TSUNAMI DISASTER MANAGEMENT IN INDONESIA
ADOPTING COASTAL SETBACK LINE

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1. Introductions

- Background: why coastal set back line
  - Indonesia is a tsunami prone areas
  - ~75% of its coastal areas have been attacked by tsunamis in the past
  - ~10,700 villages in coastal areas are vulnerable to tsunami attack without proper mitigation efforts and structures
1. Introductions

- **Background: conditions in Indonesian coastal area**
  - Rapid development of infrastructures in coastal areas | airport, hotels, houses and etc.
  - Illegal uses of coastal areas for economic activities | coastal shrimp ponds in the south coast of Java, Sulawesi and Papua

South Coast of Yogyakarta

only ~30 m left from the shore

Meulaboh, Aceh
2. Conception of Tsunami Disaster Mitigation in Indonesia

**STRUCTURAL COUNTER MEASURE**

- **SOFT STRUCTURE**
  - Mangrove, sand dune, coastal forest.

- **HARD STRUCTURE**
  - breakwater, Seawall
  - Shelter/artificial hill
  - Evacuation route
  - Stilt Houses

**NON STRUCTURAL COUNTER MEASURE**

- Tsunami Hazard map
- Tsunami Risk Map
- Land use planning
  - Setback Line
- Education and training
- Law and regulation (Disaster Management Act, Coastal Zone management Act)
- TEWS
- Public awareness
- Building Code
- Poverty alleviation
  - ICZM

"Tsunami countermeasures using hard structure (seawall, breakwater) is quite expensive for Indonesian. Hard structure will arise aesthetical and environmental problems because the structure will interrupt terrestrial-marine ecosystem. To evacuate the people who live in the dangerous area, is very difficult to persuade them."
2. Coastal Set Back Line
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• Regulations
  – Law No. 27/2007 | 01/2014 about Marine, Coasts and Small Islands Management.
    • Local government determines area for coastal set back line by referring to topographic conditions, biophysics, hydro-oceanography, socio-economic and other considerations.
    • Coastal Set Back Line is determined by carefully consider several aspects as follow:
      – Protection from earthquake and tsunamis, coastal erosions, storms, floods and other coastal disasters
      – Protection for the coastal ecosystem | mangrove, sea grass and etc.
      – Arrangement for public space
      – and arrangement for waterways and waste.
  – Presidential Decree about Coastal Set Back Line
  – Ministerial Regulation for Coastal Set Back Line
2. Coastal Set Back Line

• Function:
  – Open space for green coastal area
  – Disaster mitigation

• Coastal setback line is not avoided for
  – Small-scale fishery, agriculture, tourism, forestry, research, maritime security, port, airport and cultural/religious activities.
  – But, as long as it considers 3 things,
    • Aesthetics
    • Function
    • and area
2. Coastal Set Back Line

Determining Coastal Set back Line

Characteristic of the natural disasters

- Hazards index
- Risk index

Characteristic of coastal ecosystem

- Wet land
- Mangrove
- Sea Grass
- Coral reef
- Sand dune

Characteristic of Socio-economic

Based on the type and intensity of the activities in the coastal areas

1. Low (low impact, high frequency)
2. Medium (low impact, high frequency)
3. High (High impact, low frequency)

- In Post-Disaster Situation
  - Recent tsunami height/run-up records (as long as meet the criteria of the largest scale tsunami in the respective region)
  - Example:
    - 2004 Indian Ocean Tsunami in Banda Aceh
    - 2011 East Japan Tsunami in Japan.

![Graph showing inundation height over time](image-url)

- In Post-Disaster Situation
  - Recent tsunami height/run-up records (as long as meet the criteria of the largest scale tsunami in the respective region)
  - Joint analysis:
    - Building Fragility (i.e. Koshimura et al. 2009 | Koshimura et al. 2013)
    - Numerical Simulations

Koshimura et al. 2013
Method for Determining Coastal Set Back Line: A case in tsunami prone areas

- In Pre-Disaster Situation
  - Numerical Analysis
  - Multi scenario of earthquake generated tsunami
  - Geo-database of inundation simulations
  - Percentile of affected areas related to the number of simulation scenario
  - Average/median inundation depth related to the number of simulation scenario
  - Determination of the Coastal Set Back Line based on Fragility Analysis and average/median inundation depth

Muhari et al. 2014
Method for Determining Coastal Set Back Line: A case in tsunami prone areas

- Multi scenario hazard analysis
- Identification of influential source area
- Number of simulation ~ 500 simulations
Summary

• In order to ensure the safety of coastal community to natural disaster, ecosystem sustainability and securing public space in coastal area, Indonesian government determines the Coastal Set Back Line.
• In the case of tsunami prone area, two considerations are taking into account:
  – Post disaster situation:
    • Related to the coastal land use regulation post disaster
    • Using the largest tsunami record in the respective areas (can be from the historical record or the recent tsunami) combined with the fragility analysis
    • Example: Sendai City post 2011 East Japan Tsunami
  – Pre disaster situation:
    • Using numerical simulation by taking into account largest earthquake generated tsunami or multi scenario for probabilistic analysis
    • The result of multi-scenario analysis is delineated by using average/median tsunami inundation height.
    • The inundation height is correlated to fragility analysis to determine boundary of Coastal Set Back Line/area of Tsunami Level 1.
Thank you

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