Transport for London – Student Project Bus Network Optimisation

There is an exciting opportunity for a M.Sc. student Transport and Planning (TP) or Transport, Infrastructure and Logistics (TIL) to do a student project in the Transport Modelling team of Transport for London (TfL).

Research description

TfL is a local government body responsible for the transport system in the Greater London Area (GLA). The Mayor's Transport Strategy (MTS) sets the objective that 80% of all journeys in London in 2041 must be made using sustainable modes. London's bus network, as most flexible, most affordable and densest form of public transport, plays a key role in reducing car dependency and contributing to this target as set out in the MTS.

The current strategy for bus network development is to redistribute resources from inner to outer London, to reflect changing demand patterns. Bus demand in central London is expected to continue to decline, with the availability of new and upgraded rail services. Outer London bus demand is however expected to increase, as the potential for modal shift and housing growth in the largest in outer London areas.

Over the last years, many bus network changes have been proposed on a case-by-case basis for one or a couple of bus routes. This project aims to take the reshaping of London's bus network to the next step, by developing an optimisation-based approach to optimise routes and headways of the integrated bus network simultaneously, based on future bus demand forecasts.

This work requires using existing bus demand data (from ODX / Busto) and modelled future demand data (from Railplan) as input. The research problem should be formulated as optimisation problem and solved by applying optimisation methods or metaheuristics (e.g. simulated annealing, genetic algorithms). The proposed bus network changes should be clearly visualised using GIS. This project uses the method as developed in the following research as basis:

Gkiotsalitis, K., Wu, Z., Cats, O. (2019). A cost-minimization model for bus fleet allocation featuring the tactical generation of short-turning and interlining options. Transportation Research Part C, 98, 14-36.

Expected outcomes

The project should result in a proposal for an optimised bus network for one or more boroughs of London, or for the complete GLA (≈675 bus routes and 9,300 buses). This proposal should consist of:

- A proposal for all bus routes (full lines and short turning lines) with their corresponding frequency.
- An evaluation of the impact of this bus network on passenger journey times and bus kilometres, and a comparison with the performance of the existing bus network.

Skills required

This project requires the following skills:

- A solid understanding of public transport planning and modelling (e.g. OmniTRANS, EMME, CUBE).
- Demonstrable knowledge of, and experience with applying optimisation methods and metaheuristics, for example using CPLEX, Gurobi or Python.
- Fluent programming skills, preferably in Python or R.
- Experience with handling and processing large datasets.
- Being fluent in the English language.

Practical

- This is a full-time project of 8-10 weeks duration, which can result in 10EC as Elective course.
- Preferred start date is begin / half February 2020, with end date begin / half April 2020. There is some flexibility regarding the start date.
- The student is expected to work (almost) full-time from TfL's headquarters in London. There is some flexibility for working from home, or working the last couple of weeks (when writing up the research results) from another location.
- Unfortunately, TfL does not provide any internship payment or travel or living cost reimbursement. A travel pass for travelling within London might be provided.
- The student should be eligible and allowed to travel and stay within the UK for the aforementioned time.
- Supervision will be by Oded Cats (TU Delft) and Menno Yap (TfL).

Contact

- For more information or expression of interest, please contact Menno Yap: M.D.Yap@TUDelft.nl
- Interviews with candidates will take place on the 13th and 20th of December 2019 at the TU Delft.