Highway Asset Management

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Introduction

Background

In the presence of inadequate budgets and limited resources, it is of vital importance to operate, preserve and enhance the highway infrastructures in a cost-effective way.

Aim

The aim of this research is to develop a framework of decision making system for identifying the optimum maintenance and rehabilitation (M&R) strategy for a given highway network, under limited resources.

Work involved

Constructing a macroscopic traffic flow model;

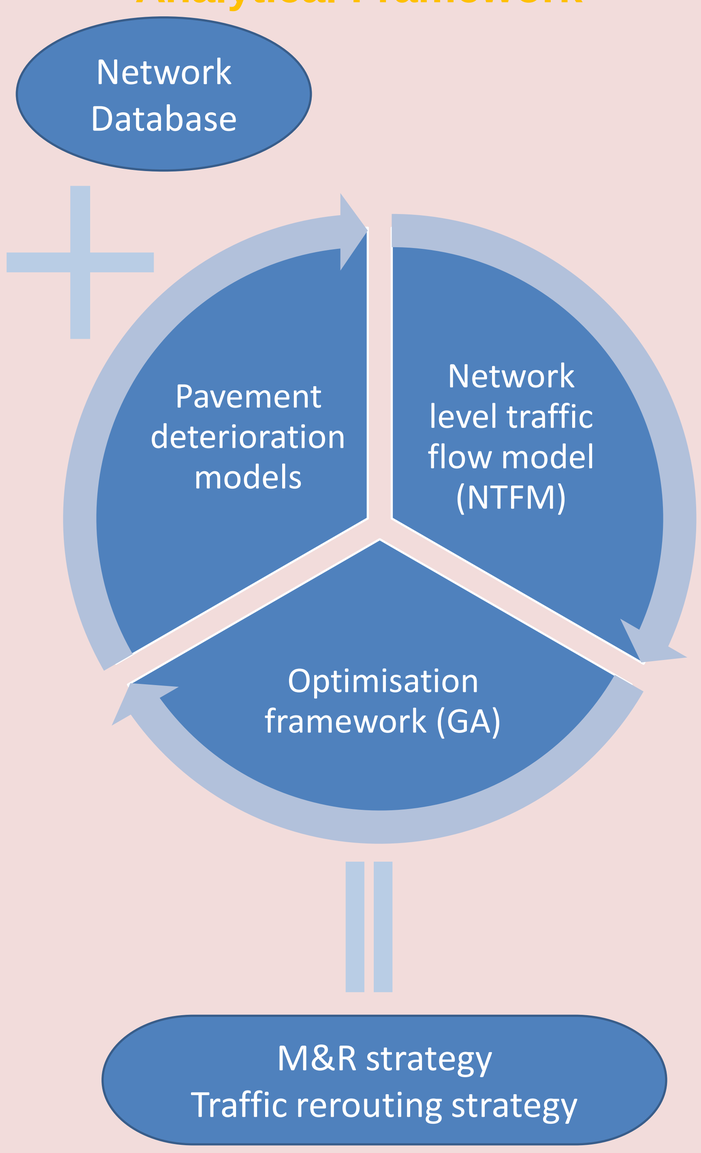
Selecting appropriate pavement deterioration models;

Deriving all combinations of M&R actions;

Embedding the traffic model within an optimization framework.

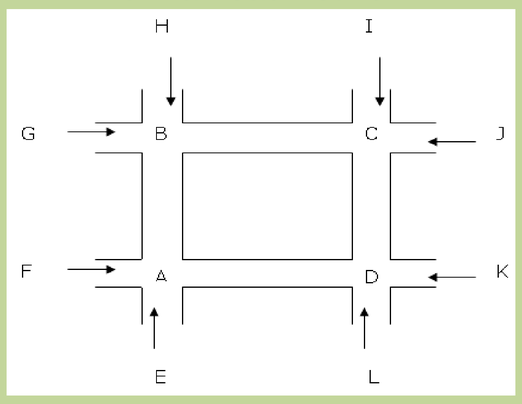
Methodology

Analytical Framework



Implementation

Normal road network



Nodes on the network can be any type of junction.

❖Inputs:

i. Inflows,
ii. Turning ratios at junctions,
iii. Junction flow capacity.

❖Outputs:

i. Outflows,
ii. Flow rates on each link,
iii. Queue length on each link.

❖Network performance Measures:

i. Aggregate queue length

$$QL = \sum_{k=1}^{K} q_k$$

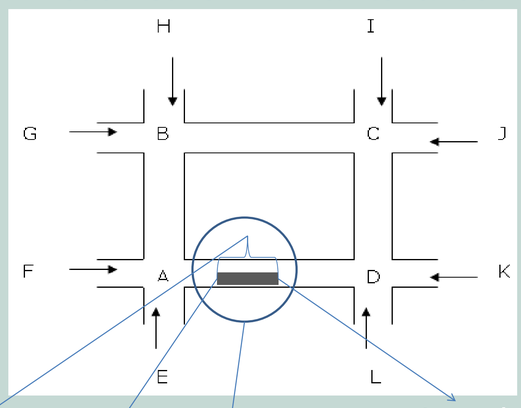
K- the amount of the road links

ii. Total travel delay

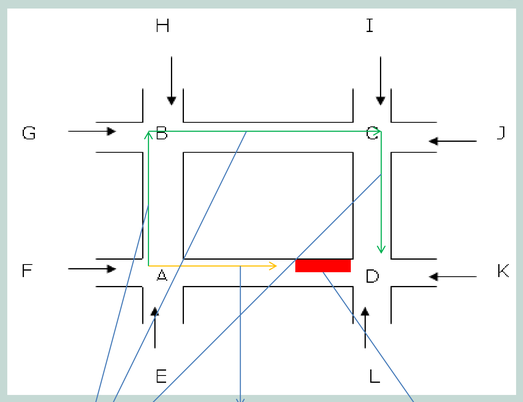
$$TDT(t_k) = \sum_{i=1}^{N} DT_i(t_k)$$

$$DT_i(t_k) = \int_{t_{k-1}}^{t_k} q(t)dt$$

Road network in maintenance



Road network with traffic rerouting



Conclusion and Future developments

❖This project developed a decision making system for managing highway infrastructures. Compared to other traffic models, NTFM accounts for both motorway and urban roads in the same road network reflecting the interactive nature of the two systems. Roadwork node is used to model worksite on the network, and traffic rerouting is taken into account so as to alleviate congestion.

❖Future work is concentrated on deriving the optimum M&R strategy for a given highway network under different constraints using GAs. Further case studies are required to test the software capability of the developed framework.