Appendix-4

Investigation result of post-earthquake temporary risk evaluation

no	nama gedung	alamat	ketinggian/koordinat	Hasil Kajian Cepat				Keterangan (Level Kerusakan)
				hijau	kuning		merah	
					perb. Struktural	perb. Non-struktural		
4 okt 09								
1	Kopertis X (Aula)	Jl. Khatib Sulaiman Padang	8 m, S: 00 55' 21,6" E: 100 21' 48,8"		v	v		50%
2	Kopertis X (Pepustakaan)	sda	sda			v		25%
3	Kopertis X (Hall Badminton)	sda	sda				v	100%
4	Kopertis X (Laboratorium)	sda	sda			v		30%
5	Univ. Eka Sakti (Ged. F1)	Jl. Bandar Purus No. 11 Padang	6m, S: 00 56' 31,1" E: 100 21' 22.3"				v	100%
6	Univ. Eka Sakti (Ged F2 & G)	sda	sda			v		30%, Dilatasi antar bangunan diperlebar
7	Univ. Eka Sakti (Ged.C Rektorat)	Jl. Veteran Dalam No. 26 B Padang	6 m, S: 00 56' 36.3" E: 100 21' 23.4"				v	100%
8	Univ. Eka Sakti (Ged B Perkuliahan)	sda	sda			v		30%
9	Univ. Eka Sakti (Ged. D)	sda	sda				v	100%
10	Univ. Eka Sakti (Ged. A)	sda	sda				v	100%
11	Univ. Eka Sakti (Lab. Komputer)	sda	sda	v				0%
12	Ged. DepKeu RI, Ditjen Perbendaharaan Kanwil III Padang	Jl. Khatib Sulaiman No. 3 Padang	10 m, S: 00 55' 30,4" E: 100 21' 40,3"				v	100%
13	Bappeda Sumbar	Jl. Khatib Sulaiman No. 1 Padang	sda				v	100%
14	Dinas Pengelolaan Keuangan Daerah	Jl. Khatib Sulaiman No. 43	8 m, S: 00 55' 08,2" E: 100 21' 38,8"				v	100%
15	LB-LIA	Jl. Jhonny Anwar	7 m, S: 00 59' 27,6" E: 100 21' 10,8"				v	100%
16	UNP (Rektorat)				v	v		35%, perbaikan struktural ringan pada sayap kiri dan kanan
17	GOR UNP					v		25%

Diperiksa oleh:
1. Dr. Wayan Sengara
2. Dr. Iswandi Imran

keterangan:
Hijau: Layak huni
Kuning: Layak huni dengan perbaikan
Merah: Tidak layak huni

no	nama gedung	alamat	ketinggian/koordinat	Hasil Kajian Cepat				Keterangan dan Level Kerusakan
				hijau	kuning		merah	
					Perb. Struktural	Perb. Non-struktural		
5 okt 09								
1	Gedung Rektorat UNP	Jl. Prof Hamka Air Tawar	7m/S 00 53'49.7" E 100 20' 59.39"			v		penambahan elemen struktural yaitu balok pengikat tiang level atap, elemen struktur pengikat dinding sayap ….(35%)
2	Laboratorium Kimia UNP		7 m / S 00 53' 41.4" E 100 20' 48.6"			v		lantai dibongkar dan tanah lantai dasar dipadatkan karena terkena likuifaksi, sambungan balok kanopi dan balok utama dperbaiki, perbaikan dinding tembok, plafon, lantai…. (25%)
3	Laboratorium Fisika UNP (sayap kiri)		sda			v		perbaikan keramik lantai dasar dan tanah lantai dasar dipadatkan, terjadi likuifaksi , dinding tembok luar yang pecah perlu dibongkar dan direkonstruksi kembali dengan diberi fondasi yang lebih baik dari fondasi sebelumnya.…(25%)
4	Laboratorium Fisika UNP (sayap kanan)		sda		v			perbaikan pada kolom yang pecah, dan pemadatan lantai tanah dasar, terjadi likuifaksi , dinding tembok luar yang pecah perlu dibongkar dan direkonstruksi kembali dengan diberi fondasi yang lebih baik dari fondasi sebelumnya.…….(25%)
5	laboratorium Biologi UNP (sayap kanan)		sda			v		perbaikan keramik lantai dasar dan tanah lantai dasar dipadatkan, terjadi likuifaksi .……..(25%)
6	laboratorium Biologi UNP (sayap kiri)		sda		v			terjadi likuifaksi dan dilatasi dengan gedung sayap kanan ….(20%)
7	gedung kuliah FMIPA		sda			v		perbaikan keramik lantai dasar dan tanah lantai dasar dipadatkan, terjadi likuifaksi, perbaikan elemen dinding
8	Gedung perpustakaan		sda			v		perbaikan non-struktural ringan(lantai, dinding, plafon), pemisahan tangga dan struktur gedung utama
9	Gedung Dekanat FMIPA UNP		sda					perbaikan keramik lantai dasar dan tanah lantai dasar dipadatkan, terjadi likuifaksi… (25%)
10	gedung laboratorium FIK		8 m/S 00 53' 52.3" E 100 20' 47.4"			v		perbaikan keramik lantai dasar dan tanah lantai dasar dipadatkan, terjadi likuifaksi,dinding yang sudah tidak satu bidang harus dibongkar, tapi bila masih 1 bidang cukup ditambal dengan semen repair….(25-
11	GOR UNP		8 m/ S 00 53' 55.7" E 100 20' 51.0"			v		dinding dibongkar, dinding baru ditambah elemen penunjang yang diikatkan ke struktur utama ….. (25-30%)
12	gedung FIK		sda	v				keramik lantai dasar dibongkar, tanah lantai dasar dipadatkan… (10%)
13	Gedung Fakultas Bahasa, Sastra, dan Seni		7 m/ S 00 54' 00.1" E 100 20' 54.6"			v		perbaikan pada dindding bata, pleseter, plafon, keramik. Ikat dinding bata dengan baik ke struktur utama bangunan melalui kolom/balok praktis, hindari plester terlalu tebal dan hindari tempelan dinding yang berat…... (30%)
14	Gedung Seni Rupa		5 m/S 00 53' 55.0" E 100 20' 54.9"	v				perbaikan keramik selasar dan plafond (5-10%)
15	Laboratorium Tek.Produksi Teknik Mesin		sda		v			perbaikan semua tumpuan console, perbaikan dinding
16	Rumah Dinas Rektor UNP		7m/S 00 53'49.7" E 100 20' 59.39"			v		garasi dibongkar dan dikonstruksi ulang, keramik diperbaiki, tanah dasar diperbaiki karena terkena likuifaksi. Dinding tembok sebelah kiri yang berbatasan dengan sungai diperbaiki dan diperkuat… (10-15%)
17	Kantor Akbid Sumbar Lubuk Alung	Jl. Sungai Labang Lubuk Alung Kab.Padang Pariaman	10 m/ S 00 39' 56.2" E 100 17' 12.9"	v				perbaikan plafon (5%)
18	Laboratorium Keperawatan Dasar Akbid Sumbar Lubuk Alung	sda	sda			v		perbaikan tembok (10%)
19	Akbid Putri Bangsa Pariaman	Jl. Abdul Muis no.10 Kota Pariaman	6 m/ S 00 38' 03.7" E 100 08' 14.1"		v	v		1 kolom retak diperbaiki, dinding diperbaiki plat labor kebidanan ditambal ….(15%)
20	STIA Bina Nusantara Mandiri Pariaman	Jl. Pahlawan Kota Pariaman	6 m/ S 00 37' 26.4" E 100 07' 28.1"			v		perbaikan tembok….(5-10%)
21	STIKES Piala Sakti Kota Pariaman (Ruang Kuliah)	Jl. Diponegoro no 5 Kota Pariaman	sda			v		perbaikan keramik lantai dasar dan tanah lantai dasar dipadatkan, perbaikan elemen dinding … (5-10%)
22	STIKES Piala Sakti Kota Pariaman (Kantor)	sda	sda	v				..(0%)

