The 2nd Annual Conference of Resilience & Robust Cities
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# Integrated Resilience of the Built-Environment


by Prof. Kazuo IWAMURA

*Professor Emeritus, Tokyo City University*
*Visiting Professor, Chu Hai College of Higher Education*
*CEO, IWAMURA Atelier Inc.*
*FJIA, Japan Institute of Architects*
*Fellow, ARCASIA/UIA*






## CONTENTS

# 0. Introduction: Notion of resilience

1) In the 21st century, most of population on the globe live and work in cities, where uncertain future risks are increasing such as global warming, multiple natural disasters, income gap-widening, aging, health problems, political conflicts, terrorism, vulnerable infrastructure, etc.

2) In 1961, Jane Jacobs, a community activist, already published "The Death and Life of Great American Cities," referring to the roots of similar risk issues of the city resilience.

3) "Resilience" is a term that emerged from the field of ecology in the 1970s to describe the capacity of a system to maintain or recover functionality in the event of disruption or disturbance. It is applicable to cities and buildings because they are complex systems that are constantly adapting to changing circumstances.



*(Ref.: "City Resilience Framework," 2015, Rockefeller Foundation + ARUP)*

# 0. Introduction (cont'd)

4) The notion of a "resilient city and building (built-environment)" becomes, therefore, conceptually relevant when chronic stresses or sudden shocks threaten widespread disruption or the collapse of physical or social systems.

5) "*Integrated Resilience of the Built-Environment*" describes, consequently, the capacity of those to function, so that the people living and working there, particularly the poor and vulnerable, survive and thrive no matter what stresses or shocks they encounter.

Such a goal towards human security must be the top priority that formulates the social responsibility of our profession worldwide.



*(Ref.: "City Resilience Framework," 2015, Rockefeller Foundation + ARUP)*

# 1. Recent Proposal

## "Meta-Sand Spiral City", Cairo

## Innovative resilience across time and scale

by
YASUI Architects & Engineers Inc. + IWAMURA Atelier Inc. JV
August 2016



## "Meta-Sand Spiral City," Cairo

# Site Location

### From Cairo to the Site:

The site is located 38km away from and to the west-southwest of the city-center of Cairo, connected by the major road 27 July Axis and Al Fauom-Al Wahat Road.

Main access to the site is given only through the northern residential areas, which is not favorable from the traffic point of view.

Although the southern buffer zone currently allows no access from Al Wahat Road, it is strongly advised to provide one to avoid any traffic inconvenience in the adjacent residential areas.

Also the southern buffer zone may be used for additional visitors parking place, as is the case of the Modern Science & Art University.

### Local Consideration:

The northern residential areas, closely developed to the site, require a buffer line along the boundary.

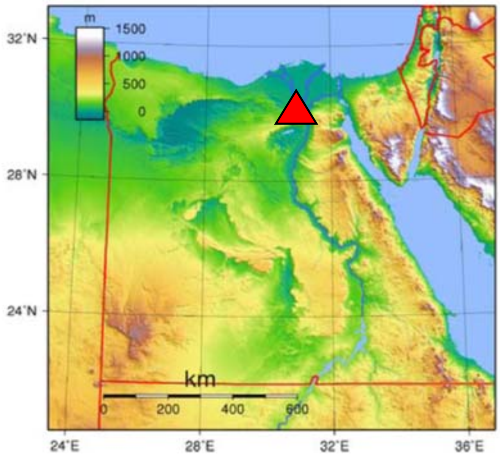
The site plan, therefore, requires to keep a distance with buildings that embraces a courtyard, which creates tranquil and attractive urban asset with a well-tempered human environment for both the users and the neighbors.

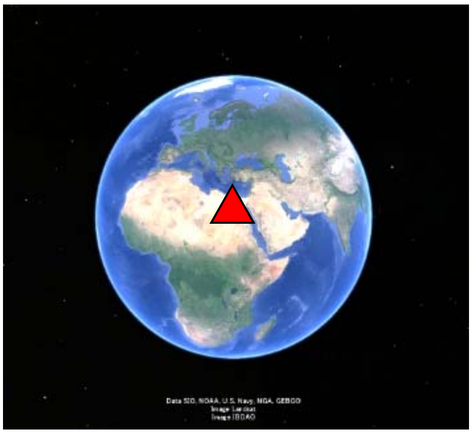
### Homage to the Pyramids:

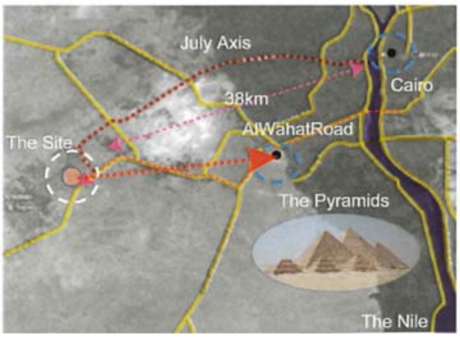
Symbolizing the time evolution, the Observatory Tower allows to appreciate the Giza Pyramids, the jewel of Egypt, over the entire view of the Science City.

### Site Planning:

The cell-like buildings are located at the center of site, surrounding a courtyard. They consist of four cells, connected with each other by spiral slopes in the courtyard. They are integrated into the site topography slightly rising toward the north and also partially connected with the landscaping.



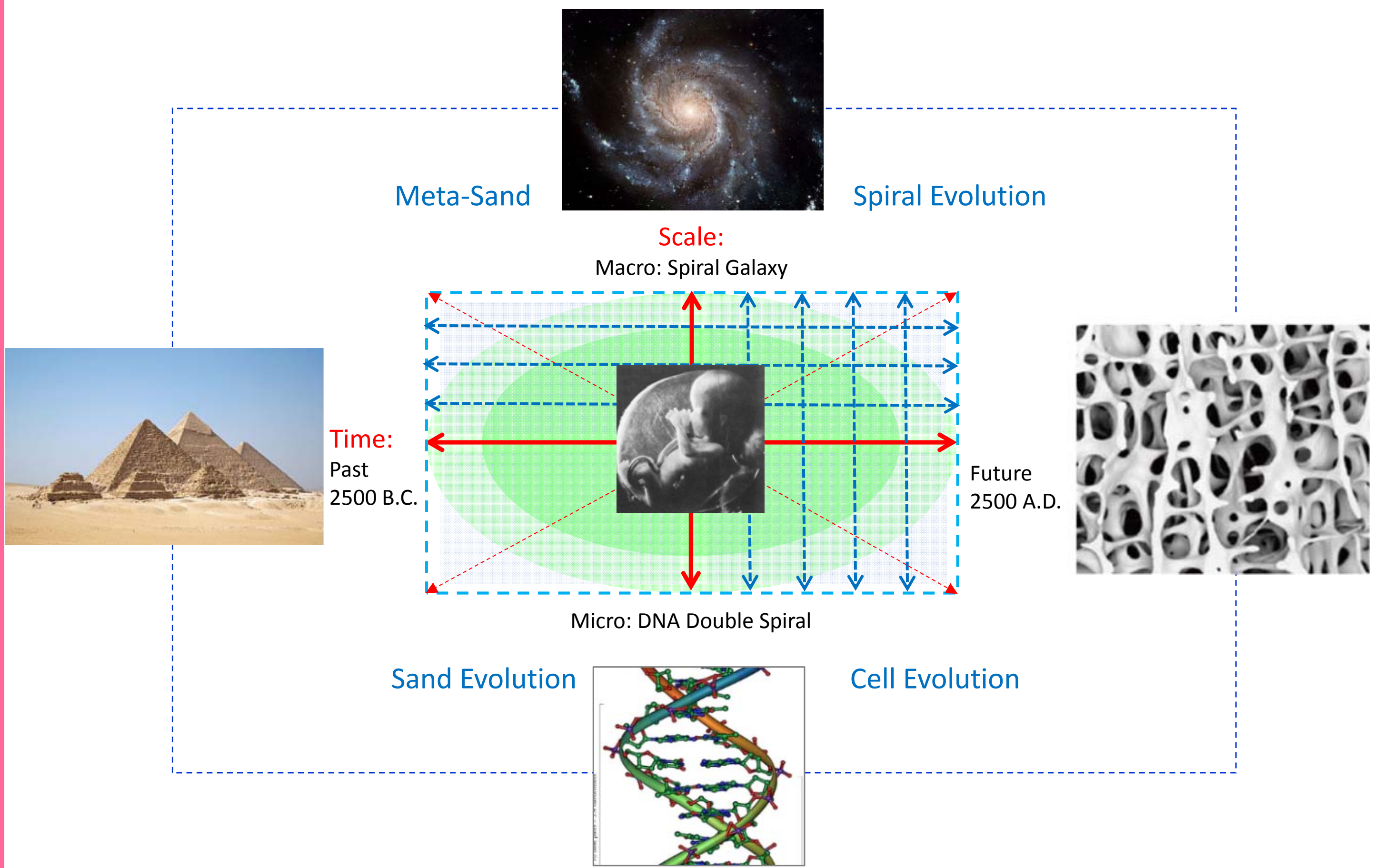








# Conceptual Coordinate across Time & Scale



# “Meta-Sand Spiral City”

The innovative incubator of scientific culture, integrating Nature, Civilization and Life, on the basis of “Meta-Sand” and “Spiral Evolution”

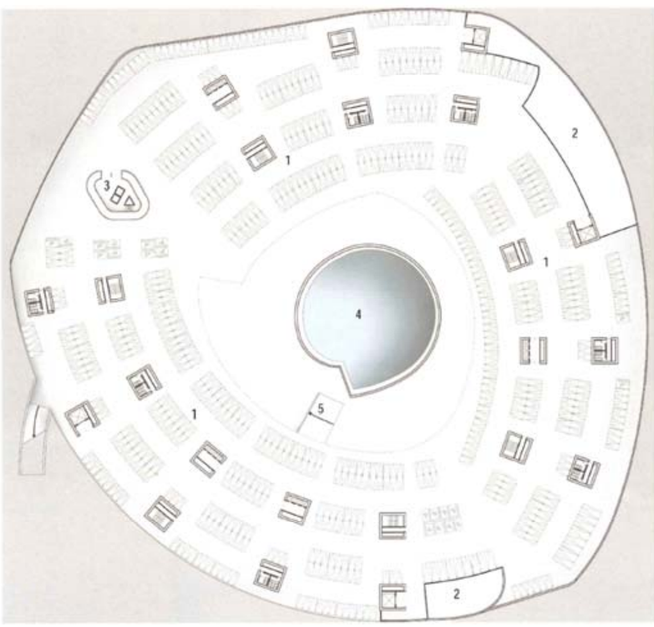
Site area: 125,000m$^2$, Built-up area: 32,000m$^2$, Total floor area: 114,500m$^2$





# Floor Plans

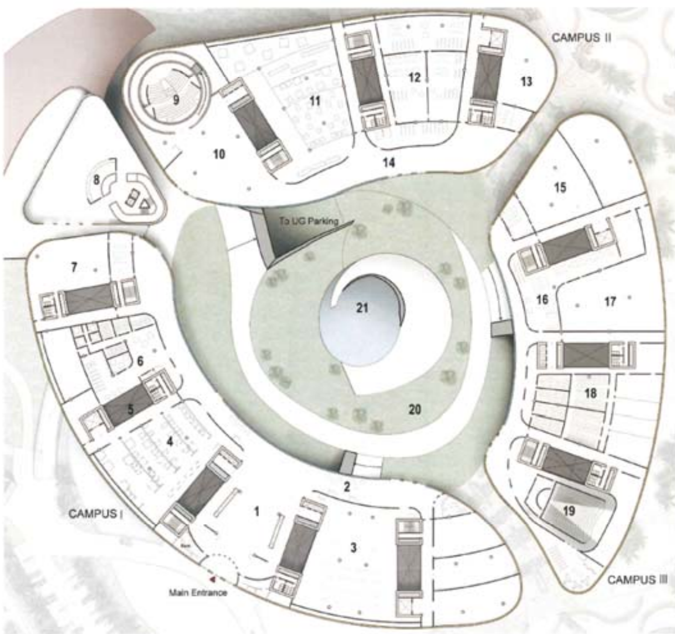
1. Car Parking
2. Service Area
3. OT Service Core
4. Central Pond
5. Spiral Slope



BF

Basement Floor
Underground Parking + Spiral Courtyard

1. Orientation Hall & Information Hall
2. Cyber Cafe
3. Interactive Exhibition Hall
4. Collection Exhibition Hall
5. Eco-Void
6. Research Center
7. Machine Room
8. OT Reception
9. Planetarium
10. Foyer
11. Temporary EXhibition Hall
12. Engineering Section
13. Technical Plant and Security
14. Visitors' Area
15. Workshop
16. Office
17. Geological Collection Hall
18. Lecture Hall
19. High Definition Theater
20. Spiral Courtyard
21. Central Pond

