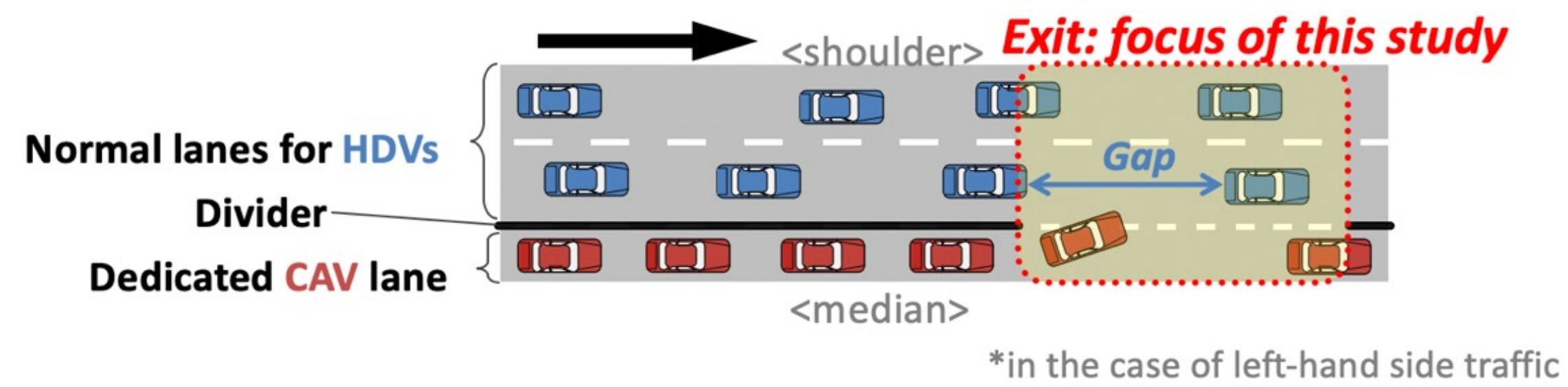# Analysis of Available Percentage of Gaps for Merging of Connected-and-Automated-Vehicles(CAVs) from Dedicated Lanes
専用車線からの協調型自動運転車両の合流のためのギャップ利用可能性の分析

By KALA, J.V., TORIUMI, A., CHEN, X.*, LIN, X.* and OGUCHI, T.
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1. Introduction

- CAVs have the potential to increase traffic capacity and reduce congestion.
  - Possible way to facilitate the early introduction of CAVs is to provide dedicated CAV lanes.
- **Motivation:** Design of exits for dedicated CAV lane.
- **Objective:** To understand the characteristics of gap distributions for HDVs along the motorway sections.

