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ITB's Involvement in the Recovery and Reconstruction from the Tsunami

Kusuma

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KOBE UNIVERSITY

ITB's Involvement in the Recovery and Reconstruction from the Tsunami

Prof. Kusuma

ITB'S Involvement in The Recovery and Reconstruction From The Tsunami

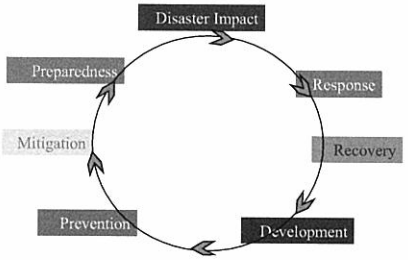
1. ITB'S Commitment on Disaster Management
2. ITB's Involvement on Aceh Case
3. Further Aim

M. Syahril B. K. et al, Kobe 7-8 March 2006

CenterFor Disaster Mitigation
Institute For Research and Comunnity Services
Institute Teknologi Bandung

I. ITB's Policy on Disaster Management:

- Significant contribution in establishing disaster management for national development.
- Established Disaster Mitigation Center in 1999
- Established curricula on disaster since 1999 at related faculty/school (Civil Engineering, Regional Planning etc)
- National & International Collaboration



Several type of contribution

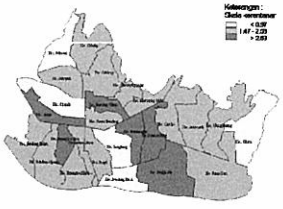
- Collaboration with disaster stake holder both national (BAKORNAS, SATLAK, NGO, related ministry and local government) and international (UN's institution, University, NGO and others)
- Development of national Disaster Zone
- Updating national building code
- Development of disaster center for supporting disaster early warning system (earthquake, flood and landslide etc)
- Risk assessment for several disaster (earthquake, flood, landslide etc) in several regency.
- Development of disaster assessment tools (mathematical model, data base etc).
- Problem solving for man-made disaster (oil spill, waste leaks etc)

Several related record

- Micro zonation of Bandung, Bengkulu and Denpasar
- Flooding map : Jakarta, Bandung and several regency
- Training on earthquake safety for both teacher and student of elementary school.
- TOT on risk assessment for several regency
- Relief and recovery of Flood Disaster in Bandung.
- Relief and recovery of Tsunami Disaster in Flores (1992), Ambon (..) and Aceh (2004)
- Relief and recovery of Earthquake Disaster in Bengkulu, Lampung (Liwa), Sukabumi, Pandegelang (1992), Nias (2004) etc.
- etc

Risk Assessment Process Focused on Earthquake

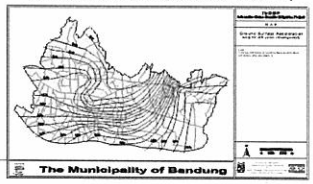
1. BANDUNG,
IUDMP team of ITB



Vulnerability Map



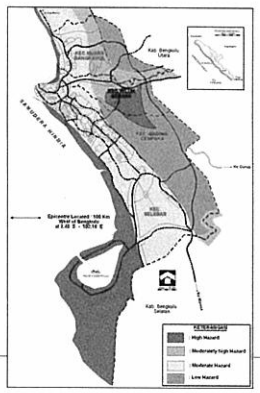
Estimated Building Damage rate Distribution Map



Microzonation Peak Ground Acceleration Map for 200 year Return Period

2. BENGKULU

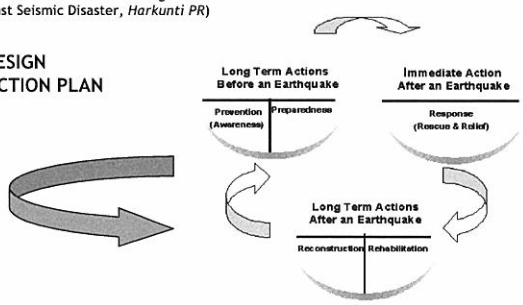
Seismic Hazard Map for Bengkulu City, *Harkunti PR et al*



