

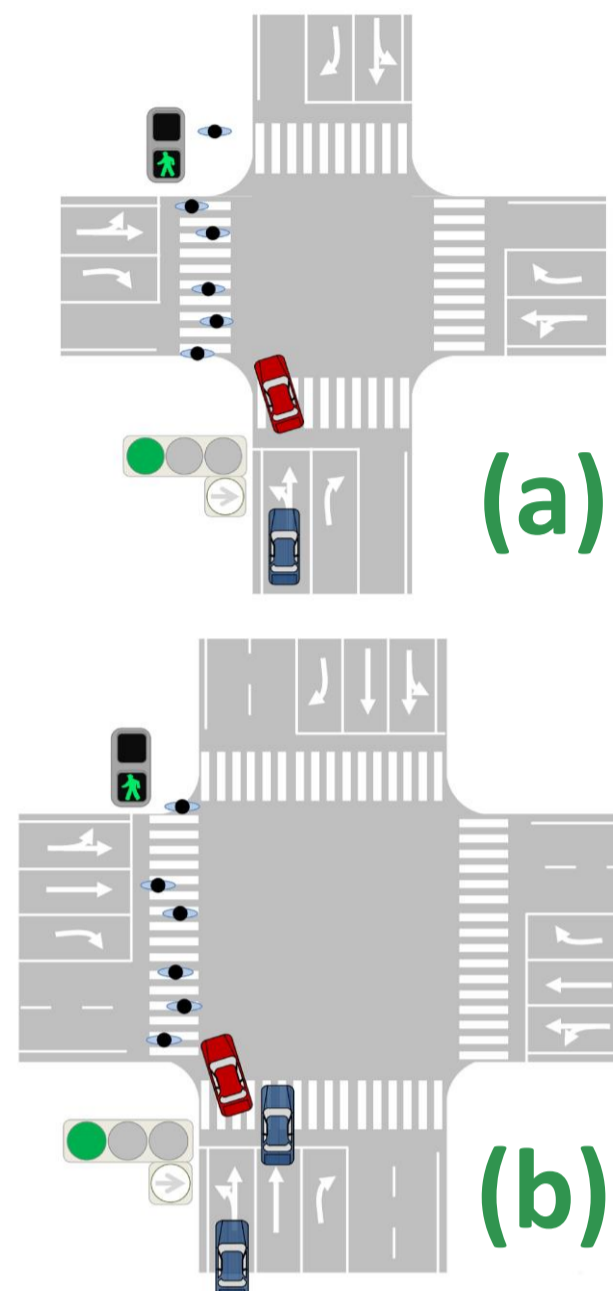
Impact of Randomness on Delay and Oversaturation in Shared Left-turn Lane

左直混用車線におけるランダム性が遅れと過飽和の発生に与える影響

By Azusa TORIUMI, Shaoluen HUANG and Takashi OGUCHI

1. Introduction

- Shared left-turn (LT) lane is typically operated under the permitted phase with an adjacent pedestrian crosswalk in Japan.
- LT vehicles are disturbed by pedestrian and block following through (TH) vehicles, random arrival of such vehicles affects the performance of the intersection.



Research Gap: Only the average performance is evaluated while the randomness of LT vehicles largely affects the performance in each cycle.

Objective: To analyze variation due to randomness on delay and oversaturation in shared LT lane and understand the issue in existing evaluation methods.

