

Section III: Preliminary Damage Assessment

A. Introduction

107. In response to the earthquake, a Bank team was dispatched within the week to work with the Government to assess the extent of the damage, to prepare reallocation of funds under existing Bank projects to meet emergency recovery needs, and to identify new investments to assist with disaster recovery. In addition, the Government requested that the Bank organize a comprehensive recovery plan to guide the reconstruction effort.

108. The main objectives of the Bank mission were: (i) to conduct a preliminary assessment of the magnitude of the disaster, (ii) to work with the relevant authorities to help improve information and communications to support an ongoing and fuller damage assessment to take place, (iii) to begin to identify the early reconstruction priorities and most urgent interventions, and to begin to identify appropriate partners for support and cooperation (governments, NGOs, private sector, multilateral agencies), and (iv) to consult with the Government concerning the development of a better emergency response strategy for the future. The figures presented in this preliminary damage assessment are a combination of the most recent figures provided by the Government and the assessments of the Bank team.

109. This assessment covers the following sectors:

- housing
- education
- health
- municipal infrastructure and environmental damage
- transportation
- telecommunications
- energy

Table 13: Summary of Initial Assessments

Sector	Reported/Assessed damage	Estimated replacement cost of damages (US\$ 000)	Notes
Housing	35,074 housing units completely destroyed or needing replacement 37,803 medium damage 42,805 light damage Only 29% of buildings suffered no damage at all.	1,100,000–1,600,000	Government figures as of 9/9/99 Does not include relocation of cities which could add significantly to the costs.
Education	43 schools were destroyed and 381 schools damaged There is a need to provide textbooks, school uniforms, trauma counseling and other basic support to displaced teachers and students	100,000	
Health	11 hospitals experienced damages; 28 health	37,000	Does not include

	centers were totally destroyed while 20 others were heavily damaged Several pharmacies have also been destroyed		contributions from bilaterals, intl org and NGOs
Infrastructure	Includes water supply, wastewater treatment, public buildings (except schools, roads and medical facilities)	70,000	Assumes 50% of infrastructure destroyed or heavily damaged
Environment	Effects of sewerage, dumping of rubble, chemicals	No figures available	
Roads, bridges and highways	Includes motorways, main highways and municipal roads No damage to forest roads	78,000	
Railways + wagon factory	Heavy losses on 60 km of track Wagon factory destroyed (also responsible for maintenance)	72,000	In Adapazari
Ports	Derince port facilities partially destroyed (2 cranes and 2 wharves)	12,000	
Telecomms	Buildings, national and regional infrastructure	38,400	Based on Turkish Telecomm figures
Electricity	Power generation, transmission and distribution	82,000	
Oil and Gas	Includes Tupras refinery, environmental damage, national and municipal gas distribution systems	387,000	

B. Assessment by Sector

110. **Housing.** Information concerning the state of the housing stock following the earthquake is being updated continuously. As more becomes available through the regional and local governments, the General Directorate of Disasters (GDDA) and the Ministry of Public Works. The estimate of housing reconstruction needs is based on the September 9 figure on housing damage provided by the General Directorate of Disaster (see Table 6). Over time, and based on the experience of the Adana earthquake, we anticipate that the damage assessment figures will continue to be revised downwards.

111. **Municipal Infrastructure.** The preliminary estimate of \$70m in damaged municipal infrastructure is based on an assumption of 50 percent destruction of public buildings (roads, schools and hospitals are estimated separately), water supply, sewerage, gas, and power distribution in Adapazari, Izmit and Yalova provinces. Relocation of entire cities or parts thereof would add very significantly to the cost of municipal infrastructure.

112. **Health Sector.** While the overall physical damage to hospitals and health centers was modest compared with the overall destruction of the earthquake, the impact on health services is significant. A limited number of health structures in the areas were actually destroyed, others have been damaged to varying degrees. Non-emergency care has been temporarily suspended in various facilities. The immediate health need following the earthquake was for emergency treatment of those suffering a range of injuries, particularly fractures and crush injuries. Many of the health facilities affected by the earthquake were not equipped to handle either the numbers or the case management complexity of many of the injured. The most seriously injured cases were evacuated to hospitals in Istanbul, which was much less affected, and Ankara. The initial response phase has now largely passed although an aftershock on September 1 resulted in a spate

of leg fractures caused through people jumping from buildings. Overall, the patient loads at hospital to which people were referred after the earthquake are now diminishing although there is still a core of the most seriously injured. Their care and rehabilitation--especially those who had limbs amputated--will clearly take some time. The Ministry of Health (MOH) reports that overall 100 temporary health centers were established immediately after the earthquake to provide first aid and other urgent curative needs. Substantial number of health personnel arrived in the region from abroad. Some are now preparing to leave since daily patient visits to the foreign managed health services facilities are dropping. The Ministry of Health has mobilized 2,600 health staff in various categories to serve the emergency area, many on a rotating basis. Once the external assistance leaves, an added burden will likely remain for the Turkish health staff, especially while people are living in tents.

113. The population is experiencing psychological trauma from the earthquake and subsequent after shocks which continue to impact several areas. In all places visited, the health personnel and people themselves reported a number of people suffering from post-traumatic symptoms. Health personnel and patients in several locations were afraid to enter health facilities and in several cases health services were operating from tents.

114. Of the nine provinces involved, five sustained substantial damage to hospitals and health centers. Of the 47 public and private hospitals, 12 (26 percent) were damaged with the degree of damages ranging from minor to major. All have had to change the role and scope of service delivery due to changes in health care needs driven by the disaster and facility limitations caused by damage or restricted access to the site. These hospitals account for 45 percent of the available beds, provide approximately 50 percent of all inpatient and outpatient services, 50 percent of all deliveries, including 3 of the 4 blood transfusion centers, provide 62 percent of haemodialysis services and account for some 45 percent of all patient bed days (1997 data). Combined with the initial increase in patient acuity from trauma, the subsequent medical support to people living in temporary accommodation, the longer term rehabilitation of traumatic injury and the ongoing psycho-social dimensions of the disaster, the effect on health services has been major. This will be further compounded by the upheaval created by temporary patient and hospital accommodation, site demolition and construction. Staff are also enduring the same tragedy as their patients including death of relatives, friends and colleagues. (Fifty five health staff - 3 percent of total health personnel in the area - died as a result of the earthquake). High acuity patients have been transferred for treatment at major sites in Ankara and Istanbul and extra emergency and primary health care teams have been established in areas of high need.

