**U.S. Department of Commerce**
National Oceanic and Atmospheric Administration
National Environmental Satellite, Data, and Information Service
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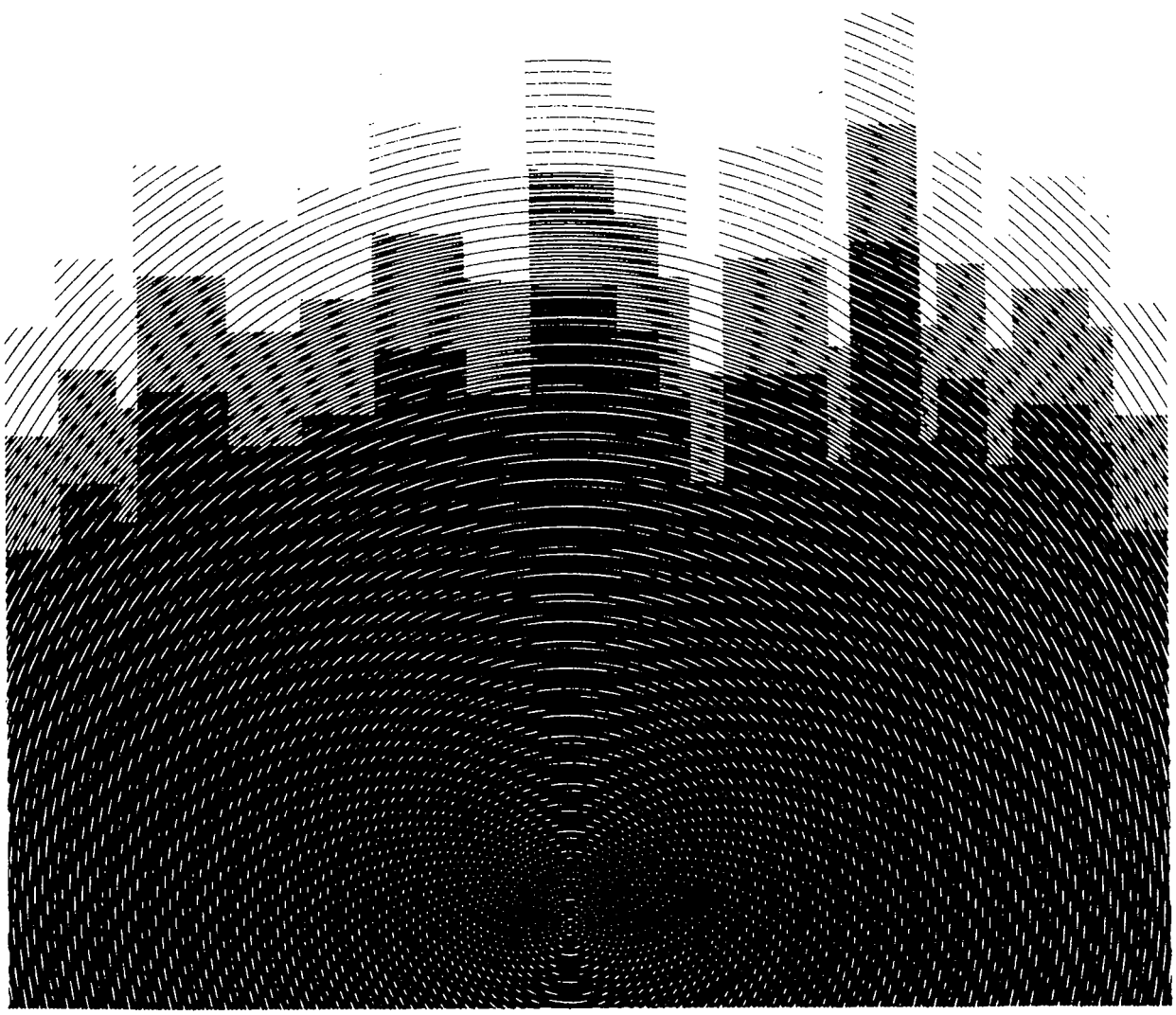
Boulder, Colorado

# SUMMARY OF EARTHQUAKE INTENSITY FILE

A computerized file of the effects of earthquakes in the United States

## KEY TO GEOPHYSICAL RECORDS DOCUMENTATION NO. 19



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# SUMMARY OF EARTHQUAKE INTENSITY FILE

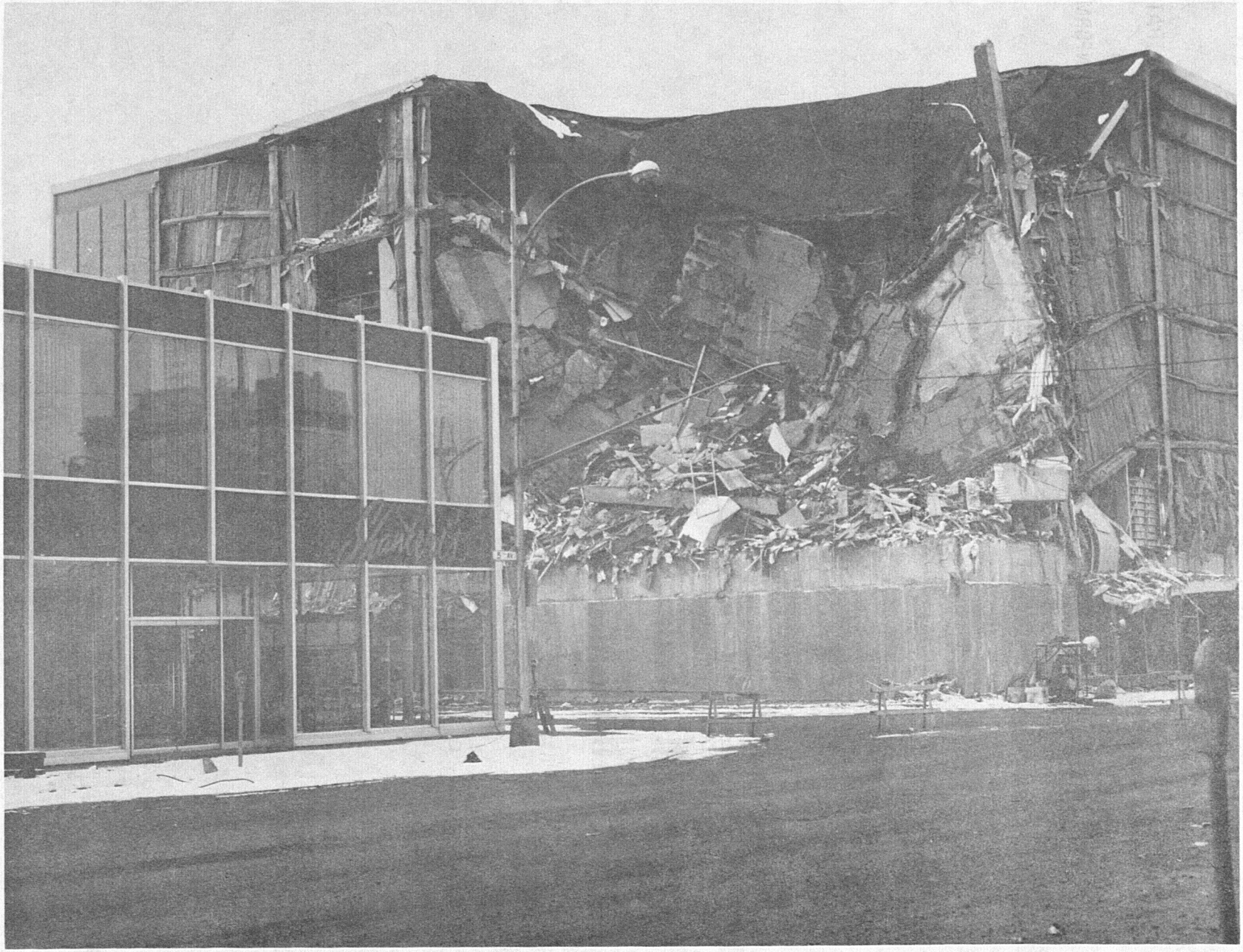
A computerized file of the effects of earthquakes in the United States

**Key to Geophysical Records Documentation No. 19**

by
Jerry L. Coffman and Carlos Angel

National Geophysical Data Center
Boulder, Colorado
1983

The 5-story J.C. Penney Company store in Anchorage, Alaska, was severely damaged by the March 27, 1964, earthquake; damage to the building was assigned intensity IX on the Modified Mercalli Intensity Scale (see appendix 1, p. A-2).



# Contents

# SUMMARY OF EARTHQUAKE INTENSITY FILE

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# Introduction

Earthquake intensities are numerical values assigned to the effects of earthquakes on people and their works, and on the natural environment. Intensities are evaluated using the Modified Mercalli Intensity Scale of 1931, which contains levels of effects ranging from intensity I, barely perceptible, to intensity XII, total damage.

