Research Report Summary

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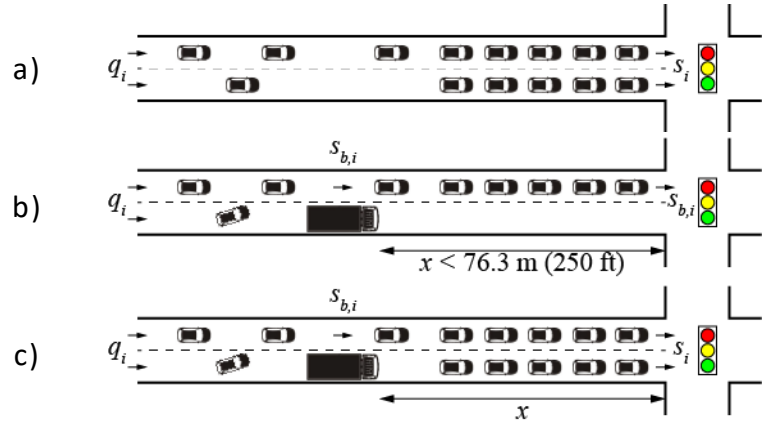
Evaluation of Urban Freight Deliveries using Microsimulation and Surrogate Safety Measures

Freight deliveries on signalized urban streets are known to cause lane blockages during deliveries. These disruptions to traffic contribute to delays and safety impacts associated with vehicle queueing and lane changes [1,2]. This study aims to quantify the relationship between the location of freight delivery along a block, the traffic demand, and the signal timings on delays and safety impacts.

Observations from 8th Avenue in New York City show that freight deliveries differ from other types of incidents and blockages:

- Stop locations are randomly distributed along the block
- Duration of deliveries is typically more than a signal cycle
- Blockages force lane changes to get around the delivery

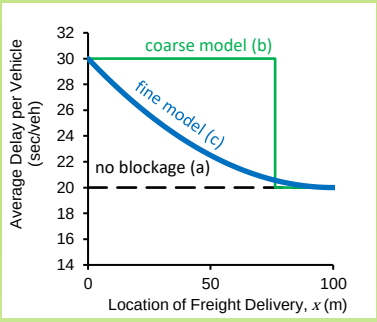


Three cases compared: a) no blockage, b) coarse model not using space in front of delivery, and c) fine model using space in front of delivery

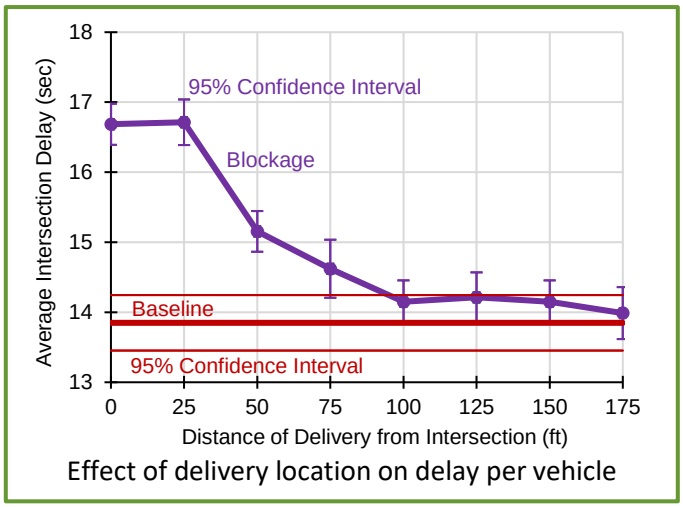
Delay and Surrogate Safety Data from Microsimulation

Freight delivery vehicles blocking lanes of 8th Avenue in New York City

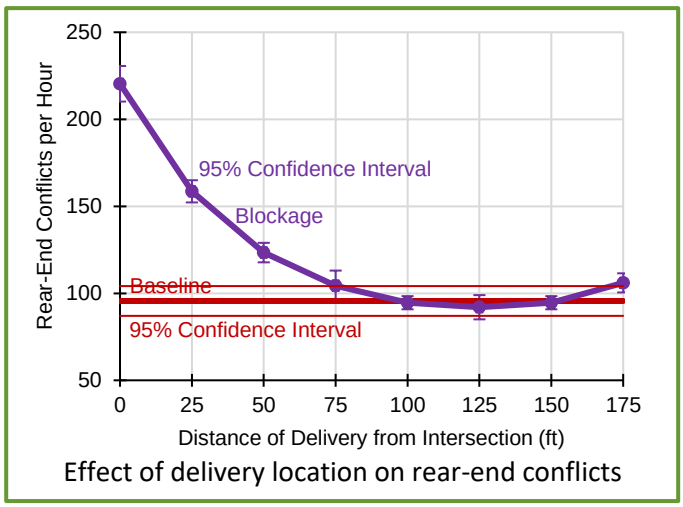
Aimsun microsimulation of 8th Avenue in New York City



Comparison of intersection delay under 3 cases considered



Effect of delivery location on delay per vehicle



Effect of delivery location on rear-end conflicts

The research method makes use of traffic flow theory to develop analytical estimates of the effect of freight delivery vehicles on traffic delays. The developed model characterizes the effect of freight deliveries in greater detail than current methods presented in the 2010 Highway Capacity Manual [3].

The findings for intersection capacity and delay show that the location of the freight delivery is an important determinant of delay, with the worst impacts for deliveries nearest the intersection. The patterns identified with analytical models are confirmed with simulation. The same simulation model was used to analyze vehicle trajectories with the Surrogate Safety Assessment Model (SSAM) [4]. The results show that the number of rear-end and lane-change conflicts follow a similar pattern, with the greatest number of conflicts associated with freight deliveries nearest the intersection.

"Moving freight deliveries to the middle of the block has the potential to reduce traffic delays by more than 15% and reduce vehicle conflicts associated with safety risk by more than 50%."

Current practice in most cities is to ban freight deliveries that double-park and block traffic lanes, but these costs are passed on to customers. Potential improvements for traffic delays (-18% in simulation) and safety (-56% rear-end conflicts; -74% lane-change conflicts) can be achieved by incentivizing deliverers to stop near the middle of the block. Furthermore, a model is introduced to optimize traffic signals with real-time information about freight delivery locations, which can increase the capacity of intersections to prevent queue spillbacks. Opportunities to improve delays and safety exist through management of urban freight deliveries.

References

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2. Ambrosini, C., & Routhier, J.-L. (2004). Objectives, methods and results of surveys carried out in the field of urban freight transport: An international comparison. *Transport Reviews*, *24*(1), 57–77.
3. Transportation Research Board (2010). *Highway Capacity Manual*. Washington, D.C.: Transportation Research Board of the National Academies.
4. Pu, L., Joshi, R. (2008). Surrogate Safety Assessment Model (SSAM): Software User Model (FHWA-HRT-08-050). Washington, D.C.: Federal Highway Administration.

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