UTC Project Information	
Project Title	MPC-463 – Rehabilitation Project Selection and Scheduling in Transportation Networks
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Project Duration	3 Year
Brief Description of Research Project	Road infrastructure in the U.S. is aging rapidly as many roads are approaching or exceeding their design life. As a result, transportation agencies need to allocate more resources to maintenance and rehabilitation (M&R) activities. The National Highway System (NHS) spent 48.5 percent of its total capital spending in 2008 in system rehabilitation, the highest percentage since 2000 (FHWA, 2010). On the other hand, stringent budgets provide insufficient funding to support all needed M&R projects. Decision makers have to prioritize and select projects based on their tangible benefits to the transportation system. Meanwhile, traffic congestion across the country has been on the rise over the past 30 years by every measure (TTI, 2012). The problem is further exacerbated by an increasing number of M&R projects performed on already-congested roads. Work zones are estimated to account for nearly 24% of non-recurring delay on freeways (USDOE, 2002). Hence, M&R project selection and scheduling not only are essential to restore and maintain a reasonable level of service on existing roads but also have profound impact on congestion mitigation. Highway project selection and scheduling are traditionally treated as two separate problems in the literature. The benefit-cost analysis (BCA) is a common approach adopted by transportation agencies to assist in project selection when an agency is operating under budget constraints. In particular, the benefit-cost ratio (BCR) is often used as the primary BCA measure to identify a collection of projects among competing ones that yields the highest ratio of benefits to costs (e.g., FHWA, 2003; Li and Kaini, 2007). When transportation projects involve

	multiple stakeholders with conflicting interests, decision makers have to make trade-offs among multiple objectives. Instead of the single-objective BCA, multi-objective optimization problems are often formulated to address the conflicting requirements of different objectives (e.g., Fwa et al., 2000; Orabi and EI-Rayes, 2012; Wu et al., 2012). When it comes to project scheduling, transportation agencies are often faced with the need to perform multiple work zone projects concurrently because of the increasing number of required M&R activities. Work zones may cause excessive congestion and delays to motorists, especially when multiple projects are under construction simultaneously in close proximity to one another. Most existing studies, however, focus on quantifying the impact of work zone delays at the individual project level (e.g., FHWA, 2006). Few studies have been done to strategically schedule multiple M&R projects in a transportation network to mitigate their impacts on traffic. Qiu (1997) assumes the impacts of different projects are independent and does not consider travelers' response to multiple concurrent projects. Chang et al. (2001) uses a simplified setting of work zone scheduling, which greatly limits the number of possible schedules. Zheng et al. (2013) uses an approximation approach to estimate travelers' route choice behavior and the Genetic Algorithm adopted has limited capability in handling large-scale problems in terms of the number of projects and network size. In summary, it is critical to investigate how to select and schedule M&R projects in a way that can maximize their benefit or effectiveness while minimizing the traffic impacts of work zones across project development phases. There is a pressing need to develop an integrated framework for simultaneous selection and scheduling of multiple M&R projects at the network level. **Research Objectives:** This proposed project is to develop a systems approach for selecting and scheduling M&R projects simultaneously. The proposed modeling framework will accomplish the following two objectives: 1. Explicitly capture the impacts of the presence of multiple M&R projects on travelers' route choice behavior. Strategically select and schedule M&R projects in a transportation network over a finite planning horizon to maximize social benefit.
Describe Implementation of Research Outcomes (or why not implemented) Place Any Photos Here	This study provides transportation agencies an integrated approach for selecting and scheduling M&R projects. The modeling framework and solution algorithm developed in this study are capable of modeling the selection and scheduling of other types of M&R projects.
Impacts/Benefits of Implementation (actual, not anticipated)	This study provides transportation agencies an integrated approach for selecting and scheduling M&R projects. Agencies can use the proposed modeling framework to choose a limited number of projects subject to budget constraints and determine the optimal sequence of implementing those selected projects within a finite planning horizon

	simultaneously.
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