

**Request for Research Funding for FY 2022-2023**

**SPR Subpart B Project: TEO-23-20**

<b>Requesting Office</b>	State Traffic Engineering and Operations Office	<b>Priority</b>	20 of 23
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<b>Proposed Title</b>	Wireless Power Transfer Technology Deployment Feasibility Testing at Signalized Intersections
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<b>Justification</b>	<p>As electric vehicle (EV) adoption increases, so does the need for charging infrastructure. Different types of charging technologies are available to address multiple use cases. Currently, there are multiple mature and widely deployed wired charging technologies. Wireless power transfer (WPT) as a method to recharge EVs has been a focal point of research and development and is an emerging technology. There are three types of WPT systems:</p> <ul style="list-style-type: none"> <li>• “Static” WPT is installed in a parking space and charges the vehicle only while parked.</li> <li>• “Quasi-dynamic” WPT is a natural extension of static technology in which vehicles are charged while they are stopped, but not necessarily parked. This can include applications such as charging at a stop-light or taxi charging while waiting in a queue.</li> <li>• “Dynamic” WPT (DWPT) takes this concept even farther and provides power to the vehicle while it is travelling down the road. Fully dynamic WPT has the potential to infinitely extend the useable range of EVs.</li> </ul> <p>There are four main components that go into a WPT system, broken “grid side” and “vehicle side”: (a) Vehicle Electronics, (b) Vehicle Assembly, (c) Ground Assembly and (d) Wall Box. Vehicle side components include vehicle electronics and the vehicle assembly, which is also called the secondary coil. Deployment of these components will be dependent upon OEM adoption of WPT technologies. The “grid side” components include wall box and ground assembly, which is also called the primary coil. These provide the link between the utility power connection and the vehicle; just as plug-in chargers do.</p> <p>FDOT has developed the EV Infrastructure Master Plan that lays out how FDOT is developing and preparing Florida’s infrastructure for wider EV adoption. WPT was identified as one of the advanced technologies to facilitate charging vehicles as they drive on a roadway. FDOT intends to conduct testing and feasibility testing of WPT technologies before the technology is implemented in the field and widely adopted.</p> <p>One of the implementable WPT technologies FDOT desires to test is “Quasi-dynamic” WPT. FDOT intends to test the feasibility of this WPT technology for the signalized intersection use case at FDOT’s Traffic Engineering and Research Lab (TERL) in Tallahassee. The project concept is to equip an intersection at the TERL with at least one charging location, so that an equipped vehicle will be charged while waiting at a stop light. The project may involve coordinating with multiple stakeholders including FDOT, a vehicle owner and/or operator, vehicle OEM, WPT vendor, and electric utility company.</p> <p>The research project should address the following items:</p> <ol style="list-style-type: none"> <li>1. Test loop detectors for interference with the coil magnetic field. Can the WPT system and traffic signal share a common vehicle detection system?</li> <li>2. Can the static WPT system use solar power, and if so, what would be the solar power infrastructure requirements?</li> <li>3. Any installation, safety, and maintenance considerations for installation at an intersection in live traffic</li> <li>4. Amount of charge received (and range provided) to the vehicle during the durations of the typical red times of a traffic movement</li> <li>5. Interaction of the grid side system with any loop detection systems or other typical intersection equipment</li> <li>6. User friendliness and requirements for proper alignment of the vehicles over the grid side system</li> </ol> <p>The project will include the following tasks:</p> <p><b>Task 1:</b> Task 1 will be focused on the project development and following sub-tasks.</p> <ul style="list-style-type: none"> <li>• Literature review of various WPT systems</li> <li>• Stakeholder coordination</li> <li>• Industry maturity and capability review</li> </ul> <p><b>Task 2:</b> Task 2 will be focused on test plan development and stakeholder coordination to implement the project.</p> <ul style="list-style-type: none"> <li>• Develop test plan for testing at the TERL</li> <li>• Outline the test requirements</li> </ul>
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	<ul style="list-style-type: none"> <li>Coordinate with TERL to understand the availability and characteristics of the test facility</li> <li>Coordinate with vehicle OEM, WPT system providers, and other stakeholders involved in the project</li> </ul> <p><b>Task 3:</b> Task 3 will be focused on actual testing.</p> <ul style="list-style-type: none"> <li>Conduct testing in coordination with all stakeholders and follow the procedure outlined in the test plan</li> <li>Validate the test requirements</li> </ul> <p><b>Task 4:</b> Distribute test outcomes with the stakeholders</p> <ul style="list-style-type: none"> <li>Document test outcomes and share with the FDOT and other identified partners</li> <li>Develop and deliver presentation to the stakeholders</li> </ul> <p><b>Task 5:</b> Mainstreaming Recommendation</p> <ul style="list-style-type: none"> <li>The research team will develop a set of recommendations for mainstreaming WPT systems for various modes of transportation</li> <li>The research team will develop a draft policy for the state agencies to prioritize corridors for facilities for WPT implementation with timeline.</li> </ul>		
<b>Impact</b>	The project will be helpful to understand if quasi-dynamic WPT charging technology is feasible to be implemented at signalized intersections to wirelessly charge vehicles while they are waiting at the signal. Without this research the feasibility of this use case will be unknown to FDOT.		
<b>Affected Offices</b>	State Traffic Engineering and Operations Office.		
<b>Existing Work</b>	WPT research exist on various topics. However, there is no research done for quasi-dynamic WPT charging at signalized intersections.		
<b>Keywords Used in Existing Work Search</b> <b>(Cannot leave blank)</b>	Wireless Power Transfer		
<b>Related Contracts</b> <b>(Give contract numbers)</b>	N/A		
<b>Funding Request</b>	\$415,000	<b>Anticipated Duration</b>	18 months
<b>Project Manager</b>	PM: Derek Vollmer Co-PM: Edith Wong	<b>Contracting Method</b>	Anticipated procurement method (e.g., supplement to existing project, RFP to all registered vendors, direct contract with university)
<b>Equipment</b>	<p><b>Equipment and Installation Cost:</b></p> <p>Grid Side Electronics – \$20K</p> <p>Grid Side Coils – \$10K</p> <p>Grid Side Installation – \$20K</p> <p>Vehicle System – \$10K</p>	This estimate includes two consecutive charging locations at the intersection along with two vehicle system.	
<b>Urgency</b>	1	The need for charging infrastructure will become critical as the ownership of electric vehicles increases. This research will lay the groundwork that will be need for future implementation of wireless electric vehicle charging technologies within the public roadway network to support electric vehicle penetration.	
<b>Implementability</b>	1	This project will implement the WPT system on the roadside and vehicle side. This a implementation only project with evaluation component included in it.	

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

EV charging technologies have taken off as more mandates emerge to make the vehicles environmentally more sustainable. WPT systems can help convert to more environmentally friendly vehicles by providing the needed power wirelessly as the vehicles sit idle, or stop for a while, or drives on a segment of roadway equipped with WPT systems. The research project will evaluate the feasibility of one of the WPT system use cases known as quasi-dynamic WPT for a signalized intersection. The use case will be tested and evaluated at the TERL, an FDOT testing facility.

<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	Determine if quasi-dynamic WPT system is feasible for signalized intersection use case	Power system data, data from ground assembly, data from vehicles and OEMs
<input type="radio"/> Materials Savings	NA	
<input type="radio"/> Time Savings	NA	
<input type="radio"/> Lives Saved/Injuries Prevented	NA	
<input type="radio"/> Other (Explain)	Technology Enhancement	New technology, environmental benefits, fuel efficiency, feasibility testing of a signalized intersection.

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