Thailand Engineering EXPO 2013
"Technology for sustainable natural hazard mitigation"

Asian Engineering Technology for Disaster Management

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The 21st Century is the era of disaster.

Increase of Catastrophic Natural Disaster Events in Asian Countries

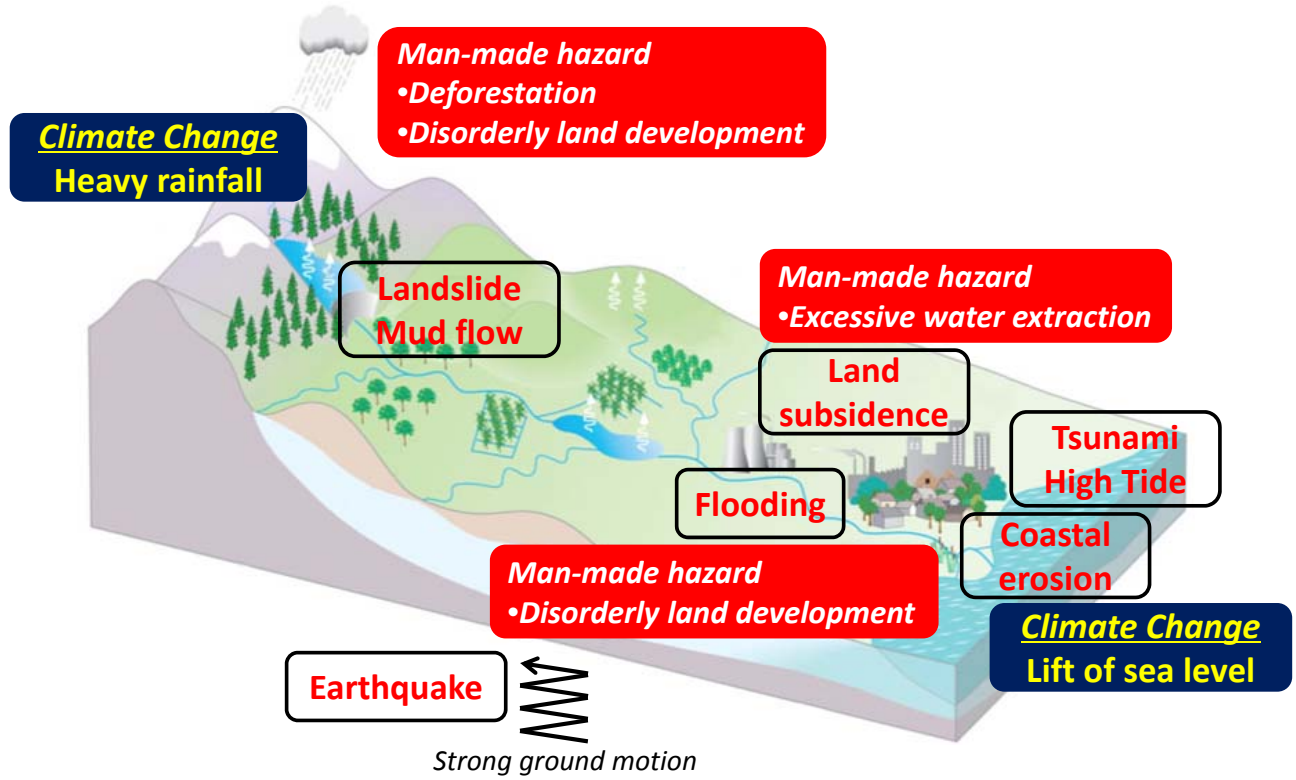
Earthquake/Tsunami

