

Law, Engineering, and the American Right-of-Way

David Prytherch

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Imagining a More Just Street



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Preface

This book is a road map of sorts. It traces evolving ideas about a fundamental element in our everyday lives: the street. And it provides a guide to exploring the roadway, not merely as a route to other places, but as a place unto itself. As the city has a geography, so too does the public street.

Like many good journeys, this book is motivated by curiosity and questions. These are highly personal for me, but shared by many. The geographically minded can't help ask: Why do places look and function the way they do? The street is a social scientific question. Pedestrians and cyclists struggle to comprehend: What ought to be our fair share of the road? The street is a question of rights. As community leaders and planners—seeking efficiency, equity, and sustainability—we ask: What would make a better street? This is a question of fairness. The roadway is a central thread which literally and figuratively connects these critical inquiries.

But the street, and dominant thinking surrounding it, have not always been very welcoming places for such questions. When I first came to geography, transportation was almost exclusively the domain of quantitative modelers. And when I first became involved in planning, the street was the (mostly) uncontested space of cars and civil engineers. Two decades later, things are changing. Fortunately, the street is increasingly safe for more diverse forms of thought and mobility. I'm so happy now to be part of both.

There are few greater satisfactions than collaboratively engaging these conceptual and practical challenges. I am grateful to have explored these with diverse mentors, colleagues, and students in geography and planning. It has been an honor to share the street with fellow pedestrians and cyclists,

and advocate for our rightful place. There is hardly any greater honor than working with fellow citizens and community leaders, and making tangible progress one crosswalk or bike lane at a time. And, finally, I cannot overestimate my gratitude to Kathleen, Eleanor, and Vivian for cheering me on.

The everyday roadway is a mundane space, but the questions it begs are among the most important we face as individuals and society. This book is a modest yet integrated attempt to address them, helping diverse readers reimagine the American street in theory and practice. And I hope it serves as something of a handbook for not only questioning the assumptions and policies that produce everyday roadways, but also planning better alternatives for the future. It's time for us to rethink and remake the street.

Oxford, OH

David Prytherch

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CHAPTER 1

Introduction

Streets and their sidewalks, the main public places of the city, are its most vital organs. Think of a city and what comes to mind? Its streets.

— Jane Jacobs in The Death and Life of Great American Cities (1961, p. 29, with permission of Penguin Random House)

Public space must be understood as a gauge of the regimes of justice extant at any particular moment. ... Utopia is impossible, but the ongoing struggle toward it is not.

— Don Mitchell in The Right to the City (2003, p. 235, reprinted with permission of the Guilford Press)

RETHINKING THE STREET

Streets have a profound yet often underestimated role in shaping the urban experience. They are the conduit and stage for the choreography of everyday life, often conducted at high speeds and with life-or-death consequences. Public rights-of-way comprise a surprisingly large proportion of our cities. We travel them as thoroughfares and experience them as public spaces. Streets connect people and places, they divide.

Despite their significance to the social life of the city, however, we often see streets as infrastructure and entrust their design to engineers. We experience interaction with others as "traffic," internalizing and taking for granted the rule systems that mediate that interaction, at least until an accident or police enforcement. And we take this social order—its efficiencies, inequalities, and indeed bodily risks—as routine. The roadway is at

once banal and technocratically complex, making it hard to study and even harder to change.

We are, however, fortunate to live in a moment when urbanists and scholars are confronting and rethinking the street. After a century in which roadways were the little disputed academic domain of motorists, planners and advocates for alternative transportation (and school children, the aged, and disabled) are openly challenging the automobile-centric biases of roadway engineering, arguing for "Complete Streets" designed for users of all modes, ages, and abilities. Simultaneously, the long hegemony of traffic engineers and regional scientists is challenged by the so-called "New Mobilities" scholarship in the social sciences and humanities, which offers a critical perspective on the spatiality and politics of transport, helping interpret streets not merely as spaces of flow but also of politics and rights and ethics. Never in recent memory have so many sought to reimagine the roadway's social relationships and design, or suggested so much potential to transform how we imagine and experience them.

But any attempt to reimagine the street raises basic questions, practically relevant as they are complex. How exactly are streets designed and regulated, and how do these shape social and spatial relations among the mobile? What does it mean to have a "right" to the street? And what would a more equitable and just street look like, in theory and practice? Amidst vibrant scholarly debates about the "politics of mobility" (Cresswell 2010), we must better understand how struggles over roadway spaces—aptly called "street fights" by scholars and planners alike (Henderson 2013; Sadik-Khan and Solomonow 2016)—help give the street its shape, and define mobility rights and justice. And while mobilities scholarship is thankfully unbound from traditionally technocratic or positivist approaches to transportation, it cannot escape their enduring policy relevance. Any rethinking of the street, and rights and justice among the mobile, in *theory* must remain firmly grounded in the details of engineering and law in practice. Such engagement is critical for both social scientists interested in the street's "power geometries" (Massey 1993) and those planners and activists who seek to change them. The burgeoning Complete Streets movement, for example, presents a unique opportunity to better define the possibilities—and limits (Zavestosky and Agyeman 2014)—of multimodal design for promoting greater justice, on and beyond the roadway. But the relevance and outcome of such policy debates are inextricable from the legal and design "rules of the road" that so powerfully structure the geography of streets.

This book therefore seeks to elaborate a theory of mobility politics, rights, and justice on the public street, grounded in the powerful but understudied frameworks of traffic law and engineering. Amidst widening debates about ethical dimensions of transport, social scientists and planners alike may benefit from a clearer articulation of what we mean by mobility rights and justice, grounded in a more detailed understanding of those legal and engineering systems that structure the social life and spatiality of streets. And as planners and activists question the auto-centric biases of urban and transport policy in the US, there is a need for both a framework to understand mobility justice and a facility with the technical expertise that might produce different, and perhaps more just, outcomes. This book therefore attempts to pair the conceptual power of critical mobilities scholarship with the problem-solving potential of planning and design.

This book stands not alone but on the shoulders of an impressive host of others. Most broadly it joins vibrant and growing conceptual debates among scholars in the social sciences and humanities on the socio-spatial politics of mobility (Urry 2007; Canzler et al. 2008; Cresswell and Merriman 2011; Cidell and Prytherch 2015, among too many others to name). Among these a number of scholars have focused on important questions of mobility rights, ethics, and morals (Bullard and Johnson 1997; Bergmann and Sager 2012; Blomley 2011). At the same time, empirically rich accounts reveal the intense intermodal politics of the city street, both past (Norton 2008) and present (Furness 2010; Henderson 2013). And planners offer policy solutions to transform auto-centric roadways into Complete Streets (McCann 2013).

I seek to connect and extend such diverse writings on mobility politics and rights first by articulating a workable theory of mobility justice on the roadway. While many writings on the politics of mobility highlight struggles for the right to the city and its streets, defining mobility justice—and a socially just street—presents a conceptual challenge demanding closer attention. Planning for alternative modes and complete streets likewise can be informed by a framework for interpreting mobility as explicit questions of rights and justice. Mobility theory and policy alike might benefit from more careful articulation of what exactly it means to speak of mobility rights and justice on the public street, and how these fit within broader debates about the "right to the city" (Lefebvre 1996; Purcell 2002; Mitchell 2003; Attoh 2011) and social justice (Delaney 2016).

At the same time, I argue that any reimagining of a more just American street requires knowledge of those legal and engineering processes necessary for operationalizing it. Here, insights from planning and design offer much to social scientists. Scholarly debates in transport and mobility, whether the positivist models of regional science or abstractions of critical social theory, must be grounded in the engineering and regulatory mechanisms that give actual street spaces material and social shape. Any person critical of typical streets and social relations upon them, whether scholar or practicing planner, would do well to become versant in the laws that define street spaces and who has the right to be mobile (and who must yield), as well as the design practices that materialize these relationships in asphalt, concrete, and roadway markings. Knowledge of traffic codes and engineering manuals is a powerful tool for identifying impediments and opportunities for progressive change, and strategies for actualizing a more just street. At the same time, it helps manage expectations for what we can reasonably hope to change through established arenas for activism and policy. This book shares the critical commitment to confront wider social injustice on and beyond "incomplete streets" (Zavestosky and Agyeman 2014), but with the planner's strategic and pragmatic emphasis on the incremental art of the possible.

As scholars and planners rethink the nature of mobility and the street, I suggest we might best understand what Jason Henderson calls "street fights" as struggles for street *rights* and street *justice*, articulated socially and spatially through the principles and practices of traffic regulation and roadway design. This project starts with conceptualizing more clearly what rights and justice mean to the mobile upon the public street. And it assumes the "right to the city" (Mitchell 2003) and social justice are in significant measure defined by the street and its complex socio-spatial relations, and the regimes of justice or injustice legislated and designed into them.

THE ROUTE AHEAD

The book is designed to unfold sequentially in three parts.

After this introduction, Part I considers what exactly is "A Right to a More Just Street." Chap. 2, "Rethinking the Street as Space of Mobility, Rights, and (In)Justice," draws from wide-ranging debates on the politics of mobility—in transport geography and mobilities studies—to approach the street not merely as infrastructure for movement but also as social space. Linking innovative writings on mobility to those on politics and representation in public space, I interpret everyday circulation on the public street through an explicit rights frame to argue that the "right to the street" is simultaneously about physical movement, safety, and accessibility.

And while the task of delineating rights claims to the city and its streets remains critical, perhaps the greater challenge is defining what we mean by a more "just street." This requires situating emerging writings on mobility justice within a broader literature on social justice generally in political philosophy, critical geography, environmental justice, and disability studies, and the law. We must not only connect mobility justice to social justice more broadly, but also define the possibilities and limits of more just or complete streets vis-à-vis the eternal and boundless struggle against social inequality (Zavestosky and Agyeman 2014). This chapter therefore offers an encompassing—yet necessarily bounded—concept of mobility rights and justice on the everyday street.

Part II of the book explores the traffic law and design systems that have traditionally—at least for the last century—shaped the use and design of American streets. Because the social order of the street is codified by law, Chap. 3, "Legal Geographies of the American 'Right-of-Way,'" explores the legislative frameworks that create and define streets, and how particular assumptions about mobility give shape to streets and ongoing struggles over them. I trace changing legal and design assumptions about what roadways are for and whom they should serve, set in context of the historical evolution of the American street as a physical and legal space for cars (Norton 2008). I provide a critical review of the national *Uniform Vehicle* Code (UVC), which defines the nature and purpose of the public roadway as a legal *space* of mobility known as the public right-of-way (or "ROW"), who constitute legitimate "users," and how the ROW should be allocated for particular modes of travel. Analyzing model codes and example state statutes in relation to mobility justice reveals how such laws codify the asymmetrical and unjust power geometries of automobility. Mobility injustice on the American roadway is, it turns out, built upon a very firm statutory foundation.

In Chap. 4, "The Contested Right to the Right-of-Way," I ask: What exactly does it mean to have a legal right to the ROW? This chapter begins by examining the critical role statutes play in regulating everyday mobility on the road as "traffic," and how legislative assumptions and language mediate social relations among users. I return to UVC and state statutes modeled upon it to explore how laws construct mobility as a legal right to the ROW known as the right-of-way or "right to proceed" in preference to others, anticipating and seeking to mediate conflict between intersecting (and potentially colliding) bodies. Because the term right-of-way confusingly refers to both a legal space and the legal right to it, I will

distinguish between the ROW (the roadway) and right-of-way (the right to proceed upon it). Legal analysis shows how such statutes construct the power geometries of the street around the preferential right of the car, though pedestrians and bikes have right-of-way to other spaces such as the sidewalk. I then look beyond the abstract framework set by statutes to how conflicts and so-called accidents on the roadway are adjudicated through the common law of torts, when judges must establish who has the right and responsibility (defined as "duty of care") and liability in case of accidents. The chapter highlights the ways statutory assumptions and biases are extended and elaborated by case law to socially construct—and unevenly allocate—mobility as a right and responsibility.

Traffic statutes may provide the legal foundations for the street, but engineering standards give it material shape via asphalt and concrete. Chapter 5, "Engineering the Roadway as Space of Flow," explores the principles and practices guiding roadway planning, construction, and maintenance. I trace the role of the American Association of State Highway and Transportation Officials (AASHTO) and other national organizations like the Transportation Research Board (TRB) in setting the design standards used by federal, state, and local engineers, in both departments of transportation and the private sector. I review for non-engineers the basics of "geometric design," and how social and legal assumptions about proper users—so-called design vehicles—are manifested and reinforced in guidance for the three-dimensional design of streets. And I explore the manner by which the science of traffic engineering today defines the quality of roadways as "capacity," formalized in standards such as Level of Service (or LOS) that grade streets and intersections in terms of uninterrupted flow. I uncover the central role of such design practices in literally constructing everyday roadways as spaces of vehicular speed and throughput, often to the detriment of wider place functions and livability. Facility with engineering standards reveals how deeply automobility is woven into design concepts like street network hierarchy and design control, and materialized in the literal geometry of roadways. A critical approach to the pretense of value neutrality in such engineering discourses and practices, particularly in relation to intermodal equity and social justice, highlights the importance of imagining and designing for different social relations on the street.

The social complexities of the street are further exemplified in Chap. 6, "Controlling the Roadway: Signs, Markings, and Signals," which examines how the foundational *Manual of Uniform Traffic Control Devices* (MUTCD) employs symbolic communication and physical engineering to

shape the social space of the street. These federally enforced standards for uniform traffic control translate societal assumptions and legal principles into signage, retroreflective paint, and traffic signals, which in turn choreograph the way people move and interact on the street. Like the geometric design and quality of service measures examined in Chap. 5, the details of the MUTCD reveal both the complex mobility politics underlying traffic control and how knowledge of these technical standards can provide a tool for reimagining the American street.

In contrast to traditional traffic regulation and roadway design, Part III of this book focuses on emerging efforts to reimagine and redesign the American street. Chapter 7, "Streets for Everyone': Intermodal Equity and Complete Streets," highlights the growing social movement to challenge automobile-centric roadway design and reclaim the public street for all users. After a century in which laws and design helped define "the automobile age" (Norton 2008), advocates of so-called complete streets have begun to argue for planning and design that can "fundamentally transform the look, feel and function of the roads and streets in our community" (National Complete Streets Coalition 2015). I show how the policy discourses of the Complete Streets Network and its complete streets policies not only exemplify conceptual principles of multimodal accessibility and street justice, but also apply these to multimodal and accessible design processes.

If the complete streets movement offers a vision of more intermodal and equitable streets, this cannot be realized without reimagining the design standards that actually produce physical streets. Thus in Chap. 8, "'Creating Real Spaces for People': Emerging Standards for Intermodal Design," I introduce alternatives to traditional engineering manuals that translate principles of intermodalism into practice. This begins with bicycle and pedestrian guidance by AASHTO (developed to complement its Policy on Geometric Design) as well as new bicycle-specific signage, markings, and signals in the MUTCD. But the most profound reimagining of the street can be found in the emergence of the National Association of City Transportation Officials (NACTO), which has developed its own bicycle and Urban Street Design Guide as an alternative to "highway engineering" that is both more intermodal and sensitive to urban, community context. Amidst divergent critiques—by traditional engineers that complete streets go too far in reallocating streets, or by critical scholars that they do not go far enough to addressing social justice more broadly (Zavestosky and Agyeman 2014)—I argue for consideration of intermodal

and context-specific design, grounded in the legal and engineering standards most relevant to produce actual streets that may be more (if not perfectly) just.

The struggle for rights and justice on the street is perhaps best understood through "The (Block-by-Block) Fight for a More Just American Street" featured in Chap. 9. Here I recount select battles for equitable and inclusive streets fought in arenas including policy, infrastructure engineering, and onthe-ground protest. I begin with broad national movements to promote complete streets policies and transform how streets are planned and engineered, as well as innovative efforts to remake streets safer through vision zero planning. I then focus on efforts to physically transform street spaces, including freeway removal, retrofitting of vehicular corridors for Bus Rapid Transit, creative placemaking, and green alleys. I conclude with more ephemeral but symbolically powerful efforts to take over streets through critical mass rides, "ghost-bike" memorials, and the transformation of parking spots into pop-up parks. Such case studies highlight the pursuit of mobility justice and complete streets through both broad policy reform and intensely local street fights, taking place in cities across the US.

The book concludes with Chap. 10, "Toward Equitable and Livable Streets." Calling for still greater engagement of critical mobilities theory with everyday practices of law, planning, and design, I argue for deeper understanding of both social justice principles and the tools required for manifesting them in space. This begins with rethinking the legal and design geographies of the public street for a more just and sustainable city. And looking beyond the contemporary street fights, I speculate on the next steps in the struggle to redefine the American street of the future.

RESTRUCTURING THE STREET

The project of rethinking streets is not a question of theory or practice alone, but requires linking innovative concepts with effective policies. The street is an important object of study and debate, central to emerging theories of mobility rights and justice. But it is, more importantly, a central element in the social life of the city where our social interactions are structured by the material and symbolic power of asphalt and steel and policing. Enter the roadway and you join a maelstrom of bodies and vehicles in motion and rest, whose interactions are conditioned by differences in speed and mass, and have life-or-death consequences. Any pedestrian who has dashed across a busy street, or cyclist who has ridden among speeding

cars and trucks, knows these power asymmetries firsthand. Any who has traversed the same roadway by car and alternative modes knows how different the experience can be, and the power of roadway design to make the same space relatively safe or dangerous, efficient or frustrating, pleasant or terrifying. If we've experienced rage at others on the street, or at the design of the street itself, we know implicitly that mobility is indeed political, with winners and losers. And, finally, those who have worked to change streets, and engaged in "street fights" with engineers or other roadway user groups, will attest to the complexity and often intractability of roadway design, maintenance, and control. In sum, most of us have long known—at least implicitly—that mobility and the street are political. Those who don't drive know this perhaps better than anyone else.

This book therefore confronts questions that are critical to mobilities scholarship and transportation planning alike. How exactly does the public space of the streets come to take the shape it does? In what sense is mobility a right? And what would make streets more just? And moving beyond critique, it seeks to answer these questions through highlighting the policy tools and design techniques that can produce more just streets in practice. Most non-engineers will never read AASHTO standards, but they are written in English. And while such standards are described as "geometric design," key questions—like how to allocate roadway space among modes—are actually simple questions of arithmetic. By reviewing and summarizing in some detail the most prominent standards of traffic law and roadway design, I hope readers may develop a facility with these standards that allows them to better advocate for their right to a more just and humane street. Reimagining the street requires at once a critical stance on inequities and a positive vision of a more efficient, equitable, and environmentally sustainable city. This book, I hope, helps us comprehensively rethink the policy discourses and practices that actually produce the American street, as they are and as we might wish them to be.

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A Right to a More Just Street?



CHAPTER 2

Rethinking the Street as Space of Mobility, Rights, and (In)Justice

The public street, like the urban landscape, is a material space and social construct. Streets are transport spaces and urban places, comprised not merely of asphalt and vehicles, concrete and pedestrians, but also social interaction and meaning. Comprehending their complex human geography requires careful attention to questions as profound as they are "pedestrian." How do social relations among the mobile shape the public spaces of the street and vice versa? In what sense exactly is mobility on the street about more than just physical movement but also contested politics and rights? And what might constitute a more equitable and just street? The challenge of rethinking the street and imagining alternatives is thus inescapably conceptual and practical, providing a rich subject for social theorists and practitioners alike.

Fortunately, vibrant scholarship increasingly looks beyond mobility-asmovement and streets-as-infrastructure. Critical scholars in "New Mobilities" and transport geography argue for greater attention to the "politics of mobility" (Cresswell 2010; Hannam, Sheller, and Urry 2006; Urry and Sheller 2006). Urban geographers and others highlight the critical role of public space in defining the "right to the city" (Mitchell 2003), prompting questions about mobility as right (Blomley 1994). And given the critical role of transportation in society, scholars increasingly emphasize access and mobility as questions of ethics (Bergmann and Sager 2008), equity (Lucas 2011; Manaugh et al. 2015), and justice (Martens et al. 2012; Sheller 2012). These academic debates parallel planners' critiques of "incomplete"

streets and arguments for complete streets "for everyone," designed for users of all ages and abilities (McCann 2013). Such distinct yet overlapping movements together challenge—implicitly or explicitly—the hegemony of technocratic approaches to transportation, whether based in regional science or engineering, whose positivism can mask powerful ideologies and biases toward particular forms of mobility. And they raise important questions about social outcomes of traditional roadway design and traffic regulation, and whether these are efficient, fair, or environmentally sustainable.

To develop a more robust theory of urban mobility, however, requires integrating debates that span disciplines and bringing them down to the level of the everyday street. In this chapter I review critical perspectives in new mobilities and transport geography for emerging insights into the spatial politics—and what Doreen Massey (1993) might call "power geometries"—of urban mobility. Linking these to diverse writings in critical human geography can help us see streets not merely as infrastructure but as public places, where spatiality and politics of mobility are questions of citizenship and rights to the city. I draw especially from political, cultural, and legal geographies to answer the question: What does it mean exactly to have a right to the street?

And if we conceive of mobility as both a social good and right, it quickly becomes clear how uneven and inequitably distributed these are. But identifying inequities in access and rights claims is only part of the challenge, and the easier part. The more difficult task is to develop a satisfying and workable theory of what we mean by mobility justice, in relation to both the specifics of the street and wider social justice issues that transcend them. I therefore draw from prominent theories of social justice—distributive and political-economic—as well as emerging writings on transport equity and mobility justice to define a more just street.

As scholars and planners try to define the role of urban mobility and street design within a broader social justice project (Zavestoski and Agyeman 2014), I argue for a theory of mobility rights and just streets at once conceptually encompassing and delimited, grounded equally in broad theories of justice and practices of traffic control and road design. This chapter begins that task by reframing urban mobility as political, exploring what it means to have a right to the street, and defining a positive vision of what a more just street ought to entail. For though we gain much conceptual insight from new social theories of mobility, ultimately addressing the practical challenges of mobility injustice will require moving beyond critique of traffic laws and roadway design to changing their

orientation for the better. We therefore need a framework for approaching urban circulation, mobility rights, and the just street that is both conceptually satisfying and policy-relevant.

Transportation and the Politics of Mobility

Looking Beyond Movement as Transport

Mobility and the street have long been understood to be central functions in the city, yet have remained largely the domain of engineers and transportation planners, who approach movement primarily through quantitative models of regional science or the geometry of roadway design. This is not surprising given the practical challenges of systematically analyzing and planning urban circulation, whose complex flows connect people and places across scales from the local to global. Designing safe and functional roadways in an age of rapid, high-volume vehicular traffic requires a specialized science like professional engineering, as well as elaborate legal systems or regulation and enforcement to maintain public order. Thus transportation geography evolved in tandem with civil engineering and economics to develop quantitative and model-based perspectives on intraand interurban transportation, as well as interactions between transport systems and places in terms of spatial separation, networks, spatial interaction, friction of distance, and "the relationship between spatial interaction and place" (Hanson and Kwan 2008, pp. xii-xiii). Such approaches, essential to systematic analysis and design of transportation systems, have enabled transport geographers to play an important role in policy and investment decisions. But quantitative and model-based perspectives abstract (by design) the social complexity of mobility as lived experience, prompting increasing challenges to technocentric transport research and policymaking (Miciukiewicz and Vigar 2012).

A variety of alternative approaches to transport exists in the social sciences. Geographers have long emphasized the importance of movement in shaping urban space and experience, whether in Hartshorne's (1939) descriptions of the Earth's regions as connected through constantly moving objects, Hägerstrand's (1982) time-space geographies of movement as paths or "continuity in the succession of situations" (p. 323), or cultural landscape studies of the street as dynamic ensemble (Meinig 1979, p. 6). Within positivist transport geography, some have advocated the progressive potential of the subdiscipline to address social differences like gender,

ethnicity, class, and life course (Monk 2010; Monk and Hanson 1982). And planners and designers have especially emphasized the qualitative experience of street life. Kevin Lynch's The Image of the City (1960) argued for looking beyond the city's stationary parts to understand the moving "spectacle" of people and activities in which we are not simply observers but "ourselves part of it, on the stage with other participants" (p. 2). Indeed, urbanist Jane Jacobs's (1961) first chapter in the Death and Life of Great American Cities focused on sidewalks and safety, interpreting the street's social order as "composed of movement and change" (p. 50). Critiquing technocratic planning through rich anecdotal observation of "the daily ballet" of her own Hudson Street (p. 54), Jacobs said of the street's mobility and order "although it is life, not art, we may fancifully call it the art form of the city" (p. 50).

Nonetheless, the mutually reinforcing relationship between regional science and engineering perspectives—gravity models and geometric design continues to dominate understanding of transport and the roadway. Grasping the full relevance of transport to urban life, and what better alternatives would look like, requires what Susan Hanson calls a greater ability to "imagine questions, methodologies, and epistemologies beyond those bequeathed ... by economists and civil engineers" (Hanson 2006, p. 232).

"New Mobilities" and the Politics of Movement

In contrast to technocratic approaches to transportation, recently "new mobilities" scholarship in critical social sciences and humanities has explored how "movement takes place in socially organized space" (Freund and Martin 2007, p. 37). Focusing less on the abstract spatiality of movement or the functionality of transport systems, sociologists like John Urry and Mimi Sheller have joined geographer Tim Cresswell in calling for critical approaches to mobility as simultaneously material, discursive, and meaningful (Cresswell 2006a, b). Instead of positivist approaches to transport as material process and infrastructure, mobilities scholars highlight the different subject positions of the mobile, prompting vibrant debates about what Cresswell and Merriman (2011, p. 110) call the "political, cultural and aesthetic implications and resonances of movements," how mobility is simultaneously produced by and productive of social relations (Shaw and Hesse 2010).

These writings emphasize a fundamental point: transportation is thoroughly and inescapably political (Cresswell 2010). The "politics of mobility" arise from "unequal power relations which unevenly distribute motility, the potential for mobility" (Hannam et al. 2006, p. 15). Such politics are not merely representational, but have very solid "infrastructural moorings" (ibid.) which shape the spatiality and social relations of mobility, a "material infrastructure of mobility opportunities" that serves some more than others (Cresswell 2006a, p. 265). Automobility, for example, is an emblematic example of uneven politics and practices of mobility fostering a "distinct way of dwelling, travelling and socializing in, and through, an automobilized time-space" and producing "awesome consequences" (Sheller and Urry 2000, pp. 737–738). Where street design emphasizes particular modes of travel, public space is essentially restructured with negative impacts on others (Freund and Martin 2007, p. 40), "severances" fostering social exclusion (p. 42).

The new mobilities perspective illuminates how politics frame every aspect of transportation: from the ideological biases that underpin seemingly "technical" fields like transportation planning and infrastructure design, to the uneven ways public resources and legal enforcement are distributed across urban space and modes, to the everyday—yet life and death—contests over street spaces. For if transportation engineers understand and design roadways for efficient traffic flow, a pedestrian advocate might interpret streets as "'place' ... the intimate context of urban life" (Patton 2007, p. 928). Critical analysis of contested social relations, discourses, and power dynamics is therefore essential for understanding how urban social relations and street spaces are co-constituted in ways that are geographically specific and often quite uneven. In short, we need to critically interpret streets for what they are: spaces of mobility politics.

A RIGHT TO THE PUBLIC STREET

Public Space and the Right to the City

Not only is mobility political, but public transport infrastructures like streets are by definition public spaces. Streets may be distinct from other places we more typically think to be public, like plazas and parks and governmental buildings, but from their centerline to edge public streets are owned, maintained, and controlled for public use. The design, control, and use of streets thus reflect and reinforce social relations, and provide an arena for struggles to use and traverse urban spaces. The allocation of public transport investments, and of access to them, are

questions of public use. Streets are public spheres, both "mediums of citizenship" and "theaters of social life" where difference is both displayed and encountered (D'Arcus 2006, p. 20). And in the same way mobility is both physical movement and a form of politics, the public street is "material space and representational forum" through which boundaries of citizenship are drawn and redrawn (ibid.).

Interpreting the street as public realm, we inevitably arrive at the question of rights. In what sense is mobility a right, and what would it mean to have a right to the street? One way to approach these questions is through wider conversations about the "right to the city." Many who are concerned with the spatial dimensions of urban life and politics find inspiration in the French philosopher Henri Lefebvre's arguments for an encompassing right to the city as "right to urban life, to renewed centrality, to places of encounter and exchange, to life rhythms and time uses, enabling the fully and complete usage of ... moments and places" (Lefebvre 1996[1968], p. 179). For Lefebvre the right to the city is a broad claim a "cry and a demand"—not only to access public space, but also to have a meaningful role in shaping it through everyday life as oeuvre and participation in decision-making. Viewing urban space not as stage for urban life, but as co-constituted with it, he famously called attention to what he called the production of space. And, against the atomization and alienation of contemporary urban life, Lefebvre argued forcefully for a right to the city premised on the project of "gathering together instead of a fragmentation," a utopian goal which might nonetheless shape the imperatives of planning (ibid.). In sum, Lefebvre's vision of la droit à la ville is at once about the right to difference and a right to participate openly and fairly in the processes that produce urban space to take full advantage of urban life (Soja 2010).

Lefebvre's articulation of the right to the city has inspired generations of geographers and other urban scholars, but many have asked, what *kind* of right exactly? Attoh (2011) commends the radical openness of such critical and philosophical approaches, but cautions the right to the city is not a singular right, and notes that competing rights claims makes distinct ways of defining rights "differences that matter" (674) for those who "wish to take the right to the city seriously" (p. 679). Purcell (2002) concurs this "promise" of the right to the city must be tempered by important questions about what social and spatial outcomes the right to the city would have (p. 106), but emphasizes a central *right to space*, to inhabit space (Purcell 2014). The right to access is for Mitchell (2003) a necessary

but not sufficient precondition for the right to the city, but is "always a negotiation" (p. 190). How such claims are articulated and contested will ultimately "give form to social justice (or its absence) in the city" (ibid.).

Rights, the Law, and Urban Space

In contested urban spaces like the street, defining and balancing rights claims among diverse people and interests is no mean challenge. There is a variety of frameworks for thinking about such politics and operationalizing rights, but some are more powerful than others. Importantly, social action is structured through law (Mitchell 2003). While some critical scholars may share skepticism of power structures that potentially contribute to injustice and sympathies for dismantling systemic "givens," Delaney (2016) reminds us "the rights that matter are the rights that matter—substantive enforceable claims" (p. 270). The politics of mobility and the right to the street are therefore questions of legal geography, how "law configures social space in ways that have consequences" (Delaney 2016, p. 268). Understanding rights to and justice upon the street must therefore acknowledge the powerful opportunities and constraints posed by the law (p. 269).

The street is quite literally a legal space (Blomley 2011, p. 38) governed by laws that closely regulate use, flow, and blockage; administrative and engineering discourses and practices; and judicial interpretations of competing claims. This "complex array of codes and specifications, operative at multiple spatial scales" provides "the essential ordering mechanism to ensure structured flow" (Blomley 2011, p. 4). Though such policies may make movement seem "decoupled from ideology" (Henderson 2013, p. 17), coded discourses and practices like the law are woven of particular "assumptions that lead to a particular ideology of mobility" (p. 18) and shape contests over the right to the city "in proportion to the power possessed in each side" (Mitchell 2003, p. 29).

What does it mean to have a legal right to the street? As any other right, it would signify a "power or privilege to which one is justly entitled" (Blomley 2009a). By the same token, civil rights are "entitlements of personal liberty given to all citizens" (Blomley 2009b), legitimated and "accorded special protection by law" (Coleman and Kraus 1986, p. 1342). Laws define rights by generating specific legitimate claims (p. 1343). Thus the right to mobility or the city implies a legitimate and enforceable claim to circulate through space (Cresswell 2006b). And while broad claims can

be made for access and representation on the street, to be legally actionable these must be grounded in relevant constitutional, statutory, or case law. Furthermore, defining rights necessitates analysis both of laws themselves and the spaces in which such legal rights are enacted. For rights to be effective rather than empty, people must be afforded practical opportunities to exercise them. Analyzing and effectuating a "right to the street" requires defining the nature and boundaries of competing rights claims, but also producing spaces for them through the design, control, and use of the roadway itself.

Defining a Right to the Public Street

The right to the street is therefore symbolic and material, abstract and particular. In defining a right to the street we must remember roadways are not mere infrastructure but public spaces defined and built around the law, which provides the basis for physical access and circulation and sorting out competing claims to the street's finite spaces. The right to the street—as a dimension of the right to the city—is about the opportunity to share and participate in a public sphere central to the urban landscape and experience. In a radically open sense, a right to the city would mean access to the street as public space that brings together rather than fragments, which empowers rather than disables. And it would mean the opportunity for everyone to play a meaningful role in the production of street spaces, whether through representation in the formal decision-making that literally constructs the street, or in the more quotidian (and Lefebvrian) sense of having a role in the choreography of street life.

But such abstract rights are premised upon access and ability to move freely, which in turn are grounded and defined by the law. The ability to enter upon the public "right-of-way," for circulation (if not also occupation and/or political expression), is constrained by material and legal geographies. While we may sympathize with the broad demand for a right to the city and street, we must recognize that diverse people have distinct and often competing demands. We might therefore pay particular attention to cognizable claims that are articulated in and enforced through institutional structures like the law. Such structures can be technical, but to the degree they are practically effective in producing the space of the street, and shaping our right to it, their ideological underpinnings become only more important to understand. Difference in how the law and design frame the right to the street are, in short, differences that matter.

FROM RIGHTS TO JUSTICE

Social Justice and Urban Space

Seeing streets as spaces of diverse and competing claims for access and the "right of way," we immediately confront questions of fairness, equity, and thus justice. Like the city itself, the street is inevitably subject to what Edward Soja calls "uneven geographical effects of every individual action and all social processes" (2010, p. 71). Geographical unevenness may be ubiquitous and inevitable, but oppressively and exploitatively "uneven geographies of power and privilege" need not be (ibid.). The production of unevenness and inequity is a key analytical challenge for urban scholarship. Defining rights and their inequitable geographies is only part of the task, however. A problem-solving approach to the street, which links urban theory to planning and other practice, demands a positive theory of justice to sort competing rights claims and produce more fair and democratic street spaces. In sum, we must define both the right to the street and what a more just street might look like.

Scholars have approached social justice in distinct yet overlapping ways. For many, social justice is primarily a question of distributional equity, famously articulated by philosopher John Rawls (1971) as "justice is fairness." Rawls looks beyond the courts to see justice in the basic structure of society itself, how major social institutions distribute fundamental rights and duties and determine "the division of advantages from social cooperation" (Rawls 1971, p. 7). Although Rawls acknowledges geographical unevenness, his conception of justice assumes an "initial position of equality" (p. 11) in which rational and self-interested persons would, at least in theory, "consent as equals when none are known to be advantaged or disadvantaged by social and natural contingencies" (p. 19). Core to this conception of justice is equality in how social goods/bads are assigned to members of society, and that any social and economic inequalities result in compensating benefits for everyone, especially the least advantaged. Treating human beings equally according to such principles would further entail the impartial administration of institutions as public systems of rules ("justice as regularity"), the assignment of equal basic rights to all persons, and finally an assumption that those who are owed justice must be themselves capable of giving it (pp. 504-505). On these premises, Rawls emphasizes not only the efficient and equitable distribution of goods but also the broader "principle of fair opportunity" (p. 511). Such theories have been extended by others like Martha Nussbaum (1999), who argues distributive justice should include capabilities essential for a good human life, including a life of normal duration, bodily health, and integrity; and freedoms of movement, expression; emotional attachment and association; affiliation on nondiscriminatory terms; and concern for nonhumans.

Distributive justice of course has spatial dimensions, prompting David Harvey in his landmark Social Justice and the City (1973) to argue for normative thinking in geographic analysis of urban process. He defined social justice broadly as a set of principles for resolving competing claims among self-interested individuals toward social cooperation, interpreted in relation to uneven distribution of resources across space. "Territorial distributive justice" would mean the adjudication of competing claims according to need, contribution to the common good, and merit. But he also argued for fairness in the rules that govern social interaction and institutional mechanisms that ensure "the prospects of the least advantaged" (p. 117). In sum, Harvey extended Rawls to define social justice as "just distribution, justly arrived at" (p. 98). Although Harvey's Marxian turn ultimately prioritized critique of the "geographical patterning of social injustice" over distributional questions (Soja 2010, p. 82), his work combines a distributive justice focus on how public institutions allocate rights/ responsibilities (à la Rawls) with political-economic understanding of urban process under capitalism (à la Marx). And taken together with Lefebvre, Harvey (1973) shows how organization of space reflects and affects social relationships, guided by the "prevailing ideology" of ruling groups and institutions, and interpreted by urban dwellers via "intricate sign-process that gives direction and meaning to daily life" (p. 310). Social justice in the city is thus about structures that engender equity in distribution of resources, rights, responsibilities, participation, and meaning.

Critical theories of uneven development in the wake of Harvey came to neglect distributive questions for critique of unjust structures of capitalist urbanization. Mitchell (2003) called theories of distributive justice inadequate to the task of "rectifying real, socially situated injustice" (p. 31). But there has been enduring critical interest in connecting the right to the city to broader questions of justice "foregrounding space as an interpretive perspective" (Soja 2010, p. 105). In Seeking Spatial Justice Edward Soja (2010) synthesizes these writings, but points particularly to Mitchell and Mark Purcell, who emphasize the right to the city is not merely a right to appropriation, participation, and difference but more specifically as "a right to space, the right to inhabit space" (Purcell 2008,

quoted by Soja 2010, p. 109). In focusing on the "production of injustices and the embeddedness of this production process in the social order" (p. 74), however, Soja declines to define what exactly justice would look like or how diverse rights claims to the city and its spaces ought to be adjudicated.

Writings on equity/fairness/justice in geography may struggle to reconcile distributional questions with wider analysis of society and space, but Hay (1995) notes certain consistent and interlocking themes. These include procedural fairness, fulfillment of legitimate expectations, formal equality (substantive fairness), substantive equality of outcomes, desert (merit-based allocation), and need. Hay's synthesis (pp. 503–504) prompts social justice inquiry to focus on key questions. First, is there substantive equality (or minimization of inequality) in how societal burdens and benefits are distributed across people and space? Is there a lack of discrimination on the basis of geographic location? Are rules consistently applied? And is there relative fairness in how society meets the basic needs of individuals in diverse geographic circumstances? Approaches to justice will vary, are often relative, and remain hard to measure. But Hay and Harvey agree: justice maintains "a political and mobilizing power that can never be neglected" (Harvey 1992, quoted in Hay 1995, p. 501).

Toward a Theory of Mobility Justice

Given the critical role of circulation in urban life, and the power of uneven transport outcomes to "reduce people's ability to fully participate in society" (Lucas and Jones 2012), it's not surprising research on transport and social justice have increasingly converged. For Wellman (2015, p. 120) and others, transportation policies and externalities are a "prime, but frequently ignored, locus of social justice considerations." In social justice scholarship this means taking transportation more seriously, and for transport scholars this means transcending the functionality of movement to see mobility as a contested social good. This profound (and long overdue) shift invites new ways of thinking about mobility and the everyday street, embodied in inspiring and diverse works that extend social justice theories to rethink mobility variously as distribution of social goods like access, a question of rights/responsibilities, and even religious questions of morality and ethics (Hartman and Prytherch 2015). These provide a foundation for defining a more just street.

Because "access" or "accessibility" is understood to be key goods distributed by the transportation system, it is therefore "a sine qua non for the social justice project" (Farrington and Farrington 2005, p. 11). Defined as the ease with which persons can reach important destinations such as employment (Golub and Martens 2014), access has a strong role in determining "life opportunities" (Martens et al. 2012, p. 686). But if planning mechanisms like demand modeling and cost–benefit analysis by definition distribute accessibility, and thus raise issues of equity, Martens et al. note most agencies "all but ignore" such implications and even well-meaning ones fail to define a clearly defined goal. Worse, such decisions typically benefit mobile populations at the expense of the "mobility-poor" (Martens 2006, p. 14).

Martens et al. (2012) therefore offer a justice-theoretic approach to the distribution of transportation benefits which draws upon both Rawls and Walzer's writings on "spheres of justice." Acknowledging unevenness across space and among individuals, they argue transportation planning and investment should seek the highest possible average access level across neighborhoods and modes, while minimizing the gap between areas with lowest and the highest level of access, and between car-owning and car-less households residing in the same area. While current transport policies emphasize vehicular mobility, they suggest transport investments may "generate disproportionate benefits for low-mobile groups in order to be considered fair" (p. 689). While they recognize the radicalness of their proposal for transport planning, much less the transport system itself, they emphasize the importance of access for enabling "each member of society to fulfill his or her life opportunities" (ibid.). Access will always be relative, akin to income disparities, so Golub and Martens (2014) argue for minimum thresholds for "access impoverishment" and planning that makes access "more equitable for more of the population" (p. 18).

From an environmental justice perspective focused on the allocation of "bads," scholars like Bullard (2000) note that people of color constitute a disproportionate percentage of pedestrian fatalities, and Holmes (1997) argues they "pay the highest social, economic and environmental costs and receive the fewest benefits from an automobile-dominated transportation system" (p. 22). From this perspective, health and environmental impacts of governmental activities like transport planning/investment, whether bodily harm or pollution and noise, should not fall disproportionately on minorities or the poor (Forkenbrock and Schweitzer 1997).

Looking beyond access as good, others approach mobility as basic human capability. Beyazit (2011) draws from Sen and Nussbaum to highlight opportunities provided by the transport system, values of people, and freedom to reach actions and decisions, and choices. In this sense, transportation is critical not only for distributing social and economic benefits, but also because transport acts like a "catalyser in supporting capabilities by linking them and, thus, enhancing functioning of individuals" (p. 131). Drawing upon Iris Marion Young, Cook and Butz (2014) look beyond distributional models to emphasize the systems that produce or reproduce inequality, and suggest we see mobility justice as both equitable distribution of motility—the ability to move—and "just institutional actions and decision-making processes about mobility issues that promote just mobility outcomes" (p. 17). Sheller (2012) likewise considers mobility a "fundamental capability for human thriving" (p. 187), and suggests we look beyond a simple de jure right to mobility to ensure de facto capability as a "common basis for social justice" (p. 200).

