

**Request for Research Funding for FY 2020-2021**

<b>Requesting Office</b>	FDOT District 6	<b>Priority</b> High	4 of 6
<b>Proposed Title</b>	Guidelines for Activating Ramp Meters During Off-peak hours to Reduce Non-Recurring Congestion		
<b>Justification</b>	<p>Traffic congestion is a growing concern on urban roadways. Agencies are implementing Transportation Systems Management and Operations (TSM&amp;O) strategies to reduce traffic congestion. Ramp metering is a TSM&amp;O strategy that utilizes signals installed at freeway on-ramps to dynamically manage traffic entering the freeway. The strategy operates by stopping and releasing vehicles traveling from the adjacent arterials to the freeway mainline on the on-ramp segment. Ramp metering is intended to improve mobility, travel time reliability, safety, and the environment while preserving freeway capacity at a lower cost than traditional capacity improvements, such as adding lanes.</p> <p>Ramp meters are usually activated during peak hours to alleviate recurring congestion. However, the recurring congestion during peak hours constitute less than half of all congestion. It is the non-recurring congestion as a result of traffic incidents, work zones, adverse weather conditions, special events, etc., that adversely impacts the performance of the freeway. Non-recurring congestion on freeways, especially during off-peak hours and weekends, could be alleviated by dynamically activating ramp meters based on prevailing traffic conditions along the freeway corridor. Since ramp meters are already installed along the corridor, activating them in response to non-recurring events does not require significant resources and would be a relatively inexpensive strategy to reduce traffic congestion in real-time. This approach is feasible because of the increasing availability of real-time traffic data. FDOT can leverage the already existing real-time traffic data sources including microwave detectors and HERE data to trigger the need for ramp metering during off-peak hours and weekends.</p> <p>The conventional approach of activating ramp meters only on scheduled peak hours has room for improvement. By leveraging the existing real-time data, agencies can potentially increase utilization of ramp meters in improving mobility and safety of freeway traffic. The goal of this research is to develop specific guidelines and criteria to dynamically activate ramp meters during off-peak hours and on weekends to prevent oversaturated conditions and traffic breakdowns as a result of non-recurrent events. In addition to the prevailing traffic conditions, the type of the non-recurring event will also need to be considered while developing the guidelines for ramp meter activation. As such, the guidelines will be based on three factors: <i>incident-related</i>, <i>traffic-related</i>, and <i>safety-related</i>. The <i>incident-related</i> guidelines will consider incident type, incident severity, incident time and location, number of lanes closed, proximity of the incident to off-ramps, etc. The <i>traffic-related</i> guidelines will consider traffic volume and speed on the freeway mainline, traffic volume on the right-most lane, traffic volume on the on-ramp, etc. The <i>safety-related</i> guidelines will focus on the likelihood of the incident resulting in secondary crashes.</p> <p>This research will also develop data-driven criteria for deciding conditions under which it would be beneficial to activate just the local ramp meter or all the ramp meters along the corridor. While activation of local ramp meters in the vicinity of, and upstream of, a temporary bottleneck, may help alleviate congestion; previous studies have warranted system-wide activation of all ramp meters. However, these studies have primarily focused on recurring congestion during peak hours. As such, this research will develop guidelines that warrant system-wide activation of all ramp meters to better manage traffic flow on the freeway mainline during non-recurring events.</p> <p>The study corridor will be 22 ramp meters along I-95 between Ives Dairy Road and NW 62<sup>nd</sup> Street in Miami-Dade County in FDOT District Six. The research team will use real-time traffic flow data on freeway mainline and on-ramps from Regional Integrated Transportation Information System (RITIS) and HERE, ramp metering activation times from FDOT District Six, traffic incident data from SunGuide, and weather information from National Oceanic and Atmospheric Administration (NOAA).</p>		
<b>Impact</b>	Ramp meters are a proven TSM&O strategy to alleviate recurring congestion on freeway. They also can better manage non-recurrent freeway congestion. Dynamically activating the existing ramp meters in response to		

