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Managing Equity in Priced Managed Lanes

October 27, 2021

@NASEMTRB
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REGISTERED CONTINUING EDUCATION PROGRAM

Learning Objectives

- 1. Discuss what data can be used to assess equity
- 2. Identify how priced managed lanes are being used by different groups and geographic areas





Managed Lane Equity Assessment Methods: Examples from Atlanta's Express Lanes

Randall Guensler (speaker), Hongyu Lu, Tian Xia; Ziyi Dai, Zixiu Fu, Michael O. Rodgers, Angshuman Guin, Haobing Liu, Chia-Huai (Chris) Chang, Diyi Liu, Daejin Kim, Yingping Zhao

Georgia Institute of Technology School of Civil and Environmental Engineering

Introduction

- Background
- > Atlanta's Express Lanes (and HOT Lanes)
- Data and collection methods for equity assessment
 - Occupancy and vehicle class data
 - License plate observation data
 - Household demographic data (licensed and public)
 - Regional modeling data (synthetic households)
 - Survey data
- Examples of analysis (scattered throughout)

I-85 Speed-Flow Relationship Data for General Purpose Lane 1



Pricing can Improve Traffic Flow on Congested Corridors



Environmental Justice

Executive Order 12898 (59 FR 7629) - February 11, 1994 > To the greatest extent practicable and permitted by law ... each Federal agency shall make ... identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations > FHWA's EJ Requirement - USDOT Order 5610.2(a)

Occupancy Data Collection Methods Study Corridors of Occupancy Collection

- I-85 Express Lanes (and I-85 extension)
- > I-75/I-575 Northwest Corridor (NWC) Express Lanes
- I-75 South Metro Express Lanes



2019 SRTA Project Overview Final Reports in December

- Update and expand the 2010-2013 vehicle occupancy, vehicle throughput, and person throughput GDOT study
 I-85 Express Lanes Extension
 - > I-75/I-575 Northwest Corridor (NWC) Express Lanes
 - I-75 South Metro Express Lanes
- Assess baseline vehicle and person throughput on each facility, and evaluate changes in each corridor (2018-2020)
- Assess relationships between household demographics, carpooling, and managed lane use in each corridor

Data Collection Methods Vehicle Occupancy

- Elevated and barrier-separated from the road
- Each data collector monitors a single lane



Data Collection at Hickory Grove Road



Tablet for Occupancy Collection

Field Collection of License Plates

Video recorded to capture vehicle license plates from overpass (behind the traffic stream)



Camcorder at the Overpass



Sample Snapshot of the Video Profiles

Identification of License Plates Methods Employed

- Four methods adopted for video license plate extraction
 - Method I: Manual plate input
 - Method II: Manual cropping of vehicle images with Facebook Detectron2 algorithms and ALPR plate extraction
 - Method III: Auto cropping and auto extraction with manual plate verification
 - Method IV: Full automation (no manual verification)

Identification of License Plates Method I

Plate state, number, and vehicle class were manually entered (undergraduate assistants)



Manual Input User Interface

Pairing with Vehicle Registration Database

- Extracted vehicle license plate information paired with vehicle registration data
- Household TAZs serve as trip origins

Site	Collection	Number of	License	Plate	GA Plates	Percentage
One	Method	Vehicles	Plates	Percentage ¹	Matched	of Plates ²
Chastain Road at I-575	I, IV	188,672	154,321	81.8%	127,151	82.4%
Hamilton Mill Road at I-85	I, II, IV	115,981	74,016	63.8%	57,968	78.3%
Hickory Grove Road at I-75	I, II, IV	194,254	130,335	67.1%	103,944	79.8%
Indian Trail Road at I-85	I, II, III, IV	477,298	369,696	77.5%	307,599	83.2%
Old Peachtree Road at I-85	II, IV	278,641	202,071	72.5%	166,104	82.2%
Roswell Road at I-75	I	19,815	14,184	71.6%	11,731	82.7%
Total	I, II, III, IV	1,274,661	944,623	74.1%	774,497	82.0%

