

Recovery Cooperation for Padang Earthquake Damage by Seismic Isolation Buildings Design

EWBJ (Engineers without Boarder, Japan)

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Time-history of the Cooperation

(1) Sep. 2009 Padang earthquake occurred.

(2) Oct. 2009 Earthquake damage research

By association team of EWBJ (Engineers without Boarder, Japan), JSCE (Japan Society of Civil Engineers), JSAEE (Japan Association for Earthquake Engineering)

(3) Dec. 2009 2nd cooperation for earthquake damage recovery

EWBJ members of architectural team (Teramoto & Okohsi) and civil team. Symposiums at Padang and Jakarta were held.

(4) Apr. 2010 3rd cooperation for earthquake damage recovery

The EWBJ members hold a symposiums at Padang for seismic isolation buildings. Local government requested design cooperation of 5 seismic isolation buildings.

(5) May and June 2010 Design of No.1 building (Governor office)

(6) March to June 2011 Design of No.2 building (Public works office)

(7) Now Under construction of two buildings

Japanese isolators were imported from Japan.

(2) Padang earthquake and official building damages

2.1 Outline of the earthquake

(Main shock)

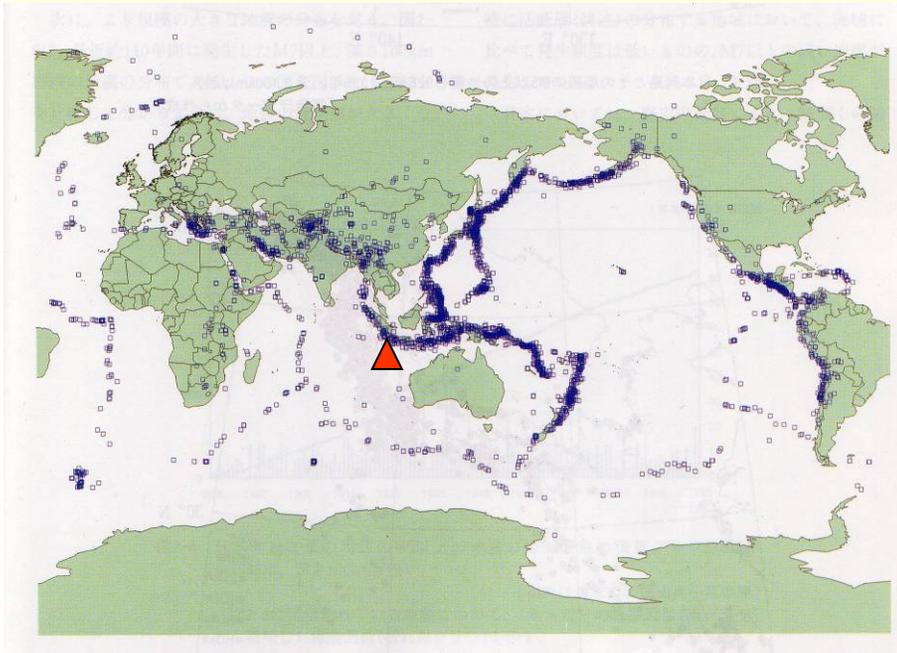
- Time : 30th September 2009 about 19:16
- Epicenter : Offshore of Padang, west Sumatra, Indonesia
- Depth : 80 km
- Magnitude : M7.6
- Dead persons: 1,100

(After shock)

- Time : 1st October about 10:52
- Epicenter : Offshore west Sumatra, Indonesia
- Depth : 15 km
- Magnitude : M6.6



