

# EL SALVADOR EARTHQUAKE, JUNE 19, 1982

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## INTRODUCTION

On Saturday, June 19, 1982, a strong earthquake was felt in all the territory of El Salvador, at 00h-22m local time (6h-22m G.M.T.). Most of the population was awakened by the strong motion and public utilities went out of service.

The epicenter was located approximately at longitude  $89^{\circ}38' W$ , latitude  $13^{\circ}21' N$  at a point on the Central American trench in the Pacific Ocean some 20 km off the coast and 70 km from the capital San Salvador. The magnitude was estimated at 7.0 Richter, and the focal depth was estimated at 80 km (100 km focal distance to the San Salvador station).

Out of four seismological stations in El Salvador, only one, equiped with a long period seismograph, registered the arrival of both the P and S waves. The other three, equiped with short period seismographs had their markers dislodged at the arrival of the P waves. The time-lag between the P and S waves was determined later for the numerous aftershocks that followed, making it possible to confirm the focal distance.

There were no foreshocks preceding the earthquake. Former earthquakes of lesser magnitude had been registered in September 17, 1959 and April 12, 1961 (magnitudes 6.2 and 6.3) with the location of their epicenter in the same area as that of June 19, 1982. On the other hand, this earthquake was followed by 174 aftershocks that took place during the 17 days succeeding it. Out of the seven strong motion accelerographs installed in San Salvador, only the one located at the National Observatory produced a good recording.

A reduced photocopy of the accelerogram is shown in Fig. 1.

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\*EERI 1979

## GROUND MOTION CHARACTERISTICS IN SAN SALVADOR

The only available accelerogram was produced by a standard USCGS strong motion accelerograph "Montana Type". The last recorded calibration of it dates back to November 19, 1967, which traces position do not coincide completely with those obtained during the June 19 earthquake. According to the calibration data of 1967, direct scaling by eye of the accelerogram yields the following information:

Max. vertical acceleration:	0.10 g
Max. N-S acceleration:	0.19 g
Max. E-W acceleration:	0.18 g
Period of vibration:	0.36 seconds
Duration:	25.00 seconds

It is worth noting that the accelerograph is located at the National Observatory, built on a layer of volcanic ashes of some 6 to 9 m thickness, underlaid by solid lava. This accelerogram has been sent to Menlo Park, California in July 1982 for digitization, its results not being available at the time of writing this report. [Dr. Gerald A. Brady, USGS, will report at a later date.]

## EARTHQUAKE INTENSITIES AND EFFECTS

An isoseismal map was prepared on the basis of inquiries regarding subjective reactions to the earthquake intensity carried out in forty four cities and towns (see Fig. 2).

The greater than MM1-7 region comprises an area of approximately 5200 Km<sup>2</sup> with an estimated population of 3.2 millions.

It has been estimated that some 300 dwellings were destroyed and some 1330 were damaged, most of them of either adobe or wattle type construction; however, a few dozen reinforced concrete engineered buildings were also damaged. Table 1 gives a sampling of such damages. [Photos of selected damage are appended.]

Damages were also observed in highways, which consisted mainly of obstructions due to landslides. Public utilities, such as pipelines and aqueducts broke down in several places.

As expected, there is a close correlation between the registered period of vibration of the earthquake and the observed damages to multistory buildings, which were heavier for those 2 to 4 stories high and negligible for buildings 7 stories high or over.

There has been no evidence of surface faulting.

#### ACKNOWLEDGEMENTS

I wish to express my gratitude to Engr. Pio Arnulfo Ayala, Minister of Public Works of El Salvador, for granting me access to the pertinent Government Institutions; to Lic. Salvador Alvarez of the National Geotechnical Institute of El Salvador, for providing the data on seismological records, and to Engr. Jose Maria Portillo of the "Dirección de Urbanismo y Arquitectura" of El Salvador and a member of the National Committee for the Assessment of Structural Damages, who furnished the information on most of the building damages assessed.

