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BEFORE THE PUBLIC UTILITIES COMMISSION
OF THE STATE OF CALIFORNIA

Order Instituting Rulemaking on Regulations Relating to Passenger Carriers, Ridesharing, and New Online-Enabled Transportation Services.	Rulemaking 12-12-011 (Filed December 12, 2012)

COMMENTS OF UC DAVIS POLICY INSTITUTE FOR ENERGY, ENVIRONMENT, AND THE ECONOMY ON THE COMMISSION'S REGULATION OF AUTONOMOUS VEHICLES

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January 21, 2020

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Summary

This rule and its successors are an important opportunity for the CPUC to lay out a framework that will support our state goals for the transportation system. In summary, these comments from the UC Davis Policy Institute for Energy, Environment, and the Economy argue:

1) The research shows that automated mobility needs to be pooled and electric to support better transportation outcomes.
2) This regulation will interact with many state goals that should be considered.
3) To avoid overlapping or conflicting rules, a reasonable focus is to view much of this Commission's regulation as supporting other state agency roles.
4) Data collection that supports policy outcomes will be particularly important, and is a distinct role for this regulation that is not otherwise sufficiently covered.

I. Introduction

Encouraging shared rides, or *pooled* rides, between multiple automated[1] vehicle (AV) chartering parties is the singular most important change needed to the existing *Pilot Test*

[1] For the purposes of this report we prefer the term "automated" and not "autonomous". The former includes all vehicles with automated driving features, including partially automated vehicles, automated

Program for Autonomous Vehicle Passenger Service. An extensive body of UC Davis research[2] points to pooling as a promising strategy for addressing the glut of single occupant vehicle travel. Pooled travel has the promise of reducing congestion and emissions, as well as providing more affordable travel options.

Encouraging pooling aligns the Commission's AV Regulations with the California Air Resources Board (CARB) efforts to reduce emissions from passenger service travel, as measured by greenhouse gasses per passenger mile basis. AV electrification will also play a crucial role in emissions reductions strategies. The best possible future scenario for climate, equity, and livability will be if automated vehicles are both shared and electric. Realizing this possible best future will first require certain procedural steps, including establishing a policy framework, a set of guiding principles, and a set of distinct roles for all AV service stakeholders.

II. Comments

a. Comments Relating to 1.1.1. the Operation and Impacts of AVs in Passenger Service: There is a need for a Policy Framework, Clear Principles, and Distinct Roles

i. A Policy Framework Should be Developed

The convergence of new shared mobility services with automated and electric vehicles promises to significantly reshape our lives and communities for the better—or for the worse. The dream scenario could bring huge public and private benefits, including more transportation choices, greater affordability and accessibility, and healthier, more livable cities, along with reduced greenhouse gas emissions. The nightmare scenario could bring more urban sprawl, energy use, greenhouse gas emissions, and inequality. Establishing a clear framework for all stakeholders is an essential first step for California to ensure automated vehicle (AV) fleet operation will lead to positive outcomes for communities and the environment.

This proceeding's D.18-05-043 sets out the initial framework and establishes the two pilot programs for the CPUC's regulation of passenger service to the public in California

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vehicles, or driverless vehicles. The latter term "autonomous" refers exclusively to vehicles in the level 5 Society of Automotive Engineers (SAE) designation that can drive anywhere in all conditions.
SAE International Releases Updated Visual Chart for Its "Levels of Driving Automation" Standard for Self-Driving Vehicles, SAE.org (2018), https://www.sae.org/news/press-room/2018/12/sae-international-releases-updated-visual-chart-for-its-“levels-of-driving-automation”-standard-for-self-driving-vehicles.

[2] See Section *F. Comments Relating to 1.1.2.6. UC Davis Academic studies* on Page 14 for a list of UC Davis research publications

using AVs. The existing framework splits jurisdiction between the DMV and the CPUC. The DMV is focused on the safe operation of AVs, while the Commission is focused on the safety and protection of consumer travelers using commercial AV providers.