115. Prior to the earthquake there were 523 private pharmacies in the area. Out of this number, no information is available on 313 pharmacies, 38 have been destroyed and 124 damaged, leaving 129 pharmacies seemingly intact. In damaged hospitals, pharmacy tents have been placed in hospital gardens. Both functioning private pharmacies and hospital pharmacies are currently open 24 hours a day and patients are allowed to obtain their prescription medicines for free. The pharmacies appear to be well stocked and have enough capacity to serve the population, the majority of which has access to the

dispensing points. According to the Ministry of Health and other sources, there is no immediate shortage of drugs since MOH has transferred drugs to the region from four warehouses located at Istanbul, Ankara, Izmir and Bursa. The demand for pharmaceuticals in the affected provinces has now generally returned to pre-disaster levels. MOH estimates the total value of the pharmaceuticals currently in warehouses at US\$1.5 million, excluding the donated medicines.

116. **Education.** The earthquake destroyed or damaged many primary and secondary schools in five provinces and fifteen subprovinces of Western Turkey. A total of 22 basic education schools (grades 1 through 8) and 21 secondary schools (grades 9 through 12) were destroyed or irreparably damaged and too dangerous to restore to use. Another 267 basic education schools and 114 secondary schools were damaged and require rehabilitation.

117. All of the earthquake-damaged schools were intensively used prior to the disaster. All but five basic education schools were used on a double-shift basis, and class sizes in general were large. Unless there is a very large number of departures from the earthquake region, the destroyed and irreparably damaged schools need to be replaced with new seismically safe schools, and the other damaged schools need to be repaired. Teams of engineers, architects, and Ministry of Education provincial authorities assessed the damages in each basic education school and secondary school in each of the earthquake area. The estimated cost of building replacements for destroyed and irreparably damaged schools is US\$28.0 million. The estimated cost of repairing damaged but functional schools is US\$11.4 million – a total of US\$39.4 million. An estimated 90 percent of the cost of this activity is for civil works and 10 percent for furniture and equipment for newly constructed and rehabilitated schools.

118. A total of 547,000 students were enrolled in the destroyed and damaged schools, and about 21,000 teachers taught in those schools. There were about 25,000 students and 590 teachers in the destroyed and irreparably damaged basic education schools, and about 11,000 students and 550 teachers in the destroyed and irreparably damaged secondary schools. The Ministry is in the process of reassigning these 37,000 students and teachers from destroyed and irreparably damaged schools to other schools in the vicinity. The reconstruction of destroyed and irreparably damaged schools is expected to take at least one complete school year. During this period, the Ministry plans to bus the majority of the temporarily reassigned students to their temporary schools. There are also likely to be conditions of severe crowding in the schools which receive the students from the earthquake area – either through reassignment to other schools or through spontaneous relocation – thus requiring additional teachers and other resources. Relocation of families from the earthquake area could also necessitate the reopening of rural schools which had recently been closed due to dwindling enrollments.

119. The Ministry estimates that about 114,000 school-aged children are homeless as a result of the earthquake. Some of these will have left the earthquake zone together with their families to stay with relatives elsewhere in Turkey. In other cases, some children will need assistance for the coming school year because their fathers have lost their jobs,

or because of other serious disruptions in their household situation resulting from the earthquake. The Ministry plans to provide support for approximately 100,000 children expected to remain in the area, including textbooks and other educational materials, school uniforms and basic clothing, and nutritional supplements to about 100,000 preschool students, basic education students, and secondary school students. About 1,500 teachers are homeless as a result of the earthquake. The few teachers without spouse and children will be temporarily housed in existing hotels for teachers (*öğretmen evi*) or in-service training centers with boarding facilities. But teachers with children and spouse will be temporarily housed in other premises such as vacant primary schools in the vicinity of the schools where they will be teaching.

120. **Environmental Damage.** Environmental impacts associated with the Marmara earthquake include impacts of broken sewerage systems, spillage of oil from the Tupras refinery (dealt with under Oil and Gas), and pollution of surface waters including the Marmara Sea. No detailed information has been provided about the status of the *sewerage systems* in affected cities yet. However, it must be anticipated that the systems have been fractured in many locations and therefore could pose a serious risk for pollution of ground and surface water, including drinking water supplies. Since the piping for sewerage and potable water are normally located in the same trench, contamination of potable water can happen easily.

121. In Adapazari, the *municipal waste water* is currently diverted into the River Sakarya, while the water supply is provided from Lake Sapanca. The water supply is out by nearly 90 percent, and the risk for contamination of the potable water through contamination between the two piping systems cannot be excluded, though there are no reports of incidents so far. In Yalova, in contrast, coverage is estimated at 85 percent, so the damage to infrastructure is clearly not nearly as severe. The *discharge of untreated waste water* creates a large load of organic substances in the receiving water bodies, which for Kocaeli and Yalova is the Marmara Sea, and for Sakarya is the Black Sea. The pollution will cause a temporary decrease in the oxygen content in the water and affect the aquatic life severely.

122. During the first days after the earthquake, *debris and rubble* were disposed of directly into the available surface waters: River Sakarya for Adapazari, and Marmara Sea for Izmit, Golcuk and Yalova. The rubble is mainly from collapsed and damaged apartment buildings and is basically construction material mixed with personal belongings such as cloths, furniture, household equipment, white wares, and food. In addition, the rubble contains products and inventories from small shops located in the damaged buildings. Hence it will also contain small amounts of chemicals, paints, solvents. However, this should not create any significant additional damage to the water bodies. From an environmental perspective the disposal from damaged small and medium scale industries is of greater concern as they might be using significant amounts of chemicals which could also be hazardous for the teams and contractors engaged in the clean-up activities. The Government plans to identify hazardous wastes and dispose of them properly during the demolition process. The *leakage of chemicals* at the Aksa plant

was stopped within a couple of days. The soil around the tanks must be considered as polluted and will require special treatment.

123. **Transportation: Roads, Railways and Ports.** The earthquake caused damage to large parts of the *streets* in the heavily hit communities, especially in Adapazari, damage which will be further increased as large earthmoving equipment is brought in to clear the debris. It also caused substantial damage to many structures of the *Istanbul - Ankara motorway* on a section of some 49 km and damage to some of the structures on 410 km of the state *and provincial highway/road network* at limited locations. Little or no damage is expected to have been caused to the forest roads in the region. The Ministry of Forestry is, however, assessing the situation on site and has so far reported that more than 90 percent of the roads are intact.

124. Substantial damage was found to the *railway track and installations* on one 61 km and one 29 km long section of the double track railway between the Istanbul region and Adapazari and on a section of the southbound double track from Beskopru train stop towards Bilecik.

125. The TCCD affiliated Tuvasas *train wagon manufacturing/repair facility* in Adapazari sustained severe damages to structures and equipment and will be unable to operate for a substantial length of time. The annual manufacturing capacity of Tuvasas wagon factory was reported to have been some 100 - 200 new wagons, but only part of the capacity has been used lately by TCCD due to budget constraints. The wagon factory provides employment for some 1,200 workers and 200 office employees. A large part of the components used at the factory were also being subcontracted and supplied by local private workshops. The TCCD operated *port facility* in Derince, which handles some 2 million tons of cargo annually, suffered heavy damage to docks, cranes and warehouses, including cracks and severe subsidence. Neither the Derince port facilities, the Tuvasas factory facilities nor any of the products on the production line were insured.

