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## **Assessment of Earthquake Vulnerability Indicators through Remote Sensing in Istanbul**

There are a number of factors that contribute to the configuration of vulnerability and thus risk in cities. The ultimate objective of this thesis is to develop a methodology for deriving vulnerability indicators from remote sensing in case of an earthquake and implementing them in a GIS environment for vulnerability assessment and analysis, as a decision support system for disaster management. When an earthquake strikes, particularly in a mega city located in a developing country, the loss becomes greater due to high density, inadequate infrastructure and services, unauthorized building, and socio-economically unbalanced development. Remote sensing technology with high spatial resolution images enables adequate and up-to date data for disaster management. In this research vulnerability indicators have been defined based on spatial and non-spatial elements, which compose city structures. Vulnerability indicators are defined into three groups: physical, social and economic vulnerability indicators. Physical indicators, which are directly derived from remote sensing data, are built-up density, building alignment, open space, road width and closeness to major roads. Social and economic vulnerability indicators are derived from remote sensing data in an indirect way, which includes combination of remote sensing data with data, gathered through ground survey. Social indicators are preparedness toward an earthquake and demographic composition of the society, such as number of women, children and elders in household. Economic indicators are household income, household insurance, car ownership, and household communication. Physical vulnerability indicators are combined through the

assessment procedures to constitute homogeneous vulnerability zones. Then social and economic indicators have been implemented in GIS and assessment is carried to investigate homogeneity of the social and economic indicators regarding the homogeneity of the physical vulnerability indicators. As a final step a homogeneous vulnerability zone map was produced for the social and economic vulnerability indicators, which show homogeneity in spatial distribution in vulnerability zones. Although the methodology is primarily designed for mega cities in developing countries, the vulnerability indicators could be generalized based on their common features and this methodology could be applied in developed and undeveloped countries as well. The methodology has been applied into Uskudar test-site, a district in Istanbul, Turkey.

**Key words:** Earthquake vulnerability indicators, Mega-cities, vulnerability assessment, Remote Sensing, GIS, Istanbul, Turkey.