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Pavement Management for a Metropolitan Area: A Case Study of Montreal

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Abstract : Pavement performance models are based on projections of observed traffic loads, which makes uncertain to study funding strategies in the long run if history does not repeat. Neural networks can be used to estimate deterioration rates but the learning rate and momentum have not been properly investigated, in addition, economic evolvement could change traffic flows. This study addresses both issues through a case study for roads of Montreal that simulates traffic for a period of 50 years and deals with the measurement error of the pavement deterioration model. Travel demand models are applied to simulate annual average daily traffic (AADT) every 5 years. Accumulated equivalent single axle loads (ESALs) are calculated from the predicted AADT and locally observed truck distributions combined with truck factors. A back propagation Neural Network (BPN) method with a Generalized Delta Rule (GDR) learning algorithm is applied to estimate pavement deterioration models capable of overcoming measurement errors. Linear programming of lifecycle optimization is applied to identify M&R strategies that ensure good pavement condition while minimizing the budget. It was found that CAD 150 million is the minimum annual budget to good condition for arterial and local roads in Montreal. Montreal drivers prefer the use of public transportation for work and education purposes. Vehicle traffic is expected to double within 50 years, ESALS are expected to double the number of ESALs every 15 years. Roads in the island of Montreal need to undergo a stabilization period for about 25 years, a steady state seems to be reached after.

Keywords : pavement management system, traffic simulation, backpropagation neural network, performance modeling, measurement errors, linear programming, lifecycle optimization
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