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CUBULAR CORRIDORS: MERGING VERTICAL URBANISM WITH ACCESSIBILITY INITIATIVES

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INTRODUCTION

Planning today strives to understand concurrently the nature of "urbanity" and "accessibility," conceiving structures to advance a community's quality of identity, cosmopolitan cultural ambience and movement, thereby informing strategic urban management.[1] America's urban planners, together with transportation regulators, must reimagine rights of

[1] *See generally* PATSY HEALEY, URBAN COMPLEXITY AND SPATIAL STRATEGIES: TOWARDS A RELATIONAL PLANNING FOR OUR TIMES 207 (Cliff Hague, Tim Richardson, & Robert Upton eds., 2007).

way as conveyors of people and goods along busy Corridors.[2] Urban land use policies and transportation infrastructure networks are inextricably intertwined, as they have been since the era of the first electric streetcars.[3] Studies demonstrate that "accessibility saturation" retards densification endeavors.[4] Both the durability of the built environment and severe costs of demolishing and reconstructing developed areas—measured both by out of pocket expense and loss of sustainability represented by teardown and "redevelopment"—slow this municipal trend.[5]

In short, further transportation network improvements have only marginal impacts unless either land use policies or transportation measures take prohibitively costly directions, such as increasing mass transit service frequency, or imposing more fuel taxes or congestion pricing to use a Corridor.[6] Alternatively, seemingly radical initiatives[7] like selling public lands to an enterprise having a transportation authority prerogative entitling it to develop transit-surrounding parcels (or selling parcels to the private sector for development),[8] repurposing brownfields, or implementing performance zoning standards[9] will spur denser land development.

Public emphasis on increasing accessibility seizes on emergent devices equipped with artificial intelligence and the Internet of Things ("IoT"), moving travelers faster and less stressfully without an emphasis

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[2] A "Corridor" refers to a three-dimensional right of way in which an at-natural-grade pavement surface occupies neither the bottom nor the top of this volumetric space. *See* the Lexicon, *infra*, for other terms of art used in this Paper.

[3] *See generally* Dena Kasraian et al., *Long-Term Impacts of Transport Infrastructure Networks on Land-Use Change: An International Review of Empirical Studies*, 36 TRANSP. REV. 772, 772–73 (2016) (noting that the relationship between land use policy and transportation infrastructure is best understood as a feedback cycle, concurrently dynamic and market-driven).

[4] *See id.* at 786–87.

[5] *See id.*

[6] *See id.* Congestion pricing arises when a local government imposes a fee on vehicles entering into the CBD's locally defined "center," creating a disincentive for using crowded streets. *See* ROBERT KROL, TOLLING THE FREEWAY: CONGESTION PRICING AND THE ECONOMICS OF MANAGING TRAFFIC 18–19 (May 2016), https://www.mercatus.org/system/files/Krol-Congestion-Pricing-v1.pdf [https://perma.cc/7292-LYKA]; SAMUEL I. SCHWARTZ & KAREN KELLY, NO ONE AT THE WHEEL: DRIVERLESS CARS AND THE ROAD OF THE FUTURE 86, 92, 208 (2018); Paul Berger, *Cities Look to New York to Lead the Way on Traffic Congestion*, WALL ST. J. (Mar. 27, 2018), https://www.wsj.com/articles/new-york-debates-congestion-pricing-as-other-cities-watch-1522143000 [https://perma.cc/KH98-6LJY].

[7] *See* Kasraian et al., *supra* note 3, at 786–87.

[8] BRUCE KATZ & JEREMY NOWAK, THE NEW LOCALISM: HOW CITIES CAN THRIVE IN THE AGE OF POPULISM 122–26 (2018).

[9] Michael N. Widener, *Animating Performance Zoning at Sustainability's Competitive Edge*, 29 GEO. ENVTL. L. REV. 647, 656–71 (2017).

on ensuring the traveler's knowledge of operations and basic skills needed to exploit means of mobility.[10] Alarmingly, many municipal dwellers assume the Internet of Things, coupled with motorized vehicle ("moto") innovations and artificial intelligence, collectively resolve all problems for conveyancing of goods and human mobility.[11] In developed countries, the widespread hope is that human agency becomes inconsequential in the realm of permanent solutions to traffic movement.[12] Citizen trust comes later, as regulation matures.[13] Attention to regional planning, especially, is conspicuously missing from this current "techno-deference" environment.[14] Two innovations in moving objects illustrate results of ignoring linkages between planning and Corridor infrastructure in favor of reliance solely on technology to facilitate tomorrow's traffic movement through Corridors: autonomously controlled vehicles[15] and

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[10] *See* EVRICK BROWN & TIMOTHY SHORTELL, WALKING IN CITIES: QUOTIDIAN MOBILITY AS URBAN THEORY, METHOD AND PRACTICE 4 (2015).

[11] *Cf.* Michael J. Lewis, *"The Road Ahead: Reimagining Mobility" Review: Future Imperfect*, WALL ST. J. (Jan. 10, 2019), https://www.wsj.com/articles/the-road-ahead-reimagining-mobility-review-future-imperfect-11547153030 [https://perma.cc/ZE7W-6WBA] (asking whether, in regard to product development, "is it possible that a great array of discrete commercial products, designed in isolation, will act collectively to bring about a better society?").

[12] *See generally* Dirk Heinrichs, *Autonomous Driving and Urban Land Use*, *in* AUTONOMOUS DRIVING: TECHNICAL, LEGAL AND SOCIAL ASPECTS 213 (Markus Maurer, J. Christian Gerdes, Barbara Lenz, & Hermann Winner eds., 2016), https://www.researchgate.net/publication/303480949 [https://perma.cc/WF6B-TXZV] (last visited Oct. 28, 2019). *But see* Nidhi Kalra & Susan M. Padock, *Driving to Safety: How Many Miles of Driving Would it Take to Demonstrate Autonomous Vehicle Reliability?*, 94 TRANSP. RES. PART A: POL'Y & PRAC. 182, 182–83 (2016) (noting it may not be possible to establish with certainty the safety of autonomous vehicles, as vehicles would have to be driven hundreds of millions of miles, and sometimes hundreds of billions of miles, to demonstrate their reliability in terms of fatalities and injuries).

[13] *See* Hayley Ringle, *Hitting the Brakes*, 38 PHX. BUS. J. 4, 4–6 (2018). One source of consumer anxiety is that autonomous vehicles must "choose" in some scenarios whether to harm pedestrians or do harm to riders in the vehicle to escape crashing into pedestrians. *See* Alexandros Nikitas et al., *How Can Autonomous and Connected Vehicles, Electromobility, BRT, Hyperloop, Shared Use Mobility and Mobility-As-A-Service Shape Transport Futures for the Context of Smart Cities?*, 1 URB. SCI. 1, 5 (2017), https://www.mdpi.com/2413-8851/1/4/36/htm [https://perma.cc/N5Y3-QEGZ]. The intelligent agent has no moral compass, only algorithms on which to base the autonomous vehicle's "decision."

[14] Anthony Townsend warns of the limits upon this deferential attitude toward technology. *See* ANTHONY M. TOWNSEND, SMART CITIES: BIG DATA, CIVIC HACKERS, AND THE QUEST FOR A NEW UTOPIA 231, 285 (2013) (noting that urban design is as much art as science and is idiosyncratic, and that the initial "tenet of our new civics is that we should never default to smart technology as the solution").

[15] To be sure, autonomy has "levels"; the anxiously anticipated gold standard is Level 4 AV technology that does not require human inputs, recognizes objects in the right of way, or, if such recognition is not possible, communicates to a data center its "confusion,"

delivery drones.[16] (Elon Musk's and his competition's "Hyperloop" systems may soon add a third disrupter to conventional movement "patterns."[17])

Mechanistic pattern-implementation agents will increase inner-city vehicular throughput, goes the argument. But municipal populations will grow and, therefore, motos will increase in numbers in Corridors.[18] Even with "car-sharing services"—shared vehicle programs like Zipcar or Co-wheels Car Club[19]—or with taxi swarms, it remains illogical to presume

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allowing its software to add that object to its catalog in the next update. *See* Dan Neil, *Could Self-Driving Cars Spell the End of Ownership?*, WALL ST. J. (Dec. 1, 2015), https://www.wsj.com/articles/could-self-driving-cars-spell-the-end-of-ownership-1448986572 [https://perma.cc/GR8N-3A2U]. To be sure, well-informed persons tell us Level 4 technology is not anywhere near ready for deployment. *See 4 Things for Transit Agencies to Remember in a World of Driverless Car Hype*, TRANSITCENTER (May 3, 2018), https://transitcenter.org/2018/05/03/4-things-transit-agencies-remember-world-driverless-car-hype/ [https://perma.cc/6U25-S4W8].

[16] Uber Technologies, Inc. intends to make food-delivery drones operational in multiple markets by 2021 under the "code name" UberExpress. *See* Greg Bensinger & Andy Pasztor, *Uber Ambitiously Eyes 2021 for Food-Delivery Drones Launch*, WALL ST. J. (Oct. 21, 2018), https://www.wsj.com/articles/uber-ambitiously-eyes-2021-for-food-delivery-drones-launch-1540163425 [https://perma.cc/8XM2-LUE7].

[17] Of course, this "Hyperloop," a magnetically powered, seven hundred mile per hour mass-transit product levitating on air or magnetic cushions in low-pressure tubes, which supposedly will connect highly urbanized areas like Los Angeles and San Francisco, must be "right-sized" for urban usage, especially on express routes from the exurbs to downtown or like commercial centers. Will Nicol, *What is the Hyperloop? Here's everything you need to know*, DIGITAL TRENDS (Oct. 6, 2018), https://www.digitaltrends.com/cool-tech/what-is-the-hyperloop/ [https://perma.cc/D8JL-F74A]. And the State of Missouri is considering a public-private partnership with Virgin Hyperloop One for a route tracing the I-70 corridor from St. Louis to Kansas City. *See* Jeff Yoders, *Black & Veatch Study Finds KC to St. Louis Hyperloop Feasible*, ENG'G NEWS-REC. (Oct. 29, 2018), https://www.enr.com/articles/45697-black-veatch-study-finds-kc-to-st-louis-hyperloop-feasible?v=preview [https://perma.cc/N6X4-7525]. Dubai intends to afford the first public application of the Hyperloop, as it plans (and has invested) in Musk's company in order to link Dubai with Abu Dhabi at approximately 375 miles per hour in low pressure tubes. *See* Nicholas Parasie, *Dubai Aims to Be the Transportation City of Tomorrow*, WALL ST. J. (Apr. 13, 2017), https://www.wsj.com/articles/dubai-aims-to-be-the-transportation-city-of-tomorrow-1492092911 [https://perma.cc/9KCE-JY8D].

[18] John D. Stoll & Adrienne Roberts, *Car Sales to Top 90 Million Globally for First Time*, WALL ST. J. (Jan. 3, 2018), https://www.wsj.com/articles/car-sales-to-top-90-million-globally-for-first-time-1514920642 [https://perma.cc/E6RW-LC5P].

[19] Car sharing is self-service and app-based; here, electric-powered autos distributed over the city are rented for short durations typically not exceeding a few hours. *See* Nikitas et al., *supra* note 13, at 12. Autolib maintained a Paris fleet of 4,000 all-electric cars for public use by paid subscription to its network of parking and charging stations. *See id.* The next advance in electric vehicle charging will be wireless induction, with charging on a "pull your vehicle into the charging plaza" basis; but these installations are a few

a basically static number of operators will exist as "market conditions" force out unsuccessful participants and barriers to entry rise. Concluding that newly funded and organized participants will avoid the marketplace is a fallacy given potential "rebound effects."[20] The truth is that ride-sharing vehicle operators owning their own motos will increase traffic congestion unless infrastructure adjustments corral the externalities of increased participation.[21] Further, only so much throughput is possible in a single right of way. A maximum traffic carrying capacity exists along established road beds in cities.[22] Whether or not the population grows radically, conventional acts such as increasing lane numbers will not compensate for this increased participation in right of way usage.

Accessibility and interconnectivity, both physically and relationally through technology advances, are critical qualities of place for cultivation in the densely urbanized space of megapolitan areas.[23] How, therefore, should infrastructure capacity be measured, assessed for future demands, and regulated? First, land planners must eliminate silos carving up spatial regulatory authority of Corridors, melding their work with that of transportation infrastructure regulators.[24] All regulators and experts must share all available data. The "Smart Mobility" dimension of the so-called "Smart City" mandates that data gathered be made readily accessible to all stakeholders in the accessibility realm.[25] Therefore, no generating agency

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years' distance. *See Paris motor show 2018: full report*, AUTOCAR (Oct. 2, 2018), https://www.autocar.co.uk/paris-motor-show-2018 [https://perma.cc/ZB7X-XP9H].

[20] *See* Heinrichs, *supra* note 12, at 227.

[21] *See The right way to handle congestion*, THE ECONOMIST (Aug. 25, 2018), https://www.economist.com/leaders/2018/08/25/the-right-way-to-handle-congestion [https://perma.cc/635X-K3XY] (London rush-hour traffic slowed after 2013–16 introduction of ride-hailing firms' vehicles); Angie Schmitt, *Uber and Lyft Are Cannibalizing Transit in Major American Cities*, STREETSBLOG USA (Oct. 13, 2017), https://usa.streetsblog.org/2017/10/13/uber-and-lyft-are-cannibalizing-transit-in-major-american-cities/ [https://perma.cc/RAH4-8FBT]. Alternatively, governments are being invited to consider the number of participants in the shared-ride space. *See* Rémi Tachet et al., *Scaling Law of Urban Ride Sharing*, 7 NATURE SCI. REP. Art. No. 42868 (2017), https://www.nature.com/articles/srep42868 [https://perma.cc/YUW5-5N48].

[22] *Cf.* Tongfei Li & Jianjun Wu, *Carrying Capacity of Urban Traffic Network: Modeling and Empirical Analysis* (2013), https://www.researchgate.net/publication/281456294; Xiaoyan Li & Zhongke Shi, *Calculation Models of the Urban Traffic Environmental Carrying Capacity*, 1ST INT. CONF. TRANSP. ENGINEERING (ICTE 2007) 4044–47 (2007).

[23] *See* HEALEY, *supra* note 1, at 212.

[24] *Cf.* Michael Neuman, *Does Planning Need the Plan?*, 64 J. AM. PLAN. ASS'N 208, 211 (1998), http://www-personal.umich.edu/~sdcamp/up540/temporaryreadings/Neuman,%201998%20(JAPA)%20plan.pdf [https://perma.cc/UL7S-PCD5].

[25] *See Smart Mobility*, SMART TRANSP. ALL., http://smart-transportation.org/smart-mobility/ [https://perma.cc/2XYK-6Z6K] (last visited Oct. 28, 2019) (noting disadvantages

can be sole conservator of its data produced and analyzed. Transportation planning at grade is not the exclusive province of traffic engineers,[26] and their "dominion" over data must not be conceded by other spatial regulating experts (nor should any other stakeholder claim sole rights of curation). While engineers tinker with routes and metrics of mobility, for instance, they are not engaged in the *storage* of vehicles, an instrumental planning criterion indeed, since at least twenty hours daily the typical passenger vehicle sits motionless.[27] Plans must have the inputs of all engaged experts and affected citizens for the planning products truly to be comprehensive, sustainable, and successful.[28]

This Paper proposes five premises, or "principles," of urban planning to be applied as modified to fit Corridor movement conditions in major urban areas where densification is a core municipal intention. First, however, I review the nature of the traffic problems affecting heavily traveled streets in urban cores today, referring to such key rights of way as "Corridors" throughout. Next, I explain why municipalities cannot bank on assigning transportation infrastructure planning to technocrats promoting artificial intelligence and the Internet of Things as the lone ingredients in Corridor management. Then, I outline five "cubular" principles of land planning for communities grappling with reduced accessibility and other issues affecting municipal quality of life from poor movement of motorized devices ("motos"), velocipedes ("velos"), and persons walking alongside city streets.

I. WHAT'S THE PROBLEM?

> Reducing empty vehicle miles to the bare minimum is . . . the ultimate math problem. How can you get a system to work so that you have the least amount of vehicles serving

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of planning being segmented into subdisciplines like transportation, urban design, and land use thus suffering from "sectorization").

[26] *See Mobility*, CTR. FOR SMART CITIES, http://www.ict-smart-cities-center.com/en/smart-cities/mobilitaet/ [https://perma.cc/Z7GA-UQUN] (last visited Oct. 28, 2019).

[27] *See* Medhi Nourinejad et al., *Designing parking facilities for autonomous vehicles*, 109 TRANSP. RES. PT. B 110, 110 (2018), http://uttri.utoronto.ca/files/2017/09/Designing-Parking-geometricDesign.pdf [https://perma.cc/3ZCL-VRMG] (noting 95 percent of vehicle's life is spent in a parking spot); Neil, *supra* note 15.

[28] *See* THERESE F. TIERNEY, INTELLIGENT INFRASTRUCTURE: ZIP CARS, INVISIBLE NETWORKS AND URBAN TRANSFORMATION 2–7, 19, 23–25 (2017). I am not suggesting that all transportation infrastructure planning must be done by local jurisdiction plebiscite. Deliberative polling will suffice for most decisions of this magnitude. *See, e.g.*, JAMES S. FISHKIN, DEMOCRACY WHEN THE PEOPLE ARE THINKING: REVITALIZING OUR POLITICS THROUGH PUBLIC DELIBERATION 122–24, 163–66, 198–208 (2018).

> the most amount of people? . . . Where we should be, from a societal point of view, is [an arrangement where] autonomous jitneys pick people up, drive them, have maximum utilization, and don't park for very long except for recharging.[29]

How do people move around in teeming Central Business Districts ("CBDs") without turning those districts into quagmires of gridlock that generate airborne and pavement-coating pollutants? In an era where billions of persons move into conurbations with vast acreages of buildings and rights of way, this becomes the essential question within the transportation infrastructure landscape. Public policy and regulation must accommodate movement of vehicles, private and public, and their temporary storage when they pause in these CBDs. This truism persists in the age of IoT and AI "computation" of traffic management logistics.[30]

Rights of way in 2020 must anticipate a variety of types of human and freight movements, including storage in their extensive non-operational periods; among them are:

- Personal transportation involving intimate control such as walking or use of "micro-mobility machines" like skateboarding, hover-boarding (and related self-balancing transporters), electric scooters, Segway®, skates, and successive new forms of these motorized "solo-craft."[31] (The explosion of national participants in the short-term rental market like Lime and Bird,

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[29] Mark Harris, *Optimus Ride Wants Autonomous Ride-Sharing Without Human Drivers in the Way*, IEEE SPECTRUM (Mar. 11, 2016), http://spectrum.ieee.org/cars-that-think/transportation/self-driving/optimus-ride-wants-autonomous-ridesharing-without-human-drivers-in-the-way [https://perma.cc/REK6-9725] (quoting Ryan Chin, Chairman of Optimus Ride).

[30] *See* TRANSITCENTER, *supra* note 15 ("Even if we reach a point where automated vehicles can operate on highways or in specially planned developments, it will be longer until they might be capable of operating in chaotic streetscapes of busy business districts . . . .").

[31] *See* Josh Dean, *OneWheel: The Futuristic Toy We Hoped For*, WALL ST. J. (Oct. 19, 2016), https://www.wsj.com/articles/onewheel-the-futuristic-toy-we-hoped-for-1476887071 [https://perma.cc/7XDB-GQHH]; Matthew Kitchen, *3 Ways Tech Will Do the Walking for You in 2019*, WALL ST. J. (Jan. 11, 2019), https://www.wsj.com/articles/3-ways-tech-will-do-the-walking-for-you-in-2019-11547232864 [https://perma.cc/LW5N-YB7R]; Mark Prigg, *A wheelie good way to commute? The $1500 one wheeled skateboard that can balance itself*, DAILYMAIL (Jan. 9, 2015), http://www.dailymail.co.uk/sciencetech/article-2903822/A-wheelie-good-way-commute-1500-one-wheeled-skateboard-balance-itself.html [https://perma.cc/S4PD-9HNH].

and their onrushing regional rivals, guarantees increased rights of way congestion.[32])

- Multi-wheeled transportation including bicycles, motorcycles, motor scooters, pedi-cycles, jitneys, rickshaws, trucks, trolleys, buses, and autos—both human-driven and guided autonomously.
- Fixed pathway transportation like light and heavy rail, as well as overhead guided-pathway buses and trolleys and, if their development succeeds, hyper-loop transit.[33]
- Drones and analogs to come in the realm of aerial freight delivery, as their advocates succeed in persuading transportation planners to allow overhead use of Corridors.[34]
- Within the next quarter century, personal jet packs for human aerial movement in closer quarters[35]

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[32] *See* Tim Bradshaw, *Crowd of scooter start-ups challenges Bird and Lime*, FIN. TIMES (Nov. 6, 2018), https://www.ft.com/content/edf6fd12-e1ee-11e8-a6e5-792428919cee [https://perma.cc/K8DX-S722]. The fickleness of consumers following micro-mobility trends is apparent in the instance of Phoenix, where dockless bike-share programs will be displaced, only months after their implementation, by electric scooters if a pilot program for the latter moto type is implemented. *See* Jessica Boehm, *Phoenix dockless bike program quietly dies, but e-scooters could arrive soon*, ARIZ. REP. (May 17, 2019), https://www.azcentral.com/story/news/local/phoenix/2019/05/17/phoenix-kills-dockless-bike-share-program-make-way-e-scooters/3668729002/ [https://perma.cc/PUF7-PXYS]. Dockless bikes rapidly became sidewalk litter, but in Maricopa County there is an abiding suspicion that e-scooters will have the same fate. *See id.*

[33] *See* Bre Bradham, *The Light Rail's Dead—Will a Hyperloop Come Instead?*, THE CHRONICLE (Aug. 7, 2019), https://www.dukechronicle.com/article/2019/08/virgin-hyper loop-one-durham-light-rail-raleigh-transit-duke [https://perma.cc/85RW-S4B9].

[34] *See* Troy Rule, *Drone Zoning*, 95 N.C. L. REV. 133, 139, 171 (2016). I previously broadcasted my views on drones in Corridors. *See generally* Michael N. Widener, *Local Regulating of Drone Activity in Lower Airspace*, 22 B.U. J. SCI. & TECH. 239 (2016). I devote little room in this Paper to restating my views on drone presence, but recapping, drones that cease functioning in mid-air literally become "dead weight." Since no guarantees of drone reliability exist, other than they reliably will appear aloft, I argue they should not fly above the ground-level plane of any Corridor where they, like other malfunctioning plummeting aircraft, are weaponized. If they must fly nearby a Corridor, they should be flown above buildings, not over paved surfaces, so that they can be landed in an emergency—or will crash—atop vertical structures, not persons. Also, rooftops may serve as battery charging stations and possibly for hosting of bins for cargo depositing. *See id.*

[35] *See* Loz Blain, *Interview: David Mayman debuts the faster, safer, six-engine JB11 jetpack*, NEW ATLAS AIRCRAFT (Jan. 11, 2018), https://newatlas.com/jetpack-aviation-jb11-david-mayman-interview/52944/#gallery [https://perma.cc/X9YH-MRB9].

> and, for wealthy users, personal helicopters[36] and other low-altitude aircrafts.[37]

These issues are not diseases exclusively plaguing conventional megapolitan areas. Juneau, the capital of America's largest state, is unique because its residents cannot enter or exit the city limits from much beyond its political boundaries by driving.[38] Travelers to the city primarily must arrive by aircraft or watercraft.[39] Nevertheless, Juneau suffers from familiar auto-centricity, exhibited by many surface-level parking lots and curbside parking for locals and tourists.[40] Despite its unique lack of exterior-to-boundaries road accessibility,[41] its downtown often resembles every other crowded American city at peak drive times.[42] Despite its isolation, Juneau, Alaska, illustrates an inescapable problem: in most

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[36] *See* Olivia Krauth, *Dubai's Autonomous Flying Taxis: A Reality in 2018*, ZDNET (Feb. 1, 2018), http://www.zdnet.com/article/dubais-autonomous-flying-taxis-a-reality-in-2018/ [https://perma.cc/6HBP-Y2SE].

[37] *See, e.g.*, UBER, FAST-FORWARDING TO A FUTURE OF ON-DEMAND AIR TRANSPORTATION (Oct. 27, 2016), https://www.uber.com/elevate.pdf/ [https://perma.cc/2KFV-9GXP]; Jake Canter, *The flying car backed by Google's cofounder just got a big update, and people can pilot it with less than an hour's training*, YAHOO! FIN. (June 6, 2018), https://finance.yahoo.com/news/flying-car-backed-google-apos-123308305.html [https://perma.cc/H9W4-7JXM].

[38] *See* William Yardley, *In Juneau, Firm Resistance to a Road Out of Isolation*, N.Y. TIMES (June 6, 2008), https://www.nytimes.com/2008/06/06/us/06road.html [https://perma.cc/2MRP-9QTB].

[39] Within the city limits, many portions are drivable after a car is delivered via ferry or barge. But the Juneau Access project, scheduled to build fifty miles of highway access to the capital city, has been gutted in Alaska's capital improvements budget. This project was planned to extend Juneau's road system to a new ferry terminal north of the Katzehin River; from there, a short ferry ride would have connected that terminal with Haines and Skagway. *See* Liz Kellar, *Assembly OKs resolution in support of Juneau Access Project*, JUNEAUEMPIRE.COM (Jan. 25, 2017), https://www.juneauempire.com/news/assembly-oks-resolution-in-support-of-juneau-access-project/ [https://perma.cc/7AE9-FK4Z]. Motor vehicles would have been taken on the ferry from the "mainland" to the new terminal, from which point they would have been driven to the capital city. If that sounds impossibly complicated as a land-based vehicular transportation solution, spend some time in southeastern Alaska.

[40] *See, e.g.*, *Downtown Parking Map*, JUNEAU PARKS & RECREATION, http://www.juneau.org/parkrec/documents/DowntownParkingManagementZone-final2.24.2014.pdf [https://perma.cc/M4LM-QFE8] (last visited Oct. 28, 2019).

[41] The Juneau borough's road network terminates a few dozen miles outside the townsite, a mere forty-five miles of asphalt piecing Juneau's downtown together with Auke Bay (northerly) to Echo Cove on the west side of the Borough of Juneau.

[42] *Downtown Juneau Traffic Map Enlargement*, ALASKA DEP'T OF TRANSP., http://dot.alaska.gov/stwdplng/transdata/pub/2012_AADT_maps/2012_ADT_Juneau_Downtown.pdf [https://perma.cc/8H68-CHCE] (last visited Oct. 28, 2019).

CBDs today, it is impossible to create, at grade, additional space between the curbs of fully developed streets.[43] Ancillary uses of rights of way include curbside parking; manhole covers and grates for utility and draining infrastructure; and sidewalks, outdoor or occasionally covered facilities for queueing for mass transit boarding. This spatial at-grade level shortage is magnified by two relatively recent phenomena in the United States. First is the movement toward "street activation,"[44] where sidewalks convert to parklets, sidewalk dining areas, and open-air displays of wares. *Activation*, so-called, prevents sidewalk recapture for vehicular lanes, except where sidewalks are enough above grade to free up their former footprints for use by vehicles.[45] Second is the soon-to-arrive presence of ubiquitous drones, those unmanned aerial surveillance vehicles with myriad tasks that will eliminate opportunities to elevate streets or sidewalks to liberate additional horizontal space for vehicles, because once long-endurance unmanned aerial vehicles ("UAVs") proliferate, they will dominate the lower altitudes while the FAA restricts them from higher-altitude deployment to avoid conflicts with piloted airborne vehicles.[46] In short, few communities in any direction can "build around congestion" since, just as limitations are arising above street grade, at-grade circumferential highways or "diverters" cannot work as designed when Waze algorithms induce traffic to pursue the fastest routes.[47] To be fair, some autonomous

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[43] *See* Paul Sorenson et al., *Reducing Traffic Congestion in Los Angeles* (2008), https://www.rand.org/pubs/research_briefs/RB9385.html [https://perma.cc/6L5Z-VX8N] (building the way out of congestion has limited community prospects). There may be some exceptions in the instance of grand boulevards, where an additional lane might be squeezed out of fifteen-foot-wide lanes or, as observed in notes 66–71 and accompanying text, *infra*, if autonomous vehicles platooning occurs. Hence the need to begin conceptualizing Corridors in three dimensions.

