THE LEGAL OBLIGATIONS, OBSTACLES, AND OPPORTUNITIES FOR AUTOMATED AND CONNECTED VEHICLES TO IMPROVE MOBILITY AND ACCESS FOR PEOPLE UNABLE TO DRIVE

Frank Douma,[*] *Adeel Lari*[**] *& Kory Andersen* [***]

2017 MICH. ST. L. REV. 75

ABSTRACT

In recent decades, several legislative and regulatory mandates, such as the Americans with Disabilities Act, "United We Ride" initiative, and Olmstead *court decision, have been issued in attempt to improve mobility and access for those who are unable to drive. Yet despite these well-intentioned and continuing efforts, our current transportation system does not fully address these disparities. Self-driving vehicles (SDVs) present an opportunity to address these disparities by providing a level of transportation access for people unable to drive that our current transportation system cannot. Yet, even though nearly every automobile manufacturer and several major technology companies are developing SDVs and related technologies, researchers and policymakers are pointing out that more work is needed if the promise of increased mobility and access is to be fulfilled. For example, the National Council on Disability noted in November 2015 that because of the development pace and "proprietary nature of its engineering," the explicit details of how*

---

* Frank Douma is a Director of the State and Local Policy Program at the Hubert H. Humphrey School of Public Affairs and a Transportation Scholar at the Center for Transprotation Studies, both located at the University of Minnesota. He conducts research into the legal and policy impacts of new transportation technologies.

** Adeel Z. Lari is currently serving as Director of Innovative Financing at the State and Local Policy Program at the Hubert H. Humphrey School of Public Affairs, University of Minnesota. He is a 30-plus year veteran of the Minnesota Department of Transportation.

*** Kory Anderson is currently a graduate student obtaining his master's in Urban and Regional Planning at the Humphrey School of Public Affairs. He is also a graduate reserch assistant for Frank Douma and Adeel Lari. His background is in U.S. history with specializations in U.S.–Mexico immigration and urban planning.

"designers and manufacturers" are ensuring equitable access for disabled and low-income individuals has nearly been non-existent.[1]

This Article will address the legal obligations, opportunities, and obstacles facing SDV technologies in this arena by articulating some of the specific challenges and questions that must be addressed. Questions such as what SDV deployment will look like, rider safety, vehicle design for wheelchair and disabled users, and the evolving role of policymakers in creating opportunities for this population will be discussed. Without answers to these questions, our ability to create an equitable transportation system through SDV technology will be limited.

TABLE OF CONTENTS

1. SUSAN HENDERSON & MARILYN GOLDEN, NAT'L COUNCIL ON DISABILITY, SELF-DRIVING CARS: MAPPING ACCESS TO A TECHNOLOGY REVOLUTION 5 (2015).

INTRODUCTION

The great changes coming in automotive technology[2] have the potential to change the way we define the "winners" and "losers" in twenty-first century transportation. Much has been written about the disparate impacts of the development of the railroads and then the Interstate Highway system in the twentieth century, pointing out how these developments favored those with the physical abilities and financial wherewithal to use these systems, at the expense of poorer people and others that could not drive.[3] However, the increasing abilities of vehicles to drive themselves are leading this description of "haves" and "have-nots" to change.

At first glance, it appears that these technological developments will bring great benefits: people with disabilities will be able to "drive" the same vehicles as those who can drive themselves, transit will become more flexible, many trips will not even be necessary, and the cost of the trips that remain will become cheaper. But these advantages will not come about automatically, nor easily. One example of this is the realization that just because a self-driving vehicle can transport a person that is physically unable to drive, it does not mean that the person will be able to easily enter and exit the vehicle, nor easily interact with it, unless the vehicle has been specifically designed to meet the needs of these users.

This Article will attempt to articulate and begin to address some of these specific issues. The Part I will discuss the current legal context calling for improved equity in transportation and the opportunities presented by self-driving vehicles. Part II will then outline some of the specific challenges faced by people who are unable to drive themselves, which is followed by a discussion of the challenges and opportunities these pose for vehicle design in Part III. Parts IV and V then introduce two different models for deploying these new technologies and discuss the opportunities and challenges for improving transportation equity that lie within each path. Finally,

---

2. Erin Griffith, *Who Will Build the Next Great Car Company?*, FORTUNE (July 1, 2016, 6:30 AM), http://fortune.com/self-driving-cars-silicon-valley-detroit/ [https://perma.cc/EE63-NMCR] (last visited Nov. 11, 2016) ("Thanks to cheap sensors, powerful machine-learning technology, and a kick in the butt from the likes of Google and Tesla Motors, driverless vehicles are becoming a sooner-than-you-think reality.").

3. *See, e.g.*, THE GEOGRAPHY OF URBAN TRANSPORTATION (Susan Hanson & Genevieve Giuliano, eds., 3d ed. 2004).

Part VI discusses the potential role for public policy in ensuring the greatest benefits are achieved.

I. BACKGROUND

A. Legal and Administrative Context

Over the course of nearly three decades, advocacy and legislation for the rights of people who cannot drive have grown more prevalent. Two cornerstones of the growth rest on the 1990 Americans with Disabilities Act (ADA)[4] and the Supreme Court case *Olmstead v. L.C.* (*Olmstead* Decision) in 1999.[5] The ADA ruling prohibited the discrimination "against people with disabilities in employment, transportation, public accommodation, communications, and governmental activities,"[6] and, as such, it required public transit agencies to serve people with disabilities.[7] The *Olmstead* Decision tested the ADA ruling. This ruling determined that the "proscription of discrimination [in the ADA required] may require placement of persons with mental disabilities in community settings rather than in institutions."[8] While the facts of that case related to decisions to isolate and segregate disabled individuals, and therefore did not affect transportation directly, the verdict had sweeping implications for defining the government's role in providing services to disabled individuals.[9] The ruling set a standard that services could not be different from those available to people without disabilities.[10] For transportation, this meant that state and federally funded public transportation services were required to accommodate the needs of disabled individuals, i.e., include flexible priority seating for wheelchairs on all buses.[11]

---

4. Americans with Disabilities Act of 1990, Pub. L. No. 101-336, 104 Stat. 327 (codified as amended in sections of 42 & 47 U.S.C. (2012)).