RADIUS

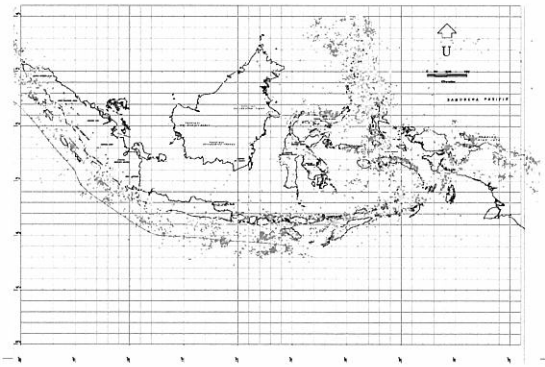
(Risk Assessment Tools for Diagnostic of Urban Areas Against Seismic Disaster, *Harkunti PR*)

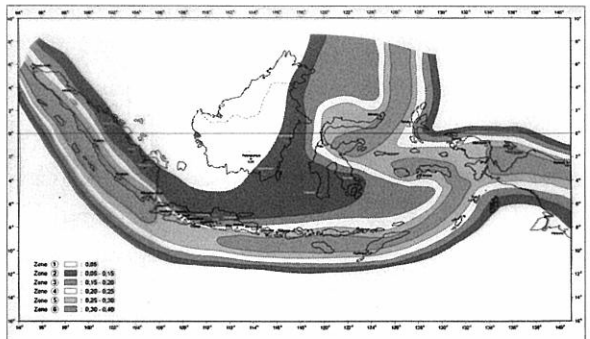
- **DESIGN ACTION PLAN**



A comprehensive and exhaustive program for earthquake risk reduction is outlined in twelve long-term objectives which essentially representing the P2R3 (P2: Prevention/Preparedness, R3: Response/Reconstruction/Rehabilitation)

Distribution of Recorded Earthquake Epicenter in Indonesia

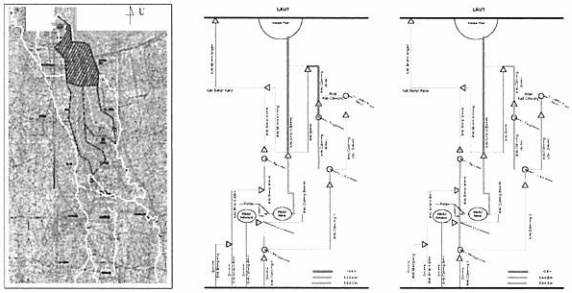




COEFFICIENT OF C_8 FOR SEVERAL ZONES IN INDONESIA
(500-YEAR RETURN PERIOD FOR HARD SOIL)

(*Source*: Tim Zonasi SKSNI, 2000)

Flooded map of Jakarta

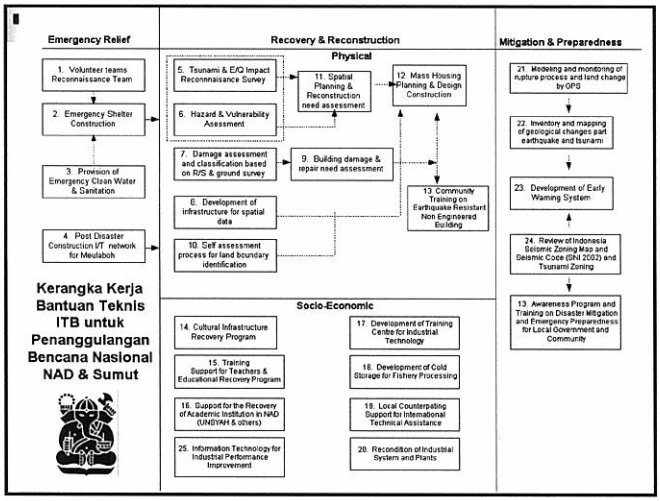


Flooded area in 2002 (left recorded data, middle predicted for 25 years period, right predicted for 1000 years period, *M. Syahril B.K, 2002*)

II. ITB's Involvement on Aceh Case

A. Previous and on going program

- Special task force in the same week of disaster
- Helping aceh's student in Bandung (bridging, therapy etc)
- Sending relief team (fac member, staff and volunteer)
- Establishing radio communication, emergency shelter, medicine etc
- Reconnaissance Survey (from the 10th day to 6th month)
- Preliminary assessment
- Further survey and study (on going)
- Establishing national and international network/coolaboration for earthquake and tsunami disaster mitigation
- Assessment the needs of updating building code
- Contributing the development of TEWS, Engineering solution (design criteria etc.) for Reconstruction etc.
- Supporting several stake holder in recovery and reconstruction program implementation
- Supporting tsunami center establishment.



