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Research Paper

Problem Investigation of Konya Flood Protection Structures

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Abstract: Floods events occur frequently in Turkey. Therefore, like earthquake and other natural disasters, floods also should be taken in to measure in advance as well. Therefore, with all other operations, constructing flood protection structures with a good planning and project, their proper using and their protection is important for ensuring that floods do not become a disaster. With lack of precaution listed above sometimes flood put huge effects on areas where are not identified as risky areas on flood risk assessment maps. In this study, primarily, the concept of flood, the effects, causes, types and the principles of protection from flood are discussed. Secondly, the problems in the flood protection structures located in Konya province, Turkey, were exemplified by photographs and evaluated. Lastly the sources of the problems, their effects on infrastructures, farmlands and domestics identified and some suggestion are made.

Keywords: *Floods, flood protections, flood risks, open channels, culverts,*

Introduction

Due to urbanization process brought by industrialization and sector diversity which greatly increases the diversity and intensity of human activities in various parts of river basins and destroys the balance in the whole watershed, it is possible to express flood disasters only as a result of meteorological occurrences. Since the earliest civilizations embracing established life, humanity tends to settle in the rivers center due to its proximity to water resources, ecological conditions, biodiversity, and its advantages for agricultural activities. As a result, most of the world is living in floodplains. Most of the floodplains around the world are large urban areas. This explains why millions of people are affected and expected to be affected by floods. The United Nations Development Program (UNDP, 2004) reported that between 1980 and 2000, approximately 196 million people in more than 90 countries were exposed to floods. The economic effect of flood phenomena to European Union from 1986 to 2006 estimated as 100 billion euro (Reducing the social and economic impact of climate change and natural catastrophes – insurance solutions and public-private partnerships, CEA, Brussels, Belgium, 2007).

The average annual flood damages in Turkey estimated as 100 million dollars, where the average investment on flood phenomena is estimated 30 million dollars per year. According to DSI reports in the last 20 years Turkey experienced over 300 flood phenomena which cause about 500 people to lose their life (DSI, Turkish state water works). In other to reduce the socio-economical risk and losses due to floods is important to state strategies such as modifying floods by structural means like dams, dikes, levees, channels, high flow diversion and land treatments in which the mean idea is keeping water away from potential damage areas; by flood forecasting which help to identify potential risky areas and keep human and movable properties away from inundated areas; lastly modifying susceptibility to flood damages (Ghosh , flood control and drainage engineering). However only a good approach for planning and designing flood protection structures and implying them fit with the plan can make structures effective.

One of the mean components of water resources structures design is estimation design flood. For this reason, accurate data on flood magnitude and flood frequency is vital. Hydrological design, which aims to estimate the expected maximum average or minimum flood handling by structures, is necessary for safety economy and proper functioning of all water structures (Ghosh, flood control and drainage engineering). Yet there are many uncertainties with different sources which effect projects negatively and make them to function in an ineffective way.

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Rainwater which causes flood in urban areas must be carried away from the region by channels and streets in a short period of time. Design of these channels considers both the channels hydraulic capacities and their future sustainability. In urban areas fitting the flood channels in an appropriate relative position are subjected to many constrains to compromise with existing utilities. Therefore, for comparison different alternatives should evaluate. The final selection generally identified by cost-effectiveness and public safety (ASCE and WEF, 1992).

Flood protection channels types and components

A proper design in the framework of standards and flood legislations will increase the effectiveness of the channels. Selection of an optimized bottom slope considering the topographic conditions, sizing cross section and to accommodate waves and jumps adjustment of freeboard heights are critic for accurate design of channels.

Grade control

In flood channel due to concentrated and high velocities, erosion in channel bed and severe back scours can be observed. To protect channels, it is imperative to setup proper lining and grade controls across the channel bed where the energy dissipation is necessary. Drop structures commonly used as grade control especially in channels with steep slope. In order to optimize grade control its building materials, degree of protection, its height and width and the force which is applied by flow is important.

Natural waterway

Natural waterways have taken their shapes with long-term erosion caused by flood flows and the hydraulic characteristic them varied related with the sections along the channel reach. Identifying and publishing floodplain along the natural waterway for avoiding inadvertent development on floodways; identifying roughness coefficient for water surface profile and velocity for scours on grade-control structures alongside the waterway is crucial here.

