



El Proyecto RESIS-II:

Reducción de Riesgos Sísmicos en Guatemala, El Salvador y Nicaragua con Cooperación Regional a Honduras, Costa Rica y Panamá

Prevalent construction typologies in Central America

1 Introduction

One of the first works towards the conduct of comprehensive seismic risk and loss assessment studies for Central American cities was the 'Mapping of Typical Buildings' in order to get an idea about the prevalent building typologies. This included:

- 1) Assignment of building typologies for each Central American country and preferably with regional applicability. Selection criteria are building height, construction material, lateral load-resisting system, gravity load-bearing structure etc. Additionally the building's occupancy type (residential, commercial etc) and its occupancy patterns (number of inhabitants, day and night time occupancy) will be considered.
- 2) Definition of building classes as a function of construction material, structural system and number of stories.
- 3) Establishment and compilation of fragility information (i.e. capacity curves, vulnerability functions) for each building type. The outcome of Work Task 1 thus establish the basis for Work Task 2 'Municipalities at Risk' in which the risk and loss computations are conducted.

2 Test study areas

Detailed building stock inventories by walk-down surveys were conducted in four different study areas (Table 1). Figure 1 exemplarily illustrates the study area in Guatemala City and its subdivision into geographical units.



Figure 1. Subdivision of the study area in Guatemala City – Part of Zona 11 into 3 geographical units (census tracts).

Table 1. Characterization of the small-scale study areas.

No.	Study area	Country	No. of geounits	No. of buildings	Total population
1	San Salvador – Distrito 2	El Salvador	16	3,377	16,870
2	Guatemala City – Zona 11	Guatemala	3	2,499	22,047
3	Managua – Distrito 4 (Racachaca)	Nicaragua	1	385	3,412
4	Masaya – inner-city area	Nicaragua	1	834	6,474

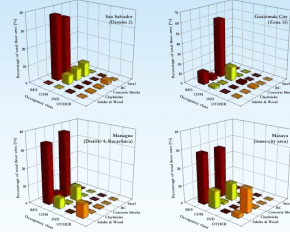


Figure 2. Composition of the building inventory in the different study areas illustrating the distribution of occupancy class and building types.

3 Prevalent construction typologies

A customized classification scheme of building typologies prevalent in Central American countries was developed based on the findings of the building stock inventories in the four test areas as well as random sample surveys in both rural and urban areas. In addition, it was checked which of the 'model building types' defined by HAZUS (FEMA, 1999, 2003) are available in Central America.

Based on these findings a final classification scheme was derived customized to the Central American conditions (Table 2). Figures 3 - 18 represent some of the more local construction typologies of different urban and rural regions in Central America.

Table 4. Final classification scheme for the Central American countries.

No. final	Index final	Index CA	HAZUS mbt	Story no.	Description
1	W1	MF	W1	1	Minifalda, wood light frames
2	AD	AD, TP	-	1	Adobe and Tapial
3	WD	TZ, BQ	-	1 (2)	Tapial and Bahareque
4	CC	CC	-	1	Calycanto (fieldstone masonry)
5	CLa	CLa	URML	1-2	unreinforced claybrick masonry
6	CLr	CLr	-	1-2	claybrick masonry reinforced with internal steel
7	CLc	CLc	RM2L	1-3	claybrick masonry confined with RC
8	CBa	CBa, PkC	URML	1	unreinforced concrete block masonry including Piedra de Canter
9	CBi	CBi	-	1-3	concrete block masonry reinforced with internal steel rods
10	CBc	CBc	RM2L	1-3	concrete block masonry confined with RC
11	PC1	BP	PC1	1	pre-cast tilt-up concrete walls including Bloque Panel
12	S3	LT	S3	1	steel light frames including Laminada Troquelada
13	SSL	-	SSL	1-3	steel frames with unreinforced masonry infill walls
14	SSM	-	SSM	4-7	
15	SSH	-	SSH	8+	
16	C1L	-	C1L	1-3	concrete moment frame (marco o portica estructural)
17	C1M	-	C1M	4-7	
18	C1H	-	C1H	8+	
19	C2L	-	C2L	1-3	concrete shear walls (muro de corte)
20	C2M	-	C2M	4-7	
21	C2H	-	C2H	8+	
22	C3L	-	C3L	1-3	concrete frame with unreinforced masonry infill walls
23	C3M	-	C3M	4-7	
24	C3H	-	C3H	8+	



Figure 3. MF - 'Minifalda' (madero y concreto)



Figure 4. AD - Adobe brick masonry with adobe mortar

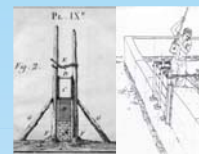


Figure 5. TP - 'Tapial' (rammed earth)



Figure 6. BH - 'Bahareque' (mixed timber, bamboo and mud wall construction technique)



Figure 7. TZ - 'Taguezal' (comparable with Bahareque, only found in Nicaragua)



Figure 8. CC - 'Calycanto' (field stone, rubble stone masonry)



Figure 9. CLa - Unreinforced claybrick masonry



Figure 10. CLc - Confined claybrick masonry



Figure 11. CBu - Unreinforced concrete blocks



Figure 12. CBri - Internally reinforced concrete blocks



Figure 13. CBrc - Confined concrete blocks



Figure 14. Pdc - 'Piedra de Canter' masonry of cut quarry stones, confined with timber elements



Figure 15. Pdc - 'Piedra de Canter' masonry of cut quarry stones, unreinforced



Figure 16. BP - 'Bloque Panel' horizontal arrangement with steel profiles



Figure 17. CBrc - Confined horizontal arrangement



Figure 18. LT - 'Laminada Troquelada' steel frames with corrugated steel plates

4 Provision of fragility information

For analytical risk computation applying the Capacity Spectrum Method (CSM) the provision of reliable capacity curves and vulnerability functions for each building typology is one of the most important issues. For the ongoing studies available capacity curves and vulnerability functions were selected from current literature and assigned to the defined building types. Many of these curves were not specifically developed for buildings in Central American but for typologies of comparable structural parameters and vulnerability.

Contact: Dr. D.H. Lang dominik@norsar.no http://www.norsar.no

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