Table 14: Costs for Damage to Transportation Infrastructure

(US\$ 000)	Estimated Cost	Notes
Motorway	32,000	Surface, bridges, toll booths
State Highways	16,000	Surface and bridges
Municipal roads	30,000	Estimate
Railway	14,000	Track and installations
Rail factory and repair facility	58,000	Includes loss of almost completed rolling stock and building
Port (Derince only)	12,000	Piers, equipment etc
Total	162,000	

126. **Telecommunications.** The failure of the telecommunications infrastructure was a major factor in the massive problems in rescue and recovery in the early days after the earthquake. It suffered major damage that might have not caused the loss of the entire systems if prompt actions could have been taken. However, with the severe overloads following the news of the quake, the system collapsed. The *national telecommunications*

system suffered one critical failure: the main fiber optic link between Istanbul and Ankara was cut where it crossed the fault just east of Izmit. This 155-MHz SONET connection carries the bulk of the traffic between these two cities and provides one of Turkey's gateways to the rest of the world. The link was repaired within 24 hours.

127. The *regional telecommunications systems* experienced considerable damage. A large portion of this was due to the destruction and damage to facilities and the resulting damage to equipment contained within. For instance, many batteries, which assure back up power supply, were broken and need to be replaced. Some trunk connections within the region were also damaged due to earth movement or falling structures. The local loops (connections between the switch and the user) were damaged to a greater extent by earth movement or falling buildings. It is expected that the removal of rubble and the general reconstruction will further damage or destroy these connections. It is highly likely that a large portion of the cabling in the region will have to be replaced. The destroyed buildings will have to be replaced and damaged buildings repaired or replaced. There are a number of older switches (Cross Bar) in the area which were thrown off their foundations. They will probably have suffered some damage. They are beyond their useful life and should be replaced with newer digital switches. This also lightens the load placed on the buildings and may help in building repair.

128. Turkish Telecomm has carried out a preliminary damage assessment, which has been provided to the Bank, but this information has not yet been verified. Turkish Telecom's estimate of damages is summarized as follows.

Table 15: Estimates for Costs of Damages to Telecommunications Sector (from Turkish Telecom)

(US\$ 000)		
Location	Estimated Costs	
Station	3,688	
Transmission	962	
Network	22,000	
Cable TV System	4,800	
Office Equipment	910	
Buildings	2,321	
Sub-Total: 34,881		
Stations that are damaged or may be found to be damaged as of August 28, 1999 are:		
Center	Station Area	Estimated Cost of Damages
Adapazari- Merkez	14,000	1,680
Bolu- Golyaka	3,000	27
Bolu-Hacisuleymanli	600	54
Izmit	1,000	90
Duzce	12,000	1,440
Sub Total		: 3,534
TOTAL		: 38,415

129. **Electric Power Sector.** Before the earthquake the region accounted for about one quarter of electricity demand in Turkey and daily consumption was reduced by about 8 percent of the total consumption in the country before the earthquake. The main power generation facilities in the region were not damaged. The main damage occurred in the power transmission and distribution facilities. Repair of the power transmission facilities is largely completed and will be finished by mid September, but in power distribution facilities will take longer and will depend on the overall progress of reconstruction of the region.

130. The electric *power supply system* in the area affected by the earthquake consists of the following facilities:

- Electric power generation plants owned by TEAS²⁴, independent power plants (IPPs) and industrial power plants;
- High voltage (HV) electric power transmission system owned by TEAS; and
- Medium voltage (MV) and low voltage (LV) electric power distribution facilities owned by TEDAS and affiliated distribution companies.

131. Electric *power generation system* in the area affected by the earthquake is spread over six provinces (Sakarya, Kocaeli, Bolu, Bursa, Eskisehir and Istanbul). The system consists of: (i) four thermal power plants with the total installed capacity of 3623 MW owned by TEAS, (ii) five hydropower plants with the total installed capacity of 280 MW owned by TEAS, (iii) three IPPs with the total installed capacity of 452 MW, and (iv) 39 industrial power plants with the total installed capacity of 965 MW

132. No damage was reported in power plants owned by TEAS and IPPs. It appears that the available capacity of these plants was not affected by the earthquake. The condition of power plants owned by industrial producers is not known as of August 30, 1999, but it is most likely that these generating plants suffered a similar degree of damage as the corresponding industrial facilities. The power transmission facilities affected by the earthquake are located in eight provinces (Sakarya, Kocaeli, Bolu, Yalova, Bursa, Eskisehir, Bilecik and Istanbul).

133. The other damages which occurred in *transmission substations* include breakage of transformer bushings, breakage of surge arresters, damage of disconnectors, movement of transformers and damages to substation buildings. Most of these damages are under repair or have been isolated so do not pose a serious treat to the substation operation.

134. The *power transmission network* in the area affected by the earthquake comprises 1766 km of 380 kV lines and 2015 km of 154 kV lines. No damage has been reported to the transmission lines which span over 2361 towers at 380 kV level and 3362 towers at 154 kV level. A detailed analysis of tower structures planned by TEAS should provide more information about possible weak spots caused by the earthquake.

²⁴ TEAS and TEDAS are stated owned companies, which were established after the split of Turkish Electric Power Company (TEK) in 1994.

135. The distribution of electricity in the earthquake area is conducted by five power distribution companies: SEDAS (Sakarya Elektrik Dagitim A.S. covers Sakarya and Bolu provinces), KEDAS (Korfez Elektrik Dagitim A.S. covers Kocaeli province), YEDM (Yalova Elektrik Dagitim Muessesesi), BEDAS (Bogazici Elektrik Dagitim A.S. covers European part of Istanbul province) and AKTAS (private distribution company which serves Anatolian part of Istanbul province). Distribution companies in other provinces affected by the earthquake (Bursa, Eskisehir, Zonguldak and Tekirdag), as well as AKTAS, did not report significant damages to the power distribution facilities.

136. A preliminary assessment of damage caused by the earthquake to the power distribution facilities in SEDAS, KEDAS, YEDM and BEDAS is shown below:

Table 16: Summary of Damages of Power Distribution Facilities

Type of Equipment	Status of Power Distribution Facilities				Equipment
	Total Before	Destroyed	Degree of Damage		Replaced
	Earthquake	Earthquake	Large	Small	as of 8/30/1999
1. Distribution Transformers					
Urban Areas					
Number of MV/MV Trafos	212	3	11	9	13
Installed Capacity MVA	2962	25	105	20	34
Number of MV/LV Trafos	11681	444	375	821	257
Installed Capacity MVA	9379	120	219	2170	142
Rural Areas MV/LV					
Number of Trafos	4979	145	77	177	61
Installed Capacity MVA	851	23	13	22	26
2. MV Distribution Lines					
Length of Underground Cables (km)	2901	122	715	179	0
Overhead Lines					
Length (km)	14779	490	220	82	0
Number of Towers	137643	3435	600	1650	1050
3. LV Distribution Lines					
Length of Underground Cables (km)	6003	430	875	1766	0
Overhead Lines					
Length (km)	141686	1075	490	2660	80
Number of Towers	524532	7949	250	18150	3000
4. Trucks					
	364	7	6	58	0

137. The heaviest damage occurred in the *low voltage (LV) distribution network* which supplies individual consumers at 0.4 kV level. About 600 medium voltage to low voltage (MV/LV) distribution transformers were destroyed and about 450 MV/LV transformers sustained large damages which can not be repaired at the site. Also, about 1000 MV/LV distribution transformers suffered smaller damages that can be repaired at the site.

