

Putting the Blindfolds on Driverless Panopticons

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Autonomous vehicle (AV) deployment will radically reshape the relationship between Americans and their cars. A society which has long prized private car ownership will see riders transition to dramatically cheaper robotaxi services. Cities will regulate AVs in real time, using a sophisticated new regulatory technology called Mobility Data Specification (MDS). The widespread use of AVs owned by impersonal operators and regulated by municipal governments will bring to the fore privacy questions which were more easily ignored when cities were using MDS to regulate more niche modes of transportation like e-scooters. Mass adoption of AVs will elevate the stakes of Fourth Amendment concerns about the collection and analysis of anonymous geolocation data.

*This Note aims to answer the important question of whether commercially deployed AVs can constitutionally be subjected to regulatory programs that mirror MDS as currently applied to the regulation of e-scooters. Robust scholarship is emerging about the scope of the concept of inescapability, first introduced in *Carpenter v. United States*, the Supreme Court's most meaningful effort to erect guardrails around location data. Scholars are also exploring how the third-party doctrine undermines Fourth Amendment values, and the breadth of modern administrative search doctrine. This Note builds on these critiques and proposals to argue that the Fourth Amendment will impose limits on cities seeking to track real-time location data from AVs. AVs are likely to become inescapable, and the data collected from the public will be uniquely sensitive. If cities want the power to demand real-time data from AVs, they will need to rigorously justify their collection of such data and take concrete steps to anonymize it.*

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INTRODUCTION

Municipal lawyers across the country are staking out claims to the data consumers generate when they rent AirBnBs, hail Ubers, or ride e-scooters.¹ “Smart city” regulators want the power to analyze a broad swathe of mobility data.² Policymakers say they are seeking this data to achieve safety, equity, and mobility goals in public rights of way.³ Using data sources like the Mobility Data Specification (MDS), cities are compelling information sharing by private firms in order to fight congestion and reduce greenhouse gas emissions.⁴

The value of this data is clear. Cities can use sharing economy data from mobility companies to determine whether operators are complying with equity targets, enforce vehicle quantity caps, plan infrastructure like bike lanes, and even charge for access to public curb space.⁵ This data could also help cities combat both large-scale global collective action problems like climate change, as well as the tangible daily challenges of urban life like traffic congestion.⁶ But maximizing these policy aspirations through

1. See NAT'L ASS'N OF CITY TRANSP. OFFICIALS & INT'L MUN. LAWS. ASS'N, MANAGING MOBILITY DATA 1 (2019), https://nacto.org/wp-content/uploads/2019/05/NACTO_IMLA_Managing-Mobility-Data.pdf [hereinafter MANAGING MOBILITY DATA] [<https://perma.cc/NBH3-4A4F>]. In 2019, the National Association of City Transportation Officials (NACTO) and the International Municipal Lawyers Association released an ambitious roadmap for gig economy data. *Id.* According to NACTO, cities require “access to the data generated by mobility service providers,” entailing “a wide variety of data” from “mobility services operating in the public right of way. . . .” *Id.* at 8.

2. See *id.* at 8.

3. *Id.* at 3.

4. *Id.* at 8.

5. POPULUS, A PRACTICAL GUIDE TO MOBILITY DATA SHARING AND CITIES 5 (2020), https://f.hubspotusercontent00.net/hubfs/3933558/Active%20Whitepapers/Populus_MobilityDataSharingAndCities.pdf [<https://perma.cc/6TJV-X625>] [hereinafter A PRACTICAL GUIDE TO MOBILITY DATA SHARING] (“There are a number of critical use cases that public agencies have for requiring access to data. . . .”). Equity targets could include requiring e-scooters to be located at a specific density in low-income neighborhoods, when operators otherwise might shift scooters to locations where more profitable trips originate. Vehicle density caps are intended to prevent e-scooters cluttering areas like downtown business districts. *Id.* at 7–9.

6. See MANAGING MOBILITY DATA, *supra* note 1, at 8; see also *Mobility Insights: Tackling the Growing Issue of Congestion in Urban Areas*, PWC, <https://www.pwc.com/us/en/industries/industrial-products/library/mobility-insights-tackling-congestion.html> [<https://perma.cc/9JLM-97U9>]. The phrase “traffic congestion” is used to describe “the breakdown in traffic flow, reduction in speed and increase in crowding that occurs when a road’s capacity is exceeded.” *Id.* Its causes include economic growth, lower gas prices, urbanization, the rise of ride-hailing services, e-commerce, and inadequate infrastructure. *Id.* One analysis suggested the average U.S. driver loses 97 hours per year, at an estimated cost of \$1,348, to congestion. INRIX, *Congestion Costs Each American 97*

programmatic collection of mobility data may be in tension with the Fourth Amendment.

MDS is a “standardized, open data format” by which third-party firms can share mobility data with local governments, with a goal of leveling “the playing field between companies and transportation providers.”⁷ Technically speaking, MDS is just a data feed which uses communications protocols called Application Programming Interfaces (APIs) to share data like location information in standardized formats between e-scooter operators and municipal agencies in real-time.⁸ Consultants working with the Los Angeles Department of Transportation (LADOT) developed MDS while trying to develop the technical capacity to regulate autonomous vehicles (AVs).⁹ From the start, MDS was cast as an open-source initiative for adoption beyond Los Angeles.¹⁰ But its creators deployed the project earlier than planned due to the surge of dockless e-scooters in Los Angeles in summer 2018.¹¹ A coalition of sixteen cities and local government units came together in support of expanding the use of MDS globally.¹² In June 2019, the City of Los Angeles transitioned ownership of the platform to that group, the Open Mobility Foundation (OMF), a public-private consortium led by municipal

Hours, \$1,348 a Year, CISION PR NEWSWIRE (Feb. 12, 2019), <https://www.prnewswire.com/news-releases/inrix-congestion-costs-each-american-97-hours-1-348-a-year-300793672.html> [<https://perma.cc/K2BR-FVXL>].

7. See MANAGING MOBILITY DATA, *supra* note 1, at 8. MDS captures the start and end location of e-scooter trips within five seconds, in addition to route data that is shared with LADOT within 24 hours. Laura Bliss, *This City Was Sick of Tech Disruptors. So It Decided to Become One*, BLOOMBERG (Feb. 1, 2020), <https://www.bloomberg.com/news/articles/2020-02-21/as-l-a-plays-tech-disruptor-uber-fights-back> [<https://perma.cc/72B8-TQZY>]. LADOT hopes to leverage this data to generate insights that can lead to safer streets. See *id.*

8. See Philippe Rapin, *MDS, Los Angeles' Response to a E-Scooter Public Private Partnership?*, LINKEDIN (Sept. 24, 2019), <https://www.linkedin.com/pulse/mds-los-angeles-response-e-scooter-mess-philippe-rapin/> [<https://perma.cc/B88F-SDM7>].

9. See Bliss, *supra* note 7. Starting in 2018, LADOT started to build out its ability to regulate micro mobility companies. *Id.* The agency sought to build regulatory tools that could level the playing field between firms and the government in terms of access to pools of data. *Id.*

10. *Id.* The consultant LADOT worked with to develop MDS actually envisioned the city owning the data generated on its streets. *Id.* From the start, the program was envisioned as an open-source model along the lines of the Android OS. *Id.*

11. *Id.*

12. Andrew Westrope, *Cities and Industry Launch New Foundation to Manage Mobility*, GOV'T TECH. (June 25, 2019), <https://www.govtech.com/biz/cities-and-industry-launch-new-foundation-to-manage-mobility.html> [<https://perma.cc/88Q8-GZQ5>].

regulators and focused on managing mobility data tools.¹³ Approximately fifty cities in the United States are now utilizing MDS¹⁴ and the Foundation estimated MDS was in use in ninety cities worldwide.¹⁵

While first envisioned as a ground-level traffic control system to guide fleets of AVs, real-world MDS application to e-scooters has focused on data collection.¹⁶ MDS facilitates the sharing of data with regulators by firms, enables regulators to inform operators about designated parking areas for mobility devices, and could support the active management of vehicles by regulators.¹⁷ But even though future cities may be able to use MDS to control where vehicles can travel, right now it is the data collection abilities of MDS that draw headlines.¹⁸ Vehicles regulated using MDS report their location, trip start and end time, beginning and end location, route, and status updates including low battery or need for maintenance.¹⁹

The augmented power of local governments to understand what micro mobility operators like e-scooter firms are doing on their streets has been challenged by both companies and privacy advocates. Uber's then-subsiary Jump Scooters (Jump) kickstarted a permitting battle with Los Angeles in 2019 after refusing to turn over real-time MDS route data, which resulted in a suspension of Jump's permit to operate e-scooters in the city.²⁰ Ultimately, Jump voluntarily dismissed the lawsuit it had filed to

13. Alexander P. Carroll, *New Technology and the Right to Privacy: Do E-Scooters Implicate the Fourth Amendment?*, 40 J. NAT'L ASS'N ADMIN. L. JUDICIARY 27, 35 (2021).

14. *Who is Using MDS?*, OPEN MOBILITY FOUND., <https://www.openmobilityfoundation.org/mds-users/> [https://perma.cc/85UT-U77V]. Members of the OMF range from the cities of Bogotá, Columbia to Ulm, Germany and Washington, DC. *Id.*

15. Robert Fischer, *How Cities Can Digitize Their 21st Century Mobility Policies*, WIS. AUTOMATED VEHICLE PROVING GROUNDS (Jan. 9, 2020), <https://wiscav.org/how-cities-can-digitize-their-21st-century-mobility-policies/> [https://perma.cc/6PAQ-7G9K].

16. See Bliss, *supra* note 7.

17. See A PRACTICAL GUIDE TO MOBILITY DATA SHARING, *supra* note 5, at 12.

18. David Zipper, *Cities Can See Where You're Taking That Scooter*, SLATE (Apr. 2, 2019), <https://slate.com/business/2019/04/scooter-data-cities-mds-uber-lyft-los-angeles.html> [https://perma.cc/JY5H-ZVD2]. Zipper describes the debate about the privacy implications of MDS as "one of the most heated controversies in urban policy." *Id.*

19. See A PRACTICAL GUIDE TO MOBILITY DATA SHARING, *supra* note 5, at 12.

20. Beatriz Botero Arcila, *Jump v. Los Angeles: Removing Platforms Further from Democratic Control?*, 68 UCLA L. REV. DISC. 160, 167 (2020) [hereinafter Botero Arcila, *Jump v. Los Angeles*].

contest the permit suspension,²¹ a month after Uber sold the company to e-scooter firm Lime.²² The upshot is that the denial of Jump's permit for failure to comply with MDS reporting obligations produced no precedent. Only a week before Jump dismissed its suit, however, the Electronic Frontier Foundation (EFF) launched its own lawsuit against LADOT.²³ Unlike Jump's litigation, *Sanchez v. LADOT* produced a decisive outcome: dismissal of EFF's claims on the merits in district court,²⁴ which the Ninth Circuit affirmed.²⁵

As municipal regulators assume a defensive posture with respect to AVs, and those AVs get closer to arriving on streets across the country, the day comes closer when a court will assess the constitutionality of MDS as applied to commercially deployed AVs. Regulators clearly intend to apply MDS to AVs. LADOT first conceived of MDS as a means to prevent empty AVs from roaming Los Angeles streets cruising for passengers,²⁶ which could increase net miles traveled, potentially leading to more emissions and congestion.²⁷ OMF's website references autonomous vehicles and drones,²⁸ while the Foundation

21. Pl. Notice of Voluntary Dismissal, *Social Bicycles LLC v. City of Los Angeles*, No. 2:20-cv-02746 (C.D. Cal. June 5, 2020). Jump was initially represented by the prominent litigator Roberta Kaplan, whose firm provided an aggressive defense of the company on constitutional grounds in municipal administrative proceedings. See Complaint ex. A at 3, *Social Bicycles LLC*, No. 2:20-cv-02746 (C.D. Cal. Mar. 24, 2020).

22. Andrew J. Hawkins, *Lime Squeezes \$170 Million from Uber and Alphabet as Scooter-Sharing Plummets Under COVID-19*, THE VERGE (May 7, 2020), <https://www.theverge.com/2020/5/7/21250420/lime-funding-uber-deal-alphabet-scooter-jump-bike> [<https://perma.cc/48Q4-QCGL>]. Lime is known for taking a collaborative approach to government affairs policy, at least in the MDS context, and has been supportive of the data-reporting program in the cities in which it operates. Katie Fehrenbacher, *Cities Organize in the Face of Scooter Data Controversy*, GREENBIZ (July 1, 2019), <https://www.greenbiz.com/article/cities-organize-face-scooter-data-controversy> [<https://perma.cc/M5Y5-SB4K>].

23. EFF, *ACLU File Lawsuit to Stop Los Angeles from Collecting Real-Time Tracking Data on Citizens' Rental Scooters*, ELEC. FRONTIER FOUND. (June 8, 2020), <https://www.eff.org/press/releases/eff-aclu-file-lawsuit-stop-los-angeles-collecting-real-time-gps-tracking-data> [<https://perma.cc/YCJ2-HMEJ>].

24. *Sanchez v. LADOT*, No. CV 20-5044-DMG (AFMx), 2021 WL 1220690, at *1, 6 (C.D. Cal. Feb. 23, 2021).

25. *Sanchez v. LADOT*, 39 F.4th 548 (9th Cir. 2022).

26. See Bliss, *supra* note 7.

27. Studies estimate anywhere from eleven to eighty-nine percent more vehicle kilometers traveled (VKT) in AV traffic simulations. See Kareem Othman, *Public Transportation on the Era of Autonomous Vehicles: Exploring Different Scenarios*, 10 CIV. ENG. RSCH. J. 105, 106 tbl.1 (2020).

28. See *The Future of Mobility*, OPEN MOBILITY FOUND., <https://www.openmobilityfoundation.org/> [<https://perma.cc/TVU5-8F8Y>].

elsewhere says that beyond e-bikes and e-scooters, “MDS can give cities the data and tools they need to digitally manage many more aspects of the public realm.”²⁹ In the same breath, OMF states that cities need to be prepared to handle “fleets of autonomous vehicles.”³⁰ The question of whether a data collection regime like MDS would be constitutional under the Fourth Amendment as applied to commercially deployed AVs thus needs to be viewed as a live issue.

AV technology is increasingly close to commercial deployment,³¹ and the constitutionality of MDS as applied to AVs likely will not remain ambiguous for long. The majority of traditional automakers have in-house research programs or investments in start-ups advancing towards what the Society of Automotive Engineers terms “Level 5” self-driving,³² i.e., fully autonomous vehicles capable of overseeing the entire driving task from beginning to end without geographical limits. AV pilot programs are active in dozens of cities across the United States,³³ and robotaxi service providers and AV technology in general may come to specific cities with favorable regulatory environments before sweeping across the country.³⁴

The ultimate goal of this Note is to determine whether the Fourth Amendment would prevent municipal regulators from collecting, in a programmatic fashion, disaggregated trip-level data from AVs. Part I of the Note examines the state of AV technology and the implications of the market structure of AVs in the future. Part II argues that MDS as applied to AVs would be a search under the Fourth Amendment, as riders would have a

29. *About MDS*, OPEN MOBILITY FOUND., <https://www.openmobilityfoundation.org/about-mds/> [https://perma.cc/5A5U-DU8R].

