood relation</td>
</tr>
<tr>
<td>Crime preventive performance</td>
<td>Administrative support</td>
</tr>
<tr>
<td>Maintenance</td>
<td>HOA, Area management</td>
</tr>
<tr>
<td>Management service</td>
<td>Administrative support</td>
</tr>
<tr>
<td>Management association</td>
<td>CASBEE evaluation</td>
</tr>
<tr>
<td>Periodic inspection</td>
<td>CASBEE evaluation</td>
</tr>
<tr>
<td>HEMS, CASBEE evaluation, House report</td>
<td></td>
</tr>
</tbody>
</table>

The following is the list of technical measures, which could be applied to the housing project of “Koyankus.”

01. Seismic-proof  
02. Ground safety  
03. Snow protection  
04. Wind relaxation  
05. Fire prevention  
06. Energy for emergency  
07. Emergent life support  
08. Health promotion  
09. Environmental design  
10. Community design
1. Seismic-proof design

Based upon the experiences of serious seismic disasters to date, seismic proof technology has been developed even for low-rise housing including 2 story detached houses as below.

1) Structural seismic design
2) Base insulation
3) Vibration damper device

2. Ground & soil safety

According to the given ground condition of the site, appropriate measures should be taken to improve the ground & soil stability against seismic ground failure through;

1) Ground & soil improvement
2) Adjusting device of differential settlement etc.

Sumitomo Forestry Co., Ltd.
3. Snow protection

Snow damage on house and residents should be avoided according to the local climate data to date. Major consideration is to be done to the roof form to hedge the risk of slipping down to the earth through;
1) Steep roof allowing the snow slipping down with gravity
2) Flat roof allowing the snow to be blown by the wind
3) Active measure applying heating system to the roof and/or eaves to avoid icicles hanging from the roof

4. Wind relaxation

Almaty is located North to Tian Shan, and is characterized by the influence of mountain-valley circulation, which is especially evident in the northern part of the city, located directly in the transition zone of the mountain slopes to the plains.
In winter, therefore, prevailing wind direction is from the south to the north, which should be relaxed by means of;
1) Tall trees planting
2) Hedge
3) Exterior wind shutters
etc.
On the contrary, the prevailing wind in summer should be utilized to relax the hot climate through the housing layout and the opening design.
5. Fire prevention

Fire prevention measures are to
1) Avoid outbreak of fire and
2) Prevent the spread of a fire.

The former includes to equip the house with all electronic home appliances or even a fire-sensing gas range (c.f. right below)

The latter includes fire and/or smoke sensors at the ceiling of each room (c.f. right above).

6. Energy for emergency

Energy supply in aftermath of disaster is a key issue for living. LPG bulk system is evidenced efficient for provisional energy supply associated with
1) Combustion unit
2) Hot water unit
3) Power generator unit

Potable water purifier
7. Life supports for emergency

In the aftermath of a disaster, life support infrastructure (e.g. water & energy supply, sewer) is damaged and out of use for certain period.

Especially, toilet system is a key issue related to human dignity. Photo on the right shows a temporal toilet installed right on a manhole of sewage disposal pipelines.

8. Health promotion at home

The indoor air of a house is unexpectedly contaminated through chemicals contained in the building materials and furniture, as well as dust and mold caused by moisture.

So called “Sick-house Syndrome” has been a serious problem for the residents’ health, which is evidenced especially in an air tight house. The measures include;

1) Low VOC materials
2) Efficient and constant air ventilation
3) Well balanced interior air temperature control

VOC free kitchen system
Environmentally conscious design is a major trend of any housing provision for both reduction of environmental loads and enhancement of QOL with regard to the sustainable built environment. This could be realized through the following design process;
1) Discover the locality to be respected in the landscape
2) Accordingly design the shape & performance of house
3) Adopt necessary equipment and appliances
4) Support the house management by the residents

In the aftermath of any disaster, it was evidenced that the mutual help of neighborhood residents was indispensable for the recovery.

Such relationship is only possible if there is a sense of community among residents to be matured through regular communal activities in common spaces within the neighborhood block. They include;
1) Monthly town cleaning
2) Maintenance of greenery
3) Birthday parties
4) Local & religious festivals
5) Town workshop for children etc.
Town management system for safe & sustainable living

1) Town Management Process
2) Maturing Process of the Community
3) Phenology Guide
4) Risk Management
5) Information Network

1) Town Management Process

Design Stage

Sales-promotion & Occupation Stage

Post-occupancy Stage

Planning and designing a town where the residents can share the value regarding living environment including:

- Beautiful townscape / Rich greenery / Communal facilities

Strategy

Value enhancing Program through seminars, workshops, etc.

