



Optimization the Number and Place of Pavement Condition Surveyed Inspection Units Using GA

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Abstract

Determine the pavement condition is important part of pavement management for selecting the maintenance and rehabilitation (M&R) activities. It is required to a visual inspection and the first step is dividing pavement sections of a network into smaller units as inspection units. Surveying all of these is costly and time consuming for transportation agencies. So the strategies for selecting specific number of inspection units as surveyed inspection units are applied for acceptably accurate pavement condition. In this paper develops genetic algorithm (GA) for determining pavement condition with optimal number and place of surveyed inspection units. The results of this paper show GA is applicative for solving the present problem and it helps to managers and human inspectors for optimal decision in inspection process and M&R activities. The numerical results describe that the 60% of surveyed inspection units achieved to optimal network for case study pavement network.

Keywords: Pavement Management, Pavement Condition, Genetic Algorithm, Surveyed Inspection Units, Maintenance and Rehabilitation activities.

1. Introduction

Pavement is an important infrastructure that requires to maintenance and rehabilitation (M&R) activities in the pavement management system (PMS). A visual inspection process by human inspectors conducts for determining the accurate condition of pavement (Durango-Cohen and Madanat 2008; Yu et al. 2013; Su. et al. 2013).

The pavement condition requires a universal scale as condition index (Buddhavarapu et al. 2013). Pavement condition index (PCI) is an operational index for estimating it and that considers the important characteristics of distresses in the pavement sections. For determining the PCI require a pavement inspection process with dividing the sections into smaller units as inspection units in first (Shahin 2005).

Surveying all of the inspection units is time consuming and costly and the budgets for agencies in M&R activities is limit. Therefore, it is required to survey an optimal number of the inspection units (as surveyed inspection units) for keeping PCI in acceptable.

In recent years, evaluating the number and place of surveyed inspection units (SIUs) in the pavement sections become an important issue for transportation agencies all over the world (Department of Environment, Heritage and Local Government 2004; Michigan Department of Transportation 2008; De la Garza et al. 2008; Mishalani and Gong 2009; Texas Transportation Institute 2010; Oregon Department of Aviation 2011; American Society for Testing and Materials 2011, D6433-11).

All previously methods have high sampling error (difference between the in-filed PCI and obtained PCI) in the sections of a pavement network and they are not reliable for an inspection process. Therefore GA as an artificial intelligent method is used for removing the deficiencies previously methods.

2. Pavement condition evaluation

The PCI is an index that is known as the most operational index and is defined by ranging from 0 for a failed pavement with high level of distress to 100 for a pavement with perfect condition and without any distress that indicates no extremely serious distress (Figure 1). The PCI calculation needs to inputs including distress type, severity and