Grass channel

Grass-covered channels are one the most attractive waterway in urban area. Grass protects channel bed and bank from erosion by providing hydraulic resistance and lowering the velocity of the flow. The maximum and minimum permissible flow velocity should be considered in order to use channel effectively.

Riprap channel

It suitable for short and steep in the slope of waterway reach. Considering to applications and usage it vital to design it with right method (stream power-based or shear stress-based method)

Composite channel

Composite channels such as low-flow trickle and wetland channels provide detention storage volume during intense storm besides of being aesthetic. An accurate design considering channel capacity, flow depth, flow velocity and freeboard is needed for sustaining the habitat, future sediment storage capacity and safe passing of flow with different conditions.

Culvert

Culverts are structures which are designed to pass a stream flow under a barrier. Designing culvert with a right alignment and slope, with respect to head and velocity of the flow and cleaning sedimentation time to time is important for effectives of their functions. Furthermore, the capacity and performance of culvert most identify considering the hydrological properties of the channels and basins where they are located.

Methodology

In this study a total 146 flood protection facilities build and commissioned by Turkish state water works (DSI) in Konya province, were used. The problems such as sedimentation, narrow sections,

intervention of channels by citizens or any other problem caused by lack of coordination between institutes and expropriation aim to be observed and identified. As a method, all flood protection facilities were visited from the upstream to the downstream channel and the identified problems were included in the study.

Figure 1. Konya Güneysınır district

Figure 2. Konya Selçuklu Sızma region

Figure 3. Konya Guneysinir district

Figure 4. Konya Cihanbeyli, İnsuyu region

As seen in Figure 1 and 2, rectangular open channel form for flood protection was built under the control of DSI and culverts by Konya municipality. The cross sections of channels and culverts are looking insufficient. As shown In Figure 3 the flood facility constructed by DSI in accordance with its project, intersects with the historical arch bridge at a certain point of its route, it has not rightly allowed to build up to 7-8 m to the historical bridge under the law of not touching the cultural assets by the Provincial Directorate of Culture and Tourism. In figure 4 in order to cross the water pipe KOSKI (Konya Water and Sewerage Administration) did demolish flood protection facility's wall which affects the function of the structure during flood flow.

Figure 5 shows the flood control structures which effected by flood water because of the lack of cadastral width on the route for building the flood protection channel.

Figure 5. Flood protection plain of Kulu

Figure 6. Narrowing the flood protection structures by construction of infrastructures (a) Konya Bozkir district, b) Konya Yarasli region, c) Konya Yarasli Region, d) Konya Kutukkusagi Region)

By the building roads by citizen over the flood channels as shown in Figure 6, a narrow section created and due to the change in section of channel they would not function proper to project and plan during the flood flow. In some of the flood facilities in Konya province as shown in the Figure7 narrowing of the section in the flood route prevents the efficient operation of the plant and also creates serious problems in terms of life and property security.

Figure 7. Narrowing the flood protection structures of a) Kirkpinar region, b) Gevrekli region, c)Yesilyurt region), Yeniceoba region

Figure 8. Konya Cihanbeyli District İnsuyu Region

In some of the flood facilities in the province of Konya, in order to reach the project criteria during the project phase, sometimes the structures do not comply with the environment and negatively affect the citizen's life as seen in Figure 8.

Figure 9. Narrowing of the cross-section by planting in a) Akcalar region, b) Harmanpinari region, c)Esence region, d) Bagbasi region

In some of the flood structures in the province of Konya, it is observed that the channels are filled with sediments or natural grasses grows in the bed both of which descrease the flow velocity, causes overflow and prevents the efficient operation of the flood facilities.

Result and Recomentdations

The problems and problem sources of the observed areas can be listed as follows:

- Due to lack of the coordination between isntitutes, problems such as building culverts with narrow and insuficient cross section on flood channels roate, crossing water pipes by demolishing channel wall and inhibiting of constructing channel near to the point that historical bridge located were observed.
- Problems due to nationalization of the parcels in which the channels planed to pass were observed in Konya where the 3 parcel owner citizen did not allow the project to be implemented over their lands and the channel roate has been changed.
- Problems like intervention of citizen to channel like building bridges and crossing pipes which affect the channel by narowing the cross section and demolishing of their walls, were observed in many protection structures.
- Because of some regional constrictions, land expropriation and condition narrowing in the section of channel were observed in many structure and cause the channels to function properly.
- Lastly in many channels sediments and grasses which narrow the cross section, increase the roughness and decrease the flow velocity of the flood and a result because overflow was observed.

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