

On-line Simulation Model for Traffic Control System of Hanshin Expressway and Enhancement of its Validity Using Dynamic Observations

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Since 2002, Hanshin Expressway in Japan has utilized a Mesoscopic traffic simulation system called HEROINE (Hanshin Expressway Real-time Observation-based & INtegrated Evaluator), in order for making traffic control more efficient and effective. This paper is aimed at explain the outlines and expected functions of HEROINE and the recent attempts to enhance the validity of simulated traffic condition utilizing ETC (Electric Toll Collection) system data. ETC system is regarded as one of key ITS sub-systems in Japan to especially mitigate congestion on expressway network.

HEROINE is designed to enable real-time traffic simulation for the purpose of supporting routine traffic control operation in online manners, examination of lane restriction plans required for maintenance and construction, and decision-making on countermeasures for traffic control and operations in offline manners. HEROINE is composed of five modules: Demand Estimation module, Demand Aggregation/Distribution module, Flow module, Route Choice module and Traffic Control module. The structural features mentioned above enable HEROINE to explicitly consider the reactions of expressway users, such as changes in route choice, to the various countermeasures including dynamic information provision, inflow control and so on.

It is clear that provision of more accurate OD data as input of simulation system leads to enhancement in validity of simulated traffic condition. Recently more than seventy percent of users of Hanshin Expressway pay their toll by ETC system, and hereby ETC system is expected to provide the traffic control system with useful information such as dynamic OD information. However, since a certain amount of users still pay their toll in cash, it is impossible for us to obtain whole dynamic OD data including trip made by users paying toll in cash. Accordingly, we propose a methodology to estimate the dynamic OD data using the information obtained from ETC system so that the error between the observed inflow/outflow at ramps and the estimated ones should be minimized. Some cases of numerical examples for network of Hanshin Expressway suggest that using the estimated OD as the input data of HEROINE leads to a drastic improvement in validity of simulation results.