

Four Measures of Disaster Intensity

I. Richter Magnitude Scale

- A. Developed by Charles F. Richter in 1935.
- B. Magnitude is determined by the logarithm of the amplitude of ground oscillations recorded by seismographs. A seismograph is a device that measures ground motion or actually the amplitude of ground movement or oscillation.
- C. Because of the logarithmic basis of the scale used, an increase from one whole number to the next, like from 5 to 6, is a tenfold increase in amplitude. From the standpoint of energy release, however, a jump from one whole number to the next indicates a release that is 31 times greater. Thus, an earthquake with a magnitude of R6 is 31 times the energy release of one measured at R5.
- D. Source: Adapted from Gerard J. Hoetmer. 1991. "Introduction." Pp. xvii-xxxiv in *Emergency Management: Principles and Practice For Local Government*, edited by Thomas E. Drabek and Gerard J. Hoetmer. Washington, D.C.: International City Management Association, p. xxvi.
- E. The 1994 Northridge earthquake in the Los Angeles metropolitan area measured R6.7 and the 1989 Loma Prieta jolt in the San Francisco Bay area was 7.1. Of greater concern, however, are predictions for larger quakes in these areas which would be highly devastating, e.g., the Newport-Inglewood fault which bisects downtown Los Angeles is predicted for with a 50 percent probability within the next 30 years. An equally significant quake in the Bay Area is predicted within a thirty year time frame with a probability set at 67 percent. Extensive development has occurred in St. Louis, MO, Memphis, TN, and other areas that were impacted in 1811 and 1812. The most violent quake in the U.S.A. history occurred there at the New Madrid fault (R8.5 and R8.7).
- F. Source: Adapted from Dennis S. Mileti. 1999. *Disasters By Design: A Reassessment of Natural Hazards in the United States*. Washington, D.C.: Joseph Henry Press, p. 86 and 118.

II. Modified Mercalli Intensity Scale

- A. Developed by Harry Wood and Frank Newmann in 1931.
- B. Roman numerals are used to specify 12 levels of intensity that are based on observed effects.
- C. Examples: I – not felt except by a very few; III – noticeably felt by persons indoors, especially by persons on upper floors of buildings; V – felt by most

people, some dishes and windows damaged; VII – considerable damage to poorly built structures, chimneys broken; IX – damage great in substantial buildings, with partial collapse; XI – few masonry structures remain standing, bridges destroyed, train rails bent; XII – total damage with lines of sight and level being distorted.

- D. Source: Adapted from Gerard J. Hoetmer. 1991. "Introduction." Pp. xvii-xxxiv in *Emergency Management: Principles and Practice for Local Government*, edited by Thomas E. Drabek and Gerard J. Hoetmer. Washington, D.C.: International City Management Association, pp. xxvi-xxvii.

III. Saffir/Simpson Damage-Potential

- A. Developed by Herbert Saffir, a consulting engineer in Dade County Florida and Robert H. Simpson, a former director of the National Hurricane Center.
- B. This measure is used to classify hurricanes into one of five categories based on barometric pressure, wind speed, storm surge and damage potential. Most commonly four qualities are reported; 1) the category, 2) wind speed, 3) surge height, and 4) damage potential.
- C. Category 1 (74-95 mph; 4-5 ft.; minimal); Category 2 (96-110 mph; 6-8 ft.; moderate); Category 3 (111-130 mph; 6-12 ft.; extensive); Category 4 (131-155 mph; 13-18 ft.; extreme); Category 5 (above 155 mph; above 18 ft.; catastrophic).
- D. Source: Robert H. Simpson and Herbert Riehl. 1981. *The Hurricane and Its Impact*. Baton Rouge, Louisiana: Louisiana State University Press, pp. 366-368.

IV. Fujita Tornado Scale

- A. Developed by Tetsuya Theodore Fujita.
- B. A six category scale that relates wind speeds to typical damages.
- C. F0 value (40-72 mph; light damage, e.g., tree branches broken off); F1 value (73-112 mph; moderate damage, e.g., mobile homes pushed off foundations or overturned); F2 value (113-157 mph; considerable damage, e.g., large trees uprooted); F3 value (158-206 mph; severe damage, e.g., roofs and some walls torn off well constructed houses); F4 value (207-260 mph; devastating damage, e.g., well constructed houses leveled); F5 value (261-318 mph; incredible damage, e.g., strong frame houses lifted off foundations and carried considerable distances).

- D. Based on data aggregated from 1953 to 1989, the following annual averages were made based on a total of 748 tornadoes studies; F0 – 29%; F1 – 40%; F2 – 23%; F3 – 6%; F4 – 1%; F5 - .1%.
- E. Sources: Adapted from Federal Emergency Management Agency, 1999. *MultiHazard Identification and Risk Assessment*. Washington, D.C.: Mitigation Directorate, Federal Emergency Management Agency, p. 40 and “Tetsuya Theodore Fujita (1920-1998): Biographic Notes” (accessed 10-30-02: <http://www.msu.edu/~fujita/tornado/ftfujita/biography..html>).