138. The first priority in repairing distribution facilities in the earthquake area is the restoration of electricity supply to the household consumers and construction of temporary distribution network in "tent villages" which shelter most of the population that lost their homes. The industrial consumption in the hard hit areas, such as Izmit and Adapazari, remains very low²⁵ due to several factors including the loss of lives of workers and damages to the production facilities.

139. A preliminary *estimate of cost in the electric power sector* due to the earthquake is given in the table below. The cost consists of two main components: (i) cost of damaged power facilities which have to be replaced or repaired in a short term to provide normal electricity supply to the areas affected by the earthquake, and (ii) cost of adjustments of regional power facilities to meet new standards of power supply in the longer term.

²⁵ The daily peak load in Izmit is currently about one third of the peak load before the earthquake.

Table 17: Cost Estimates for Power Sector

Item	Cost of Emergency Program (US\$ million)	Cost of Longer-Term Adjustments (US\$ million)	Total Cost (US\$ million)
Power Generation	0.0	0.0	0.0
Power Transmission	1.5	10.5	12.0
Power Distribution	21.0	49.0	70.0
TOTAL	22.5	59.5	82.0

Fiscal impact estimate (Table 5, Part 1) includes US\$25.5 of longer-term costs falling in 2000

140. The estimated cost of damages (about US\$22.5 million) is based on the assessment of physical damages to the power facilities in the region. The estimated cost of longer term adjustments (about US\$59.5 million) is subject to change depending on the policy decisions by the Government on the reconstruction of the region and findings of technical and economic studies which are required to determine new standards and policies in the power supply sector.

141. **Oil and Gas.** *Tupras* refinery is, with 10.5 MTA production, the largest refinery in Turkey. It was initially constructed in the 1960's and upgraded in the 70's and again in the 80's with hydro-cracking. The refinery was working at about 90 percent of its design capacity and can be considered a modern and efficient plant. The earthquake caused significant structural damages to the refinery itself and associated tank-farm with crude oil and product jetties. The consequent fire in the refinery and tank-farm caused extensive additional damage.

142. Several large diameter crude oil and product storage tanks have substantial structural damage, seven nafta tanks have burned down completely and surrounding tanks have been damaged by excessive radiated heat. The 150 meter high chimney collapsed during the quake and fell partly on the heaters and also on to the new refinery unit, causing a fire which destroyed most of the process unit for the most recently constructed part of the refinery.

143. It is difficult to give a good estimate of total damage, but it appears that the cost of complete re-construction will exceed US\$350 million. The refinery will be completely out of operation for about 3 months. After that the refinery could operate at about 50 percent of its capacity, using hydro-skimming only. The repairs repaired to bring the refinery back to 100 percent of its previous capacity will take at least 12 to 15 months.

144. The refinery is insured to cover the cost of the damage. However, the existing safety system, especially fire fighting systems were substandard and will require substantial upgrading. The required investments for the needed safety upgrades are estimated to about US\$20 to 25 million. In addition it can be expected that the cost of insurance to cover future natural disasters for this plant will most likely double if not triple.

145. *Environmental Pollution.* Due to the fire in the refinery and tank-farm it is estimated that about 1000 tons of oily liquids were discharged into the Sea of Marmara.

A specialized oil spill response team from Great Britain recovered approximately 700 tons of oily liquids from the surface of the Sea of Marmara. The rest of the pollutants have sunk to the sea bed or been washed onto the shore. The contamination of the shoreline is light to moderate; about 30 to 40 km of shoreline are affected. The cost of the cleanup for the shoreline is estimated to cost about 3 to 5 million US\$ and will take 6 to 9 months, depending on the number of teams which can be deployed in parallel for clean-up operation.

146. *Botas Petroleum Pipeline Corporation*, a State Owned Enterprise (SOE), covering all oil and gas imports, *transit and regional distribution* in Turkey, reported no damage on any of their installations. The main high pressure gas transmission pipeline from Russia via Ukraine, Bulgaria and Romania, which crosses the major North Anatolian Fault south of Izmit, was apparently not affected by the earthquake. However, it should be noted that the gas line has an off-shore crossing through the Sea of Marmara about 30 km west of Izmit. A smaller fault is running through the Sea of Marmara and has caused significant changes to the original sea-bed topography. Reports from a Turkish research vessel indicate that on some areas the sea-bed has been lowered over 25 meters. Changes in the sea-bed level, where the off-shore pipe is laid, could lead to excessive mechanical stress in the pipeline and compromise the integrity of the line. Botas will launch an investigation to check the condition of the off-shore pipeline in the next couple of weeks. An investigation will most likely be an external visual inspection using divers with cameras followed by an internal inspection using intelligent tools. The cost for a thorough inspection is estimated to be between 0.5 and 1.0 million US\$. Botas has insurance to cover the cost of damages if any are found.

147. Pipeline connections to large consumers of *natural gas* in the affected area, such as power plants, were not affected by the earthquake. However, most of Botas installations are in earthquake zones. The extensive damage in Tüpras refinery due to the earthquake and subsequent fire, indicated that the existing safety measures and emergency response planning may be inadequate to cover the potential worst case scenarios.

148. Botas installations are of key importance for the energy sector and a review of the existing safety measures and emergency response planning to incorporate the lessons learnt from disaster in the Tüpras refinery is considered necessary. The estimated cost for risk assessment studies and subsequent revised emergency response plans, for the individual installations, will be about US\$500,000 to and take about 6 to 9 months.