[44] *See generally Urban Street Design Guide: Sidewalks*, NAT'L ASS'N OF CITY TRANSP. OFFICIALS, http://nacto.org/publication/urban-street-design-guide/street-design-elements/sidewalks/ [https://perma.cc/2JKE-NWCC] (last visited Oct. 28, 2019).

[45] *See, e.g.*, *Elevate the Pedestrian—And Save His Life!*, 72 LIT. DIGEST 54 (1922). Elevated sidewalks are not new; but the idea of erecting a podium above street level to manage pedestrian traffic has been insufficiently explored.

[46] *See, e.g.*, Jeremy Hsu, *Cloudy with a Chance of Drones*, 313 SCI. AM. 20 (2015); Evan Rawn, *The Three-Dimensional City: How Drones Will Impact the Future Urban Landscape,* ARCHDAILY (Jan. 1, 2015), https://www.archdaily.com/583398/the-three-dimensional-city-how-drones-will-impact-the-future-urban-landscape [https://perma.cc/33QU-Z8KH].

[47] *See* David Metz, *Developing Policy for Urban Autonomous Vehicles: Impact on Congestion*, 2 URB. SCI. 33 (2018), https://www.mdpi.com/2413-8851/2/2/33/htm [https://perma.cc/34B6-UER7]. These are known as "genetic algorithms," which generate multiple solutions to a problem, finding the optimal or "fittest" (hence the name) solution to it—in this case, the fastest routes to take. *See* Jared Council, *At Zappos, Algorithms Teach Themselves*,

vehicle dreamers believe that current roadways are fundamentally adequate today to handle their arrival; consider this comment from Chris Urmson, former executive at Google's autonomous vehicle unit:

> I don't think we need a whole lot of investment from government in the near term . . . . Fundamentally, roads that work, that are good, and easy for people to drive on, will be good and easy for automated vehicles to drive on, and so just kind of making it a little bit better for people is all we need right now. Then, when the technology actually starts to become scaled, then we can ask the question what have we learned, what are the ways that we can make this a little bit safer, a little bit incrementally more efficient, and that's what [sic] I think local and state governments and federal government would invest in infrastructure.[48]

Inadequate volumes of ground-level pavement are challenged by introducing new human and mechanically powered modes of transport competing directly for rights of way space at grade and aloft. Increased dependency in America on direct-to-consumer deliveries of goods and services by merchants[49] compounds accessibility and throughput-level

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WALL ST. J. (July 8, 2019), https://www.wsj.com/articles/at-zappos-algorithms-teach-themselves-11562578200 [https://perma.cc/H8V9-JYL2].

[48] *See* April Glaser, *How Close Are We to Self-Driving Cars, Really?*, SLATE (June 13, 2019), https://www.slate.com/technology/2019/06/self-driving-car-chris-urmson-aurora-interview.html [https://perma.cc/DR4G-5QKN]. Of course, Urmson is sanguine about road infrastructure because he believes that only a small-scale introduction of autonomous vehicles is forthcoming in the next three to five years, and that large-scale usage is decades away. *See id.* Indeed, Urmson believes that acceptance of autonomous vehicles may depend on not asking too much of local communities: "what we really need to do is take the technology and adapt it to work the way that we work and live today, and *operate on the roads that exist today*, because if we don't do that, then I think this technology, it just won't happen." *See id.* (emphasis added). If that proposition were true, then there would have been no system of Interstate Highways engineered and constructed to move large volumes of traffic, once vehicles animated an urban transportation paradigm shift. Urmson's prescription seems both rooted in two-dimensional thought and, eventually, doomed to replacement by more realistic planning. Finally, the "[sic]" appears in the text because I believe in that location Urmson said "when," not "what," the latter making no sense in context.

[49] *See, e.g.*, Frank McGuigan, *The Evolution of the Direct-to-Consumer Supply Chain*, TRANSPLACE (July 5, 2017), https://logisticallyspeaking.transplace.com/2017/07/05/the-evolution-of-the-direct-to-consumer-supply-chain/ [https://perma.cc/76KW-BMK5] (commenting upon the "Amazon effect" driven by consumers); Patrick Sisson, *How Amazon's "invisible" hand can shape your city*, CURBED (May 2, 2017), https://www.curbed.com/2017/5/2/15509316/amazon-prime-retail-urban-planning [https://perma.cc/V8DE-9M96] (noting

challenges. The increased volume of velocipedes and motorized craft, the nuisance impact of scooters for hire, and growing "distracted driving" among drivers of all kinds of propulsion devices[50] form a public recipe for consistent gridlock and massive rider and pedestrian[51] injuries. This critical circumstance demands more sophisticated planning, with or without the aid of autonomous vehicles and other "disruptive modes" in mobility. The Internet of Things's impact on municipal planning will emphasize greater controls of headways and off-ramping of motos and velos impairing efficient movement.[52] Still, community planning functions seldom move with

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increasing deliveries increasing freight traffic on city streets). Notably, the public seems destined to demand more deliveries by third persons. *See* Heather Haddon & Julie Jargon, *Investors Are Craving Food Delivery Companies*, WALL ST. J. (Oct. 24, 2018), https://www.wsj .com/articles/investors-are-craving-food-delivery-companies-1540375578 [https://perma.cc/XX6N-NR5H]. People in the United States demand more convenient ways to eat and employ mobile apps to encourage takeout deliveries of prepared foods, which may reach 15 percent of restaurant sales within a decade. *See id.*

[50] *See, e.g.*, Sheila G. Klauer et al., *Distracted Driving and Risk of Road Crashes Among Novice and Experienced Drivers*, 370 NEW ENG. J. MED. 54, 54–59 (2014); Anne Marie Chaker, *Managing Drivers' Many Distractions*, WALL ST. J. (Oct. 25, 2016), https://www .wsj.com/articles/managing-drivings-many-distractions-1477423196 [https://perma.cc/A9VD -7SRM]; Bart Jensen, *Millennial drivers are highway hazards, survey shows*, USA TODAY (Feb. 15, 2017), https://www.usatoday.com/story/news/2017/02/15/millennial-drivers-high way-hazards-survey-shows/97888336/ [https://perma.cc/FUY6-FZ8U]. New York City's Council, frustrated with the level of traffic-related deaths and injuries in mid-2014, passed the "Vision Zero" initiative to eliminate these fatalities and reduce other pedestrian and passenger injuries within ten years of the law's adoption. *See* Eric Goldwyn, *Can New York City Achieve Vision Zero?*, NEW YORKER (June 4, 2014), http://www.newyorker.com /tech/elements/can-new-york-city-achieve-vision-zero [https://perma.cc/B6YC-WWBB]. Anthony Foxx, U.S. Transportation Secretary during the Obama Administration, said federal officials aimed to eliminate traffic fatalities by 2046. *See* John D. Stoll & Mike Spector, *U.S. Traffic Deaths Up Sharply in First Half of the Year*, WALL ST. J. (Oct. 5, 2016), https://www.wsj.com/articles/u-s-traffic-deaths-up-sharply-in-first-half-of-the-year -1475676390 [https://perma.cc/RP85-4U7T].

[51] *See* Bob Brody, *The Case Against Deliberate Deafness*, WALL ST. J. (Feb. 7, 2018), https:// www.wsj.com/articles/the-case-against-deliberate-deafness-1518046605 [https://perma .cc/56X7-CX2D] (reporting that pedestrians with headphones/earbuds who were injured while walking tripled between 2004 and 2011 even when, in almost 30 percent of the accidents, a warning was sounded but went unheard because of the distraction of "individual sound"); Scott Calvert, *Pedestrian Deaths Reach Highest Level in Nearly 30 Years*, WALL ST. J. (Feb. 28, 2019), https://www.wsj.com/articles/pedestrians-deaths-reach-high est-level-in-nearly-30-years-11551330060 [https://perma.cc/G896-F4JG]; Adrienne Roberts, *Uber Crash Highlights Growing Safety Concern: Pedestrians*, WALL ST. J. (Mar. 23, 2018), https://www.wsj.com/articles/uber-crash-highlights-growing-safety-concern-pedestrians -1521810000 [https://perma.cc/Y8PJ-KJG6] (noting pedestrian deaths increased by 25 percent in the decade between 2007 and 2016).

[52] *See How The IoT Will Reshape The City Experience*, FORBES INSIGHT (Oct. 25, 2018),

the "speed of tech."[53] They must learn, however; the public is fatigued by mounting fatalities such as the estimated forty thousand traffic deaths that occurred during calendar years 2017 and 2018, as reported by the National Safety Council.[54]

Fertile imaginations of mobility-gadgetry entrepreneurs aside, cities must refocus community conversations away from the less sexy but equally needed planning and development effort of implementing joint-usage rights of way. By this, I mean the community focus (for citizens as well as land planners) must be on *pathways*, not on *devices* traversing them.[55] The rights of way in densely urbanized areas must be perceived as resources like water and electricity—Corridors as commodities, limited in supply and well-exploited due to increasing populations and citizens' growing need for accessibility.[56] This recognition will be slowed in part by consumer attraction to new trends and object acquisition—understandably, since new devices are glistening diversions, while allocation and use deployment of Corridor space is vastly duller. But the inevitable problems of intolerable Corridors' "levels of service" (aka gridlock), accompanied by loss of worker productivity from absurdly long commute times, last-mile delivery frustrations, and associated problems ultimately will force the public to attend to opportunities for optimal exploitation of rights of way

https://www.forbes.com/sites/insights-inteliot/2018/10/25/how-the-iot-will-reshape-the-city-experience/#5e93029c73eb [https://perma.cc/CR26-22UZ].

[53] *See* Julie Littman, *Do Or Die: Cities Face Falling Behind If They Don't Implement Digital Infrastructure,* FORBES (July 17, 2017), https://www.forbes.com/sites/bisnow/2017/07/17/do-or-die-cities-face-falling-behind-if-they-don't-implement-digital-infrastructure/#11d972922ec4 [https://perma.cc/VF9R-JWCM].

[54] *See Vehicle Deaths Estimated at 40,000 for Third Straight Year*, NAT'L SAFETY COUNCIL, https://www.nsc.org/road-safety/safety-topics/fatality-estimates [https://perma.cc/Q8TP-TSYA] (last visited Oct. 28, 2019).

[55] *Cf.* TIERNEY, *supra* note 28, at 164–65 (noting emphasis on the elimination of obsolete streets in favor of "smart pathways"). This focus on pathways would be unneeded, perhaps, if the public embraced "presence robots" and other means of digital "substitution" for live encounters and physical retailing that require travel. *See* CHARLENE ROHR ET AL., TRAVEL IN BRITAIN IN 2035: FUTURE SCENARIOS AND THEIR IMPLICATIONS FOR TECHNOLOGY INNOVATION 25–28 (June 24, 2016), https://www.rand.org/content/dam/rand/pubs/research_reports/RR1300/RR1377/RAND_RR1377.pdf [https://perma.cc/NT7L-WFPR]. In this scenario, urbanites can participate from anywhere in meetings at a particular time. More greatly enhanced virtual presence may be achieved through Mica's AI Avatar, if augmented reality takes hold in workplaces. *See* Dean Takahashi, *Magic Leap's Mica is a human-like AI in augmented reality*, VENTUREBEAT (Oct. 10, 2018), https://venturebeat.com/2018/10/10/magic-leaps-mica-is-a-human-like-ai-in-augmented-reality/ [https://perma.cc/DW3G-62BY].

[56] Of course, "accessibility" comprehends more than physical mobility, and includes accessibility via the Internet and other wireless connectivity.

in ways not often contemplated today. Part II below reviews current diversions from the appropriate planning mindset.

II. BETTING THE HOUSE ON THE INTERNET OF THINGS AND AI

A. *How Well the IoT Works . . .*

By the "Internet of Things," or IoT, I mean that conceptual ecosystem consisting of physical objects equipped with sensors, electronics, software, and linked devices that coordinate the network's connectivity, so that the objects collect and exchange data among network components.[57] So, "devices" in this realm include building facades, motor vehicles, velocipedes, and anything else embedded with semiconductors, wireless connectivity, and software fronting upon the Corridor or going mobile within that Corridor. Just as your phone operates other devices located inside your house, the expansion of IoT within the streetscape serves, over time, to mitigate accidents, shortages of fuel resources, stupid-driving behaviors, surplus vehicles present in one place simultaneously, or related causes.[58]

Under the watchful "gaze" of linked devices in a cloud-based "platform" like the Transportation Mobility Cloud managing information flow and ecosystem transactions,[59] most cities will soon employ real-time positioning data to control traffic flow, dynamically rerouting cars to reduce congestion and improving commuting times by accounting for vehicle-aggregating special events, emergencies like mechanical breakdowns, and construction projects affecting Corridor carrying capacity.[60] Residents can use a "mobility assistant" from home to find the optimal routes for "getting there" or be redirected while moving toward their destination.[61]

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[57] TOBIAS ZILLNER, ZIGBEE EXPLOITED: THE GOOD, THE BAD AND THE UGLY 1, 1 (2015), https://www.blackhat.com/docs/us-15/materials/us-15-Zillner-ZigBee-Exploited-The-Good-The-Bad-And-The-Ugly-wp.pdf [https://perma.cc/2FCE-E9QN].

[58] Ekim Saribardak, *Implementation of the IoT in Transportation: Autonomous Vehicles*, IOT EVOLUTION (Nov. 12, 2018), https://www.iotevolutionworld.com/autonomous-vehicles/articles/440238-implementation-the-iot-transportation-autonomous-vehicles.htm [https://perma.cc/ZW4Y-ZRHB].

[59] *See* Rich Strader & Sunny Madra, *Why We're Working with Autonomic to Create a Platform That Can Power Future Cities*, MEDIUM (Jan. 9, 2018), https://medium.com/cityoftomorrow/why-were-working-with-autonomic-to-create-a-platform-that-can-power-future-cities-96700c2824e6 [https://perma.cc/FP8E-SNTD].

[60] *See id.*

[61] *See* Heinrichs, *supra* note 12, at 216. *See generally* Mahtot Gebresselassie & Thomas W. Sanchez, *"Smart" Tools for Socially Sustainable Transport: A Review of Mobility Apps*, 2 URB. SCI. 45 (2018), https://www.mdpi.com/2413-8851/2/2/45/htm [https://perma.cc/Z9XE-E6Z6].

Major cities soon will have an at-scale transportation solution connecting all stakeholders in Corridors, using a universal mobility vernacular where all devices interact to optimize throughput.[62] The data mined will also advise communities about locations within Corridors to implant items like multimodal transport hubs[63] and ride-sharing pickup points.[64] But that does not guarantee that municipal and private sector players (application developers like Waze) will become partners in outreach to guidance-seeking mobility-device operators.

Introducing artificial intelligence into these platforms will ease congestion, as exhibited by adaptive traffic signals already deployed in some communities.[65] These systems use IoT devices like embedded wires in streets to communicate with the signaling lamps, sensing how much traffic is moving towards and through the intersection.[66] This earlier-generation technology will yield, soon, to real-time systems like "dynamic intersections" reacting instantly to prevailing traffic conditions wherever congestion arises.[67] Signal control strategies will minimize and balance the road network's link queues to reduce the risk of queue-spillback under saturated traffic conditions.[68] ("Saturated conditions" means severe congestion during peak demand hours which, if allowed to persist, create the condition we know as "gridlock."[69])

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[62] *See* Heinrichs, *supra* note 12, at 216.

[63] *See id.* at 219. Such hubs will afford seamless transit between modes of travel; and some scholars argue that city districts should, and will, organize their land use to focus on densification proximate to such hubs. *See, e.g.*, *id.*

[64] Michal Cap & Javier Alonso-Mora, *Multi-Objective Analysis of Ridesharing in Automated Mobility-on-Demand*, CONF. ROBOTICS: SCI. & SYS. 2018, 1 (2018).

[65] *New Jersey Meadowlands Commission Deploys TransCore's Adaptive Signal Control System*, TRANSCORE (May 21, 2019), https://www.transcore.com/new-jersey-meadowlands-commission-deploys-transcores-adaptive-signal-control-system.html [https://perma.cc/36KH-93F9].

[66] *See* Willa Ng, *The next-generation intersection helps all modes share the street*, MEDIUM (Mar. 3, 2017), https://www.transcore.com/new-jersey-meadowlands-commission-deploys-transcores-adaptive-signal-control-system.html [https://perma.cc/UG5G-E6AD]; Josh Sanburn, *How Smart Traffic Lights Could Transform Your Commute*, TIME (May 5, 2015), http://time.com/3845445/commuting-times-adaptive-traffic-lights/ [https://perma.cc/B8GK-TNSR]. When traffic is heavier in one direction, the green light in that direction stays illuminated longer, allowing more throughput. During peak drive times, nearby intersections' signals synchronize, maintaining a vehicular platoon to optimize throughput.

[67] *See* Shunsuke Aoki & Ragunathan Rajkumar, *Dynamic Intersections and Self-Driving Vehicles*, PROC. 9TH ACM/IEEE INTL CONF. CYBER-PHYSICAL SYS. 320, 320–21 (2018).

[68] If you love calculus, read Konstantinos Aboudolas et al., *Store-and-Forward Based Methods for the Signal Control Problem in Large-Scale Congested Urban Road Networks*, 17 TRANSP. RES. PT. C. 163, 163 (2009).

[69] *See id.* at 164.

But AI's ultimate utility will extend far beyond when to change a busy intersection's light to permit/arrest passage. Future Corridors will combine autonomous vehicle movement with fixed columnar passageways. And the transition between the two modes of passage will be governed by AI, which will determine when and how transitions occur.[70] Using technologies like Bluetooth, these agents will "see the way ahead" and calculate an appropriate balance between what best serves the individual traveler's advantage and optimal movement patterns for the full "hive" of travelers. Bluetooth-enabled controllers aided by Light Detection and Ranging ("LIDAR") "readers" will groove numbers of approaching motos in some species of constant-velocity platooning,[71] a condition in which coordinated acceleration and braking enable reduction of the street area devoted to flowing traffic[72] until any vehicle is released for exit into a control point for pausing or into a different column.[73] Hypothetically, this segment of Corridor traffic will be handled like a Disneyland ride, everyone moving in her lane via a timed passage, with all paved lanes devoted to essentially continuous movement[74] (except for slowing or stopping at a signal or elsewhere designated for picking up a passenger at a transport hub or releasing one at an off-pavement drop zone—a mixed blessing for bicyclists and pedestrians traveling along a parallel path[75]).

B. . . . Until It Doesn't

The shiny future notwithstanding, all cities are not ready for ubiquitous Corridors. Limitations will include first, the threat of natural

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[70] *See How IoT is Driving the Autonomous Vehicle Revolution*, IOT FOR ALL (June 8, 2018), https://www.iotforall.com/iot-and-autonomous-vehicles/ [https://perma.cc/6CKR-575R].

[71] *See* Ying Huang et al., *Road sensor network for smart city applications*, SPIE (Mar. 27, 2018), https://doi.org/10.1117/12.2295949 [https://perma.cc/Z4KH-FQPP]. Peloton Technology from California is developing technology designed to allow two (so far) semi-trucks to "convoy" in close coordination by V2V linkage, while reducing driver error and fuel consumption. *See The Platooning Experience*, PELOTON, https://peloton-tech.com/how-it-works/ [https://perma.cc/CP9Y-NAPS] (last visited Oct. 28, 2019).

[72] *See* Heinrichs, *supra* note 12, at 224.

[73] *See* Walter Wachenfeld et al., *Use Cases for Autonomous Driving*, *in* AUTONOMOUS DRIVING: TECHNICAL, LEGAL AND SOCIAL ASPECTS 9, 12 (Markus Maurer, J. Christian Gerdes, Barbara Lenz, & Hermann Winner eds., 2016).

[74] *See* Heinrichs, *supra* note 12, at 218, 224–25.

[75] *See* Eva Fraedrich et al., *Autonomous Driving, The Built Environment and Policy Implications*, TRANSP. RES. PT. A (Mar. 17, 2018), https://www.elsevier.com/social-sciences/transportation/transport-collection [https://perma.cc/CM3Q-RDQX]. This Paper is partly a quantitative online survey and results of qualitative interviews with representatives from urban transport planning administrators in Germany.

disasters like hurricanes, cyclones, blizzards, tornadoes and wind shears, and flooding that can disrupt a system by, for example, ripping sensors from their moorings.[76] Second, less threatening weather or atmospheric smog, fog, or other poor road conditions can surmount proper functioning of the management platform.[77] If the platform is compromised by a natural disaster or foul weather, LIDAR sensors perform suboptimally in camera imaging detection.[78] Without redundancy in an IoT platform to deploy substitute devices for "getting the grid back up" in short order, the grid will crash—and so will vehicles depending on its proper functioning.[79] Hacking represents a third nasty, but real, deterrent to foolproof operation of the platform controlling the simultaneous movements of hundreds or thousands of vehicles.[80] One present limitation on AI, troubling in the event of a hack, is the disinclination of machines to risk.[81] These platforms are programmed to repeat rewarding "action sequences" by replicating prior

[76] *See* Andreas Reschka, *Safety Concept for Autonomous Vehicles*, *in* AUTONOMOUS DRIVING: TECHNICAL, LEGAL AND SOCIAL ASPECTS 473, 482–83 (Markus Maurer, J. Christian Gerdes, Barbara Lenz, & Hermann Winner eds., 2016).

[77] *See* Mary L. Cummings, *Hands Off: The Future of Self-Driving Cars*, U.S. Senate Testimony 1 (Mar. 15, 2016), https://governmentrelations.duke.edu/wp-content/uploads/Cummings-Senate-testimony-2016.pdf [https://perma.cc/L4AE-4ZQY]; Imran Ashraf & Yongwan Park, *Effects of Fog Attenuation on LIDAR Data in Urban Environment*, SPIE (Feb. 22, 2018), https://doi.org/10.1117/12.2289597 [https://perma.cc/CDD9-FSVS]; Mary L. Cummings & Jason Ryan, *Who Is In Charge? The Promises and Pitfalls of Driverless Cars*, 292 TR NEWS 25, 28 (May–June 2014) (an article attached to Cummings's written Congressional testimony); Laine Higgins et al., *The Bumps Ahead for Autonomous Vehicles*, WALL ST. J. (Nov. 15, 2018), https://www.wsj.com/graphics/the-long-road-ahead-for-autonomous-vehicles/ [https://perma.cc/77MB-SAW4]; Matt Posky, *Automated Cars Are Not Able to Use the Automated Car Wash*, THE TRUTH ABOUT CARS (Feb. 23, 2018), http://www.thetruthaboutcars.com/2018/02/washing-avs/?print=1 [https://perma.cc/J6GB-QFTY].

[78] *See* Heinrichs, *supra* note 12, at 224–25.

[79] *See* Reschka, *supra* note 76, at 488.

[80] Few discuss the ultimate progression of artificial intelligence in autonomous cars—where the vehicle does not rely on instructions created by a programmer, instead relying on an algorithm it invents; in other words, the vehicle's program is self-devised, following its observations of other vehicles. *See* Will Knight, *The Dark Secret at the Heart of AI*, MIT TECH. REV. (Apr. 11, 2017), https://www.technologyreview.com/s/604087/the-dark-secret-at-the-heart-of-ai/ [https://perma.cc/YW55-A585]. How, then, does a "platform" control algorithms that are "individualized" by vehicles continuously upgrading internally? Presumably there will be some community network intrusion detection system to observe anomalous patterns of traffic management protocols' compliance, followed by intervention by a controller agent with a vehicle or phalanx of vehicles intended to counter a breach of protocols. This innovation's conception would be substantially above the author's pay grade.

[81] *See* Alison Gopnik, *Curiosity Is a New Power in Artificial Intelligence*, WALL ST. J. (May 4, 2018), https://www.wsj.com/articles/curiosity-is-a-new-power-in-artificial-intelligence-1525446050 [https://perma.cc/632P-PHBK].

successful strategies.[82] Veering vehicles out of harm's way ultimately may be a routinely handled decision-point in traffic management machine agents' programs—but not today. Couple that fact with the tendency for humans to trust an algorithm's output without thinking about its consequences.[83] Humans willing to accept "artificial authority," who are not engaged in the sabotaging act, might be skeptical of the hack's existence or extent of its authentic disruption until severe damage results.

The dangers of hacking are illustrated by two events. First is a 2015 study by Cognosec that found ZigBee networks (a dominant open global wireless standard based on IEEE 802.15.4,[84] commonly used by IoT device manufacturers like Samsung, Philips, Motorola, and Texas Instruments to improve communication and compatibility between different IoT devices)[85] were easily compromised.[86] Second is the 2018 death of a pedestrian in Tempe, Arizona, that occurred when Uber's autonomous vehicle failed to stop when the system used to automatically apply brakes in potentially dangerous situations was disabled, while the on-board "backup" human driver hired to intervene remained distracted (watching video streams) until it was too late to prevent the impact.[87] Human nature suggests that distraction will be customary because one autonomous vehicle purpose is to *enable* the human passenger(s) to ignore both the road ahead and objects alongside.[88] What awaits Corridors users if (or perhaps when) antisocial computer geniuses either (a) disable guidance systems lacking sufficient[89]

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[82] *See id.*

[83] *See* Hannah Fry, *Don't Believe the Algorithm*, WALL ST. J. (Sept. 5, 2018), https://www.wsj.com/articles/don't-believe-the-algorithm-1536157620 [https://perma.cc/VBB6-CCNF].

[84] Fabio Leccese et al., *A Smart City Application: A Fully Controlled Street Lighting Isle Based on Raspberry-Pi Card, a ZigBee Sensor Network and WiMAX*, 14 SENSORS 24,408, 24,410 (2014).

[85] *Zigbee Telecom Services*, ZIGBEE ALL., https://zigbee.org/zigbee-for-developers-/applicationstandards/zigbee-telecom-services/ [https://perma.cc/93BJ-X99T] (last visited Oct. 28, 2019).

[86] *See* ZILLNER, *supra* note 57, at 5–6.

[87] *See* Kirsten Korosec, *Uber safety driver of fatal self-driving crash was watching Hulu, not the road,* TECHCRUNCH (June 22, 2018), https://www.techcrunch.com/2018/06/22/uber-safety-driver-of-fatal-self-driving-crash-was-watching-hulu-not-the-road/ [https://perma.cc/PU3U-L5WE]. Readers also will recall a fatality in March 2018, involving a fatal crash of a Tesla where that auto's speed increased immediately prior to impact while on autopilot. *See* Ryan Mac, *Fatal Tesla Crash Report Shows Autopilot Was Engaged And Car Sped into Barrier at 70 MPH*, BUZZFEED NEWS (June 7, 2018), https://www.buzzfeed.com/ryanmac/fatal-tesla-crash-report-shows-autopilot-was-engaged-and?utm_term=.eeWg856wv#.sbqBraewx [https://perma.cc/L3DU-24BK].

[88] *See* Heinrichs, *supra* note 12, at 223 (noting fully autonomous vehicles will allow passenger attention to be paid to "other activities" and avoiding down time).