5. Olmstead v. L.C. *ex rel.* Zimring, 527 U.S. 581 (1999).

6. *Americans with Disabilities Act*, U.S. DEP'T OF LABOR, http://www.dol.gov/general/topic/disability/ada [https://perma.cc/K8GW-WEKG] (last visited Nov. 11, 2016).

7. 42 U.S.C. § 12143(a) (2012).

8. *Olmstead*, 527 U.S. at 587.

9. *Id.* at 593.

10. *Id.* at 599-602.

11. *See ADA Essentials for Transit Board Members: Fundamentals of the Americans with Disabilities Act and Transit Public Policy*, AM. PUB. TRANSP. ASS'N 29 (2011), http://www.apta.com/resources/bookstore/Documents/1_ADA%20Handbook_Jan2011.pdf [https://perma.cc/X9E6-ALXJ].

In 2004, transportation-disadvantaged individuals' ability to access public transportation advanced another step. The Federal Government enacted the United We Ride initiative with the goal to improve public transport's affordability and reliability for people with disabilities, seniors, and low-income riders.[12] The initiative provided states with resources to strategically strengthen transportation planning efforts, vehicle sharing, and study outcomes, among other facets.

Efforts have continued at the state level as well. For example, the State of Minnesota formed the Minnesota Council on Transportation Access in 2010 to "study, evaluate, oversee, and make recommendations to improve the coordination, availability, accessibility, efficiency, cost-effectiveness, and safety of transportation services provided to the transit public."[13] Within the council, there are members who represent veterans, seniors, and disabled Minnesotans, among other stakeholders.[14]

In 2015, the United States District Court for the District of Minnesota approved "Minnesota's Olmstead Plan."[15] Started by an executive order from Minnesota Governor Mark Dayton on January 28, 2013, the *Olmstead* Plan aimed "to ensure people with disabilities are living, learning, working, and enjoying life in the most integrated setting."[16] The plan aimed to provide dependable, affordable, and accessible transportation choices that support disabled individuals' access to employment, housing, education, and social connections.[17] It also planned to increase Greater Minnesota

---

12. Gregory Lashutka, Edward T. Jennings Jr. & Nan P. Roman, *The United We Ride National Dialogue*, NAT'L ACAD. OF PUB. ADMIN., at vi (2010), https://www.transit.dot.gov/sites/fta.dot.gov/files/docs/UWR.National_Dialogue_Final_Report._Feb.2010.pdf [https://perma.cc/V88A-WU7M].

13. Minnesota Council on Transportation Access, MINN. STAT. § 174.285(1) (2016).

14. *Minnesota Council on Transportation Access*, COORDINATEMNTRANSIT.ORG, http://www.coordinatemntransit.org/MCOTA/ [https://perma.cc/4YQA-GQME] (last visited Nov. 11, 2016).

15. *Minnesota's Olmstead Plan*, MINN. DEP'T OF HUMAN SERVS., http://www.dhs.state.mn.us/main/idcplg?IdcService=GET_DYNAMIC_CONVERSION&RevisionSelectionMethod=LatestReleased&dDocName=opc_home [https://perma.cc/SYT4-52GF] (last visited Nov. 11, 2016).

16. *Id.*

17. *Putting the Promise of* Olmstead *into Practice: Minnesota's Olmstead Plan*, MINN. DEP'T OF HUMAN SERVS. 70 (2016), http://www.dhs.state.mn.us/main/idcplg?IdcService=GET_FILE&RevisionSelectionMethod=LatestReleased&Rendition=Primary&allowInterrupt=1&noSaveAs=1&dDocName=dhs16_196300 [https://perma.cc/8W3D-UAUP].

Transit trips by 50% by 2025 and to expand transit coverage so that 90% of public transportation service areas in Minnesota meet the minimum service guidelines for access by 2020.[18]

Furthermore, the Plan mandated that the Minnesota Department of Transportation develop a plan to serve at least 80% of the state's total transit service needs by July 1, 2015 and 90% by July 1, 2025.[19] The legislation included specific provisions to reduce "total unmet transit service needs" in urbanized areas, small urban areas, rural areas, and for seniors and the disabled.[20]

B. Development and Opportunities of Self-Driving Vehicles

Given the push to increase transit access, the introduction of self-driving vehicles presents an opportunity to meet these goals and exceed them. The idea of SDVs is not new, however, dating back nearly a century. Just decades after the first Ford Model T[21] rolled off the assembly line, people "began to think about an automated version of the passenger vehicle."[22] By the mid-twentieth century, major car brand researchers and top-tier research universities experimented with self-driving prototypes on laboratory roadways.[23] The promising research compelled the United States government to boldly predict in the 1960s that a self-driving prototype would be on the city streets by 1985.[24] The excitement and imagination whirling around SDVs even appeared in mainstream society. In the 1980s, Americans were captivated by KITT, the self-driving black Pontiac Firebird Trans Am that appeared in the popular television series Knight Rider.[25] Stephen King even wrote one of his classic horror novels, *Christine*,

---

18. *Id.* at 72.
19. MINN. STAT. § 174.24(1)(a) (2015).
20. *Greater Minnesota Transit Investment Plan 2010-2030*, SRF CONSULTING GRP., INC., at i-ii (2011), https://www.dot.state.mn.us/transit/reports/investmentplan/pdf/2011%2002%2010%20Final%20Investment%20Plan.pdf [https://perma.cc/9276-8QP9].
21. Adeel Lari, Frank Douma & Ify Onyiah, *Self-Driving Vehicles and Policy Implications: Current Status of Autonomous Vehicle Development and Minnesota Policy Implications*, 16 MINN. J. L. SCI. & TECH. 735, 740 (2015).
22. *Id.*
23. *Id.*
24. *Id.* at 741.
25. *Id.* at 740.

