



*The World's Largest Open Access Agricultural & Applied Economics Digital Library*

**This document is discoverable and free to researchers across the globe due to the work of AgEcon Search.**

**Help ensure our sustainability.**

Give to AgEcon Search

AgEcon Search

<http://ageconsearch.umn.edu>

[aesearch@umn.edu](mailto:aesearch@umn.edu)

*Papers downloaded from **AgEcon Search** may be used for non-commercial purposes and personal study only. No other use, including posting to another Internet site, is permitted without permission from the copyright owner (not AgEcon Search), or as allowed under the provisions of Fair Use, U.S. Copyright Act, Title 17 U.S.C.*

*No endorsement of AgEcon Search or its fundraising activities by the author(s) of the following work or their employer(s) is intended or implied.*

# **Heterogeneity Among Motorists In Traffic Congested Areas In Southern California**

J. F. Jennifer Lee and Jeffrey Williams

Department of Agricultural and Resource Economics, University of California Davis

[jfjlee@ucdavis.edu](mailto:jfjlee@ucdavis.edu), [williams@primal.ucdavis.edu](mailto:williams@primal.ucdavis.edu)

*Selected Poster prepared for presentation at the Agricultural & Applied Economics Association's  
2013 AAEA & CAES Joint Annual Meeting, Washington, DC, August 4-6, 2013.*

*Copyright 2013 by J. F. Jennifer Lee and Jeffrey Williams. All rights reserved. Readers may make verbatim copies of this document for non-commercial purposes by any means, provided that this copyright notice appears on all such copies.*



# Heterogeneity Among Motorists In Traffic Congested Areas In Southern California

J. F. Jennifer Lee and Jeffrey Williams

Department of Agricultural and Resource Economics, University of California Davis



## Introduction

Road users have heterogeneous preferences regarding travel choices, such as routes, willingness to carpool, and time of day to travel. Better understanding of that heterogeneity would allow better modeling of the temporal distribution of travel demand.

Past research on travel behavior has examined the travel preferences of specific demographics, such as groups defined by age, gender, income, race, and social disadvantages. These studies are based on surveys, which do not have 100% response rates and were collected from household over a long period of time. Thus, a comprehensive picture of the motorists on roads at any one moment is usually unknown.

This study analyzes the demographic and socioeconomic characteristics of highway road users in congested areas of southern California at different times of day with the help of images of the vehicles on highway entrance ramps.

