Survey Report on the Reconstruction Following the Earthquake in Marmara, Turkey on August 17, 1999

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Overview of the Earthquake

The earthquake which occurred in the north-western part of the Republic of Turkey on August 17, 1999 (magnitude: 7.8) was a major disaster, claiming over 17,000 lives and leaving approximately 32,000 injured in and around Izmit in the Marmara region (as of November 1999; figures issued by the Government of Turkey). An overview of the damage is shown in Table 1. Damage to buildings is known to have occurred on a particularly large scale, and it can be confirmed that many of the fatalities are attributable to this cause. Due to damage to bridges (see Figure 1), buildings (see Figure 2) and other structures, the adverse effect on the daily life and economic activities of the local community was also particularly severe.

Collapse of Arifiye Overpass (Courtesy of H. Hoashi)

Figure 1 Bridge damaged by the earthquake of August 17, 1999

Toppled and collapsed buildings in T c lar district of Adapazar

Figure 2 Building damaged by the earthquake of August 17, 1999

Table 1 Overview of the damage caused by the Marmara Earthquake

Category of damage	Breakdown of damage	Extent of damage	Remarks
Human casualties	Dead (as of November 16, 1999)	17,269	90% of the fatalities occurred in Kocaeli, Sakarya and Yalova.
	Injured (as of October 14, 1999)	32,430	85% of the injuries were sustained in Kocaeli, Istanbul, Sakarya and Yalova.
Damage to buildings (as of September 30, 1999)	Totally or largely destroyed (residential) (commercial)	77,342 units 66,441 homes 10,901 offices	Mostly reinforced concrete structures of medium height
	Partially destroyed (residential) (commercial)	77,169 units 67,242 homes 9,927 offices	
	Sustained minor damage (residential) (commercial)	89,872 units 80,160 homes 9,712 offices	
Social infrastructure	Expressways	Most roads remained passable	・An overpass collapsed, roadbeds and substructures subsided, tollgates collapsed, and other damage was seen, but in areas where roads were blocked, diversions were set up.
	Railways	Out of use for several days	・Railway facilities were reinstated in 2 days. ・Trains were out of action due to the fire at the Turpas refinery.
	Ports	Some damage	・An embankment was permanently deformed by 50 cm. ・One crane was destroyed by the effects of liquefaction.
	Airports	Major damage to Izmit military airfield	・Izmit military airfield's control tower almost collapsed. ・Istanbul Airport was undamaged.
	Water supply	Water supply interrupted	・Water purification plants were swiftly restored. ・In some areas, water supplies were interrupted for several months, due to cracks in supply pipes and other damage.
	Sewers	Breakdowns	・Breakdowns were caused by damage to concrete sewer pipes.
	Electricity	Power cuts	・Immediately after the earthquake, the whole of western Turkey was without power for 2 or 3 hours. ・Some areas were without power for several weeks.
	Gas	Slight damage	・Propane gas is widely used, so damage was slight.
	Telecommunications	Some damage	・The telecommunications system was congested and paralyzed immediately after the earthquake. ・Telephone systems were reinstated in 2 to 5 days.
	Other	Gasoline tank fires	・Caused by sloshing due to seismic ground motion ・Continued to burn for several days ・6 floating-roof cylindrical tanks caught fire, and the liquid they contained was completely burned up in 5 cases. ・Spherical tanks were undamaged.

Source: Survey Report on the Collection of Data on the Earthquakes in Turkey and Taiwan, and on the Verification of Japan's Earthquake Countermeasures, Asian Disaster Reduction Center, 2000

Economic damage, according to the World Bank's preliminary assessment report (dated September 14, 1999), is set between US$3.1 and 6.5 billion. Of this, between US$1.1 and 3 billion is damage to housing, between US$1.1 and 2.6 billion is damage to enterprise, and about US$500 million is damage to essential services. The remainder consists of damage to roads, ports, railways and municipal infrastructure.

