REPORT ON THE SEPTEMBER 13, 1986 EARTHQUAKE —KALAMATA, GREECE

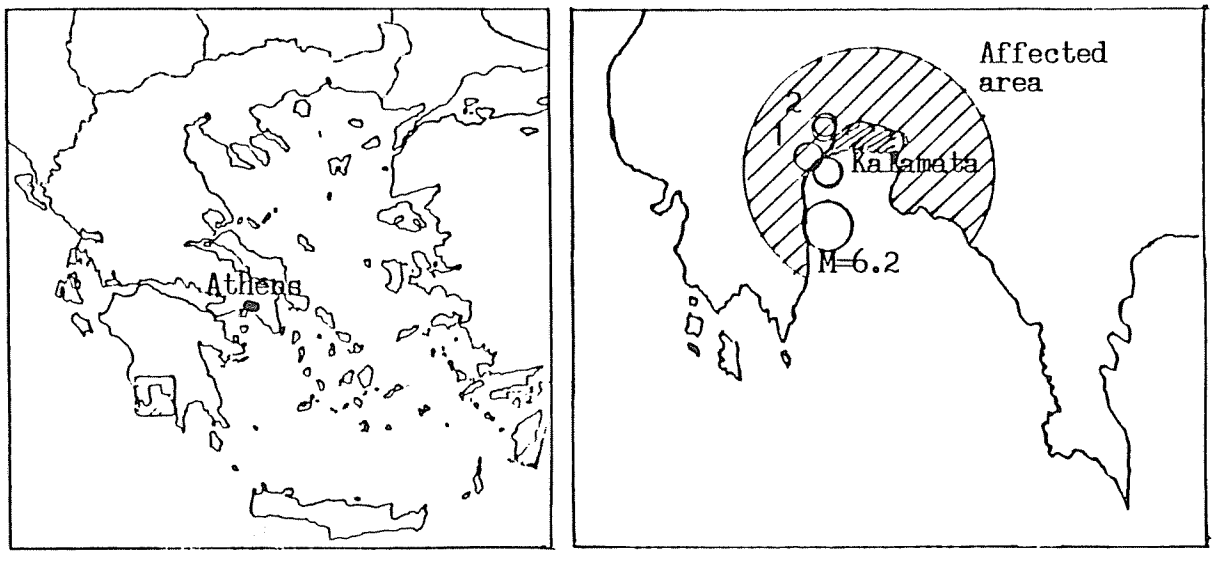

Figure 1. Location of the mainshock and aftershocks.

INTRODUCTION

Dr. Panayotis Carydis, Professor of Earthquake Engineering at the National Technical University in Athens, and a member of EERI, forwards the following brief, preliminary report on the Kalamata, Greece, earthquake. He had returned from the region and forwarded the report on September 18, 1986, before leaving again, with a team, to gather more information.

Acknowledgements are due to Mr. John Taflambas, Civil Engineer, Special Scientific Collaborator at the Laboratory for Earthquake Engineering, NTUA, for his help in preparing this short communication.

PRELIMINARY REPORT ON THE KALAMATA, GREECE, EARTHQUAKE OF SEPTEMBER 13, 1986

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GENERAL INFORMATION

On Saturday, September 13, 1986 at 20:24 local time an earthquake, M=6.2, occurred very near to the city of Kalamata, Greece (Fig. 1). Kalamata has a population of about 80,000. This event was rather sudden, with warnings from foreshocks on September 12 at about 02:00 (M=3.5), and about 17:00 (M=4.0).

The next day, Saturday evening, within a few seconds (most sources of information agree to about 5 sec duration of the main shock) the happy and relaxing city, at scattered locations turned into masses of rubble and debris. The people, in panic, were rushing out of houses to open spaces. There were 20 persons killed and about 300 injured. This rather small toll of victims is attributed to the fact that many people were concentrated at the harbour, where an inauguration of a new liner was taking place.

