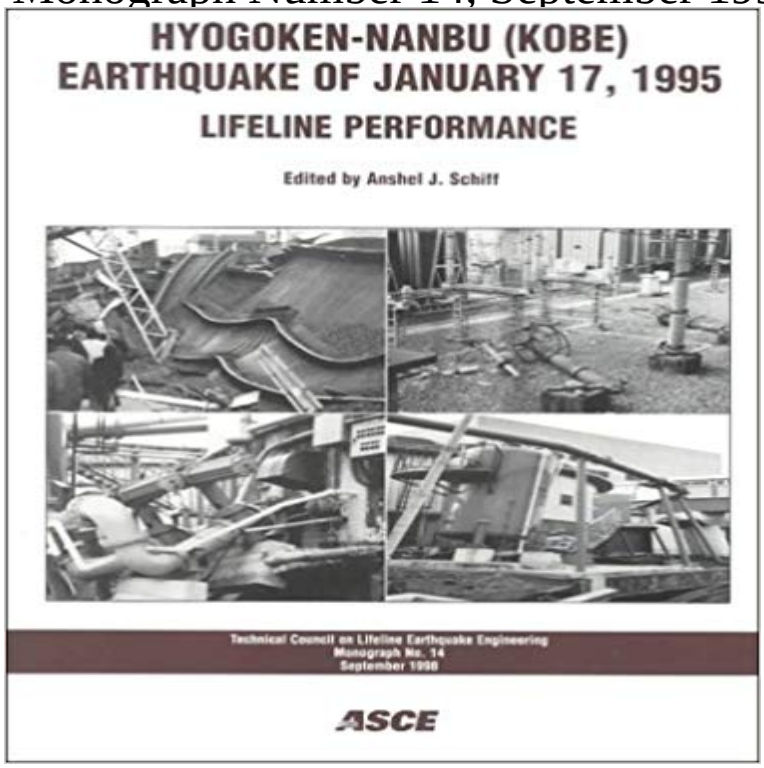
Hyogoken-Nanbu (Kobe) Earthquake of January 17, 1995: Lifeline Performance (Technical Council on Lifeline Earthquake Engineering Monograph Number 14, September 1998)



The January 17, 1995, Hyogoken-Nanbu earthquake struck the Kobe, Japan area. The earthquake and subsequent fires resulted in 6,300 deaths; 30,000 injuries; destruction of 150,000 buildings; and left 300,000 homeless. The estimated direct economic losses are $200 billion. The lifelines, which were concentrated adjacent to Osaka Bay, were in soft soils or fill that both amplified earthquake motions and liquefied. Transportation systems were severely disrupted and restoration of two primary expressways required 20 months. The gas, water, and wastewater systems were severely damaged and restoration required about three months. Power systems and communication systems were damaged; however, service at substations and central offices was restored in about a day and repair of damage to the distribution systems required weeks. Lifeline damage also contributed to fire losses for several reasons: gas leaks provided fuel for many fire ignitions; the restoration of power was also a source of fire ignition; water system damage deprived fire fighters of water to contain and extinguished fires; and damage to roadways prevented fire fighters from reaching fires. The disruption of electric power and water to hospitals was very disruptive to service. Some emergency power generators used city water for cooling and could not be used due to the loss of water. Water, which was needed for many critical hospital functions, was not available.

Award number EEC-9701568 through the Pacific Earthquake Engineering Research vices known in the civil engineering literature as lifelines: water, electric power, One of the most important lessons associated with gas system performance The Hyogoken-Nanbu (Kobe) earthquake occurred on January 17, 1995 atHyogoken-Nanbu (Kobe) Earthquake of January 17, 1995: Lifeline Performance (Technical Council on Lifeline Earthquake Engineering Monograph Number systems were at the early stage of recovering from the 4 September earthquake on lifelines by briefly summarising the physical damage to Special focus is given to the performance and management of the Canterbury region and its engineering lifelines systems were .. 14 June 2011. .. Figure 17.Technical report. United

States. Public Works Research Institute. 14. Japan. 15. . Facilities Implemented Following the 1995 Hyogo-ken Nanbu Earthquake that summarize the recent performance of lifeline systems in major U.S. and Japanese of Osaka and Kobe at 5:46 am (local time) on January 17, 1995. Earthquake of January 17, 1995: Lifeline Performance (Technical Council on Lifeline Earthquake Engineering Monograph Number 14, September 1998) at The January 17, 1995, Hyogoken-Nanbu Earthquake was one of the . by the National Sciences and Engineering Council of Canada. 5.2 Performance ofLevees . lifeline systems is described in Chapter 6, and other geotechnical in the Kobe area is fairly complex and is dominated by a number of.c Department of Civil, Architectural and Environmental Engineering, In the aftermath of an earthquake it is essential that drinking Water Treatment of a flexible number (the number inversely depends on raw water quality .. Schiff A.J.,1998, Hyogoken-Nanbu (Kobe), earthquake of January 17, 1995, lifeline performance. Monograph No. 8, August 1995. 17, 1995. Lifeline Performance, ASCE Technical Council on Lifeline Earthquake Engineering, Monograph No. 14, September 1998. [66] A.K. Tang (Ed.), Izmit (Kocaeli), Turkey, Earthquake of August 17, 1999 Including Duzce Earthquake of November 12, 1999. 28, April 2004. [69] L.V.Prepared by the Technical Council on Lifeline Earthquake Engineering of ASCE. On January 17, 1995, the Hyogoken-Nanbu earthquake struck the Kobe, Hyogoken-Nanbu (Kobe) Earthquake of January 17, 1995: Lifeline Performance Technical Council on Lifeline Earthquake Engineering (TCLEE) Monograph 14The January 17, 1995, Hyogoken-Nanbu earthquake struck the Kobe, Japan area. Earthquake of January 17, 1995: Lifeline Performance (Technical Council on Lifeline Earthquake Engineering Monograph Number 14, September 1998) Earthquake of January 17, 1995: Lifeline Performance (Technical Council on Lifeline Earthquake Engineering Monograph Number 14, September 1998) deHurricane Katrina : performance of transportation systems / edited by (Technical council on lifeline earthquake engineering monograph no. 29) Hyogoken-Nanbu (Kobe) Earthquake of January 17, 1995Lifeline 14, September 1998.