

Lifecycle cost variation of building with social aspects

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Summary

The lifecycle cost of structure has been discussed with consideration on the expected failure cost. The decision making on the safety of structures is influenced by various social aspects. The estimation of lifecycle cost can be a useful measure for considering the safety, sustainability as well as the economy. A new building approval system is proposed in order to find a social consensus among stakeholders. It is expected to achieve safer and more sustainable building construction than the current minimum requirement regulation systems as the transparent information can be shared in the community.

Keywords: Lifecycle cost, structural safety, expected failure cost, CO₂ emission, design regulation, stakeholders, minimum requirements, engineering decision making.

1. Introduction

The lifecycle cost of structure has been discussed with consideration on the expected failure cost. The optimal target safety can be rationally discussed among stakeholders once the framework for the decision making is established and sufficient information for parameters in the framework is provided. Then the lifecycle cost study is expanded with wide range of social aspects.

In most countries the structural design of building has to be checked prior to the construction by a building official to be examined if the design satisfies the minimum requirements specified in the regulation. However this situation causes a poor view on the structural safety for people. The minimum requirements provide only the limited necessary conditions to be satisfied by the structure, and yet buildings approved by the building officials are regarded as sufficiently safe. Then people have no motivation to increase the safety degree above the minimum requirements.

Lifecycle cost estimation may provide information to encourage people to increase the structural safety, when the failure consequences are great or the intended service lifetime is much longer than the ordinary lifetime of building, e.g. 50 years or cost-up increment for the higher safety demand is much lower than their common understanding.

When people realize that the lifecycle cost depends on the target safety degree, higher safety buildings may have more demands. Then the minimum requirements only assure the minimum uniform level of safety for buildings and may not be appropriate in the sustainable society. Engineering rationale for a higher safety for a longer life of structures will be one of key roles for the sustainable society.

2. Basic concept for structural safety

The safety requirement of structures has been established in practices empirically based on past experiences of natural disasters. For example in Japan, Kanto earthquake, 1923 caused a serious disaster in metropolitan area and the target seismic safety became to avoid collapses against the