2. Monte Carlo Simulation for Randomness

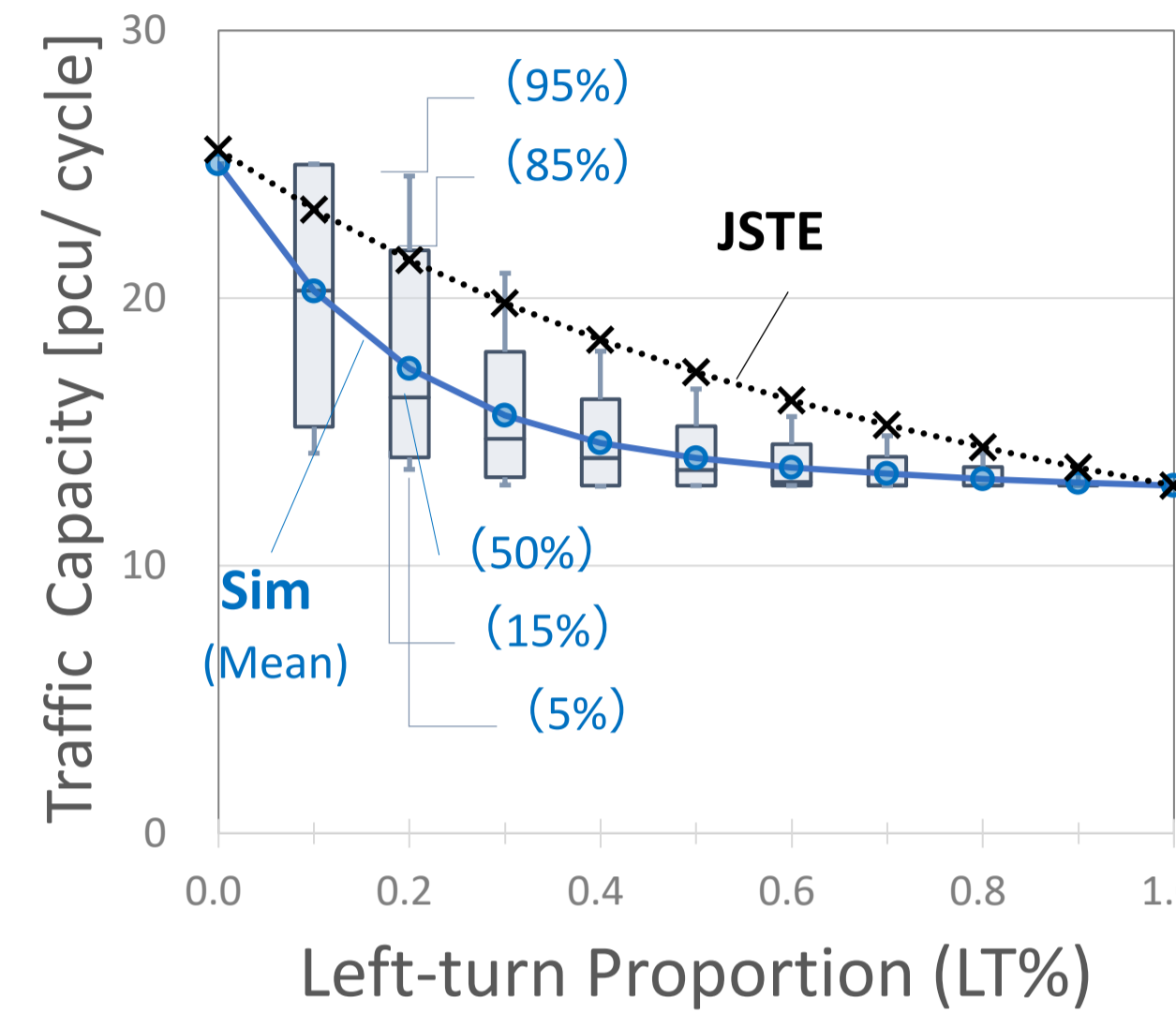
- Random arrival of LT vehicles based on LT%
- Green time divided into two stages:



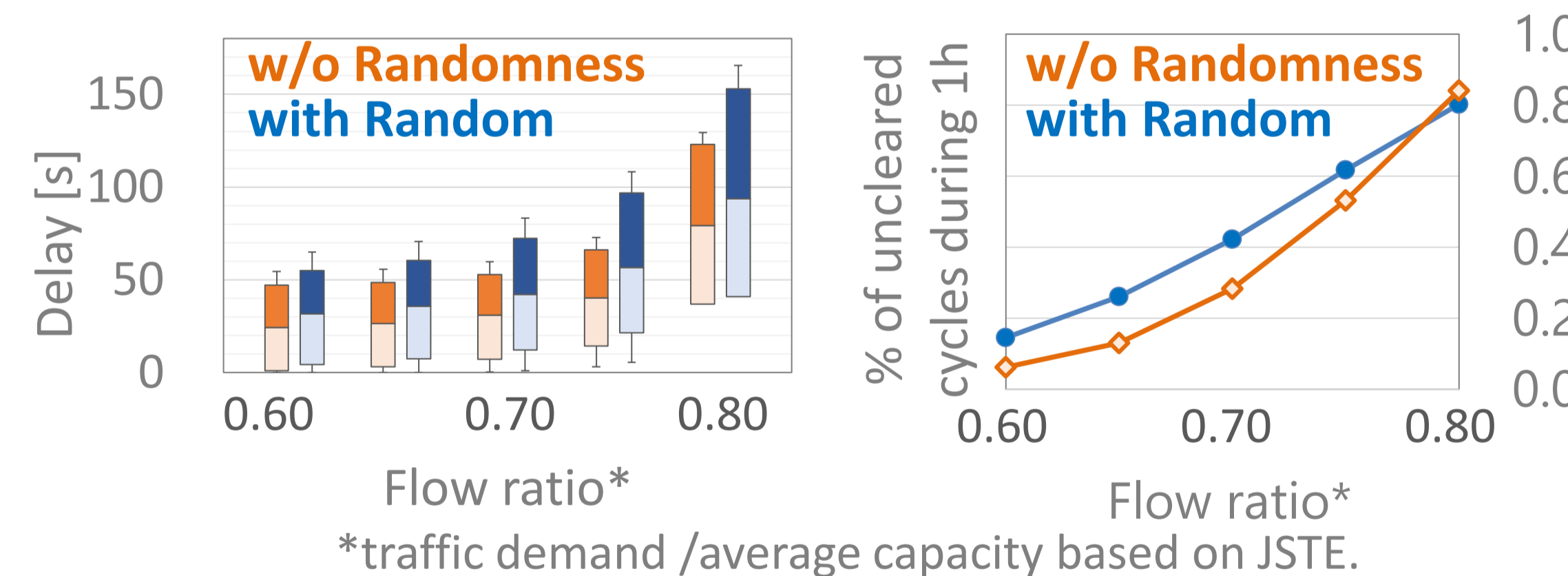
- 1- Pedestrian blocks completely LT vehicle, TH vehicle can pass until LT vehicle is blocked.
 - 2- No pedestrian, all vehicles can pass freely.
- Different departure saturation headway and start-up delay for LT and TH vehicles.

3.(a) Shared LT lane without exclusive TH lane

- Traffic capacity
 - Simulated average is smaller than estimation by JSTE.
 - The smaller the LT% is, the larger the variation of capacity by cycle is.