Nowhere are such questions perhaps more pertinent than the realm of disability and mobility in the built environment, around which vibrant scholarship has focused. Imrie (2000) and others have analyzed how the practices and discourses—and thus politics—of mobility prioritize the movement of what he calls "the mobile body," while differentiating and alienating impaired bodies. Because struggles around mobility and movement are a core feature of disabled people's everyday lives, they increasingly assert rights-based claims "to equality of opportunity in moving from one place to another" (p. 1654). To the degree disabled persons are defined and treated differently and unfairly, Corker (1998, p. 82) suggests such unequal treatment in relation to "the distribution of benefits and burdens, and in the absence of any justification, is a paradigm of injustice." For to be deprived of mobility in the public sphere is "to be a non person for whom power, choice and participation are meaningless" (Corker 1998, p. 75).

Mobility is both political and legal, meaning justice can also be approached via the equitable distribution of rights and responsibilities in the law. Mimi Sheller (2008) thereby defines mobility justice/injustice as the degree to which various personal mobility rights are evenly or unevenly distributed, as well as the ways one's desire for mobility (what she calls sovereignal freedoms) "impinge upon and have detrimental effects on others." Although she emphasizes mobility as a civic freedom enjoyed by civil societies, she suggests "freedom of mobility ... is not just a personal right or capacity, but also has sovereignal dimensions that are socially relational

and civic dimensions that are collective and public" (Sheller 2008, p. 31). Again, the law defines rights as "specific legitimate claims" (Coleman and Kraus 1986, p. 1343). But it also defines duties/responsibilities as "the obligations of persons living in a crowded society to respect the safety, property, and personality of their neighbors" (Owen 1995, p. 7). Tort law, for example, entitles individuals to rights but also obliges them to exercise "reasonable care," defining negligence as behavior creating "unreasonable foreseeable risks of injury" (Wright 1995, p. 250). Distribution of legal rights and duties thus determines justice (or its absence).

However we want to define mobility justice, it's clear that planning and administration of the transportation system inevitably involve competing claims to scarce resources like the physical space of the street. How these rights-based claims and duty-based obligations are allocated is thus unavoidably a question of equity. Policy researchers like Manaugh et al. (2015) therefore argue we must understand and squarely confront such trade-offs among multiple policy impacts for multiple groups, ensure such knowledge is transparently integrated into the planning process, and clearly communicate to decision-makers and the public (p. 169).

Defining a More Just Street

We might integrate theories of social justice and mobility to define a *just street*.

In a broad distributive sense, a just street would provide users equal opportunity to take advantage of public spaces and the social goods they provide, including but not limited to mobility and accessibility. Diverse people using different modes of transportation would enter the street, at least in theory, from an initial position of equality, none disadvantaged by street design and regulation. As a public/social sphere the street would distribute its benefits and harms equitably, ensuring diverse persons might enjoy benefits like accessibility and safety, without burdening any one group disproportionately by duties to others or with the roadway's harms. And where uneven distribution of such benefits and harms occurs, this ought to produce compensating benefits for everyone, especially the least advantaged. The allocation of the street's social goods cannot be discriminatory, but instead show fairness across populations and street spaces. And to maintain a just distribution, arrived at justly, institutions that design, control, and maintain public streets must be impartial, transparent, and regular in assigning equal basic rights to all persons.

Because the roadway is public sphere and political economy, the institutional structures reproduced in and through the street ought to reduce inequality and exploitation, making the public space of the street "the space of justice" where the right to the city can be fairly struggled over, implemented, and represented (Mitchell 2003). This is premised on a basic geographical fact: equal rights to access and inhabit the space of the street. And, instead of being a space that alienates and fragments, the street ought to be a place that gathers together, enabling everyone to exercise their rights to difference and participate openly and fairly in shaping the space and experience of the street. In this sense, the street must not be a place that reinforces political, economic, or cultural structures of inequality and domination, but instead serve as a place that opens up opportunities for struggle toward a more just city, through access to its public spaces and the decision-making that produces them.

Because the mobility is a particular kind of social good, and street is a particular kind of public space, a more just street must be defined primarily in relation to transportation. Streets can provide a setting for political representation (e.g. protests) or even habitation (e.g. homelessness), but their primary function remains circulation. Interpreted via transport geography and mobilities studies, a more just street would not be designed and operated solely to maximize mobility—the ability to move—but would optimize accessibility for everyone. A just street would seek the highest possible average access level across neighborhoods and modes, but minimize gaps between modes areas or varying levels of access, and between different modes. And instead of prioritizing vehicular mobility, fairness in transport planning and investment would need to generate disproportionate benefits for low-mobile groups. In such a transportation system, streets would fairly distribute both social goods like accessibility and bads like risk, noise, and pollution. In plain terms, rather than maximize mobility for the wealthy, fast, and dangerous, streets would prioritize access for everyone, especially the poor, the slow, and the vulnerable.

And interpreting the street as space of mobility and the law, a just street would fairly distribute legal rights to the street (e.g. the right to move or "right-of-way"). In a just street the right to access and use the street would be legally guaranteed and maximized across people and modes, and preferential rights given to the vulnerable. It would also fairly distribute the public duties borne by citizens and street users, whether defined in terms of public finance (e.g. who pays for the roadway) or mobility (e.g. who must yield to whom) or legality (e.g. who bears responsibility in case

of accident). And the overall balance of rights and duties would be fair, leaving no particular person or mode unduly burdened or deprived of rights. And more than a hypothetical set of rights, the design and regulation of a just street would facilitate the exercise of those rights by all, and would ensure that the distribution of rights and duties would be fair in practice as well as theory. Furthermore, the institutions that produce and regulate streets—whether legislatures, agencies, or the courts—would guarantee broad public participation in decision-making and consistent and fair administration of the law.

And stepping beyond these specific discourses of distribution, access, or the law, we should remember that the public street must serve the general welfare. It should support and enhance the capabilities of all people to enjoy a good human life characterized by health and longevity, freedom to move and express themselves, freedom to associate, while showing care for nonhumans (Nussbaum 1999). A just street therefore serves to enhance the capabilities of people and communities in a way that promotes social equity, environmental responsibility, and efficiency. It must be a sustainable street that allows people today to lead capable and good lives, without depriving others—in the future, in other species—the opportunity to do the same.

An Integrative Perspective on the Right to a More Just Street

Diverse writings on mobility, the right to the city, and social justice provide a valuable foundation upon which to define mobility justice and the more just street. While such approaches vary in philosophical orientation or approach, they share a common desire to understand how social and spatial processes intersect in uneven ways to shape the city we live in, travel through, and experience. And while these approaches have been developed to focus on diverse processes and practical questions, all are highly relevant for understanding mobility and the street. Here I have sought to synthesize and articulate relevant writings to develop a theory of the street as space of mobility politics, mobility on the public street as right, and the street as space of justice (or its absence). Against a backdrop of technocratic and ostensibly value-neutral approaches like transportation engineering on the one hand, or explicitly critical (but not always constructive) theories of the "right to the city" and injustice, I have sought to offer a positive vision of what a right to a just street might look like, in theory so that we may know them in practice.

From these diverse approaches I propose mobility on the public street is inherently a question of rights, integral to broader claims to a "right to the city" enabling full enjoyment of urban places and participation in their making. More than an abstract demand, however, the right to the street is grounded in institutional frameworks and actionable claims. The right to the street, like the street itself, is therefore a question of law. But if it is one thing to claim a right to the street, in representational politics or the law, it is another to adjudicate competing claims and ensure fairness upon it. For this reason we must articulate theories of social justice—drawing from distributional, political-economic, or rights-centric theories—to carefully define mobility justice and the just street. I suggest the following synthesis: A just street is a space that fairly distributes the rights and responsibilities of mobility in the public sphere, maximizing access for all while reducing inequity between people and the modes they choose to travel, produced through transparent and democratic decision-making that enhances the capabilities of diverse individuals to enjoy a good life without depriving present or future generations (human and nonhuman) of theirs.

This normative vision of the right to a just street is, of course, as radical as it is broad. But without such a critical perspective, any attempt to plan or design roadways lacks essential concepts for guiding practices whose social and distributional impacts are as profound as they are theoretically underexamined. And without this positive vision of what streets ought to look like, mobilities scholarship will remain locked in the important yet insufficient task of critiquing injustice without formulating a better alternative. Combining theoretical understanding of mobility rights/just streets with practical knowledge of transport planning practice, I suggest, is essential for imagining streets that fairly enable rather than constrain a broadly democratic right to the city and a more just and sustainable result.

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Traditional Traffic Law and Design



CHAPTER 3

Legal Geographies of the American "Right-of-Way"

The street embodies complex and often competing societal demands, making the order of public spaces inseparable from that of society itself. And while life on the street is certainly shaped by a myriad of individuals and their everyday (and often informal) practices, it is also powerfully ordered by formal mechanisms like the law. If we want to fully understand—and perhaps rethink—the public space of the street, we must trace how societal norms and beliefs about mobility and public space have been codified by legislatures, enforced by the police, and interpreted by the courts. Given the diversity of American places that streets traverse and connect, the remarkable uniformity of the roadway experience attests to the power of the social order that produces and maintains them. Making sense of the geography of the street, our right to it, and mobility justice therefore requires careful attention to the legal geography of the American "right-of-way."

In the next two chapters I explore how the law codifies and socially constructs public street spaces in the US, and adjudicates competing claims to the space of the public right-of-way or "ROW." This starts with the legislative statutes that define and structure the ROW as public space. Tracing the historical context from which modern roadways emerged, from their origin and evolution as gathering places and circulation elements, I review the formalization of traffic laws with the advent of the automobile in the early twentieth-century America. I then introduce the UVC, which has provided the template for state and local traffic laws for nearly a century, analyzing

how it defines the purpose of the roadway, who constitutes a legitimate user, and how the public spaces of the street are segregated and allocated. I highlight the powerful role of the UVC in shaping statutes adopted by various states and cities, mandated by the federal government to produce legal uniformity on public ROWs across the US. In addition, I explore how local government ownership and control of public streets is based in municipal enabling statutes and home-rule authority. This provides the foundation for Chap. 4's analysis of how statutes and case law define the right to the space of the ROW as the right to proceed or "right-of-way." Only by understanding the legal spaces of the street can we understand how statutes codify and case law adjudicates competing claims to them, determining who must yield to whom.

Knowledge of traffic laws is a powerful tool for planners and other transportation advocates, helping understand the policy frameworks that define the street. That starts with approaching such laws critically not as commonsense "givens" but as the product—and producer—of very specific mobility politics. We may thus profit from interpreting the UVC and statutes modeled upon it through the key questions underpinning this book. How do traffic and other statutes construct the spatial and social order of the street? How do such laws codify particular politics of mobility? And how do they provide a legal foundation for mobility rights to and justice (or its absence) on the street? The next chapter will explore in more depth how competing demands for street spaces are mediated and adjudicated by statutory and tort law (liability). But first we must understand how statutes legally define the purpose and spaces of the public street.

LAW AND THE PUBLIC STREET

The Street as Public, Legal Space in History

The function and character of streets reflect—and reinforce—those of the societies they connect. As Lewis Mumford chronicles in his classic *The City in History*, streets in the earliest cities like Mesopotamia's Ur functioned more as place for daily life and exchange than "open, articulated means of circulation" (Mumford 1961, p. 74). The Greek polis—the foundation of today's democratic city—developed through the transformation of streets and square into the agora, an open space "publicly held and occupiable for public purposes" (p. 149). But there has always been a tension between the street's place and circulation functions. Hellenistic street plans, the basis for the later American "gridiron," sought to provide public space,

architectural order, and a circulatory system for trade and ordered military movement. In the medieval city, the urban pattern conformed to the economic one, winding and narrow alleys favoring face-to-face communication and the pedestrian. But with the Renaissance a "new urban complex" emerged, symbolized by the straight and often oversized street to better serve expanded use of wheeled vehicles and a "hastening of movement and conquest of space, in addition to military displays of power" (pp. 368–369). In the modern era the "new mechanical pattern" of the gridiron came to dominate urban expansion in Europe and the US, serving accelerating economic and population growth and increased speed of urban circulation (p. 424). But city spaces, whether European or American, remained dominated by pedestrian movement, and the street a vibrant space shared by diverse users and modes.

In the planning of colonial American towns and cities on the gridiron, the primary purpose of streets remained open space for pedestrian travel (McShane 1994). In the preindustrial city, streets functioned as meeting places, open-air markets, and open spaces providing light and air (p. 62). Only with increasing traffic in the nineteenth century—whether horsedrawn omnibuses or electric trolleys—did streets come increasingly to be viewed as arteries for transportation, particularly by suburban dwellers who prioritized ease of travel across urban space. Municipalities struggled to improve the quality of roadways and regulate competing demands. As early as 1866, New York began to control traffic at major intersections, and other cities imposed controls mainly to protect street pavements (p. 51). With the popularization of the bicycle in the 1890s, cities began to impose speed limits (8 mph for bicycles and other vehicles), mandate hand signals for turns, and direct traffic to stay right. In response to rising traffic injuries and fatalities, police departments began to station officers at major intersections, and cable car companies in New York stationed workers with red and green flags to control traffic (though with limited compliance) (p. 51). As municipal reformers and engineers began to consider ways to speed traffic, however, local residents still valued the non-travel functions of streets, seeing them as public places connecting residential neighborhoods, more playground for children than thoroughfare (see Fig. 3.1).

What ultimately shifted understanding and regulation of the public street was the twentieth-century introduction of the automobile. Peter Norton conveys the rich complexities and profound consequences of this struggle in *Fighting Traffic: The Dawn of the Motor Age in the American City* (2008), which is worth recounting at some length here. "Motorists

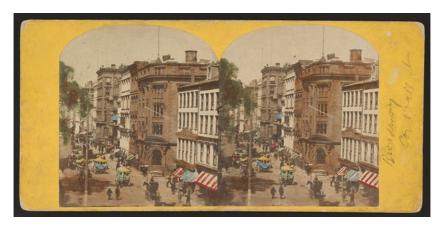


Fig. 3.1 Until the twentieth century, the street was by law and custom a public place shared by diverse users. Source: Library of Congress

arrived in American city streets as intruders," he reminds us, and "had to fight to win a rightful place there" (p. 7). When first introduced, cars were viewed as a misuse of streets, obstructing and endangering the primary, legitimate user of the street: the pedestrian. But as he puts it bluntly: "old street uses plus new automobiles equaled disaster" (p. 19). With America's first pedestrian fatality by automobile in 1899, cities underwent an "urban traffic revolution" (McShane 1994, pp. 173-174) involving decades-long struggle over what streets were for, and to whom they belonged. In the first decades of the twentieth century, the traffic safety problem was understood to be the fault of automobiles and their drivers, characterized as "speed maniacs" and "villains" who victimized innocent pedestrians like playing children (Norton 2008, p. 27). Early responses to motor vehicle accidents focused on educating drivers through public safety campaigns led by national and local safety councils. The police, in their role as "peacekeepers," sought to impose order, even at the cost of efficiency, using the police power to balance rivaling street uses (p. 20). But to reformers, pedestrians, and grieving parents the "street was their space—a place to alight from a streetcar, a place to walk, a place to play" (p. 46). Under customary assumptions, the city streets—like the city parks—were public spaces available for use by anyone, as long as they didn't unduly annoy or endanger others (p. 63).

But by the 1920s, motorists—and a wider lobby Norton (2008) calls "Motordom"-fought for a new kind of city street-a place chiefly for motor vehicles. While prevailing and customary notions of the street led early reformers to frame cars as nuisances and "violations of fairness" and police to define them as problems of order, growing demands and safety hazards of automobiles prompted new and "diverging answers to the question 'who belongs in the street?'" (p. 65) The pro-vehicle lobby, seeking to sidestep difficult questions of justice, recast the street in terms of political and market freedoms (p. 67). The result was an emerging social order in which the street was no longer a public space for diverse users, but a motor thoroughfare that confined and marginalized pedestrians to sidewalks and crosswalks (p. 65). And while this struggle was fought in a variety of realms, including public relations campaigns that reframed the pedestrian from legitimate users to "jaywalker," nowhere were these battle lines clearer or more powerfully drawn than emerging traffic laws whose explicit purpose was to create a new street order.

Codifying the Modern Street

Mobility on American streets has always been governed by customs and unwritten norms about how people should relate to each other, but only in the twentieth century were these formally codified in law. The legal definition of street spaces and proper uses was a critical element in what Norton (2008) calls the "social construction of the street for the modern age" (p. 66). Historically by "law and by custom, all had a right to the street and no one could use the street to the detriment of others' rights" (p. 67). Because the street was customarily free to all, the law's role was to promote safety and equity among diverse users. Judges and juries overwhelmingly recognized the traditional rights of pedestrians, including those of children, to the public street. And police and the courts typically assigned responsibility for safety to motorists. But these understandings, again, were largely customary. As the motor age dawned in the US, no city had what can rightly be called a traffic code (p. 48).

Increasing traffic and the asymmetries—in speed and mass—between cars and other uses made such customary practice inadequate to new realities. In 1903, New York City—following the leadership of eccentric traffic reformer William Phelps Eno—instituted the first traffic code in the US. These "Rules for Driving" codified existing norms, directing drivers to keep vehicles to the right, pass on the left, use hand signals, and travel

at a "safe and proper speed" (Norton 2008, p. 52). But some rules were entirely new to the auto age, including the requirement to make outside left turns at intersections. While many cities initially saw such regulations as unnecessary, with mass production of automobiles and resulting increases in traffic, reformers increasingly saw the need to formalize rules and traffic control techniques. Many adopted or adapted New York's rules, though often with a stricter approach to controlling speed controls (often 10 mph or less) (p. 53). This coincided with a wider expansion of municipal regulation by the 1920s as cities embraced their relatively newfound police powers, delegated by state legislatures or empowered by charter, to promote public health, safety, and welfare. A 1926 survey of national traffic experts found widespread agreement that "streets are primarily provided for general public use" and thus the rights of different classes of users were "subject to the public and civic welfare" (quoted in Norton 2008, p. 116). Confronted with chaotic streets, and empowered to regulate the public street for the public welfare, cities undertook to more clearly define and delineate street space.

With the proliferation of regulatory efforts in diverse cities across the US, both reformers and automobile interests increasingly lamented "lack of uniformity." In response, US Secretary of Commerce Herbert Hoover hosted representatives of government, safety organizations, and automobile interests in a National Conference on Street and Highway Safety, which also addressed issues of congestion and efficiency. While auto groups initially opposed regulation on principle, they came to view uniformity as a way to overcome inconsistent policing and regulation. And more profoundly, they saw in the codification of nationally uniform rules an opportunity to overturn "prevailing principles of traffic control" (p. 187). A Committee on Uniformity in Laws and Regulations—with staff assistance from a lawyer of the Automobile Club of Southern California drafted a model state vehicle statute or UVC to supersede diverse state laws (p. 188). At the same time, a Model Municipal Traffic Ordinance committee, also dominated by motor interests, focused on urban traffic problems. Overturning centuries (millennia?) of precedent, these new model laws "codified pedestrians' confinement to sidewalks and crossings." While leaving cities choices on how far to go, at a minimum it required that pedestrians yield to motorists everywhere except crosswalks. Although streetcar advocates tried to insert utilitarian language that traffic regulations seek "the greatest good for the greatest number," such language was rejected by motor interests (pp. 191–192).

Such model ordinances, sponsored by the federal government in association with business and civic groups, set the template for the proliferation of uniform regulations across US states and cities. Like state planning and zoning enabling statutes, model traffic ordinances quickly shaped how localities approached and regulated urban space. The Model Municipal Traffic Ordinance of 1927, promoted by the National Automobile Chamber of Commerce, was adopted by more than 100 cities within two years (p. 254). At the state level, the UVC was codified as state statutes in 23 states by 1930 (p. 193). Formalizing new and very different understandings of the street and who it was for. Norton concludes bluntly: "Once a public space for mixed uses, and ruled by informal customs, the street was ... becoming a motor thoroughfare for the nearly exclusive use of fast vehicles—especially automobiles" (see Fig. 3.2) (p. 254).



Fig. 3.2 With the advent of automobiles and new traffic laws, street spaces became segregated by use with vehicles at the center and pedestrians at the margins. Source: New York Public Libraries Digital Collections

THE UNIFORM VEHICLE CODE

"Safety with Freedom Through Law"

Since their publication nearly a century ago, the model ordinances devised by the National Committee on Uniform Traffic Laws and Ordinance (NCUTLO)-including the UVC and Model Traffic Ordinance-have shaped the street as legal and social space. The NCUTLO was always a private, nonprofit organization comprised of state highway officials, safety advocates, and automotive representatives, but its codification of the street gained force of law through statutes adopted by legislatures. Though many states and localities had developed their own traffic statutes prior to the development of the UVC, it provided the template for those subsequently adopted or amended. And with the 1966 passage of the Highway Safety Act, the federal government began to enforce its uniform adoption across the US. In 1968 the Department of Transportation (DOT) adopted by reference the National Vehicle Code and Model Ordinance into the Code of Federal Regulations (Section(s): 41 C FR 50-204.75), acknowledging all states already had "reasonably comprehensive traffic codes" but citing the need to "modernize" these nonconforming laws it required alignment with the UVC. In doing so the US DOT argued,

The proper purpose of all traffic legislation is not to impose unnecessary or unreasonable restrictions on highway traffic, but to insure, as far as this can be done by law and its application, that traffic shall move smoothly, expeditiously and safely; that no legitimate user of the highway, whether in a vehicle or on foot, shall be killed, injured or frustrated in such use by the improper behavior of others. (ibid.)

The code and ordinance, first published in 1926 and 1928, respectively, have been revised on regular intervals to address changing conditions and needs. The last, and current edition was published in 2000 as the *Millennium Edition of the Uniform Vehicle Code*. And though the NCUTLO has become inactive due to lack of a dedicated funding source, its sister organization the National Committee on Uniform Traffic Control Devices (NCUTCD) has worked to update the UVC, proposing an update in 2015 (American Association of State Highway and Transportation Officials 2017; National Committee on Uniform Traffic Control Devices 2015).

The UVC codifies mobility and the roadway through a series of chapters on the definition of words and phrases, highway safety administration, title and registration of vehicles, theft laws, licensing of dealers and "wreckers," vehicle insurance and financial responsibility, vehicle rental, civil liability, accidents and accident reports, vehicular equipment, vehicular inspections, and so on. At the core of the UVC are the "Rules of the Road," which specify obedience to traffic laws, traffic control devices, right-of-way, pedestrian rights and duties, speed restrictions, as well as specific rules for alternative modes (e.g. motorcycles, streetcars, bicycles). Chapter 15 specifies the "Respective Powers of State and Local Authorities," and Chap. 16 details the legal procedures for enforcement and administration of justice. Together these constitute a comprehensive set of rules and procedures governing relationships between mobile persons, government, and the space of the roadway.

The UVC, although a technical document about traffic, is therefore an expression of legal theories and direct mechanism for translating them into practice. In adopting the UVC the federal government cited as underlying "philosophy" to "provide to every highway user, through law, a maximum degree of safety within the framework of traditional freedoms." In setting forth "rules of the road—the things people shall and shall not do as they drive or walk," the federal government and NCUTLO argue for a particular kind of legal order, made uniform across American streets. The goal of such ordering is embodied in the motto of the National Committee "Salus, Libertas, Lex" or "Safety with Freedom Through Law" (CFR Section(s): 41 C FR 50-204.75). Defining the social life of the streets is defined in relation to mobility and the law, and prioritizing "uniformity of demands and responsibilities" placed upon vehicle operators and pedestrians (National Committee on Uniform Traffic Control Devices 2015), the UVC bears close examination for how it "configure(s) social space in ways that have consequences" (Delaney 2016, p. 268) and structures "unequal power relations which unevenly distribute motility, the potential for mobility" (Hannam et al. 2006, p. 15).

Defining the Purpose of Traffic Law and the Public Street

In the law, everything turns on word choice. The UVC does not include an explicit purpose statement, but implicit throughout are underlying assumptions about what the street (and the code) are for. Most obviously, the very name of the NCUTLO's model ordinance is the "Uniform Vehicle Code," rather than a generic "traffic" code. The statutes adopted by states vary somewhat in terminology, but share the same assumptions.

In states like California it is the "Vehicle Code," in New York "Vehicle and Traffic Law," and in Ohio it's still more explicitly "Motor Vehicles." In relatively few states like Florida and Vermont are such statutes merely "Traffic Laws," or still more simply "Transportation Code" as in Texas.

The core purpose of the code, and its approach to the street, can also be found in the first chapter of the UVC, which defines key words and phrases. The term "traffic" is defined inclusively (if archaically) as pedestrians, animals (ridden or herded), vehicles, streetcars, and "other conveyances ... using any highway for purposes of travel" (p. 11). But the definition of "street" (or "highway," the terms are interchangeable) is unambiguous: "the entire width between boundary lines of every way publically maintained when any part therefore is open to the use of the public *for purposes of vehicular travel*" (NCUTLO 2000, 1, emphasis added). The definition of "roadway" similarly reads "that portion of a highway, designed or ordinarily improved for vehicular travel, exclusive of the sidewalk" (p. 10).

In the UVC and state statutes adopted on its model, the street is legally governed—and is purpose defined—in relation to traffic and vehicular travel.

Defining Mobile Persons and Modes

The UVC also legally defines the people and objects that are "users" of the public street. These definitions matter not only because they specify who may legitimately access the space of the ROW overall, but also because these categories correspond to the street's distinct subspaces (e.g. roadway, crosswalk). The UVC recognizes the roadway as a social space, broadly defining the "person" as "every natural person, firm, copartnership, association or corporation." But the law immediately defines and classifies every such person by their mode of transportation. Most basic is the "pedestrian" or simply "any person afoot" (p. 8). This the law distinguishes from the "person with disabilities" defined as those who are determined by a physician to be unable to walk 200 feet without resting; without an assistive device; or severely limited due to cardiac, respiratory, or neurological condition.

But apart from these two definitions of human bodies, the law then interprets persons in terms of their mode of conveyance or as objects. Prominently "vehicle" is defined as "every device in, upon or by which any person or property is or may be transported or drawn upon a highway" (p. 13), encompassing all wheeled vehicles (including cars and bikes) though excluding rail vehicles. Within that broad category is the "motor vehicle" or "every vehicle which is self-propelled ... except vehicles moved

solely by human power and motorized wheelchairs" (p. 7). And "bicycle" means "every vehicle propelled solely by human power upon which any person may ride, having two tandem wheels" (2). The code defines the characteristic qualities of a host of other vehicles, whether bus, farm tractor, house trailer, moped, motor home, or semitrailer. And to further link the person with the vehicle, the code defines roles like driver as "every person who drives or is in actual control of a vehicle" (p. 4).

State statutes vary to some degree from the UVC framework, but only in relatively subtle ways. Some states maintain largely the same definitions, but organize and prioritize definitions differently. In the Texas Transportation Code Title 7 Vehicles and Traffic definitions are organized by persons, property areas, vehicles, and traffic. The first two definitions under persons are "operator" and "owner" (a person who has property interest in a vehicle). Most notably, perhaps, is the order of definitions in the Ohio Revised Code (4511.01), which start with (A) vehicles and (B) motor vehicle, only later defining (W) person and (X) pedestrian (!). In other statutes the terms used are the same, but vary to minor degree. For example, Kansas's Automobile and Other Vehicles statute defines pedestrians as any person afoot and those using wheelchairs or "electric personal assistive mobility device." Illinois Vehicle Code (625 ILCS5) similarly includes those afoot and using assistive devices, but also any person "wearing in-line skates." And in other states legislatures have elaborated different terms as transportation technology has evolved: while some states continue to talk about "conveyances," others like Illinois include "recreational off-road vehicle."

The UVC, like the many state statutes adopted on its model, defines the public street in terms of the persons and vehicles who access it. These conform to our typical understanding of the street as transportation space, and the vehicle as the dominant mode. While all those who use the street are ultimately humans (at least until the full advent of autonomous vehicles), the legal "person" only gains meaning in relation to his/her transportation mode. The law interprets the street as a space for mobility, and mobile persons as modes.

Roadway Spaces

The law not only codifies the purpose and legitimate users of the street, but it also differentiates between different subspaces within the ROW. These are definitions that matter a great deal, setting the legal foundation for determining who has right-of-way in each (Chap. 4), roadway engineering and design (Chap. 5), and uniform traffic control (Chap. 6).

As noted above, the UVC defines the street broadly as the width between boundary lines of public ROWs maintained for purposes of vehicular travel (NCUTLO 2000, 11). The "roadway" is that portion "designed or ordinarily improved for vehicular travel, exclusive of the sidewalk" (p. 10). We typically see this as the asphalt roadway, paved smooth for vehicles. The "sidewalk," in turn, is "that portion of a street between the curb lines, or the lateral lines of the roadway, and the adjacent property lines, intended for use by pedestrians" (p. 11). Typically, this is the concrete walkway, elevated and separated from the roadway by a curb. Roadway and sidewalk are distinct linear elements within the public street, though typically parallel and integrated, they are segregated by their purpose and function as vehicular and pedestrian spaces, respectively.

If roadway and sidewalk are linear elements in the street network, the intersection is the major node. According to the complex definition of the UVC, "intersection" means

1. The area embraced within the prolongation or connection of the lateral curb lines, or, if none, then the lateral boundary lines of the roadways of two highways which join another at, or approximately at, right angles, or the area within which the vehicles traveling upon different highways joining at any other angle may come in conflict (ibid.).

Such a definition is as specific about what is *not* an intersection as what is. The UVC therefore specifies that "the junction of an alley with a street or highway shall not constitute an intersection" (ibid.).

Perhaps most interestingly, having segregated the street into separate vehicular and pedestrian spaces (roadway and sidewalk, respectively), the law must reconcile them at intersections and other places where pedestrians and vehicles collide. The complicated definition of "crosswalk" therefore bears verbatim citation and consideration.

- 1. That part of a roadway at an intersection included within the connections of the lateral lines of the sidewalks on opposite sides of the highway measured from the curbs or, in the absence of curbs, from the edges of the traversable roadway; and in the absence of a sidewalk on one side of the roadway, that part of a roadway included within the extension of the lateral lines of the existing sidewalk at right angles to the centerline.
- 2. Any portion of a roadway at an intersection or elsewhere distinctly indicated for pedestrian crossing by lines or other markings on the surface (p. 3).

The crosswalk, in simple terms, is where the pedestrian network (e.g. sidewalk) intersects with and crosses the vehicular roadway. Everyone easily recognizes a marked crosswalk as a crosswalk, whether at an intersection (the first part of the definition) or mid-block crossing (the second). But the UVC makes clear a crosswalk exists—in legal terms—wherever a sidewalk meets any intersection, whether marked or not. Most pedestrians do not realize that the pedestrian infrastructure is continued wherever sidewalks intersect with roadways, whether that crosswalk is formally marked or not.

In addition to defining the purpose of the roadway and its proper users, the UVC breaks the public street into constituent legal parts of roadway, sidewalk, intersection, and crosswalk. From the undifferentiated space of the nineteenth-century street, where sidewalks—if any—were a convenience and not a segregated space, with the twentieth century and UVC the street was formally segregated into separate and hypothetically equal parts, and mixing only where these networks intersect.

OWNERSHIP AND CONTROL OF PUBLIC STREET SPACES

Although the UVC's "Rules of the Road" are central to how states define transportation spaces and users, the public character of the street is also founded in other statutes. Indeed, the very authority of public entities like cities to own and control streets must find basis in the law. In some states, public control of streets is part of the wider delegation of authority to municipalities. In the American constitutional system, sovereignty is shared by states and the federal government. The authority of localities—cities or townships or counties—is largely delegated by states, but can also be founded in local "home rule." Under North Carolina statutes, for example, Ch. 160A "Cities and Towns" delegates to cities "general authority and control over all public streets, sidewalks, alleys, bridges, and other ways of public passage within its corporate limits" (G.S.A. 160A-296). Likewise Ohio's Title 7 "Municipal Corporations," Ch. 723, delegates to municipal corporations "special power to regulate the use of the streets" and their authority to "open, straighten, alter, divert, narrow, or widen any street, alley, or public highway." In other states the authority originates in home-rule authority, sometimes reinforced/codified by state statute. Texas, for example, has elaborated on its Transportation Code Title 6, Ch. 311, to reiterate municipal home-rule authority and "exclusive control over and under the public highways, streets, and alleys," including that to open, improve, and control or regulate public streets or alleys.

As in the UVC, the different spaces of the street have distinct legal character. Most broadly, the street occupies a legal space known as the "right-of-way" (ROW) defined in states like Ohio to refer to "land, property, or the interest therein ... acquired for or devoted to transportation purposes" (O.R.C. 4511.01). In many regards the public street and ROW are practically synonymous, signifying a strip of space owned and/or controlled by the public for transportation. But public control of the ROW does not necessarily imply property ownership. While often governments own both the land underlying the roadway and control the ROW, the government can have property interest in the ROW without owning the land. And often street ROWs extend beyond the strip of land owned by the government, meaning the street is a hybrid space of public and private ownership, controlled by the government for the purposes of public passage, but not always owned outright.

The sidewalk is particularly interesting in this regard. While the roadway is usually both owned and controlled by the government, the sidewalk is typically within the publicly controlled ROW but outside the roadway, and is in fact owned and maintained by adjacent property owners. While privately owned, the law requires those property owners to permit public passage, and laws like Ohio Revised Code Chapter 723.011 enable cities to burden owners and occupants of abutting lots and lands to "keep the sidewalks, curbs, and gutters in repair and free from snow or any nuisance." The acquisition, construction, and regulation of the public street are paid out of the public purse. But the sidewalk is often constructed and maintained at the expense of the property owner. These distinctions can seem subtle, or even invisible, to the passing motorist or pedestrian. But they matter, as we'll learn in later chapters, when it comes to adjudicating competing (and sometimes colliding) rights and duties.

LEGAL DEFINITIONS OF THE STREET: IMPLICATIONS FOR MOBILITY RIGHTS AND JUSTICE

Review of the UVC and other laws reminds us that streets, though physically built of concrete and asphalt, are socially constructed by legal texts. These laws codify discourses about the very nature of streets—what they are for, whom they serve—and thus translate ideological politics of mobility into very real public places.

Nothing about this is new. Indeed, a historical perspective illustrates the evolving politics of mobility in the US, and the growing role of the law in shaping the street. For much of history the street was more place than thoroughfare, for pedestrian travel but also gathering for socialization, markets, political representation, or cultural displays. Even as wheeled vehicles increasingly dominated the street in the nineteenth century, redefining the road as circulation space, the rights of the pedestrian to walk (and even play) remained paramount. But with industrial urbanization and the invention of the automobile, the need to codify some "rules of the road" became apparent. And rather than formalize customary understandings of the street, the development of a UVC articulated a new legal framework for the roadway. This model statute redefined the street in profound ways, making vehicular travel the essential purpose and the motorist the dominant roadway user, and confined pedestrians—ostensibly for their own safety—to the sidewalk and crosswalk. This struggle recounted by Norton in Fighting Traffic produced a new social order on the street, formalized in statutes and ordinances that came to be adopted by states and cities across the US. The remarkable uniformity of streets is in large part due to these laws, mandated by the power of the federal government.

These statutes, in shaping the social order of the street, shape it as space of rights and/or justice. We defined a just street is a space that fairly distributes the rights and responsibilities of mobility in the public sphere, maximizing access for all while reducing inequity between people and the modes they choose to travel, produced through transparent and democratic decision-making that enhances the capabilities of diverse individuals to enjoy a good life without depriving present or future generations (human and nonhuman) of theirs. We have examined only some aspects of that legal geography here, leaving for later chapters the question of who exactly has the "right" to the public ROW, and how rights (and duties) are distributed among competing roadway users. But legal definitions alone—of the street's purpose, legitimate users, and spaces—are revealing enough.

To begin with, the very definition of the street "for the use of the public for purposes of vehicular travel" prioritizes the vehicle over the pedestrian, subordinating the claims of the non-vehicular. This is of profound legal import, for all claims to the roadway will be judged in relation to that vehicular assumption. However we may judge the rationale behind that scheme (the dangers of the early twentieth-century roadway are indisputable), there is bias built into the rules of the road. And recall that the "street," like the public ROW, is an encompassing term signifying not

merely the asphalt roadway but also everything within the boundary lines of the entire public way. The entirety of the street, even if it includes sidewalks, is by law a vehicular space. In a world of diverse peoples and modes, and diverse demands for the use of the street, this is an exclusionary definition of what public space ought to be for. It is inclusive of vehicles certainly, which can include bike and trolleys as well as cars. But if we consider the relative benefits and burdens of the vehicular versus the pedestrian, we might question the fairness in such a definition. Vehicles provide individual and societal benefits (access, mobility, speed) but at very significant costs, threatening bodily harm to individuals (over 40,000 persons died in motor vehicle accidents in the US in 2016) and societal harms (motor vehicles constitute approximately 25% of total greenhouse gas emissions in the US). And given the economic costs of vehicle ownership, the public space of the street is an economically exclusionary space for the poor, particularly where public transit is not present. Pedestrians, on the other hand, are the most energy and cost-efficient mode of transportation, posing the least harm or nuisances to others while suffering the greatest bodily risk to themselves. Except for the disabled, walking is a means of travel accessible to everyone. Any definition of the street for vehicles and not people, which prioritizes the dangerous/polluting/exclusive over the vulnerable/sustainable/inclusive, is not by any definition just. Under the UVC the street is unjust by its very definition.

The legal definition and differentiation of people by their modes of travel also has implications for the right to and justice on the street. The law starts with the basic humanity of the "person," elaborated in the law as the pedestrian or "any person afoot" (including the disabled). But all other persons are defined in terms of their vehicles, whether motor vehicle, bicycle, trolley, and so on. According to the law, everyone not on foot is a vehicle "operator." Neutral on its face, the redefinition of people into modes does fundamentally reinforce the street's nature as a place for vehicles rather than for people. And in contrast to any Lefebvrian notion of public space for "gathering together instead of a fragmentation," these categories establish the foundation for a segregative order, particularly when linked to the street's division into subspaces. In theory these definitions do not prevent what Rawls would call an initial position of equality, but one can be legitimately suspicious when legitimate users are listed not alphabetically but with "motor vehicle" first (as in Ohio statutes).

The power of the law to define uneven geographies and social relations on the street becomes really apparent when the broader public ROW is partitioned and assigned to different modes. At the center of the street space is the roadway designed or ordinarily improved for vehicular travel, exclusive of the sidewalk. Defined thus, the street and roadway became effectively synonymous, and access to the street defined in terms of vehicles. Like the overall definition of the street, this fundamentally biases access to the street in favor of the vehicle over the pedestrian. Adjacent to the roadway is the sidewalk, intended for use by pedestrians. Such facilities are in theory separate but equal, offering safe access to the non-motorized. But the sidewalk is both literally and metaphorically marginal. And distinguished from the roadway and its primary vehicular purpose, this pedestrian space became severable from the street itself (and, as we'll learn, optional).

Having segregated vehicular and pedestrian networks and spaces, the law does acknowledge their intersection at the shared space of the crosswalk. Unlike the roadway and sidewalk, the law does not define the crosswalk for either pedestrian or vehicles, and instead makes conflict between competing modes a question of legal right-of-way (Chap. 4). But it should be remembered that a century ago pedestrians had the freedom to cross, and indeed walk down, streets largely at will. Crosswalks limit pedestrian access across roadways in both space and time: designated only at intersections or other marked crosswalks, and intended only for walking briefly across an otherwise vehicular space. Most of us are probably surprised to learn that crosswalks exist even where they are not officially marked, basically at any intersection where a sidewalk approaches laterally from at least one side. By law, at least, vehicular and pedestrian access at intersections is balanced. But the pedestrian's right to access the street, once paramount and relatively unlimited, now depends on whether roadway designers mark crosswalks, drivers stop for those afoot, and police enforce such rules.

In sum, the American public street, once an undifferentiated space for diverse public uses, has been legally redefined for vehicular travel and its spaces partitioned and segregated by mode. Changing social norms and assumptions about public street have been formalized in the UVC, codified by state traffic statutes, and enforced by the federal government. While this process of legal codification was a logical result of the introduction of automobiles to historically pedestrian streets, the primacy of the vehicle was not itself inevitable. For nearly a century the street in the US has been a space of law defined for the purposes of vehicular travel. Without that basic legal premise one cannot understand—or begin to reimagine—how streets are designed, regulated, or adjudicated. And the carcentric geography of the public ROW is critical to the allocation of diverse people's right to move through it, the subject of the next chapter.

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CHAPTER 4

The Contested Right to the Right-of-Way

The term right-of-way confusingly has two distinct but related meanings: It connotes both a physical space the public has a legal right to traverse and the legal right of individuals to move in relation to one another. The previous chapter explored how statutes define the purpose and boundaries of public ROW as space, divided both lengthwise and in cross section into a complex microgeography of subspaces—sidewalk, crosswalk, and so on—allocated to different modes. The legal codification of that geography over the course of the twentieth century was central, as we saw, to the redefinition of the street from shared pedestrian space to vehicular thoroughfare. Such a spatial distribution of the ROW alone contributes to inequity on the street. But as a public space, the street is also fundamentally a space of rights, both legal and customary. This is captured most explicitly in the second sense of the public right-of-way as legal right to move vis-à-vis others. Understanding who has the right to move is essential to understanding the geography of relations among the mobile on the public street, the distribution of those legal rights (or, alternatively, burdens), and how that contributes to a more or less just street.

The street is a place of competing claims, embodied in diverse trajectories of varied and potentially colliding vehicles and bodies. It is one thing to say the public has a "right to the street," as part of a wider "right to the city." But the street is a finite space, in which the exercise of one person's rights can very literally collide with another's. To understand the politics of the street therefore requires understanding contested social relations

among the mobile, not only how law defines the right to access street spaces, but also adjudicates competing claims both by statute (prior to mobility) and case law (after accidents occur). Though much of traffic law is built around rights—defined as the "right-of-way"—this necessarily implies someone must yield. Thus mobile persons can owe each other a "duty of care," or "obligations of persons living in a crowded society to respect the safety, property, and personality of their neighbors" (Owen 1995, p. 7). Duty is both an abstract moral "obligation to do or forbear from doing something" (Calnan 2009, p. 8) and part of the law's "two-sided compromise between right and responsibility" (ibid.). The way legislative statutes and judicial cases allocate rights and duties help form "relatively stable patterns of legally oriented social behavior" (Nelkin 2009, p. 22) and frame questions of social justice (or injustice).

