

A Comprehensive Review of Flexible Pavement Failures, Improvement Methods and its Disadvantages

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Abstract. Flexible pavement failure has been a major problem encountered in various countries. Some common distress which had been listed are cracking and rutting. The causes of this distress are due to moisture, weak sub-grades and poor construction quality. High amount of distress in the pavement however is likely to cause dis-comfort for the passengers, higher accident rate and heavy traffic. Study suggested that, flexible pavement failure can be reduce, through maintenance of the wearing course of the pavement, improving the base, sub-base layer or the sub-grade soil underneath of the pavement. However, high production or material cost, high construction cost, excessive settlement, or weak inter-molecular bonds in the flexible pavement are some of the common problem encountered with the current improvement techniques. This significance difference of this review paper compare to other is that, in this review paper it focuses on the flexible pavement failure, the different types of improvement method currently applied. Consequently, it further recommend flexible pavement improvement method through by reducing the sub-base layer thickness and inclusion of light weight material in the sub-base layer so that, the settlement of the pavement is reduced.

Introduction

Land transport infrastructure is the backbone of the social-economic growth of any country [1]. Generally, road is made with flexible or rigid pavement. Flexible pavement is normally used for road construction in many countries such as Malaysia, India, Sudan, Nigeria and Pakistan [2, 3, 4, 5, 6]. Difference between flexible and rigid pavements is based on the manner in which the loads are distributed to the sub-grades. For flexible pavement, the stress will decrease with depth as the wheel load acting on the pavement will be distributed to a wider area. Meanwhile for rigid pavement, the stress distribution is almost uniform underneath due to the wheel load [7]. Flexible pavement generally consists of three layers which are the surface course, base course and the sub-base course. Generally the bonds between the flexible pavement layers are very weak in comparison with the rigid pavements [8, 9, 10]. Figure 1 demonstrates the load distribution pattern in flexible and rigid pavement.

A pavement primary function is to i) protect the sub-grade soil underneath, ii) provide sufficient surface friction, iii) provide smooth riding surface and iv) acts as a waterproofing surface [10]. Factors which influence the performance of pavement are traffic, moisture, sub-grade, construction quality and maintenance [11, 12]. This paper is a comprehensive review which summarizes facts from various independent studies regarding flexible pavement failure, case history, reduction of pavement failure through different techniques, the disadvantages of the current improvement techniques in the past 20 years. Consequently, a suggestion of potential alternatives for future research has also been listed.