Table 2 World Bank's preliminary assessment of damage caused by the Marmara Earthquake

Sector	Damage assessment (US$ million)	
	Lower bound	Upper bound
Housing	1,100	3,000
Municipal infrastructure	70	70
Environment	N/A	N/A
Roads, bridges and highways	78	78
Ports	12	12
Railways	72	72
Telecommunications	38	38
Electricity	82	82
Oil and gas	387	387
Enterprise	1,100	2,600
Education	100	100
Health	37	37
Total	3,076	6,476

Source: Turkey: Marmara Earthquake Assessment, September 14, 1999, The World Bank

Overview of Earthquake Response Activities

Search and Rescue Activities [5)]

Immediately after the earthquake struck, search and rescue activities were carried out by local residents themselves. Within 24 hours of the earthquake, several tens of members of AKUT, Turkey's national civilian voluntary search and rescue organization, began search and rescue activities, and about a thousand personnel from overseas aid teams (from 24 countries) joined in within 48 hours. By the 20th (the third day after the disaster), 50,000 Turkish army troops had begun their search and rescue activities.

Due to traffic restrictions, trunk roads were extremely congested on the first and second days. From the third day onwards, heavy machinery was brought in to start clearing away rubble. The central government deployed heavy machinery according to damage estimates by the governors of the provinces affected. Although the heavy machinery was procured mainly from the stricken north-western region, some was brought in from as far as 600 km away.

Emergency Response[5)]

Although the Prime Minister's national crisis action centre reportedly launched its emergency response activities a few hours after the earthquake, on-the-spot response by central or regional official bodies was extremely slow (reportedly taking between 1 and 4 days). Due to the lack of a systematic plan, distribution of water and food was slow, and as a result, large quantities of spoiled food (bread and other items) piled up uneaten, creating mounds of garbage.
The Government of Turkey requested help from the international community in the form of emergency aid, fire-fighting troops, recovery & reconstruction assistance, and so forth.

Problems

Mitchell[5)] makes the following points:

- For several days immediately following the earthquake, crisis control and search & rescue activities by the government seem to have been extremely slow and inefficient.
- On the day of the earthquake, command and control was extremely limited at all levels. Also, it was reported that, for a four-hour period, neither the President nor the Prime Minister could be contacted, because there was no backup facility for the telecommunications lines between Ankara and Istanbul.
- The huge extent of the stricken area, inadequate planning, lack of experience, lack of resources, lack of effective leadership and other factors militated against the smooth initial launching of an emergency response in the form of search and rescue activities.

According to the International Federation of Red Cross and Red Crescent Societies [6], following the Marmara Earthquake, 50,000 people were rescued from beneath rubble, but 98% of these were rescued by local residents, and there is obviously is a limit to what the government could do in terms of search and rescue activities in the event of a disaster on so large a scale as this.

Recovery and Reconstruction Activities

Reconstruction Programs

Although the Government of Turkey itself has no official overarching reconstruction program with regard to the aftermath of the Marmara Earthquake, it has worked with external bodies, chiefly the World Bank, to draft reconstruction programs. These reconstruction programs are the two shown in Table 3: although they are referred to in World Bank reports, they do not exist as discrete documents. The bulk of these two reconstruction programs is constituted by World Bank projects -- the Emergency Earthquake Recovery Loan (EERL) and the Marmara Earthquake Emergency Reconstruction Project (MEER) -- mentioned below.

Because the “Turkish government’s earthquake reconstruction program” requires an immense amount of money, assistance is being provided by other financial institutions and aid organizations besides the World Bank.
A comprehensive Framework Program has been drafted by the World Bank, the United Nations Development Program (UNDP), the EU and other international organizations and donors, and is being financed by the European Investment Bank as well as the World Bank.

Table 3 Turkey’s reconstruction programs

Program	Total amount (US$ million)
Turkish government’s earthquake reconstruction program	2,629
World Bank’s comprehensive Framework Program	1,795.75

Table 4 Cost breakdown of Turkish government's earthquake reconstruction program

Program		Total cost	
		(trillion Turkish Lire)	(US$ million)
1. Social aid	Housing support	108	198
	Support for rebuilding and repair	51	108
	Cash lump-sum payments	18	38
	Subtotal	177	344
2. Social security benefits		13	24
3. Other social projects		15	29
4. Business rehabilitation	Tax deferments	105	233
	Assistance for small-scale enterprise	11	23
	Credit program	2	4
	Subtotal	118	260
5. Reconstruction and disaster damage mitigation	Housing	576	1,103
	Land management and building standards	19	36
	Infrastructure	235	450
	Disaster insurance	143	273
	Emergency response system	57	110
	Subtotal	1,030	1,972
Total		1,353	2,629

