Impact of Rainfall on Urban Traffic Flow based on Probe Vehicle Data in Bangkok

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Adverse weather frequently affects the capacities and travel speeds on roadways, which result in worsened traffic congestion and incurred productivity loss. Further, with climate change predicted to increase rainfall in various cities in Southeast Asia, the risk of flood damage in this region is not only anticipated to increase and affect urban function but may also significantly aggravate daily traffic flow. This study highlighted an analysis of the effect of rainfall on urban traffic flow through the use of probe vehicle data and rainfall data in the center of Bangkok, which is known for problems with respect to maintenance of pumps and drainage channels and for many flooded roads after heavy rainfalls.

The probe vehicle data (observed in 2018) used in this study were obtained from open data (historical raw vehicles and mobile probe data in Thailand) provided by the Thai Intelligent Traffic Information Center Foundation. This data consists of Vehicle ID, GPS location collected every minute, time stamp, and speed. The rainfall data are a 5-minute unit data obtained (in 2018) from the Bangkok Metropolitan Flood Control Center.

To explain the relationship that exists between rainfall intensity and travel speed, regression models are developed.

The experimental results demonstrated that the average daily travel speed decreases by 0.02 km/h per 1 mm of daily rainfall. Especially during morning and evening peaks, the average travel speed greatly decreases due to 1-h rainfall (short-term impact) and 6-h rainfall (long-term impact) when compared to the case of no rain. As a result, loss time due to rainfall in 2018 was estimated to be about 4 million hour which is equivalent to 5% of the loss time due to much traffic demand.

Future rainfall forecast data makes it possible to assess the risk of climate change on urban traffic flow.

Keywords: Rainfall intensity, Climate change, Probe vehicle data, Urban traffic flow