Exit: focus of this study

\<shoulder\>

Normal lanes for **HDVs**

Gap

Divider

Dedicated **CAV** lane
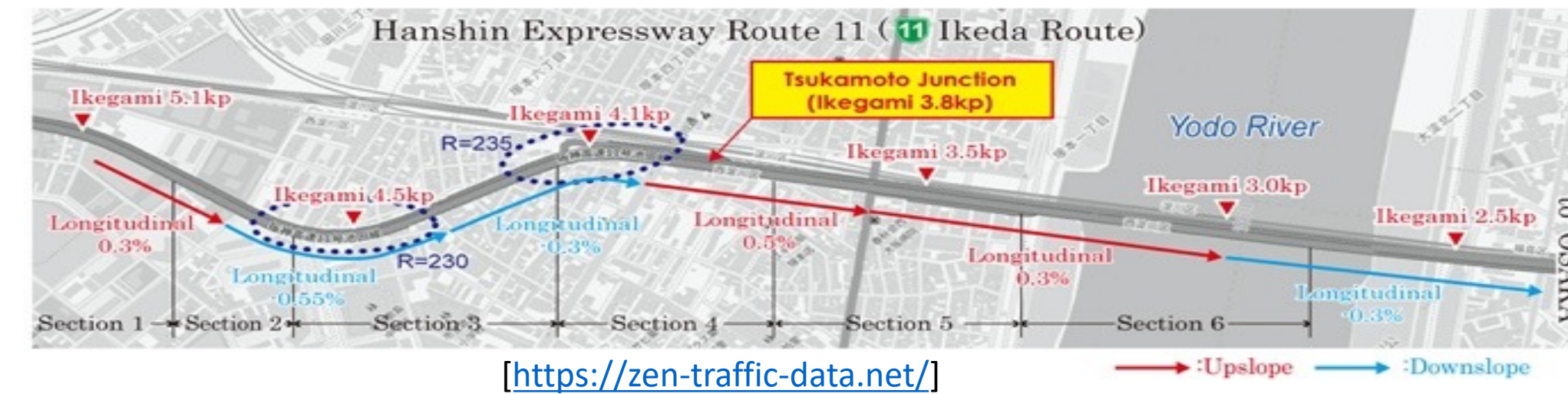
\<median\>

*in the case of left-hand side traffic

2. Methodology

- **Critical gap** → smallest gap that allows vehicles from a dedicated