Agrawal, Shubham. M.S.C.E., Purdue University, December 2015. **Routing Aspects of Electric Vehicle Users and Their Effects on Network Performance**. Major Professor: Srinivas Peeta.

This study investigates the routing aspects of battery electric vehicle (BEV) users and their effects on the overall traffic network performance. BEVs have unique characteristics such as range limitation, long battery recharging time, and recuperation of energy lost during the deceleration phase if equipped with regenerative braking system (RBS). In addition for BEVs, the energy consumed per unit distance traveled is lower at moderate speed than at higher speed. This raises two interesting questions: (i) whether these characteristics of BEVs will lead to different route selection compared to conventional internal combustion engine vehicles (ICEVs), and (ii) whether such route selection implications of BEVs will affect the network performance. With the increasing market penetration of BEVs, these questions are becoming more important. This study formulates a multi-class dynamic user equilibrium (DUE) model to determine the equilibrium flows for mixed traffic consisting of both BEVs and ICEVs. A simulation-based framework is used to obtain the solution of the DUE problem. The route selection criterion in the DUE model minimizes the generalized cost including route travel time, energy consumption and range anxiety for BEVs, and minimizes the travel time for ICEVs. As such for BEVs, the energy consumption efficiency is traded off against the travel time. Results from numerical experiments for the test network illustrate that the dominantly selected routes by BEV drivers are different from ICEV drivers. A significant fraction of BEV drivers select congested routes to conserve and recuperate battery's energy while most ICEV drivers select shortest travel time routes. The experimental results indicates that such behavior of BEV drivers can lead to reduction in total system travel time and move the system towards the optimality under certain BEV market penetration rates.