Flooding/Landslide/High Tide

Typhoon Haiyan in Philippine

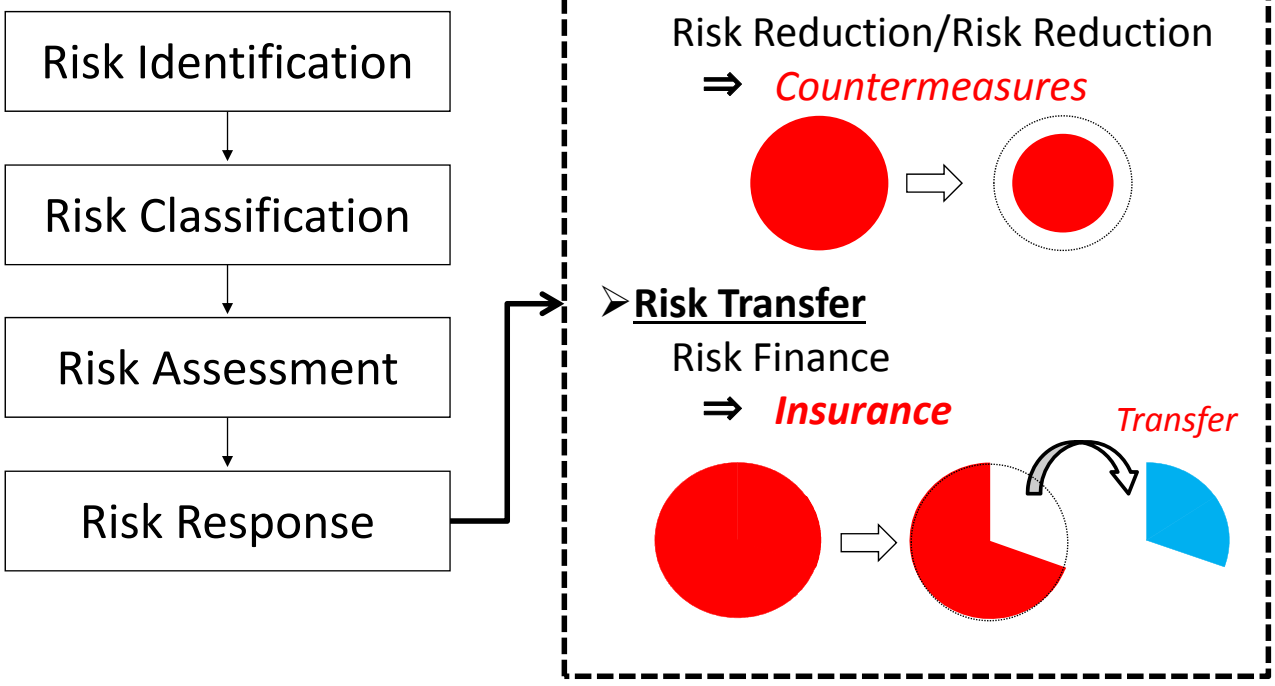
Nov., 2013

Natural/Man-made Disaster along River Basin in Asian Countries



Sources: WDR team based on World Bank, forthcoming d; Bates and others 2008.

Flow of Risk Management



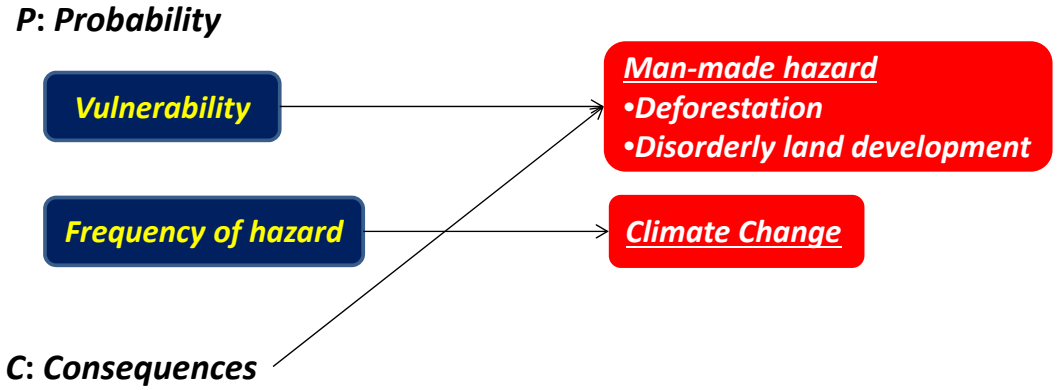
Def. of "*RISK*" in the discipline of engineering