Home Owners Association for collective management & operation of the town

A variety of supporting programs

Maturing townscape/Greenery heritage/Maintenance of common facilities/Crime & disaster prevention

Provision of more comfortable living environment

Enhancement of the residential asset value
2) Sustainable Town Management as maturing process of the community

Communal Planting

Plating trees and flowers to celebrate the new occupancy help residents enhance their feeling of attachment to the town greenery.

Such a communal program provides them opportunities to get acquaintance and to work together.

Periodical workshops about the greening neighborhood provide natural relationship between residents.

3) Phenology Guide for discovering the best specific solution

As a part of the Pre-design phase, the natural conditions of the site and its region are investigated in detail. These include sunshine duration, winds, precipitation, temperature, humidity, flora and fauna; the products of the solar benefits. The outcomes of analysis on such local information help discover the optimal solutions for the regional networking of greenery and water systems for example.

Furthermore, the socio-cultural aspects as the results of the people’s activities are investigated to understand the genius loci that lead to the best solution of architectural layout, design and post-occupancy management.

Phenology Guide of Kobe: Phenological list of natural & socio-cultural locality in Kobe
4) Seism-proof Structural System
applied to all houses
to considerably reduce the earthquake damage risk

Low rise-1: Flat plates structural system
Flat plates and columns with no beam, providing free spaces inside

Low rise-2: Flat plates & bearing walls structural system
Flat plates, columns and bearing walls with no beam, providing free spaces inside

6) Structural Monitoring System
For a safe life monitoring the building movement and damage
Aftermath voluntary contributions of architects

1) Shigeru BAN

2) Toyo ITO

1) SHIGERU BAN ARCHITECTS
Voluntary Architects Network (VAN)

Paper Partition System designed and provided by Shigeru BAN for human dignity at Ohtsuchi High-School's gymnasium as an aftermath refuge, set up by the refugees themselves
The Paper Partition System for aftermath refuge, after occupancy

Temporary 3-story housing and community facilities, using shipping containers, promoted and designed by; SHIGERU BAN

Onagawa, 2011

Meeting Hall

© Hiroyuki Hirai

Onagawa Exterior

Onagawa Interior

© Hiroyuki Hirai
SHIGERU BAN carries international respect for applying his ability in technology in architecture to not only serving the more affluent users of architecture but also to a creative exploration of shelter using paper tubes and membranes for disaster relief. He has received “Pritzker Architecture Prize 2014” for his accomplishments.

Paper Church (1995-2000) Kobe, JAPAN © Hiroyuki Hirai
Cardboard Cathedral (2013) © Bridgit Anderson

2) TOYO ITO

Since Mar.11th, 2011, he has been energetically committed in relief and recovery activities in the affected regions.

“Home-for-All” projects are among them, providing a place for peace of mind for the victims to meet and communicate each other.

10 “Homes-for-All” have been completed by Jan. 2014, whilst a few are under development.

Recent major awards;
- Architectural Institute of Japan Prize 2003,
- Royal Gold Medal from the RIBA 2006,
- Golden Lion Prize at the Venice Biennale 2012,
- Pritzker Architecture Prize 2013, and many others
TOYO ITO  (2013 Pritzker Prize-Winner)  
& ASSOCIATES, ARCHITECTS  
Initiatives of “Home-for-All” Networking

The 1st Home-for-All (Oct. 2011), built within a temporary housing site in Sendai

Home-for-All for children in Higashimatsushima  
Jan. 2013

Built in a temporary housing site, it comprises 3 tiny characteristic pavilions. It is expected for kids to grow and become key-players of their community recovery.
It was completed through a collaboration of an ICT company in Tokyo and a local NPO aiming at recovery of agriculture.

Enjoying farming and foods using ICT, it is utilized as a place for the next generations to take over the local agriculture.

Conclusion-1

1. Japan is experiencing the periodic difficulties physically, environmentally, economically and socially due to the frequent natural disasters mainly of earthquakes.

2. Accordingly, short-, mid- and long term effective relief measures should be taken to cope with them, as well as the relevant preparedness measures for very possible future disasters.
Conclusion-2

3. In this regard, a cyclical design process for the human security must be taken into consideration as the top priority involving all the stakeholders.

4. To this end, our collective efforts through communal and local solidarity beyond disasters will be the very base towards; Resiliently Sustainable Housing for Human Security.

Thanks for your attention.

Prof. Kazuo IWAMURA
iwamura@iwamura-at.com