TURKEY: *RECENT FLOOD DISASTERS IN NORTHWESTERN BLACK SEA REGION*

Ibrahim Gurer[1] and *Hamza Ozguler*[2]

Abstract. Information is provided about the approach and experience on flood management and mitigation in Turkey in general, and in river basins in the north-western part of the Black Sea Region, in particular. An IFM approach has been adopted to tackle with reduction of flood damages. Both structural and non-structural solutions for the sustainable and effective use of the flood prone areas are described for the case study area. Besides reservoirs, longitudinal and transverse structures for river training, flood forecasting and early warning, satellite and GIS data use, flood-proofing, land-use modification, building public awareness of the floods, and obligatory natural disaster (including floods) insurance, are some of the solutions being applied or proposed. Information is further provided on: (i) the data base for flood inventory that has been developed; (ii) the rules and regulations defining the responsibilities of each organization in emergency case; and (iii) on the participation of stakeholders in the planning process and decision-making for flood management. The study concludes with some suggested disaster mitigation measures for possible application in other countries with similar geographical and socio-economic development conditions.

1. Location

Due to its geographical location, geology and topography floods, landslides and snow avalanches affect Turkey. Flooding is the second most important natural hazard after earthquakes. This also occurs in the case study area located in the Western Black sea region, which has an extension of about 30,000 Km^2, encompassing 12 towns and four river basins. Most of the drainage areas of these rivers have short main courses, with steep slopes and are rather dissected with deep valleys. During floods the flows have a high speed and, due to elevated sediment load, are muddy and viscous. Man has damaged the forest cover and the water-retaining capacity of the drainage basins has decreased, therefore erosive energy is very high. A large amount of erosion and debris materials are dragged by the flows and deposited in the more plain low-lying areas. Sudden floods, especially occurring in the short river courses are common and these produce widely devastating flash floods in the study area, most frequently between May and July.

Due to topography, local people use the flood plains of rivers located in narrow valleys both for urban settlement and agriculture in rural areas. Since the fertile land is limited to the narrow valleys, it has a high value and is utilized in spite of risky conditions.

2. Nature of floods

Floods are due to heavy rainfall on the coastal areas of the western and southern parts of Turkey or to a sudden snowmelt in the eastern, mountainous part of south-eastern Turkey. In the northern and central parts of the country both factors may occur depending on the time of the year. Precipitation types are frontal, orographic or convective. During occluded fronts long lasting intense rainfall may produce flooding, depending on the season of the year. Most of the coastal precipitation in the Black Sea region, where the mountain ranges run parallel the shore sea, is of the orographic type. Convective precipitation mostly occurs during the transition seasons of spring and autumn and affects central Anatolia. The snow accumulated in the upper reaches of the

[1] Professor, Gazi University, Faculty of Engineering and Architecture, Department of Civil Engineering, 06570 Maltepe, Ankara, Turkey
[2] Hydrological Expert, APFM Focal Point, General Directorate of State Hydraulic Works (DSI),06100, Yucetepe, Ankara, Turkey

drainage basins of Anatolian rivers melts as of the beginning of February or March, and can cause flooding in downstream areas of the rivers.

Devastating flood events have occurred in various river basins of Turkey, especially in recent years. In many cases, floods have caused deaths, suffering and extensive damages to both public and private properties. Based on a flood inventory of 776 cases during the period from 1945 to 1995, a database was created which considers 68 different parameters, ranging from physical and meteorological, to economic and social aspects of each event. Accordingly, on the average 18 flood events occur in a year and they take about 23 lives. Almost after each flood, the government has paid a large proportion of the damage, in addition to losing significant revenues due to the consequences of economic disruption.