The areas for improvement in the existing framework include fares, fare-splitting, pooling, data collection, ensuring service for people with disabilities, ensuring service to disadvantaged areas, and service to airports.

ii. Clear Guiding Principles Should be Articulated

The first set to achieving AV goals is establishing a set of principles for agency and industry operation. California agency staff have already started working towards this goal. The Automated Vehicle Principles for Healthy and Sustainable Communities was developed by staff at OPR, CalEPA, CalSTA, Caltrans, CARB, CDPH, CEC, DGS, DMV, Go-Biz, and SGC. CPUC staff also participated.[3] The following are the guiding principles the staff identified for deploying AVs in alignment with the public interest and established state environmental and community goals:

1. Shared-use: Maximize deployment of shared-use vehicles as an alternative to personal car ownership;
2. Pooled: Maximize ride-sharing by encouraging pooling, prioritizing pooled vehicles' mobility, and providing for shared-vehicle passenger safety and comfort;
3. Low-emissions: Maximize deployment of AVs as low-emission vehicles in the near term and zero-emission vehicles in the long term, and employ eco-driving strategies;
4. Right-sized: Promote use of vehicles that are sufficiently sized, but not oversized, for the trip purpose;
5. Part of an efficient multimodal system: Deploy AVs as part of a multimodal system that transports people and goods to destinations quickly and efficiently and, taken as a whole, that is energy-efficient, space-efficient, environmentally benign, and beneficial to human health;
6. Particularly: Strengthen high-quality transit service rather than duplicating it. Deploy AVs to transport people to transit stations rather than duplicating transit routes.

[3] *California Multi-Agency Workgroup on AVs, Automated Vehicle Principles for Healthy and Sustainable Communities* (2018), http://opr.ca.gov/docs/20181115-California_Automated_Vehicle_Principles_for_Healthy_and_Sustainable_Communities.pdf.

These principles align with a series of publications from UC Davis' 3 Revolutions Policy Initiative published in 2017:

1. Deploy driverless vehicles as shared use vehicles, rather than privately owned;
2. Ensure widespread carpooling;
3. Deploy driverless vehicles with zero tailpipe emissions;
4. Take advantage of opportunities to introduce pricing;
5. Increase line haul transit use rather than replacing it;
6. Ensure driverless vehicles are not larger or more energy consumptive
7. Program vehicle behavior to improve livability, safety and comfort on surface streets. [4]

iii. Distinct Roles Should be Developed

An effective AV framework will also include clear designations of roles for all stakeholders, which could include new roles, changes, or deletion to outdated role designations. Narrow roles, such as AV manufacturer, asset owner, fleet operator, ride broker, will enable policymakers to regulate the technology as it evolves, without developing too many nested unique roles. Each role designation would then be subject to unique reporting requirements. If a company plays multiple roles, they are simply subject to multiple reporting requirements.

For example, if a company currently operates as a company who brokers rides between riders and independent drivers, currently classified as a Transportation Network Company (TNC), but they also choose to operate and own AV assets operating like a transportation charter party-carrier (TCP), then they would remain a TNC for the ride brokerage element of their efforts, and then they would simply honor the obligations for both a TNC and a vehicle operator (rather than entirely converting operation to TCP). If an AV manufacturer develops, operates, and brokers rides, they would have all three of these designations. By disaggregating the designations this would preserve authority for regulating bodies and policies that have historically applied to TNCs and carriers, and avoid confusion associated with numerous overlapping designations.

B. Comments Relating to 1.1.1 The Environmental Impacts of AV Passenger Service and Equity of Service, and to 1.1.2. Authorizing Fare Collection and

[4] Giovanni Circella, Chris Ganson, & Caroline Rodier, *Keeping Vehicle Use and Greenhouse Gas Emissions in Check in a Driverless Vehicle World*. INS. OF TRANS. STUDIES, UC DAVIS (2017), Policy Brief, https://3rev.sf.ucdavis.edu/sites/g/files/dgvnsk6431/files/files/page/k.pdf.

