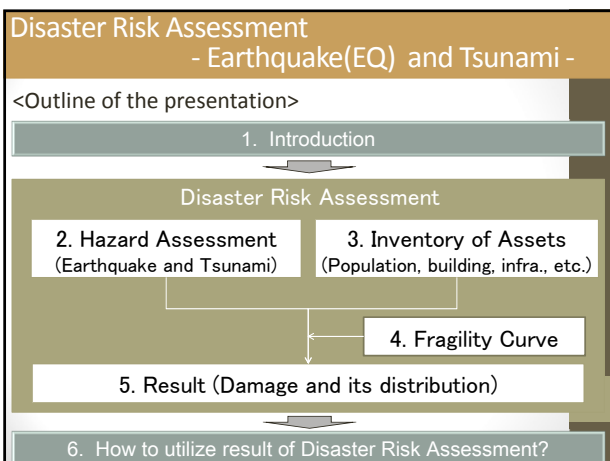


Building Disaster and Climate Resilient Cities in ASEAN (CN18)

1st Workshop for Urban Resilience in ASEAN
Risk Assessment (Earthquake & Tsunami Disaster)

December 8, 2016
JICA Project Team



1. Introduction : Objective of risk assessment

- 1) To identify **vulnerable area**
-> Prioritize area for the disaster mitigation measures
- 2) To know the impact(damage amount) of disaster.
-> Identify the **gap** between impact and capacity
- 3) To utilize result of risk assessment
to **all level of disaster risk management plan**
(Prevention/Mitigation/Preparedness/ Response/Recovery/Reconstruction)
- 4) To utilize result of risk assessment as
evidence for future investment on DRM project

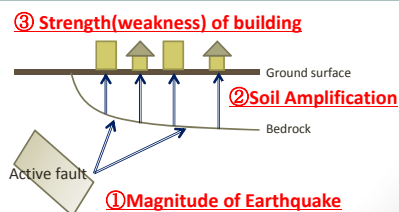
Source: JICA Project Team

2. Hazard Assessment

(1) Mechanism of Earthquake damage

Q. What determine the damage of earthquake?

- A. ① Magnitude of Earthquake
 ② Soil amplification
 ③ Strength(weakness) of building

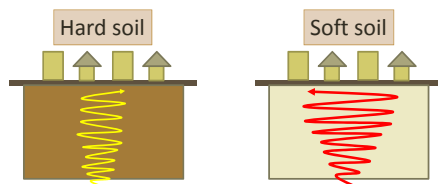


Source: JICA Project Team

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2. Hazard Assessment(2) soft soil vs hard soil

Soft soil amplifies seismic motion more than hard soil (site effect)



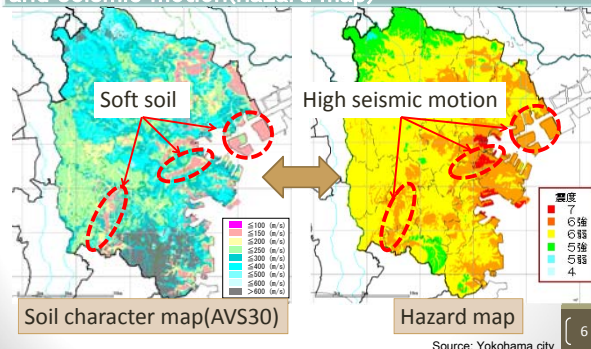
Buildings on soft soil will get more damage
 → It is important to know where soft soil locates

Source: JICA Project Team

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2. Hazard Assessment(3) Earthquake hazard map

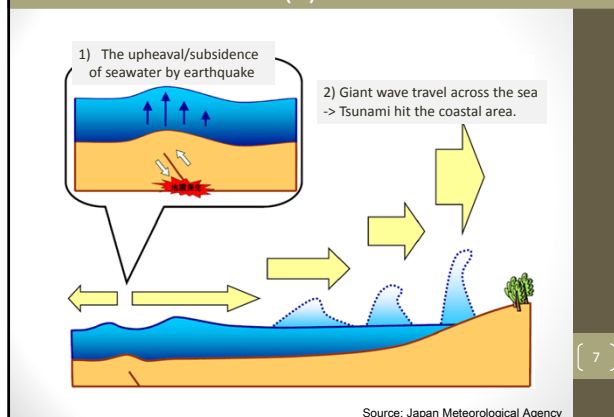
Example of relationship between soil character and seismic motion(hazard map)



