Transportation Management and Operation

Qing MENG a, Jing SHI b

a Department of Civil and Environmental Engineering, National University of Singapore, 1 Engineering Drive 2, E1A 07-03, 117576, Singapore; E-mail: ceemq@nus.edu.sg
b Department of Civil Engineering, Tsinghua University, Haidian District, 100084, Beijing, China; E-mail: jingshi@tsinghua.edu.cn

This issue comprises seven papers focusing on the transportation management and operation problems in Asia including road traffic (three papers: Alhajyaseen et al.; Meng and Weng; Ryu et al.), surface public transportation (two papers: Tu et al.; Kariyazaki et al.), and air transportation (two papers: Hirata et al.; Akebayashi and Ishikura). Their academic contributions and practical significances are summarized below.

1. ROAD TRAFFIC

Human-friendly traffic management and operation is emphasized by Alhajyaseen et al., who discussed how to better design traffic signals considering the existence of pedestrians. Meng and Weng examined how to realize much more smooth traffic operation during road maintenance, where work zone configuration and heavy truck traffic are especially analyzed. Aiming at a better design of toll roads, Ryu et al. investigated travel time reliability by explicitly incorporating the influence of network uncertainties. Simulation techniques are creatively used by these three papers. Alhajyaseen et al. jointly applied two types of simulation software, i.e., Synchro/SimTraffic for estimating vehicular traffic delay and NOMAD for estimating pedestrian flow delay, to deal with the conflicts of car traffic and pedestrian flow for multi-modal traffic signal operation in metropolitan areas with heavy pedestrian flow. In the simulation, an activity-based approach is adopted to reflect pedestrian’s walking behavior at different parts of routes for crossing an intersection. The case study was done at a sequence of intersections in Nagoya City, Japan. Aiming to evaluate the effects of the activity area length, transition area length, traffic flow, and heavy vehicle traffic flow on traffic delay at work zones, Meng and Weng developed a heterogeneous cellular automata model that improves the way to describe interactions between different types of vehicles and work zone configuration in a more efficient computational manner. A case study was implemented at a six-lane two-way arterial road. This study provides a promising methodology to scientifically support decisions on the management of road maintenance projects and as a result, won the Best Paper Award for “Methodological Development” at the 9th EASTS Conference in Jeju, South Korea. Focusing on the toll design problem, Ryu et al. developed a simulation-based genetic algorithm to solve the stochastic bi-level programming problem, where the upper level subprogram is to determine the optimal link tolls and the lower level deals with the user-equilibrium problem with elastic demand. Five types of travel time reliability measures are separately incorporated in the upper level problem.

2. SURFACE PUBLIC TRANSPORTATION

To realize smooth traffic management and operation, the role of surface public transportation systems must be emphasized and given a higher priority in policy agenda than road traffic.
Considering the ever-increasing car traffic flow, it is becoming more and more important to introduce bus exclusive and priority lanes and effectively operate them under various traffic conditions, which has however been received little attention in literature. This was analyzed based on a simulation approach by Tu et al., who made full use of the PARAMICS software to compare the performance of three popular types of bus lane operation in a local Japanese city. They found that bus priority lanes are better than exclusive bus lanes and ordinary lanes in mitigating the negative impacts on car traffic. In contrast, exclusive bus lanes perform better than other types of lanes when car traffic flow on main streets is low and there are more bus users. It is recommended that the long-term effects of bus lane operations should be clarified.

Similarly, railway systems also play an ever-increasing role in meeting massive mobility demand, especially in Asian megacities. A novel method of reducing the delay in train operation was proposed by Kariyazaki et al. Targeting the operation of railway system in Tokyo metropolitan area, which is now operating very close to its capacity, but has a much better reputation of travel time reliability of railway systems than that in other countries, Kariyazaki et al. examined how to further improve the train operation from the recovery of knock-on delay based on a simulation model, where interactions between trains under high frequent operation are explicitly represented. It is found that keeping a moderate separation between trains under the delay situation is more effective to shorten the running time and recover the train delay earlier.

3. AIR TRANSPORTATION

Air transportation systems are indispensable to any country for supporting the ever-increasing competition in the global market. Two major challenges are addressed: improvement of existing airports (Hirata et al.) and impact analysis of low cost carriers and efficient management of multiple airport systems (Akebayashi and Ishikura). Focusing on the Haneda Airport in Tokyo, Japan, Hirata et al. developed the first analytical runway capacity model for airports with multiple interdependent crossing runways in literature. The capacity is calculated based on a Monte-Carlo simulation, where occupancy time by all sequences of departure and arrival aircrafts in different crossing runways is incorporated. Hirata et al. empirically clarified the importance of sequencing strategy in the Haneda Airport, which started the operation of its fourth runway in October 2010 and now has two sets of open-parallel runways with crossing layout. Motivated by the rapid growth of low cost carriers in the Eastern Asia international passenger transport market, Akebayashi and Ishikura examined their impacts on the market by building a Stackelberg games based bi-level air transport market model, which includes a stochastic user equilibrium submodel for capturing passenger flows and a profit maximization submodel for calculating carriers’ profits. The case study of the Osaka-Korea international market, where three airports are concentrating in Osaka region, suggests that the entrance of low cost carriers improves passengers’ utility, but leads to a serious loss of legacy carriers’ profits. It is also revealed that to protect legacy carriers’ shares, re-internationalizing the Osaka-Itami International Airport, conditional on legacy carriers’ efforts of reducing their operation costs, might be required to put into the Japan international air transport policy agenda.