Challenges to a Sustainable Society in Japan

18 NOV 2007

Yasumitsu Watanabe
Shimizu Corporation
CONTENTS

1. Construction Market in Japan
2. Recent Climate Change
3. Predicted Natural Disasters and Countermeasures
4. Contractor’s Contribution to a Sustainable Society
1. Construction Market in Japan
Construction Investment in Japan

- Total Investment
- New Construction
- Re-build
- Maintenance

Fiscal year

 Const. Investment (bil. €)

1990 2000 2010 2020
Big Domestic Project (1)

Loop Highways in Tokyo

Tokyo - Yokohama 150km
Big Domestic Project (2)

Linear Shinkansen

Experimental Line

TOKYO

OSAKA

NAGANO

NAGOYA

NARA

LI NEAR CHUO-SHI N KANSEN

TOKYO

OSAKA

500km

TOKYO.OSAKA 2'33'. 60'
Big Domestic Project (3)

Radioactive Waste Disposal

Low Level Waste

![Low Level Waste Image]

50-100m

2011~2050
Const. Budget : 1 bil.€

High Level Waste

![High Level Waste Image]

300m

2025~2100
Const. Budget 12 bil.€
2. Recent Climate Change
Natural Damage Risk in the World

Metropolis Risk Index

- Natural Disaster
- Housing Fragility
- Economic Magnitude

167
San Francisco

42
New York

100
Los Angeles

710
Tokyo

Yokohama

10
Earthquake and Tsunami Disasters (1)

Events with more than 1000 casualties

- **Asia**: The region with the highest number of events, particularly in the 1980s and 1990s.
- **America**: Not as high as Asia but still significant, especially in the 1980s.
- **Europe**: The lowest among the three regions, with a few events in the 1950s and 1980s.
- **Others**: A mixed region with events scattered throughout the decades.
Earthquake and Tsunami Disasters (2)

**Ratio of events**
- Total: 25
- Asia: 64% (16)
- America: 16% (4)
- Europe: 12% (3)
- Others: 8% (2)

**Ratio of casualties**
- Total: 552,181
- Asia: 82% (496,656)
- America: 10% (62,392)
- Europe: 7% (42,300)
- Others: 1% (4,866)
Number of Earthquakes in the World

Number of events (More than M7)

Magnitude Above 6 and 7

Number of events (More than M6)

Above 7
Above 6
The Hanshin-Awaji Earthquake (1)

1995.1.17 5:46am
M7.3, Dead: 6,434
Lost: 62 bil.€
The Hanshin-Awaji Earthquake (2)

Shear Failure in Pier

Quay Movement by Liquefaction
The Hanshin-Awaji Earthquake (CG)
The Niigata-ken Chuetsu Earthquake

2004.10.23  17:56
M6.8 ,  Dead : 14
Lost : 19 bil.€

Dam Up by Landslide

Derailing of Shinkansen
Tsunami at Banda Aceh

2004.12.26 7:58am
M9.2, Dead: 220,000
Flood Disaster

Events of heavy rain (more than 50mm/h)
Floods at Omaru River

2004.8.30 3,790m³/ sec  2005.9.5 4,300m³/ sec

Design Flood Discharge : 4,400m³/ sec
(Return period : 200years)
3. Predicted Natural Disasters and Countermeasures
Predicted Coming Earthquake

- Tokyo
- Nagoya
- Shizuoka
- Osaka
- Hiroshima
- Nankai Trough
- Suruga Trough
- Tokai
- Tonankai
- Philippine Sea Plate
- Continental Plates
Damage Estimation of Tokyo Earthquake

Assumption: M7.3/ Winter/ 18:00/ Wind Velocity 15m/ s

<table>
<thead>
<tr>
<th>Burned House</th>
<th></th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Economical Loss</th>
<th>70 bil.€</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct Loss</td>
<td></td>
</tr>
<tr>
<td>Building</td>
<td>35 bil.€</td>
</tr>
<tr>
<td>Others</td>
<td>7 bil.€</td>
</tr>
<tr>
<td>Indirect Loss</td>
<td></td>
</tr>
<tr>
<td>Manufacture</td>
<td>24 bil.€</td>
</tr>
<tr>
<td>Time, opportunity</td>
<td>4 bil.€</td>
</tr>
</tbody>
</table>