149. Of all affected cities, only Izmit had a *municipal gas distribution system* which is operated by Izgaz. The gas distribution system is fairly new, constructed between 1995 to 1997. Izgaz serves about 26,000 customers (households and SME's) and two large industries (Mannesmann pipe manufacturer and a fertilizer plant). Shortly after the earthquake, Botas shut down the two city gate valves for safety reasons. Izgaz closed all isolation valves in their gas distribution system, vented most of the house connections, but kept the main distribution system under pressure to determine if and where damage to pipe network occurred. After preliminary inspection no damage of the main distribution network was found. Izgaz has about 21,000 service boxes (pressure regulator, metering

unit and other instrumentation). The services boxes are mostly installed on the outside of the houses and about 15 percent of all boxes were damaged due to collapsing houses. On August 27th Botas re-opened the city gate valve for Izgaz to allow re-pressuring of the vented areas and partial supply of gas where the system has been completely checked. The cost of one service box is roughly US\$1,000, the total cost for replacement of all the damaged service boxes is about US\$3 MM, the repair to the damaged house connections is estimated to be about US\$2 MM. The repair schedule of the damaged parts is dependent on the re-construction of the damaged housing which were connected to the gas distribution system. Izgaz has insurance to cover the cost of the damages. Below are estimated costs of damage to the oil and gas sector resulting from the earthquake:

Table 18: Cost estimates for the Damage to the Oil and Gas Sector

	Insured Damage *	Uninsured Damage **	Follow-on Cost ***	Total
1. Tüpras Refinery	> \$350m		\$20m to \$25m	> \$375m
2 Pollution		\$5m		\$5m
3. Oil & Gas Pipelines/Terminals			\$2m	\$2m
4 Municipal Distribution	\$5m			\$5m
Total	> \$355m	up to \$5m	up to \$27m	> \$387m

* Assuming the insurance will cover the cost of all damage to the respective industrial plant or system.

** Clean-up cost for environmental damage will most likely not be covered by the insurance

*** Follow-on cost is meant for studies to improve safety standards and carry out risk assessment studies. These costs are investments that the individual operators have to finance on their own

Table 1: Assumptions Used in Estimates of GNP, 1999-2000

	Kocaeli	Sakarya	Bolu	Yalova	Total Affected Region
Share of GDP (%)	4.8	1.1	0.9	0.4	7.2
Assumption on disruptions to industry and services component of GDP in most severely affected regions					
1999 Q3	50%	50%	50%	50%	4%
1999 Q4	30%	30%	30%	30%	2%
2000 Q1	15%	15%	15%	15%	1%
2000 Q2	8%	8%	8%	8%	1%
The above disruptions are, however, expected to be partially (1/3) offset by increased economic activity in other areas. Expected disruption after adjustment thus are:					
1999 Q3	33%	33%	33%	33%	2%
1999 Q4	20%	20%	20%	20%	1%
2000 Q1	15%	15%	15%	15%	1%
2000 Q2	8%	8%	8%	8%	1%

Source: SIS, Staff Estimate

Table 2: Seasonally Adjusted Growth Rates (Baseline)

	Agriculture	Industry	Services	GDP	Factor Income	GNP	GNP Index 1999=100
1992Q1	2.7	2.4	3.8	3.2	(26.4)	3.0	104.6
Q2	6.7	(2.2)	(0.6)	0.1	62.3	0.4	105.1
Q4	4.8	3.8	3.0	3.5	(213.2)	2.4	109.5
1995Q1	2.7	5.3	0.9	2.3	(306.3)	4.1	113.9
Q2	(4.0)	5.1	2.6	2.2	1.0	2.2	116.5
Q3	0.0	2.4	2.1	1.9	10.8	2.0	118.8
Q4	(1.2)	(0.5)	0.5	(0.1)	(0.4)	(0.1)	118.7
1996Q1	4.2	1.7	3.9	3.3	50.2	3.8	123.3
Q2	1.6	3.1	1.8	2.1	(30.3)	1.6	125.2
Q3	(2.1)	0.9	0.8	0.4	(10.1)	0.3	125.5
Q4	8.3	2.0	(0.2)	1.6	(0.8)	1.6	127.5
1997Q1	(12.4)	3.2	3.9	1.3	44.9	1.7	129.7
Q2	6.2	3.9	4.0	4.3	24.4	4.6	135.6
Q3	0.4	1.6	0.3	0.7	28.8	1.2	137.2
Q4	(4.6)	1.2	2.2	1.0	9.5	1.2	138.9
1998Q1	0.1	2.1	2.1	1.8	(20.1)	1.3	140.7
Q2	8.4	(2.1)	(2.0)	(0.8)	67.8	0.5	141.4
Q3	3.0	0.7	(1.5)	(0.2)	(28.6)	(1.1)	139.9
Q4	3.9	(5.8)	(0.8)	(1.6)	148.0	1.8	142.4
1999Q1	(13.0)	(2.3)	(4.8)	(5.3)	(66.6)	(8.7)	129.9
Q2	(1.1)	9.0	4.5	5.1	(17.2)	5.0	136.4
Q3	14.3	4.0	4.0	5.3	12.0	5.0	143.3
Q4	1.1	1.5	1.5	1.4	12.0	1.6	145.6
2000Q1	0.2	0.1	0.1	0.1	0.5	0.1	145.8
Q2	0.2	0.1	0.1	0.1	0.5	0.1	146.0
Q3	0.2	0.1	0.1	0.1	0.5	0.1	146.2
Q4	0.2	0.1	0.1	0.1	0.5	0.1	146.4
Implied non-seasonally adjusted growth rates							
1997	(2.3)	10.4	8.6	7.5	68.1	8.3	
1998	7.6	1.8	2.1	2.8	53.4	3.8	
1999	(0.1)	2.3	(0.6)	0.3	(38.7)	(0.8)	
2000	4.4	5.3	4.2	4.6	11.8	4.7	

Source: SIS, Staff Estimates

Table 3: Seasonally Adjusted Growth Rates (After Earthquake)