[89] *See id.*

redundancies to "outwit" their attackers, or (b) attack the software controlling a vehicle, in order to manipulate it's function?[90]

Today, three means of hacking into a traffic-management system threaten breath-taking disruption. The first serves to confuse the sensors; the second alters "rules" or protocols for how the system functions; while the third tampers with IoT devices generally, but so-called actuators in particular.[91] The process of confusing sensors incorporates compromising dynamic navigation maps in the vehicle (taking it in an unintended direction), faking an apparent obstacle, or blocking a sensor's vision so it will not detect a genuine vehicle or pedestrian.[92] In changing these rules, the hacker obtains access to the protocols and adds or deletes rules, creating false alarms or eliminating true alarm triggers.[93] A hack that compromises actuators opens the system to numerous mischief options, including switching off controls like lights, speedometers, brakes, activating air bags, disengaging the engine, or altering its rotation-controlling vehicle acceleration.[94] It also can send false alerts, or misdirect the vehicle by tampering with its navigation system.[95] In addition, hacking can compromise other features of traffic management systems such as smart parking meters designed to notify vehicles of the available inventory of stalls to reduce time expended in diverting away from the Corridor.[96] Finally, threats from hacking are as real in the vertical space as along the horizontal axis.[97]

Besides hacking and bad weather, threats to the efficacy of AI as divine enabler of traffic management include the "black box" effect of a neural network in which internal parameters interact in such complex ways that human understanding is elusive and "reverse engineering" from results is challenging, especially in the context of deep reinforcement

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[90] *See* Andy Greenberg, *Securing Driverless Cars From Hackers Is Hard. Ask The Ex-Uber Guy Who Protects Them*, WIRED SECURITY (Apr. 12, 2017), https://www.wired.com/2017/04/ubers-former-top-hacker-securing-autonomous-cars-really-hard-problem/ [https://perma.cc/6Z6X-MNC7].

[91] *See* Opher Etzion, *Hacking: Three Ways Data and Devices Are Vulnerable*, RTINSIGHTS (Aug. 5, 2015), https://www.rtinsights.com/hacking-the-internet-of-things-a-look-at-risks/ [https://perma.cc/L6P4-LHT5].

[92] *See id.*

[93] *See id.*

[94] *See id.*

[95] *See id.*

[96] *See* Nina V. Juliadotter, *Hacking Smart Parking Meters*, INT'L CONF. INTERNET OF THINGS & APPLICATIONS (IoTA) 191, 194 (2016).

[97] *See, e.g.*, Muhammad F.B. Abdul Rahman, *Protecting the Vertical Space of Cities: Perspectives for Singapore*, 10 ASIAN J. PUB. AFF. 27, 32, 36 (2017).

learning involving huge data sets.[98] Additionally, concerns arise about the bias in the manner in which AI agents are "instructed" about the desired results of algorithmic analysis and prediction, when humans label the training data provided.[99] Consequently, humans believe it should remain unknown to a degree whether the agent will respond and when. Transportation planners must exploit this deep-learning convention of artificial intelligence[100] to produce continuous, safe vehicle movements and maximum utilization of CBD-based parking lots for low-occupancy vehicles.[101] One limitation (undergirding likely regulator reservation about AI's "readiness") is that little research on deep-learning architecture predicts salutary long-range traffic-management planning.[102] Then again, AI is intended to enable planning in multivariable environments, not to dictate it. That particularly is apparent in assessing ethical dilemmas implicating forced-choice algorithms, where agents substitute their "judgments" for those of their teachers.[103]

Optimism, however, requires citizen confidence in American entrepreneurial ingenuity partnering with intelligent agents to develop robust predictive and management models. So, boldly, in Part III, I describe five

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[98] *See* Rusul Abduljabbar et al., *Applications of Artificial Intelligence in Transport: An Overview*, 11 SUSTAINABILITY 1, 4, 12–14, 17 (2019), https://www.mdpi.com/2071-1050/11/1/189/pdf [https://perma.cc/ZHW9-9RDK]; Marianne Lehnis, *Can we trust AI if we don't know how it works?*, BBC NEWS (June 15, 2018), https://www.bbc.com/news/business-44466213 [https://perma.cc/95GA-TPZH].

[99] *See* Abduljabbar et al., *supra* note 98, at 13–14, 17.

[100] *See id.* at 4, 12–14. Deep-learning is the artificial intelligence approach requiring algorithmic analysis of vast troves of data and other information like images or speech commands, with the purpose of enabling abstract machine thinking. *See* SCHWARTZ & KELLY, *supra* note 6, at 179; Don Clark, *Intel, Apple Add to Artificial-Intelligence Deal Wave*, WALL ST. J. (Aug. 9, 2016), https://www.wsj.com/articles/intel-apple-add-to-artificial-intelligence-deal-wave-1470772801; Neil, *supra* note 15. But some pundits believe that deep-learning has limits, expressly, that pattern recognition cannot alone imitate genuine human intelligence because of a lack of machine "common sense." *See* Clive Thompson, *How to Teach Artificial Intelligence Some Common Sense*, WIRED (Nov. 13, 2018), https://www.wired.com/story/how-to-teach-artificial-intelligence-common-sense/ [https://perma.cc/FVC7-D67Y]. Additionally, deep-learning systems have yet to integrate abstract knowledge. *See id.*

[101] All passenger vehicles by their nature are "low occupancy" during a twenty four hour period. Indeed, it is estimated that the utilization rate for American automobiles is 5 percent, meaning 95 percent of the time, they merely take up space. *See* Neil, *supra* note 15. Even car-pool vehicles sit idle the big majority of the time. *Id.*

[102] *See* Abduljabbar et al., *supra* note 98, at 15–16.

[103] *See* Janet Fleetwood, *Public Health, Ethics and Autonomous Vehicles*, 107 AM. J. PUB. HEALTH 532, 534–36 (2017), https://ajph.aphapublications.org/doi/pdfplus/10.2105/AJPH.2016.303628 [https://perma.cc/TQ4C-8VQP].

municipal premises towards implementing improved Corridor movement and enhancing personal safety.

III. FIVE CUBULAR CORRIDOR PRINCIPLES

A. *Optimally Accessible Transport Systems Thrive Using Numerous Data-Capturing Devices Communicating Ubiquitously and in Real Time*

Corridor fluid movements of persons and goods will rely upon massive deployment of various IoT devices (e.g., CCTV cameras, dynamic message signs,[104] vehicle detection systems, travel time systems) and sensors to collect real-time traffic information on travel conditions along roadways.[105] The goal is to maximize the potential of the existing physical infrastructure through smarter interactions among pedestrians, motorists, and mass-transit vehicles using the IoT. Bluetooth communication protocol enabled on mobile phones and vehicles can allow for: (a) Vehicle-to-Infrastructure ("V2I") interaction (to communicate between vehicles and roadway sensors) enabled to determine travel times from one point-of-interest ("POI") to another designated POI;[106] (b) Vehicle-to-Roadside ("V2R") (communicating between vehicles and roadside units) technologies wirelessly facilitating the interaction between vehicles and traffic controllers for exchanging information about signalized intersections;[107] and

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[104] "Signs" are a highly sensitive subject because of the federal Manual of Uniform Traffic Control Devices for Streets and Highways ("MUTCD"), governing items like text, logos and symbols, retro-reflectivity in crosswalk treatment and even pavement markings, or colors indicating "exclusive" purposes of lanes. If a community or regional transportation authority wants to incorporate changes to the ways vehicle users are directed to or prohibited from places or movements, it must seek approval for "experimenting" from the Federal Highway Administration's Office of Transportation Operations, if the community receives federal highway appropriations. *See Experimentation*, FED. HIGHWAY ADMIN., https://mutcd.fhwa.dot.gov/condexper.htm [https://perma.cc/SY95-6AF6] (last updated June 12, 2019). A number of initiatives are in experimental stages, such as red-painted bus lanes like those used in Baltimore. *See* David Collins, *Legality of Baltimore City red bus lanes questioned*, WBALTV (May 31, 2018), http://www.wbaltv.com/article/legality-of-baltimore-city-red-bus-lanes-questioned/20980810# [https://perma.cc/TCS3-7R64]. This is one reason why general planning must thoughtfully be approached and federal reaction anticipated.

[105] *See* Ford Burkhart, *An Inside Look at Next-Gen "Talking Cars*," ARIZONA ALUMNI (Fall 2018), http://arizonaalumni.com/article/inside-look-next-gen-%E2%80%98talking-cars%E2%80%99 [https://perma.cc/8E3T-BEZQ].

[106] *See id.*

[107] The "V2" initialism becomes jargon-laden when addressing connectivity with other vehicles and traffic infrastructure as possibilities soar. Essentially, V2V intends to leverage short-range radio transmissions connecting with braking and adaptive cruise control systems

(c) Vehicle to Vehicle ("V2V") (communicating between vehicles) technologies, allowing vehicles to "talk" to one another, equipping thereby each vehicle with 360-degree awareness of its surrounding environment.[108] Such communication protocols themselves ultimately will yield to technologies serving Connected Vehicles/Autonomous Vehicles ("CV/AV"), introducing the future of travel on our roadways.[109] But in the short term, sensors and related devices will need to be implanted, occasionally somehow, on private property when no public right of way is suitable for management functions like connecting or active traffic monitoring.

Cities today are prohibited under the Fifth Amendment to do the last thing.[110] In *Loretto v. Teleprompter Manhattan CATV Corp.*,[111] the Supreme Court of the United States held that when the character of the governmental action is a permanent physical occupation of property, a *regulatory taking* arises to the extent of the occupation, no matter whether the action achieves an important public benefit or has only minimal (or even no) economic impact on the owner.[112] In doing so, the Court established the *permanent physical presence* test for finding a regulatory taking's occurrence.[113] Since our federal courts reject any legislation compelling private owners to agree to allow utilities providers to cross land and occupy,

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to warn vehicle "operators" of oncoming vehicles. Currently, "V2I" and "V2X" appear interchangeably used: the reference means vehicles communicating with everything else within range that is equipped with sensors or an Internet of Things engaging motor vehicles with "smart" traffic lights. *See id.*

[108] *See id.*

[109] *See* George Dvorsky, *Here's How to Get Rid of Traffic Jams*, GIZMODO (July 9, 2014), https://io9.gizmodo.com/could-new-technologies-make-traffic-jams-a-thing-of-the-1602353172?utm_medium=sharefromsite&utm_source=gizmodo_email&utm_campaign=bottom [https://perma.cc/ZK9W-B7A6].

[110] U.S. CONST. amend. V ("nor shall private property be taken for public use, without just compensation.").

[111] Loretto v. Teleprompter Manhattan CATV Corp., 458 U.S. 419 (1982). New York law at the time provided that an owner of a multi-unit apartment building "must permit a cable television company to install its cable facilities upon his property." *Id.* at 421. Writing for the Court, Justice Thurgood Marshall concluded that such a "permanent physical occupation authorized by government is a taking without regard to the public interests that it may serve." *Id.* at 426. *Loretto* establishes that the government may not require (without just compensation) a property owner to grant access to a third party (or its wares) so that the latter permanently can occupy the owner's premises. *See also* Corsello v. Verizon New York, Inc., 967 N.E.2d 1177, 1184–85 (N.Y. 2012) (noting that when a telephone company "attached a box to a building that plaintiffs own, and used the box to transmit telephone communications to and from Verizon's customers in other buildings," the building owner may state a valid claim for inverse condemnation).

[112] *See Loretto*, 458 U.S. at 451.

[113] *See* Fry, *supra* note 83.

even in the smallest way, any owner's improvements,[114] there are but two obvious solutions. One is to legislate that communities are not subject to the same limitations as are utilities companies under *Loretto*, as they are not acting for a profit motive but are acting for a public safety (police power) purpose. The second solution is to use the "carrot approach," cajoling dedications of non-exclusive easements (in three dimensions[115]) for municipal occupancy of sensors and ancillary devices in trade for higher density allowances or some other incentive to permit increased revenue-generation. Simply stated, either performance zoning or future development agreements coupling the private and public sectors in a property development "alliance" will build incentives to permit a greater magnitude of IoT device installation inside the private property owner's physical boundaries.[116]

B. Corridors Are to Be Assessed and Planned Three-Dimensionally, Repurposing Them Strategically While Municipalities Continuously Explore New Accessibility Options

> *[O]ur Western world is yielding to a fluid organization of space that we as yet do not entirely understand, nor know how to assimilate as a symbol of what is desirable and worth preserving.*[117]

Earlier, this author laments that the IoT, powered by artificial intelligence, is touted as the solution to all traffic management and

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[114] *See, e.g.*, Cable Holdings of Georgia v. McNeil Real Estate Fund VI, 953 F.2d 600, 604–06 (11th Cir. 1992).

[115] "Non-exclusive" means that the owner continues to have use, albeit a more limited use, of the portion of her property subject to the easement rights. The three-dimensional aspect is mandated because sensors may be needed by local governments to monitor the movement of objects (drones, monorails, moving sidewalks, embarking/disembarking points) and even non-sensor infrastructure may be installed above or below grade level. 3D easements are not news everywhere. *See* Haim Sandberg, *Three-Dimensional Partition and Registration of Subsurface Space*, 37 IS. L. REV. 119, 121 (2003), http://juritecture.net/3ddoc/104.pdf [https://perma.cc/8YMK-XWZB] (describing that subsurface space "can be used to solve traffic and parking problems . . . where any above-ground solution would cause real damage to existing land use."); Anna Aalto & Saara Paronen, *Legal Alert—Three-Dimensional Real Estate Formation Provisions To Be Included in Legislation*, BORENIUS (Apr. 4, 2017), https://www.borenius.com/2017/04/04/legal-alert-three-dimensional-real-estate-formation-coming-true/ [https://perma.cc/9X8Q-TAH6] (noting impending Finnish legislation permitting creating a number of 3D real properties above or under the basic surface level real property; these aerial and subterranean properties would require an approved city plan and a binding subdivision plan in a building block area).

[116] *See generally* Widener, *supra* note 9, at 649–59 (noting the manner in which performance zoning incents developers seeking entitlements).

[117] JOHN BRINKERHOFF JACKSON, A SENSE OF PLACE, A SENSE OF TIME viii (1994).

accessibility problems. Rights of way henceforth must be visualized as three-dimensional, adopting one fundamental premise. No version of "surface transportation" is viable in Corridors bombarded with constantly evolving ways of moving about. Coupling new transport inventions with looming infrastructure degradation plus the new-urbanist's desire for "street activation" compels concluding that not enough roadbed width exists to accommodate "last mile" deliveries of freight and people at grade level. Comprehensive, long-range planning must occur on the vertical as well as the horizontal axis, to move people, freight, and their mobility devices—a more fluid conception of planning.[118] Vertical urbanism is becoming familiar to municipalities thinking deeply about "territorializing" vertical space.[119] This premise is vital in the era of smart technologies, given a community's need to reimagine infrastructure to achieve density scale through optimizing public space utilization while protecting the public from cyber- or physical-terrorist threats.[120]

Most consequentially, future land planning requires artificial intelligence incorporation into forms of interrelated "smart" infrastructure components. It is simple-minded to reject employing artificial intelligence to conceptualize potential solutions to massive accessibility problems. Acceptance is not capitulating to the "let IoT sensors figure it all out in league with AI" mentality. Initially, however, land and transportation planners should feel competent to intervene with artificial intelligence[121]—animated

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[118] *See generally* Stephen Graham & Lucy Hewitt, *Getting off the Ground: On the Politics of Urban Verticality*, 37 PROG. HUM. GEO. 72, 73–74 (2012), https://journals.sagepub.com/doi/10.1177/0309132512443147 [https://perma.cc/JQC4-PTKQ]; Andrew Harris, *Vertical Urbanisms: Opening up Geographies of the Three-Dimensional City*, 39 PROG. HUM. GEO. 601, 612 (2015); Jean-Claude F. Thill & H. Diep Dao, *Traveling in the Three-Dimensional City: Applications in Route Planning, Accessibility Assessment, Location Analysis and Beyond*, 19 J. TRANSPORT GEO. 405 (2011); Sisson, *supra* note 49 (quoting the director of the Urban Freight Lab at the University of Washington, who opines that freight movement largely is ignored in urban planning for transportation corridors today; another transportation planner argues that "planners and architects believe that freight magically appears on your mailbox."*)*.

[119] Samba Siva Kiran, *Three-dimensional City Planning Using Photogrammetry and GIS*, DIRECTIONS MAG. (Jan. 20, 2015), https://www.directionsmag.com/article/1273 [https://perma.cc/F6ME-E8N6]; *3D Urban Mapping: From pretty pictures to 3D GIS*, ESRI 7, 12 (Dec. 2014), https://www.esri.com/library/whitepapers/pdfs/3d-urban-mapping.pdf [https://perma.cc/4KYN-BKBQ].

[120] *See, e.g.*, Rahman, *supra* note 97, at 29–30, 32; Ian G.R. Shaw, *The Great War of Enclosure: Securing the Skies*, 49 ANTIPODE 883, 883 (2017); Laura Bliss, "*Ubiquitous as Pigeons": Imagining Life in the City of Drones*, CITYLAB (Aug. 5, 2014), https://www.citylab.com/life/2014/08/ubiquitous-as-pigeons-imagining-life-in-the-city-of-drones/375568/ [https://perma.cc/8WFT-2YSH].

[121] Artificial intelligence generally is defined as programming computers to "think like

tools "observing" patterns of traffic behavior, projecting future patterns, and applying reason for optimal vehicular and pedestrian usage of rights of way.[122] Fortunately, data sharing and visualization realms will speed development of these items.[123]

First on the scene, Maptitude offered street-level geographic analysis devised to aid retailers in optimizing store networks by charting straight-line distances, road-travel distances, and elapsed travel times in various map layers.[124] Unfortunately, these map layers focused on driving times and not on accessibility means other than movement in passenger vehicles.[125] Lately, Remix cooperates with the National Association of City Transit Officials ("NACTO") (incorporating NACTO's SharedStreets) to create a next-generation route-planning tool.[126] The tool creates shared visualization of transportation with an interface that allows discrete team collaboration efforts without cross-cancellation results.[127] This allows planners to share the realm of transportation planning with traffic engineering specialists and reduce siloed work by equipping land planners and other stakeholders with improved platforms.[128] In the near term, quantum

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humans" via algorithms, so that machines can autonomously process volumes of data and find among the data patterns, imitating cognitive states. These machines then will "reason" through deriving hypotheses or formulating recommendations, such as changing lanes, forging ahead or slowing down, as machines "learn" from that data processed. *See* Ginni Rometty, *The Natural Side of A.I.*, WALL ST. J. (Oct. 18, 2016), https://www.wsj.com/articles/the-natural-side-of-a-i-1476799723 [https://perma.cc/SQF3-6HVA]. This is accomplished largely by looking through vast data points for patterns, carrying out tests to evaluate the data while extrapolating results from it, and creating new patterns to discover solutions to problems beyond the vision of their programmers. *See* Julie Sobowale, *How artificial intelligence is transforming the legal profession*, ABA J. (Apr. 1, 2016), http://www.abajournal.com/magazine/article/how_artificial_intelligence_is_transforming_the_legal_profession [https://perma.cc/L67X-296A].

[122] *See* Jason Anders & Jenn-Hsun Huang, *Inside the Brain of the Driverless Car*, WALL ST. J. (Oct. 31, 2016), https://www.wsj.com/articles/inside-the-brain-of-the-driverless-car-1477879741 [https://perma.cc/83M4-GKNW].

[123] Patrick Sisson, *This urban design tool helps planners understand the entire street network*, CURBED (Jan. 17, 2018), https://www.curbed.com/2018/1/17/16901798/transportation-urban-planning-street-design-urbanism-remix [https://perma.cc/87FX-7FRM].

[124] *See Maptitude Mapping Software*, CALIPER, https://www.caliper.com/maptitude/mappingsoftware.htm [https://perma.cc/VA35-A2AZ] (last visited Oct. 28, 2019).

[125] *Id.*

[126] Sisson, *supra* note 123.

[127] *See id.*

[128] *See* GOVERNOR'S OFF. OF PLAN. & RES., TECHNICAL ADVISORY: ON EVALUATING TRANSPORTATION IMPACTS IN CEQA (2018), http://www.opr.ca.gov/docs/20180416-743_Technical_Advisory_4.16.18.pdf [https://perma.cc/2UM6-H499]. A land use model can be used to estimate the land use effects of a roadway capacity increase, and the traffic patterns that result from the land use change can then be fed back into the travel demand model,

computing needs community deployment to aid in design of mobility scenarios based upon changing conditions "in the field," accounting for changing Corridor capacities (horizontally and vertically) and desired average carriage-velocities in all dimensions.[129] Related premises here are:

1. Subterranean Areas in a CBD Are Not the Private Preserve of Utility Vaults, Conduits, and Pipes

Elon Musk proposes using rights of way subsurfaces to propel vehicles at high speeds via "electric sleds" through tunnels across substantial distances.[130] Networked tunnels eventually may boost automated and seamless "transfers" between those tunnels.[131] Of course, physical limitations on this mode of 3D street design will challenge communities until engineers learn how to eliminate or relocate vital underground utilities lines to avoid conflict with tunnel passageways.[132] Greater impedances still include underground mass transit routes or artifacts such as historic building foundations to be worked around.[133]

PLP/Architecture proposes a robust grid of small-bore tunnels spaced at one-kilometer distances, serving as a primary underground grid, where traffic never ceases to move.[134] Accompanying "spurs," akin to a

leading both planning model and travel demand model to be reiterated to produce an accurate impact result.

[129] *See infra* text accompanying notes 324–28.

[130] *See Elon Musk unveils a 125 mph electric sled to fast-track cars through tunnels*, CBS NEWS (May 12, 2017), http://www.cbsnews.com/news/elon-musk-electric-sled-fast-track-cars-tunnels-boring-company/ [https://perma.cc/3X4Z-8BDP]. Musk claimed that the company's initial tunnel in Hawthorne would open to the public in December 2018. *See also* Laura J. Nelson, *Plans offer a peek into Elon Musk's tunnel in Hawthorne, including an elevator hidden in a garage*, L.A. TIMES (Oct. 23, 2018), http://www.latimes.com/local/lanow/la-me-ln-elon-musk-hawthorne-20181023-story.html [https://perma.cc/GC3T-5ZRL].

[131] *See* Nelson, *supra* note 130.

[132] *See* Aarian Marshall, *Inside the Tunnel Elon Musk is Already Digging under Los Angeles*, WIRED (Jan. 30, 2017), https://www.wired.com/2017/01/inside-tunnel-elon-musk-already-digging-los-angeles/ [https://perma.cc/R3FV-UFKR].

[133] *See id.* But the "proof of concept" of using the subterrain in even densely populated areas is the Mumbai Metro Rail Corporation Ltd.'s boring and building of the city's Metro Line 3, its first underground (and sometimes above-ground) train constructed beneath the most packed neighborhoods in the metroplex. *See* Corinne Abrams, *'You Have to Actually Cut Open Mumbai's Belly'—Inside One of the World's Most Audacious Transit Projects*, WALL ST. J. (Jan. 7, 2019), https://www.wsj.com/articles/through-monsoons-around-slums-under-templesmumbai-builds-its-first-subway-11546803877 [https://perma.cc/EE94-HKS9]. Work began in 2016 and, at the pace of one mile per month, is scheduled for completion sometime late in 2021. *See id.*

[134] *See* Lloyd Alter, *Another look at PLP/Architecture's CarTube*, TREEHUGGER.COM

railroad's network, serve as exit stations so that one's vehicle emerges from the steadily moving tube network to traverse the last short distance to the rider's ultimate destination.[135] Further, in communities like the proposed Quayside development being transformed along Toronto's waterfront by the city in partnership with Alphabet's Sidewalk Labs, robots will transport mail and garbage through underground tunnels.[136] The underground clearly provides too many infrastructure resources to ignore in favor of dead storage of static objects—particularly when outdated or undersized utility, water, and sewer lines have been abandoned in place.[137]

2. While Respecting Existing Air Rights of Corridors' Abutting Owners, Open Space Above Aerial Utilities Lines and Facilities Will Serve More Purposes than UAV Cargo Transport, Billboards, and Cell Tower Facilities

Multi-purposing of motos must occur in all Corridor "directions." When communities accept that fact and demand it of their owners, aerial opportunities expand. These innovations along Corridors are open to experimentation:

a. Opportunities for vertical pathways of limited stoppage; and
b. Elevated linear motion guideway systems for drones and other vehicles enabling them to "drop" loads to ground level or into a building "cargo receptacle mezzanine."

Linear Motion Guideways take numerous forms and are not new technology in the machinery realm;[138] but nothing yet has been built

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(Dec. 12, 2016), https://www.treehugger.com/urban-design/another-look-plparchitectures-cartube.html [https://perma.cc/4JQR-JGAN].

[135] *See How it Works*, CARTUBE, http://cartube.global/index.html [https://perma.cc/55EZ-JQYV] (last visited Oct. 28, 2019). Of course, this plan implicates a need for a highly robust grid of tubes in order to cause the overall transit time to be substantially reduced; in other words, the tubes have to take the riders where they need or desire to go. *See* Alter, *supra* note 134.

[136] *See* Elizabeth Woyke, *A smarter smart city*, MIT TECH. REV. (Feb. 21, 2018), https:// www.technologyreview.com/s/610249/a-smarter-smart-city/ [https://perma.cc/356M-CA7Y].

[137] *See* Al Field, *Out of sight, out of mind? Are abandoned utilities affecting you?*, 84 APWA REP. 94, 94–95 (2017), https://www.apwa.net/Library/Reporter/201708_ReporterOnline.pdf [https://perma.cc/9MQJ-PXRR] (noting that cities "abuse rights of way" by leaving abandoned facilities in place).

[138] Manjushree D. Sutar et al., *Linear Motion Guideways—A Recent Technology for*

resembling what is proposed here—incorporating an elevated bearing-roller system rapidly transporting drones in a fixed linear path through a Corridor at times of day when the airways' congestion level threatens conflicting movements with other mobile objects. Frequent "stops" located along the guideway would enable "drops" of drone cargo into receptacles for pickup by other delivery modes or customer pickup, limiting chances of plummeting UAV objects or its cargo into occupied areas.

Kitty Hawk is developing its ten-rotor, single-seat machine called the "Flyer,"[139] while Uber creates the Uber Elevate Network, featuring vertical takeoff and landing vehicles ("VTOLs") that provide an urban aviation rideshare product called UberAir, which should be better for the environment than petroleum-fueled vehicles.[140] Uber proposes adaptive reuse of parking garages and helipads, repurposing them for use as "vertiports" and "vertistops."[141] Concurrently, Dubai is partnering with Ehang Inc., the Chinese drone-maker, to commence a "drone taxi era" in that emirate, moving a single passenger with luggage short distances at sixty miles per hour to her destination.[142] Of course, myriad challenges attend this initiative in America.[143] First, flying machines must operate under FAA regulations by licensed pilots.[144] Secondly, these new VTOLs must compete for air space with drones soon to be deployed for surveillance, television productions, and commercial deliveries promoted by enterprises like Amazon.[145] Thirdly, developers in major metropolises possess preexisting air rights (a real property right), attaching to their land parcels up to the "navigable airspace" as defined by the Air Commerce Act of 1926 where a commercial "freedom of transit" arises.[146] Transferable development rights may be compromised by municipal regulations endorsing a trespass upon the

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Higher Accuracy and Precision Motion of Machine Tool, 3 INTL J. INNOVATIONS IN ENG.'G & TECH. 104, 104 (2013).

[139] *See* Dan Neil, *The First Flying Car Review*, WALL ST. J. (Sept. 12, 2018), https://www.wsj.com/articles/the-first-flying-car-review-1536753601 [https://perma.cc/ZK2U-LLRP].

