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Pavement Maintenance Applications using Geographic Information Systems

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Abstract

The aim of this work is to develop a Pavement Maintenance Management System (PMMS) for the roads and parking network. An extensive review was carried out on previous PMMS projects used for roads in Jordan and other countries. This research focuses on the software called PAVER system that is used to create a comprehensive and integrated database and GIS-based map layers for the road pavement and engineering characteristics. The research will contribute to the provision of a systematic method for the control of the Maintenance and Rehabilitation (M&R) process for paved networks. Although many researches in Jordan discuss reasons and procedures for M&R of road networks, there is still a lack of the systematic strategy and prediction procedure.

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1. Introduction

Managing paved networks such as roads, parking lots, pedestrians' sidewalks, walkways and yards is an important issue in Al-Zaytoonah University of Jordan as well in other universities and organizations, which includes large paved areas utilized as parking spaces and students' bus terminals. A PMMS can be a useful tool for evaluation and prioritization of M&R projects, determination of funding requirements and optimum allocations. The development of Pavement Management System (PMS) products has supported systematic and economic management of pavements [1, 2]. The maintenance at early stages of pavement deterioration proved to produce large savings before the start of the costly sharp decline in pavement condition as clearly illustrated in Fig. 1.

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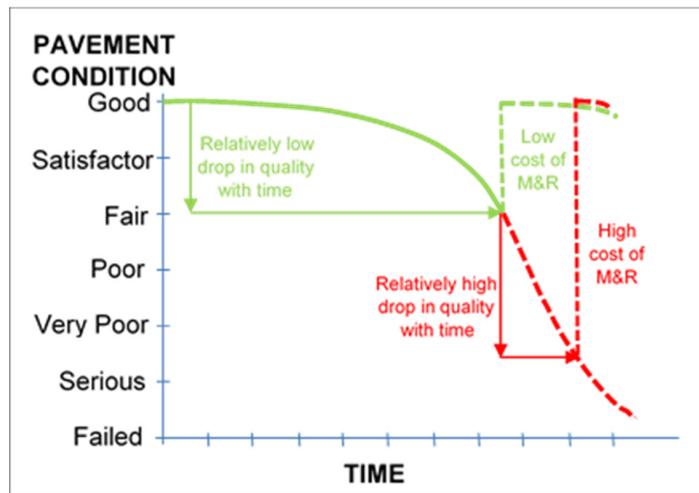


Fig. 1. Illustration of Pavement Condition Variability with Cost of M&R over Time.

2. Literature Review

Many researchers have studied the performance of paved networks and the probable factors that caused distresses. It was concluded that trucks with axle loads exceeding the legal limit, poor designed drainage systems and lack of quality control are the most probable causes for deterioration of road network in Jordan [3].

The relationship between roads pavements failures, engineering indices and underlying geology of sub-grade layers were studied [4]. It was noted that roads with high failure rates are supported by poor sub-grades, whereas highways with low failure rates are supported by weathered sub-grades. The researchers also emphasized the provision of drainage systems to reduce rates of road failures.

Some researchers stated that rutting has gradually developed in the wheel path due to increasing number of traffic repetitions under hot weather [5]. They illustrated that rutting phenomenon is the result of both consolidation, which occurs at earlier stages of pavement service life, and shear deformation. Some researches have evaluated the condition of road network in Jordan by using Maintenance Management System (MMS). Other researchers [6] studied pavement condition for selected road sections in Amman city by using Micro PAVER system. They considered three classes of roads including arterial, collector and local roads. The authors claimed that the roads condition in western Amman is relatively better than eastern Amman, and it is better in Amman than other governorates. There were projects in which computer software were used as a part of MMS. Some projects incorporated Micro PAVER system for the evaluation of 153 pavement sections in Irbid city [7]. It was concluded that 70% of the pavement sections require different levels of maintenance treatments.

There were also some attempts to develop a review and analysis of the pavement management system currently adopted by the Ministry of Public Works and Housing (MPWH) in Jordan [8]. Suggestions and opportunities for the improvement of the existing system were proposed. Other researches also noted that Pavement Management System (PMS) approach can be used to set priorities for maintenance and repair while including a provision for the evaluation of pavement performance on a periodic basis to identify sections with a need for maintenance [9].

3. Research Objectives

The aim of this research project is to develop a Pavement Maintenance Management System (PMMS) for the roads and parking network in Al-Zaytoonah University of Jordan (ZUJ). Research objectives can be summarized as follows:

- Developing of a comprehensive and integrated database for the road pavement at Al-Zaytoonah University of Jordan (ZUJ)

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