EL SALVADOR EARTHQUAKE  
JUNE 19, 1982  
NATIONAL OBSERVATORY  
SAN SALVADOR

T

5 cms

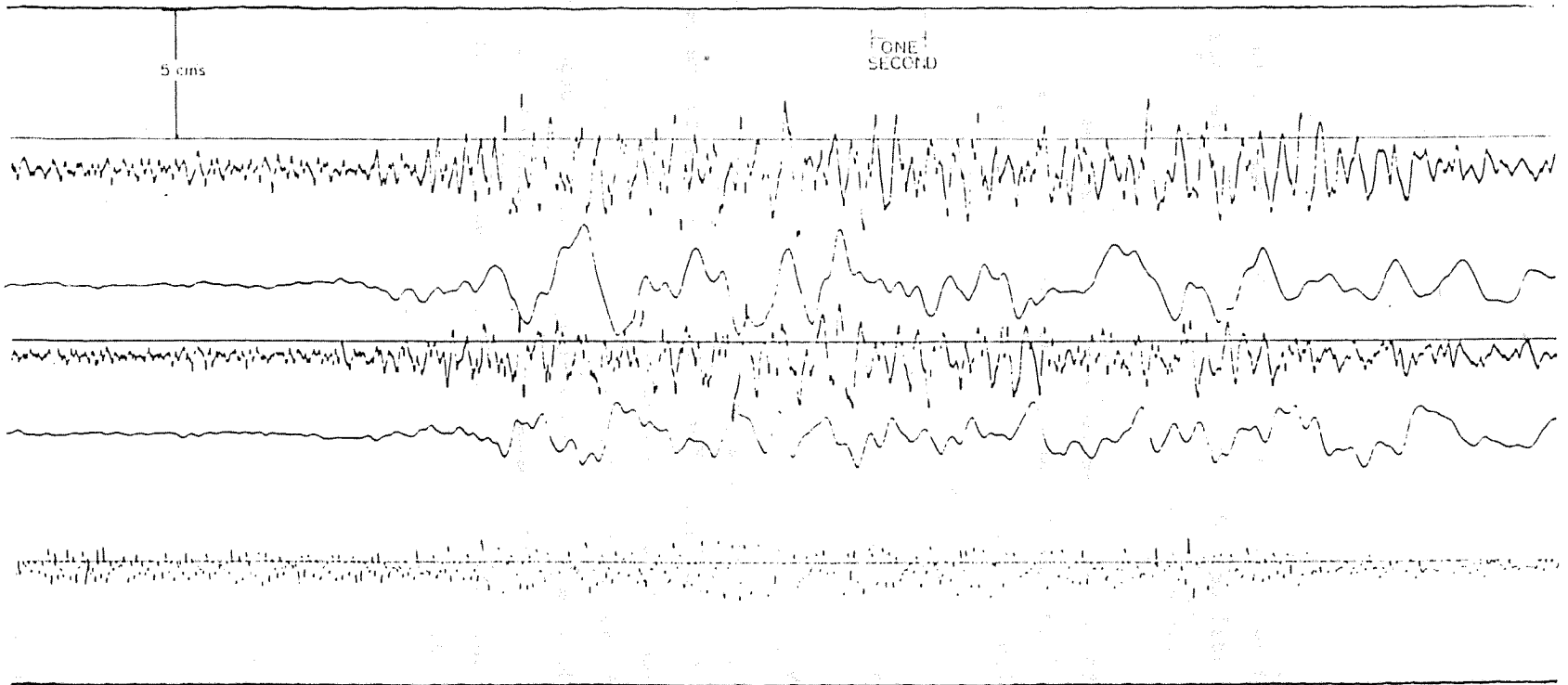
ONE  
SECOND

EAST-WEST  
( 14.7 cm/g )

NORTH-SOUTH  
( 12.2 cm/g )

06

VERTICAL  
( 11.6 cm/g )