In the study region, 10 flood events took place between 1972 and 1998. Particularly during the latter year - the flood disaster in northwestern Anatolia (inner Black Sea Region) in May 1998 - affected four cities, 10 towns, 110 villages, and 25 000 ha agricultural land. During this flood mainly the residential areas along the rivers, the infrastructure of cities and towns, agricultural plains and existing river-training structures were heavily affected. The flood discharge in the Bartin, one of the rivers in the catchment, caused the largest flood loss in Turkey in the past 100 years, loss estimations going as high as US$ 2 billion. 30 people died and 2200 houses were destroyed or badly damaged.

The experiences gained from flood events in Turkey in the last decade have shown that almost all essential infrastructures might be at the risk of costly damage. On the other hand, unplanned urbanization on both banks of rivers and upper reaches of the basins have a major role in the rising cost of floods, besides the meteorological and hydrological magnitudes of the events.

3. Flood management and mitigation measures

At present there are mainly structural protection measures to control floods in the case study area. These consist of multi-purpose reservoirs, dikes and levees, and channel improvements. There are 53 flood control structures completed and in operation, and 23 more are at a planning stage. As non-structural measures, the infrastructure of a real-time data collection and flood-warning system has been completed, but its operation has as yet not started.

In urban areas of the western Black Sea region, flood-prone plains along the rivers crossing cities and towns are used as car parking, for recreational purposes and for sport activities, but in rural areas these plains are used for agricultural purposes. When a flood occurs the farmers, which cultivate the land, with the help of local legal people sue the state for repayment, usually without success. The floodwaters are not used under any circumstances; the local people and authorities try to get rid of the water as quick as possible.

Experience gained from the floods of last decade indicate that structural measures implemented basin-wide in the study area are effective in reducing the risk of flood damages but that, in addition to the early flood warning system to be put in operation, more importance should be given to other non-structural measures. This should be achieved particularly through modification of traditional land-use and updating building code guidelines and design standards, creation of public awareness, insurance, and timely and effective emergency management, in order to achieve a more effective and integrated flood management in the study area in particular, and in the whole country in general. In the present situation, however, the existing non-structural measures are not always successful because of two main reasons: (i) they are mostly dealt with by the local administrations including municipalities, mayors, “muhtars”; due to the current economic situation, the implementation of the needed activities by these bodies is limited - for example, their budget cannot cover the cost of land-use modification projects; and (ii) the local units do not have enough educated and trained personnel to implement the non-structural measures.

In this context, with the assistance from the World Bank, an Integrated Flood Management programme, named TEFER (Turkey Earthquake and Flood Emergency Recovery) Project was initiated after 1998. With this Project the establishment of all kinds of structural and non-structural measures as flood control alternatives is being undertaken. During the last five years a series of flood protection structures were designed and built for the rehabilitation of the region. Besides the construction of new reservoirs, longitudinal and transverse structures for river training, flood forecasting by using the real-time data collected along the river courses, satellite data use, and GIS and non-structural flood protection studies such as flood proofing, early warning, land use modification, building public awareness of the floods, keeping flood danger in the agenda of flood zones, the change in urban planning concept to keep the settlements as far as possible from the flood plains, obligatory natural disaster (including floods) insurance, to discourage the ongoing trend to settle at flood plains in narrow valleys, higher tax for those settlements at flood prone areas, and education of the young generation.

4. Flood and water management instruments

The basic legislation in water sector is the Turkish Constitution, which states that water resources are the natural wealth of the country, and under the authority of the State, to be used for the benefit of the public. The following laws deal specifically with integrated flood management:: (i) *Law of Turkish State Hydraulics Works (DSI)* states that DSI is to prevent the disaster effects of both surface and groundwater; and to build protective structures against the floods; (ii) the *Turkish State Meteorological Organization (DMI) Law* states that DMI is to supply the meteorological support to the sectors of agriculture, forestry, tourism, transportation, energy, health, environment, military, etc; (iii) the *Law of General Directorate of Rural Affairs (KHGM***)** refers to the preparation and application of service and investment programs for the requirements of farmers in the rural areas in order to protect, develop and achieve effective use of water and land resources in compliance with the policies determined in the national development plan; and (iv) the *Law of Bank of Provinces (IB) and Municipalities* also establishes the responsibility of local organizations to fight against the all natural disasters faced in the region under consideration; IB provides the funds to the Municipalities for this purpose.

