Forum on Preparing for Automated Vehicles & Shared Mobility

-DIRECTORY OF INFORMATION RESOURCES-

This directory has been assembled by TRB staff to help inform the work of this National Academies/TRB Forum. While far from exhaustive, the list includes resources that relate directly to the mission of this Forum. With a few exceptions, the list is limited to items that have been published or posted in 2017 or later.

TRB staff continues to keep this list updated, and the most current version is posted on the Forum’s website (https://trb.org/AVSMForum). Forum participants and others are encouraged to bring similar resources to the attention of the TRB staff.

Contents

SCENARIOS FOR AUTOMATED VEHICLES AND SHARED MOBILITY................................. 1
GUIDANCE FOR STATE, AND LOCAL AGENCIES.............................................................. 4
FEDERAL AGENCY NOTICES, GUIDANCE, AND INFORMATION .................................... 8
SAFETY & SECURITY ........................................................................................................... 10
ROLE OF SHARED MOBILITY ............................................................................................ 12

SCENARIOS FOR AUTOMATED VEHICLES AND SHARED MOBILITY

  o Summarizes a symposium held in June 26–27, 2018, in Brussels, Belgium, hosted by the European Commission and TRB. The 2-day invitation-only symposium brought together high-level experts to share their views on the socioeconomic impacts of connected and automated vehicles and shared mobility (CAVSM). With the aim of fostering trans-Atlantic collaboration in research and deployment, symposium participants discussed challenges and opportunities arising from the diffusion of CAVSM and innovative approaches to mitigate any negative socioeconomic impacts.

  o Summarizes the deliberations of this TRB forum launched in early 2018 to facilitate evidence-based research needed to deploy automated vehicle technologies in a manner and timeframe that informs policy to meet long-term goals. Includes
opportunities, challenges, impacts, research needs, and cross-cutting issues to be addressed.

  
  o Despite concerns that a rise in automated vehicles (AVs) will displace significant numbers of truck drivers in the United States, only a modest number of truck driver jobs, if any, will be affected, according to this new report commissioned by the American Center for Mobility (ACM), led by Michigan State University (MSU) and supported by Texas A&M Transportation Institute (TTI).

  
  o Addresses the implications for how automated vehicles (AV) may affect the automobile industry and the transportation sector. Specifically, this report makes predictions about the future of AVs based on economic models.

  
  o Presents the findings from a three year collaboration that explored how autonomous vehicles could reshape the future of urban mobility. Includes steps that government leaders need to take to ensure the future of mobility remains safe, clean and accessible for all people.

  
  o Experts address a set of key questions, including: 1) what precedents can we rely on in thinking about the impacts of AVs?, 2) what is the scale of concrete benefits AVs can offer to the broader population?, and 3) how can we inject rational, well-researched perspectives into the emotionally-charged yet critical conversation around the potential job impacts of AVs?

  
  o Assesses the state-of-the-practice of automated vehicles (AVs) and their effects on travel and the environment. This paper identifies changes that AVs may have on increased roadway capacity, reduced travel time, monetary costs, parking, induced travel demand, new traveler groups, and energy.

- Explores the state of autonomous trucking technology from multiple stakeholder perspectives. This paper specifically focuses on how autonomous technology can affect fuel use and emissions in the freight sector.

  - Explores autonomous vehicle benefits and costs, and impacts on transportation planning issues. It investigates how quickly self-driving vehicles are likely to be developed and deployed, and how they are likely to affect travel demands and planning decisions such as optimal road, parking and public transit supply.

- **Will Self-Driving Cars Usher in a Transportation Utopia or Dystopia?** Yale E360, January 2018: [http://e360.yale.edu/features/will-self-driving-cars-usher-in-a-transportation-utopia-or-dystopia](http://e360.yale.edu/features/will-self-driving-cars-usher-in-a-transportation-utopia-or-dystopia)
  - Analysis by Jacques Leslie - Innovation visionaries say electric, self-driving, shared cars will soon revolutionize the way humans move about. But experts caution that unless this paradigm shift is guided by sound public policies, the future of transportation could lead to more pollution, more emissions, and more gridlock.

