

## Seismic Risk Assessment of the Buildings in Iran with TRUST Platform

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## Abstract

For the first time, a building-specific seismic risk assessment tool is developed for the country of Iran. This platform, named TRUST, characterizes the performance of buildings with the cost and time needed to restore structures to their pre-earthquake condition. A comparative study between TRUST and PACT is used to examine the accuracy of the implemented methodology, which showed a subtle difference. Moreover, in order to verify TRUST loss estimation algorithms, data from the damaged buildings during 2017 Iran-Iraq border earthquake are collected. A close comparison is observed between the actual losses and the results of TRUST.

Keywords: Seismic risk assessment, Resilience-based design, Loss estimation, TRUST, PACT.

## 1. INTRODUCTION

Destructive earthquakes as a natural disaster have happened frequently around the world over the past years, and they have a major impact on the functionality of the cities, due to their damage to buildings and infrastructures. The reduction and prediction of the losses such as casualties, building destructions and indirect economic losses are tremendous challenges [1], especially in seismic zones like Iran. According to the rapid growth of the urban areas which leads to more buildings and overpopulation, a lot of different methodologies with the consideration of rapid recovery, the resilience of the cities and the enhancement of buildings performance have been proposed [2].

In general, different tools have been developed because of the need for a framework which evaluates the functionality of the structures faster, more easily and accurately [3]. Following this, improving these software packages for making them compatible with new and existing buildings, developing the database and information of structural and nonstructural components, assessing the effect of post-earthquake condition and making an efficient communication with stakeholders has been taken into consideration by researchers. In addition, the main focus of these programs is to develop a framework which helps to increase the capacity of the structures beyond the scope of the current building codes [4].

The most famous loss estimation tools are Hazard United States for Multi-Hazards (HAZUS-MH), Seismic Performance and Loss Assessment Tool (SLAT), Performance Assessment Calculation Tool (PACT), Resilience-based Earthquake Design Initiative for the Next Generation of the Buildings (REDi Rating System) and Seismic Performance Prediction Program (SP3). HAZUS-MH earthquake model is a program which is designed to predict different types of losses like structural and nonstructural components, facilities, contents, incomes, fatalities and lifelines. Although this program can be used for a single structure, the results are based on a group of structures. Additionally, the results might not be compatible with the reality accurately because of the oversimplification of the lifeline systems, assumptions in the modeling of the faults and inherent and aleatory uncertainties [5]. SLAT is a FORTRAN-based program which calculates