This chapter therefore begins by exploring how NCUTLO's UVC—and state traffic statutes—defines the right to the public street as "right-of-way," and how it assigns that right to users differently based on their mode, their trajectory on the street, or where upon the street they happen to be. We must also understand how the UVC counterbalances rights with responsibilities, who gets preferential rights to the roadway, who must yield, and who assumes the burden or duty of care. Because rights (like duties) are not categorical but preferential, depending on the circumstances, we must situate them in the various spaces of the street: the "open" roadway, the sidewalk, the intersection, and the crosswalk. Doing so reveals the statutory/legal geography of the American street. While the UVC provides the model, it is not itself a legal document. We must then scrutinize how it is adopted—and adapted—by legislatures as state traffic, motor vehicle, or transportation statutes.

And because the law not only regulates behavior to prevent accidents, but also adjudicates legal conflict after accidents occur, this chapter concludes by discussing the common law of torts: legal precedents judges make when deciding fault and liability. Such common law does not directly regulate behavior, but there are consequences to how they assign rights and duties and ultimately determine negligence or "behavior that creates unreasonable foreseeable risks of injury" (Wright 1995, p. 250). To the degree perception/fear of liability informs and modifies behavior, rulings can also directly influence the life of the street. There is no equivalent of the UVC's national model to shape tort law, so we must look to case law rulings in particular states. I do not offer a comprehensive state-by-state analysis here, but an overview of key concepts in tort law, such as "contributory

negligence," and examples from various states, which reveal how rights and responsibilities are allocated to different users in different contexts, further shaping the contested right to and justice upon the street.

The broader right to the city is thus premised on a question: "Who has the right to the public ROW?" Who among the public can legally access street spaces, under what circumstances, and who must yield to whom. If a just street can only come through fair allocation of street spaces, it also requires a fair allocation of preferential rights and responsibilities within them. This requires careful, critical analysis of the UVC, state traffic statutes, and rulings by judges when accidents occur and order fails.

STREETS AS SPACE OF LEGAL RIGHTS: UVC AND THE "RULES OF THE ROAD"

The NCUTLO's UVC (2000) comprises various chapters that seek to codify roadway spaces and proper conduct upon them. At its heart, and critical to right to the street, is Chap. 11 "Rules of the Road."

The UVC's Rules of the Road, not surprisingly, begin by emphasizing the importance of rule-bound behavior, including "required obedience to traffic laws" and "obedience to authorized persons directing traffic," making exceptions only for highway workers and emergency personnel. However, laws themselves only exist on statutory page or website, the minds of street users, and the structures and procedures of law enforcement and judicial administration. To make the law more present within the street, the UVC emphasizes the importance of traffic control devices—the signs, markings, and signals detailed in Chap. 6—that communicate the law via the streetscape itself. The UVC thus requires that drivers "shall obey the instructions of any official traffic control-device" (NCUTLO 2000, p. 127), further emphasizing the link between traffic law and traffic engineering/design.

Right-of-Way as Preferential "Right to Proceed"

The UVC begins with "Words and Phrases Defined." As we saw in Chap. 3, these include the spaces of the ROW (roadway, sidewalk, and crosswalk) as well as users (motor vehicle, pedestrian, etc.). Another fundamentally important concept at the heart of the UVC Rules of the Road is the explicitly right-based concept of "right-of-way," which signifies

The right of one vehicle or pedestrian to proceed in a lawful manner in preference to another vehicle or pedestrian approaching under such circumstances of direction, speed or proximity as to give rise to danger of collision unless one grants precedence to the other. (NCUTLO 2000, p. 10)

The concept of right-of-way emerges from the very practical public problem of trying to prevent collision among people and vehicles. But in framing mobility in this way, about who legally can proceed and who must yield, the law codifies already contested power relations and makes them explicitly questions of legal rights. And because it is articulated as a situational right, not inherent in the person but defined by the context or "circumstances" of speed or direction or proximity, geography—spatial relationships between users and the street—matter.

Right-of-Way Along the Roadway

Most of the roadway network in the US comprises linear segments between intersections, even in dense urban environments where intersections are major features situated at regular intervals. Therefore most street spaces we traverse, along or across, exist as open "roadway" outside intersections, defined by the UVC as that portion of highways improved, designed, or ordinarily used "for vehicular travel," exclusive of the sidewalk, berm, or shoulder (NCUTLO 2000, p. 9). Having defined the purpose of the roadway for vehicular travel, the UVC actually does not make explicit that vehicles have preferential right-of-way, but that assumption underpins the entire UVC. Indeed, UVC Article IV "Right-of-Way"—though titled broadly—is exclusively about vehicles, parsing preferential rights among different vehicular users. It emphasizes vehicles shall be driven on the right half of the roadway, except when obstructions force drivers to cross the centerline. And it specifies the various circumstances under which cars can overtake and pass other vehicles proceeding in the same direction, but specifying they shall yield right-of-way to approaching vehicles (p. 130). In those cases when cars turn to and from roadway, Article IV specifies vehicles entering the roadway from driveways and so on must yield to all approaching vehicles (p. 137), and drivers intending to turn left shall yield the right-of-way to any approaching vehicle "which is so close as to constitute an immediate hazard" (p. 136). Assigning right-of-way to various passing and turning vehicles is the central focus of the UVC.

Only in UVC Article V "Pedestrians' Rights and Duties" (note the emphasis on "duties" here absent in the vehicular section) is the vehicle's preferential right made explicit. After instructing pedestrians to obey the instructions of traffic control devices, and defining their rights in the crosswalk (see below), the UVC states categorically, "Every pedestrian crossing a roadway at any point other than within a marked crosswalk or within an unmarked crosswalk at an intersection shall yield the right-of-way to all vehicles upon the roadway" (NCUTLO 2000, p. 138). Note that crossing outside of a crosswalk—so-called jaywalking—is not illegal per se, but pedestrians must yield to vehicles. But the law does specify that between adjacent signalized intersections pedestrians "shall not cross at any place except in a marked crosswalk" (p. 139). In such circumstances jaywalking does in fact become illegal. Overall, then, the roadway outside of intersections and crosswalks is legally defined as a vehicular space in which cars have right-of-way and pedestrians must yield.

Bicycles have a right to ride along the roadway, but also in deference to automobiles. A relatively recent addition to the UVC is Article XII "Operation of bicycles, other human-powered vehicles, and mopeds." After reiterating that failure to comply with this article is a misdemeanor (and that parents shall not knowingly permit children to violate it), it states: "every person propelling a vehicle by human power or riding a bicycle shall have all of the rights and all of the duties applicable to the driver of any other vehicle" (p. 168). The bicycle, though very different from a car, is considered by law to be a vehicle. The definition of the roadway for vehicular travel therefore incorporates bikes, and bicycles—like other vehicles—have right-of-way on the open road (relative to pedestrians). But among vehicles, the bicycle has limited rights. In the section "Position on Roadway," the UVC stipulates any "person operating a bicycle or a moped upon a roadway at less than the normal speed of traffic at the time and place and under the conditions then existing shall ride as close as practicable to the right-hand curb or edge of the roadway" (ibid.). Though bicycles and cars are both defined as vehicles, the "normal" speed of traffic is defined in relation to vehicles, and speed is prioritized over slowness and bicycles must move over. They may leave the edge only when passing another bicycle or vehicle, preparing for a left turn, or when they need to avoid hazards (parked cars, pedestrians, animals, etc.). Only when lanes are of "substandard width"—too narrow for a motor vehicle and bicycle to travel side by side—may bikes legally take the full lane, to which they are, by dint of being vehicles, entitled to.

Pedestrians have the most limited right to travel along the highway. Where a sidewalk is provided and its use "practicable" then it's unlawful for pedestrians to walk upon the roadway. Pedestrians may walk on the street only when sidewalks are absent, and then "only on the shoulder, as far as practicable from the edge of the roadway," or when shoulders are also absent "only as near as practicable to an outside edge of the roadway, and if on a two-way roadway, shall walk only on the left side" (ibid.). Except for these limited exceptions, the UVC states "any pedestrian upon a roadway shall yield the right-of-way to all vehicles upon the roadway" (p. 140), though the UVC does caution every driver "shall exercise due care to avoid colliding" within any pedestrian or other human-powered vehicle (ibid.).

Thus drivers, bicyclists, and pedestrians all have rights to—and duties upon—the open roadway. But having defined roadways for purposes of vehicular travel, the UVC allocates preferential rights (and limits duties) to cars. Other users, including bicycles, though legally also vehicles, are legally and spatially marginalized. And roadways may often be the only public ways available to pedestrians, but their access is limited only to crosswalks and sidewalks, where they exist. Otherwise they must stay to the far margins and yield while crossing the street. The right to the open roadway is largely the car's.

Right-of-Way on the Sidewalk

Among the "Pedestrians' Rights and Duties" detailed in Article V, the UVC reiterates the distinct and separate nature of the sidewalk, defined as "that portion of a street between the curb lines, or the lateral lines of a roadway, and the adjacent property lines, intended for use by pedestrians" (NCUTLO 2000, p. 10). The UVC specifies any "driver of a vehicle crossing a sidewalk shall yield the right-of-way to any pedestrian and all other traffic on the sidewalk" (p. 141), and pedestrians only must yield to authorized emergency vehicles. Under related rules, "No person shall drive any vehicle upon a sidewalk or sidewalk area," except if human-powered and no person shall stop, stand, or park vehicles on sidewalks, except when necessary to avoid conflict with other traffic (p. 162).

Bicycles too have a right to the sidewalk, but the UVC states those propelling a bike along a sidewalk must yield right-of-way to any pedestrian and must give an audible signal before overtaking/passing them, but not where prohibited by traffic control devices (p. 169). And while bicycle

parking along sidewalks is permitted under certain circumstances, they cannot "impede the normal and reasonable movement of pedestrian and other traffic" (ibid.). Those propelling human-powered vehicles—like wheelchairs—along a sidewalk have all the rights and duties applicable to pedestrians under similar circumstances (p. 170).

Where sidewalks are installed, pedestrians have strongly preferential right-of-way. Vehicles cannot drive along them, and when crossing drive-ways must yield. Bicycles may use the sidewalk, but also must yield to pedestrians. But UVC does not in fact recommend or mandate sidewalk installation in the first instance. Pedestrians have a right to the sidewalk, but they may not have a sidewalk where they can exercise it.

Right-of-Way in Intersections

Intersections are by nature areas where right-of-way must be established. Unlike roadway segments or sidewalks where different users travel in parallel, intersections represent places where different lines of travel cross and potentially collide. Intersections are defined by the UVC as that "area embraced within the prolongation or connection" of curb or lateral lines where highways join or any area where vehicles traveling on different highways "may come in conflict" (NCUTLO, p. 5). They thus represent areas of conflict not only among vehicles moving and turning, but also with pedestrians crossing the roadway from approaching sidewalks. To create order from potential chaos, the UVC identifies who has right-of-way in intersections, whether or not controlled by traffic signals or stop/yield signs.

Busy intersections, by their traffic volume and complexity, present the need to control flows through signals. Signals have the defined purpose, as we'll see in Chap. 6, of controlling movement by assigning right-of-way. Because the roadway is defined for vehicular use, the UVC likewise envisions the intersection as primarily a vehicular space. The rules reiterated by the UVC are straightforward and familiar to most drivers, since we're trained from childhood to recognize them. Vehicular traffic facing a green signal may proceed straight through or turn (p. 127). Green means go! But this right is not unconditional: Such traffic must yield right-of-way to other vehicles and to pedestrians lawfully within the intersection (p. 127). Traffic facing a steady yellow are "warned" that the green movement will end. And traffic facing a steady red shall stop at the stop line or crosswalk. After stopping to face a red, a vehicle may cautiously enter intersections to turn right unless otherwise prohibited, but must yield to any vehicle in the inter-

section or approaching "so closely as to constitute an immediate hazard" as well as any pedestrians within the intersection or adjacent crosswalk (p. 128). The system of traffic signals, including colored circular lights and arrows, thus choreographs mobility by communicating who may proceed in preference to whom, and who must yield. The complexity of signalization systems varies with the complexity of intersections, but ultimately order is sought by carefully allocating rights-of-way.

Other intersections may not have signals, but are nonetheless controlled by "stop" or "yield" signs, which indicate "preferential right-of-way" (p. 136). Stop signs indicate where approaching drivers must cease movement to yield right-of-way to any vehicle "in the intersection or approaching on another roadway so closely as to constitute an immediate hazard" as well as yield to pedestrians within an adjacent crosswalk (p. 136). In the case of yield signs, drivers must slow down to a "speed reasonable" for conditions (including stopping if necessary) before yielding right-of-way to drivers in or approaching the intersection or pedestrians in adjacent sidewalks (ibid.). Though some intersections lack any specific controls, they still have relevant rules. For example, when two vehicles approach an uncontrolled intersection simultaneously, the vehicle on the left shall yield to that on the right and left-turning vehicles yield to any vehicle from the opposite direction "which is so close as to constitute an immediate hazard" (ibid.).

But what of pedestrians? In intersections, pedestrians, like vehicles, are commanded to obey any official traffic control device if present, whether the traffic signal or pedestrian-specific signals. And like vehicles, pedestrians must obey the light and "shall not" enter the roadway when faced with a steady circular red or red arrow. When facing a green signal they "may proceed across the roadway within any marked or unmarked crosswalk," unless a pedestrian-control signal directs otherwise (p. 128). Once they have the light, pedestrians have right-of-way in the crosswalk and "the driver of a vehicle shall yield the right-of-way, slowing down or stopping if need be to yield to a pedestrian crossing the roadway within a crosswalk" (p. 138). But pedestrian right-of-way in the crosswalk is not absolute, but is preferential and somewhat partial (see section on right-of-way in crosswalks below). Furthermore, the placement of pedestrian-only signals can be of mixed benefit. While pedestrians share right-of-way with cars when faced with a green traffic signal, some pedestrian signals are actuated (by push button or sensor). So while pedestrians may otherwise have the right to proceed, they cannot cross if a pedestrian-control signal directs otherwise, and must push the button and wait for the next cycle.

Bicycles have the same rights and duties as vehicles in the intersection, as they do elsewhere on the roadway. Their turning movements therefore are governed by the same standards. But in making a left turn, the UVC treats bikes separately, and specifies two different ways to turn. They can turn and signal like vehicles under Article VI—which provides for "required position and method of turning" and proper turn signaling (p. 142). But under Article XII it specifies another option in which bicycles remain to the far right of the roadway, cross the intersection, stop "as much as practicable out of the way of traffic," and only then "yield to any traffic proceeding in either direction" on the roadway they're currently using, before proceeding in the new direction (p. 169). When turning in intersections bicyclists may join the flow of cars, but otherwise proceed carefully around the outside of intersections in deference to cars. In intersections, like roadways, bicyclists do not really have the same rights as other vehicles, and assume greater duties.

Thus intersections are complex environments where the UVC seeks to impose order by assigning preferential right-of-way under different circumstances, often communicated via signs and signals controlling the roadway. Like the rest of the roadway, the intersection is first and foremost a vehicular space. But this must be shared with other users. Because pedestrians are by law directed to cross at intersections and crosswalks, the UVC grants them right-of-way within the crosswalks, though conditioned by certain duties of care. Similarly, bicycles also have the right to traverse intersections, if under more limited circumstances than cars. In theory, these arrangements produce a fair distribution of access and mobility, depending on their engineering and traffic control, but with the underlying assumption that vehicular mobility is paramount.

Right-of-Way in the Crosswalk

Like intersections—of which they are typically part—crosswalks are among the most complicated roadway spaces, shared by pedestrians and drivers (and even bicycles and wheelchairs). Recall the UVC defines crosswalks as that portion of the roadway within "connections of the lateral lines of the sidewalks on opposite sides of the highway measured from the curbs" or the "extension of the lateral lines" of a sidewalk on just one side (NCUTLO 2000, p. 3). But crosswalks also include "any portion of a roadway at an intersection or elsewhere distinctly indicated for pedestrian crossing," which can include so-called "mid-block" crossings separate from intersections.

The UVC does not explicitly define the crosswalk for one type of user, but instead uses ROW to define the space based on circumstances. When signals aren't in place, drivers "shall yield the right-of-way, slowing down or stopping if need to yield to a pedestrian crossing the roadway within a crosswalk" (p. 138). Crosswalks may traverse the vehicular roadway, and are typically striped on asphalt between the curbs, but in many ways are an extension of the sidewalk network and its pedestrian spaces.

The pedestrian's right to the crosswalk is preferential, except when signals control otherwise, and not categorical. The UVC requires drivers to yield only "when the pedestrian is upon the half of the roadway upon which the vehicle is traveling, or when the pedestrian is approaching so closely from the opposite side of the roadway as to be in danger" (p. 139). Pedestrians have preferential right, but cars may traverse this space so long as they are on the opposite side and danger of collision is not immanent. Further, the UVC states, "No pedestrian shall suddenly leave a curb or other place of safety or run into the path of a vehicle which is so close as to constitute an immediate hazard" (ibid.). The pedestrian has preferential rights over automobiles, but only over a portion of the crosswalk, and shares a burden of care to proceed carefully.

Under Article XII of the UVC, bicycles may use crosswalks, where not otherwise prohibited, but shall yield right-of-way to pedestrians within them and give an audible warning when passing. Those in wheelchairs or other human-powered vehicles within a crosswalk shall have the same rights and duties as pedestrians in those same circumstances (p. 170).

The law poses certain conundrums, however. Crosswalks are defined in relation to sidewalks, and exist at such intersections whether marked or not, implicitly granting pedestrians right-of-way at all intersections. But sidewalks are often absent, meaning crosswalks do not exist except where otherwise marked, and that right disappears. And even when crosswalks are present, how can the pedestrian secure right-of-way from the curb? If they are not yet "upon the roadway," then right-of-way still belongs to the cars. To exercise the right-of-way in the crosswalk, pedestrians must leave the curb and enter the roadway, placing their bodies in the path of vehicular travel. Cars legally need not yield to pedestrians waiting by the curb. Pedestrians have the choice to wait for a break in traffic when that comes, or trigger their right-of-way by stepping out carefully. This again is commonsensical—pedestrians ought not run in front of cars—but is at the same time contradictory, often leaving pedestrians with a right to the crosswalk they may not be able exercise without bodily risk or voluntary deference by drivers. Can one be said to have a right, if it means one must yield to others first until exercising it?

And the UVC, again, does not mandate the marking of crosswalks at all. Where sidewalks are absent on both sides, or are not marked at all, the pedestrian's implied right to the crosswalk legally disappears. Outside marked crosswalks or unmarked intersections crosswalks the geography of the open roadway reappears, with its emphasis on vehicular rights and pedestrian duties, a space where every pedestrian "shall yield" to vehicles. By law, the existence of a roadway by definition implies the preferential rights of vehicles. But crosswalks (like sidewalks) are legally subsets of the roadway and not intrinsic to it, making the installation of such spaces—and the pedestrian's preferential right to them—contingent on the decisions of roadway designers.

STATE STATUTORY VARIATIONS ON THE UVC THEME

The UVC is not itself law, but it becomes effective through its adoption via state statutes. These vehicle or transportation codes, adopted by state legislators, vary in structure and content. But at the core of each are the "Rules of the Road" modeled closely after the UVC. In some states the UVC has been adopted whole cloth, and all its language of rights and duties is faithfully replicated. There are, however, certain nuanced variations worth noting. What follows is not a comprehensive survey of state statutes, but a sampling of how particular states further define and expand upon (or limit) the rights and duties of particular users.

Defining Right-of-Way

State definitions for right-of-way typically mirror the language of the UVC, though with interesting variations. Minnesota's Vehicle Code defines right-of-way broadly as "the privilege of the immediate use of highway" (Minn. Stat. § 169.011). Ohio's Revised Code reads like the UVC, but elaborates as the right "to proceed *uninterruptedly* in a lawful manner" in preference to another (Ohio Rev. Code § 4511.01, emphasis added). Other states maintain the exact definition in the UVC but emphasize that right-of-way is counterbalanced by duty of care. Within Idaho's definition of right-of-way, the legislature states that "this term shall not be interpreted to mean that a highway user is relieved from the duty to exercise reasonable care at all times and from doing everything to prevent an accident" (Idaho Code Ann. § 49–119). Oregon's "Rules of the Road for Drivers" also begins by stipulating "[n]one of the provisions of the vehicle code relieve a pedestrian from the duty to exercise due care or relieve a

driver from the duty to exercise due care concerning pedestrians" (Or. Rev. Stat. § 811.005).

The UVC's overall allocation of the right to the ROW—between cars, bikes, pedestrians—is in force across all 50 states. But some have begun to redefine these. California's Vehicle Code's "Rules of the Road" was in 2001 amended to specify "safe and convenient pedestrian travel and access ... be provided to the residents of the state" (Cal. Veh. Code § 21949). And citing the "paramount importance" of reducing congestion and emissions, it has specifically provided for a greater diversity of users, including pedicabs, motorized scooters, personal assistive mobility devices, and so on (Cal. Veh. Code § 2125–21282). Other states have expanded the range of potential users, but for different reasons. Northerly states like Vermont, for example, permit the use of public highways by snowmobiles as long as they are no closer than five feet from the plowed portion (23 V.S.A. § 3206). Others like Arizona have specifically defined "Golf Carts and Neighborhood Electric Vehicles" and adopted legislation mandating they yield the right-of-way to vehicles traveling in the same direction and intending to turn to the right (Ariz. Rev. Stat. § 28–777).

Crosswalks

The right to the crosswalk remains consistent across states, but some have defined crosswalks slightly differently to expand pedestrian rights. For states like Washington this includes a more encompassing definition of the crosswalk that does not require presence of adjacent sidewalks, whose state Traffic Codes define "[c]rosswalk to mean both that portion of the roadway between the intersection area and a prolongation or connection of the farthest sidewalk line" or "in the event there are no sidewalks then between the intersection area and a line ten feet therefrom" (Wash, Rev. Code § 46.04.160). And while most states follow the UVC in granting to pedestrians preferential rights to only one side of the crosswalk, California offers more categorical rights to the entire crosswalk (Cal. Veh. Code § 21949). And addressing to some degree the conundrum in which pedestrians must enter the roadway to activate their right to the crosswalk, Oregon statutes specify "a pedestrian is crossing the roadway in a crosswalk when any part or extension of the pedestrian, including but not limited to any part of the pedestrian's body, wheelchair, cane, crutch or bicycle, moves onto the roadway in a crosswalk with the intent to proceed" (Or. Rev. Stat. § 811.028). Some such states now place handheld flags at either end of mid-block crossings or uncontrolled intersections, allowing pedestrians to communicate and activate their right-of-way without needing to step bodily into the roadway.

Other states, however, deviate from the UVC in ways that limit pedestrian rights. Massachusetts have narrowed the definition of crosswalks by specifying that outside controlled intersections, drivers need only yield to pedestrians crossing "within a crosswalk marked in accordance" with state highway standards (Mass. Gen. Laws Ch. 89, § 11). And Arizona elaborates on the UVC to say that pedestrians must move "expeditiously" along the right half of the crosswalk (Ariz. Rev. Stat. § 28–795).

Bicycles

States deviate from the UVC most around the topic of bicycles. All states grant bicycles the same rights and duties as vehicles, unless specified otherwise. But states like Minnesota recognize that bicycles are distinct, and exempts them from "those provisions of this chapter which by their nature cannot reasonably be applied to bicycles" (Minn. Stat. § 169.222). And they frequently also ascribe different rights to bicycles depending on where they are operated. Minnesota grants to bicycles on the roadway the same rights/duties as other vehicles, but a person lawfully operating a bike on a sidewalk or crosswalk "shall have all the rights and duties applicable to a pedestrian under the same circumstances" (Minn. Stat. § 169.222).

While cars and bicycles are both legally vehicles on the roadway, they operate at different speeds. States, like the UVC, address this by requiring bikes to ride as close as practicable to the right-hand curb. But given the dangers that result from close passing, many states have amended their vehicle codes. Many have introduced safe passing laws for vehicles, like the New York statute reading "The operator of a vehicle overtaking, from behind, a bicycle proceeding on the same side of a roadway shall pass to the left of such bicycle at a safe distance until safely clear thereof" (NY Veh. & Traf. L § 1122-a). Oregon's codes define "safe distance" to mean a distance "sufficient to prevent contact with the person operating the bicycle if the person were to fall into the driver's lane of traffic" (Or. Rev. Stat. § 811.065). But sometimes bicycles move more quickly than cars, particularly in urban environments. So while the UVC generally requires all vehicles—including bikes—to pass on the left, Massachusetts provides a bicycle operator "may keep to the right when passing a motor vehicle which is moving in the travel lane of the way" (Mass. Gen. Laws Ch. 89, § 11B). Vermont statutes state bicyclists upon a roadway "shall exercise

due care when passing a standing vehicle or one proceeding in the same direction" while generally riding as near to the right side of the highway (23 V.S.A. § 1139).

And with the growth in bicycle lanes, states have developed relevant ordinances not found in the UVC. Many now require that bicyclists use such lanes where available. Florida statutes require bicyclists moving at less than the "normal speed of traffic" to ride in bike lanes or as close as practicable to the right-hand curb (FLA. STAT. § 316.2065). California's Vehicle Code Division 11 "Rules of the Road" prohibits cars in bike lanes but also requires bikes to remain within them except under specific circumstances.

A notable variation to the UVC is the so-called Idaho Stop, in which that state's motor vehicle laws permit bicyclists to merely slow down for stop signs and "only if required for safety, stop before entering the intersection." Cyclists must slow to a reasonable speed or stop, yield the rightof-way to any vehicle constituting an immediate hazard, before proceeding. At stop lights, cyclists must stop, but can "proceed through the steady red light with caution" after having yielded right-of-way (Idaho Code Ann. § 49–720). The law—which gives cyclists a chance to clear intersections, especially where traffic sensors fail to detect them—has helped reduce accident rates in the state. Though considered by legislatures elsewhere, other states have been slow to adopt Idaho's model. But many have recently enacted "dead red" laws permit bicyclists and motor scooters to proceed through a red signal when it fails to change, typically because vehicular sensors do not actuate the signal. For example, Indiana is one state that permits bicycle operators to proceed if they come to a complete stop for at least 120 seconds and exercise due care by "otherwise treat(ing) the traffic control signal as a stop sign" (I.C. § 9-21-3-7).

Oregon, known nationally for its bike friendliness, has added to its traffic statutes a new Class A misdemeanor "Vehicular assault of bicyclist or pedestrian," defined as "recklessly" operating a vehicle in a manner that results in contact between the person's vehicle and a bicycle, which causes physical injury to the person operating a bicycle or the pedestrian (Or. Rev. Stat. § 811.060).

Disabled Persons, Mobility Devices, and Other Modes

Codes increasingly recognize the rights and duties of modes beyond cars, bicycles, and pedestrians. Wheelchairs, for example, have been traditionally defined as "human-powered vehicles" and treated like pedestrians.

But with new technologies, particularly those that serve an aging and disabled population, codes have started to diversity. Florida, like California, has specifically developed "Traffic regulations to assist mobility-impaired persons" that specify whenever such a person is crossing a public street and here it does not specify marked crosswalk—drivers must bring his/her vehicle to a full stop before arriving at the intersection. And those using motorized wheelchairs may leave the sidewalk temporarily "to avoid a potential conflict, if not alternative route exists" (FLA. STAT. § 316.1303). Minnesota statutes also require motorists to stop for any blind pedestrian "carrying a cane predominantly white or metallic in color, with or without red tip, or using a guide dog," but specifies it shall be unlawful for "any person to carry a white painted cane unless said person is a blind person" (Minn. Stat. § 169.202). Indeed, Minnesota has made special provision for specific crossings for disabled persons and senior citizens (§ 169.215), as well as the power of localities to provide extra time than that provided by the MN MUTCD (§ 169.2151).

States also provide for other modes not necessarily related to mobility impairment, but which serve those other than drivers, cyclists, or pedestrians. California interestingly provides specifically for the rights and duties of those riding animals (same as) applicable to drivers, and gives right-of-way to them at bridle path/equestrian crossings (Cal. Veh. Code Div. 11).

THE ROLE OF COMMON LAW IN BALANCING "RIGHTS AND DUTIES"

The UVC and state statutes establish "rules of the road" by allocating both mobility rights and duties. Duties receive less statutory emphasis, but their relevance comes to the fore after accidents, when someone has failed to yield and fault (and perhaps penalties) must be assigned. The common law of torts includes judge-made rulings that establish civil liability following accidents. As noted in this chapter's introduction, duties refer to the obligation of persons to respect the safety and property of others (Owen 1995, p. 7), usually by forbearing to do something (Calnan 2009, p. 8). As part of a "two-sided compromise" between right and responsibility, duty imposes "obligations to specific obligees, creating in the obligee a personal right against or power over the obligor, and imposing upon the obligor a personal vulnerability to that power" (p. 8).

Failure to meet that obligation can take two forms. First is so-called intentional torts or strict liability for illegal or intentionally harmful acts

(35). But it also arises where individuals do not exercise "reasonable care" when doing otherwise legal things, what is known as "negligence" or "behavior that creates unreasonable foreseeable risks of injury" (Wright 1995, p. 250). Judges must therefore interpret statutory intent and perform a multifactor analysis to determine liability. Sometimes responsibility is even shared between the injurer and injured, known as "contributory negligence" (Calnan 2009, p. 50). Indeed, accident victims can be partially negligent if they do not exercise duty of care. Failure to obey statutory rules of the road does not establish liability per se, but it merely provides to the courts "evidence, prima facie, of negligence which the jury may consider in connection with all other relevant proven facts" (Counihan v. J. H. Werbelovsky's Sons, Inc., 5 A.D.2d 80, 168 N.Y.S.2d 829, 1957).

Traffic codes are state statutes, but negligence cases are questions of state law heard by judges in various states. How these legally define the balance of rights and duties not only establishes fault/civil settlement claims, but also sets precedents that further clarify statutory rules of the road. And because duties establish obligations, they establish an expectation that is akin to a right (on the part of the obligee). A quick review of key concepts in traffic liability law, illustrated by examples of different states, can help us better understand rights and duties on our local streets.

Roadway Rights and Duties

Rights to the roadway, established by traffic statutes, are clarified by case law. Across all states, for example, the vehicular preferential right to the open roadway is echoed by the courts. And though communities may try to modify the rights of particular users—as Black Hawk, Colorado, did when it tried to use home rule authority to ban bicycles from certain city roadways—the courts reaffirm statutory "rules of the road" over conflicting local codes (Webb v. City of Black Hawk, 2013 CO 9 Colo. Feb. 4, 2013). But in exercising their rights, people must also respect their obligations or duties to each other, since the roadway is a risky space. For example, Oregon rulings going back to 1925 recognize that statutes requiring drivers to "look out for and give right-of-way" to certain other vehicles in intersections may seem "more or less arbitrary," but are motivated both to protect all parties, making "the obligation of the rule ... constant so long as possible danger of collision exists" (Ramp v. Osborne, 115 Ore. 672, 239 112, 1925). The Supreme Court of Hawaii puts it bluntly: "right-ofway provided under the state traffic code is not absolute and cannot be

exercised with impunity under all circumstances" (*Samson v. Nahulu*, 136 Haw. 415, 363 3d 263, 2015).

State case law varies in balancing rights and duties on the open road. Statutes establish the preferential right-of-way of motorists outside intersections and crosswalks, and the obligation of pedestrians to yield. Some states interpret this balance of rights and duties in a relatively extreme way. The Ohio Court of Appeals has ruled "a driver of a vehicle owes no duty of care to a pedestrian who walks into the path of the vehicle in an area not marked by a crosswalk, therefore violating the driver's right-of-way" (Snider v. Nieberding, Clermont Ap No. CA2002-12-105, 2003-Ohio-5715). Furthermore, a driver is not required to look for pedestrians or vehicles violating their ROW, but instead is only required to exercise due care once the driver discovers a dangerous or perilous situation (Deming v. Osinki, 24 Ohio St.2d 179, 1970). Other states strike a different balance. California's Appellate Court acknowledges the vehicle's statutory right-of-way outside the crosswalk, and the pedestrian's "higher degree of care while crossing between intersections," but makes clear pedestrians are not negligent per se for jaywalking, but instead courts must determine whether "judgment by a pedestrian when crossing a street, as to the speed and danger of an approaching vehicle constitutes contributory negligence" (Lang v. Barry, 71 Cal. Ap 2d 121). Again, Hawaii's Supreme Court puts it simply: "common sense and general negligence principles require a reasonable driver to look out for pedestrians given the foreseeable range of danger and gravity of possible harm ... all drivers have a duty to look for 'special hazards' with respect to pedestrians or other traffic, and must act reasonably under the circumstances" (Samson v. Nahulu, 136 Haw. 415, 363 3d 263, 2015).

Sidewalk Rights and Duties

Courts—like legislatures—also reiterate the pedestrian's preferential right to the sidewalk, which can be applicable to bicyclists, and the vehicle's duty to yield. But rulings are often less clear. Maine's Supreme Court has ruled that sidewalks may be for the exclusive use of pedestrians and not vehicles, but argues "the degree of care required of each as a matter of law is the same, for each is required, whether on the sidewalk or in the street, to observe the care that the ordinarily careful and prudent person would observe" (*Young v. Potter*, 133 Me. 104 Me. 1934). And while Ohio statutes give bicyclists similar rights to pedestrians on the sidewalk, in some places municipal codes prohibit adults from riding "on sidewalks adjacent

to streets with a speed limit of under 35 miles per hour." Thus courts found a cyclist struck by a car backing from a driveway had no rights and instead "breached a duty of care towards himself" (*Leizerman v. Kanous*, 181 Ohio Ap 3d 579 [Ohio Ct. Ap, Lucas County Mar. 20, 2009]).

Crosswalk Rights and Duties

The crosswalk is by statute a place where the pedestrian's right is preferential, but courts have made clear this right is also balanced against duty of care. Ohio Courts of Appeals rulings state this is "a preferential but not an absolute right in favor of the pedestrian ... such a pedestrian is still under the legal duty to exercise ordinary care for his own safety" (Farley v. Allan, 1981 Ohio Ct. Ap, Montgomery County Oct. 26, 1981). California Appellate Courts have also ruled that pedestrians may have a "walk" signal and ROW, and the street may be clear to cross, but it must exercise due care "at all times while crossing the street" (Lang v. Barry, 71 Cal. Ap 2d 121), what is known as "continuous duty of care." Where pedestrians have sought to assert a categorical right to the entire crosswalk, court rulings in New York and elsewhere find "a traffic regulation that would require all vehicles to slow down or stop every time a person was on any part of a street crossing would jam traffic and be unreasonable," and where "both parties held an equal right of passage through the intersection" it's a matter for courts to determine whether these parties exercised reasonable care (Schaffer v. Gambetta, 261 A.D. 132 [N.Y. Ap Div. Jan. 17, 1941]). But New York Appeals Courts nonetheless reaffirm that once a pedestrian has started to cross with a green light in her favor, "she had the right to continue to the other side of the street" (Counihan v. J. H. Werbelovsky's Sons, Inc., 5 A.D.2d 80 N.Y. Ap Div. 1st Dep't Dec. 17, 1957). Courts in Washington state have likewise found that "bicyclists, though not pedestrians, were to be treated akin to pedestrians" when using crosswalks akin to pedestrians, and thus have preferential rights and are owed a "duty of continuous observation" by motorists (Pudmaroff v. Allen, 138 Wn.2d 55 [Wash. June 3, 1999]).

Governmental Duty to Maintain Streets and Sidewalks

Many have sued public entities like cities for their allegedly negligent design and maintenance of public streets. Because streets are public spaces, state statutes in Illinois as elsewhere establish "a local public entity

has the duty to exercise ordinary care to maintain its property in a reasonably safe condition for the use in the exercise of ordinary care" by those people permitted or entitled to use the property in a reasonable manner (Ill. Rev. Stat. 1987, ch. 85, par. 3–102a). However, local governments are commonly exempt from liability for injuries arising "out of an act or omission of the public entity or its employees," except if the harm was caused by a dangerous condition known to that government (California. Gov. Code, § 815).

Failure to safely operate and maintain public streets can, under certain circumstances, constitute a "breach" of the government's duty of care to an "intended and permitted user of the property under the control of the city" according to the Illinois Supreme Court (Wojdyla v. Park Ridge, 148 Ill. 2d 417 Apr. 16, 1992). In designing streets according to statute for vehicular use, localities are potentially liable for injuries to motorists driving or parking their cars (Curatola v. Niles, 154 Ill. 2d 201 Ill. Jan. 28, 1993). Pedestrians are not, however, owed any duty of care on the street outside crosswalks because "roads are paved, marked and regulated by traffic signs and signals for the benefit of automobiles." Pedestrians who cross at mid-block are not "intended users" and are not owed duty of care (Wojdyla v. Park Ridge, 148 Ill. 2d 417 Ill. Apr. 16, 1992). Appellate courts in Ohio have ruled that municipalities can be liable for such injuries that happen in poorly designed crosswalks (e.g. inadequate timing) or a "faulty condition or nuisance which creates an unreasonable risk of harm, which in due course results in injury to another" (Hart v. Blue, 1982 Ohio Ap LEXIS 13234 Ohio Ct. Ap, Franklin County June 29, 1982). Pedestrians may be owed duty of care within crosswalks, but courts in Illinois and elsewhere have longstanding case law that municipalities are not required to provide improvements such as lights or crosswalks (Freeport v. Isbell, 83 Ill. 440 Ill. 1876). Another Illinois case similarly makes clear bicyclists may possess the same statutory rights and duties of drivers, but only on a street "marked or signed to suggest that it was intended for use by bicycles" does the city have a duty "to provide safe passage," otherwise bicycle use is merely "permitted" and cyclists are owed no duty of care by municipalities (Latimer v. Chi. Park Dist., 323 Ill. Ap 3d 466 [Ill. Ap Ct. 1st Dist. June 12, 2001]). In another conundrum for bicyclists, the same Illinois Court has ruled that on sidewalks cyclists are permitted and not intended users, and thus owed not duty of care by cities (Diefendorf v. City of Peoria, 308 Ill. Ap 3d 465 [Ill. Ap Ct. 3d Dist. Nov. 3, 1999]).

Still more complicated is the sidewalk, which has historically been considered part of the street, but is often both physically owned and maintained by the owner of underlying land. For much of history the municipal duty of care to maintain streets free of nuisances and obstructions extended to the sidewalk, and its intended user the pedestrian. According to rulings in New York, for example, local and state governments have "a duty to design, construct, and maintain its highways in a reasonably safe condition in view of traffic conditions to be expected as well as a host of other criteria" including providing "pedestrians with a reasonably safe place to travel" and failing to correct a defective condition after constructive notice, established negligence (Sanford v. State, 94 A.D.2d 857 N.Y. Ap Div. 3d Dep't May 12, 1983). However, in Ohio as elsewhere, cases make clear "a municipal corporation is not an insurer of the safety of persons in the use of its streets and sidewalks" and "cannot be held responsible for injuries caused by every depression, difference in grade, or unevenness in sidewalks" (Kimball v. Cincinnati, 160 Ohio St. 370 Ohio 1953). And where sidewalks are excluded by statute from the definition of the roadway—as recently done in Ohio—governmental duty of care to pedestrians is still further limited: "maintenance and repair of sidewalks is a governmental function for which the City is immune" (Hahn v. Redmond, 2008-Ohio-5002 Ohio Ct. Ap, Summit County Sept. 30, 2008).

MOBILITY JUSTICE AND THE "RULES OF THE ROAD"

The street is a space of legal rights and duties. Statutes not only define the purpose of the street, but also allocate rights and obligations among different users. Laws therefore play a fundamental role in shaping how we as human beings relate to each other on the vast and interconnected system of public roadways. We defined a just street as a space that fairly distributes the rights and responsibilities of mobility, maximizing access for all while reducing inequity between people and modes, produced through transparent and democratic decision-making that enhances the capabilities of diverse individuals. If we believe in greater social justice among the mobile, then it behooves us to take a hard look at the "Rules of the Road" established by the UVC, how these are replicated or adapted by states, and interpreted by judges. These not only govern "proper" forms of mobility, but also negatively reinforce the improper, while providing the basis for how streets are designed and engineered. If we want to answer the question "who has a right to the street?" we might best start with the "Rules of the Road."

So who *does* have the right to the street? By statute all modes of transportation—motor vehicles, bicycles, pedestrians, even animals—have a right to travel along or across the highway, except where specifically prohibited (e.g. interstates). The street may be defined principally for purposes of vehicular travel, but it is a shared space which diverse users have a right to access. The law, as we saw in Chap. 3, allocates those rights differently in different roadway spaces: the open roadway is defined for vehicular travel, sidewalks are for pedestrians. But diverse users can access those spaces: pedestrians can walk across and along streets, cars can drive across sidewalks, bicyclists can share the road with cars or sidewalks with pedestrians, and everyone can access crosswalks. In principle, at least, all streets are shared streets.

The right to be mobile is not equal but relational, however. At the heart of the UVC is the concept of right-of-way: the "right to proceed in a lawful manner in preference to another vehicle or pedestrian" (NCUTLO 2000). The necessary counterpoint to that right is the obligation of others to yield. And counterbalancing rights is the duty of care, the obligation to forbear from doing something to prevent accidents. Statutes suggest everyone has a right to the street, but the allocation of rights and duties says something different.

At this point in this book it is already redundant to say that, according to the statutory "Rules of the Road," the right-of-way on the public street belongs most fully to the motor vehicle. The vast majority of roadway space is open road between intersections, where the preferential right belongs to the car. Bicycles may also be vehicles, but they are marginalized to the edge of the roadway and may only occupy the full lane when there is insufficient width for cars to pass safely. And pedestrians too may walk along the street, but only when sidewalks are absent, and then only on the shoulder or roadway edge. Pedestrians may also cross the street at any point not prohibited by law or controlled by signal, but only by yielding to vehicles. On the roadway, according to the UVC, faster and bigger users should have right to "proceed uninterruptedly" (as stated in the Ohio Revised Code, for example), and slower and more vulnerable users must yield and move to the side. Roadways are defined not only spatially but also temporally in terms of "normal speed," making vehicular travel the norm before which all other uses must yield. Furthermore, vehicles have relatively limited duty of care, while non-motorized users must assume a greater burden of care to avoid accidents (and their own harm). Such a distribution of rights and duties is hardly fair, because it maximizes access for some users at the

expense of all others, and reinforces already profound inequities between motorized and other forms of transportation. Traffic statutes are passed by legislatures, which we presume to be democratic, but merely reproduce the model UVC of the NCUTLO, which largely represents highway departments and other vehicular interests.