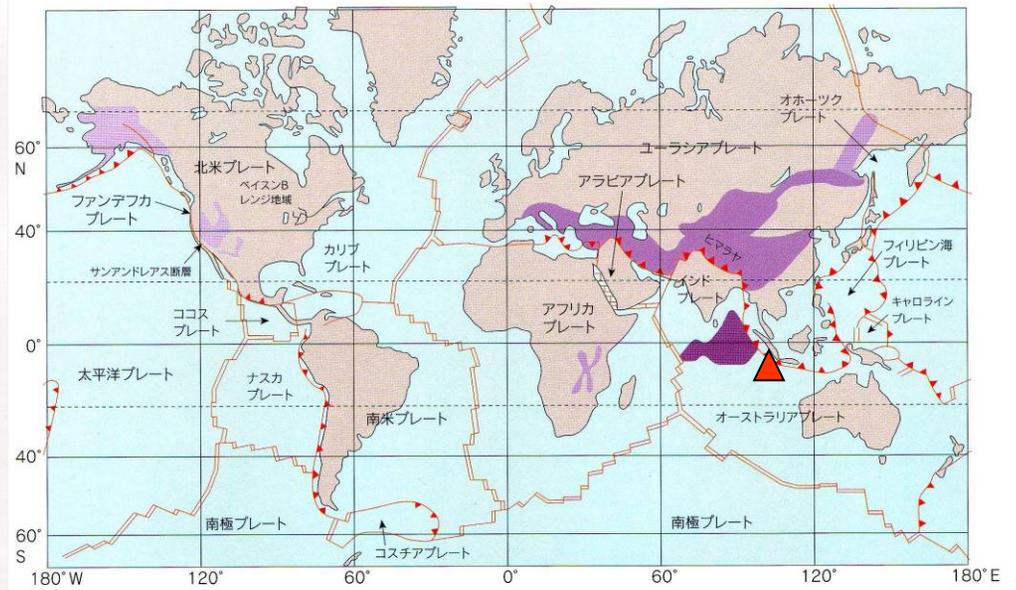
2.2 World earthquake environment



Map of world epicenters

M4以上の地震の震源

(1993年、深さ100Km以浅)