Shared Rides for Driverless AVs: Electrification, Pooling, & Aligning with CARB are Most Important Factors

i. Electric AVs are Essential for Reaching State Emissions Reductions Goals

In both Public Utilities Code §§ 740.12 and 740.16 the Legislature has declared that it is the policy of the state and the intent of the Legislature to advance transportation electrification as a means of achieving ambient air quality standards and the state's climate goals. According to the State Alternative Fuels Plan analysis by the Energy Commission and the State Air Resources Board, light-, medium-, and heavy-duty vehicle electrification results in approximately 70 percent fewer greenhouse gases emitted, over 85 percent fewer ozone-forming air pollutants emitted, and 100 percent fewer petroleum used. [5]

Automated vehicles can support these broader state electrification goals, and there are co-benefits to electrifying automated vehicles. Electrification assists with the power and energy demands of the vehicles. And according to UC Davis researchers "automation can assist electrification in terms of battery operation and recharging management, such as automatically seeking opportunities to recharge during slow periods." [6]

To understand the broader environmental and societal impacts, UC Davis researchers built estimations for three scenarios, using a global high shift model, to envision an automated future: 1) a business as usual scenario, which assumes automation occurs in gasoline operated vehicles, 2) an electric-automated vehicle future, and 3) a shared, automated and electric scenario. Comparing these possible scenarios (not predicting their likelihood) researchers concluded that electric AVs will only yield significant emissions reductions if coupled with widespread and rapid energy decarbonization. Researchers observe the most significant emissions benefits in the shared electrification scenario. This scenario could result in the following benefits: [7]

- Reductions in global energy use from urban passenger transportation by over 70%
- Reductions in global CO_2 emissions by over 80%
- Reductions in the measured costs of vehicles, infrastructure, and transportation system operation by over 40%

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[5] Public Utilities Code §§ 740.12 and 740.16.
[6] Lewis Fulton, Jacob Mason, & Dominique Meroux, *Three Revolutions in Urban Transportation*, INS. OF TRANS. STUDIES, UC DAVIS (2017), Research Report UCD-ITS-RR-17-03. Page 7.
[7] *Ibid.* Pages 1, 6.

- Global savings approaching $5 trillion per year [8]

Shared, automated, electric vehicles could create a dramatic positive impact on transportation in California. A 2019 study finds that,

> *"[A]ll mobility in the United States (U.S.) currently served by 276 million personally owned vehicles could be served by 12.5 million SAEVs ("shared autonomous electric vehicles") at a cost of $ 0.27/vehicle*-mile *or $ 0.18/passenger-mile. The energy requirements for this fleet would be 1142 GWh/day (8.5% of 2017 U.S. electricity demand) and the peak charging load 76.7 GW (11% of U.S. power peak). Several model sensitivities are explored, and it is found that sharing is a key factor in the analysis."*[9]

ii. Fares, Fare Splitting and Shared rides are All Essential Elements to Ensure Environmentally Sustainable and Equitable AV Operation

The scenario estimations listed in section *i*. are based on assumptions that highly AVs will likely lead to increases in passenger miles traveled (PMT) due to early estimations that AV travel will be cheaper per mile than driven vehicles. Early research comparing miles traveled in partially automated Tesla Model S (with Autopilot) vehicles with other battery electric vehicles demonstrates that "semi-automated BEVs have significantly higher VMT compared to other vehicle types.[10]

UC Davis researchers estimate that highly AV service may yield deeper cuts to non-monetary costs, such as a reduced time burden sitting behind a driving wheel, or reduced time spent searching for parking. Net costs are estimated to be cheaper if AVs are operated in a for-hire fleet, rather than personally owned. This is partially due to the economies of scale savings for service and maintenance of the vehicles, among other factors. Even further reductions in cost per passenger mile may be achieved when individuals are sharing rides among a single party, i.e. fare splitting, or sharing a ride among two chartering parties, i.e. pooling.[11]

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[8] *Ibid.* Page 2.