TSUNAMI HISTORY IN INDONESIA

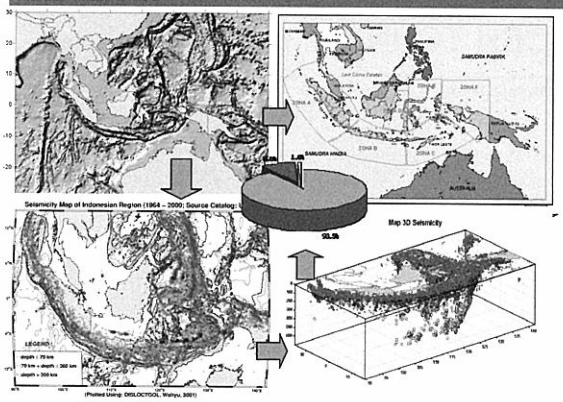
Tsunami events in Indonesia and generating sources:
total 105 events (1600-2000): (Latief,2000)

Sources	Occurence	Probability
Earthquake	95	90.5%
Volcanic Explosion	9	8.6%
Landsslide	1	1.1%
Total	105	100%

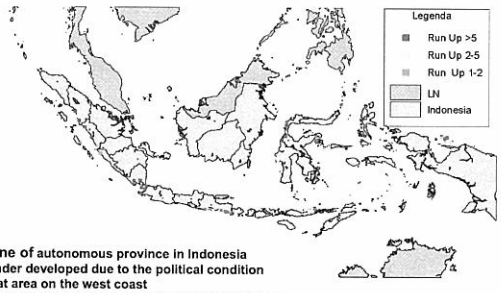
Tsunami Events for the last 10 in di Indonesia

Event Location	Year of Event	Number of Casualties
Flores	1992	1950
East Java	1994	238
Irian Jaya	1996	110
Toli-Toli	1996	6
Tallabu	1998	18
Banggai	2000	4
ACEH	2004	135.000

Tectonic setting of Sumatra and INDONESIA :
IUDMP team of ITB

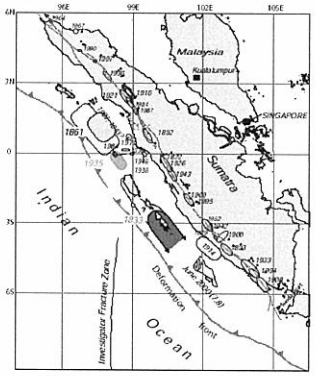


Predicted Potential Tsunami Area based on recorded data
(*Latief, ITB*)



1. One of autonomous province in Indonesia
2. Under developed due to the political condition
3. Flat area on the west coast
4. Lack of recorded data and assessment capability

Seismologic summary of Sumatra (Natawidjaja, 2002)



Great Earthquake:
1381
1608
1833
2004

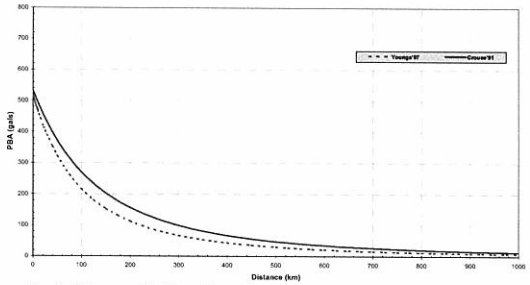
With Interval of 170 years
(Triyoso)

TSUNAMI HISTORY ALONG WEST SUMATRA SHORELINES (Latief, 2002)

Year M D h m	Lat Lon	MOp	Tm	H(m)	Dead/ Injure	Observed Area Province location	Zone
1797 02 10	0 59 100,2			Strong		W. Sumatera, Padang	A
1799				16		Sumatera	A
1918 11 18	-3.5 100.5					Bengkulu	A
1833 01 29		9				W. Sumatra: Padang, Priaman	A
1833 11 24						Bengkulu	A
1843 01 5-6	2.08 98.23			Large		N. Sumatera: Banus Is., O. Sitoli	A
1861 02 16		8.4			50	Sumatra: Batu Is., Nias Is.	A
1861 09 25	-2.04 100.6		1			Sumatra: Padang, Indrapura	A
1864						W. Sumatra: Padang, Batu	A
1883 08 26	-5.8 105.3	Volc		35	36000	Sumatera: Sunda St., Java,	A
1904 07 04						W. Sumatra: Sim-sim	A
1907 01 -						Sumatra: Western Coast	A
1908 02 06	-2.0 100.0					W. Sumatra	A
1909 06 03 18 41U	- 2.5 101.5	7.3			200	Sumatra: Kerinci-Jambi	A
1926 03 26	-5.8 105.3	Volc				S. Sumatera: Sunda St., Lampung,	A
1935 12 26	-0.3 97.9					N Sumatera: Batu Island	A
1936 03 01	-	7.0			110/479	Sumatra	A
1967 04 12	5.3 98.5	6.5		big		N Sumatera: Sigli	A

