

**Request for Research Funding for FY 2023–2024**

**Project Number** (Research Center Use Only): TEO-24-09

<b>Requesting Office</b>	District 7 Traffic Operations and Safety	<b>Priority:</b> Medium	9 of 11
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**Proposed Title** Evaluation of Promising Countermeasures and Innovative Techniques on Speed Management to Improve Pedestrian and Bicycle Safety

**Background and Motivation for Proposed Research**

Florida has recently become known as the 2<sup>nd</sup> worst state for pedestrian safety. Seven of the 20 deadliest U.S. cities for pedestrians are in Florida. The Tampa Bay region is the 4<sup>th</sup> most dangerous metropolitan area for pedestrians, and the most dangerous major metropolitan area in Florida with a population > 1M. On average, 707 pedestrians were killed on Florida public roads and 7,565 pedestrians were injured per year during 2017-2020.

**THE TOP 20**  
Most dangerous metropolitan areas for pedestrians (2016-2020)



**Figure 1. 20 U.S. cities with the highest rates of pedestrian fatalities**  
(source: [Smart Growth America 2022](#))

**Justification**

The Florida Department of Transportation (FDOT) District 7 (D7) is facing challenges with speeding-related crashes. According to the FDOT SSOGIS, during 2017-2020, District 7 experienced 4,401 speeding-related crashes (receiving a speeding citation), which resulted in 152 fatalities and 3,204 injuries. Hillsborough County is the 2<sup>nd</sup> highest county with overrepresented speeding crashes (2,924 for 2017-2020), and Pinellas is number 11 (892 for 2017-2020). In FDOT District 7, pedestrians and cyclists experienced 613 fatalities and 6,184 injuries during 2017-2020, the 2<sup>nd</sup> highest region in Florida. For speeding-related pedestrian/bicycle crashes, Hillsborough and Pinellas are the fifth and seventh highest county respectively.

The average risk of death and severe injury for a pedestrian at impact rises as vehicle speed increases. Effective speed management is essential to the safety of pedestrians and bicyclists. The major results of a study on “Impact Speed and a Pedestrian’s Risk of Severe Injury or Death” by the American Automobile Association (AAA) Foundation, indicated the following:

- The average risk of severe injury for a pedestrian struck by a vehicle reaches 10% at an impact speed of 16 mph, 25% at 23 mph, 50% at 31 mph, 75% at 39 mph, and 90% at 46 mph.
- The average risk of death for a pedestrian reaches 10% at an impact speed of 23 mph, 25% at 32 mph, 50% at 42 mph, 75% at 50 mph, and 90% at 58 mph.

Findings from Road Safety Web Publication No. 16 from the Department for Transport, London, “Relationship between Speed and Risk of Fatal Injury: Pedestrians and Car Occupants”, showed the following:

- Pedestrian fatality risk increases slowly until impact speeds of around 30 mph. Above this speed, risk increases rapidly, with an increase of 3.5–5.5 times from 30 mph to 40 mph.
- Although the risk of pedestrians being killed at 30 mph is relatively low, approximately half of pedestrian fatalities occur at this impact speed or below.

Bicycling analyses often are conducted together with pedestrian analyses. For bicyclists, the severity of urban cycling injuries is associated with the relationship of four metrics, including personal, trip, route, and crash characteristics (Cripton et al., BMJ Open, 2015). Analyses have determined that higher-speed roads are associated with greater injury severity to cyclists. Cyclist injury risk is higher at intersections at which motor vehicle speeds are greater than 18.6 mph, and routes with high vehicle speeds deter cycling.

#### ***Need for Proposed Research***

A variety of speed management countermeasures and techniques have been developed and implemented nationwide, considering many factors regarding roadway characteristics, road user features, speeding-related crash history, and cost-effective countermeasures. For urban areas, major countermeasures and techniques include, but are not limited to, vertical traffic calming (speed humps, speed tables, speed cushions, etc.), horizontal traffic calming (center islands, lane narrowing with markings, roundabouts, on-street parking, etc.), warning of speeding with speed feedback information (dynamic speed feedback signs), surface treatments, signs and markings (transverse rumble strips, enhanced curve delineation, etc.), traffic operation treatment (lower speed limits, traffic signal coordination, etc.), and enforcement countermeasures (fixed and mobile camera enforcement, etc.). Among these countermeasures, some have been implemented in Florida and proved to be effective, but other countermeasures or new techniques that have been implemented in other states have not been fully tested and evaluated under Florida roadway and traffic conditions. Therefore, it is necessary to conduct research to fully document the effectiveness of these countermeasures and to implement and evaluate specific countermeasures and new techniques for speed management under the unique characteristics and traffic conditions of urban roadways in Florida. The major goal of this research project is to develop, deploy, and evaluate those promising countermeasures and new techniques in FDOT D7 and other selected districts to effectively reduce vehicle speeds on urban roadways to alleviate pedestrian and bicyclist fatalities and severe injuries.