Diperiksa oleh:
1. Dr. Wayan Sengara
2. Dr. Iswandi Imran

keterangan:
Hijau: Layak huni
Kuning: Layak huni dengan perbaikan
Merah: Tidak layak huni

no	nama gedung	alamat	ketinggian/koordinat	Hasil Kajian Cepat				Keterangan dan Level Kerusakan
				hijau	kuning		merah	
					Perb. Struktural	Perb. Non-struktural		
6 okt 09								
1	Gedung Asrama LPMP "Nusa Indah"		10 m/ S 00 93' 46.5"/ E 100 20' 54.0"	v				Perbaikan non struktural ringan pada dinding
2	Gedung kantor LPMP Sumbar			v				perbaikan non-struktur ringan (dinding), sumber bocor diperbaiki, retak >3mm di dempul, retak >3mm diperbaiki dengan mortar repair
3	Gedung Asrama LPMP "Cemara"				v			struktural ringan pada rangka sopi-sopi yang rusak harus dibuatkan rangka baru adengan tulangan yang mengikat pada elemen struktural disekitarnya. Untuk semetara daerah di bawah sopi-sopi jangan
4	Gedung Asrama LPMP "Teratai"			v				perbnaikan non-struktural ringan pada dinding dan plesteran kolom
5	Gedung Laundry LPMP						v	sebaiknya dibongkar. Sebelum pembangunan yang baru, tanah dasar dipadatkan, dan sebaiknya dipasang pondasi lajur, dan dipasang diatas lapisan tanah pendukung yang padat.
6	Gedung Laboratorium LPMP			v				Kebocoran diperbaiki. Jangan berada di daerah dekat dinding yang retakannya >5mm
7	Gedung Bung Hatta LPMP			v				Lapisan tanah dasar dipadatkan, Lokal 1B jangan ditempati dulu.
8	SMA 10 Padang Gedung Kelas Sayap Kanan	Jl. Situjuh Padang	10m/ S:00 56' 09.6" E: 100 21' 49.5"		v			Kerusakan struktural berat pada kolom, balok dan join dan tangga. Perbaikan struktural dan pembangunan oleh konsultan yang kompeten. Gunakan campuran semen yang lebih banyak pada coran
9	SMA 10 Padang Gedung Kelas Sayap Kiri				v			perbaikan kolom, lantai dan dinding
10	SMA 10 Padang Kantor Kepsek			v				perbaikan ringan pada dinding
11	SMA 1 Padang Gedung Kelas Utara bagian depan	Jl. Sudirman No. 1	9m/ S: 00 56' 51.4 E: 100 21' 45.0"				v	
12	SMA 1 Padang Gedung Kelas Utara bagian Belakang					v		perbaikan pada dinding dan tangga
13	SMA 1 Padang Gedung Kelas Lama Utara				v			perbaikan struktural dan perencanaan sebaiknya oleh konsulan yang kompeten, tambahkan pengikat dinding dan kolom bertulang
14	SMA 1 Padang Gedung kelas lama selatan				v			perbaikan kolom dan koridor, tambahkan pengikat dinding dan kolom bertulang. Perbaikan struktural dan perencanaan sebaiknya dilakukan oleh konsultan yang berkompeten.
15	SMA 1 Padang Gedung Kantor					v		Penguaan elemen struktural beton bertulang yang dilaksanakan oleh konsultan yang kompeten
16	SMK 9 Padang Kelas 1 lantai	Jl. Bundo Kanduang	8m/ S: 00 57' 15.9" E: 100 21' 34.3	v				Bangunan tambahan diberi celah dengan bangunan sebelahnya.
17	SMK 9 Padang Kelas 3 lantai						v	
18	SMK 9 Padang Kelas blok barat						v	
19	SD 14 Olo Ladang	Jl. Belakang Olo	7m/ S: 00 56' 48.7" e: 100 21 07.4"				v	perbaikan tembok ringan
20	SD 27 Olo Ladang	Jl. Belakang Olo	7m/ S: 00 56' 39,8" e: 100 21 06.1"				v	perbaikan ringan pada tembok dan pagar.
21								
22								

