Study on the impacts of weather condition on motorway network performance

高速道路ネットワーク性能に天候条件が与える影響

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1. Introduction

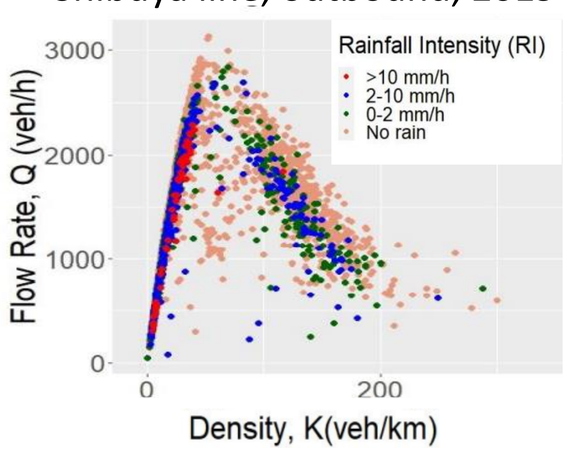
Weather conditions have a significant impact on traffic flow parameters such as free-flow speed, capacity, and density.

Fundamental equation,

$q = f(k, u)$.....1)

Under rainfall impact,

$q = f(k, u, RI)$.....(2)



The breakdown of the flow occurs when the demand flow rate exceeds the capacity. Such breakdown may occur even at lower flowrate, under the influence of poor weather condition.

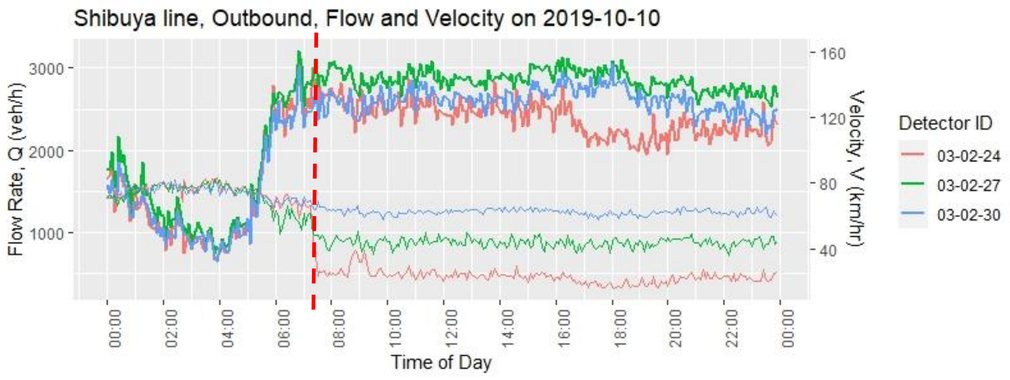
Objective - To evaluate the impact of weather condition on motorway network performance by evaluating the bottleneck capacity and departure flow rate under the influence of rainfall.

2. Methodology

Data Collection

Data	Source	Resolution (Spatial)	Resolution (Temporal
Traffic data	MEX Detector	Detector data, Sectional data	5 min aggregated
Weather Data	AMeDAS RADAR	Approx. 17 km interval 250m*250m grid	Hourly 5 min aggregated

Congestion event Identification

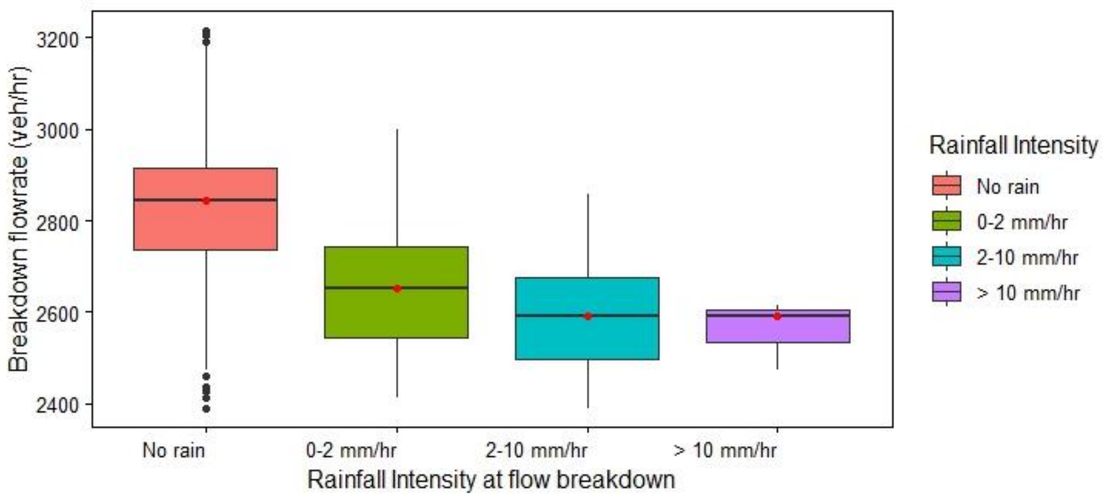


- Listed the bottleneck section of the network.
- When a flow level of “R” or “Y” observed for 20 minutes in row, considered as a congestion event.

3. Result and Discussion

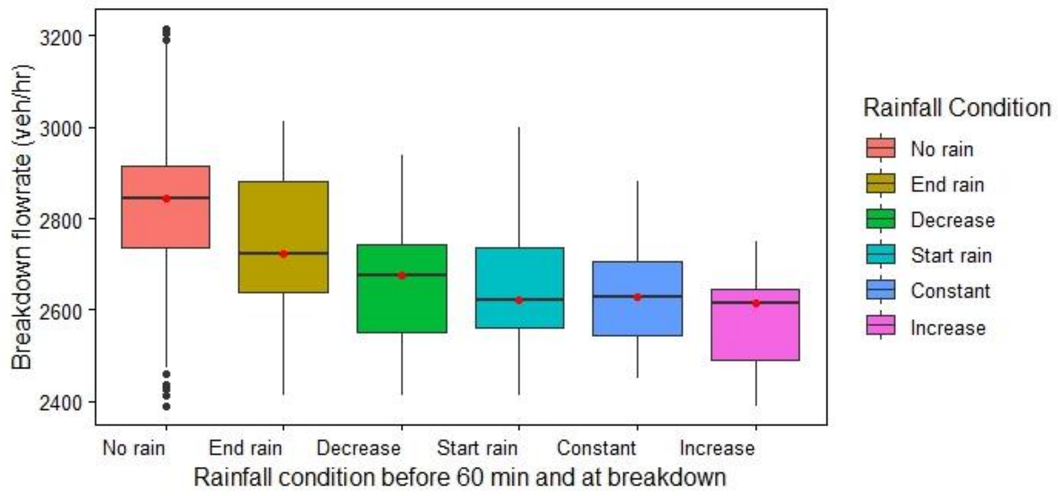
Rainfall affects the traffic flow by two ways

1. Intensity of rainfall at the time of driving



The breakdown flow rate is reduced when there is higher intensity of rainfall at the time of breakdown

2. Surface condition of the roadway as a result of continuous rainfall



When considered the rainfall from one hour before to the start of breakdown, the breakdown occurred at lower flow rate at the condition of continuous and increased rainfall.

4. Summary

- Poor weather condition further reduces the capacity of bottleneck section causing higher chance of breakdown of flow even at lower flowrate.
- Such reduced performance may impact to the whole motorway network performance.
- Large variation of the breakdown flowrate was observed even at the no rainfall condition, so other variables are also important to be considered.
- Surface condition evaluation should be performed carefully as other weather parameters will also affect on it.