2004 12 26 Tsunami Sumatra 2004 Casualties> 135,000

Aceh Earthquake Attenuation



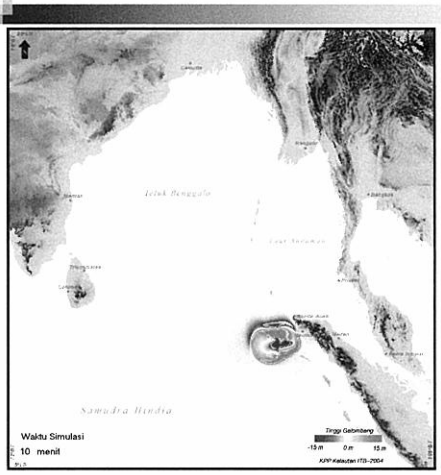
Peak Baserock Acceleration:
- At Banda Aceh: approximately 0.08-0.12g;
- At Meulaboh: approximately 0.175-0.2g (***Sengara, 2005***)

PRELIMINARY SIMULATION OF ACEH TSUNAMI *(Latief & Triyoso, 2005)*

Model boundaries	North : 25 ° LU
	South : 5 ° LS
	West : 75 ° BT
	East : 105 ° BT
Grid number	900 x 900
Grid size	3700 meter
Time step (dt)	5 second
Simulation Duration	5 hour

	Aceh 1	173 x 10^3	86.5 x 10^3	274	13	55	13	7 10^3
	Aceh 2	173 x10^3	86.5 x 10^3	130	79	98	13	10^3

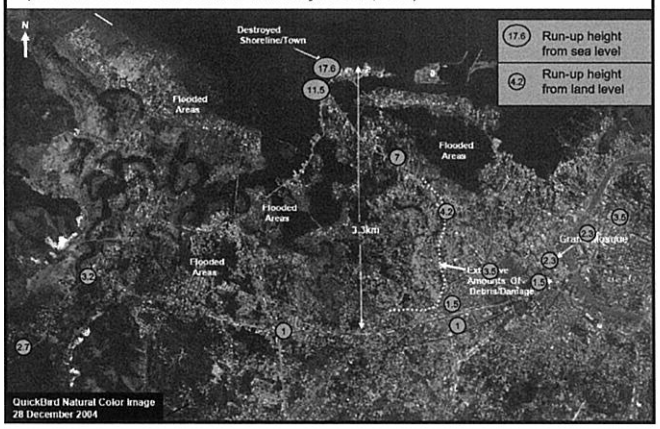
(Latief and Triyoso)



Mathematical model assessment

(Latief and Triyoso)

Post Tsunami survey plotted to Digital Globe data,
(Task force of ITB-coolaborated with Unsyiah Univ, 2005)

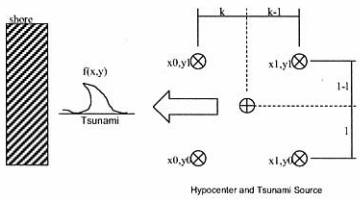


Maximum Height and Travel Time

No	Location	Maximum Height	Travel Time	
			Low tide	High tide
1.	Meulaboh	4.16 meter	-	27 minutes
2.	Banda Aceh	5.60 meter	31 minutes	55 minutes
3.	Lhokseumawe	1.62 meter	57 minutes	80 minutes
4.	Phuket (Thailand)	1.11 meter	106 minutes	126 minutes
5.	Sri Lanka	1.42 meter	135 minutes	155 minutes
6.	India	0.73 meter	163 minutes	201 minutes

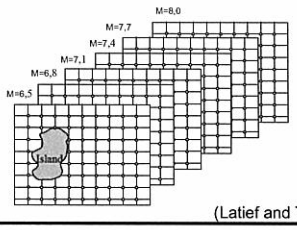
Conceptual Tsunami Warning System as second priority compare to earthquake

Interpolation concept for 2-D coordinates (Tatehata, 1996)



