

NEW MODELS FOR THE BUS DRIVER SCHEDULING PROBLEM

CHALLENGES

Smart, green and integrated transport

The Industrial Problem

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 labour laws and the bus company.

TRANSPORTATION SECTOR

BME Optimization Research Group



Developing optimization models, specialized algorithms for industrial applications in the area of public transportation, supply chain and human resource management.

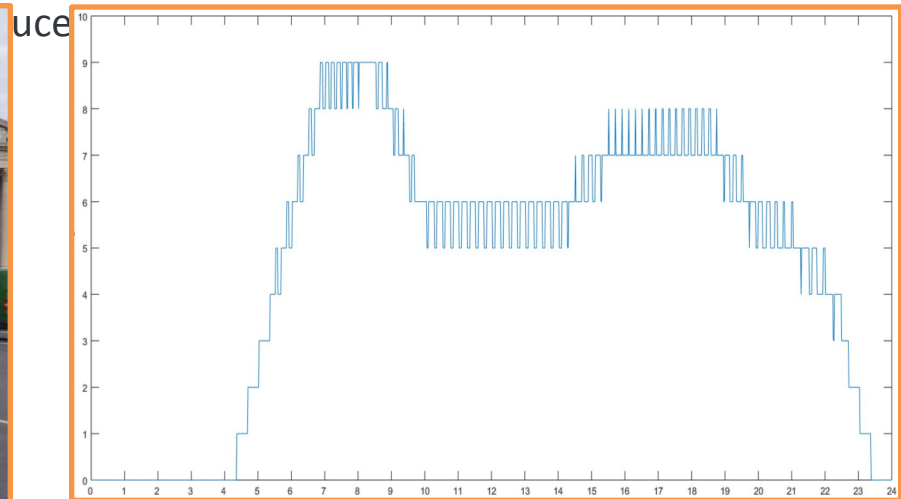
Research Group

NEW MODELS FOR THE BUS DRIVER SCHEDULING PROBLEM

Challenges & Goals



- To introduce new mixed integer programming models for the bus driver scheduling problem
- To build complex, detail-oriented models that can guarantee the fulfilment of special constraints that have not been handled in the literature before (breaks, split shifts etc.)
- To bring theoretical models closer to real-life applications



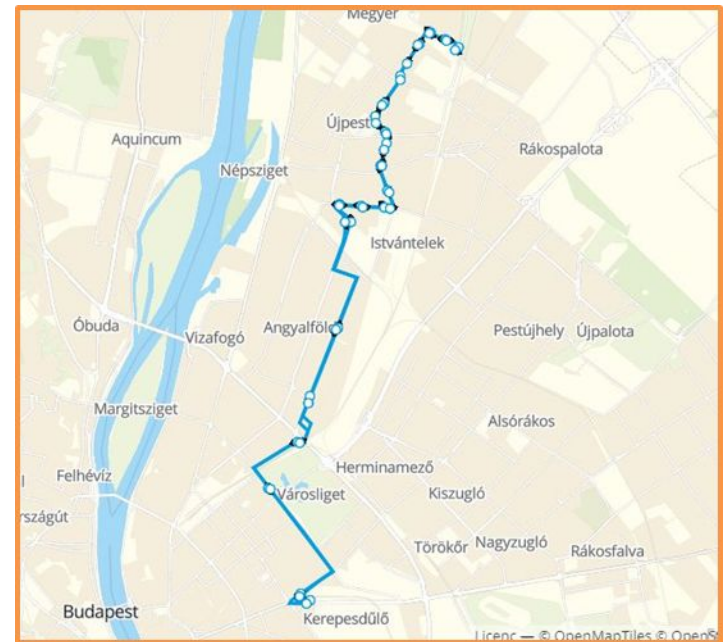
Bus 20E (Budapest, Hungary)

Number of drivers needed over the time horizon

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Mathematical and computational methods and techniques applied

- Different **mixed integer programming models** have been introduced in order to solve the problem.
- A two-phase algorithm has been developed based on the mixed integer programming formulations of two subproblems.
- The models and algorithms have been implemented using the **XPRESS-Mosel Optimization Software**.
- Numerical computations have been carried out using the data from **bus line 20E** between Keleti pályaudvar and Káposztásmegyer in Budapest, Hungary. The total number of tasks for a day was 81.
- The computations have been performed on a laptop with processor i5-8400 and with 8GB RAM.



Bus line 20E (Budapest, Hungary)

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Results & Benefits to the company

- We have developed new, complex mixed integer programming models that describe the real-life problem better than the previous models from the literature.
- Due to the applied reformulations, the new models and algorithms produce high quality feasible solutions in reasonable time.

		Number of drivers				
		18	19	20	21	22
Split shifts	1	-	-	8512	8399	9034
	2	-	-	8193	8320	8546
	3	-	8061	8137	8334	8320
	4	-	8188	8286	8282	7934
	5	7981	7887	8993	7817	8405
	6	7840	8113	7914	8010	8389

Numerical results (total working time of all drivers together within a day in minutes) for different parameter values (bus line 20E, Budapest)

A complex, detail-oriented description of a real-life problem; efficient solution algorithms