[9] Colin J.R. Sheppard, Gordon S. Bauer, Brian F. Gerke, Jeffery Greenblatt, Alan Jenn, & Anand R. Gopal, *A Joint Optimization Scheme for Planning and Operations of Shared Autonomous Electric Vehicle Fleets Serving Mobility on Demand*, TRANS. RESEARCH RECORD (2019), 1 – 19.

[10] Hardman, Scott, Rosaria M. Berliner, Gil Tal, *A First Look at Vehicle Miles Travelled in Partially-Automated Vehicles*, INS. OF TRANS. STUDIES, UC DAVIS (2018), Working Paper UCD-ITS-WP-18-01.

[11] Lew Fulton *Three Revolutions in Urban Passenger Travel*, JOULE (2018), https://www.sciencedirect.com/science/article/pii/S2542435118300941?via%3Dihub.

All the listed reductions in cost for travel are estimated to result in increased demand for travel, and may result in more travel per person. A total ban on fares (if instituted for long enough) could yield significant induced demand impacts and should be avoided. Free service also presents challenges for AV providers as they attempt to evaluate market forces. Testing the viability of the AV fleet business model will be impossible without fares and could result in poorly balanced supply and inflated usage (which could result in more VMT, more congestion, and more emissions).[12]

Pricing mechanisms represent the most effective tool to navigate this critical crossroads. If we can price AV travel effectively, it will determine the system-wide impacts of AVs. Either extra passenger travel demand can occur in extra vehicles, bleeding extra vehicle miles traveled (VMT) into our already congested roadway networks, or steps can be taken to encourage pooling (as well as public transit use) in order to absorb increasing travel demand. In the latter case, society benefits from increased PMT, and increased mobility and accessibility, without paying a VMT penalty.[13]

The Commission should therefore not be asking the question of whether to *allow* pooling- but all California policymakers need to consider how they can *encourage* pooling as much as possible. This crossroads may allow us a "do-over", to right the wrongs of half a century of auto-centric and unsustainable planning practices. We can continue on this path or forge a new path. This will not only avoid excessive time and resources wasted on roadways for individuals stuck in traffic in automated vehicles, but could avoid exacerbating access inequities for individuals who continue to operate legacy driven vehicles, or those riding on buses in regular flow traffic, during the early and mid-adoption cycle, and pay the real price of increased travel times.[14] Therefore, the importance of pooling cannot be understated. As Dan Sperling states in his notable book *Three Revolutions, Steering Automated, Shared, and Electric Vehicles to a Better Future,*

> "The answer is pooling. If the question is how to ameliorate traffic congestion, the answer is pooling. If it's how to reduce climate change, still pooling. Social equity? Also pooling. Soaring transportation infrastructure costs? Pooling! What to do about the potential negative effects of automated vehicles (AVs)? Pooling.

[12] *Ibid.*
[13] Dan Sperling, *Three Revolutions: Steering Automated, Shared, and Electric Vehicles to a Better Future*. Washington, DC: Island Press (2018).
[14] Dan Sperling, *Three Revolutions: Steering Automated, Shared, and Electric Vehicles to a Better Future*. Washington, DC: Island Press (2018).

> Going forward, pooling must be the principal focus of our thinking and actions related to transportation."[15]

Market forces are not yielding sufficient pooled travel. Discounted app-based pooling systems like share rides from Lyft, and UberPool can flourish in cities, but these services are not offered in all markets, likely will not work as well outside dense urban areas without additional incentives.[16]

1. Addressing Safety Concerns with AV Pooling

The Commission has expressed safety concerns with pooling and ride-sharing in AVs.[17] In a recent UC Davis white paper researchers, defined safety as "the condition of being secure from accidental harm; security is defined to be the condition of being safe from intentional harm." [18] Users of shared electric automated vehicles will take on a constellation of risks to both their safety and their security. These risks likely vary by user demographic characteristics.