Diperiksa oleh:
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2. Dr. Iswandi Imran

keterangan:
Hijau: Layak huni
Kuning: Layak huni dengan perbaikan
Merah: Tidak layak huni

Appendix-5

Presentation material of AIFDR

(Padang Earthquake Post-Disaster Survey)

Padang Earthquake Post-Disaster Survey

23rd Oct – 11th Nov 2009

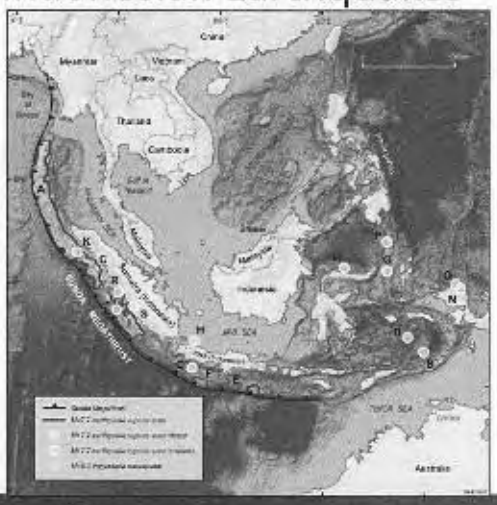
AUSTRALIA–INDONESIA
FACILITY FOR
DISASTER REDUCTION

Large and Deadly Indonesian Earthquakes 2004-2009

17 events magnitude 7.0 or larger

3 caused large tsunamis

4 caused over 1,000 fatalities



AUSTRALIA-INDONESIA FACILITY FOR DISASTER REDUCTION

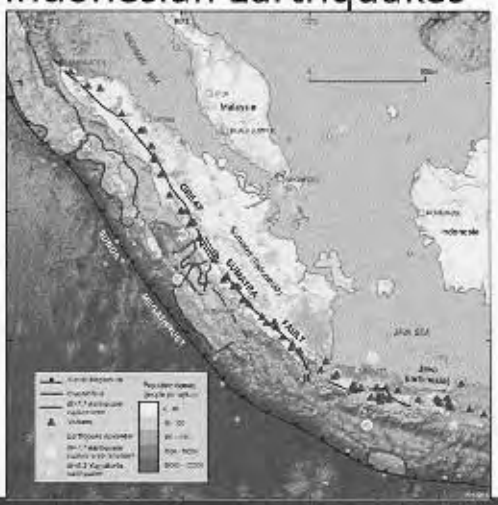
Large and Deadly Indonesian Earthquakes 2004-2009

17 events magnitude 7.0 or larger

3 caused large tsunamis

4 caused over 1,000 fatalities

'Seismic gap' off Padang could cause mag 8.5 earthquake

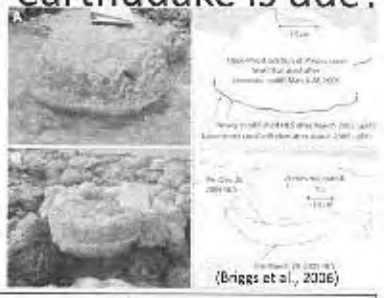


AUSTRALIA-INDONESIA FACILITY FOR DISASTER REDUCTION

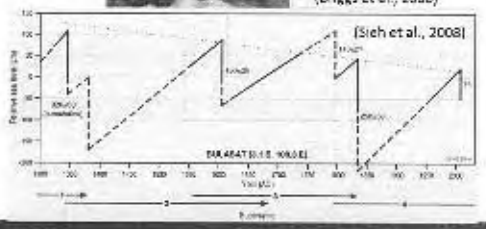
How do we know another earthquake is due?

Scientists from LIPI, Singapore and USA have used coral growth patterns to study past uplift and subsidence events.

The pattern is one of earthquake 'supercycles'; the current one is not yet over



(Briggs et al., 2006)

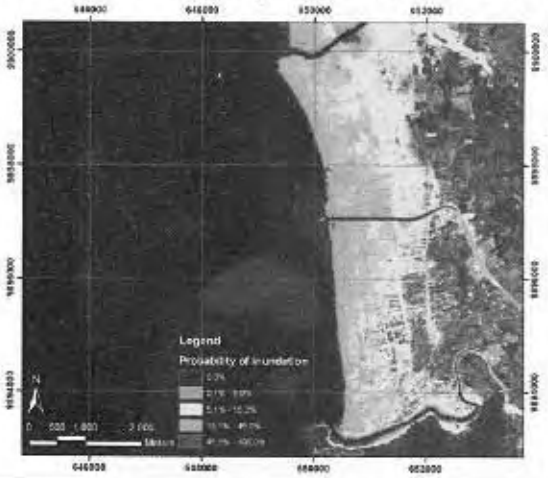


(Sieh et al., 2008)