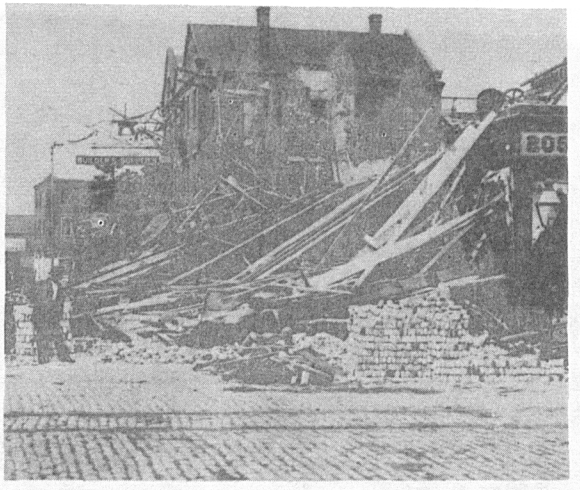
Although the development of seismological instruments and instrumental techniques the past 80 years has been impressive, earthquake intensity remains among the most acceptable criteria on which to base earthquake risk factors and to project future seismic activity (Brazee, 1976). This, in part, is due to the extensive availability of earthquake intensity data (from the mid-1600s) compared to the availability of earthquake instrumental data (from about 1897).

Earthquake intensity information is a unique and valuable data source for the research seismologist, the structural engineer, the actuary, and the earth science instructor. Although published information on earthquake effects has been available for many years (see "Sources of Data"), compiling comprehensive lists of earthquakes and the intensities that were experienced at nearby cities still required much time and effort by the researcher.

In the early 1960s, however, preparing lists of historical earthquakes became less laborious and time consuming after the U. S. Coast and Geodetic Survey compiled a computerized data file of worldwide earthquakes. The file not only contained epicenters of earthquakes but also held other valuable information on each event, including the maximum reported intensity. The new file still had limitations, however, because the names of cities experiencing the earthquakes and the intensities at those cities were not included in the data base. The next logical step, therefore, was to compile another file--an Earthquake Intensity File--that not only would include instrumental earthquake data, but also would contain the important ancillary data on earthquake effects. This summary describes a computerized data file of this kind at the National Geophysical Data Center in Boulder, Colo.

# Description of File

This report describes the Earthquake Intensity File (also called the Earthquake Effect File), a unique data base that the National Geophysical Data Center (NGDC)



The South Carolina earthquake on Aug. 31, 1886, left this damage on Bay Street in Charleston; the damage was assigned intensity IX on the Modified Mercalli Intensity Scale (see appendix 1, p. A-2).

has been developing for several years. The file now contains more than 137,000 reports on about 21,000 earthquakes that affected the United States from 1638 through 1980. The principal data included for each earthquake in the file are the names and geographic coordinates of cities that have reported effects from earthquakes (hereafter called "reporting cities") and the intensities assigned to those effects. Each intensity has been assigned using the Modified Mercalli Intensity Scale of 1931 (Wood and Neumann, 1931; see appendix 1). Other information given for each earthquake includes: distance of each reporting city from the epicenter of the earthquake; number of hours to subtract from Universal Time (UT) to obtain origin time in local standard time; reference (authority) codes for reporting cities and intensity values; and State codes. In addition, the date, origin time, epicenter, magnitude, and depth (where available) are given for all earthquakes (see appendixes 2 and 3 for a description of the formats for magnetic tape and printouts).

Although the Earthquake Intensity File represents an important contribution to seismology research, it has several limitations that should be mentioned:

1) About 25 percent of the 2,500 earthquakes reported from 1638-1928 and 10 percent of the 18,500 events from 1928-80 do not have instrumental epicenters; this omission is mainly due to the fact that seismological instruments were not developed until the late 1800s, and further that the instruments were not widely distributed for many years later.

2) Several of the reporting cities listed in the file have not been assigned geographic coordinates; however, the locations of these cities will be included when additional atlases and gazetteers have been checked.

3) The file contains data only for those earthquakes that have epicenters in the United States (including nearby territories and areas of Canada and Mexico that border the United States); however, some data for a few events in the Philippines and Guam also have been included (from the late 1930s through 1941).

The principal sources from which intensities and names of reporting cities were taken for the Earthquake Intensity File are: Earthquake History of the United States, 1638-1980; Monthly Weather Service Seismological Reports, Dec. 1914-June 1924; Quarterly Seismological Report, 1925-27; United States Earthquakes, 1928-80; and Abstracts of Earthquake Reports for the United States, 1933-70. In addition, information about earthquakes in Alaska was extracted from Meyers and others (1976).

The Earthquake Intensity File may sometimes be used more effectively in conjunction with another data file at NGDC--the Earthquake Epicenter File (also called Earthquake Data File). Although both files contain epicenters of earthquakes and their maximum reported intensities, only the Intensity File contains information on

the effects at all cities reporting the earthquake. Several other important differences between the two files should be pointed out; for example, the Epicenter File contains the following information that is not included in the Intensity File:

1) data on earthquakes worldwide (including explosions, coal bumps, rock bursts, and other earth disturbances);

2) quality factors for epicenters and information on phenomena associated with the earthquakes (such as tsunamis, volcanics, and faulting);

3) values for several different magnitudes, including body-wave, surface-wave, local, and miscellaneous magnitude values; and

4) maximum intensities reported on several different scales, including Modified Mercalli, Rossi-Forel, Japanese, and European scales (see appendix 1, p. A-3).

# Sources of Data

The main sources of data used in compiling the Earthquake Intensity File are described below. For other sources of data, see the Bibliography on page 8.

## Earthquake History of the United States

This publication is a summary of all earthquakes (intensity V and above) that have occurred in the United States and its territories from earliest recorded history (about 1638 in the New England region) through 1980. The 1982 edition of this publication (Coffman and others, 1982) contains revised epicenters and intensities for several earthquakes. This source, therefore, is the authority for epicenters of significant earthquakes in the file and also for most intensities of MM $\geq$V. In addition, pages xi-xii of "Earthquake History" contain several addenda and corrigenda, which have been used to update information in the Intensity File.

## United States Earthquakes

Much of the intensity data in the Earthquake Intensity File for 1928-80 were taken from this annual report. Its publication in 1928 began a continuing program of collecting comprehensive effect reports on all earthquakes in the United States and its territories. This publication not only contains brief descriptions of all earthquakes that were felt or damaging, but also includes MM intensities for most of the cities in which the tremors were observed. For earthquakes in 1928-31, however, published intensities were assigned using the Rossi-Forel (RF) intensity scale. Where included in the Intensity File, these intensities are converted to values on the MM Scale (see p. A-3 for a comparison of the RF and MM scales). In addition, some descriptions of earthquake effects in United States Earthquakes were not assigned an intensity because the effect information was insufficiently detailed (e.g., "slight," "feeble," "felt"). To make the computerized file as complete as possible, NGDC has assigned an intensity of II to earthquake reports that had only the slightest of details, and an intensity of III to earthquake reports that were grouped as intensity I-III.

## Quarterly Seismological Report

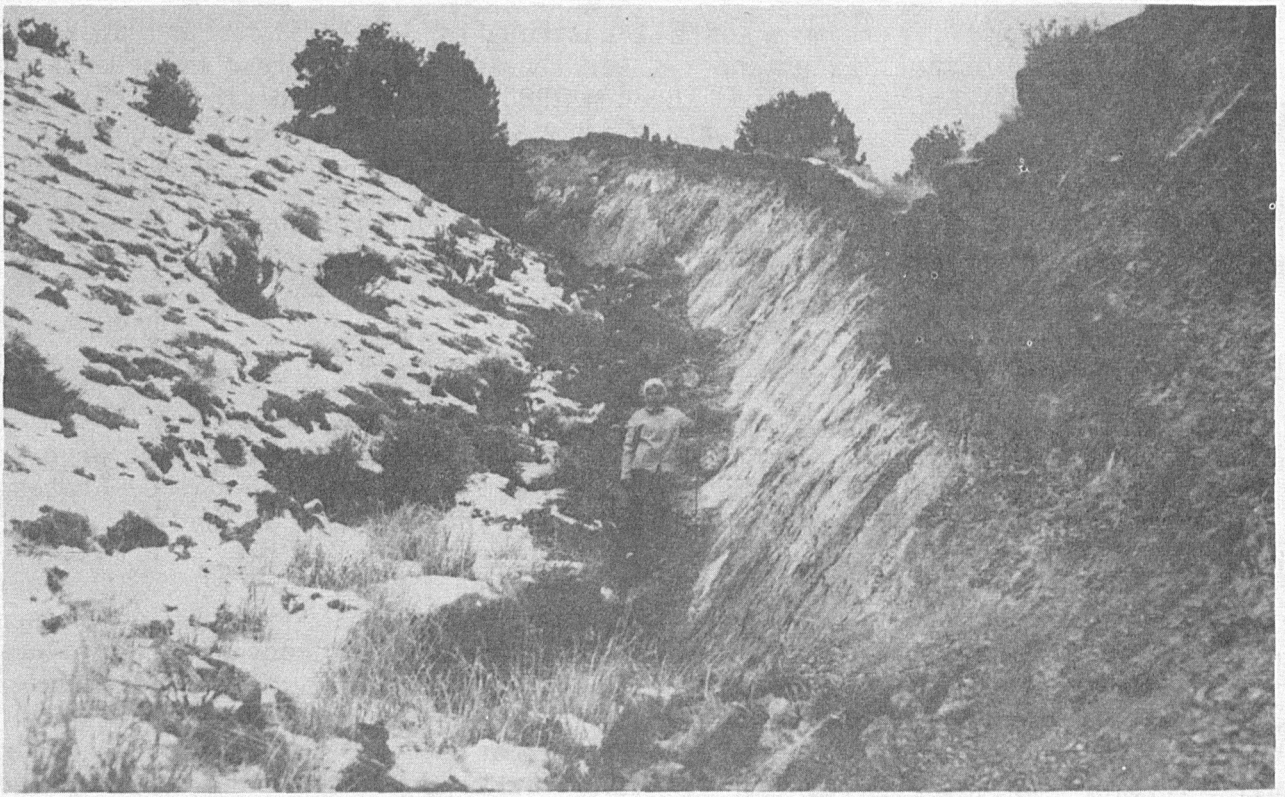
This publication, which was published by the U.S. Coast and Geodetic Survey, was a source of information on reporting cities and intensities for the years 1925-27. All Rossi-Forel intensities assigned to earthquake reports during this period have been converted to the MM Intensity Scale. Where omitted, intensities have been assigned according to the method described in the preceding paragraph.