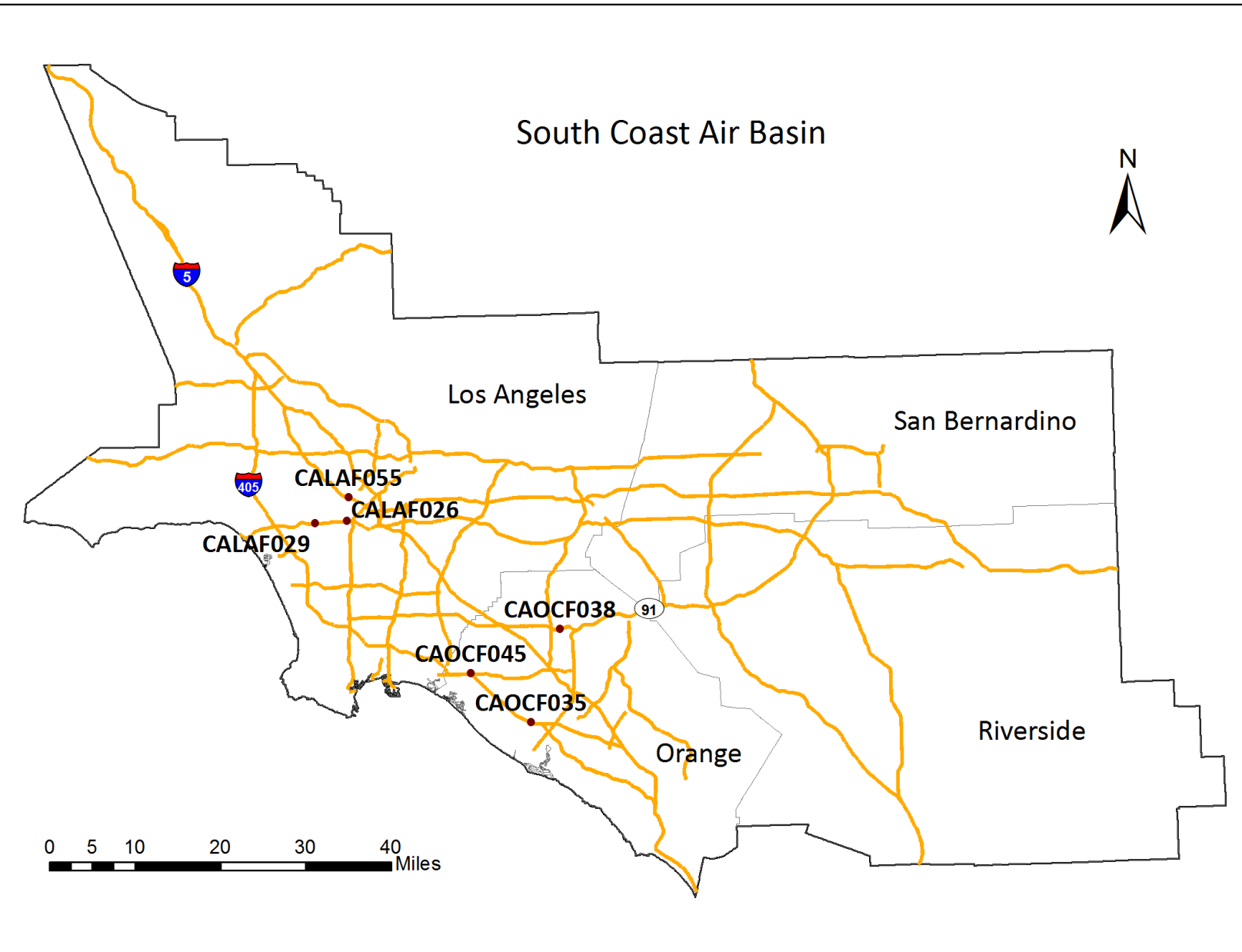
## Research Question

What are the demographic and socioeconomic characteristics of highway road users at different times of day?