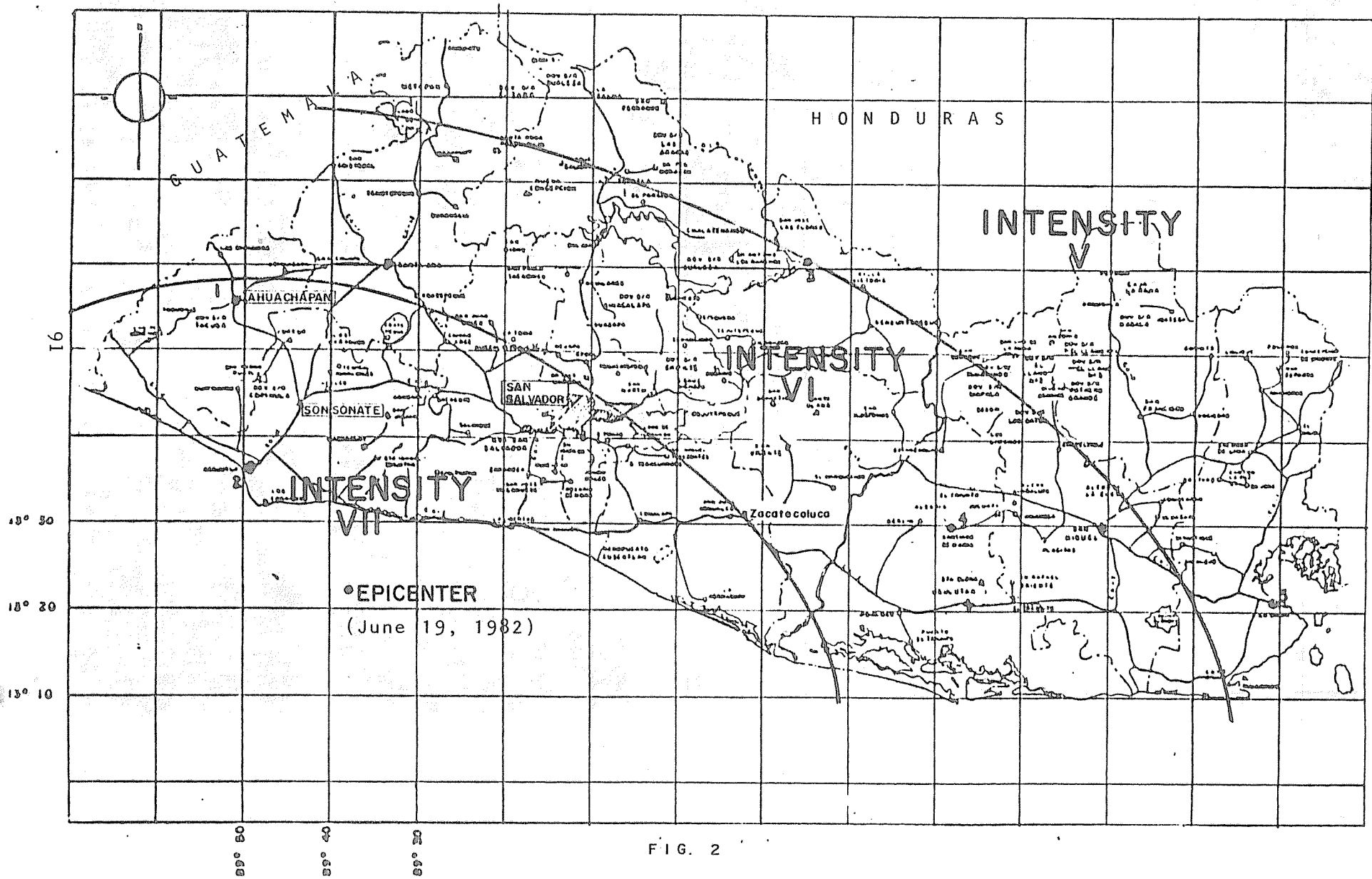
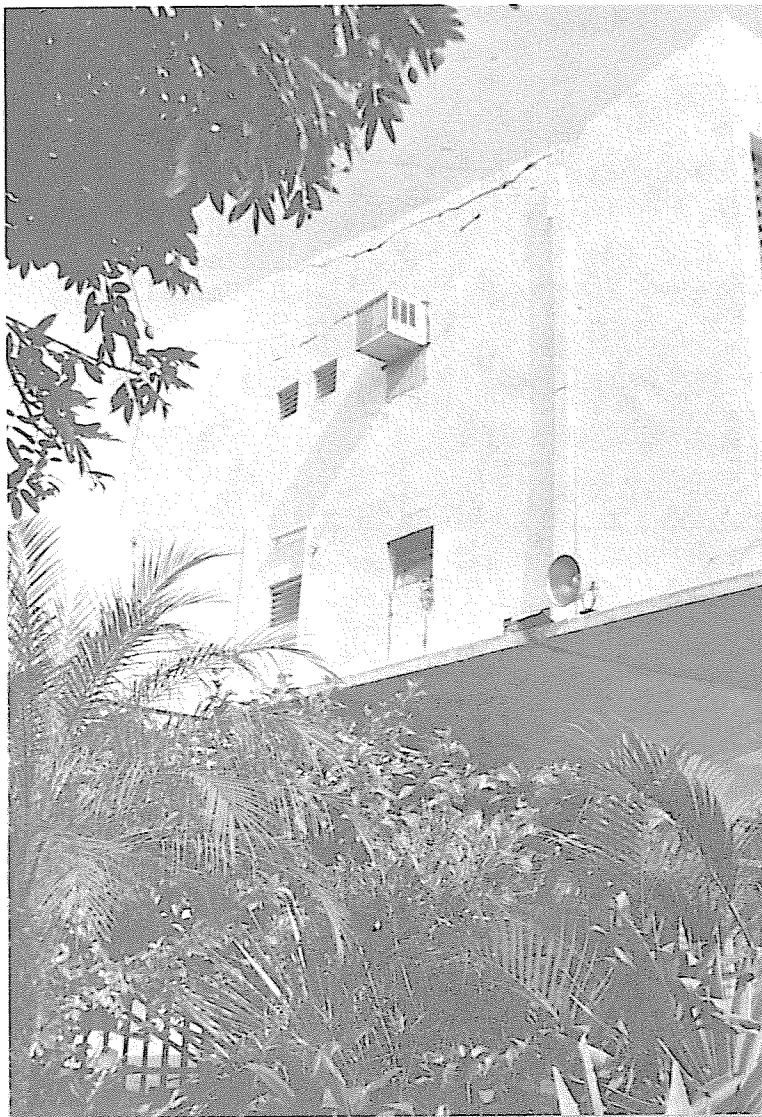


