Annex D. Measuring Earthquakes: Using Richter and Mercalli Scales

Richter Scale: Seismologists have developed various ways to measure the strength of earthquakes. The first and most well-known is the Richter magnitude scale, developed earlier this century by California seismologist Charles Richter. The calculation of Richter magnitude is based on the maximum strength of the vibrations (measured by a seismograph) and the distance of the instrument from the epicenter of the earthquake. The Richter scale is logarithmic, which means that each increase in magnitude indicates a tenfold increase in the strength of the quake. A magnitude-6.0 earthquake, for instance, is ten times stronger than a magnitude-5.0. In terms of the energy released, the differences are even greater. A magnitude-6.0 earthquake releases 32 times the seismic energy as a magnitude-5.0.

Richter	Comments
1.0	Only ascertainable with use of instruments
2.0	Smallest quake people can normally feel
3.0	Only those near epicenter feel the quake. Nearly 100,000 occur every year of size 2.5 - 3.0
4.0	A small fission atomic bomb. Quakes > 4.5 can cause local damage. Generally noticeable in the range of 30 kilometres.
5.0	Standard fission bomb, similar to first bomb tested in New Mexico.
6.0	Equivalent to a hydrogen bomb. Can cause casualties and much damage in heavily populated areas. About 100 shallow quakes of size 6.0 every year
7.0	Major earthquake - about 14 every year. Enough energy to heat New York City for 1 year. Can be detected all over globe.
8.0	Largest known: 8.9 in Japan and in Chile/Ecuador. San Francisco destroyed by 8.25 in 1906
9.0	Roughly the world's energy usage in a year

"Modified Mercalli Intensity" (MMI) Scale: Measures observable results or effects of earthquake: damage caused, sensations described by people, etc. (Mercalli numbers do not correspond directly to Richter numbers; for example, V on the MMI Scale is not equivalent to 5 on the Richter Scale).

Mercalli	Observable Results and Effects
I	Not felt. Most people do not notice. Animals may be uneasy, can be detected by seismograph
II	Felt by persons at rest, on upper floors, or favorably placed. Hanging objects may sway back and forth
III	Felt indoors. Vibration like passing of light trucks. Parked cars may rock
IV	Doors, windows, and shelves may rattle, people indoors can feel movement. Vibration like passing of heavy truck or jolt like a heavy ball striking the walls.
V	Felt outdoors, sleepers wakened. Light furniture moves, pictures move, objects may fall from shelves
VI	Felt by all. Persons walk unsteadily. Windows dishes and glasses broken. Pictures off walls. Furniture moved or overturned. Weak plaster and masonry cracked.
VII	Difficult to stand. Noticed by car drivers. Furniture broken. Damage to weak masonry, some cracks in ordinary masonry. Weak chimneys broken at roof line. Fall of plaster, loose bricks, stones, tiles and unbraced parapets.
VIII	Steering of cars affected. Damage to ordinary masonry, partial collapse. Twisting, fall of chimneys, factory stacks, monuments, towers, elevated tanks. Frame houses moved on foundations if not bolted down; loose panel walls thrown out. Cracks in wet ground and on steep slopes.