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Rigid pavement performance models by means of Markov Chains with half-year step time

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ABSTRACT

Pavement management systems employ pavement performance models to plan the most effective allocation of public funds. The most used models are the deterministic and the probabilistic or stochastic ones. Among stochastic models, the Markov Chains are receiving considerable research attention. In this paper, transition probability matrices (TPMs) are presented for Portland Cement Concrete (PCC) pavement road network in the Republic of Moldova with available International Roughness Index (IRI) data collected in spring and in autumn from 2013 to 2015. Although one-year cycle time is usually employed, half-year cycle time was defined to handle a bigger amount of

transitions. The aim of this paper is to prove that TPMs for rigid pavements can be developed using IRI values from a short period, with a half-year step time, for a road network where the time since last major rehabilitation varies in each section and where maintenance and rehabilitation activities are carried out simultaneously. In order to consider all these aspects, some assumptions must be made. Roughness seasonal variations can arise in PCC pavements due to the effect of curl and warp. Hence, a threshold of 0.40 m/km was defined as the maximum improvement on a section after half-year step for not being considered as maintenance work or spurious data. When the IRI value improves more than 4 m/km after one step, a rehabilitation activity is considered. That rehabilitation is not used in the matrix calculation, but the subsequent deterioration contributes. Results demonstrate that rigid road sections can jump two condition states in one transition, instead of only remaining in the same condition state or shifting to the next one. Obtained matrices give an overview of deterioration tendencies of rigid pavements, and they fit better to real data if a large proportion of no rehabilitated or maintained sections are compared to predicted values.