The main shock was followed by several aftershocks, the strongest of which occurred at midnight on September 13 (M=5.0), and at about 14:40 on September 15 (M=5.6). See locations 1 and 2 in the map of Fig. 1, as given from the Seismological Institute of the National Observatory. Due to the last shock many people were injured, because they had entered their damaged houses to retrieve some belongings. People are still living in tents and instructions are given not to approach any building, due to

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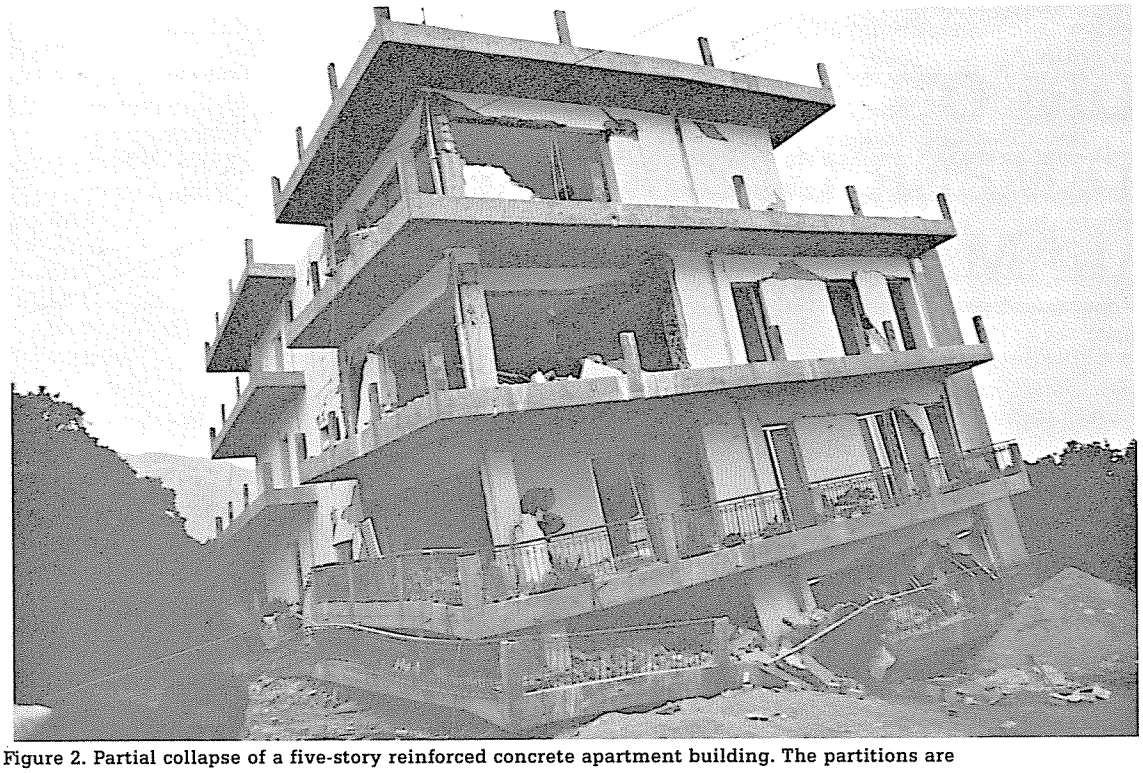

Figure 2. Partial collapse of a five-story reinforced concrete apartment building. The partitions are brick walls. The building was brand new.

