



Environmental and Economic Analysis of Selected Pavement Preservation Treatments

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Abstract

Pavements are one of the highest assets and represent massive investment. The need to design and provide a sustainable maintenance service is becoming a priority and this comes mutually with the intentions to reduce impacts caused by maintenance treatments to the environment. This paper through a case study presents a Life Cycle Cost and Assessment technique during a 30 year analysis period to measure the cost effectiveness, embodied energy and carbon emissions of selected preservation treatments. These treatments can either be applied separately or in combination during the preventive maintenance of road pavements. This study entails three life cycle phases of material extraction and production, transportation and construction of maintenance activities. Through a literature review, raw materials energy and emission inventory data was averaged followed by the analysis of the equipment involved by using the specific fuel consumption to calculate the energy and emissions spent by the machine and finally the selected treatment energy and emissions was computed. Results show that preservation treatments can have an LCC of 30-40 % and embodied energy and carbon emission of 3-6 times lower than the traditional approach. This study bridges gaps in literature on integrated evaluation of environmental and economic aspects of preservation treatments.

Keywords: Pavements; Sustainability; Life Cycle Assessment; Life Cycle Cost; Preventive Maintenance.

1. Introduction

The road network has an important role to play in the development of a country for social and economic growth. A good road network is also important for connectivity, movement of goods and job creation. Zambia has a total gazette road network of 67671 km of which 60% comprises the Core Road Network (CRN). The CRN infrastructure in Zambia consists of a sparsely interconnected network of Trunk (T), Main (M), District (D), Primary Feeder (PF) and Urban (U) roads [1].

The Government of the Republic of Zambia (GRZ) has implemented three notable initiatives in the road sector. Firstly, to improve inter-urban and urban connectivity and accessibility; this will see over 12000km of roads rehabilitated or upgraded to bituminous standard at a total cost of US\$8.5 billion. Secondly, GRZ has developed a ten year (2015 – 2024) National Maintenance Strategy which aims to reduce road maintenance backlog and to improve the general condition of CRN. The estimated cost of implementing the entire strategy over the 10 years is US\$1.5 billion [2]. Thirdly, the Output and Performance Based Road Contracting (OPRC), which underpins sustainability in road maintenance, is a major key decision adopted [2-3].

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