The enforcement of the laws is realized through close cooperation of the central government in Ankara and the top-level representatives in the provinces where the flood disaster is encountered.

5. Institutions responsible for flood management

In accordance with the above laws and instruments, a number of governmental and non-governmental organizations have direct and indirect responsibility in integrated disaster management of floods in Turkey. They are the *General Directorate of Disaster Affairs* (AFET), the *General Directorate of Civil Defense*, *Army*, *Local Administrations* and *Municipalities*. The institutional framework has three levels; namely, decision-making, executive and users' level. In decision-making level, the Prime Ministry, state planning organization and ministries take place. Governmental organizations under the ministries are at the executive level. There are both governmental and non-governmental organizations at the water-users level. The *General Directorate of State Hydraulic Works (DSI)* is authorized to plan and manage all aspects and issues of flood management, especially after the flood event.

In 1988 the "Regulations on Emergency Aid and Planning for Disasters" were set up and the *Ministry of Civil Works and Settlement* was appointed as coordinator for Integrated Disaster Management. In case of large disasters, the *Central Planning and Coordination Council* in Ankara regulates the services to optimize the available resources in time for integrated disaster management. A similar type of structure is set up in cities from the representatives of the local organizations and state offices under the leadership of the governor and a "*Provincial Crises Table*" is set up. It organizes mobilization of the emergency personnel, damage assessment, restoration of essential public services, recovery planning, resolution of conflicts over the goals,

anticipation of the possible impacts of the disaster are organized by this committee. All the disaster mitigation decisions are shaped by the members of the local crises table, under the leadership of the corresponding governor.

5. Policy

The experiences gained from the floods show that structural measures implemented basin-wide in the study area are effective but too costly in reducing the risk of flood damages. Therefore, after the 1998 floods more importance was given to non-structural measures. This change of policy is reflected in the implementation of the TEFER Project mentioned above. In this context, a work programme is being implemented under the Project's framework to develop flood management and to reduce and when possible to eliminate long-term risks and damage to people and their property from natural hazards and their effects.

Local stakeholders assist in defining the integrated flood management policy and participate in decision-making. Accordingly, the local municipalities and governors are in the position to have an influence on the flood projects both at the planning and implementation level. Village elders and the elected members of the rural communities initiate the idea to solve any problem related to their small community and they pass it to the local administration in form of a written petition, and to central government through their representatives in the parliament. Local media and NGO follow-up the developments and inform the community.

6. Main lessons learned

- The dams and other flood control structures play an important role in protecting the human life. However, flood control and management based on structural solutions could be insufficient. Effective solutions based on land-use control, zoning, building ordinance, modifications in building codes, flood information programs by local communities are needed. This requires restructuring of both present legal systems and institutions responsible for management.

- The present situation as regards risk assessment, underwriting and rating is not yet satisfactory for the insurance industry as a whole. Floods in Turkey are not only the result of climatic conditions but also of uncontrolled urbanization and inefficient infrastructure. Consequently, floods represent a real risk for both insurance industry, their re-insurers and to the state. It is very important that the insurance companies be equipped with the knowledge necessary to deal with the insurability of high floods in terms of geographical areas and for individual risks.

- During past floods in reducing the adverse effects such as loss of life, both central and local flood management mechanisms were rated as succesful, but at the same time government also noticed some lacks of the present management system. The need to modernize the current disaster management system and increase its capability had been recognized in Turkey in the past, but their solution had been deferred because of the budget constraints. Recently proposed new legislation will give more power to local administrations and they will have their own budgets. It is expected that floods will be managed at local level.

- Prior to and during a flood, all the state organizations should cooperate. In this respect, they should be able to work together to collect and use the most up-to-date hydro-meteorological data in Turkey. This may lead to institutional and legal changes.