Commuters in urban areas suffer from traffic congestion on a daily basis. The increasing number of vehicles and vehicle miles traveled (VMT) are exacerbating this congested roadway problem for society. Although literature contains numerous studies that strive to propose solutions to this congestion problem, the problem is still prevalent today. Traffic congestion problem affects society’s quality of life socially, economically, and environmentally. In order to alleviate the unsustainable impacts of the congested roadway problem, Intelligent Transportation Systems (ITS) has been utilized to improve sustainable transportation systems in the world. The purpose of this thesis is to analyze the sustainable impacts and performance of the utilization of ITS in the United States.

This thesis advances the body of knowledge of sustainability impacts of ITS related congestion relief through a triple bottom line (TBL) evaluation in the United States. TBL impacts analyze from a holistic perspective, rather than considering only the direct economic benefits. A critical approach to this research was to include both the direct and the indirect environmental and socio-economic impacts associated with the chain of supply paths of traffic congestion relief. To accomplish this aim, net benefits of ITS implementations are analyzed in 101 cities in the United States. In addition to the state level results, seven metropolitan cities in Florida are investigated in detail among these 101 cities. For instance, the results of this study indicated that Florida saved $1.38 \times 10^5$ tons of greenhouse gas emissions (tons of carbon dioxide equivalent), $420$ million of annual delay reduction costs, and $17.2$ million of net fuel-based costs. Furthermore, to quantify the relative impact and sustainability performance of different ITS technologies, several ITS solutions are analyzed in terms of total costs (initial and operation & maintenance costs) and benefits (value of time, emissions, and safety). To account for the uncertainty in benefit and cost analyses, a fuzzy-data envelopment analysis (DEA) methodology is utilized instead of the traditional DEA approach for sustainability performance analysis. The results using the fuzzy-DEA approach indicate that some of the ITS investments are not efficient compared to other investments where as all of them are highly effective investments in terms of the cost/benefit ratios approach. The TBL results of this study provide more comprehensive picture of socio-economic benefits which include the negative and indirect indicators and environmental benefits for ITS related congestion relief. In addition, sustainability performance comparisons and TBL analysis of ITS investments contained encouraging results to support decision makers to pursue ITS projects in the future.

Major: Civil Engineering

Educational Career:
Bachelor’s of Civil Engineering, BS, 2009, Cukurova University

Committee in Charge:
Omer Tatari, Chair, Civil, Environmental, and Construction Engineering
Haitham Al-Deek, Civil, Environmental, and Construction Engineering
Amr Oloufa, Civil, Environmental, and Construction Engineering

Approved for distribution by Omer Tatari, Committee Chair, on October 8, 2013.

The public is welcome to attend.