## Abstracts of Earthquake Reports for the United States

This publication includes all the effect data collected for earthquakes in the United States and its territories during the 1933-70 period. Because the quarterly "Abstracts" report contains only preliminary earthquake data, information in United States Earthquakes annual reports and in Earthquake History of the United States is preferred, for they contain additional reporting cities and revised intensity information.

## Monthly Weather Service Seismological Reports

These reports represent a main source for information on earthquake effects in the United States and nearby territories for December 1914 through June 1924. As in



Vertical ground displacement accompanied the Fairview Peak, Nev., earthquake of December 16, 1954; the displacement was assigned intensity X on the Modified Mercalli Intensity Scale (see appendix 1, p. A-2).

other pre-1931 publications all intensities were assigned according to the Rossi-Forel scale; however, minimal reported effects (e.g., slightly felt) were not assigned intensities. NGDC, therefore, has assigned intensities to all effects and, in addition, has converted Rossi-Forel intensities to the MM Scale.

# History of Earthquake Intensity Scales

Although the history of the development of earthquake intensity scales is long and interesting, only a brief summary will be presented here. Poardi, an Italian, made the first known attempt to classify earthquakes by intensity in 1627; he used a scale of four levels of intensity to describe effects of earthquakes experienced at different towns. Although many additional attempts were made in the 18th and 19th centuries to develop comprehensive scales for measuring earthquake intensity, none was more widely used than that formulated in 1873 by M.S. de Rossi of Italy and F.A. Forel of Switzerland. But this scale also had severe limitations, and therefore was superseded in the early 1900s by Mercalli's revised intensity scale; it contained 12 levels of intensity.

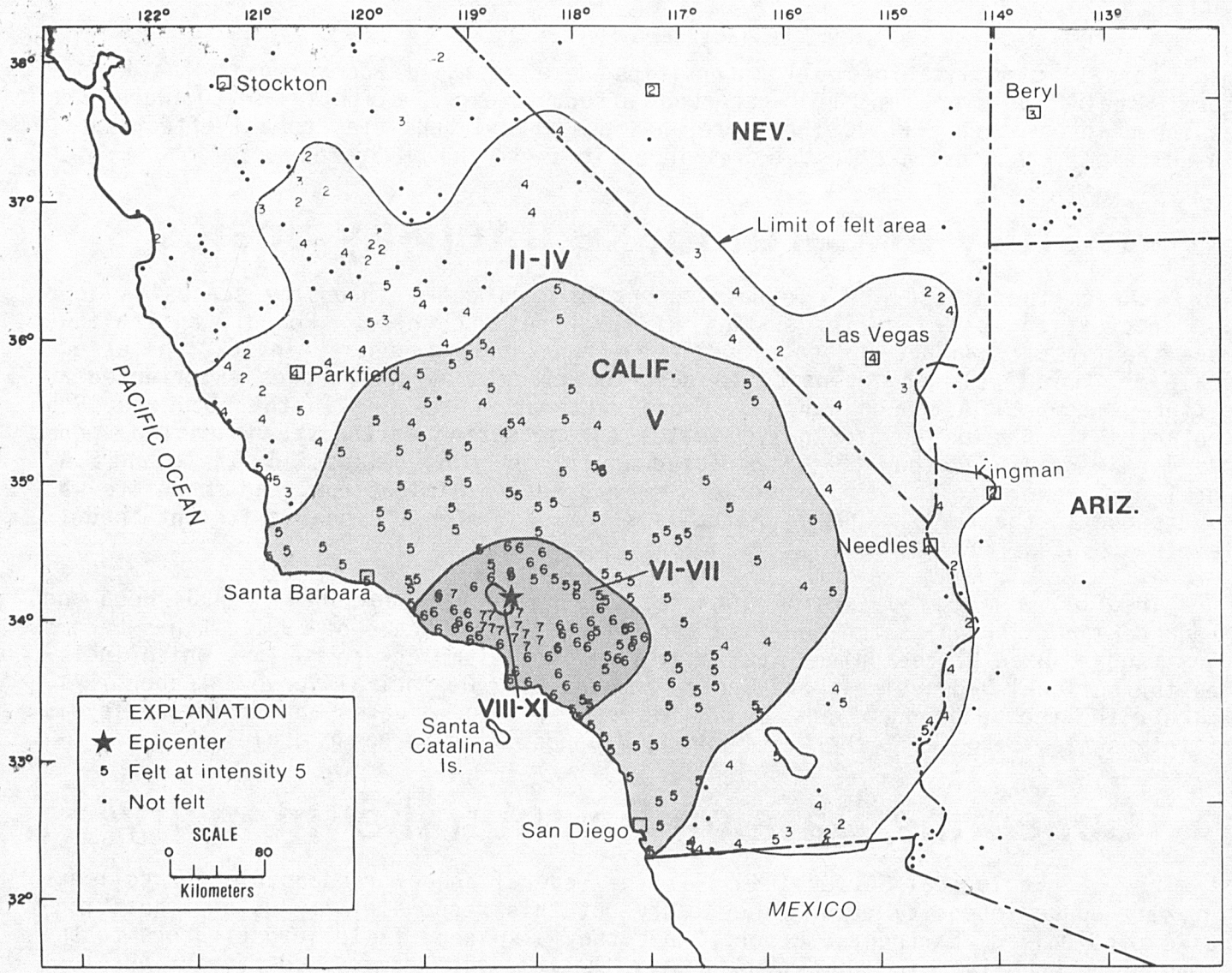
In 1931, a modified version of Mercalli's scale was published by H.O. Wood and Frank Neumann. Known as the Modified Mercalli Intensity Scale of 1931, it has become the standard used by the United States engineering seismology community, which includes the National Geophysical Data Center and the U.S. Geological Survey. Appendix 1, which gives the unabridged version of this scale, also compares the intensity levels of this scale to those of the Rossi-Forel, Japanese, and European scales.

# Collecting Data on Earthquake Intensity

The U.S. Geological Survey (USGS) is the Federal agency responsible for collecting earthquake intensity data. They carry out this responsibility using a questionnaire card called "Earthquake Report," but they also send field investigators to the scene of destructive earthquakes to analyze the resulting damage. Different versions of this card have been used since the mid-1920s by several groups who were responsible for collecting intensity data. The present questionnaire contains pertinent questions about earthquake effects that enable a seismologist to evaluate the intensity of the earthquake in all parts of the shaken area; it also is designed specifically for computer processing.

The USGS sends questionnaires immediately after each U.S. earthquake to postmasters, National Weather Service offices, military installations, and others, requesting that they report all effects of the earthquake in their area. If the earthquake is damaging, expert observers travel to the field to investigate and photograph the damage incurred. This data-collection program is supplemented by newspaper accounts of earthquake effects, published scientific reports, and reports provided by seismology collaborators.

After the completed earthquake questionnaires are returned to USGS, a seismologist analyzes each report and assigns intensities on the basis of the effects at each town; intensity (or isoseismal) maps (see example on next page) are then constructed for earthquakes felt over large areas. Descriptions and maps of these events are published annually in the United States Earthquakes series, and a summary of the stronger earthquakes (MM intensity $\geq$V) is published periodically in Earthquake History of the United States.




Isoseismal map prepared for San Fernando, Calif., earthquake on Feb. 9, 1971. Roman numerals represent Modified Mercalli intensities between isoseismals; Arabic numerals represent Modified Mercalli intensities at specific cities.

# Formats of Data

The Intensity File is available either on magnetic tape or as computer printout listings. Appendixes 2 and 3 explain each field of data for both formats, and appendix 4 lists State codes used in these formats. Table 1 is an example of a computer search for all cities that reported the earthquake at Charleston, S.C., in 1886; table 2 lists all earthquakes on record that have affected New York City. Tables 3 and 4 are statistical tables that give the number of earthquakes in the Intensity File by State and the number of earthquakes by year (or interval of years).