Map of the plates

プレートの境界



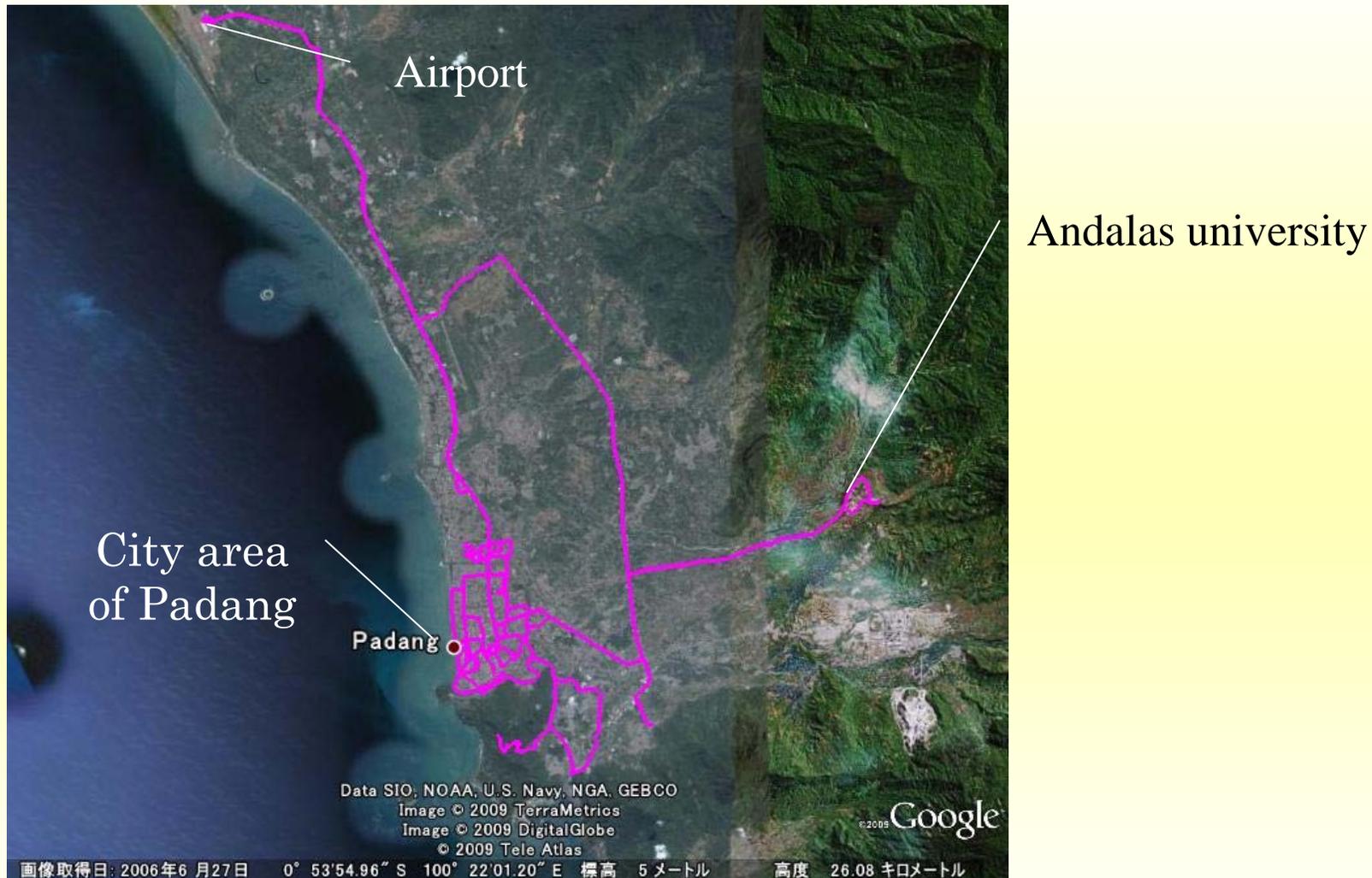


2.3 Epicenter of the Padang earthquake





2.3 Map of the Padang city



Padang city is at the flat alluvium plane. The mountains are so far about 15km. Tsunami refuge buildings are requested for the city area.





2.3 Earthquake damage of official buildings



Landscape of Padang city/ Roofs are imaged from water buffalo horns.





3.1 Building damage 1 / Board of audit (BPKP)



Reinforced concrete rigid frame structure of 6-story with brick wall



3.1 Building damage 1 / Board of audit (BPKP)



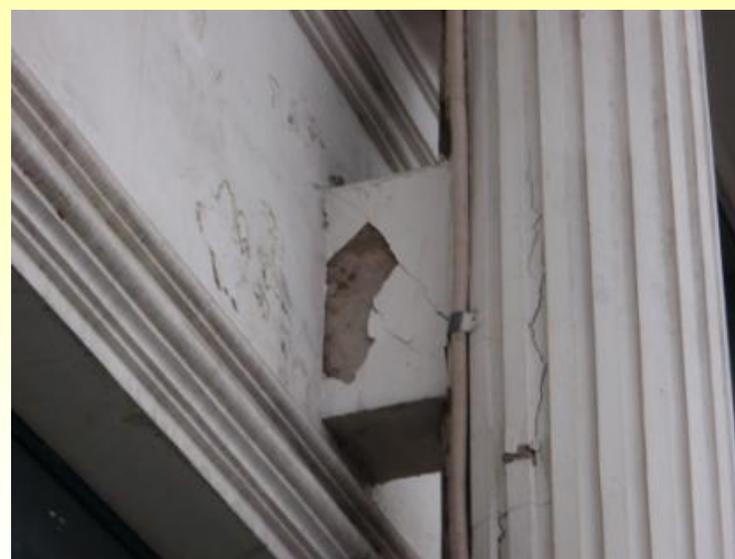
Damage of exterior brick wall and curtain wall

3.2 Building damage 3/ Public works office



Reinforced concrete rigid frame of 4-story with brick wall

3.2 Building damage 3/ Public works office



Shear-crack of reinforced concrete beams connected to the outer columns

3.3 Building damage 10/ State government office



Historical reinforced concrete rigid frame with brick wall

3.3 Building damage 10/ State government office



Brick wall with curtain wall and conflict of exp. joint



3.4 Building damage/ Andalas university



Falling-down of brick wall, they started to repair using the same method.