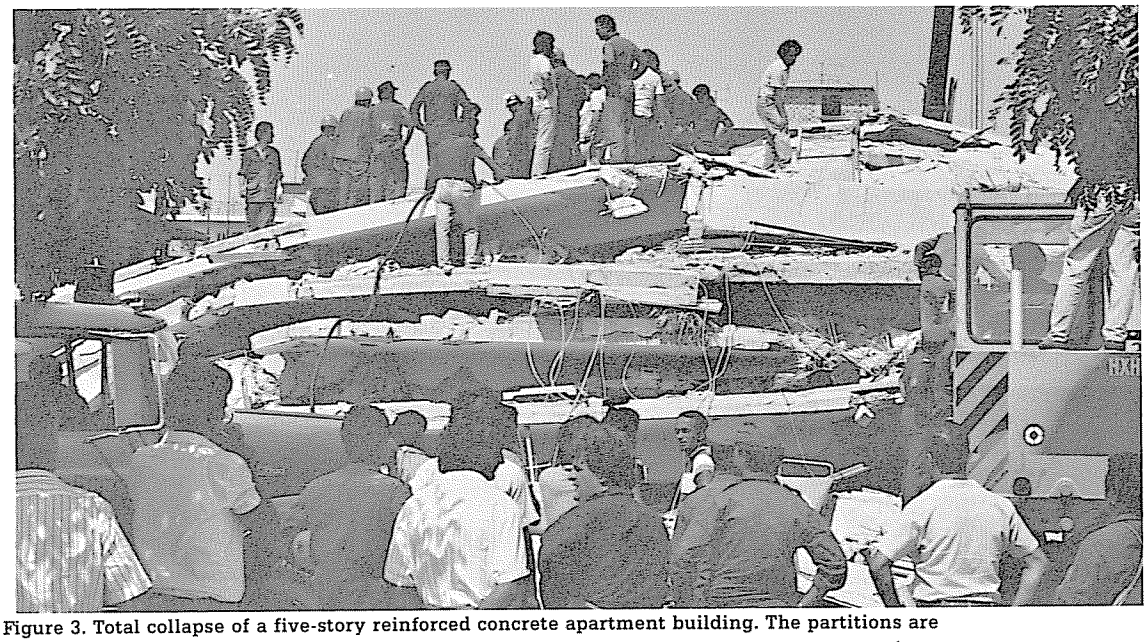

Figure 3. Total collapse of a five-story reinforced concrete apartment building. The partitions are brick walls. Many inhabitants were buried under the debris. The figure shows rescue operations.

the fear of future earthquakes.

From the first general observations (the vertical fall of architectural pediments, the direction and location of damage in the buildings, the intense dispersion of debris around the damaged buildings) one may infer that during the main shock a dominating vertical component of ground shaking was developed. This observation agrees with the seismological data, that locates the focus close to the city at a distance of about 20 km and depth 13 km.

Most of the collapsed buildings (although widely scattered) were observed to the south. Many torsional effects were observed.

According to witnesses, people standing in the streets lost their balance. This description, combined with other observations, gives an estimation of the MM Intensity of about VIII in this part of the town.

People in a ship moored at the dock say that they felt a shock as though they had run aground.

The lower part of the city, where the most modern buildings were damaged, is located on loose sand and gravel soil deposited by the

river which flows through the town. This part of the city is modern, whereas the ancient city is located to the north, at a distance of about 2-3 km from the shore line. There, many old buildings (150-200 years old) suffered extensive damage.

The material of the old buildings is stone or unreinforced brick masonry, with wooden floors, while that of the modern buildings is reinforced concrete with brick infill walls. The old buildings have one or two stories, while the modern ones may reach five stories.

DESCRIPTION OF DAMAGE

Damage in the city has a wide range even within a distance of a few tens of meters. Towards the east of the city the damage is more homogeneous. At the village of Eleohori (a few kilometers from Kalamata), of 120 houses, 117 were reported as collapsed.

In the city, one five-story block of flats collapsed, causing most fatalities. About 10 trapped people were rescued the next day. Other modern buildings suffered heavy damage which increased with the M=5.6 shock of September 15. Some buildings collapsed due to this shock.

Towards the north of the city, at a distance less than 15 km, there are just very small cracks in the buildings.

Some slope failures which blocked the main roads to the city were reported.

Many cars were damaged due to the fall of facades of buildings on to the streets below. This was also the reason for some fatalities and injuries.

Some isolated fires broke out but were quickly extinguished.

The accompanying pictures provide some early indications of characteristic damage to some of the structures in the region.