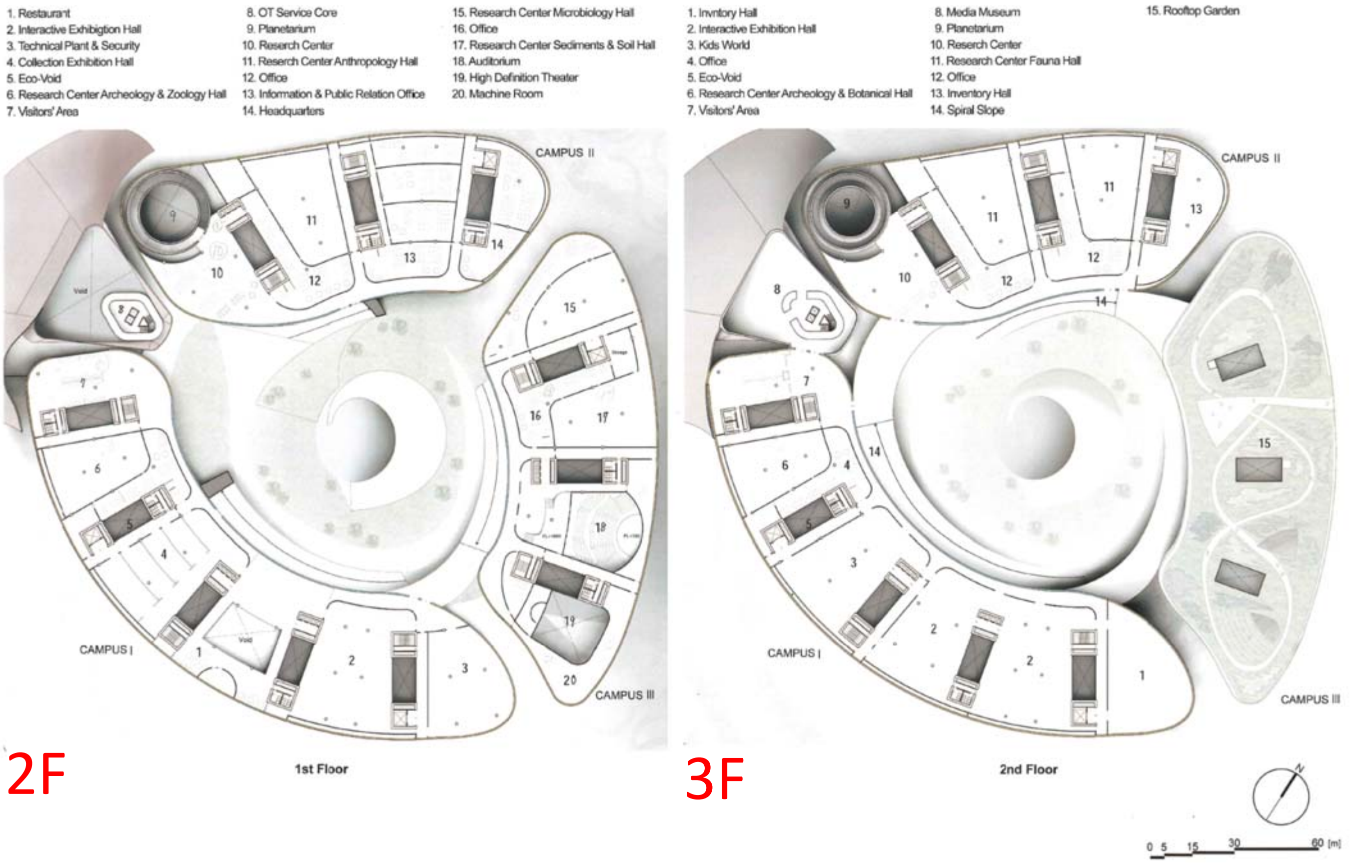



1F

Ground Floor
Main entrance + Administration + Facilities

0 5 15 30 60 [m]

# Floor Plans



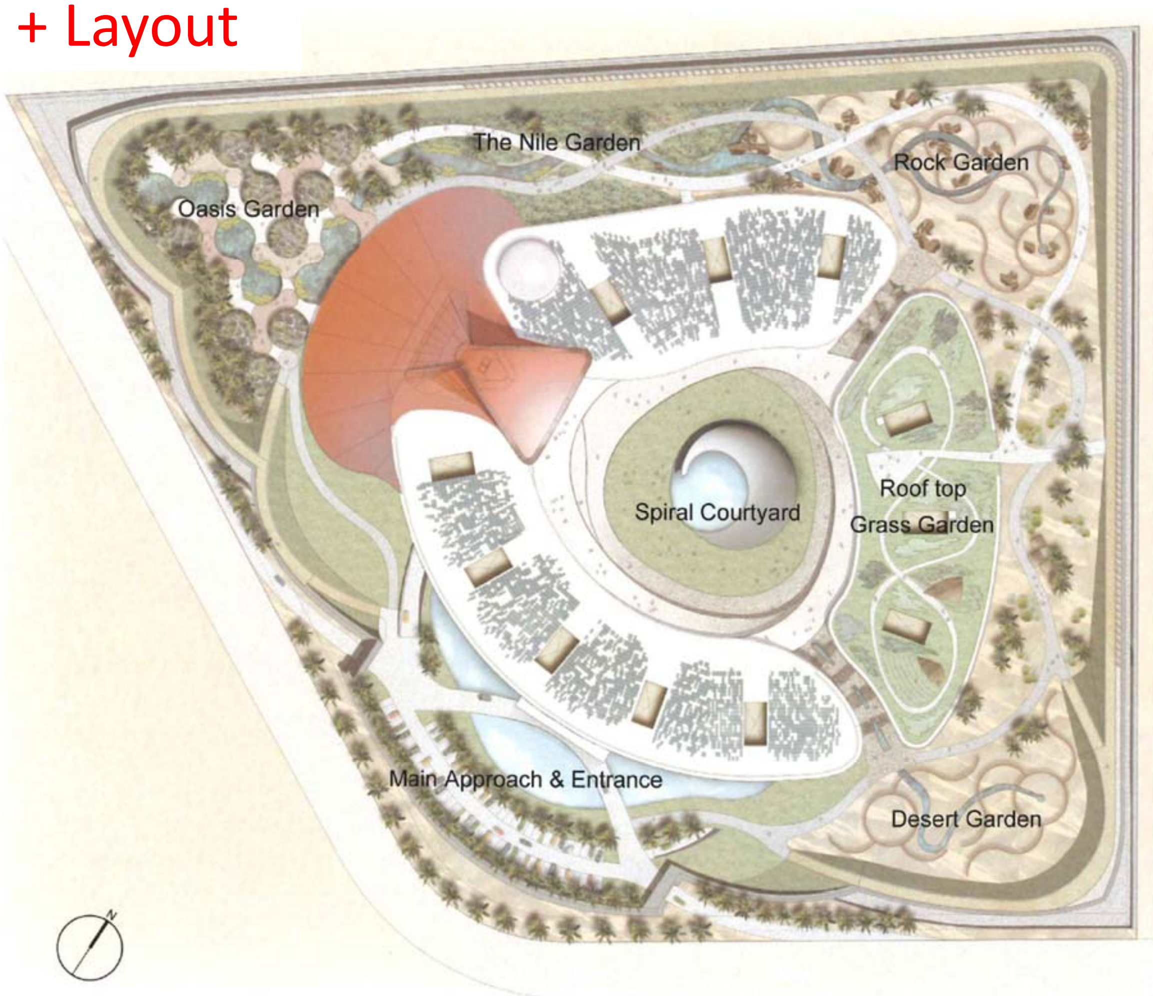

2F

3F

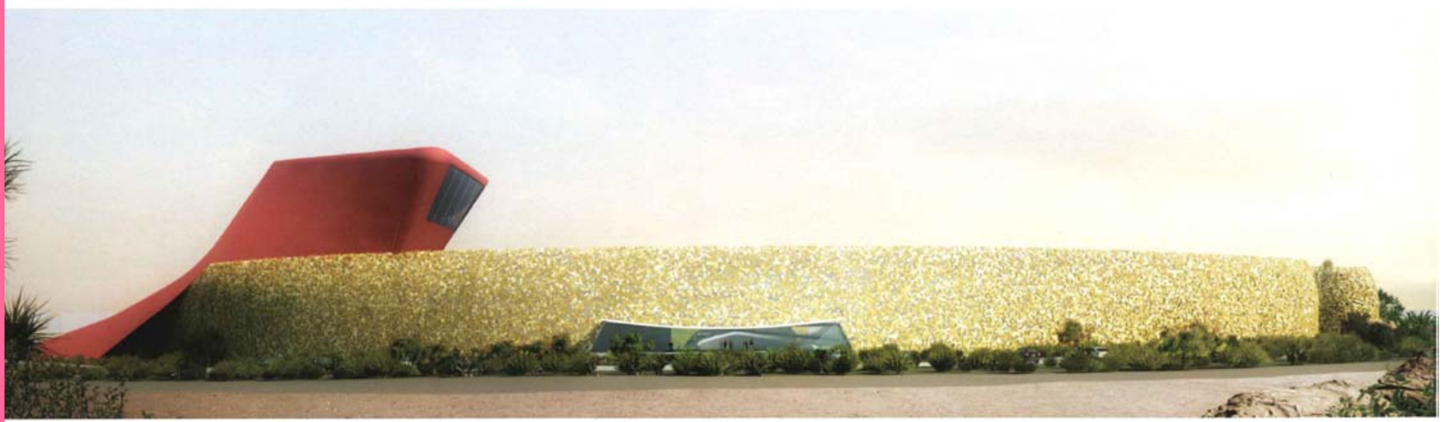




# Rooftop + Layout



# Elevation (South)

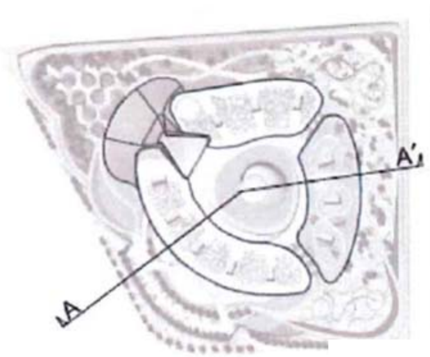


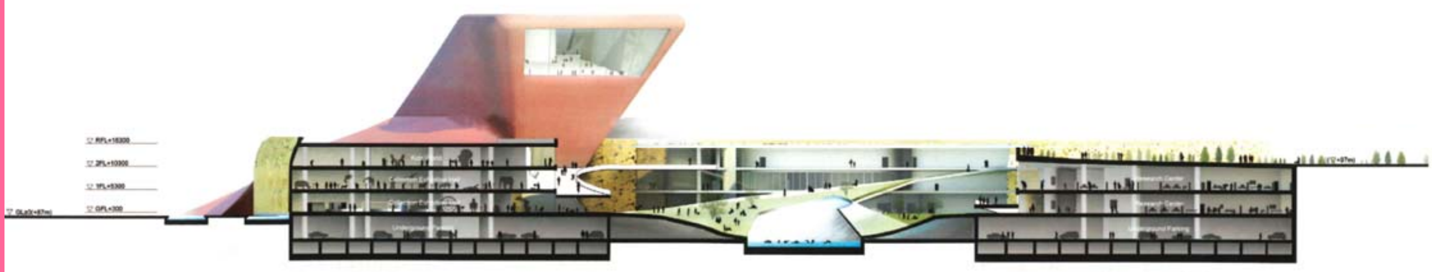
South Elevation





# Section (A-A')



A-A' Section

# Landscaping

**1) Organically integrated landscaping through;**
Site specific topography and geography

**2) Impressive surroundings along the site boundary by;**
Moats, mounds and rampart for security

using similar material to the façade for harmony

**3) Memorable approach & entrance by;**
welcome water basin reflecting the unique façade and the stardust lighting

**4) Region specific outer-gardens constituted of:**
Desert, Rock, The Nile, Oasis, Grass and etc.

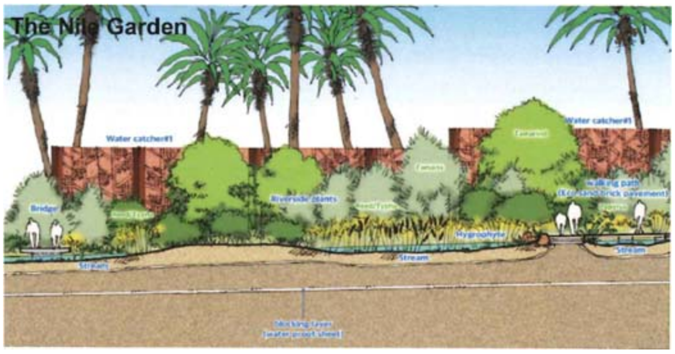
Roof-top garden on the Campus III linked to Grass Garden

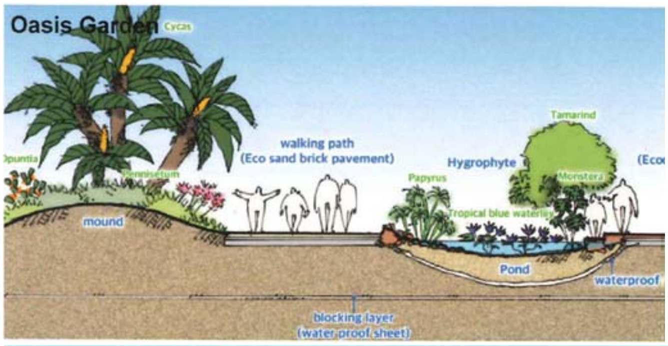
**5) Peaceful unique inner-garden as the courtyard characterized by;**
lawn and pond at the middle surrounded by the three organic buildings and the tower

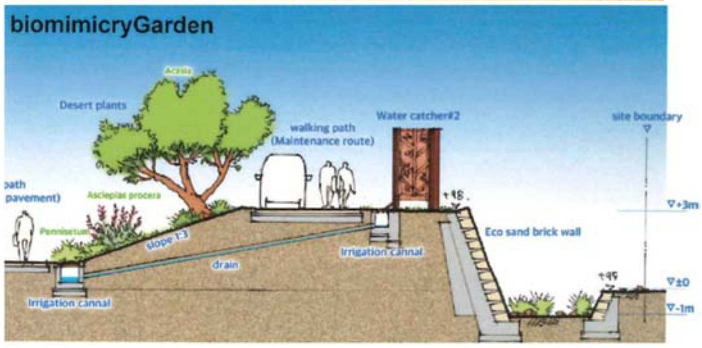
spiral pedestrian slopes connecting each floor

**6) Natural irrigation water provision by means of;**
air-water catcher devices taking advantage of the hourly fluctuation of temperature & humidity

**7) Consideration for maintenance and security by;**
the maintenance road beside the mound and rampart along the site boundary








# Interior images


Orientation & Information Hall

Interior View of the Colletion Exhibition Hall

Interior view of Reseach Center around the the Planetarium

Interior View of the Eco-Balcony

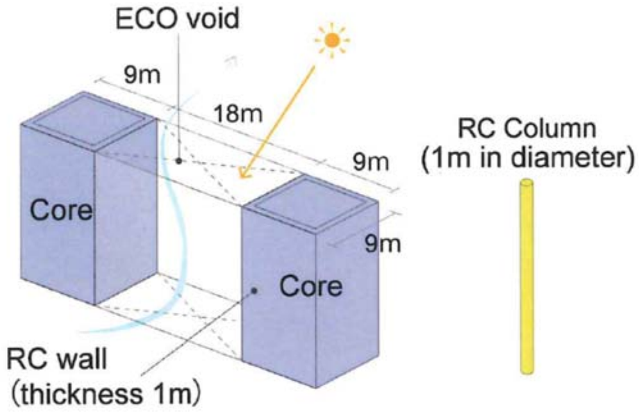
# Innovative Structural Design

## Main Structure

Main Structure is composed of RC 9m x 9m core system to support normal force, while random RC columns are set to support horizontal force to allow free and flexible space provision by means of:

1) Column-less space through long span PC beams

2) Full usage of the story height between the voided flat slabs

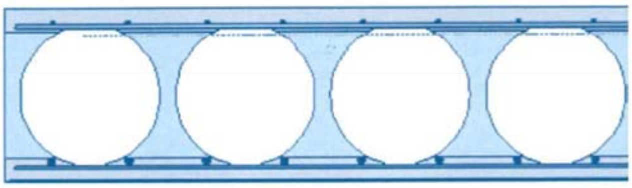



**<Core >** **<Column>**

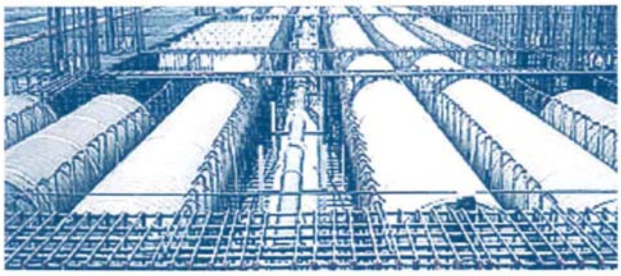
| | Number of Core Units | Number of Columns |
|---|---|---|
| 1. Campus I | 5 | 28 |
| 2. Campus II | 3 | 22 |
| 3. Campus III | 3 | 18 |
| Total (1+2+3) | 11 | 68 |

## Voided flat slab system:

Voids contribute to reducing the weight and can be used for utility piping & wiring



**Cross section of a voided flat slab**

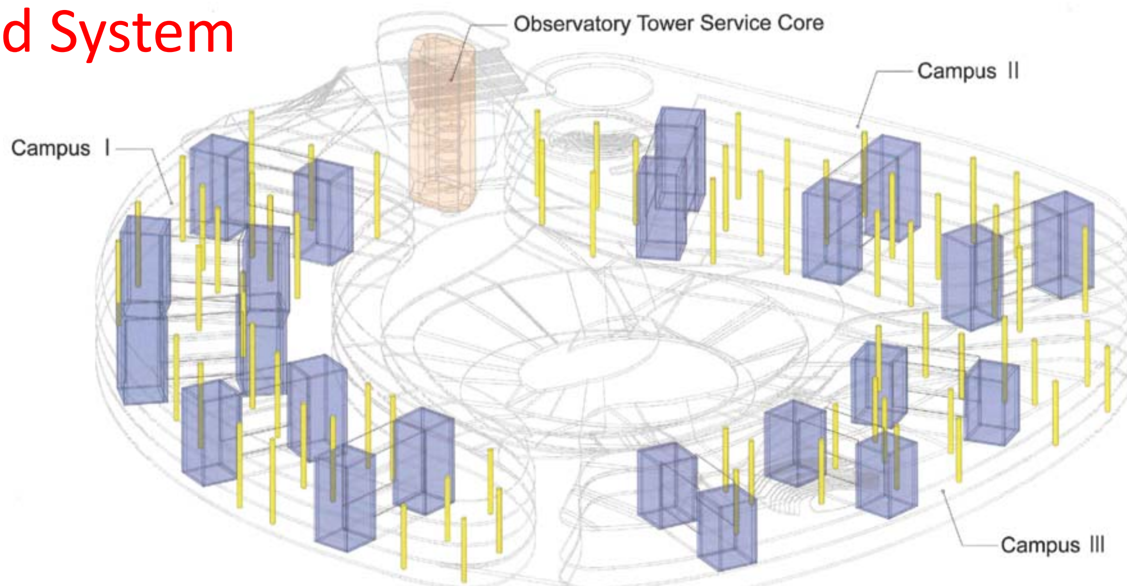


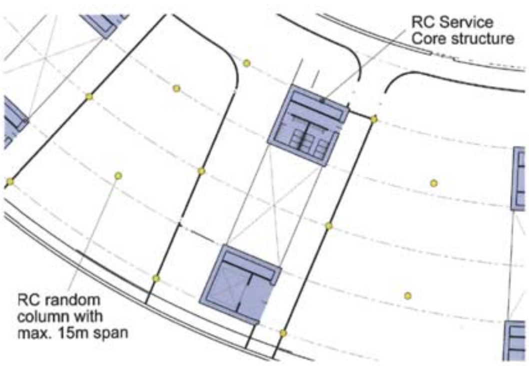
**Voided flat slab under construction**





# Eco-Void System




InteriorView through an Eco - Void

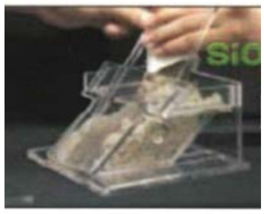
# Meta-Sand Brick

is a state-of-the-art structural material that can be easily made injecting $CO_2$ gas into $SiO_2$ and soak in urethane liquid afterward.

$SiO_2$ is abundantly available in the adjacent desert and therefore very affordable.

(Courtesy of Prof. Norihide IMAGAWA)

When CO2 gas injected into SiO2, it becomes immediately solid SiC that is equivalently hard to a conventional brick in terms of the strength against compression (approximately 27 Newton) This process is very simple and fast as follows; 1) pack SiO2 sand into a mold, and 2) inject CO2 into SiO2 through the holes of mold, which contribute to stabilizing CO2.




$$[SiO_2 + \alpha] + CO_2 \rightarrow [SiC + \beta] + 2O_2$$

This solid brick, however, is weak against tension and bent force, which can be improved by soaking it in a macromolecule chemical to attain the strength against bending (approximately 16 Newton). Finally, this Eco-Sand Brick has a strength equivalent to the reinforced concrete (RC).


Most characteristic advantage of this material is the considerably short period of production, which is altogether one day in comparison to one month of RC including the period of recuperation. In addition, the overall cost of production is equal to or even less than RC because no reinforcing bar is required. (Patent pending)

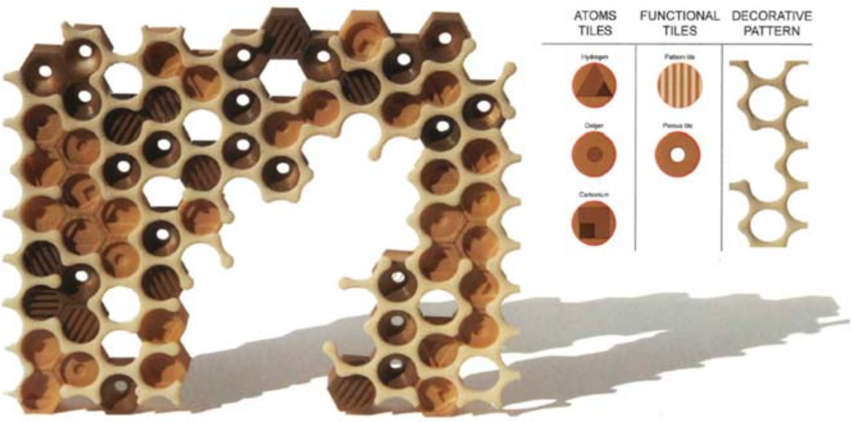


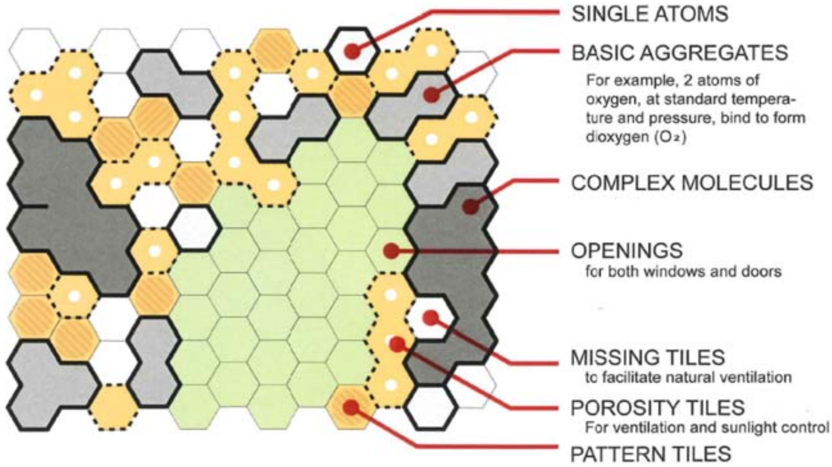


# Abacus of Meta-Sand Brick Elements

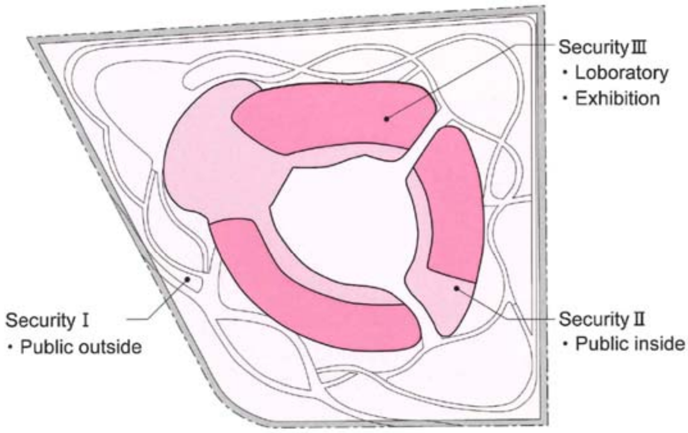
The elements of the Meta-Sand Façade represent a variety of molecules and compose diverse patterns according to the requirement of the related interior space.

This pattern characterizes the whole façade of the Meta-Sand Spiral.



# Design for Resilience -1: Security System



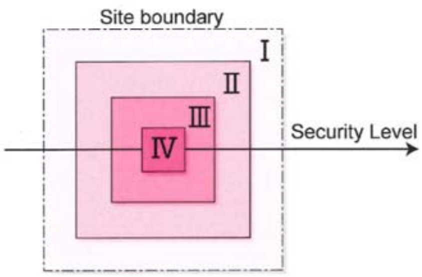

Security Level of the site and building

## Security

### 1)Security zoning

Comprehensive security system is indispensable element to realize resilient operation of the Science City.

The security zoning is herewith proposed to be divided into the Level I to VI according to the functional importance, and the security check-points are set in every zone.



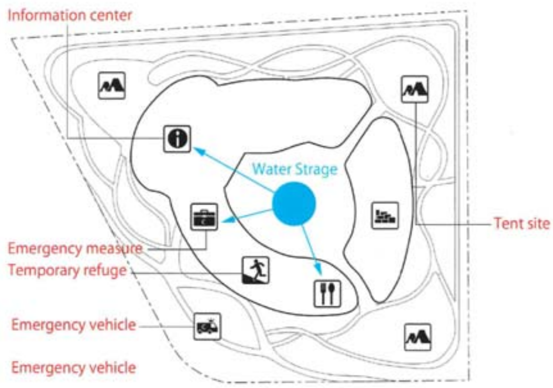

### 2)Security level

The level of security is systematically established from I to IV covering the site, the buildings, general rooms and a special room respectively. Also a personal authentication system through a chip card and fingerprint is introduced for security operation and management.






# Design for Resilience -2: BCP System




Support funcion during disaster

## BCP (Business Continuity Plan)

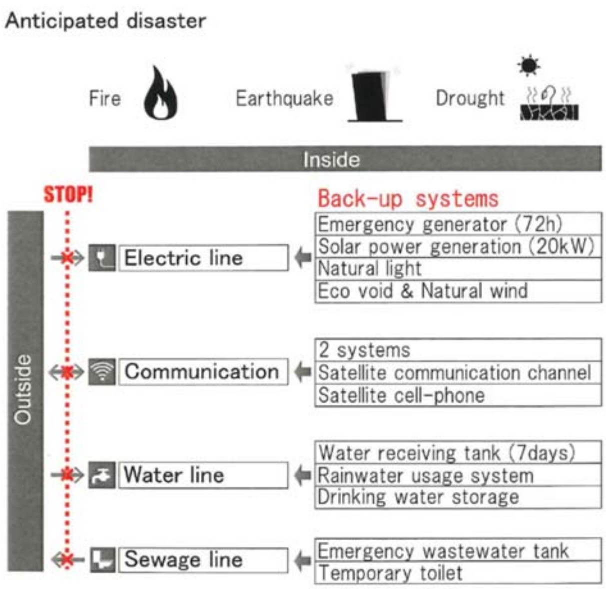
### Disaster preparedness

Facing unexpected risks including natural disasters and/or terrorism, BCP is indispensable for both public and private business entities to support the stakeholders as well as the relevant company to survive beyond the prospective risks and dangers.

The figure on the right show an image of BCP framework simply customized in the Science City in case of the infrastructure shutdown.

### Recovery during the aftermath

Simulation of recovery is the core of BCP in view of the survival with ever changing requirements during the aftermath. The Science City could be used as an evacuation venue for the employee, the visitors and the neighbors.



# Nightscaping

According to the daily and seasonal change of natural lights, the Meta-Sand Spiral City is designed to appreciate the ecological lighting effects through the porous façade and the Tower.