NGDC can furnish searches for earthquakes by:

1. Name and date of event (e.g., cities reporting the Charleston, S.C., earthquake of September 1, 1886--see table 1);

2. Modified Mercalli intensity (e.g., all earthquakes of intensity VI-XII);

3. Date (e.g., all earthquakes that were assigned intensities in 1980);

4. Name of city (e.g., historical listings for the New York City area--see table 2); and

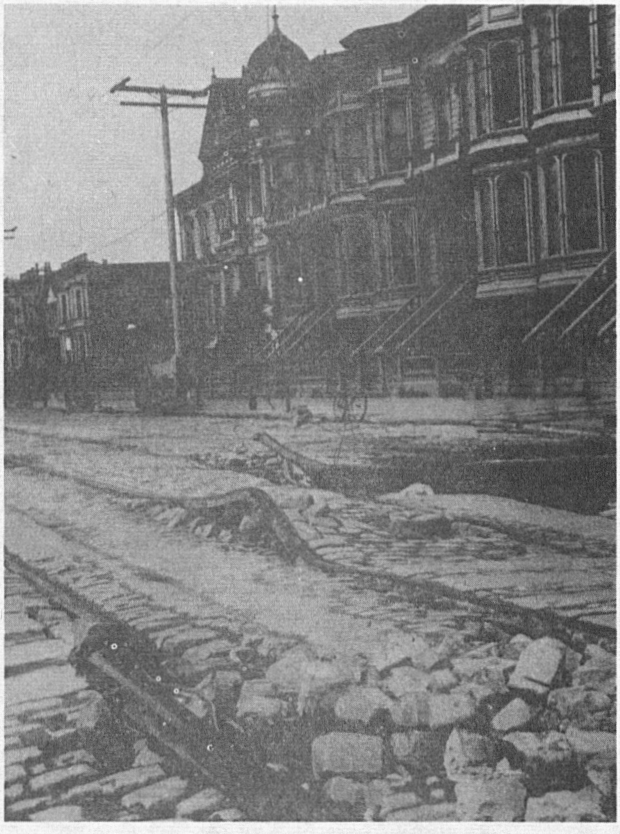
5. Radius about any city or geographic point (e.g., earthquakes within a 50-km radius of Charleston, S.C., or within a 100-km radius of 32.79° N., 79.94° W.).

NGDC will provide data-file searches upon request, or, if desired, users can obtain the Intensity File on magnetic tape to make their own searches.

NGDC also maintains a 16-mm microfilm file of reports on earthquakes, which includes "felt" and "not felt" reports, personal letters, postcards, newspaper clippings, and wire service bulletins. Although earthquakes from about 1900 to 1980 are covered, information is not available for each event during that period. The information in this file, which in most cases was provided by on-site observers, represents the basis for many of the intensities that have been assigned to effects at reporting cities. To provide a choice of formats to customers, NGDC plans to furnish these reports on microfilm cassettes in the near future.

Please address all inquiries and requests for data to:

National Geophysical Data Center
NOAA/NESDIS, Code E/GC1-J
325 Broadway
Boulder, CO 80303



Damage to railroad tracks in San Francisco from earthquake of April 18, 1906; intensity X was assigned to this damage (see appendix 1, p. A-2).

# Acknowledgments

Several NGDC employees, past and present, compiled the information that was finally to become the Earthquake Intensity File. The authors extend their appreciation to Susan Godeaux, and Steven Paull, who assisted both in compiling the data base and in checking the final listings; to Rich Shoulberg, who prepared the tables for the report; and to Herbert Meyers, Chief, Solid Earth Data Services Division, who provided administrative and technical support for the project.

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Table 1.--Computer search of Earthquake Intensity File for effects on specific earthquake

[MM INT = Modified Mercalli Intensity; UTC = Universal Coordinated Time. Under REF. CODE: B = Bollinger and Stover, 1976]

SEARCH FOR INTENSITY VIII TO X EFFECTS FROM CHARLESTON, SOUTH CAROLINA, EARTHQUAKE, SEPT. 1, 1886, 02:51 UTC.

| STATE | CITY | MM INT | N LAT | W LONG | DISTANCE FROM SOURCE (KM) | REF. CODE | EARTHQUAKE SOURCE | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | UTC | | | | | | N LAT | W LONG | |
| | | | COORDINATES | | | | YEAR | MO | DA | HR | MN | SEC | COORDINATES | | MAG DEPTH (KM) |
| SOUTH CAROLINA | CHARLESTON | X | 32.79 | 79.94 | 13 | B | 1886 | 09 | 01 | 02 | 51 | | 32.90 | 80.00 | |
| SOUTH CAROLINA | LANGLEY | X | 33.55 | 81.75 | 178 | B | 1886 | 09 | 01 | 02 | 51 | | 32.90 | 80.00 | |
| SOUTH CAROLINA | LINCOLNVILLE | X | 33.01 | 80.16 | 19 | B | 1886 | 09 | 01 | 02 | 51 | | 32.90 | 80.00 | |
| SOUTH CAROLINA | SUMMERVILLE | X | 33.02 | 80.18 | 21 | B | 1886 | 09 | 01 | 02 | 51 | | 32.90 | 80.00 | |
| SOUTH CAROLINA | WOODSTOCK | X | 32.85 | 80.30 | 20 | B | 1886 | 09 | 01 | 02 | 51 | | 32.90 | 80.00 | |
| SOUTH CAROLINA | CARTERSVILLE | IX | 34.07 | 80.00 | 129 | B | 1886 | 09 | 01 | 02 | 51 | | 32.90 | 80.00 | |
| SOUTH CAROLINA | COOSAW | IX | 32.48 | 80.72 | 82 | B | 1886 | 09 | 01 | 02 | 51 | | 32.90 | 80.00 | |
| SOUTH CAROLINA | EFFINGHAM | IX | 34.07 | 79.75 | 131 | B | 1886 | 09 | 01 | 02 | 51 | | 32.90 | 80.00 | |
| SOUTH CAROLINA | GOURDIN | IX | 33.48 | 79.88 | 65 | B | 1886 | 09 | 01 | 02 | 51 | | 32.90 | 80.00 | |
| SOUTH CAROLINA | PORT ROYAL | IX | 32.37 | 80.55 | 78 | B | 1886 | 09 | 01 | 02 | 51 | | 32.90 | 80.00 | |
| GEORGIA | ATLANTA | VIII | 33.77 | 84.33 | 414 | B | 1886 | 09 | 01 | 02 | 51 | | 32.90 | 80.00 | |
| GEORGIA | AUGUSTA | VIII | 33.47 | 81.96 | 193 | B | 1886 | 09 | 01 | 02 | 51 | | 32.90 | 80.00 | |
| GEORGIA | COLUMBUS | VIII | 32.53 | 84.92 | 462 | B | 1886 | 09 | 01 | 02 | 51 | | 32.90 | 80.00 | |
| GEORGIA | COVINGTON | VIII | 33.58 | 83.80 | 362 | B | 1886 | 09 | 01 | 02 | 51 | | 32.90 | 80.00 | |
| GEORGIA | SAVANNAH | VIII | 32.08 | 81.10 | 137 | B | 1886 | 09 | 01 | 02 | 51 | | 32.90 | 80.00 | |
| KENTUCKY | ASHLAND | VIII | 38.23 | 82.62 | 637 | B | 1886 | 09 | 01 | 02 | 51 | | 32.90 | 80.00 | |
| NORTH CAROLINA | CHARLOTTE | VIII | 35.23 | 80.74 | 267 | B | 1886 | 09 | 01 | 02 | 51 | | 32.90 | 80.00 | |
| NORTH CAROLINA | RALEIGH | VIII | 35.78 | 78.64 | 343 | B | 1886 | 09 | 01 | 02 | 51 | | 32.90 | 80.00 | |
| NORTH CAROLINA | WILMINGTON | VIII | 34.24 | 77.95 | 241 | B | 1886 | 09 | 01 | 02 | 51 | | 32.90 | 80.00 | |
| SOUTH CAROLINA | ABBEVILLE | VIII | 33.18 | 81.42 | 136 | B | 1886 | 09 | 01 | 02 | 51 | | 32.90 | 80.00 | |
| SOUTH CAROLINA | ALLENDALE | VIII | 33.03 | 81.20 | 113 | B | 1886 | 09 | 01 | 02 | 51 | | 32.90 | 80.00 | |
| SOUTH CAROLINA | ALSTON | VIII | 34.25 | 81.30 | 192 | B | 1886 | 09 | 01 | 02 | 51 | | 32.90 | 80.00 | |
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| SOUTH CAROLINA | BARMORIS | VIII | 34.35 | 82.47 | 279 | B | 1886 | 09 | 01 | 02 | 51 | | 32.90 | 80.00 | |
| SOUTH CAROLINA | BATESBURG | VIII | 34.88 | 82.25 | 302 | B | 1886 | 09 | 01 | 02 | 51 | | 32.90 | 80.00 | |
| SOUTH CAROLINA | BEAUFORT | VIII | 32.38 | 80.70 | 87 | B | 1886 | 09 | 01 | 02 | 51 | | 32.90 | 80.00 | |
| SOUTH CAROLINA | BENNETTSVILLE | VIII | 34.67 | 79.67 | 198 | B | 1886 | 09 | 01 | 02 | 51 | | 32.90 | 80.00 | |
| SOUTH CAROLINA | BLACK MINGO | VIII | 33.43 | 79.58 | 70 | B | 1886 | 09 | 01 | 02 | 51 | | 32.90 | 80.00 | |
| SOUTH CAROLINA | BONNEAU | VIII | 33.30 | 79.92 | 40 | B | 1886 | 09 | 01 | 02 | 51 | | 32.90 | 80.00 | |
| SOUTH CAROLINA | BRIGHTON | VIII | 32.67 | 81.25 | 119 | B | 1886 | 09 | 01 | 02 | 51 | | 32.90 | 80.00 | |
| SOUTH CAROLINA | BRIGHTSVILLE | VIII | 34.75 | 79.60 | 208 | B | 1886 | 09 | 01 | 02 | 51 | | 32.90 | 80.00 | |
| SOUTH CAROLINA | BUFORDS BRIDGE | VIII | 33.13 | 81.17 | 112 | B | 1886 | 09 | 01 | 02 | 51 | | 32.90 | 80.00 | |
| SOUTH CAROLINA | CAMDEN | VIII | 34.26 | 80.63 | 161 | B | 1886 | 09 | 01 | 02 | 51 | | 32.90 | 80.00 | |
| SOUTH CAROLINA | CAMPBELLS BRIDGE | VIII | 34.30 | 79.23 | 170 | B | 1886 | 09 | 01 | 02 | 51 | | 32.90 | 80.00 | |
| SOUTH CAROLINA | CHERAW | VIII | 34.68 | 79.92 | 197 | B | 1886 | 09 | 01 | 02 | 51 | | 32.90 | 80.00 | |
| SOUTH CAROLINA | CLIO | VIII | 34.62 | 79.58 | 194 | B | 1886 | 09 | 01 | 02 | 51 | | 32.90 | 80.00 | |
| SOUTH CAROLINA | COLUMBIA | VIII | 34.00 | 81.03 | 155 | B | 1886 | 09 | 01 | 02 | 51 | | 32.90 | 80.00 | |
| SOUTH CAROLINA | DARLINGTON | VIII | 34.26 | 79.83 | 151 | B | 1886 | 09 | 01 | 02 | 51 | | 32.90 | 80.00 | |
| SOUTH CAROLINA | DONALDS | VIII | 34.33 | 82.47 | 278 | B | 1886 | 09 | 01 | 02 | 51 | | 32.90 | 80.00 | |
| SOUTH CAROLINA | DOVES STATION | VIII | 34.38 | 79.92 | 164 | B | 1886 | 09 | 01 | 02 | 51 | | 32.90 | 80.00 | |
| SOUTH CAROLINA | DUE WEST | VIII | 34.26 | 82.37 | 266 | B | 1886 | 09 | 01 | 02 | 51 | | 32.90 | 80.00 | |
| SOUTH CAROLINA | EDGEFIELD | VIII | 33.82 | 81.92 | 205 | B | 1886 | 09 | 01 | 02 | 51 | | 32.90 | 80.00 | |
| SOUTH CAROLINA | FLORENCE | VIII | 34.17 | 79.75 | 142 | B | 1886 | 09 | 01 | 02 | 51 | | 32.90 | 80.00 | |
| SOUTH CAROLINA | GADSDEN | VIII | 33.87 | 80.75 | 128 | B | 1886 | 09 | 01 | 02 | 51 | | 32.90 | 80.00 | |
| SOUTH CAROLINA | GEORGETOWN | VIII | 33.37 | 79.28 | 85 | B | 1886 | 09 | 01 | 02 | 51 | | 32.90 | 80.00 | |
| SOUTH CAROLINA | GILBERT | VIII | 33.93 | 81.38 | 171 | B | 1886 | 09 | 01 | 02 | 51 | | 32.90 | 80.00 | |
| SOUTH CAROLINA | GRANITEVILLE | VIII | 33.58 | 81.74 | 178 | B | 1886 | 09 | 01 | 02 | 51 | | 32.90 | 80.00 | |
| SOUTH CAROLINA | GRANNYS QUARTER | VIII | 34.38 | 80.67 | 175 | B | 1886 | 09 | 01 | 02 | 51 | | 32.90 | 80.00 | |
| SOUTH CAROLINA | GREENVILLE | VIII | 34.83 | 82.38 | 307 | B | 1886 | 09 | 01 | 02 | 51 | | 32.90 | 80.00 | |
| SOUTH CAROLINA | HODGES | VIII | 34.26 | 82.25 | 257 | B | 1886 | 09 | 01 | 02 | 51 | | 32.90 | 80.00 | |
| SOUTH CAROLINA | KIRKWOOD | VIII | 34.33 | 80.60 | 168 | B | 1886 | 09 | 01 | 02 | 51 | | 32.90 | 80.00 | |
| SOUTH CAROLINA | TIMMONSVILLE | VIII | 34.12 | 79.88 | 135 | B | 1886 | 09 | 01 | 02 | 51 | | 32.90 | 80.00 | |
| SOUTH CAROLINA | WILLINGTON | VIII | 33.93 | 82.45 | 254 | B | 1886 | 09 | 01 | 02 | 51 | | 32.90 | 80.00 | |
| VIRGINIA | RICHMOND | VIII | 37.55 | 77.40 | 567 | B | 1886 | 09 | 01 | 02 | 51 | | 32.90 | 80.00 | |