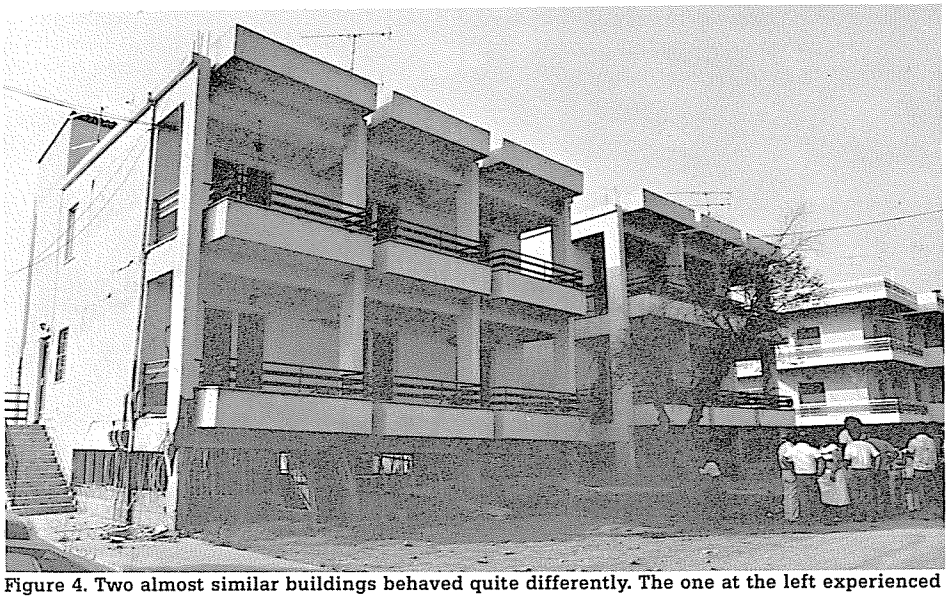

Figure 4. Two almost similar buildings behaved quite differently. The one at the left experienced extensive damage in the "short columns" of the basement, coming to rest as though torsion behavior had been prominent.

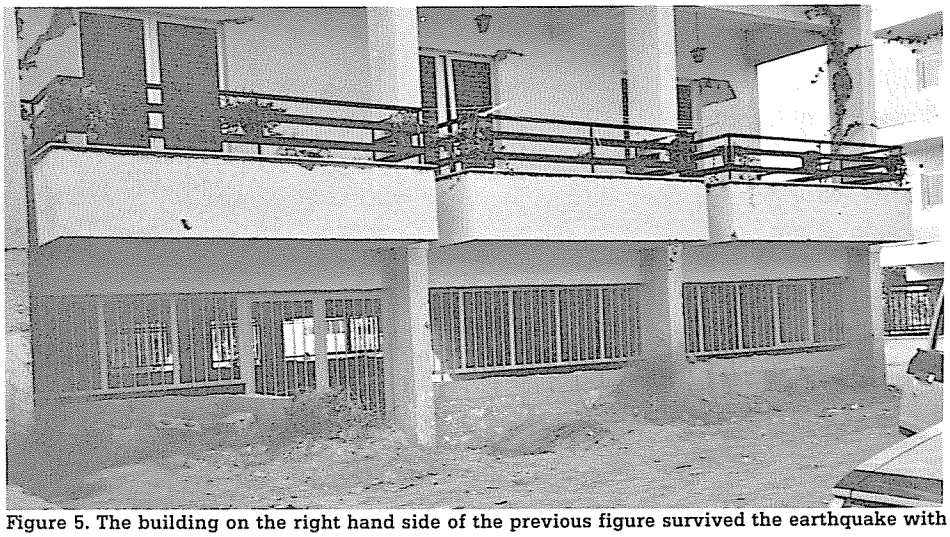

Figure 5. The building on the right hand side of the previous figure survived the earthquake with very small cracks.

