



## PEELING/FLACKING PREDICTION MODEL FOR RC HANDRAILS IN CONSIDERING A SPATIAL CHAIN

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### Summary

Occurrence of peeling/flacking (P/F) of concrete is a typical deterioration phenomenon in a concrete structure. From the point of view of structural safety and third party damage, it is necessary to evaluate the risk of P/F accurately and to cope with P/F. In this study, authors propose the methodology to predict on P/F of concrete in consideration of uncertainty. Concretely, a Weibull hazard model is formulated to express a corrosion of reinforcement with progress of time and an increase of the number of P/F, and is extended to a spatial Weibull hazard model by considering a spatial chain. By doing so, the proposed model expresses a partial increase of the number of P/F caused by a corrosion of reinforcement. Finally, the appropriateness of the proposed method is discussed through the empirical analysis of the visual inspection data on RC handrails in the railway bridge.

**Keywords:** peeling/flacking of concrete, spatial Weibull hazard model, MCMC, risk evaluation.

### 1. Introduction

Recently, deteriorated infrastructures are increasing and the structural administrator is urged to maintain and reinforce them. Particularly, the damage to not only users but also others must be maintained and reinforced immediately. To prevent the damage, a structural administrator do the routine inspection and preserve safety of infrastructure. The risk that the damage left a long time can be decreased by increasing the routine inspection frequency and discovering the damage immediately. On the other hand, by doing so, maintenance cost increases. Moreover, there's a possibility an occurrence of the damage increases with progress of deterioration of infrastructure. Therefore, if inspection interval is set up regular interval, there's a possibility that an occurrence of the damage increases over time. To cope with the damage reasonably, it is important for structural administrator to consider efficient methodology about inspection and reinforcement. Moreover, it is necessary to evaluate occurrence risk of the damage fitted actual phenomenon.

In this paper, occurrence process of peeling/flaking (P/F) of concrete on RC handrails in the railway bridge is focused on. Occurrence of P/F of concrete is a typical deterioration phenomenon in a concrete structure and their process greatly depends on not only structural condition and environmental condition of the structure but also carbonation and injury in salt. Corrosion process of reinforcement is expressed based on theory and knowledge in previous research and occurrence process of P/F can be analyzed by using it. However, many methods express their process determinately. Thereby, if such a method is applied, it is difficult to express uncertainty of their process. Therefore, it is impossible to express actual phenomenon by applying a determinate method. To express actual phenomenon, it is necessary to construct the model of their process considering uncertainty.

This paper proposes the prediction model of occurrence of P/F of concrete considering uncertainty. Concretely, a Weibull hazard model is formulated to express a corrosion of reinforcement with progress of time and an increase of the number of P/F, and is extended to a spatial Weibull hazard model by considering a spatial chain. By doing so, the proposed model expresses a partial increase of the number of P/F which caused by a corrosion of reinforcement. Following section gives a basic line of thinking in this study. Section 3 describes the formulation of a spatial Weibull hazard model. Section 4 discussed an empirical study using inspection data on RC