Injustice in how roadway spaces are allocated by mode is therefore reinforced and compounded by the distribution of rights to those spaces, including by courts after the fact of accidents. And while local governments owe a duty of care to intended users of public facilities, that duty is not distributed evenly. In defining and constructing roadways for vehicles, governments have a duty to provide safe and unobstructed movement to motorists alone (and pedestrians and bicyclists, as permitted but not intended users, are owed none). Thus the asphalt roadway not only dominates most public ROWs *spatially* but also *legally*, giving motorists preferential rights and limited duties, and allocating to them greater government duty of care to ensure their safe passage.

Statutes do however define spaces like sidewalks and crosswalks for pedestrians, and grant them preferential ROW. On the sidewalk, pedestrian rights are fairly categorical. But the presence of a sidewalk for pedestrians to exercise those rights is not guaranteed: many, if not most, roadway segments in the US lack any sidewalk, making this preferential right meaningless. Governments are typically not under any legal obligation to provide such facilities. And while governments owe duty of care to motorists upon the roadway their duty to pedestrians on the sidewalk is typically less because the sidewalk is often on private property (and some states like Ohio have even redefined the street to exclude the sidewalk). The crosswalk is more complicated still. Pedestrians within the crosswalk have rightof-way unless signals command otherwise, and cars must yield. But they do not have a right to the entire crosswalk, but typically only that half they are upon. And they must physically be in the street to trigger that right, though they many not leave the curb so suddenly as to pose an immediate hazard. And pedestrians in crosswalks exercising their right to the crosswalk must maintain a "continuous duty of care" and can be "contributorily negligent" if they fail to do so. That preferential right exists at any intersection with sidewalk approaches—defined by the UVC as a crosswalk, even if unmarked—but most drivers are probably unaware of their obligation to yield, making crosswalk markings essential for communicating the duty of vehicles to yield. Again, however, local governments are under no obligation to mark crosswalks in the first place. Pedestrians are owed duty of care on sidewalks or crosswalks, but only if they are provided and their hazards known to public authorities. Bicycles, permitted but not intended users on both the street and the sidewalk, are owed duty of care on neither. So statutes may suggest equity in shared use, but upon closer inspection reveals the more limited rights of the non-motorized. Only on sidewalks, where installed, do pedestrians have fullest preferential rights and reduced duties. Elsewhere they must literally step carefully.

The law, which in theory establishes the sharing of roadway spaces, reveals fundamental inequities in how rights and duties are distributed upon them. Human beings in motor vehicles are entitled to broad rights to mobility along the roadway, and their obligations to yield and show duty of care to others is limited to subspaces like crosswalks. Pedestrians and bicyclists have preferential rights to limited subsets of the roadway, but often such sidewalks and crosswalks and bike lanes are not present. And even within them they must assume continuous duty of care for their own safety. Such legal structures are not fair in principle, providing a major foundation for injustice on the roadway.

Such injustice is compounded when we recall the basic asymmetries between pedestrians, bicycles, and motor vehicles. The average American human weighs approximately 160 pounds, and walks between three and four miles per hour. Cyclists may approach 200 pounds, and travel 15-20 miles per hour. But even compact cars in the US weigh between 2000 and 3000 pounds (sport utility vehicles or light trucks 3000–4000 pounds) and travel at permitted speeds between 25 and 70 mph, depending on the roadway. If force equals mass times velocity, then one can imagine how asymmetrical is the relationship between mobile human bodies and vehicles, and how vulnerable non-motorized users are. Even at 25 mph 12% of pedestrians struck by cars are killed, at 30 mph that increased to 20%, and at 40 mph nearly half of all pedestrians die (Tefft 2011). To treat cars and pedestrians in the crosswalk more or less equally, for example, may seem equitable by law but is less so in practice. Early case law recognized this imbalance by assigning proportionally more duty of care to vehicles. But today the law's strategy for handling this asymmetry—giving larger and faster vehicles right-of-way, and forcing pedestrians and cyclists to the roadway margins (for their own safety)—reinforces rather than mitigates this asymmetry.

A just roadway might prioritize protection of its most vulnerable users, or at least use the law to mitigate the physical inequalities between cars and other users, but that's not how statutes currently work. And courts, when interpreting case law to establish liability, are as likely—if not more so—to assign greater duty to vulnerable users *because* they are vulnerable. That's certainly not what we might call mobility justice on the American street.

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CHAPTER 5

Engineering the Roadway as Space of Flow

The street, though a legal space codified by legislators, is a physical land-scape designed and constructed through engineering. The modern street is a form of high-performance infrastructure, a kind of conduit carefully designed to channel high volumes of rapid, heavy vehicular traffic. It is hardly a surprise engineers play a fundamental role in shaping the roadway. But the public right-of-way (ROW) is not just physical infrastructure but also a complex social space, guiding and informing the behavior of diverse users. In designing material streets, roadway engineering therefore translates legal and cultural norms into physical places, which in turn reproduce particular social relations. Engineering may appear as a technical and apolitical discipline, but it must be considered a central element in the politics of mobility on the modern street. To understand mobility rights and just streets, we must critically analyze roadway engineering, its underlying assumptions about what and who street networks and spaces are for, and how exactly these are translated into the material streets we traverse.

In this chapter, I outline the principles and practices of roadway engineering in the US, and how these imagine and design the American street. I begin with a brief historical overview of the co-evolution of the American roadway with the discipline of civil and traffic engineering, how the Good Roads Movement of the early twentieth century gave rise to key organizations like the American Association of State Highway Transportation Officials (AASHTO), the National Committee on Uniform Traffic Control Devices (NCUTCD), the Transportation Research Board (TRB), and the

Federal Highway Administration (FHWA). Analyzing the mission, organization, and role of these organizations provides a window into the social (and power) structures behind roadway design in the US. But of more direct relevance are the engineering standards themselves, developed by these organizations—and adopted by federal, state, and local governments—to guide the construction and control of everyday streets.

Most important among these standards is the so-called bible of roadway engineering, AASHTO's (2011) A Policy on Geometric Design of Highways and Streets or the "Green Book." This "comprehensive reference manual" for planning and administering "efficient and safe roadways" textually and graphically defines the purpose of the street, its proper uses, and standards for design. It uses geometry to imagine the physical roadway as conduit for travel, much as the science of fluid dynamics informs the design of water distribution systems. I therefore analyze how AASHTO systematizes the street network as hierarchy, spatial characteristics of different kinds of design users, design elements of street spaces, and their so-called cross-sectional elements, and applies these to roadways based on roadway hierarchy and geographic context. Close engagement with this 800-page manual—its overarching assumptions as well as technical details—shows how ideologically laden discourses about mobility and the street are translated into geometric spatiality and applied through the materiality of asphalt.

But if geometric design structures the street as conduit, the TRB's Highway Capacity Manual (HCM) (2014) provides scientific methods for understanding and planning for the capacity of traffic flow to assess the "quality" of service these facilities provide. Such analysis and projection of traffic volumes is critical to both the operation and geometric design of roadways under AASHTO standards, making engineering approaches to highway capacity worthy of close attention. The discourses and techniques of the HCM help define how traffic engineers conceive of and judge the function of roadways, allocate mobility within them, and design street spaces to match. Critically analyzing them provides conceptual insight as well as practical tools for engaging the obscure yet influential work of traffic engineers.

Together AASHTO's *Policy on Geometric Design* and the TRB's HCM play enormously powerful roles in shaping the public space of the street, reflecting and reinforcing how people relate to each other and their built environment. They shape the materiality of the street networks and spaces, which are then further controlled by the signs, markings, and signals of the Manual of Uniform Traffic Control Devises (MUTCD) (discussed in

Chap. 6). If critical mobilities scholars wish to understand how political and legal understandings of mobility take material shape in the street, structuring social relations as well as rights and justice, they might start with the technicalities of engineering. And for planners and advocates wishing to construct a more just street, knowledge of engineering standards can help move beyond critique to contest and perhaps reform the powerful, obdurate, but strategically central processes shaping actual roadways. By entering the sphere of the civil engineer, we can better understand and perhaps challenge the assumptions and techniques that produce streets.

HISTORICAL EVOLUTION OF ROADWAY ENGINEERING AND DESIGN

The Good Roads Movement and the Rise of the Traffic Engineer

The increasing volume and complexity in traffic in the nineteenth century (described in Chap. 3) prompted rethinking of how roadways were regulated and designed. In New York City, for example, pioneering traffic expert William Eno not only wrote new "rules for the road" (traffic codes or ordinances) but also developed engineering solutions, helping create the first professional organization of traffic engineers in the US (McShane 1994, p. 185). New rules like wide left turns at intersections paralleled experimentation with rotary traffic circles, utilizing barriers, signage, and markings—backed up by police enforcement—to rationalize chaotic intersections. Leadership in innovation soon passed from such amateurs and the police to engineers. Networks of civil and newly hired "traffic" engineers began to confront traffic with new research techniques of systems analysis (e.g. traffic counts) and controls (e.g. signals). Ultimately, McShane notes, "engineers, not police, would develop the traffic rules" (p. 200).

With the rise of civil engineers came increasing redefinition of traffic as engineering problem, what the editors of the *Engineering News-Record* called a "new view of traffic control" (quoted in Norton 2008, p. 202). Where the automobile had been considered inefficient and intrusive, requiring strict regulation and policing, engineers came to suggest a shift from regulation to instead "change the physical factor" (ibid.). By the late 1920s, civil engineering not only produced a new branch of highway engineering, but also further specialization in urban traffic. Against the backdrop of wider policy shifts surrounding the

street—embodied by the National Conference on Street and Highway Safety—new engineers undertook increasingly bold redesign of roadways for a motor age, with new gasoline tax revenues at their disposal. The formalization of a new Institute of Traffic Engineers in 1930 marked the culmination of a profound "completion of a transformation in city traffic management" (p. 204). Where once police had been charged with regulating the public street for efficient and equitable use by diverse users, by mid-century "highway engineers were the leading city traffic experts" (p. 245).

American Association of State Highway Transportation Officials

From the "Good Roads Movement" also emerged what was to become perhaps the most influential voice in the design of American roadways: today's AASHTO. When the federal Office of Public Roads created a new American Association for Highway Improvement in 1912, a group of state highway officials formed their own American Association of State Highway Officials (AASHO) in 1914. Its original constitution stated AASHO's purpose to "study the various materials, methods of construction and maintenance, and other highway problems," exchange ideas, and promote relationships among state highway departments toward greater uniformity and efficiency (Weingroff 2014). AASHO was an early and consistent advocate for a national system of highways funded by federal aid administered by states, leading to the Federal Aid Road Act of 1916. From the beginning, AASHO and the federal government have maintained a close relationship, indeed one of the first and longest-serving directors of the US Bureau of Public Roads was a state highway engineer (ibid.).

AASHO not only played a leading role in planning America's system of federal-aid highways, but also developed signage and marking conventions for all US roadways. AASHO helped lead a Joint Board on Interstate Highways in 1925 to define a system of numbered US highways, and develop a uniform system of signage to designate the highway network (a US shield) and promote safety upon it (e.g. STOP, CURVE, SLOW, etc.) (ibid.). In 1929 AASHO published a *Manual and Specifications for the Manufacture, Display, and Erection of U.S. Standard Road Markers* (AASHTO 2017, p. 2), paralleling an urban-focused effort by the National Conference on Streets and Highway Safety.

But AASHTO plays an even more fundamental role by developing criteria for how roadways are engineered and constructed. In the early twentieth century different states and cities adopted distinct design strategies. From

its founding AASHO created a Committee on Standards to create uniform standards of construction and maintenance, such as width, surfacing materials, and pavement thickness (Weingroff 2014). While the committee first reported to states, by the late 1920s its "standards of practice" were used by roadway engineers in all jurisdictions. In the 1930s and 1940s it published "geometric design policies" for new roadway construction and maintenance, addressing issues like hierarchical roadway classification, geometry and pavement widths, and intersection design (ibid.). These were combined by 1950 in *Policies on Geometric Highway Design*, which focused on highways and rural roadways.

By mid-century the organization's scope expanded to include both highways and urban streets, and was renamed the AASHTO. Since 1984, its *A Policy on Geometric Design of Highways and Streets*—commonly known as the "Green Book"—has combined rural and urban guidebooks to serve as the roadway engineering "bible" in the US. Engineers working for states, counties, cities, and developers use AASHTO's Green Book to design roadways ranging from interstate highways to local neighborhood streets. AASHTO's myriad of other publications on various aspects of traffic engineering, for example separate manuals for the design of pedestrian and bicycle facilities, have become standard in training and guiding American traffic engineers.

In recent decades AASHTO's mission has grown to focus on all five transport modes—air, highways, public transportation, rail, and water—and its "primary goal is to foster the development operation, and maintenance of an integrated national transportation system" (AASHTO 2017). It maintains an array of committees to inform transportation policy and technical design standards. But as AASHTO's scope has become more multimodal, its directorship remains limited to the US Secretary of Transportation and state transportation departments, who are more concerned with wider-scale highway networks than local streets (and their diverse users). And its technical standards remain centered on the development of the highway system. AASHTO's work now guides diverse transport systems for diverse users, but it was born of the movement for uniform highway networks, and its initial bias toward highways for cars remains built into the organization itself.

Transportation Research Board

The engineering reinterpretation of the American street from public space to transportation conduit also required a new field of scientific inquiry to support it. In 1920 a National Advisory Board on Transportation Research—renamed the Highway Research Board in 1925—was founded to exchange information on emerging highway technologies (Transportation Research Board 2016). If the street had once been understood as social space, for interaction and commerce and even play, new research understood the street to be a physical engineering challenge tackled through geometry and physics. And while the TRB originally served merely as clearinghouse, by the 1960s its scope grew to encompass continuing research management addressing multiple modes. Renamed the Transportation Research Board since 1974, it has expanded its mission to include promotion of "innovation and progress in transportation through research" (ibid.). Today the TRB provides a major point of engagement for thousands of engineers, scientists, and transportation professionals, financially supported by state transportation departments, and federal agencies like the US DOT, among other organizations. Like AASHTO, the TRB is not a governmental agency and its policies are not legally enforceable. But like AASHTO's Green Book and other publications, the work of the TRBespecially its Highway Capacity Manual—reflects the combined thinking of state and federal transportation officials, and provides a deeply established guide shaping customary best practice, and is cross-referenced to federally enforced standards like the MUTCD. These manuals, written by highway engineers outside of government, have enormous influence on how public streets are designed and administered.

Engineering Roadway Spaces: AASHTO's A Policy on Geometric Design of Highways and Streets

The Street as Geometric Space

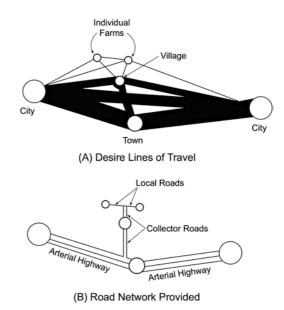
Perhaps the most fundamental text in roadway engineering and design is the AASHTO's *A Policy on Geometric Design of Highways and Streets*. This comprehensive manual analyzes and systematizes the geometry of the roadway, translating concepts about proper use and function into three-dimensional design recommendations. Though ostensibly "technical," its text reveals underlying ideologies that guide traffic engineering and its designs show how these should be materialized in physical space.

The core ideology of traffic engineering is made clear in the Foreword to the Green Book, which states that "these geometric design guidelines are intended to provide operational efficiency, comfort, safety, and convenience for the motorist" (AASHTO 2011, p. xlii, emphasis added). It recognizes growing emphasis on joint use of transportation corridors with pedestrians, cyclists, and transit vehicles, and that designers should recognize implications of sharing transportation corridors to consider not only vehicular movement but also movement of people, distribution of goods, and provision of essential services. And it suggests consideration of environmental quality should be combined with aesthetic consistency to "provide highways that are safe and efficient for users, acceptable to non-users, and in harmony with the environment" (ibid.).

Despite these allusions to the street's shared use and place functions, the body of the manual begins by classifying highways functionally based on motor vehicle characteristics. Theorizing travel as a set of distinct movements—main movement, transition, distribution, collection, access, and termination—it envisions a hierarchical network of facilities classified based on mobility/movement or access. It recognizes the tension between mobility and access, and meeting the needs of access "causes a limitation of mobility" (p. 1-7). These are balanced differently depending on the geographic context and roadway hierarchy. Within urban areas, AASHTO specifies four systems: principal arterials that prioritize mobility and limit access, minor arterials that distribute travel to smaller places and put greater emphasis on land access (and thus offers lower traffic mobility), collector streets that provide land access and traffic circulation in neighborhoods and commercial areas, and local streets that primarily permit direct access to abutting lands and often discourage through traffic (pp. 1–11 to 1–12). These functional classifications provide the basis for the geometric design criteria in the Green Book (see Fig. 5.1) (ibid.).

Having theorized the spatial structure of the overall roadway network, the Green Book then establishes the operational characteristics of its distinct users as spatial and geometric "criteria to optimize or improve the design" of highways. If the street is conduit, the vehicle is the basic unit of flow. It categorizes different classes of vehicles (e.g. cars, trucks, motor homes), and then seeks to standardize a so-called design vehicle within each class around which the roadway should be designed. Because the size of different vehicles in each class varies, it sets proportions and characteristics that err toward dimensions and turning radii larger than most in its class (p. 2–1), and encourages engineers to consider the largest design vehicle likely to use any facility with frequency. For example, it imagines a Passenger Car Design vehicle, 19 feet long and 7 feet wide, with a maximum steering angle of 31.6 degrees, to establish a minimum turning radius

Fig. 5.1 Streets are classified within a functional network of arterial, collector, and local roads. From *A Policy on Geometric Design of Highways and Streets*, 6th edition, 2011, by the American Association of State Highway and Transportation Officials, Washington, DC. Used by permission



of 21.8 feet (see Fig. 5.2) (p. 2–6). It specifies design vehicles in each class, including city buses, tractor trailers (single, double, and triple combinations), and even motor homes towing boats. The policy then establishes standards for vehicle performance (acceleration and deceleration) for such design vehicles, as well as human factors of driver performance based on age, driving tasks (e.g. guiding the vehicle, detecting and reacting to information), and error.

AASHTO aggregates vehicles and drivers as "traffic" defined geometrically. One key measure for traffic is volume, measured by average daily traffic (ADT) or by a peak-hour traffic counts. Another includes characteristics such as directional distribution, composition (cars vs. trucks), and speed. Arguing there are predictable interrelations between traffic volume, speed, and density that can guide design, the Green Book defines capacity as the maximum hourly rate at which people/vehicles can traverse a section of roadway during a given time under prevailing conditions. It analyzes and operationalizes capacity as design volume projected for a hypothetical design year 10–20 years in the future (p. 2–61). It defines a major objective of highway design to "create a facility with dimensions and alignment that can serve the design service flow rate" defined as the peak 15-minute period of the design hour. Although it states the ideal goal of

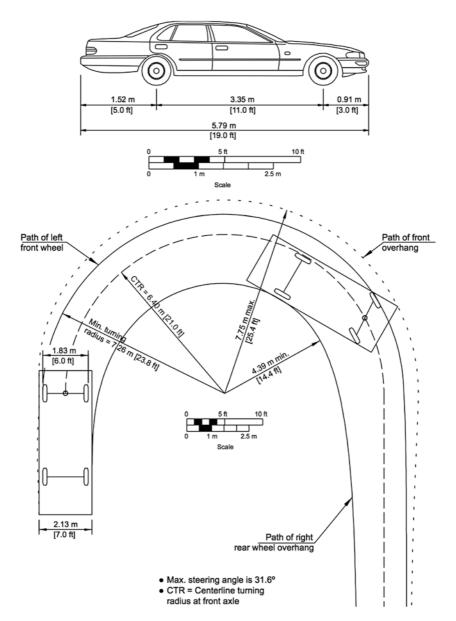


Fig. 5.2 Roadway geometry is built around the basic unit of the "design vehicle," in this case a passenger car. From *A Policy on Geometric Design of Highways and Streets*, 6th edition, 2011, by the American Association of State Highway and Transportation Officials, Washington, DC. Used by permission

"a well-balanced, economical highway" (ibid.), it uses maximalist standards to design the roadway around the largest vehicles and the highest traffic volumes.

Having defined the street as a conduit to serve design service flow rates (p. 2-61), the engineering problem to be solved naturally becomes congestion or "restriction or interference to normal free flow" (p. 2–62). The Green Book's discussion of acceptable degrees of congestion is illuminating. It understands each user would ideally would like exclusive right to the highway, but notes "users recognize that if others are to share in the costs of transportation facilities, they are also entitled to share in their use." Users will accept a moderate amount of congestion, but how much depends on relative factors. Equating motorist and user, the manual suggests drivers are more likely to accept some congestion when costs to alleviate it are high, or when trips are short, and will be dissatisfied when traffic volume approaches capacity. Designers seeking an appropriate degree of congestion thus must weigh desires of motorists against the resources available to satisfy them (p. 2–63). In its discussion of these key priorities, however, AASHTO only considers the desires of motorists, and what motorists may consider acceptable.

AASHTO thus uses congestion to define the quality of traffic service, cross-referencing the *Highway Capacity Manual* (HCM) discussed later in this chapter. So-called level of service (LOS) is a key measure defined by speed and travel time, freedom to maneuver, traffic interruptions, and comfort and convenience (p. 2–66). I discuss LOS in more depth later, but in brief AASHTO and HCM give an "A" to facilities that operate with "free flow," a "B" for "reasonably free flow," a "C" for "stable flow," a "D" for "approaching unstable flow," an "E" for "unstable flow," and an "F" for "forced or breakdown flow" (ibid.). The LOS system, in using a grading system familiar to any school child, not subtly values free flow over stoppage. And while it contains no recommendations for appropriate LOS, and recognizes the importance of context, it argues highway agencies should strive for the highest LOS possible (ibid.).

AASHTO design controls and criteria do ultimately acknowledge users and design considerations apart from vehicles. It calls pedestrians "a major consideration," since they are part of the everyday roadway environment and because they are "lifeblood of our urban areas" (p. 2–78). The manual also describes a typical—if not exactly a design—pedestrian who walks between 0.8 and 1.8 m (2.5–6 ft) per second, tends to choose the shortest distance between two points, avoids grade/elevation changes, and is more

unpredictable than motorists: the manual complains many pedestrians "consider themselves outside the law in traffic matters," making "it difficult to design a facility for efficient pedestrian movements" (p. 2-78). It discusses but does not elaborate upon a Walkway LOS analogous to that on the roadway, imagining an optimal speed and density under which the sidewalk will serve the greatest volume. And it recognizes the interruption in pedestrian flow posed by intersections, and thus the importance of intersection design for reducing pedestrian-vehicular conflicts. But if pedestrians may have the statutory ROW in mid-block crosswalks or otherwise uncontrolled intersections, it nonetheless argues "pedestrians need to wait for suitable gaps in the traffic to cross" and efforts to reduce crossing distance must still meet "reasonable roadway and intersection capacity needs" for vehicles (p. 2-80). The policy also focuses briefly on persons with disabilities, arguing accessible features can "greatly enhance the mobility of this sector of our society" (p. 2-81), referring readers to the separate AASHTO Public Rights-of-Way Accessibility Guidelines. And it dedicates half a page to bicycles as "an important element for consideration" in highway design, leaving more detail to AASHTO's (2012) Guide to Development of Bicycle Facilities. And last (and perhaps least), AASHTO's discussion of design controls concludes by arguing the importance of highway location and design decisions on adjacent development, and that environmental variables be given "full consideration," though the entirety of this section is two paragraphs.

Elements of Design

Having established underlying performance metrics, the AASHTO *Policy on Geometric Design* establishes what it calls the basic elements of design, which literally shape the spatial environment and experience of the roadway, producing "great impact on the environment, the fabric of the community, and the highway user" (AASHTO 2011, p. 3–1). These include characteristics like sight distance, superelevation, width, grade, and horizontal and vertical alignments. This is where roadway design is most explicitly and fully a science of geometry, analyzing and visualizing mobility in terms of direction, mass, and velocity taking place within the three dimensional space of the street.

The Green Book again equates users with drivers to understand the proper use of the roadway in terms of rapid vehicular movement. For example, in discussing sight distance the Green Book guides designers to a sufficient length so drivers can control their vehicles to avoid striking unexpected objects and be able to stop (based on brake reaction time and distance), pass other vehicles (based on speed), and make decisions at complex intersections (p. 3-2). The criteria for measuring sight distance are based fundamentally on the height of driver's eye, as well as the 3D spatial context. Another element is horizontal alignment designed to operate at a design speed "likely to be observed under the normal conditions for that roadway for a vast majority of motorists" and the curvature of the roadway, understood through basic laws of mechanics that govern vehicle operation on curves (p. 3-18). Calculating design speeds and stopping distance in relation to sight distance, it establishes standards for the vertical curvature of roadways for safety as well as "passenger comfort" (p. 3-159). Finally, it argues for careful combination of horizontal and vertical alignment to enhance vehicle control, encourage uniform speed, and improve appearance (p. 3-165). All of these design elements—and thus the basic geometry of the street—are calculated exclusively around the operational need of motor vehicles (see Fig. 5.3).

Cross-sectional Elements

Especially critical to the geography and spatial allocation of the roadway are so-called cross-sectional elements, which include all elements of highways or streets from "right-of-way line to right-of-way line" (AASHTO 2011, p. 4–1). Within this encompassing lateral space are a set of distinct subspaces, including the traveled way (portion of the roadway for the movement of vehicles, exclusive of shoulders and bicycle lanes), roadway (portion of a highway, including shoulders for vehicular use), shoulders, and roadside. The spatiality and design of these elements help channel longitudinal flow of traffic down the roadway, and bound mode-specific spaces.

While the street can be defined by its ROW boundaries, AASHTO approaches street cross sections from the centerline outward. AASHTO begins with the fundamentally vehicular space of the traveled way to describe proper materials and crown and lateral slope. Lane widths, furthermore, influence driver comfort, operational characteristics, likelihood of crashes, and LOS (p. 4–7). While AASHTO does not acknowledge fully the role of lane widths in the lateral allocation of limited street space, it provides more flexibility than many engineers realize. AASHTO recommends widths between 2.7 and 3.6 m (9–12 ft), with 12 ft being "predominant on most high-speed, high-volume highways" (p. 4–7), and

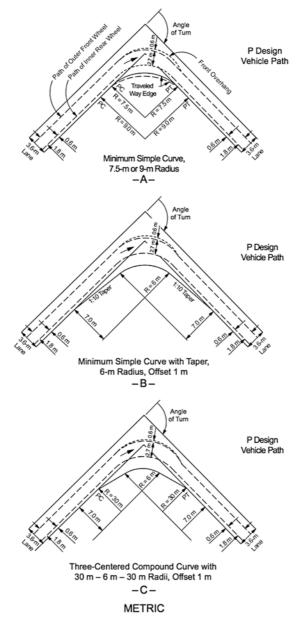


Fig. 5.3 The needs of design vehicles—like turning radius—shape street spaces. From *A Policy on Geometric Design of Highways and Streets*, 6th edition, 2011, by the American Association of State Highway and Transportation Officials, Washington, DC. Used by permission

notes that narrow lanes affect LOS by forcing drivers to operate closer than they'd desire. But the manual is clear urban streets with pedestrian crossings and limited ROW space may be more appropriately served by 3.3 m [11 ft] lanes, even accepting lanes 3.0 m wide [10 ft] on low-speed facilities, and lanes as low as 2.7 m [9 ft] in residential areas. Recognizing the challenge of balancing vehicular and bicycle travel, AASHTO suggests narrower lanes on multilane roadways may permit space for bike lanes (p. 4–8). Local engineers may often hew to a roadway—consuming 12 ft. standard for vehicular travel lanes, but the AASHTO's Green Book shows no bias toward wider lanes, and is open to narrower lanes that allow shorter pedestrian crossing distance and can permit bike lanes.

Outside the traveled way are shoulders and roadside facilities like curb/ gutter. Shoulders are contiguous with the traveled way to accommodate stopped vehicles, emergency use, lateral support for the roadway surface, and "in some cases, the shoulder can accommodate bicyclists" (p. 4-8). Last listed among these functions is the opportunity they provide for nonvehicular users in rural areas where sidewalks are typically absent, though spaces for bicycle and pedestrian use are aggregated with occasional vehicle encroachment, mail delivery, and detouring of traffic construction (p. 4-9). The width of shoulders is determined by use, and the goal of allowing stopped vehicles to clear the roadway, leading AASHTO to recommend a minimum shoulder of 3.0 m [10 ft] as the standard for higher speed/volume highways. Where bikes and pedestrians are to be accommodated, the minimum width should be 1.2 m [4 ft]. But even the "roadside" beyond the traveled way and shoulder is not really engineered for alternative modes, but instead prioritized for "clear zones" for recovery of errant vehicles, and in crowded urban areas to provide lateral offset from vertical obstructions like power poles. As AASHTO imagines the roadway, everything—from the centerline to shoulder to the roadside—is engineered to accommodate vehicles: speeding down the roadway, broken down, or errantly traveling off the road.

As the border between traveled way (for vehicular flow) and roadside space (for pedestrian sidewalk travel and nonmobile urban life), the curb serves an important socio-spatial role. AASHTO cites the purpose of curbs to include drainage control, delineation of roadway edge and pedestrian walkways, ROW reduction, aesthetics, and orderly roadside development (p. 4–16). Traditional vertical curbs are intended to discourage vehicles from both driving too closely and leaving the roadway, providing a hard-edged barrier for pedestrians, but AASHTO discourages their use on

higher speed roadways where an "out-of-control vehicle" may overturn or become airborne. Sloping curbs, on the other hand, are designed to ease driver discomfort, protect impacting vehicles, and allow vehicles to cross them "readily when need arises" (pp. 4–18 to 4–19). Curb design therefore represents a choice about how vehicular and pedestrian spaces—and uses—are separated.

The last key cross-sectional element in the Green Book are pedestrian facilities. It recognizes "sidewalks are an integral part of city streets," and though rarely provided in rural areas would be effective in reducing pedestrian collisions. It sets sidewalk widths depending on urban context and volume of pedestrians. While in residential areas sidewalks may vary from 1.2 to 2.4 m [4–8 ft], if sidewalks are less than 1.5 m [5 ft] then the passing sections should be installed periodically for accessibility. It suggests a buffer strip of 0.6 m [2 ft] be created between sidewalk and roadway, and where absent sidewalks should be 0.6 m [2 ft] wider than the minimum width. AASHTO notes the justification for sidewalk construction depends on vehicle-pedestrian conflicts, and admits that pedestrian traffic volume warrants for sidewalks have not been established, but states "in general, wherever roadside and land development conditions affect regular pedestrian movement along a highway, a sidewalk or path area, as suitable to the conditions, should be furnished" (p. 4–56). And even though pedestrian traffic may be light, sidewalks should be constructed on any street that lacks shoulders, particularly if they connect nearby urban areas. These statements, in the context of the Green Book's overall autocentrism, are quite strong in defense of pedestrian facilities. Furthermore, it references laws like the Americans with Disabilities Act of 1990 to stipulate "facilities for pedestrian use be readily accessible to, and usable by, individuals with disabilities" (p. 4-61). It then proceeds to mandate facilities like curb ramps, detectable warnings, and maximum cross slopes. It states that curb ramps should not be limited to intersections and marked crosswalks, but also at other points of pedestrian concentration like mid-block pedestrian crossings, supplemented by additional warning signs (p. 4–62).

Finally, cross-sectional elements include facilities for bikes, pedestrians, and parking. In a three-paragraph section on bicycles, AASHTO makes the broad—if debatable—statement "most of the facilities needed for bicycle travel are provided by the street and highway system as it presently exists" (p. 4–66). But it does recognize at certain locations or corridors that dedicated bikeways may be appropriate to supplement the existing highway system, in accordance with the AASHTO's *Guide for Development of Bicycle Facilities*. It also recognizes the increasing importance of mass

transportation and the potential of bus turnouts to remove the bus from the traveled way, providing designs for buses to decelerate, stand, and merge back into the flow of traffic. And, finally, while emphasizing the primary function of roadways remains vehicular movement, it acknowledges land use conditions may necessitate on-street parking in some locations. As part of the cross section, AASHTO sets desirable dimensions for parking lanes depending on the roadway hierarchy: from 2.4 m [8 ft] on urban collectors to 2.1 m [7 ft] in residential neighborhoods.

Ultimately, the width of roadways powerfully shapes the allocation of street spaces to different modes, and such distributions are a simple matter of arithmetic. These cross-sectional dimensions help explain why streets in many communities have a fairly standard 10.8 m [36 ft] width, including two travel lanes of 3.3 m [11 ft] and 2.1 m [7 ft] parking lanes on each side. But because on-street parking demands in many residential neighborhoods are low (zoning often already mandates off-street parking), AASHTO recognizes a 7.8 m [26 ft] roadway can be sufficient in many urban residential areas, since random intermittent parking on both sides usually allows safe but careful two-way movement (p. 4–74). Again, while much of AASHTO's Green Book errs on the side of overdesigning roadways around vehicles, in allocating widths it provides more flexibility for narrower and calmer roadways than many alternative transportation advocates—and even local engineers—may realize.

Applying Geometric Design to Hierarchical Roadways: Engineering Access or Flow?

Having laid out general principles to guide design of street spaces, AASHTO's *Policy on Geometric Design* applies these to different roadways based on functional classification.

LOCAL ROADS AND STREETS: ACCESS OVER FLOW

Local roads and streets are designed to provide access to abutting properties, while serving a limited amount of local through traffic. Given their limited volumes and extent (they constitute a high proportion of total roadway mileage in the US), AASHTO describes their design criteria as "of a comparatively low order," but should serve predictable traffic operations consistent with development abutting the ROW (AASHTO 2011, p. 5–1). Recognizing the importance of context and link between transportation

and land use, it suggests urban street design be guided both by functional classification and community planning, using design criteria appropriate for planned development (ibid.). In this sense design features are "constrained" by practical limitations like development patterns limiting available ROW and underlying zoning restrictions. In terms of cross sections, AASHTO accepts low minimum widths of traveled way (18–24 ft based on design speed). And while recommending two travel lanes, loss of convenience from having only one unobstructed travel lane in residential areas is "remarkably low." And AASHTO is very flexible on lane width for local streets, recommending travel lanes of 3.0 to 3.3 m [10–11 ft] and intersection turning lanes of least 2.7 m [9 ft], depending on percentage of trucks (pp. 5–12 to 5–13). To accommodate pedestrians, it specifies sidewalks on both sides in commercial areas or near public facilities, and on at least one side in residential areas (p. 5–15). It calls local streets "generally sufficient" to accommodate bicycle traffic, but where facilities are desired it refers readers to the AASHTO's Guide for the Development of Bicycle Facilities. And it highlights the importance of lighting to facilitate both vehicular and pedestrian traffic, though defining visibility in terms of "fundamental needs of motorists" (p. 5-22).

Collector Roads and Streets: Flow Over Access

Collector roadways serve moderate traffic volumes like local streets, but combine aspects of local streets and arterial thoroughfares. The collector serves a duel function of collecting traffic for movement and providing access to adjacent property (p. 6–1). In urban environments the collector like the local street—is a "public facility for vehicular travel" but also serves bicycle and pedestrian traffic. Because the function of the urban collector is divided between mobility and access, striking this balance is a challenge, particularly since access can impede both through mobility and create conflict with sidewalk users. But expediting traffic mobility is the major goal (p. 6-11). In cross section, the ROW should accommodate planned roadway, shoulder, border area, bicycle facilities, and so on and should be wide enough to include "the ultimate number of lanes for moving traffic, parking and bicycles, including median width where appropriate" (p. 6-13). Typically, two travel lanes of 3.0-3.6 m [10-12 ft] are sufficient, but number of lanes should be determined by capacity analysis in a future design year. Parking is often necessarily to accommodate adjacent development, whose lane widths should consider possible future use

for moving traffic. In terms of pedestrian and bicycle facilities, it specifies sidewalks should be provided "as far as practical from the traveled way" on both sides in commercial areas and where collectors serve public facilities, and on at least one side in residential areas. Minimum sidewalk widths are 1.2 m [4 ft] in residential areas and 1.2 to 2.4 m [4–8 ft] in commercial areas, though it's recommended they be at least 1.5 m [5 ft] (p. 6–16). While local streets and collectors are best suited to accommodate bicycles, no accommodations are recommended other than referring to AASHTO's *Guide for the Development of Bicycle Facilities* (2012) when included. In rural areas, collectors should be designed to include "the most favorable horizontal alignment, profile, and cross section practical, consistent with traffic volume and topography" (p. 6–2). And while rural roads provide local transportation access, there are no recommendations for bicycle or pedestrian facilities.

ARTERIALS: HIGH-VOLUME, HIGH-SPEED THOROUGHFARES

The last segment of the roadway hierarchy shared by multiple types of users is the arterial, which provides high-volume and higher-speed connections between major points. Arterials present a design challenge to balance safe and efficient operations, allow accessibility to adjoining properties, and serve motor vehicles as well as alternative modes (p. 7–1). Arterials are primarily conduits designed for flow, but they naturally attract major private and public uses. Imagine your local state highway strip that connects downtown and suburbs with nearby exurbs and rural areas, and the major retailers and schools and neighborhoods that line it. These community uses generate local travel by diverse users, vehicular and non-vehicular alike, but must traverse roadways designed for throughput. These tensions and contradictions of arterials are on display in their design.

In urban areas, arterials have the principal objective of balancing large volume with limited access (p. 7–27), since "such access service should ... not unduly hinder the arterial's primary function of serving major traffic" (ibid.). AASHTO recommends planners "protect" desired LOS from anticipated strip development or location of new traffic generators, but optimistically suggests a "well-designed arterial can complement such development" and provide desired LOS (ibid.). These are typically wide and multilane highways, with four to eight through lanes combined across a span adequate to include travel lanes, medians, curbs, and so on. Widths of individual lanes may vary from 3.0 to 3.6 m [10–12 ft]: wider lanes are desirable on "high-speed, free-flowing, principal arterials" but

11 ft lanes can have certain advantages in interrupted flow and lower speed conditions (allowing for more lanes within a constrained ROW, shorter pedestrian crossing times, and reduced construction costs) (p. 7–29). And given complex movements involved in arterial intersections, AASHTO emphasizes the importance of a signal system that safely serves traffic demands of all users at an appropriate LOS (p. 7–44).

Though urban arterials are designed for vehicular throughput, AASHTO recognizes the need to accommodate alternative modes. Pedestrian accommodations "should" include sidewalks, crosswalks, and sometimes grade separated crossings, depending on pedestrian and vehicular traffic. AASHTO recognizes the problem of conflicts between pedestrians and vehicles at major intersections (p. 7–41), which can be reduced by shortening crossing distances and other "adequate" pedestrian crossing treatments (p. 7–44). Crosswalks at unsignalized intersections may be provided in heavily traveled areas, since "enforcement of a ban on pedestrian intersections at an intersection is very difficult" (p. 7–42). In terms of bicycles, the Green Book notes that bicycle usage "can be expected" on urban arterials and "should be considered" in their design through features like wider outside lanes (with or without shared lane markings), bike lanes, and shared use paths. Furthermore, intersections should have timing and markings to facilitate bicycle clearance and turning movements (p. 7–41).

In rural areas, arterials range from two-lane highways to multilane controlled access highways. While number of lanes is determined by volume and other factors, travel lanes should be no less than 3.6 m [12 ft]. Access should be limited to provide better traffic service, prioritizing long-distance mobility, but AASHTO recognizes these rural arterials "often provide the only direct connection between populated areas and locations to which the public wishes to travel" (such as schools, parks, and rural housing) (p. 7–25). The Green Book acknowledges bicycles and pedestrians may also wish to travel to these same destination points, where demands for non-motorized travel exist the designer "should" consider their needs and "provide facilities where appropriate" (ibid.).

Intersections

The AASHTO's Green Book concludes with a lengthy (300-page) discussion of intersections—areas where two or more highways join or cross—and those "intersection legs" that radiate from them (p. 9–1). Intersections are critical features as focuses of activity, conflicts between diverse modes, sites of traffic control where "movement of users is assigned," and thus

potential limits on the capacity of intersecting roadways (p. 9-2). Broadly, the geography of intersection design encompasses not only the physical area where roadways overlap, but also the functional area in which users approach, perceive and react, maneuver, and often queue. AASHTO defines the main objective of intersection design to "facilitate the convenience, ease, and comfort of people traversing the intersection while enhancing the efficient movement" of vehicles, bikes, and pedestrians (p. 9-4). While roadways are understood to be primarily for vehicular movement, AASHTO approaches intersections as spaces of intermodal interaction, which should "achieve balance among the needs of all roadway user groups" (p. 9–5). In dense urbanized areas, for example, priority is given to pedestrians and vehicles while trucks are given "basic accommodation," but in a suburban highway cars and trucks may be prioritized and basic accommodation given to alternative modes. AASHTO cautions that design elements for one group of users has consequences for others (with consequent trade-offs) and intersection design is also of direct interest to owners of adjacent lands (pp. 9-5 to 9-6).

Like roadways themselves, intersections are defined by their capacity and other design elements. Capacity is still defined in terms of maximum hourly volumes, so the role of intersections in stopping or slowing or otherwise "interrupting" traffic is significant. Capacity and LOS are in turn shaped by intersection design, including their alignment, sight distance, turning patterns, and so on. Intersections are categorized by their number of legs and degree of channelization separating "conflicting traffic movements into definite paths" (p. 9–9). AASHTO recommends alignment should be as straight, roads should meet at right angles, and gradients should be as flat as practical (p. 9–25). But intersections vary, so AASHTO develops complex tables for the geometry of sight distance, curve radii, and so on for different design vehicles and contexts. Over 150 pages of roadway geometry guide how intersections should be designed, traffic flows structured, and conflicting trajectories reconciled.