- 1. Percentage of the identified license plates over all observed vehicles
- 2. Percentage of the matched Georgia plates with registration data

Top 10 Makes and Models Northwest Corridor Express Lanes

				Model					Model
Lane	Make	Model	Count	Year	Lane	Make	Model	Count	Year
GP	Ford	F-150 Conventional	3708	2009.7	ML	Ford	F-150 SuperCrew	753	2016.6
GP	Chevrolet	Silverado C-150	2184	2012.3	ML	Ford	F-150 Conventional	594	2011.8
GP	Ford	F-150 SuperCrew	2082	2016.2	ML	Jeep	Grand Cherokee	538	2014.1
GP	Honda	CR-V	2076	2010.7	ML	Chevrolet	Silverado K-150	393	2015.1
GP	Jeep	Grand Cherokee	1865	2011.7	ML	Toyota	Tacoma Double	341	2014.8
GP	Ford	Explorer	1812	2010.2	ML	Ford	Explorer	324	2013.2
GP	Toyota	Camry SE	1805	2011.8	ML	Honda	CR-V	305	2012.5
GP	Toyota	Tacoma Double	1754	2013.1	ML	Chevrolet	Silverado C-150	285	2014.0
GP	Chevrolet	Silverado K-150	1666	2013.5	ML	Ford	Fusion SE	280	2016.0
GP	Honda	Civic LX	1452	2010.6	ML	Toyota	4-Runner	273	2009.8
			Avg.	2012.0				Avg.	2013.8

Managed Lanes are NOT "Lexus Lanes"

Top 10 Makes and Models Indian Trail at I-85 HOT Lanes

				Model					Model
Lane	Make	Model	Count	Year	Lane	Make	Model	Count	Year
GP	Ford	F-150 Conventional	3973	2009.1	ML	Ford	F-150 Conventional	1128	2011.4
GP	Toyota	Camry SE	3190	2011.8	ML	Ford	F-150 SuperCrew	852	2016.6
GP	Honda	CR-V	2936	2010.9	ML	Tesla	Model 3	631	2018.3
GP	Honda	Civic LX	2461	2010.4	ML	Chevrolet	Silverado C-150	619	2014.3
GP	Toyota	Sienna	2381	2008.5	ML	Nissan	Leaf	601	2014.6
GP	Chevrolet	Silverado C-150	2229	2012.3	ML	Jeep	Grand Cherokee	589	2013.7
GP	Ford	F-150 SuperCrew	1979	2016.2	ML	Honda	CR-V	495	2012.3
GP	Honda	Accord LX	1940	2009.6	ML	Ford	Explorer	438	2013.0
GP	Honda	Accord EX	1901	2012.2	ML	Chevrolet	Volt	423	2013.6
GP	Toyota	Tacoma Double	1899	2013.6	ML	Honda	Pilot	388	2011.0
			Avg.	2011.5				Avg.	2013.9

EVs with Green Leaf Plates use I-85 HOT Lanes for free....

Commutershed Assessments

Geographic Analysis

- Geographic commutersheds (catchment areas)
 Households that provide facility travel demand
- Basic methods
 - Field recorded vehicle license plates
 - Pair plates with registration database
 - Identify trip origin TAZs
 - > Prepare commutershed ellipses using GIS tools

Commutershed Generation 68% Ellipses vs. 95% Ellipses

- 68% ellipses are better at excluding unrepresentative data points
 - e.g., young adults registered at parents' addresses
 - e.g., delay in updating registration addresses after moving



Commutershed Analysis Summary of findings

- Express Lane commutersheds are smaller than GP Lane commutersheds
- GP Lane commutersheds contracted after Express Lane implementation/extension
- GP Lane commutersheds moved slightly towards the metro center after implementation/extension at Chastain Road, Indian Trail, and Old Peachtree Road

