

## STATISTICAL SEISMIC VULNERABILITY ASSESSMENT OF EXISTING REINFORCED CONCRETE BUILDINGS IN TURKEY ON A REGIONAL SCALE

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A statistical procedure, called discriminant analysis, is used to develop a model for the preliminary assessment of the seismic vulnerability of low- to medium-rise (2–7 storey) reinforced concrete buildings. The earthquake damage data compiled in Düzce province after the 12 November 1999 Düzce earthquake formed the damage database. Number of storeys, minimum normalised lateral stiffness index, minimum normalised lateral strength index, normalised redundancy score, soft storey index and overhang ratio are selected as the basic damage inducing variables. Two discriminant functions are derived in terms of these variables considering immediate occupancy and life safety performance levels. In the proposed preliminary seismic vulnerability assessment model, the discriminant scores obtained from these two discriminant functions are combined in an optimal way and are used to classify existing buildings as “safe”, “unsafe” and “requires further evaluation”. The optimality criterion imposed into the model is the minimisation of the misclassification rate of damage states causing collapse. The validity of the proposed model is checked by using the seismic damage data associated with recent earthquakes that occurred in Turkey. The consistency between the observed damage distribution and the predictions of the proposed model supports the effectiveness of the proposed model.

*Keywords:* Seismic vulnerability; reinforced concrete; discriminant analysis; seismic performance; Düzce earthquake.

### 1. Introduction

The estimation of probable future losses is a matter of increasing interest to those concerned with earthquake insurance and the management of facilities or public administration in earthquake-prone regions. Over the last decade, a lot of effort has been devoted to the problem of how to devise reliable estimates, given the

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