

TOP TEN

Antonios Georgantas
University of Cyprus

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Bi-objective MFD-based Staggered School Schedules Optimization for the morning commute problem

One of the major causes of road traffic congestion in urban transportation networks during the morning rush hour can be attributed to the fact that schools start at the same time. We consider two classes of commuters: in the first class, commuters are directed to the school their children are assigned to and subsequently depart towards their workplace, while in the second class, the commuters head directly to the workplace without pursuing intermediate stops. In their effort to head to their destination, both classes will unavoidably use the same part of the network at the same time, leading inadvertently to the formation of congestion. To remedy this shortcoming, this research proposes a novel macroscopic approach that regulates the start time of schools, anticipating the emergence of congestion during the morning commute.

The related problem is formulated as a Bi-Objective Mixed Integer Program (MILP) whose target is to jointly minimise:

- the Total Time Spent (TTS) of all vehicles inside the network;
- the associated overall mismatch between the initial and the shifted start time of each school located in the urban network.

We demonstrate through extensive simulation experiments that by properly selecting the school start time, we can shift the demand to less congested time periods and, as a result, alleviate the congestion. Macroscopic simulation results verify the efficiency of our linear approximation solution approach, being capable of retrieving close to optimal solutions identified based on an Exhaustive Search procedure in less than three minutes.