about a vintage car: The book's namesake could drive itself aided by supernatural powers.[26]

A landmark moment for the development of SDVs and increased federal support for the technology was the Defense Research Advanced Projects Agency (DARPA) Grand Challenge that took place in 2004, 2005, and 2007.[27] The challenge offered a prize of $2 million for a "driverless vehicle."[28] The challenge brought leading researchers and engineers together; coincidentally, many of the research teams formed in the mid-2000s are at the center of SDV development today.[29]

Sebastian Thrun, the lead researcher on Stanford's winning DARPA project, took the momentum to Google where he eventually founded Google's self-driving-car project in 2009.[30] Since then, a range of car companies including, but not limited to, Audi, Tesla, and General Motors have studied SDV technology at some level.[31] The research produced advances such as enhanced driverless cruise control, automatic braking, and piloted parking; BMW, Tesla, and Hyundai are several companies that have begun adopting these technologies into their new vehicles.[32] Such advances suggest SDV development is nearing the precipice of fully self-driving vehicles.[33] Elon Musk, CEO of Tesla Motors, has boldly stated that their fully autonomous vehicle will be able to "operate in any condition and on any road" in a short "two years."[34] Furthermore, on February 1, 2016, "Google announced that its self-driving car program was simulating driving 3 million miles a day" in a garage simulator in addition to the

---

26. *See* Ian Bogost, *The Secret History of the Robot Car: How Self-Driving Vehicles Took Off*, THE ATLANTIC (Nov. 2014), http://www.theatlantic.com/magazine/archive/2014/11/the-secret-history-of-the-robot-car/380791/ [https://perma.cc/2P63-E87E].

27. *Urban Challenge Overview*, DARPA, http://archive.darpa.mil/grandchallenge/overview.html [https://perma.cc/FX5W-VECC] (last visited Nov. 11, 2016).

28. *Id.*

29. *See* Burkard Bilger, *Auto Correct: Has the Self-Driving Car at Last Arrived?*, THE NEW YORKER (Nov. 25, 2013), http://www.newyorker.com/magazine/2013/11/25/auto-correct [https://perma.cc/6UU4-R9L4].

30. *See* Bogost, *supra* note 26; *Journey*, WAYMO, https://waymo.com/journey/ [https://perma.cc/E8FT-DULR] (last visited Jan. 23, 2016).

31. Lari, Douma & Onyiah, *supra* note 21, at 745-49.

32. *Id.*

33. *Id.* at 742.

34. Kirsten Korosec, *Elon Musk Says Tesla Vehicles Will Drive Themselves in Two Years*, FORTUNE (Dec. 21, 2015, 2:00 PM), http://fortune.com/2015/12/21/elon-musk-interview/ [https://perma.cc/Z3LA-TD5L].

1.4 million miles driven by Google's fifty-five car fleet on the roads of Austin, Texas and the San Francisco Bay Area.[35] Given the anticipated arrival of SDVs, there are many who wonder how state and federal governments will work with the automobile industry to ensure disabled individuals can benefit from SDVs.

II. STAKEHOLDER ANALYSIS

A. Senior Citizens

A major focus in the literature on the potential effects of self-driving cars is improving the mobility of senior citizens. Florida State University (FSU) in partnership with the Florida Department of Transportation (FDOT) published a study in December 2015 entitled *Enhanced Mobility for Aging Populations Using Automated Vehicles*. The study examined a variety of factors that may influence one's willingness to use, and general attitudes towards, self-driving cars.[36] The study found that "[y]ounger adults, Hispanics, and higher socio-economic status groups appear to be the core market" for self-driving cars.[37] Nevertheless, the study suggested that if people could

---

35. Mike Murphy, *Google's Self-Driving Cars Have Driven Very Few Miles in the Grand Scheme of Things*, QUARTZ (Feb. 3, 2016), http://qz.com/608187/googles-self-driving-cars-have-driven-very-few-miles-in-the-grand-scheme-of-things/ [https://perma.cc/9RYB-APR6]; Matt McFarland, *Google Launches Waymo and Moves Closer to Self-Driving Cars*, CNN (Dec. 13, 2016, 3:48 PM), http://money.cnn.com/2016/12/13/technology/google-waymo/ [https://perma.cc/VMR9-SNHV] (stating Google has also announced plans to begin testing its vehicles in Washington state and Arizona).

36. MIKE DUNCAN ET AL., FLA. DEP'T OF TRANSP., ENHANCED MOBILITY FOR AGING POPULATIONS USING AUTOMATED VEHICLES 65-66, 70 (2015). The survey's respondents were:

> characterized as older, better educated, and less diverse than the state as a whole. The most notable deviations in these socio-demographics are the far lower share of respondents that were Hispanic, a far higher percentage of respondents with at least a college degree, and a very large share of respondents who are retirees. Almost three out of five respondents report annual household incomes of at least $50,000, which is above the Florida median household income of ~$47,000 in 2013. While the demographics of the respondents do not closely match the state's demographic conditions, they do capture the attitudes of the populations most likely to be early adopters of autonomous vehicle technology, as respondents have the education and means to more easily learn about and afford this technology.

Id. at 65.

37. *Id.* at 82.

become more familiar with the technology, sentiments might change across demographics.[38]

B. Disabled Individuals

In 2012, Google famously released a "much-watched YouTube video of its autonomous car transporting a blind man" to the dry cleaners and a taco joint.[39] Steve Mahan, the CEO of the Santa Clara Valley Blind Center, who is legally blind, explained that a self-driving car would "give me the independence and flexibility to go [to] the places I both want to go and need to go, when I need to do those things."[40] The ability for disabled individuals to be able to move and access life on par with people who are not disabled is at the heart of the discussion. In the right circumstances, a self-driving car could give the disabled, seniors, and children benefits such as "personal independence, [reduction in] social isolation, and . . . access to essential services."[41]

The National Council on Disabilities produced an extensive report entitled "Self-Driving Cars: Mapping Access to a Technology Revolution" in the fall of 2015.[42] It explores the potential for self-driving cars to revolutionize the lives of the disabled.[43] However, the report also points out that these benefits are not necessarily guaranteed.[44] Development of self-driving cars has been relatively secretive and fast-paced. The developers are "explicitly considering disability access . . . [however], insufficient information is publicly available to assess how close designers and manufacturers are to ensuring access to this very promising technology."[45] This Article is

---

38. *Id.* at 57.

