Tech Brief

Operational Improvements at Traffic Circles

Need a solution?
Think Jersey DOT

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BACKGROUND

- There has been an increasing interest in improving traffic circles to address congestion and safety problems. Several states are in the process of exploring effective operational alternatives for enhancing the safety and efficiency of traffic circles built in the early 20th century.

- Many traffic circles were designed to handle lower traffic volumes than today's volumes. These traffic circles need to be improved because they are faced with increasing congestion and safety problems.

- Although the replacement of these traffic circles with more efficient interchanges appears to be a viable option, time and money needed for the construction of alternative designs can be prohibitive. An alternative option would be to upgrade the circles until they can be totally rebuilt.

- NJDOT is interested in modifying three circles in New Jersey: Collingwood Circle, Brooklawn Circle and Asbury Circle.

- These circles are not roundabouts, but they are traffic circles with unusual operational and geometric designs. The priority rule that governs the roundabout traffic operations (i.e. yield at entry rule) does not always apply to these circles.

HERE’S THE PROBLEM

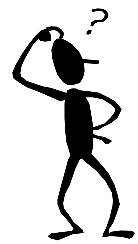
- To assess the benefits of the operational alternatives at these circles, reliable microscopic traffic simulation models of the current and proposed designs of the circles are required.

- Many standard simulation packages do not have reliable gap acceptance behavior of vehicles at traffic circles. Correct modeling of vehicles' gap acceptance is important since the operational efficiency of a circle is governed by how vehicles accept and reject gaps.

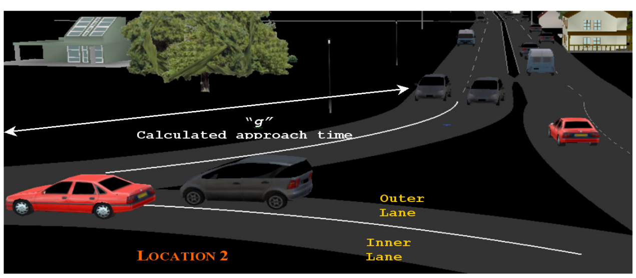
THE SOLUTION

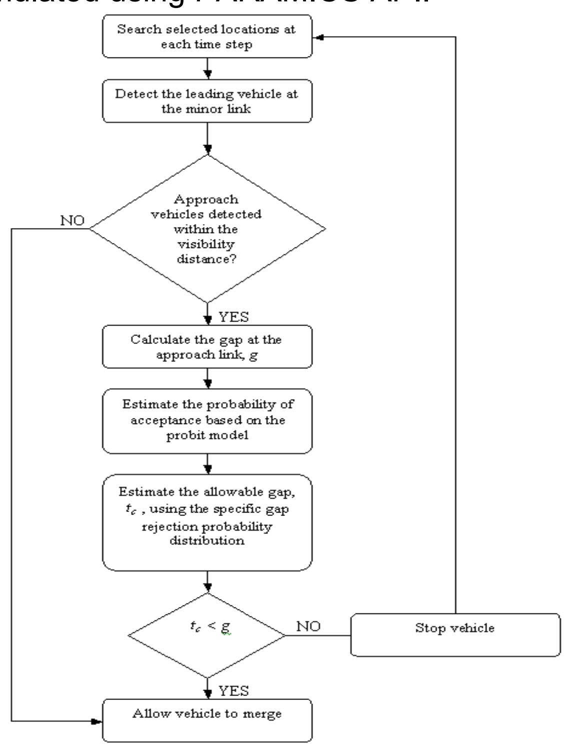
- We propose the use of PARAMICS traffic simulation software.
- PARAMICS is used to model the movement and behavior of individual vehicles on urban and highway road networks. It allows users to customize many features of the underlying simulation model through Application Programming Interfaces (API).
- PARAMICS API allows users to build and simulate their own site-specific gap acceptance models.

BUT HOW CAN IT BE DONE?



- Traffic data collection can be collected at each traffic circle and the data then can be extracted for each yield and stop sign.
- Using the data, vehicles' gap acceptance behavior can be modeled at yield and stop signs.
- These gap acceptance models can then be simulated using PARAMICS API.





THESE ARE OBJECTIVES…

- Develop location-specific gap acceptance models for each circle using field data.
- Estimate gap acceptance models using known statistical methods.
- Develop the simulation models of Collingwood, Brooklawn and Asbury circles in PARAMICS

- Simulate the traffic circles in PARAMICS using the estimated gap acceptance models.

- Evaluate the efficiency of proposed modifications to the three selected traffic circles in terms of congestion and safety.

- Conduct a cost-benefit analysis to determine if the proposed modifications are financially viable.

HERE IS WHAT WE DID…

- The research team collected traffic data at the three selected traffic circles. Data were collected using a portable tower video surveillance system (POGO) which has two dome cameras and two infrared cameras, and a portable mast with a Sony camcorder and an omni-directional camera.

- The recorded traffic data were then extracted. Data included hourly vehicle counts, inter-arrival times, wait times, and gap acceptance times of vehicles.

- Simulation models of each circle were generated in PARAMICS. The simulation models are validated and calibrated based on average wait time and average interarrival times.

FINDINGS

- The proposed design of the Collingwood circle does not adversely affect the congestion at the circle. Because the heavy traffic at the approaches has to yield to the circulating traffic in the proposed design, long queue times are observed in the simulation results. However, the overall efficiency of the circle is improved because the circle itself keeps operational as a result of lock-ups being removed.

- The simulation results show that the proposed design of the Brooklawn circle increases the overall network travel time, especially during the afternoon peak hours.

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