Commutershed Analysis Facilities at the Edge of the Metro Area

- Floyd County, Gordon County, Pickens County, Hall County and Jackson County had to be included in the analysis
- Households allocated to ZIP level for these counties



Analysis of GP and ML Use Across Household Demographics

- Household-level demographic information
 - Licensed marketing firm demographic dataset
 - > Double-blind pairing (no names, no addresses)
 - > Addresses replaced with TAZ IDs
- Year and lane type (GP vs. ML) demographic comparisons
 Annual income, ethnicity, household size

Guensler, R., H. Liu, H. Lu, C.H. Chang, Z. Dai, Z. Fu, D. Liu, D. Kim, Y. Zhao, and A. Guin (2021). Atlanta Metro Area Managed Lane 2018-2020 Vehicle and Person Throughput Analysis Volume II: Commutershed and Demographic Analysis for the I-75 Northwest Corridor and I-85 Express Lanes.. Georgia State Road and Tollway Authority. Atlanta, GA. 120 pages. June 2021.

Annual Income Comparisons (Forthcoming) Indian Trail Lilburn Road at I-85

Annual Household Income Distributions by AM and PM Peak - Indian Trail/Lilburn Road at I-85



Observations vs. Regional Modeling

Observed Trip Origins vs. Regional Model (ABM-Predicted) Origins

- Roswell Road new dedicated direct access ramp
- > Observations vs. ABM-predicted
 - > ABM2020-TIPA1-2020 model version
 - Compare origin TAZs
- Demographics
 - > Annual income
 - Household size
 - Ethnicity not available in the ABM

Activity-based Model Outputs (7AM-8AM) All Trips, Trips by Occupancy, Trips by Income



I-75 at Roswell Road Dedicated Entrance/Exit Ramps





Trip Origin, Observed and ABM-Predicted Dedicated Roswell Ramp at I-75, 2018

Roswell Road and I-75 Express Lane Ramp Trip Origin Distribution Observed License Plate Data, AM-Peak (07:00 - 10:00 AM), 4 Weekdays, 2018 Number of Observed Vehicles = 1,714



Roswell Road and I-75 Express Lane Ramp Trip Origin Distribution ABM-Predicted, AM-Peak (07:00 - 10:00 AM), Weekday Number of Modeled Vehicles = 3,721



Trip Origin, Observed and ABM-Predicted Dedicated Roswell Ramp at I-75, 2019

Roswell Road and I-75 Express Lane Ramp Trip Origin Distribution Observed License Plate Data, AM-Peak (07:00 - 10:00 AM), 4 Weekdays, 2019 Number of Observed Vehicles = 1,643



Roswell Road and I-75 Express Lane Ramp Trip Origin Distribution ABM-Predicted, AM-Peak (07:00 - 10:00 AM), Weekday Number of Modeled Vehicles = 3,721



Trip Origin Percentage Differences Dedicated Roswell Ramp at I-75

Roswell Road and I-75 Express Lane Ramp Trip Origin Distribution Percentage Difference, AM-Peak (07:00 - 10:00 AM), 2018 Number of Observed Vehicles = 1,714, Number of Modeled Vehicles = 3,721



Excluding TAZs with less than two observed vehicles in 2018 and 2019 and none predicted vehicle, or one predicted vehicle and none observed vehicle in 2018 and 2019





Excluding TAZs with less than two observed vehicles in 2018 and 2019 and none predicted vehicle, or one predicted vehicle and none observed vehicle in 2018 and 2019

Income Comparison (Observed vs. Modeled) Dedicated Roswell Ramp at I-75

Annual Household Income Distributions - Roswell Ramp at I-75 AM Peak (7:00 - 10:00 AM)



