ESTIMATION OF SEISMIC RISK IN TEHRAN METROPOLITAN

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Similar to all earthquake prone regions in the world, cities of Iran are disposed to seismic threats and experienced earthquakes with large magnitudes in their history. Despite the significant development of urban areas in Iran after 1984, still some deficiencies such as population growth, improper occupancy of the land, as well as vulnerability of old buildings, infrastructures, and other urban elements increase the potential consequences of earthquake in Iran cities. These condition, make it essential to perform a comprehensive assessment of risk in Iran cities to provide an applicable tool for managers and decision makers to allocate their resources for risk mitigation appropriately.

In this paper, a new methodology which is presented by the authors (Hajibabaee et al., 2013 and 2014) for comprehensive assessment of the seismic risk in urban zones of Iran, is introduced and implemented for Tehran City. In this method, the seismic risk is defined by physical, human life and socio-economic risk indices. Each of the risk indices are estimated through combination of the related vulnerability and hazards. Moreover, the response capacity of each urban zone is measured by indicators of planning, resource, accessibility, and evacuation capacity. Tables (1) and (2) show the indicators, parameters and their associated weight factors considered to characterize each of the risk and response capacity indices.

Table 1. Risk indices and their indicators (Hajibabaee et al. 2013)

Index	Sub-components (Indicators)	w
Physical risk (R_{PH}) (w_{PH}=0.30)	R1: Building vulnerability	0.60
	R2: Utility lifeline vulnerability	0.30
	R3: Transportation vulnerability	0.10
Human life risk (R_{HL}) (w_{HL}=0.50)	R4: Casualty potential	0.75
	R5: Density	0.15
	R6: Unpreparedness (of people)	0.10
Socio-economic risk (R_{SE}) (w_{SE}=0.20)	R7: Social disruption potential	0.50
	R8: Household's economic condition	0.50

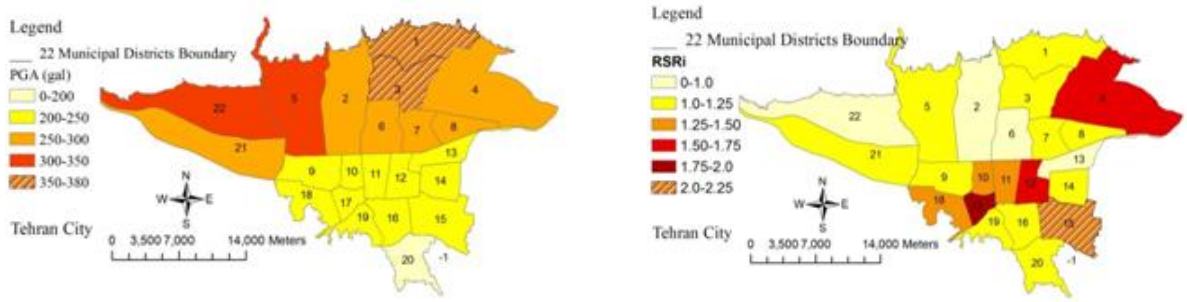
Table 2. Response capacity indicators (Hajibabaee et al., 2014)

Index	Sub-components (Indicators)	w	Sub-indicators	w
Response capacity (Rc)	C1:Planning Indicator (Rc_P)	0.25	Adequacy level of plan(s)	0.50
			Implementation level of plan(s)	0.50
	C2:Resource Indicator (Rc_R)	0.35	Available financial resources	0.30
			Equipment and facilities	0.35
			Trained manpower	0.35
	C3:Accessibility Indicator (Rc_A)	0.20	Road physical damage	0.30
			Road blockage	0.70
	C4:Evacuation Capacity Indicator (Rc_E)	0.20	Regional evacuation capacity	0.50
			Community evacuation capacity	0.50

The total seismic risk index (*RSRi*) is then defined by equation (1) as a combination of risk and response capacity indices.

$$RSRi = \frac{w_{PH}R_{PH} + w_{HL}R_{HL} + w_{SE}R_{SE}}{1.0 + Ln(Rc)} \quad (1)$$

In this paper, this method is implemented to assess the risk in 22 municipal districts of Tehran City in case of North Fault scenario of earthquake. Consequently, the effect of each indicator in measured values of the risk is revealed. Such results have a significant role in determination of priority activities for risk mitigation. The distribution of peak ground acceleration for this scenario is presented in Figure (1a) based on JICA (2000) studies. Figure (1b) shows the measured values of *RSRi* in different districts of the city. As illustrated, the overall risk in districts 15, 12 and 4 is higher than other districts and *RSRi* of district 15 is the highest.



(a) (b)

Figure 1. Values of (a) *PGA*, (b) Normalized *RSRi*, in districts of Tehran, North fault scenario of earthquake

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