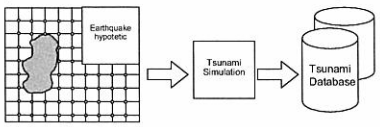
Hypocenter and Tsunami Source

Database structure for tsunami forecast (Tatehata, 1996)

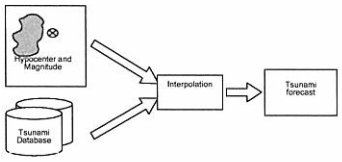


(Latief and Triyoso)

Tsunami height database, arrival time, etc., for each earthquake event

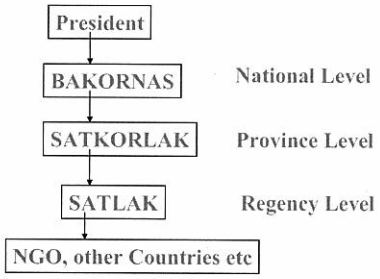


Actual tsunami forecast

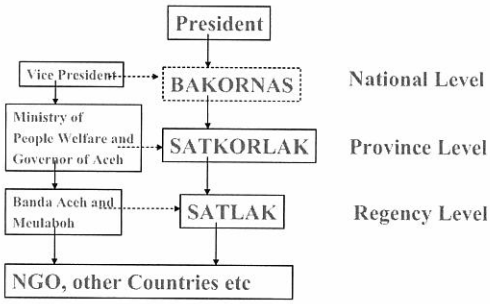


(Latief and Triyoso)

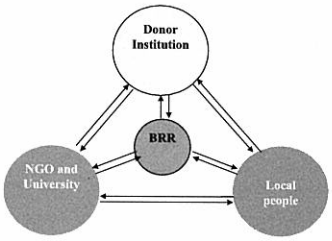
Organization of National Disaster Agency



Organization of National Disaster Agency for Aceh Case



Organization during Recovery & Redevelopment



Damaged buildings

- By earthquake : main structures collapsed
  →not complied to national building code
- BY tsunami :
  - Damaged building by Eq: swept a way
  - Standing building : singular-long wave force, scouring & buoyancy (lift up).
    - felled down
    - Swept a away

Environmental losses

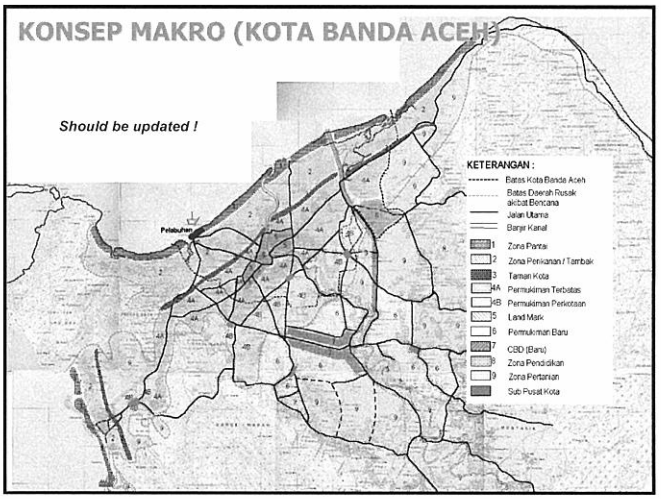
- Saline ground water
- Toxic and saline sedimentation over top soil
- Contaminated public wells
- etc