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“Meta-Sand Spiral City,” Cairo

# 2. Disasters

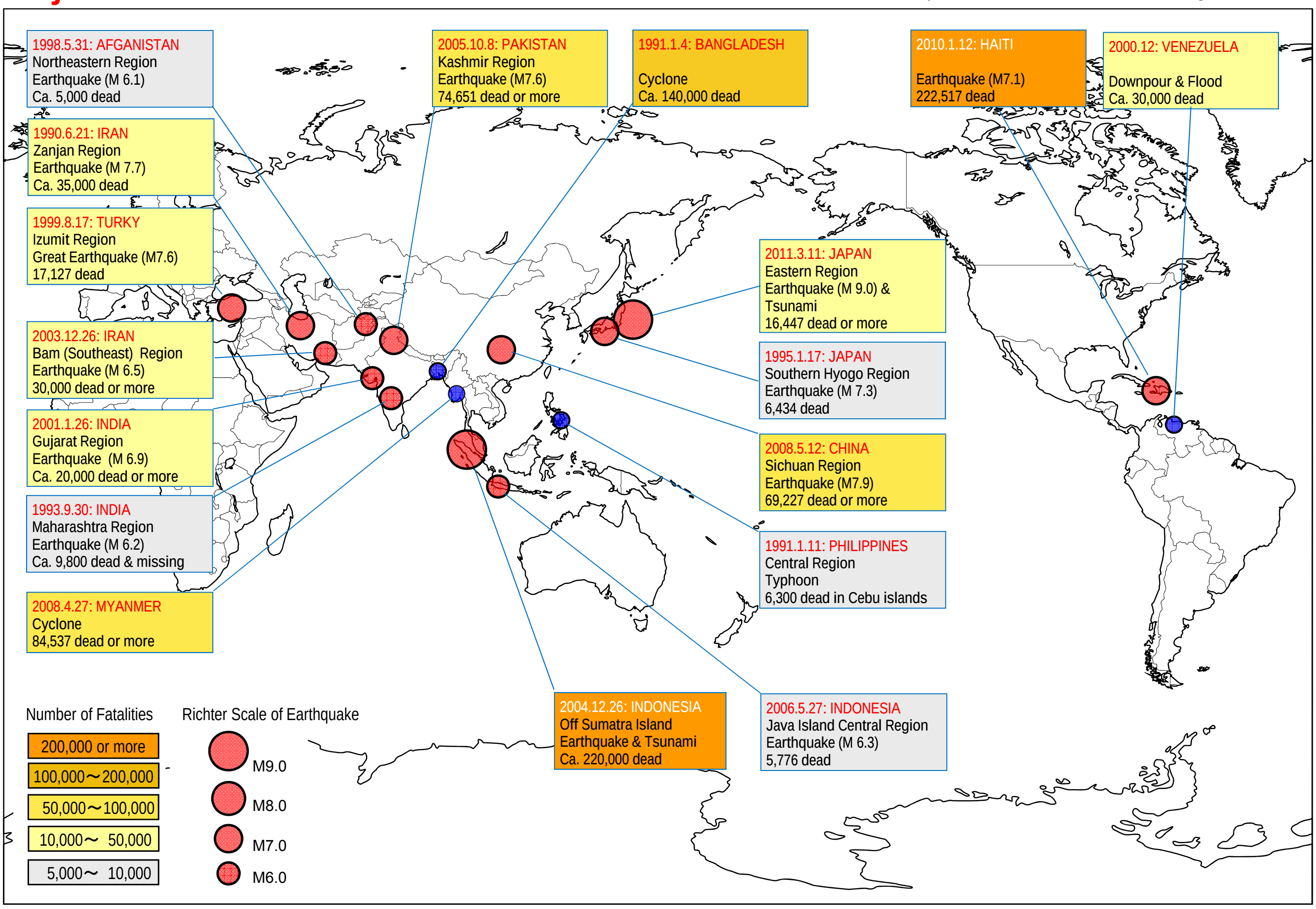
## 2.1 Occasional Disasters

Japan, like many other Asian counties, has been experiencing the frequent difficulties physically, environmentally, economically and socially, due to a variety of temporary & natural disasters including typhoons, floods, earthquakes, tsunamis, volcanic eruptions and the like.

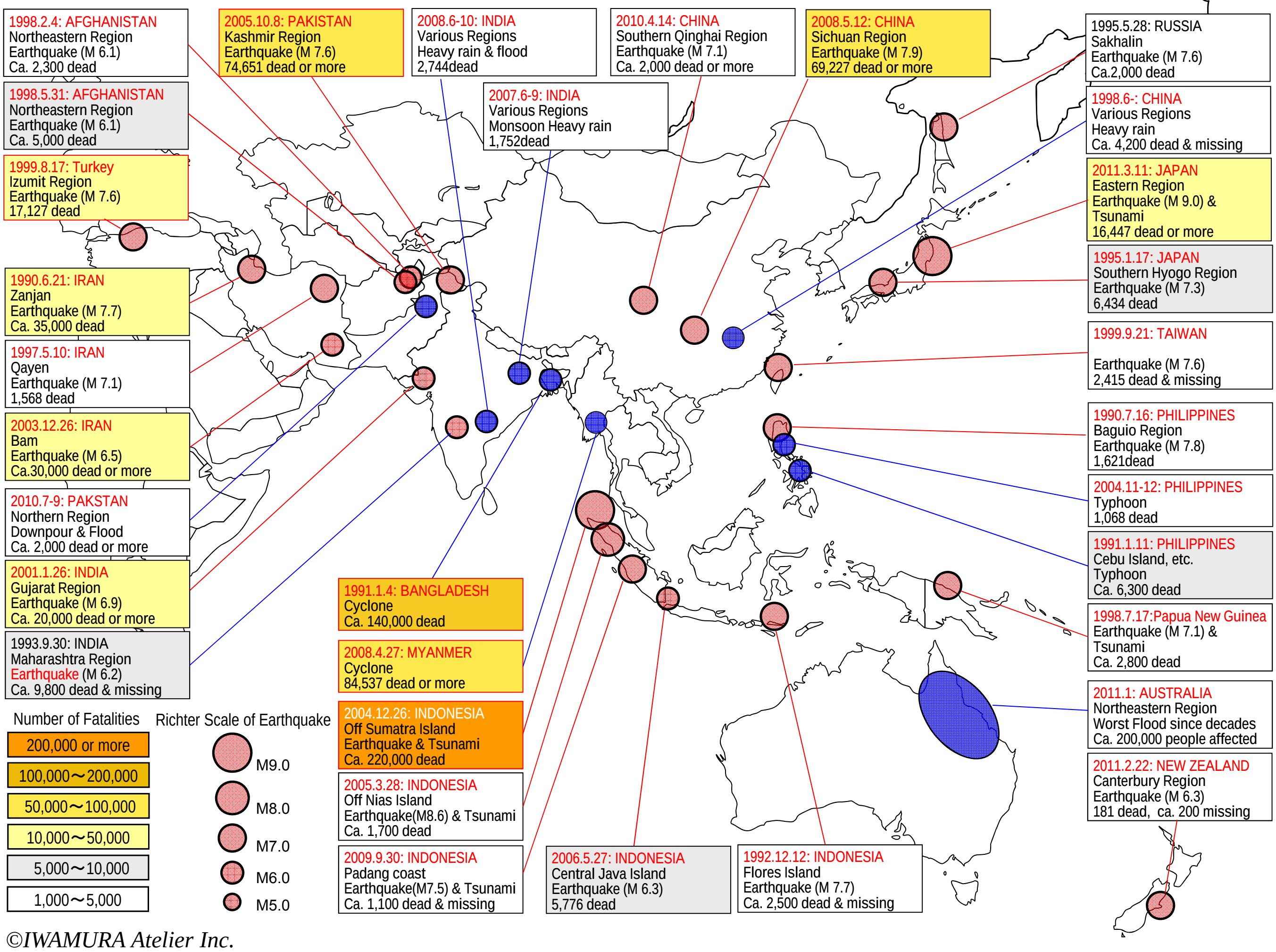




## Major Natural Disasters around the World since 1990 (more than 5,000 dead, as of Aug. 31st, 2011)



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






# 28 Record of Major Natural Disasters in Japan since 2011

| Date | Location | Category | Note |
|---|---|---|---|
| 2011 | | | |
| Jan.- | Kyushu | E. Eruptions | Since 0.5 century |
| Mar.9 | Miyagi | EQ:M7.3 | |
| Mar.11 | East Japan | EQ:M9.0 & Tsunami | 15,900D, 2,500M |
| Mar.12 | Nagano | EQ:M6.7 | |
| Mar.15 | Shizuoka | EQ:M6.4 | |
| Apr.11 | Fukushima | EQ:M7.1 | |
| May.- | West J.apan | Typhoon & Floods | Heavy rain |
| Jun.- | All Japan | Intense Heat | Heatstroke Deaths |
| Jul.- | Shikoku + α | Typhoon & Floods | Heavy rain |
| Jul.28- | Hokuriku | Floods | Heavy rain |
| Aug.30- | East to Kyushu | Typhoon & Floods | 20,000-Flooded Houses |
| Sep.- | All Japan | Typhoon & Floods | 7,800-Flooded Houses |
| Nov.- | Amami | Tornado | |
| Dec.3 | Okinawa | EQ:M7.0 | |
| Dec.3 | All Japan | Cold Wave | Heavy snow |
| 2012 | | | |
| Jan. | Torishima | EQ:M7.0 | |
| Apr.3 | All Japan | Windstorm | |
| May.6 | Ibaragi | Tornado:F3 | 1,000-Collapsed Houses |
| Jun. | All Japan | Typhoon & Floods | |
| Jul.- | West Japan | Heavy rains & Floods | 12,000-Flooded Houses |
| Aug. | Kinki + α | Heavy rains & Floods | |
| Aug.25 | Hokkaido | EQ:6.1 | |
| Sep.- | All Japan | Typhoon & Floods | |
| Dec.- | All Japan | Cold wave | Snow storm & Snowfalls |
| 2013 | | | |
| Feb.2 | Tokachi | EQ:M6.5 | |
| Feb.25 | Tochigi | EQ:M6.2 | 2,000-Collapsed Houses |
| Apr.14 | South Hyogo | EQ:M6.3 | 2,000-Collapsed Houses |
| Apr.17 | Miyake Isl. | EQ:M6.2 | |
| May.18 | Fukushima | EQ:M6.0 | Offshore |
| Jul.- | Chugoku Region | Heavy rains & Floods | +Tornado |
| Aug- | West Japan | Intense heat | Heatstroke Deaths |
| Aug.4 | Miyagi | EQ:M6.0 | Offshore |
| Sep.- | All Japan | Typhoon & Floods | 10,000-Flooded Houses |
| Oct.- | East Japan | Typhoon & Floods | |
| Oct.26 | Fukushima | EQ:M7.1 | Offshore |
| Nov.- | Ogasawara | E. Eruptions | New island |
| 2014 | | | |
| Jan.- | All Japan | Influenza epidemic | 1.5mil. Affected people |
| Feb.- | East of Kinki | Heavy snow +storm | Snowfall records |
| Mar.14 | Iyo-nada | EQ:M6.2 | Offshore |
| May.5 | Izu-oshima | EQ:M6.0 | Offshore |
| Jun.- | West Japan | Torrential rain | Record rains |
| Jul.- | All Japan | Typhoon & Floods | Heavy rain & Landslide |
| Aug.- | All Japan | Typhoon & Floods | Heavy rain |
| Aug.10 | Aomori | EQ:MM6.1 | Offshore |
| Aug.- | West Japan | Torrential rains | Thousands of Flooded Hs. |
| Sep.- | E & N Japan | Torrential rains | Recorded 120mm & more |
| Sep.27 | Gifu & Nagano | E. Eruptions | Postwar worst E. disaster |
| Oct.- | Mid Honshu | Typhoons & Floods | Heavy rains & Landslides |
| Nov.22 | North Nagano | EQ:M6.7 | |
| Dec.16 | All Japan | Snow storms | Heavy snow & Cold wave |
| 2015 | | | |
| Feb.6 | South Tokushima | EQ:M6.0 | |
| Feb.17 | Iwate | EQ:M6.9 | Offshore |
| May.13 | Miyagi & Iwate | EQ:M6.8 | Offshore |
| May.29- | Kuchinoerabu | E. Eruptions | Pyroclastic flow |
| May.30 | Ogasawara | EQ:M8.1 | Offshore |
| Jun.29- | Hakone | Phreatic eruptions | Since few centuries |
| Jul.15- | West Japan | Typhoon & Floods | Heavy rains |
| Aug.- | S & W Japan | Typhoon & Floods | Windstorm & Heavy rains |
| Sep.- | Shikoku & East | Typhoon & Floods | Torrential rains |
| Sep.14 | Mt. Aso | Phreatic eruptions | |
| 2016 | | | |
| Jan.14 | South Hokkaido | EQ:M6.7 | |
| Jan- | All Japan | Record cold wave | Heavy snow & Storm |
| Feb.- | Sakurajima | E. Eruptions | Volcanic smoke: 4,000m |
| Apr.14- | Mid Kumamoto | EQ:M6.5 | Thousands of DH<br>Frequent aftershocks |
| Jun.- | Kinki & East | Torrential rains | Floods & landslides |
| Aug.- | Chubu & East | 4 Typhoons | Windstorms & heavy rains |
| | West Japan | Record hot days | Heatstroke sufferers |
| Sep.- | West Japan | Typhoon & Floods | Windstorms & heavy rains |
| Oct.- | South Japan | Typhoon & Floods | Windstorms & heavy rains |

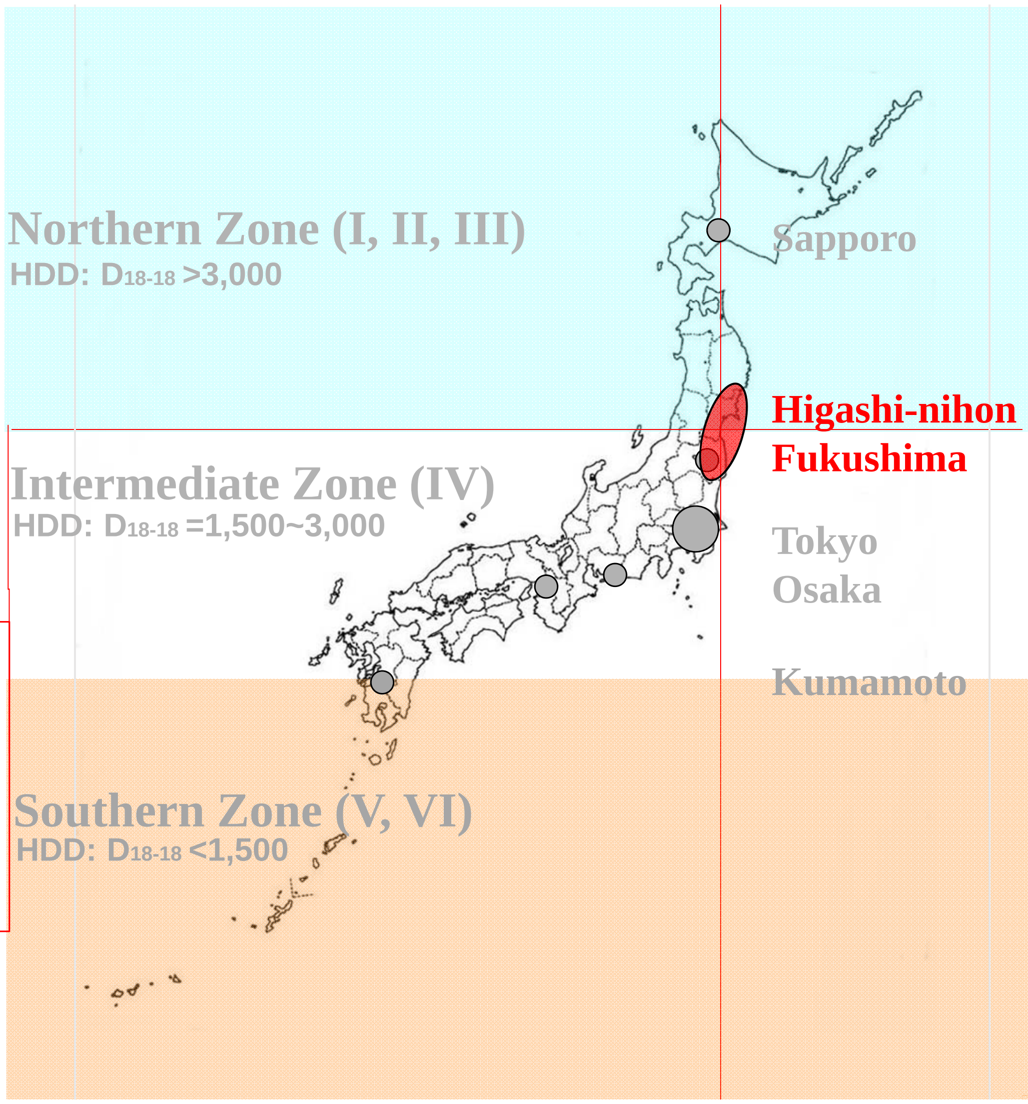
Note) EQ: Earth Quake (only M=6.0 or more), E. Eruptions: Explosive Eruptions