AUSTRALIA-INDONESIA FACILITY FOR DISASTER REDUCTION

The threat from the next earthquake includes a major tsunami

A large earthquake similar to the 1797 event off Padang will cause a large tsunami that will inundate the costal strip of Padang



AUSTRALIA-INDONESIA FACILITY FOR DISASTER REDUCTION

Expectations for Padang

- Another large earthquake is still expected off Padang
- It will likely cause not only strong ground shaking but also a large tsunami
- Reconstruction in Padang that considers both earthquake- and tsunami-resilient design will save lives

Survey Aim

The systematic collection and analysis of data on earthquake damage, with a particular focus on houses, medical facilities and schools. This information will help:

- **Understand the vulnerability of buildings to earthquake ground motion.**
- **Inform the development of better building codes.**
- **Undertake realistic earthquake risk assessments for national and sub-national disaster risk management.**
- **Inform earthquake planning and safety education campaigns.**

Survey Approach

Over 70 collaborators in Padang from 27th Oct – 11th Nov

- Detailed survey teams – medical facilities and schools.
- General survey teams – household buildings.

INTERNATIONAL TEAM

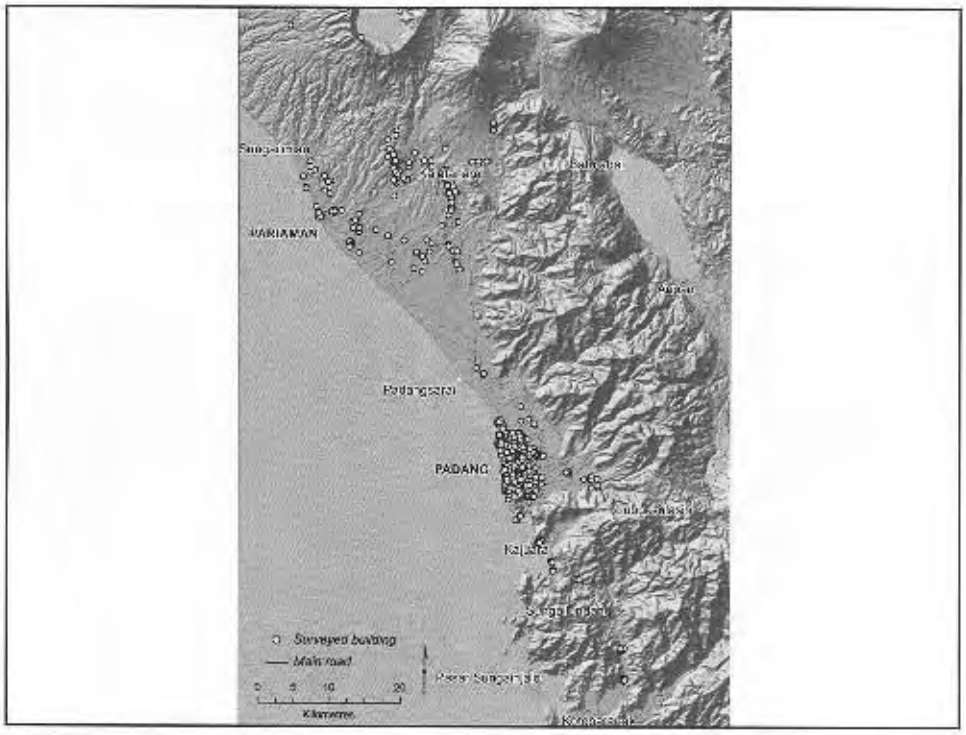
- Institute Technology, Bandung
- Andalas University
- Geoscience Australia
- University of Adelaide
- University of Auckland
- Cardno Consulting
- Geophysical and Nuclear Sciences, NZ
- Nanyang Technical University, Singapore

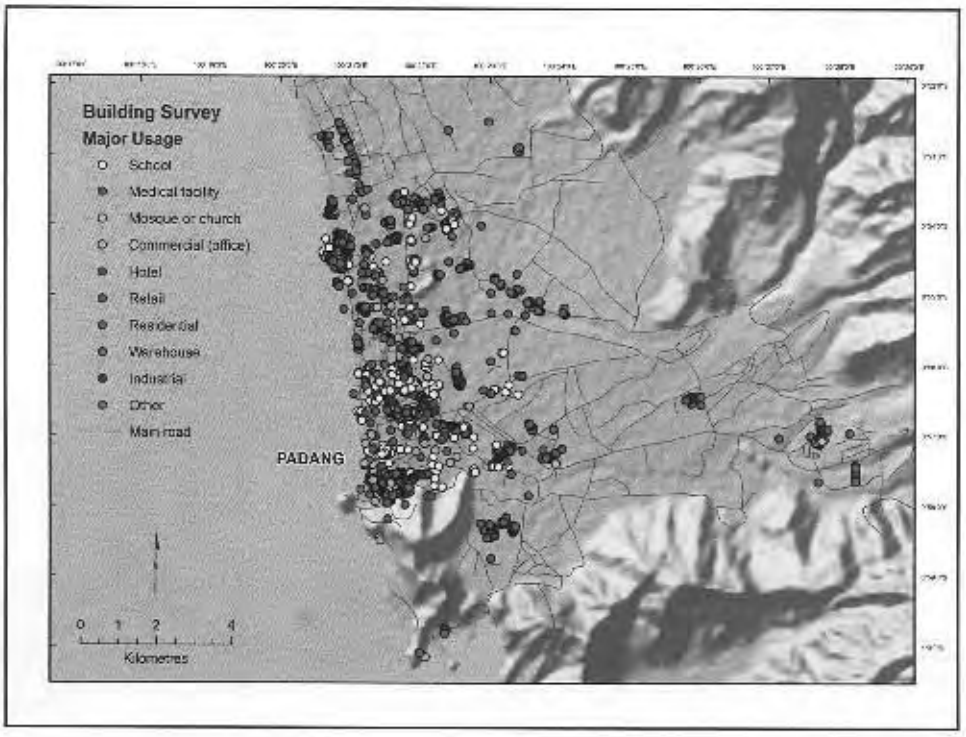
AUSTRALIA-INDONESIA FACILITY FOR DISASTER REDUCTION

Survey Results

- 50+ building types identified in schema with 5 broad structural systems.
- 4,000 buildings surveyed over three week period.
- Local felt intensity assessed using the Modified Mercalli scale.
- Data cleaning, augmentation and integration of other information (e.g. building age) to follow.
- Preliminary analysis and recommendations made.

