

# Emergency Action Plan for Flash Flood Due to Dambreak - Case study: Shahrchai Dam, Urmia (Iran)

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## Abstract

Emergency Action Plan for Flash Flood Due to Dambreak - Case study: Shahrchai Dam, Urmia (Iran) Seyed M. Heidaria, Seyed Jalal Heidari a Department of Civil Engineering, Sharif University of Technology, Tehran, Iran. (SeyedMHeidari@gmail.com) b Department of Civil Engineering, Betasaze Corporation, Mashhad, Iran. (j.heidari37@gmail.com) Abstract: A large number of dams have been built on the upstream of residential regions. Flash flood from these dams' failure is a constant threat to the thousands of lives and million-dollar municipal facilities in downstream. Therefore, it is crucial to identify potentially flooded areas and develop an early warning system for downstream cities to mitigate the loss of life and financial damages. We prepared an emergency action plan (EAP) for flash floods in Iran for the first time in this work. Shahrchai Dam was selected as the case study since it is a large dam with a 220 million m<sup>2</sup> capacity reservoir and is located close to a large city, Urmia, with 667,000 population and more than 197,000 households. We used HEC-RAS to model dambreak for two scenarios, piping and overtopping. ArcGIS was employed to identify flooded regions in downstream. The escape time was estimated based on the time that first waves reach residential zones. Time was 170 and 140 minutes for the piping and overtopping scenario, respectively. Water depth and water velocity were mapped for each scenario for flooded areas in downstream to identify secure shelters. EAP was developed for residential, commercial, and municipal buildings located in the flooded areas. Nine hospitals, four hotels, six mosques, more than ten municipal buildings, 54 public, and private schools, and five universities are determined within the flooded regions and considered in the EAP. We divided these regions into five categories, with three to five subcategories based on population and building types. For each subcategory, we identified an evacuation plan with detailed guidelines for residents and involved municipal organizations to avoid chaotic behaviors, which usually happens during flash floods. Results from this study are useful for educating people to be prepared for disasters like flash floods. Municipal policymakers can also use the findings to legislate required rules to protect urban areas from future floods and reduce associated fatality and financial costs. Acknowledgment: Authors would like to appreciate Sharif University of Technology and Dr. Fardin Jafarzadeh for their supports.

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## INTRODUCTION

A large number of dams have been built upstream of residential regions.

The case study is Shahrchai Dam located in the Northwest of Iran.

Shahrchai is a large dam with a 220 million m<sup>3</sup> capacity reservoir located close to a large city, Urmia, with a 667,000 population and more than 197,000 households.

## PROBLEM STATEMENT AND OBJECTIVES

Flash flood due to dams' failure is a constant threat to the thousands of lives and million-dollar municipal facilities in downstream.

It is crucial to identify potentially flooded areas and develop an early warning system for downstream cities to mitigate the loss of life and financial damages

## METHODOLOGY

We used HEC-RAS to model dambreak for two scenarios, piping and overtopping.

ArcGIS was employed to identify flooded regions in downstream.

The escape time was estimated based on the time that first waves reach residential zones.

We used ArcGIS to map water depth and water velocity for each scenario to identify secure shelters in flooded regions.

Emergency Action Plan (EAP) was prepared using results from dambreak modeling in HEC-RAS and mapped areas in ArcGIS.

We divided these regions into five categories, with three to five subcategories based on population and building types.

## RESULTS

Scape time is 170 and 140 minutes for the piping and overtopping scenario, respectively.

We prepared an emergency action plan (EAP) for flash floods in Iran for the first time in this work.