30. *Id.*

31. *See* Part I.A.

32. Alyssa Altman, *The Race to Level 5 Will Be Won Through Collaboration*, AUTO. WORLD (Jan. 10, 2022), <https://www.automotiveworld.com/articles/the-race-to-level-5-will-be-won-through-collaboration/> [https://perma.cc/E8TL-BU2Z]. Many of today’s vehicles have what is considered “Level 2” driver assistance technology, like lane assist. *Id.* No fully autonomous “Level 5” vehicle is commercially available today. *Id.*

33. *AV TEST Initiative, Test Tracking Tool*, NAT’L HIGHWAY TRANSP. SAFETY ADMIN., <https://www.nhtsa.gov/automated-vehicle-test-tracking-tool> [https://perma.cc/6WHF-XVJK]. AV pilot programs are located in major U.S. cities including Austin, Miami, Los Angeles, San Francisco, and Washington, D.C. *Id.*

34. Bradley Berman, *What Cities and Countries Are Opening the Roads to Self-Driving Cars?*, GROUND TRUTH (Sept. 10, 2021), <https://groundtruthautonomy.com/business/what-cities-countries-are-self-driving-cars-deployed/> [https://perma.cc/9AR5-TDLG].

reasonable expectation of privacy in the data that would be collected and could thereafter be analyzed. Part III interrogates *Carpenter's* concept of inescapability to contend that the third-party doctrine does not bar Fourth Amendment challenges to MDS as applied to AVs. Finally, Part IV concludes that administrative search doctrine could justify a modified form of MDS as applied to AVs. In short, this Note sees MDS as a revolutionary and valuable regulatory technology, but one that cannot be applied to commercially deployed AVs without violating the Constitution.

I. STATE OF TODAY'S AV INDUSTRY

This Part argues that sooner than many skeptics realize, AVs will likely become part of the fabric of everyday life in major metropolitan areas.³⁵ Urban residents will probably primarily use AVs via hailing rides from fleets of robotaxis, and concentration among AV firms and AV fleet providers will deepen the privacy concerns created by MDS-style real-time data collection and regulation.³⁶

A. AV TECHNOLOGY IS BECOMING VIABLE, DESPITE CRITICISMS

Constitutional problems are inconsequential if they concern a technology that will never exist, and the AV industry has repeatedly failed to meet self-proclaimed deadlines for AVs to become commercially available.³⁷ Prototype AVs may struggle to deal with difficult weather conditions, unmapped locations, and cyclists.³⁸ AVs might be initially restricted to tasks like package

35. See Part I.B.

36. See Part I.B.

37. See Aarian Marshall, *You May Be Able to Own a Self-Driving Car After All*, WIRED (Jan. 8, 2022), <https://www.wired.com/story/you-own-self-driving-car/> [<https://perma.cc/9AJX-WYV8>] (“Now, almost a decade into the self-driving experiment, the future looks more complicated. Progress on AVs has slowed, as both automakers and tech companies have missed self-imposed deadlines for autonomy.”). GM, Lyft, and Ford all planned to debut AVs before 2021. *Id.* Since 2014, Tesla founder and CEO Elon Musk, has annually predicted that the company’s vehicles will achieve advanced degrees of autonomy (without success). See Victor Tangermann, *Watch Elon Musk Promise Self-Driving Cars “Next Year” Every Year Since 2014*, FUTURISM (Jan. 19, 2022), <https://futurism.com/video-elon-musk-promising-self-driving-cars> [<https://perma.cc/A99Y-E5CB>].

38. See Stephen Shladover, *‘Self-Driving’ Cars Begin to Emerge from a Cloud of Hype*, SCI. AM. (Sep. 25, 2021), <https://www.scientificamerican.com/article/self-driving-cars->

delivery, public shuttle service on fixed routes, and ride-hail pilots in a handful of cities.³⁹ Pilots in which the car's computer handles all aspects of driving within a geofenced area might not take place on highways before 2025.⁴⁰ Sensors and data processing mean there are high fixed costs for operating AVs at scale.⁴¹ Crashes,⁴² government investigations,⁴³ and critical media coverage⁴⁴ have marred the deployments of Tesla's quasi-autonomous vehicles.

The last year has seen vocal criticism of the limits of present AV technology from expert observers.⁴⁵ *Bloomberg's* October 2022 headline, *Even after \$100 Billion, Self-Driving Cars Are Going Nowhere*, speaks to the sense of malaise.⁴⁶ The technological failures can verge on the tragicomic, as in the case of a homeowner interviewed for the *Bloomberg* feature, who endured weeks of dozens of Waymo AVs using her driveway to perform three-point turns, ultimately calling a local news channel to videotape the odd behavior.⁴⁷ More seriously, the sheer number of confounding situations an AV can encounter on the road, and the limits of the perception and prediction capabilities

begin-to-emerge-from-a-cloud-of-hype/ [https://perma.cc/DWY5-SGTB]. Especially bad weather conditions like heavy rain or snow may pose serious problems for AVs. *Id.*

39. See *id.* ("Even when ADS are able to drive vehicles without an onboard human driver as a backup, they will still need remote support from humans who are skilled drivers to manage "corner case" conditions that the automation cannot handle.").

40. Kersten Heineke et al., *What's Next for Autonomous Vehicles?*, MCKINSEY & CO. (Dec. 22, 2021), <https://www.mckinsey.com/features/mckinsey-center-for-future-mobility/our-insights/whats-next-for-autonomous-vehicles> [https://perma.cc/KD9W-JLPY].

41. See, e.g., Shladover, *supra* note 38.

42. See, e.g., Andrew J. Hawkins, *Tesla Vehicle in 'Full Self-Driving' Beta Mode 'Severely Damaged' After Crash in California*, THE VERGE (Nov. 12, 2021), <https://www.theverge.com/2021/11/12/22778135/tesla-full-self-driving-beta-crash-fsd-california> [https://perma.cc/3NFU-MNX7].

43. See, e.g., Keith Barry, *Federal Government Opens Safety Defect Investigation Into Tesla Autopilot Crashes*, CONSUMER REPS. (Sept. 1, 2021), <https://www.consumerreports.org/autonomous-driving/nhtsa-safety-defect-investigation-tesla-autopilot-crashes-a6996819019/> [https://perma.cc/ADX5-5RQC].

44. See, e.g., Editorial, *Slam the Brakes on Tesla's Self-Driving Madness*, L.A. TIMES (Dec. 20, 2021), <https://www.latimes.com/opinion/story/2021-12-20/editorial-slam-the-breaks-on-teslas-self-driving-madness> [https://perma.cc/U6XX-3X4J].

45. Nick Carey and Paul Leinert, *Truly Autonomous Cars May Be Impossible without Helpful Human Touch*, REUTERS (Sept. 19, 2022), <https://www.reuters.com/technology/truly-autonomous-cars-may-be-impossible-without-helpful-human-touch-2022-09-12/> [https://perma.cc/H6DK-VRTM].

46. Max Chafkin, *Even after \$100 Billion, Self-Driving Cars Are Going Nowhere*, BLOOMBERG (Oct. 6, 2022), <https://www.bloomberg.com/news/features/2022-10-06/even-after-100-billion-self-driving-cars-are-going-nowhere> [https://perma.cc/354T-HVMY].

47. *Id.*

of present AVs, have been enduring sources of concern.⁴⁸ Even though up to \$100 billion may have been bet on the AV industry, AVs still struggle when asked to complete left turns into oncoming traffic.⁴⁹ Obviously, if the AV industry fails to produce a working product, municipal collection of data from non-existent vehicles would not present any Fourth Amendment issues worth considering at length.

But there is hope for AVs. Despite the external criticism, the industry continues to progress, and commercial deployment of ride-hailing services may actually be on the horizon within two to three years.⁵⁰ Argo AI, formerly one of the major players in the AV industry, did fail in October 2022, but the news of its dissolution coincided with a remarkably strong initial public offering by MobilEye, another major AV industry participant.⁵¹ GM's subsidiary, Cruise, plans to deploy tens of thousands of AVs as it enters a "rapid scaling phase" in 2023 in which it leverages GM's production capabilities to start commercializing its AV technology.⁵² Admittedly, there are different estimates of when AV deployment at scale will occur—Bain Capital has given a target date of 2028 by which it expects to see AVs gaining significant traction in terms of the state and cost of the technology, as well as supporting factors like regulations and customer acceptance.⁵³ Still, both Bain and Cruise clearly see

48. Carey and Leinert, *supra* note 45.

49. Chafkin, *supra* note 46.

50. See James Jeffs, *Autonomous Mobility-as-a-Service (MaaS) Is 2–3 Years Away, For Real*, IDTECHEX (May 31, 2021), <https://www.idtechex.com/en/research-article/autonomous-mobility-as-a-service-maas-is-2-3-years-away-for-real/23921> [<https://perma.cc/H82N-A74R>].

51. Brad Templeton, *Argo.AI Dies while MobilEye Soars on the Same Day, What Does It Mean for the Industry?*, FORBES (Oct. 26, 2022), <https://www.forbes.com/sites/bradtempleton/2022/10/26/argoai-dies-while-mobileye-soars-on-the-same-day-what-does-it-mean-for-the-industry/?sh=3a255a9d72b0> [<https://perma.cc/SCK5-K8QA>].

52. Rebecca Bellan, *Cruise Plans to Have 'Tens of Thousands' of Origin AVs on Roads in Coming Years*, TECHCRUNCH (Oct. 7, 2021), <https://techcrunch.com/2021/10/07/cruise-plans-to-have-tens-of-thousands-of-origin-avs-on-roads-in-coming-years/> [<https://perma.cc/75US-W7DZ>] ("Ammann broke down Cruise's path to market into three phases. . . . Phase three, the 'rapid scaling phase,' begins in 2023, when production of the Cruise Origin will begin at GM's Zero Assembly Plant, a factory dedicated to the production of electric vehicles.").

53. *Electric and Autonomous Vehicles: The Future Is Now*, BAIN CAP. GRP. (Oct. 29, 2020), <https://www.bain.com/insights/electric-and-autonomous-vehicles-the-future-is-now/> [<https://perma.cc/SXT7-3FAY>] ("Exactly when will it become normal to see driverless cars zipping down highways and through city streets? We anticipate autonomous vehicles will start to gain momentum by 2028. . . .").

commercial deployment of AVs at scale as possible within the next decade.⁵⁴

Recent market research also suggests that the market cap of the AV industry sector could reach hundreds of billions of dollars by 2030.⁵⁵ VC-backed AV startups have given way to a smaller field of competitors with better technology.⁵⁶ The market research consultancy firm Renub Research forecasts 47.1% compounded annual growth in the AV industry between 2021 and 2030, with the market volume reaching \$325.9 billion by the final year.⁵⁷ While that figure is less than the trillions of dollars in market value that some AV companies had allegedly pitched as possible to venture capitalists,⁵⁸ it's in the same neighborhood as the projected annual revenue for the entire U.S. real estate sector in 2022, which the market research firm Statista projects to be \$369.90 billion.⁵⁹ As GM's ambitious deployment plans suggest, and its chief AV engineer has stated on the record, the auto giant believes that personal AVs could be available for purchase as soon as the mid-2020s⁶⁰—an ambitious pace that in turn suggests that potential privacy issues with AV technology retain relevancy.

AV technology is also improving, as AV manufacturers seek to develop safer and more skilled systems. Larger training datasets are facilitating safer driving by the models that enable AVs to make decisions.⁶¹ AV companies and third-party vendors have developed highly capable simulators that enable companies to

54. See BAIN CAP. GRP., *supra* note 53, Bellan *supra* note 52.

55. *Global Autonomous Vehicles Market, Size, Forecast 2022-2030, Industry Trends, Growth, Impact of COVID-19, Opportunity Company Analysis*, RENUB RSCH. (Feb. 2022), <https://www.researchandmarkets.com/reports/5546183/global-autonomous-vehicles-market-size-forecast?> [<https://perma.cc/CH9T-T35H>].

56. See *Autonomous Vehicles, Part I: Why Aren't They Dominating the Roads?*, CREATIVE VENTURES (Aug. 23, 2021), <https://creativeventures.vc/2021/08/23/autonomous-vehicles-part-i-why-arent-they-dominating-the-roads/> [<https://perma.cc/4CF7-PQB2>].

57. See RENUB RSCH., *supra* note 55.

58. See Chafkin, *supra* note 46.

59. *Real Estate - United States*, STATISTA (Oct. 8, 2022) <https://www.statista.com/outlook/io/real-estate/united-states> [<https://perma.cc/7K9V-U4BR>].

60. Marc Saltzman, *Self-Driving Cars Are a Thing of the Future. But Is That Future Right Around the Corner?*, USA TODAY (Aug. 29, 2022), <https://www.usatoday.com/story/tech/2022/08/29/self-driving-cars-future-gm-tesla/7896389001/>

61. See Asif Razzaq, *Huawei Releases 'SODA10M', a Large-Scale 2D Dataset for Object Detection in Autonomous Driving with 10M Unlabeled Images and 20K Labeled Images Over 6 Classes*, MARKTECHPOST (Aug. 3, 2021), <https://www.marktechpost.com/2021/08/03/huawei-releases-soda10m-a-large-scale-2d-dataset-for-object-detection-in-autonomous-driving-with-10m-unlabeled-images-and-20k-labeled-images-over-6-classes/> [<https://perma.cc/UJQ2-WD3V>].

test AVs against artificial weather, terrain, and road user behavior scenarios.⁶² Renub Research pointed to positive shifts in components and systems including LIDAR, mapping hardware, and intelligent speed assistance as steps forward in the path towards more fully autonomous vehicles.⁶³ 2021 saw AVs drive more than 4 million miles in California alone, with Waymo, the Google AV startup, contributing more than 2.3 million miles driven to that total.⁶⁴ In simulated crash scenarios discussed in peer-reviewed papers, Waymo's AV technology has performed even better than digitized models of human drivers whose performance was modified to eliminate distraction and fatigue⁶⁵—a remarkable accomplishment that speaks to the promise of AV technology to deliver safer streets.

