**Name(s)**

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**Project Number**

**J1015**

**Project Title**

# Powered Infrastructure: Reducing Electric Vehicle Range Limitation and Charging Downtime via Resonant Inductive Coupling

## Abstract

**Objectives**

The objective of this project was to determine the feasibility of reducing the range and charging downtime limitations of electric vehicles by embedding electrical infrastructure for wireless power transfer via resonant inductive coupling into automotive transportation infrastructure. A key determinant of feasibility is the degree to which wireless power transfer between circuits that are in relative motion is equivalent to wireless power transfer between circuits that are relatively stationary.

**Methods**

Built and optimized primary (transmitter) and secondary (receiver) circuits for wireless power transfer via resonant inductive coupling using inexpensive and widely available electronic components. Embedded primary circuits into a model road. Embedded secondary circuits into a model vehicle. Measured distances over which wireless power transfer was effective. Built motorized structure to move the model vehicle over the model road at varying speeds. Tested both instantaneous power transfer and total power transfer over time through multiple trials for multiple movement cases (stationary, slowly moving, quickly moving).

**Results**

Results for instantaneous power transfer and total power transfer over time revealed that, as hypothesized, the degree to which the primary and secondary circuits are in realistic relative motion does not significantly affect the efficacy of wireless power transfer via resonant inductive coupling. Further, it is more likely than not that observed differences in power transfer resulted from imprecision in test design, instrumentation, or a combination of both.

**Conclusions**

Construction of circuits to enable wireless power transfer via resonant inductive coupling was straightforward and inexpensive, as was construction of a realistic model wherein primary circuits were embedded into a road and secondary circuits were embedded into a vehicle. Tests revealed that power transfer between the model road and the model vehicle in realistic relative motion was similarly effective to power transfer between the model road and the model vehicle when relatively stationary. All indications suggest that the proposed powered infrastructure could significantly improve the utility and appeal of electric vehicles by increasing range and reducing charging downtime, and thus help achieve the benefits associated with their increased use relative to fossil-fueled vehicles.

**Summary Statement**

I showed that wireless power transfer via resonant inductive coupling between primary road circuits and secondary vehicle circuits could charge batteries in a moving electric vehicle, and thus reduce range limitation and charging downtime.

**Help Received**

None. I designed and built the equipment and circuitry myself, as well as designed and conducted the experiments myself.