AUSTRALIA-INDONESIA
FACILITY FOR
DISASTER REDUCTION


PARIAMAN
Padangpariaman
PADANG
Surveyed building
Main road
Kilometres

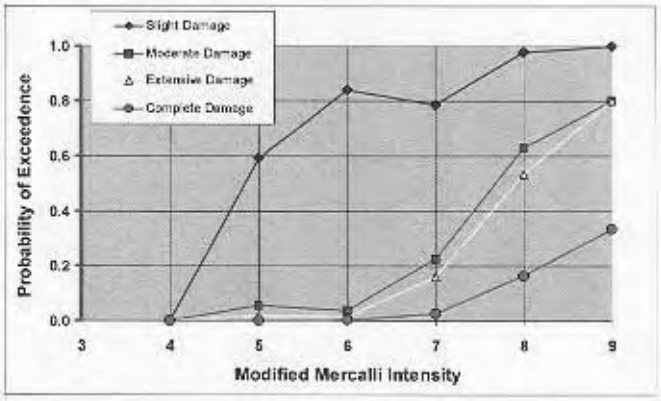

Building Survey
Major Usage
School
Medical facility
Mosque or church
Commercial (office)
Hotel
Retail
Residential
Warehouse
Industrial
Other
Main road
PADANG
0 1 2 4
Kilometres

Confined Masonry

AUSTRALIA-INDONESIA FACILITY FOR DISASTER REDUCTION

PRELIMINARY RESULTS: Confined Residential Masonry

Fragility Curves



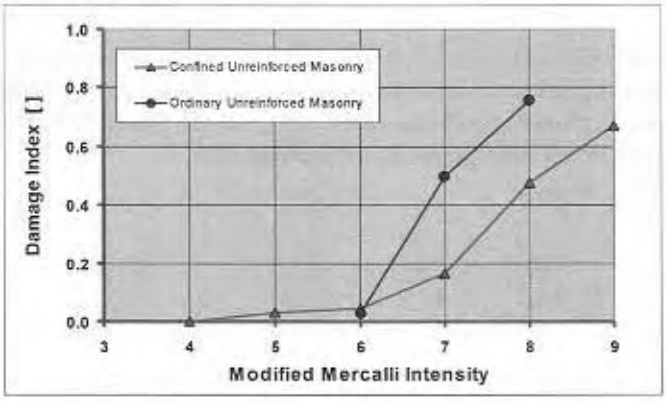
AUSTRALIA-INDONESIA FACILITY FOR DISASTER REDUCTION

Unconfined

Masonry

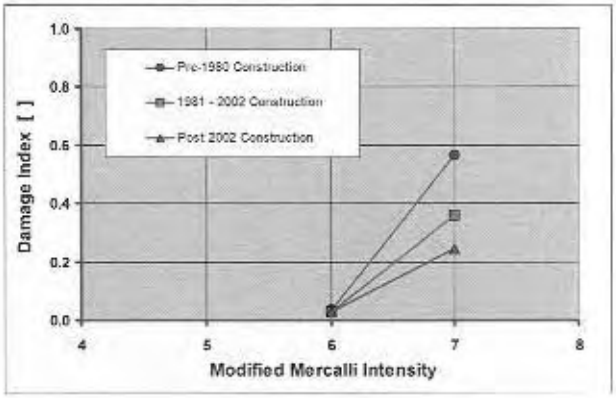
AUSTRALIA-INDONESIA FACILITY FOR DISASTER REDUCTION

PRELIMINARY RESULTS: Confined and Unconfined Residential Masonry Aggregated Vulnerability Curves



AUSTRALIA-INDONESIA FACILITY FOR DISASTER REDUCTION

PRELIMINARY RESULTS: Non-Residential Reinforced Concrete Frame Low-Rise (1-3 stories)



AUSTRALIA-INDONESIA FACILITY FOR DISASTER REDUCTION

Engineering Recommendations

To improve the safety of the West Sumatra community the following recommendations are made to maximise building performance, assist recovery and reduce the impact on populations during the next earthquake.

AUSTRALIA-INDONESIA FACILITY FOR DISASTER REDUCTION

Immediate-Term Recommendations, all Building Types

- Increase public awareness of the potential for earthquakes and the importance of earthquake resistant construction in saving lives.
- Review seismic design criteria need to be prepared and the current Building Codes for West Sumatra revised.
- Improve design and construction quality by further training in fundamentals of reinforced concrete construction and seismic detailing for the professional and construction communities in West Sumatra.
- Training of building workers and education of building owners to assist in the reform process.

Immediate-Term Recommendations, Engineered Buildings

Design and reconstruction should comply with building codes, this includes:

- Design compliance prior to the issue of building permits.
- Construction compliance prior to building occupation.