The strides forward that companies are making technologically are reflected in regulatory changes and statements that respond to that progress. The National Highway Traffic Safety Administration updated the Federal Motor Vehicle Safety Standards (FMVSSs) to reflect the likely absence of steering wheels from AVs.⁶⁶ The nation's top transit official, U.S. Secretary of Transportation Pete Buttigieg, has underscored that even though he thinks the AV industry is still working on developing safe AVs, "frankly, it would be hard to do worse than human drivers when it comes to what we could get to, theoretically, with the right kind of safe, autonomous driving."⁶⁷ California's demanding permitting regime authorized seven

62. Kyle Wiggers, *Training Autonomous Vehicles Requires more than Simulation*, VENTUREBEAT (Feb. 17, 2022), <https://venturebeat.com/ai/training-autonomous-vehicles-requires-more-than-simulation/> [<https://perma.cc/KZG3-UK6A>].

63. See RENUB RSCH., *supra* note 55.

64. Andrew Hawkins, *Fewer Robot Cars Are Driving More Miles in California*, THE VERGE (Feb. 10, 2022), <https://www.theverge.com/2022/2/10/22927660/california-autonomous-cars-miles-disengagement-waymo-cruise-2021> [<https://perma.cc/4HE7-TLH9>].

65. Andrew Hawkins, *Waymo pitted its autonomous vehicles against a virtual superhuman driver to see which was safer*, THE VERGE (Sept. 29, 2022) <https://www.theverge.com/2022/9/29/23377219/waymo-av-safety-study-response-time-crash-avoidance>.

66. Yi Liu, Marin Leci, and Greg Rafter, *Autonomous Vehicles: Cross Jurisdictional Regulatory Perspectives Update*, LEXOLOGY (Oct. 7, 2022), <https://www.lexology.com/library/detail.aspx?g=e0eb6c9b-55e0-4a72-8d2a-2e88b7584cc6> [<https://perma.cc/L89Q-7JUM>].

67. Owen Bellwood, *U.S. in 'Valley of Death' as Autonomous Cars Write Checks the Tech Can't Cash*, Warns Pete Buttigieg, JALOPNIK (Oct. 25, 2022), <https://jalopnik.com/u-s-in-valley-of-death-as-autonomous-cars-write-chec-1849699276> [<https://perma.cc/7NX6-GTDQ>].

robotaxi passenger service trials as of January 2022,⁶⁸ and several AV companies have begun either mapping or conducting pilot programs in New York City.⁶⁹

B. ECONOMICS OF THE FUTURE AV INDUSTRY

While Part I.A makes the case that the AV industry and AV technology can still succeed in providing a viable AV product to the mass market over the next decade, this section argues that as AV technology comes to fruition and is commercially deployed, the likely outcome given the superior unit economics of AVs will be a highly consolidated AV industry. That new economic sector could deliver ride-hail services to many urban-dwellers, which would raise significant privacy risks. The AV industry has been consolidating since 2019, a phase marked by numerous acquisitions by the remaining players with more capital.⁷⁰ McKinsey forecasts rapid evolution in the AV ride-hailing business over the next decade, as economies of scale drive prices farther and farther down.⁷¹ The lower price points that operational scale enables will also favor consolidation of the industry.⁷² This Part envisions a relatively near-term future where AV ride-hail services are not just affordable and convenient, but omnipresent at least in urban centers, and arguably inescapable.

AVs are getting cheaper to make. Cheaper lidar⁷³ lowers input costs, while radar systems were already affordable sensor

68. See *AV Program Quarterly Reporting*, CAL. PUB. UTILS. COMM'N, <https://www.cpuc.ca.gov/regulatory-services/licensing/transportation-licensing-and-analysis-branch/autonomous-vehicle-programs/quarterly-reporting> [https://perma.cc/4D8U-SJEM].

69. See Andrew J. Hawkins, *Waymo is Bringing its Autonomous Vehicles to New York City for (Manually Driven) Mapping*, THE VERGE (Nov. 3, 2021), <https://www.theverge.com/2021/11/3/22761058/waymo-autonomous-vehicles-nyc-mapping-manual> [https://perma.cc/4X48-8JTU].

70. Justin Ho, *The Next Stage of the AV Industry: Consolidating and Refocusing*, AXIOS (Jan. 16, 2019), <https://www.axios.com/2019/01/16/next-stage-av-industry-consolidating-refocusing?> [https://perma.cc/6TCP-XQYV]. Arguably, the failure of Argo AI reflects the continuation of the consolidation trend. See Templeton, *supra* note 51.

71. *The Road to Affordable Autonomous Mobility*, MCKINSEY & CO. (Jan. 3, 2022), <https://www.mckinsey.com/industries/automotive-and-assembly/our-insights/the-road-to-affordable-autonomous-mobility> [https://perma.cc/3BWA-N55S].

72. *Id.*

73. See Naoki Watanabe & Hideaki Ryugen, *Cheaper Lidar Sensors Brighten the Future of Autonomous Cars*, NIKKEI ASIA (May 30, 2021), <https://asia.nikkei.com/Business/>

systems.⁷⁴ Solid-state lidars may reduce the cost of the critical sensors from a peak of \$75,000 per vehicle⁷⁵ to around \$700.⁷⁶ Global navigation satellite system receivers, which provide precise location data for AVs, have fallen in price from \$200 to \$50 in the last fifteen years.⁷⁷ Increasingly standardized processes on assembly lines also suggest mass production of AVs at commercial scale is increasingly realistic.⁷⁸

Although people differ significantly in their appetite to give up car ownership,⁷⁹ commercial deployment of AVs will likely reduce appetite for private car ownership among some groups.⁸⁰ When mobility functions as a service, cars move between users in a given geographical sector, preventing the loss of productivity which occurs when privately owned cars are otherwise immobile during ninety-five percent of their shelf lives.⁸¹ The number of cars on the street may drop as commercial AV fleet providers

Automobiles/Cheaper-lidar-sensors-brighten-the-future-of-autonomous-cars
[<https://perma.cc/C99L-K2XZ>].

74. See Christopher Mims, *For Self-Driving Cars, the Hot New Technology Is . . . Radar*, WALL ST. J., (Sept. 25, 2021), <https://www.wsj.com/articles/for-self-driving-cars-the-hot-new-technology-is-radar-11632542430> [<https://perma.cc/CL75-Y3BX>].

75. 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/YBN4-Z99D>].

76. See Watanabe & Ryugen, *supra* note 73.

77. See Matteo Luccio, *GNSS in the Fast Lane: Meeting Autonomous Vehicle Navigation Challenges*, GPS WORLD (June 1, 2021), <https://www.gpsworld.com/gnss-in-the-fast-lane-meeting-autonomous-vehicle-navigation-challenges/> [<https://perma.cc/89VD-74AE>].

78. See *Moving Autonomous Vehicles from R&D to Mass Production Is Closer Than You Think*, VENTUREBEAT (July 6, 2021), <https://venturebeat.com/2021/07/06/moving-autonomous-vehicles-from-rd-to-mass-production-is-closer-than-you-think/> [<https://perma.cc/T3C7-XNRV>].

79. ACCENTURE, *Nearly Half of Drivers in Multi-Country Survey Indicate Willingness to Give Up Car Ownership in the Future in Favor of Autonomous Mobility Solutions, Accenture Report Finds* (Oct. 10, 2019), <https://newsroom.accenture.com/news/nearly-half-of-drivers-in-multi-country-survey-indicate-willingness-to-give-up-car-ownership-in-the-future-in-favor-of-autonomous-mobility-solutions-accenture-report-finds.htm> [<https://perma.cc/X7ZN-A434>].

80. See Nikhil Menon et al., *Shared Autonomous Vehicles and Their Potential Impacts on Household Vehicle Ownership: An Exploratory Empirical Assessment*, 13 TRANSP. 111–122 (2019) (“Socioeconomic characteristics are significant indicators toward people’s likelihood of relinquishing a household vehicle for SAVs.”).

81. ANNA HAUPT, INDUSTRIFONDEN, *FROM AUTOMOTIVE INDUSTRY TO ROBOTAXI INDUSTRY: THE BIGGEST TRANSFORMATION IN AUTOMOTIVE SINCE THE HORSE BECAME HORSEPOWER?* 5 (Dec. 14, 2021), https://industrifonden.com/wp-content/uploads/2021/12/From-Automotive-to-Robotaxi_20211214-1.pdf [<https://perma.cc/M9TQ-DJNS>] (“The higher the accuracy in predicting mobility need, the shorter the waiting times for users, enabling a higher service level and higher usage attractiveness.”).

efficiently predict demand.⁸² These firms will hopefully be well-integrated with public transport systems, further enabling users to avoid the sunk costs of vehicle ownership and benefit from flexible consumption-based transit.⁸³

AVs may be significantly cheaper and safer to use per mile traveled, which means that a very high proportion of the population is likely to use AVs in the future. While current private car ownership in a world of human drivers has been estimated to cost around \$0.60–\$1.00 per mile traveled, the cost of shared-trip AV travel could be as low as \$0.15 to \$0.30 per trip-mile.⁸⁴ Affordability and convenience mean AVs could be driving two-thirds of all miles traveled by 2040.⁸⁵ AV technology is likely to be the distinguishing factor in making MaaS and shared car utilization the dominant mode of car ownership.⁸⁶

The economies of scale involved in developing and producing AVs favor consolidation.⁸⁷ Consolidation matters because it has antitrust and privacy implications. The largest firms have access to the largest pools of data.⁸⁸ Firms that get regulatory approval will snap up market share and hone top-of-market maintenance facilities for their fleets of AVs.⁸⁹ In turn, the MaaS service providers will be able to meet demand very quickly.⁹⁰ Safety

82. *See id.* at 9.

83. *See* Pierluigi Coppola & Fulvio Silvestri, *Autonomous Vehicles and Future Mobility Solutions*, in *AUTONOMOUS VEHICLES AND FUTURE MOBILITY* 1, 10 (Pierluigi Coppola & Domokos Esztergár-Kiss eds., 2019).

84. Patrick M. Bösch, *Cost-Based Analysis of Autonomous Mobility Services*, 64 *TRANSP. POL'Y* 76, 76–77 (2018).

85. Timo Möller et al., *The Future of Mobility Is at Our Doorstep*, MCKINSEY & CO. (Dec. 19, 2019), <https://www.mckinsey.com/industries/automotive-and-assembly/our-insights/the-future-of-mobility-is-at-our-doorstep> [<https://perma.cc/36BP-SQUH>].

86. *See* RIDECELL, *REINVENTING CARSHARING AS A MODERN (AND PROFITABLE) SERVICE* 2, 14 (Sept. 24, 2018), https://ridecell.com/wp-content/uploads/White-Paper-Presentation_Reinventing-Carsharing-As-A-Modern-And-Profitable-Service.pdf [<https://perma.cc/35LG-T4TY>] (“The introduction of autonomous vehicles into new markets will be the inflection point for mobility service growth, as many consumers choose to rely heavily, and possibly primarily, on autonomous mobility services.”). *Id.* at 14.

87. *The Market for Driverless Cars Will Head Towards Monopoly*, *ECONOMIST* (June 7, 2018), <https://www.economist.com/finance-and-economics/2018/06/07/the-market-for-driverless-cars-will-head-towards-monopoly> [<https://perma.cc/5EJM-CL9L>].

88. *Id.* Larger data pools, lower maintenance costs, pricing dynamics, and regulatory action could all tilt the AV industry towards consolidation. *Id.*

89. *See id.* (“Maintenance and other costs should be lower for fleets of hailable AVs, because centralised facilities ought to enjoy productivity advantages over distributed mechanics’ shops . . .”).

90. *See id.* (“Yet car-hailing services, like bike-sharing businesses, become more useful as their user-base grows. The more riders there are in an area, the more vehicles it pays to operate, and the more likely a user is to find an open ride nearby.”).

standards could amount to an exclusive privilege to operate for the first AV company to crack the code, since regulators will be hesitant to license less safe competitors. Globally, antitrust regulators are already mobilizing to investigate competitiveness issues in the connected and AV industries.⁹¹

Mature AV technology is probably coming soon, and when it does, it is likely to produce a competitive landscape dominated by a limited number of winning firms. Moreover, the AV companies that emerge as winners will do so in a space which is likely to be tightly regulated, and in which losing permission to operate in a lucrative jurisdiction could be devastating. This Note argues that by demanding trip-level data from fleet operators in a MaaS model with widespread AV adoption, regulators could compel firms to divulge data that, if de-anonymized, could provide intimate details about the lives of practically every American. Privacy experts such as Shoshana Zuboff have lately focused primarily on the concerns raised by corporate power vis-à-vis consumers when large technology companies sit on enormous pools of data provided by their customers.⁹² But state power over the individual remains a live wire in the era of advanced mobility.

II. MDS AS APPLIED TO AVS IS A SEARCH UNDER THE FOURTH AMENDMENT

This Part argues that municipal data collection from AVs using MDS is a Fourth Amendment search, and that such a search would not be constitutional if the current e-scooter regime were applied to AVs. The first element of the Fourth Amendment analysis is confirming that MDS is a “search.” The applicable case law, doctrinal principles, and sound public policy all point to the conclusion that using MDS to collect real-time data from AVs would be a search for the purposes of the Fourth Amendment. While it is not possible to predict the exact test the Supreme

91. Leah Nylen, *Big Tech's Next Monopoly Game: Building the Car of the Future*, POLITICO MAG. (Dec. 26, 2021), <https://www.politico.com/news/magazine/2021/12/27/self-driving-car-big-tech-monopoly-525867> [<https://perma.cc/EG3R-QYAA>].

92. Joanna Kavenna & Shoshana Zuboff, *Surveillance Capitalism Is an Assault on Human Autonomy*, GUARDIAN (Oct. 4, 2019), <https://www.theguardian.com/books/2019/oct/04/shoshana-zuboff-surveillance-capitalism-assault-human-automomy-digital-privacy> [<https://perma.cc/W7UU-PL5K>].

Court would use given the lack of clarity in digital age Fourth Amendment doctrine, this Note proposes one plausible test that would be suitable for capturing privacy harms in the context of facially anonymous searches that generate data that supports sensitive inferences. A court considering whether a search exists under these circumstances should conduct (1) an analysis of the inescapability of AV technology, along with (2) an assessment of the intimacy of the information revealed by a search, the amount of information revealed, and the cost of conducting the search.⁹³ AVs are likely to be inescapable, and searching AV location data would generate an enormous amount of inference-rich intimate data at low cost. Unless Fourth Amendment rights are waived or an exception to the warrant requirement like administrative search doctrine applies, then finding that MDS as applied to AVs is a search would make it unreasonable and unconstitutional.