5) No.1 building/ Governor office and Tsunami refuge center

1) Requirement

The building design was completed and foundations are under construction.

The governor required more seismicity and redesign with seismic isolation was required for EWBJ with no or less payment.

2) Outline of building

Reinforced concrete rigid frame of 4-story with brick wall, pile foundation.

Governor office from 1st to 3rd story, tsunami refuge area from 4th to roof.

3) Seismic isolation members

Natural rubber isolators 500φ, 35 sets Lead rubber isolators 600 φ , 18 sets

4) Design works

Isolators, 1st floor structural members, column base and mat-slab were designed by Japanese standard. Upper structures are examined by local engineers using Indonesian code. Dynamic analysis was Japanese style of 50 cm/sec seismic input using Padang wave.

5) Final document by English

Structural drawings, specification, analysis documents and architectural sketches

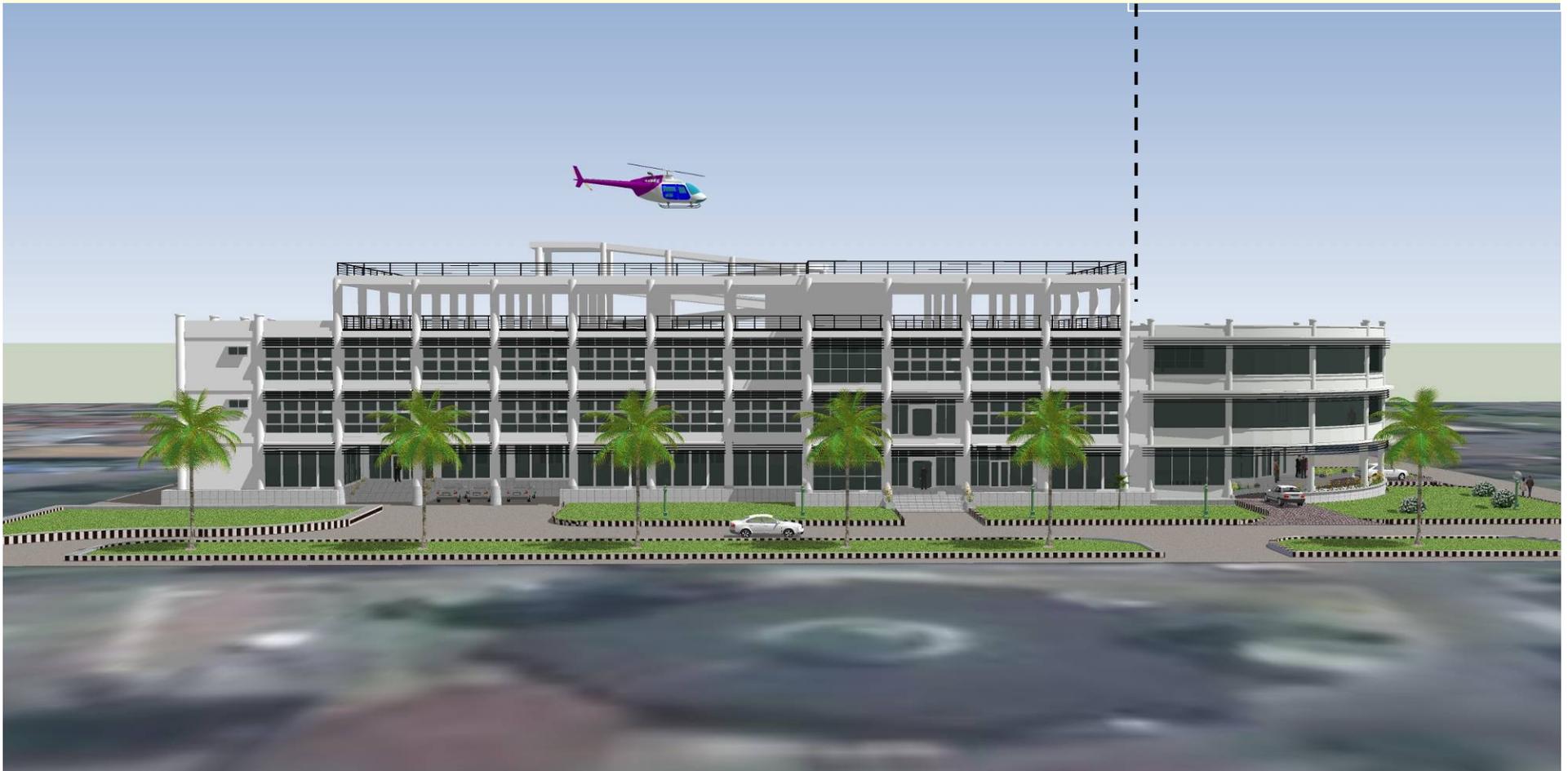


No.1 building perspective

Governor office (1F~3F) Tsunami refuge space(4F~RF)

Seismic isolation structure/ Construction stopped at mat slab.

Governor work space
Completed seismic
structure





No.1 building model





No.1 building construction site



Mat slab is under construction. Governor work space has completed already.



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No.2 building/ Public works office

1) Requirement

Rough structural design was done following No.1 building. EWBJ was required to design seismic isolation details with payment of minimum expenses.

2) Outline of building

Reinforced concrete rigid frame of 4-story with brick wall, pile foundation.
Public works, tsunami refuge area on the roof.

3) Seismic isolation members

Natural rubber isolators 500φ- 29 sets
Lead rubber isolators 600 φ - 22 sets, 650 φ - 3 sets

4) Design works

Upper structure was designed for base-shear 0.15 by local engineers, and 1st floor members, column base and mat-slab were designed by Japanese standard.
Dynamic analysis was Japanese style of 50 cm/sec seismic input as No.1 building.

5) Final document by English

Structural drawings, specification, analysis documents and “Seismic isolation buildings construction standard” by JSSI translated by Okoshi & Teramoto.

