Building Information Extraction from Satellite Imagery for Regional Risk Assessment

Pooya Sarabandi[1], Anne S. Kiremidjian[2]

Abstract

In order to perform regional earthquake vulnerability and risk assessment, there are several essential structural attributes that should be collected as a priori information for risk models. Structural height and building footprint are among the key inputs of risk models. The taller a structure is, the larger its total square footage will be and therefore more area is exposed to a given hazard. Irregularities in plan and elevation are also among the factors that contribute to the earthquake risk and need to be considered when modeling structures. In addition to these attributes, density of structures in a city is another determining factor in assessing vulnerability of urban areas to natural hazards such as earthquake.

Current building inventories have serious shortcomings that include incomplete information on attributes, missing attributes, or erroneous values for attributes. Furthermore, most of the existing databases are out-dated and are typically available in paper format requiring a long and expensive translation to electronic format.

Rapid growth of urban areas and constant need for monitoring these areas to support different organizations in their decision making process makes remote sensing technology a desirable tool for this purpose capable of acquiring considerable amount of information in a relatively short amount of time. As mentioned, a pervasive problem for urban areas around the world is lack of well-documented databases of their infrastructures. This is particularly important when it comes to planning or responding to disasters such as earthquakes or hurricanes. Recent advances in high-resolution satellite imaging extend the application of commercial satellite images - such as those acquired by IKONOS, QuickBird and Orbview - to accurate 3D building modeling and geospatial information extraction.

This paper presents a methodology for updating structural information that is critical for earthquake risk assessment from high-resolution satellite images. Methods for extracting building attribute information such as spatial information (longitude and latitude), height of buildings, number of stories, total footprint area, irregularity in plan and density of buildings are introduced. Examples of 3D models generated for city of London, UK and Long Beach, California are presented. Accuracy of models is verified against independent survey data and results are reported.

[1]Department of Civil and Environmental Engineering, Stanford University, USA, psarabandi@stanford.edu.
[2]Department of Civil and Environmental Engineering, Stanford University, USA, ask@stanford.edu.