

Roundabout Performance Analysis Using Connected Vehicle Data

Abstract

There are over 8,000 roundabouts in the United States and their implementation continues to rise. The current techniques for assessing their performance require field counts to provide inputs to analysis or simulation models. These techniques are labor-intensive and are complicated to scale well.

This study presents a methodology to use commercially available connected vehicle (CV) trajectory data to estimate delay and Highway Capacity Manual level of service for roundabout approaches by adapting the Purdue Probe Diagram used for traffic signal analytics. By linear referencing vehicle trajectories with a particular movement based on the location and time they exit a roundabout, delay can be calculated. The scalability is demonstrated by applying these techniques to assess over 100 roundabouts in Carmel, IN, during the weekday afternoon peak period in July 2021. Over 264,000 trajectories and 3,600,000 GPS points were analyzed to rank over 300 roundabout approaches by delay and summarize in Pareto-sorted visualization and maps.

The methodology presented in this study can be used by any agency that wants to assess the performance of all roundabouts in their system without the need of detection and communication equipment or site visits.