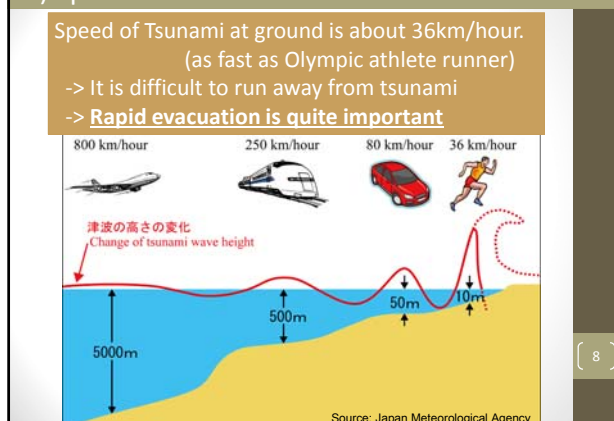
Source: Yokohama city

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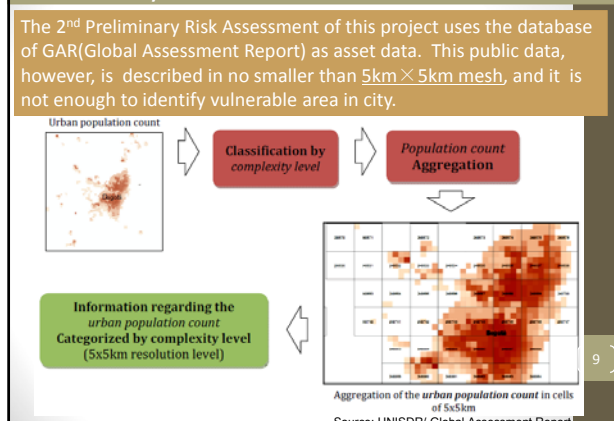
2. Hazard Assessment(4) Mechanism of Tsunami



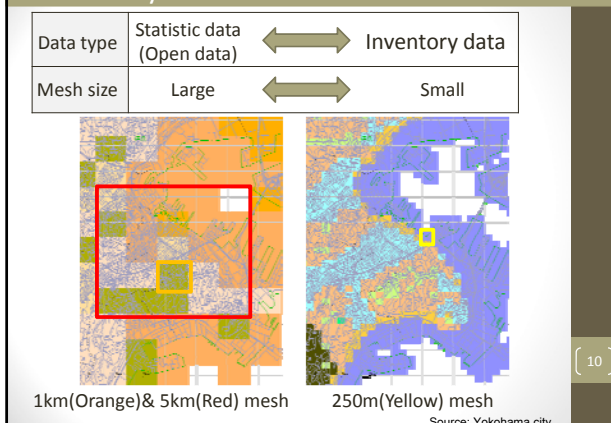
Cf) Speed of Tsunami



3. Inventory of Assets for Risk Assessment



3. Inventory of Assets for Risk Assessment



4. Fragility Curve (Strength of building)

Number of damaged building =
 (Total number of buildings) × (damage ratio)
 Damage ratio depends on magnitude of hazard and building type

Hazard (inundation depth)		Fragility function (damage ratio)				
1 5m	2 2.5m					
3 1.5m	4 0.5m					
			H<1m	1m≤H<2m	2m≤H<4m	4m≤H
		Adobe	No damage	Half collapse	Collapse	Collapse
		RC	No damage	No damage	Half collapse	Half collapse

Mesh No.	Total		Collapse		Half collapse	
	Adobe	RC	Adobe	RC	Adobe	RC
1	4	4	4	0	0	4
2	5	2	0	0	5	0
3	2	5	0	0	2	0
4	5	5	0	0	0	0