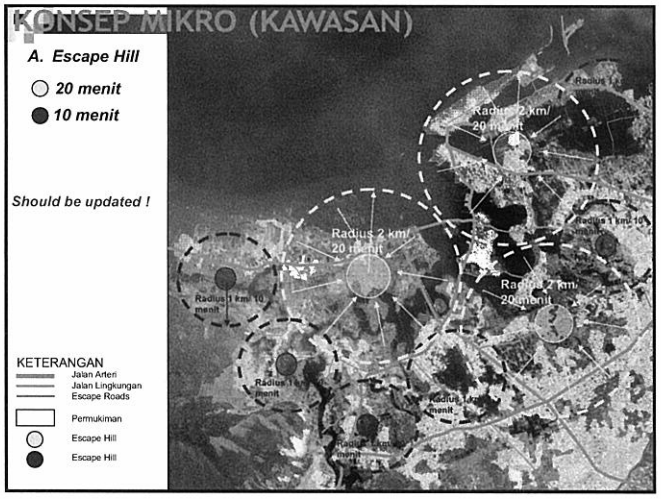
Casualties

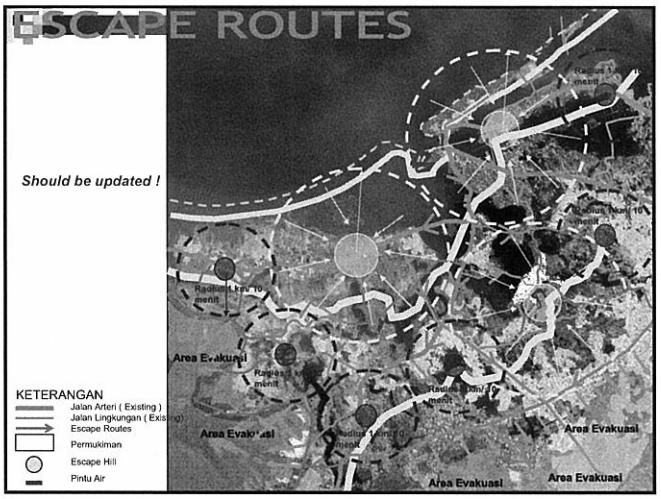
- Dominated by tsunami

Shelters

- Should be a walking/runing distance of about 5-10 minutes (fastest time of the under developing warning system is 5 minute + communication time losses??)
- Should be friendly users (children, old people etc)
- Should be affordable (maintenance etc)
- Site specific
- Alternatives : Schools, Hospitals, Mosque, Church







Early warning System

- There was no tsunami early warning system (TEWS)
- EEWS should be strengthened
- TEWS should be developed
  - Friendly users
  - Affordable

Recommendation-Stage 1

1. Short-Term Program Activities

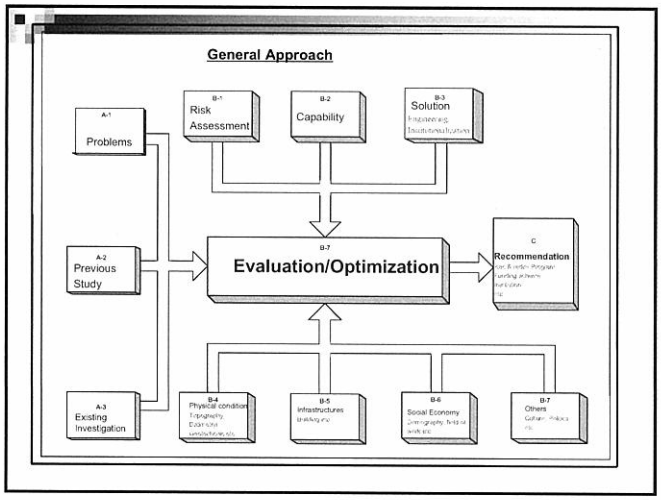
- Conduct rapid seismic and collateral hazard assessment.
- Evaluate the potential of future hazards.
- Review the current seismic zonation and building codes.
- Generate hazard maps such seismic microzonation map, liquefaction potential map, and so forth.
- Damage assessment of buildings, infrastructures, and lifelines.
- Define cities vulnerability condition from various aspects.
- Evaluation of existing risks level on strength and weakness identification of existing element at risks.
- Provide further initiatives and recommendations that are needed for disaster mitigation, public awareness, and initial input for spatial planning.
- Etc

Intermediate-Term Program Activities

- Spatial Planning for the city and region re-development
- Planning and controlling of earthquake resistant building, building enforcements, specifically for *engineered & non-engineered structures*,
- City and region Infrastructures Planning,
- *Community based reconstruction*,
- Development and deployment of university cooperation for teaching and research staffs for undergraduate and graduate student.
- Scholarship for local student.

Long-Term Program Activities

- Set up Early Warning System,
- Training for the communities,
- Planning and establish *Disaster management unit*,
- Training for Local Government Official, Teachers, Consultants, Contractors, and Technicians.
- Networking with the local universities and Universities from developed country