FIG. 2

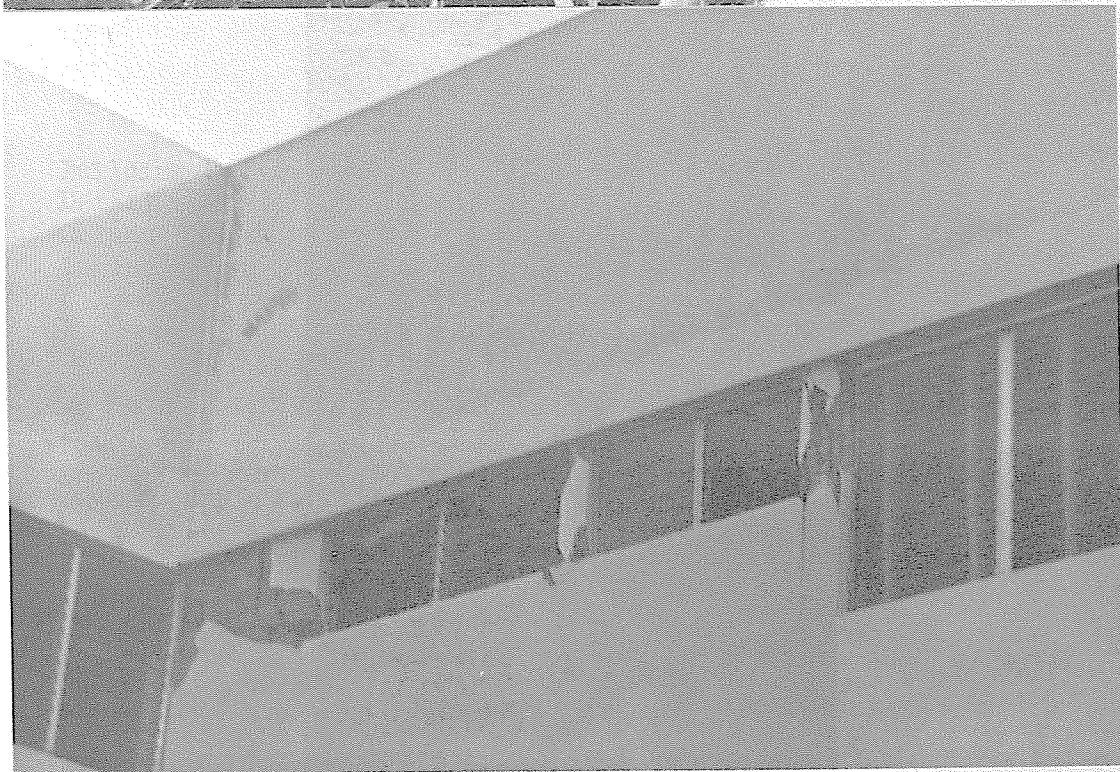
TABLE 1 - EL SALVADOR EARTHQUAKE - JUNE 19, 1982  
DAMAGES OBSERVED IN BUILDINGS BY VISUAL INSPECTION