However, the solutions to these critical problem will require innovative and well-thought out AV designs from manufacturers, AV operators, and TNCs to strive to address and reduce risks and build trust for users. What this Commission can do is to set a goal, for encouraging safe and secure pooled service opportunities, and allow the sector to innovate solutions. It is beyond the scope of this Commission to encourage vehicle design features that increase safety for passengers sharing a vehicle. However, we will call attention to recent UC Davis research that makes the following suggestions:

> *"Design features that might mitigate these risks include large windows to afford a high degree of visibility into and out of the vehicle, spacious seating and legroom (relative to larger shared vehicles like buses, trains, and planes), access to a remote human administrator who can observe inside the vehicle at all times, easy means to program private stops that are nearby one's ultimate*

[15] *Ibid*.
[16] Austin Brown & Dan Sperling, *3 Revolutions in Transportation*, EM MAG (2018).
[17] D.18-05-043 at 38.
[18] Kenneth S. Kurani, *User Perceptions of Safety and Security: A Framework for a Transition to Electric-Shared-Automated Vehicles*, INS. OF TRANS. STUDIES, UC, DAVIS (2019), Research Report UCD-ITS-RR-19-50 https://escholarship.org/uc/item/40g1637b#main.

origins and destinations (to maintain privacy), and options for large groups or associations to "own" a particular vehicle (e.g., a female only SAV)."[19]

iii. Aligning CPUC AV Regulations with CARB Efforts

The California Air Resources Board (CARB) is in the process of implementing an addition to Section 5450 of the Public Utilities Code (passed under SB1014). CARB found the greenhouse gas emissions per-passenger-mile baseline for TNCs is approximately 301 gCO2/PMT, and targets and goals for companies to reduce emissions from the baseline will be announced by 2021, with adoption beginning in 2023.[20] These emission reduction mandate "applies to transportation providers regulated by the commission that provide pre-arranged transportation services for compensation using an online-enabled application or platform to connect passengers, including autonomous vehicles, charter-party carriers, and new modes of ridesharing technology that may arise through innovation and subsequent regulation."[21]

If the AV fleet service open for discussion under this rulemaking can be provided "for compensation", then the requirements of SB1014 will be unequivocally applicable to AV fleet services. This underscores the need for all service operators, TNCs, etc. to be allowed to receive compensation.

iv. Restricting Airport Access Could Encourage More Solo Driving

A UC Davis study points towards increased usage of TNC service correlated with long-distance trips, among suburban dwellers. [22] With this class of people drive more than city dwellers, there is a trend towards substituting driving alone, taxi or rental car, with TNC use for approaching and exiting an airport. While there are challenges associated with TNC airport service, and certainly gains should be made to improve access to airports via public transit, it is likely that for car-dependent individuals fleet service may be attractive for airport access. Restricting AV fleet access may simply slow adoption of this mode

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[19] Angela Sanguinetti, Ken Kurani, & Beth Ferguson, *Is It Ok to Get Into a Car With a Stranger? Risks and Benefits of Ride-Pooling in Shared Autonomous Vehicles*. INS. OF TRANS. STUDIES, UC DAVIS (2019), https://escholarship.org/uc/item/1cb6n6r9.

[20] California Air Resources Board, *SB 1014 Clean Miles Standard: 2018 Base-year Emissions Inventory* Report, https://ww2.arb.ca.gov/sites/default/files/2019-12/SB%201014%20-%20Base%20year%20Emissions%20Inventory_December_2019.pdf.

[21] California S.B. 1014, https://law.justia.com/codes/california/2018/code-puc/division-2/chapter-8/article-7/section-5450/.

[22] Farzad Alemi, Patricia Giovanni Circella, & Susan Handy Mokhtarian, *Exploring the Latent Constructs behind the Use of Ridehailing in California*, J. OF CHOICE MODELLING, (2018) p. 47–62, doi:10.1016/j.jocm.2018.08.003.

among this user group, which will result in more single occupant trips, and more parked vehicles at airports.