Photo Credit: Nicholle McClelland-Beteille

## Study Sites



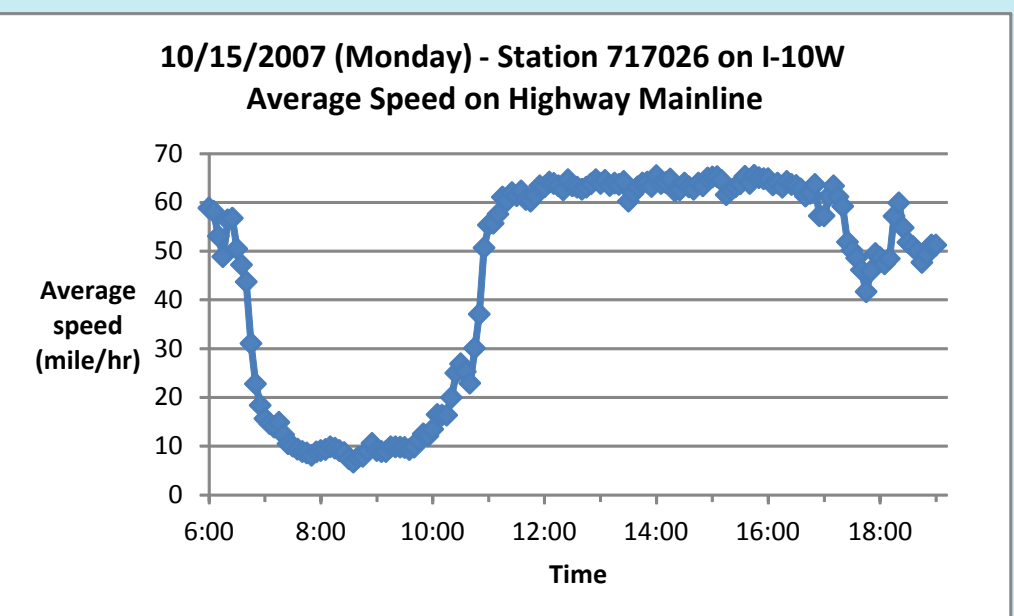
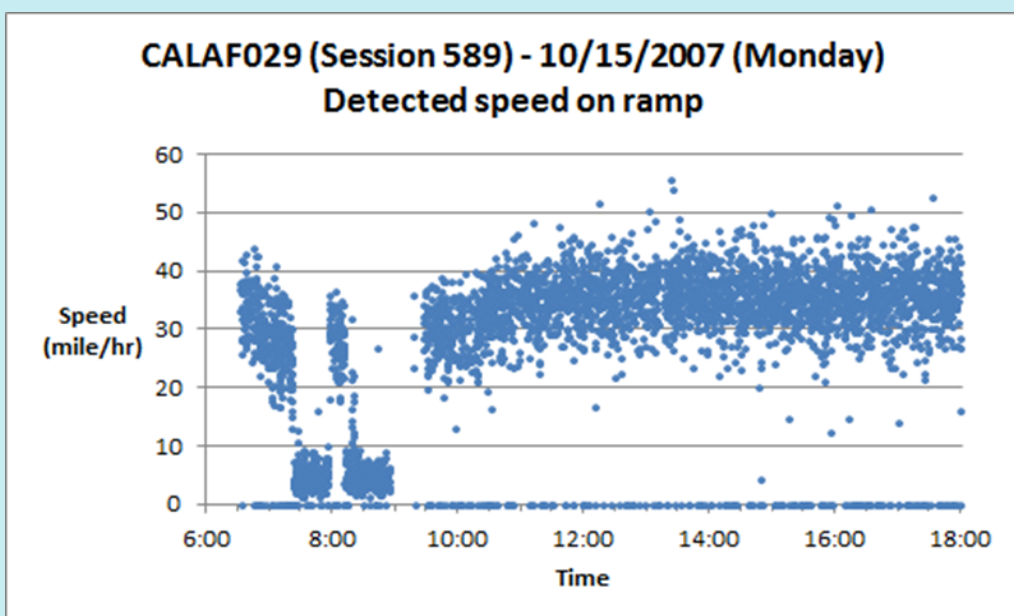
## Data

- More than 4 million on-road vehicle emissions reading were obtained in 2007 and 2008 at 98 different sites by the South Coast Air Quality Management District. The intention was to identify 10,000 high emitters, with the hope that the owners of those vehicles might be induced to retire them.
- Remote sensing technology was used to measure the emissions and velocity.
- All readings were taken in the weekdays. Many of the monitoring periods include both morning and afternoon peak hours. They were all located at highway entrances or interchanges.
- In addition to speed, time log, and emissions data, the remote-sensing data provide license plate images. By matching the license plate images to California Department of Motor Vehicles registration records, the census block groups of the vehicle owners were obtained. The aggregate demographic and socioeconomic profiles of local communities from the Census were used as proxies for the missing characteristics of the vehicle owners.

