**Coupling Ridesharing and Public Transit System as First-mile/Last-mile Transit Strategy**

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The majority of commuting trips in the US use private cars as travel mode with single-occupant travel. Large numbers of trips with low vehicle occupancy rates often lead to severe traffic congestion in urban areas and produce excess traffic gas emissions. Following the current decarbonized transportation efforts, local governments suggest the use of public transportation as one of the strategies to reduce such negative external effects of car travel. However, there are some challenges to public transit. First, it has low efficiency of operation management, low frequency, and delays. Second, its accessibility is low, such as long commuting time, parking problems, stopping points far away from the starting point or final destination. Therefore, transportation agencies must find better solutions to the first- and last-mile transit problems to attract people to public transportation. A cheaper and more environmentally sustainable strategy for addressing the first-mile/last-mile transit problem is by utilizing the shared mobility of commuting vehicles as shuttles connecting to the public transit. Ridesharing systems, which are sustainable and more flexible, can share passenger mobilities with similar travel patterns (e.g., origin, destination, and schedule), are efficient in improving vehicle occupancy and effective in reducing emissions.

Our project aims to study the potential benefits of integrating peer-to-peer ridesharing and the transit system to improve the first-mile/last-mile transit strategy. We construct the problem as Capacitated Vehicle Routing Problem with Time Window (CVRPTW) to minimize the total travel cost and maximize the rider's satisfaction. We construct Saving Method with time window constraints to solve the problem heuristically at a larger network size. The model formulation and solution consistency are verified on small problem size using Gurobi (optimal solution) and proposed constructed heuristic methods. Finally, we implement our proposed model on 30 New York City trip request data as our experimental area. Our problem is that given a set of requests, a road network, and a transit network, find: (1) An optimal match between drivers and riders for ridesharing so that a given objective function is optimized; (2) Optimal ridesharing chain for each driver and rider.