Motorway Gap Distribution Analysis for Designing Dedicated Connected-and-Automated-Vehicle (CAV) Lanes

1. Introduction
- CAVs have the potential to improve traffic capacity and relieve congestion.
- It will take long time to fully replace human-driven vehicles (HDV) with CAVs.
- Long transition period of mixed CAV and HDV flow.
- Possible way to facilitate the early introduction of CAVs is to provide dedicated CAV lanes.

Motivation: To design exit for dedicated CAV lane

Objective: To understand the spatiotemporal characteristics of HDV gap distributions.

2. Methodology
- Critical Gap is the smallest gap allowing vehicles from a dedicated CAV lane to merge with the adjacent normal lane.
- Available Percentage is defined as the percentage of available gaps longer than the critical gap.
- Available Percentage is calculated at different assumed critical gaps.

3. Subject Site and Data
- Pulse Data [provided in Zen Traffic Data: https://zen-traffic-data.net/]
  - About 2-km section of the Hanshin Expressway Route 11 Ikeda line (bound for Osaka); 5.1kp -> 3.0kp
  - Two-lane, with curve, sag, merging, and river bridge; only median-side lane is analysed
  - Five vehicle detectors (▼) for the pulse data
  - Collected in September 2018
  - 5 hours of time period (A1, A2, B, C1,C2)

4. Preliminary Results
- Cumulative Gap Distribution
  - SS defines Small vehicle is followed by a Small vehicle.
  - C or U defines congested cond or uncongested cond.
  - With the presence of large vehicles, gaps are larger.
- Available percentage under 4-s critical gap (only Small-Small vehicles)
  - Lower in congested cond than in uncongested cond.
  - Relatively high from 4.5 to 4.1 kp
- Sensitivity of the assumed critical gap
  - Large reduction when the critical gap increase from 2s to 3s.
  - During congestion, available percentage is very small if the critical gap >3s

5. Summary
- Available percentage and its reduction with congestion differs by location
- Future work
  - Investigate the impacts of geometry and traffic flow levels using more detailed information of gap distributions at different locations.
  - Final results would contribute towards the design of exit of dedicated CAV lane

[Image: Motorway Gap Distribution Analysis for Designing Dedicated Connected-and-Automated-Vehicle (CAV) Lanes]