# The Great Japan East Earthquake & Tsunami

March 11, 2011

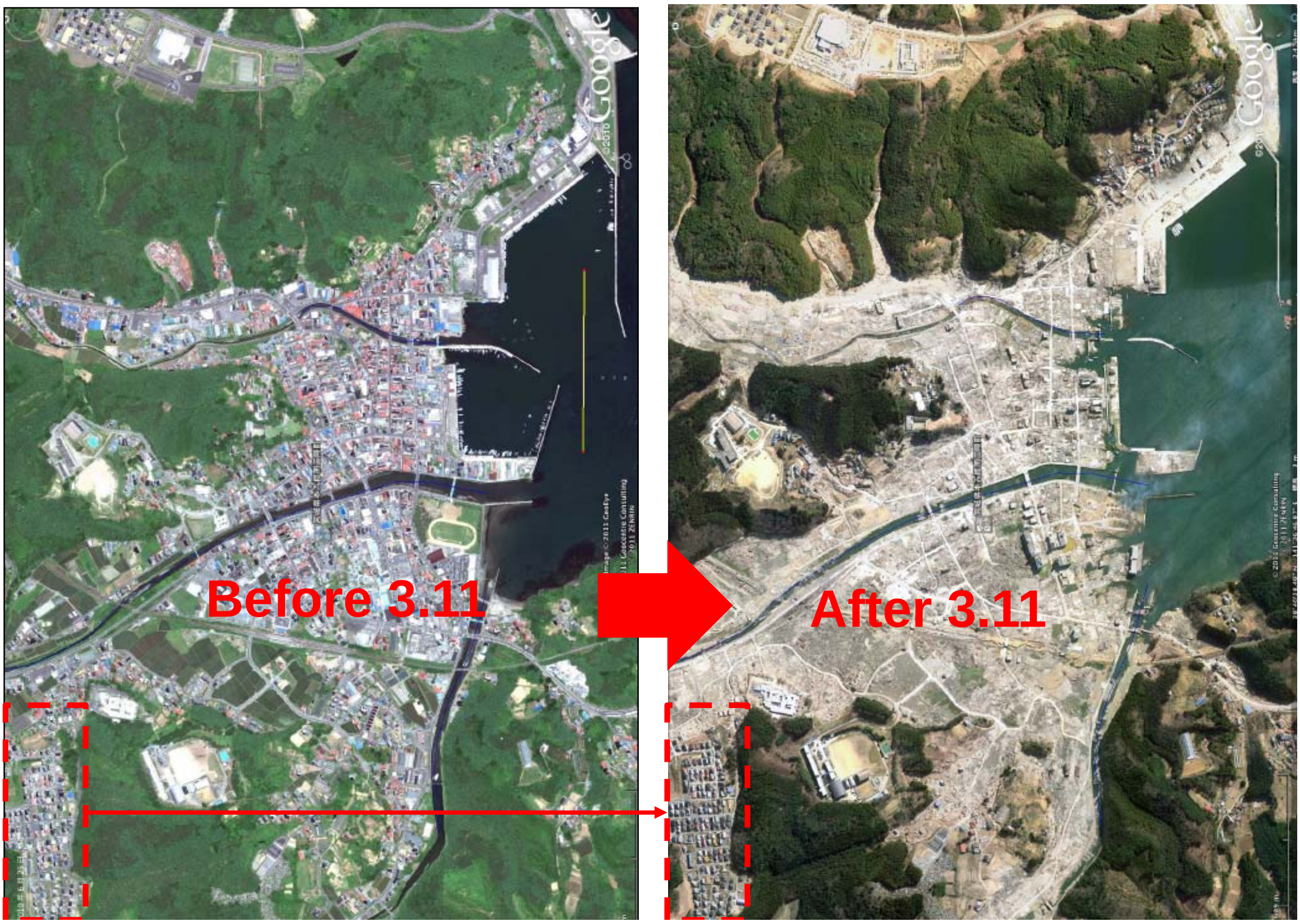
Casualties:
（as of Mar. 10, 2016）

Deaths ： 15,894p
Missing ： 2,561p
Injured ： 6,152p



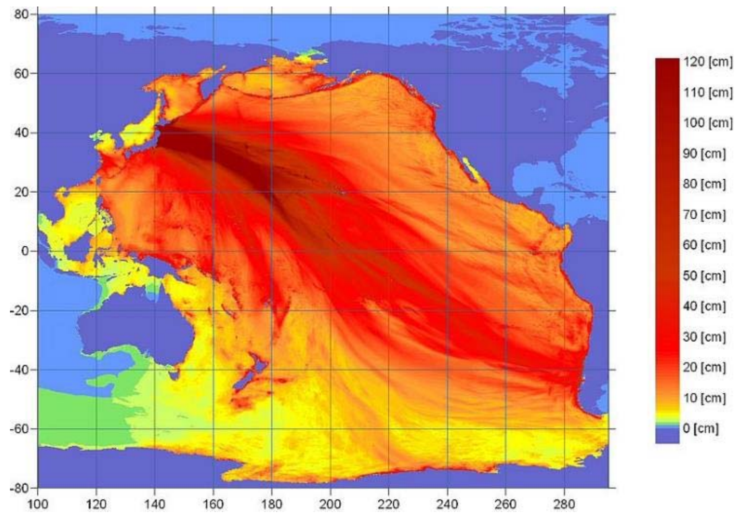


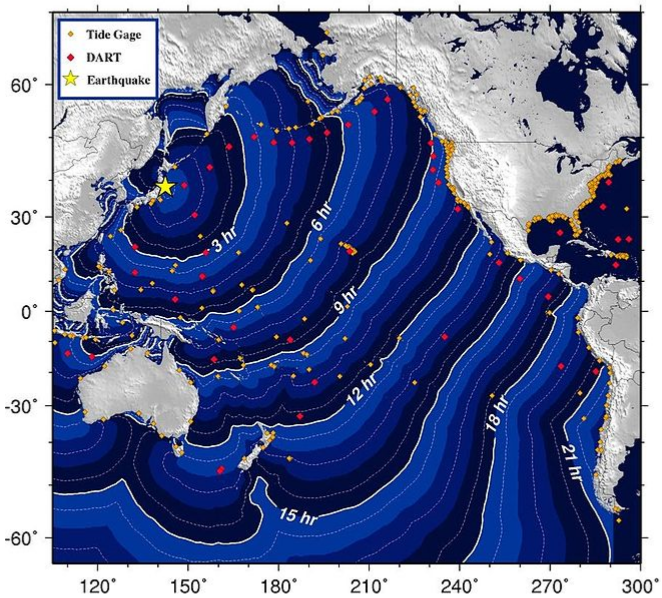

# Minami-Sanrikucho totally devastated by the 3.11 Tsunami




# Local disaster ⇒ Global disaster

Energy Transmission of the Tsunami triggered by 3.11 Earthquake




Arrival Time of the Tsunami to the Pacific Coasts after 3.11 Earthquake

(Source: 2011Sendai-NOAA-Energylhvpd9-05.jpg
NOAA: National Oceanic and Atmospheric Administration, US Department of Commerce)

# 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

(2015 Pritzker Prize-Winner)

Before

After





# TOYO ITO

(Winner of 2013 Pritzker Prize and 2017 UIA Gold Medal)

## & ASSOCIATES, ARCHITECTS

## Initiatives of "Home-for-All" Networking

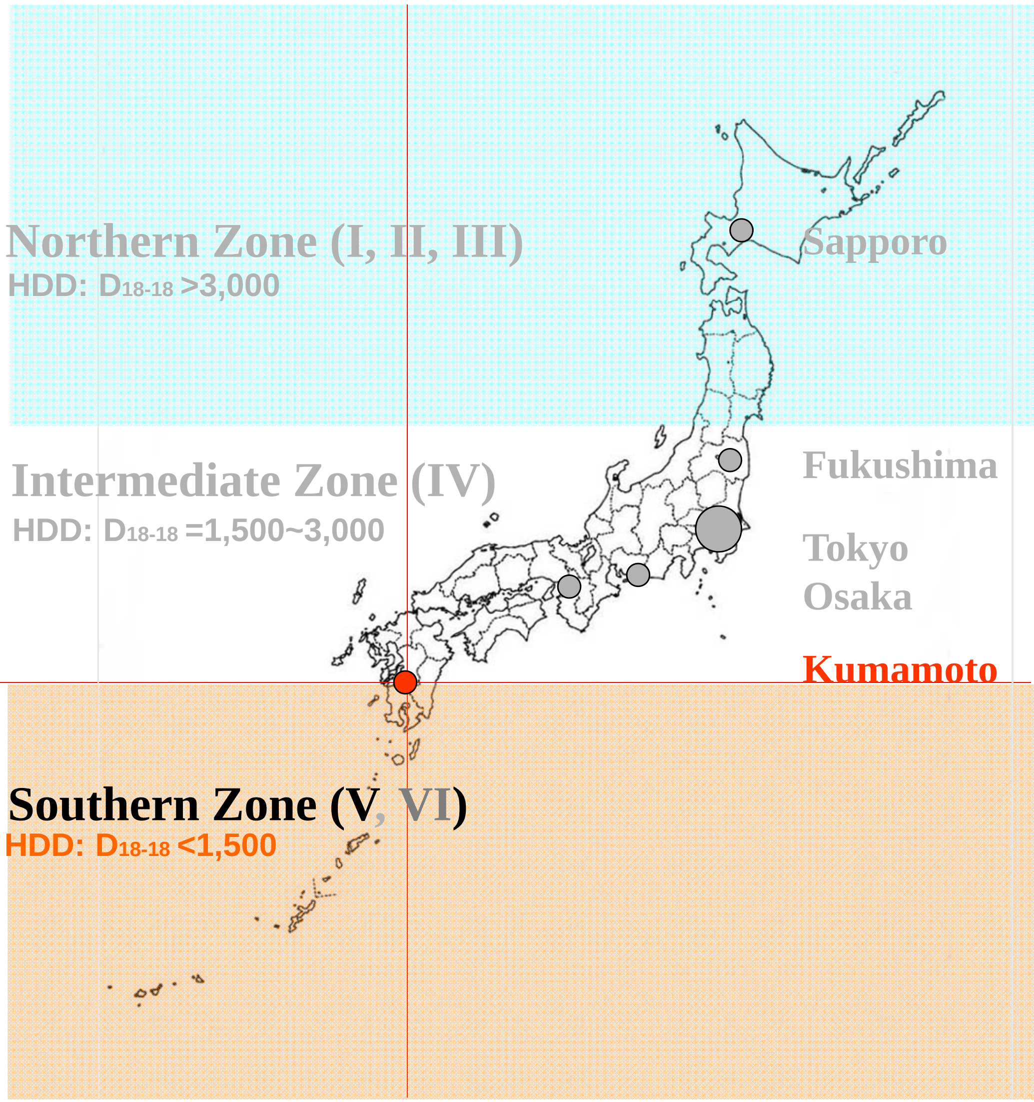
The 1st Home-for-All (Oct. 2011), built within a temporary housing site in Sendai