But these traffic designs are premised on vehicles as the basic unit of flow, and the travel patterns of other modes limited to "Other Intersection Design Considerations." Only after frontage roads does AASHTO address the specific concerns of bicycles in one short paragraph, stating "when onstreet bicycle lanes or off-street bicycle paths or both enter an intersection, the design of the intersection should be modified accordingly" (p. 9–180), referencing its *Guide for the Development of Bicycle Facilities*. Pedestrians are also addressed in a short paragraph listing the kind of pedestrian facilities that exist, and recommending that when curbs or adjacent sidewalks

are planned to accommodate pedestrian traffic, "proper attention" be given to location and design of traffic ramps and traffic control devices to accommodate the disabled. Though the Green Book recognizes the intersection to be a shared space of conflicting flows, the spatial needs of pedestrians and bicyclists are mere coda to a geometry entirely based on the car.

Analyzing and Planning Traffic Flows: The HCM

The engineering of streets as conduits is ultimately informed by the science of traffic flows within, known as highway capacity analysis (again analogous to plumbing engineering's relationship to the science of fluid dynamics). Thus geometric design of streets in three dimensions under AASHTO follows from the HCM's "tools for quickly evaluating and comparing the operational effects of alternative design scenarios" (Transportation Research Board 2016, p. V1-i). These are produced by experts on the TRB's Committee on Highway Capacity and Quality of Service, grouped into subcommittees on traffic management, bicycles and pedestrians, freeways and multilane highways, signalized intersections, and more. The manual itself comprises four volumes on concepts, conditions of "Uninterrupted Flow" (e.g. freeways), "Interrupted Flow" (e.g. streets designed with controlled/signalized intersections), and application tools. The performance models included in the HCM, particularly the LOS, are influential tools that shape decisions about how streets should be planned, operated, and maintained.

Purpose and Scope of the HCM

The purpose and scope of the HCM reflect its evolution from planning a new interstate highway system, and its original objective to provide methods for quantifying highway capacity to determine lane requirements (p. 1–1). The scope of the manual has however expanded to provide a reference manual on concepts, performance measures, and analysis techniques for operation of all streets, highways, freeways, and even off-street shared use paths, today including "multimodal operation" (ibid.). Its sixth edition, *Highway Capacity Manual: A Guide for Multimodal Mobility Analysis* (2016), emphasizes the operational performance of several modes, including pedestrians and bicycles, and their interactions (p. V1–i). Its declared purpose is to provide methods for evaluating multimodal performance, both operational measures and quality-of-life, to define performance metrics and survey methods for key traffic characteristics, provide methods for

estimating and predicting performance, and explain those methods. It avowedly "does not establish a legal standard for highway design or construction" (p. 1–4), but its techniques are assuredly operationalized via standards like AASHTO's Green Book. For example, the Green Book mandates engineering study of whether stop signs are warranted, but the HCM provides the methods for those warrants.

Why capacity analysis? As traffic engineers seek to optimize street networks and plan new ones, they design such conduits around current and projected traffic flows. In the short term, operational analysis can guide minor improvements to optimize existing roadways through lane reconfiguration, alternative traffic control devices, signal timing, or the balancing of traffic needs with transit or bike or pedestrian facilities. But the HCM also guides design of new facilities by projecting future capacity and LOS to help determine how many lanes are needed, lane width, and so on. And in longer-term planning of entire roadway systems, the HCM is intended to help screen possible problem locations, make long-range projections, and analyze performance at regional and statewide scales to inform systemic policies and wider transportation investments (TRB 2016, p. 2–4).

Defining Street Networks and Users

The HCM imagines the roadway as a spatial network comprised of points, segments, facilities, corridors, areas, and wider systems (p. 2–7). It defines performance in "six dimensions": (1) quantity measures like person miles; (2) delay or intensity of congestion; (3) quantity of service measured by number of people, and their travel time and distance; (4) duration of congestion; (5) reliability or variability; and (6) accessibility or the ability of people to achieve their mobility goals or use portions of the system (p. 2–10). Within the system, users are categorized as motor vehicles, pedestrians, bicycles, and transit. And it distinguishes between different types of operating conditions associated with different kinds of roadways: these include "undersaturated flow" where cars freely arrive and depart from a segment of the roadway network without delay, "oversaturated flow" where arriving vehicles outnumber departing vehicles and must queue, or "queue discharge flow" where traffic has passed through a bottleneck and has begun to clear (pp. 2–14 to 2–15).

The HCM—like AASHTO's Green Book—theorizes different users by mode, their design characteristics, and how they relate to street space and each other. While the roadway ROW is "allocated among the modes

through the provision of facilities that ideally serve each mode's needs," it recognizes that constraints force engineers and planners "to consider trade-offs" (p. 3-1). Starting with the motor vehicle mode, which comprises "the majority of the traffic stream," the HCM defines the characteristic of light and heavy vehicles, seasonal and daily variations in their demand, and distribution of traffic volume across the roadway network and road lanes. The HCM is all about flow: pedestrians, bikes, and transit are interpreted as a source of delay and reduction in capacity for vehicles. But the HCM also recognizes pedestrians constitute 10% of all trips in the US and are "considerably more exposed than are motorists, in both good and bad ways" (p. 3-22). It emphasizes both quantity and quality of service for pedestrians, making conflict with vehicles at intersections not only a source of pedestrian delay and reduction in crossing opportunities, but also a factor influencing "perception of the intersection's quality of service" (p. 3-25). In terms of bikes, the HCM notes they make up fewer trips in North America than elsewhere, but are used for a variety of trips. The operational characteristics of bikes are both similar to cars (measured similarly by vehicle effectiveness) but also distinct (hindrance). Like pedestrians, bicyclists are perhaps less affected by quantity/capacity than quality of roadway environment, but are influenced strongly by interactions with other modes (pp. 3–29 to 3–31). Transit too is discussed separately, since it plays major roles serving both "choice riders" who have other means available and "transit-dependent" riders who are unable to drive for various reasons. While transit is similar to vehicles, it is understood to be more of a "service rather than a facility" because its availability is limited, making frequency and reliability key measures of quality of service. The patterns of demand for and on-street characteristics of transit are also distinct, and quality of service is highly influenced by other modes: high vehicular volumes can slow transit, and pedestrians and bike can delay buses. But since all transit users are also originally pedestrians (or bicyclists), the quality of service for transit is strongly correlated with that for those other modes (pp. 3–32 to 3–35).

Defining Highway Capacity as LOS

For the highway engineers who wrote the HCM, the highway and its traffic are matters of physics, in which relationships between volume, speed, and density are fundamental (p. 4–1). These relationships contribute to the overall measure of capacity, or the "maximum sustainable hourly rate" at which

people can reasonably travel a roadway segment or point during a given time given prevailing contexts. This "reasonable expectancy" is the basis for defining capacity (ibid.). For vehicles, this is a mathematical question of volume and flow, speed, density of vehicles on a particular roadway segment, and headway or time/space between successive vehicles. The HCM supports deterministic or simulation models of these interrelationships to analyze capacity under distinct circumstances (p. 4–7).

While vehicular volume, speed, and density are at the core of the HCM's concept of capacity, it also develops such concepts for other modes. For pedestrians it generalizes characteristics like walking speed, shoulder width, and walking space to argue the fundamental relationship between speed, density, and volume is "analogous to that for vehicular flow" (p. 4-29). The HCM therefore seeks to generalize capacity concepts for pedestrian circulation, defined when "the maximum flow rate is achieved" and measured as pedestrian per minute per foot of walkway width (p/min/ft). Likewise for bicycles, the HCM struggles to define capacity, since facilities rarely achieve capacity as measured by bicycles/hour/lane (except at major intersections), leading it to suggest capacity be measured in terms of number of effective lanes, as well as delay. For transit, the HCM distinguishes between highway capacity and transit capacity, since transit depends on size and operation of vehicles as well as the roadway. Although the HCM distinguishes between vehicle and person capacity, it emphasizes vehicle capacity at loading areas and bus stops (p. 4-43).

All of these concepts are the foundation for the primary purpose of the HCM: to measure quality of service or "how well a transportation facility or service operates from the traveler's perspective" (p. 5–1). The HCM recognizes that quality measures of a highway facility can include place-based factors like aesthetics, but ultimately the HCM focuses on pure mobility measures including travel time, speed, delay, reliability, maneuverability, and "comfort aspects" (p. 5–2). These are systematized in a much-used measure called level of service (LOS), a "quantitative stratification" to "translate complex numerical performance results into a simple A–F system representative of travelers' perceptions" (p. 5–3) to simplify decision-making and provide a common set of definitions to guide engineers and planners (ibid.). The HCM recognizes the limits of such a model, particularly one that is ultimately simplified into a school grading system, but emphasizes the power of LOS to communicate with nontechnical decision-makers.

LOS is a step function represented by a set of grades, from LOS A representing "the best operating conditions from the traveler's perspective" through to LOS F or the worst. These are modeled by street segment or point/intersection. Historically LOS was only a functional measure of vehicular throughput, but since 2010 the HCM incorporates research on traveler perceptions, particularly for alternative modes, and emphasizes the importance of reporting separately by mode. A blended LOS, while better than traditional measures focused on vehicles, still can tend to overlook quality-of-service issues that discourage non-vehicular modes (p. 5–5), and while the HCM recognizes the shared use of urban streets it still defines service for the motorized vehicle in terms of simple "through-vehicle travel speed" along street segments and "control delay" at intersections (pp. 5–12 to 5–14). For pedestrians it measures service by combining quality of walking along a street, crossing at signalized intersections, and crossing between traffic signals (p. 5–12). For bikes, LOS is defined in terms of the quality of riding along streets and through signalized intersections. And for transit, service measures include traveler perceptions of walking to a transit stop, waiting, and riding in the vehicle (p. 5–13). In theory, LOS has broadened to include a diversity of modal perspectives, but remains a measure of the street as conduit for flow.

LOS, like any model, reflects the decisions and priorities of the model designer. HCM recognizes that such details matter because operational decisions to improve service "can sometimes have an adverse impact on the service provided to another mode" (p. 16-1). The design of the model itself thus matters, but so too does its application, since the HCM defers to analysts "the relative importance given to each mode's LOS," reflecting the street's functional class and purpose (p. 16-3). But ultimately the priorities and biases of LOS are not exactly subtle in prioritizing flow over other street functions. Vehicular LOS defines optimal conditions or LOS A as "free-flow operation," LOS B as "reasonably impeded operation," LOS C as "less stable," LOS E as "unstable operation and significant delay," and LOS F as "extremely low speed" (p. 16-8). The HCM may caution such results must be interpreted carefully since estimates of "true" values reflect variability in measured values and thus uncertainty based on inputs, the estimate itself, and "imperfect model specification" (p. 7-3). And in terms of grading, the HCM appears value neutral in defining LOS F. But any school child knows that F connotes "failure."

The HCM has moved beyond a single performance measure toward a wider range of variables to determine LOS, but vehicular performance

inputs remain dominant. This follows from the auto-centric bias of traffic law and engineering, but also the fact that measures to assess multimodal performance are not as well developed as those for cars. For example, at urban intersections, bicycle performance is based on hard-to-measure "perceived separation between bicycles and motor vehicles" and crossing distance, while vehicular performance is more easily quantified (p. 8–13). Despite the development of multimodal LOS measures, the HCM's grading of roadways remains biased toward high-speed vehicular flow as the definition of a high-quality roadway.

The bulk of the HCM is dedicated to the mathematical calculation of LOS, first on highways designed for "Uninterrupted Flow" (Volume 2) and then urban streets designed for "Interrupted Flow" (Volume 3). These too are revealing. The methodology in Volume 2 analyzes both multilane, separated highways with full control of access "dedicated to the exclusive use of motorized traffic" as well as rural highways that provide local access (p. 10-3). No measures of pedestrian or bicycle LOS are offered for such roadways, because such users are excluded from them. However, the volume on uninterrupted flow does include two-lane rural highways, which provide access to communities and are not limited to cars. But the HCM still provides only very limited attention to bicycle LOS on such roadways and none to pedestrian LOS, while dedicated primarily to vehicular quality of service. LOS A on a rural highway in this case means high speeds (>55 mph), little encumbrance from other cars, and high percentage of free-flow speeds. To the HCM, a good interstate or rural highway is fast and free-flowing, and devoid of obstacles like pedestrians or bikes.

Volume 3 "Interrupted Flow" takes a more balanced view of the urban street, and the HCM details methodologies for evaluating performance for motorists, pedestrians, bicyclists, and transit riders (p. 16–1). And it offers a framework for an integration—if not combination—to aid in the allocation of both ROW spaces and signal timing. The HCM then applies this in depth to a variety of urban street segment and intersection types, providing ways to calculate LOS for each mode in each context. Given the power of LOS models to guide transportation decisions, this is a major step toward more inclusively engineered streets.

But if the HCM helps measure the experience of distinct modes on different parts of the roadway system, it does not actually recommend multimodal analysis per se, and leaves to analysts the decision about the "relative importance" given to each mode (p. 16–3). And the framework for integrating these often-competing uses is more conceptual than operational,

letting designers figure out how best to reconcile levels of service that vary between mode, and rise and fall in proportion to each other. The HCM, despite having evolved to address multiple modes, remains of limited value in determining how best to reconcile their needs. And, most basically, by defining mobility in terms of throughput, regardless of mode, it reveals its core assumptions about the street as space of flow, optimally designed for speed and fluidity.

ROADWAY ENGINEERING AND RIGHTS AND JUSTICE ON THE STREET

Like traffic law, roadway engineering emerged in the twentieth century to both promote a new order among the mobile and physically redesign the street for changing uses. Streets had always been governed by laws and subject to engineering, but the introduction of the automobile prompted a more systematic redesign of the roadway and social and physical space for vehicular travel. The emergence and ultimate hegemony of traffic engineers over the public space of the street, while unsurprising given the challenges posed by car traffic, nonetheless reveals changing thinking and politics of mobility. Indeed, the remaking of the street from public space for diverse uses to vehicular thoroughfare required rethinking not only traffic law, but also what (and who) streets should be designed for. Today these assumptions are manifest in the engineering manuals that powerfully shape roadway design.

If mobility is a question of rights—in the sense of both having legal rights conceptually and the ability to exercise them *practically*—then roadway design matters enormously to the ability of individuals to enjoy their right to the city street. Socially conscious engineering would recognize both the societal dimensions and physical aspects of movement, understanding the roadway to be place as well as thoroughfare, and providing full access for diverse people to share in the public sphere and design process (including development and application of engineering standards). And such engineering would promote mobility justice by producing physical streets that fairly distribute rights and burdens of mobility, maximizing access for all while reducing inequity, enhancing the capacities of the mobile, especially the most vulnerable among us, while promoting more sustainable transportation that recognizes the needs of future generations.

Unfortunately, while the street is a social space, traffic engineering imagines the street primarily as physical conduit for vehicular flow, addressing itself squarely to the physics of movement while largely neglecting their social implications. And where it engages social values, these are interpreted narrowly in terms of operational convenience. But if engineering affects a stance of technical detachment and value neutrality, it is central to shaping social relations among the mobile, and rights and justice among them. How just is the engineered street? Unfortunately, not only do AASHTO standards reflect and operationalize the inequities codified by traffic law, but its geometric design and capacity analysis reinforce and in many ways extend them. As traffic laws define the roadway for the purposes of vehicular travel, AASHTO's geometric design guidelines are explicitly "intended to provide operational efficiency, comfort, safety, and convenience for the motorist" (AASHTO 2011, p. xlii, emphasis added). And while AASHTO standards follow the law in recognizing the diversity of roadway users, developing design parameters for them, the Green Book overwhelmingly imagines and designs the street as space for vehicular mobility. The operational and spatial wants of drivers—speed and free flow—are made central guiding principles of how roads are hierarchically ordered, designed, and street spaces allocated in cross section. The 3D geometry of street spaces is so thoroughly designed around the rapid movement of motor vehicles, and the needs of other users are marginalized, that drivers will not illogically assume the space is theirs and others are inconvenient impediments. The AASHTO's Green Book translates the biases of traffic laws into a system of hierarchically ordered roadways designed to privilege the driver's legal right to the road and desire for speed. And while AASHTO standards provide for other modes, vehicular travel remains the primary purpose—and design mandate—of roadway design, and the needs of other users are voluntarily "accommodated."

AASHTO guides for the design of bike and pedestrian facilities, explored at more length in Chap. 8, represent a major step. But throughout pedestrians or bicyclists are understood to be optional recommendations or even mere information, but not essential features. This scheme ultimately expresses more bias than the law itself. For if traffic codes grant legal rights to diverse users along and across the street, AASHTO's designs for vehicular speed and throughput and motorist convenience can adversely affect the ability of the non-motorized to enjoy their safety and their right-of-way. A pedestrian may have legal right-of-way in an unsignalized intersection, but without a crosswalk that right will be meaningless. A bicyclist

may have a right to share a travel lane, but at design speeds and volumes it may become reckless to exercise that right. Ultimately the emphasis on speed creates a need for separate pedestrian and bicycle facilities, but these are left as optional accommodations. Too often, the natural result are streets that freely enable vehicles to exercise their legal right, at conveniently fast speeds and without interruptions, while leaving little or no safe space for the non-motorized. Such priorities are by definition unjust. Until standards for the non-motorized design are made central and mandated features of roadway engineering, the auto-centric geometric design of AASHTO will remain a major source of injustice on the American street.

These same biases also underpin the TRB's HCM and its LOS measures. Developed to aid in the planning of interstate highways, HCM and its LOS measures are now widely used to analyze, operate, and plan urban streets and intersections. And while it has evolved to address the needs of diverse modes, its grading system explicitly prioritizes speed and convenience and throughput as measures of well-performing streets. An "A" grade signifies uninterrupted and free-flowing speed (a driver's dream but pedestrian's nightmare), and a failing "F" a roadway that is slow and congested (potentially a benefit to pedestrians). This inherently biases the movement functions of streets over their place functions, whatever the mode. And despite the development of diverse LOS measures, ultimately the choice of which model to apply (or not) is within the discretion of the highway engineer. In many communities, vehicular LOS models remain the exclusive measure of intersections and streets. Even in those cases where analysts seek to calculate LOS for all modes, data for vehicular performance is typically more easily gathered and quantified. To the degree quantification of the nonmotorized experience is more challenging than measuring vehicular speed and volume, then application of non-motorized LOS standards less likely.

And, finally, while the HCM provides methods for evaluating LOS by mode, it does not offer any way to integrate them quantitatively. Modespecific LOSs can be compared, but trade-offs among them are hard to analyze. This conundrum has prompted the TRB to sponsor research on "Multimodal Level of Service: Analysis for Urban Streets" testing perceptions of LOS by different users and developing an integrated model capable of quantifying "the interactions of the modes sharing the same street right-of-way" (Dowling et al. 2008, p. 1). Only with such an integrated model can the analysts really test trade-offs of various allocations of the urban street (ibid.). The researchers developed a user's guide written for "potential incorporation" in future editions of the HCM, but to date

multimodal analysis is thus voluntary, and application of vehicle-only LOS remains both common and accepted engineering practice.

In sum, close examination of AASHTO's *Policy on Geometric Design* and the TRB's HCM reveal how evolving assumptions about the street, which emerged from early twentieth century to be codified by law, are today manifest in the engineering standards that shape everyday streets. They reveal how engineering ways of thought have come to dominate thinking about streets, systematized as processes for analyzing, planning, and designing them. These are hardly value neutral. Engineering approaches to maximize vehicular safety and convenience, prioritizing speed and throughput, not only offer a very constrained way to think about these social spaces, but also produce physical streets inequitable in how they serve diverse users. After nearly a century of designing urban streets as conduits for motor vehicle flow, it is time to rethink the strengths and limitations of traditional highway engineering.

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CHAPTER 6

Controlling the Roadway: Signs, Markings, and Signals

Traffic engineering imagines the roadway as conduit for vehicular flow, analyzed and designed through the logics of geometry and physics. It cannot however escape the reality that flows within the system, though many are mechanical, are still human. Ordering is therefore a question of human behavior. Unlike the hydraulic engineering of a pipe to channel water molecules, traffic engineering's pursuit of speed and efficiency and safety and flow can only be achieved if human users behave according to design. In part, this is about translating the law, which exists on the statutory page, into the physicality of the roadway to order how people relate to each other and the street. But although the law sets the basic rules, it cannot govern the often chaotic, moment-to-moment behavior of diverse individuals traversing the street. The safe and orderly operation of streets must come through safe and orderly interrelation along those who walk or "pilot" their vehicles. This is ultimately a communications challenge, for which the geometric designs of AASHTO's Green Book or the capacity analyses of the TRB's HCM are insufficient.

Effective communications require a system of language and symbols, readily seen and comprehended by diverse readers who are in motion, many of whom at great speeds. And given the diversity of users and contexts through which they travel, such a system must be sufficiently established and uniform to prevent confusion. And they must be inscribed on the roadway itself to efficiently capture attention and convey critical information to people making split-second decisions. This is the role of the

MUTCD, developed by the National Committee on Uniform Traffic Control Devices (NCUTCD), an organization representing state and federal highway agencies and other organizations. The MUTCD is both sponsored and enforced by the Federal Highway Administration (FHWA), which requires it or a substantially similar version be adopted by all states and used by federal, state, and local transportation officials. It promotes uniformity in signage, markings, and traffic controls. The federal MUTCD, or state versions that mimic it, provides standards for how the physicality of roadway infrastructure is transformed into a communicative space.

The MUTCD is therefore among the most important texts in roadway design, meriting close attention by critical scholars, planners, and transport advocates alike. Like other manuals, it reveals how engineering techniques give everyday roadways their remarkably and predictably uniform shape. For those interested in the geography of the American roadway, this is important enough. But critical analysis of the MUTCD reveals how particular assumptions about the roadway are manifest in signage, marking, and traffic control standards. Some of this is mere extension of the legal norms and engineering standards explored in prior chapters. But since the MUTCD is so powerful in producing uniformity on the street, and communicating with users about their proper use, it plays its own unique role. And because the signs, markings, and control of the street are plain for all to see—unlike the subtleties of geometric design or technicalities of LOS analysis—they provide highly visible reminders of how traffic engineering enables or constrains our right to streets and particular interactions upon them. Close analysis of the MUTCD is therefore essential not only to understanding structures of mobility equity (or its absence) on the roadway, but also how alternative strategies might communicate—and construct—a more just street.

EVOLUTION OF UNIFORM STANDARDS, FEDERALLY ENFORCED

National Committee on Uniform Traffic Control Devices

Like other highway engineering standards, uniform traffic control manuals are the product of diverse public and nonprofit organizations in close coordination with the federal government. Because the earliest traffic control experimentation happened first in cities and states, initially there was some variability in approaches. Efforts in the 1920s to achieve some uniformity in traffic rules (producing the UVC) and roadway geometry (AASHTO's

Green Book) also addressed the challenge of uniformity in signage, marking, and control/signalization. Since 1932 these were combined in a Joint Committee on Uniform Traffic Control Devices, representing state highway departments (via AASHO), city and other transportation officials (formerly convened as the National Conference on Streets and Highway Safety, or NCSHS), automobile and other interests, and later the Institute of Traffic Engineers. In 1935 the joint committee assumed responsibility for drafting a comprehensive Manual on Uniform Traffic Control Devices for Streets and Highways (MUTCD) (American Association of State Highway and Transportation Officials 2017, p. 2), which the federal government published and adopted as its standard for all federal-aid highways after 1961. By the early 1970s the joint committee became an "official advisory committee" to the FHWA, and the FHWA administered the MUTCD. Formally reorganized in 1980 as the NCUTCD, it represents an evolving host of sponsoring organizations, which regularly updates the MUTCD and recommends it to the FHWA (ibid.).

Today the NCUTCD works to "assist in the development of standards, guides and warrants for traffic control devices and practices used to regulate, warn and guide traffic on streets and highways" (NCUTCD 2017). Its work is supported and guided by 19 sponsoring organizations, including major engineering associations like AASHTO and the Institute of Transportation Engineers, as well as advocacy groups like the American Automobile Association. It works through eight technical committees focused on the major elements of the MUTCD, including regulatory and warning signs, guide/motorist information signs, markings, signals, and so on. Recently it has added a Bicycle Committee, which helped draft Part 9 of the MUTCD, "Traffic Control for Bicycle Facilities" (NCUTCD 2017). But although the NCUTCD has expanded to include participation from non-motorized interests (e.g. the League of American Bicyclists), its membership, executive board, and leadership of technical committees remain weighted toward state highway engineers.

The Federal Highway Administration and State DOTs

While state transportation officials have long played a key role in shaping roadway design through organizations like AASHTO and the NCUTCD, the federal government is critical to maintaining uniformity of standards. The concept of a federal transportation agency dates to the nineteenth century, and Washington had maintained various agencies to plan roadways,

but a new cabinet-level DOT was not created until 1966 (Weingroff 2016). The Department of Transportation Act (Public Law 89-670) transferred the functions of the Bureau of Public Roads to a new FHWA, whose stated mission is to "improve mobility on our Nation's highways through national leadership, innovation, and program delivery." It plays a key role in shaping the roadway particularly through its oversight of the Federal-Aid Highway Program, which funds interstate highways, US routes, and most state routes. But its influence extends to all American roadways through its research on roadway safety, congestion, engineering standards, and its publication of MUTCD. Although it, like the NCUTCD and AASHTO, continues to view roadways in terms of vehicular highways, its recently revised strategic goals include a highway system that "provides safe, reliable, effective, and sustainable mobility for all users" (Federal Highway Administration 2017).

States had long maintained highway departments, but with the passage of the Department of Transportation Act, the federal government encouraged states to create their own wider transportation departments (Weingroff 2016). New Jersey was the first state to create a state-level DOT in 1966, and today all states but one have such a department (Nebraska maintains a Department of Roads). The state-level departments remain focused in large measure on highways, reflecting both their historical legacy and funding allocation. Like the federal DOT, state-level departments of transportation administer the planning and construction of highways and provide engineering and design guidance. Historically, many states maintained their own manuals of uniform traffic control devices, providing somewhat distinct guidance for engineers, but the federal government now mandates states adopt the 2009 national MUTCD as their legal state standard, or they adopt a state MUTCD in substantial conformance with the national version. Currently 18 states have adopted the national MUTCD, 22 have adopted it with a state supplement, and 10 have adopted their own (Federal Highway Administration 2017).

Together federal and state departments of transportation, working together with organizations like the NCUTCD, exert powerful influence on the design and uniformity of US streets. The UVC defines the legal space of the roadway, and the Green Book engineers the physical geometry of the street, but the MUTCD weaves law and asphalt, using symbolic communication and physical controls to shape how people relate on the roadway.

Controlling the Street: Manual of Uniform Traffic Control Devices

The FHWA considers traffic control devices "very critical for the safe and efficient transportation of people and goods" (Federal Highway Administration 2017) and publishes the MUTCD as a set of minimum standards and guidance to promote uniformity in messages, location, size, shapes, and colors. The MUTCD integrates the UVC's legal "rules of the road" including its definitions of the street/highway as "public way for purposes of vehicular travel" (p. 14)—and translates them into "signs, signals, markings, and other devices used to regulate, warn, or guide traffic, placed on, over, or adjacent to a street" (Federal Highway Administration 2012, p. I-1). The purpose of traffic control devices is to "promote highway safety and efficiency by providing for the orderly movement of all road users" (p. 1) by notifying road users of regulations and providing warning and guidance to minimize the incidence of crashes (ibid.). According to the manual, traffic control devices should fulfill a need, command attention, convey a clear and simple meaning, command respect, and give adequate time for proper response. Uniformity in such devices is key, helping users' recognition and understanding to reduce perception/reaction time, and ensuring highway users, police, and the courts all have the same interpretation of the law (p. 2).

The MUTCD, incorporated by reference in the Code of Federal Regulations, has the force of "law governing all traffic control devices" (Federal Highway Administration 2012, p. I-1). It shapes engineering practice by providing specifications it deems "standard" (mandatory or prohibitive, indicated in the manual by "shall"), "guidance" (recommended by not mandatory, indicated by "should"), "option" (not required or recommended but permitted, indicated by "may"), or "support" (for information only) (p. 10). However, engineering judgment ultimately guides selection and application of such devices, like the location and design of roads and streets themselves (ibid.). And while the MUTCD describes the proper application of traffic controls, it "shall not be a legal requirement for their installation" (p. 4). The MUTCD—like the UVC, AASHTO's Green Book, or TRB's HCM—addresses all modes, particularly with the recent addition of separate sections on bicycle facilities (Part 9, pp. 789-816). But the bulk of the manual is focused on "Roads" understood to be vehicular in purpose (Part 1, p. 1-788), while making accommodation for pedestrians and other users.

Signs: Regulating, Warning, and Guiding the User

The communicative dimension of traffic engineering is best exemplified by signs, whose function is to "provide regulations, warnings, and guidance information for road users," through words, symbols, and arrows (Federal Highway Administration 2012, pp. 27-28). Signs are classified by function: regulatory signs give notice of laws or regulations, warning signs give notice of situation that might not be otherwise readily apparent, and guide signs show routes and other geographical information. The MUTCD generally recommends that signage use be conservative and only as justified by engineering judgment, signage locations should follow from engineering study of physical and traffic factors, and sign application and geometric design should be coordinated. And it recognizes that contextual factors for example, urban vs. rural—should guide sign design and placement (ibid.). But as a means of communication, any sign should be "legible for those for whom it is intended and that it be understandable in time to permit a proper response." And, fundamentally, signs should be simple and uniform in their design, positioning, and application (p. 28). The different functions of signs are matched by different design standards, and play distinct roles in mediating competing uses of the street.

Regulatory signs, by informing users of laws and indicating their applicability, are a direct extension of the legal "rules of the road." These signs typically rectangular—are installed where particular regulations apply and provide "visibility and legibility to obtain compliance" (p. 45). Because many of the key rules of the road are taken for granted and thus implicit, no signage is needed: motorists know they have primary use of the roadway, as pedestrians do the sidewalk. Therefore most signage about proper users is prohibitive, indicating which users are not permitted. Of these socalled selective exclusion signs, only one prohibits vehicles specifically ("No Motor Vehicles"), and no guidance or options are provided for its use. However eight signs are available to prohibit various forms of nonmotorized traffic (e.g. pedestrians, bicycles, non-motorized traffic, etc.) (p. 75). Furthermore, regulatory signs communicate how such users can behave. Maximum speed limits, again, can be dictated for entire classes of roadway by state or local statute (pp. 57–58). Engineering studies can specify altered speed zones where speeds are reduced, but the MUTCD recommends that such speeds be within 5 mph of the 85th-percentile speed of free-flowing traffic, giving priority to flow over stoppage, and deferring to the behavior of motorists rather than community or neighborhood public

safety goals. Again, other factors like pedestrian activity and roadside development and environment can be used to limit speeds under that established by statute, but only as an option. Regulatory signs also guide travel movements, such as direction of travel (e.g. "One Way"), and how traffic should flow along the street (e.g. lane control signs like "Left Lane Must Turn Left"). These signs also can be used to supplement traffic signals by guiding users through intersections (e.g. "Left Turn on Green Arrow Only"). On roadways designed by law for vehicular use, such signs not surprisingly are oriented to and reinforce automobility. Indeed, even those signs focused on pedestrian crossings are mostly prohibitive, used to "limit pedestrian crossing to specific locations" (p. 92).

Regulatory signs, like the law itself, also indicate right-of-way: who must stop or yield to whom, under what circumstances, and where. The UVC's rules apply even where signage is absent, for example dictating that those approaching intersections generally must yield to those already in an intersection, but the MUTCD indicates when stop and yield signs are necessary (pp. 49-55). It does not mandate placement, but it defers to engineering judgment of vehicular, bicycle, and pedestrian traffic, approaches, speeds, sight distance, and crash experiences. It does, however, recommend specific thresholds-known as "warrants"-to justify when stop or yield signs should be used. For example, the intersection of minor streets should only have a stop sign when combined traffic volumes average more than 2000 units per day, visibility is low, or crashes exceed five in a 3-year period. These warrants reflect the implicit intent of prioritizing free-flowing traffic and limiting stops, reinforced by the principle that the lower volume roadways be controlled. These have implications for multimodal use of the roadway, since the ability of pedestrians to safely cross through intersections depends on whether traffic is controlled or stopped. While the MUTCD does recognize that placement of a STOP or YIELD sign should be influenced by established pedestrian crossing activity (or school walking routes) when two streets have equal volume, such standards are not "guidance" but merely informational "support." And while four-way stops can improve safety for pedestrians, their placement near locations that generate high pedestrian volumes is merely an "option" (p. 52). "Yield Here to Pedestrians" and "Stop for Pedestrians" signage can also be used in advance of marked crosswalks, but their application is limited only to states with such laws, again only as a permissible "option" rather than a recommendation (see Fig. 6.1) (p. 54).









Fig. 6.1 Regulatory signs help communicate the "Rules of the Road" and who has right-of-way. From the *Manual of Uniform Traffic Control Devices*, 2012, by the Federal Highway Administration, Washington, DC

The second major category of signs includes warning signs and object markers, whose purpose is to "call attention to unexpected conditions" (Federal Highway Administration 2012, p. 103). These signs also are to be used based on engineering study or judgment, but kept to a minimum since unnecessary use "tends to breed disrespect or all signs" (ibid.). Most warning signs are diamond shaped, with black legend and border on a yellow background to ensure visibility. These signs do not communicate the law, but provide advance warning for hazards related to the roadway (e.g. "Winding Road"), traffic (e.g. "Stop Ahead"), or other supplemental information. Because such signs guide safe physical movement through the street environment rather than mediate among competing uses, their role in structuring social relations is limited. But certain traffic warning signs do address spatial relations among modes. For example, there are optional vehicular warning signs to alert road users of "unexpected entries" by alternative modes like bikes and horse-drawn vehicles, and non-vehicular signs to warn of pedestrians, animals, or equestrians (pp. 129-130). Importantly, these signs can be used with "Share the Road" signs, which are optional "in situations where there is a need to warn drivers to watch for slower for slower forms of transportation" (p. 134). But these signs again reflect the assumption that non-vehicular users along and across the roadway are different and "unexpected." And while "share the road" signage theoretically advances a more equitable use of the roadway, in engineering practice it merely warns motorists to "watch" for non-vehicular modes.

Finally, guide signs "direct road users" along streets and highways, inform them of intersecting routes, identify nearby features, and give "such information as will help them along their way in the most simple, direct manner possible" (p. 137). These signs typically have a white message and border on green background. And while street signs have

long marked local roadways, the advent of the automobile prompted the creation of highway networks at national, state, and local scales. Separate conventions therefore exist for both conventional roads and high-volume, high-speed expressways and toll roads (which occupy a full 80 pages of the MUTCD) (pp. 181–252). Although signage standards have been developed for bicycles as part of Part 9 "Traffic Control for Bicycle Facilities" (see below), generally the content and style of traffic signs assume and reinforce the street as a space of automotive flow, symbolically and spatially structured to promote fluid and rapid vehicular travel through structured and extensive roadway networks.

Markings: Inscribing the Roadway to Guide and Inform

While signs are placed adjacent to or above the roadway, markings are literally embedded in the roadway itself. These pavement and curb markings, colored pavements, channelizing devices, and islands thus "provide important information while allowing minimal diversion of attention from the roadway" (Federal Highway Administration 2012, p. 347).

Markings are typically placed by using retroreflective paint or thermoplastics on the roadway surface, while delineators or channeling devices are placed vertically like signs. Classes and colors of marking are uniform to serve particular purposes. "Longitudinal markings" are most common, channeling the flow of vehicles along the roadway. White longitudinal markings delineate the edge of the roadway or separate traffic flowing in the same direction, yellow separates traffic flowing in opposite directions, blue indicates parking spaces for those with disabilities, among others. The width of longitudinal lines indicates degree of emphasis, and the amount of markings itself corresponds to the volume of traffic and street width (pp. 348-349) to visually reinforce patterns of flow along the street, help structure turning movements through intersections, and divert traffic around potential obstacles like median islands (see Fig. 6.2). In contrast, transverse markings cross the roadway and are typically white to include stop lines, yield lines, crosswalk lines, speed reduction markings, among others (p. 381). The MUTCD is firm in recommending stop lines to mark where vehicles should stop in compliance with traffic control signals, but leaves as optional such lines at stop signs or "Stop Here for Pedestrians" signage, instead mandating advance yield markings for those places like crosswalks where drivers are by law required to yield to pedestrians (p. 381).

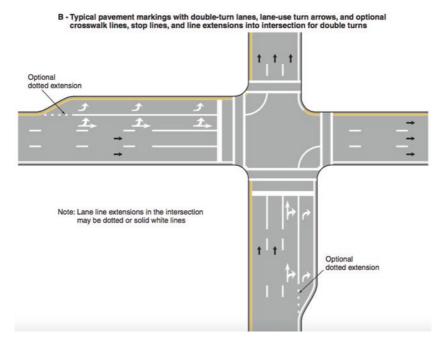


Fig. 6.2 Markings help channel flows upon the roadway. From the *Manual of Uniform Traffic Control Devices*, 2012, by the Federal Highway Administration, Washington, DC

Because crosswalks represent a situation where the pedestrian network transverses the roadway, the MUTCD specifies crosswalk markings to (1) provide guidance for pedestrians to define and delineate approach paths, (2) alert road users of a designated pedestrian crossing point outside intersections, and (3) at non-intersection locations legally establish the crosswalk (p. 383). While elsewhere the MUTCD recommends transverse markings like stop lines, the marking of crosswalks is optional, leaving the MUTCD to guide how they should be marked but not when. In fact, the MUTCD is very explicit in cautioning "crosswalk lines should not be used indiscriminately" (p. 384). The UVC defines crosswalks to exist as the prolongation of sidewalks in any intersection, giving pedestrians ROW, but the MUTCD recommends intersections without traffic signals or stops only result from engineering study of roadway geometry, pedestrian volumes, ADT, posted or 85th-percentile speed,

and the "possible consolidation of multiple crossing points." And it argues that new crosswalks alone, without other measures to reduce traffic speeds and reduce crossing distances, should not be installed across uncontrolled roadways where speed limits exceed 40 mph. Crosswalks reinforce the pedestrian's existing ROW at all intersections (and particularly at those lacking a sign or signal to stop traffic), but concern for pedestrian safety prompts the MUTCD to only recommend crosswalks when additional safety features are in place (e.g. speed limit reductions, beacons). And because non-intersection pedestrian crossings are "generally unexpected by the road user," the MUTCD recommends warning signs at all marked crosswalks at non-intersection locations (p. 35). But given the costs and challenges of conducting engineering study and adding additional safety features—in addition to crosswalk materials themselves—engineers may interpret the MUTCD as an "all or nothing" set of standards and be discouraged from placing crosswalks at all.

Signals: Assigning "Right-of-Way" and Controlling Flow

The third major category of traffic control devices are signals, which are important because "they assign the right-of-way to the various traffic movements and thereby profoundly influence traffic flow" (p. 434). When properly designed, the MUTCD cites their advantages including providing for orderly movement of traffic, increasing traffic-handling capacity of intersections, reducing frequency and severity of certain types of crashes, and interrupting heavy traffic at intervals to permit the crossing of other traffic. However, the MUTCD cautions against the overuse of signals, with negative consequences including excessive delay, excessive "disobedience," and increased use of alternate routes and rear-end collisions (p. 435).

The MUTCD establishes rigorous warrant standards to justify traffic signals, based on "engineering study of traffic conditions, pedestrian characteristics, and physical characteristics," and contextual factors (p. 437). Signal warrants require minimum vehicular volumes (vehicles per hour, without taking into account pedestrians) on both the major and minor streets over an eight-hour, four-hour, or peak-hour periods. Other warrant standards, however, provide justification based specifically on pedestrian traffic. For example, the MUTCD supports signals on major streets only where vehicular volume is so heavy that pedestrians experience "excessive delay," defined as a minimum ratio of crossings by pedestrians to vehicles per hour (p. 442). But where other stop signs or signals are

nearby within 300 ft, signals cannot be warranted unless the proposed signal will "not restrict the progressive movement of traffic" (ibid.). Signals can be warranted at school crossings, but this too requires minimum peak and four-hour volumes, and only after consideration of other measures like warnings signs and flashers, crossing guards, or grade-separated crossings (!). Signals can also be warranted where there is a history of crashes resulting in injury or property damage, where it is desired to "encourage concentration and organization of traffic flow on a roadway network" (p. 446), or intersections near rail crossings.

Traffic signals by definition stop the free flow of vehicles, benefiting pedestrians wishing to cross the street at intersections or mid-block crossings. But prioritizing flow over stoppage, the MUTCD is careful to encourage alternatives that increase safety of cross-wise movements without blocking the continuous longitudinal flow, recommending installation only when a signal would improve overall safety and/or operation of the intersection *and* will not seriously disrupt progressive traffic flow.

The MUTCD also specifies circumstances when signals should (or shouldn't) be used, and how they should be configured. Because traffic signals are a central element in the choreography of everyday mobility, and how right-of-way is distributed, their design therefore plays an important role in the mobility politics of the everyday intersection. We are all familiar with the symbolic conventions of traffic signals: steady circular green means permission to proceed straight or turn, green arrows permit one to "cautiously enter the intersection only to make the movement indicated by the arrow" (p. 451), steady yellow indicates a warning of an upcoming red signal, and red signals indicated that traffic entering the intersection shall stop. Flashing yellow indicates users should proceed cautiously, and flashing red shall stop. Though such signals allocate preferential right-of-way, making vehicles traveling in one leg of the intersection stop to yield to others, such controls address more nuanced and complicated circumstances. For example, turning vehicles may have a green signal, but must yield right-or-way to other vehicles and "pedestrians lawfully within an associated crosswalk" (p. 451). And while a pedestrian may theoretically have right-of-way granted by the overhead traffic signal, if the pedestrian signal prohibits crossing they would not be crossing lawfully and thus must yield to turning vehicles. Even when pedestrians may have the circular green and thus right-of-way, permitting them to proceed, they must yield to "vehicles lawfully in the intersection or so close as to create an immediate hazard at the time the green signal indication is first displayed" (ibid.). Signals therefore modify—and often circumscribe—the legal right-of-way enjoyed by pedestrians at intersections.