Immediate-Term Recommendations, Non-Engineered Buildings

- Provision of technical advice and guidelines to support public knowledge of good residential construction practice.
- Encourage better practices for confined masonry and avoidance of unreinforced masonry.
- Reconstruction payments should be linked to, and support better building practices.

AUSTRALIA-INDONESIA FACILITY FOR DISASTER REDUCTION

Medium-Term Recommendations (1)

- Detailed hazard mapping for West Sumatra and city of Padang should be undertaken to support better spatial planning by government (site amplification, liquefaction, landslide, etc.).
- A review of national seismic hazard maps and building codes to better reflect recent advances in Indonesian earthquake experience.
- Buildings over 2 stories and within the tsunami inundation zone should be designed to function as emergency tsunami evacuation points.

AUSTRALIA-INDONESIA FACILITY FOR DISASTER REDUCTION

Medium-Term Recommendations (2)

- Training in fundamentals of reinforced concrete construction and seismic detailing should be provided to the broader construction communities in West Sumatra (and Indonesia) to improve design and construction quality.
- Training of building workers and education of building owners will help compliance with building codes and assist the reform process.

AUSTRALIA-INDONESIA FACILITY FOR DISASTER REDUCTION

Conclusions

These recommendations are fundamental for reducing the human, social and infrastructure losses associated with any future earthquake.

To assist recovery and reduce the impact on populations during the next earthquake there needs to be fundamental improvements in:

- Regulation of building codes, multi-hazard planning, non-engineered design and hazard mapping.
- Enforcement of building codes and permits, inspection programs and increased training of construction professionals.
- Specific engineering design improvements including improvements in confined and unconfined masonry.

AUSTRALIA-INDONESIA FACILITY FOR DISASTER REDUCTION

Appendix-6

Questionnaire of AIFDR

(Padang Region Post 30.09.09 Earthquake Survey)

Padang Region Post 30.09.09 Earthquake Damage Survey

Bldg ID no.	Date	Team	Sequence No
Address / Location			
GPS Co-ordinates	Lat	Long	
Filenames	First Photograph	Last photograph	

Description

Same as last? ☐

Usage (1,2,3,..)		Structural system		Wall type		Roofing type	
Residential	☐	URM	☐	Mud brick/daub	☐	Thatch. etc	☐
Commercial (office)	☐	RM	☐	Unreinf'd masonry	☐	Tile	☐
School	☐	Timber frame	☐	Reinf'd Masonry	☐	Metal	☐
Retail	☐	Steel frame	☐	Timber on subfram	☐	Concrete	☐
Hospital	☐	Plain concrete	☐	Metal on subframe	☐	Other	☐
Hotel	☐	RC frame / walls	☐	Insitu Concrete	☐		
Warehouse	☐	Other	☐	Other	☐	**Age**	
Other industrial	☐	**Floor type**		**Number of Storeys**		0-10 years	☐
Church /Mosque	☐	Timber	☐	1	☐	11-20years	☐
Other	☐	RC	☐	2	☐	21-49years	☐
		Other	☐	3	☐	50+ years	☐
Length (m)				4-7	☐	Unknown	☐
Width (m)				8-	☐		
Irregularity codes	☐☐☐☐	Long axis bearing	☐			Plan shape code	☐

Miscellaneous

Same as last? ☐

Site morphology	Hill top ☐	Steep slope ☐	Mild slope ☐	Flat ☐
MMI from interview	☐	**Seismically separated?** ☐		

Notes on bldg and damage to non-bldg structures: garden walls, footpaths, roads, power poles, etc.

Inspection accuracy	Outside only ☐	Partial interior ☐	Complete ☐

Damage – Non URM

Same as last? ☐

	Architectural			Parapets, Gables, Walls			Structural Frame	
0	Negligible	☐	0	Negligible	☐	0	Negligible	☐
1	Slight damage to acceleration sensitive elements	☐	1	In-plane cracking of in-fill masonry	☐	1	Minor cracking or distortion to frame elements	☐
2	Moderate damage to acceleration sensitive elements	☐	2	Out of plane failure of in-fill masonry	☐	2	Severe cracking or distortion to frame elements	☐
3	Slight drift damage	☐	3	Severe damage of in-fill masonry	☐	3	Column confinement failure	☐
4	Moderate drift damage	☐	4	Slight damage to non-masonry walls	☐	4	Column flexural failure	☐
5	Severe drift damage	☐	5	Moderate damage to non-masonry walls	☐	5	Column shear failure	☐
6		☐	6	Severe dam to non-mason	☐	6	Displacement from found	☐
7		☐	7		☐	7	Foundation failure	☐
8		☐	8		☐	8	Soft storey failure	☐
9	Destruction	☐	9	Destruction >75% walls	☐	9	Destruction	☐

Damage - URM

Same as last? ☐

Architectural			Parapets, Gables, Walls			Structural Frame		
0	Negligible	☐	0	Negligible	☐	0	Negligible	☐
1	Minor cracking at some door and windows	☐	1	Cracking at base of parapets or gables	☐	1		☐
2	Moderate cracking at many doors and windows	☐	2	Collapse of some parapets	☐	2	Roof frame damaged	☐
3	Extensive cracking at many door and window openings.	☐	3	Any wall crack up to 1mm	☐	3	Detachment of floors / roof from walls	☐
4	Complete cracking at many door and window openings	☐	4	Wall cracks up to 4mm types 1,5,6; up to 2mm types 2,3,7; up to 1mm types 4,8,9	☐	4		☐
5	Ceiling collapse	☐	5	Wall cracks up to 10mm types 1,5,6; up to 5mm types 2,3,7; up to 1mm types 4,8,9	☐	5		☐
6	Collapsed awnings	☐	6	Wall cracks > 5	☐	6	Displacement from found	☐
7	Roofing damaged	☐	7	Collapse < 26% walls	☐	7	Foundation failure	☐
8		☐	8	Collapse 26-75% walls	☐	8	Soft storey failure	☐
9	Destruction	☐	9	Destruction >75% walls	☐	9	Destruction	☐

Population

Same as last? ☐

No of inhabitants in bldg	
Day	Night

Bldg evacuated during Earthquake?