CAV lane to merge into the adjacent normal lanes.
- **Available percentage** is percentage of gaps longer than a Critical gap.

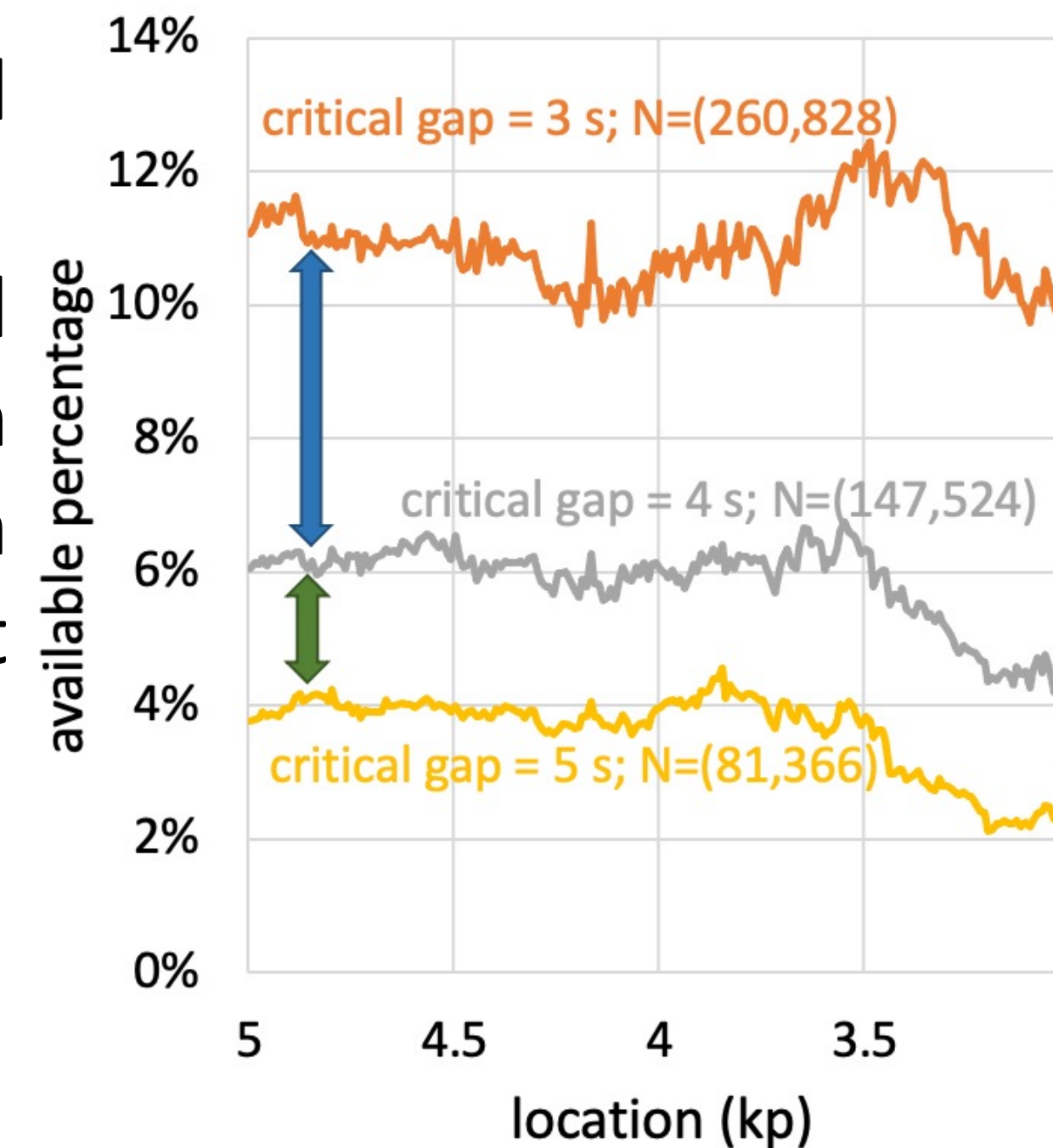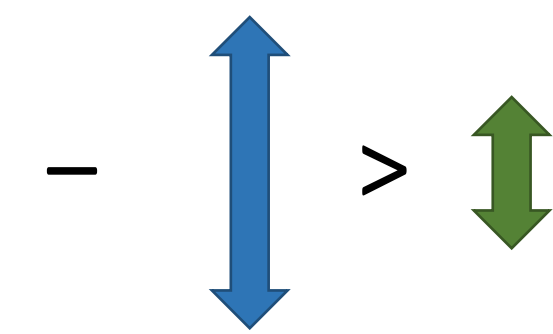Available percentage is calculated for different assumed Critical gaps.