C. Comments Relating to 1.1.1. and 1.1.2. Data Reporting:

i. Collection and Analysis of Data on AVs is Essential to Ensuring Policy Objectives are Achieved

Mobility data enables planners and policymakers to make informed decisions and enables researchers to model the effects of various transportation solutions. To reiterate and expand briefly on comments the Policy Institute submitted on December 17, 2019, the most useful type of data will enable tracking for good performance-based policy objectives. Further, it is critical that the state leads this data collection effort. All parties will benefit from consistent reporting requirements that cross jurisdictional boundaries. This will reduce administrative burdens on vehicle owners, operators, TNCs, etc. and reduce compliance costs that could be passed onto consumers.[23]

Oversharing and undersharing mobility data are both problematic. A middle-ground approach, in which data are shared in specific contexts and managed by a trusted third party, such as the University of California – Institute of Transportation Studies (UC ITS)[24], can capture the benefits of data sharing while minimizing risks.

D. Comments related to 1.1.1 The Accessibility Needs of Persons with Disabilities:

i. Providing Service to Persons with Disabilities Should be a Priority

AV fleet service may present an opportunity to address the needs of individuals with physical or mental disabilities in achieving greater independence, but it must first be acknowledged that there is an extremely diverse set of unique needs in the community of persons with disabilities. If AVs can do a better job than cars, taxis, and TNCs in addressing some of this community's needs, then there will be significant societal and economic benefits. However, there will also be limitations for AV service, and for some individuals who cannot enter, buckle in, egress, or ride alone in an AV safely, additional

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[23] Mollie D'Agostino, Paige Pellaton; Austin Brown, *Mobility Data Sharing: Challenges and Policy Recommendations*, INS. OF TRANS. STUDIES, UC DAVIS (2019), https://escholarship.org/uc/item/4gw8g9ms.

[24] UCD ITS' ability to store TNC data will be subject to mutually acceptable contract terms and approval of those contract terms by applicable university authorities.

accommodations, including traditional chauffeured service if necessary, may be the safest alternative.

The TNC Access for All Fund administered by the commission presently includes fees collected from TNCs ($0.10/trip) pursuant to Decision (D.) 19-06-033 and in order to ensure the longevity of this funding stream, AV passenger service vehicles should also participate in this program and contribute to the TNC Access for All Fund.[25] If AV passenger service providers input fees into this fund, then a portion of the expenditures from this fund should likely also be targeted at improving WAV AV service.

i. Ensuring Equitable Service in Disadvantaged Communities Should be a Priority

Granular trip data from TNCs was initially required by the CPUC for the purpose of evaluating whether TNC transportation was made available to people with disability and was available in disadvantaged areas, as required by regulation. These goals must continue to be advanced with AVs as well. In addition to ensuring data on this issue continues to be collected, there must also be mechanisms to ensure that the data is adequately evaluated and enforced.

E. Comments Relating to 1.1.1. Workforce Impacts:

While it is too early to make predictions on the workforce impacts of AVs, displacement of some workers is likely. However, automation is not a new phenomenon, and much like preceding innovations, early research points to the likelihood that AVs will result in a net increase in overall worker productivity, create more (while different) jobs, and result in widespread economic gains. As we described in a recent chapter in the book, *Empowering the New Mobility Workforce*, there are a number of historical examples where technology substitutes for labor, including the introduction of technology in farming, mechanization in factories, and standardization of freight with containers.[26]

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[25] The Commission Decision (D.) 19-06-033 stipulated that "Beginning on July 1, 2019, pursuant to CPUC Decision 19-06-033, transportation network companies (TNCs) are required to collect a ten cent ($0.10) fee on each TNC trip in California. The funds generated from the fee support the expansion of on-demand transportation for non-folding wheelchair users who require a wheelchair accessible vehicle (WAV)."

[26] Brown, Austin; Hannah Safford and Daniel Sperling "Chapter-One Empowering the New Mobility Workforce Educating, Training, and Inspiring Future Transportation Professionals" Empowering the New Mobility Workforce. (2019), Pages 3-30.

These transitions varied in speed and scale, so solutions will come into focus as the trajectory of AV transitions become clearer. It will be incumbent upon policymakers (while out of the scope of this commission) to work proactively to ensure there is a pathway for transitioning workers to new opportunities.