Table 2.--Computer search of Earthquake Intensity File for all effects on a specific city

[MM INT = Modified Mercalli Intensity; UTC = Universal Coordinated Time. Under REF. CODE: H = Coffman and von Hake, 1982; blank = U.S. Department of Commerce, United States Earthquakes]

SEARCH FOR ALL EFFECTS IN NEW YORK CITY (40.71N, 74.00W)

| STATE | CITY | MM INT | N LAT W LONG COORDINATES | DISTANCE FROM SOURCE (KM) | REF. CODE | EARTHQUAKE SOURCE | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | UTC | | | | | | N LAT | W LONG | |
| | | | | | | YEAR | MO | DA | HR | MN | SEC | COORDINATES | | MAG | DEPTH (KM) |
| NEW YORK | NEW YORK CITY | VIII | 40.71 74.00 | 0 | H | 1737 | 12 | 19 | 04 | 00 | | 40.7 | 74.0 | | |
| NEW YORK | NEW YORK CITY | IV | 40.71 74.00 | | H | 1783 | 11 | 30 | 01 | 00 | | | | | |
| NEW YORK | NEW YORK CITY | IV | 40.71 74.00 | | H | 1783 | 11 | 30 | 03 | 00 | | | | | |
| NEW YORK | NEW YORK CITY | III | 40.71 74.00 | | H | 1783 | 11 | 30 | 07 | 00 | | | | | |
| NEW YORK | NEW YORK CITY | III | 40.71 74.00 | 158 | H | 1791 | 05 | 19 | 03 | 00 | | 41.5 | 72.5 | | |
| NEW YORK | NEW YORK CITY | III | 40.71 74.00 | 630 | H | 1870 | 10 | 20 | 16 | 25 | | 47.4 | 70.5 | | |
| NEW YORK | NEW YORK CITY | III | 40.71 74.00 | 8 | H | 1884 | 08 | 10 | 19 | 07 | | 40.6 | 74.0 | | |
| NEW YORK | NEW YORK CITY | VI | 40.71 74.00 | 1090 | H | 1886 | 09 | 01 | 02 | 51 | | 32.9 | 80.0 | | |
| NEW YORK | NEW YORK CITY | V | 40.71 74.00 | 0 | H | 1893 | 03 | 09 | 05 | 30 | | 40.7 | 74.0 | | |
| NEW YORK | NEW YORK CITY | IV | 40.71 74.00 | 877 | H | 1925 | 03 | 01 | 02 | 19 | 18.0 | 48.25 | 70.75 | 7.0 | |
| NEW YORK | NEW YORK CITY | III | 40.71 74.00 | 434 | | 1929 | 08 | 12 | 11 | 24 | 48 | 42.87 | 78.35 | | |
| NEW YORK | NEW YORK CITY | III | 40.71 74.00 | 1611 | | 1929 | 11 | 18 | 20 | 31 | 54 | 44.5 | 55.0 | | |
| NEW YORK | NEW YORK CITY | IV | 40.71 74.00 | 787 | | 1935 | 11 | 01 | 06 | 03 | 40 | 46.8 | 79.1 | 7.2 | |
| NEW YORK | NEW YORK CITY | III | 40.71 74.00 | | | 1935 | 11 | 02 | 14 | 32 | | | | | |
| NEW YORK | NEW YORK CITY | III | 40.71 74.00 | 409 | | 1940 | 12 | 20 | 07 | 27 | 26.0 | 43.8 | 71.3 | 5.6 | |
| NEW YORK | NEW YORK CITY | III | 40.71 74.00 | 35 | | 1951 | 09 | 04 | 01 | 26 | 28 | 41.2 | 74.1 | | |
| NEW YORK | NEW YORK CITY | IV | 40.71 74.00 | | | 1953 | 08 | 17 | 04 | 22 | 50 | | | | |