Expected losses $$R = \sum_{i=1}^{J} P_i \times C_i$$

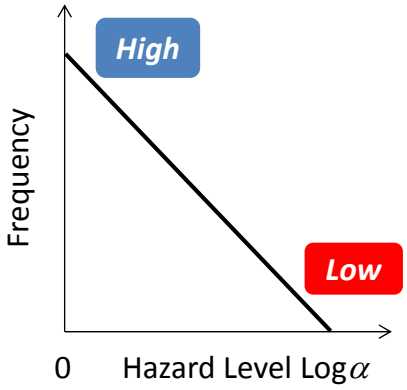
R : Expected loss (Risk)

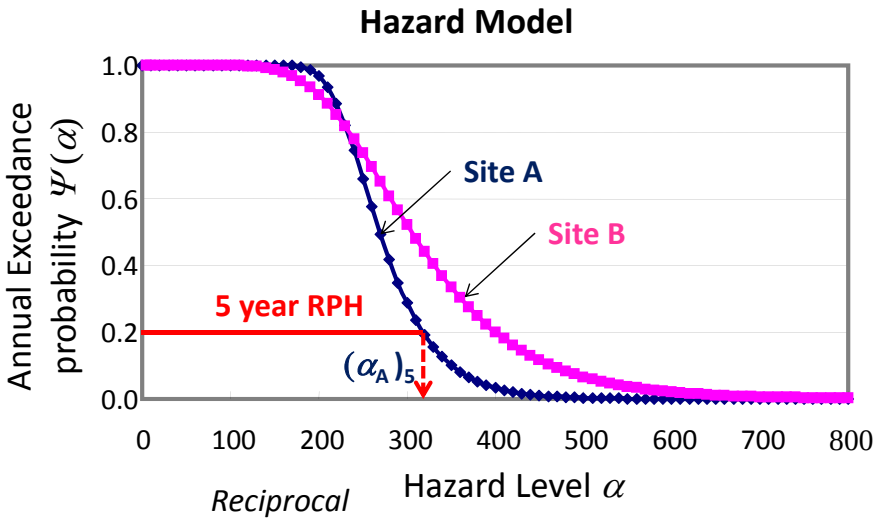
P_i : The probability of event i occurring