Traffic signals positioned above intersections control both vehicles and pedestrians, but the MUTCD also provides for pedestrian-specific signal heads (p. 495). The meanings of these signals are familiar to us. "WALK" or a walking person symbol indicates a pedestrian facing the signal is permitted "to start to cross the roadway ... possibly in conflict with turning vehicles" though the pedestrian "shall yield the right-of-way to vehicles lawfully in the intersection at the time." Conversely, flashing "Don't Walk" or UPRAISED HAND indicates "a pedestrian shall not start to cross the roadway" but any who has already started to cross on a steady green "shall proceed to the far side of the traveled way of the street or highway" unless directed to proceed only to the median. And the steady upraised hand indicates a pedestrian "shall not enter the roadway in the direction of the signal" (ibid.). The MUTCD provides standards for the use of pedestrian signal heads only in conjunction with vehicular traffic controls and when warranted.

Addition of pedestrian signals alters how intersections would otherwise be controlled and right-of-way allocated. When present, pedestrian signal heads override cues from vehicular signals to controlling when people must enter and leave the crosswalk, thus distinctly enabling or constraining pedestrian right-of-way vis-à-vis cars. For example, while a yellow signal for vehicles signifies an upcoming red, it does not specifically prohibit cars from entering the intersection. But a flashing "Don't Walk" signal prohibits pedestrians from entering the intersection unless already crossing. And in specifying timing of walk signals, the MUTCD does not require but merely recommends signal length be sufficient to allow a pedestrian legally entering the crosswalk at a standard walking speed of 3.5 ft to cross at least to the median, and leaves as an option to allow longer times to enable slower pedestrians to cross (p. 497). The MUTCD recommends only a minimum 7 second walk interval, but allows intervals as short as 4 seconds (!) when pedestrian volumes or characteristics are low. In any case, pedestrian signals do not grant those on foot any additional right-of-way, but in fact reduce the amount of time they may enjoy that right compared to cars according to the vehicular signal. And while overall the design of both vehicular and pedestrian signals is designed to "clear" the intersection of cars and pedestrians, ultimately vehicular concerns drive the length and timing of vehicular traffic signals, and pedestrian-only signals work within that framework.

Some signals are automatically timed to grant vehicles or pedestrians right-of-way at regular intervals, but others only change when activated by detectors like coiled loops in the asphalt or pedestrian push buttons. When pedestrian signals are not timed, their activation controls pedestrian

right-of-way. This can benefit pedestrians. For example, the MUTCD provides engineers the option of using pedestrian signal activation to extend pedestrian clearance time or introduce a walk interval, giving pedestrians a head start before vehicles can turn across the crosswalk. Indeed, it mandates that when a steady walk signal or flashing upraised hand is displayed, a steady or flashing red signal "shall be shown to any conflicting vehicular movement" that is approaching the intersection perpendicular to the crosswalk (p. 497). But, conversely, in activated crosswalks the "WALK" symbol doesn't appear unless a pedestrian pushes a button or trips a sensor. A pedestrian who forgets to push or arrives too late will not get a signal, and may have to wait until the next green, thereby being denied the right-of-way the vehicular signal would otherwise entitle them. And while accessible pedestrian signals and detectors have been developed to "provide information in non-visual formats" like audible tones (p. 504), these really only communicate existing right-of-way rather than change control of the intersection. Pedestrian hybrid beacons installed at otherwise unsignalized crosswalks (e.g. mid-block) can be activated to make cars slow/yield or stop, but only where warranted (p. 510).

Traffic Control and Mobility Rights and Justice

Critical analysis of the MUTCD reveals how social and legal rules of the road are translated into engineering standards or guidance for the signing, marking, and controlling of roadways. It is a key source for understanding how assumptions about the proper purpose and use of streets are translated into symbolic communication and the materiality of steel signs and retroreflective markings. While it is a separate question how effective such communications are in modifying the behavior of street users, their uniformity and power in defining the street experience are hard to argue. Concern for the social geography and mobility rights and justice on the street therefore demands closer attention of this fundamental text of roadway design.

What kind of roadway geography does the MUTCD produce? Intended to "promote highway safety and efficiency by providing for the orderly movement of all road users," over a century MUTCD has carefully crafted a system of texts and symbols to inform, warn, guide, and control those who travel on the roadway. Its signs along and above the roadway remind us of the law, tell us where to go, what to watch out for, what to do (and what not to do). Markings laid down on the asphalt itself in retroreflective

paint or thermoplastic help allocate street space to different modes, channel our flows, guide us, and warn us. And while we may think of signals merely in terms of controlling flows, the same way a valve would in any hydraulic system, they play a critical social role in translating traffic laws about right-of-way to physically control who has the "right to proceed uninterruptedly" and who must yield, perhaps the clearest expression of the politics of mobility on the street. Ultimately, these symbolic conventions transform the blank asphalt street into immersive communication device, at once highly visible yet taken for granted, and whose uniformity and ubiquity belies its complexity and power.

The MUTCD, like other engineering manuals, implements the rights and relationships contained in the UVC and state statutes adopted in its image. In striping a roadway laterally with edge and lane separation lines, for example, the MUTCD reminds users that the roadway is legally for lengthwise vehicular travel, and a space pedestrians only cross at their risk. On the other hand, by striping a crosswalk the MUTCD visually communicates the presence of that legal space and indicates pedestrian right-of-way within it, sometimes elaborated through signage. In general, the MUTCD replicates the power structures codified in the UVC prioritizing the automobile but also providing separate but equal rights for pedestrians and bicyclists. Its signs, markings, and traffic controls are determinative in shaping the roadway as space for vehicular flow, while detailing best design practices for sidewalks, crosswalks, bike lanes, and so on.

But the MUTCD plays its own important role in determining when and how particular traffic controls are used. It is itself a legal document, enforcing uniformity through the power of the federal government. The way the manual differentiates between mandatory standards, recommended guidance, permitted options, and informational support has great influence on which of its designs actually are implemented. And, generally, the MUTCD prioritizes the safety and convenience of motorists by more often making vehicular-specific signs, markings, and controls "standard," and leaving those that benefit other modes merely recommendations or options. For example, the MUTCD recommends transverse markings to indicate where vehicles should stop in intersections, but leaves marking of crosswalks optional and cautions "crosswalk lines should not be used indiscriminately" (p. 384). Worse, while the UVC specifies that crosswalks exist at any intersection with sidewalk approaches, MUTCD discourages crosswalks at unsignalized intersections except if justified by elaborate engineering study. Thus the rights granted to pedestrians by law, already limited, are further constrained by MUTCD's cramped standards. Bicycle signage and markings, likewise, are mere options for roadway designers but never standard. In such cases the MUTCD not only reproduces inequities already in the law, but expands upon them.

In sum, the MUTCD joins other foundational texts in traffic law and engineering-like the UVC, the Green Book, and the HCM-to shape the experience of the roadway. Cross-referenced with these legal and design standards, it translates the social order of the street—and its regime of automobility—into a communications system that is both symbolic and durable material. It literally inscribes social order onto the asphalt, with the aim of producing order and safety. But to the degree the MUTCD articulates bias toward automobiles over other users, it helps produce an unjust street. It is commendable that the MUTCD increasingly addresses alternative modes, providing guidance for designers wishing to better accommodate diverse users. But until accommodations for alternative modes are made as central and standard as those for automobiles, these additions to the MUTCD will be limited in their impact.

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Reimagining and Redesigning the American Street



CHAPTER 7

"Streets for Everyone": Intermodal Equity and Complete Streets

If traffic laws and engineering standards are pervasively biased in their regulation and design of the everyday American street, what might a more just alternative look like? Today's codes and standards reflect a century of the street's evolution from public sphere to vehicular thoroughfare. Those people concerned with mobility justice need not look hard to find that bias in the Uniform Vehicle Code's (UVC) definition of streets for "purposes of vehicular travel" and its disproportional distribution of the right-of-way to cars over others, in the American Association of State Highway Transportation Officials' (AASHTO) geometric design for the "operational efficiency, comfort, safety, and convenience for the motorist" (American Association of State Highway and Transportation Officials 2011, p. xlii), and in the *Manual of Uniform Traffic Control Device's* (MUTCD) car-centric system of signs, markings, and signals. But closer analysis of these standards reveals how deeply inequity is woven into the details of everyday American roadways.

Fortunately, a growing movement confronts this auto-centric regime of traffic regulation and design, and the vast network of vehicular thoroughfares built in its image, and argues for rethinking the street. Debates around the meaning, regulation, and design of the public street are not new (Jacobs 1962; Norton 2008). But recent years have witnessed a rapidly growing critique of auto-centrism and advocacy of a more inclusive notion of mobility. The website of National Complete Streets Coalition (last accessed October 10, 2017) argues bluntly:

Streets are a vital part of livable, attractive communities. Everyone, regardless of age, ability, income, race, or ethnicity, ought to have safe, comfortable, and convenient access to community destinations and public places—whether walking, driving, bicycling, or taking public transportation. But too many of our streets are designed only for speeding cars or creeping traffic jams.

Reframing the street as a place and not just infrastructure, as question of fairness and livability and not just movement, it argues for so-called "Complete Streets" or "streets for everyone ... designed and operated to enable safe access for all users" (ibid.). The complete streets movement not only expresses a critique and vision, it also directly confronts standard engineering assumptions and practices that produce "incomplete" streets. It advocates complete streets resolutions or laws that make design for all modes the rule rather than exception. And this movement—in concert with other legislation like the Americans with Disabilities Act—parallels and has prompted innovation and development of multimodal design practices, explored in Chap. 8.

This chapter explores the burgeoning movement toward complete streets and intermodal design, interpreted as a question of mobility rights and justice. I review the policy discourses of the National Complete Streets Coalition, the key elements used to define model complete streets policies at both state and local levels, and how these have been manifested in actual resolutions or laws. Because the movement is articulated in the language of fairness, it begs certain questions about mobility rights and justice. To what degree do the movement's discourses and design standards maximize access, reduce inequity, and enhance the capacities of users? And do they provide greater transparency and empowerment for those who use the street?

Streets are a fundamental element in urban life, but we must be cognizant of the limits of their design—complete or incomplete—to address broader forms of inequality (Zavestoski and Agyeman 2015). Indeed, all streets by law and design—whether traditional or multimodal—manifest bias toward mobility and access of "users" over other place functions, a basis for possible critique. But if we seek ways to provide greater mobility justice, within established frameworks of traffic regulation and engineering standards that are unlikely to go away any time soon, we might pragmatically ask: How might regulation and design better maximize access for all users, while reducing inequalities among them and maximizing their capacities? How might this be done transparently and democratically? This chapter assesses the potential of complete streets to produce such a more just street, in theory and in practice.

THE COMPLETE STREETS VISION AND POLICY FRAMEWORK

Normative Vision of "Streets for Everyone"

The movement for complete streets has origins in a 2003 task force led by America Bikes and the League of American Bicyclists, together with the American Association of Retired Persons, American Planning Association, and American Heart Association, among others, to advocate for inclusion of a complete streets provision in federal transportation policy. America Bikes proposed the term "Complete Streets" as a replacement for the existing term "routine accommodation." But according to founding member Barbara McCann (2010), "right away we knew that we had a concept that was bigger than bicycles" and members "soon recognized the power of the complete streets policy concept on the state and local level." These organizations collaborated to define the meaning of complete streets, and joined other key partners-including Smart Growth America and the National Association of Realtors—to form a National Complete Streets Coalition in 2005. As stated on its website, as of October 1, 2017, the Coalition's mission is to promote "development and implementation of policies and professional practices that ensure streets are safe for people of all ages and abilities, balance the needs of different modes, and support local land uses, economies, cultures, and natural environment." The Coalition articulates "Our Vision":

We believe that the streets of our cities and towns must allow all people, regardless of age, ability, income, race, or ethnicity, to safely, comfortably, and conveniently access homes, employment centers, schools, shops, health facilities, and other destinations by foot, bicycle, public transportation, car, or truck. A community's street network should reflect the current and planned built environments and support overall public and economic health. (ibid.)

The Coalition Steering Committee includes transportation organizations that play a key role in policies like the MUTCD (e.g. state DOTs, the Institute of Transportation Engineers), but notably also includes place-based organizations traditionally not part of transportation policymaking (e.g. National Association of Realtors, American Society of Landscape Architects, Voices for Healthy Kids) (ibid.).

The complete streets movement is framed around an argument motivated by a critique of traditional planning and engineering. "For decades," the Coalition argues, "the fields of transportation planning and design

focused on moving able-bodied adults in automobiles ... however, the needs of travelers outside that group ... have been routinely overlooked" (National Complete Streets Coalition 2013, p. 6). As a result, neighborhoods lack safe places to walk or bike, and thousands are injured or killed every year "in part due to the inhospitable environment" (ibid.). The Coalition argues on its website that "transportation agencies must change their approach to community roads" to ensure planners and engineers "routinely design and operate the entire right of way to enable safe access for all users, regardless of age, ability, or mode of transportation" (ibid.) This vision of "streets for everyone" adopts the terminology of "user" from highway planning/engineering, but expands beyond the conception of different transportation modes to articulate a vision in which all people are able to safely move along and across streets regardless of their mode (National Complete Streets Coalition 2013, p. 6).

The Coalition's work, though grounded on broad theories of equity, is also underpinned by powerful public safety arguments. In a separate publication Dangerous by Design, the Coalition (2017b) notes 46,149 people are struck and killed annually by cars while walking in the US, making Americans 7.2 times more likely to "be killed as a pedestrian than from a natural disaster" (p. ii). Calling this an "alarming epidemic," it continues bluntly "each one of those people was a child, parent, friend, classmate, or neighbor" (ibid.). Analyzing pedestrian fatalities by metropolitan area and race/income, it further reveals older people and people of color are overrepresented among fatalities, making up 34.9% of the national population but 46.1% of pedestrian deaths, and low-income metro areas are "predictably more dangerous" than higher-income communities (p. iv). The report shares both metro and national statistics as well as anecdotes about "stories as tragic as (they) are common." While some of this may be related to pedestrian behavior, it argues street design is an "enormous part of both this problem and solution" (p. 3). Streets with wide lanes and no safe pedestrian facilities are "simply designed to be dangerous" for pedestrians, and if people walk upon them "this is not user error ... rather, it is a sign these streets are failing to adequately meet the needs of everyone" (p. 3). The Complete Streets Coalition highlights the multiple forms of inequality that intersect in the American roadway.

Linking Policy Vision to Design Practices: Key Policy Elements

To translate this critique and normative vision into more equitable streets, however, requires changing standard practices of roadway planning and

design. The complete streets movement's primary emphasis therefore has been to translate its "streets for everyone" vision into model policies that can guide local officials, and influence access to the roadway where it is most fundamentally determined: in the offices of state and local transportation engineers. The Complete Streets Coalition and Smart Growth America—with the support from the Centers for Disease Control and Prevention—therefore developed policy models, including model complete streets state statutes to complement the UVC's "Rules of the Road" (AARP 2013) and locally adopted complete streets ordinances or resolutions that "require the needs of all users be addressed in transportation projects and change city code accordingly" (National Complete Streets Coalition 2013, p. 8). These policies are designed to make broad policy statements and prompt revision of design processes and standards to address failures of inclusivity.

The Coalition sets out "The Ten Elements of a Complete Streets Policy" (2016). First, it states such policies should begin with a "vision" that "can inspire a community to follow through" (p. 1). Second, a true policy "must apply to everyone," since a sidewalk without curb ramps is useless to the disabled, a street without safe crossings is unsafe for transit riders, a fast-moving road will discourage cyclists, and children and older people are particularly vulnerable. The policies should recognize automobiles are an important part of a complete street and must be taken into account, but argues that many improvements can benefit both motorized and non-motorized (p. 2). Third, because not every street can be perfect for every traveler, it argues for creating "an interwoven array of streets that ... provide quality accessibility for everyone" (ibid.). By taking a network approach across the patchwork of local streets, often controlled by multiple agencies, the fourth element advocates for policies for cross-jurisdictional collaboration and inclusion of complete streets in subdivision regulations.

The expression of such inclusive values is essential, creating an ethical framework for thinking about transportation decisions. Many communities already emphasize multimodalism in their comprehensive plans, yet struggle to see an impact on their local streets, particularly since those spaces are controlled not by planners but by traffic engineers. Therefore, a key emphasis of the National Complete Streets Coalition (2016) is reshaping the priorities and practices of transportation investment and design. This begins by the fifth element specifying Complete Streets principles apply to "all projects ... both new and retrofit projects," including design, planning, maintenance, and operations, for the entire ROW (p. 1). Lamenting

"multi-modal streets have been treated as 'special projects,'" it argues that all transportation improvements can become opportunities for safer, more accessible streets for all users (p. 2).

Most profound, perhaps, is the argument that multimodal streets become the rule rather than the exception, and any exceptions be "specific" and determined by "a clear procedure that requires high-level approval" (p. 2). In the sixth element, the Coalition recommends a careful process to justify exceptions. Drawing from the Federal Highway Administration guidance, it suggests exceptions only when accommodation is not necessary because non-motorized users are prohibited, where cost of accommodation is "excessively disproportionate to the need or probable use," or where there is a "documented absence of current or future need" (ibid.). In this new scenario, accommodations for all modes become the standard except in those limited circumstances where they are demonstrably not legal, financially feasible, or necessary. And it argues there must be a clear process for granting them, made by a senior-level department head, and any exceptions be on record and publicly available (ibid.).

The National Complete Streets Coalition acknowledges the importance of both engineering standards and professional judgment, but its seventh element argues for a review of local design policies to "ensure their ability to accommodate all modes of travel, while still providing flexibility" tailored to unique circumstances and community context (Element Eight). For some communities this might mean rewriting their design manual, but for many this would mean referring to existing pedestrian and bicycle guides like those issued by AASHTO. These have been understood to be optional and informational, but mandating multimodal design drives engineers to standards they might not otherwise apply. And where such manuals have traditionally made auto-centric design elements mandatory and accommodation of alternative modes discretionary, these criteria leave local engineers less wiggle room in making multimodal design rule rather than the exception. It doesn't mandate particular design techniques, but does encourage flexibility in how-but not if-engineers apply multimodal best design.

And, ninth, the Complete Streets Coalition critiques the limits of vehicular Level of Service (LOS) and suggests complete streets planning take a "broader look at how the system is how the system is serving all users" (p. 2). It advocates a diverse range of performance measures, including things like miles of on-street bicycle routes, and application of a multimodal LOS, which it optimistically looks for in revision of the *Highway Capacity Manual*.

Finally, it acknowledges difficulties in implementation, but it advocates new policy structures that ensure routine accommodation, develop new design policies and guides, offers training to planners and engineers, and institutes better ways of measuring and tracking performance (ibid.).

These elements all advance a more just street, better maximizing access for all users, while reducing inequalities among them and maximizing their capacities, in a way that is transparent and democratic. Complete streets do not address regulation per se (leaving the UVC as the "rules of the road"). But it offers other policies to supplement those roles, including a broader vision of "streets for everyone" promoting access for all users of all ages and abilities, and specifying clearly the diversity of modes that ought to be planned/designed for. While it seeks greater parity among modes, it also is attuned to the particular needs of the more vulnerable among us. And it specifically targets how streets are designed, directing designers to those manuals and standards that support multimodal and accessible street design, and thus the capabilities of diverse users. And, finally, it promotes greater democracy and transparency than typically found in traffic engineering. It asks elected officials to vote on complete streets policies, making their assumptions/priorities transparent, and for traffic engineers and others to document and justify their decisions, and report on measurable progress. In theory, then, the complete streets concept offers a vision for more just streets, upon which the right to the street is shared more equitably.

Model State Laws and Local Ordinances

To help translate these principles into specific law and policies, the AARP with the Coalition produce model state statutes in *Complete Streets in the States: A Guide to Legislative Action* (AARP 2013) and model local ordinances/resolutions in *Complete Streets Local Policy Workbook* (National Complete Streets Coalition 2013). These again articulate an equity argument for multimodalism, linked to strategies for redesigning streets, buttressed by policy justifications.

The model state statute developed by the Coalition and AARP (2013) begins with Section 1. Complete Streets, stating

1. Vehicular, public transportation, bicycle, and pedestrian modes are integral to the transportation system, and the [state Department of Transportation] shall view all transportation improvements as opportunities to improve safety, access, and mobility for all travelers.

- 2. All transportation projects receiving federal or state funds shall improve safety, access, and mobility for users of all ages and abilities.
- 3. Accommodations for all users shall be included in the planning, design, construction, reconstruction, rehabilitation, maintenance, and operations of any state, county, or local transportation facilities receiving funds from the [Department of Transportation] (AARP 2013, p. 4).

In justifying such language, for example, the guide argues for language "establishing parity among travel by foot, bicycle, transit, and automobile" (note the order, so different from existing laws!) (p. 8). But it acknowledges the difficult politics and "sticking points" for state D.O.T. officials, offering suggested compromise language, and reassuring officials that not every street need be equally multimodal as long as states "build an integrated network" that emphasizes different modes and provides "high-quality access for everyone" (p. 10).

The model state statute directly confronts pushback from traditionminded engineers, proposing language "1.4 The [Department of Transportation] shall use the latest and best design standards" applying to bicycle, pedestrian, transit, and highway facilities, including latest editions of the AASHTO's Green Book and pedestrian and bicycle guides, as well as new publications by the Institute of Transportation Engineers Designing Walkable Urban Thoroughfares: A Context Sensitive Approach: An ITE Recommended Practice or US Access Board "Public Rights-of-Way Accessibility Guidelines." The guide notes some engineers may be using older manuals, and thus multimodal design options may falsely be considered "not 'in the book'" (p. 10), and laments some practitioners will "mistakenly declare" the Green Book does not allow for "application of safe, cost-effective multimodal transportation networks," but it highlights the "significant flexibility" to allow for complete streets planning and design (p. 11). And it seeks to ensure application of such standards by requiring exceptions be made only when multimodal use is prohibited by law, when cost of new accommodation is excessively disproportionate to need, and there is a demonstrated absence of future need (p. 13). It grounds these in federal guidance, so exceptions are determined as part of a process, with "sign-off" for exemptions at a higher level than project managers (ibid.).

And, interestingly, the model state statute also stipulates "documentation on any granted exceptions shall be made publicly available" to encourage transparency in decision-making, so "advocates can hold the state accountable for making decisions that they feel are out of line with the

intent of the law or the needs of the local community" (AARP 2013, p. 14). It suggests an advisory board including alternative transportation advocates be created to provide guidance and make annual reports specifying implementation of the statute/policy. And, finally, it suggests development of multimodal performance indicators be used to measure all modes of travel and all user groups.

At the local level, in its Complete Streets: Local Policy Workbook the National Complete Streets Coalition (2013) provides sample language and justification for city and county policies, drawing from model policies already adopted by US communities. For example, it argues that clear statements of intent become a "guidepost" providing "clarity in purpose" (p. 19). It likewise emphasizes the need to accommodate all users, and justifies such language by the need to "address equity issues, taking into account potential past systemic marginalization" based on race, ethnicity, or income (p. 20). In discussing exceptions, it looks to policy language that ensures flexibility for legitimate exceptions without creating loopholes, by requiring exceptions be made only at high levels and that such decision-making be transparent through public documentation (p. 26). And seeking to provide both firm guidance and design flexibility, the guide recognizes the need for some roads to offer "greater or lesser degrees of accommodation for each type of user" but on the premise "basic accommodation is provided for all permitted users" (p. 34). And it concludes with implementation strategies, through incorporation of complete streets principles in comprehensive plans, review and revision of subdivision regulations and other design standards, creation of an advisory committee, or requiring annual reporting.

Adopted Complete Streets Laws and Policies

The UVC provides a template for rules of the road implemented through legislation, but complete streets must also be analyzed not only through policy models but also through those laws and resolutions adopted by states, counties, or cities in its image. The National Complete Streets Coalition annually publishes *The Best Complete Streets* of the prior year, summarizing trends in policy adoption and evaluating state and local policies in relation to its ten standards (e.g. vision, all users and modes, all projects and phases, etc.). In its review of policies adopted as of 2016, for example, the National Complete Streets Coalition (2017a) noted adoption of 222 new policies (over 114 adopted in 2015), bringing the total to 1232

policies in places spanning all 50 US states, Puerto Rico, and the District of Columbia (p. 6). Of these, most were resolutions or policies with a fewer number of ordinances or statutes. Many policies emerged from localities in Massachusetts and Washington, states which now have incentive programs, while New Jersey had the most programs overall (ibid.). In scoring the policies, the Coalition found a vast majority covered "all abilities" and "all ages" (94.6%) and modes of transit beyond just cars and bike/pedestrians/ transit (96.1%), emphasized interconnected networks (88.3%), and made specific reference to design guidance (79%). All represented marked convergence around the Coalition's key elements, particularly in relation to policies adopted in prior years (ibid.). And in response to questions about equity, the Coalition analyzed income and radial demographics in communities that adopted policies, finding such communities were whiter and wealthier than the US as a whole, prompting concern that many communities of color and lower income "are not accessing the economic and safety benefits" of complete streets, of concern given the disproportionate risk pedestrians face in such communities documented in the Coalition's separate Dangerous by Design (2017b).

In its evaluation of state and local policies, Coalition applies its key elements/standards to assess state and local policies and cites policy models, which provide both a ready guide to policymakers and a rich source for analysis. For example, among policies that rank highly for expressing a vision, Binghamton, NY, is lauded for its goals to "create an equitable, balanced, and effective transportation system where every roadway user can travel safely and comfortably, and where sustainable transportation options are available to everyone" (National Complete Streets Coalition 2017a, p. 14). Further, Shelborn, MA, seeks to provide "safe, convenient transportation routes for users of our roadways, pathways and sidewalks, for the benefit of people of all ages and all abilities" including pedestrians, bicyclists, motorists, commercial vehicles, transit vehicles, emergency vehicles, and users of wheelchairs and other power-driven mobility devices (p. 15). To ensure this standard is applied to all projects, communities like Hull, MA, suggest complete streets will be integrated into "all types of public and private projects," including new construction, reconstruction, rehabilitation, repair, and maintenance of transportation facilities (p. 16). Brockton, MA, provides for demonstration and documentation of limited exceptions, only by a review panel from multiple city departments and pedestrian/bike advocates, using "clear reasoning," presented at public hearing to hear "opposing views" to the exemption, and specifying "no exemption can be

proposed without mitigation" (p. 18). Similarly, emphasizing a connected network and mitigation for exemptions, Mansfield, MA, argues that "where sidewalks are not viable, the town will seek to expand its trail and walking path network to link neighborhoods" (ibid.). Because these principles must ultimately come through design, however, the language of model policies is quite explicit. For example, Wenatchee, WA, emphasizes best and latest design guidelines to provide a balanced approach considering a "human scale for the needs and comforts of all All Users," including AASHTO guidelines and those of the NACTO (p. 20). And seeking to broaden the purposes of street design beyond just moving vehicles, cities like Chester, MA, have emphasized context-sensitive design that addresses a range of social goals, including "goals related to livability with greater participation of those affected in order to gain consensus" (p. 21). And, finally, it highlights language designed to measure performance and ensure implementation. Recognizing conflicting needs among users and modes, Missoula, MT, for example, specifies the prioritization scheme:

(1) above all, safety is paramount, followed by mobility; (2) among modes, pedestrians shall come first citywide, followed by the next most vulnerable types of users; and finally, (3) seek balance among all modes involved. (p. 24)

Though all modes cannot receive the same accommodation and space on every street, Missoula again specifies a goal that everyone—"young, old, and of varying ability"—can travel safely and conveniently across the network (ibid.).

COMPLETE STREETS, MOBILITY RIGHTS, AND JUSTICE

The complete streets movement provides a very direct critique of autocentric roadway engineering, a normative vision for how streets ought to be designed, and policy strategies for fundamentally shifting intermodalism from voluntary exception to standard practice. Directly confronting the auto-centrism of roadway design, which can be obscured behind feigned value-neutrality and technocratic process, the Complete Streets movement boldly redefines streets as spaces "that ought to be for everyone." And by contrasting complete with incomplete streets, the movement challenges political leaders to embrace (or reject) principles of inclusivity, and planners and engineers to translate them into the design of

"integrated, connected networks of streets that are safe and accessible for all people, regardless of age, ability, income, ethnicity, or chosen mode of travel" (National Complete Streets Coalition 2013, p. 6). Starting with hard-to-counter normative principles of equity and inclusiveness, it links these to actual processes of street design (discussed in more depth in Chap. 8).

This move is both commonsensical and radical. Without challenging the underlying rules of the road, which posit a certain degree of equity in theory but do not ensure it in practice, the complete streets movement is tactical in emphasizing hard-to-disagree-with principles of intermodal equity without advocating any singular design prescription. The question is not "Can we have bike lanes?" to which engineers frequently wield engineering standards to answer "No, it can't be done." Instead, it's "How can we best accommodate all rightful users, including cyclists?" This challenges decision-makers to be inclusive rather than exclusive, and designers to ensure all projects are planned and designed to meet the needs of all community members. And by cross-referencing best practices in roadway design, including AASHTO and the MUTCD and other established standards which actually incorporate intermodal design, it narrows the opportunity for engineers to hide auto-centric bias behind professional judgment. These standards, which include intermodal design as mere options, have a different value when paired with a mandate for equitable consideration of all modes, and prioritization of safety—particularly of vulnerable persons—over vehicular convenience. And it takes roadway design out of the exclusive and often obfuscating domain of the auto-centric engineering standards to make incomplete streets subject to high-level exceptions and a transparent public process. This is a far cry from how streets have traditionally been designed over the past century.

This complete streets vision and process are straightforward, but in many ways radically inclusive. It argues for transportation policies and roadway design would be premised on maximization of access for all users—an initial position of equality among roadway users—and fairer and more just distribution of roadway space, access, and thus capabilities among diverse users. It shifts basic assumptions from auto-centrism to demand inclusivity as the rule rather than exception. And when exceptions are made, they are done so transparently at high levels, subject to input and review by experts and stakeholders beyond the highway engineer. And, increasingly, communities are measuring the performance of their streets not only in terms of vehicular throughput, or safety and convenience of

non-motorized transportation, but in terms of impact on people who are socially or economically disadvantaged.

Together, principles and practices of the complete streets constitute a major rethinking of how we plan, design, and maintain roadways. While it leaves intact legal "Rules of the Road," it provides a policy vision and strategies for achieving "streets for everyone." Together these represent one of the most significant shifts toward mobility rights and justice on the American street.

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CHAPTER 8

"Creating Real Spaces for People": Emerging Standards for Intermodal Design

The growing "Complete Streets" movement promotes a more inclusive vision of "streets for everyone," but ultimately the physical street is a direct product of the details of engineering and design standards. To reimagine a more intermodal and just roadway, these standards themselves must be reimagined.

Innovation and development of multimodal design practices have paralleled, and been prompted by, the complete streets movement and legislation like the Americans with Disabilities Act. In this chapter I explore how roadway design standards increasingly address the challenges of intermodal equity, accessibility, and livability. Analyzing the language of these various manuals reveals changing assumptions about whom and what streets should be designed for. But for those committed to a more equitable street, they also provide guidance for how the principles of intermodalism—and broader goals of quality of life—can be translated into a different kind of street.

I begin by reviewing efforts by AASHTO to elaborate on its Green Book through separate guidance, including A Guide for the Planning, Design, and Operation of Pedestrian Facilities (2004) and Guide for the Development of Bicycle Facilities (2011). In addition, the MUTCD (2012) has been revised to include bike-specific signage, markings, and controls. But perhaps the most intriguing development in street design has been the emergence of NACTO, whose mission is "to build cities as places for people, with safe, sustainable, accessible and equitable transportation choices

that support a strong economy and vibrant quality of life" (website accessed November 1, 2017). Frustrated with the limits and biases of AASHTO, it has developed its own *Urban Street Design Guide* (2013) and *Urban Bikeway Design Guide* (2014) to improve both intermodal equity and broader community goals for streets as public spaces. And, finally, I review the Federal Highway Administration's (FHWA) (2016) *Guidebook for Developing Pedestrian and Bicycle Performance Measures* for insights into innovative ways to evaluate roadways, not merely as vehicular conduits, or even multimodal transport networks, but also as places central to urban communities and economies.

The ongoing reimagination of the roadway starts with articulating a different vision about who streets are for, but also requires rethinking the technical standards for how street spaces are constructed, allocated, and situated in urban context. These standards, like complete streets policies, or traditional highway design standards, are limited in their scope to streets. Increasingly, however, these standards seek not only to reimagine how streets are shared among diverse users and uses, but also to consider more fully how such design choices relate to broader issues of social inequality and urban quality of life.

AASHTO GOES INTERMODAL: PEDESTRIAN AND BICYCLE GUIDES

With passage of the Americans with Disabilities Act in 1990 and the Transportation Equity Act for the twenty-first century (TEA-21) in 1998, transportation agencies were called upon to make accommodation for bicycling and walking as a routine part of planning, design, construction, operations, and maintenance (American Association of State Highway and Transportation Officials 2004, p. 2). This shift has been only further strengthened by the complete streets movement. As a result, nonmotorized modes have received greater attention not only in the Green Book itself, but in separate, mode-specific design manuals.

Guide for the Development of Bicycle Facilities

AASHTO's Green Book has long addressed both vehicular and pedestrian mobility, making it intermodal in at least that regard. But it traditionally lacked specific design guidelines for bicycles, instead treating them as vehicles (or, alternatively, as pedestrians on the sidewalk). But in recent decades it has developed a *Guide for the Development of Bicycle*

Facilities. When published in 1999, the guide's introduction somewhat grudgingly acknowledged the role of bicycles as a "viable transportation mode" (American Association of State Highway and Transportation Officials 1999). By the guide's fourth edition in 2012, however, AASHTO recognized bicycling as an "important" transportation mode and "design imperative" that should be addressed in all phases of transportation planning for "all roads, streets, and highways, except those where bicyclists are legally prohibited" (American Association of State Highway and Transportation Officials 2012, p. 1-1). While calling provisions for bicycle travel consistent with and similar to normal highway engineering practices such as the MUTCD, the guide has the specific purpose to provide "information on how to accommodate bicycle travel and operations in most riding environments" (pp. 1-2). Unlike the Green Book's implicit assumption of automobility, this guide justifies the importance of planning for bicycles in both functional terms—as important, as flexible, convenient, and affordable travel option, particularly for short-distance trips—as well as normative argument that "like other users of the transportation system, bicyclists need access to jobs, goods and services, recreational activities, and other destinations" (p. 2-1).

As with the other manuals, AASHTO's bicycle guide defines the design parameters of diverse cyclists to engineer facilities for accommodating them. The guide recognizes cyclists are diverse in their motivations, which can range from recreational/discretionary to those utilitarian/nondiscretionary riders who may not have access to automobiles or licenses or are otherwise dependent on bicycling (such as schoolchildren). These cyclists also have varying skill levels depending on age, experience, and confidence (pp. 2–3). Thus the bicycle as design vehicle also varies, leading to a range of spatial parameters like bicyclist operating space (minimum operating width of 4 ft and height of 8.3 ft) and speeds (typically 8–15 mph) (see Fig. 8.1) (p. 3.3).

In defining basic operating principles for bicycles, AASHTO notes the complex and hybrid role of bicycles on the roadway as something between vehicle and pedestrian. US traffic codes variously define bicycles distinctly or give them the same rights/responsibilities as other vehicles, but for AASHTO "the fact remains … the bicycle has different physical dimensions and performance characteristics than a motor vehicle" and bicyclists are more vulnerable in the event of a crash (pp. 3–5). According to the basic principles of bicycle operation in traffic, bicyclists must observe stop and yield signs, yield when changing lanes, and ride with traffic on the right side of the roadway. The manual does support the notion bicyclists should

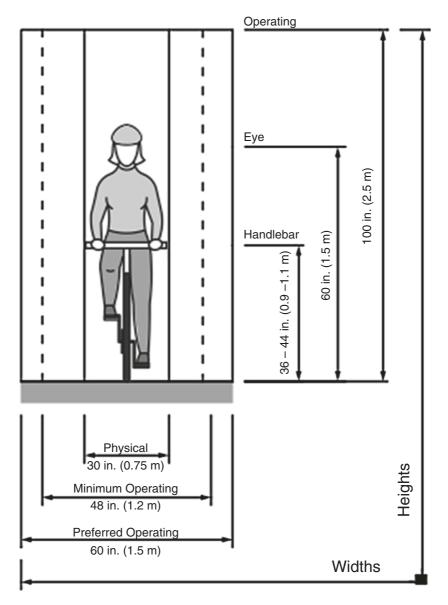


Fig. 8.1 Using the bicycle as design vehicle leads to different roadway design. From the *Guide for the Development of Bicycle Facilities* Fourth Edition, 2012, Washington, DC. Used by permission

"take the lane" when traveling at the same speed as traffic, or where a travel lane is too narrow for a motor vehicle to pass without encroaching on the adjacent lane (pp. 3–6), but bikes must otherwise yield and hug the side of the roadway, allowing faster cars to pass. And when traveling faster than cars, as in many urban contexts, they are expected like cars to pass on the left and not the right (unless in a bike lane). Bikes are thus both a vehicle and not a vehicle, and in the case of intersections can act like vehicles or pedestrians. They can either make a "vehicular-style" turn from the left side of the roadway or a "pedestrian-style" turn using crosswalks (ibid.).

If bicyclists have similar access and mobility needs as other users, AASHTO attributes to them "unique features and characteristics" that require specific treatments (p. 4-1). Because bicycles "may use the street system as their primary means of access" except where prohibited (ibid.), all streets are legally shared. Basic geometric design for motor vehicles can thus accommodate on-street cyclists without bicycle-specific designs or dimensions, particularly at low speeds and traffic volumes. But AASHTO recognizes "Share the Road" signage can alert motorists that they "should be mindful and respectful of bicyclists," but are no substitute for appropriate geometric design measures since it will not significantly improve conditions for cyclists (p. 4-3). Shared-use markings or "sharrows" can also be used to provide a higher level of guidance, particularly where there is insufficient width to provide bike lanes, by informing users the practical path or alignment of bicycle travel under typical conditions (pp. 4-5).

Given their distinct needs and vulnerabilities, however, AASHTO calls bicycle lanes "the appropriate and preferred" bicycle facility for thoroughfares in both urban and suburban areas (American Association of State Highway and Transportation Officials 2012, pp. 4–11). Bike lanes delineate available road space for preferential use by bikes, enabling them to ride at their preferred speed, be more visible, and encouraging them to "operate in a manner consistent with the legal and effective operation of all vehicles" (ibid.). In this sense, proper bicycle facilities help foster proper bicycling. AASHTO provides specific criteria for bike lane design, including a recommended width of 5 ft in most conditions, but in other circumstances should be as much as 8 ft where adjacent to parking, bicycle use is high, or on high-speed and high-volume roadways (pp. 4-14). AASHTO specifies a bike lane minimum of 4 ft, but only on constrained and low-speed roadways, and where this width cannot be achieved even after narrowing all other travel lanes to their minimum widths (pp. 4–15). This is significant, because local engineers may cite insufficient roadway width as a reason not to stripe bicycle lanes, but AASHTO actually advocates reducing vehicular travel lanes to their minimum (10 ft) where space is constrained. At intersections such choices become even more acute, since most conflicts between bicycles and motor vehicles happen here, particularly because bikes ride "along the periphery" of where traffic flows and drivers concentrate. To help bicyclists safely navigate intersections, AASHTO recommends bike lanes and good lighting, design to enable direct and logical routes through the intersection, actuated signals that detect bicyclists, and access management to reduce conflict points (pp. 4–22).

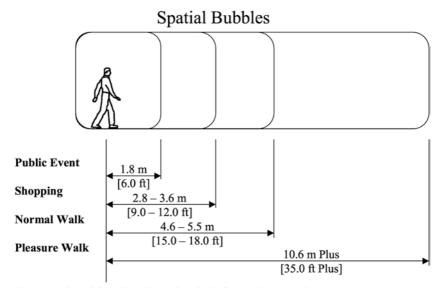
Although these more bike-friendly standards can be met through new roadway projects, many urban areas must be retrofitted to accommodate bikes. Physical widening is impractical in built-out urban areas, so AASHTO offers three alternatives: reducing or reallocating width used by travel lanes, reducing number of lanes, and reconfiguring or reducing on-street parking (pp. 4-29). Because these changes impact the distribution of roadway space, they are often politically sensitive and resisted by engineers and other stakeholders. But AASHTO notes travel lane widths can be reduced without significant changes in LOS (pp. 4-29). Travel lanes on many streets are wider than Green Book minimums, and geometric design includes flexibility for travel lanes as low as 10 ft. Indeed, AASHTO admits that narrow streets effectively reduce speeds as motorists adjust their speed to available lane width (pp. 4-51). Alternatively, AASHTO's bike manual suggests reducing the number of travel lanes where excess capacity exists. Such "road diets" can have the benefits of trading a single travel lane for two bike lanes, and reduce top-end speeds and thus accident severity (including so-called multiple threat accidents), as well as reducing noise for adjacent property owners (pp. 4-30). These strategies often require reduction in on-street parking, whether from one or both sides, requiring careful negotiation with the affected businesses and residents (pp. 4-22). Finally, AASHTO's bicycle manual specifies an entirely distinct form of bicycle facility: the multiuse path separated from motorized traffic and shared with pedestrians and other non-motorized users. Engineered like roadways at a smaller scale and lower speed, these shared-use pathways should be a minimum of 10 ft, but can be as low as 8 ft where usage is low or environmental constraints exist. While most shared paths are separate from the street, adjacent "sidepaths" can be designed to provide an alternative (particularly for children) adjacent to the roadway (pp. 5–8).

