Performance Evaluation of Sydney Coordinated Adaptive Traffic System (SCATS) for Non-Lane-Based Heterogeneous Traffic in the Asia-Pacific Region using Microscopic Traffic Simulation

Master‘s Thesis of Maryna Pobudzei

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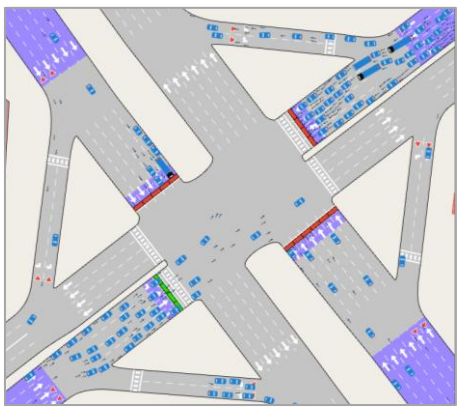
Adaptive traffic control systems are one of the tools which are believed to bring value in dealing with traffic-related challenges. In real-time, these systems adjust control parameters based on the existing traffic demand. As most of these algorithms originate from developed countries, they consider orderly vehicles’ movements in separate lanes and neglect heterogeneous traffic composition. The traffic environments in developing countries are characterized as mixed and dynamic, with a particularly high share of two- and three-wheeled motorized vehicles, short lateral distances, and lack of lane discipline. This study aimed to explore whether one of the world-spread adaptive traffic control techniques, SCATS (Sydney Coordinated Adaptive Traffic System), could be a suitable engineering solution for the non-lane-based heterogeneous areas. The purpose was to evaluate if SCATS adaptive control can improve the current and future traffic performance in the heterogeneous areas in terms of reduction of queue lengths, total delays, number of stops, and travel times in comparison to the fixed-time control that is currently operating on-site.

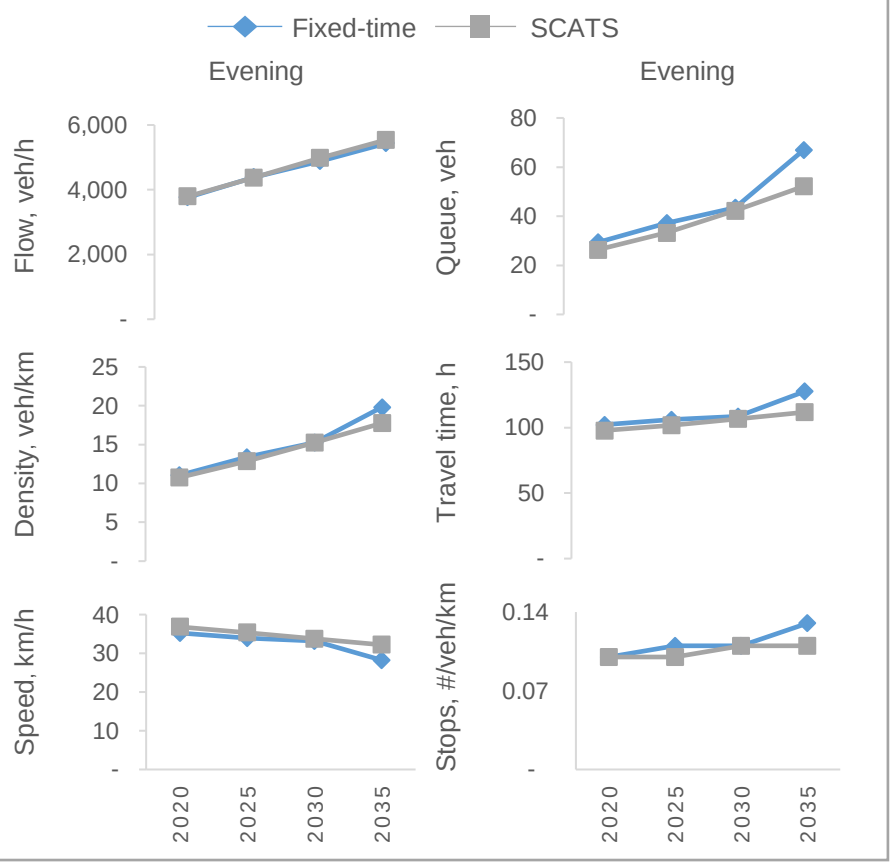
AI-based video
for traffic data collection
and processing

Aimsun Next 20
for modeling
non-lane-based
heterogeneous behavior



The study focuses on the three intersections in Hanoi (Vietnam), Ahmedabad (India), and Bangkok (Thailand). Real-world data concerning traffic counts, composition, turning movements, and current field time signaling were captured via AI-based analytical tools. Aimsun Next 20 enabled the representation of the selected sites through the microscopic simulation models. SCATSIM “software-in-the-loop” control logic was applied to the traffic simulations to evaluate SCATS performance against currently operating fixed-time programs in the non-lane-based conditions. A range of traffic demand scenarios was designed to ascertain the long-term benefits of SCATS concerning increasing traffic demand in the selected regions. The results of this study demonstrated that SCATS might outperform the existing fixed-time control programs in cases when fixed-traffic control is not customized and calibrated to the traffic demand fluctuations. The positive effects associated with SCATS could not be attained automatically and each project should be evaluated separately.

Example of traffic performance assessment at the intersection in Bangkok, Thailand



Depending on the pre-defined settings in the traffic personality files which should be thoroughly adjusted to the specialties of an environment, the adaptive control algorithm might bring positive results also in the long term considering the increasing demand. As the standard deviation in the simulation outcomes was rather high, the results of the study were not seen as statistically significant. Network coordination, which is one of the most important SCATS features, was not tested in this study. The hypothesis that “green wave” and adaptive offset adjustment could bring further improvements to the traffic performance in the non-lane-based sites should be deliberately tested.