QUANTIFYING NON-RECURRING CONGESTION IMPACT ON SECONDARY INCIDENTS USING PROBE VEHICLE DATA

Hyoshin Park, University of Maryland
Ali Haghani, University of Maryland
Masoud Hamedi, University of Maryland

ABSTRACT

As a significant cost and externality to economic efficiency, congestion is partly caused by traffic incidents. For more systematic, planned and coordinated incident management, quantifying a primary incident's impact on secondary incidents is crucial and challenging. Many thresholds have been suggested in defining the secondary incidents, but there is no universal acceptance of a definition and corresponding set of measurement parameters. Static threshold methods cannot consider the actual representation of prevailing traffic conditions when the incidents took place. On the other hand, dynamic methods have disadvantages because necessary traffic detector data may not be available, and replication of the incidents using a simulation package can be time consuming. The novelty of this study rests in the attempt of a probe vehicle technique for capturing the dynamics of traffic evolution during the primary-crash incidents. Compared to the previous thresholds which have many errors, proposed speed contour map from Traffic Message Channel codes provides accurate feasible area for identification of secondary incidents.

INTRODUCTION

Quantification of Incident's Impact

Congestion is a significant cost and externality to economic efficiency. Viable studies estimate that total U.S. congestion costs range from $14 billion to $200 billion annually. Fifty-five percent of total delay experienced by motorists is caused by roadway incidents in urban area population groups (TTI, 2011); and secondary crashes are estimated to cause 18% of all fatalities on freeways (TIM, 2010). Every minute that an incident remains partly cleared during peak congestion causes many more minutes of travel delay. Mitigating non-recurring congestion will return a strengthening economy.

Rubbernecking, physical impedance in the travel lanes, and other incident-related obstructions reduce capacity and impede flow. The resulting speed reduction and queue formation foment additional incidents, referred to as secondary incidents. Incident characteristics, incident duration, traffic conditions, and secondary incident occurrence are related to one another in a close way (Figure 1). Indeed, the longer an incident scene is in place caused by its characteristics, the greater the likelihood for secondary incidents. Moreover, the total time for an incident to be cleared can be increased by the occurrence of secondary incidents, and the travelers may experience ever-increasing congestion.

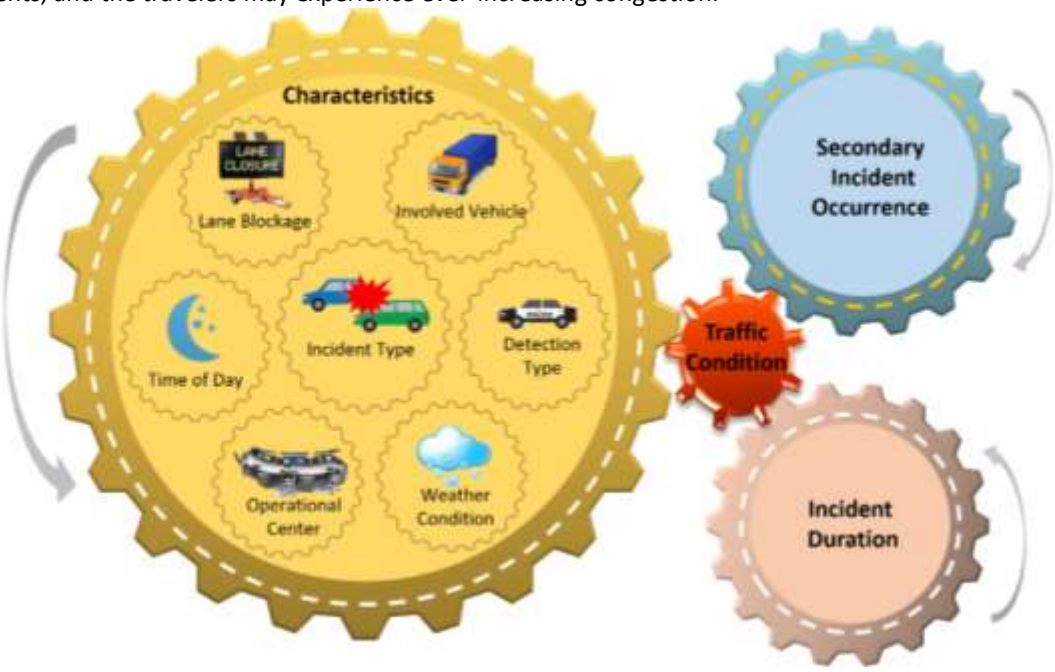

Figure 1. Relationship between Secondary Incident Occurrences and Contributing Factors