DESCRIPTION	NON-STRUCT. WALLS	STRUCT. WALLS	COLUMNS	BEAMS	COLUMN-BEAM JOINTS	STAIRS	FLOOR	WALL-FRAME JOINTS	PLASTERING	CEILING	LOCATION
1- Church building, walls of adobe and wattle type walls, 1.72 m thick and 0.72 m thick	partial collapse*	partial collapse	---	---	---	---	---	---	---	---	Sonsonate
2- Church building, wattle type walls, 0.8 m thick	partial collapse*	partial collapse	---	---	---	---	---	---	---	---	Ahuachapán
3- 7 one-story houses, wattle type walls*	partial collapse*	partial collapse	---	---	---	---	---	---	---	---	San Salvador
4- 1 story hospital bldg., adobe walls 0.8 m thick and wattle type walls	severely cracked*	---	---	---	---	---	---	---	---	---	Ahuachapán
5- 2 story bldg., reinf. concrete frames & slabs, reinf. masonry walls	severely cracked*	---	---	---	---	severely cracked*	---	---	---	---	San Salvador
6- 3 story bldg., reinf. concrete frames, reinf. masonry walls	severely cracked*	---	---	---	---	---	---	---	---	---	San Salvador
7- 3 story school bldg., reinf. concrete frames and reinforced masonry walls	severely cracked	---	cracked	cracked	cracked	---	---	damaged	damaged	---	San Salvador
8- 3 story reinforced concrete frames and reinf. masonry walls	partial collapse*	---	---	---	---	---	sunken	---	damaged	---	San Salvador
9- 3 story reinforced concrete frames and reinf. masonry walls	---	---	---	---	---	cracked	---	damaged	damaged	damaged	San Salvador
10- 3 story reinforced concrete and reinf. masonry walls	cracked	---	cracked	cracked	cracked	---	---	---	damaged	---	San Salvador
11- 3 story bldg., reinf. concrete struct. & reinf. masonry walls	cracked	---	---	---	---	---	---	---	damaged	---	San Salvador
12- 3 story bldg., reinf. concrete frames & reinf. masonry walls	cracked	---	cracked	---	---	---	---	damaged	damaged	damaged	San Salvador
13- 4 story bldg., reinf. concrete struct. & reinf. masonry walls	cracked	---	cracked	---	---	---	---	---	damaged	---	San Salvador
14- 4 story bldg., reinf. concrete frames & reinf. masonry walls	---	---	---	---	---	severely cracked*	---	damaged	damaged	---	San Salvador
15- 4 story bldg., reinf. concrete frames & reinf. conc. masonry walls	severely cracked*	---	---	---	---	---	---	damaged	---	---	San Salvador
16- 6 story bldg., reinf. concrete struct. & reinf. masonry walls	cracked	---	---	---	---	---	---	---	damaged	---	San Salvador
17- 7 story reinf. concrete frames & reinf. masonry walls	---	---	---	---	---	---	---	---	damaged	---	San Salvador
18- 7 story reinf. concrete frames & reinf. conc. masonry walls	---	---	---	---	---	---	---	damaged	cracked	---	San Salvador

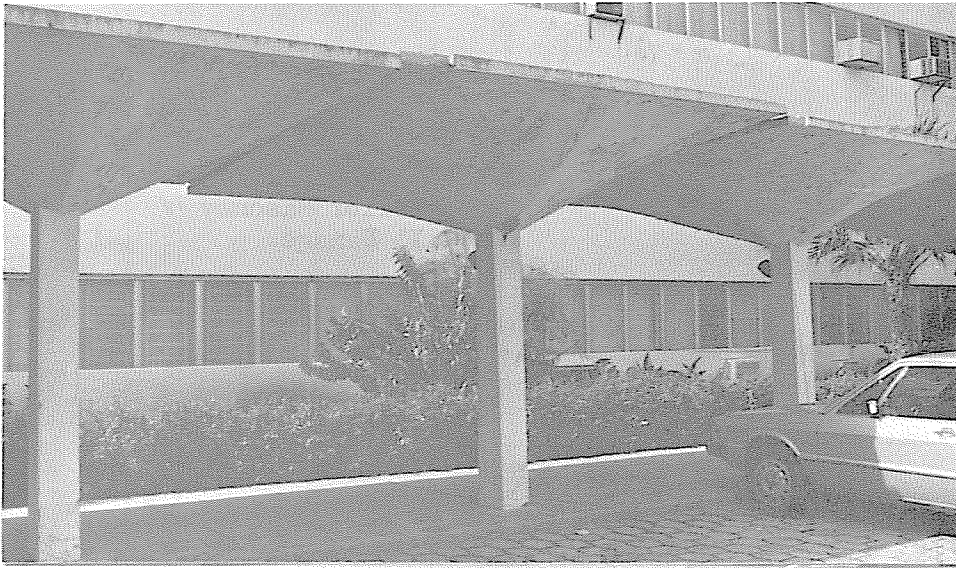
\* To be demolished (walls mistakenly tied to the structural frames)



Building No. 10  
Exterior Masonry  
Wall Damage.



Building No. 10  
Detail of  
Column Damage  
at Third Story.



Building No. 10  
Tilted  
HP Umbrellas



Building No. 13  
Ground Level  
Column Damage



Building No. 13  
Detail of  
Column Damage





Building No. 16, View Showing Building Configuration



Building No. 16  
Detail of  
Column cracking  
in 1st Story column



Typical Landslide on Highway



Severely Damaged 2-Story House in Ahuachapan -- Wattle Construction