39. JAMES M. ANDERSON ET AL., RAND CORP., AUTONOMOUS VEHICLE TECHNOLOGY: A GUIDE FOR POLICYMAKERS 16 (2016), http://www.rand.org/pubs/research_reports/RR443-2.html [https://perma.cc/SZ53-Z2QZ].

40. Google, *Self-Driving Car Test: Steve Mahan*, YOUTUBE (Mar. 28, 2012), https://www.youtube.com/watch?v=cdgQpa1pUUE [https://perma.cc/WB7L-7UY6].

41. *See* Jon Burkhardt, Arlene M. Berger & Adam T. McGavock, *The Mobility Consequences of the Reduction or Cessation of Driving by Older Women*, *in* WOMEN'S TRAVEL ISSUES: PROCEEDINGS FROM THE SECOND NATIONAL CONFERENCE 441, 441 (1996).

42. *Self-Driving Cars: Mapping Access to a Technology*, NAT'L COUNCIL ON DISABILITY (Nov. 2, 2015), www.ncd.gov/sites/default/files/NCD_AutomatedVehiclesReport_508-PDF.pdf [https://perma.cc/UK6Z-W2N3].

43. *See generally id.*

44. *See id* at 21-23.

45. *Id.* at 5.

motivated by this lack of information about how SDVs will address the needs of the disabled and of those who cannot drive.

C. Undocumented Immigrants and the Formerly Incarcerated

It is important to note that there are other disadvantaged groups that could benefit from SDVs. For instance, undocumented immigrants and the formerly incarcerated currently have restricted mobility. In many states, undocumented immigrants cannot obtain driver's licenses.[46] This is a problem. A 2014 study estimated that there were 11.1 million undocumented immigrants living in the United States, which accounts for 3.5% of the total population.[47] Currently, there is a growing national movement to allow undocumented immigrants to obtain at least temporary driver's licenses.[48] Only twelve states and the District of Columbia have passed resolutions that allow undocumented immigrants to obtain driver's licenses.[49]

For the formerly incarcerated, the mobility issue is a little different. In many states, formerly incarcerated individuals re-enter society without any identification "that would enable them to obtain a state-issued identification card, i.e., driver's or non-driver's license."[50] The possessions of incarcerated individuals such as birth certificates, social security cards, and state identifications are often lost while individuals are moved around within the criminal justice system.[51] Upon release, some states offer "prison discharge slips," but these are often insufficient for proving identity.[52] The loss of these documents becomes a barrier to securing employment or housing, applying for a new license, and receiving public benefits.[53]

---

46. *See* Gilberto Mendoza, *States Offering Driver's Licenses to Immigrants*, NAT'L CONFERENCE OF STATE LEGISLATURES (July 8, 2015), http://www.ncsl.org/research/immigration/states-offering-driver-s-licenses-to-immigrants.aspx [https://perma.cc/J23G-4GFV].

47. *See* Jens Manuel Krogstad, Jeffrey S. Passel & D'vera Cohn, *5 Facts About Illegal Immigration in the U.S.*, PEW RESEARCH CTR. (Sept. 20, 2016), http://www.pewresearch.org/fact-tank/2015/11/19/5-facts-about-illegal-immigration-in-the-u-s/ [https://perma.cc/63S7-2BT4].

48. *See* Mendoza, *supra* note 46.

49. *Id.*

50. *Securing Official Identification for Individuals Leaving Prisons and Jails*, LEGAL ACTION CTR., http://lac.org/toolkits/ID/ID.htm [https://perma.cc/Z7GN-TEWW] (last visited Nov. 11, 2016).

51. *Id.*

52. *Id.*

53. *Id.*

SDVs could greatly enhance the mobility of undocumented and formerly incarcerated individuals who are living without driver's licenses.

III. VEHICLE DESIGN

In 2013, the National Highway Transportation Safety Administration (NHTSA) defined SDV technology into five automation levels.[54] Level zero is when the driver is in complete control.[55] Level four is full self-driving automation.[56] The levels in-between are increasing degrees of automation.[57] Given that the greatest benefits will accrue when human intervention is not expected or required, and that all levels except the highest have this expectation, this Article assumes and advocates that SDVs will achieve level four.

There is speculation, but it is unclear what the physical form and other design elements SDVs will take on. A variety of examples have emerged with designs such as a simple retrofit of a traditional human-piloted vehicle, Google's two-seater "Smart Car-looking" SDV, and even futuristic looking pods that run on set tracks in Masdar City, Abu Dhabi.[58] The potential for an SDV to have no steering wheel is a strong possibility.[59] Furthermore, if SDV expectations are correct, auto-accidents should dramatically decline.[60] If the collision risk can be significantly reduced, then safety features such as airbags and steel-reinforcement may no longer be required.[61] The design of SDVs could be unlike anything we have ever seen on the road.

A. Disabled Individuals

The SDV design reports have said little to nothing about accommodating disabled individuals. To their credit, Google and

---

54. NHTSA, PRELIMINARY STATEMENT OF POLICY CONCERNING AUTOMATED VEHICLES 4-6 (2013).

55. *Id.* at 4.

56. *Id.* at 5.

57. *Id.* at 4-5.

58. *See Masdar PRT*, ADVANCED TRANSIT ASS'N, http://www.advancedtransit.org/advanced-transit/applications/masdar-prt/ [https://perma.cc/C8GF-CSAY] (last visited Nov. 11, 2016).

59. *See* Lari, Douma & Onyiah, *supra* note 21, at 753.