C_i : The losses incurred when the event i occurs



Natural Hazard Information





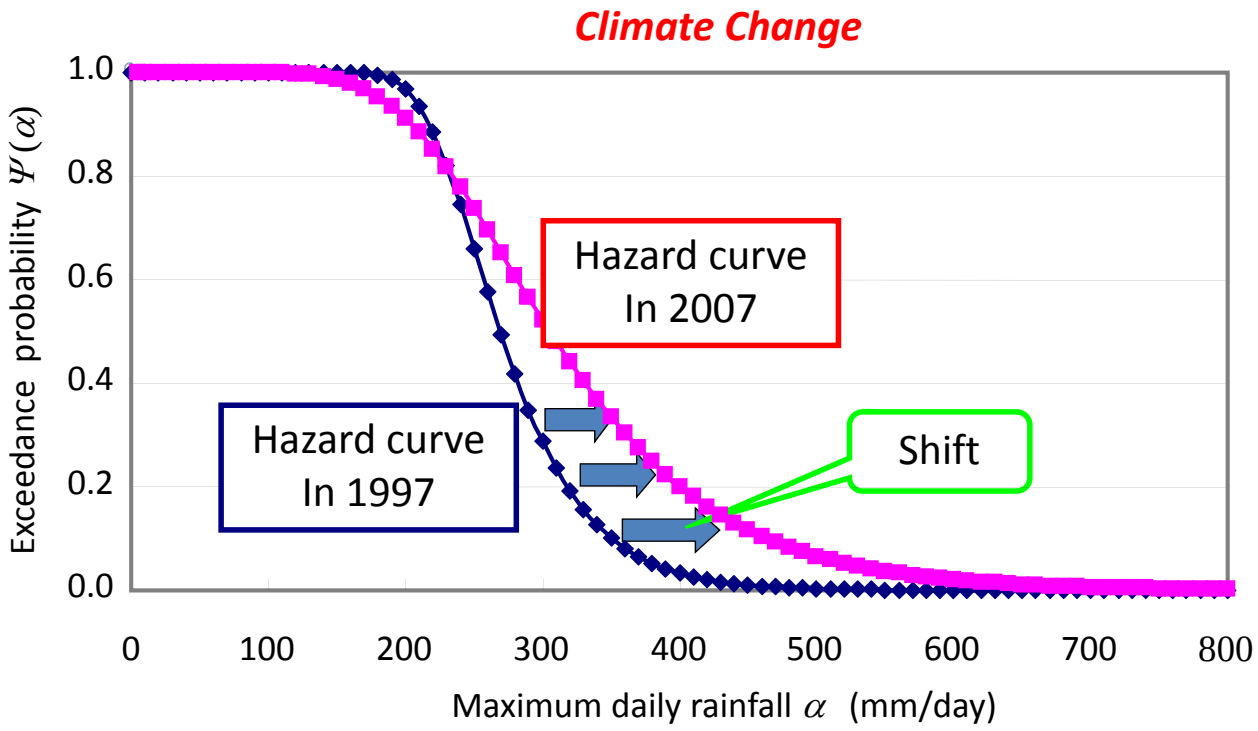
Examples of Hazard Level

- **Ground motion (Earthquake/Landslide)**
- **Rainfall intensity (Landslide)**
- **Height of tidal wave (Tsunami)**

$1/\Psi(\alpha)$: Return period of hazard level α

10 year-return period hazard?
100 year-return period hazard?
1,000 year-return period hazard?

Example of change of Rainfall Hazard（in Wakayama, Japan）



Landslide in Japan, National Road No. 168

Landslide in Japan, National Road No. 168

How to Mitigate Risk

Def. in the discipline of engineering

Expected losses $$R = \sum_{i=1}^{J} P_i \times C_i$$

R : Expected loss
P_i : The probability of event i occurring
C_i : The loss incurred when the event i occurs

***Strategy* 1: Reduction of P_i**

***Strategy* 2: Reduction of C_i**

What is the difference between ASEAN Countries and Japan on Development of Disaster Prevention Infrastructures?

Poor Development of Disaster Prevention Infrastructures in Japan

Late 19th Century — Memory of my grandmother
→Evacuation to the roof of house during flooding

Awareness of Disaster

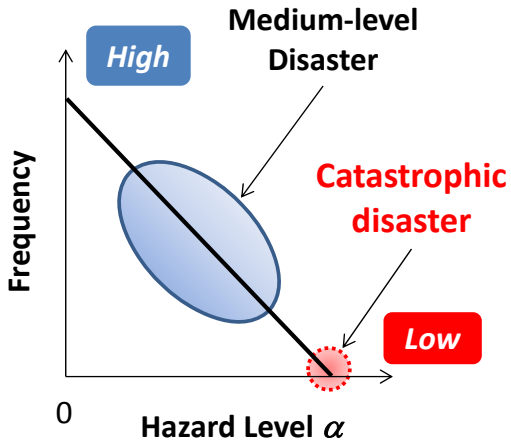
1960s — Memory of mine
→ Inundation of my house by typhoon

⇩ **Development of Disaster Prevention Infrastructures**

1995 Great Hanshin-Awaji Disaster
2011 Great Tohoku Disaster

Limitation of Conventional Design Concept

Difference between ASEAN Countries and Japan on Development of Disaster Prevention Infrastructures?