  - This document is envisioned as a reference for modelers and decision makers. Aggregates current information and research on the state of key trends and emerging technologies/services, documented impacts on California's transportation ecosystem, and future growth projections (as appropriate).

- **Are We Going Too Fast on Driverless Cars?** Science, Jeffrey Marvis, December 2017: [http://www.sciencemag.org/news/2017/12/are-we-going-too-fast-driverless-cars](http://www.sciencemag.org/news/2017/12/are-we-going-too-fast-driverless-cars)
  - Makes the case that predictions to date turn out to be based on surprisingly little research. While developers amass data on the sensors and algorithms that allow cars to drive themselves, research on the social, economic, and environmental effects of AVs is sparse. Truly autonomous driving is still decades away, according to most transportation experts. And because it's hard to study something that doesn't yet exist, the void has been filled by speculation—and starkly contrasting visions of the future.

  - The pace of change in transportation is creating a critical conundrum for transportation planners and policymakers. One of the planners' roles is to broker information that informs decision-making. But what in the world do we tell decision-makers? Who should one believe regarding the pace and impacts of transportation technology deployment?

  - Presents views on operating safety, hybrid road infrastructure, automation and traffic management, driving activity, interactions with pedestrians, impacts on territories and lifestyles, freight and logistics, and legal challenges
• Rethinking Transportation 2020-2030; RethinkX, James Arbib and Tony Seba, May 2017: https://www.rethinkx.com/transportation/
  o We are on the cusp of one of the fastest, deepest, most consequential disruptions of transportation in history. The disruption will be driven by economics. By 2030, within 10 years of regulatory approval of autonomous vehicles (AVs), 95% of U.S. passenger miles traveled will be served by on-demand autonomous electric vehicles owned by fleets, not individuals, in a new business model we call “transport-as-a-service” (TaaS).

  o Focuses on the range of possible impacts this transformation may have on energy, while acknowledging the economic, safety, and accessibility implications. In addition, this paper highlights the impacts that the mobility system of the future will have on our built environment, and how these interactions could change our cityscapes, as well as suburban and rural areas.

  o Outlines the impacts of automated truck (AT) deployment on the topics found within ATRI’s 2015 Top Industry Issues. To accomplish this, the report explores the role of each top industry issue across several levels of truck automation, offering a discussion of impacts to drivers, companies and operations in general. Additional issues related to AT impacts on the industry are also discussed.

  o This primer provides an introduction and background to shared mobility; discusses the government’s role; reviews success stories; examines challenges, lessons learned, and proposed solutions; and concludes with guiding principles for public agencies. The primer provides an overview of current practices in this emerging field, and also looks toward the future in the evolution and development of shared mobility.

GUIDANCE FOR STATE, AND LOCAL AGENCIES
  o Identifies and evaluates opportunities, constraints, and guiding principles for implementing dedicated lanes for connected and automated vehicles. This report describes conditions amenable to dedicating lanes for users of these vehicles and develops the necessary guidance to deploy them in a safe and efficient manner. This analysis helps identify potential impacts associated with various conditions affecting lane dedication, market penetration, evolving technology, and changing demand.
  o Provides guidelines to help agencies update their modeling and forecasting tools to address expected impacts of connected and automated vehicles (CAVs) on transportation supply, road capacity, and travel demand components. Under requirements for long-range transportation planning, state departments of transportation and regional metropolitan planning organizations are required to have a multimodal transportation plan with a minimum time horizon of 20 years. Because manufacturers and shared fleet operators suggest that CAVs will be present on the highway system in significant numbers well before 2038, the planning community will require procedures and methods to address the potential positive and negative direct and indirect outcomes from their deployment.