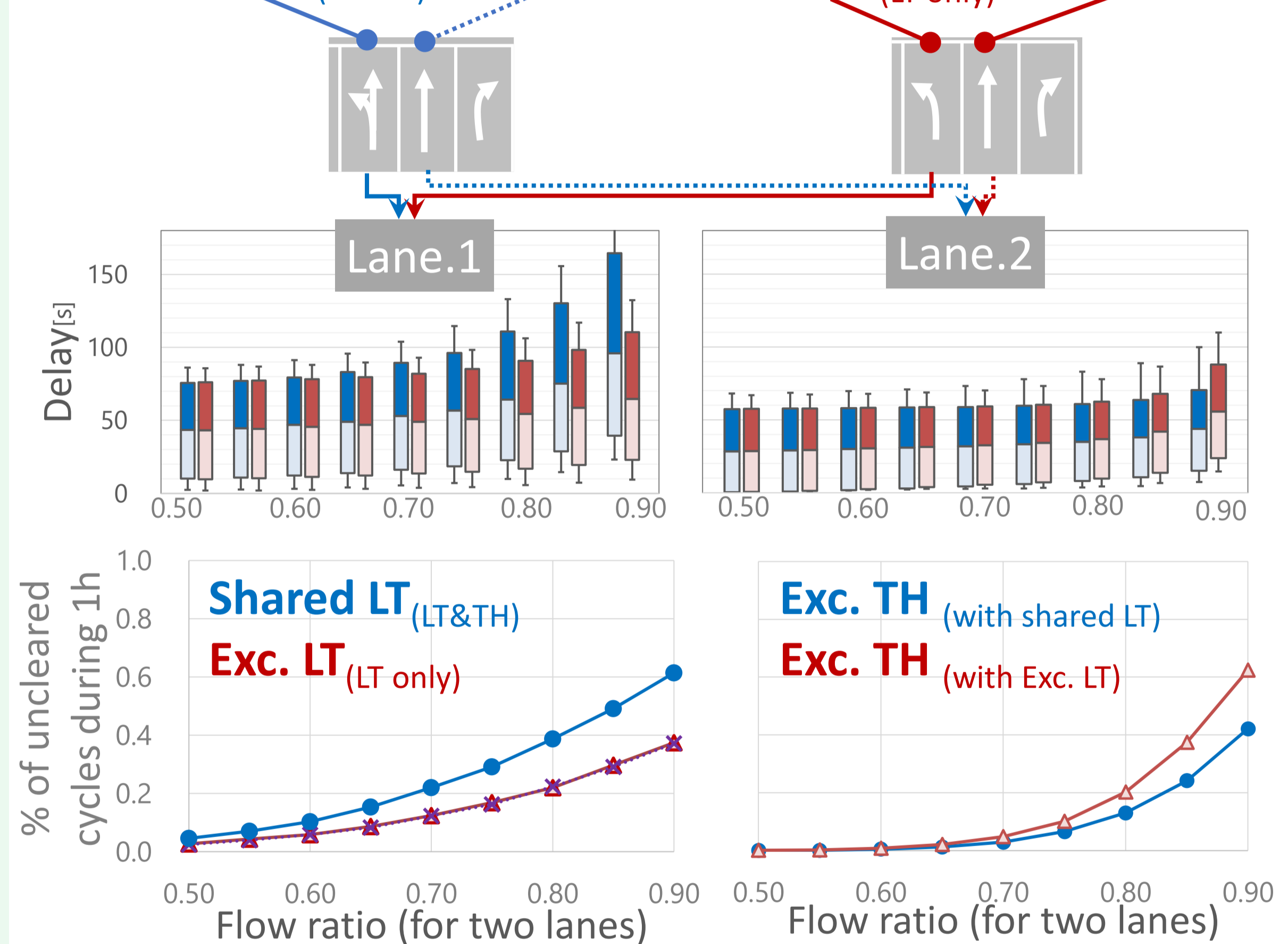


- Delay and Oversaturation (LT%=0.2)
 - Average delay increases, variation is significant.
 - More vehicle remains uncleared in each cycle.



3.(b) Shared LT lane with exclusive TH lane

- Delay and Oversaturation (LT%=0.2)
 - Shared LT (LT&TH) + Exc. TH vs. Exc. LT (LT only) + Exc. TH



- Larger delay and its variation in Shared LT lane even at low demand.
- Slightly larger delay in exclusive TH lane with Exc. LT lane only at high demand.

4. Conclusion

- In shared LT lane, due to the randomness, traffic capacity varies by cycle, delay distributes largely, and oversaturation occurs even when demand is smaller than the average capacity.
- With a dedicated left-turn lane, delay in TH lane is slightly higher at high demand only with smaller variation.
- Future task : verification of result by actual data analysis.