	<p>non-recurrent events during off-peak hours and weekends would improve the performance of the freeway mainline.</p> <p>FDOT District Six currently operates a total of 22 ramp meters along I-95 between Ives Dairy Road and NW 62<sup>nd</sup> Street in Miami-Dade County. Another ramp metering deployment is scheduled in District Six on SR 826 from SR 836 to NW 154<sup>th</sup> Street. FDOT District Four is also considering deploying ramp meters at over 60 ramps in Broward and Palm Beach counties.</p> <p>The study results will help FDOT District Six and District Four to activate ramp meters to alleviate non-recurring congestion during off-peak hours. The study results, once implemented, will improve the operational performance of the freeway corridor. The results will also help inform future decisions to deploy ramp meters at other locations.</p>		
<b>Affected Offices</b>	State Traffic Engineering and Operations Office, District Six and District Four Traffic Operations Offices		
<b>Existing Work</b>	<p>Most of the states that use ramp meters operate in conventional peak hour schedules. Based on published literature, only the state of Oregon has explored the operation of ramp meters on weekends as documented in the report listed below.</p> <ul style="list-style-type: none"> <li>• Bertini, R., Rose, M., and El-Geneidy, A., Eder, A., Leal, M., Malik, S., Tantiyanugulchai, S., &amp; Yin, T. (2004). <i>Using Archived Data to Measure Operational Benefits of ITS Investments: Ramp Meters</i>.</li> </ul> <p>The proposed research provides an opportunity to innovatively use the existing system to improve mobility and safety during non-recurrent congestion events without an additional infrastructure investment.</p>		
<b>Keywords Used In Existing Work Search (Cannot leave blank)</b>	Ramp metering signals, Ramp metering warrants, System-wide ramp metering, Traffic responsive ramp metering, Ramp metering activation strategies		
<b>Related Contracts (Give contract numbers)</b>	<ul style="list-style-type: none"> <li>• BDV29 977-25: Guidelines for Evaluation of Ramp Signaling Deployments in a Real-time Operations Environment</li> <li>• BDV29 977-46: Developing Florida-specific Mobility Enhancement Factors (MEFs) and Crash Modification Factors (CMFs) for TSM&amp;O Strategies</li> </ul>		
<b>Funding Request</b>	\$175,000	<b>Anticipated Duration</b>	18 months; but interim results will be disseminated for immediate use by FDOT District Six
<b>Project Manager</b>	Alejandro Motta, P.E. TSM&O Engineer - Freeways FDOT – District Six Phone: (305) 640-7375 <a href="mailto:Alejandro.Motta@dot.state.fl.us">Alejandro.Motta@dot.state.fl.us</a> Co-PM: Raj Ponnaluri	<b>Contracting Method</b>	Direct contract with Florida International University – Dr Priyanka Alluri is the Principle Investigator
<b>Urgency</b>	1	Ramp meters have been operational in District Six for over a decade. However, these are activated only during peak hours. Till date, the Department does not have the guidelines that warrant activating these ramp meters during off-peak hours and weekends. This study helps to fill this gap by developing the criteria to activate ramp meters in response to non-recurring events.	
<b>Implementability</b>	1	The research results will be readily implementable. District Six will use the developed guidelines to activate ramp meters to alleviate non-recurring congestion during off-peak hours and weekends.	
<b>Project Benefits (Succinct, complete explanation)</b> The project anticipates developing guidelines and specific criteria to dynamically activate ramp meters in response to non-recurring events during off-peak hours and on weekends. This project’s main goal is to efficiently use the existing infrastructure and TSM&O strategies to alleviate non-recurring congestion in real-time. This project will			

help enhance the operational performance of I-95 by improving mobility and travel time reliability. This project will provide key inputs to inform deployment of ramp meters at other locations across the state.

<b>Project Benefits</b> <b>(Select all that apply and explain)</b>	<b>Quantifiable Benefits (units, dollars, etc...if applicable)</b>	<b>Methodology or Data Sources Used to Determine Quantifiable Benefits. If not applicable, please give justification of project benefits</b>
○ Materials Enhancement		
○ Materials Savings		
✓ Time Savings	Benefit: Improve mobility, travel time reliability, and throughput during off-peak hours.	This study develops guidelines and specific criteria to dynamically activate ramp meters in response to non-recurring events during off-peak hours and on weekends. The developed guidelines will improve mobility, travel time reliability, and throughput during off-peak hours and weekends.
✓ Lives Saved/Injuries Prevented	Benefit: Potentially reduce the likelihood of occurrence of secondary crashes.	The developed guidelines will potentially reduce the likelihood of secondary crashes along the freeway mainline, especially during off-peak hours and weekends.
○ Other (Explain)		

\*Comments should explain and support urgency, financial benefit, and implementability scores