The Great Hanshin-Awaji (Kobe) Earthquake in Japan

17 January 1995

The Earthquake, On-Site Relief and International Response (Case Report)

DHA-Geneva
Relief Coordination Branch
Mission

28 February - 10 March 1995

****

I. The Seismic Event and Characteristics of the Hanshin-Awaji Area

A. Seismological Aspects

The earthquake occurred at 5:46 a.m. (local time) on 17 January 1995. The epicenter, at 34.36 deg. north and 135.00 deg. east, with a depth of 14 km, was located on the northern tip of Awaji Island, approximately 20 km southwest of the central business district of Kobe City. The magnitude was computed at 7.2 on the Richter scale. The earthquake is believed to have been caused mainly by fault rupture, described as a right-lateral, strike-slip motion of the Nojima Active Fault. A ground survey showed a horizontal displacement of 1.2 to 1.5 meters along this active fault.

The magnitude and shallowness of the epicenter led to a ground motion of intensity unprecedented in Japan. A maximum horizontal ground velocity of 818 gal (cm/sec2) and maximum vertical ground velocity of 332 gal were observed at the Kobe Ocean Meteorological Observatory, which was close to the epicenter. A horizontal velocity of 306 gal and vertical of 446 gal were registered at Kobe University. On Rokko Island (reclaimed island offshore from Kobe) a record-breaking vertical velocity of 507 gal was observed. A maximum ground motion speed of 90 cm/sec was noted. The duration of peak ground motion was 10-15 seconds. Seismic intensity in the center of Kobe was identified as VII on the JMA (Japan Meteorogical Agency) seismicity scale, which corresponds to a seismic intensity of 11 - 12 on the Modified Mercalli Scale.

Table 1
Summary of Seismological Aspects

Time and Date	05:46 hours on 17 January 1995 (local time)			
Epicenter	34.36 deg. north, 135.00 deg. east, depth 14 km			
Magnitude	7.2 on Richter Scale			
	Horizontal		Vertical	
Ground Velocity (cm(sec2)	N-S	E-W	U-D	
	818 269	617 306	332 446	(KobeOceanMeteorologicalObservatory) (Kobe University Observation Point)
Max. Ground Speed	90cm/sec 55cm/sec			(Kobe Ocean Meteorological Observatory) (Kobe University Observation Point)
Duration of Peak Motion	10-15 sec			
Seismic Intensity	9 - 12 on Modified Mercalli Scale (in Kobe City area)			

This seismic event was described by Japanese seismologists as a typical "Shallow Direct Hit" earthquake. Strong upward ground velocity compared to the horizontal component and a short duration of peak motion are typical characteristics of such an earthquake. Japan has experienced numerous earthquakes in the past. However, most of the major ones, including the famous Great Kanto Earthquake of 1923, were of the ocean tectonic type. in which the ground motion element was mostly horizontal. This present earthquake was the first "Shallow Direct Hit" one to affect a major metropolitan area in modern Japan. For several years, the potential danger of such an earthquake has been pointed out for the Tokyo Metropolitan Area; but for the Hanshin (Kobe-Osaka) Metropolitan Area this event was a surprise.

The presence of the Nojima Active Fault (Photo 1) has long been known to seismologists and is marked on published geological maps. Geological research carried out after the earthquake indicates that this fault moved once, approximately 1,000 years ago, and has been dormant ever since. The local authorities and the public never regarded this "active" fault as a potential risk factor.

B. Characteristics of the Affected Area

The Hanshin (Kobe-Osaka) Metropolitan Area, together with the neighboring city of Kyoto and its vicinity forms the Kansai or Keihanshin Metropolitan Area, which is the second largest metropolitan area in Japan. The earthquake violently shook the cities of Kobe, Akashi, Ashiya, Amagasaki, Itami, Kawanishi, Miki, Nishinomiya, Takarazuka, Sumoto and the northern half of Awaji Island in Hyogo Prefecture, and the cities of Osaka, Ikeda, Suita, Toyonaka and Minoo in Osaka Prefecture. The earthquake was

兵庫県南部地震により淡路島北部に出現した地震断層

1995年1月18日

国土地理院撮影

Photo of the Epicenter of Nojima Active Fault Zone
© January 1995, Geographical Survey of Japan

strongly felt (8 on the Modified Mercalli Scale) in Kyoto City. The total population which experienced vigorous seismic shaking (stronger than 8 on the Modified Mercalli Scale) is estimated to be more than 4 million. The City of Kobe, which was most severely shaken, has a population of 1.5 million.

> ***Background Note:*** Japan has two layers of local government. The country is divided into 47 Prefectures ("ken" in Japanese). Prefectures are composed of Cities ("shi"), Towns ("cho") and Villages ("mura"). Major Cities are further divided into Wards ("Ku") for administrative purposes. The earthquake affected mostly Hyogo Prefecture and Osaka Prefecture and also shook Kyoto Prefecture. Emergency response is also based on this two-layer local government system. The national government assists the local government efforts in emergency response.

The average population density of the City of Kobe is 2,779 per sq. km and 64.5% of the population (979,000 people) live in a densely populated area of more than 5,000 persons per sq. km.

Table 2
Population of Kobe City

City and Ward	Population	Population Density (per square km)
Kobe (total)	1,516,913	2,779
by Ward:		
Higashinada	191,349	6,301
Nada	125,144	4,007
Chuoo	111,803	5,082
Hyogo	118,272	8,191
Kita	215,105	889
Nagata	130,846	11,368
Suma	188,750	6,366
Tarumi	237,734	8,877
Nishi	197,910	1,434

Kobe is a city which developed on a narrow plain belt, sandwiched in between the Rokko Mountains in the north and Osaka Bay in the south. Kobe started as a port city. It is now the second largest port in Japan and, along with neighboring Osaka, has developed into a commercial, industrial center for the western half of Japan.