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Earthquake Disaster Risk Index –A Simple Method for Assessing Relative Risk in a Country

Introduction:

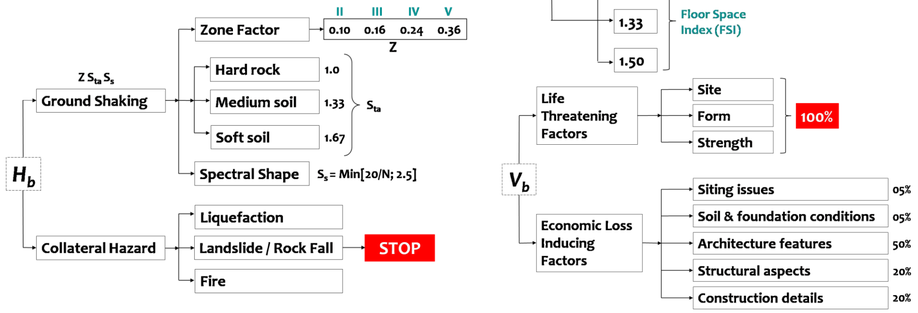
- *There is a significant rise in the world's urban population under earthquake threat in the past 50 years.*
- *The infrequent revision of design codes , municipal bye-laws, poor awareness about negative effects of disasters and lack of quantitative fell of the possible life loss and economic loss jeopardizes the earthquake safety in the country.*
- *There is a need assess earthquake risk of cities periodically that will help mitigate negative consequences, prepare and respond to future events.*

Proposed Methodology

- *The buildings in a town or city are grouped into different building typologies like load bearing wall buildings , frame buildings, braced buildings and mixture of these three.*
- *The Earthquake Disaster Risk Index ($EDRI_b$)for each building is calculated as*

$$EDRI_b = H_b \text{X } E_b \text{X } V_b$$

H_b-Hazard factor prevalent in the area.
E_b-Exposure factor in each building.
V_b-Vulnerability factor of building.



Proposed Methodology

Considering the maximum and minimum value of hazard, exposure and vulnerability the range of $EDRI_b$ is [0,9]

$$EDRI_{Typ,i} = \frac{\left(\sum_{j=1}^{N_T} EDRI_{Typ,i,j}\right)}{\left(\sum_{i=1}^{N_T} N_{Typ,i}\right)}$$

In which N_T is total number of typologies and $EDRI_{Typ,i,j}$ is EDRI of sample building J surveyed of typology i.

$$EDRI_{Town} = \frac{\left(\sum_{i=1}^{N_T} N_{Typ,i}\, EDRI_{Typ,i}\right)}{\left(\sum_{i=1}^{N_T} N_{Typ,i}\right)}$$

Example

Table 1: Selected cities located in hilly and plain regions

S.No.	City or Town	Region	Population	Total Number of Buildings	Number of Buildings Surveyed
1.	City A	Hilly	10,70,602	224,736	**596**
2.	Town B	Hilly	1,00,286	28,672	**183**
3.	Town C	Plain	1,43,286	32,681	**722**
4.	City D	Plain	**16,84,222**	**2,81,986**	**488**

Table 2: EDRI scores of all the surveyed buildings

Building Typology	EDRI$_{SB}$ of Surveyed Buildings			EDRI$_{Town}$ of all Buildings in Town		
	Number of Buildings Surveyed	EDRI$_{Typ}$	EDRI$_{SB}$	Number of Buildings in Town	Number of buildings with Life Threat	EDRI$_{Town}$
City A						
Reinforced Concrete Building	187	0.39	0.33	9,763	3,844	**0.31**
Brick Masonry Building with Concrete Roof	382	0.31		1,66,496	50,879	
Town B						
Reinforced Concrete Building	145	0.67	0.67	5,825	3,910	**0.68**
Brick Masonry Building with Concrete Roof	38	0.68		11,330	7,724	
Town C						
Reinforced Concrete Building	580	0.19	0.18	11,298	2,167	**0.17**
Brick Masonry Building with Concrete Roof	142	0.13		6,585	849	
City D						
Reinforced Concrete Building	359	0.77	**0.70**	11,779	9,105	**0.53**
Brick Masonry Building with Concrete Roof	**129**	**0.52**		**1,82,994**	**94,248**	

- *For demonstrating the method two towns and two cities located n the hills and the plains are selected.*
- *The EDRI for an individual building of a particular typology is calculated by addressing the questions related hazard, exposure and vulnerability.*
- *From the EDRI score of individual buildings of all typologies the final EDRI score of the city/Town is estimated.*

Conclusion

- *The proposed EDRI for cities and towns is simple to estimate and generic enough to be used in any country.*
- *The comparison of earthquake risk of cities and towns quantitatively, guides in the rational allocation of the available limited mitigation resources.*
- *Improves awareness of the stake holders to take immediate actions on the factors contributing to risk.*

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