# Kumamoto Earthquake

April 14~, 2016

**Casualties:**
（as of Apr. 28, 2016）

Deaths ： 49p
Missing ： 1p
Injured ： 1,496p

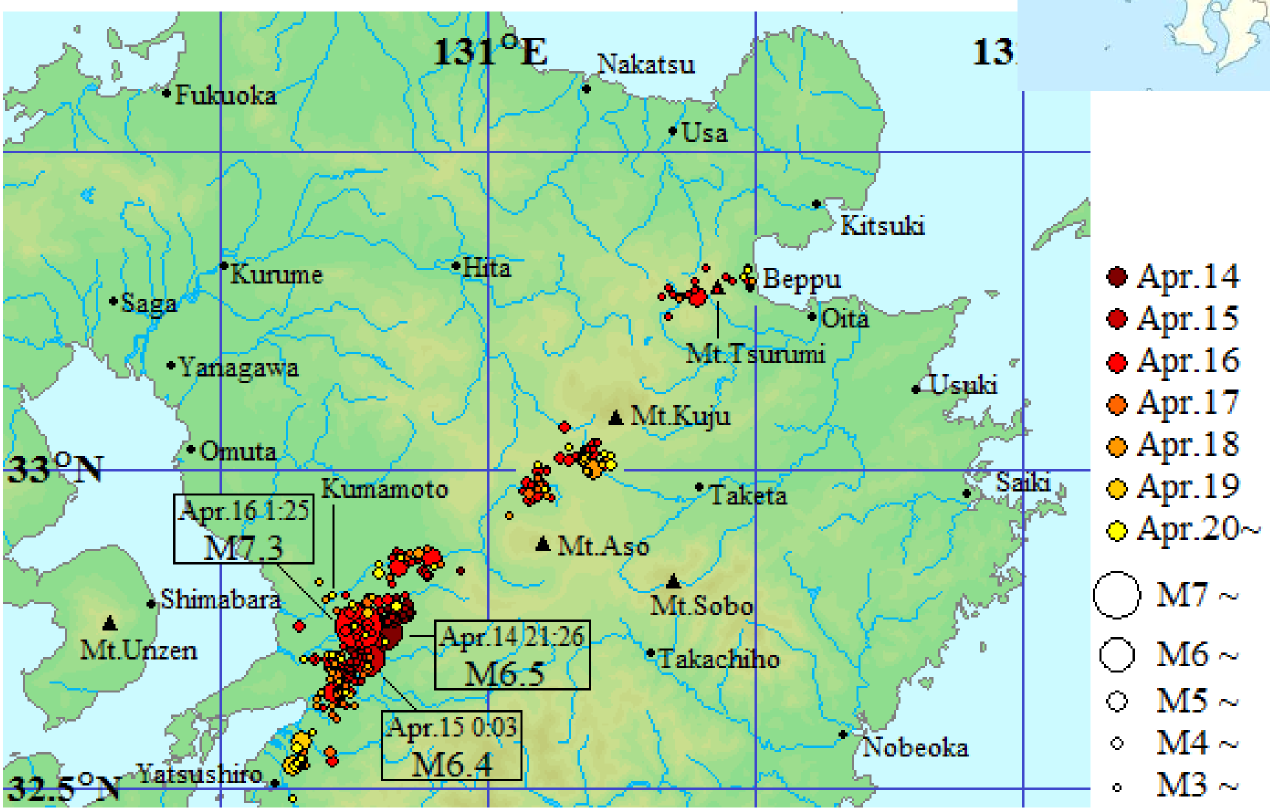







# Kumamoto Earthquake Apr.14 ~, 2016

No Tsunami, but frequent severe aftershocks



# Kumamoto Earthquake Apr.14 ~, 2016





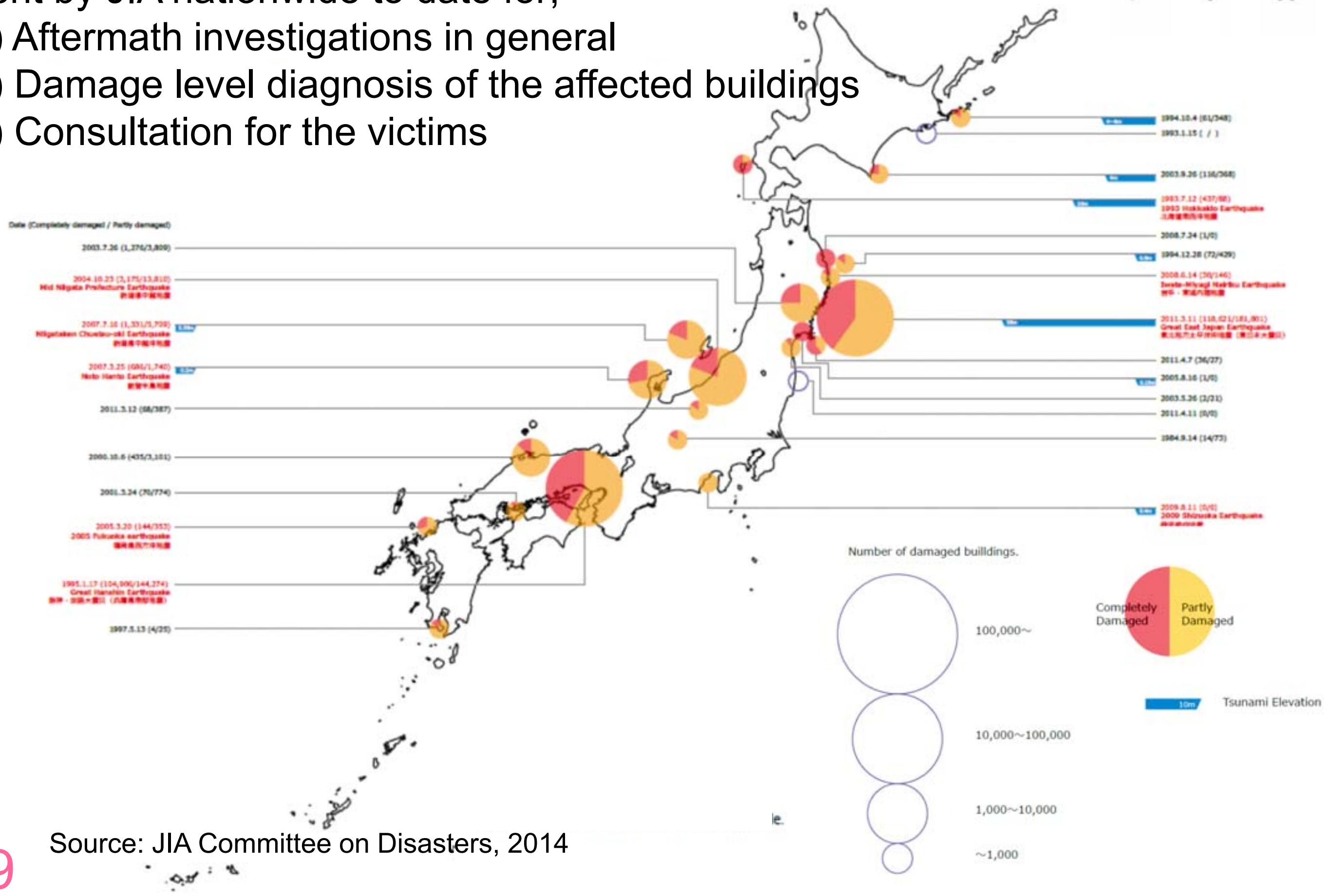

# Mt. ASO's explosive eruptions

A series of explosive eruptions at Mt. Aso's Nakadake Crater occurred at 21:52 on 7 October and 01:46 on 8 October, 2016, after a period of deformation was detected. The last similar eruption was recorded 36 years ago.

The volcanic ash fell as far as 320km away from the crater (see below the Aso City covered by ash).


# Emergency Architects for disaster relief

sent by JIA nationwide to date for;
1) Aftermath investigations in general
2) Damage level diagnosis of the affected buildings
3) Consultation for the victims

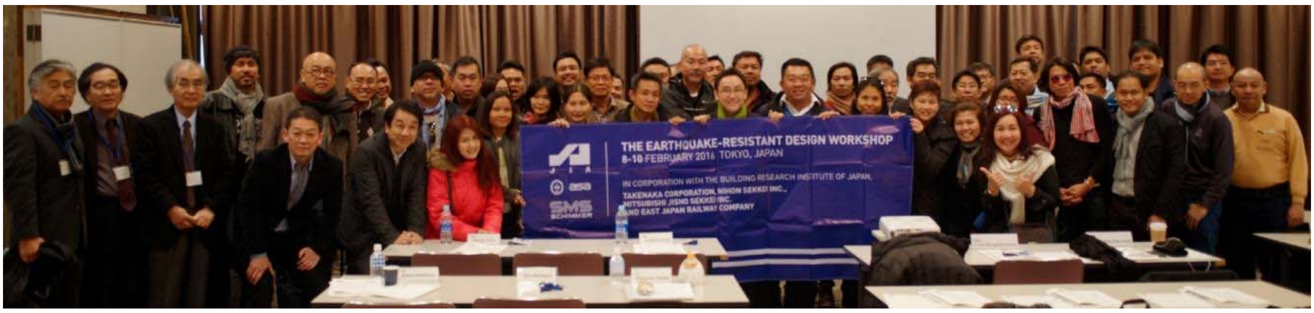



Source: JIA Committee on Disasters, 2014



# International Workshops about seismic-proof design

February 2016: The Earthquake Resistance Design Workshop in Tokyo for Thai architects.




March 2016: The first Iran-Japan International Workshop in Tokyo on Architectural and Urban Design for erthquaque.



*Organized and moderated by Kazuo IWAMURA, FJIA*

# 2.2 Daily Disasters

In Japan, domestic accidental death toll amounts more than three times as much of traffic accident.

↓

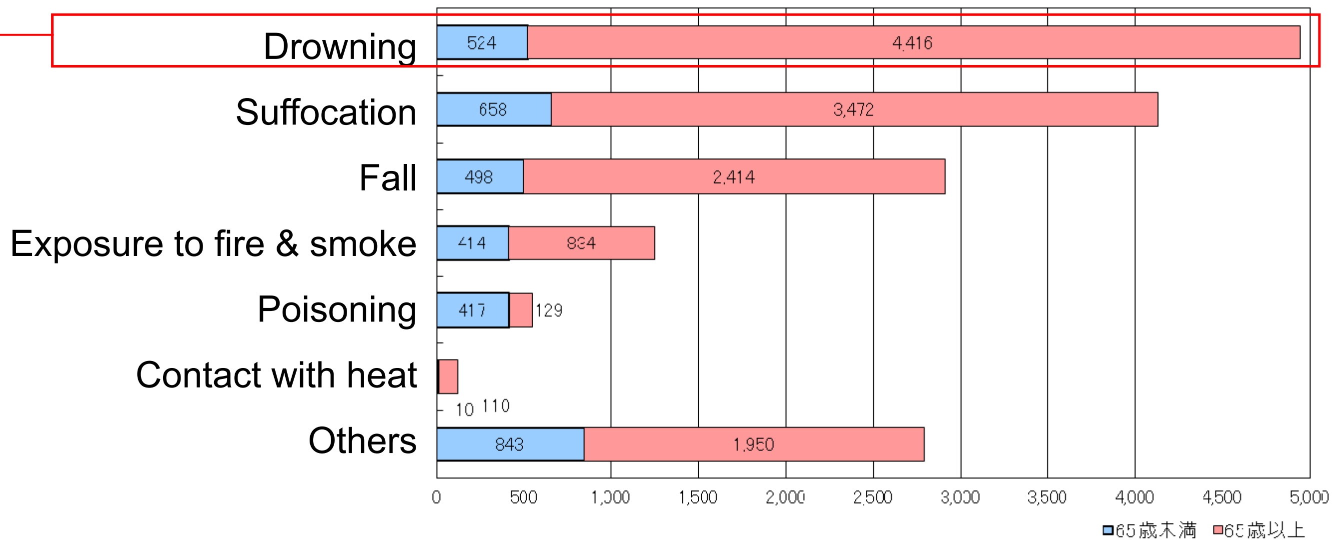
This should be called “Daily Disaster.”

↓

The key architectural solution is providing a whole house with high thermal insulation to relax the Indoor Heat Shock in existing old houses.

## Annual death toll of domestic accidents in Japan (2011)

**Total：16,722p,** of which 13,325p（79.7%）are seniors (>65)




**Death toll of accidental drowning： 4,941p（seniors：4,416p, 89.4%）**

＜Reference＞ Annual death toll of traffic accidents in 2011:
4,664p (seniors: 2,291p, 49.1%) >3,904p in 2016

Death toll of drowning in bathtub has been rapidly increasing in existing old houses, while that of traffic accident became a half during 1995～2012.

The major cause of this accident is considered:

Indoor Heat Shock,

due to the intense temperature difference between

①living room (24℃),

②undressing room (14℃) and

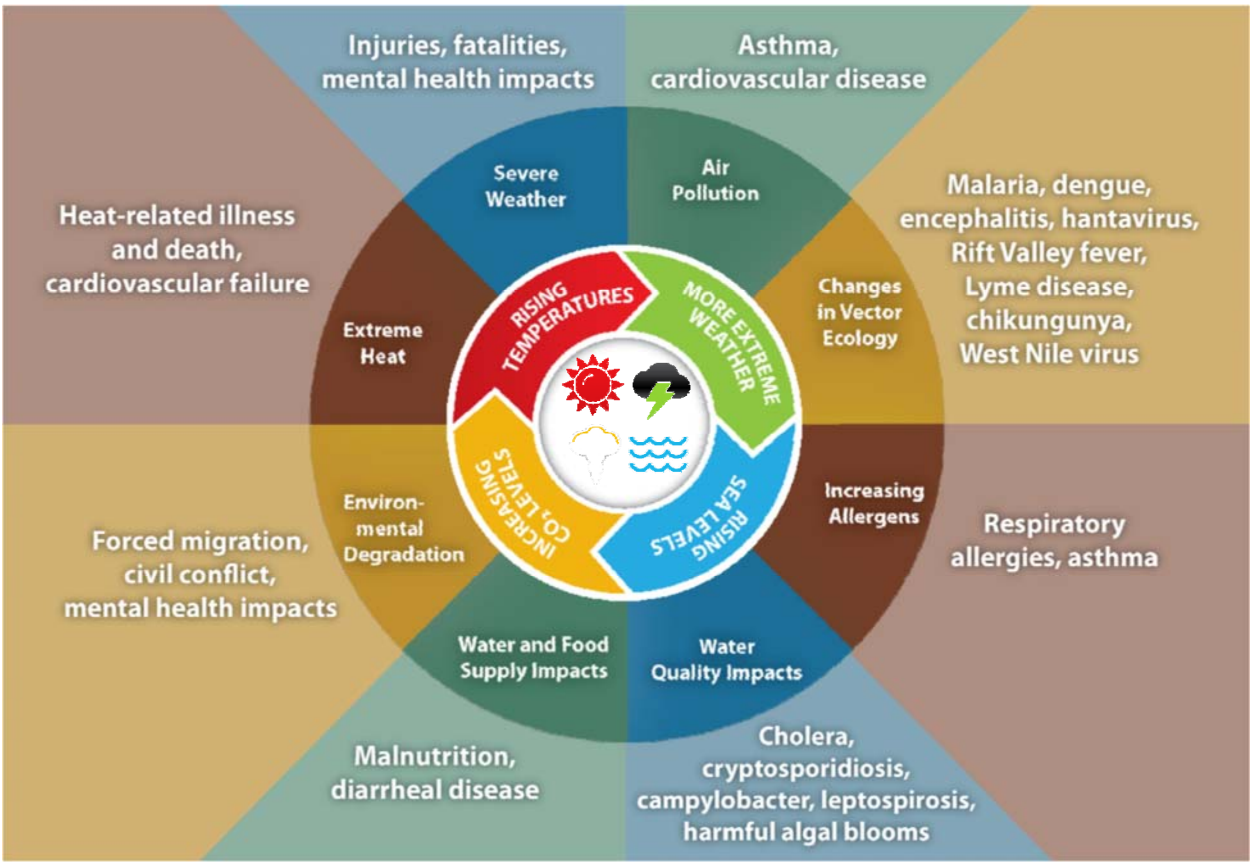
③bathtub (42℃),

which causes sudden change of blood pressure, and consequently stroke or cardiac failure.

High thermal insulation of the whole house is proved very effective to prevent such accidents.



# Impact of Climate Change on Human Health




*Source:* https://www.cdc.gov/climateandhealth/effects

# 3. Methodological Approach towards Resilient Built-Environment



## 3.1 Trigger

EARTH SWEET HOME
環境共生住宅

Iwamura et al. started developing so entitled "Environmentally Symbiotic Housing" as a national initiative of Japan in collaboration with governments, academia and industry in the year of 1990. The trigger was the Japanese cabinet's project in view of coping with the Global Warming (1990). Since then as ever, 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 along a cyclic sequence of time,

1) In ordinary time,
2) At the disaster and
3) In the aftermath.