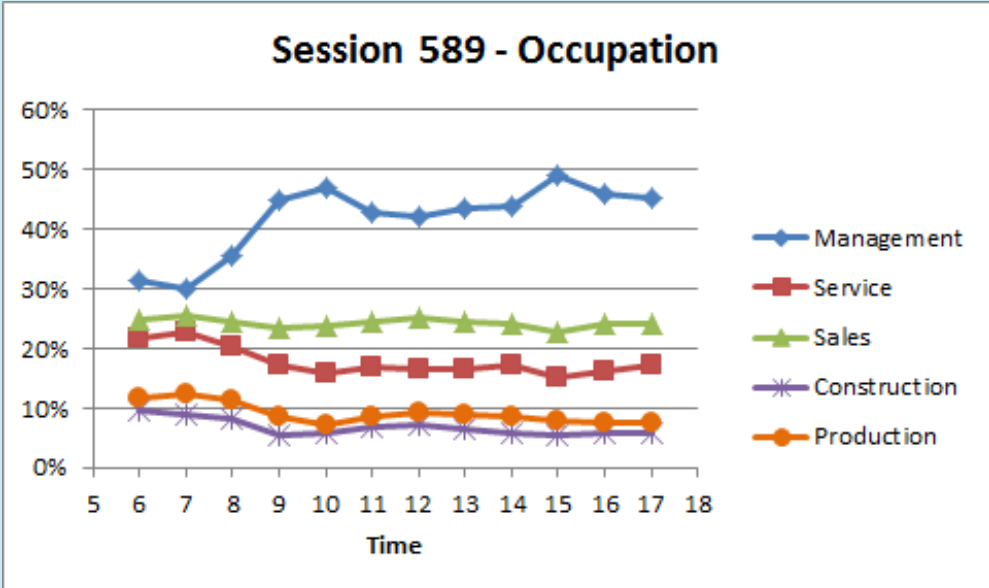
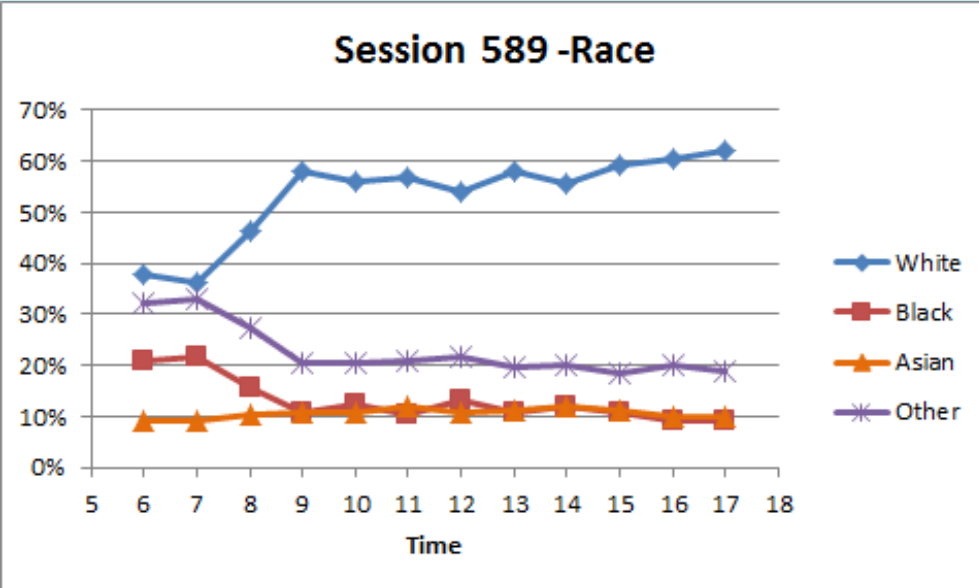
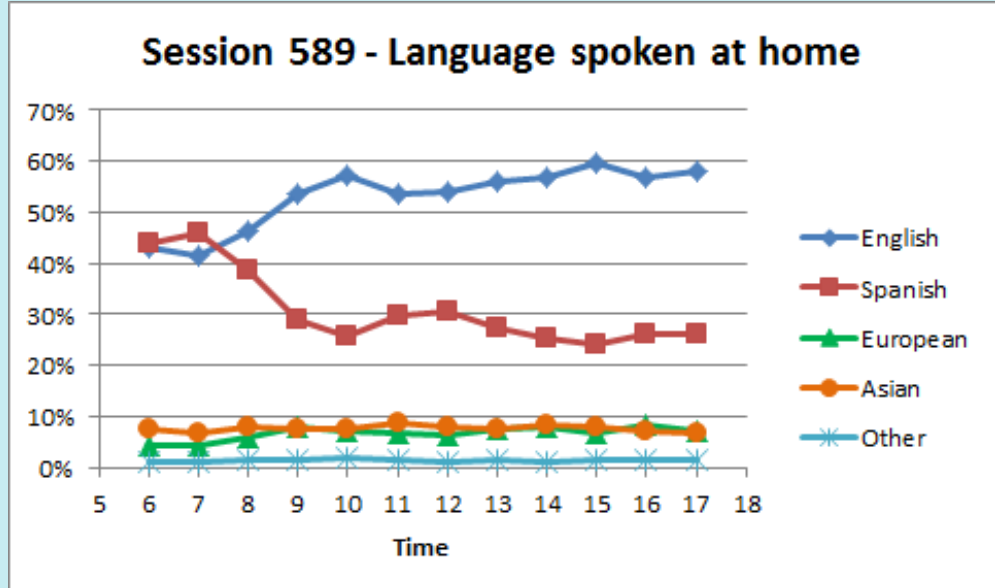
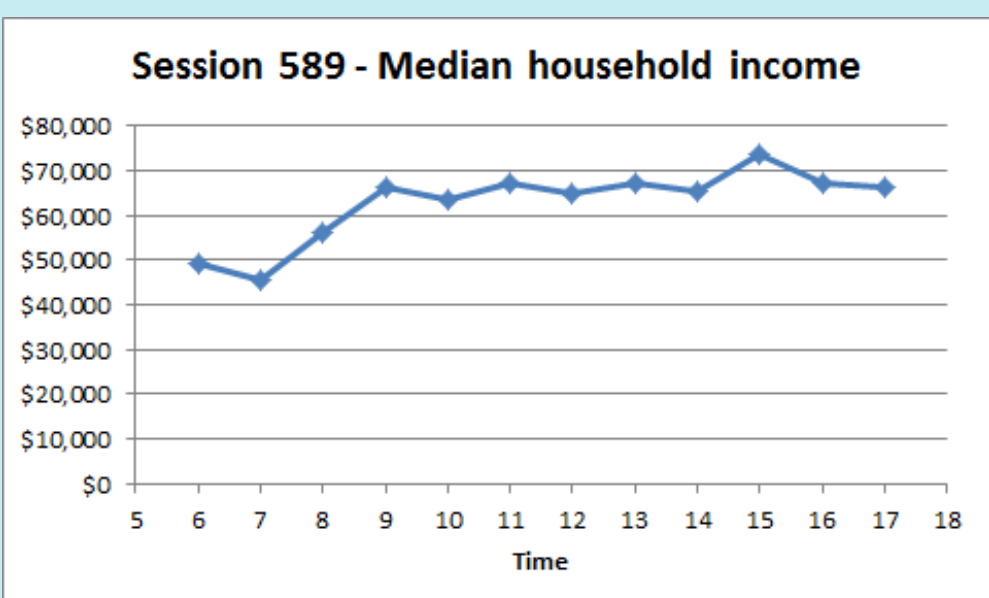