A. DEFINING A SEARCH UNDER THE FOURTH AMENDMENT IN THE DIGITAL AGE

The cornerstone of Fourth Amendment jurisprudence is the concept of the reasonable expectation of privacy. This test for the existence of a Fourth Amendment search derives from *Katz v. United States*, 389 U.S. 347 (1967), when the Supreme Court moved away from over a century of jurisprudence that had restricted the protective scope of the Fourth Amendment to persons, papers, houses, and effects.⁹⁴ The *Katz* court held that the plaintiff, Katz, had a reasonable expectation of privacy that was violated when police officers taped him while he was making a call from a telephone booth.⁹⁵

93. While this suggested test is my own, it borrows heavily from the suggested intimacy, cost, and amount of surveillance test that Professor Matthew Tokson proposes in his critique of inescapability as a Fourth Amendment concept, as outlined by him in *Inescapable Surveillance*, 106 CORNELL L. REV. 409, 453 (2021). Professor Tokson argues that using inescapability as the key factor in whether Fourth Amendment rights apply to user data generated by a technology causes administrability issues and underprotects privacy. *Id.* at 413. One of his suggested alternative tests would ask “the intimacy, amount, and cost of surveillance” in the context of a given surveillance method to determine “whether it violates a reasonable expectation of privacy.” *Id.* at 454.

94. The Court applied the property test to identify a trespassory search by police officers leading a canine unit onto a homeowner’s porch in *Florida v. Jardines*, 569 U.S. 1 (2013). *Jardines* treated the property test as a supplement to the *Katz* inquiry. *Id.* at 5–6.

95. *Katz*, 389 U.S. at 352.

Katz was a decisive moment in the Court's long struggle to come to grips with the reality of technological surveillance as an intrusion on Fourth Amendment values. The Court cleared the way for legal electronic surveillance through wiretapping, even without notice to the surveilled person, but nonetheless curbed that power by reiterating the warrant requirement.⁹⁶ Although still dominant today, the *Katz* test as refined by Justice Harlan in his influential concurrence⁹⁷ has received varying degrees of criticism from originalists on the Court, including Justices Scalia, Thomas, and Gorsuch.⁹⁸ But despite criticisms of the *Katz* test as ahistorical, or as burdening legislatures, the *Katz* test retains staying power as the dominant test for what constitutes a "search" under the Fourth Amendment.⁹⁹

Justice Harlan's *Katz* concurrence explains that the twofold *Katz* test for whether a Fourth Amendment search has occurred is for an actual legal person to evince a subjective expectation of privacy, and for society to subsequently deem that expectation to be reasonable.¹⁰⁰ The subjective expectations people have about privacy are informed by the objective legal rules and social context that govern the arena in which they are asserting a privacy interest.¹⁰¹ After *Katz*, a new normative idea of privacy animated Fourth Amendment protections, which gave courts "more flexibility to protect a broader concept of human dignity at a time when information technology had outstripped what property rights alone could protect."¹⁰²

In adopting an understanding of the Fourth Amendment that protects "people, not places," the *Katz* court recognized that privacy rights reflect social norms governing technology, much as *Katz* relied on his belief that he was "in private" when speaking through a public telephone.¹⁰³ Both technological change, in terms of the means available to conduct surveillance, and social change, in terms of how people seek to preserve their privacy

96. See Peter Winn, *Katz and the Origins of the "Reasonable Expectation of Privacy" Test*, 40 MCGEORGE L. REV. 1, 3–4 (2009).

97. *Id.* at 6–7.

98. Nicholas A. Kahn-Fogel, *Katz, Carpenter, and Classical Conservatism*, 29 CORNELL J.L. & PUB. POL'Y 95, 119 (2018).

99. *Id.* at 120.

100. Winn, *supra* note 96, at 6–7.

101. *Id.* at 8.

102. *Id.* at 9.

103. STEPHEN J. SCHULHOFER, *MORE ESSENTIAL THAN EVER: THE FOURTH AMENDMENT IN THE TWENTY-FIRST CENTURY* 118 (2012).

even when in public, are taken into account post-*Katz*.¹⁰⁴ The Fourth Amendment's protections are triggered by incursions on an individual's reasonable expectation of privacy, such that "the Fourth Amendment aims to guarantee every citizen the opportunity to claim areas of life that can be insulated from unrestricted government spying."¹⁰⁵

When recently confronted by massive shifts in the technological reach of government surveillance, the Supreme Court again expanded the scope of the Fourth Amendment to safeguard the amendment's privacy values. In *Kyllo v. United States*, the Supreme Court refused to adopt a "mechanical" interpretation of the Fourth Amendment that would leave homeowners "at the mercy of advancing technology."¹⁰⁶ Instead, the Court emphasized how increasingly sophisticated thermal imaging technology was revealing more intimate details about once sequestered spaces, and required that the Government secure a warrant to authorize the technology's use when directed at the interior of homes.¹⁰⁷ A little over a decade later, the Court recognized in *United States v. Jones* that extended location monitoring using a GPS installed on a suspect's vehicle was a search under the Fourth Amendment, although it relied on common law trespass principles.¹⁰⁸ Justice Sotomayor's powerful concurrence emphasized that the trespass approach was only "an irreducible constitutional minimum," and that "the government's unrestrained power to assemble data that reveal private aspects of identity is susceptible to abuse."¹⁰⁹ Sotomayor questioned whether there was a social norm of accepting government data collection that could facilitate ascertaining sensitive facts at will.¹¹⁰

104. *Id.* at 119–20. Professor Schulhofer explains that after *Katz*, the Supreme Court came to recognize "that people were living differently and that the privacy the Framers cherished was taking different forms." *Id.* at 119.

105. *Id.* at 121–22.

106. *Kyllo v. United States*, 533 U.S. 27, 35 (2001).

107. *Id.* Writing for the majority, Justice Scalia emphasized that the Court had a responsibility to take note of sophisticated new imaging systems in development, not just the cruder systems before it in the instant case. *Id.* at 36.

108. *United States v. Jones*, 565 U.S. 400, 407 (2012).

109. *Id.* at 414–16 (Sotomayor, J., concurring).

110. *Id.* at 416 (Sotomayor, J., concurring).

The thrust of Justice Sotomayor's concurrence was adopted by the Supreme Court in *Carpenter v. United States*.¹¹¹ The Court held that an individual "maintains a legitimate expectation of privacy in the record of his physical movements as captured through" historical cell-site location information (CSLI), and thus querying a suspect's CLSI was a search under the Fourth Amendment.¹¹² *Carpenter* reaffirmed the *Jones* holding that individuals maintain a privacy interest in the whole of their physical location. The Court also noted that tracking CLSI is "remarkably easy, cheap, and efficient compared to traditional investigative tools," giving instant access to a "deep repository" of historical data for free.¹¹³ Finally, the Court flagged the "inescapable and automatic" nature of collecting CLSI, given the 400 million devices generating CSLI in the United States and that most people take their cellphones everywhere.¹¹⁴ Allowing the government to access CSLI data without a warrant would let the State achieve "near perfect surveillance, as if it had attached an ankle monitor to the phone's user."¹¹⁵ The *Carpenter* holding, however, is limited to historical data, and the Court expressly reserved judgment regarding the Fourth Amendment's implications for real-time location data.¹¹⁶

The logic of *Carpenter* provides ample support for a modified *Katz* test that would protect the reasonable expectation of privacy that people have in facially anonymous data which facilitates highly sensitive inferences, much like geolocation data compiled from AVs using MDS. Georgetown Law professor Paul Ohm has characterized *Carpenter* itself as quietly reshaping the *Katz* test, such that whether a Fourth Amendment search has occurred when the government demands data now depends on "whether a given category of information (1) has a deeply revealing nature; (2) possesses depth, breadth, and comprehensive reach; and (3) results from an inescapable and automatic form of data

111. See *Carpenter v. United States*, 138 S. Ct. 2206, 2217 (2018). The Court referred favorably to the *Jones* concurrences of Justices Sotomayor and Alito, to support its proposition that a "majority of this Court has already recognized that individuals have a reasonable expectation of privacy in the whole of their physical movements." *Id.*

112. *Id.* at 2217.

113. *Id.* at 2218.

114. *Id.*

115. *Id.*

116. *Id.* at 2220.

collection.”¹¹⁷ This Note proposes a similar test derived from *Carpenter* as interpreted by law professor Paul Ohm and, elsewhere, in a separate, similar formulation by Utah law professor Matthew Tokson, whose preferred framing would look to “the intimacy of the thing searched, the amount of information obtained, and the cost of the surveillance practice.”¹¹⁸ Because a court would be unlikely to fully abandon the *Carpenter* inescapability analysis, the balancing test proposed here is closer to Ohm’s, and looks to (1) the future inescapability of AVs and (2) the intimacy, amount of information, and cost of conducting a search in the AV context. Inescapability would be essentially a threshold inquiry before the balancing test conducted in the second step.

Conducting the second step of this proposed test would mean weighing “the intimacy of the thing searched, the amount of information obtained, and the cost of the surveillance practice,” with more intimate searches collecting more information at lower cost are most likely to violate reasonable expectations of privacy.¹¹⁹ This proposed test for Fourth Amendment searches is well-supported by case law, is applied in *Carpenter* as a complementary rationale to inescapability, and avoids the drawbacks of solely inescapability-centric privacy theory.¹²⁰ Those drawbacks include the undesirability of forcing consumers to take great lengths to avoid surveillance, because in theory almost any technology is escapable;¹²¹ the administrative difficulty of a highly fact-intensive inquiry into indispensability;¹²² and how some technologies may be indispensable for particular people, as a ride-sharing app might be for a person with disabilities.¹²³

117. Paul Ohm, *The Many Revolutions of Carpenter*, 32 HARV. J.L. & TECH. 357, 378 (2019).

118. Tokson, *supra* note 93, at 453.

119. *Id.* The Court has implicitly relied on these three factors in a significant number of its privacy decisions, and this intuitive approach to identifying privacy violations is easy to apply. *Id.* at 454. In contexts like streaming, smart homes, and search history, this analysis would likely force the government to get warrants more frequently. *Id.*

120. *Id.* at 453. Focusing on how inescapable a technology is as the key factor in whether the government can easily gain access to associated data incentivizes those who dislike surveillance to not use technologies that are escapable but useful.

121. *Id.* at 428.

122. *Id.* at 430.

123. *Id.* at 431.

B. MDS LITIGATION TO DATE AND FOURTH AMENDMENT SEARCH DOCTRINE

Whether MDS is a Fourth Amendment search, in light of how *Carpenter* refined *Katz*'s reasonable expectation of privacy test, is contested.¹²⁴ Sciences Po law professor Beatriz Botero Arcila characterized the post-*Katz* privacy jurisprudence as reflecting the courts' understanding that "all forms of information that [are] freely accessible or available in public spaces" are public.¹²⁵ In the major Washington Supreme Court case *State v. Athan*, the court refused to find a reasonable expectation of privacy even when suspects abandon "genetic material, fingerprints, footprints, or other evidence of their identity in public places."¹²⁶ The ruling reiterated that even in the context of DNA, there is no subjective expectation of privacy in physical characteristics exposed to the public.¹²⁷ In his student Note, Alexander Carroll stresses the ease with which facially anonymous data gathered through MDS can be re-identified.¹²⁸ For Carroll, state surveillance, in the form of the permitting process that enforces MDS, is enough to implicate Fourth Amendment concerns.¹²⁹ Finally, a leading privacy advocacy group, the Center for Democracy & Technology, has argued that because of the privacy interests held by companies in user records, cities compelling firms to provide those records may be conducting Fourth Amendment searches.¹³⁰

124. See Botero Arcila, *Jump v. Los Angeles*, *supra* note 20, at 172. Professor Arcila describes the Court's ruling in *Carpenter* as "narrow," contending that it neither "call[ed] into question conventional surveillance techniques and tools, such as security cameras," nor "address[ed] other business records that might incidentally reveal location information." *Id.*

125. Beatriz Botero Arcila, *The Case for Local Data Sharing Ordinances*, WM. & MARY BILL RTS. J. 23 (forthcoming) [hereinafter *The Case for Local Data Sharing Ordinances*].

126. *Id.* at 24.

127. See *id.* Arcila cites the Washington State Supreme court's ruling *State v. Athan*, which held that "[t]here is no subjective expectation of privacy in discarded genetic material just as there is no subjective expectation of privacy in fingerprints or footprints left in a public place." *Id.* (quoting *State v. Athan*, 158 P.3d 27, 37 (2007)).

128. Alexander P. Carroll, *New Technology and the Right to Privacy: Do E-Scooters Implicate the Fourth Amendment?*, 40 J. NAT'L ASS'N ADMIN. L. JUDICIARY 27, 49–50 (2021).

129. *Id.*

130. MANA AZARMI & NOAH RESNICK, CTR. FOR DEM. & TECH., SMART-ENOUGH CITIES: GOVERNMENTS THAT SEEK MOBILITY DATA MUST RESPECT INDIVIDUAL PRIVACY 10 (2020), <https://cdt.org/wp-content/uploads/2020/06/2020-06-25-CDT-Mobility-Data-Whitepaper-full-FINAL.pdf> [<https://perma.cc/J4YF-FGHZ>].

When the issue of whether MDS as applied to e-scooters constitutes a search under the Fourth Amendment reached federal district court in *Sanchez*, Judge Gee of the Central District of California clearly responded in the negative in an opinion which as a whole hints at the extent to which a pro-regulatory Fourth Amendment could be read to justify invasive data collection.¹³¹ The opinion's implications for Fourth Amendment values are concerning. Judge Gee recognized continuities between *Carpenter*, *Jones*, and the issue of location data collected by a third party and turned over to the government in the MDS context. But ultimately Judge Gee held that the plaintiffs' failure to plausibly argue that all of someone's movements could be re-identified using MDS meant that no search under the Fourth Amendment had occurred—even if individual trips by specific people could theoretically be re-identified.¹³² The plaintiffs' failure to adequately allege the feasibility of data disaggregation was fatal to their argument that any expectation of privacy had been breached.¹³³ Because the e-scooters were shared and used only for individual rides, the court concluded that “[d]e-anonymizing one location data point would therefore reveal only a sole trip . . .,” which was the kind of short-term location monitoring which *Jones* explained is reasonable for Fourth Amendment purposes.¹³⁴

The plaintiff's arguments in his unsuccessful appeal to the Ninth Circuit in *Sanchez* are valuable in the AV context, because those arguments underscore the technical capabilities of MDS and persuasively analogize to the reasons why the Fourth Circuit struck down a comprehensive aerial surveillance program in *Leaders of a Beautiful Struggle*.¹³⁵ In *Sanchez*, the plaintiff emphasized the incredible precision of MDS geolocation data—accurate to several centimeters and more precise than the tracking in both *Carpenter* and *Jones*;¹³⁶ the ease with which

131. *Sanchez v. LADOT*, No. CV 20-5044-DMG (AFMx), 2021 WL 1220690 (C.D. Cal. Feb. 23, 2021).

132. *Id.* at *3.

133. *Id.*

134. *Id.*

135. Appellant's Opening Br. on Appeal at 41, *Sanchez v. LADOT*, 39 F.4th 548 (9th Cir. 2022) (No. 21-55285). The Fourth Circuit underscored that the government could make deductions from the recorded overflights of Baltimore that could identify individuals. *Leaders of a Beautiful Struggle v. Balt. Police Dep't*, 2 F.4th 330, 343 (4th Cir. 2021).