Table 3.--Number of earthquakes in Earthquake Intensity File listed by State and maximum Modified Mercalli (MM) intensity

| State | Number of earthquakes and maximum MM intensity | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | I-III | IV | V | VI | VII | VIII | IX | X | XI | XII | TOTAL |
| Alabama | 14 | 13 | 11 | 4 | 2 | 0 | 0 | 0 | 0 | 0 | 44 |
| Alaska | 2347 | 473 | 209 | 45 | 10 | 7 | 1 | 1 | 3 | 0 | 3096 |
| Arizona | 125 | 55 | 52 | 20 | 8 | 0 | 1 | 0 | 0 | 0 | 261 |
| Arkansas | 42 | 31 | 34 | 8 | 4 | 0 | 0 | 2 | 1 | 0 | 122 |
| California | 4330 | 2443 | 1227 | 425 | 141 | 36 | 12 | 8 | 4 | 0 | 8626 |
| Colorado | 106 | 66 | 52 | 20 | 2 | 0 | 0 | 0 | 0 | 0 | 246 |
| Connecticut | 19 | 25 | 12 | 5 | 1 | 1 | 0 | 0 | 0 | 0 | 63 |
| Delaware | 9 | 8 | 6 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 25 |
| Dis. of Columbia | 11 | 1 | 3 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 21 |
| Florida | 4 | 8 | 3 | 4 | 1 | 0 | 0 | 0 | 0 | 0 | 20 |
| Georgia | 18 | 9 | 22 | 10 | 0 | 1 | 0 | 0 | 0 | 0 | 60 |
| Hawaii | 2153 | 236 | 89 | 21 | 11 | 6 | 1 | 1 | 0 | 0 | 2518 |
| Idaho | 91 | 74 | 58 | 18 | 4 | 1 | 0 | 0 | 0 | 0 | 246 |
| Illinois | 64 | 44 | 37 | 21 | 5 | 0 | 0 | 0 | 0 | 0 | 171 |
| Indiana | 28 | 17 | 23 | 8 | 9 | 0 | 0 | 0 | 0 | 0 | 85 |
| Iowa | 13 | 5 | 13 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 32 |
| Kansas | 17 | 12 | 13 | 3 | 2 | 0 | 0 | 0 | 0 | 0 | 47 |
| Kentucky | 69 | 39 | 48 | 13 | 6 | 1 | 0 | 0 | 0 | 0 | 176 |
| Louisiana | 8 | 5 | 5 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 20 |
| Maine | 43 | 27 | 25 | 13 | 2 | 0 | 0 | 0 | 0 | 0 | 110 |
| Maryland | 26 | 6 | 6 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 40 |
| Massachusetts | 35 | 25 | 33 | 7 | 2 | 4 | 0 | 0 | 0 | 0 | 106 |
| Michigan | 20 | 11 | 11 | 2 | 1 | 1 | 0 | 0 | 0 | 0 | 46 |
| Minnesota | 6 | 4 | 1 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 14 |
| Mississippi | 13 | 8 | 9 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 37 |
| Missouri | 88 | 41 | 42 | 26 | 6 | 2 | 0 | 0 | 0 | 3 | 208 |
| Montana | 882 | 425 | 128 | 38 | 2 | 4 | 0 | 1 | 0 | 0 | 1480 |
| Nebraska | 17 | 10 | 7 | 6 | 3 | 0 | 0 | 0 | 0 | 0 | 43 |
| Nevada | 561 | 301 | 104 | 40 | 6 | 1 | 4 | 3 | 0 | 0 | 1020 |
| New Hampshire | 31 | 23 | 31 | 7 | 4 | 0 | 0 | 0 | 0 | 0 | 96 |
| New Jersey | 19 | 16 | 15 | 5 | 1 | 0 | 0 | 0 | 0 | 0 | 56 |
| New Mexico | 125 | 39 | 33 | 19 | 4 | 4 | 0 | 0 | 0 | 0 | 224 |
| New York | 84 | 56 | 43 | 19 | 4 | 2 | 0 | 0 | 0 | 0 | 208 |
| North Carolina | 43 | 24 | 34 | 11 | 0 | 1 | 0 | 0 | 0 | 0 | 113 |
| North Dakota | 4 | 5 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 11 |

Table 3.--Number of earthquakes in Earthquake Intensity File listed by State and maximum Modified Mercalli (MM) intensity--Continued

| State | Number of earthquakes and maximum MM intensity | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | I-III | IV | V | VI | VII | VIII | IX | X | XI | XII | TOTAL |
| Ohio | 28 | 16 | 21 | 8 | 8 | 1 | 0 | 0 | 0 | 0 | 82 |
| Oklahoma | 47 | 23 | 22 | 7 | 2 | 0 | 0 | 0 | 0 | 0 | 101 |
| Oregon | 74 | 36 | 41 | 28 | 3 | 1 | 0 | 0 | 0 | 0 | 183 |
| Pennsylvania | 26 | 10 | 23 | 11 | 6 | 0 | 0 | 0 | 0 | 0 | 76 |
| Rhode Island | 9 | 8 | 11 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 30 |
| South Carolina | 70 | 34 | 28 | 15 | 3 | 0 | 0 | 1 | 0 | 0 | 151 |
| South Dakota | 26 | 19 | 15 | 4 | 2 | 0 | 0 | 0 | 0 | 0 | 66 |
| Tennessee | 71 | 61 | 70 | 25 | 3 | 1 | 0 | 3 | 0 | 0 | 234 |
| Texas | 17 | 14 | 20 | 10 | 1 | 1 | 0 | 0 | 0 | 0 | 63 |
| Utah | 139 | 89 | 55 | 35 | 9 | 3 | 0 | 0 | 0 | 0 | 330 |
| Vermont | 19 | 7 | 18 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 50 |
| Virginia | 34 | 24 | 30 | 14 | 3 | 2 | 0 | 0 | 0 | 0 | 107 |
| Washington | 257 | 167 | 128 | 53 | 5 | 2 | 0 | 0 | 0 | 0 | 612 |
| West Virginia | 12 | 13 | 6 | 3 | 2 | 0 | 0 | 0 | 0 | 0 | 36 |
| Wisconsin | 13 | 3 | 2 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 21 |
| Wyoming | 315 | 273 | 76 | 20 | 2 | 1 | 0 | 0 | 0 | 0 | 687 |
| TOTAL | 12622 | 5372 | 3007 | 1081 | 295 | 84 | 29 | 19 | 8 | 3 | 22,520 |

NOTE: Many earthquakes were experienced in more than one State.

Table 4.--Number of earthquakes in Earthquake Intensity File by Modified Mercalli intensity and year of occurrence (or interval of years)

| Year | Number of earthquakes and maximum MM intensity | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | I-III | IV | V | VI | VII | VIII | IX | X | XI | XII | TOTAL |
| 1638-1800---- | 2 | 3 | 4 | 2 | 8 | 3 | 4 | 1 | 0 | 0 | 27 |
| 1801-1850---- | 2 | 4 | 13 | 11 | 7 | 2 | 1 | 5 | 0 | 3 | 48 |
| 1851-1900---- | 9 | 8 | 101 | 86 | 55 | 20 | 9 | 6 | 3 | 0 | 297 |
| 1901-1927---- | 799 | 510 | 412 | 108 | 71 | 29 | 6 | 2 | 1 | 0 | 1938 |
| 1928------- | 90 | 41 | 29 | 15 | 3 | 0 | 0 | 0 | 2 | 0 | 180 |
| 1929------- | 107 | 18 | 14 | 21 | 13 | 2 | 0 | 0 | 0 | 0 | 175 |
| 1930------- | 214 | 32 | 31 | 25 | 4 | 4 | 0 | 0 | 0 | 0 | 310 |
| 1931------- | 215 | 28 | 64 | 11 | 2 | 2 | 0 | 0 | 0 | 0 | 322 |
| 1932------- | 160 | 46 | 16 | 6 | 1 | 1 | 1 | 1 | 0 | 0 | 232 |
| 1933------- | 209 | 90 | 27 | 6 | 2 | 2 | 1 | 0 | 0 | 0 | 337 |
| 1934------- | 280 | 140 | 49 | 10 | 6 | 3 | 2 | 0 | 0 | 0 | 490 |
| 1935------- | 222 | 62 | 48 | 8 | 2 | 3 | 0 | 0 | 0 | 0 | 345 |
| 1936------- | 229 | 71 | 50 | 19 | 2 | 0 | 0 | 0 | 0 | 0 | 371 |
| 1937------- | 184 | 25 | 33 | 3 | 2 | 3 | 0 | 0 | 0 | 0 | 250 |
| 1938------- | 406 | 14 | 14 | 12 | 1 | 2 | 0 | 0 | 0 | 0 | 449 |
| 1939------- | 302 | 66 | 32 | 8 | 3 | 0 | 0 | 0 | 0 | 0 | 411 |
| 1940------- | 143 | 58 | 38 | 15 | 4 | 0 | 0 | 2 | 0 | 0 | 260 |
| 1941------- | 160 | 29 | 21 | 15 | 2 | 2 | 0 | 0 | 0 | 0 | 229 |
| 1942------- | 134 | 68 | 32 | 8 | 1 | 0 | 0 | 0 | 0 | 0 | 243 |
| 1943------- | 119 | 92 | 21 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 242 |
| 1944------- | 114 | 83 | 23 | 13 | 1 | 1 | 0 | 0 | 0 | 0 | 235 |
| 1945------- | 209 | 59 | 18 | 11 | 1 | 0 | 0 | 0 | 0 | 0 | 298 |
| 1946------- | 211 | 69 | 21 | 15 | 1 | 2 | 0 | 0 | 0 | 0 | 319 |
| 1947------- | 122 | 73 | 22 | 12 | 4 | 2 | 0 | 0 | 0 | 0 | 235 |
| 1948------- | 96 | 120 | 34 | 18 | 2 | 0 | 0 | 0 | 0 | 0 | 270 |
| 1949------- | 140 | 109 | 16 | 27 | 2 | 2 | 0 | 0 | 0 | 0 | 296 |
| 1950------- | 137 | 117 | 42 | 13 | 1 | 1 | 0 | 0 | 0 | 0 | 311 |
| 1951------- | 133 | 81 | 28 | 21 | 4 | 0 | 1 | 0 | 0 | 0 | 268 |
| 1952------- | 246 | 181 | 82 | 20 | 9 | 1 | 0 | 0 | 1 | 0 | 540 |
| 1953------- | 221 | 139 | 42 | 8 | 1 | 0 | 0 | 0 | 0 | 0 | 411 |
| 1954------- | 189 | 86 | 49 | 16 | 4 | 3 | 2 | 1 | 0 | 0 | 350 |
| 1955------- | 194 | 103 | 64 | 11 | 3 | 0 | 0 | 0 | 0 | 0 | 375 |
| 1956------- | 155 | 96 | 44 | 18 | 1 | 0 | 0 | 0 | 0 | 0 | 314 |
| 1957------- | 246 | 86 | 40 | 13 | 2 | 1 | 0 | 0 | 0 | 0 | 388 |