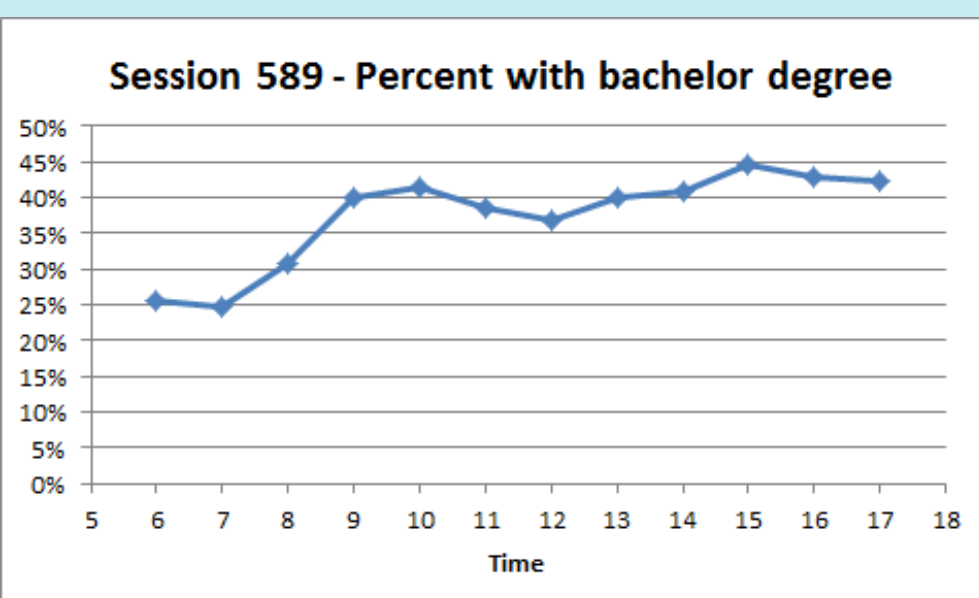
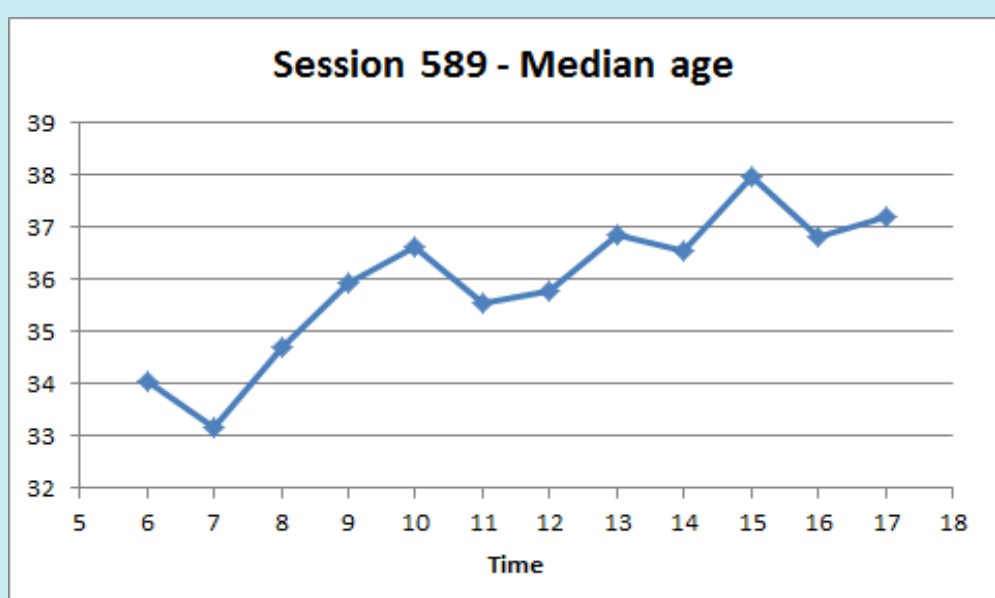
### The neighborhood around one of the study sites (CALAF029) in Los Angeles