Cumulative percentage

100%

Available gaps for CAVs

0%

Critical Gap

Gap[s]

Gap distribution of HDVs
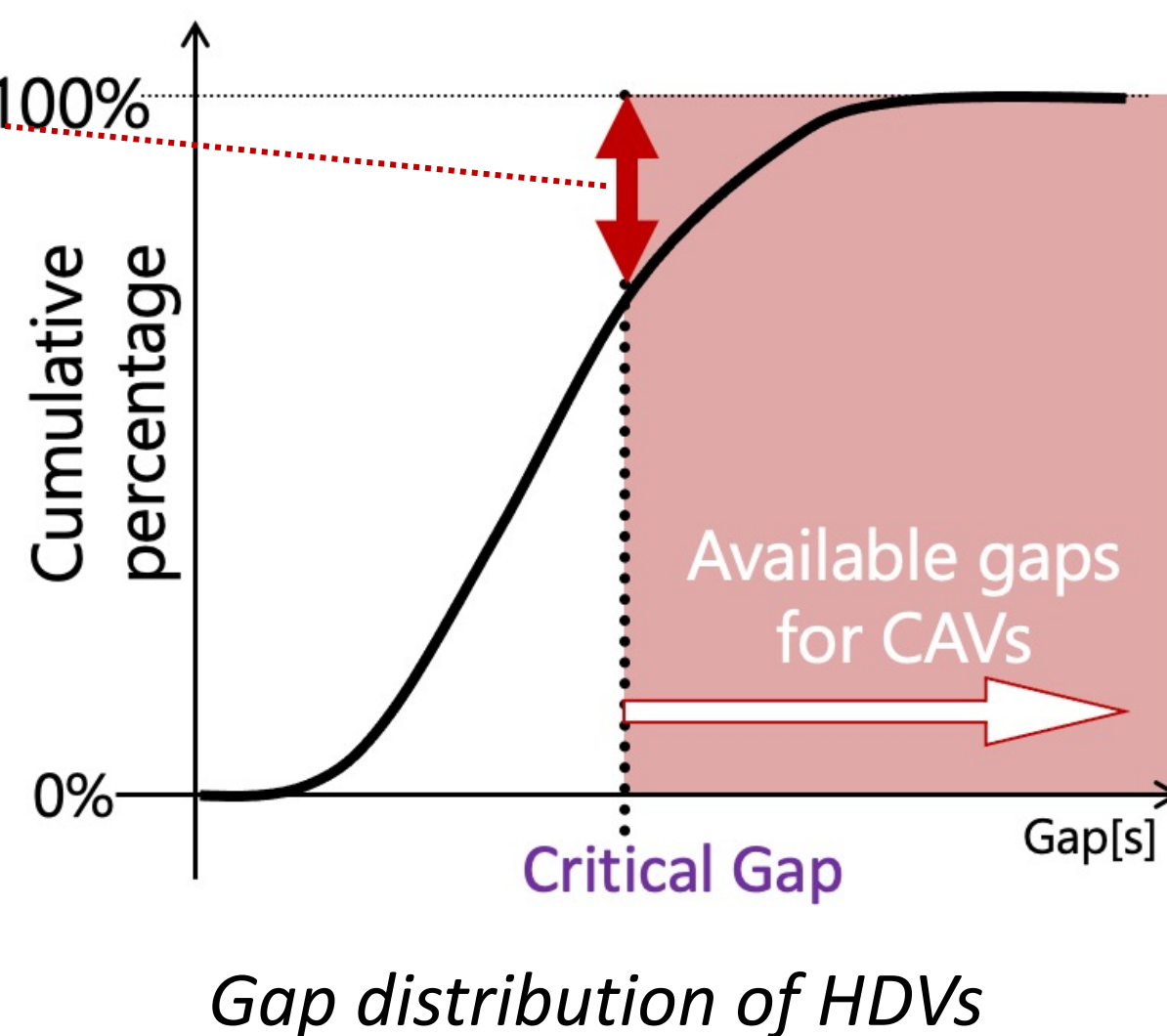
3. Data and subject site

- Route 11, Ikeda line, bound to Osaka, Hanshin Expressway by Zen Traffic Data. (>60km/h)

Hanshin Expressway Route 11 (11 Ikeda Route)

Tsukamoto Junction (Ikegami 3.8kp)

Yodo River

Ikegami 5.1kp — Ikegami 4.1kp — Ikegami 4.5kp — Ikegami 3.5kp — Ikegami 3.0kp — Ikegami 2.5kp — to OSAKA

R=235 — R=230

Longitudinal 0.3% — Longitudinal 0.55% — Longitudinal 0.3% — Longitudinal 0.7% — Longitudinal 0.3% — Longitudinal 0.3%