  o Provides state departments of transportation (DOTs) and motor vehicle departments with guidance and resources to assist with the legal changes that will result from the rollout of connected and automated vehicles. Coordinated with work being done by the American Association of Motor Vehicle Administrators (AAMVA). The six volumes include: 1) Legal Landscape, 2) State Legal and Regulatory Audit, 3) Legal Modification Prioritization and Harmonization Analysis, 4) Autonomous Vehicle Action Plan, 5) Developing the Autonomous Vehicle Action Plan, and 6) Implementation Plan.

  o Provides a municipal action guide that is meant to give cities the ability to better understand and approach the impending rollout of autonomous vehicles in their cities. Lays out the current typologies of how cities and other levels of government are working together with the private sector to begin to integrate self-driving cars onto the roadways. Provides the reader with: analysis of the current legal/regulatory structure, the state of AV pilot programs, city approaches to AV pilots, best practices from cities throughout the country, action steps on city leadership to move forward.

  o Provides advice on what infrastructure is required to pave the way for highly automated and zero emissions vehicles in Victoria, Australia. Includes 17 recommendations in total, tested against the context of seven possible scenarios for the future and key triggers for action.

- Governors Staying Ahead of the Transportation Innovation Curve – A Policy Roadmap for States: National Governors Association, July 2018: https://www.nga.org/wp-
Reviews challenges that states face as they seek to address concerns and reap the benefits of new transportation technology. Presents seven strategies for governors to help prepare their states to embrace transportation innovation.

- Guidelines for the Regulation and Management of Shared Active Transportation: National Association of City Transportation Officials (NACTO), July 2018: https://nacto.org/home/shared-active-transportation-guidelines/
  - Provides standards for cities to manage companies (including dockless bike share and scooter share) that are not otherwise overseen or selected through competitive procurement processes or contracts, and sets minimum standards that all cities should require for managing this new industry on city streets.

  - Assists motor vehicle and law enforcement agencies seeking to address the testing or use of Level 3, 4, and 5 automated vehicles in their jurisdiction.” It provides voluntary guidance and recommendations to assist agencies as they wrestle with this topic, in hopes of “creating a consistent regulatory approach across jurisdictions.”

  - Illustrates potential safety considerations and infrastructure needs to support the mass adoption of autonomous and connected vehicles in the motor carrier industry. This report focuses on infrastructure requirements as a primary policy concern.

  - Presents an evaluation framework for assessing technological impacts within transportation-related city projects. This report focuses on how data can improve safety, equity, environment, energy, and congestion.

  - Website tracks status of federal and state legislation and regulations on automated vehicles. Includes autonomous vehicles legislative database, providing up-to-date, real-time information about state autonomous vehicle legislation that has been introduced in the 50 states and the District of Columbia.

  - Summarizes the findings of a symposium and research on the implications of autonomous vehicles for cities and regions. It is intended for planners and local government officials involved in land-use planning, urban design, and transportation. Readers will learn about the need to plan for the potential benefits and negative impacts of autonomous vehicles and what steps they can take now to prepare their communities.
  o Addresses a wide range of issues including, but not limited to, greater access, equity, reducing transportation-related greenhouse gases, vehicle safety, public health, land use planning issues, community livability, parking and managing the streets. The identified policies should be viewed as concepts for further discussion.

  o Assesses policy and planning strategies at the state, regional, and local levels that could influence private-sector automated vehicle (AV) and connected vehicle (CV) choices to positively affect societal goals. The report aims to assist agencies with exploring actions that might increase the likelihood that AV and CV technologies will have beneficial impacts on traffic crashes, congestion, pollution, land development, and mobility.


  o Summary of discussion and background information for state CEO panel held in conjunction with 2017 ITS World Congress in Montreal. Includes CAV state-of-the-art, DSRC and 5G, progressing independent of federal action, cybersecurity, workforce, coordination and collaboration, messaging, and CAV preparation by state DOTs.

  o It is clear that our nation’s cities cannot only be defined by the growth of the tech and the creative sectors. Instead, cities must act deliberaently for growth of any kind to be truly sustainable. As the tide of innovation in cities rises, local leaders must work assiduously to lift all boats by planning for inclusive economic development. Includes chapter on infrastructure - autonomous vehicles, road pricing and more.

  o Traditional urbanism evolved over millennia to meet human needs. The adoption of AVs should not be allowed to replace time-tested places with something that would probably make our lives worse.