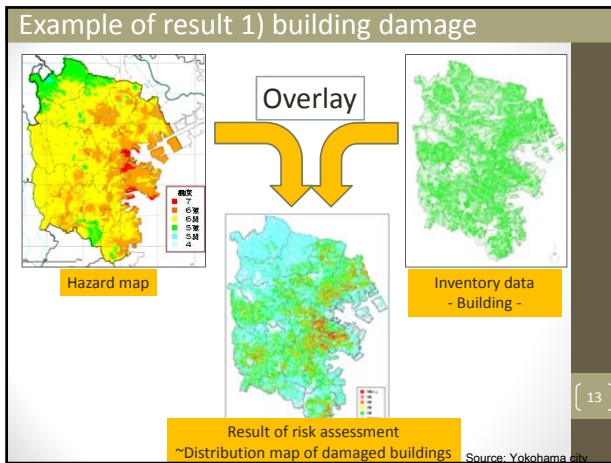
Source: JICA Project Team

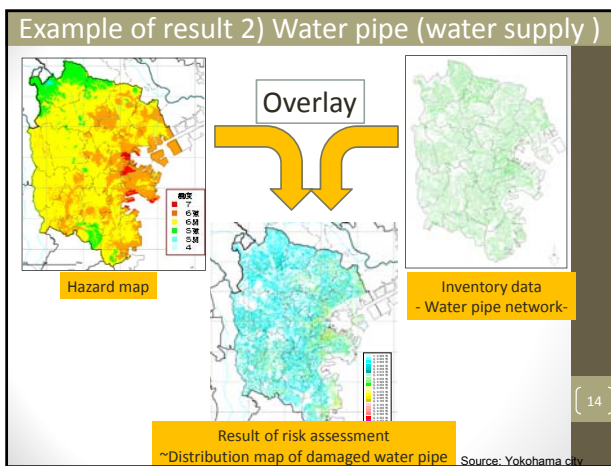
5. Result (damage amount and distribution)

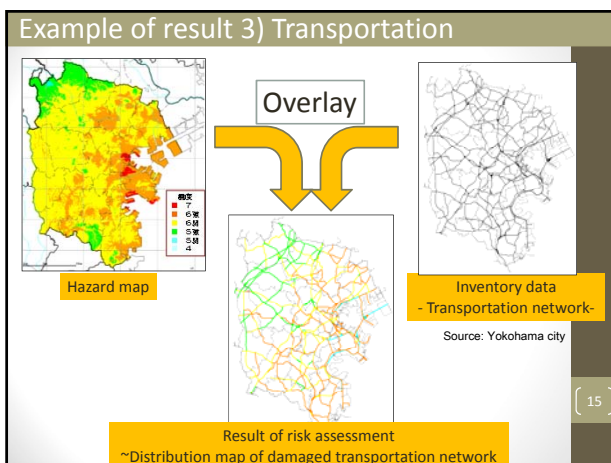
Damage amount and its distribution can be identified

Category	Damage item/factor	Amount
Building damage	Earthquake	34,300
	Fire	77,700
	Liquefaction	204
	Tsunami	11
Casualties	Death	3,260
	Injure	21,700
Lifeline	Water outage household	399,000
	Sewage outage household	72,900
	Electricity outage household	266,000
Transportation	Bridge damage	1
	Road obstacle	183
Others	Evacuee	577,000
	Disaster Wastes	1,670
	Economic damage	11.7