Section 1 — Section 2 — Section 3 — Section 4 — Section 5 — Section 6

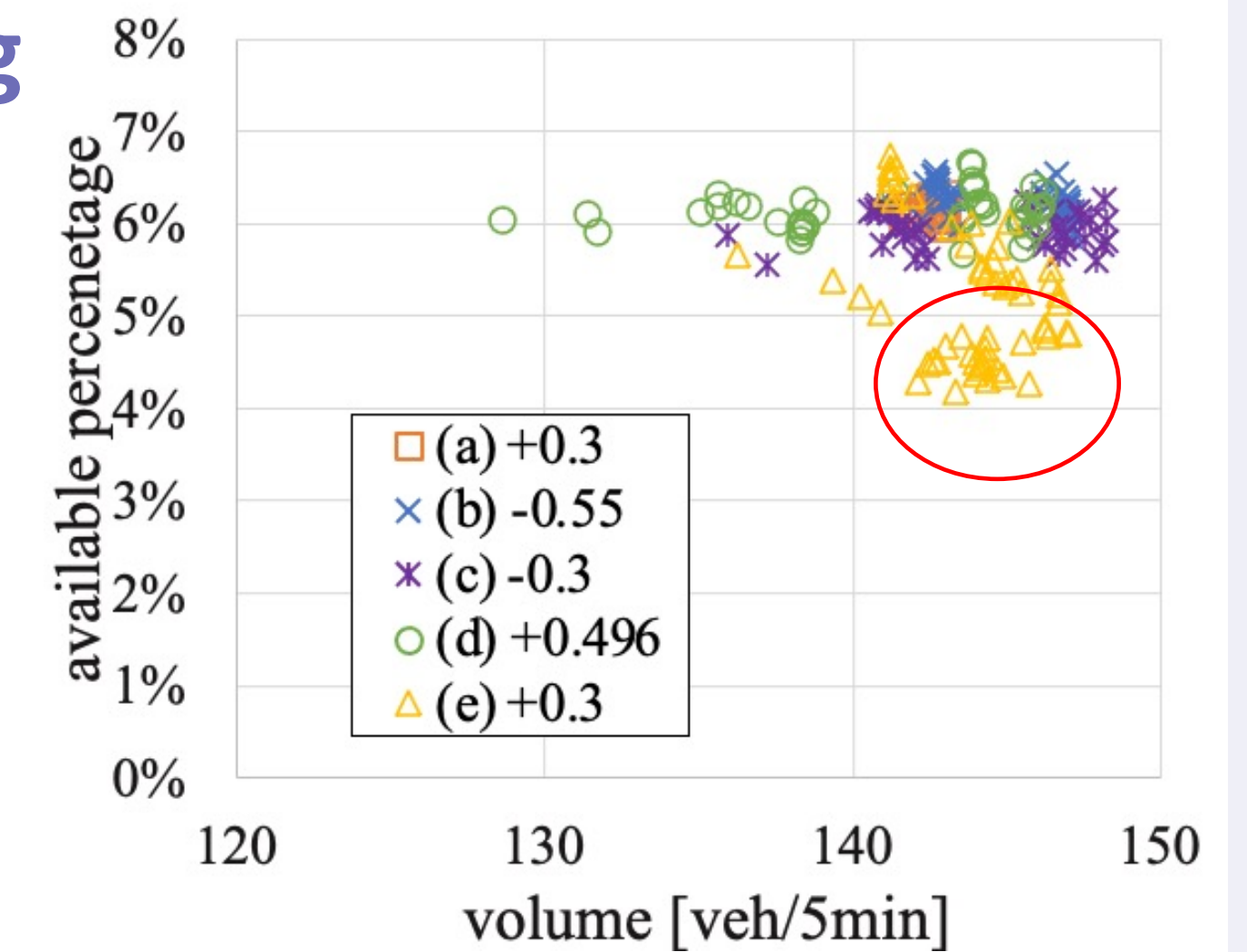→:Upslope →:Downslope

[https://zen-traffic-data.net/]

4.1 Available percentage

- At different critical gaps as 3 s, 4 s, 5 s:
 - A similar trend exits in the variation along road section even for different critical gaps.
  - ⬆ > ⬆

critical gap = 3 s; N=(260,828)

critical gap = 4 s; N=(147,524)

critical gap = 5 s; N=(81,366)

available percentage

location (kp)

4.2 Factors impacting

- For assumed critical gap of 4 s:
  - For **(e) +0.3%**, available percentage fluctuates even under the similar volume condition.

available percentage

volume [veh/5min]

(a) +0.3
(b) -0.55
(c) -0.3
(d) +0.496
(e) +0.3

available percentage vs volume

  - At **(e) +0.3%**, available percentage decreases with increase in relative elevation.