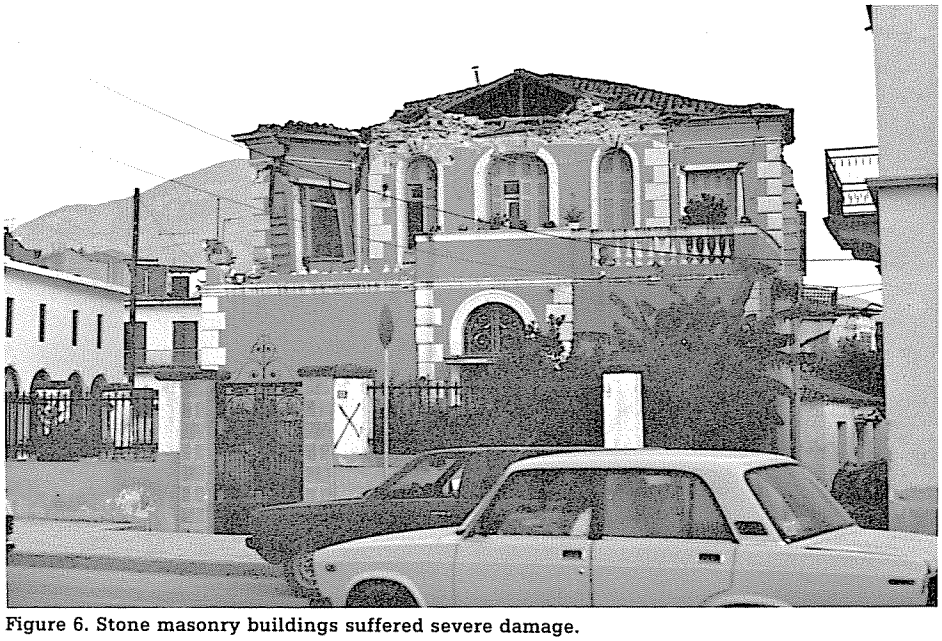

Figure 6. Stone masonry buildings suffered severe damage.

Figure 7. Many cars were damaged by fallen facades.

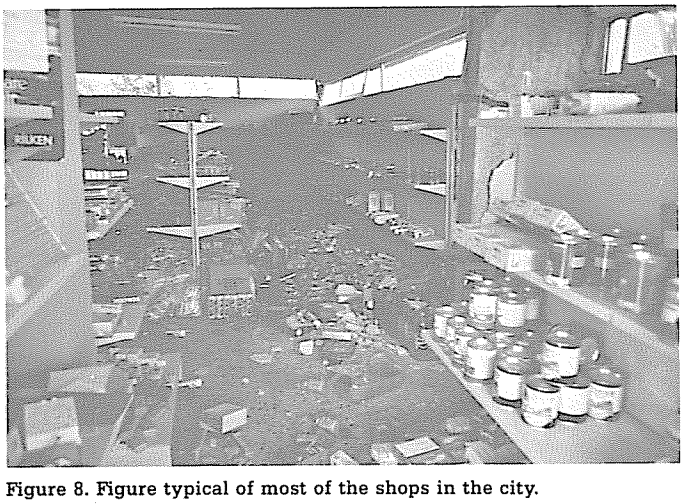

Figure 8. Figure typical of most of the shops in the city.

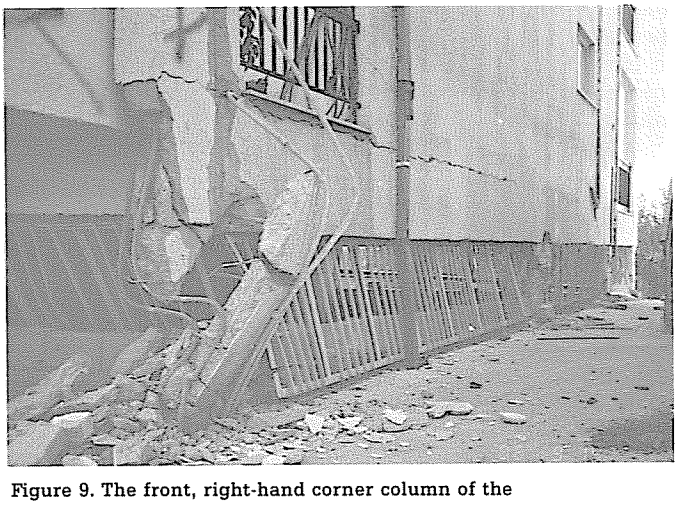

Figure 9. The front, right-hand corner column of the damaged building on the left in Fig. 4.