Yes		No	

Bldg evacuated after Earthquake?

Yes		No	

Did inhabitants have a EQ evacuation plan?

Yes		No	

How long before bldg reoccupied?

Days	
Weeks	
Unable	

Temporary accommodation	
None (homeless)	☐
Friends / family	☐
Local community bldg	☐
Aid agency	☐
Govt temporary accommodation	☐
NA – non residential bldg	☐
Unknown	☐
Distance to temp accomm'n from home (km)	☐

Injuries	
No of persons injured	☐
Severe cuts, minor burns	☐
Severe injuries, breaks, burns requiring hospitalisation or surgery	☐
Life threatening requiring quick intensive treatment to avoid death	☐
Deaths	☐

% Floors Collapsed (count roof as a floor) ☐

Loss of utilities

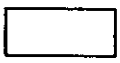
Service	Days	Weeks
Water		
Power		
Gas		
Telecom		

MMI Scale

MMI Value	Description of shaking	Full Description
1		Not felt. Marginal and long period effects of large earthquakes.
2		Felt by persons at rest, on upper floors, or favorably placed.
3		Felt indoors. Hanging objects swing. Vibration like passing of light trucks. Duration estimated. May not be recognized as an earthquake.
4		Hanging objects swing. Vibration like passing of heavy trucks; or sensation of a jolt like a heavy ball striking the walls. Standing motor cars rock. Windows, dishes, doors rattle. Glasses clink. Crockery clashes. In the upper range of IV, wooden walls and frame creak.
5	Light	Felt outdoors; direction estimated. Sleepers wakened. Liquids disturbed, some spilled. Small unstable objects displaced or upset. Doors swing, close, open. Shutters, pictures move. Pendulum clocks stop, start, change rate.
6	Moderate	Felt by all. Many frightened and run outdoors. Persons walk unsteadily. Windows, dishes, glassware broken. Knickknacks, books, etc., off shelves. Pictures off walls Furniture moved or overturned. Weak plaster and masonry D cracked. Small bells ring (church, school). Trees, bushes shaken (visibly, or heard to rustle).
7	Strong	Difficult to stand. Noticed by drivers of motor cars. Hanging objects quiver. Furniture broken. Damage to masonry D, including cracks. Weak chimneys broken at roof line. Fall of plaster, loose bricks, stones, tiles, cornices (also unbraced parapets and architectural ornaments). Some cracks in masonry C. Waves on ponds; water turbid with mud. Small slides and caving in along sand or gravel banks. Large bells ring. Concrete irrigation ditches damaged.
8	Very Strong	Steering of motor cars affected. Damage to masonry C; partial collapse. Some damage to masonry B; none to masonry A. Fall of stucco and some masonry walls. Twisting, fall of chimneys, factory stacks, monuments, towers, elevated tanks. Frame houses moved on foundations if not bolted down; loose panel walls thrown out. Decayed piling broken off. Branches broken from trees. Changes in flow or temperature of springs and wells. Cracks in wet ground and on steep slopes.
9	Violent	General panic. Masonry D destroyed; masonry C heavily damaged, sometimes with complete collapse; masonry B seriously damaged. (General damage to foundations.) Frame structures, if not bolted, shifted off foundations. Frames racked. Serious damage to reservoirs. Underground pipes broken. Conspicuous cracks in ground. In alluvial areas sand and mud ejected, earthquake fountains, sand craters.
10	Very Violent	Most masonry and frame structures destroyed with their foundations. Some well-built wooden structures and bridges destroyed. Serious damage to dams, dikes, embankments. Large landslides. Water thrown on banks of canals, rivers, lakes, etc. Sand and mud shifted horizontally on beaches and flat land. Rails bent slightly.
11		Rails bent greatly. Underground pipelines completely out of service.
12		Damage nearly total. Large rock masses displaced. Lines of sight and level distorted. Objects thrown into the air.

Masonry A: Good workmanship, mortar, and design: reinforced, especially laterally, and bound together by using steel, concrete, etc.; designed to resist lateral forces.
Masonry B: Good workmanship and mortar; reinforced, but not designed in detail to resist lateral forces.
Masonry C: Ordinary workmanship and mortar; no extreme weaknesses like failing to tie in at corners, but neither reinforced nor designed against horizontal forces.
Masonry D: Weak materials, such as adobe; poor mortar; low standards of workmanship; weak horizontally.

Plan Shape Codes

Square 	Hollow 	U shaped 
Rectangular 	A triangular 	X cranked 
L shaped 	Circular 	K cruciform 
T shaped 	Polygonal 	Irregular 