#### ***How the Research Affects Your Office’s Mission Critical Focus Areas***

The mission of the FDOT Traffic Engineering and Operations Office is to improve safety and mobility through the efficient application of traffic engineering principles and practices. A critical focus area is speed management. Effective speed management is critical to the safety of pedestrians and bicyclists. The proposed project will research, identify, implement, and evaluate proven countermeasures and new techniques for speed management. This proposed research is urgently needed to fully support FDOT’s mission and its critical focus area of speed management and to assist in achieving its priority on the improvement of pedestrian and bicycle safety in Florida.

The Florida Pedestrian and Bicycle Strategic Safety Plan (PBSSP) was developed in May 2017 as an important implementation element to address the Pedestrian and Bicyclist Emphasis Area of Florida’s Strategic Highway Safety Plan (SHSP). The FDOT Traffic Engineering and Operations Office is the lead for the Highway and Traffic Engineering Emphasis Area in the PBSSP. A major objective in this Emphasis Area is to research, identify, implement, and evaluate proven countermeasures and new techniques for speed management. This research project not only can assist in successfully achieving this important objective, but can also provide FDOT with the most effective, suitable, and implementable speed management countermeasures and techniques to reduce fatalities and injury severities of pedestrians and bicyclists in Florida.

#### ***Objectives of Proposed Research***

This major objectives of the proposed research include the following:

- Identify and document proven countermeasures of speed management for reducing vehicle crashes involving pedestrians and bicyclists via intensive literature review.
- Identify and document new techniques of speed management for reducing vehicle crashes involving pedestrians and bicyclists via intensive literature review.
- Examine and/or implement promising countermeasures and new techniques for speed management evaluation under Florida roadway characteristics and traffic conditions via field data collection and/or traffic simulation.
- Investigate the combination of treatment with other countermeasures, such as law enforcement and education.
- Collect public opinions on selected proven countermeasures and new speed management techniques of speed management among different demographic groups (age, gender, etc.).
- Provide detailed analysis, research findings, and recommendations on implementation of effective, suitable, and implementable speed management countermeasures and techniques on Florida urban roadways for reducing vehicle speeds to alleviate pedestrian and bicyclist fatalities and severe injuries in speeding-related crashes.