Comparison of Development level of Disaster Prevention Infrastructures at current situation

	Medium-level Disaster	Catastrophic disaster
ASEAN Countries	?/OK?	*N/A*
Japan	OK	*N/A*

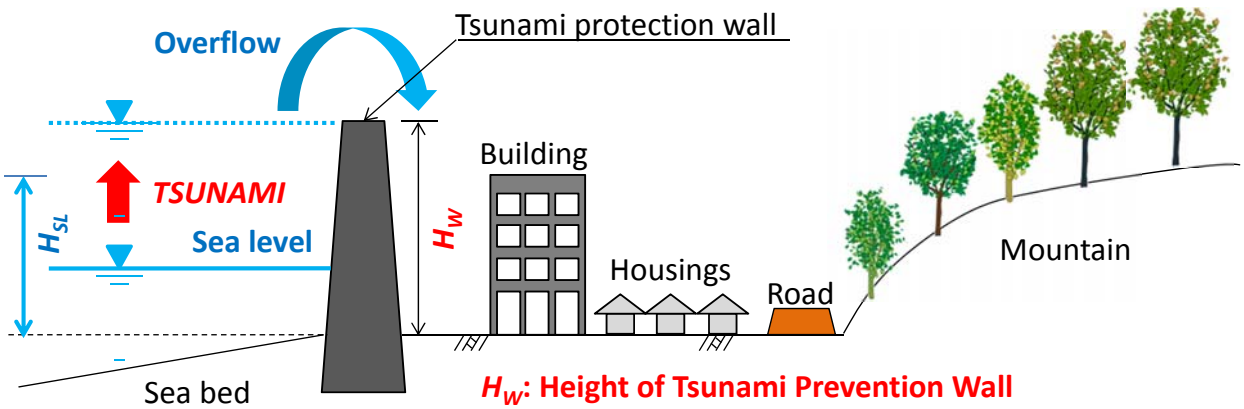
Examples of Hazard

- **Ground motion (Earthquake/Landslide)**
- **Rainfall intensity (Landslide)**
- **Height of tidal wave (Tsunami)**

Tsunami Disaster

Tsunami Protection Wall, Tarou-cho, Iwate Pref.

Tsunami Event



H_W: Height of Tsunami Prevention Wall

H_{SL}: Height of Sea Level

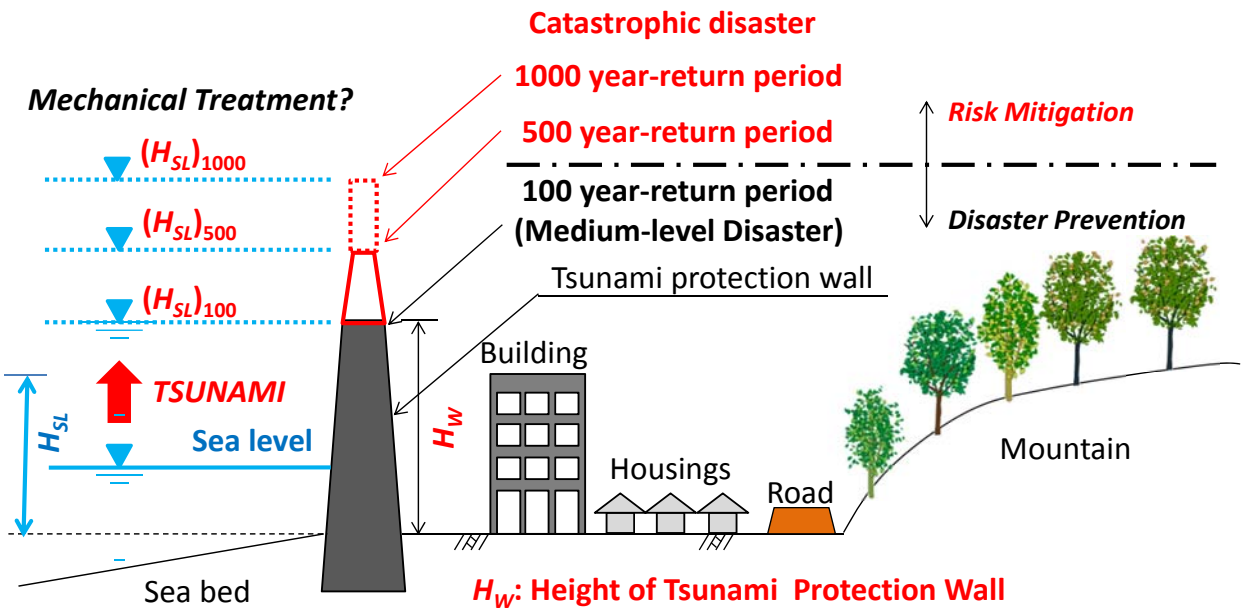
H_{SL}<H_W: Safety
(H_{SL}=H_W: Critical condition)

⇒ **Traditional Design Concept**

Height of Sea Level, H_{SL} is function of Hazard level α, which is pre-determined in design phase.

