Project Title: The Effects of Rain on Freeway Traffic in Southern California

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Abstract: A number of studies in the past have quantified the impact of rain on traffic parameters but all of them were limited to wet areas. The research reported in this paper have expanded the literature by studying the impact of rain in a dry area such as Southern California, and investigating for regional differences in the impact. Traffic data (loop detectors) and precipitation data (rain gauges) from Los Angeles Metropolitan Area has been analyzed to access the impact of rain on traffic stream parameters such as free-flow speed, the speed at capacity, and capacity. Rainfall events have been categorized as light, medium, and heavy as discussed in Highway Capacity Manual (HCM) 2010. Density plots and fundamental diagrams for different rain types proved that free-flow speed, speed at capacity and capacity are reduced by 5.7%, 6.91%, and 8.65% respectively for light rain, 11.71%, 12.34%, and 17.4% respectively for medium rain, and 10.22%, 11.85% , and 15.34% respectively for heavy rain. The reductions for free-flow speed are lower, whereas, for speed at capacity and capacity are higher than those reported in HCM 2010. Moreover, the headway is increased during rain that exhibits cautious driving behavior. Multiplicative weather adjustment factors have been computed to compensate the loss of speed and capacity. This paper also demonstrates the spatial and temporal impact of rain on traffic. Downstream traffic is not much affected by a rainfall event while the upstream traffic is negatively impacted. This paper is expected to support weather-responsive traffic management strategies for dry areas.

Keywords: freeway, traffic, rainfall, dry area, free-flow speed, speed at capacity, capacity, weather-responsive