Kansas Department of Transportation

TECHNICAL SUMMARY

Wireless Charging Revenue Generation from Kansas Pavements

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Introduction

The electrification of transportation systems—roads and vehicles—has increased in popularity in the last decade due to federal and targeted incentives to encourage increased usage of electric vehicles (EVs). As a result, the need for an accessible, affordable, and sustainable charging infrastructure has emerged. Consequently, the current U.S. presidential administration supports the building of a novel national network of charging stations (approximately 500,000 access points) throughout the United States. The National Electric Vehicle Infrastructure (NEVI) program is expected to offer states $5 billion in formula funding to build charging infrastructure along highway corridors to increase charging access in rural and disadvantaged communities.

In addition to the expected environmental and energy security related benefits, however, high EV adoption raises concerns about the negative impact on revenue generation that has previously come from the gasoline tax. The Highway Trust Fund (HTF) has been challenged repeatedly for future sustenance, including declining gas tax revenue as consumers choose plug-in EVs (PEVs). Similar to other states, road maintenance and improvements in Kansas are dependent upon the availability and distribution of state highway funds. Therefore, the identification of alternative revenue sources, such as wireless charging pavements, is vital to maintain a sustainable flow of highway funds as EV usage increases in Kansas.

Project Description

The Wireless charging pavements, which leverage induction charging via primary and secondary coils in concrete pavements, allow an EV to charge either while stationary or traveling as fast as 62 miles per hour (mph) (e.g., the Qualcomm developed testbed). Wireless charging pavements can help reduce the “range anxiety” of EV owners and eventually increase the EV market share in the geographic region where wireless charging pavements are used. A properly designed network of wireless charging pavements that utilizes induction charging coils only on selected road segments would allow the Kansas Department of Transportation (KDOT) and/or the Kansas Turnpike Authority (KTA) to charge EV owners fees for wireless charging, thereby generating sustainable revenue.

Before investing in this potential revenue-generating technology, however, financial and economic feasibility must be assessed, the EV market in Kansas must be better understood, and the response to the introduction of wireless charging pavements must be estimated. Therefore, this study utilized five main tasks to accomplish the research objectives. Task 1 synthesized current wireless charging technologies, while Task 2 estimated existing and projected EV ownership and usage trends for Kansas. Task 3 developed the EV market share model, and Task 4 investigated the correlation between

charging station availability and PEV adoption, including assessment of the effects of charging station availability, gasoline prices, and home charging installation costs on PEV market adoption. Task 5 explored and summarized pricing/business/cost-benefit models for EV charging from pavements.

Project Results

The benefits of a dynamic wireless power transfer (DWPT) system include cost savings, including recouping initial investments, and positive environmental impacts. Cost savings for DWPT users include decreased fuel costs, travel-time savings (charging time), financial incentives related to EV purchase, and minimal maintenance costs. The life cycle cost analysis (LCCA) for DWPT systems is complex and generally incorporates significant uncertainty. We do not focus on the LCCA in this chapter. This study initially focused on the overall financial feasibility of DWPT systems, including initial capital cost investments and fees imposed on DWPT users.

Project Information

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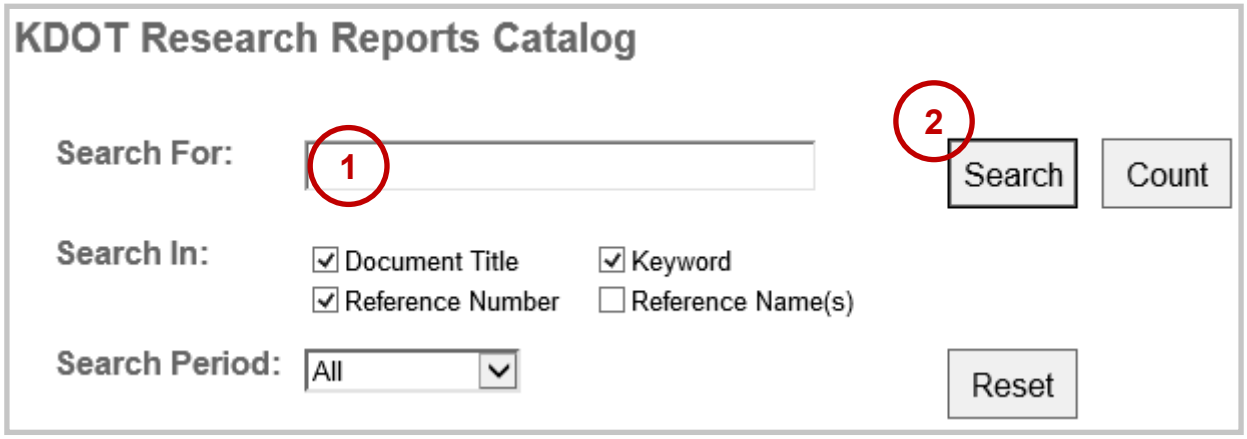

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