60. ANDERSON ET AL., *supra* note 39, at 16.

61. *See* Lari, Douma & Onyiah, *supra* note 21, at 753.

other SDV developers have begun to talk about the potential of SDVs for the blind and disabled. This is epitomized by Google's YouTube video of Steve Mahan.[62] Furthermore, in recent months, Google has begun to collaborate with Fiat Chrysler Automobiles to transfer its SDV technology to Fiat's Pacifica Hybrid minivans.[63] The move to "a larger vehicle that could be easier for passengers to enter and exit . . . hint[s] at one of [Google's] long-stated goals to serve disabled people who are unable to drive."[64] Should such results come to fruition, it would be a significant step in making SDVs more accessible. As of now, there has been no SDV prototype that would be easily accessible for someone in a wheelchair or motorized scooter.

Luckily, there do exist design precedents that SDV manufacturers could reference. The all-electric Austin, Texas-based KLD Energy Technologies produces the "Kenguru car" specifically designed for wheelchair uses.[65] With a larger "pop-up" backdoor and access ramp, wheelchairs can simply roll in.[66] Unfortunately, the vehicle has limitations. The car has a "maximum speed of just 25 miles per hour and an estimated range of about 60 miles on an eight-hour charge."[67] Regardless, the precedent set by manufacturing cars for handicapped individuals is a significant step.

The Australian company "Freedom Motors Australia" has an even easier solution. Its business is in converting car models such as Toyota, Honda, Mercedes-Benz, and others to be wheelchair/ motorized scooter accessible. Freedom Motors retrofits all its cars

---

62. *See* Google, *Self-Driving Car Test: Steve Mahan*, *supra* note 40.

63. *See* Bill Vlasic & Neal E. Boudette, *Google to Get Fiat Chrysler Minivans for Self-Driving Tests*, N.Y. TIMES (May 3, 2016), http://www.nytimes.com/2016/05/04/technology/google-fiat-chrysler-minivans-self-driving.html?_r=2 [https://perma.cc/KCF9-8G34].

64. Kirsten Korosec, *Google and Fiat Have a Plan to Make Self-Driving Cars Totally Uncool*, FORTUNE (May 3, 2016, 5:14 PM), http://fortune.com/2016/05/03/fiat-google-self-driving-minivans [https://perma.cc/VCM7-9XJS].

65. *See KLD Energy Technologies, Inc. Acquires Texas-Based Mobility Vehicle Designer Kenguru, Inc.*, KLD ENERGY TECHS. (Sept. 16, 2015) http://www.kldenergy.com/2015/09/kld-energy-technologies-inc-acquires-texas-based-mobility-vehicle-designer-kenguru-inc [https://perma.cc/NZS2-CXFW].

66. *See id.*

67. Sarah Parvini, *See the Electric Car That Allows a Wheelchair to Roll Right In*, TAKEPART (Feb. 26, 2014), http://www.takepart.com/article/2014/02/26/meet-kenguru-electric-car-designed-specifically-wheelchair-users [https://perma.cc/A223-JM5M] (last visited Nov. 11, 2016).

with a rear entry.[68] The rationale is that the design "assures you the greatest amount of seating options."[69] The advantage of Freedom Motors' work is that wheelchair access is seamlessly arranged around traditional seating.

B. Low-Income Individuals

Another challenge to making SDVs benefit all people is keeping the costs affordable. Keeping down the cost of an SDV's manufacture has proved challenging, and this is mostly due to the SDV's safety technology. The United States Department of Transportation: National Highway Traffic Safety Administration released statistical data in February 2015 that 94% of car crashes were caused by human error.[70] At the same time, only 2% of crashes were due to vehicle failure.[71] There is reason to believe that SDVs, being completely computer controlled, will reduce the number of car crashes caused by human drivers. SDV developers speculate that typical safety features such as airbags and steel and aluminum car cages and frames could be eliminated.[72] Cutting these features will likely decrease an SDV's cost. The SDV's most costly feature, however, is its turret-like LIDAR sensor. Functioning as the eyes of the SDV, the sensor allows the vehicle to see where it is going. Cost estimates predict that the sensor alone could cost twice as much as the body of the car. An early LIDAR system manufactured by Velodyne cost $75,000.[73] Velodyne and other developers are competing to drive this price down.[74] Velodyne predicts that it can develop a smaller "sub-$500 LIDAR sensor, the VLP-32 that . . . will be powerful enough for high-level assisted driving, and

---

68. *See Wheelchair Vehicle Conversions, Wheelchair Ramp & Access Designs*, FREEDOM MOTORS AUSTL., http://www.freedommotorsaustralia.com.au/vehicle-design [https://perma.cc/9DPN-F972] (last visited Nov. 11, 2016).

69. *Id.*

70. *Critical Reasons for Crashes Investigated in the National Motor Vehicle Crash Causation Survey*, NHTSA (Feb. 2015), http://www-nrd.nhtsa.dot.gov/pubs/812115.pdf [https://perma.cc/FX9K-2K24].

71. *Id.*

72. ANDERSON, ET AL., *supra* note 39, at 30-33.

73. *See* Matt McFarland, *The $75,000 Problem for Self-Driving Cars Is Going Away*, WASH. POST (Dec. 4, 2015), https://www.washingtonpost.com/news/innovations/wp/2015/12/04/the-75000-problem-for-self-driving-cars-is-going-away [https://perma.cc/X5M6-N2SJ].

74. *See id.*

autonomous driving."[75] If this price reduction can be accomplished, it could significantly improve the affordability of SDVs.

C. Other Groups Who Currently Have Limited Driving Privileges

Google's recent collaboration with Fiat Chrysler Automobiles suggests that SDVs will come in different shapes and sizes. This will be critical for larger families and/or groups to access SDVs.[76] Also, barring policy decisions, fully autonomous SDVs might very well not include a steering wheel.[77] Removing the wheel and pedals would allow currently unlicensed drivers to use the vehicle. This could provide mobility to children, senior citizens who can no longer drive, undocumented immigrants, and the formerly incarcerated. A recent development that could address several of these needs is Olli, a twelve passenger, self-driving electric vehicle developed by Local Motors.[78]

IV. OWNERSHIP MODEL

SDVs will likely initially enter the market as available for private purchase. Replacing private human-operated cars, SDVs present a variety of potential benefits for car owners. First, SDVs do not need to be parked. The hours spent sitting in a parking lot could be used to transport other people. For instance, a family could own an SDV that first takes a parent to work then returns home to take a child to school, and then transports grandma to her doctor's appointment. Hours once spent sitting idle in a parking lot would be put to better use. Families would require fewer cars to accomplish their daily tasks, thereby cutting down on a significant household expenditure.