Guide for the Planning, Design, and Operation of Pedestrian Facilities

AASHTO followed its development of a bicycle facility guide with a Guide for the Planning, Design, and Operation of Pedestrian Facilities in 2004, which opens with the statement "Walking is the oldest and most basic mode of travel and is a fundamental part of the United States Transportation System" (American Association of State Highway and Transportation Officials 2004, p. 1). While pedestrian facilities have been and remain an element in the Green Book, AASHTO has moved beyond its terminology of pedestrian/vehicular interactions as "major consideration" to argue "because pedestrians are the most vulnerable of all transportation facility users, particular attention to pedestrian safety is needed." Therefore, AASHTO developed a separate manual whose explicit purpose and focus is to identify effective measures for accommodating pedestrians on public rights-of-way" (ibid.). The pedestrian facilities guide is intended for use in conjunction with other relevant manuals—including the Green Book, MUTCD, UVC, and the TRB's HCM—but addresses the specific design needs of those afoot.

The pedestrian guide begins by noting that everyone is a pedestrian at one time or another, so the design and construction of streets "must consider pedestrians" (p. 2). Following the directives of the FHWA and TEA-21, it acknowledges that walking facilities will be incorporated in all transportation projects unless "exceptional circumstances" exist, such as law that prohibit pedestrian use of roadway (e.g. interstates), establishing walkways would be "excessively disproportionate" to the need or probably use (e.g. greater than 20% of the total project), or scarcity of population indicates absence of need. And while the needs of pedestrians, motor vehicles, and bicycles may conflict, the guide offers guidance for resolving conflicting needs so that all modes of travel can be accommodated (ibid.). It cites multiple factors shaping the decision to walk, including distance and density, personal safety and security, and comfort and attractiveness, but acknowledges current low levels of walking may reflect the absence of safe facilities.

As the Green Book is built around the design considerations of vehicles, this guide elaborates the distinct characteristics of the so-called design pedestrian, including a range of walking speeds (2.5 to 6 ft per second), spatial needs (4.67 ft of space for two pedestrians to walk side by side or pass) and "spatial bubbles" (volume of space desired by pedestrians under



Source: Adapted from Time-Saver Standards for Landscape Architecture

Fig. 8.2 The pedestrian also has specific design considerations, including "spatial bubbles" based on walking speeds. From the *Guide for the Planning, Design, and Operation of Pedestrian Facilities*, First Edition, 2004, Washington, DC. Used by permission

different walking conditions) (see Fig. 8.2), and mobility issues for those with diverse impairments (ambulatory, visual, cognitive). Informed and guided by laws informed by discourses of fairness and justice (ADA and TEA-21), AASHTO's pedestrian guidance translates these into a categorical statement that pedestrian facilities should be "designed to safely accommodate all types of pedestrians including children, adults, the elderly, and those with disabilities" (p. 16).

Although AASHTO recognizes the importance of urban contextual factors like pedestrian-friendly site development and traffic management, it is an engineering manual. Therefore it focuses on translating pedestrian design principles into street infrastructure or facilities. This starts with identifying attributes of good or pedestrian-accommodating roadway design, including circulation that serves all users (including frequent opportunities to cross streets at well-designed intersections), features that "equitably" balance needs of all users, overall connectivity in which every

destination is served by an accessible path of travel, safety, accessibility, engineering elements that account for pedestrians, and landscaping that contributes to "the overall psychological and visual comfort of sidewalk users" (p. 49). In practical terms, AASHTO translates this into a set of key parameters. It argues for appropriate design speeds, particularly since faster travel increases risks of injury, which it relates to the number and width of travel lanes since narrower widths reduce both vehicular speed and crossing distance. While many engineers err toward wider lane widths to accommodate larger vehicles, the manual reiterates that the AASHTO's Green Book permits a range of urban lane widths from 10 to 12 ft. It also highlights the importance of sight distance and sight lines for safe crosswalks, as well as proper lighting.

And, importantly, the manual sets out design considerations for separate pedestrian facilities. It states all roadways along which pedestrians are not prohibited should include an area where people can safely walk, whether sidewalks, off-road paths, shared-use paths, and even "shared streets" with extremely low vehicle speeds (p. 54). AASHTO states firmly that "connectivity in the walking environment is just as important for pedestrians as a completely developed roadway network is for motorists" (p. 95). Applying the spatial needs of the design pedestrian to the sidewalk, the manual specifies a minimum clearance of 4 ft to accommodate two people passing, but argues for increased widths in many locations like central business districts (typically 6-8 ft with planting strip, but a desirable width of 10 ft). To provide greater safety and an enhanced pedestrian experience, sidewalks should be buffered by on-street parking, landscaped planting strips, and/or plantings and benches (p. 59). It argues for access management that minimizes access points and driveways designed to the standards of sidewalks (p. 61). And, finally, AASHTO's pedestrian manual focuses on street crossings as an essential component of any roadway design, which should be clear, predictable, and visible; have a reasonable waiting time, adequate crossing time, and limited exposure; and be free from barriers or hazards (p. 72). In providing best practices for crosswalks, the guide specifies intersections should be designed on the premise that pedestrians will be present, should be able to cross, and do so safely.

These manuals represent a major shift in highway engineering in the U.S. AASHTO remains the dominant source of guidance for how streets should be engineered. While its Green Book is ostensibly intermodal, the development of separate bicycle and pedestrian design guidelines is important. Now engineers have well-developed guidance that is focused on the

particular needs of non-motorized users, and can be used to design streets accordingly. Together with the MUTCD, they provide well established and respected standards for making streets more intermodal, and thus more equitable and protective of vulnerable users. But ultimately pedestrian- and bicycle-specific concerns and designs remain secondary to vehicular, and this guidance is merely informational and optional. And even when applied, the standards do not reflect the full scope of design alternatives that may be otherwise proven and supported by the MUTCD. They thus represent a significant but limited step toward design for more just streets.

THE MUTCD AND TRAFFIC CONTROL FOR BICYCLES

Recent editions of the MUTCD (Federal Highway Administration 2012) include a Part 9, "Traffic Control for Bicycles." While the UVC largely subsumes bicycles within the overall category of vehicles, and the MUTCD traditionally focused on vehicles and pedestrians, it is increasingly recognized that bicycles have rights and responsibilities like vehicles but distinct operational characteristics. In recognition, the MUTCD now specifies signs, signals, pavement markings, and traffic controls specifically related to bicycle operation (p. 789). It is careful, however, to remind readers that the absence of a marked bicycle lane or related traffic controls "shall not be construed to mean that bicyclists are not permitted to travel on the roadway" (ibid.).

MUTCD Chap. 9 specifies bicycle signs to regulate and guide the interaction of bikes with vehicles and other users. On the roadway, regulatory signage reinforces the UVC in allocating space to cars and bikes. For example, the "Bicyclists May Use the Full Lane" sign is an option, but only when no bicycle lanes or adjacent shoulders are usable and where travel lanes are too narrow for side-by-side operation, or in locations "where it is important to inform road users that bicyclists might occupy the travel lane" (p. 795). Other regulatory signage assigns ROW where shared-use paths intersect with roadways. Based on these criteria bikes will more often be made to yield, but the MUTCD does note that speed should not be the sole factor, and vehicles may be stopped where a high-volume path crosses a low-volume street, or a regional path crosses a minor collector street (p. 794). And as shared-use path networks have grown in scale and importance, the MUTCD has developed distinct guide signage, sized and colored differently to confirm bicycle route direction,

distance, and destination. As the MUTCD historically emerged from the need to designate state and local highway networks, today it helps designate new shared-use networks expanding across the US.

Equally important to multimodal traffic control are markings and signals. Markings indicate separation of lanes for road users, assist cyclists by indicating assigned travel paths, and provide advance information for turning and maneuvering (p. 806). These include markings for bicycle lanes, which "designate that portion of the roadway for preferential use by bicyclists" and inform of the restricted nature of the bike lane. The MUTCD does not provide standards for when bike lane markings should be used (in contrast to warrants for other longitudinal markings like center lines), but does specify how they should be used. Shared lane markings may also be used to assist bicyclists position themselves laterally to avoid impacting car doors, or in lanes too narrow for vehicles and bikes to operate side by side, and alert road users to the presence of bicyclists (p. 810). Like "Share the Road" and "Bicyclists May Use the Full Lane" signage, such markings do not give bicyclists any right they do not already enjoy on the roadway, but merely guide bicyclists and warn drivers of their presence (see Fig. 8.3). The only standard mandated by the MUTCD is that these "sharrows" not be used on shoulders or in designated bike lanes, but recommended guidance specifies they should not be used on roadways with a speed limit above 35 mph (ibid.). And, finally, Part 9 provides additional standards related to signal operations for bicycles, though limited to allowing bicycles to be counted as either vehicles or pedestrians in signalwarrant evaluation, and requires signal timing and actuation be "reviewed

Fig. 8.3 Signage communicates a bicyclist's equal right to the street, at least when there is insufficient room on the roadway margin. From the MUTCD, 2012, by the Federal Highway Administration, Washington, DC



and adjusted to consider the needs of bicyclists" on bikeways (p. 816). This is a significant issue, since many actuated signals detect the presence of automobiles but not bicycles, leaving cyclists waiting for lights that never change.

Part 9 of the MUTCD is limited in scope and detail, but represents a step toward recognizing the rights of cyclists to the roadway and the need for distinct traffic controls. In developing signage, markings, and signals specifically for bicycles, the MUTCD has advanced multimodal parity on the roadway. But the MUTCD leaves the installation of such features to the judgment of engineers, without providing recommendations (much less standardized warrants) for their use.

Urban Alternatives: NACTO Guides

Roadway engineering has for decades been dominated by a limited set of standards developed for highways by a few key organizations (AASHTO, NCUTCD, Institute of Transportation Engineers), but recently a new player has emerged in the nonprofit NACTO. According to its website, NACTO's mission is "to build cities as places for people, with safe, sustainable, accessible and equitable transportation choices that support a strong economy and vibrant quality of life" (accessed October 20, 2017). Echoing the complete streets movement, its goals are "communicating a bold vision for twenty-first century urban mobility and building strong leadership capacity among city transportation officials ... empowering a coalition of cities to lead the way on transportation policy at the local, state, and national levels ... and raising the state of the practice for street design that prioritizes people walking, biking, and taking transit" (ibid.). The organization comprises 23 major member cities—ranging from Atlanta to Washington, DC-and affiliates in the US, as well as major transit agencies like New York MTA, and Canadian cities like Toronto and Vancouver. Its board of directors is led by Janette Sadik-Khan, principal with Bloomberg Associates and former NYC transportation commissioner, and includes directors of DOT in Los Angeles, Seattle, Charlotte, Denver, and former Chicago DOT director Gabe Klein.

NACTO has made major contributions by articulating a different and broader vision of streets as both inclusive transport systems and high-quality places, and providing alternative design guidance to fulfill it. Achieving greater equity among modes, and access for broader place-based uses, requires changing both priorities *and* design practices. As we learned

in Chap. 3, distinction between city and rural roads in traffic regulation and design was collapsed by mid-century in the US, as the AASHTO's Green Book integrated what were earlier distinct standards appropriate to distinct contexts. So-called "highway" engineering came to influence the design of urban streets, with some lamentable results. To help cities recover a distinctive voice in roadway design, and apply standards more appropriate to multimodal street environments, NACTO has developed a set of new guides including an *Urban Street Design Guide* (2013), *Urban Bikeway Guide* (2014), and *Transit Street Design Guide* (2016). These bear examination for how they reimagine the street, and articulate that vision into guidelines that can be applied to it.

Urban Bikeway Guide

The *Urban Bikeway Guide*, first published in 2011 and revised in 2014, was written to "provide cities with state-of-the-practice solutions that can help create complete streets that are safe and enjoyable for bicyclists" (p. ix). The guide was, in NACTO's words, "developed by cities for cities, since unique urban streets require innovative solutions." The manual reflects implicit frustration with the limits of AASHTO, since many bicycle safety treatments are not directly referenced in AASHTO's bikeway facilities guide, though tested on the ground permitted under the MUTCD, and approved by the FHWA. The *Urban Bikeway Guide* provides design guidance for bike lanes, cycle tracks, intersections, signals, signing and marking, and bicycle boulevards.

In its Chap. 1 on bike lanes, for example, NACTO's bikeway guide argues for the benefits of exclusive space for bicyclists to enable them to ride at their preferred speed "without interference from prevailing traffic conditions" and facilitate predictable behavior and movements between bicyclists and motorists (p. 3). Design guidance for conventional bike lanes therefore specifies required features like minimum widths (4 ft of rideable surface), buffering from parking, labeling, and positioning in relation to turning lanes; recommended features like additional width, flush gutter seams, separation from parking, and so on. It provides a separate set of guidance for buffered bike lanes, contra-flow bike lanes, and left-side bike lanes. The power of NACTO guidance, however, is its graphics that make it easy to visualize implementation of these different features in realistic urban contexts, buttressed by photographs of applications in various model cities (see Fig. 8.4). These graphics are supplemented on NACTO's



Fig. 8.4 NACTO translates roadway design criteria—from AASHTO or the MUTCD—in a more accessible format for non-engineers, including design of buffered bike lanes. From *Urban Bikeway Design Guide* by National Association of City Transportation Officials. Copyright © 2014 NACTO. Reproduced by permission of Island Press, Washington, DC

website, which shows how such best practices can be used to retrofit existing roadways. These easy-to-use and visualize design guidelines also provide cross-referencing of each proposed treatment to established guidance like the MUTCD, which reinforce their legitimacy as engineering practices. Together they help advocates as well as engineers understand design guidance, and imagine how streets might—within inevitable constraints—be made more inclusive for bicyclists.

Other chapters in NACTO's *Urban Bikeway Design Guide* (2014) address the proper design of exclusive bike facilities like cycle tracks, bike-specific marking and signage, and so-called bicycle boulevards with low speeds and traffic volumes designated and designed to prioritize bicycles (p. 145). And given their critical role in mediating competing flows, "Intersections" highlights ways to reduce conflict between vehicles and bicyclists (and other vulnerable road users) by heightening visibility, denoting clear right-of-way and facilitating eye contact and awareness among competing modes (p. 47). And it provides guidance—required, recommended, and optional features—for such improvements as bike boxes to enable cyclists to get ahead of queuing traffic during red

signals, intersection markings to provide a clear path for cyclists, median refuge islands to facilitate pedestrian and bicycle crossings, through bike lanes, combined turn and bike lanes, and cycle-track intersection approaches.

Again, the guide provides easy-to-use graphics of intersection design, with each treatment cross-referenced to supporting portions of the MUTCD, to assert more forcefully the legitimacy and importance of best practices for the bike design. In the words of NACTO President, the *Urban Bikeway Design Guide* is "actively transforming how our cities think about streets—whom they are for, and how they might be best used ... being translated into a series of game-changing street Projects" (p. viii).

Urban Street Design Guide

Looking beyond design for different alternative modes, NACTO's *Urban Street Design Guide* (2013) is, in the words of Janette Sadik-Khan, "much broader in scope" (p. vii). "Pulling away from a bias towards highway designs that simply don't meet the complex needs of cities," it is part of a growing movement to build sustainable streets and "create a new DNA for city streets" by not only making streets "safe and inviting" for diverse modes but ultimately is about "creating real spaces for people on city streets" (p. viii). Contrasted with AASHTO's *A Policy on Geometric Design*, NACTO emphasizes city street design as a "unique practice with its own set of design goals, parameters, and tools" (p. x). But it is still positioned as legitimate alternative to standard roadway design, cross-referenced to the MUTCD to provide guidance on which treatments are required, recommended, or optional.

Unlike standard engineering manuals, which take a technical approach to optimize transportation systems for mobility, NACTO's *Urban Street Design Guide* adopts a broader perspective. It begins by stating that "streets are the lifeblood of our community and the foundation of our urban economies ... They make up more than 80% of all public space in cities," and not only provide a "safe place for people to get around" but also foster business activity and "serve as a front yard for residents" (ibid.). It frames an overarching principle that streets are both public spaces for people and traffic/transportation arteries (p. 3), specified by secondary principles that streets are public spaces and great for business, can be changed by designers who work flexibly ("traffic engineers can and should do better" to prevent avoidable crashes), are ecosystems where human and natural systems interact, and cities should "Act Now!" to implement projects quickly (p. 5).

To translate these principles into meaningful change, it provides clear graphics to help readers critically assess the details of existing typical streets and imagine their transformation through interim redesign through lowcost treatments and ultimately full capital reconstructions in 5-10 years (see Fig. 8.5) (p. 6). It applies principles of context-specific design to show how current streets—transformed by traditional highway engineering into vehicular thoroughfares over the twentieth century—can be redesigned over phases to accommodate pedestrians, bikes, and transit, while improving place functions and environmental sustainability. It notes how many streets are underutilized even for vehicular traffic and parking, much less "spaces for play and leisure" (p. 16). Thus NACTO's Urban Street Design Guide shows how different allocations of space within the public ROW can produce results that are very different in how the street is shared among transport modes, as well as residents, shoppers, and landscaping elements. While streets high in the transport network hierarchy emphasize mobility, all designs account for surrounding context and place functions of streets, and low-volume residential streets are reimagined as shared streets that serve "foremost as a public space for recreation, socializing, and leisure" by residents (p. 26).

Like other manuals, The Urban Street Design Guide establishes design elements around which streets are engineered. Acknowledging immediately that all elements vie for space within a limited ROW, it argues for ways to optimize community benefit (p. 31). For example, it emphasizes the allocation of lane width should be considered within the "assemblage" of a street to serve all needs, in contrast to wider travel widths to make drivers comfortable at the expense of other users. It therefore advocates lanes narrower than 11 ft as a general rule so cars don't speed unintentionally or "assume valuable right-of-way at the expense of other modes" (p. 34). It highlights the "vital role" of sidewalks in city life as both conduits for pedestrian movement and as public spaces are "front steps to the city, activating streets socially and economically" (p. 37), and provides very detailed design guidance to ensure a high-quality pedestrian experience. Other elements include curb extensions to narrow the roadway and create shorter crossings, vertical speed control elements like speed humps and tables, transit street elements like bus lanes and pull-outs and stops, and stormwater management elements like bioswales and pervious surfaces.

NACTO recognizes the challenges of retrofitting existing streets, so it dedicates a chapter in its *Urban Street Design Guide* to "Interim Design Strategies" or tools and tactics cities can use in the near term. Arguing cities



Fig. 8.5 NACTO guides help visualize street transformations, from incomplete to complete. From *Urban Street Design Guide* by National Association of City Transportation Officials. Copyright © 2013 NACTO. Reproduced by permission of Island Press, Washington, DC

have both "opportunity and responsibility to make the most efficient use of street space," NACTO suggests that interim design can build support for and test projects before they are fully constructed (pp. 72–73). Most strategies involve reallocation of existing street spaces, since expansion of ROW is a longer-term challenge, and many roadways have ample roadway space out of proportion to vehicular demand. The guide argues for tactics like "moving the curb" by converting parking spaces or curb-side travel lanes

into bus lanes or cycle tracks to reallocate street space for transit or bikes. In an even more fundamental reimagining of the street space, NACTO argues for the return of street space from transport/movement to public uses. For example, it argues for converting parking into parklets—public seating platforms, often reflecting a partnership with local vendors and neighborhoods—to create "vibrant community spaces" (p. 77) that can "activate street life and create a destination within the street" (see Fig. 8.6) (p. 74). Other interim tactics include temporary street closures that restrict streets to pedestrians or bicyclists at specific times of day or week, to create spaces for play, community/cultural events, active transportation corridors, and so on. Similarly, it proposes creation of interim public plazas to transform underutilized areas of roadway into public spaces for surrounding residents and businesses, thereby reconfiguring and revitalizing otherwise unsafe or underutilized intersections (see Fig. 8.7) (p. 85). These reflect a fundamental, albeit interim, reimagination of streets for public uses broader than just transportation.

NACTO applies this same, broader, understanding of street space to intersections. To meet the "needs and demands of everyone" intersections must function safely and efficiently, but they must also "bring people together and invigorate a city, while making traffic more intuitive, seamless, and predictable for those passing through" (p. 89). NACTO establishes design goals for intersections as both nodes in the transport network

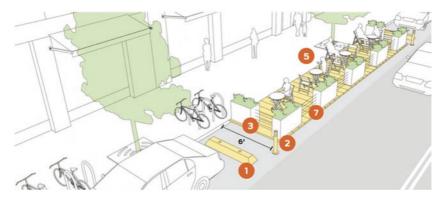


Fig. 8.6 Going beyond intermodalism, NACTO guides envision non-transport uses of the public street, such as "parklets." From *Urban Street Design Guide* by National Association of City Transportation Officials. Copyright © 2013 NACTO. Reproduced by permission of Island Press, Washington, DC

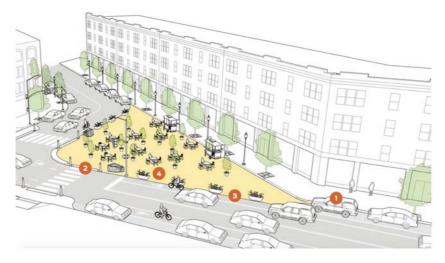


Fig. 8.7 Interim designs guide transformation of underutilized vehicular space into public plazas for gathering places for residents and business. From *Urban Street Design Guide* by National Association of City Transportation Officials. Copyright © 2013 NACTO. Reproduced by permission of Island Press, Washington, DC

and places, specifying intersections should be as compact as possible to reduce pedestrian exposure and slow traffic, analyzed as part of a network and not in isolation, their design must "integrate time and space" to improve function through signalization before widening is considered, and intersections are shared spaces where good design can not only reduce conflict but create a space of mutual awareness among users (p. 93). But also important are place-making goals that excess space be utilized as public space that enhances civic life and designs be forward thinking to account for existing and future land uses, related to the "desires and objectives of the surrounding community" (ibid.).

And given the importance of intersections, NACTO provides intersection design elements to mobility and safety goals and enhancing the public realm (p. 107). For example, it emphasizes the importance of crosswalks to support a walkable urban environment, benefiting and guiding pedestrians while reinforcing their right-of-way (p. 109). NACTO takes a more firm stance than AASHTO in arguing all legs of signalized intersections "must have marked crosswalks" unless prohibited, and discouraging pedestrian

crossings by leaving uncontrolled crossings unmarked "is not a valid safety measure" (p. 110). It argues for intersection crosswalk markings to offer pedestrians "as much comfort and protection" possible, and for mid-block crosswalks that "facilitate crossings to places that people want to go but that are not well served" (p. 114). Thus it argues for installation of such crossings where significant pedestrian desire lines exist (ibid.). Other techniques include pedestrian shelter islands and minimizing corner turning radii to create compact intersections with safe turning speeds. It also emphasizes the important role of traffic signals in allocating time as well as space to govern mobility, safety, and public space functions of streets. Looking beyond mere throughput, NACTO argues that traffic control should be guided by principles that include shorter signals to increase turnover, prioritizing walking/biking/transit, keeping signals phases to a minimum, timing signals to intended speeds, timing for peak and off-peak volumes, and using fixed rather than actuated signals to ensure consistent opportunities for pedestrian crossings and cross traffic (p. 127).

Some of the design elements it highlights are pedestrian-leading intervals to give those on foot a head start to increase visibility and reinforce their right-of-way, split phasing to mitigate left-turn hazards, shorter signal lengths to "help city streets function as a complete network, rather than a series of major corridors," and coordinated signal timing optimized for slower speeds of bikes and pedestrians and transit headways rather than cars (p. 131). Such details, though "often invisible to the public ... have a significant impact on the urban realm" by affecting pedestrian wait times, which, compounded over multiple intersections, can make walking prohibitive and frustrating (ibid.). And addressing the pros and cons of fixed vs. actuated signals, NACTO argues for fixed-time signals to promote regularity, network organization, predictability, and reduce delays. Because actuated signals prioritize movement along the primary corridor they can "present obstacles to cross traffic," making it critical that designers look at "desirable crossing intervals to achieve a pedestrian-friendly environment" (ibid.).

And, finally, the *Urban Street Design Guide* sets design controls or key criteria that critically shape design decisions (p. 135). Echoing the basic argument in this book, it argues for "keen understanding of the analytical processes and assumptions underlying" technical decisions that shape streets, and argues for a proactive (rather than passive) design strategy that "uses design to affect desired outcomes, guiding user behavior through physical and environmental cues" (p. 136). For example, in contrast to traditional design on highway principles that anticipate driver error and

accommodate higher speeds, and utilization of techniques that degrade the walkability of streets, it argues for design that targets the speed drivers are intended to go, typically 10–30 mph on most urban streets, erring toward lower speeds where there are above-average pedestrian volumes (p. 141). And in direct contrast to AASHTO, it argues for designing streets for the most vulnerable street user rather than the largest vehicle, and thinking about ideal design before selecting a design vehicle (p. 143). Also drawing a contrast to traditional engineering, NACTO suggests design should balance needs and functions over different periods rather than focus on peak periods of intensity, and limited measures like ADT and peak volumes (p. 148). Similarly, rather than plan for a design year using methods that assume steady traffic growth, "often at odds with local policy and recent travel trends," it argues that such standards be "qualified by intended outcomes and goal-driven city policies" (p. 151).

The last two design criteria merit specific discussion. Performance measurement, NACTO argues, is both a "rigorous and imperfect process" since a street that works well for one set of users may be dangerous for others. Thus performance measurement must take a multidisciplinary approach through the integrated lens of "safety, economy, and design, and inclusive of the goals and behaviors of everyone using the street" (p. 155). It recognizes that goals of different users "often stand at odds," so design must "balance these goals, making strategic tradeoffs in search of a win-win scenario" (ibid.). NACTO considers and contrasts the diverse needs of different users: pedestrians want activity and variety and safety, bicyclists want connectivity and to feel safe and protected, motorists want to get to their destination quickly and safely, transit users want speed and convenience, and freight operators want to move their goods "easily, quickly, and conveniently" (pp. 156-157). Therefore it critiques LOS for its failure to measure streets beyond their "ability to process motor vehicles" (p. 157), and argues for the adoption and use of multimodal performance measures. For pedestrians these might include safety, pedestrian LOS, WalkScore, delay, and so on. For cyclists this might include safety, bicycle LOS, and delay. And for transit these could include on-time performance, average speed, ridership, and so on. As we note below, such measures provide a framework for comprehending existing street function and guide future designs. So NACTO argues for holistic performance measures that recognize "streets are places to sit and stay as much as they are conduits for movement" (p. 156). And, lastly, the guide suggests reconsideration of the functional classification system that has defined streets for generations based on their hierarchy in the

highway network, whether or not they consider local context. Because city streets are "complex places," functional classification is too limiting a basis for design capable of meeting quality of life, mobility, and livability goals (p. 160). NACTO therefore argues for updated standards that do not base design exclusively on a street's place in the hierarchy, but also attempts to capture "the unique relationship between the built realm and the surrounding streetscape" (p. 160).

RETHINKING PERFORMANCE MEASUREMENT

FHWA Guidebook for Developing Pedestrian and Bicycle Performance Measures

Performance measurement is a key part of the transportation planning, engineering, and funding decisions at federal, state, and local levels. But if states and metropolitan planning organizations and cities are theoretically supposed to analyze a variety of performance measures—mobility, congestion, safety, quality of life, environment, maintenance, and so on—they often rely on a much narrower set focused on vehicular mobility: delay, congestion, speed, throughput, travel time, reliability, incident duration, and so on. Emphasizing vehicular flow, however, these fail to offer more balanced assessment of transportation facilities and can bias decisionmaking and investment toward cars. In response, the US DOT Federal Highway Administration (2016) has recently developed a Guidebook for Developing Pedestrian and Bicycle Performance Measures to help communities fully integrate pedestrian and bicycle planning into performance management (6), offering another window into changing assumptions behind transport planning/design, and how these address mobility justice on the street.

The guide is straightforward in arguing walking and bicycling are together "the most equitable, environmentally friendly, and healthy means of transportation" as well as being efficient and economically productive, making bike and pedestrian performance measures critical for ensuring transportation systems support community goals (p. 20). The guidebook looks beyond traditional transportation metrics to wider community goals of connectivity, economic productivity, environmental quality, equity, livability, health, and safety. And it offers ways to assess the performance of any transportation system accordingly.

The result is a set of new and integrated performance measures. For example, it offers an integrative performance measure of "Access to Community Destinations" defined as proximity of pedestrian, bicycle, and transit to origins and destinations (p. 38), which can be measured by the proportion of residences within walking or biking distance of key destinations, residences proximate to bike or pedestrian facilities, residences with access to wider community destinations, and so on (p. 39). It provides a similar measure for "access to jobs." Another is "Adherence to Accessibility Laws" like the Americans with Disabilities Act, tracked via measures including percent of street crossings, sidewalks, pedestrian signals, and shared-use paths that meet accessibility standards. Other measures include traditional transportation metrics like average travel time, but incorporate bike and pedestrians and take a different perspective. For example, the guide critiques the traditional emphasis on traffic counts and vehicle delay (e.g. LOS) for exaggerating severity of congestion, and points to new sources of data like smartphones and web-based mapping to provide a more rounded way to "frame traffic impacts related to bicycle and pedestrian projects" (p. 47). Other more multimodal measures include connectivity, crashes by all modes, distance between designated bike and pedestrian crossings, delay by all modes, density of destinations, physical condition of pedestrian and bike facilities, miles of bike/pedestrian facilities, mode split, network completeness, route directness, and population served by walk/bike/transit. Such measures already challenge planners and engineers to think differently about transportation, but the guide pushes them further to think about the societal impacts beyond just mobility, offering performance measures for job creation, land consumption and value, physical activity and health, and even street trees.

The guide does offer more typical measures like LOS and volume, but these are framed in a very different way. For example, it includes LOS but looks beyond the HCM's "methodology ... primarily based on vehicular delay" (p. 68) to include multimodal LOS (MMLOS), and others like the Danish Bicycle/Pedestrian LOS, the City of San Francisco Department of Health's Bicycle Environmental Quality Index (BEQI), and Pedestrian Environmental Quality Index (PEQI), among others (ibid.). And in discussing volume, it includes pedestrians and bicycle as well as vehicles. And even when describing vehicle miles traveled it focuses on Vehicle Miles Travelled Impacts to emissions levels and air quality (p. 94). And, perhaps most fundamentally, it argues for measurement of person throughput as a "mode neutral estimate of the person through-capacity of a given corridor"

(p. 78). Critiquing the traditional measurement of capacity as function of vehicle units, it argues "the fundamental unit of measure is a person" (ibid.)

The FHWA's Guidebook for Developing Pedestrian and Bicycle Performance Measures resonates with broader goals of multimodal equity espoused by the complete streets movement. To the degree our streets—and decisions about them—are based on measurement of existing and anticipated performance, then the struggle for more equitable streets must inevitably engage systems of performance measurement. And in contrast to auto-centric measures of quality like LOS, which amplify already existing legal and engineering biases toward cars, it offers a much more holistic view of the street as transport infrastructure and social system. They take a concern for modal equity and streets-as-places, and not just conduits, and translate it into quantifiable variables engineers can measure and factor into their models and decision-making. Such standards are new and not well established, but have the potential to remake how we imagine and redesign streets.

A More Just Street by Design?

In the growing movement for a more inclusive and complete street, multimodal design standards reflect a fundamental rethinking of who/what streets are for and how they should be engineered and constructed. These emerging standards, like the complete streets movement or the Americans with Disabilities Act, reflect a changing vision of the street premised on equality of opportunity among people of diverse modes and abilities. More than mere vision, application of these standards has real power to create spaces that structure different and more just relations among the mobile. They merit close study by both students of changing social relations on the street and those who wish to transform them in everyday practice.

While these manuals may be cross-referenced in support of intermodal design, their perspective and roles vary. AASHTO's relatively new guides for pedestrian and bicycle facilities represent a major step for incorporating other modes into the theory and practice of geometric design, and when applied have the potential to make walking and biking a safer and a more integral part of the street. These standards, like pedestrian and bicycle facilities themselves, however, remain supplementary and informational. And innovation in design is constrained by the overriding assumption of automobility that remains central to AASHTO's conception of the public ROW. Recent revisions of the MUTCD have not only elaborated on best

practices in pedestrian design, but also now include standards for how streets may be signed, marked, and controlled for the safety and convenience of bicycles. But the most significant change in roadway engineering has been the emergence of NACTO, whose guides make intermodalism a core principle for the design of urban streets, in addition to addressing place functions of streets as community spaces. And offering easy-to-visualize designs for the creation of more equitable and livable streets, cross-referenced to the MUTCD, it promotes a return of city streets to the greater public functions they served a century ago, before highway engineers took over. Finally, both NACTO and the FWHA now emphasize the importance of measuring the performance of streets not only in terms of vehicular throughput, but through broader measures of intermodal equity and community quality.

Together these standards represent the leading edge in imagining a different kind of public street, articulating principles of intermodal equity and inscribing them in the social space of the roadway. When applied, these standards help construct a street explicitly designed to maximize access for all users, promote greater equity among them, while remaining attentive to the most vulnerable among us. And written in more easy-to-read language, relying less on geometry and more on graphical communication, they encourage a broader spectrum of planners and community members to engage engineers in the technicalities of roadway design. And rather than guidance produced by state highway engineers, whose agenda is driven more by the function of large networks rather than particular places, they are attuned to the needs of cities where streets are as much places as conduits. And beyond offering designs for more inclusivity and sustainable streets, NACTO and FHWA guidance suggests ways to measure these qualities as performance variables, changing how we evaluate, plan, design, and measure streets. More than just promoting our right to a more just street in theory, these offer detailed designs for a much different—and much more equitable—street in practice.

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CHAPTER 9

The (Block-by-Block) Fight for a More Just American Street

Rethinking traffic law and design standards is key to making mobility more equitable. But ensuring a right to a more just street requires transforming actual roadway spaces. This does not happen without a struggle. Much as our modern vehicular thoroughfares are products of pitched battles by automotive forces over pedestrians and transit (Norton 2008), today advocates for alternative modes and complete streets engage highway engineers in "street fights" for greater safety, access, and equity (Henderson 2013). Despite legal and engineering efforts to make streets orderly, conflict is ever present on the everyday street. And this conflict only becomes more visible when the dominant social order is challenged. A century after automobiles forced other users to the margins of the public street, people are again asking pointed questions about who has a right to the street, whom streets should be designed for, and how diverse interests might be more equitably served. A fight for the street is waged daily among individual users. But at certain times there is a wider-scale, even epochal, struggle to reshape the geography of the street. We live in such a moment.

This chapter explores the multifront, block-by-block struggle for the right to a more just street. I begin with the scale of policy, tracing the application of complete streets principles and elements to ordinances and resolutions across the US, and how these parallel a growing "Vision Zero" movement for "eliminating all traffic fatalities and severe injuries—while increasing safe, healthy, equitable mobility for all" (visionzeronetwork.org, last accessed December 1, 2017). I then turn from policy to application

through different strategies for physically redesigning streets. These include efforts to remove urban freeways to build multimodal boulevards and parkland, retrofitting existing streets with Bus Rapid Transit (BRT) to expand transit and pedestrian/bike access, placemaking efforts to create public plazas from street spaces, and green alleys transforming "uninviting, concrete corridors into safe, green, community spaces" (as described on the Trust for Public Land website, last accessed November 20, 2017). I conclude by looking at more performative and ephemeral—but symbolically powerful—efforts to rethink the public space of the street. These include artistic "ghost-bike" memorials for bicycle fatalities, Critical Mass rides in which cyclists take over public streets, Open/Free Streets closures "where people traffic replaces car traffic, and streets become places where people of all ages, abilities and background can come out and improve their health" (openstreetsproject.org, last accessed November 21, 2017), and annual Parking Day events when "citizens, artists and activists collaborate to temporarily transform metered parking spaces into 'PARK(ing)' spaces: temporary public places" (parkingday.org, last accessed November 21, 2017).

We can learn much from the principles and tactics of these various movements to remake the actual street, whether through policy reform, physical planning, or social events. Each represents distinct theories of the street, how people of different transport modes and capabilities might best relate to each other, and how streets might function both as spaces for transport flows and as places for urban life. We might explore how these movements imagine the socio-space of the street, much as we critically examined the assumptions and traditional traffic law and engineering. But as I've argued, it's equally important to examine how "the rubber meets the road," how different assumptions can be applied to produce different kinds of street spaces and social relationships. These, again, may be scrutinized in relation to principles of mobility justice on the street. And, perhaps more radical even than intermodalism, these efforts bear examination for how they help return streets from spaces of mobility to public places for urban life. In short, how may these various movements—both singly and together—help produce more just "streets for everyone?"

REVOLUTIONIZING TRANSPORTATION POLICY

Complete Streets Implementation

Because state and local governments govern the public street, they represent the key policy arena where the battle for the right to the street is

waged. As noted in Chap. 7, the complete streets movement advocates "streets for everyone ... designed and operated to enable safe access for all users" by focusing on policy reform through state statutes or local ordinances/resolutions (National Complete Streets Coalition 2013). These set out the goal of ensuring all modes are accounted for in the planning of roadways, and access be provided across modes as a general rule, except when proven infeasible through a high-level review process. The principle of intermodal equity underpins these model policies and resulting actual laws/resolutions, directly confronting the biases of auto-centric roadway design in which pedestrian/bicycling/transit are "alternative" modes whose "accommodation" is optional. These broad policy statements for intermodal equity and livability are applied via best practices in intermodal design (summarized in Chap. 8).

In theory, the movement itself represents a significant challenge to auto-centrism. But what is the movement's practical impact on the stateby-state, city-by-city, block-by-block struggle for mobility justice? Given the breadth of the movement's vision and goals, it may be said to encompass any investment in non-vehicular travel, suggesting its impact is both everywhere and impossible to separate. But adoption of complete streets statutes, ordinances, resolutions, or other policies is indicative. The Coalition's own annual The Best Complete Streets Policies publications provide both a rolling summary of policies adopted across the US and an assessment of individual plans according to key policy elements. By the end of 2016, 1232 jurisdictions—across all 50 states, Puerto Rico, and the District of Columbia—had adopted some kind of policy, including 33 state governments, 77 regional planning organizations, and 955 individual municipalities (National Complete Streets Coalition 2017, p. 2). Of policies adopted by municipalities, 50 were in large cities, 55 in mid-sized cities, 131 in small cities, 44 in large suburbs, 109 in mid-sized suburbs, 209 in small suburbs, and 241 in towns. Fourteen of the 15 largest cities have a complete streets policy (p. 6). Of policies adopted nationwide, 542 were nonbinding resolutions, 299 are policies, 208 are legislation, and the remainder were other plans or policies (including elements incorporated in design standards) (p. 7). Among those policies adopted, a vast majority specify streets should serve people of all abilities and ages, specify diverse transport modes, highlight the importance of an integrated and multimodal street network, and specifically cross-reference best design practices/guidance (p. 9).

The complete streets movement has certainly not yet overturned the hegemony of auto-centrism in transport policy and traffic engineering. Those 955 municipalities with complete streets policies by the end of 2016 represented only 4.9% of the total of 19,492 municipalities in the US (National League of Cities website, last accessed December 15, 2017). But the growth in the total number of policies is still remarkable. The US went from a mere 64 complete streets policies in 2007 to 1232 by the end of 2016, representing 1825% growth in a decade. At the scale of government, which is itself a front in the battle for more equitable streets, the rapid proliferation of complete streets policies represents a significant shift in how communities in the US think about and plan streets. And given the population sizes of participating cities—including 14 of the 15 most populous in the US—these policies cover very large segments of the American population.

More important than broad policy adoption, however, is the manner complete streets are implemented. National data on implementation are not available, but case studies are illustrative. For example, Boston, MA, exemplifies a comprehensive approach to complete streets. More than just adopting a policy statement, an interagency group was formed to create streets that are "both great public spaces and sustainable transportation networks" (bostoncompletestreets.org, last accessed October 20, 2017). The Boston Transportation Department leads the effort to promote multimodal, green, and smart streets, but the group also includes diverse other public works, environmental, recreation, redevelopment, and other agencies. To support multimodal design, the Boston Transportation Department (2013) created its own Boston Complete Streets Design Guidelines, which offer "new vision" for designing roadways and sidewalks. Its chapters articulate a vision, classify street types, and provide design guidance for sidewalks, roadways, intersections, "smart curbsides," and implementation. The chapters use clear-to-read text and rich graphics to illustrate various design strategies, providing an overview/justification, defining their proper use, and detailing design considerations (including which city department is responsible for what). Finally, the guidelines set out implementation principles, from project initiation through maintenance agreements (p. 252). These have guided major projects, including redevelopment of historic Audubon Circle through traffic-calming redesign and reemphasis of its place functions as gateway (while treating stormwater through green infrastructure); redevelopment of auto-oriented portions of Boylston Street through walkable mixed use and "capture" of setback space for wider sidewalks, street trees, and bike lanes; and reclaiming expanses of

asphalt around Central Square in East Boston through narrowed streets, park expansions, and sidewalk widening for outdoor seating (bostoncompletestreets.org/projects, last accessed October 20, 2017). These efforts represent an integrated effort connecting policy reform, governmental restructuring, design innovation, and infrastructure investment toward more complete streets.

Chicago, IL, adopted a complete streets ordinance in 2006 to ensure all modes are "accommodated and balanced in all types of transportation and development projects ... so that even the most vulnerable ... can travel safely with in the public right-of-way" (Chicago Department of Transportation 2013, p. 5). The Chicago DOT incorporated this vision within its Complete Streets Chicago Design Guidelines (2013), which are premised on a pedestrian-first modal hierarchy: all transportation projects and programs "will favor pedestrians first; then transit riders, cyclists, and automobiles" (ibid.). To create "complete, safe, and sustainable streets," it then develops a typology of streets based on their type and context that might be applied in transportation master planning (p. 13). The manual then seeks to transform decision-making by relating this mode hierarchy and typology to roadway form and function, suggesting an "assemblage" of roadway cross sections that do not "dictate dimensions, as street design requires making tradeoffs within limited rights-of-way" (p. 84) but guide innovative design. Furthermore, it critiques standard techniques like vehicular LOS for producing outcomes inconsistent with complete streets (p. 110). And it specifies a project delivery process for identifying and promoting projects, addressing broad goals (project needs, exceptions, desired outcomes), specifying scoping objectives (alternative cross sections, geometric intersection design, and evaluations of trade-offs), ensuring projects are designed for complete streets (addressing issues and opportunities), measuring the effectiveness of projects (safety, mode share, and other transport and community goals), and ensuring accommodation of all users over project lifespan (p. 123). These are incorporated within a project management/delivery process checklist, and the plan sets out parameters by which its success will be measured, ranging from reduction of pedestrian and bicycle crash fatalities to increases in sales tax revenue to reduction of stormwater runoff. Together these strategies translate the broad ethical principle of complete streets to transform how streets are actually planned, engineered, and operated in America's third-largest city.