• New Mobility – Autonomous Vehicles and the Region; Regional Plan Association, October 2017: http://library.rpa.org/pdf/RPA-New-Mobility-Autonomous-Vehicles-and-the-Region.pdf
  o Highlights key recommendations from RPA’s Fourth Regional Plan for the New York-New Jersey-Connecticut metropolitan area. Included are policy
recommendations regarding autonomous vehicles, goods movement and autonomy, the shared economy and social equity, and impacts on the built environment.

  
  o Assesses the potential impacts of CAVs and innovative mobility services on local communities in the state of Michigan. These technologies and services promise many benefits for local Michigan communities, but in many cases, new infrastructure or policies are required to maximize their societal benefits and overall effectiveness. This policy development and infrastructure deployment will often require an innovative and collaborative approach between local units of government, state agencies, in partnership with private organizations.

  
  o An overview of AV technology and answers frequently asked questions for city leaders around AV manufacturers, public policy considerations, municipal coordination, and infrastructure investment.

- **Iowa Automated Vehicle Technologies Project:** Iowa DOT, Iowa State University, University of Iowa, HERE, April 2017: [https://www.iowadot.gov/pdf_files/IowaVisionDocument.pdf](https://www.iowadot.gov/pdf_files/IowaVisionDocument.pdf)
  
  o The State of Iowa is taking a proactive approach to preparing for increasing levels of vehicle automation. This document sets out a comprehensive vision for the Iowa Department of Transportation’s (DOT) role in the future transportation environment, and a plan for accelerating progress towards that future.

  
  o Examines the state of technology for both autonomous vehicles (AVs) and connected vehicles (CVs). Discusses adoption predictions. Propose multiple potential planning scenarios to reflect the wide range of potential connected and autonomous vehicles impacts.

---

**FEDERAL AGENCY NOTICES, GUIDANCE, AND INFORMATION**

  
  o Latest federal guidance for automated vehicles, supporting the safe integration of automation into the broad multimodal surface transportation system. Builds upon—but does not replace-voluntary guidance provided in ‘Automated Driving Systems 2.0: A Vision for Safety.’

Investigates how emerging connected-vehicle (CV) and automated-vehicle (AV) technologies can address roadway-departure (RwD) crashes. The objective of this report is to develop a framework for the FHWA regarding how the infrastructure components may need to change to accommodate CV and AV technologies to help reduce the frequency and severity of RwD crashes.

  - The FHWA seeks information directly from the public and stakeholders to better understand FHWA’s role in automation and inform future agency research and activities. In addition, FHWA seeks comments more broadly on planning, development, maintenance, and operations of the roadway infrastructure necessary for supporting ADS, including any information detailing the costs associated with implementation. Comments are requested in response to ten questions.

  - Requests transit industry comment regarding the current and near-future status of automated transit buses and related technologies. Comments received will assist FTA in developing future Notices of Funding Opportunity’s (NOFO) for transit bus automation demonstrations with respect to the industry’s ability and interest.

  - The Strategic Transit Automation Research (STAR) Plan builds on extensive stakeholder consultation and use case analysis to define a five-year research agenda which will move the transit industry forward. “Bus” is defined broadly to consider a range of sizes and passenger capacities, and could include both traditional and novel vehicle designs (e.g. full-size city buses, articulated buses, and small shuttles).

  - GAO concluded that policymakers will need to decide if the current approach to vehicle testing and standards is sufficient to ensure adequate vehicle safety, according to many stakeholders GAO interviewed. Further, policymakers may want to address how automated vehicles interact with other road. Likewise, automated vehicles may require infrastructure changes, and policymakers will need to decide what changes to pursue, while also providing for conventional vehicles since many stakeholders expect conventional vehicles to remain on the roads for decades.