H_{SL}<H_W: Disaster ⇐ ***Limitation***

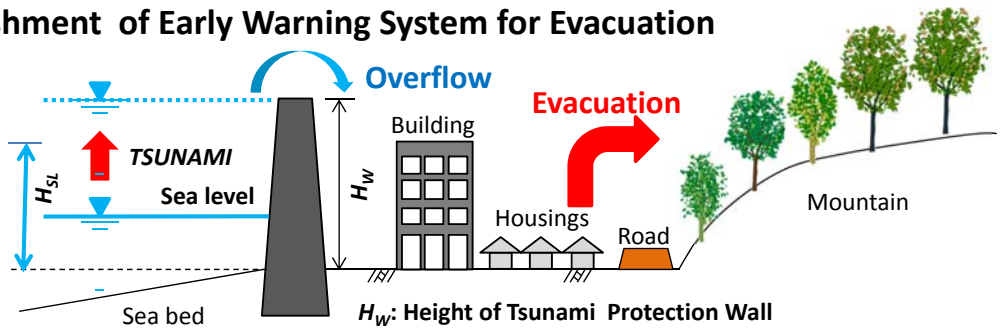
Traditional Design Concept Based on a Certain Hazard level α



Risk Mitigation/Recovery/Restoration

Response 1

Establishment of Early Warning System for Evacuation

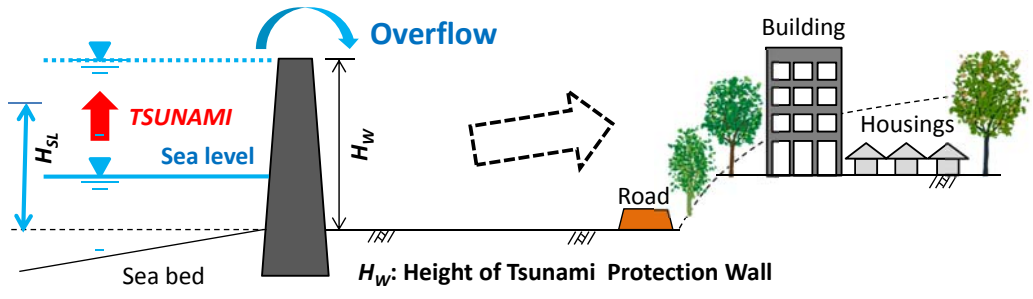


H_{SL}: Height of Sea Level

Awareness of Disasters

Response 2

Movement/Reconstruction of Commercial/Residential Areas



H_{SL}: Height of Sea Level

Approval of Residents

Disaster

	Main cause	Reconstruction
Kobe Eq. 1995	Strong motion	Swiftly (A few years)
East Japan Eq. 2011	Tsunami	Under investigation

Elapsed time *t*

Planning for Disaster Risk Mitigation

Interdisciplinary Knowledge

Development of Disaster Prevention Infrastructures

Engineering Knowledge

Evacuation

Awareness of Disasters

Recovery

Interdisciplinary Knowledge

Restoration/Reconstruction

Approval of Residents

In Kobe, most buildings were reconstructed at the same place as previous time.

However, what happened in Tohoku?

