Chapter 1. Introduction

An earthquake hit the western region of Turkey including cities of Izmit in the Kocaeli Province, Adapazari in the Sakarya Province and Istanbul at 00:01, August 17, 1999 (GMT); i.e., 03:01 AM in local time. The Kocaeli, Turkey earthquake occurred on the active North Anatolian Fault, of which epicenter is located at 40.702N and 29.987E, closely west of Izmit, the capital city of Kocaeli Province, with the epicentral depth of 17km. The magnitude is reported 7.4 as the moment magnitude and 7.8 as the surface magnitude from the USGS, USA.

According to the OCHA (UN Office for the Coordination of Humanitarian Affairs) situation report on the web-site released on September 15, 1999, the number of casualties from the Prime Minister's Crisis Management Center (PMCMC), Turkish Government, as of September 12, 1999 has been tabulated as follows:

Table 1.1. Statistics of casualties.

Province	Dead	Injured
Bolu	264	1,163
Bursa	263	333
Eskisehir	86	83
Istanbul	978	3,547
Kocaeli	4,088	4,147
Golcuk	4,556	5,064
Sakarya	2,627	5,084
Tekirdag	-	35
Yalova	2,501	4,472
Zonguldak	3	26
Total	15,466	23,954

As of September 12,1999.

The sum of the dead persons in columns in Table 1.1 is equal to 15,366, while the total number in the row is 15,466 within the table. See Table 3.1.1 in Chapter 3 for further reference.

The figures in Table 1.1 released from the PMCMC have increased to 15,637 in the total number of death, and to 24,941 in the total number of injured as of September 18, 1999. The other source describes the number of death reaches to about 20,000 with the as much missing, and that of hospitalized injuries is about 24,000.

The damage statistics from the PMCMC mainly on building structures were summarized as in the following table:

Table 1.2. Damage statistics on building structures.

Province	Heavily Damaged	Moderately Damaged	Lightly Damaged	Damaged[*1]	Damaged[*2]
Bolu	3,226	4,782	3,233	9,625	8,200
Bursa	32	109	431	357	300
Eskisehir	70	32	204	204	200
Istanbul	3,614	12,370	10,630	21,299	17,600
Kocaeli	23,254	21,316	21,481	55,311	48,900
Sakarya	20,104	11,381	17,953	40,462	37,000
Yalova	10,134	8,870	14,459	26,234	23,600
Total	60,434	58,860	68,391	153,490	

1] [Damaged] is defined by [(Heavily Damaged)+(Moderately Damaged)+1/2(Lightly Damaged)].

2] [Damaged] is defined by [(Heavily Damaged)+0.7(Moderately Damaged)+0.5*(Lightly Damaged)].

As of September 12, 1999.

The updated figures in Table 1.2 can be revised on September 18, 1999 as below:

Table 1.3. The updated damage statistics on building structures.

	Residential Buildings	Business Buildings
Collapsed/ Heavily Damaged	65,385	10,761
Moderately Damaged	64,565	9,746
Lightly Damaged	76,452	9,413

As of September 18, 1999.

The economic losses, not definitely estimated, has been reported to be about 16 billion US dollars (USD) including socio-economic losses, with physical losses of 5 billion USD for buildings, 2 billion USD for industrial facilities, and others for railway, harbor facilities and highway systems.

The heavily damaged zones, where the number of reported death is greater than 2,000 and/or that of the damaged buildings in the sixth column in Table 1.2 greater than 20,000, are the provinces of Kocaeli, Golcuk, Sakarya and Yalova, locating along the North Anatolian Fault. Note that within a province, a city is located as a capital for the province: i.e., the city of Izmit is the capital city for the Kocaeli Province, and the city of Adapazari for the Sakarya Province.

Following the occurrence of the quake, Earthquake Disaster Mitigation Research Center, Institute of Physical and Chemical Research (*RIKEN*), hereinafter abbreviated as EDM, has initiated immediately its activities on the survey, assessment and analysis on the damage caused by the earthquake.

The first step towards the activities is to estimate the special distribution of the damaged areas during the quake utilizing the DMSP (Defense Meteorological Satellite Program) imagery data. By comparing the nighttime satellite image taken after the quake with that taken before the quake, the deviation of lighting image has been evaluated. Due to the reasons such as electric power shut-down, structural failure to residential buildings, stagnation of human activities and possible others caused by a hazardous event, the nighttime lights would be reduced within the areas suffered serious damage during an earthquake disaster. The light reduction can be a

good measurement to estimate the special distribution of the damaged area. Using the nighttime satellite light images, we can estimate the special distribution of the damaged areas in the office located away from the actually damaged areas. The EDM has reported the evaluated estimation instantaneously on the homepage.

The second step is to provide advices and suggestions on the related items for emergency relief and disaster management. Two researchers of the EDM, Haruo Hayashi and Norio Maki, Team Leader and Deputy Leader, Disaster Process Simulation Team, EDM, visited Turkey during the period of September 1 to 7 and August 27 to September 3, individually as members in an advisory group organized by the Hyogo Prefectural and Kobe Municipal Governments. They gave the Turkey governmental agency advices mainly on emergency responses and disaster management against the quake based upon the experiences during the 1995 Great Hanshin Earthquake.

During the period of September 3 to 15, Hiroshi Arai, Research Member, Structural Performance Team, EDM visited the damaged areas of Golcuk, Degirmendere, Yalova, Sapanca and Adapazari joining the earthquake reconnaissance team organized by the Architectural Institute of Japan, Tokyo, Japan. His activities are primarily focused upon to reveal what types of damages are generated during the quake from a viewpoint of structural engineering.

And the EDM has dispatched a reconnaissance research team consisting of the following five members to the damaged areas, Fumio Yamazaki, Masashi Matsuoka and Yuuki Okuma from the Disaster Information System Team, and Tetsuo Kubo and Hiroshi Hibino from the Structural Performance Team, during the period of September 27 to October 4, 1999. The activities of the dispatched team can be itemized as in the following:

(1) Damage reconnaissance primarily on the building structures in the damaged areas of Avcilar near to the city of Istanbul, Yalova, Degirmendere, Golcuk, Derince Port, Spanca and Adapazari
(2) Microtremor measurement at the sites where the strong ground motion records obtained at the Yarimca and Sakarya stations
(3) Microtremor measurement on ground in the damaged and undamaged areas of Golcuk and Adapazari
(4) Microtremor measurement within the damaged and undamaged buildings in Adapazari and Golcuk, respectively
(5) Drawing of a street map of the damaged areas at Golcuk utilizing a handy GPS (Global Positioning System) with a portable personal computer in collaboration with US research team coordinated by Dr. Ronald T. Eguchi, EQE International
(6) Detailed damage survey along the streets, with which the evaluated damage obtained from the use of satellite images should be compared and verified

Within this EDM report, the reconnaissance reports on the earthquake, ground motions and structural and ground failures have been briefly reviewed and included. Our major endeavor, however, is intended to be focused upon the research works expanded from analysis utilizing data obtained during our reconnaissance activities to the damaged areas.

References

Brief Information about Losses, Kandilli Observatory, Bogazici University, Turkey Homepage: http://kandilli.koc.net/losses.htm

EDM Homepage: http://www.miki.riken.go.jp

UNOCHA-Online Homepage: http://www.reliefweb.int/ocha_ol/country/tur/tur_hp.html