[140] UBER, *supra* note 37; Canter, *supra* note 37; Neil, *supra* note 139.

[141] *See* UBER, *supra* note 37.

[142] *See* Parasie, *supra* note 17.

[143] *See* Widener, *supra* note 34, at 246–48.

[144] *See id.* at 260.

[145] *See id.*

[146] *See* Air Commerce Act of 1926, 44 Stat. 572, 49 U.S.C.A. § 176 (Supp. III, 1952); Martin A. Schwartz, *It's Up in the Air: Air Rights in Modern Development,* 89 FLA. BAR J. 42, 42 (2015), https://www.floridabar.org/the-florida-bar-journal/its-up-in-the-air-air-rights-in-modern-development/ [https://perma.cc/ET7B-MF8Z]. Navigable airspace today is deemed as being five hundred feet from the ground. *See id.*

airspace of the so-called "contributing site."[147] Local land use regulations will have a role to play in governance of this "sub-navigable" space—or chaos will ensue as property owners license, in *ad hoc* fashion, use of their shafts of space overlaying the land's boundaries.[148]

C. Corridors' Transportation Has Regional Consequences, So Accessibility Solutions Will Be Interconnected Across Jurisdictional Lines Instead of Being Locally Managed

The Anton Anderson Memorial Tunnel—the longest (2.5 miles) highway tunnel in North America—must be shared by cars and trains taking turns traveling in outbound and inbound directions so it reverses course on the half-hour.[149] (Entering Whittier, Alaska you move on the half-hour; while leaving from Whittier, you move forward at the top of each hour.)[150] This ferrying-oriented, fixed-schedule traffic plan, relatively successful in uncongested areas, will not serve a metropolitan area swollen with commuters indifferent to its rhyme and reason. Nor will these conditions: inside Leonia, New Jersey, non-resident commuters intermittently are banned from driving on sixty of its streets during morning and evening rush hours.[151] New rules implemented in January 2018 prohibit New York metropolitan workers taking shortcuts through this town by following routing instructions from navigation apps like Waze, Google Maps, or Apple Maps—a phenomenon Leonia's mayor, Judah Zeigler, says caused town gridlock, costing money and putting townspeople in danger.[152] Meanwhile, intercity rail lacked sufficient connection with

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[147] *Cf.* Schwartz, *supra* note 146, at 45 (noting that the TDR process severs unused development rights from a contributing site, allowing its owner to convey for value those surrendered development rights to another property known as the "receiving site" and enabling increased density of development upon that receiving site); *see* Chad J. Pomeroy, *All Your Air Right Are Belong to Us*, 13 NW. J. TECH. & INTELL. PROP. 277, 284–86, 297 (2015), http://scholarlycommons.law.northwestern.edu/njtip/vol13/iss3/1 [https://perma.cc/U24J-Y2C5].

[148] Widener, *supra* note 34, at 263–65 (noting the wisdom of surrendering air space to governance by cities); *see also* Rahman, *supra* note 97, at 40.

[149] *Anton Anderson Memorial Tunnel: Accomplishments*, ALASKA DEP'T OF TRANSP. & PUB. FACILITIES, http://www.dot.state.ak.us/creg/whittiertunnel/accomplishments.shtml [https://perma.cc/Q35N-63C4] (last visited Oct. 28, 2019); *Anton Anderson Memorial Tunnel: Schedules and Hours of Operations*, ALASKA DEP'T OF TRANSP. & PUB. FACILITIES, http://www.dot.state.ak.us/creg/whittiertunnel/schedule.shtml [https://perma.cc/WF5B-ZBDH] (last visited Oct. 28, 2019).

[150] *Anton Anderson Memorial Tunnel: Schedules and Hours of Operations*, *supra* note 149.

[151] Leonia, N.J. CODE § 194-25.1(a) (2018); *Anton Anderson Memorial Tunnel: Schedules and Hours of Operations*, *supra* note 149.

[152] *See* Svetlana Shkolnikova, *Englewood to seek legal challenge to Leonia's road closures*, NORTHJERSEY.COM (Mar. 8, 2018), https://www.northjersey.com/story/news/bergen/engle

urban transit systems, so passengers traveling from one city to another may not be able to pick up a bus, streetcar, or other form of "local ride" upon completing the longer journey by rail.[153] The New Jersey Superior Court in August 2018 ruled that Leonia's ordinance was invalid but did not bar the town from passing a different style ban.[154] Which quickly ensued.[155]

These illustrations of "zero summing" point to the general failure of regional transportation planning and lack of understanding about congestion-avoidance's limitations. The problem of turf-protection is magnified today because of professional planner self-confidence crises fueled in

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wood/2018/03/08/englewood-seek-legal-challenge-leonias-road-closures/403155002/ [https://perma.cc/CV7S-4ZR8]. A citizen of nearby Edgewater, N.J. filed a lawsuit to compel the city to allow her access. *See* John Surico, *What Happens When a City Bans Non-Resident Drivers?*, CITYLAB (Apr. 18, 2018), https://www.citylab.com/transportation/2018/04/the-small-town-that-took-on-waze /558215/ [https://perma.cc/V6TL-JD2Z]. Then, the New Jersey Attorney General's Office joined as a party on behalf of the Department of Transportation in June, asking the court to declare the closures illegal and compel Leonia to remove all signs restricting access. *See* Svetlana Shkolnikova, *Attorney general joins lawsuit against Leonia's road closures*, NORTHJERSEY.COM (July 11, 2018), https://www.northjersey.com/story/news/bergen/leonia/2018/07/11/attorney-general-joins-lawsuit-against-leonia-nj-road-closures/772438002/ [https://perma.cc/Q9XC-EKTK]. The court forbade implementing these regulations but undaunted Leonia devised similarly purposed regulations and put them into effect, triggering another lawsuit. *See* Kiran, *supra* note 119.

[153] *See* Jonathan English, *Why Public Transportation Works Better Outside the U.S.*, CITYLAB (Oct. 10, 2018), https://www.citylab.com/transportation/2018/10/while-america-suffocated-transit-other-countries-embraced-it/572167/ [https://perma.cc/SZL5-3N52]. Sadly, the United States hasn't coordinated its rail-transit infrastructure investment and development policies for decades. *See* MICHAEL RENNER & GARY GARDNER, GLOBAL COMPETITIVENESS IN THE RAIL AND TRANSIT INDUSTRY 27–28 (2010), https://www.adhesives.org/docs/pdfs/globalcompetitiveness-rail.pdf?sfvrsn=6247e1f7_0 [https://perma.cc/SE6C-3XJT].

[154] *See* Noah Cohen, *North Jersey town forced to open its roads to commuters, vows to try ban again*, NJ.COM BERGEN COUNTY (Aug. 30, 2018), https://www.nj.com/bergen/index.ssf/2018/08/north_jersey_town_forced_to_open_its_roads_to_commuters_vows_to_try_ban_again.html [https://perma.cc/B3RS-MTX9]. Sadly, Leonia adopted the new ordinances in response to the August ruling by a Superior Court judge that voided the road closures based on the borough's failure to get permission for closing some of them from the state Department of Transportation. *See* Kiran, *supra* note 119. Another motion submitted by Attorney General Gurbir Grewal on behalf of the state Department of Transportation sought to overturn the new ban. Svetlana Shkolnikova, *NJ attorney general mounting another legal challenge to Leonia's road closures*, NORTHJERSEY.COM (Oct. 5, 2018), https://www.northjersey.com/story/news/bergen/leonia/2018/10/05/nj-attorney-general-mounting-legal-challenge-leonias-road-closures/1510660002/ [https://perma.cc/JAD9-WUBL]. The case was removed to the U.S. District Court in New Jersey and then returned to state court. *See* Svetlana Shkolnikova, *Leonia's road closure ordinance ruled invalid*, NORTHJERSEY.COM (Aug. 30, 2018), https://www.northjersey.com/story/news/bergen/leonia/2018/08/30/leonia-nj-road-closure-ordinance-ruled-invalid/1145418002/ [https://perma.cc/8762-YF2Z] [hereinafter Shkolnikova, *Leonia's road closure ordinance ruled invalid*].

[155] Shkolnikova, *Leonia's road closure ordinance ruled invalid*, *supra* note 154.

part by inexperience with phenomena like incoming 5G technology and autonomous vehicle capabilities. This in turn leads to anxieties about how to invest in infrastructure, given the fluid "disruptive-technologies" environment.[156] Moreover, not every local public official thinks that coordination matters even in jurisdictions where transportation planning is critical.[157]

Some in public life do recognize the virtue of regional transportation planning, and a number of so-called Metropolitan Planning Organizations ("MPOs")[158] have sprung to life with various levels of regional clout.

> MPOs are designated by agreement between the governor and local governments that together represent at least 75 percent of the affected population (including the largest incorporated city, based on population) or in accordance with other procedures established by applicable state or local law. When submitting a transportation improvement program to the state for inclusion in the statewide program, MPOs self-certify that they have met all federal requirements.[159]

Under 49 U.S.C. section 5303(j), each MPO is charged to develop a Transportation Improvement Program ("TIP")—a list of upcoming transportation projects—covering a period of at least four fiscal years in concert

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[156] *See* Tom Cohen & Clemence Cavoli, *Automated Vehicles: Exploring Possible Consequences of Government (Non)intervention for Congestion and Accessibility*, 39 TRANSP. REV. 129, 141–43 (2019), https://www.tandfonline.com/doi/full/10.1080/01441647.2018.1524401?af=R [https://perma.cc/796D-4XGP] (noting bureaucratic fear of intervention for "anticipatory governance" in areas of traffic flow and accessibility due to ignorance of emerging technologies); Erick Guerra, *Planning for Cars That Drive Themselves: Metropolitan Planning Organizations, Regional Transportation Plans, and Autonomous Vehicles*, 36 J. PLAN. ED. & RES. 1, 5–7 (2016) (noting some planners feel they are "pondering the imponderable," helpless to anticipate future developments in an ITS environment where technology components are iterative and continuous, and AI is subject to a black box effect and biased inputs into agent-instructions).

[157] On May 3, 2018, Mayor Bill de Blasio opined that "each element of our mass transit planning has to be seen individually," referring to his desire, without integration into other systems, to augment the city's ferry services as well as promoting a light-rail streetcar for the Brooklyn-Queens waterfront. Integrating these services to afford transit options does not seem to be the Mayor's priority. Ben Max & Gabriel Slaughter, *New York City Doesn't Have a Comprehensive Plan; Does it Need One?*, GOTHAM GAZETTE (May 16, 2018), http://www.gothamgazette.com/city/7674-new-york-city-doesn-t-have-a-comprehensive-plan-does-it-need-one [https://perma.cc/42J6-E9EL].

[158] *See* FED. TRANSIT ADMIN., METROPOLITAN PLANNING ORGANIZATION (MPO) OVERVIEW (2019), https://www.transit.dot.gov/regulations-and-guidance/transportation-planning/metropolitan-planning-organization-mpo [https://perma.cc/XV52-KL4V].

[159] *See id.*

with state and public transit providers.[160] The TIP must include capital and non-capital surface transportation projects, bicycle and pedestrian facilities and other transportation enhancements, Federal Lands Highway projects, and safety projects included in the State's Strategic Highway Safety Plan.[161]

One such MPO, the Maricopa Association of Governments ("MAG"), concluded a 2040 Regional Transportation Plan for central Arizona's megapolitan area.[162] This entity's transportation division is charged with devising transportation plans and implementing strategies to improve transportation safety and mobility using intelligent transportation systems while remaining sensitive to the environment and supporting social and economic goals for the region.[163] MAG's transportation policy committee consists of twenty-two members representing cities and towns across the region, the private sector business community, the Arizona Department of Transportation, Maricopa County, and the Native American Communities.[164]

As a result of this public-private sector alliance, "the MAG [planning] region is nationally known for innovations in planning and implementing [intelligent transportation systems] ("ITS") solutions."[165] MAG is introducing sensor, computer, electronics and communication technologies, and management strategies cohesively, implementing them in the MAG region on area freeways, surface street arterials, and within the transit system.[166] The ITS Strategic Plan adopted by MAG is the "regional roadmap" for deploying these ITS projects and programs.[167] Constituent

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[160] 49 U.S.C. § 5303(j)(1) (2012).

[161] 49 U.S.C. § 5303(c)(2) (2012). To be clear, however, there are no federal standards requiring specific infrastructure provision by local authorities where "connected" vehicle systems are concerned. *See* PUBLIC SECTOR CONSULTANTS & CTR. FOR AUTOMOTIVE RESEARCH, PLANNING FOR CONNECTED AND AUTOMATED VEHICLES 27–28 (Mar. 2017), https://www.cargroup.org/wp-content/uploads/2017/03/Planning-for-Connected-and-Automated-Vehicles-Report.pdf [https://perma.cc/6WBT-9QHT].

[162] MARICOPA ASS'N OF GOV'TS, REGIONAL TRANSPORTATION PLAN (RTP) (2017), http://azmag.gov/Programs/Transportation/Regional-Transportation-Plan-RTP [https://perma.cc/2E3P-QVNQ].

[163] *Id.* at 1-1, 1-2.

[164] *Transportation Policy Committee*, MARICOPA ASS'N OF GOV'TS, http://www.azmag.gov/Committees/Policy-Committees/Transportation-Policy-Committee (last visited Oct. 28, 2019).

[165] *See Intelligent Transportation Systems Program*, MARICOPA ASS'N OF GOV'TS, http://www.azmag.gov/Programs/Transportation/Road-Safety-and-Technology/Intelligent-Transportation-Systems-Program [https://perma.cc/BYZ6-B79L] (last visited Oct. 28, 2019).

[166] *Id.*

[167] *Id.*

MAG members' political figures acknowledge that ITS solutions must be regionally integrated to succeed.[168]

Not all MPOs have been widely lauded for their performance; some are critiqued for being moderators within affected regional jurisdictions.[169] Still, too many, if not most, regional transportation plans in the United States continue employing performance metrics focused on reducing the roadway congestion experienced by automobile drivers[170] with higher vehicle speeds as the "fundamental criterion for success."[171] Speed-based metrics include roadway level of service ("LOS"), peak-period delay, traffic volume/road capacity, travel time/speed, vehicle hours of travel, the duration of peak-period congestion, and other indicators.[172] Even high-occupancy toll lanes, the most common demand-management strategy used in the United States, are typically bolted on to increase capacity, rarely *replacing* existing highway travel lanes.[173] Focus upon the proper metrics of achievement is lacking. What matters are metrics demonstrating what all transit forms collectively accomplish for accessibility. Accessibility focuses planners on how each technology innovation adds value.[174] Shifts

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[168] *See* Jordan Buie, *Diane Black's Republican opponents for governor diverge from her on transportation*, TENNESSEAN (June 22, 2018), https://www.tennessean.com/story/news/politics/tn-elections/2018/06/21/tennessee-governors-race-diane-black-randy-boyd-beth-harwell-bill-lee-transportation-plans/723162002/ [https://perma.cc/AM57-GV2M] (citing Randy Boyd's comments about regional technology solutions to greater Nashville's traffic movement issues). In 2016, Guerra noted that not many regional transportation plans incorporated the uses and impacts of self-driving cars. *See* Guerra, *supra* note 156, at 5, 8.

[169] *See* Guerra, *supra* note 156, at 7.

[170] *See* KEVIN J. KRIZEK & DAVID LEVINSON, ACCESS FOR PERFORMANCE (2010), http://ssrn.com/abstract=1737789 [https://perma.cc/N9TR-FL9D]; S.L. Handy, *Planning For Accessibility in Theory and in Practice, in* ACCESS TO DESTINATIONS 131, 131–32 (David M. Levinson & Kevin J. Krizek eds., 2005); Reid Ewing, *Transportation Service Standards—As if People Matter*, 1400 TRANSP. RES. REC. 10, 13 (1993).

[171] Jonathan Levine et al., *Does Accessibility Require Density or Speed*?, 7 J. AM. PLAN. ASS'N 157, 158 (2012). That speed is a "comfort metric" is suggested by higher freeway speed implementation across the country, safety attributes of speed notwithstanding, see Jo Craven McGinty, *Speed-Limit Boosts Show No Sign of Slowing*, WALL ST. J. (Mar. 17, 2018), https://www.wsj.com/articles/speed-limit-boosts-show-no-signs-of-slowing-down-1521205200 [https://perma.cc/A5ZW-KKPA].

[172] Reid Ewing, *Beyond Speed: The Next Generation of Transportation Performance Measures*, PERFORMANCE STANDARDS FOR GROWTH MANAGEMENT 31, 31 (1996).

[173] Reid Ewing & David Proffitt, *Improving Decision Making for Transportation Capacity Expansion Qualitative Analysis of Best Practices for Regional Transportation Plans*, 2568 TRANSP. RES. REC. 1, 1–8 (2016).

[174] *See* TRANSITCENTER, *supra* note 15. An aid to that focus may be from federal authorities. In January 2017, the Federal Highway Administration announced it would begin using the metric of how many people get moved, apart from vehicular levels of service. *See* Angie Schmitt, *Engineers to U.S. DOT: Transportation Is About More Than Moving Cars*,

in "movement" paradigms brought about by autonomous vehicles, artificial intelligence, and their intersections with the Internet of Things[175] are instrumental here. Resistance to this new perspective stems from the belief that autonomous vehicles' roadway saturation threatens increased use of public transport and distracts from proper focus on improving publicly funded transport—without reducing congestion or environmental contaminants.[176] The second source of some planner resistance is the underlying belief that autonomous vehicles optimally complement, not supplant, public transport systems.[177]

STREETSBLOGUSA.COM (Aug. 26, 2016), https://usa.streetsblog.org/2016/08/26/engineers-to-u-s-dot-transportation-is-about-more-than-moving-cars/ [https://perma.cc/252P-S6G5].

[175] X. Krasniqi & E. Hajrizi, *Use of IoT Technology to Drive Automotive Industry from Connected to Full Autonomous Vehicle* 269, 270–71, 274 (Oct. 2016) (unpublished conference paper), *available at* https://www.sciencedirect.com/science/article/pii/S2405896316325162.

[176] *See* Fraedrich et al., *supra* note 75, at 4–6, 15–16. Indeed, impacts of autonomous transportation on sustainability within the power grid anchoring corridors may unfold slowly. Swarms of shared vehicles on busy roads, moving steadily but at slower speeds, may increase nonrenewable energy production in the short term. But if shared vehicle use includes relying on generated power from microgrids or peer-to-peer power distribution systems through vehicle charging-stations, such shared vehicles may become critical to grid survival, as electric vehicles feed their internally generated power from their lithium-ion batteries into power lines serving the grid. *See* Kyle Field, *New V2G Pilot In Genoa Aims To Define Operating Standard For V2G In Italy*, CLEANTECHNICA (May 18, 2017), https://cleantechnica.com/2017/05/18/v2g-pilot-in-italy-hopes-to-define-operating-standard/ [https://perma.cc/CTE6-QFK3]; Steve Hanley, *Vehicle-To-Grid (V2G) Research Study Beginning In UK*, CLEANTECHNICA (Feb. 15, 2018), https://cleantechnica.com/2018/02/15/vehicle-grid-v2g-research-study-beginning-uk/ [https://perma.cc/B4V2-QA8T]; Rob Stumpf, *Companies and Cities Look to Distributed Charging for Electric Cars*, THE DRIVE (May 3, 2018), http://www.thedrive.com/tech/20396/companies-and-cities-look-to-distributed-charging-for-electric-cars?iid=sr-link2 [https://perma.cc/6VLL-JJF8]; *The Grid-Integrated Vehicle with Vehicle to Grid Technology*, U. DEL., https://www1.udel.edu/V2G/V2Gconcept.html [https://perma.cc/WHP6-PXVW]. *See generally* Adrene Briones et al., *Vehicle to Grid (V2G) Power Flow Regulations And Building Codes Review by the AVTA*, IDAHO NAT'L LAB. (2012), https://www.energy.gov/sites/prod/files/2014/02/f8/v2g_power_flow_rpt.pdf [https://perma.cc/8M67-2V58]. Some predict that V2G (vehicle to grid) initiatives will gain broader acceptance as denser urban populations seek sustainable mobility using "not owned" or "co-owned" ubiquitously moving, autonomous vehicles in the sharing economy. *See* Heinrichs, *supra* note 12, at 216. Interesting autonomous vehicle issues include whether the age requirement for a driver's license will decrease (as it loses its relevance over time) and who will own the insurance and/or tort liability when the individual enters a shared vehicle for a ride. *See id.* at 217. If the passenger in the fully autonomous vehicle informs the Alexa-type "assistant" of the address of the destination and the vehicle crashes, how is the rider culpable if she speaks no further instructions to the robotic agent before the crash?

[177] *See* Fraedrich et al., *supra* note 75, at 4–6, 15–16; Eric Jaffe, *Where new mobility and traditional transit are actually getting along*, MEDIUM SIDEWALK TALK (June 8, 2018), https://medium.com/sidewalk-talk/where-new-mobility-and-traditional-transit-are-ac

California's planners recognize the need to think about accessibility. In California, LOS has been jettisoned in favor of the metric of Vehicle Miles Traveled, one considerably more in line with environmental and urban mobility goals on a regional basis.[178] Planning for higher travel speeds that facilitate longer trips and create the opportunity for more frequent trips, a *mobility* paradigm, is not destined to be the gold standard in community planning. What is needed is maximizing *accessibility* to diverse citizens in the town.[179] To that end, Transport for London devised a "Public Transport Accessibility Index," evaluating the accessibility of main streets to all forms of public transport on a six-point scale.[180] This measurement drives decisions about transportation planning in diverse cities—whether travelers can reach their destinations affordably and can conveniently "catch a ride."[181]

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tually-getting-along-15b235242430 [https://perma.cc/GU2T-MJVG] (noting Pinellas County's Suncoast Transportation Authority's "Direct Connect" experiment since 2016 to have Uber drivers deliver or pickup riders to and from twenty-four separate points along the Authority's core bus routes).

[178] *See* GOVERNOR'S OFF. OF PLAN. & RES., *supra* note 128, at 8–9, 19; Eric Jaffe, *Transit Projects Are About to Get Much, Much Easier in California*, CITYLAB (July 8, 2014), https://www.citylab.com/transportation/2014/07/transit-projects-are-about-to-get-much-much-easier-in-california/374049/ [https://perma.cc/R4X6-EJ3A]. Vehicle miles traveled in California will mean "the amount and distance of automobile travel attributable to a project" where the term "automobile" refers to on-road passenger vehicles, specifically cars and light trucks. *See* GOVERNOR'S OFF. OF PLAN. & RES., *supra* note 128, at 3 (quoting CAL. CODE REGS. tit. 14, § 15064.3(a) (2019)). Interestingly, California notes that VMT has "largely a regional impact." *See id.* at 23; *see, e.g.*, ANDREW OWEN ET AL., ACCESSIBILITY ACROSS AMERICA: TRANSIT 2016, FINAL REPORT (2017) (noting that of all ways to measure accessibility, "the number of destinations reachable within a given travel time is the most comprehensible and transparent [gauge] as well as the most directly comparable across [American] cities."). This study notes that: "Accessibility is a function of both transportation networks and land use decisions, which has important policy implications. There are two broad avenues to increasing accessibility: improving transportation systems and altering land use patterns." *Id.* at 8. "Broad" refers to the imperative of regional planning for these elements. *Id.*

[179] Accessibility as an analytical construct began with the work of Walter G. Hansen in the late 1950s. *See generally* Walter G. Hansen, *How Accessibility Shapes Land Use*, 25 J. AM. INST. PLAN., 73, 73–76 (1959). Today, time-geographic accessibility measures attempt to gauge accessibility to work and to essential services such as health care facilities. *See, e.g.*, Jinhyung Lee & Harvey Miller, *Measuring the Impacts of New Public Transit Services on Space Time Accessibility: An Analysis of Transit System Redesign and New Bus Rapid Transit in Columbus, Ohio*, 93 APP. GEO. 47, 48, 51, 63 (2018), https://www.researchgate.net/publication/323586903_Measuring_the_impacts_of_new_public_transit_services_on_space-t [https://perma.cc/5B47-3CHB].

[180] Matthew Carmona, *London's Local High Streets: The Problems, Potential and Complexities of Mixed Street Corridors*, 100 PROGRESS. PLAN. 1, 36 (2015).

[181] *See id.*

As a region's population grows, the weakest link in that metro area pulls down an otherwise efficient transportation grid in densely populated areas.[182] While benefits need to be demonstrable for all segments of the region,[183] cooperation (or at least coopetition[184] if neighboring communities cannot look past rivalries in other arenas) among jurisdictions needs to occur in realms such as these:

1. Coordination of municipal and unincorporated master plans—stitching together area-wide movement, so that efficiency is not lost at community boundaries.[185] Each community's general plan must mandate traffic management strategies dovetailing with the traffic-impacts programming in adjacent communities.
2. Coordination of inducements to "move" via non-congested pathways
    a. Emphasizing off-peak travel times (if commuting to a remote office remains sensible);[186]

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[182] *See* THE BROOKINGS INST., METROPOLITAN POLICY PROGRAM, MOUNTAIN MEGAS: AMERICA'S NEWEST METROPOLITAN PLACES AND A FEDERAL PARTNERSHIP TO HELP THEM PROSPER 29–30 (2008).

[183] *See* Joey Garrison, *Nashville Voters Overwhelmingly Reject Transit Referendum*, TENNESSEAN (May 1, 2018), https://www.tennessean.com/story/news/politics/2018/05/01/nashville-transit-vote-davidson-county-mass-transit/564991002/ [https://perma.cc/2DDQ-GTX3].

[184] *See, e.g.*, Martha Koch & Gregory L. Newmark, *Legislating "Coopetition": Privatization and Planning Devolution in Germany*, 2543 TRANSP. RES. REC. 45, 45–47, 51 (2016) (describing Germany's *Verkehrsverbund* model that encourages individual transit firms to engage in cooperative planning instead of directly competing with each other thereby streamlining the public's transportation experience and consequently attracting greater ridership). Cooperative planning also is being spurred by Deutsche Bahn's initiative to make travel more seamless. *See* Michael Stalter, *Nahtlos Bahn Fahren-Mit Digitalisierung*, AMADEUS (Mar. 27, 2019), https://newsboard.amadeus.com/nahtlos-bahn-fahren-mit-digitalisierung/ [https://perma.cc/9RRK-6WRW].

[185] *See*, *e.g.*, Geoff Gerhardt, *How can we make one of the region's busiest roads safe for commuters and locals?* GREATER GREATER WASHINGTON (Oct. 23, 2018), https://ggwash.org/view/69568/make-the-washington-dc-regions-busiest-roads-usable-for-commuters-locals [https://perma.cc/NT6D-CEUF]. Consider the example of updating busy Georgia Avenue, where, in Montgomery Hills, installing a median would match that road's configuration in Silver Spring and Wheaton, Maryland; this would allow landscaping to be planted, preventing drivers from making dangerous mid-block turns and affording a pedestrian refuge for avenue crossing pedestrians. *See id.*

[186] *See* Walter Russell Mead, *Environmentalists Need to Get Real*, WALL ST. J. (Sept. 4, 2018), https://www.wsj.com/articles/environmentalists-need-to-get-real-1536010580 [https://

b. Keeping non-essential vehicles out of CBDs via congestion pricing or "cordon" tolling for driving through or parking in the critically congested areas;[187]

c. Multi-vehicle sharing of a single pathway—this will eliminate, for instance, "curbing off" of bus lanes as occurs in Nice, France, and other places where bus rapid transit is in vogue[188] and enabling AI leveraging for multimodal use of individual lanes; and

d. Moving at a constant velocity to minimize signalization that slows traffic.[189]

3. Coordination of public-private partnerships in traffic infrastructure such as encouraging developers to create (i) interior-to-building "passenger stations" for reserving rights of way widths for movement,[190] (ii) delivery facilities to take cargo from passing delivery vehicles within CBDs for customer storage pending pickup, (iii) easements across private property to link with above-grade pathways/guideways, and

perma.cc/2C5F-MEBS] (noting that sustainability should command worker "digital commuting" and avoid physical commuting with advances in technology that make presence inefficient); *see also* Fraedrich et al.*, supra* note 75.