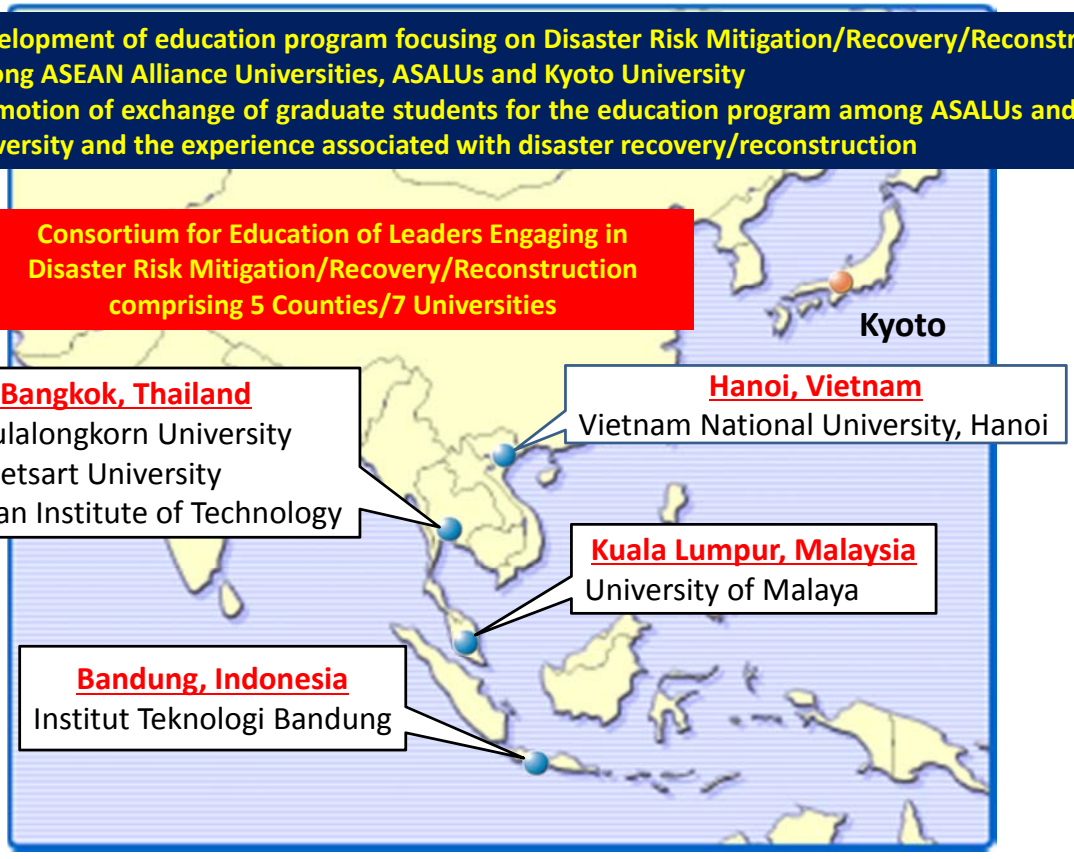
Collapse of Elevated Highway (The Kobe Earthquake 1995)

Tsunami Debris (The East Japan Earthquake 2011)