<b>Impact</b>	<p>The results of this research could provide effective, suitable, and implementable proven countermeasures and new techniques for speed management in Florida and procedures to successfully implement them to significantly improve pedestrian and bicycle safety in Florida. These countermeasures and techniques may include but are not limited to speed humps, speed tables, center islands, reduced lane width with markings, road diets, dynamic speed feed-back signs, roundabouts, variable speed limits, curve delineation, and engineering speed limits.</p> <p>The consequence of not doing this research would be a significant delay for the achievement of the objectives in the Highway and Traffic Engineering Emphasis Area of the PBSSP for improving pedestrian and bicycle safety and reducing associated fatalities and injury severities via speed management. FDOT will not be able to obtain the most effective, proven, suitable, and implementable countermeasures and techniques on speed management for Florida to implement them in a timely manner. The number of speed-related fatalities and severe injuries for pedestrians and bicyclists likely could not be reduced.</p>
<b>Affected Offices</b>	State Traffic Engineering and Operations Office; State Safety Office; District Traffic Operations and Safety Offices
<b>Existing Work</b>	<p>A variety of peer studies regarding speed management have been conducted by national and state agencies, and multiple speed countermeasures and techniques have been proven effective or partially tested in peer states. However, limited studies regarding the effectiveness of several proven speed management countermeasures and new techniques to reduce vehicle speeds on Florida urban roadways to improve pedestrian and bicyclist safety have been done. Therefore, given the urgent need of pedestrian and bicyclist safety improvement and the consideration of the unique characteristics and traffic conditions on Florida urban roadways, research is needed to thoroughly research this topic, and provide effective countermeasures and techniques for FDOT to address speeding-related pedestrian and bicycle safety issues, and help reduce fatalities and severe injuries of pedestrians and bicyclists on Florida urban roadways.</p> <p>References for major research documents and literature reviewed for the existing work include the following:</p> <ul style="list-style-type: none"> <li>• Smart Growth America and National Complete Streets Coalition, <i>Dangerous by Design 2022</i></li> <li>• AAA Foundation for Traffic Safety, “Impact Speed and a Pedestrian’s Risk of Severe Injury or Death”, September 2011.</li> <li>• Department for Transport, “Relationship between Speed and Risk of Fatal Injury: Pedestrians and Car Occupants Road Safety”, Web Publication No. 16, London, September 2010.</li> <li>• BMJ Open, “Severity of Urban Cycling Injuries and the Relationship with Personal, Trip, Route and Crash Characteristics: Analyses Using Four Severity Metrics”, January 2015.</li> <li>• Florida Department of Transportation (FDOT Safety Office, Florida’s Pedestrian and Bicycle Strategic Safety Plan, updated May 2017.</li> <li>• FDOT Safety Office, Florida Strategic Highway Safety Plan, August 2016.</li> <li>• FDOT Safety Office, FDOT 2016 Highway Safety Plan.</li> <li>• Federal Highway Administration (FHWA), “Alabama Speed Management Action Plan—Problem Identification, Solutions, Implementation, Evaluation”, FHWA-SA-15-017, 2015.</li> <li>• FHWA, “Development of a Speeding-related Crash Typology”, FHWA-HRT-10-024, April 2010.</li> <li>• FHWA, “Engineering Speed Management Countermeasures: A Desktop Reference of Potential Effectiveness in Reducing Crashes”, FHWA-SA-14-100, July 2014.</li> <li>• FHWA, “Speed Limit Basics”, FHWA-SA-16-076, 2016.</li> <li>• FHWA, “Speed Management Case Study”, FHWA-SA-16-078, 2016.</li> <li>• FHWA, “Speed Management Countermeasures, More Than Just Speed Humps”, FHWA-SA-16-077, 2016.</li> <li>• FHWA, “Speed Management Toolkit”, FHWA-SA-15-017, 2015.</li> <li>• National Transportation Safety Board (NTSB), “Reducing Speeding-Related Crashes Involving Passenger Vehicles, Safety Study”, NTSB/SS-17/01, PB2017-102341, July 2017.</li> <li>• National Highway Traffic Safety Administration (NHTSA), <i>Traffic Safety Facts 2015</i>, DOT HS 812 384, 2017.</li> <li>• NHTSA, Speed Management Program Plan, 10811-052814-V3, May 2014.</li> <li>• “Speed Zoning for Highways, Roads &amp; Streets in Florida”, Topic No. 750-010-002, March 2010.</li> </ul>
<b>Keywords Used In Existing Work Search (Cannot leave blank)</b>	Speed management, speed reduction, countermeasures, speed limit, traffic calming, road diet, pedestrian/bicyclist fatality, injury severity, urban roadway, traffic safety, risk of death, risk of severe injury, strategic safety plan
<b>Related Contracts (Give contract numbers)</b>	None.

<b>Funding Request</b>	\$170,000	<b>Anticipated Duration</b>	15 months
<b>Project Manager</b>	Ginger Regalado Co-PMs: Mariano Amicarelli and Brenda Young	<b>Contracting Method</b>	Direct contract with University of South Florida's Center for Urban Transportation Research (CUTR); Dr. Lin
<b>Urgency</b>	Score = 4	The average risk of death and severe injury for a pedestrian or a bicyclist at impact rises as vehicle speed increases. Effective speed management is essential for the safety of pedestrians and bicyclists. Therefore, there is an urgent need to conduct the proposed research to develop best practices, identify proven countermeasures, and recommend innovative techniques and technologies on speed management to significantly reduce pedestrian and bicyclist fatalities and injuries.	
<b>Implementability</b>	Score = 4	The products from this research, including best practices, proven countermeasures, and recommended innovative techniques and technologies, will be highly implementable, which can lead to tangible results in significantly reducing pedestrian and bicyclist fatalities, injuries, and crashes.	

**Project Benefits (Succinct, complete explanation)**

Major project benefits include the following:

- Complete a literature review of proven countermeasures and new techniques on speed management to improve pedestrian & bicycle safety.
- Identify specific proven countermeasures and new techniques for further pilot implementation and evaluation in FDOT D7 to evaluate their effectiveness in reducing vehicle speeds in urban areas.
- Assist FDOT D7 and other districts in reducing speeding-related fatalities and severe injuries of pedestrians and bicyclists.
- Provide effective, proven, suitable, and implementable countermeasures and techniques on speed management for Florida to implement them in a timely manner to improve pedestrian and bicycle safety.
- Quantify the benefits of recommended speed management countermeasures and techniques to improve pedestrian and bicycle safety and reduce the number of associated fatalities and severe injuries.
- Provide recommendations on how to implement recommended proven countermeasures and new techniques.
- Achieve the objective of “research, identify, implement, and evaluate proven countermeasures and new techniques for speed management” in the Highway and Traffic Engineering Emphasis Area in the PBSSP and their associated tasks.
- Fully support the mission of FDOT Traffic Engineering and Operations Office and FDOT’s priority on pedestrian and bicycle safety.
- Project outcomes can be used by FDOT to maximize the safety effect of existing urban roadways in terms of speed control. The research results, findings, and recommendations potentially could save many lives and reduce severe injuries of pedestrians and bicyclists in Florida.

