Preliminary Report on Investigations of
Japanese Earthquake June 12, 1978

A. Gerald Brady
USGS, Menlo Park, California

An earthquake with Richter magnitude 7.4 occurred at
1714 hr on June 12, 1978 (local) off the coast of Japan's
Miyagi prefecture. The following report contains some very
preliminary assessments of the earthquake and its effects.
All the statements concerning numerical values particularly,
and other statements not obviously the writer's opinions,
await confirmation both by subsequent investigation teams
and by official Japanese reports.

The epicentral region is located at 38°9'N latitude,
142°13'E longitude, at a depth of 30 km. The distance to
the nearest land and instrumental recordings is 70 km, and
the distance to the city of Sendai (pop. 600,000) where
there are several instrumented buildings, is 140 km.

The earthquake was preceded by a smaller shock at 1703
hr and by a magnitude 6.8 shock, with its own aftershocks,
on February 20 this year in the same, general, highly
seismic area.

The intensity of shaking reached V on the JMA scale
over an area perhaps 180 km x 60 km, and particularly in the
areas of Ofunato, Sendai, Shinjyo and Fukushima. JMA V
corresponds to MMI VII and VIII, and is partially described
as "Very Strong - cracks in walls, overturning of
gravestones, stone lanterns, etc., damage to chimneys and
mud-and-plaster warehouses."

Within a few days of the earthquake intensive
discussions and arrangements were under way between the U.S.
Geological Survey (USGS) and both U.S. and Japanese members
of the U.S.-Japan Panel on Wind and Seismic Effects, one of
a dozen or so panels in the U.S.-Japan Cooperative Program
in natural resources (UJNR). Most of the plans for meeting
planes, hotels, travel to the Sendai area, and preliminary
itineraries were made between Dr. E. O. Pfrang of NBS and
Dr. H. S. Lew of NBS, chairman and secretariat of the U.S.
Panel on the one hand, and Dr. Tadayoshi Okubo, of the
Public Works Research Institute (PWRI), secretary-general of
the Japan Panel, on the other.

Three teams eventually travelled, representing EERI,
FHA, and URS/J.A. Blume and Associates, in addition to UJNR,
USGS and NBS.
1. A. G. Brady, arrived June 19, representing UJNR, USGS,
   EERI.
2. J. Cooper (UJNR, FHA), B. Ellingwood (UJNR, NBS), and P.
   Yanev (URS/J.A. Blume); arrived June 22.
3. E. Harp (USGS), D. Keefer (USGS), C. Wentworth (USGS),
arrived June 23.

The interests of the writer included damage to civil engineering structures, the effects on instrumented buildings, and the details of strong motion instrumental records. Two days only were spent in the Sendai area under the guidance of Dr. Masamitsu Ohashi of PWRI. A brief description of the damage to various structures follows.

1. Cracking and spalling concrete on bridge piers at the location of a change in the reinforcing cross-section. Most cracks indicating pier movement in the longitudinal direction of the bridges.

2. River embankment failures due to settlement, sliding, and cracking, in the same area as ground settlement, liquefaction and sand-boils.

3. Two to four story reinforced concrete buildings suffering complete failure of the first story columns in areas of the building with no support from shear walls.

4. The engineering building at Tohoku University, a 9-story structure suffering very little damage—minor cracking of first story columns and some architectural brickwork veneer falling away in the first story foyer. Strong-motion records indicate 1 g acceleration at the ninth floor, in a 1 sec first mode vibration, corresponding to 25 cm displacement amplitudes.

5. The natural gas tank of the upturned cap type which collapsed and caught fire.

6. The oil storage tanks of the Tohoku Oil Company, six of which ruptured at the base, three seriously enough to allow leakage and subsequent partial vacuum collapse of the top. Crews were still cleaning up the last of the big spill into the harbor caused by failure of both inner and outer retaining systems.

7. The Sunny Heights private apartment building of 14 stories, with L-shaped plan and typical pounding damage, and diagonal shear cracks at several locations throughout the height of the building.

8. The National Railways building in Sendai, also instrumented and with no evident structural damage.

The acceleration amplitudes across Sendai varied significantly with location. No evident pattern of damage can yet be seen, except that the south-eastern half of the city is built on alluvial deposits, considerably worse, from foundation considerations, than the remainder of the city and the hills behind it.

The actual values of acceleration have yet to be checked within the Japanese agencies responsible for the instruments. Typical accelerations at ground level are in the range of 0.25 g to perhaps as high as 0.4 g. Upper level structural accelerations have reached as high as 1 g.
Some copies of the records have been transferred to the writer as a member of the Task Committee on Strong-Motion Instrumentation Arrays and Data, U.S.-Japan Panel on Wind and Seismic Effects, UJNR, by Mr. Hajime Tsuchida, of the Port and Harbor Research Institute, the Japanese Task Committee chairman.

A report containing copies of the records throughout the felt area numbering about fifty, and their chief characteristics, will be available by August, 1978, under the auspices of the Strong Motion Earthquake Observation Council, National Research Center for Disaster Prevention, Science and Technology Agency. Digitization of the traces will be carried out by the individual owner agencies and reported on subsequently.

Without the assistance of countless Japanese, an investigative trip like this, and that of the two teams following, would not have been possible. In addition to those members of the Japan Panel already mentioned, acknowledgments are due Mr. Toshio Iwasaki of the PWRI, Mr. Keiichi Ohtani of the National Research Center for Disaster Prevention, Dr. Makoto Watabe of the Building Research Institute, Mr. Yoshi Koshi of the Sendai Branch Office, Ministry of Construction, Professor Shiga of Tohoku University, and Mr. Kawashima of PWRI, together with probably many more.

Authors note: The location of the epicenter was provided by the Public Works Research Institute, Ministry of Construction, on June 22, 1978. The president of EERI, John Blume, was represented by team member P. Yanev. Further team member reports will be forthcoming.

Editors note: See also newspaper clippings, pages 88-90.