NEW MODELS FOR THE BUS DRIVER SCHEDULING PROBLEM

CHALLENGES: Smart, green and integrated transport

PRODUCTIVE SECTOR: Transportation sector

PROBLEM DESCRIPTION

Let us consider a bus line with two terminals, where the set of tasks between the two terminals is given. The goal is to find the minimum number of bus drivers such that all tasks are assigned to a driver and the shifts of the drivers satisfy a set of constraints given by labor laws and the bus company.

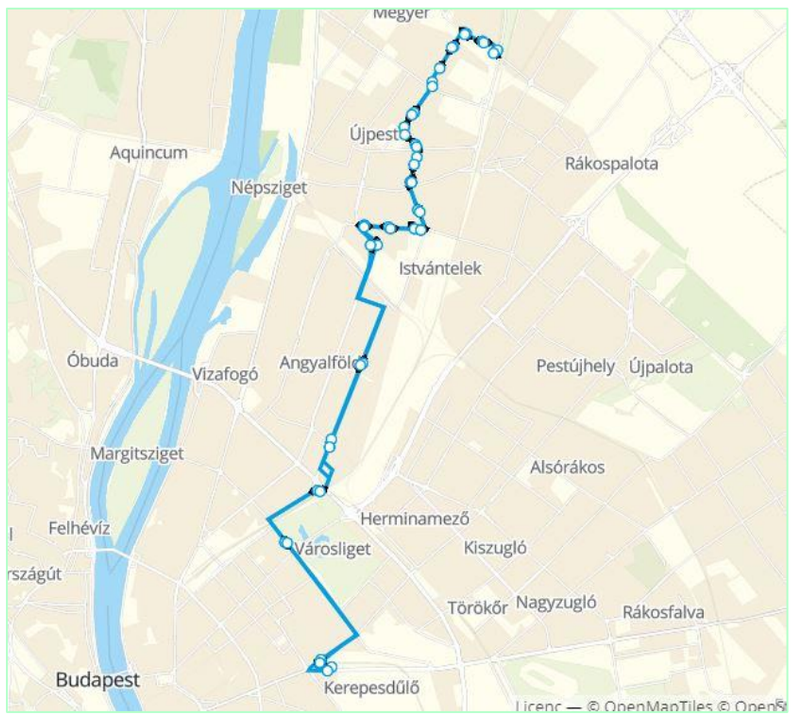
CHALLENGES AND GOALS

The goal was to introduce new algorithms that can determine solutions to the above problem efficiently. The models from the literature are not detailed enough to make it possible to handle the special constraints of this problem, i.e. another important goal was to bring theoretical models closer to real-life applications in this area.

MATHEMATICAL AND COMPUTATIONAL METHODS

A two-phase algorithm has been developed in order to determine a feasible solution to the bus driver scheduling problem. We have to solve mixed integer programming problems in both cases. The aim of the first, simplified model is to determine an upper bound on the number of drivers. The second part considers this number as given, and provides a feasible schedule while minimizing the sum of working hours during the shifts.

We used the XPRESS-Mosel Optimization Software to solve the mixed integer programming problems and tested the models on bus line 20E between Keleti pályaudvar and Káposztásmegyer in Budapest, Hungary.



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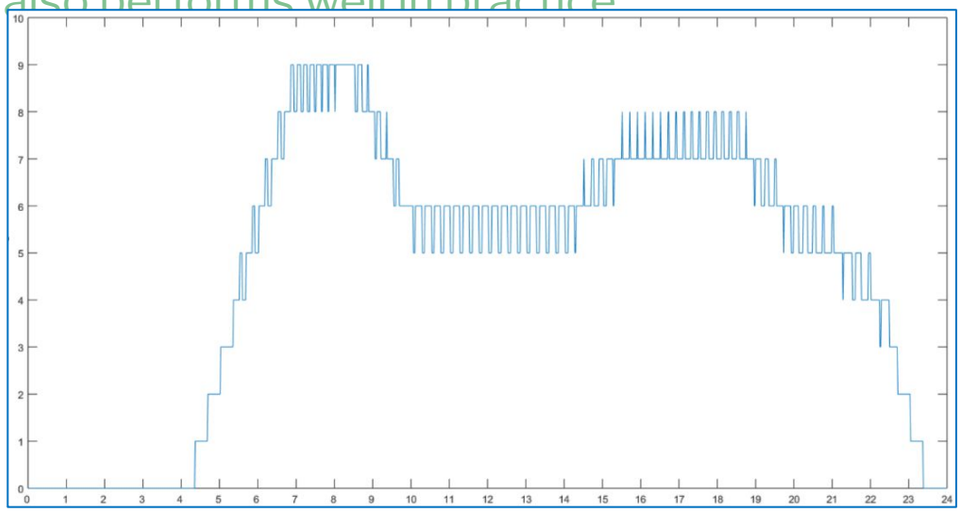
Results and Benefits

Using the new mathematical models we could develop better quality solutions to the bus driver scheduling problem using interval covering approach. We could guarantee the fulfilment of specific conditions related to the shifts that have not been handled in the literature so far (breaks, split shifts etc.).

Based on the results of the numerical tests with bus line 20E we found that the method also performs well in practice.



Number of drivers needed over the time horizon

We introduced a new algorithm based on solving mixed integer programming models. Our numerical experiments with the data from bus line 20E indicate that this new methodology can provide high quality solutions, faster than the existing models from the literature.

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