Dead 11,000
## History of Seismic Design Codes

<table>
<thead>
<tr>
<th>Building</th>
<th>Earthquake</th>
<th>Bridge</th>
</tr>
</thead>
<tbody>
<tr>
<td>Static Lateral Force</td>
<td>1923/ M7.9 Great Kanto</td>
<td>Static Lateral Force</td>
</tr>
<tr>
<td>Quality &amp; Quantity of Wall</td>
<td>1948/ M7.1 Fukui</td>
<td>Liquefaction Assessment</td>
</tr>
<tr>
<td>Shear Reinforcement Detail</td>
<td>1964/ M7.5 Niigata</td>
<td>Modified Static Lateral Force</td>
</tr>
<tr>
<td>Ductility Design</td>
<td>1968/ M7.9 Tokachi Offshore</td>
<td>Dynamic Analysis (Recommended)</td>
</tr>
<tr>
<td>Limit Strength Design</td>
<td>1978/ M7.4 Miyagi-ken Offshore</td>
<td>Elastic &amp; Ductility Design</td>
</tr>
<tr>
<td></td>
<td>1995/ M7.3 Hyogo-ken Nambu</td>
<td></td>
</tr>
</tbody>
</table>
Aseismic Reinforcement - Building -

Strength

Ductility

Response

Osaka Chuo Kokaido
Steel Plate Bandage

Katsushika Harp Bridge
Aseismic Reinforcement
- Earth Dam -

Dike Width 7.3m ➤ 10m
Dike Volume 1.4 mil.m³ ➤ 2.37 mil.m³

Yamaguchi Dam
Aseismic Reinforcement - Cultural Property -

The Edo Castle Nakanomon gate
Tsunami (2)

Refuge Simulation
“Who controls the flood governs the nation”

1981.7 Kanda River
Underground River Plan

Flood in Urban Area (2)
Flood in Urban Area(3)

Imaigawa Retention Reservoir

Retention Reservoir beneath the Road
ID 10.8m  L=2000m  Capacity 180,000m³
4. Contractor’s Contribution to a Sustainable Society
CONTENTS

4.1 Contractor’s Ecology Mission

4.2 Clean Energy Business
  - LNG Power Station
  - Wind Power Station
  - Ocean Thermal Energy Conversion

4.3 Clean Development Mechanism
Ecology Mission in SHIMIZU

- CO₂ emissions that would be produced if all buildings were built to 1990 standards
- CO₂ produced by buildings constructed by Shimizu

Changes in the total volume of CO₂ produced:

- 1990: 18.55 million tons
- Fiscal 2006: 18.54 million tons (97.3% of 1990 emissions)
- 2010: 17.44 million tons (81.1% of 1990 emissions)

6% reduction in CO₂ emissions from 1990 to 2010
Clean Energy Business/ LNG

Natural Gas Chain in the World
Clean Energy Business/ Wind Farm

Wind turbine turnkey projects

Planning  Project  Design  Construction  Operation

Misaki Wind Park

Shimizu’s wind turbine engineering tools.
Clean Energy Business / OTEC

Ocean Thermal Energy Conversion

![Diagram of OTEC system]

NH₄(Gas) → TURBINE → GENERATOR → NH₄(Liquid)

NH₄(Evaporator) → CONDENSOR → NH₄(Liquid)

Thermal Difference btw. Surface & 1000m deep

Pilot Plant @ NAUL
Clean Development Mechanism

Developed Country

Government Power Company, etc

Developing Country

Credited Company

SELL

CREDIT

Money Technology

Emission Credit

Reduction

Greenhouse GAS Reduction enterprise

: Japanese CDM Project

Countries involved: Ukraine, Georgia, Armenia, Macedonia, Uzbekistan, Jordan, China, Vietnam, Thailand, Malaysia, Indonesia, Vietnam, Japan.
Europe    Japan

Sometimes Competitors
Sometimes Collaborators
for a Sustainable Society

Shimizu Corporation