



An Initialization Model with Reference to Finite Number of Failures

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Abstract

In order to manage the expressway assets, it is important to properly predict the scale of failures occurring in infrastructures in future. In this paper, the authors propose an initialization time model to predict the scale of failures. Specifically, the number of latent failure places where there are possibility of failure occurrence is assumed to be followed to Poisson distribution. Furthermore, a time-dependent probability of a failure occurrence in latent failure places is expressed by using Weibull deterioration hazard model. In consequence, an initialization time model is formulated as a mixed probability model. Lastly, the authors discuss the usefulness of the model in this study through the empirical analysis of actual expressway assets.

Keywords: Initialization time of failures; Weibull model; finite sets; deterioration; bridge.

1 Introduction

In recent years in Japan, aged deterioration of expressway structure has become remarkable. Large-scale renewal and large-scale repair of lapsed expressway structures is carried out. Meanwhile, for expressway structures that are currently relatively healthy, it is usually required to repair individual failures properly and effectively. It is indispensable to know the characteristics of deterioration through a periodic inspection in order to repair accurately in limited human resources and budget. Because there are restrictions as described above for the implementation of normal repair, it is necessary to manage like that failures will not occur beyond the feasible amount in the future. In order to achieve levelling of the repair budget, it is necessary to keep it in a certain state by balancing the numbers of failure occurrence and repair, and ensuring that the structure soundness is maintained constantly.

Failures occurring in civil infrastructures exist as many types such as cracks, water leakage, lifting or exfoliation. If we keep observing these individual failures with no-repaired, there is a possibility that new failures will occur due to that failures and expand the scale of the failures. In order to effectively manage the structure over a long term period under a limited human resources and budget, it is necessary to grasp as accurately as possible a time-dependent probability distribution of the accumulative number of failures occurring over the entire structure.

2 Basic ideas of this study

2.1 Conventional study outline

With regard to the forecast model for the deterioration process of civil infrastructures, both of a dynamic model and statistical model have already accumulated a lot of study. In this study, we focus on the statistical deterioration forecast