Our Transportation System is in Crisis – 231

As traffic problems continue to increase, as society becomes more concerned about traffic-related issues, and as computer processing power continues to increase dramatically, a leading emerging technique for traffic analysis has been computer simulation modelling of traffic. Traffic simulation is the replication of actual traffic conditions observed on roadways.

The ability to accurately reproduce traffic behaviour is dependent on the calibration process of the software to effectively capture road user behaviour and vehicle acceleration characteristics. Calibration is the process of adjusting the output of the simulation in order to match a set of actual conditions, within an acceptable level of accuracy. Of course, gathering of suitable data is key to traffic analysis.

Calibrating a simulation model is an important step and requires method and rigour—and a proportion of a project's time—but it should be a well-structured process free from obscurity. All calibration parameters (that is, the factors that support the input components) should have an intuitive, real-world meaning and be thoroughly documented. There should be enough parameters to do a good job of matching real-world data but not too many to turn the calibration process into a vicious cycle.

Practical applications of traffic simulation include assessment and testing of measures such as:

- Mobility plans;
- Traffic control plans and signal optimisation;
- Modelling highways and urban networks with driver behaviour models that are sensitive to complex inter-vehicle interactions in merging areas and intersections;
- Modelling roundabouts that capture the unique interactions between vehicles entering and vehicles inside the roundabout;
- Modelling high occupancy vehicle (HOV) lanes, bus lanes and toll facilities to better understand their effects on traffic system dynamics;
- Modelling evacuation plans and scenarios for response to natural disasters, hazardous spills, and other emergencies;
- Modelling work zones to manage traffic during construction and maintenance projects;
- Support system for public transport management including, lines, stops and terminals, reserved lanes, time dependent time tables, transit pre-emption in control plans;
- Impact analysis of Infrastructure modifications;
- Traffic management actions including, lane or turning closure, speed modification, force turning, re-routing, and control plan change;
- Application of traffic management strategies or Conditions (sets of actions): to the whole simulation, or to a time period, or based on attributes, and,
- Pedestrian simulation including, at intersections without protected pedestrian phase, and at public transport terminals, such as City Gate.

Traffic simulation can therefore be a very useful tool to (1) Compare scenarios of proposed traffic management schemes, (2) Avoid the typical "trial and error" approach to implementation of traffic improvement measures, (3) the opportunity to review multiple outputs for technical assessment and cost/benefit analysis, and (4) the opportunity for improved presentations of the various scenarios through images and real-time video demonstrations, and other formats that could be more easily understood by the decision-makers.

Singapore has a simulator model for 10,580 intersections and 4,483 km of traffic lanes, and it runs at 2-3 times faster than real time. A model of Barcelona city centre with a typical 1-hour demand micro-simulates in 1 minute (60 times faster than real time).

Pedestrian modelling is a new component of traffic simulation modelling. It enables traffic engineers and planners to model how vehicles and pedestrians interact at crossings, public transport (transit) stops and taxi ranks (stands).

The insights from modelling can inform important decisions, directly leading to improved public safety, reduced congestion and smoother multi-modal journeys.

I feel privileged to have facilitated a recent traffic simulation training course for technical staff at the Ministry of Works and Transport. With practice, these officers can become proficient in the traffic simulation software and associated techniques. More importantly, they would be able to assess the likely effectiveness of proposed plans, thus avoiding ad hoc approaches, and minimizing trial and error 'line drawing' suggestions. An appropriately organised and scheduled data collection programme is critical, but woefully lacking. The recently installed East-West Corridor traffic surveillance and master control system can assist with this shortcoming, and hopefully this database is being made available for traffic analysis.

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