136. Appellant's Opening Br. on Appeal, *supra* note 135, at 30.

LADOT could flick on a virtual dragnet by compelling companies to report MDS data,¹³⁷ and MDS's combination of real-time tracking with potential historical location data collection.¹³⁸ Although MDS does not record the trip data of individuals in a format that can be searched by name, the plaintiff in *Sanchez* compellingly argued that the Fourth Amendment still applies.¹³⁹ When the government engages in a search to acquire information with which it can determine an individual's identity, Sanchez argued that constitutional privacy protections are available even though that information itself is not associated with a specific person.¹⁴⁰ His counsel cited to the Fourth Circuit's major decision in *Leaders of a Beautiful Struggle*, which concluded that constant aerial surveillance of Baltimore was a search even though further analysis would be required to identify pixelated individuals.¹⁴¹

The Ninth Circuit's ruling in *Sanchez* only discussed whether a search occurred as part of its analysis of whether the third-party doctrine applied, which the court found it did. But the opinion's discussion of the privacy issues did not bode well for privacy concerns about MDS as applied to AVs. The court did at least confer Sanchez standing, given that he had alleged that "the collection of the MDS location data itself—without more—violates his constitutional rights today."¹⁴² Judge Hurwitz, writing for the panel, recognized that government analysis of a historical dataset which contains the whole of a person's physical movements can violate a reasonable expectation of privacy post-*Carpenter*.¹⁴³ But Judge Hurwitz distinguished the MDS data from "the dragnet, continuous monitoring of an identified individual's movements," citing *Kyllo* for the rule that an inference is not a search.¹⁴⁴ Refusing to consider the possibility that a sophisticated entity could associate individual searches, Judge Hurwitz said that MDS as applied to e-scooters was less like *Carpenter* and "more like the remote monitoring of a discrete 'automotive journey' in *Knotts* . . . as MDS only collects route data and real-time location

137. *Id.* at 31.

138. *Id.* at 33.

139. *Id.* at 34.

140. *Id.* at 34.

141. *Leaders of a Beautiful Struggle*, 2 F.4th at 343.

142. *Sanchez*, 39 F.4th at 554.

143. *Id.* at 556.

144. *Id.* at 560.

of an e-scooter for a single ride.”¹⁴⁵ He concluded the discussion of privacy by stating that unlike cellphones, e-scooters are not indispensable.¹⁴⁶

C. APPLYING FOURTH AMENDMENT SEARCH DOCTRINE TO AN MDS REGIME FOR AVS

Plainly, a court dealing with AVs which precisely followed the Ninth Circuit’s lead regarding MDS and e-scooters in *Sanchez* would not reach a privacy-protective result. There are good doctrinal reasons, however, to think a future court would reason along different lines. Applying the plausibly modified *Carpenter* test proposed in Part II.A reinforces this conclusion.

Commercially deployed AVs will most likely be deemed “inescapable” under *Carpenter*, which cuts in favor of finding that MDS is a Fourth Amendment search. AVs are likely to be “inescapable” given their cheapness and convenience, the increased productivity they offer the workforce, and the potential for regulatory intervention in their favor.¹⁴⁷ Because LADOT has hinged so much of its defense of MDS on the comparative *escapability* of e-scooters, AV technology is legally distinct. The district court judge in *Sanchez* flatly stated that, unlike a cellphone, “[r]iding a one-time rental scooter is not indispensable to modern life.”¹⁴⁸ Whatever short shrift the district court, Ninth Circuit, and LADOT gave to the centrality of e-scooters that are already important transit options for young and low-income people,¹⁴⁹ AVs will create an inescapable tracking capacity which “runs against everyone,” meaning that the government “need not even know in advance whether they want to follow a particular individual, or when.”¹⁵⁰ People from all walks of life will need to use AVs as part of their weekly routine while navigating the

145. *Id.*

146. *Sanchez v. LADOT*, 39 F.4th 548, 560 (9th Cir. 2022).

147. See discussion of AV safety *supra* Part I.B. Regulators could even conceivably ban human drivers once AV technology dramatically outpaces the safety of manned vehicles.

148. *Sanchez v. LADOT*, No. CV 20-5044-DMG (AFMx), 2021 WL 1220690, at *4 (C.D. Cal. Feb. 23, 2021).

149. See Farzana Mehzabin Tuli et al., *Factors Influencing the Usage of Shared E-Scooters in Chicago*, 154 TRANSP. RSCH. PART A: POL’Y & PRAC. 164, 165 (2021) (discussing research showing that e-scooter users trend younger and low-income).

150. *Carpenter v. United States*, 138 S. Ct. 2206, 2218 (2018).

cities of the future, unlike the (for now) supplementary role e-scooters play in the modern transit landscape.¹⁵¹

Carpenter's discussion of inescapability directly supports the idea that AVs in the future will likely be considered inescapable, as argued in Part I. The *Carpenter* court noted that cell phones follow their owners to "private residences, doctor's offices, political headquarters, and other potentially revealing locales."¹⁵² A cell phone "tracks nearly exactly the movements of its owner," such that "when the Government tracks the location of a cell phone it achieves near perfect surveillance, as if it had attached an ankle monitor to the phone's user."¹⁵³ While the *Sanchez* trial court concluded summarily that "[r]iding a one-time rental scooter is not indispensable to modern life"¹⁵⁴ (a conclusion that is predicated on contestable assumptions about the rapidly evolving last-mile transit options available to lower-income people in urban centers), AVs in the likely scenario outlined in Part I would be genuinely indispensable. Large numbers of Americans will rely on AVs that transmit location and route data incredibly precisely,¹⁵⁵ just like an ankle monitor. They will take AVs to their doctors' offices, to political rallies, and to the living quarters of their friends and romantic partners. Admittedly, unlike the cell phones discussed in *Carpenter*, normal people will most likely not take AVs into the shower¹⁵⁶—although there's nothing preventing an AV freed from traditional design constraints from having an internal shower.

Having determined that AVs will likely be inescapable as a threshold matter, the next phase of the Fourth Amendment search analysis this Note proposes is the intimacy, amount, and cost assessment. Because AV data would implicate a person's privacy rights in the whole of their physical movements, it would intrude upon an intimate type of data that *Carpenter* indicates is constitutionally protected.¹⁵⁷ Mirroring the reasoning of *Jones*,

151. See Part I.A.

152. *Carpenter*, 138 S. Ct. at 2218.

153. *Id.*

154. *Sanchez v. LADOT*, No. CV 20-5044-DMG (AFMx), 2021 WL 1220690, at *6 (C.D. Cal. Feb. 23, 2021).

155. NIELS JOUBERT ET AL., DEVELOPMENTS IN MODERN GNSS AND ITS IMPACT ON AUTONOMOUS VEHICLE ARCHITECTURES 6 (Apr. 19, 2020), <https://arxiv.org/pdf/2002.00339.pdf> [<https://perma.cc/32R7-RJWA>]

156. *Carpenter v. United States*, 138 S. Ct. 2206, 2218 (2018) (quoting *Riley v. California*, 573 U.S. 373, 395 (2014)).

157. *Id.* at 2218.

the *Carpenter* opinion emphasizes an individual's reasonable expectation of privacy in the whole of their physical movements.¹⁵⁸ In holding that the collection of Carpenter's CSLI violated his reasonable expectation of privacy, the Court emphasized that it had to "take account of more sophisticated systems that are already in use or in development."¹⁵⁹ The Court took notice of the proliferation of cell sites, their increasing accuracy in reflecting the geographic location of cellphone users, and the fact that the technology had rapidly become more sophisticated since Carpenter's arrest and prosecution.¹⁶⁰ Like cellphones, data from fleets of AVs operated in a MaaS model will provide detailed insight about an individual's physical movements and will be capable of being recombined with other datasets to ease de-anonymization.¹⁶¹

Circuit-level persuasive precedent from the Fourth Circuit's lodestar decision in *Leaders of a Beautiful Struggle* reinforces the idea that the data MDS acquires is especially intimate. *Leaders of a Beautiful Struggle* builds on *Carpenter* and *Jones* to demonstrate that retrospective, comprehensive, geographical surveillance is a search, even if it does not identify individuals at the outset.¹⁶² Per the majority's author Chief Judge Gregory, the photographic aerial surveillance program that Baltimore conducted (AIR) was a search even though its photos only showed people as anonymous pixelated dots.¹⁶³ Like MDS as applied to AVs, Baltimore's AIR program gave the government historical information about essentially everyone in the targeted zone ("the movements of a city"), while the data facilitated deductions about intimate associations and activities.¹⁶⁴ Judge Gregory held that the AIR program "enables police to deduce from the whole of individuals' movements," so "accessing its data is a search," and the program's warrantless operation violated the Fourth Amendment.¹⁶⁵ Like MDS, AIR records "variable location points

158. *Id.*

159. *Id.* at 2218–19 (quoting *Kyllo v. United States*, 533 U.S. 27, 36 (2001)).

160. *Id.* at 2219.

161. See, e.g., GUILLERMO BALTRA ET AL., ON THE DATA FIGHT BETWEEN CITIES AND MOBILITY PROVIDERS 4 (Apr. 20, 2020), <https://arxiv.org/pdf/2004.09072.pdf> [<https://perma.cc/33SA-78LY>].

162. *Leaders of a Beautiful Struggle v. Balt. Police Dep't*, 2 F.4th 330, 343–44 (4th Cir. 2021).

163. *Id.*

164. *Id.* at 346.

165. *Id.*

from which movements can be reconstructed,” and Judge Gregory took notice of the ease of re-identifying an individual’s mobility data, and the potential for recombination of the AIR data with data from other police tools.¹⁶⁶ Courts reviewing digital surveillance schemes should and will consider the intimacy of what the government is able to deduce by accessing that data in combination with its other analytical capabilities and datasets.

The amount of information obtained when a historical record of individual trip-level AV data is demanded by the state would be enormous. The tracking of even anonymized individual trip-level locational data creates a significant risk of de-anonymization, with just four data points often being enough.¹⁶⁷ Datasets containing CLSI, which can be significantly less precise than MDS, have been used by data journalists to re-identify individuals.¹⁶⁸ Concurring in *Jones*, Justice Sotomayor identified several key characteristics of surveillance technology, such as the generation of a “precise, comprehensive record of a person’s public movements that reflects a wealth of detail about her familial, political, professional, religious, and sexual associations.”¹⁶⁹ Each of those factors would be embodied concretely by an MDS-style regime for AVs which maintains a historical records of millions individual trip-level data points without meaningful privacy safeguards.

The cost of generating sensitive inferences from data acquired from AVs using MDS would be low, since location data this granular can be associated with specific individuals without great effort by the government. Using data from an open mobility data standard called the General Bikeshare Feed Specification (GBFS), which, unlike MDS, does not have the capability to support historical queries of individual trips, it is already possible to de-anonymize individuals engaging in sensitive activities like visiting a marijuana dispensary.¹⁷⁰ Researchers were able to identify specific customers using a probabilistic model and could have determined the start point of the trip using the GBFS

166. *Id.* at 343.

167. AZARMI & RESNICK, *supra* note 130, at 7.

168. *Id.*

169. *United States v. Jones*, 565 U.S. 400, 415 (2012) (Sotomayor, J., concurring).

170. BALTRA ET AL., *supra* note 161, at 1, 3. This report argues that LADOT does not need the data it is requesting to meet the needs of the use cases it has identified. *See id.* at 1.

dataset alone.¹⁷¹ Other extensive human mobility datasets confirm just how unique and revealing the movement history of individuals can be.¹⁷² Researchers looking at a dataset containing one and a half million people's mobility data, where individual data was updated hourly and the dataset as a whole contained fifteen months' worth of historical data, identified ninety-five percent of the individuals in the dataset using just four data points.¹⁷³ A growing greater municipal area like Los Angeles, which has 3,898,747 residents¹⁷⁴ and attracted 50-million-plus tourists per year in 2018,¹⁷⁵ would supply a vastly larger number of potential targets for re-identification.

MDS datasets containing AV data would pose unique vulnerabilities that would make it even easier for the government to de-identify individuals. The trip-level data which LADOT obtains through MDS can already likely be de-anonymized with trivial ease, because computer scientists do not need even the unique IDs of individual vehicles to reconstruct and re-identify individuals from MDS-style datasets.¹⁷⁶ MDS data is updated within five seconds of the start and end of every trip, and the entire route of an individual trip is made available to the city within twenty-four hours.¹⁷⁷ The GPS data utilized in the e-scooters tracked by MDS can already track location data within

171. *Id.* at 4.

172. See Yves-Alexandre de Montjoye et al., *Unique in the Crowd: The Privacy Bounds of Human Mobility*, 3 SCI. REP. 1 (2013), <https://www.nature.com/articles/srep01376> [<https://perma.cc/JV8K-3UJS>] (demonstrating that anonymized mobile phone datasets can be used to identify individuals with just four data points, Montjoye et al. discuss how individual mobility traces can be used by anti-competitive purposes by businesses or by individuals going to sensitive locations like abortion clinics).

173. *Id.* at 1.

174. *Los Angeles Population Estimates*, U.S. CENSUS BUREAU (July 1, 2021), <https://www.census.gov/quickfacts/losangelescitycalifornia> [<https://perma.cc/BMA9-3PZM>].

175. *Los Angeles Reached Record Milestone of 50 Million Visitors in 2018*, NBC LOS ANGELES (Jan. 18, 2019), <https://www.nbclosangeles.com/news/local/los-angeles-visitors-2018/2386/> [<https://perma.cc/XCU3-8KAD>].

176. See BALTRA ET AL., *supra* note 161, at 4. Baltra and his co-authors looked at clusters that were popular trip destinations for e-scooter users, like a marijuana dispensary, and were able to develop a method that could have identified specific riders visiting the dispensary on recurring trips. *Id.*

177. Kia Kokalitcheva, *Inside Uber's Privacy Battle with Los Angeles*, AXIOS (Dec. 18, 2019), <https://www.axios.com/uber-scooter-data-privacy-battle-los-angeles-962f2f01-7146-4f33-9ebc-7f5eabd271f2.html> [<https://perma.cc/B593-QSS9>]. Before Jump dropped its lawsuit against LADOT, Jump and Uber argued that sharing trip start and end location data via MDS within five seconds was unduly intrusive. *Id.*

ten centimeters.¹⁷⁸ Fleets of AVs used by millions of riders in large metropolitan areas will generate rich datasets that, if collected using MDS, will not only report riders' start and end locations with incredible precision but also their entire routes. Moreover, MDS data has unclear deletion timelines, which means that MDS datasets could support queries that look as far back in time in the dataset as the searcher wants.¹⁷⁹ Because de-anonymization of MDS data will not be challenging, the need for Fourth Amendment guardrails in the AV context is clear.

