DRISI
Caltrans Division of Research,
Innovation and System Information

Research Results

Activity-Travel Patterns and Tour Formation of Transit Users

Investigate the daily activity pattern and tour formation of transit users.

Modal

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Project Title:
Analysis of Activity-Travel Patterns and Tour Formation of Transit Users

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WHAT WAS THE NEED?

The complexity of travel behavior has evolved over time as travelers respond to various activity demands and the changing supply environment, measured by congestion, cost, and emerging technologies. Complexity in travel behavior is often manifested by an increasing tendency to chain several activity purposes within a tour to minimize total travel time and the number of trips. In response, travelers seek more flexible travel modes to complete their complex travel demand.

While personal vehicles arguably provide the most flexibility in terms of managing travel needs, the more sustainable mode of transport is public transit. However, public transit often offers less flexibility and mobility services than a private car in chaining activities due to temporal and spatial constraints such as fixed routes and schedules, transfer requirements, waiting times, and access/egress issues. Its widespread adoption is arguably dependent on its ability to offer effective chaining of activities as well as trips. Unfortunately, little is known in the context of American travel about the complex travel behavior of transit users.

WHAT WAS OUR GOAL?

The primary project goal was an in-depth analysis of the complexity of activity-travel patterns for transit users.

Project research objectives included:

- To understand the socio-demographics and tour behavior of transit users.

- To identify latent classes of transit users based on heterogeneity in activity-travel patterns and tour formation.
- To develop a tour choice model to characterize transit commuters based on the complexity of work tours.
- To analyze activity-travel patterns of transit disadvantaged groups.

WHAT DID WE DO?

First, the researchers analyzed how and when public transit commuters incorporate non-work activities within their work tours, constrained by factors such as work time commitments, transit operating characteristics, and access/egress issues. In particular, they identified dominant patterns of work tours made by transit commuters and analyze these tours using a set of activity-travel analytics and data from the 2017 National Household Travel Survey (NHTS).

Second, the researchers also analyzed the activity pattern behavior of transit users by using a comprehensive approach—Latent Class Analysis (LCA). They identified latent classes of transit users based on heterogeneity in activity-travel patterns and then associated those classes with socio-demographic characteristics of transit users in the class.

Finally, the researcher team developed a tour choice model to characterize public transit commuters (who) based on the complexity of work tours and also to assess the impacts of demographic, location, and activity-travel factors on the likelihood of a transit commuter choosing a particular type of work tour (why). Based on the 2017 NHTS data, a Structural Equation Model (SEM) was developed.

WHAT WAS THE OUTCOME?

The primary insights from how and when public transit commuters incorporate non-work activities within their work tours was:

1. about 80 percent of work tours consist of seven dominant patterns whereas the remaining 20 percent of tours demonstrate a total of 106 diverse and more complicated patterns;
2. half of the transit work tours are complex;
3. most simple tours are transit-only tours whereas most complex tours are multi-modal tours; and
4. transit use is more complex than the traditional home to work commute with a diverse set of choices at various stages of activity scheduling.

The results from analyzing the activity pattern behavior of transit users by using a comprehensive approach was the researchers found that disadvantaged groups used transit differently than non-disadvantaged groups. More specifically, these groups of people typically used transit in non-work activity-travel patterns.

The research team developed a tour choice model that characterizes public transit commuters results suggested that married men with no children and high vehicle ownership living in low-density areas tended to make simple work tours while single, non-millennial women with children who live in high-density neighborhoods were more likely to make complex work tours. Also, millennial white males with higher income and higher education who are living in denser areas were more likely to make complex tours with work-based sub-tours. Moreover, denser residential neighborhoods, flexible work schedules, and private vehicle availability in work tours were observed to increase the propensity of making any kind of complex tours.

WHAT IS THE BENEFIT?

Transit agencies can benefit from the research findings on tour formation and daily activity-travel patterns of transit users by developing market strategies to address transit users travel needs and thus to improve the quality of transit serviced provided.

IMAGES

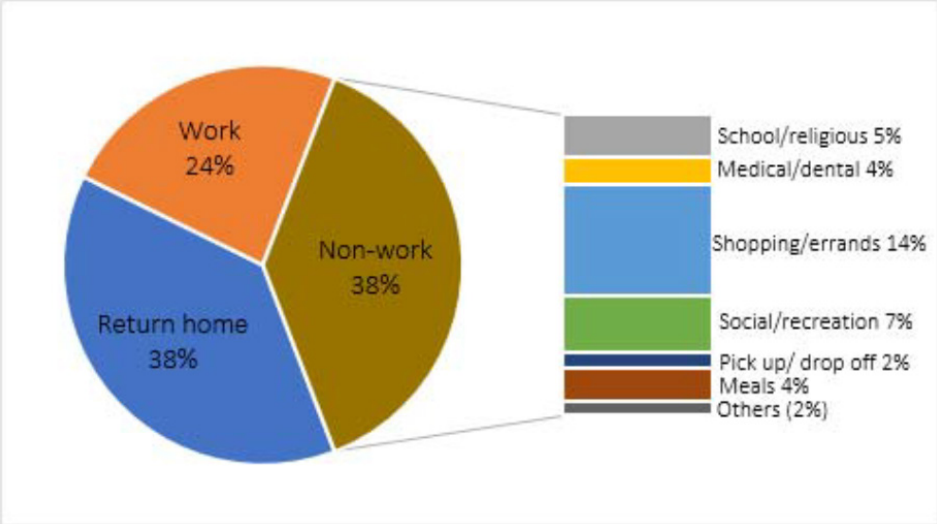

Image 1: Distribution of Transit Trips by activity purpose

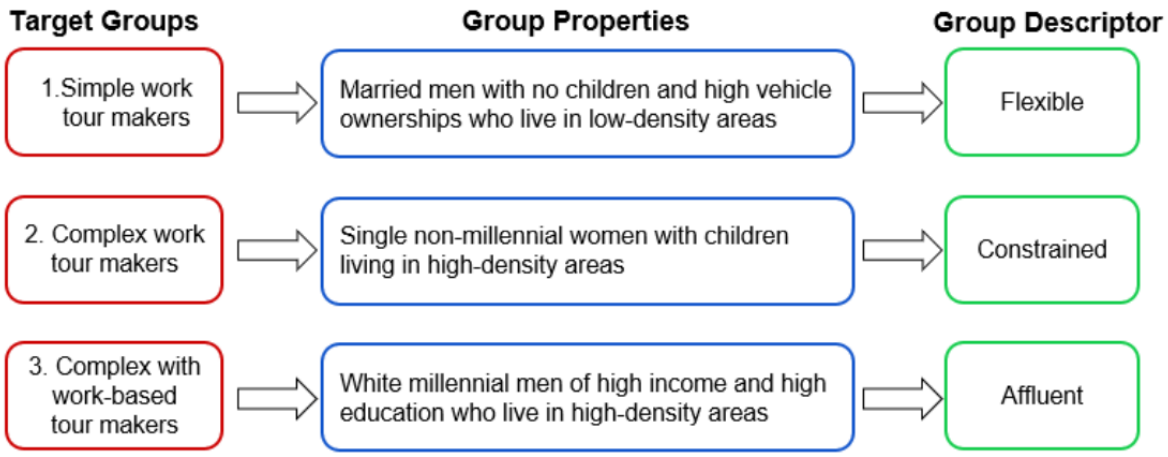

Image 2: Tour Choice Model Findings