9th International Congress on Civil Engineering, May 8-10, 2012
Isfahan University of Technology (IUT), Isfahan, Iran

Feasibility study of the use of light weight steel structures in high-seismic regions of Iran using modified APRAM method

Mehran Zeynalian[1], Bambang Trigunarsyah[2], Hamid Reza Ronagh[3]
1, 3- School of Civil Engineering, The University of Queensland, Australia
2-School of Urban Development, Queensland University of Technology, Australia
z.mehran@uq.edu.au

Abstract

The use of light steel frame (LSF) structures as the main load-bearing structural system is becoming more popular in the housing industry, especially in low rise residential buildings. This paper discusses the feasibility of using LSF structures in high seismic regions of IRAN using modified advanced programmatic risk analysis and management model (APRAM). This method is capable to address project failure risks simultaneously including cost, time and quality risks over the whole life cycle of a project. The APRAM model is employed to optimize the allocation of budget reserves through trade-offs between technical and managerial failure risks based on the preferences of the decision maker(s). It allows for checking whether technical and managerial risks meet the thresholds of acceptability. LSF system and conventional construction system (CCS) as the two main possible alternatives for construction of an actual two-story building are compared considering all technical and managerial issues. The comparison shows that LSF system is more sustainable and reliable for a residential building

Keywords: Light steel frame, feasibility study, risk analysis, non-linear optimization, APRAM

1. INTRODUCTION

The use of light steel frame (LSF) members as the main framing elements in a structure is becoming more accepted in the housing industry, especially in low rise residential buildings. Its light-weight property leads to some advantages such as ease of construction and transportation. As LSF is factory-made, is therefore quality controlled. These two, are very important features that make this system attractive for earthquake prone regions such as Iran. It is envisaged that this system will have a huge impact on the way houses are built in Iranian villages. However, for construction engineers, it is necessary to employ an efficient decision-support tool for selecting the best technical alternative amongst the available construction systems such as LSF, and conventional construction system (CCS). Moreover, it can help the engineers in order to improve the distribution of the allocated project resources considering cost, time and quality, while simultaneously minimizing the risks of project failure.

Complicated as it is, balancing resource allocations and risks of project failure become even more complicated as project's resources become more constrained. Project managers need to make critical decisions that affect their project outcomes. They have to choose a feasible construction style, including both design and construction (D&C) issues, with respect to all potential technical and managerial failures as well as in-service problems which might affect project's performance.

Advanced Programmatic Risk Analysis and Management Model (APRAM), which was first introduced for the aerospace industry [1, 2], is one of the techniques which can be used as an effective decision-support tool for risk management of project failures [3]. However, some modifications are required to use this method properly in covering not only the initial costs of a project, but also its project whole life cycle costs, including design, construction, operation and maintenance. These modifications are essential to specify whether the higher initial cost of a project is economically justified by the reduction in future costs when compared with other alternatives that have lower initial costs but higher future costs.

The APRAM model can be employed to optimise the allocation of budget reserves through trade-offs between technical and managerial failure risks based on the preferences of the decision maker(s), and it allows for checking whether technical and managerial risks meet the thresholds of acceptability [1]. Imbeah and Guikema (2009) declared that this method can be used in the housing industry to help project managers address all identifiable failure risks and compare different potential construction methods. It is notable though, that in reaching this conclusion, they took into account only the design and construction parts of the project. Hence, to investigate the feasibility of use of light weight steel structures in high-seismic regions of