Survey Data

- Census data (2020)
- Regional household travel diary data
 - > 10,000 one-day surveys every 10 years, with 5% GPS
- National household travel survey annual sampling data
 NextGen NHTS (forthcoming)
- Regional transit intercept surveys
 - > 19,000 intercept surveys every 10 years
- Regional commuter surveys (annual)
- Targeted surveys of Express Lane users
 - Customer service surveys
 - Corridor commuter surveys (users and non-users)

Conclusions

- > Geographic and demographic impact assessment is feasible
- > Data availability is critical in equity assessment
 - > Observational vehicle activity data
 - > Paired with household income, race, and other data
- > GP vs. ML use
 - > We see a shift to higher incomes on ML facilities
 - > Higher income households use the lanes more frequently
 - We also see income/race and household size correlations
 - > But, all income groups are using the Express Lanes
- Criteria for target demographic groups (income and race)
 Not seeing disproportionate negative impacts
 - > Express lanes appear to be improving travel for all users

Current Research (2018-2021) Related Publications of Interest

- Guensler, R., H. Liu, H. Lu, C.H. Chang, Z. Dai, Z. Fu, D. Liu, D. Kim, Y. Zhao, and A. Guin (forthcoming). Atlanta Metro Area Managed Lane 2018-2020 Vehicle and Person Throughput Analysis Volume I: Vehicle Occupancy, Vehicle Throughput, and Person Throughput Analysis for the I-75 Northwest Corridor and I-85 Express Lanes. Georgia State Road and Tollway Authority. Atlanta, GA. 220 pages. October 2021.
- Guensler, R., H. Liu, H. Lu, C.H. Chang, Z. Dai, Z. Fu, D. Liu, D. Kim, Y. Zhao, and A. Guin (2021). Atlanta Metro Area Managed Lane 2018-2020 Vehicle and Person Throughput Analysis Volume II: Commutershed and Demographic Analysis for the I-75 Northwest Corridor and I-85 Express Lanes.. Georgia State Road and Tollway Authority. Atlanta, GA. 120 pages. June 2021.
- Xia, T., H. Lu, M.O. Rodgers, and R. Guensler (accepted). Atlanta Metro Area Managed Lane 2018-2020 Commutershed Assessment using Bootstrap Analysis of Catchment Area Ellipses. 101st Annual Meeting of the Transportation Research Board. Proceedings.
- Liu, H, M.O. Rodgers, and R. Guensler (2021). "Effectiveness and Equity Assessment of Plug-In Electric Vehicle Purchase Incentives in the United States." Transportation Research Board, Committee on Air Quality and Greenhouse Gas Mitigation. Subcommittee on Mitigation and Policy Analysis. January 11, 2021.
- Chang, C.H., H. Li, Y. Wang, Y. Zhao, and R. Guensler (2020). Estimating Door-to-door Travel Time Savings Provided by Managed Lanes using Shortest Path Algorithms (20-06120). 99th Annual Meeting of the Transportation Research Board. Lectern Session and Proceedings. Washington, DC. January 2020.
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- Guensler, R., J. Ko, D. Kim, S. Khoeini, A. Sheikh, and Y. Xu (2019). "Factors Affecting Atlanta Commuters' High Occupancy Toll Lane and Carpool Choices." International Journal of Sustainable Transportation. DOI: 10.1080/15568318.2019.1663961. September 2019.