	Agriculture	Industry	Services	GDP	Factor Income	GNP	GNP Index 1999=100
1992Q1	2.7	2.4	3.8	3.2	(26.4)	3.0	104.6
Q2	6.7	(2.2)	(0.6)	0.1	62.3	0.4	105.1
Q4	4.8	3.8	3.0	3.5	(213.2)	2.4	109.5
1995Q1	2.7	5.3	0.9	2.3	(306.3)	4.1	113.9
Q2	(4.0)	5.1	2.6	2.2	1.0	2.2	116.5
Q3	0.0	2.4	2.1	1.9	10.8	2.0	118.8
Q4	(1.2)	(0.5)	0.5	(0.1)	(0.4)	(0.1)	118.7
1996Q1	4.2	1.7	3.9	3.3	50.2	3.8	123.3
Q2	1.6	3.1	1.8	2.1	(30.3)	1.6	125.2
Q3	(2.1)	0.9	0.8	0.4	(10.1)	0.3	125.5
Q4	8.3	2.0	(0.2)	1.6	(0.8)	1.6	127.5
1997Q1	(12.4)	3.2	3.9	1.3	44.9	1.7	129.7
Q2	6.2	3.9	4.0	4.3	24.4	4.6	135.6
Q3	0.4	1.6	0.3	0.7	28.8	1.2	137.2
Q4	(4.6)	1.2	2.2	1.0	9.5	1.2	138.9
1998Q1	0.1	2.1	2.1	1.8	(20.1)	1.3	140.7
Q2	8.4	(2.1)	(2.0)	(0.8)	67.8	0.5	141.4
Q3	3.0	0.7	(1.5)	(0.2)	(28.6)	(1.1)	139.9
Q4	3.9	(5.8)	(0.8)	(1.6)	148.0	1.8	142.4
1999Q1	(13.0)	(2.3)	(4.8)	(5.3)	(66.6)	(8.7)	129.9
Q2	(1.1)	9.0	4.5	5.1	(17.2)	4.6	135.9
Q3	14.3	4.0	4.0	5.3	12.0	5.4	143.3
Q4	1.2	1.5	1.5	1.7	12.0	1.9	146.0
2000Q1	0.2	0.1	0.1	0.4	0.5	0.4	146.6
Q2	0.2	0.1	0.1	0.4	0.5	0.4	147.2
Q3	0.2	0.1	0.1	0.2	0.5	0.2	147.5
Q4	0.2	0.1	0.1	(0.4)	0.5	(0.4)	146.9
Implied Non-Seasonally Adjusted Growth Rates, After Quake							
1997	(2.3)	10.4	8.6	7.5	68.1	8.3	
1998	7.6	1.8	2.1	2.8	53.4	3.8	
1999	(0.1)	1.3	(1.6)	(0.5)	(38.7)	(1.6)	
2000	4.5	5.9	4.8	5.7	11.8	5.8	
Implied Non-Seasonally Adjusted Growth Rates, Baseline							
1997	(2.3)	10.4	8.6	7.5	68.1	8.3	
1998	7.6	1.8	2.1	2.8	53.4	3.8	
1999	(0.1)	2.3	(0.6)	0.3	(38.7)	(0.8)	
2000	4.4	5.3	4.2	4.6	11.8	4.7	

Source: SIS, Staff Estimate

Table 4: Emergency Revenue Bill in Parliament

	1999	2000	1999	2000
	(TL trillion)		(US\$ million)	
Personal Income Tax (Withholding) 1/	75.0	37.5	158.6	66.8
Corporate Income Tax 1/	100.0	50.0	211.4	89.1
Supplementary Motor Vehicle Tax	90.0	0.0	190.3	0.0
Stamp Tax on Check Transactions	1.4	2.7	3.0	4.8
Cellular Telephone Use Surcharge	63.4	172.6	134.0	307.5
Property Tax	7.5	7.5	15.9	13.4
"Article 13" 2/	--	--	--	--
TOTAL	337.3	270.3	713.1	481.7

1/ 50% of 1998 tax base will be paid in three equal installments, two in 1999 and third in Jan. 2000.

2/ Article 13 pertains to stock exchange activities, 'Competition Board' activities. Uncertain at this stage whether this will be assessed and what impact it will have.

Source: SPO, MoF, Staff Estimate

Table 5 : Losses from Reduced Tourism Revenues

	1999 (US\$ million)
Forecast Tourism Revenues in 1999 1/	5,000.0
Share from Istanbul and Marmara Region 2/	20%
Estimated Regional Revenues for Aug-Dec, 1999	580.0
Assumed Decline due to Earthquake	35%
Loss in Value Added Due to Earthquake	203.0
Share of VA loss from Istanbul	162.4
Tax Loss (marginal rate = 20%)	32.5

1/ Forecast from the IMF, major drop from 1998 levels due primarily to elevated civil disturbances unrelated to the Earthquake.

2/ Share of tourism in Istanbul and Marmara region based on tourist arrivals into Istanbul Airport, 1998

Source: Staff Estimate

Table 6: Estimated Tax Losses from 1999 Government Tax Deferral

(TL Billion)	Central		Municipal Tax Share	Total	Total loss in 1999 Tax Collections		Tax Losses Due Slower Growth		Imputed Cost of Deferral	Loss due Irrecoverable Damage		Total Imputed Tax Loss
	Government Tax Share	Share			1999 Tax Collections	Due Slower Growth	Cost of Deferral	Loss due Irrecoverable Damage				
Projected tax yield Aug-Dec. (w/o quake)												
Personal income tax (withholding)	58,687.0	10,356.5	69,043.5	69,043.5	69,043.5	22,093.9	5,720.6	23,474.8	27,814.6			
Personal income tax (declaration)	5,870.0	1,035.9	6,905.9	6,905.9	6,905.9	2,209.9	572.2	2,348.0	4,557.9			
Corporate income tax	6,267.0	1,105.9	7,372.9	7,372.9	7,372.9	2,359.3	610.9	2,506.8	2,970.2			
Advance CIT tax	20,117.0	3,550.1	23,667.1	23,667.1	23,667.1	7,573.5	1,960.9	8,046.8	9,534.4			
VAT (dom)	47,686.0	8,415.2	56,101.2	56,101.2	56,101.2	17,952.4	4,648.3	19,074.4	22,600.7			
Customs	15,187.0	2,680.1	17,867.1	17,867.1	17,867.1	2,858.7	348.3	1,429.4	3,207.1			
VAT on imports (KDV)	82,854.0	14,621.3	97,475.3	97,475.3	97,475.3	15,596.0	1,900.3	7,798.0	17,496.4			
Other (excludes BOLLU 2-5 ilçe)	48,995.0	8,646.2	57,641.2	57,641.2	57,641.2	18,445.2	4,775.9	19,598.0	23,221.1			
Indirect Tax Loss from Tourism industry 1/	12,649.9	2,710.7	15,360.6	15,360.6	15,360.6	15,360.6	0.0	0.0	15,360.6			
TOTAL	298,313	53,122	351,435	351,435	273,002	104,450	20,537	126,414.3	124,987.0			

1/ Tourism industry losses are unrelated to the tax deferral program.

Assumptions

- 1- Tax deferral assumed for 9 months, with no amnesty granted
- 2- Loss on collections assumed to correspond to output loss, seasonally adjusted.
i.e. loss of Sept output (1/9 annual output) and 20% Q4 output (24% of annual total).
- 3- Loss in 1999 corresponds to full tax deferral, and collections are all accounted for in 2000
- 4- Advanced CIT tax and declared income tax excludes August due to collection prior to quake
- 5- Petroleum consumption tax excluded; collection through others assumed to fully offset losses
- 6- VAT on imports and customs duty is assumed proportional to GDP loss.
- 7- Lost municipal taxes assumed fully compensated by government transfers.
- 8- One-quarter of deferred taxes assumed irretrievable due provisions (eg. capital losses over 1/3 qualifies for total write-off)
- 9- Tourism industry losses due to cancellations through Istanbul gateway, unrelated to regional tax deferral program.

