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# Risk-based design of flood mitigation master plan: A case study in IRAN

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Abstract

Flood protection is one of the practical methods in damage reduction. Although it not possible to be completely protected from flood disaster but major part of damages can be reduced by mitigation plans. This paper concern all process of flood damage risk-based analysis, including determination of flood damage rate for different flood levels in existing situation (without project) and with considering different alternatives of flood mitigation plans. The effort aims to provide details of the approach and methodology for the following key components:

- Review of historical data for flood magnitudes and frequency analysis;
- Upper storage reservoir flood control simulation;
- Collection of historical data for flood damages;
- Flood damage field survey;
- Hydrodynamic river modeling;
- Analysis of flood mitigation options;
- Model simulation aimed at predicting flood levels and determining the protection standards needed;
- Flood damage risk-based analysis and cost-benefit economic analysis.

The flood mitigation study will identify the most critical areas of flooding, and determine the best alternative for flood damage reduction. The study focuses on the areas where damages and losses are greatest and proposes accordingly a preliminary master plan for the region. The process includes damage cost assessment for different flood levels in various plans separately. It is therefore necessary to carry out a cost/benefit analysis for the main mitigation schemes and select the best alternative by means of flood damage risk-based analysis and cost assessment.

Flood frequency analysis is required to identify the flood magnitude for each return period. Therefore a comprehensive flood frequency analysis has been carried out for the upper and intermediate catchments. Reservoir flood control simulation determines flood attenuation by upper storage reservoirs and provides the flood hydrograph for the downstream area for different return periods. The critical situation is assumed regarding to initial condition of reservoirs and flood hydrographs combination of the catchments. Therefore the computed hydrograph in upstream of floodplain area is the maximum possible flood based on the river system features. In order to determine flood inundation depth in the floodplain areas, hydrodynamic river model is required. In this regard, HEC-RAS and Milk11- HD models were used with available data of the Dez and Karun rivers.

Flood damage estimation in inundated areas is one of the key parts of the flood studies. In order to provide an accurate damage amount, a flood damage survey was carried out in the most critical areas of the flood plains in addition to gathering historical data of damage from recent floods. In the survey, potential flood damage areas were identified and a set of questionnaires were designed and filled out by technical teams for residential, agricultural and industrial properties. A GIS database was built using maps and the results from the survey. The hydrodynamic model was developed to predict discharges and water levels of each reach for different return periods of floods in existing situation and mitigation plan alternatives

In this paper, the optimum flood mitigation master plan is determined by economic evaluation in trading off between the construction costs and expected value of damage reduction as the benefits. Size of the certain mitigation alternative is also be obtained by risk analysis by accepting possibility of flood overtopping. Different flood mitigation alternatives are investigated from various aspects in the Dez and Karun river floodplain areas as a case study in south west of IRAN. The results show that detention dam and flood diversion are the best alternatives of flood mitigation methods as well as enforcing the flood control purpose of upstream multipurpose reservoirs. Dyke and levees are not mostly justifiable because of negative impact on down stream by enhancing routed flood peak discharge magnitude and flood damages as well.