[187] *See What is Congestion Pricing?,* FED. HIGHWAY ADMIN., https://ops.fhwa.dot.gov/publications/congestionpricing/sec2.htm [https://perma.cc/FFP8-YK5G] (last visited Oct. 28, 2019).

[188] *See* Nikitas et al., *supra* note 13, at 8 (discussing that bus rapid transit is "in vogue" in more than 100 cities worldwide; BRT applies rail-like infrastructure and operations to increase service levels; the infrastructure includes segregated rights of way, intelligent transport systems (AI-powered) and station-like platforms). The right of way conundrum is that while BRT typically is cheaper for consumers, and in some jurisdictions has priority at signalized intersections (increasing accessibility), BRT eliminates lane width otherwise available to other vehicles due to busway/loading platform segregation from remaining traffic. *See* Stephen Ford, *Albuquerque's Electric Bus Takes a Wrong Turn and Goes Nowhere*, WALL ST. J. (Mar. 29, 2019), https://www.wsj.com/articles/albuquerques-electric-bus-takes-a-wrong-turn-and-goes-nowhere-11553899172 [https://perma.cc/D3PG-CG3N]; Nikitas et al., *supra* note 13, at 8. Another problem, noted by Ford, is that dedicated lanes eliminate side-street ingress via left turns, creating navigation problems and inviting vehicular accidents. Ford, *supra*.

[189] *Roundabout benefits*, WASH. STATE DEP'T TRANSP., http://www.wsdot.wa.gov/Safety/roundabouts/benefits.htm [https://perma.cc/PS9P-HHWQ] (last visited Oct. 28, 2019).

[190] *See* Alan Ohnsman, *The End of Parking Lots as We Know Them: Designing for a Driverless Future*, FORBES (May 18, 2018), https://www.forbes.com/sites/alanohnsman/2018/05/18/end-of-parking-lot-autonomous-cars/#474bbe227244 [https://perma.cc/J22T-BP4H] (noting the advent of the "coach lobby" roundabout for rider drop off inside the building).

(iv) privately owned but publicly operated jitneys to accomplish last-mile passenger deliveries.[191]

The challenge with achieving item 3 just above is that despite those crucial municipal benefits of private sector partnering,[192] inertia intervenes while communities do not move with the speed of tech, so to say. Therefore, where an MPO is too static or local leadership is too timid to advance boldly in concert with the private sector, government bodies should hire a "Chief Transportation Innovation Officer" ("CTIO").[193] This official serves several functions; first among them is to explain and interpret the onrush of technological gizmos and frequently indecipherable language of 5G and IoT to members of governing bodies and moderate leadership discussions with private developers seeking to forward intelligent transportation systems in communities (if those developers can "just make themselves understood" to elected leaders). Second, the CTIO becomes the chief strategist and catalyst for coordinating governance for accessibility while members within the local community's leadership are surmounting the knowledge gap. For example, the CTIO can steer a community's development of methodology for transport planning by showing planners how to combine an analytic hierarchy process with GIS data analysis, taking into account different economic, infrastructure, environmental, technological, and other parameters.[194] Finally, the CTIO can steer impressionable local officials away from fads or commercial platforms

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[191] *See, e.g.*, Laura Bliss, *Love the Bus, Save Your City*, CITYLAB (May 7, 2018), https://www.citylab.com/transportation/2018/05/love-the-bus-save-your-city/559262/ [https://perma.cc/MJA9-H6GK]; Linda Poon, *Meet the High-Tech Buses of Tomorrow*, CITYLAB (Dec. 7, 2016), https://www.citylab.com/life/2016/12/meet-the-high-tech-buses-of-tomorrow/509417/ [https://perma.cc/5LAF-ALK4]. *But see* Linda Poon, *Bridj Collapses After Just Three Years*, CITYLAB (May 1, 2017), https://www.citylab.com/transportation/2017/05/bridj-collapses-after-3-years-microtransit-bus/524955/ [https://perma.cc/KZD6-GRHG] (noting Bridj failed to get financing in its endeavor to combine mass transit with individual ride haling—how does that bode for jitney-type service widely available to the public?). Viable bus rapid transit depends on enabling buses avoiding congested streets, stymieing passengers reaching their destinations in the same timeframe as car driving affords. *See* Ethan Millman, *As Bus Ridership Plummets in Los Angeles, Efforts to Boost It Hit Speed Bumps*, WALL ST. J. (Aug. 26, 2019), https://www.wsj.com/articles/as-bus-ridership-plummets-in-los-angeles-efforts-to-boost-it-hit-speed-bumps-11566725400 [https://perma.cc/6U4C-7FJ2]. Millman reports bus ridership reduction on Los Angeles's bus system of 24 percent since 2013, compared to its rail system ridership's decline of only 5 percent during the same period. *See id.*

[192] *See* KATZ & NOWAK, *supra* note 8, at 3, 10.

[193] *See* Cohen & Cavoli, *supra* note 156, at 140, 142; Guerra, *supra* note 156, at 10–11.

[194] *See, e.g.*, Asim Farooq et al., *Transportation Planning through GIS and Multicriterial Analysis: Case Study of Beijing and XiongAn*, J. ADVANCED TRANSP. 1, 8 (2018), https://www.hindawi.com/journals/jat/2018/2696037/ [https://perma.cc/ND3V-Y5H2].

designed in isolation and not yet purposeful for permanent integration into the transportation system.[195]

D. *Corridor Land Use Decision-Making Requires Dynamic Modification of Municipal General Plans to Resolve Traffic Congestion and Enhance Quality of Life*

> *If getting somewhere is as important as being somewhere, then mobility affects our very sense of place. . . . Planners and architects lay out the avenues and expressways . . . but these don't add up to much if a strong sense of urban community doesn't take root.*[196]

1. Recasting Dynamic and Coordinated Comprehensive Plans

Place attachment and accessibility to place are symbiotic.[197] Admittedly, some *ad hoc* accessibility solutions can be implemented in Corridors, but these solutions should dovetail with aspirational policy statements contained in a community's General Plan pertaining to physical accessibility. A General Plan (or "comprehensive" or "master" plan as some jurisdictions have it) is a sort of "field manual" for planning and development in a community intended to provide users with a long-range vision (expressing a "common destiny"[198]) for community development and, conversely, land conservation. Since all states have adopted the Standard Zoning Enabling Act of 1926 in some form, community zoning must be conducted in "accordance with a comprehensive plan."[199] There,

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[195] *See, e.g.*, Christopher D. LeGras, *Vision Zero, a "Road Diet" Fad, Is Proving to Be Deadly*, WALL ST. J. (Jan. 18, 2019), https://www.wsj.com/articles/vision-zero-a-road-diet-fad-is-proving-to-be-deadly-11547853472 [https://perma.cc/5PSK-PAAZ] (noting public safety danger arising from failure to address suitable emergency vehicle access needed to respond to dangers in preference for "traffic calming" measures); Lewis, *supra* note 11 (noting discrete commercial goods designed without seamless integration).

[196] WITOLD RYBCZYNSKI, CITY LIFE: URBAN EXPECTATIONS IN A NEW WORLD 232, 234 (1995).

[197] Limitation of access to sites like parks and recreational spaces impacts an individual's capacity to form or maintain social bonds. *See* Rebecca Madgin et al., *Connecting Physical and Social Dimensions of Place Attachment: What Can We Learn from Attachment to Urban Recreational Spaces?*, 31 J. HOUSING BUILT ENV'T 677, 691 (2016).

[198] Michael N. Widener, *Moderating Citizen "Visioning" in Town Comprehensive Planning: Deliberative Dialog Processes*, 59 WAYNE L. REV. 29, 31 (2013)*; see* Neuman, *supra* note 24, at 214.

[199] U.S. DEP'T COMMERCE, A STANDARD STATE ZONING ENABLING ACT § 3 (rev. ed. 1926) [hereinafter STANDARD ACT]. *See* Edward J. Sullivan & Matthew J. Michel, *Ramapo Plus Thirty: The Changing Role of the Plan in Land Use Regulation*, 35 URB. LAW. 75, 75 (2003).

a community's goal-oriented text describes spatial-planning virtues and desired community outcomes. It provides its readers a statement of the community's values while setting certain ground rules for later application of specific zoning regulations to a parcel of land.[200] In virtually all such plans, one of the required elements is the "circulation" or "transportation" element.[201] This element's narrative and accompanying maps instruct what the community's expectations are for how everyday citizens will access destinations throughout a city or town.[202]

Because these solutions are fluid and rapidly incoming, General Plans themselves will require frequent updating, a historically unfamiliar notion. General Plans typically are revised once a decade or more, but cities will need to begin allowing Corridor General Plans to be dynamically revised.[203] In that vein, Corridor master planning should be viewed as a platform of iterative generation to be changed constantly like customization of smart phones—not merely reflecting central planning (as convention) but mirroring current needs of those who live and work in

[200] This is because the states require local government decisions on rezoning cases to be consistent with, or (minimally) based upon consideration of, its General Plan. *See* STANDARD ACT, *supra* note 199, or that the General Plan be revised concurrently with adopting the specific zoning ordinance so that the two dovetail. This is not to say that the General Plan is the "tail of the dog," however, as that plan serves as the community's land use "constitution." *See* Lesher Communications, Inc. v. City of Walnut Creek, 802 P.2d 317, 318 (1990). Ironically, New York City never adopted a comprehensive plan, although it did produce a multivolume 1969 City Planning Commission's Plan for New York City, apparently required for New York to qualify for federal funding for public housing in the 1960s. (In addition, the 1938 New York City Charter called for a comprehensive plan but work never proceeded beyond the 1969 production.) The Plan for New York City essentially encapsulated Mayor John Lindsay's desires for tackling many municipal problems extending well beyond land use issues. *See Former CPC Chair Discussed 1969 Plan for New York City*, CITYLAND (May 16, 2013), https://www.citylandnyc.org/former-cpc-chair-discussed-1969-plan-for-new-york-city/ [https://perma.cc/S3QD-V4DF]. It never was formally adopted by the New York City Council. *See* Max & Slaughter, *supra* note 157.

[201] *Lesher*, 802 P.2d at 318.

[202] *See id.* at 329 n.3.

[203] Indeed, in New York, some planning officials assert that in particularly dynamic communities the need for the planning realm to be responsive and nimble means that a pragmatic, incremental strategy driven by market forces trumps the wisdom of comprehensive planning. *See* Max & Slaughter, *supra* note 157 (quoting Anita Laremont, General Counsel and Chief Data Officer at the New York Department of City Planning). In the meantime, a non-profit planning association named the Regional Planning Association produces documents amounting to mini-master plans including its fourth regional plan affecting the tri-state region that includes New York City. *See The Fourth Regional Plan*, REG. PLAN ASS'N. (Nov. 30, 2017), http://www.rpa.org/publication/fourth-regional-plan [https://perma.cc/E8F7-3QYG].

the immediate vicinity using the Corridor constantly.[204] In "master planning version 2.0," fewer than all the Corridors in a community should be singled out for experimentation with new platforms and applications for three-dimensional accessibility planning.[205] As master plans are continuously updated, frequent modeling and open-source communication of plan parameters with the public enables both innovation and "dovetailing" of the comprehensive planning in neighboring communities.[206]

2. Acknowledging Verticality and Public Safety

Development of parcels, coupled with mobility innovations, will drive this dynamism in planning, especially on a vertical axis where lower airspace in Corridors will become vertical pathways, and its adjoining surfaces become tomorrow's neighborhoods.[207] "Deck parks," where Corridors are covered above their rights of way to create open space, are one implication of 3D planning.[208] Mitigation of paving over open space (by substituting open space aloft) and "greening" the surroundings are apparent opportunities. But what coordination implications arise from vertical improvements intersecting lower-altitude airspace? Are opportunities for aerial deliveries of goods and persons thereby reduced? This sort of conceptualization engages as well the realms of law enforcement and counterterrorism in maintaining public order—and of smart-building management bounding the cubic volume of these vertical byways.[209] For reasons of maintaining iterative security protocols, master planning cannot, in the future, remain the reactive and sporadically addressed exercise exhibited in most metropolitan American areas.[210] Routinizing lower elevation aerial traffic is precedented.

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[204] *See* Woyke, *supra* note 136.
[205] *See generally* Thill & Dao, *supra* note 118 (advocating for 3D network-based urban research in urban analytical route planning, spatial accessibility assessment, and facility location planning).
[206] *See* Woyke*, supra* note 136.
[207] *See* Rahman, *supra* note 97, at 28.
[208] *See* Cameron McWhirter, *To Woo Millennials, Atlanta Considers Covering Highways With Parks*, WALL ST. J. (Jan. 1, 2019), https://www.wsj.com/articles/to-woo-millennials-atlanta-considers-covering-highways-with-parks-11546344000 [https://perma.cc/JKE7-WGNG].
[209] *See* Rahman, *supra* note 97, at 31. As Rahman notes, densification implicates high-rise buildings clustered together, featuring facilities drawing and connecting people which in turn renders these buildings and neighborhoods target rich terrorism opportunities. *See id.* at 35.
[210] *See id.* at 34.

One immediate concern for the future is drone-involved aerial collisions resulting in debris "fallout" harming people and property for whom sidewalks provide no protection.[211] Another likelihood is protestors disrupting public order by dominating portions of the lower airspace with UAVs to block commercial aerial traffic.[212] A third opportunity involves terrorist actions attempting disruption of everyday life and even violence by targeting citizens, including public figures and influencers, via "weaponizing" of commercial drones like those used in Caracas in August 2018.[213] Less intensely, protestors or terrorists may endeavor economic disruptions by compromising a lower airspace smart traffic management system by confusing the underlying technology.[214] This suite of "horribles" requires not just regional vigilance but nimbleness in rewriting master plans to accommodate growing situational awareness and responses in the full cubular "grid."[215]

3. Lumbering Towards Accessibility

The transportation element of a General Plan must recognize two major features of urban planning in three dimensions. The first is the dynamic relationship between accessibility and land value over time.[216] Accessibility is defined as the ease of reaching desired destinations,[217]

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[211] *Cf. Domestic drone accidents*, ROCHESTER DEMOCRAT & CHRONICLE (2019), http://rochester.nydatabases.com/map/domestic-drone-accidents [https://perma.cc/Q3ZN-2YUV].
[212] *See* Rahman, *supra* note 97, at 34–35.
[213] *See* Andy Pasztor & Dustin Volz, *Worries Mount Over Ability to Weaponize Drones*, WALL ST. J. (Aug. 6, 2018), https://www.wsj.com/articles/worries-mount-over-drone-safety-after-venezuela-attack-1533601121 [https://perma.cc/C75B-KW4P]; Nick Paton Walsh et al., *Inside the August plot to kill Maduro with drones*, CNN WORLD (June 21, 2019), https://www.cnn.com/2019/03/14/americas/venezuela-drone-maduro-intl/index.html [https://perma.cc/4WJC-8RW9]; *see also* Rich Schapiro & Tony Capra, *Terrorists likely to attack U.S. with drones*, *says FBI Director*, NBC NEWS (Oct. 10, 2018), https://www.nbcnews.com/politics/national-security/terrorists-likely-attack-u-s-drones-says-fbi-director-n918586 [https://perma.cc/B3VX-Q9BA].
[214] *See* Rahman, *supra* note 97, at 37.
[215] *See generally id.*
[216] *See* Michael Iacono & David Levinson, *Accessibility Dynamics and Location Premia: Do Land Values Follow Accessibility Changes*, 54 URB. STUD. 1, 1–2 (2015). The authors note, however, that benefits from contemporary improvements depend at least partly on prevailing accessibility provided in the entire network. *See id.* at 15.
[217] *See id.* at 2; KRIZEK & LEVINSON, *supra* note 170, at 3; but more technically, accessibility applies within cities *and* between cities, weighing opportunities (the quantity of an activity such as employment) by impedance, as a function of travel time or cost (or both).

and it must supplant *reducing congestion per se*, measured by vehicular "levels of service" in a Corridor, as the core mobility planning value.[218] A congestion reduction-narrowed focus represents disjointed thinking. Until recently, the boldest approaches to reducing gridlock in the United States have been implementing congestion pricing[219] and "Lexus lanes."[220] These are effective to curb Corridor utilization by vehicular type but do not address personal movement convenience or safety. Nor do these initiatives create additional space for transportation movement. Additionally, accusations of violating basic equity principles dog congestion-reducing solutions. Other innovations deserve attention and, in Corridors, imitation. Safety can be enhanced by forcing self-directed vehicles to move more slowly in traffic lanes. To force driver speed reduction, land planners should experiment with reducing lane widths on congested streets.[221]

See, e.g., *id.*; David G. Proffitt et al., *Accessibility Planning in American Metropolitan Areas: Are We There Yet?*, 56 URB. STUD. 167, 170 (2017).

[218] *See* Ewing & Proffitt, *supra* note 173, at 3–4.

[219] *See* Berger, *supra* note 6. London was the first metropolitan area to impose stringent pricing controls in vehicles entering its CBD. American cities such as New York, Portland, Seattle, Los Angeles and San Francisco now are considering implementing such a fee program. *Id.* Some argue that perceived optimal congestion pricing policy produces net negative economic outcomes. *See* Jeffrey C. Brinkman, *Congestion, Agglomeration, and the Structure of Cities* 5 (Fed. Reserve Bank Research Dep't, Working Paper No. 13-25, 2014), https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2272049 [https://perma.cc/NAG5-HRGX]. For types of such urban pricing, see Sarah J. Fox, *Planning for Density in a Driverless World*, 9 NE. U. L. REV. 151, 194–95 (2017); Luigi Ranieri et al., *A Review of Last Mile Logistics Innovations in an Externalities Cost Reduction Vision*, 10 SUSTAINABILITY 782, 792–93 (2018). Apparently, when tolls are "capped" at certain ceilings, they undermine the effect of congestion pricing. *See* Scott Calvert, *Why not all Tolls Rise to Nearly $50*, WALL ST J. (May 4, 2016), https://www.wsj.com/articles/should-supply-and-demand-determine-the-price-for-a-fast-commute-1525426200 [https://perma.cc/K67D-E2J3].

[220] Lexus Lanes are what they sound like—toll lanes on selected freeways; these have been attacked as functionally a regressive tax on those unable to afford the toll, even when dynamic pricing is applied. *See* Peter Funt, *Highway Robbery Targets the Poor*, N.Y. TIMES (May 16, 2017), https://www.nytimes.com/2017/05/17/opinion/california-express-lanes.html [https://perma.cc/TX3T-PSVS]. *But see* KROL, *supra* note 6, at 24 (noting tolls have no greater regressive impact than a fuel tax). Seemingly these protocols fail to induce more car-pooling. *See id.* at 22. Of course, congestion pricing itself has been attacked as regressive. *See* Fox, *supra* note 219, at 195. Fox notes that the inequity of such pricing would be ameliorated by using revenue generated thereby to fund public transit or subsidize affordable housing. *See id.* at 196.

[221] *See, e.g.*, NAT'L ASS'N OF CITY TRANSP. OFFICIALS, URBAN STREET DESIGN GUIDE, LANE WIDTH (2013), https://nacto.org/publication/urban-street-design-guide/street-design-elements/lane-width/ [https://perma.cc/VLK7-U6ZZ] [hereinafter NACTO LANES]; Jeff Speck, *Why 12-Foot Traffic Lanes Are Disastrous for Safety and Must Be Replaced Now*, CITYLAB

Psychologically, drivers feel enabled to exceed safe velocities when lanes are wider.[222] Typical lane widths on America's local streets are eleven feet or greater.[223] It is unsettled whether reducing lane widths in CBDs will permanently and effectively lower speeds or discourage the use of cars in those most densely traveled areas.[224] But for designated truck or large-capacity transit vehicular routes, a travel lane of eleven feet is sufficiently wide.[225] Also, narrowing travel lanes decreases pedestrian exposure and crossing distances for pedestrians whether at street intersections or mid-block crossings.[226] Sensibly, General Plans should adopt lane width parameters specific to each Corridor depending on carrying capacity and linkages with adjoining rights of way across political boundaries of adjacent jurisdictions.

The second major feature of general planning for people movement is the collision between elemental policy choices requiring inputs of all

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(Oct. 6, 2014), https://www.citylab.com/design/2014/10/why-12-foot-traffic-lanes-are-disastrous-for-safety-and-must-be-replaced-now/381117/ [https://perma.cc/88EG-DFUA]. Kensington High Street in London experimented with narrowing its lane widths while removing unneeded signs (a design concept called "shared space") to reduce complexity and driver confusion while increasing driver uncertainty and inducing drivers instinctively to behave more cautiously. *See* Carmona, *supra* note 180, at 11–12; Christophe Haubursin, *Road signs suck. What if we got rid of them all?*, VOX (Nov. 24, 2017), https://www.vox.com/2017/11/24/16693628/shared-space-design [https://perma.cc/4DCV-G6BV]. Reportedly, pedestrian injuries along this Corridor fell in number substantially. *See id.*

[222] For contrast, consider that the standard width for an interstate highway carrying vehicles going fifty-five miles per hour or more (inside urban town limits) is twelve feet. *Cf.* Matt McFarland, *The last place in America you should try and cross a street*, CNN TECH (Apr. 13, 2017), http://money.cnn.com/2017/04/13/technology/pedestrian-safety-florida-delaware/index.html [https://perma.cc/ZFF2-CJPC] (freeway speeds on twelve foot wide highways are sixty-five miles per hour and up). The perception that higher speed within narrower lanes (so long as the right of way is not eight lanes wide) will induce crashes makes human drivers more cautious (likely this has zero impact on autonomous agents). Consequently, reduced lane widths and numbers of lanes on either side of the dividing line between opposing traffic directions is warranted in cases where speed, but not flow rate, reduction is the goal. This appears to be part of the goal of Quayside's developers in Toronto in addition to carving out more room for sidewalks. *See* Woyke, *supra* note 136.

[223] NACTO LANES, *supra* note 221, at 11.

[224] *Compare* NACTO LANES, *supra* note 221, *and* Speck, *supra* note 221, *with* PARSONS TRANSP. GRP., RELATIONSHIP BETWEEN LANE WIDTH AND SPEED 1 (2003); *compare* Kay Fitzpatrick et al., *Design Factors that Affect Driver Speed on Suburban Arterials*, 1751 TRANSP. RES. REC. 18–25 (2000), *with* FLA. DEP'T TRANSP., CONSERVE BY BICYCLE PROGRAM STUDY FINAL REPORT, APPENDICES A–P, A152 (2007) (reducing lane width from twelve to ten feet produces no substantive increase in urban street capacity and "saturation flow rates" are similar comparing lanes in the two widths).

[225] NACTO LANES, *supra* note 221; Speck, *supra* note 221.

[226] *See* Carmona, *supra* note 180, at 17–18; Speck, *supra* note 221.

these stakeholders and an accessibility-seeking public: freedom of movement versus safety and personal autonomy.[227] With a torrent of technological advances presenting few boundaries, choosing one virtue comes with nuanced trade-offs. This is one challenge inherent in the concept of Mobility-as-a-Service ("MaaS"). The underlying principle behind MaaS is to limit complications in personal movement by integrating on-demand multimodal transportation services through robust, publicly available algorithmic journey information for route planning, fares calculation, seamless (perhaps cashless) single transaction-payment options, and other amenities reducing barriers to implementing optimal transport choices.[228]

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[227] This tension is one especially chafing to the economic sector introducing mobility-disruptive technologies into public life at the first moment. *See* Stephen Zoepf et al., *Scooter Companies vs. the Regulators*, SLATE (Dec. 12, 2018), https://slate.com/technology/2018/12/scooters-lime-bird-regulators-pilots-cities.html [https://perma.cc/2H78-VD58]. As the blog post's authors describe the promoters' perspective:

> Functional mobility depends on the widespread availability of vehicles. Without it, users don't stay on a platform for long. There's also mounting evidence that the safety of new mobility types can *improve nonlinearly with scale*—in other words, early users of new devices can face dramatically higher risks if drivers don't know to look out for them. Simply put, you can't pilot [*i.e.*, do experimental trials on the operability of] Uber or Lime. . . .
>
> But this inherent limitation of pilots isn't just bad for innovators. It affects regulators too. That's because they're tasked with evaluating the benefits *and* risks of new technologies. And effective evaluation means observing and understanding innovation's true impacts—good and bad. Often, these cannot be assessed by simply looking at a small-scale pilot, then multiplying by 10 or 100. Some properties of scale are emergent—they don't follow predictably from growth.

See id. This statement is so articulate that its logic feels irrefutable, until the reader recalls that in this nation, imperfect though it is, citizens still do not regard pedestrian and motorist deaths and injuries as "collateral damage." Naturally, communities can trial these projects at less than "scale," as evidenced by projects ongoing around the country to deploy driverless motos. This custom, like the custom of moving slowly in clinical trials of new pharmaceuticals, is simply inconvenient to those who want to "go fast and break things." *See id.*

[228] *See* Warwick Goodall et al., *The Rise of Mobility as a Service: Reshaping How Urbanites Get Around*, 20 DELOITTE REV. 111, 118, 120 (2017); Nikitas et al., *supra* note 13, at 14. The current leader in this space appears to be Deutsche Bahn's Qixxit, a nationwide scheme for journey planning and one-stop payments. *See* QIXXIT, https://www.qixxit.com/en/ [https://perma.cc/29LT-E285] (last visited Oct. 28, 2019). Deutsche Bahn is in the process of making its Bahncard a full-fledged mobility card, offering discounts on transport-related services such as car rental, car sharing, public transport, bicycle hire, and other services. Of course, the fear of identity theft, much less the shortage of universal Internet access by those of limited means, impairs user embrace of such software platforms. *Id.*

But conflicts between surveillance, privacy, public safety, and personal data protection afford a fulcrum that decision-makers likely will teeter upon for decades.

Planners will be challenged to seek development of spaces, horizontal and vertical, facilitating the growth of social bonds undergirding the spirit of local community. General Plans will be one tool through which governmental units collaborate, producing strategies for building a relationship of trust and confidence among citizens and agencies (or public-private partnerships) controlling transportation planning and execution.[229] General Plans may be perfect vehicles for "test beds," districts designated for saturation of new mobility technologies where persons of like frames of mind can "practice" conjoint use of motos and velos in controlled conditions.[230] These plans also must operate to foster equity in transportation provision by incentives and mandates.[231]

4. Pathways to Walking and Public Health Enhancement

Less moto congestion alone does not guarantee the optimal quality of life along city streets. What *replaces* moto-centeredness in rights of way determines quality of life for Corridor users and adjoining dwellers alike.[232] To remain competitive among municipalities, transportation

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[229] Rahman, *supra* note 97, at 15. One function of local government is to bang heads together and further cooperation among service providers in the public transportation space. Goodall et al., *supra* note 228, at 123, 125–26 (noting an important government role is "to bring everyone to the table"). The challenge today is getting providers to share data with their competitors on riders, movement opportunities, and pricing when those providers are concerned about competition. *See* Goodall et al., *supra* note 228, at 126; Nikitas et al., *supra* note 13, at 15; *see also* Koch & Newmark, *supra* note 184. A second concern is the lack of uniform broadband access, branded the "digital divide." *See* Monica Anderson & Andrew Perrin, *Nearly one-in-five teens can't always finish their homework because of the digital divide*, PEW RES. CTR. FACT TANK (Oct. 26, 2018), http://www.pewresearch.org/fact-tank/2018/10/26/nearly-one-in-five-teens-cant-always-finish-their-homework-because-of-the-digital-divide/ [https://perma.cc/9LGD-2M3B]. Lower income households disproportionately rely on lower-cost, public transit modes; therefore they have the most to gain from coordination of accessibility. Sidewalk Labs has endorsed a new public entity using tech and pricing models to drive use of transit, walking, cycling, and sharing trips; but the public entity proposed would be influenced no doubt by Sidewalk Labs and other players in the private sector. *See About Sidewalk Labs*, SIDEWALK LABS, https://www.sidewalklabs.com/ [https://perma.cc/ZC6Q-8PBX] (last visited Oct. 28, 2019).