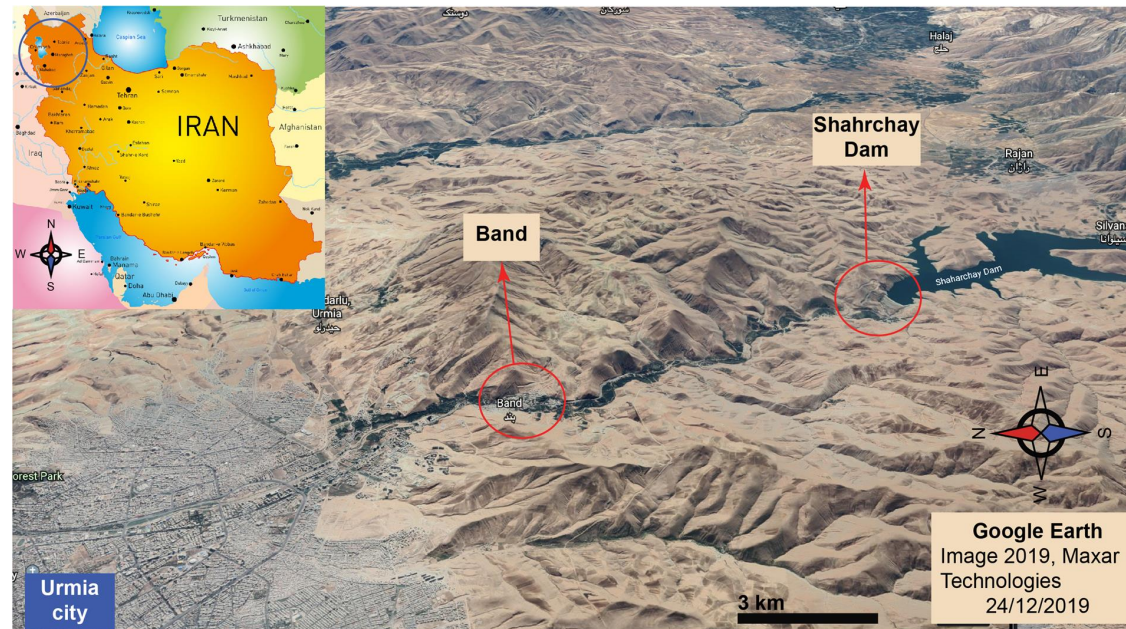
EAP was developed for residential, commercial, and municipal buildings located in the flooded areas.

## RESULTS

Nine hospitals, four hotels, six mosques, more than ten municipal buildings, 54 public and private schools, and five universities are determined within the flooded regions and considered in the EAP.

Results from this study are useful for educating people to be prepared for disasters like flash floods.

Municipal policymakers can also use the findings to legislate required rules to protect urban areas.



## ABSTRACT

A large number of dams have been built on the upstream of residential regions. Flash flood from the failure of these dams is a constant threat to the thousands of lives and million-dollar municipal facilities in downstream. Therefore, it is crucial to identify potentially flooded areas and develop an early warning system for downstream cities to mitigate the loss of life and financial damages. For the first time in this work, we prepared an emergency action plan (EAP) for flash floods in Iran. Shahrchai Dam was selected as the case study since it is a large dam with a 220 million m<sup>2</sup> capacity reservoir and is located close to a large city, Urmia, with 667,000 population and more than 197,000 households. We used HEC-RAS to model dambreak for two scenarios, piping and overtopping. ArcGIS was employed to identify flooded regions in downstream. The escape time was estimated based on the time that first waves reach residential zones. Time was 170 and 140 minutes for the piping and overtopping scenario, respectively. Water depth and water velocity were mapped for each scenario for flooded areas in downstream to identify secure shelters. EAP was developed for residential, commercial, and municipal buildings located in the flooded areas. Nine hospitals, four hotels, six mosques, more than ten municipal buildings, 54 public and private schools, and five universities are determined within the flooded regions and considered in the EAP. We divided these regions into five categories, with three to five subcategories based on population and building types. For each subcategory, we identified an evacuation plan with detailed guidelines for residents and involved municipal organizations to avoid chaotic behaviors, which usually happens during flash floods. Results from this study are useful for educating people to be prepared for disasters like flash floods. Municipal policymakers can also use the findings to legislate required rules to protect urban areas from future floods and reduce associated fatality and financial costs.