Source: Technical Annex for an Emergency Earthquake Recovery Loan in the amount of US$252.53 Million to the Republic of Turkey, October 27, 1999, The World Bank

Table 5 Cost breakdown of World Bank's comprehensive Framework Program

	Component		Cost (US$ million)	Source of funding
A	Disaster Response System and Risk Reduction Strategy	A1 National Emergency Management System	110.17	World Bank, Government of Turkey
		A2 Disaster Insurance Scheme	273.00	World Bank, Government of Turkey
		A3 Land Use Planning and Enforcement of Construction Codes	11.78	World Bank, Government of Turkey
		A4 Cadastre Renovation and Land Management	24.21	World Bank, Government of Turkey
		Subtotal	419.16	World Bank, Government of Turkey
B	Trauma Program for adults		6.89	World Bank, Government of Turkey
C	Construction of Permanent Housing in Bolu, Kocaeli and Yalova		293.32	World Bank, Government of Turkey
D	Project Management		12.69	World Bank, Government of Turkey
E	Business Rehabilitation		109.72	European Investment Bank
F	Construction of Permanent Housing in Bolu, Sakarya, Yalova, Istanbul, Bursa and Eskisehir		177.07	European Investment Bank
G	Repair of Existing Housing Stock and Healthcare Facilities		632.12	European Investment Bank
H	Rebuilding and Repair of Roads, Water Supply Systems, Wastewater Systems and Power Distribution Networks		139.73	European Investment Bank
	Front-end Fee		5.05	
	Total Program Cost		1,795.75	Of which US$505 million to be loaned by the World Bank

Source: MEER Project Information Document, The World Bank

World Bank Reconstruction Programs

The reconstruction programs whose drafting was spearheaded by the World Bank are the EERL (US$252.53 million) and the MEER (US$737.11 million (of which the World Bank is to loan US$505 million). The EERL was used for short-term purposes, while the MEER was used for short-term and medium-term projects. In the Turkish government's earthquake reconstruction program shown

in Table 4, item 5 (reconstruction and disaster damage mitigation) was covered by the MEER, as were items A to D in the World Bank's comprehensive Framework Program shown in Table 5, while the remaining parts of the Turkish government's earthquake reconstruction program were covered by the EERL.

At the request of the Government of Turkey, the World Bank dispatched a team of experts immediately after the earthquake: they drew up a damage assessment report in about three weeks. This report led to the aforementioned comprehensive reconstruction programs and to the World Bank projects (EERL and MEER).

Relative Size of Contributions by Donors

In terms of the size of contributions made by donors to the recovery after the Marmara Earthquake, the World Bank provided by far the largest sum of money. Other bodies contributing money included the European Investment Bank, the Counsil of Europe Development Bank (CEB), and the Japan Bank for International Cooperation.

Reconstruction Achievements and Challenges Remaining

Under the reconstruction projects spearheaded by the World Bank, the building of permanent housing and the provision of infrastructure is proceeding smoothly, and on the whole, it is fair to say that this work is yielding good results. However, on the urban regeneration front, a number of tasks remain outstanding, chiefly those listed below.[7)]

1) The tradition of *gecekondus* -- poorly-constructed housing erected without planning permission -- is entrenched in Turkish society, making it difficult to convince householders of the need to replace their homes with earthquake-resistant structures.

2) Various schemes linked to the earthquake reconstruction -- such as the system for state compensation for damaged buildings under the Disaster Law, and the scheme for partial ownership of real-estate, which give the owners very powerful rights -- are beset by major problems, and reform is likely to be needed in the future.

3) Home-owners are able to acquire new houses using long-term low-interest loans (due to high inflation, these are effectively almost free handouts). However, it is not clear what measures are being adopted to help renters (temporary rent assistance is being provided, but this is not a permanent measure).

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