[230] *See* Goodall et al., *supra* note 228, at 125–26.

[231] *Id.* at 125.

[232] *See, e.g.*, ANISTASIA LOUKAITOU-SIDERIS & RENIA EHERNFEUCHT, SIDEWALKS: CONFLICT

infrastructure should promote the goals of improved public health, environmental sustainability, and place attachment.[233] MaaS's social benefits allegedly include increased access to healthcare and leisure venues and improved social inclusion which reduces isolation and encourages more active and healthier lifestyles.[234]

Connections between improved public health and transportation innovations are well-documented in peer-reviewed journals in both the public health and transportation sectors.[235] Complete streets and land use strategies addressing public health issues head-on hypothetically will: increase physical activity, improve accessibility and safety, reduce air pollution, and ease roadway congestion.[236] Whether "complete streets" development remains viable in Corridors (other than street crossings implemented at signals and access control points) is unclear when physical segregation of uses increases accessibility while slowing the flow of motorized vehicles and reducing throughput.[237] Priority to pedestrians is essential if we are going to accentuate the public health benefits of accessibility by velos and leg muscles instead of moto reliance.[238]

Sidewalks, especially when coupled with raised curbs, at their inception were critical.[239] Sidewalks for walking in CBDs are being replaced

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AND NEGOTIATION OVER PUBLIC SPACE 269 (2009); EUROPEAN COMMISSION ENVIRONMENT DIRECTORATE-GENERAL, RECLAIMING CITY STREETS FOR PEOPLE: CHAOS OR QUALITY OF LIFE? 11–13 (2004). To begin with, shared self-driving vehicles means fewer vehicles under outright ownership, which decreases family costs of living. *See* Woyke, *supra* note 136.

[233] *See* JEFFREY SACHS, BUILDING THE NEW AMERICAN ECONOMY 31 (2017). Placemaking is discussed in Michael N. Widener, *Populist Placemaking: Grounds for Open Government-Citizen Spatial Regulating Discourse,* 121 W. VA. L. REV. 461, 469–71 (2018).

[234] *See* Nikitas et al., *supra* note 13, at 15.

[235] *See* JUN-SEOK OH ET AL., TRANSPORTATION SYSTEM AND ITS ASSOCIATION WITH HUMAN HEALTH—A REVIEW AND MODELING APPROACH 7–13 (2016), https://wmich.edu/sites/default/files/attachments/u883/2017/TRCLC_RR_14_03_0.pdf [https://perma.cc/6UBD-8C7H] (noting studies making connection between street networks designs and health disparities among travelers); Eloisa Raynault & Ed Christopher, *How Does Transportation Affect Public Health?*, 76 PUB. ROADS 29 (2013).

[236] *See* OH ET AL., *supra* note 235; Raynault & Christopher, *supra* note 235. *But see* LeGras, *supra* note 195 (noting danger to first responders arising from complete streets choking down pathways for crisis access).

[237] *See* OH ET AL., *supra* note 235; Raynault & Christopher, *supra* note 235.

[238] *See* ARUP, CITIES ALIVE: TOWARDS A WALKING WORLD 21, 35–37 (2016), https://www.arup.com/perspectives/publications/research/section/cities-alive-towards-a-walking-world [https://perma.cc/VA6Z-ZHC4].

[239] Their original purposes were to (a) segregate walkers from other roadside functions by defining the area for pedestrian circulation; (b) keep mud and other roadbed detritus off pedestrians' clothing and personal property; (c) expand the realm of merchants to the

by concrete for "consumption activities."[240] Conjure up "sidewalk" displays of merchandise, café lounging, and the public display of the idle to the rest of the bustling public (where sidewalks became places to be seen).[241] Future requirements for sidewalk-like structures and crosswalks must be assessed. Until traffic is seamless under robotic management, we need spaces in Corridors to keep pedestrians out of harm's way from the threat of faster-moving objects—including objects (and their users) gaining dominance upon the raised surface.[242] Corridors still need to transport workers and other walkers in "last mile" fashion from drop-off points.[243] Artificial intelligence–guided as they may become, pedestrians still need pathways to recreate and exercise on and, with limited open space, this function must somehow be integrated with other uses of sidewalks.

Pedestrian walkways cannot be privatized for the benefit of a smaller group of users.[244] Instead, egalitarian sidewalks require multifunctionality, accommodating future needs of the pedestrian traveler with leisure and commercial activities of stationary sidewalk occupants. As Jeffrey Sachs notes, infrastructure for transportation must be accessible to all, becoming socially inclusive public goods.[245] This requires thoughtful behavior from users not evident in the era of self-indulgence. Self-absorption is exemplified by the glut of motorized scooters; stand-up vehicles parked on sidewalks between sessions of operation that irritate pedestrians as the former weave around the latter.[246] Sidewalks and road

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edge of the curbing; and (d) keep surface water drainage in channels, especially in locations of inadequate storm water drains and piping. *See* LOUKAITOU-SIDERIS & EHERNFEUCHT, *supra* note 232, at 19–21.

[240] *See id.* at 138–55. This isn't a new phenomenon; competition for sidewalk usages with "walkers" has antecedents in the 19th century. *See* Avi Selk, *The death of the sidewalk*, WASH. POST (June 30, 2019), https://www.washingtonpost.com/lifestyle/style/the-death-of-the-sidewalk/2019/06/28/b89c9bb2-9900-11e9-8d0a-5edd7e2025b1_story.html [https://perma.cc/3FAK-T6FD].

[241] *See* LOUKAITOU-SIDERIS & EHRENFEUCHT, *supra* note 232, at 83, 255.

[242] *See* Selk, *supra* note 240.

[243] *See* ARUP, *supra* note 238, at 81.

[244] *See* LOUKAITOU-SIDERIS & EHRENFEUCHT, *supra* note 232, at 247 (noting the "privatization" of public sidewalks). As Selk, *supra* note 240, observes, the alternative to seeking balance in use of the sidewalk is banning of certain uses, another phenomenon dating to the nineteenth century. Amusingly, in the first week after Selk posted his article on the Post's blogsite, 568 reader comments followed, suggesting this is not one isolated person's gripe. *Id.*

[245] *See* SACHS, *supra* note 233, at 31, 35–36.

[246] *See* Eliot Brown, *Adults Are Terrorizing San Francisco On Tiny Electric Scooters*, WALL ST. J. (Apr. 25, 2018), https://www.wsj.com/articles/adults-are-terrorizing-san-francisco-on-tiny-electric-scooters-1524670611 [https://perma.cc/8XRW-5JBD]; Rachel Swan, *SF supervisors pass law to regulate scooters that have descended on city*, S.F. CHRONICLE

shoulders cannot persist as "storage sites" for shared-bicycle and personal "scooter" inventory without appropriate corralling.[247] The goal must be to make foot-powered conveyances a shared use with transporting walkers across stretches of CBDs where little human activity potential exists. In other words, pedestrian rights of way must become equally as multi-purposed as moto rights of way for movement.

Curbside parallel parking causes reduced moto speeds on streets, because the moto operator is forced to heed cars maneuvering in and out of those spaces.[248] Ironically, room for additional curbside parking is gained if, on a four-lane road, traffic lanes are made two or more feet narrower.[249] Another approach, in busy areas where planners intend to make safe pedestrian movement a higher priority than platooning greater volumes of velocipedes through the same at-grade location, is removing altogether the lines between pedestrians and vehicular "spaces."[250] Where no, or minimal, sidewalks exist, motos' and velos' operators must avoid direct contact with pedestrians—not an easy task when the typical four-way intersection has about fifty-five "conflict points" confronting vehicles and pedestrians today.[251] Such a strategy makes sense where planners desire motorized speeds to be fifteen miles per hour or lower, or where planners aim for all humans, however mobilized, to share an identified segment of a horizontal right of way.

(Apr. 17, 2018), https://www.sfchronicle.com/bayarea/article/SF-supervisors-pass-law-to-regulate-scooters-that-12842796.php [https://perma.cc/XW59-9CZ5]. Scooters temporarily became banned in San Francisco in June but were reinstated in July 2018, after city staff limited permitting to five providers of rental machines which were permitted to rent no more than 500 scooters apiece. *See* Marco della Cava & Jessica Guynn, *In the Scooter Wars of 2018, it's not really about the scooters*, USA TODAY (June 21, 2019), https://www.usatoday.com/story/tech/news/2018/06/21/scooter-wars-2018-its-not-really-scooters/694274002/ [https://perma.cc/TP7K-MCXG].

[247] Eliot Brown, *Dockless Bike Share Floods into U.S. Cities, with Ride and Clutter,* WALL ST. J. (Mar. 27, 2018), https://www.wsj.com/articles/dockless-bike-share-floods-into-u-s-cities-with-rides-and-clutter-1522076401 [https://perma.cc/9SBT-DAYA]; David Pierce, *Uber for Bikes Is a Commuter Dream . . . When It Works*, WALL ST. J. (Mar. 14, 2018), https://www.wsj.com/articles/uber-for-bikes-is-a-commuter-dream-when-it-works-1520955508 [https://perma.cc/KNW4-M4MN] (dockless bicycle sharing is a disaster of littering in Chinese cities); *see also* della Cava & Guynn, *supra* note 246.

[248] *See* Mark Schnell, *Still Waiting to Cross the Street*, SEASIDE TIMES (May 2016), https://theseasidetimes.com/wp-content/uploads/2013/07/Newstand/2016/sstmayjune16.pdf [https://perma.cc/E5NH-TNMH].

[249] *Cf.* NACTO LANES, *supra* note 221 (parking lane widths of seven to nine feet generally are recommended).

[250] *See id.* This would involve eliminating sidewalks or striping of lanes for motorized traffic or bicycles.

[251] *See* Ng, *supra* note 66.

E. All Corridor-Located Vehicles Shall Move Continuously Along Rights of Way Except at Crucial Signalized Intersections and Programmed Access Control Points[252]

1. Adios to Curbside Parking Stalls and Racks for "Unoccupied" Velos and Motos

Curbside parking once relieved structured parking demand and the "front yard" parking lot installed behind the curb.[253] But parallel parking effectively shaves off a car width and perhaps more, depriving the street of another lane for moving traffic. Curbside parking interspersed with bicycle parking stations assumes nightmare proportions when bikes or "hipster scooters" are not docked at prescribed stations.[254] Bicycle ersatz storage has such potential to congest Corridors' lanes that a solution may be to elevate bicycle paths above grade,[255] where continuous movement would enable greater average bipedal speeds, making this mode of transit more attractive to working commuters.

2. Optimizing Use of Alleys and Passageways for Access Control Points

A popular current of repurposing city off-street passageways for social spaces[256] is likely not the best function for such "remnant" urban

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[252] By "programmed access control points," I mean places where onloading and offloading of persons or goods occurs.

[253] *Parking and Curbside Management*, GLOB. DESIGNING CITIES INITIATIVE, https://globaldesigningcities.org/publication/global-street-design-guide/operational-and-management-strategies/parking [https://perma.cc/NK26-N9AF] (last visited Oct. 28, 2019).

[254] *See* Brown, *supra* note 247. If the reader thinks the author is ambivalent about curbside parking, consider which ought to be a city's primary virtue in busy urban rights of way: speed-calming or throughput? Will autonomous vehicles therefore be welcomed, or shall they generally be vilified? Such analyses determine whether reducing available pavement section with curbside parking makes sense within a Corridor.

[255] *See* Alex Davies, *So, BMW Wants to Build Networks of Elevated Bicycle Paths*, WIRED.COM (Nov. 24, 2017), https://www.wired.com/story/bmw-elevated-bike-cyclist-paths-concept/ [https://perma.cc/XCY8-D632]. For series of bridges in the Quayside neighborhood development proposed for Toronto that feature a bridge for the Martin Goodman Trail, which will segregate and elevate bicycle riders, see DRAFT QUAYSIDE SITE PLAN (Nov. 29, 2018), https://storage.googleapis.com/sidewalk-toronto-ca/wp-content/uploads/2019/06/13210448/18.11.29_Quayside_Draft_Site-Plan.pdf [https://perma.cc/C3CM-3RQD]. Of course, a transition point must be provided to bring riders to surface grade, together with a practical solution for corralling these bicycles.

[256] *See* Brenna Goth, *Food, shopping coming to Phoenix's downtown alleys?*, AZCENTRAL

living features. They are better used to receive vehicles otherwise stopping and dropping off passengers closer to the passengers' ultimate destinations. While other human-gathering nodes can be incorporated in proximity to these stops, alleyways and abandoned stub streets must become precious resources in mobility management.[257] Installing more shops and restaurants into these passageways reprises what now populates sidewalks adjoining the streets and buildings. Shopping, regardless of positioning, reaches a saturation point, impeding pedestrian and vehicular flow. Thus, it must give way to use of these locations to siphon motos and velos out of moving Corridor traffic. Motos must become hybrids susceptible to autonomous guidance. Platooned in a consistently moving column or phalanx, motos must satisfy on-demand and dynamically routed requirements.[258] Platooning may be accomplished using a guidance system as simple as a "grappling hook," or by magnetic levitation[259] along a guided, near-natural grade pathway. Alternatively, a driver's surrendering of the vehicle's accelerator to an embedded IoT controller allows scooting motos in a manner minimizing inefficiency.

3. Maneuvers for "Perpetual Motion"

It's far easier to state that vehicles must continuously move in Corridors than to envision that goal's achievement. Accessibility requires mass conveyances (compare moving sidewalks in an airport terminal, or the clothing movers in a dry-cleaner shop) propelling vehicles along at, above, or below grade in different portions of the CBD, influenced by costs of construction and risk of damage to natural or man-made improvements. At intersections, three-dimensional solutions would include keeping motos requiring ninety degree movements at intersections within the Corridor from pausing there by elevating their vehicles above grade or otherwise segregating them to eliminate conflicting movements with the balance of at-grade moving vehicles.[260]

(Nov. 23, 2016), https://www.azcentral.com/story/news/local/phoenix/2016/11/23/phoenix-promotes-food-shopping-downtown-alleys/93819368/ [https://perma.cc/HBE2-SJ3R].

[257] Beijing is using ancient narrows streets called "Hutongs" for pedestrian ways to increase accessibility and cultural heritage awareness, and to encourage walking. *See* ARUP, *supra* note 238, at 97. But these passageways are not shopping malls.

[258] *See* Patrick Sisson, *Microtransit: How cities are, and aren't, adapting transit technology*, CURBED (Jan. 12, 2018), https://www.curbed.com/2018/1/9/16871474/microtransit-mass-transit-uber-lyft [https://perma.cc/NQ4J-5G9C].

[259] *How Maglev Works*, DEP'T OF ENERGY (June 14, 2016), https://www.energy.gov/articles/how-maglev-works [https://perma.cc/VR48-W2D2].

[260] *See* Emily Badger, *Could These Crazy Intersections Make Us Safer?*, CITYLAB (Jan. 23,

Of course, it bears repeating that such innovations must engage the private land developer sector unless communities discover a magic formula for widening the horizontal rights of way. For the proper trade-offs,[261] developers whose tracts front upon or adjoin Corridors should welcome the opportunity to distinguish their developments from humdrum projects lacking similar features of "prompt passage" along vibrant pathways. Innovation should be rewarded with incentives if accessibility and mobility are improved by integrating Corridor-based vertical development into transportation systems.

IV. CORRIDOR INNOVATIONS FOR TRANSPORTATION PLANNING

The American public does not have to wait for seismic technological events like IoT and artificial intelligence disruptions; it should be led by leadership to start tinkering with the problems attending Corridor accessibility through reasonably simple acts of personal,[262] corporate, and regional government behavior modification, including those described below.

A. Personal: Eliminating Gapping and Increasing Lane Merging Turn-Taking Through Driver Re-education

Traffic jams can be prevented by repudiating just two bad driving habits: tailgating and cutting off inbound vehicles trying to merge into the lane a self-centered driver occupies.[263] These two habits arise from impatience (or chronic late departures for one's destination); but they are responsible for many low "levels of service" on local streets.[264] Here, autonomous vehicle operation affords hope, but mindfulness in human driving (for the moment) eliminates the need for low-level technological

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2013), https://www.citylab.com/solutions/2013/01/could-these-crazy-intersections-make-us-safer/4467/ [https://perma.cc/A7UK-HE8Q]. Badger also notes the "holy grail" of intersection design eliminates left-hand turns while enabling drivers to move in all compass-point directions, like applying what the roundabout is supposed to achieve on far busier rights of way. *See id.*

[261] *See supra* text accompanying notes 9 and 114; *see also* Brown*, supra* note 247.

[262] *But cf.* TIERNEY, *supra* note 28, at 9–10 ("Design possibilities notwithstanding, we cannot presume that ICTs are a wholesale solution to complex urban issues.").

[263] *See* TOM VANDERBILT, TRAFFIC: WHY WE DRIVE THE WAY WE DO 46–50 (2008); *see also* Sue Shellenbarger, *One Driver Can Prevent a Traffic Jam*, WALL ST. J. (Oct. 12, 2016), https://www.wsj.com/articles/one-driver-can-prevent-a-traffic-jam-1476204858 [https://perma.cc/XV7B-G9PU].

[264] Information on levels of service is available in TRANSP. RESEARCH BD., HIGHWAY CAPACITY MANUAL (6th ed. 2016), https://www.nap.edu/read/24798/ [https://perma.cc/85V7-F5NJ].

solutions such as gap-creating stop-and-go lights on freeway on-ramps, or so-called zipper-merge rules.[265] Of course, human selfishness, aggression, and impatience get in the way of this solution's current viability.[266]

B. *Corporate: Implementing Employee and Deliveries Flexible Work Hours*

Workplace commuting trips during a standard set of weekday hours (for instance, 8:00 a.m. to 4:30 p.m. or 9:00 a.m. to 5:00 p.m.) undergird traffic congestion problems at popular "drive times."[267] Some inflexibility on the employment side is rooted in the belief that work hour schemes are necessary evils. For example, the nature of certain professions such as financial services firms (constrained by trading-market opening and closing hours) or chained family activities such as dropping off children at child care centers or schools before parents' workday begins mandate that commuters must travel during "workplace-wide" intervals.[268] Americans can talk *ad nauseum* about working from home (telecommuting) or using "third spaces" in lieu of coming to the office or plant, but such approaches need not be the sole alternatives for companies seeking optimal productivity when configuring employee overlapping work hours for collaborating synergistically.[269] Employers who either doubt personal accountability (believing that their workers cannot be trusted to choose their own commute times of day[270]) or are convinced that workers must simultaneously occupy the working space at the same core hours for optimal agglomeration-collaboration opportunities (the philosophy that

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[265] VANDERBILT, *supra* note 263, at 48; Shellenbarger, *supra* note 263.
[266] VANDERBILT, *supra* note 263, at 48; Shellenbarger, *supra* note 263.
[267] *See, e.g.*, Se-il Mun & Makoto Yonekawa, *Flextime, Traffic Congestion and Urban Productivity*, 40 J. TRANSP. ECON. & POL'Y 329 (2006), https://www.jstor.org/stable/pdf/20053990.pdf?ab_segments=0%2Fbasic_SYC-4341%2Fcontrol&refreqid=excelsior:9c647d4fd657ff1cca03824beddbb360 [https://perma.cc/SG8L-W5K5]; Yuki Takayama, *Bottleneck Congestion and Distribution of Work Start Times: The Economics of Staggered Work Hours Revisited,* 7 TRANSP. RES. PROCEDIA 830 (2015); Laura J. Nelson, *Stuck in Bad Traffic? Good Chance it's Thursday Evening*, L.A. TIMES (Nov. 11, 2014), http://www.latimes.com/nation/la-me-california-commute-20141111-story.html [https://perma.cc/DM7H-ESST].
[268] *See* Yang Liu, *Flexible Work Hour Scheme with Heterogeneous Commuters*, KUHMO-NECTAR CONF. 2015 (Feb. 24, 2015), https://editorialexpress.com/cgi-bin/conference/download.cgi?db_name=ITEA2015&paper_id=175 [https://perma.cc/3AZH-MJSC].
[269] *See* Takayama, *supra* note 267, at 830 (noting that some studies indicate staggered work hours reduce productivity externalities).
[270] *Cf.* Tony Schwartz, *Reward Value, Not Face Time*, HARV. BUS. REV. (2012), https://hbr.org/2012/02/my-manager-expects-me-to.html [https://perma.cc/84R4-XBBG].

"face to face, serendipitous interactions produce the most creative ideas") pose further impediments.[271] While this flexible working debate is not new,[272] it may become less relevant due to the advances in telepresence and robotic presence as vehicles become fully operationally autonomous—since working from the vehicle, in virtual presence of others (including other "commuters") in route to and from work, will become commonplace.[273]

Staggering the hours of deliveries of goods to commercial property may have analogous impacts;[274] here, however, goods deliveries via ground vehicles may be replaced by floating warehouses, blimp-like vessels crammed with goods plying low-elevation skies to fulfill rapidly online-initiated orders.[275] It seems staggered hours of operation and other low-tech alternatives addressing peak drive-time gridlock are worthy conversations in the realm of corporate social responsibility and sustainability, since these issues impact public health, improved exterior environments, and the social contract.[276] Creating a series of policies incentivizing businesses to take their motos' deliveries during off-peak driving times has been tried in New York and Stockholm with desirable results.[277] For instance, communities adopting tax incentives for businesses to offset

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[271] *See* Ben Waber et al., *Workspaces That Move People*, HARV. BUS. REV. (2014), https://hbr.org/2014/10/workspaces-that-move-people [https://perma.cc/WAF7-Y86E].

[272] *See* Mun & Yonekawa, *supra* note 267, at 330 (citing studies dating back to the early 1980s).

[273] *See* Heinrichs, *supra* note 12, at 217–18, 223. Interestingly, this mode of work favors individually occupied vehicles or "company vehicles" over modes of mass transit due to privacy of communications and confidential information or trade secret concerns.

[274] *See Designated Loading/Unloading Zones on Las Olas Boulevard*, CITY OF FORT LAUDERDALE, https://www.fortlauderdale.gov/departments/transportation-and-mobility/transportation-division/construction-projects/designated-loading-unloading-zones [https://perma.cc/ZM86-3P3C] (last visited Oct. 28, 2019) (noting that Las Olas Boulevard creates several daytime delivery zones converting to parking spaces for evening usage).

[275] *See* SCHWARTZ & KELLY, *supra* note 6, at 106–07; Marco Margaritoff, *Amazon Patents Aerial Fulfillment Centers for Improved Drone Delivery*, THE DRIVE (July 24, 2018), http://www.thedrive.com/tech/22374/amazon-patents-aerial-fulfillment-centers-for-improved-drone-delivery [https://perma.cc/5C4V-MKAL].

[276] *See* Eric Jaffe, *How Washington State Convinced Big Companies to Dramatically Reduce Drive Alone Commutes*, CITYLAB (Apr. 6, 2015), https://www.citylab.com/solutions/2015/04/how-washington-state-convinced-big-companies-to-dramatically-reduce-drive-alone-commutes/389658/ [https://perma.cc/A44W-XB2D]; *Why transportation should be a part of corporate social responsibility*, WASTE WISE PRODUCTS: SUSTAINABILITY BLOG (May 6, 2015), https://www.wastewiseproductsinc.com/blog/sustainability/why-transportation-should-be-a-part-of-corporate-social-responsibility/ [https://perma.cc/6L43-FKYZ].

[277] Sam Grobart, *Five Ways to Redesign Cities for the Scooter Era*, BLOOMBERG HYPERDRIVE (Oct. 16, 2018), https://www.bloomberg.com/news/articles/2018-10-16/five-ways-to-redesign-cities-for-the-scooter-era [https://perma.cc/GZ56-9JNC].

costs associated with overtime pay due to receiving employees create a virtuous cycle because, when rush hour and daytime traffic is radically reduced by converting to a nocturnal schedule, businesses gain greater productivity from their employees and cities benefit from the attending tax receipts—both stakeholders are thus "reimbursed."[278]

C. *Regional Governments: Leading in the Transition to an AI-Controlled Movement Paradigm*

1. Sharing the Way

Groups of local jurisdictions can lead merely by insisting that public education, ordinance adoption, and marketing of new mobility innovations receive substantial emphasis in addition to the attention lavished on technology "disruptors," so that there is groundwork laid for the success of rapidly changing vehicular and infrastructure iterations.[279] Balancing high-tech with low-tech solutions like bus rapid transit should be emphasized in the interim period before an AI mobility paradigm replaces human endeavors in the planning function. Optimal access to public transport promotes physical activity because many trips incorporate walking or cycling.[280] And pedestrian access to public transport benefits lower-income citizens when local governments afford walking safely to access points as part of the accessibility paradigm.[281]

Imagine the impact upon regional transportation planning if the state's capital city, and all affected local governments in their surrounding regions, were to place their entire vehicular fleets into a pool for periodic citizen car-sharing usage outside regular work hours and days.[282] The shared deployment of such fleets would reduce the demand for privately owned cars while keeping the vehicles moving along the streets instead of sitting idly (most of the time) in parking lots maintained at taxpayer expense.[283] Alternatively, regional consortia of governments could:

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[278] *See id.*
[279] *See* Nikitas et al., *supra* note 13, at 16.
[280] PEGGY EDWARDS & AGIS TSOUROS, PROMOTING PHYSICAL ACTIVITY AND ACTIVE LIVING IN URBAN ENVIRONMENTS: THE ROLE OF LOCAL GOVERNMENTS 11–14 (2006).
[281] *Id.*
[282] *See generally Local Governments and Positive Disruption: Leveraging the Sharing Economy for Sustainable Communities*, LOCAL GOV'T COMM., https://www.lgc.org/leveraging-sharing-economy-sustainable-communities/ [https://perma.cc/3KZN-G9TW] (last visited Oct. 28, 2019).
[283] *Id.*

(a) abandon "government vehicles" except those used by first responders and emergency-oriented workers in favor of employing car sharing services or (b) procure and maintain a discreet vehicular fleet shared multi-jurisdictionally among all public employees at every level of government.[284] Such initiatives demonstrate leadership from the front of the line.

It is difficult to conjure "dedicated lanes" for certain moto types when what really is needed is *hybridizing* them, eliminating lane segregation and dependency.[285] Accessibility-centric planning must entail multi-purposing individually operated vehicles, like putting cargo on mass transit line "cars" and using trunks of autonomous cars and trucks for freight delivery.[286] In this vein, a "quid pro quo" for Corridor use for personal conveyance is having the moto owner carry cargo when interior storage capacity remains.