Speculation and community surveys tend to show that people would prefer private SDV ownership over sharing a vehicle with other people. FSU and FDOT surveys found that "almost three-fifths of respondents . . . indicated a willingness to use a privately owned"

---

75. *Id.*

76. *See* Korosec, *supra* note 64.

77. Alissa Walker, *Why Self-Driving Cars Should Never Have Steering Wheels*, GIZMODO (Feb. 24, 2016, 8:15 PM) http://gizmodo.com/why-self-driving-cars-really-shouldnt-ever-have-steerin-1758292942 [https://perma.cc/7DB2-9HZV].

78. *Olli: Forward Thinking Transportation*, LOCAL MOTORS, https://meetolli.auto/ (last visited Nov. 1, 2016) [https://perma.cc/VV75-6LYP].

SDV as opposed to other SDV deployment models.[79] One-fourth of respondents preferred a shared-ownership system, and two-fifths of the remaining respondents were in favor of a public transit and SDV-for-hire program.[80] The results decidedly indicate a preference for private ownership.

A. Disabled Individuals

In terms of enhancing mobility for people with disabilities, private ownership presents a cost barrier. Public transit agencies could also benefit from the private ownership. "Where existing public transit agencies provide services to the disabled, 14 to 18 percent of their budgets, on average, are used to provide on-demand paratransit services. The per-trip costs of these services are often three or more times those of fixed-route transit services."[81] If disabled individuals can transport themselves, these services and costs could be greatly reduced. However, while the technology could provide a disabled individual with driving mobility on par with SDV owners who don't have disabilities, this model assumes that these individuals would absorb the costs, leaving a situation where only the most well-off individuals would reap the benefits.

B. Low-Income Individuals

The Georgia Public Policy Foundation released an article entitled *Car Ownership Plants the Seeds for Upward Mobility* in 2014, arguing that subsidizing a human-operated car ownership for low-income Americans would be more cost effective than continuing to support public transportation.[82] This report is not about SDVs; however, it suggests an argument that private-vehicle ownership could very well be more cost efficient and effective at increasing the mobility of low-income individuals.[83] Quantitative studies would need to be carried out to identify if this argument carries over to SDV projections.

---

79. DUNCAN ET AL., *supra* note 36, at 73.
80. *Id.*
81. ANDERSON ET AL., *supra* note 39, at 17.
82. *See* Scott Beyer, *Car Ownership Plants the Seeds for Upward Mobility*, GA. PUB. POL'Y FOUND. (June 17, 2014), http://www.georgiapolicy.org/2014/06/studies-cars-not-transit-will-help-the-poor/ [https://perma.cc/84H8-9EG3].
83. *See id.*

The article raises the point that many cities are not dense enough to efficiently support public transit;[84] furthermore, the report cites a 2011 Brookings Institution study that found that only "one-quarter of jobs in low- and middle-skill industries are accessible via transit within 90 minutes for the typical metropolitan commuter, compared to one-third of jobs in high-skill industries."[85] The Georgia Public Policy Foundation claims providing every American with a car would cost only $10 billion, including road expansions for extra traffic, compared to an annual cost of $25 billion spent annually on transit subsidies.[86] SDVs create a different situation that would need to be considered. The lack of accessibility, however, to low- and middle-skill jobs is a problem. Perhaps private SDV ownership could address this issue?

C. Senior Citizens

Private ownership could reduce the amount of funds that the healthcare industry spends on para-transit and shuttle services. The FSU and FDOT study highlights the fact that para-transit and shuttle services "are the most expensive modes of transportation for any public agency to operate."[87] Para-transit services often offer services to rural and small town communities. SDV ownership among senior citizens who can no longer drive could reduce the need for para-transit. And not a moment too soon, for the proportion of the population aged sixty-five and older is rapidly growing: the Center for Disease Control and Prevention estimates that by 2030, this segment of the total population will have increased from 12.4% in 2000 to 19.6%.[88]

V. FLEET MODEL

As opposed to continuing the current "ownership model" discussed above, moving towards a model where fleets of SDVs function as a circulatory system for the population at large, not

---

84. *See id.*

85. ADIE TOMER ET AL., BROOKINGS INSTITUTION, MISSED OPPORTUNITY: TRANSIT AND JOBS IN METROPOLITAN AMERICA 1 (2011).

86. Beyer, *supra* note 82.

87. DUNCAN ET AL., *supra* note 36, at 4.

88. *Public Health and Aging: Trends in Aging—United States and Worldwide*, CDC (Feb. 14, 2003), http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5206a2.htm [https://perma.cc/R2H4-XMF7].

unlike the rideshare systems of Uber and Lyft, could provide mobility benefits to more people at lower costs.

Studies suggest that such a system could have a positive impact on the environment. Firstly, these additional miles travelled would be "clean miles." Future SDVs will "be electric, and thus powered from an increasingly renewable energy source."[89] In terms of greenhouse gases, a 2015 study in Nature Climate Change by Jeffery Greenblatt and Samveg Saxena of the Lawrence Berkeley National Laboratory projected that the "autonomous taxis" system would "decrease[] US per-mile [greenhouse-gas] emissions in 2030 per [autonomous taxis] deployed of 87-94% below current conventionally driven vehicles . . . and 63-82% below projected 2030 hybrid vehicles" not counting any additional energy saving benefits through SDV technology.[90] In addition, the "autonomous taxis" and "high-capacity transit" could reduce the current number of vehicles by up to 90%.[91] Obtaining these benefits, however, depends completely on how people use the system. For instance, if SDV technology ends up acting as a catalyst for suburban sprawl, then there may be an unintended increase in energy and land consumption.