<b>Project Benefits (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>
<input type="radio"/> Materials Enhancement		
<input type="radio"/> Materials Savings		
<input type="radio"/> Time Savings	Reduction of vehicle delays due to pedestrian fatalities and injuries.  Up to \$0.87M time saving per year	Reduction of speed-related pedestrian and bicyclist fatalities, injuries, and crashes could reduce delays from traffic congestion.  Based on the information on <a href="#">Pedestrian Traffic Fatalities by State: 2021 Preliminary Data   GHSA</a> published by the Governors Highway Safety Association (GHSA), there was 8.62% of U.S. pedestrian fatalities in which speeding was indicated as a factor in 2020. It is reasonable to assume a slightly lower rates of 7% for incapacitating injuries and 6% for other pedestrian injuries due to vehicle speeding. We can use these rates to estimate the potential lives saved and injuries prevented due to reduction of speeding related pedestrian fatalities and injuries. Then, we can use these crash reduction to estimate the reduction of traffic congestions.  According to <a href="#">Traffic Crash Facts Annual Report 2020</a> published by the Florida Highway Safety and Motor Vehicles, the 3-year average pedestrian fatalities, incapacitating injuries and other injuries in 2018, 2019 and 2020 were 723, 1,444, and 5,933, respectively. If we can implement the recommended countermeasures and techniques produced from this proposed project to reduce 10% of pedestrian fatalities and injuries due to speeding, 6

		<p>pedestrian fatalities (<math>=723 \times 8.6\% \times 10\%</math>), 10 pedestrian incapacitating injuries (<math>=1,444 \times 7\% \times 10\%</math>), and 36 pedestrian other injuries (<math>=5,933 \times 6\% \times 10\%</math>) can be prevented.</p> <p>According to the data from Urban Mobility Report produced by the Texas Transportation Institute (TTI), the traffic congestion cost for Florida was \$9.236B in 2019. On average, about half of traffic congestion occurs in urban and suburban arterials. According to FHWA, approximately, 25% of traffic congestion is due to traffic incidents such as crashes. Therefore, an estimated traffic congestion cost on urban and suburban arterials in Florida due to crashes is \$1.1545B (<math>=\\$9.236B \times 50\% \times 25\%</math>).</p> <p>Serious traffic congestion due to crashes mostly occurs with fatalities and serious injuries. Based on the crash data in 2018, 2019 and 2020 included in the <a href="#">Traffic Crash Facts Annual Report 2020</a>, there were 21,234 fatalities and serious injuries per year on average in Florida. If 16 (<math>=6+10</math>) pedestrian fatalities and serious injuries out of 21,248 total fatalities and serious injuries can be prevented, the estimated value of time saving from the traffic congestion is <b>\$0.87M</b> (<math>=\\$1.1545B \times 16 / 21,248</math>)</p>
<ul style="list-style-type: none"> <li>○ Lives Saved/Injuries Prevented</li> </ul>	<p>Up to 6 lives saved and 10 incapacitating, and 36 other pedestrian injuries prevented per year</p> <p>Up to \$76.9M of total cost saving per year for saving lives and preventing injuries</p>	<p>Findings and outcomes from this research project could provide FDOT with crucial and needed information and data to implement the most effective and suitable proven countermeasures and techniques on speed management for Florida to significantly reduce speeding-related fatalities and severe injuries of pedestrians and bicyclists.</p> <p>Based on the calculation in the Time Savings section, estimated 6 pedestrian lives (<math>=723 \times 8.6\% \times 10\%</math>) can be saved, 10 pedestrian incapacitating injuries (<math>=1,444 \times 7\% \times 10\%</math>), and 36 pedestrian other injuries (<math>=5,933 \times 6\% \times 10\%</math>) can be prevented.</p> <p>The total estimated saving of social costs of lives saved and injuries prevented per year using the <a href="#">FDOT KABCO Crash Cost</a> published in 2014 is <b>\$76.9M</b> (<math>=723 \times 8.6\% \times 10\% \times \\$10.1M + 1,444 \times 7\% \times 10\% \times \\$818,636 + 5,933 \times 6\% \times 10\% \times \\$163,254</math>)</p> <p>Note:</p> <p>The bicyclist lives saved and injuries prevented are not included in the above calculation. If included, more lives will be saved and more injuries will be prevented.</p>
<ul style="list-style-type: none"> <li>○ Other (Explain)</li> </ul>		

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