6.1 No.2 building architectural perspectives

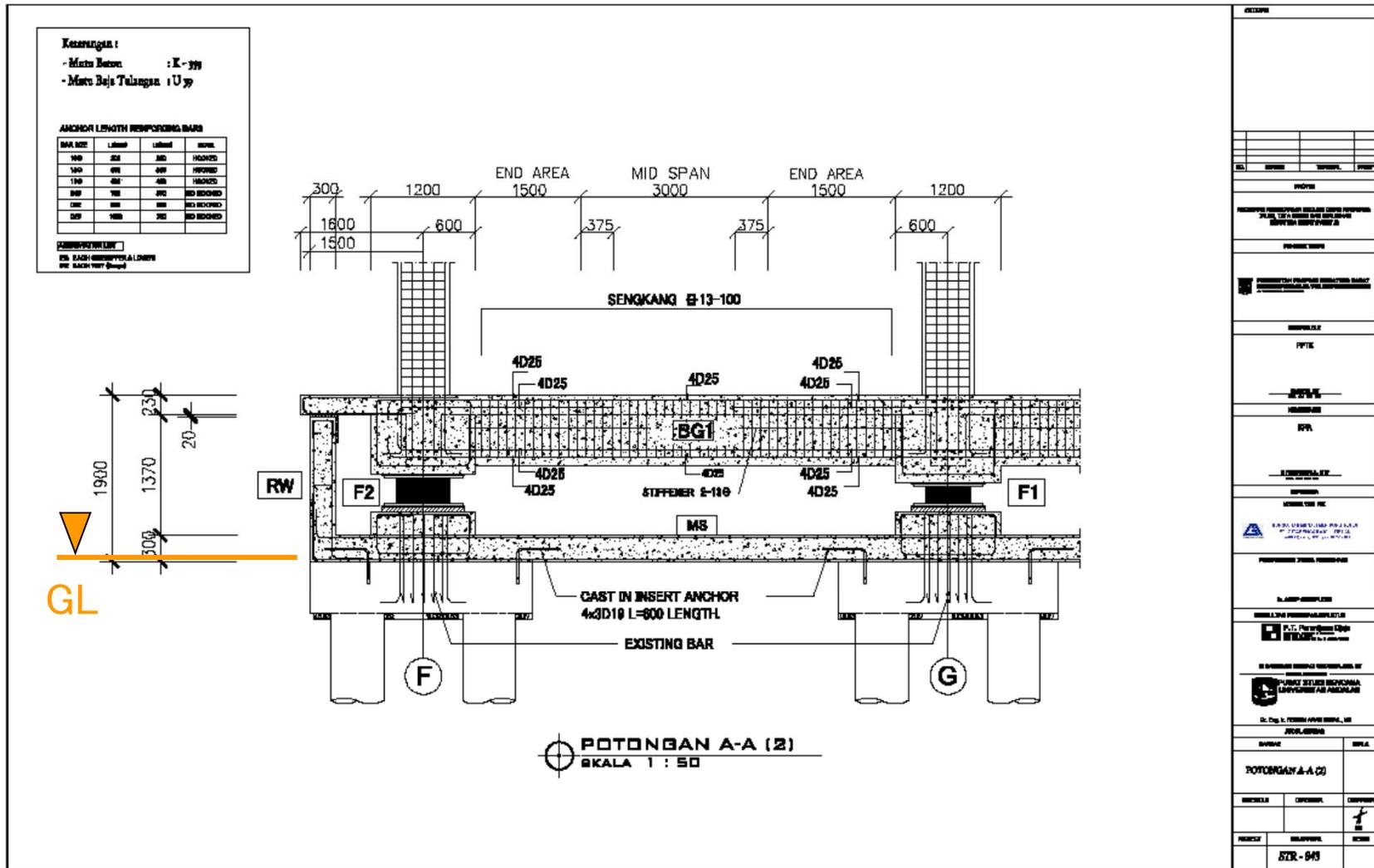
Public works office (1F-4F), Tsunami refuge space (Roof)