Source: MoF, Staff Estimate

**Table 7: Energy Infrastructure and Distribution Rehabilitation Costs
(Fiscal Impact)**

	Total	1999	2000
	(US\$ million)		
Risk Assessment Studies for Existing Installations	0.7	0.1	0.6
Tupras Refinery Uninsured Damage	--	--	--
Tupras Refinery Follow up Safety Upgrade 1/	25.0	2.5	22.5
Pollution Abatement in Marmara Sea 2/	5.0	1.3	3.8
Oil and Gas Pipeline Repair (Follow on Cost)	2.0		2.0
Municipal Distribution Costs 3/	5.0	1.3	3.8
Total	37.0	5.0	32.0
Total w/o 'Safety Upgrade'	12.7	2.6	10.1

Assumption: 20% of risk assessment completed in 1999

1/ Tupras follow up safety measures excluded from fiscal costs (Table 5, Part I)

2/ Pollution measures uses high assessment, 25% falls in 1999 based on 6 to 9 month time frame.

3/ Municipal distribution costs, 25% occurs in 1999.

Source: MEER Mission

Table 8: Electric Power Supply System Rehabilitation Cost (Fiscal Impact)

	Total	1999	2000
	(US\$ million)		
Power Generation	--	--	--
Power Transmission	12.0	1.5	10.5
Power Distribution	36.0	21.0	15.0
Total	48.0	22.5	25.5

Assumption: The emergency program costs for rehabilitation of transmission and distribution is all undertaken in 1999

Source: MEER Mission

Table 9: School Rehabilitation and Related Supplemental Education Expenditures

	Number of Recipients	Unit Cost (US\$)	Total Cost	1999	2000
			(US\$ million)		
School Reassignment Costs (busing, etc.)	37,000	150.0	5.6	2.2	3.3
School Cost Support to Affected Families (uniforms, textbooks, meals, etc.)	101,500	487.7	49.5	37.1	12.4
School Rehabilitation Costs			39.4	9.9	29.6
Psycho-social Counseling Services			3.0	1.2	1.8
Monitoring, Evaluation and Contingencies			2.6	1.3	1.3
Total			100.0	51.7	48.4

Source: MEER Mission and Staff Estimate

Table 10: Health Sector Rehabilitation Fiscal Cost Estimates

	Number	Unit costs (US\$ 000)	Total	1999	2000
			(US\$ million)		
Rehabilitation of Health Centers					
Urban	18.0	226.4	4.1		
Rural	10.0	153.0	1.5		
Site Preparation, Renovation					
Urban	18.0	22.6	0.4		
Rural	10.0	15.3	0.2		
Renovation	20.0	22.6	0.5		
Prefab	28.0	18.0	0.5		
Sub-Total			7.1	3.6	3.6
Rehabilitation of Hospitals					
Reconstruction/Renovation	10.0	750.0	7.5		
Site Preparation	10.0	75.0	0.8		
Prefab Units	3.0	150.0	0.5		
Sub-Total			8.7		
Total Civil Works			15.8	7.9	7.9
Medical Equipment - Health Centers					
- Hospitals			0.8		
Sub-Total					
			2.0	1.4	1.4
Total			18.6	9.3	9.3

Source: MEER Mission Estimate

Table 11: Temporary Housing Costs

	Number of Units	Population Affected	Unit price 1/ (US\$)	Total Cost	
				1999 (US\$ million)	2000
Estimated Prefabricated Housing Demand	30,000	120,000	8,000.0	240.0	0.0
Relocation to Alternative Housing	20,000	280,000	2,160.0	151.2	101.3
Total	50,000	400,000		391.2	101.3

1/ Unit cost of prefabricated housing and alternative housing (occupied hotels etc.) from the MEER mission

Source: MEER Mission, Staff Estimate

Table 12: Region's Contribution to Turkish Economy

	% Share in GDP (1997)	% Share in Manufacturing Sector Value Added
Kocaeli	4.8	15.3
Sakarya	1.1	0.8
Yalova	0.4	0.8
Bolu	0.9	0.3 1/
Avcilar and Bagcilar		2.5
Total	7.2	19.7

1/ Only Gölyaka and Düzce Districts

Source: SIS

Table 13: The Breakdown of Members of KCI

	Number of Enterprises	% Share
Gebze	587	52.1
Izmit	421	37.4
Korfez	71	6.3
Gölcük	39	3.5
Kandıra	7	0.6
Karamürsel	2	0.2
Total	1,127	100.0

Source: Kocaeli Chamber of Industry

Table 14: Earthquake Insurance Policies in Turkey (As of Dec. 31, 1998)

Zone	Number of Policies	Total Insured (US \$ million)
1	239,893	35,432
2	17,577	6,007
3	26,157	7,014
4	45,031	9,197
5	102,440	10,288
6	23,181	3,817
7	28,994	5,579
8	54,912	8,551
9	15,722	2,260
10	64,228	7,467
11	12,734	1,909
12	20,148	2,149
13	3,156	431
14	9,218	1,202
15	2,479	1,223
Total	665,870	102,524

Source: Treasury Undersecretariat

Table 15: Exposure of Halk Bank to Region

(TL million)	Industrial	Commercial	Fund Based	Cooperative	Total
Bolu	391,080	16,164	178,688	1,385,000	1,970,932
Istanbul (Avcilar)	245,090	1,394,087	196,221	175,000	2,010,399
Kocaeli	661,334	1,598,381	1,093,327	3,745,000	7,098,042
Adapazarı	963,052	348,995	468,202	3,860,600	5,640,850
Yalova	153,258	57,806	7,360	1,639,000	1,857,424
Total	2,413,814	3,415,433	1,943,798	10,804,600	18,577,647

Source: Halk Bank

Table 16: Exposure of Ziraat Bank to Region

(TL million)	Industrial	Commercial	Fund Based	Cooperative	Total
Bolu	3,661,366	5,589,495	888,611	116,794	10,256,266
Istanbul (Avcilar)					
Kocaeli	948,751	2,153,576	1,446,333	148,795	4,697,455
Adapazarı	1,931,327	6,055,077	950,165	26,434	8,963,003
Yalova	2,439,292	311,760	103,474	37,616	2,892,142
Total	8,980,736	14,109,908	3,388,583	329,639	26,808,866

Source: Ziraat Bank

Table 17: Emlak Bank- Deferred Loans Due to Earthquake

	(US \$)
Deferred Commercial Loans	24,360,587
Doubtful Commercial Loans	30,432,115
Deferred Individual Loans	32,793,408
Doubtful Individual Loans	3,000,000
Maritime Industry	60,000,000
Total	150,586,110

Source: Emlak Bank

Table 18: Age Distribution of Population (mid-year 1998)

Age	(000)	
0-4	6,550	
5-9	6,390	
10-14	6,554	
15-19	6,654	
20-24	6,295	
25-29	5,473	
30-34	4,986	
35-39	4,536	
40-44	3,767	
45-49	3,052	
50-54	2,355	
55-59	1,887	
60-64	1,719	
65-69	1,513	
70-74	925	
75 & up	793	
Total	63,451	
	(000)	(%)
Children 0-17	23,487	37
Adults 18-54	33,127	52
Elderly 55 +	6,837	11
Total	63,451	100

