

Master Thesis

Investigation of Robustness of Structural Systems

Introduction

The awareness of the significance of the robustness of structures has gradually intensified over the years due to experiences with failure and collapse of many structures. A significant amount of research has hence been invested into the various aspects of robustness resulting in a number of useful recommendations on how to achieve robust structures. However, despite many significant theoretical, methodical and technological advances over the recent years, structural robustness is still an issue of controversy and poses difficulties with regard to its interpretation as well as regulation. A risk based framework (see Figure 1) has been recently proposed for the assessment of robustness. The *direct risk*, which is associated with the direct consequences arising from potential damages to components of a structural system and *indirect risk*, which corresponds to consequences resulting from loss of system functionality or failure are evaluated. The robustness of the structural system is then assessed by the ratio of the direct risk to the total risk. Some past applications of this framework include the assessment of robustness for a highway overpass structure for vehicular impact, the investigation of robustness for a highway bridge considering the effect of deterioration caused damage states such as corrosion and cracking and a quantitative evaluation of structural robustness for a high rise building structure for an explosion event.

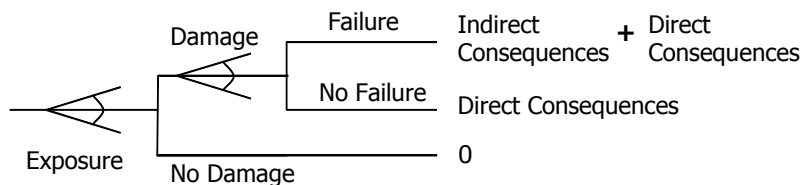


Figure 1 A risk based assessment framework for robustness **Figure 2** Collapse of a building in Manila

The envisaged master thesis principally involves the application of this framework for the investigation of robustness for a chosen structural system and exposure. The choice of the structural system and exposure would be based on the interest of the student.

Tasks and scientific relevance

The master thesis would involve the following tasks:

1. Identification of a suitable structural system for study considering material type, functional use and form of load resisting system
2. Identification and modeling of exposures/loads, damage and failure scenarios for the system
3. Modeling of consequences resulting from damage and failure scenarios
4. Risk assessment of the structural system under study and assessment of robustness

The master thesis is expected to provide the student a fundamental understanding of risk based decision theory and structural robustness and also an opportunity for application of this theoretical knowledge to a problem of his/her choice.

Further information

Harikrishna Narasimhan
ETH Zurich
Group of Risk and Safety, Institute of Structural Engineering
Tel: +41 44 633 42 15
E-Mail: harikrishna@ibk.baug.ethz.ch