In Corridors, certain lanes likely should be reserved for robotically controlled moving vehicles, constrained to a uniform speed, traversing a fixed-path guideway separated from other traffic lanes. Several alternatives may emerge here. One would employ conveyor-belt analogs for moving static vehicles along fixed pathways above and at grade to predetermined destinations.[287] At grade, this would permit tight bumper clearance tolerances and slower speeds abide. Aloft, drones, for one aerial conveyance, do not need to operate continuously under "their own power" each moment of their delivery trip—so long as they efficiently remain in motion.[288]

An extraordinary opportunity for directing movement at grade may arise by moving vehicular components into their wheels. Companies

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[284] *See id.*

[285] Accordingly, one option in transportation planning is to make lanes perform different functions at different intervals, such as autonomous vehicular travel during peak drive times and pedestrian ways at off-peak hours. *See* Gregory Scruggs, *How agile is your city? Urban experts call for more flexible land use*, PLACE (Sept. 19, 2018), http://www.thisisplace.org/i/?id=f0be9774-3ba4-47ce-b200-1259e94f08cf [https://perma.cc/2WQA-FRJF].

[286] Strangely, Amazon and likely others are currently toying with storing consumers' packages in your vehicle trunk anyway. *Cf.* Laura Stevens & Mike Colias, *Amazon to Start Offering In-Car Deliveries*, WALL ST. J. (Apr. 24, 2018), https://www.wsj.com/articles/amazon-can-now-deliver-packages-to-your-car-1524568172 [https://perma.cc/7RG6-U6DP]. Query: Why *not* take your neighbors' stuff home to them while you are headed in their direction? Just do not inspect the box of goods before the neighbors receive it.

[287] *See* Dimitrios Kolios, U.S. Patent No. 12/778,384 (filed May 12, 2010), https://patents.google.com/patent/US20100294621 [https://perma.cc/QDB2-L46E]. One proposed "embodiment" of this invention is a device "utilized to transport vehicles across a pedestrian plaza," or elsewhere in "environmentally delicate or important areas" where the goal is "improved safety to through passing vehicles and bystanders." *See id.*

[288] Adam Piore, *Rise of the Insect Drones*, POPULAR SCI. (Jan. 29, 2014), https://www.popsci.com/article/technology/rise-insect-drones/ [https://perma.cc/3576-6PL7].

like Israel's Ree Company and America's Indigo Technologies are inserting inside each wheel the steering, suspension, drive-train, sensors for brakes, thermal systems, and electronic components.[289] Of course, the immediate primary benefit is weight savings for vehicle components; this savings allows diminishing the size of the vehicular battery packs—another weight savings.[290] Any such savings is critical, due to the significance of lithium-ion batteries' cost which is crucial to assuring affordability of electric vehicles.[291]

More consequential still may be the longer-term opportunity to integrate with roadway actuators. If the in-wheel motors turn only as fast as the vehicle's wheels rotate (requiring relatively low speeds from an electric motor), the motor need not be as powerful, operating under lower voltage.[292] Suppose components embedded in roads for connectivity could communicate at "curb height" with the in-wheel drive system of this new vehicle design. In that event, Corridors might be guidance system–equipped, determining in real time where each vehicle is best positioned to transit along the pathway, with such a system communicating to each vehicle's drive system how seamlessly to continue to its destination. That destination, in turn, would be communicated automatically by each vehicle to the curb height guidance system, allowing the latter to consider in calculating the optimal path any programmed passenger or cargo drop zone to be used within or adjacent to the Corridor.[293] Since these in-wheel drive systems enable separate control of the

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[289] *See* Nancy Cohen, *Motor, other components, in wheels may shape future of car industry*, TECH XPLORE (July 13, 2019), https://techxplore.com/news/2019-07-motor-components-wheels-future-car.html [https://perma.cc/GD2D-CTSS]; *A new type of engine for electric cars*, THE ECONOMIST (July 11, 2019), https://www.economist.com/science-and-technology/2019/07/11/a-new-type-of-engine-for-electric-cars [https://perma.cc/38UV-6M7V].

[290] *See* THE ECONOMIST, *supra* note 289.

[291] *See* Stephen Wilmot, *The Big Obstacle on the Road to Electric Vehicles*, WALL ST. J. (July 18, 2019), https://www.wsj.com/articles/the-big-obstacle-on-the-road-to-electric-vehicles-11563459592 [https://perma.cc/46B2-U3GR] (noting that batteries' costs must reduce for electric vehicles to be affordable to consumers, as they contain volatile commodities that must be mined and processed).

[292] *See* THE ECONOMIST, *supra* note 289.

[293] This is not farfetched, since Huawei Technologies Co. is producing its Ascend 910 chip designed to crunch data and build algorithms. *See* Dan Strumpf, *Huawei Launches AI Chip in Push to Unseat U.S. Makers*, WALL ST. J. (Aug. 23, 2019), https://www.wsj.com/articles/huawei-launches-ai-chip-in-push-to-unseat-u-s-makers-11566556836 [https://perma.cc/L4BJ-VXYH]. The Huawei AI chip is the width of a human palm—a smaller width than six-inch high curbs installed along major streets in Seattle. *See* SEATTLE RIGHT-OF-WAY IMPROVEMENTS MANUAL, *Curbs* (June 9, 2017), https://streetsillustrated.seattle.gov/design-standards/roadway-construction/curbs/ [https://perma.cc/Z8SD-ZBKU].

power applied to each wheel, there is better grip and increased stability during braking and cornering.[294] In turn, this allows rapid course corrections dictated by the guidance system, communicated to vehicles that perhaps will accommodate "turning on a dime," pivoting quickly to optimize Corridor throughput and increasing the efficiency and safety of traveler movement, despite vehicles traveling at slower average speeds than commuters expect.[295]

2. Co-Ownership and Storage of Motos

Vehicle storage abutting Corridors' destinations shall be reimagined, so long as privately owned vehicles are permitted there, increasing capacity for their collective temporary stoppage for delivering, picking up, maintaining, or recharging of batteries.[296] Storage design research will consider the possibilities in design of autonomously operated vehicles.[297] If vehicles are stackable (perhaps by robots) by retracting tires beneath identical 3D printed vehicle frames and electric powertrains,[298]

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[294] *See* THE ECONOMIST, *supra* note 289.
[295] See *infra* text accompanying note 354.
[296] *See generally* Nourinejad et al., *supra* note 27, at 113. Indeed, the author notes that fully automated vehicles do not need to be parked abutting the Corridors, because they can be "haled" far enough in advance to allow vehicles to move further to pick up their passenger compliment. *See id.* at 113, 136. Theoretically, that might make parking rates less expensive because vehicles will not be parked in a "premium" location where land is more expensive. *See id.* at 111.
[297] *See id.* at 111–16 (suggesting AV technology diminishes average stall area and narrows driving lanes as well as reduces elevator use in structures). In addition, the author notes that the same storage facility can have dynamic layouts according to demand changes. *See id.* at 116.
[298] *See* SCOTT CURRAN ET AL., BIG AREA ADDITIVE MANUFACTURING AND HARDWARE-IN-THE-LOOP FOR RAPID VEHICLE POWERTRAIN PROTOTYPING: A CASE STUDY ON THE DEVELOPMENT OF A 3-D-PRINTED SHELBY COBRA, SAE TECH. PAPER (2016). This assumes a certain uniformity among types of passenger vehicles devoted to fleets of travelers such as CBD employees, especially those who do no traveling in their jobs. *See, e.g.*, Ryan C.C. Chin et al., *City Car: A New Design Approach Enabling Urban Mobility*, MIT MEDIA LAB (Oct. 16, 2006), https://www.media.mit.edu/publications/city-car-a-new-design-approach-enabling-urban-mobility/ [https://perma.cc/4PNK-QXK2]. While the United States appeared to be heading in the direction of favoring electric vehicles, current inclinations by federal regulators to roll back regulations governing miles per gallonage and air-pollutant and greenhouse gas emissions may substantially delay any capacity to mass-produce near exact replicas of motos that could be stacked by component type and rapidly reassembled in the storage hub in response to increased demand. *See* Christopher Mims, *Driverless Hype Collides With Merciless Reality*, WALL ST. J. (Sept. 13, 2018), https://www.wsj.com/articles/driverless-hype-collides-with-merciless-reality-1536831005 [https://perma.cc/ZBA8-WYXG]; Timothy Puko, *Trump Administration May Eliminate Increases in Fuel-Economy Standards*, WALL ST. J. (Apr. 27, 2018), https://www.wsj.com/articles/trump-administra

storage capacity in a single parking facility increases dramatically[299] without substantial structural height above grade or depth below grade.

Vehicle storage must become an integral part of any transit hub. Storage, including the parking upon entry and pullout for passenger loading-in, will become robotically controlled.[300] The passenger will exit the vehicle and the robot will park it by "jukebox" movement (like returning a vinyl record to a horizontal "stack") in a multi-story, vertical structure that will nest "stock" (identically designed) taxi fleet vehicles.[301] Privately owned vehicles will be parked in a different area, a humanly accessible co-op portion of such storage facilities. In this model, there may well be multiple owners of "private" vehicles, operating in a sharing-economy model—that is, once the individual driver's insurability problem is solved.[302] One's co-op "membership" entitles an owner to a certain number of weekly hours of "drive time" of the "chartered" vehicle (or perhaps a small fleet of vehicles).[303] The membership will further include a

tion-may-eliminate-increases-in-fuel-economy-standards-1524859884 [https://perma.cc/86BN-FMM3].

[299] *See* Elise Bohan, *How Self-Driving Cars Will Transform Urban Living for the Better*, BIG THINK (Mar. 14, 2017), https://bigthink.com/how-self-driving-cars-will-transform-urban-living-for-the-better [https://perma.cc/SLV5-K4V5].

[300] *See* Jack Stewart, *Step into the Garage Where Robots Do All the Parking*, WIRED (Oct. 28, 2016), https://www.wired.com/2016/10/step-garage-robots-parking/ [https://perma.cc/P4E6-DUSH].

[301] *See, e.g.*, Chin et al., *supra* note 298 (discussing stackable cars); Phil Patton, *Parking as a Destination*, N.Y. TIMES (Feb. 25, 2007), https://www.nytimes.com/2007/02/25/automobiles/25PARK.html [https://perma.cc/UV3M-DQ2V] (discussing robotic parking).

[302] *See* Eillie Anzilotti, *Can we create a new kind of car insurance for a world where we share cars?* FAST COMPANY (Sept. 25, 2018), https://www.fastcompany.com/90239836/can-we-create-a-new-kind-of-car-insurance-for-a-world-where-we-share-cars [https://perma.cc/R3QS-JQ3P] (describing Arity's driver data aggregation moving toward behavior-based insurance plans to enable ownership of shared cars easier).

[303] Didi Chuxing in China announced in April 2018 its alliance with multiple manufacturers for a vehicle-sharing platform intended "to provide everything needed for a user-friendly service, including insurance and maintenance on the 'purpose-built' electric vehicle fleet." *See* Shunsuke Tabeta, *Didi forms global alliance for car sharing*, NIKKEI ASIAN REV. (Apr. 25, 2018), https://asia.nikkei.com/Spotlight/Sharing-Economy/Didi-forms-global-alliance-for-car-sharing [https://perma.cc/EN3J-3CWG]. Some predict that "V2G" (vehicle to grid) initiatives will gain broader acceptance as denser urban populations seek sustainable mobility using "not owned" or "co-owned," ubiquitously moving, autonomous vehicles in the sharing economy. *See* Heinrichs, *supra* note 12, at 216. Interesting autonomous vehicle issues in the United States include whether the age requirement for a driver's license will decrease (as licensure [or even the maturity of the passenger] loses relevance over time), and who owns the insurance (or has tort liability) when a co-owner enters a shared-ownership autonomous vehicle. *See id.* at 217. If the passenger in this fully autonomous vehicle informs the AI "assistant" of her destination's address and the

fractional interest in a parking stall in the co-op garage, including the right to a certain number of routine "cleaning and maintenance" service tasks per month performed by a robotic "grease-monkey." These storage structures further may serve as package delivery hubs, hosting bins for each co-op member to receive deliveries of larger containers than members would allow (or want) delivered to the member's residential interior, garage, or front doorstep.[304] Residential subdivisions then can de-emphasize garage or carport profiles on residential or multifamily lots, since co-op members leave cars elsewhere.[305]

The vehicle storage hub ought to be combined with a delivery-of-cargo type hub that may indeed combine with an omnibus fulfillment center.[306] As environmentally unsustainable as partially empty vehicle interiors seem, nearly all moving vehicles have unused capacity in their rear quarters (autos have "trunks," "dickies," or "boots," depending on your culture) for cargo.[307] If robotics can change parking, prepping, and mobilizing of future motorized vehicles, then robotics with sensor and AI support will (i) identify empty trunks/beds and their present locations, (ii) identify suitable routes for intermediate potential drop-off waypoints en route to a projected final destination, and (iii) locate "loads" awaiting "passage." This autonomous agent will arrange for joint and concurrent delivery of persons and goods.

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vehicle crashes en route, how is the rider (as opposed to the ownership "group") culpable, if she says nothing further to the robotic agent before the crash? Is there joint and several liability among the co-owners? *See generally* Carrie Schroll, *Splitting the Bill: Creating a National Car Insurance Fund to Pay for Accidents in Autonomous Vehicles*, 109 NW. U. L. REV. 803 (2015); Matthew W. Daus, *Peer-to-Peer Car Sharing and its Impact on Insurance: Examining the Road Ahead for Public Policymakers*, https://www.naic.org/documents/cipr_events_liability_issues_and_p2p_car_sharing_presentation.pdf [https://perma.cc/8CN2-226L] (last visited Oct. 28, 2019).

[304] This alternative may be more viable than deliveries made directly to or through the resident's front door. *See* Phil Lempert, *Consumers Are Wary of Amazon Key—No Surprise*, FORBES (Mar. 16, 2018), https://www.forbes.com/sites/phillempert/2018/03/16/consumers-are-wary-of-amazon-key-no-surprise/ [https://perma.cc/4K5N-NBTC].

[305] The author is not *that* naïve. Garages will continue to be used as family-sheltered storage of undeployable yet somehow invaluable possessions. *See* Robert Duffner, *3 steps to decluttering your garage*, CHI. TRIB. (May 9, 2017), http://www.chicagotribune.com/lifestyles/springcleaning/sc-spring-cleaning-garage-autotips-0511-20170509-story.html [https://perma.cc/Z5MB-EVXL].

[306] *See* Patrick J. Kiger, *Driving Hard to Secure Last-Mile Logistics*, URBANLAND (Feb. 5, 2018), https://urbanland.uli.org/industry-sectors/industrial/driving%E2%80%85hard-secure-last-mile-logistics/ [https://perma.cc/T6E2-W8SM].

[307] *See* Adele Peters, *This Package Rideshare App Pays To Use Your Empty Trunk,* FAST COMPANY (Feb. 5, 2015), https://www.fastcompany.com/3041884/this-package-rideshare-app-pays-to-use-your-empty-trunk [https://perma.cc/83QH-2YVF].

Visualize worker Jericho, who is commuting in a "pool" vehicle to her office. Jericho hails her swarm taxi (stock vehicle) unit for a ride to the workplace on her personal device. The responding program identifies these factors: (a) how long the commute will require depending on whether Jericho chooses Model A, Model B, or Model T conveyancing and (b) what the ride pricing will be, depending on Jericho's preference. Model A is a one-passenger vehicle (subcompact) that, upon leaving the hub, requires *M* minutes to reach Jericho's destination, and will cost 3X, because that vehicle's lone trip function is to fetch and transport Jericho to work. Model B, a larger vehicle, will require approximately *2M* minutes to reach the same destination but will cost just 2X. Why? Because Model B passage entails an intermediate detour, whether to pick up (and maybe drop off) another human passenger or cargo items.[308] Model T[309] is a bigger vehicle still with a heavier load capacity. Model T either will use an indirect, more time-consuming route, incorporating intermediate diversions for pickups and/or deliveries, involving arrival at the hailer's destination in *3.5M* minutes, but will cost Jericho just X to ride based upon her perceived inconvenience. Jericho will calculate the "money value of time" based upon her schedule, balancing her haste against her appetite for working inside the vehicle, after she decides the optimal accessibility scenario. Furthermore, load owners will receive dynamic pricing options for cargo delivery, depending on whether their selected vehicles will carry a single passenger, multiple passengers, and/or multiple loads within its cargo delivery grid—implicating variable delivery times.

3. Incentivizing Smarter City Movement

Congestion pricing in CBDs will continue to be debated in a continued effort to keep out persons with no consequential need to move along a Corridor.[310] The focus here must remain upon improving reliability of

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[308] *See* Ranieri et al., *supra* note 219, at 790 (deviating from historical route patterns is rewarded for a package delivery).

[309] Apologies to Henry Ford for invoking his "types"; today, Ford Motors is fully engaged in this smart-infrastructure shared-transportation mix. *See* Kate Gibson, *Ford CEO Takes a Philosophical Approach in Widening its Vision of Mobility*, THE DRIVE (Jan. 9, 2018), http://www.thedrive.com/sheetmetal/17525/ford-ceo-takes-a-philosophical-approach-in-widening-its-vision-of-mobility?iid=sr-link1 [https://perma.cc/GRR3-5S7L]. And Ford and Volkswagen are discussing joint production of light trucks. *See* William Boston, *Volkswagen to Pour Billions Into Electric Cars*, WALL ST. J. (Nov. 16, 2018), https://www.wsj.com/articles/volkswagen-to-spend-50-billion-on-electric-car-drive-1542384180 [https://perma.cc/2ZMU-LZDB].

[310] *See* Ben Fried, *Can Cuomo Deliver an Effective Congestion Pricing Plan Without East*

mass transit routes via improving finer-grained, local connections.[311] The result is that today American fixed mass transit usually cannot accomplish human "last mile deliveries,"[312] resulting in lost worker productivity stemming from the disconnect in delivering workers on their individual timetables. The way forward will become clearer as communities and their private partners begin to focus upon understanding immediate, activity-based needs of the individual traveler[313] to afford on-demand transit to hubs with mass-movement equipment.

As to co-owned vehicle scenarios, congestion pricing in the Corridor may be waived or reduced if the co-operative owner/participant shares his ride with third-party cargo, to be loaded (robotically or naturally) before it leaves the transit hub. Indeed, a co-operative owner even may receive some credits (against future enhanced pricing) if he agrees to share his passage with another person boarding at the hub or another access control point along the owner's route.

Further, American land planning enterprises will integrate "movement" strategies into more densely built districts, akin to the European

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River Bridge Tolls? STREETSBLOG NYC (Jan. 17, 2018), https://nyc.streetsblog.org/2018/01/17/can-cuomo-deliver-an-effective-congestion-pricing-without-east-river-bridge-tolls/ [https://perma.cc/Q5KF-9GWJ]. The federal government may be weighing in on this issue, if a recent initiative is a bellwether of DOT policy. *See, e.g.*, Ted Mann, *States That Raise Tolls and Taxes Will Have an Edge in Getting DOT Funds,* WALL ST. J. (Apr. 27, 2018), https://www.wsj.com/articles/states-that-raise-tolls-and-taxes-will-have-an-edge-in-get ting-dot-funds-1524821401 [https://perma.cc/LZJ9-ZMK7] (local agencies will receive favorable treatment for generating additional revenue streams by charging for use of public roads).

311 *Cf.* CITY PLANNING DIVISION, CITY OF TORONTO, SCARBOROUGH TRANSIT PLANNING UPDATE 8 (Jan. 21, 2016), https://www.toronto.ca/legdocs/mmis/2016/ex/bgrd/backgroundfile-87737.pdf [https://perma.cc/T23B-LPMB] (noting that transit planning priority must be enabling "better connections of people to everyday places").

312 *See* English, *supra* note 153. English argues that as passengers switch between/among transit modes, the fares should have an integrated fare structure, eliminating penalizing for transference. Is learning taking place? In May 2018, Nashville rejected a mass transit upgrade initiative. Apparently a consensus of sorts was reached that (a) the benefit to the city was outweighed by costs in the form of more taxes, and (b) the plan benefitted downtown Nashville commuters more than the balance of the metroplex's citizens dwelling outside downtown who pay, in the aggregate, more income and sales taxes than downtown dwellers. *See* Garrison, *supra* note 183. That (b) above may be true doesn't make the 'burbs the economic engine of Greater Nashville, however.

313 *See* CITY PLANNING DIVISION, *supra* note 311, at 2, 8, 18 (advocating for "better transit" investment to "meet people's needs for daily living"). In truth, currently there is no perfect activity-based travel-demand model replicating behaviors on the individual passenger level; but, representative behaviors are being observed that, at an aggregate level, imbue analysts with sufficient confidence that such modeling is working. *See generally* Farhana Yasmin et al., *Macro-, Meso-, and Micro-Level Validation of an Activity-Based Travel Demand Model*, 13 TRANSPORTMETRICA A: TRANSP. SCI. 222 (2017).

planning model where towns and suburbs are designed to retain viability of transit use.[314] Examples include what is planned for Oakland's Fruitvale Transit Village[315] or West Windsor, New Jersey, within the Princeton Junction Transit Village.[316] These living- and transit-hub mash-ups will involve communities partnering in each location with the private development sector.[317] Maximizing utility of private resources will enable infrastructure upgrades and facilitate densification through owner land use incentives by local governments, such as (1) performance zoning allowances and incentive zoning awards,[318] affording additional density

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[314] *See* English, *supra* note 153.

[315] *See* J.K. Dineen, *Transit-village housing in Oakland's Fruitvale gets going, after years of delays*, S.F. CHRONICLE (Mar. 5, 2018), https://www.sfchronicle.com/bayarea/article/Transit-village-housing-in-Oakland-s-Fruitvale-12730103.php [https://perma.cc/7K3N-SSD7].

[316] *See Township of West Windsor Designated a Transit Village*, U.S. HUD (June 2012), https://www.huduser.gov/portal/node/4098 [https://perma.cc/5TMR-99HF]; TOWNSHIP OF WEST WINDSOR REDEVELOPMENT PLAN FOR PRINCETON JUNCTION (2009), http://www.westwindsornj.org/redevelopment/2009/20090323ADOPTEDVERSIONREDEVPLAN.pdf [https://perma.cc/V769-R9A7]. ("[T]he Princeton Junction redevelopment plan called for more than 200,000 square feet of retail and office space, along with 487 residential units, of which 36 percent (176 units) would be affordable housing. The latest addition to the redevelopment plan is Freedom Village, a 100 percent affordable housing complex off Bear Brook Road spearheaded by the disability nonprofit Project Freedom."). *See* Hye-Jin Kim, *New wave of residential development may alter West Windsor master plan*, COMMUNITY NEWS (Apr. 11, 2018), https://communitynews.org/2018/04/11/new-wave-of-residential-development-may-alter-west-windsor-master-plan/ [https://perma.cc/7PLK-MVMW].

[317] *See, e.g.*, KATZ & NOWAK, *supra* note 8, at 125–26. Progressive developers welcome such partnering. One reason for their enthusiasm is that having available accessibility options is viewed as an amenity to a project, as well as a statement of the developer's commitment to innovative technologies. *See, e.g.*, Esther Fung, *City Planners, Property Developers Fuel Push for Driverless Vehicles*, WALL ST. J. (May 29, 2018), https://www.wsj.com/articles/city-planners-property-developers-fuel-push-for-driverless-vehicles-1527598801 [https://perma.cc/6ZMV-NV7A] (noting developers courting pilot projects for driverless vehicles). The main attraction for continuously operating driverless vehicles, however, is the reality that fewer parking stalls yield land purposed for profitable vertical development density. *See id.*; Robert Kunzig, *To build the cities of the future we must get out of our cars*, NAT'L GEOGRAPHIC (Apr. 2019), https://www.nationalgeographic.com/magazine/2019/04/to-build-cities-of-the-future-stop-driving-cars/?cmpid=org=ngp::mc=display::src=ngp::cmp=editorial::add=citiesfooter [https://perma.cc/X5H3-LKCF] (noting Calthorpe's El Camino thought experiment with continuously moving shuttle vans in dedicated lanes).

[318] *See* Anthony Flint, *Braving the New World of Performance-Based Zoning*, CITYLAB (Aug. 12, 2014), https://www.citylab.com/equity/2014/08/braving-the-new-world-of-performance-based-zoning/375926/ [https://perma.cc/B2Q6-NDHF]. An incentive-based zoning "award" is exemplified in Chandler, Arizona; this community approved a regulation allowing developers to provide less than conventional parking facilities if they design to accommodate future self-driving vehicle fleets or, in the interim, loading zones for ride-sharing

for private developers installing diversion lanes to enable off-street turns or implementing valet drop-off points, keeping slower moving, disembarkation interference to a minimum, or (2) infrastructure development agreements obligating developers to make direct contributions to traffic management though payments or in-kind mitigation measures such as flexible working hours for employees.[319] Communities must give as well as take; so a "quid pro quo" of waiving, or reducing, tolls or dynamic congestion pricing points in return for innovations like employers implementing on-demand employment movement or other solutions to reducing numbers of vehicles in the Corridor, requires community recognition of the quality-of-life value proposition inherent in proposed innovations.[320]

CONCLUSION: FOUR SURRENDERS, OR, THE ROAD TO NEOM

Jim Hackett, the CEO of Ford Motors, sees movement of persons in densely populated areas in terms of a transportation "operating system" analogous, perhaps, to a computer's operating system: "[F]or the first time in a century, we have mobility technology that won't just incrementally improve the old system, but it can completely disrupt it. So, a total redesign of the surface transportation system [is involved], with humans and community at the center."[321]

The *technological* solution to freeing up Corridor "capacity" is, fairly stated, both revolutionary and elementary. Control of all externally powered vehicles eventually must be surrendered—when they are proven to be fit for the task—to intelligent agents as vehicles enter the Corridor's Agent-Control Zone ("Control Zone"). If a moto (versus a velo) is not

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services. *See* ZCA18-0001, CITY OF CHANDLER/AUTONOMOUS VEHICLES ZONING CODE AMENDMENT, http://www.chandleraz.gov/content/20180426_INFO1.pdf [https://perma.cc/WQ7J-JNZ2] (last visited Oct. 28, 2019). Chandler began hosting Waymo in 2016 and, beginning in 2017, Waymo has been testing vehicles without human passengers in the city. *See id.*

[319] *See, e.g.*, Development Agreement Between Agave Ponce, LLC, and City of Coral Gables (June 2015), https://coralgables.legistar.com/LegislationDetail.aspx?ID=2990787&GUID=C16C0C66-04D0-4F91-8782-70E6CF397E28&Options=&Search= [https://perma.cc/ZKT2-6GC6].

[320] *Cf.* JOHN SWANSON & BENJAMIN HAMPTON, WHAT DO PEOPLE THINK ABOUT CONGESTION PRICING? A STUDY OF THE PUBLIC ACCEPTABILITY OF CONGESTION PRICING THROUGH A DELIBERATIVE DIALOGUE WITH RESIDENTS OF METROPOLITAN WASHINGTON, NATIONAL CAPITAL REGION TRANSPORTATION PLANNING BOARD, METROPOLITAN WASHINGTON COUNCIL OF GOVERNMENTS & BROOKINGS INSTITUTION 58–59 (2013).

[321] Stephen J. Dubner, *Can an Industrial Giant Become a Tech Darling?*, FREAKONOMICS RADIO (Nov. 7, 2018), http://freakonomics.com/podcast/ford/ [https://perma.cc/UD6F-3YHT] (interviewing Jim Hackett, President and CEO of Ford Motor Company).

either: (i) scheduled or (ii) authorized (as an exception to scheduling), to operate in the Control Zone at the moment of its entry there, its energy source will cease functioning, and the vehicle will be pulled over to the curb.[322] Other robotic devices will cause the now-inoperable vehicle to be pulled out of the line of traffic, enabling passage for energized motos, velos, and pedestrians. Heavy financial penalties will be collected as a precondition of releasing the de-energized vehicle. This scheme forces changes in transportation mode choices and in human work schedules of moto-operators using Control Zones. Aiding choosing a velo mode of movement are motos storage facilities available on adjoining rights of way or increasing storage capacity found at nearby commercial realty transit hubs.