Previous Research (2010-2013) Related Publications of Interest

- Guensler, R., V. Elango, A. Guin, M. Hunter, J. Laval, S. Araque, S. Box, K. Colberg, F. Castrillon, K. D'Ambrosio, D. Duarte, K. Kamiya, S. Khoeini, E. Palinginis, L. Peesapati, C. Rome, A. Sheikh, K. Smith, C. Toth, T. Vo, and S. Zinner (2013). "Atlanta I-85 HOV-to-HOT Conversion: Analysis of Vehicle and Person Throughput." Prepared for the Georgia Department of Transportation, Atlanta, GA. Georgia Institute of Technology. Atlanta, GA. October 2013.
- Guensler, Ř., S. Araque, C. Toth, A. Guin, V. Elango, M. Hunter (2013). "Atlanta I-85 HOV-to-HOT Conversion: Analysis of Changes in Weaving Activity." Prepared for the Georgia Department of Transportation, Atlanta, GA. Georgia Institute of Technology. Atlanta, GA. October 2013.
- Khoeini, S., R. Guensler, M.O. Rodgers, and V. Elango (2012). "Sensitivity of Commuters' Demographic Characteristics to License Plate Data Collection Specifications: A Case Study of the I-85 HOV-to-HOT Project in Atlanta, GA." Transportation Research Record. Number 2308, pp. 37-46. National Academy of Sciences. Washington, DC. 2012.
- Khoeini, S., R. Guensler, et al. (2013). "Spatial and Demographic Changes of Atlanta I-85 Commutershed for the Managed Lane for the HOV-to-HOT Conversion." P13-6078. 92nd Annual Meeting of the Transportation Research Board, Washington DC. January 2013.
- Elango, V., S. Khoeini, S., R. Guensler, et al. (2013). "Evaluation of Changes in Person and Vehicle Throughput for the I-85 Corridor HOV-to-HOT Lane Conversion." P13-6068. 92nd Annual Meeting of the Transportation Research Board, Washington DC. January 2013.
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I-405 High Occupancy Toll Lanes Usage, Benefits, and Equity

JNIVERSITY of WASHINGTON

ience

FELLOWS

Shirley Leung Cory McCartan CJ Robinson Kiana Roshan Zamir

> **LEADS** Mark Hallenbeck Vaughn Iverson

Are the HOT anes equitable?

Letters to the Editor • Opinion

Virginia's 'Lexus lanes' deserve their nickname

Washington Post





(Sidebar) How do we define equitable?

For this study Who uses the HOT lanes, Overall benefits, How benefits are distributed

Our Data – HOT & GP Facility Performance

Time Milepost Lane speed Lane volume HOT Lane 5:30 p.m. 6/3/2018 17.5 60 miles/hour 200 cars/hour

	General	Purpose	Lane
ime		5:30	p.m. 6/3/2018
lilepost		17.5	
ane spe	ed	35 m	niles/hour
ane volu	ume	800	cars/hour

Our Data — Toll Transaction Data



Census Block Groups For 3,100 block groups (think neighborhoods): \rightarrow No. of households → Population → Income

Average household income





Data Filtering

- Excluded commercial users
- Commercial users defined as:
 - \circ >6 tags
 - \circ >10,000 trips per ID
- Small businesses?

Factors Considered

- → Income
- → Geography
- → User frequency
- → Peak/off-peak use
- → Routes

→ Race

→ Modes of transport (SOV vs. HOV vs. transit)

User frequency

Frequency categories Number of trips (2018) Single 1 trip 2–40 trips Monthly Weekly 41–120 trips 121–250 trips Regular Daily 251–600 trips High Over 600 trips

Ecological Inference

used to assign census demographics to IDs



Ecological Inference: The Problem

Rich voters vote Republican ...

... but rich states don't.



statmodeling.stat.columbia.edu







Overall, higher-income households use the HOT lanes more



Most households that use the system are not high-income



Most users don't use the system much



Few trips are made by low-frequency users

Income by frequency of use

Median income, King & Snohomish counties



One-time

Others

\$125,000

One-time users have lower incomes



High-income drivers travel more often during low-toll periods



Summary Usage Results

Higher income households use the lanes more, but all household income levels use the lanes.

Most users use the lanes infrequently.

One-time users have lower incomes.

Summary Usage Results

Lower income households travel more during peak periods and pay higher tolls.

Households in the north pay more and travel further, but have relatively lower incomes.

What Are the Overall



Travel Time and Reliability





Time savings are highest at peak, reliability gains vary



Value of time



Value of reliability



Reliability matters more in the morning



Net benefit = Time savings + Reliability - Toll



Overall, high-income households use the HOT lanes more



Higher-income households benefit overall



Per trip, lower-income drivers get more net benefit







\$7.39

\$2.72

\$1.00





Who gains and who loses?

