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Integrating Pavement Management System into Infrastructure Planning

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Pavement management system (PMS) utilizes the condition coding of roadways to determine maintenance, rehabilitation, and construction activities within an intended horizon; it includes the identification of optimum strategies and a maintenance/rehabilitation activity schedule to keep a paved road network serviceable based on optimization of benefits and minimization of costs at the network level. Practically, a PMS is a planning tool optimally prioritizing project activities to maintain a paved network based on pavement and surface deterioration models incorporating the effects of traffic and environmental ageing and other relevant physical factors.

Four crucial inputs, namely budget allocating to the proposed activities, planning horizons for projects, pavement distress models, and an updated database including ongoing roadway projects, very much determine the outputs from an implemented PMS. Proposed projects for pavement maintenance and rehabilitation initiated via the PMS usually falls within a few of the funding programs/categories depending on an agency's administration structure. On the other hand, many projects are actually initiated through various other programs/categories, such as traffic operational improvement, safety improvement, drainage improvements, or bridge/tunnel construction or retrofit program. All these proposed and ongoing non-PMS projects will directly or indirectly change the budget allocation to the proposed PMS projects and add new roadway information to the network database stored in the PMS. Updating the database continuously is one of the keys to derive good strategies from the PMS. The planning horizon for budget allocation may not coincide with the planning horizon for projects. The actual budget allocations in most programs, depending on the amount of fuel tax, bond issuance, other financial resources/means of raising capitals, often fluctuate with national or statewide economic conditions. As a result, the proposed optimal strategies need not match with the optimal ones that would be called for with the actual received funding. The planning horizon at project level, usually around 30 years, varies with agency's policy, vision, and the project significance, and can go up to 50 years or more. Physical modeling of pavement distress so far mostly remains at the mechanistic-empirical level. Upon the advancing of roadway materials and construction methods, careful monitoring of pavement distress and the calibration of physical models are needed to predict pavement distress development. These four important inputs/aspects in a PMS framework actually intertwine; but in reality they are sliced into various divisions/programs in an agency.

The State of California was among the first to adopt a PMS in 1979. The first PMS was based in a mainframe computer and contained provisions for an extensive database. With data updated from a biennial condition survey, District Maintenance Supervisors used the printouts from the PMS to confirm their suspicions regarding pavement deterioration and recommended maintenance or rehabilitation activities. The California PMS has been enhancing over time to include economic analysis capability and optimization at both project and network levels.

Code of Federal Regulation 23 CFR 500 published in 1996 added into the existed PMS three additional components: (1) Data collection and management; (2) Analysis, at a frequency established by the State, consistent with its PMS objectives; (3) Annual evaluations and upgrades as necessary in conformance with agency policies, practices, engineering criteria, and experience. Up till now, it appears that an adopted PMS still has to be improved and tailored to fit into the evolving infrastructure planning. A more effective and powerful PMS that can be well integrated into infrastructure planning may emerge as an infrastructure management system (IMS) in the future.