III. THE THIRD-PARTY DOCTRINE DOES NOT PRECLUDE FOURTH AMENDMENT RIGHTS WHEN MDS IS APPLIED TO AVS

After establishing that MDS as applied to AVs constitutes a search under the Fourth Amendment, the next issue is whether the third-party doctrine will deprive AV users targeted by MDS searches of any grounds to sue given that they will voluntarily hand their data over to AV fleet providers. The seminal cases *Smith v. Maryland* and *Miller v. United States* create serious impediments to holding the government accountable for surveilling personal data in the custody of third parties.¹⁸⁰ But because of the automatic nature of AV data collection in an MDS-style format, the likely inescapability of AVs, and the public policy arguments against permitting waiver of Fourth Amendment rights through form contracts, the third-party doctrine does not and should not prevent constitutional protections from safeguarding private data in the context of MDS as applied to AVs.

A. MODERN THIRD-PARTY DOCTRINE JURISPRUDENCE

In *Smith v. Maryland*, the police installed a pen register device at the facility of a telephone company to track the numbers dialed by the petitioner, a suspect in a robbery and harassment

178. *Centimeter-Level Accurate Positioning*, DEUTSCHE TELEKOM, <https://iot.telekom.com/en/solutions/precise-positioning> [https://perma.cc/SBR9-Y4TY].

179. *Using MDS Under GPR*, OPEN MOBILITY FOUND., <https://www.openmobilityfoundation.org/using-mds-under-gdpr/> [https://perma.cc/N8GF-VM4G]. OMF advises even EU users subject to GDPR's data erasure regime that most of the time they should be able to lawfully dismiss such requests.

180. *Smith v. Maryland*, 442 U.S. 735 (1979); *Miller v. United States*, 425 U.S. 435 (1976).

case.¹⁸¹ Although the police neglected to obtain either a court order or a warrant for the installation of the device, the Court held that in dialing the phone numbers of his stalking victim, the petitioner voluntarily gave up that information to his telephone company, assuming the risk that the company would voluntarily share it with the police.¹⁸² The *Smith* Court viewed switching equipment as the automated equivalent of a human operator, the questioning of whom would not have involved the petitioner's Fourth Amendment rights.¹⁸³ In the end, the Court found that automation was of no constitutional significance even though the pen register had a perfect memory unlike a fallible human operator.¹⁸⁴

In *United States v. Miller*, the Court reiterated that when an individual “takes the risk[] in revealing his affairs to another,” he also takes on the risk that the third party might share that information with the government.¹⁸⁵ In *Miller*, the entity sharing records was a bank subject to a subpoena, and the Court held that the search was justified by the third-party doctrine despite the relation of trust between the defendant depositor and his bank.¹⁸⁶ The depositor's “assumption that [his information] will be used only for a limited purpose and the confidence placed” in the bank was constitutionally insignificant.¹⁸⁷

The third-party doctrine has come under sustained criticism, and recent opinions indicate the Supreme Court recognizes its shortcomings. The doctrine is falling out of favor both for its dismissive attitude towards consumer expectations,¹⁸⁸ and also because, taken to an extreme, it leaves almost everyone without protection for the personal information they entrust to

181. *Smith*, 442 U.S. at 737. The pen register was a device installed at the telephone company's headquarters which recorded the numbers the defendant dialed. *Id.* at 741.

182. *Id.* at 735, 744.

183. *Id.*

184. *Id.* at 735, 745.

185. *Id.* at 735, 743.

186. *United States v. Miller*, 425 U.S. 435, 443 (1976) (“This Court has held repeatedly that the Fourth Amendment does not prohibit the obtaining of information revealed to a third party and conveyed by him to Government authorities, even if the information is revealed on the assumption that it will be used only for a limited purpose and the confidence placed in the third party will not be betrayed.”).

187. *Id.*

188. See SCHULHOFER, *supra* note 103, 133–34 (“The Supreme Court's view that information conveyed to a third party is inevitably at risk of misuse is far too sweeping at a time when service providers, adapting to market pressure and to their own expanding responsibilities, have become quite sensitive to privacy concerns.”).

indispensable digital repositories like Internet Service Providers (ISPs), banks, and data-processing centers.¹⁸⁹ Justice Sotomayor sounded the first major alarm bell for the third-party doctrine in her *Jones* concurrence, noting that it might be necessary to reconsider the doctrine entirely given that in the digital age “people reveal a great deal of information about themselves to third parties in the course of carrying out mundane tasks.”¹⁹⁰ She argued that as a matter of social reality, it’s unlikely that people are actually comfortable letting their ISP warrantlessly disclose months or years of browsing history to the government.¹⁹¹

In *Carpenter*, the Supreme Court began to revise the third-party doctrine given the implications of automatic, non-voluntary data collection by indispensable technology.¹⁹² The Court described the “exhaustive chronicle of location information casually collected by wireless carriers,” and said cellphone location data was not “truly shared” given that it both is collected automatically by phone companies, and cellphones are “indispensable to participation in modern society.”¹⁹³ The “qualitatively different nature” of cellphone records, going wherever the cellphone’s owner goes and conveying “a detailed and comprehensive record of the person’s movements,” was the basis of the Court’s refusal to extend the third-party doctrine in *Carpenter*.¹⁹⁴ The *Carpenter* Court would not let the government leverage “the technology of a wireless carrier” to gain location information it could not constitutionally obtain through its own surveillance.¹⁹⁵

189. *See id.* at 176 (arguing that the analytical capabilities of the federal government make current third-party doctrine dangerous to civil liberties).

190. *United States v. Jones*, 565 U.S. 400, 417 (2012) (Sotomayor, J., concurring).

191. *See id.* at 417–18 (Sotomayor, J., concurring) (“I for one doubt that people would accept without complaint the warrantless disclosure to the government of a list of every web site they had visited in the last week, or month, or year.”).

192. *Carpenter v. United States*, 138 S. Ct. 2206, 2223 (2018).

193. *Id.* at 2210 (internal quotations omitted).

194. *Id.* at 2216–17.

195. *Id.* at 2217 (reiterating that an individual has a privacy right in all their physical movements).

B. MDS LITIGATION AND THIRD-PARTY DOCTRINE

In its attempt to limit *Carpenter* to its facts, the district court opinion in *Sanchez* read the third-party doctrine to fatally constrict the plaintiff's constitutional claims.¹⁹⁶ Judge Gee stressed that location data is only tracked by MDS while someone is using a scooter, and that location tracking is “an obvious, core design feature of the service.”¹⁹⁷ While acknowledging that the third-party doctrine had been subjected to scrutiny in *Jones*, Judge Gee said e-scooters were less indispensable than the bank in *Miller* or the phone in *Smith*, neither of which received the protection found for cellphones in *Carpenter*.¹⁹⁸ Accordingly, Judge Gee concluded that the “knowing and voluntary” disclosure by riders of their location data to e-scooter firms vitiated Fourth Amendment protections.¹⁹⁹

On appeal, *Sanchez* argued that *Carpenter* reflects a concern for the automatic collection of sensitive data which should sway courts evaluating MDS to cabin the third-party doctrine.²⁰⁰ Given the similarity between the instantaneous transmission of CSLI data by phones in *Carpenter* and the similarly automatic transmission of GPS data by e-scooters subjected to MDS, *Sanchez* argued that applying the third-party doctrine to uphold MDS would achieve exactly the expansion of third-party doctrine which *Carpenter* rejected.²⁰¹ In response, LADOT argued that *Carpenter* did not change the third-party doctrine in a manner which would help *Sanchez*.²⁰² The agency noted that the e-scooter firms' terms of service generally state that the firms may

196. *Sanchez v. LADOT*, No. CV 20-5044-DMG (AFMx), 2021 WL 1220690, at *5 (C.D. Cal. Feb. 23, 2021) (“Even if Plaintiffs could adequately allege the feasibility of this data disaggregation, their claim would still be barred as a matter of law by the ‘third-party doctrine . . .’”).

197. *Id.* at *4.

198. *See id.* (“Viewed retrospectively through the framing of *Carpenter*, a telephone and checking account are far more essential to modern life (or at least were to life in the 1970s) than rental scooters are today.”).

199. *Id.*

200. Appellant's Opening Br. on Appeal, *supra* note 135, at 37.

201. *Id.* at 39.

202. *See* Def.'s Answering Br. on Appeal at 41 n.8, *Sanchez v. LADOT*, 39 F.4th 548 (9th Cir. 2022) (No. 21-55285) (“Rumors of the third-party doctrine's demise . . . are premature. *See* *Carpenter v. United States*, 138 S. Ct. 138 S. Ct. 2206, 2220 (2018) (“We do not disturb the application of *Smith* and *Miller*”).”).

comply with local regulatory or reporting requirements,²⁰³ although LADOT later acknowledged that future courts might not always be deferential to contracts when defining the scope of a reasonable expectation of privacy.²⁰⁴ LADOT's argument is in conflict with *United States v. Diggs*,²⁰⁵ where a district court found that regardless of the terms of a contract made by the defendant's spouse, a car's user had a reasonable expectation of privacy in their movements.²⁰⁶ LADOT's argument sought to transform boilerplate terms and conditions into specific user permission for granular location tracking.²⁰⁷

Unfortunately, given the privacy implications, Judge Hurwitz and the Ninth Circuit proved receptive to LADOT's arguments about the third-party doctrine in the context of MDS as applied to e-scooters.²⁰⁸ The court noted that the Supreme Court had left the third-party doctrine undisturbed in non-CLSI cases in *Carpenter*.²⁰⁹ Judge Hurwitz concluded that Sanchez knowingly and voluntarily exposed his location data by virtue of renting e-scooters which charge based on trip length.²¹⁰ Hurwitz rested this holding on two facts, the first being that the location data was knowingly disclosed by Sanchez "as a central feature of his transaction with a third party."²¹¹ The second determinative fact was that the privacy policy Sanchez signed as part of using the e-scooter app included language indicating Lyft would share data to "comply with any applicable . . . local law or regulation."²¹² The Ninth Circuit's reliance on vague contractual language and dismissive "knowing and voluntary" analysis are both problematic omens for privacy advocates concerned with MDS'

203. See *id.* at 42–43 (“[U]nder the bold heading ‘How We Use Information,’ the policy informs the rider that ‘[w]e use your information, including information about your location . . . to comply with our legal obligations including to meet regulatory or local law requirements.’”).

204. *Id.* at 49 (“Another is to observe—consistently with the law and the City’s position here—that while the terms of a contract can bear on a person’s reasonable expectation of privacy, they aren’t always dispositive of it.”).

205. *United States v. Diggs*, 385 F. Supp. 3d 648 (N.D. Ill. 2019).

206. *Id.* at 652–64; see also Def.’s Answering Br. on Appeal, *supra* note 202, at 48.

207. See Def.’s Answering Br. on Appeal, *supra* note 202, at 47 (“Following *Smith*, then, an agreement to share information is *precisely* the kind of thing a court should consider in deciding whether the third-party doctrine applies.”).

208. See *Sanchez v. LADOT*, 39 F.4th 548, 552, 560, 562 (9th Cir. 2022).

209. *Id.* at 559.

210. *Id.*

211. *Id.*

212. *Id.*

future application to AVs. There are, however, strong counterarguments to both prongs of Judge Hurwitz's application of the third-party doctrine.

C. APPLYING EVOLVING THIRD-PARTY DOCTRINE TO AN MDS REGIME FOR AVS

The Supreme Court's refusal to extend the third-party doctrine to cover CSLI in *Carpenter* strongly implies that the doctrine should likewise not extend to justify the warrantless imposition of MDS on AVs. The *Carpenter* court looked to the exhaustive, deeply revealing nature of locational CSLI, the automatic transmission of CSLI, and the indispensable nature of cellphones.²¹³ *Carpenter* was "a substantial retreat from the traditional bright-line approach of the third-party doctrine,"²¹⁴ as the Court adopted something akin to a balancing test in which both a person's subjective expectation of privacy and the degree of "voluntary exposure" are considered.²¹⁵

The *Carpenter* Court insisted that an individual's choice to expose data be truly voluntary and active, unlike CSLI, which is generated automatically.²¹⁶ MDS collects geolocational data which facilitates historical inquiry and is just as deep and revealing as CSLI, arguably more so given the greater precision of the navigation equipment on AVs. Location data is transmitted to municipal regulators automatically by virtue of the operation of e-scooters and AVs. In terms of indispensability, AVs are likely to be very nearly as widespread as cellphones in the near-to-mid-term future.²¹⁷ MDS as applied to AVs would likely implicate all of the factors the Court looked to in *Carpenter* including the revealing nature of the relevant data, the automatic transmission of the data, and the indispensability of the technology doing the tracking.

The geolocational data generated by AVs tracked using an MDS-style regime will be precisely the kind of "exhaustive chronicle of location information casually collected" by the

213. *Carpenter v. United States*, 138 S. Ct. 2206, 2219 (2018).

214. Mary-Kathryn Takeuchi, *A New Third-Party Doctrine: The Telephone Metadata Program and Carpenter v. United States*, 94 NOTRE DAME L. REV. 2243, 2244 (2019).

215. *Id.* at 2250.

216. *Id.* at 2253.

217. *See supra* Part I.B.

government that the Court restricted access to in *Carpenter*.²¹⁸ In the same way that a cellphone unceasingly tracks its owner “into private residences, doctor’s offices, political headquarters, and other potentially revealing locales,”²¹⁹ AVs tracked by MDS will have perfect memories of the individual trips they have made right up to the doors of those residences. Riders will be left vulnerable to trip reconstruction attacks by analysts seeking to de-anonymize the visitors’ travel to places like marijuana dispensaries.²²⁰

The court in *Carpenter* did distinguish phones from the suspect’s car in *Jones*, as phones actually travel inside buildings and cars do not.²²¹ But the distinction between traveling inside or right up to a sensitive space is thin and does not relate to the core surveillance concerns that the *Carpenter* court spoke to in terms of tracking a networked object’s user with surgical precision and costlessly querying that data with perfect historical accuracy.²²² The trip-level datasets in MDS, like the CSLI records in *Carpenter*, will be unlimited by “the frailties of recollection,” allowing the government to “travel back in time to retrace a person’s whereabouts,”²²³ and will run against everyone who rides in an AV operated in a fleet. Ultimately, that is likely to be just about everyone,²²⁴ which is why the third-party doctrine should not preclude Fourth Amendment protections for riders in AVs in a MaaS model.

An AV will also transmit geolocation information “by dint of its operation, without any affirmative act on the part of the user . . .,” much like cellphones’ transmission of CLSI in *Carpenter*.²²⁵ The government may have trip-level insight into where citizens leave, where they arrive, and the route they will take to get there,

218. *Carpenter v. United States*, 138 S. Ct. 2206, 2219 (2018).

219. *Id.* at 2218.

220. See BALTRA ET AL., *supra* note 176, at 4 (identifying clusters of e-scooter riders shopping at a dispensary).

221. See *Carpenter*, 138 S. Ct. at 2219 (finding automatic operation of cellphones in sharing CLSI militated against application of the third-party doctrine because it undermined the voluntariness of the data-sharing).

