DRISI

CALTRANS DIVISION OF RESEARCH, INNOVATION AND SYSTEM INFORMATION

Research Results

Modeling Multi-Modal Mobility in a Coupled Morning-Evening Commute Framework that considers Deadheading and Flexible Pooling

Developing a unified transportation planning model.

Planning, Policy and Programming

SEPTEMBER 2023

Project Title:
Modeling Multi-Modal Mobility in a Coupled Morning-Evening Commute Framework that considers Deadheading and Flexible Pooling

Task Number: 3453

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WHAT WAS THE NEED?

The rapid rise of e-hailing and e-pooling are transforming urban passenger transportation. The addition of these new mobility modes has produced more interactions between these new modes and the traditional modes. As a result, this complex travel behavior calls for new modeling tools to properly account for them.

There is a clear need to not only understand the nature and effect of these new mobility services better, but also to understand, model, and study the interactions between the various modes of transportation, and integrate them in a unified transportation planning model that includes morning and evening commutes. However, there is little research that captures the complex interactions between solo driving, ridesharing, and e-hailing and allows travelers to switch between different transportation modes in a coupled morning-evening commute.

WHAT WAS OUR GOAL?

The goal was to develop a general modeling framework to simultaneously consider the morning and evening commute while accounting for deadhead miles for ride-hailing and allowing for passengers from different origin/destination pairs to carpool together.

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WHAT DID WE DO?

We developed the dual network representation of coupled morning-evening; then formulated it under the dual-network representation. We then developed the solution algorithm. Next we estimated the e-hailing deadhead miles. Lastly, we developed a case study using the Sioux Falls network to compare how the modal share and Vehicle-Miles-Traveled (VMTs) change after we incorporate deadheading miles and flexible ridesharing.

WHAT WAS THE OUTCOME?

The results showed our model captures the possible mode switches between morning and evening commutes as well as the detour of rideshare drivers to pick up or drop off passengers. Also, examples demonstrated morning and evening commutes separately overestimated the number of drivers and VMT in the network when accounting for interactions between morning and evening commutes.

WHAT IS THE BENEFIT?

The model helps transportation planners in terms of analyzing the morning and evening commute trips in terms of: 1) how to quantify a travelers mode switch between the morning and evening commute; and 2) how to capture the interactions between the various modes of transportation in the morning and evening commutes. This model considers the joint travel decisions and interactions between solo driving, rideshare and ridehailing in a coupled morning-evening framework with features of: 1) providing results of traffic flows and travelers mode choices; 2) quantifying possible mode switches across various transportation services between morning and evening commutes; 3) allowing for passengers from different origin and destination pairs to share a ride together; 4) capturing the deadhead time of ridehailing vehicles; and 5) modeling the interaction effects between morning and evening commutes.

LEARN MORE

For more information, see report at: METRANS | Research Projects.

IMAGES

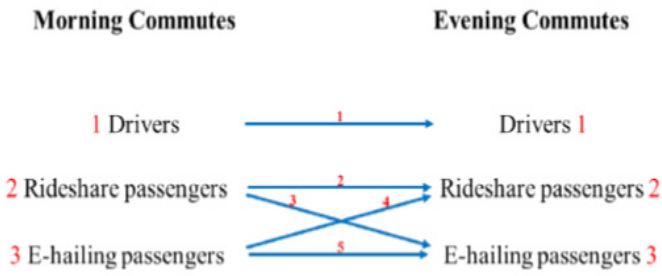

Image 1: The Different Combination of AM/PM Commuting Modes for a Daily Commute