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# Guidelines for Evaluation of Ramp Signaling Deployments in a Real-Time Operations

*March 2018***Current Situation**

As Florida's highways become more crowded and its rights-of-way become more limited, improved traffic flows have been achieved using traffic management strategies such as placing traffic signals at on-ramps to limit the rate at which vehicles enter the highway at that point. The signal on a ramp is activated only when it is warranted, which means that certain criteria for that ramp have been met, such as the number of vehicles using the ramp, normal traffic conditions on the highway, and other variables. The effectiveness of ramp signaling can be improved if a group of nearby signals and their criteria are considered together.

**Research Objectives**

Florida International University researchers developed a method for identifying where ramp signals should be installed and when they should be activated, based on system-wide traffic conditions.

**Project Activities**

The researchers examined the current ramp signal activation criteria (called warrants by traffic engineers) and associated issues by interviewing transportation system management and operations (TSM&O) personnel and traffic management center (TMC) staff in Florida Department of Transportation (FDOT) Districts 4 and 6. They also reviewed the literature about existing warrants, metering algorithms and methods, and other related topics.

The researchers demonstrated the developed method using a 15-mile section of I-95 in Broward County that includes 10 on-ramps, as a case study. The method required collecting traffic data, including volume, occupancy, and speed; incident data; and weather data for the study section.

For the offline selection of ramps to signalize, a preliminary study confirmed that a method based on system-wide conditions, rather than local conditions, led to improved traffic flows. With positive results from the preliminary study, the researchers extended their analysis to develop a method that considers recurrent as well as non-recurrent conditions, such as rain and traffic incidents. The method takes into account the stochastic capacity and demand at the system bottleneck and the amount of traffic that the on-ramp can accommodate (called queue storage) before the feeder road is affected. The method can also evaluate the influence of acceleration requirements of trucks merging from the signalized ramps. The researchers also proposed two methods to activate the ramps based on real-time conditions and assessed their effectiveness. Safety consideration in this activation was also addressed.

The simulations showed that the researchers' method improved the simulated traffic flows compared to the traditional ramp signal warrants.

**Project Benefits**

More efficient management of existing infrastructure is a very cost-effective way to improve the efficiency and safety of Florida's highway system.

*For more information, please see [www.fdot.gov/research/](http://www.fdot.gov/research/).*



*A line of cars move past a ramp signal as they enter I-95 in South Florida.*