  - Autonomous vehicles are an emerging risk that will affect critical infrastructure. This study identifies and examines risks and issues likely to develop as autonomous vehicles become more common throughout the United States, and is intended to help decision makers mitigate potential consequences before they become significant problems.
• The U.S. Department of Transportation’s Smart City Challenge and the Federal Transit Administration’s Mobility on Demand Sandbox; TRB Transportation Research Circular E-C219, March 2017: http://www.trb.org/Publications/Blurbs/175826.aspx
  o Features presentations and dialogue from a January 8, 2017 workshop at the TRB Annual Meeting. The workshop explored the role of public transit, shared mobility, and advanced technology (including connected and automated vehicle technology, sensing, cameras, etc.) in the recent competitions, along with next steps and plans for researching the pilot projects and documenting best practices. Sessions featured the U.S. DOT Smart City Challenge winner: Columbus, Ohio, and highlighted pilot projects from the FTA Mobility on Demand (MOD) Sandbox, along with selected public–private partnerships and research initiatives on the future of mobility.

SAFETY & SECURITY

  o Presents a framework for measuring safety in automated vehicles (AVs) that could be used broadly by companies, policymakers, and the public. In it, the authors considered how to define safety for AVs, how to measure safety for AVs, and how to communicate what is learned or understood about AVs. Presents a structured way of thinking about how to measure safety at different stages of an AV’s evolution, and proposes a new kind of measurement. Highlights the kinds of information that could be presented in consistent ways in support of public understanding of AV safety.

  o Presents the results of a survey of over 1,200 owners of vehicles equipped with advanced driver assistance systems (ADAS). The data reflects owners’ opinions about, understanding of, and experiences with the ADAS technologies. Although the majority of drivers generally have favorable impressions of the technologies on their vehicles, many respondents demonstrated lack of awareness of the key limitations of the technologies.

  o Outlines new and perhaps unanticipated state traffic safety issues that automated vehicles may bring to states, and discusses how law enforcement and State Highway Safety Offices (SHSOs) should prepare for them. Includes recommendations to states on automated vehicle testing and deployment, management, and traffic laws.

  o Reports on early results from testing level 2 driver assistance systems, including whether the systems handle driving tasks as humans would. The early results underscore the fact that today's systems aren't robust substitutes for human drivers.
• Safer Roads with Automated Vehicles?: International Transport Forum, May 2018: 
  o Examines how increasing automation of cars and trucks could affect road safety. This report focuses on which security vulnerabilities may be affected by the rise of self-driving vehicles and how vehicle automation could impact the principles of the “Safe System” approach, which aspires to a long-term policy goal that no one should be killed or seriously injured in a highway crash.

  o Investigates the quality and security of information flow in the connected vehicle (CV) environment. Conducts a comparative analysis of two major enabling technologies for V2V (vehicle-to-vehicle) and V2I (vehicle-to-infrastructure) communication, namely LTE (Long-Term Evolution) and DSRC (dedicated short-range communication). Their technology standards, performance, and cost are analyzed. Provides a critical review of potential attacks on CVs and limitations of existing DSRC standards to address these threats. Identifies open issues that remain unsolved by existing technologies and security protocols.

  o Provides an overview and comparison of the inherent security flaws in automotive radar and DSRC technologies. Discusses the motivation for combining radar and DSRC into a joint system and provides an overview of the potential consequences of an insecure vehicular system.

  o Some people think autonomous vehicles must be nearly flawless before humans take their hands off the wheel. But RAND research shows that putting AVs on the road before they’re perfect improves the technology more quickly—and could save hundreds of thousands of lives over time

  o Replaces the Federal Automated Vehicle Policy released in 2016. This updated policy framework offers a path forward for the safe deployment of automated vehicles by: encouraging new entrants and ideas that deliver safer vehicles; making Department regulatory processes more nimble to help match the pace of private sector innovation; and supporting industry innovation and encouraging open communication with the public and with stakeholders.
  o This report is written for state DOTs, DMVs, and State Highway Safety Offices (SHSOs). It describes the key topics that states must address to manage traffic safety in a world with both driver-operated and autonomous vehicles. The report then summarizes what some states already have done to address autonomous vehicles. Finally, the report suggests what all states can and should do to prepare for autonomous vehicles and to assure that traffic safety is at the forefront of all autonomous vehicle discussions.