NET BENEFIT/ HOUSEHOL D; TOTAL BENEFITS/ DOLLAR Highest and lowest benefits per household



Highest and lowest benefits per dollar



High Low




Higher-income households benefit more overall, but

Lower-income households benefit more per trip , and HOT lanes are used by people with a wide array of income levels

Higher income households use the facility more and pay more (total outlay) Lower income users use the facility more strategically

Thank you







CASCADIA URBAN ANALYTICS COOPERATIVE

> GORDON AND BETTY FOUNDATION

San Mat	teo Co. Express Lanes JPA	Follow	SAN MATEO 101 EXPRESS LANES PROJECT	US 101 SMC Express Lanes JPA
San Mateo Co. Express Lanes JPA @SMCExpressLanes · Mar 4 · · · · · · · · · · · · SMC 部內的新快速车道将资助一个交通流点计划,皆在帮助长期以来服务不足的社区。欢迎参加讨论: 3月18日 (星期四)下午 5:30 至下午 6:30 bit/ly/SMC101Equity; Zoom ID:925 5484 9450。将提供西班牙语、零语和中立中口记者的		EQUITY STUDY HOJA INFORMATIVA Panorama general del proyecto		
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San Mateo County's U.S. 101 Express Lanes Equity Program

LACY VONG

SENIOR PROJECT MANAGER, TOLLING & EMERGING MOBILITY SOLUTIONS

ΗΝΤΒ

Outline

Express Lanes Project

 Introduction to the San Mateo County Express Lanes Joint Powers Authority (SMCEL-JPA)

- Commitment to Equity Beyond Requirements
- Implementing an Equity Program
- Key Takeaways & Lessons Learned

Express Lanes Project

U.S. Highway 101 Managed Lanes Project

SANTA CLARA COUNTY, CALIFORNIA AND SAN MATEO COUNTY, CALIFORNIA DISTRICT 4 – SCL – 101 (PM 50.6/52.6) 4 – SM – 101 (PM 0.0/21.8) EA 04-1J560/ID 0413000206

Final Environmental Impact Report/ Environmental Assessment with Finding of No Significant Impact

Volume 1: Text and Appendices A-H

Whipp

Woods

Mars



SMCEL-JPA Organizational Chart

SMCEL-JPA Board of Directors

- 3 Members of the City/County Associations of Governments of San Mateo County Board (C/CAG)
- 3 Members of the San Mateo
 County Transportation Authority (SMCTA)



Commitment to Equity Beyond Requirements



Funding

SMCEL-JPA continues to seek additional funding opportunities to support and grow the Equity Program



Research



- Guiding Principles
- Technical Analysis
- Community Engagement
- Equity Program Recommendation

San Mateo US 101 Express Lanes Equity Study June 2021

C/CAG SMCTA Arup Estolano Advisors

Implementing an Equity Program

Determining Eligibility

Approach:

- Input from community-based organizations (CBOs), local advocates, and community members
- Analysis of county household income
- Research on income eligibility limits for benefits to priority communities

Considerations:

- Ease of application process
- Ensuring priority community members could qualify

Providing Choice in Benefits







Leveraging Community Connections

Partnering with Samaritan House and Core Service Agencies Network to administer the Equity Program





Coastside Hope Neighbors Helping Neighbors











Creating Impact & Being Accountable



Key Takeaways & Lessons Learned

Leadership showed commitment to equity through active engagement Develop equity goals and a framework for accountability Meaningful engagement takes time – virtually and in-person

Compensate CBOs and community members for their time

Leverage resources through new and existing partnerships Words matter in connecting with priority communities

Today's Panelists





Moderator: Matt Click, HNTB

Randall Guensler, Georgia Institute of Technology



Mark Hallenbeck, University of Washington



Lacy Vong, HNTB

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