

Planning, Policy,  
and  
Programming

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Project Title:  
Modeling e-hailing and car-pooling  
services in a coupled morning-  
evening commute framework

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## Modeling E-hailing And Car-pooling Services In A Coupled Morning- evening Commute Framework

Leverage previous study on e-hailing and ridesharing to develop a general equilibrium model that captures the complex interactions between solo-driving, e-hailing, car-pooling, and transit

### WHAT IS THE NEED?

There are significant challenges in modeling the multi-class, sometimes competing and sometimes cooperating modes of travel in a single modeling framework. These challenges include how to represent these various modes and their connections in a unified and potentially layered transportation network, how to account for the various "cost" factors of each service such as waiting time for e-hailing and car-pooling, how to model these factors and the competition between different modes or mode combinations in a general network equilibrium, and how to link morning and evening commute in such a general equilibrium model such that both the essential features of this complex system are captured and it is still mathematically tractable.

### WHAT ARE WE DOING?

The researchers will divide the work in four parts to tackle the above-mentioned challenges:

1. Extend the development of a broad traffic equilibrium model to address the fusion of the recent emergent industry of e-hailing service providers and shared rides with the traditional transportation modes of public transits and solo-driving.
2. Explore different approaches to model the home-work-home travel because of the options to switch modes between the morning and evening commute, and the choice of a mode in the morning depends on the choice of the mode in the evening.



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knowledge that improves  
California's transportation system

3. Develop the components of waiting time and other inconvenience costs of both e-hailing services and car-pooling.
4. Conduct scenario studies to evaluate the impacts of various pricing and incentive policies on system performance.

## WHAT IS OUR GOAL?

This project aims to understand the impact of the new mobility modes on traffic congestion, travelers' behavior of mode choices, added vehicle miles driven by empty service cars, and efficiency of the overall urban transportation systems for travelers.

## WHAT IS THE BENEFIT?

This project addresses several of Caltrans' goals in its strategic plan: efficiency, sustainability, and accommodating and supporting innovative mobility technologies. The potential of integrating e-hailing, car-pooling, and transit services seamlessly and more effectively could reduce solo-driving, and consequently lessen traffic demand, congestion, and vehicle miles traveled.

A better understanding of this integration can also lead to better deployment of high-occupancy vehicle lanes and car-pool pick-up and drop-off locations, to just name a few.

## WHAT IS THE PROGRESS TO DATE?

### 1. The researchers have completed Deliverable 1A for Task 1

- Conducted a thorough review of the literature on modeling e-hailing and car-pooling services in a coupled morning-evening.
- Developed a description of the unified network representation of all services (e-hailing, car-pooling, transit, solo driver, etc.)
- Completed the development of the generalized equilibrium model that links the morning and evening commutes.

- Completed the development of all the mathematical models and ensure that they are formulated in such a manner that they can be solved by an optimization software package.
- Drafted the final report and is now preparing a presentation to Caltrans.

### 2. Plan For Next Quarter

- None. The project is completed with a draft final report submitted.

## Complete List of Tasks

### Task 1: Developing the network representation and generalized equilibrium model

- **Deliverable 1A:** A thorough review of the literature on modeling e-hailing and car-pooling services in a coupled morning-evening commute framework. As well as a unified network representation of all services considered in the study.
- **Deliverable 1B:** A general equilibrium model for either morning or evening commute.

### Task 2: Linking evening and morning commute together

- **Deliverable 2:** An integrated morning-evening commute general equilibrium model.

### Task 3: Modeling waiting times and mode-switching costs in an integrated system

- **Deliverable 3:** Inconvenience costs of both e-hailing services and regular car-pooling.

### Task 4: Case studies

- **Deliverable 4:** Modeling results of the case study

### Task 5: Preparing project report and data management

- **Deliverable 5A:** Final report and a policy brief
- **Deliverable 5B:** Project Data