

Reduction of Seismic Risk of Infrastructure via Daily Management Works

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1 Abstract

During recent years, the possibility that damage at the time of earthquake could change depending on the deterioration condition of infrastructure has been noted through analytical calculations. Faced with such a possibility, management policy should be optimized by internalizing the external elements of earthquake damage, evaluating the appropriateness of management policy for infrastructure, and optimizing the system. In this study, the deterioration process for infrastructure was modelled using the Markov process model, and a methodology to determine the optimal management policy is proposed by considering the two risks: i) the risk that infrastructure fails because of deterioration independent of external factors such as an earthquake, and ii) the risk of infrastructure failure at the time of earthquake, which changes due to deterioration of the infrastructure. In an example of the application, it is demonstratively shown that the optimal management policy would change in the case where earthquake risk is not considered.

Keywords: disaster risk management; infrastructure management; optimization; Markov process.

2 Introduction

It is essential, for social and economic activities, to keep infrastructure and its network always usable. Also the risk caused by both deteriorations of infrastructure and external influence of a disaster such as earthquake would reduce users' safety. To minimize such risk, it is important to rationally and optimally maintain infrastructure. Furthermore, the time has come in Japan when considerable infrastructure constructed during the period of high economic growth (from 1954 to 1973) has deteriorated. Considering the difficulty in securing a budget for responding to deterioration of such infrastructure, a certain level of management which

could keep the level of risk below a certain degree should be adopted decreasing the management cost as much as possible.

During recent years, the possibility that damage at the time of earthquake could be different depending on the deterioration condition of the infrastructure (in other words, deterioration could lower earthquake resistance) has been noted through analyses, simulations, etc. Furthermore, as for earthquake occurrence probability, research has accumulated in the fields of science and technology for quantification such as "the probability of earthquake occurrence in the next certain years (earthquake occurrence probability) [1] is XX%". In the case that damage by an earthquake would differ