ROLE OF SHARED MOBILITY

  o Estimates the effect of Uber on public transit ridership using a difference-in-differences design that exploits variation across U.S. metropolitan areas in both the intensity of Uber penetration and the timing of Uber entry. Finds that Uber is a complement for the average transit agency, increasing ridership by five percent after two years. This average effect masks considerable heterogeneity, with Uber increasing ridership more in larger cities and for smaller transit agencies.

• Taxonomy and Definitions for Terms Related to Shared Mobility and Enabling Technologies: SAE, September 2018: https://www.sae.org/shared-mobility
  o Addresses discrepancies in the use and definition of terms, which often create ambiguity and confusion. Developed as an SAE Recommended Practice J3163, the standard covers six categories of terms related to shared mobility: travel modes, mobility applications, service models, operational models, business models, and deprecated terms.

• Partners in Transit – A Review of Partnerships Between Transportation Network Companies and Public Agencies in the United States: Joseph P. Schwieterman, Mallory Livingston, & Stijn Van Der Slot; Chaddick Institute for Metropolitan Development at DePaul University, August 2018: https://las.depaul.edu/centers-and-institutes/chaddick-institute-for-metropolitan-development/research-and-publications/Documents/Partners%20in%20Transit_Live1.pdf
  o Summarizes the status of twenty-nine partnerships between TNCs and public bodies around the United States designed to improve mobility, twenty-two of which are currently active. For each partnership observed, the research team evaluated: when the programs were active; whether they have been modified since their inception; how the programs were financially structured; and audits of program performance made publicly available.

  o Combines recently published research and newly available data from a national travel survey and other sources to create a detailed profile of TNC ridership, users and usage. Discusses how TNC and microtransit services can benefit urban transportation,
how policy makers can respond to traffic and transit impacts, and the implications of current experience for planning and implementation of shared autonomous vehicles in major American cities.

  - Summarizes the current state and general purposes of TNC taxes and fees to date in the United States, and provides guidance on the main questions cities and states are trying to answer when they levy taxes and fees on TNCs.

  - Explores the effect of app-based transportation network companies on the city where they operate, including on public transit ridership, single-occupancy vehicles trips, and traffic congestion. Built upon the findings of TCRP Research Report 188, this report explores how shared modes—and ridesourcing companies in particular—interact with the use of public transit and personal automobiles.

  - Discusses how to manage growing competition for curb access in cities. This report explores the potential for a shift away from curb use focused on street parking to more flexible allocation that includes pick-up and drop-off zones for passengers and freight.

- **Why TNCs Will Be Regulated Like Taxis—Historically Speaking:** Institute for Transportation at Iowa State University, May 2018: [http://www.trb.org/main/blurbs/177752.aspx](http://www.trb.org/main/blurbs/177752.aspx)
  - Forecasts how transportation network companies (TNCs) will be regulated in the near future. The authors hypothesize that when TNCs are regulated like taxis, customers will experience a high level of service at reasonable rates.

  - The report explores the efforts made by public transit agencies to provide on-demand services to the public. It also provides transit agencies with legal guidance for considering whether to enter into relationships with ridesourcing service providers (RSPs). The report includes a description of ridesourcing services in the United States, state and municipal legislative and regulatory schemes, procurement and procurement processes, contractual and partnership provisions in agreements between RSPs and a public transit agency, issues of compliance with federal legislation and civil rights requirements and those under the Americans with Disabilities Act, legal claims and litigation, and risk management issues stemming from relationships between RSPs and transit agencies.

Analyzes the effects of ride-hailing services on elements of the transportation system, including congestion, vehicle miles traveled, and greenhouse gas emissions. This report also determines the effects of ride-hailing on individual vehicle ownership choices, use of ride-hailing services by those who would otherwise not travel independently by car, destination choice, mode choice, operation of ride-hailing vehicles without a traveler, and land use.