available percentage

(a) +0.3
(b) -0.55
(c) -0.3
(d) +0.496
(e) +0.3

relative elevation [m]
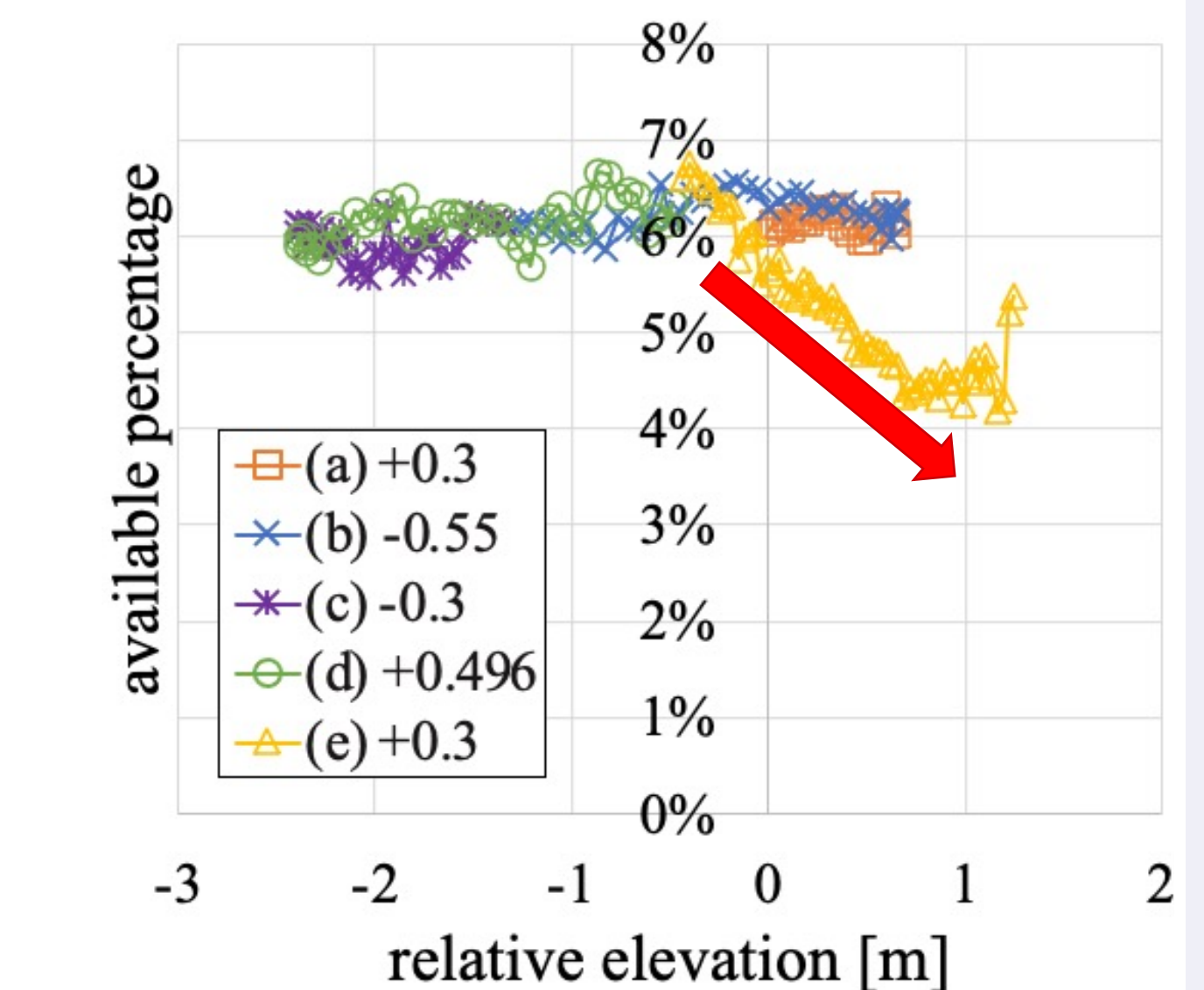
available percentage vs relative elevation

5. Summary

- Available percentage differs with location.
- Impact of geometry seems to exist but because of small gradient changes, we cannot determine the available percentage is solely affected by it.
- Further, gap distribution modelling will be done to understand where to locate an exit for a dedicated lane.

For more details, please refer to this paper.

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