Table 4.--Number of earthquakes in Earthquake Intensity File by Modified Mercalli intensity and year of occurrence (or interval of years)--Continued

| Year | Number of earthquakes and maximum MM intensity | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | I-III | IV | V | VI | VII | VIII | IX | X | XI | XII | TOTAL |
| 1958------- | 142 | 71 | 44 | 13 | 0 | 1 | 0 | 0 | 0 | 0 | 272 |
| 1959------- | 421 | 193 | 51 | 36 | 1 | 0 | 0 | 1 | 0 | 0 | 703 |
| 1960------- | 256 | 189 | 37 | 9 | 0 | 0 | 0 | 0 | 0 | 0 | 491 |
| 1961------- | 254 | 96 | 63 | 21 | 2 | 0 | 0 | 0 | 0 | 0 | 436 |
| 1962------- | 172 | 79 | 55 | 13 | 2 | 0 | 0 | 0 | 0 | 0 | 321 |
| 1963------- | 195 | 82 | 63 | 22 | 2 | 0 | 0 | 0 | 0 | 0 | 364 |
| 1964------- | 278 | 74 | 46 | 17 | 2 | 0 | 0 | 1 | 0 | 0 | 418 |
| 1965------- | 170 | 48 | 24 | 19 | 2 | 1 | 0 | 0 | 0 | 0 | 264 |
| 1966------- | 250 | 80 | 41 | 13 | 4 | 0 | 0 | 0 | 0 | 0 | 388 |
| 1967------- | 272 | 75 | 41 | 15 | 3 | 0 | 0 | 0 | 0 | 0 | 406 |
| 1968------- | 265 | 66 | 35 | 5 | 4 | 1 | 0 | 0 | 0 | 0 | 376 |
| 1969------- | 254 | 87 | 55 | 13 | 2 | 1 | 0 | 0 | 0 | 0 | 412 |
| 1970------- | 223 | 75 | 53 | 7 | 1 | 0 | 0 | 0 | 0 | 0 | 359 |
| 1971------- | 458 | 116 | 77 | 2 | 1 | 0 | 0 | 0 | 1 | 0 | 655 |
| 1972------- | 201 | 73 | 47 | 9 | 1 | 0 | 0 | 0 | 0 | 0 | 331 |
| 1973------- | 215 | 68 | 44 | 4 | 1 | 1 | 0 | 0 | 0 | 0 | 333 |
| 1974------- | 238 | 63 | 58 | 7 | 0 | 1 | 0 | 0 | 0 | 0 | 367 |
| 1975------- | 237 | 118 | 43 | 25 | 3 | 2 | 2 | 0 | 0 | 0 | 430 |
| 1976------- | 304 | 69 | 55 | 26 | 0 | 0 | 0 | 0 | 0 | 0 | 454 |
| 1977------- | 218 | 103 | 46 | 22 | 1 | 0 | 0 | 0 | 0 | 0 | 390 |
| 1978------- | 188 | 142 | 39 | 14 | 1 | 0 | 0 | 0 | 0 | 0 | 384 |
| 1979------- | 302 | 128 | 30 | 16 | 4 | 0 | 1 | 0 | 0 | 0 | 481 |
| 1980------- | 303 | 111 | 33 | 6 | 6 | 0 | 0 | 0 | 0 | 0 | 459 |
| TOTAL | 12215 | 5014 | 2654 | 949 | 269 | 99 | 30 | 20 | 8 | 3 | 21260 |

NOTE: Totals include earthquakes that occurred in areas that border the United States.

## APPENDIX 1. Modified Mercalli Intensity Scale of 1931 (Unabridged) (Wood and Neumann, 1931)

I. Not felt - or, except rarely under especially favorable circumstances. Under certain conditions, at and outside the boundary of the area in which a great shock is felt: sometimes birds, animals, reported uneasy or disturbed; sometimes dizziness or nausea experienced; sometimes trees, structures, liquids, bodies of water, may sway--doors may swing, very slowly.

II. Felt indoors by few, especially on upper floors, or by sensitive or nervous persons. Also, as in grade I, but often more noticeably: sometimes hanging objects may swing, especially where delicately suspended; sometimes trees, structures, liquids, bodies of water, may sway, doors may swing, very slowly; sometimes birds, animals, reported uneasy or disturbed; sometimes dizziness or nausea experienced.

III. Felt indoors by several, motion usually rapid vibration. Sometimes not recognized to be an earthquake at first. Duration estimated in some cases. Vibration like that due to passing of light, or lightly loaded trucks, or heavy trucks some distance away. Hanging objects may swing slightly. Movements may be appreciable on upper levels of tall structures. Rocked standing motor cars slightly.

IV. Felt indoors by many, outdoors by few. Awakened few, especially light sleepers. Frightened no one, unless apprehensive from previous experience. Vibration like that due to passing of heavy, or heavily loaded trucks. Sensation like heavy body striking building, or falling of heavy objects inside. Rattling of dishes, windows, doors; glassware and crockery clink and clash. Creaking of walls, frame, especially in the upper range of this grade. Hanging objects swung, in numerous instances. Disturbed liquids in open vessels slightly. Rocked standing motor cars noticeably.

V. Felt indoors by practically all, outdoors by many or most: outdoors direction estimated. Awakened many, or most. Frightened few--slight excitement, a few ran outdoors. Buildings trembled throughout. Broke dishes, glassware, to some extent. Cracked windows--in some cases, but not generally. Overturned vases, small or unstable objects, in many instances, with occasional fall. Hanging objects, doors, swing generally or considerably. Knocked pictures against walls, or swung them out of place. Opened, or closed, doors, shutters, abruptly. Pendulum clocks stopped, started, or ran fast, or slow. Moved small objects, furnishings, the latter to slight extent. Spilled liquids in small amounts from well-filled open containers. Trees, bushes, shaken slightly.

VI. Felt by all, indoors and outdoors. Frightened many, excitement general, some bushes, shaken slightly to moderately. Liquid set in strong motion. Small bells rang--church, chapel, school, etc. Damage slight in poorly built buildings. Fall of plaster in small amount. Cracked plaster somewhat, especially fine cracks in chimneys in some instances. Broke dishes, glassware, in considerable quantity, also some windows. Fall of knickknacks, books, pictures. Overturned furniture in many instances. Moved furnishings of moderately heavy kind.

VII. Frightened all--general alarm, all ran outdoors. Some, or many, found it difficult to stand. Noticed by persons driving motor cars. Trees and bushes shaken moderately to strongly. Waves on ponds, lakes, and running water. Water turbid from mud stirred up. In-caving to some extent of sand or gravel streambanks. Rang large church bells, etc. Suspended objects made to quiver. Damage negligible in buildings of good design and construction, slight to moderate in well-built ordinary buildings, considerable in poorly built or badly designed buildings, adobe houses, old walls (especially where laid up without mortar), spires, etc. Cracked chimneys to considerable extent, walls to some extent. Fall of plaster in considerable to large amount, also some stucco. Broke numerous windows, furniture to some extent. Shook down loosened brickwork and tiles. Broke weak chimneys at the roofline (sometimes damaging roofs). Fall of cornices from towers and high buildings. Dislodged bricks and stones. Overturned heavy furniture, with damage from breaking. Damage considerable to concrete irrigation ditches.

VIII. Fright general--alarm approaches panic. Disturbed persons driving motor cars. Trees shaken strongly--branches, trunks, broken off, especially palm trees. Ejected sand and mud in small amounts. Changes: temporary, permanent; in flow of springs and wells; dry wells renewed flow; in temperature of spring and well waters. Damage slight in structures (brick) built especially to withstand earthquakes. Considerable in ordinary substantial buildings, partial collapse: racked, tumbled down, wooden houses in some cases; threw out panel walls in frame structures, broke off decayed piling. Fall of walls. Cracked, broke, solid stone walls seriously. Wet ground to some extent, also ground on steep slopes. Twisting, fall, of chimneys, columns, monuments, also factory stacks, towers. Moved conspicuously, overturned, very heavy furniture.