The peak hours at each study location were identified by the speed patterns at the monitoring sites (left), and by the highway mainline speeds from the California Department of Transportation's Performance Measurement System (right).



The estimates of the demographic and socioeconomic variables were taken from the five-year estimates (2005-2009) of the American Community Survey from the U.S. Census Bureau. The figures show the hourly mean of the estimates.



## Model

Survival analysis (duration analysis) is used to analyze the varying demographic and socioeconomic profiles of motorists during 6 a.m. and 6 p.m. for the case of weekdays in Los Angeles and Orange counties.

The "event" of the study is the moment when a vehicle was captured by a camera. Let  $T$  represent the length of time (elapsed second since 6 a.m.) until a vehicle's plate is captured by a camera;  $S(t) = Pr[T > t]$  be the survivor function; and  $\lambda(t)$  be the hazard function. The hazard, in this study, is the likelihood of a vehicle being captured by a camera.

Extended Cox Model

$$\lambda(t|\mathbf{x}(t)) = \lambda_0(t) \exp \left[ \sum_{i=1}^k \beta_i x_i + \sum_{j=1}^m \delta_j x_j(t) \right]$$

where  $\lambda_0(t)$  is the baseline hazard, and  $\mathbf{x}(t)$  is a vector of demographic and socioeconomic variables.

## Results and Implications

The estimation results show large variations in terms of motorists' profiles at different times of day. Those motorists traveling at peak hours are more likely to be younger, to have lower education attainment, to have lower median household income, and to be non-white.

The largest component of congestion cost is the cost of travel time delay, which is based on a standard and widely used assumption of 50 percent of the gross wage rate for personal trips. The empirical results suggest that the cost of travel time delay is not uniform across the day.

The proposed method can be used to examined the change in user profiles before and after a congestion pricing scheme is implemented to assess the equity impacts.

## Acknowledgments

The authors would like to thank Peter McClintock of Applied Analysis, a California based independent consultant contracted by Environmental System Products (ESP), East Granby, CT, for providing the on-road remote sensing data.

### Contact Information:

Jennifer Lee at [jflee@ucdavis.edu](mailto:jflee@ucdavis.edu)