/ Seismic isolation structure





6.2 No.2 building structural drawing





6.2 No.2 building construction site photograph



Construction site/

Re-bar arrangement of isolator base at
5th May, 2011



Construction site/

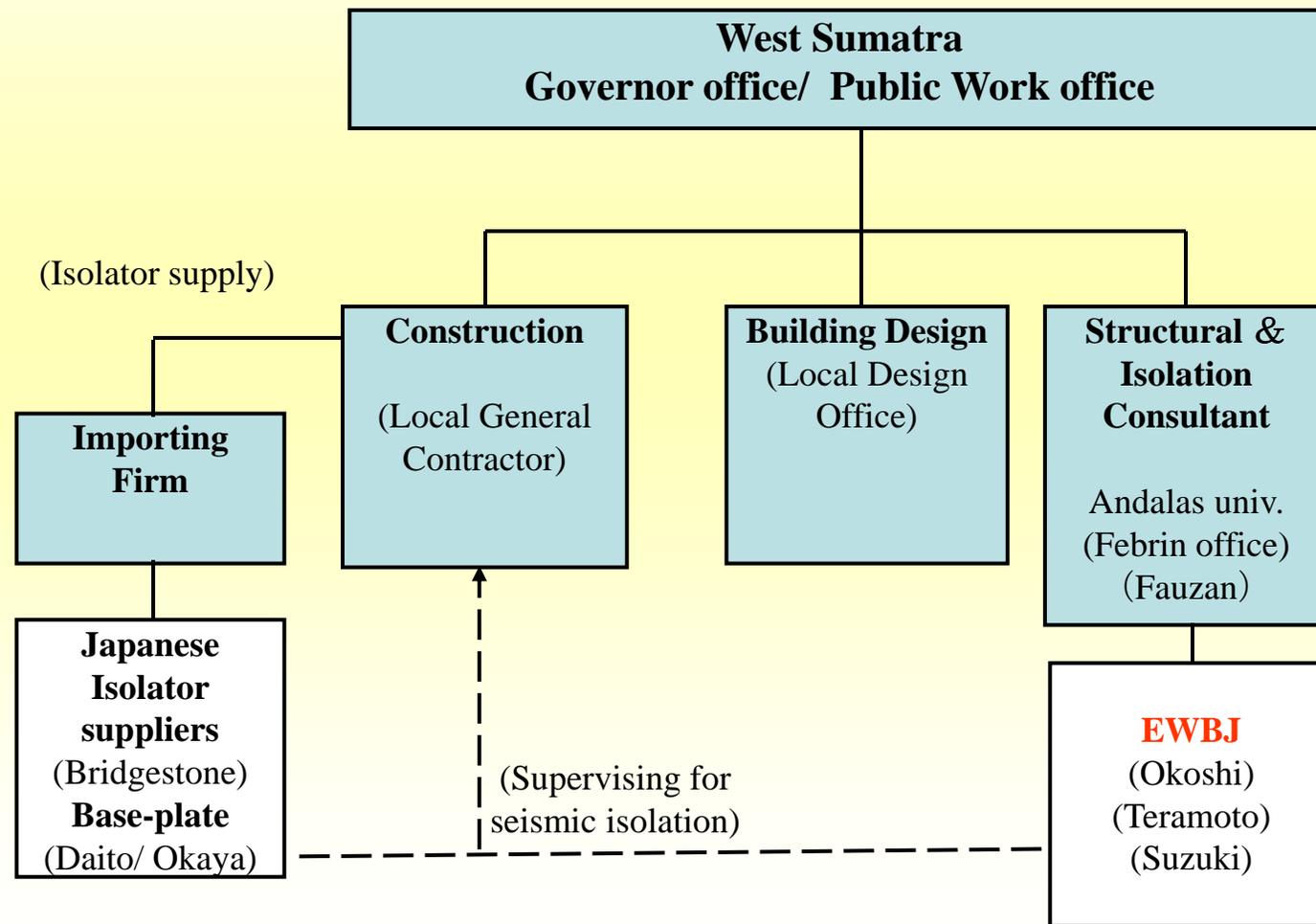
Re-bar arrangement of 300mm mat
slab at 6th June, 2011



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Cooperation system

EWBJ wanted to contract with the state government but not realized. Finally, we cooperated with Andalas university staffs without the contract. Consultant fee was transferred from unknown somebody.



⑧ Evaluation of the cooperation project (1)

(1) No project manager (Who is responsible for final decision?)

Responsibility for architecture, structure, equipment and construction?

(2) Very rough architectural design (there are only rough planning and perspective.)

Detailed architectural design may be arranged by the client and contractor at the construction stage.

For the design change requested by EWBJ, no one reply and no response from the client. (The cost should be responsible for someone replied.??)

(2) No one keep the schedule

4F-concrete-casting of No1 building should be completed until December 2010. But only mat slab was completed at June 2011, and no one was worried about for this. (Project did not smoothly advanced, but was not gone back.)

(4) Consultant fee

We got some minimum consulting fee for these two buildings. The payment are for structural analysis, structural drawings and the business trip expenses. The balance of the budget of EWBJ is about zero with the aid of JSSI.

⑧ Evaluation of the cooperation project (2)

(5) First seismic isolation building of Indonesia

One experimental building was constructed before, these buildings are the first seismic isolation buildings in Indonesia.

(6) Cooperation was possible only by Non-Profit-Organization

The client request was very irregular one which was impossible to manage by a usual design office. (No payment assurance, short and hard design schedule and less response by client and local engineers.)

(7) Good relationship between the state government, Andalas university and EWBJ

EWBJ made up good relationship between the state government and Andalas university. When they visited Japan, Professor Hamada of EWBJ, Professor Wada of Tokyo Institute of Technology and Dr. Kani of JSSI were helped us so much.

(8) Japanese products exportation

Japanese isolators and base-plates were exported to Indonesia at the first time. This project may be useful for the generalization of seismic isolation techniques for South-east Asia.