Source: Yokohama city

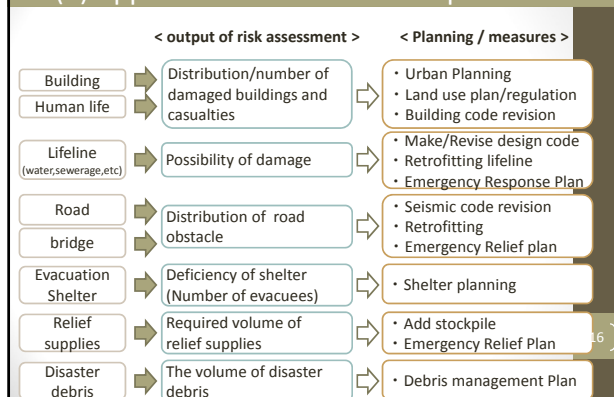






6. How to utilize result of risk assessment?

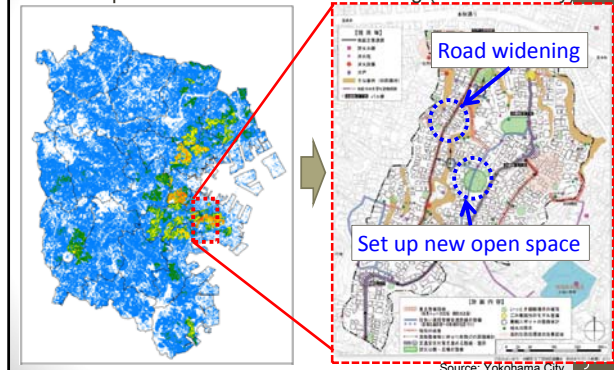
(1) Application on various DRM plan



6. How to utilize result of risk assessment?

(2) Identification of weak area

Example: Risk-sensitive Urban Planning (Yokohama city)



6. How to utilize result of risk assessment?

(3) Disaster mitigation measures

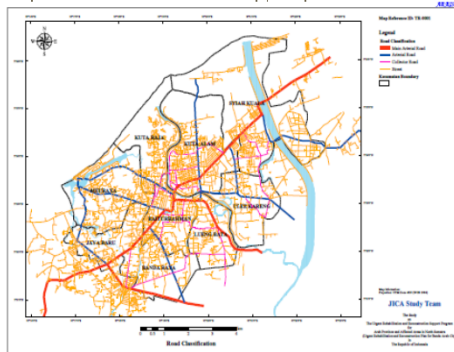
Example of earthquake induced fire prevention measures



6. How to utilize result of risk assessment?

(4) Disaster preparation measures

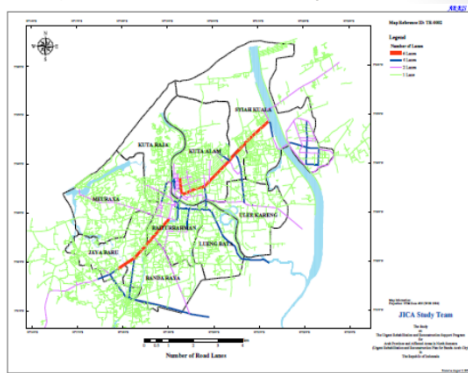
Example: Road Classification Map, Project in Indonesia



Source: Aceh Tsunami Project JICA/NK, 2005

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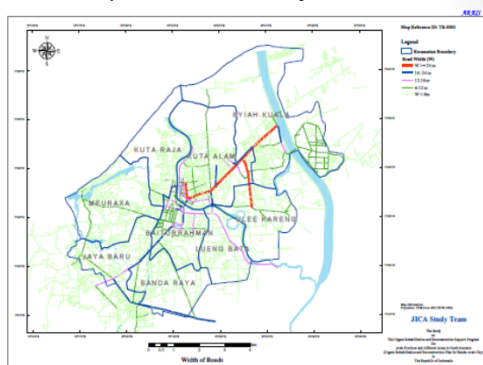
Example: Number of Road Lane, Project in Indonesia



Source: Aceh Tsunami Project JICA/NK, 2005

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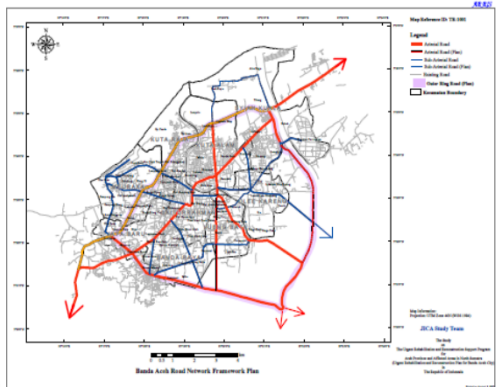
Example: Width of Road, Project in Indonesia



