**Project Title:** Scheduling Workzones in Multimodal Networks

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**Abstract:**
The repair and maintenance of the network results in “workzones”, where the capacity of a link, or a segment of a link, is out of commission for a predicted period of time, until the work is completed. While a single, or few widely scattered concurrent workzones, will not have a large effect upon daily commuter driving patterns, several workzones that are close together and affect large flows of traffic may result in traffic patterns that are both costly to the travelers and vehicle-based services, resulting in significant negative environmental and safety consequences. That is, the concurrent execution of several workzones within a network sometimes leads to the following adverse effects that include (1) commuting traffic delays, (2) delays in vehicle-based service systems, such as goods delivery, parcel/mail delivery, transit, etc. with possible negative effects on customer service and loss of profit/revenues, (3) safety concerns, and (4) stress on resources.

Through proper scheduling, to the extent possible, in terms of both, spatial location in the network and the time period of the workzone, it may be possible to reduce the negative impacts of the workzones. Furthermore, the capability to estimate the traffic diversion due to work zones to facilitate the development of congestion mitigation strategies (e.g. signal re-timing) would be of great benefit to the traveling public.

Furthermore, current considerations of scheduling workzones focus mostly on automobile traffic congestion in the network, even though agencies responsible for the workzones consider safety due to varied multimodal traffic – automobiles, trucks and buses – when designing each workzone staging area, which is normally much larger than that needed if automobile traffic operations were the only concern. This project will explicitly consider the workzone traffic delays of both, (1) daily commuters traveling from their origins to their destinations,
having the objective of minimizing individual travel times and (2) fleets of vehicles (e.g., commercial trucks and buses) that have scheduled pickups/deliveries of good/ people to meet company’s or agency’s objectives of meeting deadlines with minimum cost. From a conceptual point of view, we consider that two flows of “agents” are using the same physical network: commuter agents and service agents. All agents compete with each other to use the physical space of the network at any given time. Commuter-agents’ objectives dominate in deriving these equilibria (in the literature the term “assignment” is often used here instead of “equilibrium”). This assumption is appropriate if most of the vehicles in the network are due to commuter travel.

When one considers service agents, there are scheduled service times such as times to pick/up deliver packages, times to pickup and transport passengers, and they may have more complicated objectives such as completion of service at minimum cost and or the maximization of vehicle utilization. From a game-theoretic perspective, the goal of scheduling workzones and operating the network should be to trade-off the objectives of the competing commuter agents and the service agents

**Research Plan**

The research problem will be addressed through the following subtasks.

**Task 1:** Conduct literature review on scheduling workzones considering commuter traffic  
**Task 2:** Develop Scheduling Model considering only commuter agents  
**Task 3:** Develop Algorithms to Solve Model of Task 2  
**Task 4:** Evaluate Model and Algorithm for Case of Tasks 2-3  
**Task 5:** Develop Final Report for Phase 1  
**Task 6:** Conduct literature review on scheduling workzones considering service vehicles  
**Task 7:** Develop Scheduling Model considering only service vehicles  
**Task 8:** Develop Algorithms to Solve Model of Task 6  
**Task 9:** Evaluate Model and Algorithm for Case of Tasks 6-7  
**Task 10:** Develop Integrated Model considering commuters and service vehicles  
**Task 11:** Develop Algorithms to Solve Model of Task 9  
**Task 12:** Evaluate Model and Algorithm for Case of Tasks 9-10  
**Task 13:** Develop Final Report for Phases 1 and 2.