IX. Panic general. Cracked ground conspicuously. Damage considerable in (masonry) structures built especially to withstand earthquakes: threw out of plumb some wood-frame houses built especially to withstand earthquakes; great in substantial (masonry) buildings, some collapse in large part; or wholly shifted frame buildings off foundations, racked frames; serious to reservoirs; underground pipes sometimes broken.

X. Cracked ground, especially where loose and wet, up to widths of several inches; fissures up to a yard in width ran parallel to canal and streambanks. Landslides considerable from riverbanks and steep coasts. Shifted sand and mud horizontally on beaches and flat land. Changed level of water in wells. Threw water on banks of canals, lakes, rivers, etc. Damage serious to dams, dikes, embankments. Severe to well-built wooden structures and bridges, some destroyed. Developed dangerous cracks in excellent brick walls. Destroyed most masonry and frame structures, also their foundations. Bent railroad rails slightly. Tore apart, or crushed endwise, pipelines buried in earth. Open cracks and broad wavy folds in cement pavements and asphalt road surfaces.

XI. Disturbances in ground many and widespread, varying with ground material. Broad fissures, earth slumps, and land slips in soft, wet ground. Ejected water in

large amounts charged with sand and mud. Caused sea waves ("tidal" waves) of significant magnitude. Damage severe to wood-frame structures, especially near shock centers. Great to dams, dikes, embankments, often for long distances. Few, if any, (masonry) structures remained standing. Destroyed large well-built bridges by the wrecking of supporting piers, or pillars. Affected yielding wooden bridges less. Bent railroad rails greatly, and thrust them endwise. Put pipelines buried in earth completely out of service.

XII. Damage total--practically all works of construction damaged greatly or destroyed. Disturbances in ground great and varied, numerous shearing cracks. Landslides, falls of rock of significant character, slumping of riverbanks, etc., numerous and extensive. Wrenched loose, tore off, large rock masses. Fault slips in firm rock, with notable horizontal and vertical offset displacements. Water channels, surface and underground, disturbed and modified greatly. Dammed lakes, produced waterfalls, deflected rivers, etc. Waves seen on ground surfaces (actually seen, probably, in some cases). Distorted lines of sight and level. Threw objects upward into the air.

## Comparison of Modified Mercalli (MM) and Other Intensity Scales

| Modified Mercalli | Rossi-Forel | Japanese | European |
|---|---|---|---|
| I | I | 0 | I |
| II | I-II | I | II |
| III | III | II | III |
| IV | IV-V | II-III | IV |
| V | V-VI | III | V |
| VI | VI-VII | IV | VI |
| VII | VIII- | IV-V | VII |
| VIII | VIII+ to IX- | V | VIII |
| IX | IX+ | V-VI | IX |
| X | X | VI | X |
| XI | ------ | VII | XI |
| XII | ------ | ------ | XII |

APPENDIX 2. Description of Magnetic Tape Format for Earthquake Intensity File

[Blocking factor: 50 records (90 characters each) per tape block]

| Tape position | Field | Comments |
|---|---|---|
| 1-8 | Earthquake date (UT). | Positions 1-4, year; 5-6, month; 7-8, day; (e.g., 19800131 = Jan. 31, 1980). |
| 9-15 | Earthquake origin time (UT). | Positions 9-10, hour; 11-12, minute; 13-15, seconds (implied decimal between positions 14 and 15); (e.g., 0130100 = 01:30:10.0). |
| 16 | Number of hours to substract from UT to get local zone time. | 5 = 75° meridian;<br>6 = 90° meridian;<br>7 = 105° meridian;<br>8 = 120° meridian;<br>9 = 135° meridian;<br>X = 150° meridian. |
| 17 | Intensity (MM) assigned that was not listed in source document; | U (unpublished intensity). |
| | Intensity grouped I-III in source document was reassigned int. III. | G (grouped intensity). |
| 18-22 | Geographic latitude of epicenter in decimal degrees. | Given to two decimal places (e.g., 37.35). |
| 23-28 | Geographic longitude of epicenter in decimal degrees. | Given to two decimal places (e.g, 117.90). |
| 29 | East or west longitude (for positions 23-28). | E if east; W if west. |
| 30-32 | Earthquake magnitude (either mb, MS, or ML). | Generally as published in United States Earthquakes or Earthquake History of the United States (e.g., 7.8). |
| 33-36 | Earthquake focal depth in km. | 0013 = 13 km. |
| 37-40 | Distance from epicenter to city (or locality) affected in km. | 0150 = 150 km. |

APPENDIX 2 (Continued)

| Tape position | Field | Comments |
|---|---|---|
| 41 | East or west longitude (for positions 47-52). | E if east; W if west. |
| 42-46 | Geographic latitude of reporting city in decimal degrees. | Given to two decimal places (e.g., 34.15). |
| 47-52 | Geographic longitude of reporting city in decimal degrees. | Given to two decimal places (e.g., 118.15). |
| 53-54 | Modified Mercalli intensity at reporting city (I through XII). | 01 = I; 02 = II; 03 = III...; 12 = XII. Blank = not felt. |
| 55-56 | State code. | Numerical identifier for State (see appendix 4). |
| 57-84 | Name of reporting city (or locality). | City where reported intensity occurred. |
| 85 | Location of epicenter. | A = Atlantic; C = Canada; M = Mexico; P = Pacific; Blank = United States. |
| 86 | Record may appear to have an uncorrected error. | E |
| 87 | Blank. | Blank. |
| 88 | Source (authority) codes for intensity data. | B = Report by Bollinger and Stover, 1976.<br>C = Quarterly Seismological Reports, 1925-27.<br>H = Earthquake History of the United States.<br>K = Report by Carnegie Institution, 1908, 1910.<br>N = Report by Nuttli, 1973.<br>Q = Abstracts of Earthquake Reports for the United States, 1933-70.<br>S = Unpublished report by Nina Scott, 1965.<br>W = Monthly Weather Service Seismological Reports, 1914-24.<br>Blank = United States Earthquakes, 1928-80. |

## APPENDIX 3. Description of Printout Format for Earthquake Intensity File

STATE - State in which earthquake was reported (felt) by residents.

CITY - City in which earthquake was reported (felt) by residents.

INT - Modified Mercalli (MM) intensity assigned to reporting city.

N LAT - Geographic latitude for reporting city.

W LONG - Geographic longitude for reporting city.

DISTANCE FROM SOURCE - Distance (in km) that reporting city (or locality) is located from epicenter of earthquake.

REF. CODE - Reference (authority) for one or more of the reported parameters (e.g., epicenter, city and intensity).

EARTHQUAKE SOURCE (corresponds to positions 1-15 and 18-36 in Tape Format--see appendix 2):

YEAR - Year earthquake occurred (e.g., 1970).

MO - Month earthquake occurred (e.g., 01 = January).

DA - Day (in UT) earthquake occurred (e.g., 23).

HR - Hour (in UT) earthquake occurred (e.g., 24 = 12 p.m.).

MN - Minute (e.g., 59).

SEC - Second (e.g., 09.4).

N LAT - Geographic latitude of epicenter in decimal degrees (e.g., 39.90).

W LONG - Geographic longitude of epicenter in decimal degrees (e.g., 105.10).

MAG - Earthquake magnitude (mb, MS, or ML).

DEPTH - Earthquake focal depth in kilometers (e.g., 005 = 5 km).

## APPENDIX 4. List of State Codes Used in Earthquake Intensity File

[See columns 55-56 in appendix 2.]

| | | | | | |
|---|---|---|---|---|---|
| 01 | Alabama | 25 | Michigan | 48 | Texas |
| 02 | Alaska | 26 | Minnesota | 49 | Utah |
| 03 | Arizona | 27 | Mississippi | 50 | Vermont |
| 04 | Arkansas | 28 | Missouri | 51 | Virginia |
| 05 | California | 29 | Montana | 52 | Virgin Islands |
| 07 | Colorado | 30 | Nebraska | 54 | Washington |
| 08 | Connecticut | 31 | Nevada | 55 | West Virginia |
| 09 | Delaware | 32 | New Hampshire | 56 | Wisconsin |
| 10 | District of Columbia | 33 | New Jersey | 57 | Wyoming |
| 11 | Florida | 34 | New Mexico | 74 | Panama |
| 12 | Georgia | 35 | New York | 75 | Philippine Is. |
| 14 | Hawaii | 36 | North Carolina | 80 | Mexico |
| 15 | Idaho | 37 | North Dakota | 81 | Baja California |
| 16 | Illinois | 38 | Ohio | 90 | Canada |
| 17 | Indiana | 39 | Oklahoma | 91 | Alberta |
| 18 | Iowa | 40 | Oregon | 92 | Manitoba |
| 19 | Kansas | 41 | Pennsylvania | 93 | Saskatchewan |
| 20 | Kentucky | 42 | Puerto Rico | 94 | British Columbia |
| 21 | Louisiana | 43 | Rhode Island | 95 | Ontario |
| 22 | Maine | 45 | South Carolina | 96 | New Brunswick |
| 23 | Maryland | 46 | South Dakota | 97 | Quebec |
| 24 | Massachusetts | 47 | Tennessee | 98 | Nova Scotia |
| | | | | 99 | Yukon Territory |