Selection of type of the pavement

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Abstract: This article presents a brief review on the current practice of the selection of the type of pavement for a given project. It identifies the complexities associated with the process.

Introduction

A brief review on the current practice of the selection of the pavement type is presented here. The pavements are primarily classified as bituminous and concrete. However, there can be different types of bituminous pavements (for example, thin or thick bituminous pavement with granular base, full depth bituminous pavement, perpetual pavement and so on); similarly, there can be different types of concrete pavements (for example, jointed plain concrete pavement (JPCP), jointed reinforced concrete pavement (JRCP), continuously reinforced concrete pavement (CRCP) and so on). Composite pavements are also possible (for example, bituminous pavement with cemented base, cement grouted bituminous pavement, white-topping on bituminous pavement and so on), where effort is being made to combine the advantages of both bituminous and concrete pavement (NPTEL 2006). Thus, the selection of a pavement type for a given project is an exercise of choosing one specific pavement design out of many options that are possible.

Selection of pavement type

The selection of pavement type is typically done by comparing the life cycle cost analyses (LCCA) of various pavement types (AASHTO 1993, FDOT 2013, Hallin et al. 2011, Wathne 2014). In LCCA, different cost components (for example, the agency cost (involving the cost of material, construction and maintenance over the analysis period, and the user cost) are considered and brought to a base year for comparison purpose (Hallin et al. 2011, Walls III and Smith 1998). Each type of pavement may involve different maintenance schemes, because of different (i) deterioration pattern (ii) type of maintenance action or, (iii) threshold values that prompt maintenance (refer Figure 1). It is a complex problem to decide the optimal maintenance scheme for a given pavement (Irfan et al. 2012), primarily because of the difficulty associated in predicting deterioration of pavement due to traffic repetitions and effect of environmental variations (Swei et al. 2015, Walls III and Smith 1998). If life cycle assessment (LCA) is performed, considerations of various environmental factors (for example, pollution caused and energy required during construction, noise during service period etc.) can also be included (Hallin et al. 2011, Muench and Anderson 2009, Mukherjee and Darrell 2011).

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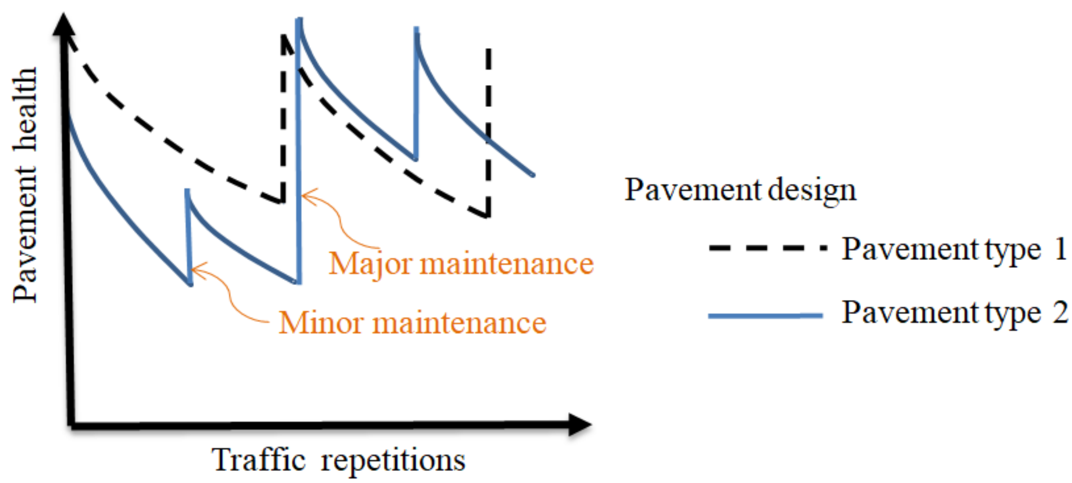

Figure 1: Various alternative designs and maintenance schemes are compared using LCCA

Besides the economic considerations, local conditions are also considered while deciding the pavement type. The local conditions may include, local availability of materials, equipment, experience and expertise (Hallin et al. 2011). Considering the specific site design conditions (for example, the condition of the subgrade, level of water-table, existing road geometry etc.), weather conditions (for example, freeze-thaw, rainfall situation etc.), or safety conditions, certain type of pavements may assume more weightage in the process of choice making (AASHTO 1993, FDOT 2013, Hallin 2011). The considerations involved in the selection of pavement type is schematically represented in Figure 2.

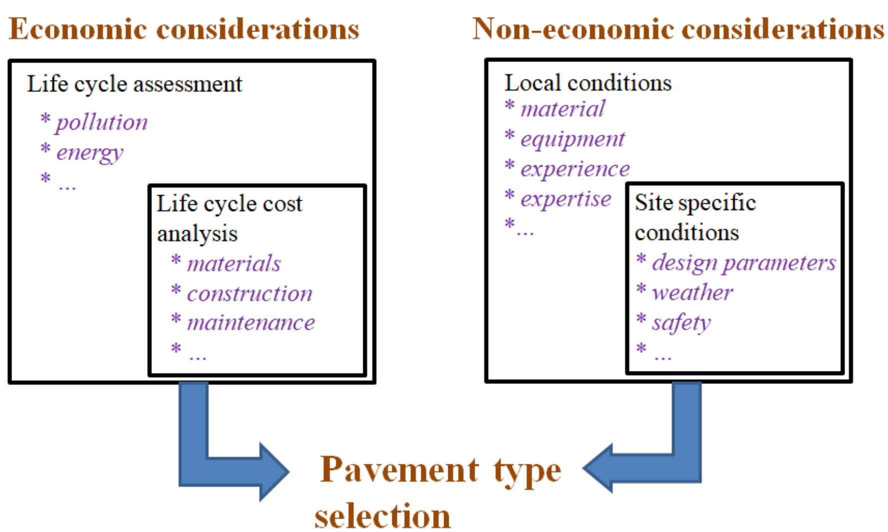

Figure 2: Considerations involved in pavement type selection

The type of contract (in construction and maintenance of the road), the market competition and the financing plan may also affect the decision on the choice of the type of pavement (Hallin et al. 2011, Wathne 2014). Thus, the considerations and the priorities may be different for the agency and the contractor (Gransberg et al. 2017, Hallin et al. 2011) while choosing a pavement type.

Closure

The selection pavement type is a complex task. As the review of limited literature suggests, it is primarily done based the life-cycle-cost analysis (LCCA).

However, at present a number of new materials are being developed for pavement applications (for example, bituminous mix with modified binder, warm bituminous mix, foamed bituminous mix, porous mix, fiber-reinforced mix and so on). With the advent of these new pavement materials, innovations are possible with the pavement design – in terms of the different types of layers that can be provided in a pavement structure (Das 2017). This gives rise to a number of design alternatives, even within a given type of pavement (concrete or bituminous) and each of these design alternatives may give rise to different levels of benefit in economic and non-economic terms (Das 2017, Wathne 2014). Further, sustainability considerations (for example, use of waste materials (Das and Swamy 2014), re-recyclability) are some of the emerging issues while choosing the best pavement type for a given project.

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