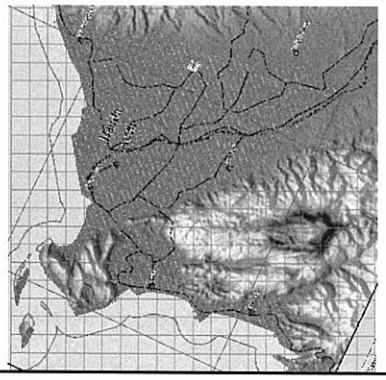


ITB's Involvement on Aceh Case

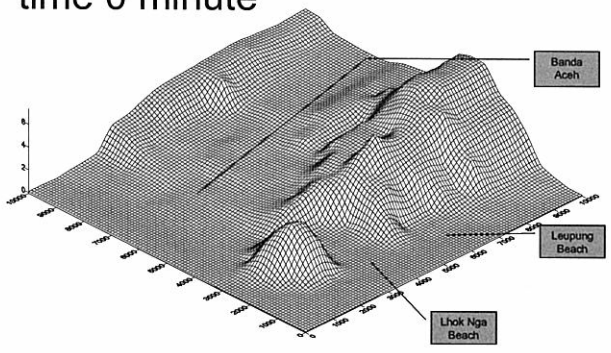
B. On going program

- Looking for partner for supporting reestablishment of proper education in Aceh
- Further survey and study (on going)
- Establishing national and international network/collaboration for earthquake and tsunami disaster mitigation
- Preliminary assessment for updating building code
- Contributing the development of TEWS
- Supporting several stake holder in recovery and reconstruction program implementation (engineering solution etc)
- Supporting tsunami center establishment.

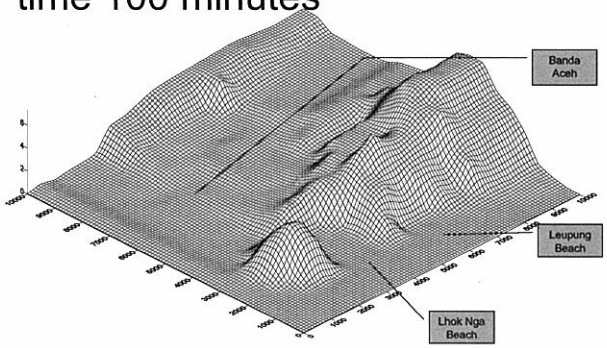
Preliminary effort on tsunami land propagation/ inundation, *(M Syahril BK etal, 2005)*