- Peer-to-Peer (P2P) Carsharing: Understanding Early Markets, Social Dynamics, and Behavioral Impacts: Susan Shaheen, Elliot Martin, and Apaar Bansal, University of California Transportation Center, March 2018: https://escholarship.org/uc/item/7s8207tb
  - Studies the effect of peer-to-peer carsharing on behavior and its operational challenges and opportunities, as well as market characteristics.

  - The study broadens the understanding of the interplay among emerging and established modes of transportation. Built upon the findings of TCRP Research Report 188, this report explores how shared modes—and ridesourcing companies in particular—interact with the use of public transit and personal automobiles.

- Shared Mobility Principles for Livable Cities: 2017: https://www.sharedmobilityprinciples.org/
  - These principles, produced by Robin Chase (ZipCar co-founder) and a working group of international NGOs, are designed to guide urban decision-makers and stakeholders toward the best outcomes.

  - A review of the many issues that need to be addressed regarding autonomous vehicles and their potential impacts on traditional taxi services, TNCs, and the for-hire ground transportation industry in general

  - Presents findings from a comprehensive travel and residential survey deployed in seven major U.S. cities, in two phases from 2014 to 2016, with a targeted, representative sample of their urban and suburban populations. The purpose of this report is to provide early insight on the adoption of, use, and travel behavior impacts of ride-hailing. The report is structured around three primary topics: adoption of ride-hailing, vehicle ownership and driving, ride hailing and public transit use.

  - Provides an overview of the Mobility on Demand (MOD) concept and its evolution, description of the MOD ecosystem in a supply and demand framework, and its stakeholders and enablers. Leveraging the MOD ecosystem framework, this report...
reviews the key enablers of the system including business models and partnerships, land use and different urbanization scenarios, social equity and environmental justice, policies and standards, and enabling technologies. This review is mostly focused on the more recent forms of MOD (e.g., shared mobility).

- **Travel Behavior: Shared Mobility and Transportation Equity:** Susan Shaheen, Corwin Bell, Adam Cohen, and Balaji Yelchuru, U.S. Department of Transportation, August 2017: [https://www.fhwa.dot.gov/policy/otps/shared_use_mobility_equity_final.pdf](https://www.fhwa.dot.gov/policy/otps/shared_use_mobility_equity_final.pdf)
  - Shared mobility—the shared use of a motor vehicle, bicycle, or other low-speed transportation mode that allows users to obtain short-term access to transportation on an as-needed basis—has the potential to help address some transportation equity challenges. In an effort to categorize the myriad of transportation equity barriers facing transportation system users, this primer proposes a ‘STEPS to Transportation Equity’ framework including: Spatial, Temporal, Economic, Physiological, and Social barriers. For each barrier category, shared mobility opportunities and challenges are explored along with policy recommendations.

  - Provides an introduction to the current state of vehicle automation and shared mobility. The paper discusses current shared mobility business models to foster a better understanding of these systems at present and to set the stage for possible future shared automated vehicle (SAV) business models. The discussion covers current SAV pilot projects around the world and then explores potential SAV business and service models considering high or full automation (Level 4 and higher).

  - An analysis of five North American Cities

- **Shared Mobility and the Transformation of Public Transit; TRB Transit Cooperative Research Report 188, Shared Use Mobility Center, June 2016:** [http://www.trb.org/Main/Blurbs/174653.aspx](http://www.trb.org/Main/Blurbs/174653.aspx)
  - Examines the relationship of public transportation (including paratransit and demand-responsive services) to shared modes, including bikesharing, carsharing, microtransit, and ridesourcing services provided by companies such as Uber and Lyft. The report also explores issues and opportunities and challenges as they relate to technology-enabled mobility services, including suggesting ways that transit can learn from, build upon, and interface with these new modes. A supplemental infographic summarizes the aspects of the sharing economy and its intersection with transit.