# 3.2 Life Continuity Plan (LCP)

Given the above, it must be recognized that we are always confronted with disasters both “Occasional” 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 as follows;

*“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 proposed a similar initiative, replacing “Business” by “Life,” namely “Life Continuity Plan (LCP)” to take care of the holistic planning and design of resiliently sustainable housing and community.



## Life Continuity Plan (LCP)

Basic Frame of Housing for Human Security

| Phase | Items | Housing Level | | Community Level | |
|---|---|---|---|---|---|
| | | Detached | Collective | Neighborhood | Region |
| 1. Ordinary Time | Physical Health | | | | |
| | Physical Security | | | | |
| | Mental Health | | | | |
| | Peace of mind | | | | |
| | Crime Prevention | | | | |
| | Maintenance | | | | |
| | Periodic Inspection | | | | |
| 2. At the Disaster | Place of Refuge | | | | |
| | Energy Sources | | | | |
| | Energy Supply | | | | |
| | Tap Water | | | | |
| | Sewerage System | | | | |
| | Toilet | | | | |
| | Traffic | | | | |
| 3. In the Aftermath | Place of Refuge | | | | |
| | Energy Sources | | | | |
| | Energy Supply | | | | |
| | Tap Water | | | | |
| | Sewerage System | | | | |
| | Toilet | | | | |
| | Traffic | | | | |
| | ICT | | | | |
| | Provisions | | | | |

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 ordinary time, at the disaster, and in the aftermath, which are always cyclically repeated).

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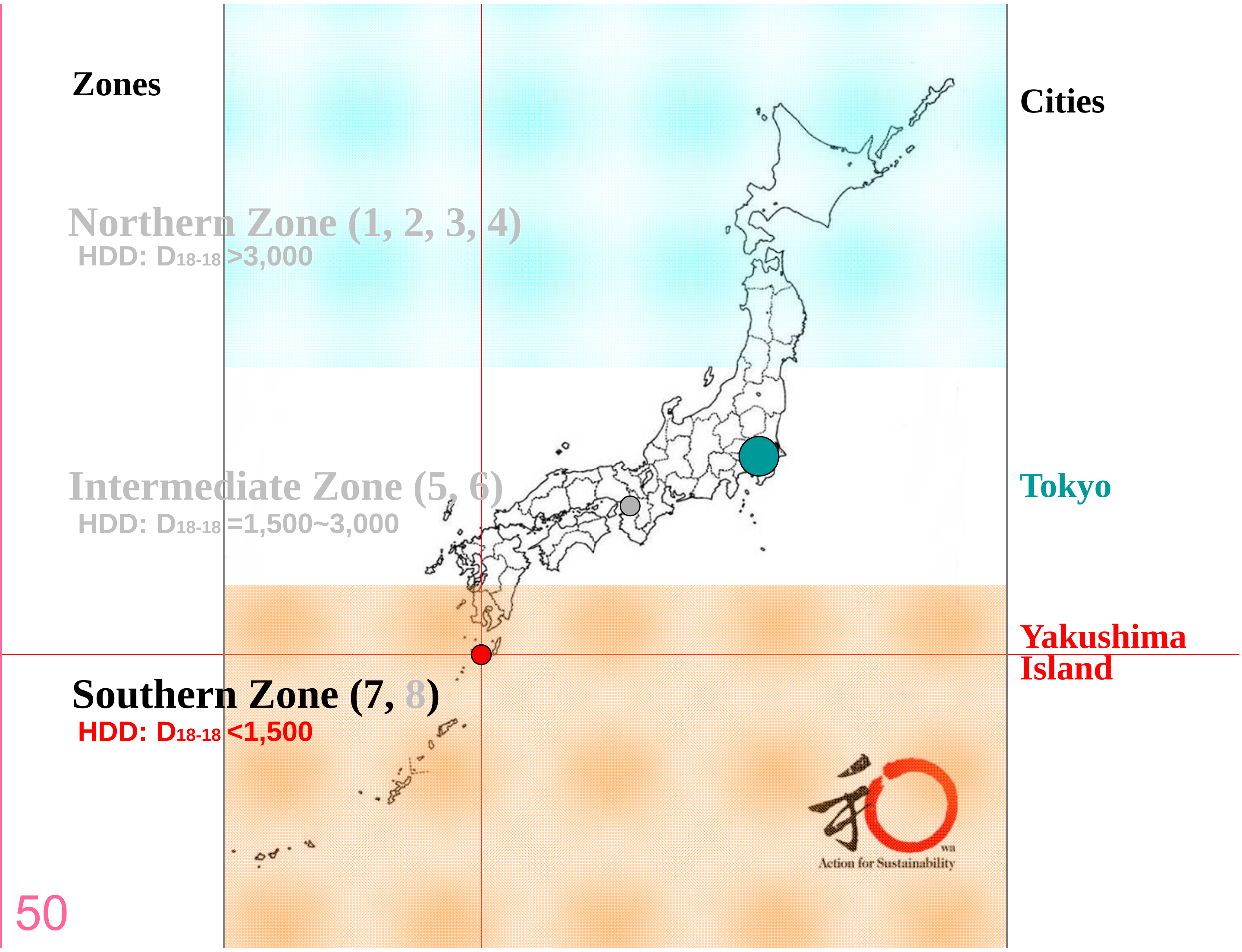
# 4. Implemented Practice

## Yakushima Symbiotic Housing

designed for
passive & indigenous resilience

by
IWAMURA Atelier Inc.
2001-2006

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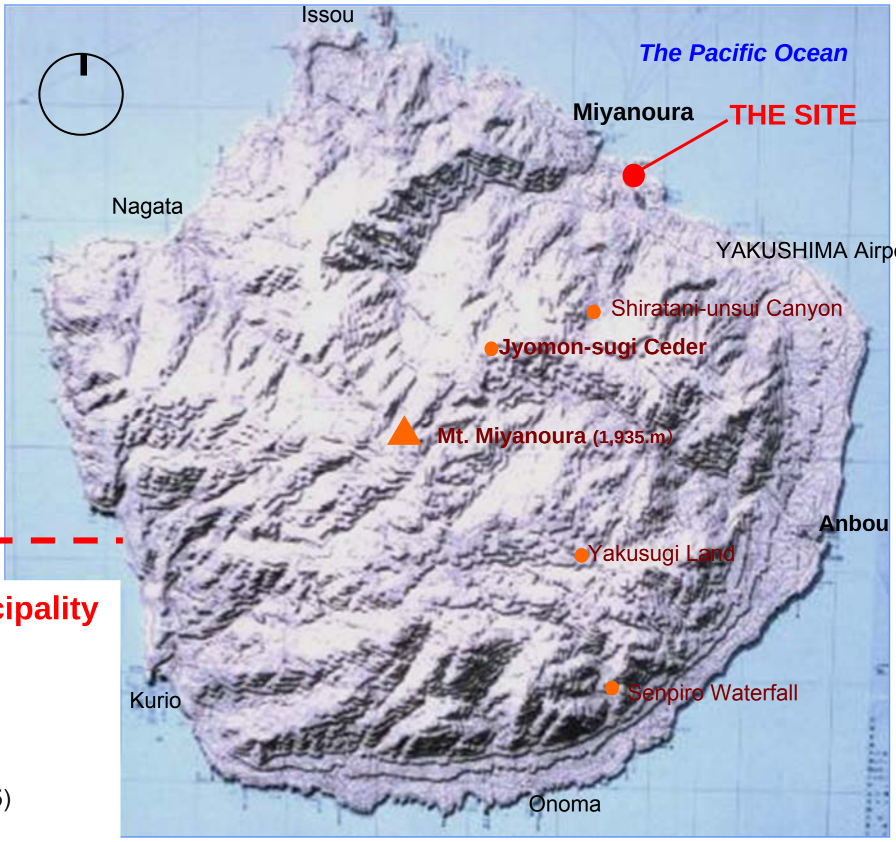
# Location


## Yakushima Island Municipality

Location:

Long. 130° 34'E
Lat. 30° 25'N

Area: ca. 503km$^2$

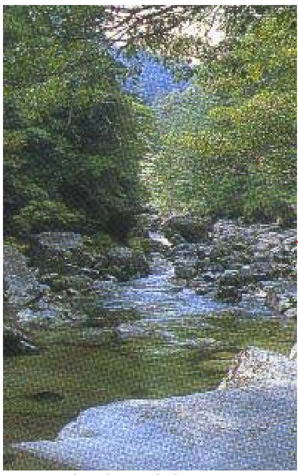
Population: 13,761 (as of 2005)

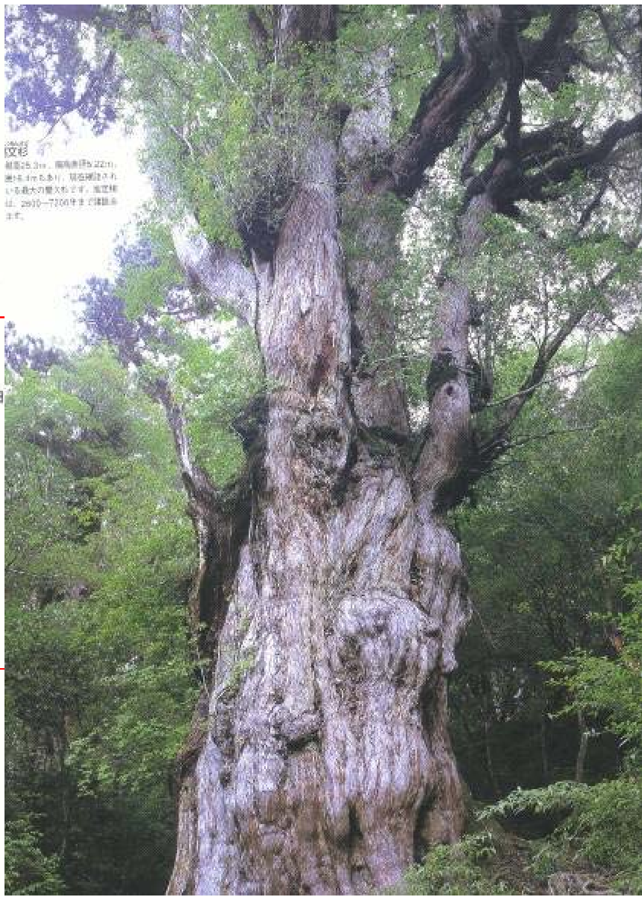


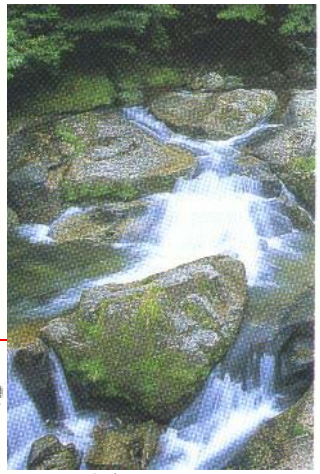


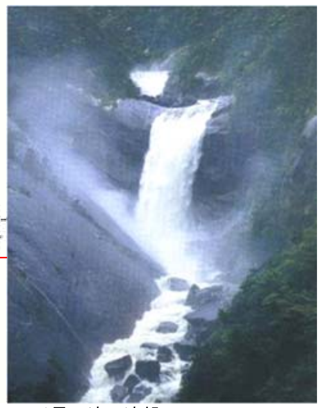
# Nature of Yakushima: *World Natural Heritage*


■小花之江河の眺め


■ﾔｸｽｷﾞﾗﾝﾄﾞ内の清流

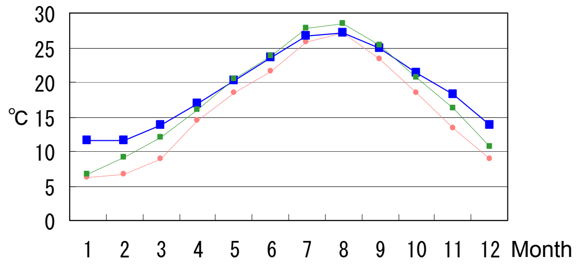

■Jomon Cedar Tree: 7,000 years old


■白谷雲水峡


■千尋の滝の遠望

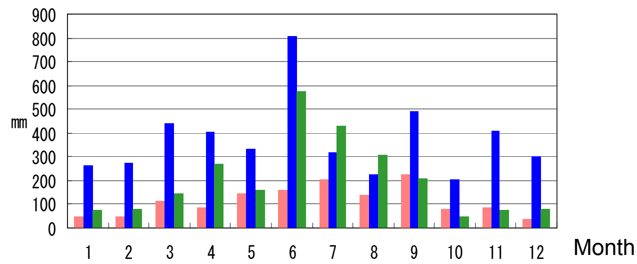
# Local climate

### TEMPERATURE




Annual Mean Temperature：
**19.14℃**

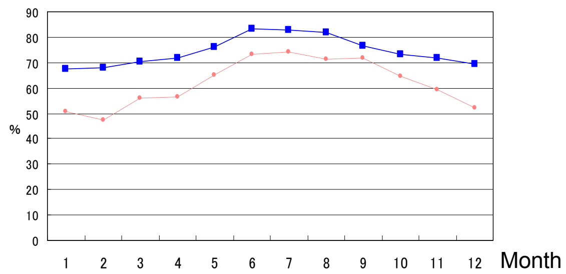
### PRECIPITATION




Annual Mean Precipitation：
**4,488 ㎜**

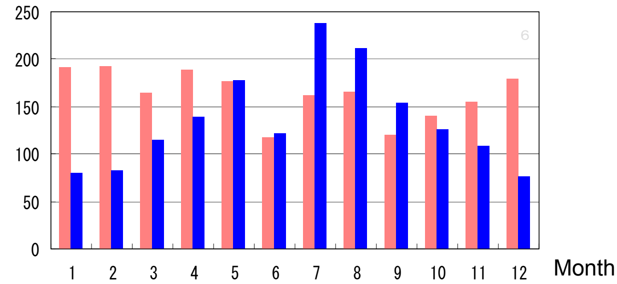
YAKUSHIMA TOKYO KAGOSHIMA

### HUMIDITY




Annual Mean Humidity：
**74.35%**

### HOURS OF SUNSHINE




Annual Mean Hours of Sunshine：
**1,627 hr**

Source：AMEDAS Data by the Meteorological Agency (1993～97)