222. *Id.* In theory, being inside of someone’s home gives a recording device the ability to capture more intimate information. However, geolocation data is equally intimate, conveying the same degree of sensitive detail, but about life outside the home.

223. *Id.* at 2218.

224. See *supra* Part I.B.

225. *Carpenter v. United States*, 138 S. Ct. 2206, 2220 (2018).

all down to the decimeter.²²⁶ In the same way that AVs will communicate with their surroundings for functions like emergency braking, detouring, and obeying traffic signals,²²⁷ they will also record their location and communicate it to fleet providers and potentially the government. This programmed response is the equivalent of the automatic interaction of cellphones with cell-site towers in *Carpenter*,²²⁸ meaning the user has no real choice in the vehicle's communication of this information.

User awareness of this feature of AVs should have no impact on how courts consider their potential consent to data collection. The district court in *Sanchez* held that rider awareness of the connectedness of e-scooters to GPS signaled consent to location tracking,²²⁹ but this simplistic logic cuts against the thrust of *Carpenter*. The argument that location tracking is “an obvious, core design feature of the service”²³⁰ and therefore the government should be able to warrantlessly access that data could just as easily justify compelling warrantless access to the location data of a GPS-equipped boat, bicycle, Apple Watch, or for that matter a smartphone. The collection of trip-level geolocation data by AVs will be just as automatic and lacking in affirmative consent from users as was the generation of CSLI in *Carpenter*.

As the idea of “participation in modern society” suggests,²³¹ people rely on cellphones and the apps they support to meet romantic partners, do their jobs, follow the news, and literally find their way in the world with maps and ride-hailing apps. For people relying on AVs for door-to-door service, or door-to-public-transit service, AVs are likely to be nearly as integral to their daily lives.²³² Courts should not treat the AVs, which will move most people from place to place in urban areas, as any more dispensable to human flourishing than cellphones were regarded

226. See JOUBERT ET AL., *supra* note 155, at 6 (explaining that GNSS data could be used to track a person's location based on that person's single use of an AV).

227. See Chanyoung Jung et al., *V2X-Communication-Aided Autonomous Driving: System Design and Experimental Validation*, 20 SENSORS 2903 (2020) (explaining the function of vehicle-to-everything, or V2X, infrastructure).

228. See *Carpenter*, 138 S. Ct. at 2211 (“Second, a cell phone logs a cell-site record by dint of its operation, without any affirmative act on the user's part beyond powering up.”).

229. *Sanchez v. LADOT*, No. CV 20-5044-DMG (AFMx), 2021 WL 1220690, at *3–4 (C.D. Cal. Feb. 23, 2021).

230. *Id.* at *4.

231. *Carpenter v. United States*, 138 S.Ct. 2206, 2220 (2018).

232. See *supra* Part I.B.

in *Carpenter*. Courts certainly should not legitimate surveillance regimes by regarding a beneficial technology that can be avoided with great effort as escapable,²³³ because it could conceivably be difficult to navigate a busy metropolitan area without hailing an AV. Public transit advocates already worry that the cost and convenience of AVs could erode the viability of public transit, meaning consumers might face few options other than ride-hail AVs for distances too far to walk.²³⁴ While *Miller* demonstrated that courts were once willing to justify extending the third-party doctrine to a service as inescapable as retail banking, *Carpenter* represents an about-turn in the doctrine's expansion.²³⁵ Moreover, whereas banks *do* possess very revealing information about their customers, bank records—unlike the data collected by CLSI or from AVs—do not encompass users' constitutionally protected "whole of their physical movements."²³⁶

Boilerplate language used by AV fleet providers might contain language about providing user data to the authorities, but *Carpenter* and public policy both cut against construing template forms to justify MDS as applied to AVs. An instructive e-scooter example is Lime's user agreement, which informs users that Lime may use their location data to "comply with our legal obligations including to meet regulatory or local law requirements."²³⁷ This vague clause doesn't warn users that trip starts, endpoints, and routes will all be sent to the government. Generalities about how powerful firms intend to comply with the law should not abrogate users' rights not to be surveilled. It would also be inequitable for contract law to so undermine the

233. See Tokson, *supra* note 93, at 413 (discussing socially harmful incentives of orienting a privacy regime around the concept of inescapability).

234. Andy Furillo, *Some Say Self-Driving Cars Will Make Transit Obsolete. That's Wrong*, GREATER GREATER WASH. (Oct. 25, 2017), <https://ggwash.org/view/65239/catos-vision-for-autonomous-vehicles-will-ensure-they-fail-heres-how-cities-should-incorporate-them> [<https://perma.cc/P575-Q3PU>]. Furillo argues that libertarians who want to replace public transit with demand-responsive private AV service would create dangerous congestion. *Id.*

235. Compare *United States v. Miller*, 425 U.S. 435, 443 (1976) ("The depositor takes the risk, in revealing his affairs to another, that the information will be conveyed by that person to the Government."), with *Carpenter v. United States*, 138 S. Ct. 2206, 2217 (2018) ("Given the unique nature of cell phone location records, the fact that the information is held by a third party does not by itself overcome the user's claim to Fourth Amendment protection.")

236. *Carpenter v. United States*, 128 S. Ct. 2206, 2210 (2018).

237. Def.'s Answering Br. on Appeal, *supra* note 202, at 43.

Fourth Amendment rights of non-native English speakers and people with lower literacy levels.

The law around contracts and Fourth Amendment rights is ambiguous, as demonstrated by LADOT's efforts in *Sanchez* to distinguish MDS from law enforcement use of a car's GPS in *Diggs*, where a contract did not stop a court from finding that a suspect's Fourth Amendment rights were not waived.²³⁸ *Diggs* stands for the idea that courts must scrutinize the "particular documents" at issue to determine whether there's a reasonable expectation of privacy, even when the third-party doctrine is in play.²³⁹ In *Diggs*, contractual language in which a suspect's wife agreed that a dealership that sold her a car could use a GPS device to find it did not waive his Fourth Amendment rights.²⁴⁰ The *Diggs* court noted that "the government points to no decision holding that the doctrine also applies when a third party is authorized to collect only a limited amount of information but exceeds its authorization and collects much more."²⁴¹ When the government invokes boilerplate terms to bring in the third-party doctrine, courts should employ the same strict constructionism of contracts as the *Diggs* court.

IV. MDS AS APPLIED TO AVs COULD BE A REASONABLE ADMINISTRATIVE SEARCH IF JUSTIFIED BY PURPOSE AND LIMITED

Constitutional administrative searches are characterized by "a substantial concern for the public welfare, no less intrusive way to address [the need for the search], a systematic inspection system based on neutral criteria, and the absence of a prosecutorial purpose."²⁴² The Court's initial administrative search cases, *Camara v. Mun. Court* and *See v. City of Seattle*, also established that such searches must be "authorized and governed by standards, contemplate alternatives, limit discretion in the field, and allow for pre-compliance review."²⁴³ In practice,

238. *See* United States v. Diggs, 385 F. Supp. 3d 648, 653–54 (N.D. Ill. 2019) (citation omitted).

239. *Id.* at 653.

240. *Id.* at 650, 655.

241. *Id.* at 661.

242. SCHULHOFER, *supra* note 103, at 98.

243. G. S. Hans, *Curing Administrative Search Decay*, 24 B.U. J. SCI. & TECH. L. 1, 7 (2018).

courts are deferential to administrative convenience.²⁴⁴ If MDS is a search, it is undoubtedly an administrative search given its programmatic nature, its lack of warrants, the police power goal of safely managing public infrastructure, and the fact that MDS is clearly not aiding the state in its prosecutorial function.²⁴⁵ While administrative search doctrine has loosened, MDS still needs to change to remain constitutional if it is applied to AVs.

A. REVIEW OF ADMINISTRATIVE SEARCH DOCTRINE

Administrative searches are a special regime of warrantless, suspicionless searches which are otherwise constitutional due to “special needs, beyond the normal need for law enforcement, [which] make the warrant and probable-cause requirement impracticable.”²⁴⁶ Examples of sufficient needs include building code inspections and routine highway stops to enforce immigration or drug laws, where the government must discover “latent or hidden conditions, or . . . prevent their development.”²⁴⁷ Some situations automatically present those kinds of special needs, such as public schools,²⁴⁸ government supervisors’ searches of their employees’ desks, the probation system, and supervision of a regulated industry.²⁴⁹ Once special needs are established, the search is then evaluated for reasonableness.²⁵⁰ *Bd. of Educ. of Indep. Sch. Dist. No. 92 v. Earls* requires a three-fold inquiry

244. SCHULHOFER, *supra* note 103, at 99.

245. See *Sanchez v. LADOT*, No. CV 20-5044-DMG (AFMx), 2021 WL 1220690, at *37 (C.D. Cal. Feb. 23, 2021) (“The privacy risks from administrative searches are challenging to apprehend in the abstract. It takes incidents like the TLC re-identification mishap to fully see how and why overbroad government collection for regulation and civil enforcement can lead to privacy and security risks.”).

246. *Griffin v. Wisconsin*, 483 U.S. 868, 873 (1987) (Blackmun J., concurring) (internal quotations and citation omitted).

247. *Nat’l Treas. Emp. Union v. Von Raab*, 489 U.S. 656, 668 (1989).

248. See *Bd. of Educ. of Indep. Sch. Dist. No. 92 v. Earls*, 536 U.S. 822, 822 (2002) (“[A] probable-cause finding is unnecessary in the public school context because it would unduly interfere with maintenance of the swift and informal disciplinary procedures that are needed.”).

249. See *Griffin*, 483 U.S. at 873 (analogizing probation to other situations in which special needs justify administrative searches). Closely regulated industries such as junkyards, liquor stores, and pawnshops are characterized by a long history of close governmental control and inspection of a licensed industry. See *New York v. Burger*, 482 U.S. 691, 700–01, 703–04 (1987).

250. SCHULHOFER, *supra* note 103, at 99 (“Once a ‘special need’ is shown, . . . the Court usually gives extraordinary weight to ordinary administrative convenience when it rules on whether the inspection program strikes a ‘reasonable’ balance between privacy concerns and government objectives.”).

for assessing the reasonableness of administrative searches which takes into account: (1) “the nature of the privacy interest allegedly compromised by the [search],” including whether there’s a reasonable expectation of privacy given the facts; (2) “the character of the intrusion imposed,” such as whether the search is “minimally intrusive”; and (3) “the nature and immediacy of the government’s concerns and the efficacy of the Policy in meeting them.”²⁵¹

Administrative search doctrine, like the third-party doctrine, has come under fire in the digital age.²⁵² The overbreadth that sometimes characterizes administrative searches can easily result in channeling large swaths of personal data to the government via regulation.²⁵³ The early administrative search cases required the government to essentially prove that a given search was the only way to achieve its ends.²⁵⁴ However, over time the reasonableness test outlined above became the dominant paradigm, with something akin to rational basis review.²⁵⁵ That said, when the court last reviewed the administrative search doctrine, in *City of Los Angeles v. Patel*, it enforced the requirement for pre-compliance review as an element of the constitutionality of an administrative search under the Fourth Amendment.²⁵⁶

Social and technological changes mean that administrative searches gather more personal information more easily now than at the doctrine’s inception. Today’s businesses have digital, not analog, files and they are more likely to deal with customers more frequently in more locations, thereby centralizing records in a single database.²⁵⁷ Every time a customer opens an app, they create a record which could be shared with a regulator.²⁵⁸ Proposed changes to the doctrine include strict scrutiny,²⁵⁹ an explicit least intrusive means test,²⁶⁰ or a proportionality inquiry.²⁶¹ Given the status quo of strong regulatory power to

251. *Bd. of Educ. of Indep. Sch. Dist. No. 92*, 536 U.S. at 824.

252. Hans, *supra* note 243, at 20.

253. *Id.* at 38.

254. *Id.* at 8.

255. *Id.* at 10.

256. *Id.* at 13 (referencing *City of Los Angeles v. Patel*, 576 U.S. 409 (2015)).

257. *Id.* at 15.

258. Hans, *supra* note 243, at 15.

259. *Id.* at 17.

260. *Id.* at 18–19.

261. *Id.* at 21.

compel sensitive data transfers, reshaping the administrative search doctrine down one of these paths could be warranted. For the purposes of this Note, however, the case law is sufficiently rich in terms of courts requiring the government to at least consider less intrusive alternatives, and that such considerations are overpoweringly forceful in the context of an MDS regime as applied to AVs.

B. MDS LITIGATION AND ADMINISTRATIVE SEARCH DOCTRINE

The *Sanchez* litigation demonstrates that deciding whether MDS as applied to AVs is a reasonable administrative search will depend on both the intrusiveness of the search and the strengths of the government interests at play. First, the district court held that re-identification would “at the absolute most” reveal “knowledge of the places that Plaintiffs have traveled to on rental scooters in Los Angeles.”²⁶² In her order, Judge Gee portrayed this violation of the plaintiffs’ privacy as non-intrusive, because the search would be difficult and at any rate the plaintiff had voluntarily surrendered the data under the third-party doctrine.²⁶³ Second, Judge Gee identified several government interests including diminishing clutter, prohibiting e-scooters without safety features, and ensuring street access for persons with disabilities.²⁶⁴ While the city may not have articulated why it needed precise route data, Judge Gee concluded that it seemed “self-evident that understanding where scooters tend to transit and park would help the City determine how and where to adjust the rules of the road to accommodate them. . . .”²⁶⁵ Government interests at stake in the e-scooter program included equity, aesthetic, safety, and planning considerations.²⁶⁶ If MDS were considered an administrative search, per Judge Gee, it was justified by these legitimate government interests.²⁶⁷

262. *Sanchez v. LADOT*, No. CV 20-5044-DMG (AFMx), 2021 WL 1220690, at *5 (C.D. Cal. Feb. 23, 2021).

263. *Id.*

264. *Id.*

265. *Id.*

266. *Id.* at 7 (“At best, the scooters could ‘represent[] a novel and potentially useful form of transit,’ but at worst, they ‘clutter[] city sidewalks, lack[] safety features, and interfere[] with disabled access to city streets.’”).

267. *Id.* at 8.