Source: Aceh Tsunami Project JICA/NK, 2005

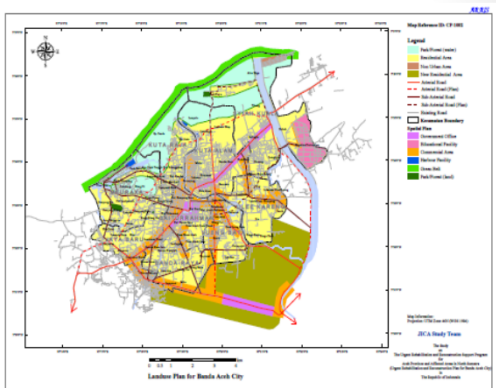
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Example: Road Network Plan, Project in Indonesia



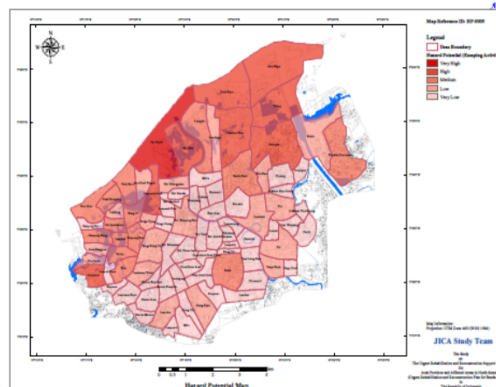
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Example: Land Use Plan, Project in Indonesia



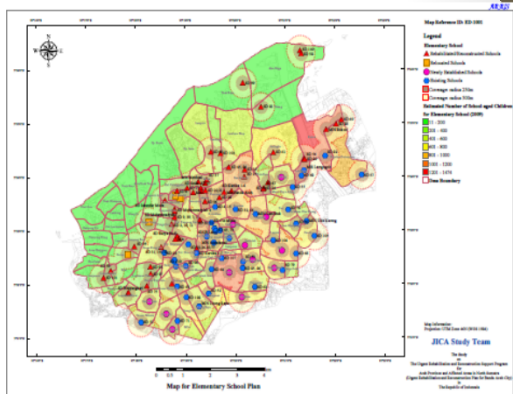
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Example: Potential Hazard Map, Project in Indonesia



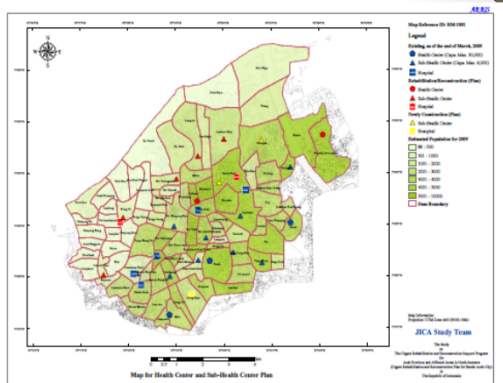
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Example: Map of Schools, Project in Indonesia



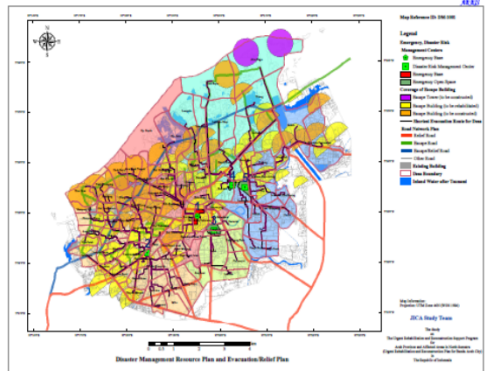
Source: Aceh Tsunami Project JICA/NK, 2005

Example: Map of Hospital, Project in Indonesia



Source: Aceh Tsunami Project JICA/NK, 2005

Example: Disaster Management Plan and Evacuation/Relief Plan, Project in Indonesia



Source: Aceh Tsunami Project JICA/NK, 2005