Another advantage of the fleet system is the potential to order different SDV types. For instance, one could order an SDV appropriate for a group or for just a single person. The ability to customize a vehicle order to one's specific needs eliminates wasted space and inefficiencies that that are likely to occur in a private ownership system.

A potential downside of the fleet model is a projected increase in vehicle miles-of-travel (VMT). A February 2016 paper by Zia Wadud, Don MacKenzie, and Paul Leiby, entitled *Help or Hindrance? The Travel, Energy and Carbon Impacts of Highly Automated Vehicles*, conducted a variety of tests to predict the long-

89. Chris Mooney, *A Fleet of 'Robocabs' Could Dramatically Slash Vehicle Emissions, Study Suggests*, WASH. POST (July 6, 2015) https://www.washingtonpost.com/news/energy-environment/wp/2015/07/06/new-research-suggests-that-robotaxis-could-be-good-for-the-planet/ [https://perma.cc/3XVW-6A6F].

90. Jeffery B. Greenblatt & Samveg Saxena, *Autonomous Taxis Could Greatly Reduce Greenhouse-Gas Emissions of US Light-Duty Vehicles*, NATURE CLIMATE CHANGE (July 6, 2015), http://www.nature.com/nclimate/journal/v5/n9/full/nclimate2685.html [https://perma.cc/R93R-8KNU].

91. *Urban Mobility System Upgrade: How Shared Self-Driving Cars Could Change City Traffic*, INT'L TRANSP. FORUM 19 (2015), http://www.itf-oecd.org/sites/default/files/docs/15cpb_self-drivingcars.pdf [https://perma.cc/UH7N-BNUN].

range (by 2050) impacts of SDVs in the market.[92] The studies concluded that the potential for increased VMT is more than likely, particularly if "vehicles would spend some time deadheading (traveling empty to pick up passengers) in an on-demand mobility system."[93] Studies indicate that this could lead to as much as a 10% increase in VMT for fleet SDVs.[94] Another study, produced by the 2015 OECD International Transport Forum, projected the introduction of an SDV fleet into Lisbon, Portugal.[95] The result of the project estimated that if "shared-use AVs reached 50% of total vehicles, with the rest being human driven, total VMT would increase between 30 and 90 percent."[96]

A. Low-Income Individuals

Eliminating the cost of the driver and ownership could create a more affordable product. Todd Litman of the Victoria Transport Policy Institute published a report on the financial implications of SDVs in September 2016.[97] Litman speculates that a shared autonomous model could range between today's carshare pricing of "$0.60-$1.00 per vehicle-mile, including ownership, operation, and administrative costs" to conventional taxi pricing of "$2.00-3.00 per vehicle-mile, including ownership, operation, administration and labor costs."[98] Another advantage to the fleet model is that there is evidence that the pay-per-trip model used in car share systems reduces travel demand. By contrast, owning a private vehicle carries a high-fixed-cost of purchasing the vehicle, but enjoys a low marginal cost over time.

---

92. Zia Wadud, Don MacKenzie & Paul Leiby, *Help or Hindrance? The Travel, Energy and Carbon Impacts of Highly Automated Vehicles*, 86 TRANSP. RESEARCH 1, 4, 9 (2016).

93. *Id.* at 10.

94. *See, e.g.*, Daniel J. Fagnant & Kara M. Kockelman, *The Travel and Environmental Implications of Shared Autonomous Vehicles, Using Agent-Based Model Scenarios*, 40 TRANSP. RESEARCH 1 (2014).

95. *See Urban Mobility System Upgrade*, *supra* note 91, at 7, 13.

96. Robert Poole, *Emerging Consensus on Autonomous Vehicles and VMT*, SURFACE TRANSP. NEWS (Apr. 13, 2016), www.reason.org/news/show/surface-transportation-news-150 [https://perma.cc/3S9W-KU8K].

97. TODD LITMAN, VICTORIA TRANSPORT POL'Y INST., AUTONOMOUS VEHICLE IMPLEMENTATION PREDICTIONS: IMPLICATIONS FOR TRANSPORT PLANNING (Sept. 1, 2016), http://www.vtpi.org/avip.pdf [https://perma.cc/N5X5-WAHM].

98. *Id.* at 6.

One equity point to consider is that the fleet system may require the user to own a smartphone. The rideshare systems Uber and Lyft require an individual to have a smartphone to order and pay for a ride. This system allows drivers to quickly respond to and locate the rider. The Pew Research Center published a report in spring 2015 that estimated 64% of American adults own some kind of smartphone.[99] Of the smartphone owners who are completely dependent on their phone for internet, 48% of them have at least once suspended "service due to financial constraints."[100] Twelve percent of African Americans and 13% of Latinos are cell phone dependent.[101] Moreover, "13% of Americans with an annual household income less than $30,000 per year are smartphone-dependent."[102] Without increased smartphone ownership, 36% of American adults would not be able to order an SDV, assuming an SDV fleet operated like Uber or Lyft.[103] If Internet access could not be guaranteed, they would be even more at risk of losing access to the fleet system.

B. Disabled Individuals

The management of the fleet model is important to consider. If the fleet deployment operated through an existing public transit agency, it would likely be subject to the *Olmstead* Decision requirements.[104] While this might apply an extra burden on the deployment of the fleet system, these costs could be spread across all users, including those who are not disabled. Implementation in this way would provide disabled users with the greatest improvement in service, as they would have access to the greatest number of vehicles, on demand.

C. Undocumented Immigrants

Paying for an SDV ride could also be complicated for an undocumented immigrant. Undocumented immigrants often do not

---

99. PEW RESEARCH CTR., U.S. SMARTPHONE USE IN 2015, at 13 (Apr. 1, 2015), http://www.pewinternet.org/2015/04/01/us-smartphone-use-in-2015/ [https://perma.cc/K7CN-7SQS].

100. *Id.* at 19.

101. *Id.* at 4.

102. *Id.* at 17.