Sanchez argued that MDS as applied to e-scooters was too invasive to be justified under administrative search doctrine, and lacked an adequate governmental purpose.²⁶⁸ Sanchez emphasized that MDS tracks “where he lives, works, and travels, and with whom and how he associates with others.”²⁶⁹ Meanwhile, Sanchez claimed LADOT lacked a reasonable governmental purpose given its stated plans “to experiment with data collection, not to resolve any pressing or legitimate transportation planning need.”²⁷⁰ While administrative searches ought to be subordinated to narrow, compelling objectives, and limited in a fashion consistent with the governmental need,²⁷¹ the district court wrongly assumed that knowing where e-scooters park is necessary to regulate the right of way.²⁷²

The need for more transparent government articulation of its intent in using data garnered through MDS is apparent in LADOT’s weak justifications on appeal for its experimental plans. On appeal, LADOT relied heavily on *Naperville Smart Meter Awareness v. City of Naperville*, in which the smart meter program used by the city of Naperville, Illinois to measure energy usage by citizens was upheld against privacy claims.²⁷³ The *Naperville* court emphasized the non-invasiveness of the meters, on the one hand, and the government interests on the other, which it concluded were very strong since the meters facilitated rapid recovery from outages, reduced strain on the grid, and decreased labor costs.²⁷⁴ Seemingly conscious that it was on weak ground in terms of its lack of an articulated government need to justify wide-ranging experimentation with MDS data, LADOT noted that in *Naperville*, the Seventh Circuit found the smart meter regime justified on the basis of just “a journal article about smart metering to describe its benefits.”²⁷⁵ But even that facile justification was more of a concrete justification than LADOT provided for MDS.

268. Appellant’s Opening Br. on Appeal, *supra* note 135, at 47.

269. *Id.* at 44–45.

270. *Id.* at 45–46 (internal quotation marks omitted).

271. *United States v. Bulacan*, 156 F.3d 963, 968 (9th Cir. 1988).

272. See Appellant’s Opening Br. on Appeal, *supra* note 135, at 46.

273. Def.’s Answering Br. on Appeal, *supra* note 202, at 54 (citing *Naperville Smart Meter Awareness v. City of Naperville*, 900 F.3d 521 (7th Cir. 2018)).

274. *Id.* at 55–56.

275. *Id.* at 56.

On appeal, the Ninth Circuit did not reach the issue of whether MDS as applied to e-scooters was a reasonable administrative search. Judge Hurwitz explained that evaluating the lower court's alternative determination that MDS was a justified administrative search was unnecessary because the Ninth Circuit was resting its holding on the narrow grounds that the third-party doctrine squarely applied to Sanchez under the facts of the case.²⁷⁶ While the Ninth Circuit did not take the privacy-protective measure of rejecting or at least scrutinizing Judge Gee's determination that MDS as applied to e-scooters was justified "in the context of safety and administrative regulations,"²⁷⁷ it also refrained from affirming her reasoning. The Circuit's wise judicial restraint leaves the door open for other courts to hold that MDS as applied to AVs is, at least as constituted under a given municipal government's policies, unreasonable.

C. APPLYING ADMINISTRATIVE SEARCH DOCTRINE TO AVS DEPLOYED IN MAAS MODEL

Were MDS as it exists to be translated with no changes to a world of commercially deployed AVs, the major constitutional objections to such an administrative search regime would concern the lack of a clear governmental purpose, as well as the intrusiveness of the search. *Board of Ed. of Independent School Dist. No. 92* restates the familiar principle that "reasonableness under the Fourth Amendment does not require employing the least intrusive means," given that a requirement to constantly seek out a less invasive alternative could fatally undermine law enforcement.²⁷⁸ But the degree of intrusiveness relative to alternatives is nonetheless an important part of determining whether an administrative search is constitutional.²⁷⁹ Current doctrine gives the government only the "latitude to choose among

276. *Sanchez v. LADOT*, 39 F.4th 548, 561 (9th Cir. 2022).

277. *Id.* at 561 n.10 (quoting *Bd. of Educ. of Indep. Sch. Dist. No. 92 v. Earls*, 536 U.S. 822, 829 (2002)).

278. *Bd. of Educ. of Indep. Sch. Dist. No. 92*, 536 U.S. at 837.

279. See SCHULHOFER, *supra* note 103, at 98 (explaining that an "independent judicial assessment" of a search's reasonableness is required even when there is no prosecutorial purpose for the search).

reasonable alternatives.”²⁸⁰ MDS is far too experimental and expansive to justify its granular focus, especially when less intrusive alternatives are available.

LADOT does not need to rely on individualized suspicion, but the law suggests it should have a burden to better explain the reasons for its conduct in order for MDS as applied to AVs to be constitutional. When scrutinizing administrative searches, “purpose is often relevant when suspicionless intrusions pursuant to a general scheme are at issue.”²⁸¹ Admittedly, the early stringent requirements in administrative search doctrine have relaxed. Courts don’t rigidly require agencies to review alternatives, limit executive discretion during the search itself, and facilitate pre-compliance review in all instances. But case law suggests that for a modified version of MDS to remain constitutional as applied to AVs, regulators should consider better justifying their need for the data and limiting the intrusiveness of MDS relative to alternatives.

Administrative searches must have some governmental purpose to be constitutional, typically an exercise of the police power for “health and safety reasons,” but MDS in general and as applied to AVs has an unacceptably vague purpose. LADOT has made highly enigmatic statements about its intent to date. LADOT General Manager Seleta Reynolds, who spearheaded the development of MDS, described e-scooters as “a pretty interesting sandbox to start experimenting.”²⁸² The regulatory sandbox concept allows open-ended, iterated testing of how new business models and technology interact with prototype legal frameworks²⁸³—the opposite of the limited, articulated purpose that is the ideal justification for an administrative search. LADOT at no point explained to Jump Scooters, whose operating permit it revoked over MDS reporting non-compliance, why it

280. Eve Brensike Primus, *Bringing Clarity to Administrative Search Doctrine: Distinguishing Dragnets from Special Subpopulation Searches*, 39 SEARCH & SEIZURE L. REP. 61, 70 (2012).

281. *City of Indianapolis v. Edmond*, 531 U.S. 32, 47 (2000).

282. Zipper, *supra* note 18.

283. *Regulatory Sandbox: What Is It and What Projects Does It Support?*, WORLD FUNERAL NEWS (Sept. 29, 2021), <https://news.wfuneralnet.com/en/regulatory-sandbox/> [<https://perma.cc/6BEX-FRGB>]. In the fintech context, jurisdictions such as the United Kingdom and Singapore have employed a regulatory sandbox approach to identify what regulations best encourage financial innovation. *Id.*

needed real-time data.²⁸⁴ The agency also did not explain why its safety, equity, and aesthetic concerns could not be addressed through aggregated data or data provided on a 24-hour delay.²⁸⁵ LADOT personnel testified that the agency did not need trip start or end data to enforce Jump's e-scooter permit.²⁸⁶

The status quo justification for MDS is not good enough to constitutionally sustain the expansion of the program to AVs in the future. In Los Angeles, MDS is deployed for vague ends to give LADOT the chance to think up the questions it wants to ask. As it currently stands, MDS is regulation by "unknown unknowns."²⁸⁷ Such a weak justification should not suffice to subject passengers transiting through every large municipal area that deploys MDS to regulate AVs to real-time requests for their trip origins, destinations, and daily requests for their trip routes in the future.

Agencies using MDS to regulate AVs should be required to supply the kind of health and safety justification that has historically supported constitutional administrative searches. Contrasting sharply with constitutional searches related to fire safety, prisons, or probation systems, there is no specific police power motive proffered to support MDS' use in the free-for-all evolving use cases in Los Angeles. For the Supreme Court to even conduct the kind of analysis of purpose that it did in *City of Indianapolis v. Edmond*,²⁸⁸ agencies using MDS to regulate AVs must indicate what that purpose is. Plausible examples in the AV context might include something like identifying hot zones of AV usage to reduce congestion linked to accidents. That potential

284. See Complaint, *supra* note 21, ex. A at 23–24 (“[T]he City insists on propelling JUMP to provide this data to the City in real-time or have its permit revoked without ever explaining to JUMP, to the citizens of Los Angeles, to the users of e-bikes or e-scooters on its streets, or even in its pretrial brief why such real-time surveillance is necessary or appropriate.”).

285. *Id.* at 27.

286. *Id.* at 75. LADOT's chief sustainability officer acknowledged here that real-time trip start data was not strictly necessary for the agency to understand trends in e-scooter location data, or enforce scooter caps in given areas. *Id.*

287. *Pentagon Briefing*, CNN (Feb. 12, 2002), <https://transcripts.cnn.com/show/se/date/2002-02-12/segment/04> [<https://perma.cc/T5CU-L752>]. Secretary Rumsfeld famously said, regarding the possibility that Iraq would supply weapons of mass destruction to terrorists, that “We also know there are known unknowns. That is to say, we know they're some things we do not know. But there're also unknown unknowns; the ones we don't know we don't know.” *Id.*

288. *City of Indianapolis v. Edmond*, 531 U.S. 32, 46–47 (2000) (inquiring into programmatic purpose given that the government's general scheme of drug interdiction checkpoints lacked individualized suspicion).

justification aligns with the limited public safety-oriented role the Supreme Court envisioned for administrative searches when they were formalized by the Warren Court.²⁸⁹

Most importantly, agencies must consider the availability of less intrusive alternatives, which means more anonymous alternatives. The status quo is that MDS “collects precise location data associated with *every single rider* of scooters within the City, *every single time* they ride such a vehicle” and “at the maximum precision generated by the vehicles,”²⁹⁰ with the only real safeguard being that it doesn’t collect information directly identifying riders such as their name.²⁹¹ This is an unsupportable use of regulatory technology that will have real-time insight into the geolocation data of every passenger in an AV in a MaaS system.

Given the ease of de-anonymizing human mobility traces, courts should and will likely conclude, in line with *Leaders of a Beautiful Struggle*, that additional formal privacy safeguards are constitutionally required for this administrative search regime to remain “reasonable.” What Judge Gee described as “at the absolute most, knowledge of the places that Plaintiffs have traveled to on rental scooters in Los Angeles”²⁹² will, in the context of widespread adoption of AVs, be knowledge of the places that most people travel in robotaxis wherever any city chooses to employ this technology to regulate them. This data will be maintained historically, about everyone, with no clear data deletion obligations in place, if cities choose to follow Los Angeles’ example. Such an ongoing administrative search should not be deemed reasonable. As Judge Engelmayer wrote in the digital age administrative search case *Airbnb, Inc. v. City of New York*, “The universality of the Ordinance’s monthly production demand . . . the sheer volume of guest records implicated, and the

289. Explaining the Court’s reasoning in *Camara v. Municipal Court*, Professor Schulhofer wrote that that key Warren Court administrative search decision reflected the presence of a public safety concern, systematic selection of targets based on neutral criteria, and no intent to uncover a crime. SCHULHOFER, *supra* note 103, at 96–97.

290. Complaint at 3, *Sanchez v. LADOT*, No. CV 20-5044-DMG (AFMx), 2021 WL 1220690 (C.D. Cal. Feb. 23, 2021), *aff’d*, 39 F.4th 548 (9th Cir. 2022).

291. *Id.* at 8.

292. *Sanchez*, 2021 WL 1220690, at *5.

Ordinance's infinite time horizon all disfavor the Ordinance when evaluated for reasonableness under the Fourth Amendment."²⁹³

Reasonable, less intrusive alternatives to using MDS to regulate AVs exist. The main problem with real-time reporting of geolocation data is that people can be too easily de-anonymized, particularly when historical data is retained for a long time. As a preliminary manner, cities can implement data deletion policies. While courts might accept a range of potential deletion solutions, they must reject the idea that data about how millions of people consume an essential service like shelter or transportation can be retained indefinitely, as one court has already done in AirBnB's suit against New York City.²⁹⁴ As to alternatives to recording trip-level data that has no privacy safeguards beyond not recording a rider's name, easy substitutes abound that render de-anonymization more challenging while still providing useful information for cities. For example, researchers who swapped segments of taxi route data generated unchanged aggregate insights while ensuring that users' home locations and frequently visited locations could not be re-identified.²⁹⁵ Other alternatives for anonymizing data from "cyber physical systems" like mobility data include cryptographic techniques, k-anonymity, and differential privacy.²⁹⁶ In practice, public servants may find that one of these techniques works better than others: probably differential privacy, which is gaining real momentum as a preferred technique among experts.²⁹⁷ Experimenting to find a

293. *Airbnb, Inc. v. City of New York*, 373 F. Supp. 3d 467, 491 (S.D.N.Y. 2019) (describing the New York City ordinance as "the antithesis of a targeted administrative subpoena for business records").

294. *See id.* (emphasizing that a legislative edict to issue a sweeping monthly subpoena is unconstitutional).

295. Julián Salas et al., *SwapMob: Swapping Trajectories for Mobility Anonymization*, in *PRIVACY IN STATISTICAL DATABASES* 331, 331–46 (2018) (demonstrating that anonymized data still provides useful insights about the directions and lengths of taxi trips).

296. MUNEEB UL HASSAN ET AL., *DIFFERENTIAL PRIVACY TECHNIQUES FOR CYBER PHYSICAL SYSTEMS: A SURVEY* (2019), <https://arxiv.org/pdf/1812.02282.pdf> [<https://perma.cc/822J-GLFZ>]. Encryption seeks to render data inaccessible to users who lack access keys. *Id.* at 2. Differential privacy introduces statistical "noise" to prevent any given search of a database from generating enough information to identify an individual. *Id.* at 6. Associated techniques like k-anonymity are statistical privacy protection methods that seek to anonymize big datasets while still facilitating rapid querying for research purposes. *Id.* at 13.

297. *See id.* at 1. *See also* Maxime Agostini and Michael Li, *Implement Differential Privacy to Power Up Data Sharing and Cooperation*, *TECHCRUNCH* (Feb. 24, 2022), <https://techcrunch.com/2022/02/24/implement-differential-privacy-to-power-up-data-sharing-and-cooperation/> [<https://perma.cc/D65V-E2UM>].

model which sufficiently protects people subject to universal surveillance from de-anonymization will require patience from courts as officials engage in good-faith iterated trials. Judges will need to deepen their understanding of privacy, data, and encryption, while not dismissing the concerns the public has about government surveillance out of hand. At a minimum, however, applying a technique like MDS to commercially deployed AVs will not be reasonable unless some basic steps are taken to shield the identities of the users of what will become an indispensable technology.

CONCLUSION

The current trajectory MDS is on will intersect with AVs in the next decade or so. If, and in all likelihood when, AVs are ubiquitous, that intersection will create a high-stakes standoff between the state's need to govern and the privacy rights of its citizens. Managing the negative externalities AVs are likely to impose on cities around the world, alongside the benefits from a quality of life, convenience, and productivity viewpoint, will be a whole-of-government task for cities. But it will not entitle them to warp Fourth Amendment search, third-party, or administrative search doctrine beyond recognition, nor to casually collect infinite pools of pinpoint data. Municipal governments should be humble enough to explain what they are doing and limit themselves in the process, for both legal and practical reasons. Whatever appropriate best practices ultimately do emerge, regulators will have to accept that the ease of identifying the individuals represented by ostensibly anonymous mobility traces means that trip-level data is not made secure simply by stripping away the names of passengers. While cities might lament the loss of flexibility, all indications suggest that the governmental functions MDS aims to support will not need access to unaltered trip-level data from AVs, while constitutional law cannot abide by it.