# Existing vernacular settlement in Nagata on the western shore

# Conceptual design guidelines

**1. 太陽と暮らす**
Live with the sun

- 太陽エネルギーを利用する
- 適切な断熱と日射遮蔽を行う
- 適切な廃熱を行う
- 内外に影をつくる
- 土面を確保し、しつらえを工夫する
- 北側空間を有効利用する

**2. 水と暮らす**
Live with water

- 排水する
- 雨を避ける
- 雨水を利用する
- 保水力を高める
- 節水・水質浄化に寄与する

**3. 風と暮らす**
Live with wind

- 空気の流れをつくる
- 風力エネルギーを利用する
- 強風・塩風害に対応する

**4. 資源と暮らす**
Live with resources

- 省エネルギー設備機器を採用する
- 躯対構造を長持ちさせる
- ライフスタイルの変化に対応する
- リサイクル資材・建材を用いる
- 廃棄物を削減する
- 地場産材を積極的に採用する

**5. 生き物と暮らす**
Live with creatures

- 表土の流出を防止する
- 薬剤を過剰に利用しない
- 水と緑の軸をつくる
- 多様性を確保する
- 貴重種・希少種の保護に配慮する
- 多孔質な空間を確保する

**6. 地域社会と暮らす**
Live with local community

- 界隈を引き継ぐ
- 伝統的住いに学ぶ
- 伝統的暮らしに学ぶ
- 人と人の交流を進める
- 家づくりに参加する
- まちづくりに参加する
- リサイクルマーケットを設置する

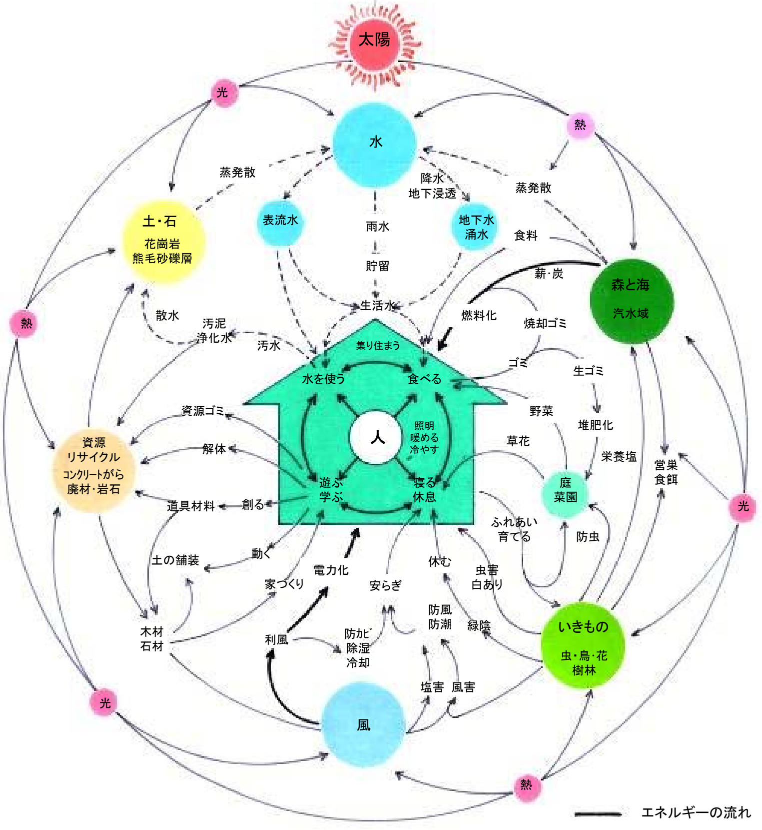
**7. 自然と暮らす**
Live with the nature

- 生き物とふれあう
- 音・香り・感触を楽しむ
- 緑化によって、熱環境の質を向上する
- 原風景を引き継ぐ

**8. 安心して暮らす**
Live safe

- 利用者の特性に配慮する
- 白ありの被害に対応する
- 安全な材料を用いる
- カビ・結露を防ぐ
- 非常時に備える

■屋久島環境共生住宅の流れと循環モデル図




エネルギーの流れ
水の流れ
物質の流れ







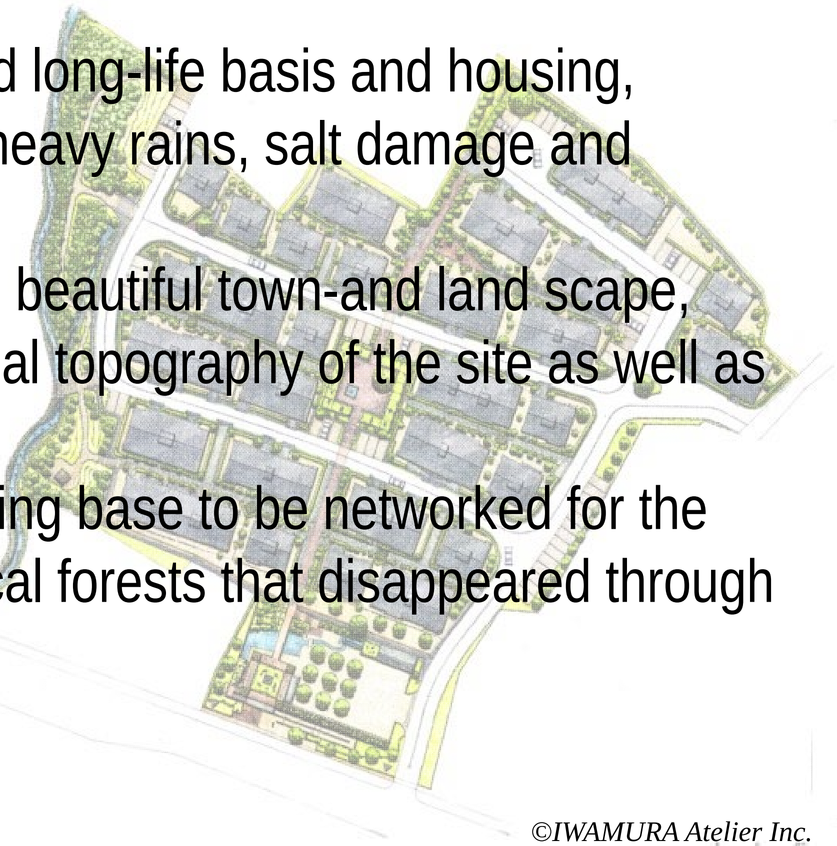
# Yakushima Symbiotic Housing

- **Public Leasehold Housing**
  - 50 Dwelling Units
  - Public Facilities
  - Commons + Parking
- **Site area: 19,750 m$^2$**

EARTH SWEET HOME
環境共生住宅

# Major strategies of Yakushima Symbiotic Housing -1

1) Provision of safe and long-life basis and housing, resisting typhoons, heavy rains, salt damage and termites
2) Creation of safe and beautiful town-and land scape, respecting the original topography of the site as well as the local life-style
3) Provision of a greening base to be networked for the restoration of the local forests that disappeared through exploitation to date





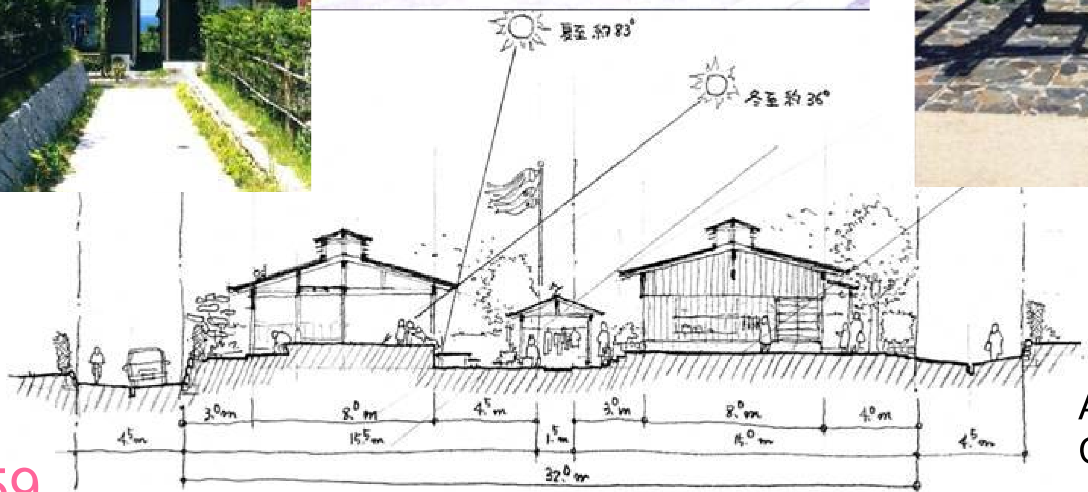


# Major strategies of Yakushima Symbiotic Housing -2

4) Housing development using the indigenous resources of the Yakushima island
5) Provision of a variety of housing types based upon the simple and flexible timber structure
6) Consideration of the property maintenance through participatory initiatives of the residents

for Human Security and Resilient Sustainability

# Townscape for the Human Security




A Typical
Cross Section





# Common paths for the residents

*as of August 2004*

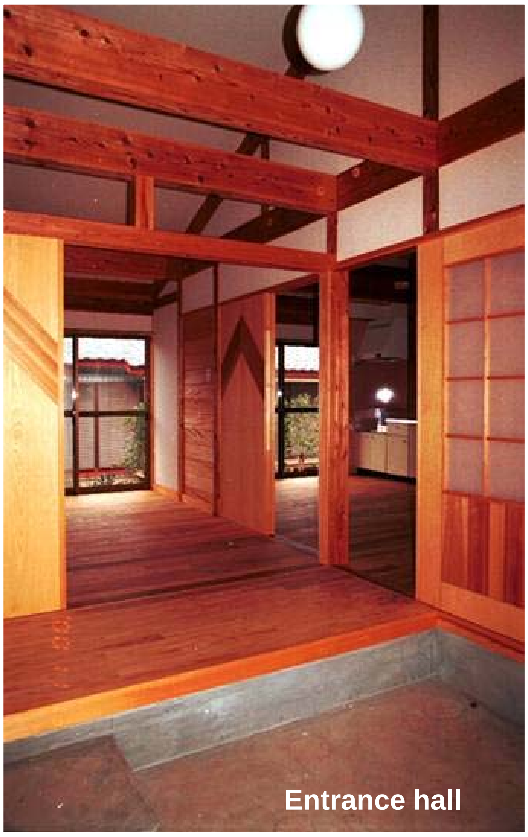
For the neighborhood exchange as well as evacuation route at disasters

# Indoor and outdoor relationship

A typical block (model)

-Traditional closed housing layout to protect each other against typhoon's strong wind

-Open interior for providing flexibility and natural ventilation



Entrance hall





# Interior solutions of passive design

*As of October 2000*

■Upward View toward the Upper Roof

■Tatami, Cedar Flooring and Recycled Charcoal for Humidity Control

# Central Square for provisional refuge *as of August 2004*

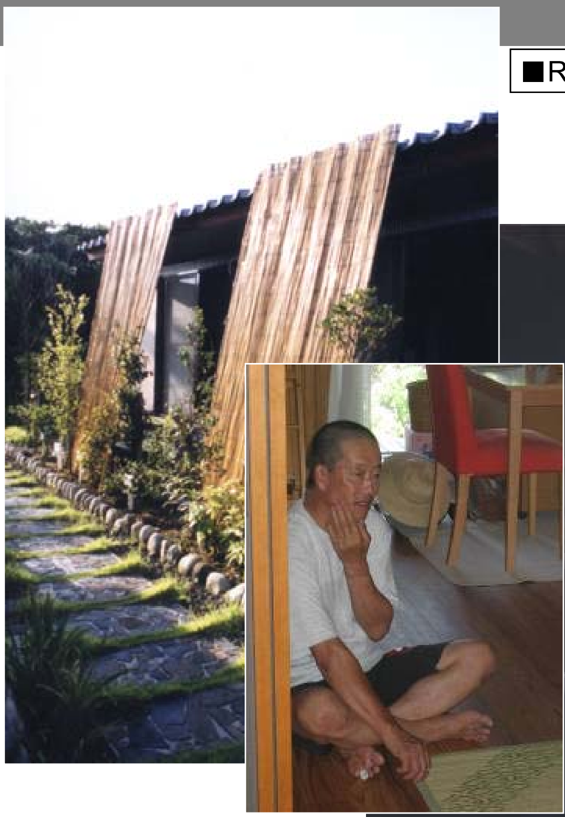


# Neighborhood’s Meeting Hall as an indoor refuge

# Occupants' intervention

*as of August 2004*

■Resident's initiative to mitigate harsh day-light in summer



■An indoor scene of post-occupancy in summer





# New resilient village, learned from the heritage

# <Reference-1>

Well known "Footprint" is metaphorically used to symbolize the negative impacts,
while "Handprint" symbolizes positive and innovative management that contributes to the sustainable development.

Current Footprint approach is focused on the negative impacts to individual, organization or states.

Ecological Footprint

On the other hand, Handprint means to identify, measure and evaluate the positive sustainable impacts including social and economic levels.

Handprint

HARVARD T.H. CHAN School of Public Health

shine



# <Reference-2>

- Wasting resources
- Generate waste
- Emissions
- Social impacts
- Others

Decrease Footprint

- Quality of life
- Recognition of sustainability
- Quality of eco-system
- Social benefits
- Others

Increase Handprint

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# 5. Conclusion

1) Japan, similar to other Asian countries, has been experiencing the frequent difficulties physically, environmentally, economically and socially, due to a variety of natural and occasional disasters including typhoons & earthquakes, as well as the daily indoor disasters.

2) Accordingly, short-, mid- and long term effective relief measures should be taken to cope with them, especially the relevant preparedness measures for predicted future disasters.

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# 5. Conclusion (cont'd)

3) In this regard, a cyclical design process for the human security must be taken into consideration as the highest priority involving all the stakeholders beyond simply being "Green" or "Smart."

4) To this end, our collective efforts through communal and local solidarity will be the very base towards; Integrated Resilience of the Built Environment for Human Security.

# 5. Conclusion (cont'd)

5) Consequently, it describes the capacity of those to function, so that the people living and working there, particularly the poor and vulnerable, survive and thrive no matter what stresses or shocks they encounter.

6) Such a goal towards human security must be the top priority that formulates the social responsibility of our profession worldwide;

Beyond Disasters
Through Solidarity
Towards Resilient Sustainability

内気萌生
外気成形
内外相乗
風水自生

Thanks for your attention.

Prof. Kazuo IWAMURA
iwamura@iwamura-at.com
http://www.Iwamura-at.com