Such are not well-understood matters outside the technical community. Tragic though the loss of life is when an autonomous vehicle kills a person, today's technologies swiftly will be replaced by more "vigilant" and consequently "reliable" technologies.[323] Quantum computing will allow cities to do things in entirely new ways with greater mathematical computation capacity. Such computing reduces analytical functions that on conventional supercomputers either cannot be performed or require weeks of computation time.[324] Since a quantum system's unit, a qubit, or quantum bit, can be present in more than one "state of being" concurrently (known as superposition of states), we cannot understand yet how so-called qubits interact because of their volatility, being unstable in other than frozen temperatures and under other environmental conditions.[325] We do know that massive, seemingly insurmountable air traffic management systems eventually may be managed as these quantum computers replace lineal computing with calculating all imaginable permutations simultaneously.[326] That is, because qubits are paired with other interdependent

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[322] By a magnetic field embedded in the adjoining curb perhaps, if any metal remains among moto parts. Alternatively, since the moto cannot just be marooned in a right of way with continuous surrounding traffic movement, a warning that the energy source will "cease" in X seconds notifies the operator, which automatically pulls the moto up to the nearest edge of the Corridor's right of way.

[323] Indeed, Jim Hackett believes that IoT sensors and the cloud system "mediating" interactions of vehicles at a nearly light speed will enhance collision avoidance. *See* Dubner, *supra* note 321.

[324] *See* Will Knight, *Serious quantum computers are finally here. What are we going to do with them?*, MIT TECH. REV. (Feb. 21, 2018), https://www.technologyreview.com/s/610250/hello-quantum-world [https://perma.cc/MMT5-2ELS].

[325] *See id.*

[326] *See* Larry Greenemeier, *How Close Are We—Really—to Building a Quantum Computer?*, SCI. AM. (May 30, 2018), https://www.scientificamerican.com/article/how-close-are-we-really-to-building-a-quantum-computer/ [https://perma.cc/U2WQ-4F8N].

qubits, computers can perform in significantly less time far more complicated logic operations (such as who should move next at a complicated traffic interchange such as a multimodal three-dimensional junction).[327] First, however, programmers must reimagine what programming is, abandoning all conventional "languages" and many protocols. The application of quantum realms will, however, advance dramatically traffic management in dense city cores.[328]

Technology solutions implicate the first of four surrenders—turning human physical control over to robotic devices and artificial intelligence "agents." The uncertainty of this surrender triggers startled and anxious reactions in some and repulsion in others.[329] Why? Michael Lewis notes, "a future predicated on product development alone, with little to offer the human heart, is a cheerless future indeed."[330] But such surrender does not dictate abdication of goal-making achieved through planning policy development undergirded by human compassion, especially the desire to achieve equity in accessibility.

The second surrender sees local jurisdictions outsourcing Corridors planning and management to regional agencies, like MPOs,[331] composed of many local jurisdictions. Such bodies represent the broad spectrum of stakeholders and comprehensively must dictate policy for IoT-with-AI management of accessibility at, below, and above grade within the larger territory, so that quantum computing–driven AI maximally can impact accessibility. In this realm, MaaS[332] is refined to the point that travelers will rely on standard and publicly accessible algorithms to traverse urban cores and perhaps entire communities' boundaries.

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[327] *See* John Loeffler, *Google's Quantum Processor May Achieve Quantum Supremacy in Months*, INTERESTING ENGINEERING (June 23, 2019), https://interestingengineering.com/googles-quantum-processor-may-achieve-quantum-supremacy-in-months [https://perma.cc/6GFG-QVTB].

[328] *See* Stephen Edelstein, *Volkswagen and Google Partner on Quantum Computing for Traffic Management, Materials Science*, THE DRIVE (Nov. 8, 2017), http://www.thedrive.com/sheetmetal/15880/volkswagen-and-google-partner-on-quantum-computing-for-traffic-management-materials-science [https://perma.cc/5A5V-KEFX].

[329] *See* Abigail Shrier, *Our Future is Safer, but Terrifying*, WALL ST. J. (Mar. 26, 2018), https://www.wsj.com/articles/our-future-is-safer-but-terrifying-1522103429 [https://perma.cc/9PGD-FXTZ]. *But see* Fry, *supra* note 83; Alex Roy, *How the Language of Self-Driving Is Killing Us*, THE DRIVE (May 1, 2018), http://www.thedrive.com/opinion/20495/how-the-language-of-self-driving-is-killing-us?iid=sr-link5 [https://perma.cc/T7RX-JU9W].

[330] *See* Lewis, *supra* note 11.

[331] *See supra* text accompanying notes 158–68.

[332] *See supra* text accompanying notes 183–85.

The third surrender implies sacrificing visceral satisfaction, including social interaction "systems" accompanying self-directing one's vehicle[333] from behind the wheel or other guidance system, in favor of improving one's transportation efficiency and safety. This third surrender is no small feat for those driving during much of their adult lives, especially among those over forty. For this demographic group, the right to drive in directions (as well as at speeds and RPMs) one chooses (including the least efficient or slowest routes) has informed individual self-determination for more than a century. The lure of the "open road," or the "road trip," resonates with fundamental freedoms to explore one's surroundings and our reactions to them.[334] Indeed, the liberty of exploring unfamiliar terrain is one manifestation of national identity;[335] motor vehicle usage cannot be reduced

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[333] *See, e.g.*, Edward R. Straub & Kristin E. Schaefer, *It Takes Two to Tango: Automated Vehicles and Human Beings Do the Dance of Driving—Four Social Considerations for Policy*, 122 TRANSP. RES. PT. A 173 (2018), https://www.sciencedirect.com/science/article/pii/S0965856417301659 [https://perma.cc/22UG-SS2Q]. The authors note that introducing volumes of AVs results is a diminution of positive social norms like human communication, participation, and reciprocity. Residing just beyond the "road rage envelope" myself, I find this theory contorted yet fascinating. Perhaps some local norms like knowing well in advance (and perhaps sharing with others) where the bottlenecks routinely occur on local streets or successful detour options exist will be lost to AI "animators," but it seems these virtues are offset by increased safety and improved efficiency in resource sustainability.

[334] *Cf.* JACK KEROUAC, ON THE ROAD (1957) (novel barely disguising identities of "beat" generation figures journeying during the 1940s); RICHARD RATAY, DON'T MAKE ME PULL OVER! AN INFORMAL HISTORY OF THE FAMILY ROAD TRIP (2018); JOHN STEINBECK, TRAVELS WITH CHARLEY: IN SEARCH OF AMERICA (1962); TOM WOLFE, THE ELECTRIC KOOL-AID ACID TEST (1968); Jeff Guinn, *The Invention of the Summer Road Trip*, WALL ST. J. (June 29, 2019), https://www.wsj.com/articles/the-invention-of-the-summer-road-trip-11561780860?mod=searchresults&page=1&pos=2&ns=prod/accounts-wsj [https://perma.cc/AQT3-W5HB] (noting Edison's and Henry Ford's contributions to popularizing summer auto vacations); Paul Theroux, *The Romance of the American Road Trip*, WALL ST. J. (Sept. 1, 2017), https://www.wsj.com/articles/the-romance-of-the-american-road-trip-1504281812 [https://perma.cc/4JUA-FT4C]; King Rose Archives, *Dinah Shore "See the USA in your Chevrolet"—1953*, YOUTUBE (Mar. 17, 2013), https://www.youtube.com/watch?v=boertpylK0M [https://perma.cc/9Z4D-LJUU] (advertisement promoting automobile distance travels). *Reactions* (as used in the text) literally include the driver's participating in the dynamics of the driving experience itself. *See* Lance Morrow, *A Marriage of Man and Machine*, WALL ST. J. (July 31, 2019), https://www.wsj.com/articles/a-marriage-of-man-and-machine-11564613752?mod=searchresults&page=1&pos=2 [https://perma.cc/QUY5-UKYS] (author noting that his car's manual transmission connected him to the vehicle's "energies and motions"). There is truth to the proposition that, during the manual transmission heyday, the human brain became an extension of the drive train, instructing the driver's extremities operating the clutch and the gearshift knob. *See id.* (This author owns a Wolfsburg assembled, Type 1 Air Cooled Beetle that Corridor authorities can pry, if they are able, from his icy phalanges wrapped around its narrow steering wheel.)

[335] *See, e.g.*, Fox, *supra* note 219, at 202–03 (noting one public perception of America as

merely by condemning the public's wasteful consuming of fuels and building excessive parking fields.[336] Motoring undeterred by authority underscores individuality and opportunity not readily surrendered.[337] Unless, that is, no alternative is afforded consumers.[338]

But surrender we will, however unwillingly; there are two inescapable reasons for this. One reason is social equity.[339] Autonomous vehicles enable accessibility to those excluded today from many independent-mobility living options, including the blind and other persons with disqualifying disabilities like the elderly, working poor, and criminal offenders who cannot get behind a steering wheel. Add to that number youth disqualified by age from independent travel in an owned vehicle, and you're describing a wide swath of society.[340] However, the way planning occurs for

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limitless in expanse and full of possibilities, a concept magnified by automobile travel and evidenced by settlement patterns).

[336] *See* Caitlin Dewey, *Good news for Buffalo's revival: Some downtown parking lots are going away*, BUFF. NEWS (Oct. 25, 2018), https://buffalonews.com/2018/10/25/surface-parking-downtown-buffalo-value-development/ [https://perma.cc/3QFP-QPAD].

[337] *See, e.g.*, Eric Adams, *Can Big Automakers Be Trusted With Big Data?*, THE DRIVE (Apr. 13, 2018), http://www.thedrive.com/tech/20102/can-big-automakers-be-trusted-with-big-data?iid=sr-link3 [https://perma.cc/LQS7-7SGB] ("These technologies will give incredible power to these companies by enhancing their abilities to identify individuals, to recognize or predict undesirable behaviors, and then to enforce norms privately by denying access to essential transportation services or publicly by notifying the police of potential crimes—if they choose to do so.").

[338] Prince Mohammed bin Salman's fantasy metropolis, Neom, will not (should the Crown Prince have his way) have roads or pavement except in certain scenic areas where (according to planning documents) surface cruising survives only for entertainment. In congested areas of the Prince's metropolis, drone taxis will accommodate commuters. *See* Justin Scheck et al., *A Prince's $500 Billion Desert Dream: Flying Cars, Robot Dinosaurs and a Giant Artificial Moon*, WALL ST. J. (July 25, 2019), https://www.wsj.com/articles/a-princes-500-billion-desert-dream-flying-cars-robot-dinosaurs-and-a-giant-artificial-moon-11564097568 [https://perma.cc/9Z88-U6XQ].

[339] By social equity, I mean the principle of seeking equality in distribution of accessibility opportunities. *See* Mimi Sheller*, Sustainable Mobility and Mobility Justice: Towards a Twin Transition*, *in* MOBILITIES: NEW PERSPECTIVES ON TRANSPORT AND SOCIETY 289 (Margaret Grieco & John Urry eds., 2016). The author has avoided the politics of social justice, because it is not the subject of this Paper. If readers seek a more jaundiced view of activists' alleged desire to control the urban transit realm, see, e.g., Christopher F. Rufo, *'New Left Urbanists' Want to Remake Your City*, WALL ST. J. (Aug. 22, 2019), https://www.wsj.com/articles/new-left-urbanists-want-to-remake-your-city-11566512564 [https://perma.cc/G7TW-ZF5T] (author claiming activists desire to control transportation infrastructure to make the masses conform to a singular vision of social equity); *cf.* Millman, *supra* note 191 (quoting the chief executive of LA Metro: "Sometimes you have to tell people what's good for them," as it pertains to bus rapid transit lanes' physical implementation).

[340] *See* Neil, *supra* note 15.

infrastructure, and how autonomous vehicles are priced, may impose other inequities.[341]

Second, millennials, and those behind them in age, largely are not "fellow travelers." For them, "connectivity" emblems (and brand emphases) are their smartphones, their hardware, and software peripherals and applications, but not a four-wheeled motorized vehicle.[342] In identifying the growing disconnect between vehicular ownership and movement, Arun Sundararajan observes: "A lot of people's identity used to be tied up in, 'This is the car I drive. This is whom I am.' All of you have probably taken an Uber. None of you have probably sent your Uber away because the car was the wrong brand."[343] Indeed, autonomous vehicles promise that attention to one's moto brand is less consequential than the passenger's increased ability to choose her diversion while being driven.[344]

Replacing the freedom to roam inside one's rolling property (the passion of the millennial's grandparents), the "surrendered" driver becomes part of the accessibility environment, where all motos larger than a Onewheel are available "on demand," without being operated by just one owner using a Corridor. Associated with this surrender, Americans will have to stop relying on successive self- and motor-propelled innovations replacing those they own (and trade in for another) every few months or years. They will allow others owning state-of-the-art machines to loan them a ride instead. If among the motor vehicle's attractions is its capacity to empower a driver and positively impact passenger socialization, abandoning ownership roles will be challenging. Vehicles are a key feature of modern

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[341] *See, e.g.*, Doug Carroll, *How a UA Engineer Gets Cars to Talk*, UA NEWS (Mar. 14, 2018), https://uanews.arizona.edu/story/how-ua-engineer-gets-cars-talk [https://perma.cc/78EX-9NKU] (split between the 'haves' who can afford autonomous vehicles and the 'have nots' who cannot might lead to the haves having access to dedicated road lanes, if not entire corridors, while the latter jostle for space on lanes dedicated to just them or have nots exclusion from access to entire road segments).

[342] *See* Angie Schmitt, *High Stakes for Cities as Feds Start Regulating Self-Driving Cars*, STREETSBLOG USA (Jan. 21, 2016), http://usa.streetsblog.org/2016/01/21/high-stakes-for-cities-as-feds-start-regulating-self-driving-cars/ [https://perma.cc/HRH6-R2RN]. With limited budgets, Generation Z and what comes after are not seduced by personal transportation in the period where it costs 17 percent of a household's budget. *See* Neil, *supra* note 15.

[343] Jacob Schlesinger, *Taxis. Hotels. What Industry is Next to Be Disrupted by the New Economy?*, WALL ST. J. (June 18, 2017), https://www.wsj.com/articles/taxis-hotels-what-industry-is-next-to-be-disrupted-by-the-new-economy-1497837840 [https://perma.cc/K7F7-2SX2].

[344] *See* Heinrichs, *supra* note 12, at 213. *See* Neil, *supra* note 15, explaining that consumers will choose from a large catalog of vehicles to be a passenger in. If that's correct, this will cause parking challenges that stackable fleet-based, Corridor-traversing vehicles would not confront. *See supra* notes 299–301 and accompanying text.

culture because of what they mean for those controlling their movements.[345] Ironically, the autocentric attitudes of planners requiring "parking minimum" zoning code requirements for commercial development cannot be stemmed altogether unless wide segments of the public surrender to an "on demand" car usage model.[346] There is evidence, on the other hand, that shared ownership of autonomous automobiles could replace multiple conventionally owned and operated vehicles, substantially decreasing the parking burden.[347]

The fourth surrender entails abandoning the belief that future CBDs at grade level will be readily traversable by motos at conventional "local street" speeds (say, twenty-five miles per hour).[348] CBDs need to be rebuilt as shared spaces with Corridors as their spines and, in the case of crossing in the perpendicular by less consequential Corridors, perhaps one or two CBD limbs. This means that drivers of single-occupant motos will not make the most rapid passage through its boundaries. In short, the single occupant in a passenger vehicle wanting to move through the Corridor will be highly restricted in diverting from her routes or increasing her moto's speed. There are a variety of means of accomplishing this. One is to cause that rider to travel underground beneath the Corridor's surface level, without emerging from below to resume traversing the Corridor (unless the rider returns via another mode of travel). A second requires that rider to reserve in advance the use of a traffic lane through the Corridor. A third is to devote a single lane of traffic, alternating in opposing directions, to move single-occupant, low-speed vehicles via conveyor belt or under their own, IoT-regulated power across the CBD.[349] In short, *Wind*

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[345] Tim Dant & Peter J. Martin, *By Car: Carrying Modern Society*, *in* ORDINARY CONSUMPTION 143, 149 (Jukka Gronow & Alan Warde eds., 2001), http://www.lancaster.ac.uk/people/dant/by%20car.pdf [https://perma.cc/5DCX-HFWU].

[346] *Cf.* Todd Litman, *Reduced and More Accurate Parking Requirements*, PLANETIZEN (Apr. 24, 2017), https://www.planetizen.com/node/92360/reduced-and-more-accurate-parking-requirements [https://perma.cc/XF84-242L] ("Planners must apply professional judgement when developing adjustment factors and parking management programs, . . ."). Planners are entrusted with maintaining urban traffic safety, impacted by parking shortages in high demand areas, necessitating acts to quell "conflicting traffic movements," slang for vehicle crashes with other vehicles and pedestrians in undersupply situations.

[347] *See* Daniel J. Fagnant & Kara M. Kockelman, *The Travel and Environmental Implications of Shared Autonomous Vehicles, Using Agent-Based Model Scenarios*, 40 TRANSP. RES. PT. C: EMERGING TECHNOLOGIES 1 (2014), http://www.caee.utexas.edu/prof/kockelman/public_html/TRB14SAVenergy_emissions.pdf [https://perma.cc/4B62-2QDG].

[348] For perspective, in 2018, average speed in midtown Manhattan of motorized vehicles was estimated to be approximately nine miles per hour, while in San Francisco and Philadelphia the average was ten miles per hour. *See* Berger, *supra* note 6.

[349] The concept is not fantasy. Zoox is developing autonomous electric vehicles that can

in the Willows[350] protagonist Mr. Toad–operators will yield the right of way to those using mass transportation, velos, and to pedestrians. The rate of this conversion to use of velos and pedestrian ways depends on how many interesting neighborhoods are created by planning and development activities intended to make non-car alternatives safe, reliable, and inviting.[351]

Autonomous vehicle operation will alter the land planning realm in substantial ways. Reaction to changes forthcoming depend upon whether one identifies as a Glaeserian[352] or a Kotkinite,[353] believing in densification or suburbanization. It appears both scholars may be prescient. Being able to engage in other activities inside an autonomous vehicle (such as performing one's job for workers with Bluetooth connectivity) may increase willingness of some households to transition from the most-intensely developed portions of a city into "bedroom communities," since land prices and rents there will remain less costly than inside the city's core.[354] More robust Corridor movement, coupled with densification and street activation, impacts more than accessibility. It entices those having eighteen to twenty-four hour social lifestyles, who prefer substantial variety in consumption opportunities in vibrant places, to seek mobile private-activity

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move without human guidance in both directions; it cruises into a location traveling one way and leaves in the opposite direction without turning around. *See* Ashlee Vance, *$800 Million Says a Self-Driving Car Looks Like This*, BLOOMBERG (July 17, 2018), https://www.bloomberg.com/news/features/2018-07-17/robot-taxi-startup-zoox-has-800-million-and-a-wild-pitch [https://perma.cc/ZD4R-DV62].

[350] *See generally* KENNETH GRAHAME, WIND IN THE WILLOWS (1908).

[351] *See* Hal Harvey, *Getting Around: How Urban Transportation And Planning Unlock The Future Of Accessibility*, FORBES (Apr. 5, 2017), https://www.forbes.com/sites/energyinnovation/2017/04/05/getting-around-how-urban-transportation-and-planning-unlock-the-future-of-accessibility/amp/ [https://perma.cc/9G5V-QVX8].

[352] *See generally* EDWARD GLAESER, TRIUMPH OF THE CITY 145, 176, 200–01, 204–05 (2011) (denouncing local conservationists for their devotion to "leafy suburbs" that are not environmentally sustainable and certain poorly reasoned public policies that feed sprawling suburban living, like federal highway programs, the mortgage tax deduction, and low gas prices). Oddly, Glaeser might note that reducing the subjective value of travel time savings for AV users could lead to substantial increases in suburban living appetite, leading to intensified suburbanization. *See* Fraedrich et al., *supra* note 75, at 3, 5–6.

[353] *See generally* JOEL KOTKIN, THE HUMAN CITY (2016) (condemning densification promoted by urbanists as bad for birth rates and thus population growth, and arguing that suburbs deserve new appreciation; arguing further expanding public transportation is bad policy because adults starting and raising families want to live in suburbs with yards and better schools). *But see* Michael Lewyn, *Does Suburbia Promote Fertility?*, PLANETIZEN (Nov. 7, 2016), https://www.planetizen.com/node/89558/does-suburbia-promote-fertility [https://perma.cc/54UG-EZ9V].

[354] *See* Heinrichs, *supra* note 12, at 213–14, 218, 223.

spaces like autonomously driven motos. Such motos will contribute to eliminating commuter-time calculations as a primary factor in urban planning strategies.

Heinrichs notes that predicting the speed and form of urban transport systems' integration of autonomous vehicles is guesswork while the chicken-and-egg dilemma abides. In other words, land use policy where transportation is concerned will seem "disoriented" until the landscape of autonomous vehicles' operation is well understood.[355] Planners ought to assume, however, that eventually built forms like garages, surface lots for car rentals and vehicle storage,[356] petroleum stations, and loading docks abutting Corridors will be repurposed to integrate denser development.[357] Timing of such redevelopment (and the possibility of a new paradigm of Corridor dependency upon new forms of transit), however, will hinge on the acceleration rate of planner and traveler embrace of accessibility and of those consumer "surrenders" identified in this part.

But surrenders cannot be demanded of consumers alone. *Communities* must sacrifice rigid adherence to outdated traffic control techniques, creatively adapting to increase personal movement infrastructure within Corridors, enabling accessibility for all. Agility must become a municipal and regional transportation planning mantra. A former director of New York City's Department of Transportation offered these observations about today's pervasive "scooter dilemma" with broader implications:

> The problem isn't the [vehicular] mode. The underlying problem is street management and the failure of imagination to update our streets. It's not that these riders are a bunch of outlaws. It's that the infrastructure hasn't kept up with the changes on the street, and the street is forcing people to wing it.[358]

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[355] *Id.* at 227.
[356] *See* Dewey, *supra* note 336.
[357] *See* SCHWARTZ & KELLY, *supra* note 6, at 209–10. Such adaptive reuse in denser areas already is the subject of conversation and experimentation among developers and architects. *See* Julia Cooke, *From parking garage to community space*, CURBED (Dec. 13, 2016), https://www.curbed.com/platform/amp/2016/12/13/13902916/parking-garage-reuse-sergio-lopez-pineiro [https://perma.cc/56W4-RWKF]; Alissa Walker, *Parking garages are getting a second life as places for people*, CURBED (Apr. 26, 2017), https://www.curbed.com/platform/amp/2017/4/26/15421594/parking-garages-driverless-cars-gensler [https://perma.cc/76JV-V4NX].
[358] *See* Grobart, *supra* note 277 (quoting Jenette Sadik-Khan, former city transportation commissioner).

One illustration of the community imagination required is to convert dangerous street four-way intersections to gentler-flowing roundabouts for the direction of two-wheeled traffic that cannot match four-wheeled vehicle acceleration rates.[359] But any solution that slows traffic down to the point that no alert person will be blindsided or move too fast to dodge collisions is a start, as is any approach separating pedestrians from those with greater momentum, including animating pedestrians above or below the street grade.

Infrastructure investments, well-conceived and designed, stand the test of millennia. When communities build accessibility-resonant mobility infrastructure, citizens will respond.[360] First, however, design and operational elements of future infrastructure programming must focus on directly supporting pedestrian and velo access instead of assisting motos operators in better controlling vehicles to augment safety.[361] Futurists in the land use realm will reflect this wisdom in planning.[362]

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[359] *See id.*

[360] Harvey, *supra* note 351.

[361] *Cf.* Kevin DeGood, *Understanding the Difference Between Safety and Access*, CTR. AM. PROG. (Dec. 6, 2018), https://www.americanprogress.org/issues/economy/reports/2018/12/06/461796/understanding-difference-safety-access/ [https://perma.cc/2GFH-EP3A].

[362] *See* Christopher Ingraham, *How 2,000-year-old roads predict modern-day prosperity*, WASH. POST (Aug. 7, 2018), https://www.washingtonpost.com/business/2018/08/06/how-year-old-roads-predict-modern-day-prosperity/?noredirect=on&utm_term=.a3334be84449 [https://perma.cc/7HU7-QWKS] (noting studies indicating that density of ancient Roman roads in specific places in Europe strongly correlate with present-day prosperity, suggesting that long-term infrastructure investments lead to prosperity where properly made).

LEXICON

Artificial Intelligence (AI): Machine-learning and its application. AI is technology that appears to emulate human performance typically by learning, coming to its own conclusions, appearing to understand complex content, engaging in natural dialogs with people, enhancing human cognitive performance (also known as cognitive computing), or replacing people altogether on occasion. See also the definition of AI at footnote 121 in the text.

Central Business District, or CBD: This term generally refers to highly congested traffic areas associated with the commercial center(s) of a municipality; and these areas typically are the most congested with the most frequent headways but suboptimal throughput. Consequently, these geographic enclaves are the focus of this Paper. Note that a single municipality may have multiple CBDs—counter-intuitive, given the use of the word "central." For instance, Phoenix, Arizona, and Houston, Texas, America's fourth and fifth largest cities, have multiple CBDs, admittedly not always equal in building densities or throughputs.

Corridors: The author's term of art describing a right of way in which motos and velos move essentially continuously along the pavement section and sometimes the abutting sidewalk(s)—and the spaces above and below the surface pavement section.

Headways: In public transit terms, the time elapsing between consecutive services. If you catch a bus that "comes every half hour," that service has a thirty minutes' headway. Headways is a word also used sometimes to indicate elapsed times between waves of vehicles traveling in a group. The headways concept is useful as accessibility guidelines for how frequently a public transport service arrives and, therefore, how long passengers must wait following the preceding service's departure.

Internet of Things: The network of physical objects containing embedded technology to communicate, sense, or interact with their internal states or with the external environment. These objects are embedded with electronics, software, sensors, actuators, and connectivity; together, these devices enable these objects to connect and exchange data amongst themselves. See also the text at footnotes 55 and 56.

Lane Group: A lane, or an adjacent set of lanes, that accommodates one or more traffic movements (such as right turn on red, a right turn controlled by a "yield" sign, or a permitted left turn) in a homogeneous manner at a traffic signal (stop light or sometimes a four-way stop sign).

Motorized vehicles, or "motos": Vehicles having motorized components, meaning a vehicle not animated by human pushing, pedaling, and so forth. Segways and hoverboards are moto types. Horses, mules, camels, ostriches, and other quadrupeds are neither motos nor velos; so they are not addressed in this Paper.

Platooning: When vehicles travel within a single wave, or headway, of local traffic. The assumption is that automated systems will enable "convoys" of controlled vehicles, travelling in a tight formation at a higher speed, than if these vehicles were humanly operated.

Saturation flow rate: This concept, expressed for a *lane group* (defined above) is the maximum number of vehicles from a lane group passing through the intersection during one hour of continuous "green light" conditions, under prevailing traffic and roadway conditions (such as dampness).

Throughput: The numbers of vehicles moved successfully from one place to another in a given time; otherwise, the average quantity of cargo and passengers passing a fixed point in a given time.

Velocipedes, or Velos: Human-animated, land-based vehicles having one or more wheels. The most common type of velocipede today is the bicycle, although this category of items includes the skateboard, nonmotorized scooters, recumbent-wheeled vehicles, and so on. The term first was used to describe a precursor of the first bicycles; here, one sat astride a wooden frame, propelled by pushing the feet against the ground (recall Fred Flintstone and Barney Rubble). In this Paper, it is coined to batch and distinguish all human-powered land vehicles from motos.