Source: SIS

Table 19: Social Assistance: Fiscal Cost Estimates

	Total	1999	2000	Total	1999	2000
	(TL trillion)			(US\$ million)		
One-Time Lump Sum Loss of life and disabilities compensation	14.4	14.4	0.0	30.5	30.5	0.0
Emergency social assistance						
Food assistance 1/	50.0	20.0	30.0	96.4	42.3	54.1
Emergency drugs and health services 2/	5.8	3.3	2.6	11.5	6.9	4.6
Other emergency health costs 2/	3.5	2.0	1.5	6.9	4.1	2.8
SHÇEK field costs	1.3	0.3	1.0	2.4	0.7	1.7
Cost of earthquake child victims care	1.6	0.4	1.2	3.0	0.8	2.2
Subtotal	62.2	25.9	36.3	120.2	54.9	65.3
Total	76.7	40.4	36.3	150.7	85.4	65.3

1/ Estimates from the SPO

2/ Numbers from MEER mission, includes sanitation, drugs, vaccines, prosthetics, and mobile health services

Share assumed to be 60% in 1999 and 40% in 2000.

Table 20: Estimated Social Protection Institution Reconstruction Needs

Type of institution	Construction Needed			Subtotal	Construction Subtotal	Installation	Total Unit Cost	Rounding Total UC	Total Cost
	Number	Size (m ²)	Unit cost (TL million)						
Nursery	3	2000	100	200	449,438	425,000	874,438	900,000	2,700,000
Elderly home	1	2000	100	200	449,438	425,000	874,438	900,000	900,000
Community center	10	1500	60	90	202,247	425,000	627,247	650,000	6,500,000
Training centers	2	1500	60	90	202,247	425,000	627,247	650,000	1,300,000
								Total	11,400,000

Source: SHÇEK, Staff Estimate

Table 21: SHÇEK Field Costs

Staff in Field	100	
Monthly Salary (TL million)	300	
Staff Costs, 1999 (TL million)	120,000	
Staff Costs, 2000 (TL million)	360,000	
Other Field Costs (TL billion)	50	1/
Estimated Other Field Costs 1999	200	
Estimated Other Field Costs 2000	600	
	<u>1999</u>	<u>2000</u>
Estimated Field Costs, total (TL billion)	320	960
o/w staff	120	360
o/w other field costs	200	600

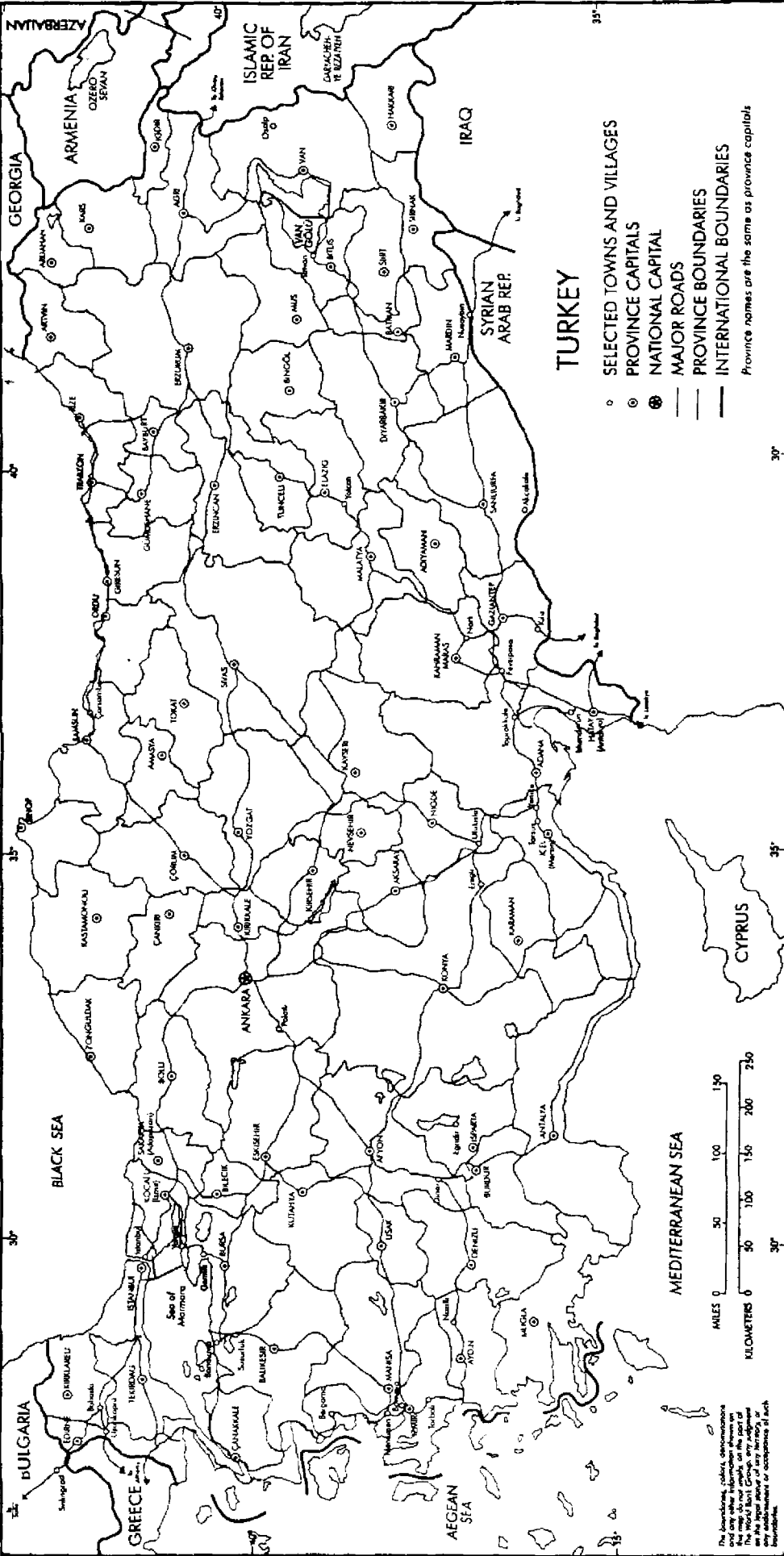
1/ Aug. 17-Sept 7 1999 has been taken as representative of one month

Source: SHÇEK, Staff Estimate

Table 22: Estimated Cost of Earthquake Child Victims

Estimated Number of Children		
Who Will Become Wards of SHÇEK		1,000
Cost per Child per Month (TL million)		100
Total Cost for 4 months of 1999 (TL million)		400,000
Total Cost for 12 months of 2000 (TL million)		1,200,000
	<u>1999</u>	<u>2000</u>
Child Ward Costs (TL billion)	400	1,200

Source: SHÇEK, Staff Estimate



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