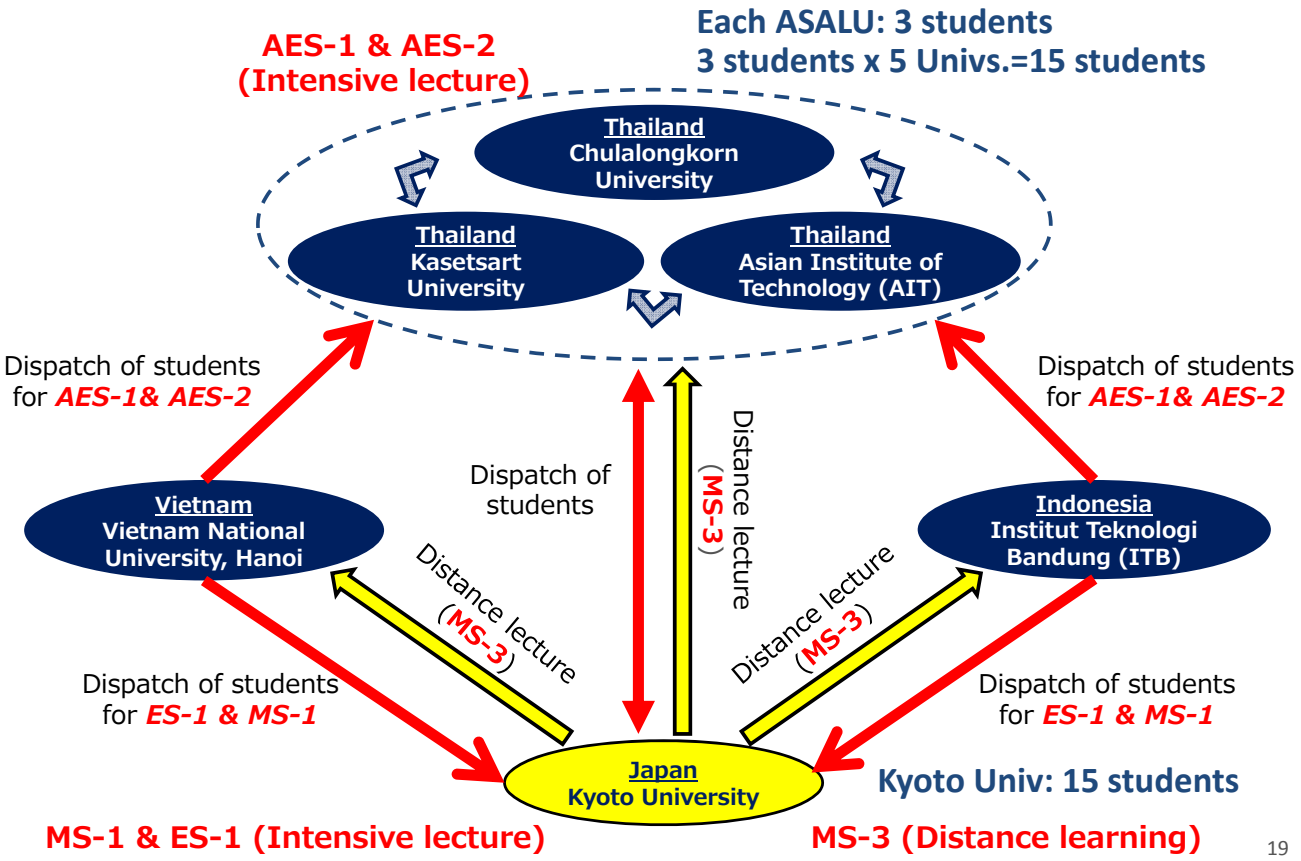
Scope of the Project

- **Development of education program focusing on Disaster Risk Mitigation/Recovery/Reconstruction among ASEAN Alliance Universities, ASALUs and Kyoto University**
- **Promotion of exchange of graduate students for the education program among ASALUs and Kyoto University and the experience associated with disaster recovery/reconstruction**

Consortium for Education of Leaders Engaging in Disaster Risk Mitigation/Recovery/Reconstruction comprising 5 Counties/7 Universities



IMPLEMENTATION Program in 2013



Contents of Education Program in 2013

Aiming at offering Interdisciplinary knowledge to accept students who have diverse background

Name of Subject		Feature	Key words
ES-1	Environmental Issues for Disaster Recovery	Combination of Environment, Geo-Environment and Engineering knowledge	•Treatment of disaster debris for recycling/reuse •Management of geo-environmental contamination
AES-1	Engineering Seminar on Disaster in ASEAN Countries (1)	Disasters in ASEAN Countries	Earthquake, Tsunami, Landslide
AES-2	Engineering Seminar on Disaster in ASEAN Countries (2)	Disasters in ASEAN Countries	Flooding, Coastal Erosion, Land subsidence
MS-1	Disaster and Health Risk Management for Liveable City	Combination of Medical, Environment and Urban planning knowledge	• Human brain function and behavior after disaster • Disaster medicine and epidemiology • Concern on health and mobility of elderly people in rural area
MS-3	Policy Evaluation	Combination of Socio-economic and Engineering knowledge	• BCP (Business Continuity Plan) • Risk Management • Disaster Recover