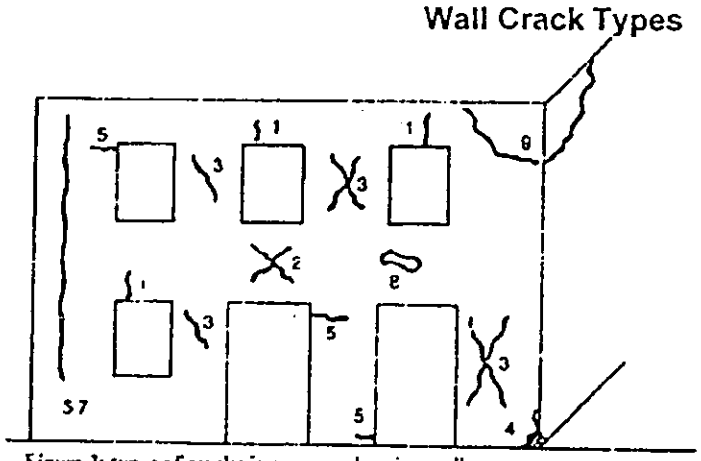


Figure 1: types of cracks in masonry bearing walls:
1) vertical cracks on openings; 2) diagonal cracks on parapets and on doors and windows lintels; 3) diagonal cracks on vertical walls between openings; 4) local masonry crushing with or without spalling; 5) horizontal flexural cracks on top or bottom of vertical walls between openings; 6) vertical cracks at wall intersections; 7) passing through vertical cracks at wall intersections; 8) spalling of material due to beam o. floor pounding; 9) separation and expulsion of two corner walls

(Ref: Goretti & Di Pasquale, 2002, EERI Invitational Workshop)

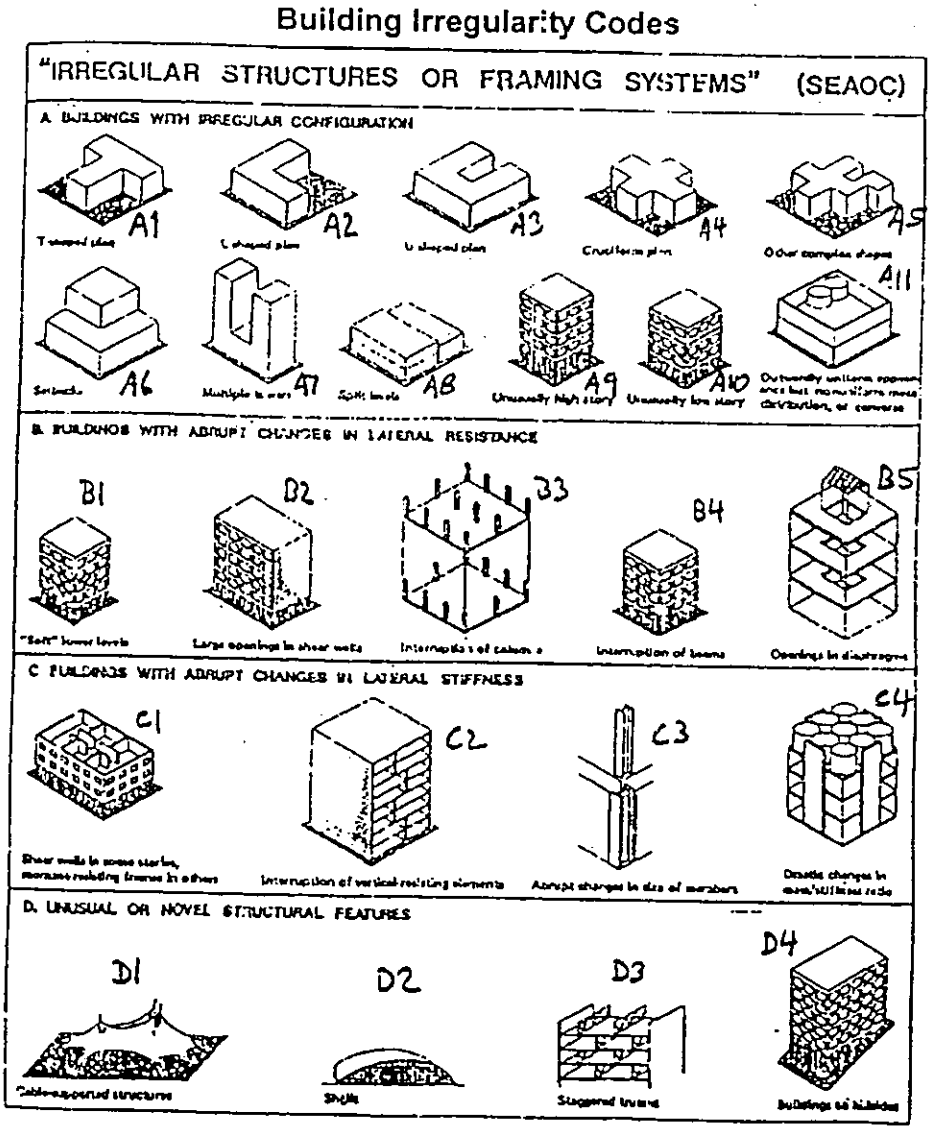


Figure 6.2 Graphic interpretation of "irregular structures or framing systems" from the commentary to the SEAOC Recommended Lateral Force Requirements and Commentary. From "Building Configuration and Seismic Design" by Arnold and Reitherman (Ref 6.2).

Some Comments to the Proposed Form of Padang Region Post 20.09.09 Earthquake Damage Survey:

Description -Structural System:
- Confined masonry
- Bamboo frame

Description - Wall type
- Mud brick
- Red/burned clay brick
- Concrete/sand+cement brick
- Wood
- Bamboo
- Metal

Description - Roofing type
- Wood shingle

Description - special details?
- Long cantilever
- Tall tower/chimney
- Heavy ornament
- Wide patio
- Short column/beam
- Soft storey
- Pounding potential
- No gap/separation to neighbor building

Miscellaneous:
- Sign of liquefaction
- Ground crack/displacement

Damage - non URM structural frame:
- Concrete crushing
- Short column failure
- Beam-Column joint failure
- Reinforcement buckling
- Reinforcement full out (slip, due to inadequate anchorage)
- roof frame damage/displaced
- pounding?

Damage - URM
URM usually without Structural Frame ?