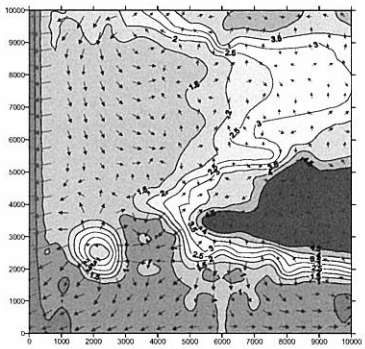
time 0 minute



time 100 minutes

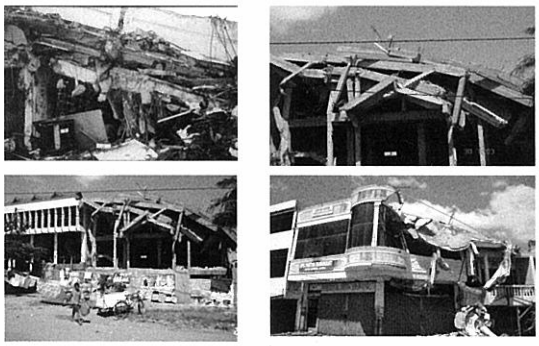


Extreem time 60 minutes

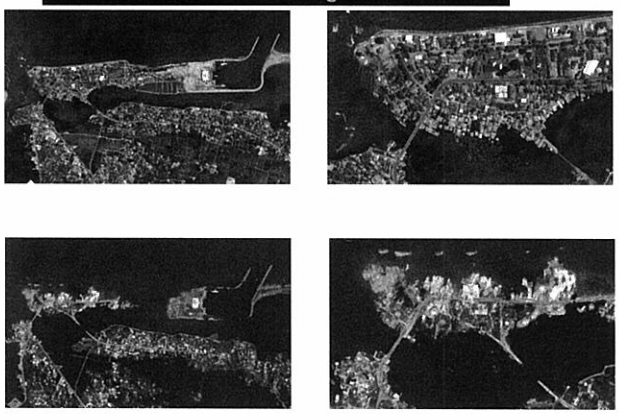


Several Pictures

Earthquake Damages 1 Public Facilities

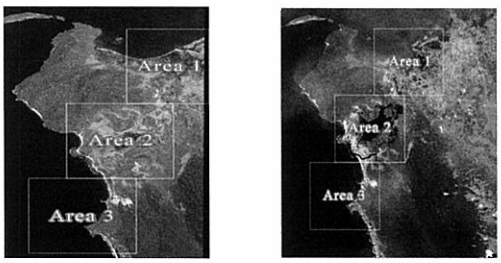


Tsunami Damages 1



Recorded damages & looses from several resources

Before → After



1. Banda Aceh, Ulele, Lhok Nga & part of west Coast, Ikonos

Environmental






Roads and Bridges






Earthquake and Tsunami Damages 2






Mesjid Blan Raya

Mesjid Blan Raya




Saline sedimentation on rice field




Impact on Agriculture

- 20,000 ha wetland & 30,000 ha dry land affected:
  - soil salinization
  - erosion of bunds
  - sedimentation of lands and irrigation and drainage canals
- high livestock mortality
- animal health status unknown, but major diseases not yet evident
- loss of tools, implements, and machinery
- loss of working capital

Land Reclamation - considerations

- original soils
- sediments
- ground water
- rain and irrigation water

Land Reclamation - measures

- Removal of unfertile layer(s)
- Surface drainage
- Surface flushing
- Drying top layer
- Drainage tillage
- Dry ploughing
- Deep tillage
- Puddling (2 x)
- On-field water management
- External drainage

Strategic components

- recapitalization of farmers
- restoration of market functions
- improved capacity of intermediary support organizations
- examination and creation of new livelihood opportunities

Survey on Nias Earthquake





Survey on Nias Earthquake





Conclusion & Recommendation Stage 2

- Based on earthquake attenuation analysis it is found that Peak Baserock Acceleration (PBA) due to the Aceh earthquake of 26th December 2004 is *0.2–0.25g* in Banda Aceh and *0.3-0.33g* in Meulaboh. This value of PBA still meet the SNI 2002 (Indonesian national building code) but bigger than those of SNI 1983.
- Most of the damages buildings were developed before 2002 which ere not meet to the SNI 2002.
- Damages building that were constructed after 2002 had two possibilities :
  - Destroyed by tsunami after being weakened by earthquake
  - Destroyed by earthquake due to the under qulification of SNI 2002
  - Destryed by tsunami which is never been considered in SNI 2002

Preliminary Recommended Plan

Short-Term Program Activities

- Update emergency relief system
- Develop action plan that Involving the survivor on every effort emergency relief, recovery and redevelopment of the region for redeveloping their life.
- Conduct assessment of current and potential future hazard based on the 26 December 2004 earthquake and tsunami
- Revisit and review the current seismic zonation in the region and review its current seismic building codes.
- Generate hazard maps such as: tsunami potential maps, seismic microzonation map, liquefaction potential map, and so forth.
- Update damage assessment of buildings, housings, infrastructures, and lifelines post earthquake and tsunami.
- Update vulnerability and risk condition from various aspects in the region.
- Provide further initiatives and recommendations that are needed for disaster mitigation, public awareness, and initial input for spatial planning.

Intermediate-Term Program Activities

- Spatial Planning for the city and region re-development
- Planning and controlling of earthquake resistant building, building enforcements, specifically for *engineered & non-engineered structures*,
- City and region Infrastructures Planning,
- *Community based reconstruction*,
- Re-development of Unsyiah (Government University) and other universities at the disaster stricken area
- Development and deployment of university cooperation for teaching and research staffs for undergraduate student.
- Scholarship for aceh's student.

Long-Term Program Activities

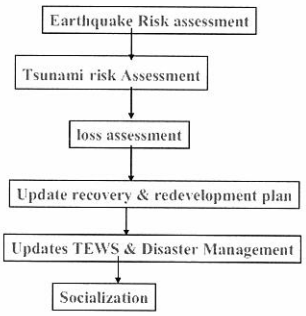
- Set up Early Warning System,
- Training for the communities,
- Planning and establish *Disaster management unit*,
- Training for Local Government Official, Teachers, Consultants, Contractors, and Technicians.
- Networking with the local universities

III. Further aim (looking for partner & support)

On going/future program

- Establishing tsunami center :
  - Information Center
  - National & International Network
- Developing risk map of earthquake & tsunami disaster →National/Regional : contour line for each hazard probability: microzonation.
- Updating building code
- Increasing public awareness→ participation/share
- Updating TEWS
- Reforming national disaster management institution

Risk Map of Earthquake and Tsunami



Urgently required

Survey/data collecting

- Topography
- Geotechnic
- Bathymetry
- Existing land use
- Environment : top soil etc

Conclusion

- There are still a lot of works to do
- The task is very complex
- Require a large resources/funding support
- Require national and international collaboration

Thank you