103. *See id.* at 13.

104. *See* Olmstead v. L.C. *ex rel.* Zimring, 527 U.S. 581, 588-89 (1999).

enjoy easy access to banking services.[105] This leads many to "carry large amounts of cash," which makes them vulnerable to crime.[106] To address this issue, cities such as Oakland, Los Angeles, and Dayton, Ohio have created a card system that provides undocumented immigrants and any resident, for that matter, with a combination of an identification card and debit card.[107] In the case of Oakland, the card allows undocumented immigrants to make deposits and withdrawals at partnering area merchants.[108] The idea is that individuals can access makeshift banking services through familiar neighborhood stores.[109] Moreover, the creation of semi-traditional banking services allows individuals, who might have been dependent on costly and debt generating check-cashing services and payday lenders, to have more financial stability.[110]

Undocumented immigrants are often ineligible for traditional banking services because they do not have a social security number (SSN) to open an account.[111] There are a couple ways around the SSN requirement, but they are not dependable. "Undocumented immigrants can get an individual tax identification number (ITIN), but it is less universally accepted than a SSN."[112] For undocumented immigrants from Mexico, the Mexican consulate can provide individuals with a *matricula consular* card as a form of identification for Mexican nationals living outside of the United States.[113] Nevertheless, most financial institutions within the United States do not accept these cards as valid identification to open a bank account.[114] Without changes, these existing barriers would likely deny many, if not all, undocumented immigrants from easily accessing an SDV fleet.

---

105. *See* Aaron Sankin, *Undocumented Immigrant Debit Cards: Oakland Introduces Landmark New Program*, HUFFINGTON POST (Feb. 26, 2013, 8:27 PM) http://www.huffingtonpost.com/2013/02/26/undocumented-immigrant-debit-cards_n_2769198.html [https://perma.cc/EA24-C7MD].

106. *Id.*

107. *Id.*

108. *See id.*

109. *See id.*

110. *See* Eileen Díaz McConnell, *Diverging Dividends, Diverging Futures: Nativity, Citizenship Status, Legal Status, and the Non-Housing Asset Accumulation of Latinos*, 15 ETHNICITIES 255, 257 (2015).

111. *See id.* at 260.

112. *Id.*

113. *Id.*

114. *Id.*

VI. THE ROLE AND RESPONSE OF PUBLIC POLICY

As discussed above, SDVs have the potential to benefit those unable to drive.[115] The extent to which these groups fully obtain these benefits, however, will depend on public policy decisions. Should no changes be made, there will likely be little incentive for car manufacturers to develop SDVs for anything other than private ownership. Public opinion surveyed in FDOT's report aligned with this speculation suggesting that 58.4% of those surveyed in Florida preferred the idea of privately owning an SDV as opposed to sharing, which came in at 24.4%.[116] Senior citizens will likely not see nor have the willingness to change their opinions, but the potential benefits produced in a fleet system are hard to ignore.

The fleet model eliminates any large up-front cost barriers. Instead, individuals pay by trip, which makes it easier to budget. Moreover, the fleet model would eliminate the necessity of costly paratransit resources, and overall, take advantage of economies of scale by driving down costs for everyone. Furthermore, it would be appropriate to offer discounted payment rates to disabled individuals, veterans, and seniors.

Public policy could lead the development of an alternative payment system that does not rely on owning a credit card to participate. Another position could be to provide a plan for specific pick-up locations that would allow individuals to order an SDV without needing a smartphone.

Policy developments such as these would create a more desirable end state for individuals who are unable to drive. Tax incentives should be created to prompt vehicle manufacturers to design SDVs to service people with disabilities. For state governments, there are a variety of potential steps to take in preparation for SDVs. Assistant Law Professor Bryant Walker Smith at University of South Carolina wrote *How Governments Can Promote Automated Driving*, which is under publication at the *New Mexico Law Review*.[117] Walker Smith's piece suggests actions ranging from administrative governmental strategies to on the ground community work.[118] As it relates to this Article, Walker

---

115. *See supra* Part II.

116. *See* DUNCAN ET AL., *supra* note 36, at 73.

117. Bryant Walker Smith, *How Governments Can Promote Automated Driving*, 46 N.M. L. REV. (forthcoming 2017), https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2749375.

118. *See id.*

Smith suggests that developing local plans that take into account SDV technology could "stimulate interest from a variety of public and private actors."[119] The work could lead to grants for transit oriented urban development, green energy, and position the community to be a "show-case" for SDV technology.[120] How this might lead to more equitable access is unknown; however, more intentional discussion and deliberate action on the ground could encourage conversation.

Outside of community preparations, states could reform existing legislation and enact new policy that encourages an SDV fleet system. For instance, the State of Minnesota could consider reducing or eliminating its sales tax on car sharing services. All car-sharing transactions in Minnesota are taxed at a rate of approximately 14% on top of regular sales tax.[121] This tax could limit the growth and comprehensive quality of an SDV fleet model.

It should be noted that the demographic groups that enjoy the advantages and suffer the disadvantages of this twenty-first century transportation system will not be different from those similarly affected by the twentieth-century system. However, there is nothing inherent in the technologies that will bring about undesirable results. These very technologies could allow seniors to live in their homes longer, provide access to new economic opportunities for residents of poor neighborhoods, and remove barriers for people with disabilities. Without due attention from public officials, advocates, and this wide and varied group of stakeholders themselves, however, these benefits may not be realized. Regardless of how the private market ends up picking winners and losers in terms of technologies and deployment models, there will be a role for public policy to ensure that the benefits are enjoyed as widely as possible.

---

119. *Id.* (manuscript at 41).

120. *See id.* (manuscript at 41-42).

121. *Minneapolis Climate Action Plan: A Roadmap to Reducing Citywide Greenhouse Gas Emissions*, MINNEAPOLIS CITY COORDINATOR 26 (June 28, 2013), http://www.minneapolismn.gov/www/groups/public/@citycoordinator/documents/webcontent/wcms1p-113598.pdf [https://perma.cc/4Y58-3S7H].