EL SALVADOR EARTHQUAKE, JUNE 19, 1982

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San Salvador, September 1982

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°38' W, latitude 13°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, equipped with a long period seismograph, registered the arrival of both the P and S waves. The other three, equipped 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.

*EERI 1979
GROUND MOTION CHARACTERISTICS IN SAN SALVADOR

The only available accelerogram was produced by a standard USGS 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 Km² 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

EAST-WEST
(14.7 cm/g)

NORTH-SOUTH
(12.2 cm/g)

VERTICAL
(11.6 cm/g)

FIG 1
### Table 1 - El Salvador Earthquake - June 19, 1982

**Damages Observed in Buildings by Visual Inspection**

<table>
<thead>
<tr>
<th>Description</th>
<th>Non-Struct. Walls</th>
<th>Structural Walls</th>
<th>Columns</th>
<th>Beams</th>
<th>Column-Beam Joints</th>
<th>Stairs</th>
<th>Floor</th>
<th>Wall-Frame Joints</th>
<th>Plastering</th>
<th>Ceiling</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Church building, walls of adobe and wattle type walls, 0.72 m thick and 0.72 m thick</td>
<td>partial collapse</td>
<td>partial collapse</td>
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<tr>
<td>2. Church building, wattle type walls, 0.8 m thick</td>
<td>partial collapse</td>
<td>partial collapse</td>
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<tr>
<td>3. 7 one-story houses, wattle type walls*</td>
<td>partial collapse*</td>
<td>partial collapse*</td>
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<tr>
<td>4. 1 story hospital bldg., adobe walls 0.8 m thick and wattle type walls</td>
<td>severely cracked*</td>
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<tr>
<td>5. 2 story bldg., reinf. concrete frames &amp; slabs, reinf. masonry walls</td>
<td>severely cracked*</td>
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<td>severely cracked*</td>
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<td>6. 3 story bldg., reinf. concrete frames, reinf. masonry walls</td>
<td>severely cracked*</td>
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<tr>
<td>7. 1 story school bldg., reinf. concrete frames and reinforced masonry walls</td>
<td>severely cracked</td>
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<td>cracked</td>
<td>cracked</td>
<td>cracked</td>
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<td>damaged</td>
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<tr>
<td>8. 3 story reinforced concrete frames and reinf. masonry walls</td>
<td>partial collapse*</td>
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<td>damaged</td>
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<td>9. 1 story reinforced concrete frames and reinf. masonry walls</td>
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<td>cracked</td>
<td>damaged</td>
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<tr>
<td>10. 3 story reinforced concrete and reinf. masonry walls</td>
<td>cracked</td>
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<td>cracked</td>
<td>cracked</td>
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<td>damaged</td>
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<tr>
<td>11. 3 story bldg., reinf. concrete street &amp; reinf. masonry walls</td>
<td>cracked</td>
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<td>damaged</td>
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<tr>
<td>12. 3 story bldg., reinf. concrete frames &amp; reinf. masonry walls</td>
<td>cracked</td>
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<td>cracked</td>
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<td>damaged</td>
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<tr>
<td>13. 4 story bldg., reinf. concrete street &amp; reinf. masonry walls</td>
<td>cracked</td>
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<td>cracked</td>
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<td>damaged</td>
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<tr>
<td>14. 4 story bldg., reinf. concrete frames &amp; reinf. masonry walls</td>
<td>severely cracked*</td>
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<td>damaged</td>
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<tr>
<td>15. 6 story bldg., reinf. concrete street &amp; reinf. masonry walls</td>
<td>severely cracked*</td>
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<td>damaged</td>
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<tr>
<td>16. 7 story reinf. concrete frames &amp; reinf. masonry walls</td>
<td>cracked</td>
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<td>damaged</td>
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<tr>
<td>17. 7 story reinf. concrete frames &amp; reinf. masonry walls</td>
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<td>damaged</td>
<td>cracked</td>
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</tbody>
</table>

* 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. 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