F. Comments Relating to 1.1.2.6. UC Davis Academic studies:

	Shared, Automated, and Electric: the Three Revolutions in Transportation	
2018	Book: Three Revolutions: Steering Automated, Shared, and Electric Vehicles to a Better Future	Sperling, Daniel
2018	Article: Three Revolutions in Transportation	Sperling, Daniel and Austin Brown
2018	Article Re Cost of Future Travel: Three Revolutions in Urban Passenger Travel	Fulton, Lewis and Junia Compostella
2017	Full Modeling Report: Three Revolutions in Urban Transportation	Fulton, Lewis, Jacob Mason, Dominique Meroux
2017	Automated Vehicle Policy and Technology: The Potential to Intersect with Shared Use Mobility Services	Pike, Susan
	Surveys of Mobility Trends: TNCs and AVs	
2019	Uncovering Early Adopter’s Perceptions and Purchase Intentions of Automated Vehicles: Insights from Early Adopters of Electric Vehicles in California	Berliner, Rosaria M., Scott Hardman, Gil Tal
2019	Who Will Be the Early Adopters of Automated Vehicles? Insights from a Survey of Electric Vehicle Owners in the United States	Hardman, Scott, Rosaria M. Berliner, Gil Tal
2019	How Do Drivers Use Automation? Insights from a Survey of Partially Automated Vehicle Owners in the United States	Hardman, Scott, J.H. Lee, Gil Tal
2018	A First Look at Vehicle Miles Travelled in Partially-Automated Vehicles	Hardman, Scott, Rosaria M. Berliner, Gil Tal

	AVs and Modeling Future Demand for Travel and Emissions	
2019	A Joint Optimization Scheme for Planning and Operations of Shared Autonomous Electric Vehicle Fleets Serving Mobility on Demand	Sheppard, Colin J.R., Gordon S. Bauer, Brian F. Gerke, Jeffery Greenblatt, Alan Jenn, Anand R. Gopal
2019	Policy Brief: The Effects of Ride-Hailing Services on Greenhouse Gas Emissions	Rodier, Caroline J. and Julia Michaels
2018	NCST White Paper: The Effects of Ride Hailing Services on Travel and Associated Greenhouse Gas Emissions	Rodier, Caroline J.
2018	Projecting Travelers into a World of Self-Driving Vehicles: Estimating Travel Behavior Implications via a Naturalistic Experiment	Harb, Mustapha, Yu Xiao, Giovanni Circella, Patricia L. Mokhtarian, Joan L. Walker
2018	Automated Vehicle Scenarios: Simulation of System-Level Travel Effects Using Agent-Based Demand and Supply Models in the San Francisco Bay Area	Rodier, Caroline J., Miguel Jaller, Elham Pourrahmani, Joschka Bischoff, Joel Freedman, Anmol Pahwa
	AVs and Safety	
2019	User Perceptions of Safety and Security: A Framework for a Transition to Electric-Shared-Automated Vehicles	Kurani, Kenneth S.
2019	Is It OK to Get in a Car with a Stranger? Risks and Benefits of Ride-pooling in Shared Automated Vehicles	Sanguinetti, Angela, Kenneth S. Kurani, Beth Ferguson
2019	Policy Brief: Vehicle Design May Be Critical to Encourage Ride-Pooling in Shared Automated Vehicles	Sanguinetti, Angela, Kenneth S. Kurani, Beth Ferguson
	Labor and Workforce	
2019	Empowering the New Mobility Workforce Chapter One: Historical Perspectives on Managing Automation and Other Disruptions in Transportation	Brown, Austin, Hannah Safford, Daniel Sperling

	AVs and Bicycle/Pedestrians	
2017	Active Transportation in an Era of Sharing, Electrification and Automation	Handy, Susan L.

Conclusion

We look forward to working on the many important and complex issues that will be addressed in this proceeding and providing further detail or research synopses.

Dated: January 21, 2020

Respectfully submitted,

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