The examples of Boston and Chicago suggest how thoroughly the process of transportation planning and design are being transformed by

complete streets principles and practices, to the extent that some cities have explicitly flipped the modal hierarchy to prioritize pedestrians over cars. Implementation strategies across 1232 jurisdictions will inevitably vary. In some communities, these policies may likely fail to transform how engineers do their work. But in others we see fundamental reorientation toward planning for intermodal equity and concern for the most vulnerable, translated from policy principles into design processes and projects.

Vision Zero

Related to complete streets is vision zero, a burgeoning movement toward "eliminating all traffic fatalities and severe injuries—while increasing safe, healthy, and equitable mobility for all" (visionzeronetwork.org, last accessed October 20, 2017). The movement emerged in Sweden in 1997, when the Swedish Parliament and Transport Administration adopted the "ethical standpoint that no-one should be killed or suffer lifelong injury in road traffic" (Kommunikationsdepartementet 1997). Swedish officials took a systems approach to the street as entity in which roadway, vehicles, and users "must be made to interact with each other so that safety can be guaranteed" (ibid.). The movement has since spread across Europe and to major Canadian and American cities. A Vision Zero Network has emerged to promote the movement, whose website makes the basic argument that tens of thousands of people are killed or injured each year in traffic collisions that "could, and should, be prevented" (last accessed October 20, 2017). Like complete streets it frames the problem not merely in terms of public safety, but as a fundamental question of equity and rights: "we believe that all of us—whether driving, walking, bicycling, using a wheelchair, or riding transit—have a right to safe mobility" (ibid.). And it defines this as both public health problem and policy failure:

For too long, we've considered traffic deaths and severe injuries to be inevitable side effects of modern life. We face a crisis on our streets—with traffic violence taking too many lives—but there has traditionally been a lack of urgency from the public and our policymakers to reverse this fatal trend. ... And because so many fear for their safety on our streets, there is no true freedom of mobility—no right to choose to walk or bike. (ibid.)

Vision zero—like complete streets—directly challenges the *status quo* of transport policies and strategies. The network seeks to contrast traditional assumptions and approaches to traffic safety (traffic deaths are inevitable,

and an emphasis on perfecting human behavior, preventing collusion, and individual responsibility) with a "new vision for safety" that assumes traffic deaths are preventable through an emphasis that "integrate(s) human failing" to prevent fatal/severe crashes through a systems approach (ibid.). Redefining road safety not as individual problem but a failure of the transportation system, it argues for solutions for "perfecting a transportation system that failed to protect people who made predictable errors." It specifies nine components of a vision zero commitment including political commitment from highest ranking officials, multidisciplinary leadership representing diverse municipal departments, an action plan, a commitment to equity defined as "inclusive and representative processes" and "equitable outcomes," meaningful collaboration and input, a systems-based approach, driven by reliable data, public input/community engagement, and transparency (ibid.).

Vision zero frames road safety very explicitly in terms of social equity, noting that traffic injuries and fatalities disproportionately impact vulnerable communities. In a fact sheet "Equity Strategies for Practitioners" it argues "at its core, Vision Zero recognizes that all people have the right to move about their communities safely" (Vision Zero Network 2017, p. 1). It challenges planners to ensure that vision zero processes, strategies, and outcomes "serve all, particularly vulnerable and traditionally underserved populations," and asks how unintended consequences of vision zero can be mitigated. It argues for addressing inequities by prioritizing interventions and meaningfully engaging with and empowering communities, creating institutions and processes incorporating vulnerable populations in decision-making. Among these equity strategies are a commitment to diversity in leadership, using data to identify how traffic safety and social inequities are linked, making sure enforcement does not exacerbate already biased enforcement, and meaningfully engaging (and not alienating) communities. Ultimately, the Vision Zero Network acknowledges equity is a complex topic and producing equitable outcomes "will not be fast or easy," but "transformation requires us all to think and do things differently" (ibid.).

The Vision Zero Network, led by California planners and pedestrian/bicycle advocates and supported by Kaiser Permanente, serves as a clearing house of best practices emerging from leading-edge cities to support "strong, distributed leadership" for vision zero policies and practices. But their impact on the actual street is best understood through those cities that are applying the approach, ranging from major cities (e.g. New York,

Los Angeles, Chicago, Philadelphia, San Francisco, and Minneapolis, among others) to smaller ones (e.g. Austin, TX; Columbia, MO; Durham, NC; and Monterrey, CA, among others).

New York City, for example, has developed a vision zero initiative whose website establishes the principle that the "primary mission of government is to protect the public" and laments that traffic crashes annually claim the lives of 250 New Yorkers and injure approximately 4000 (last accessed October 30, 2017). It argues that these should not be considered mere accidents but "as preventable incidents that can be systematically addressed ... No level of fatality on city streets is inevitable or acceptable" (ibid.). The city adopted a Vision Zero Action Plan (New York City Department of Transportation 2014) translating this zero tolerance policy into a set of initial steps for reducing death and serious injury on the city's streets, assigned to various city departments and commission. The plan tasks City Hall with creating a permanent vision zero task force and leading a legislative campaign to reduce citywide speed limits to 25 mph; the Police Department with increasing enforcement of traffic violations and improving crash data collection; and the DOT with implementing safety improvements at 50 intersections, creating arterial and neighborhood "slow zones," and enhancing street maintenance and lighting. The plan also charges the Taxi and Limousine Commission with improving driver education, safety enforcement, and vehicle design; the Department of Citywide Administrative Services with ensuring all city fleet vehicles have speed recording technology and collision tracking; and the Department of Health and Mental Hygiene with improving public health surveillance and engaging community partners in education and research (ibid.). These and subsequent initiatives are tracked and reported publicly on a Vision Zero Scorecard, while crash data and interventions, as well as public input data, are mapped via online GIS. Most of these efforts are targeted at governmental agencies and partners, but the Action Plan ties back to the public life and choreography of streets emphasized by Jane Jacobs half a century ago: "Vision Zero also needs each and every New Yorker to become aware of the new public discourse on street safety, to appreciate the consequences of careless and dangerous behavior and to do their part to lend civility and consideration to the daily life and rhythm on the streets of our City" (City of New York 2014, p. 7).

San Francisco is another city with a vigorous vision zero initiative. The city adopted a Vision Zero Policy in 2014, with the goal of eliminating all traffic deaths in the city by 2024. Its vision zero website argues "As we live, work and play in the City by the Bay, we want to feel safe as we move

around" and "our streets should be safe, no matter where we go or how we get around." Putting safety first will, it argues, create a "lively, vibrant city that works for everyone" (last accessed November 1, 2017). A Vision Zero San Francisco Two-Year Action Strategy 2017-2018 is guided by broad goals of prevention, preservation of human life, equity ("safe for all road users, all modes of transportation, in all communities and for people of all incomes, races and ethnicities, ages and abilities"), safe streets that anticipate error, safe people and vehicles, and design for "speeds that protect human life" (p. 5). It justifies the effort based not only on crashes (70% of severe/fatal accidents occur on 12% of streets), but also inequities in who is affected by them: only 33% of the city's streets are in low-income areas, but 47% of those streets characterized as the "High Injury Network" are in these communities of concern, and while only 27% of trips in 2016 were on foot or by bike, 63% of fatalities were pedestrians or cyclists. These data lead the report to state flatly that "[e]quity is not only a social and moral issue, but also a traffic safety issue" (p. 8). It then outlines action items toward safe streets, safe people, and safe vehicles. For safe streets the plan targets implementation of 13 miles of treatments in high-injury areas and communities of concern, reduced delivery time for safety improvements, and comprehensive analysis of bicycle collisions and evidence-based solutions. To promote safe people it proposes automated speed enforcement legislation, high-visibility education and enforcement related to dangerous behaviors, and safety training to all new city employees. Toward safe vehicles it proposes public reporting of telematics data from city vehicles and routine updating of safety and collision avoidance technologies (p. 5). And it lays out a strategy of measuring progress, including a set of metrics (e.g. percentage of safety treatments installed in communities of concern), baseline data, and targets. And it concludes these with a pledge signed by the Mayor, heads of major departments, transit agency directors, and others. And the public can track progress on an online GIS map viewer, to see the location, details, and status of various projects.

Vision zero parallels the complete streets movement in critiquing the auto-centrism of the American roadway, but joins discourses of intermodal equity and inclusivity with deeply powerful arguments about the human costs of vehicular speed. Staking a moral argument about zero tolerance for traffic fatality and injury, it attacks some of the very basic premises that underlie traffic engineering. Prioritizing safety over throughput, it reframes how we see everyday trade-offs in the planning and design of streets. And, like complete streets, it connects these ethical discourses about a just street

to a different and more transparently democratic form of planning process, which is especially concerned with vulnerable communities of concern. In short, vision zero is quite explicitly a movement for regulating and designing a more just street, intersection by intersection, block by block.

RETROFITTING STREETS

Urban Highway Removal

If the construction of the Interstate Highway System represented an apogee of auto-centric policy in the US, today we increasingly witness a very different kind of phenomenon: a teardown movement to remove aging, dangerous, or damaging freeways (Rose and Mohl 2012). Faced with costs of maintenance and renovation, and concerned about negative urban impacts from poor twentieth-century planning, many communities are seeking to relocate highways to corridors where they will be less offensive, bury them, or most dramatically remove the freeways altogether in favor of park-like boulevards. Where once freeways were considered essential "not only for automobility but also for the very salvation of the central city itself," today activist mayors and planners are eying obsolete expressways, many elevated, with a skepticism informed by urban design principles espoused by Jane Jacobs and advanced by New Urbanism (pp. 178–179). The idea of removing freeways and replacing them with more functional urban spaces resonates with other twenty-first-century challenges, like reconnecting with natural amenities such as waterfronts, promoting urban redevelopment, and opening new mixed use and recreational spaces for tourists and residents alike.

While this movement has been largely local and decentralized, the Congress for the New Urbanism has launched a "Highways to Boulevards" Initiative. On its website the CNU complains the American highway building movement "created sprawling freeways that cut huge swaths through our cities ... too often vibrant, diverse, and functioning neighborhoods were destroyed or isolated by their construction, devastating communities and economies alike" (last accessed November 3, 2017). As these freeways—many of which are elevated structures—reach the end of their useful lifespan, replacing freeways with surface streets is proposed as "practical alternative to rebuilding expensive highways and as a means to restore and revitalize communities" by transforming "broken liabilities into assets ... transformations that support socially and economically valuable places" (ibid.). It periodically publishes a report it calls "Freeways

without Futures," a comprehensive report on the current state of highway removal, and a list of ten highways in the US that presents a "roadmap to better health, equity, opportunity, and connectivity in every neighborhood" by converting highways into "human-scaled streets" (Congress for the New Urbanism 2017). Suggesting that American cities face a watershed moment, the report highlights various highways that have divided cities from waterfronts, and historic downtowns and communities from each other, and the disproportionate impact of these projects on minority communities. And the CNU provides information on model cities where highway removal has been successful and campaign cities where the organization and its allies are actively engaged in proposed removals.

A pioneer in freeway removal was Portland, OR. In the 1940s a fourlane, ground-level freeway was constructed along the west bank of the Willamette River, but by the 1960s a citizens group Riverfront for People began to advocate removal to open the waterfront for parks and recreation. In 1968 Governor Thomas McCall created a Harbor Drive task force to study highway alternatives and develop a redevelopment plan to emphasize mass transit, walkability, and waterfront protection. Despite predictions by highway engineers of high future daily traffic volumes, in 1974 the highway was removed (Rose and Mohl 2012). The lands formerly occupied by Harbor Drive were converted to parkland, and local traffic rerouted onto a landscaped boulevard later renamed Naito Parkway. The efforts to reclaim the waterfront are credited with supporting the revitalization of Portland's downtown, and dramatic increases in property values in a formerly industrial area (as described on the Congress for the New Urbanism website, last accessed November 3, 2017). And in recent years the amount of parkland has been doubled, and the boulevard itself redesigned to incorporate bike lanes and improve pedestrian safety. Together these investments, radical at the time in the 1970s, translated the anti-freeway protests of the 1960s into a planning effort to reimagine vehicular space for more diverse urban uses. Transportation is still key to the corridor, and Naito Parkway remains a relatively high-speed arterial, but today the infrastructure serves all modes. And the freeway's redevelopment as parkland has transformed exclusively vehicular space into a public place.

San Francisco is famed for both its role in early freeway revolts and highway demolition. Resistance to highway construction dated to the 1950s, provoked particularly by the building of the double-decked, waterfront Embarcadero Freeway. Resistance among neighborhood groups and environmentalists, later supported by the city's political and business elite,

helped limit construction to a portion of the freeway (Rose and Mohl 2012). When that segment was damaged and closed by the 1989 Loma Prieta earthquake, the city saw diverted traffic absorbed by surface streets, and a rise in transit ridership. This experience—and escalating highway replacement costs—helped convince the city to demolish the freeway in 1991. In its place was constructed a multiuse boulevard containing three lanes of through traffic in each direction with a streetcar in the center, together with pedestrian accommodations. Demolition enabled redevelopment of more than 100 acres of land as public plazas and waterfront promenade and mixed commercial/residential development (www.cnu. org/highways-boulevards/model-cities). A later multi-jurisdiction Embarcadero Enhancement Project uses complete streets conceptual design to address growing volumes of bicycle traffic, and related pedestrian conflict issues, to propose separate and more clearly defined pedestrian walkways, bikeways, and vehicular areas. The Embarcadero, already converted from a limited-access vehicular freeway to a more accessible surface boulevard, continues to be modified to become "safer and more comfortable for all roadway users" through quality urban design both as intermodal infrastructure and as "important public and recreational gathering place" (San Francisco Municipal Transportation Agency 2014, p. 4).

Another notable example is Milwaukee, WI, where Mayor John Norquist led efforts to remove a one-mile segment of the deteriorating Park East Freeway and return to the old street grid. Once part of a plan to encircle the city's downtown with highways, the corridor had been cleared and only a portion of the elevated highway completed by the 1970s. But plans concluded the freeway structure created "a visual barrier between neighborhoods" and "perceived lack of safety" discouraged pedestrians from crossing between neighborhoods and downtown (Milwaukee Redevelopment Authority 2004, p. 12). To "repair the fabric of the city" (ibid.), \$45 million in federal, state, and local funding was secured to replace the freeway in 2002 with an at-grade, landscaped, six-lane McKinley Boulevard. No alternative highway was constructed. New block configurations opened 24 acres of downtown lands for redevelopment, guided by new form-based zoning (City of Milwaukee website, last accessed November 6, 2017). Mixed-use development and new corporate offices have been built in the surrounding area and average assessed land values within the footprint of the former highway grew 180% between 2001 and 2006 (Congress for the New Urbanism website, last accessed November 6, 2018). Norquist, an admirer of Jane Jacobs, went on to author a book *The Wealth of Cities*, which advocated transit-driven alternatives to highway construction, and became executive director of the Congress for the New Urbanism. Norquist and the CNU leaders remain committed, in their own words, to "rolling back the freeway system" (quoted in Rose and Mohl 2012, p. 182).

These projects represent tangible progress in reversing the autocentrism of mid-century planning toward more complete and livable urban streets, led by some who were once community and anti-freeway advocates but have now become today's mayors and governors. Portland was the vanguard, but an increasing number—ranging from Austin to Toronto, Buffalo to St. Louis—is considering or planning similar transformations. They are perhaps the boldest example of how roadways can be reimagined for greater intermodal equity, use as public space, economic redevelopment, and aesthetics.

Bus Rapid Transit

Another innovation in reimagining urban streets is the development of BRT. Faced with mounting costs for creation or expansion of rail transit networks, a growing number of cities is considering BRT as a cost-effective alternative for transforming existing roadways into high-quality transit corridors with metro-level capacity, by providing dedicated bus lanes and off-board fare collection, limited stops, and quick operation (Institute for Transportation and Development Policy 2016). These features, often together with signal prioritization, can enable BRT to operate much more rapidly, reliably, and conveniently than standard bus service, ideally equivalent to light rail or even metropolitan rail at much less cost. First pioneered in Curitiba, Brazil, in the 1970s, a growing host of cities across the world has developed BRT systems, including Ottawa, Bogotá, Quito, and more recently Lagos. In the US, Pittsburgh, PA, was an early adopter with its South Busway (1977) and East Busway (1983).

One advocate of BRT is the Institute for Transportation & Development Policy, whose website describes its mission to "implement high quality transport systems and policy solutions that make cities more livable, equitable, and sustainable" (last accessed November 8, 2017). Its board of directors includes representatives from international design and engineering firms, as well as NGOs like Transportation Alternatives, with leadership from the overlapping world of the NYC DOT and NYC Bicycle Share (former transportation commissioner Janette Sadik-Khan with Bloomberg

Associates, is also a member). The institute promotes "Eight Principles for Better Streets and Better Cities": promoting walking, prioritizing non-motorized transport, connecting street networks, implementing transitoriented development, planning for mixed use, densifying, creating compact regions, and regulating parking to shift modes. Viewing transportation more broadly than just movement, it argues for sustainable cities that concentrate people in an environment that is "pleasant and provides good social infrastructure through good physical infrastructure." The organization promotes BRT as a cost-effective alternative to traditional rail service, and emphasizes basic features like bus-only lanes to avoid congestion, center of roadway alignment to keep buses from busy curbsides, reduced delays through standard fare collection at stations, intersection treatments to reduce turning movements, and platform-level boarding to promote accessibility (ibid.).

Because BRT is typically created by transforming existing streets into transit corridors, with associated pedestrian accessibility (and often bicycle) improvements, these projects align with the complete streets movement and represent another effort to reclaim streets for diverse modes and public uses. Cleveland's "Health Line," for example, is a \$200 million BRT project to connect downtown with the University Circle neighborhood, home of major universities and medical facilities. It created a 9.2-mile BRT corridor converted from (and adjacent to) busy Euclid Avenue, long a major vehicular thoroughfare. The conversion to dedicated bus lane, along with consolidated stops, reduced bus travel time by 25% and provides 24-hour service with 5-minute headways during peak periods (Cleveland RTA website, last accessed November 8, 2017). Furthermore, the redesign of Euclid included bicycle lanes adjacent to the dedicated bus lane, creating a model complete street and Cleveland's longest contiguous bike route, as part of the city's Bikeway Master Plan (2007). These investments paralleled Cleveland's adoption of a "Complete and Green Streets" ordinance and later Complete and Green Streets Typologies Plan (2013) to create "an agreed-upon framework for decision making in the right-ofway" in compliance with that ordinance (p. 4). That plan includes typologies for "Transit Spines" like Euclid to better "coordinate bicycle and pedestrian accommodations with transit design to ensure access for transit customers" (p. 20). While the primary purpose of BRT was to improve transit access between two of Cleveland's most important districts, at lesser cost than traditional heavy or light rail, the transformation of Euclid Avenue was also carefully planned to improve pedestrian and bicycle access to street spaces. And because the Health Line connects major employment centers with lower-income and minority neighborhoods, it improves access for non-motorized users and existing communities of concern.

BRT's reallocation of street spaces does not, however, go uncontested. A good example is Chicago's halting effort to introduce BRT. The Chicago Transit Authority (CTA) developed plans to improve surface bus service and extend the reach of rapid transit to complement the traditional huband-spoke network of elevated trains centered on the downtown "Loop." Projects completed to date include many-if not all-elements of BRT. The "Jeffrey Jump" enhanced an existing express CTA bus line by converting a travel lane into dedicated bus lane during congested periods, providing signal prioritization and bypass lanes in key intersections, and spacing stations at half a mile intervals with enhanced pedestrian and bicycle facilities (Chicago MTA website, last accessed November 20, 2017). Another has been the "Loop Link," creating a dedicated bus lane through key downtown streets, improving stations with raised platforms, expanding pedestrian space for queuing, and protecting bike lanes and bike traffic signals. Such projects have not yet matched the speed of heavy rail, but they have improved service and more fairly allocated street space to diverse modes. But the greater the impact of such projects on street spaces, the greater resistance they can meet. CTA also planned a 26 km, north-south BRT line for Ashland Avenue, one of the city's busiest and most diverse corridors, in which one in four residents does not have a car and highridership CTA routes are slowed by vehicular congestion (CTA 2013, pp. 2-3). Ashland Avenue BRT was planned with a dedicated center-running transit lane, off-board fare collection, and signal priority to connect seven "El" stations, two regional Metra stations, and 37 bus routes. Pedestrian improvements would have helped make this congested vehicular corridor a safer and more complete street. But proposed removal of street parking and limits on left-turn movements generated significant opposition among business owners, and planning was suspended in 2015. Such halting progress proves the enduring political power of vehicular interests on the Chicago street.

BRT—in conjunction with complete streets redesign—expands access to both rapid-transit networks and street spaces. BRT thus represents a potentially significant reimagining of street spaces to better prioritize transit, walking, and biking and make the street, at least incrementally, a more just public space.

Creative Placemaking and Public Plazas

While many of these efforts maintain the assumption of streets as spaces for mobility, others emphasize their role as public places. A diverse movement has emerged to rethink streets for public life, gathering, and cultural expression.

The nonprofit Project for Public Spaces (PPS), for example, describes its mission on its website as "helping people create and sustain public spaces that build stronger communities" (last accessed November 14, 2017). Founded in 1975 to expand on the work of William Whyte, author of *The Social Life of Small Urban Spaces*, the organization advocates a "placemaking" approach that "capitalizes on a local community's assets, inspiration, and potential" to create "quality public spaces that contribute to people's health, happiness, and well being" (ibid.). Recently the organization's attentions have turned specifically to streets, arguing,

Streets are our most fundamental shared public spaces, but they are also one of the most contested and overlooked. Today, and for most of the last century, we have taken for granted the idea that our streets are primarily zones for cars, parking, and the transporting of goods. This has not been the case, however, throughout most of history. Across many cultures and times—since the beginning of civilization, in fact—the street has held vast social, commercial, and political significance as a powerful symbol of the public realm. (ibid.)

The PPS argues that today's streets, once multiple-use town centers, are now "failing us" and we must "reverse these trends and begin turning streets back into places—into destinations for culture, creativity, and community" (ibid.).

Like complete streets, the PPS argues that "access to good places is a right, not an option or privilege that only a fortunate few can enjoy" (MacKenzie 2015). But the PPS looks beyond intermodalism to suggest "when streets are great places, they encourage people to linger, to socialize, and to truly experience the unique culture and character of a particular street." The PPS website, drawing from the likes of Jane Jacobs, lays out eight principles for making streets great places, and provides examples of model streets. The first principle is to have great activities and destinations, a mixture of uses that spills onto the street, exemplified by 25th Street in Ogden (UT), Santee Alley in Los Angeles's Fashion District, or State Street in Madison (WI). Second is safety from both crime and fear of

traffic dangers, particularly those posed by speeding, citing the calming of streets like East Boulevard in Charlotte (NC), Carmel (IN), or Prospect Park West in Brooklyn (NY). The third criterion is design inviting and rich in detail, including the ability to peer into building's activities, such as Clarion Alley's murals in San Francisco, or Bleecker Street's window shopping in New York. Great streets are also "designed for lingering," in contrast to measures of throughput, for which Española Way in Miami Beach (FL) or Roosevelt Avenue in New York are examples. Other criteria include interactivity—a multisensory experience—and sociability that builds sense of place and community. The best streets should be unique, with a particular "identity" and distinct features, such as South Street in Philadelphia or Canyon Road in Santa Fe. And ultimately such streets need to be accessible to all, prioritizing pedestrians, if streets are to be "true meeting grounds of local society—where people of different ages, ethnicities, and income levels intersect and interact," such as the Portland Transit Mall or Pennsylvania Avenue in DC. And, lastly, they should be flexible-and not static-to meet multiple community goals over the course of a day or year, such as NW Davis Festival Street in Portland or Bell Street Park in Seattle (ibid.).

The broader effort to reimage streets for public uses beyond transportation has, as we noted in Chap. 8, become formalized in NACTO Urban Street Design Guidelines. For example, transforming parking into "parklets" with seating and greenery to create new community spaces, or transforming underutilized roadway spaces into public plazas. Perhaps the most famous example of this in the US has been the redesign of Broadway Boulevard in New York City. In 2009 New York City DOT undertook a "Green Light for Midtown Program" to "improve mobility and safety in the Midtown core, and ultimately to make the area a better place to live, work and visit" (NY DOT 2010, p. 1). To reduce traffic congestion and increase pedestrian space it permanently closed Broadway to vehicles at Times Square and Herald Square, converting the closed blocks into pedestrian malls. Some of the goals were safety and mobility related, but it also sought to provide "a comfortable walking environment, inviting streetscapes and pleasant places ... to rest and congregate" (6). These transformations were piloted through temporary paving and installation of street furniture. But the city hired the Norwegian design firm Snøhetta to permanently redesign Times Square as "stage for public life and freedom of expression" by resurfacing former roadway space with custom pavers that connect the facades of surrounding buildings, including steel disks that reflect the glow of the square's distinctive signage, as well as granite

benches to serve to attract visitors and provide an orientation device for both tourists and locals (Snøhetta website, last accessed November 20, 2017). The design doubled the amount of pedestrian space and created what the founder of the PPS called the "ultimate diverse, multi-use, dynamic, changing public space" and commentators commend as "canvas for community expression" (Rhodes 2017).

Creative placemaking and the redesign of vehicular into true public space represents a full reimagining of the American street. The articulation of a different vision with innovative design standards, applied both to iconic urban streets and individual parklets, creates a template for how cities across the US might return their streets to their original intended purpose not only as thoroughfares but also as spaces for walking, dwelling, commerce, and public expression.

Green Alleys

Also seeking to reimagine American streets is the movement for "Green Alleys." While alleys have traditionally served mundane functions like vehicular access and refuse collection, they nonetheless represent a significant portion of the public roadway network. Their low traffic and infrequent repaving cycles can make them "uninviting or unattractive," but they can be redesigned with sustainable materials, pervious pavements, and effective drainage "to create an inviting public space for people to walk, play, and interact" (NACTO 2013). Much of the motivation for green alleys is environmental: improving the quantity and quality of urban stormwater runoff to comply with the Clean Water Act without costly infrastructure projects. The website of Philadelphia's Green Stormwater Infrastructure Program, for example, emphasizes the potential of retrofitted alleys to allow infiltration to reduce combined sewer overflows (last accessed November 20, 2017). Chicago and Washington, DC, also have well-developed green alley programs to address stormwater and heat island effect issues. But increasingly these alleys are seen as more than just green infrastructure, but also an opportunity to create pedestrian-oriented public spaces.

One of the more ambitious visions is the "LA Green Alley Master Plan" (2012) developed by the Trust for Public Land for the Los Angeles Sanitation Bureau to construct a network of green alleys, streets and community connections in a traditionally underserved area of the city. The plan seeks to improve air quality and water supply, urban heat island, open space and recreation, safety, walking and bicycling, and education/

awareness. While many of these goals are environmental, others focus on the value of alleys for intermodal transportation and broader place functions. To encourage walking and biking, it aims to improve comfort, safety, and connectivity for alternative modes. But it equally emphasizes the goal to "increase access to and quality of open space and recreation opportunities," especially in areas with the most need. Noting that 252 acres of alleys within the project area are greater than the sum total of its park spaces, in a part of the city lacking in parks, the plan "demonstrates both how and why these hidden spaces are resources that can supplement and complement large, formal, open spaces" (p. ix). The plan identified certain pilot projects. One complete project is the Avalon Green Alley Network in Los Angeles's South Park neighborhood. Though these alleys had suffered from litter and crime, they were well poised to provide direct multimodal connections to two schools, two parks, and a grocery store. They were redesigned to include better lighting, art, entrance features, traffic calming, plantings, decorative permeable pavers, and directional signage. At the project's dedication, Councilman Curren D. Price, Jr. noted, "For far too long, this was just another underused, overlooked and neglected space" but was now transformed into a "community asset that serves a variety of critical functions, such as providing safe passageways for local families" (Los Angeles Bureau of Sanitation 2016). The plan is intended as a model for developing green alleys in other city neighborhoods across Los Angeles.

TAKING OVER THE STREET

This book has focused on the legal and engineering standards that structure the physical street and social relations upon it. Laws and infrastructure are powerful, but there are other powerful—albeit ephemeral—manifestations of the changing politics of mobility on the American street. Below are some movements that help reimagine the street through cultural expression or temporary takeover of street spaces for non-vehicular purposes.

Ghost Bikes

Pedestrians and bicyclists suffer disproportionate risk of injury and fatality on streets designed for vehicular speed and flow. To mark these tragedies, a "ghost bike" movement has emerged to mark the locations where cyclists have been hit or killed. This movement started in

St. Louis in 2002 when volunteer activists placed 20 white-painted "broken bikes" at site where cyclists had suffered collisions with cars, but has spread across the world. A website ghostbikes.org serves as clearinghouse of information for an entirely grassroots movement, described as

small and somber memorials for bicyclists who are killed or hit on the street. A bicycle is painted all white and locked to a street sign near the crash site, accompanied by a small plaque. They serve as reminders of the tragedy that took place on an otherwise anonymous street corner, and as quiet statements in support of cyclists' right to safe travel (last accessed November 28, 2017).

For those who advocate or create memorials, "the death of a fellow bicyclist hits home. We all travel the same unsafe streets and face the same risks; it could just as easily be any one of us. Each time we say we hope to never have to do it again—but we remain committed to making these memorials as long as they are needed" (ibid.). To memorialize those lost, bicycles are painted all white and locked near a crash site with accompanying plaque acknowledging the victim and details of the accident. Recognizing that news coverage often fails to account for fatalities, advocates create a durable and striking reminder of the risks faced by cyclists on the public street.

The New York Street Memorial Project, for example, honors those cyclists and pedestrians killed on the city's streets. Its website describes the goal of a "compassionate and supportive community" for survivors and to "initiate a change in culture that fosters mutual respect among all people who share the streets" (last accessed November 29, 2017). According to its press kit, the New York Street Memorial Project's (2015) goals are to transcend the technocratic language of engineering to put these tragedies in human terms. Some of its goals are social, directed at street users. The ghost bike movement asks for "mutual respect among all street users" and to instill in everyone "the responsibility we share to look out for each other." It argues for the need to "incite more humanity" in the city, by assuring that every person is remembered, by building "solidarity among non-drivers," and acknowledging each death as tragic but not an isolated event and the ripple effect of each and every death. But the government is also a target of its laments and frustrations. It demands policy improvements to "make the city follow through" on necessary improvements and compel it to conduct full investigations by calling for "outrage that makes a lasting difference"

through sensitive media reporting, city accountability, and inspiring all residents to be "grieved and angered when someone is killed." And it concludes by stating flatly "we want to stop having to do this" (ibid.). While the movement's immediate physical representation is the installation of a ghost bike, the intended outcome is longer term. These include improved, complete street design with physically separated spaces like buffered bike lanes and sidewalk extensions, as well as more vigorous enforcement and prosecution of existing traffic laws. They also include better outreach and education: "Because of their potentially deadly force," the project asserts, "it is particularly important that drivers of motorized vehicles recognize the rights of more vulnerable road users." And asking for a cultural shift that aligns with the vision zero movement, the project argues for use of appropriate language in reporting on crashes, avoiding use of words such as "accident that connote lack of culpability for the driver" and "avoidance of crash descriptions that unfairly blame the victim" (ibid.).

Ghost bikes have been placed in more than 125 localities in the US, and in many more across the globe. The movement remains local in its visibility and orientation, but ghost bikes have offered poignant icons for national press coverage of terrorist attack on the Hudson River Greenway on Halloween 2017, which highlighted the lack of safety features that made its users vulnerable (Otterman 2017). The Ghost bike movement is linked to complete streets and vision zero, but confronts the design, legal, and cultural inequities of the everyday American street not with policy but in the visual language of art, which bears silent but powerful witness to tragedy.

Critical Mass

Confronting automobility's hegemony on the street even more directly is the "Critical Mass" protest movement, monthly events when cyclists gather to ride in large groups down public streets. Not only demonstrating collective strength by taking over the street, in the words of Zack Furness's great book *One Less Car*, the movement "sparks a necessary dialogue about car culture and reframes the politics of public space around and through the bicycle" (p. 79).

First organized in San Francisco as a bicycle "Commuter Clot" group ride in the 1990s, the event quickly swelled in size, took on a festive air, and ultimately spread around the US and globe. Critical mass is "essentially direct action, anarchic event" (Furness 2010, 80), typically lacking

any formal organization or prior route selection or official sanction, but safety and order is often maintained by certain riders who block or "cork" intersections to allow the group to stay together and safely pass. Such illegal practices and complaints of bicycles taking over vehicular space often prompt public anger and police enforcement, indeed San Francisco Mayor Willie Brown once called one particularly raucous ride "the ultimate arrogance" (Garofoli 2002). But the anarchic and spontaneous nature of the event has made policing difficult. And in contrast to movements that seek to directly shape the material shape of the street—whether through policy like complete streets or even direct action/sabotage, critical mass uses what reporters have called "guerrilla theater on wheels" (ibid.) to initiate "a break with dominant ideology through a direct intervention in the spaces where it is quite literally materialized" (Furness 2010, p. 84).

Given its decentralized and anarchic nature, there is no single manifesto guiding critical mass events. But a sampling of local websites or Facebook pages gives an idea of the nature of the critique, and the different vision of the street the movement offers. These range and weave elements of both protest and festival. The Seattle Bike Blog website, last accessed November 29, 2017, describes critical mass rides as both "social bike rides" and an argument for equity: "Cars rule the road every day, but one day a month we get together to celebrate our love for bicycles and have fun riding our bikes." In Portland, critical mass faded in the face of both police enforcement (of corking in particular) and a general mainstreaming of bicycle culture, but the mantle of protest has been taken on by "bike swarms" that evolved out of the Occupy movement to support marches and other demonstrations. A self-described "religious historian ... aggressive cyclist" blogger states the goals as following: "By rolling along through streets jammed with people, they maintained the principle that these streets are there to provide places for traffic to flow. By their personal vulnerability on their fragile machines, they accented the importance of using modest modes of demonstrating power" (keithwatkinshistorian.wordpress.com, last accessed November 30, 2017). Others like Los Angeles Critical Mass, billed as the largest community bicycle ride in the US with over 4000 participants, is described on its website as "celebratory rides with a purpose" to "celebrate bicycling and encourage cycling as a leisure activity, as a sport or as a means of transportation" (last accessed December 1, 2017). In response to more aggressive tactics of critical mass, alternative "Critical Manners" rides emphasizing compliance with traffic laws have been organized in San Francisco, Tucson, and elsewhere.

Critical mass rides and their variants represent a physical occupation of the city streets by those who have legal rights to, but are also legally marginalized within, the public street. The movement has been motivated by both a celebration of solidarity and community among cyclists, as well as a more hard-edged protest of automobility. In either case it manifests a different politics of the street, in which users place their vulnerable bodies within street spaces to remind drivers and others that "[w]e are not blocking traffic; we are traffic!" (Furness 2010, p. 79).

Open/Free Streets

Recently the movement to take over public streets for non-vehicular uses has taken shape in "Open" or "Free Streets" events in which roadways are temporarily closed to vehicular traffic along officially designated routes. Advocating and organizing such events is the Open Streets Project, a joint effort of a Toronto-based nonprofit 8 80 Cities (which advocates public spaces that serve people ranging from 8 to 80) and a design firm that claims to be a leader in the "tactical urbanism movement." The Project's website, last accessed December 1, 2017, describes how on an open street "people traffic replaces car traffic, and streets become places where people of all ages, abilities, and background can come out and improve their health," which offer communities the opportunity to "experience their city streets in a whole new way" (ibid.).

A number of cities have undertaken open streets events. The "Philly Free Streets" movement grew out of the longtime weekend closure of Martin Luther King, Jr. Drive along the scenic Schuvlkill River, and the experience of a car-free city during the 2015 visit of Pope Francis. That experience has grown into a wider event that temporarily closes seven miles of major roadways "inviting people to walk, bike, and play ... on car-free streets!" in what is described as "a people-powered initiative of the City of Philadelphia" (www.phillyfreestreets.com, last accessed December 2, 2017). Not only encouraging use for non-motorized transit, the event involves a host of activities, including yoga classes, handball demonstrations, storytelling, or a "powerwalk" with the city's mayor. Sponsors and partners provide bike sharing opportunities as well as restrooms. Introducing the 2017 event, Major Jim Kenney stated, "Philly Free Streets will transform our streets into a safe environment for physical activity and learning and further my commitment to improving neighborhoods and bettering the futures of children." More than just a pop-up event, Philly

Free Streets has evolved in response to surveys, which suggested strong public desire to see events held in their neighborhood (90% of respondents) and/or monthly (65% of respondents), leading to conclusions the event should be used to "reinforce community revitalization efforts" in diverse neighborhoods in addition to redesigning streets for safer walking and bicycling (Penn Praxis 2017).

Other cities have also experimented with street closures. In New York City, a DOT program called "Summer Streets" closes seven miles of road on three consecutive weekends for people to "play, run, walk and bike" and celebrate the city's "most valuable public space—our streets" (website last accessed December 1, 2017). The program seeks to provide space for healthy recreation and encourage sustainable transportation from the Brooklyn Bridge to Central Park along Park Avenue and connecting streets. A variety of rest stops are provided with diverse activities, including bike rentals, helmet fittings, zip lines, obstacle courses, and urban agriculture workshops. In 2016, nearly 300,000 people took advantage of the opportunity to walk and bike and enjoy cultural events in what is typically vehicular space. Car Free NYC has organized similar events to celebrate Earth Day, closing Broadway from Union Square to Times Square (ibid.). Likewise, Open Streets Detroit closed 3.5 miles of roadway to create a "free, safe and inclusive event that brings Detroiters together in the streets by providing opportunities for fitness, recreation and community building" (openstreetsdet.org). Jackson, MS, has created a "Play Streets Jackson" effort that closes streets to vehicles and so they can be "opened up for 'human powered' transportation!" (www.facebook.com/JacksonStreetsAlive, last accessed December 2, 2017). Efforts like these have spread across the US in places as diverse as Detroit, Ft. Lauderdale, Fort Collins, Indianapolis, Las Vegas, Minneapolis, Pittsburgh, Spokane, and many others.

Though temporary, and not that different from other street festivals that periodically close streets, Open Streets involve much lengthier segments of roadways with the express intention of encouraging active transportation. Culture, entertainment, and other activities are key parts of the events. But the combination of turning vehicular space over to walking and biking, as well as using streets as multipurpose public spaces for urban life, represents a significant step in the rethinking of the public street in the American city. What began as annual events have in some places increased to become monthly, and the more often and more widely distributed these efforts are, they invite urban dwellers to experience and reimagine their streets in entirely new ways.

Park(ing) Day

Another ephemeral event, but with significant potential consequences for our understanding of streets, is worldwide "Park(ing) Day" in which artists, designers, and citizens "transform metered parking spots into temporary public parks" (parkingday.org, last accessed December 2, 2017). The event was first organized in 2005 by the San Francisco art and design studio Rebar, which converted a single metered parking space into a temporary public park in the city's downtown. Promoted by Rebar, Park(ing) Day has grown into a worldwide movement with the mission to "call attention to the need for more urban open space, to generate critical debate around how public space is created and allocated, and to improve the quality of urban human habitat ... at least until the meter runs out!" (ibid.).

The original park was constructed using sod, potted trees and plants, and street furniture to convert a parking space into a public park for two hours, after which the materials were removed. The installation was intended as both critique and thought experiment. Lamenting that a majority of downtown outdoors space is "dedicated to movement and storage of private vehicles, while only a fraction of that space is allocated to serve a broader range of public needs," Rebar used the idea of metered parking to "explore the range of possible activities for this short-term lease, and to provoke a critical examination of the values that generate the form of urban public space" (ibid.). The image of the park and the idea went viral, and today variants of Park(ing) Day include free health clinics, temporary urban farms, ecology demonstrations, political seminars, or free bike repair shops. Rebar maintains a website including a Parking(Day) DIY Planning Network, a manifesto, a how-to manual, and posters and graphics to support local efforts to reimagine and revalue the metered parking space as an "important part of the commons—a site for generosity, cultural expression, socializing and play. And although the project is temporary, we hope PARK(ing) Day inspires you to participate in the civic processes that permanently alter the urban landscape" (ibid.).

Not merely a takeover of streets for other uses, Park(ing) Day represents a very different way of thinking about public spaces. Unlike the functionalism and instrumentalism of roadway engineering and parking management, Park(ing) Day is ultimately a form of artistic expression. As such it offers a stark contrast to the structures of thought and spatial relations that dominate the legal and engineering practices that govern streets, and thus not a bad way to round out this book. Rebar (2011) lays out these theories

in "The Park(ing) Manifesto: User-Generated Urbanism and Temporary Tactics for Improving the Public Realm." Drawing on the theories of Pierre Bourdieu, Rebar frames its movement in terms of tactical urbanism or the use of temporary "revisions to urban space to seed structural environmental change" (p. 3). It highlights how seemingly self-evident societal beliefs (what Bourdieu called doxa) powerfully shape and are reinforced by the physical environment and our operation within it (habitus). Confronting assumptions about what the street is for, and who it should serve, Rebar promotes Park(ing) Day conversions as a tactic that helps "remix environmental signs and symbols, often within the official vocabulary that gives doxa its force and meaning" (p. 4). Rebar advocates a new "generous urbanism" or "creation of public situations between strangers that produce new cultural value" but not commercial transactions. Drawing common cause and parallels with critical mass, it posits Park(ing) Day as a form of DIY artistic production, meant to be experienced both immediately by inhabitants of the public realm and mediated experience of those who view images or descriptions (p. 6). Though it highlights the authenticity and absurdity of spontaneously converting single parking spaces to parkland, Rebar asks a bigger question: "can the result of this experiment become a tactical turning point in the urban structure itself?" And it judges the answer not in terms of how many times the Park(ing) Day "meme" is repeated, but how "possible it becomes for anyone to use the public landscape as a field of experimentation and play" (p. 9).

Park(ing) Day has been articulated by Rebar as both modest and radical form of tactical urbanism, but local organizers around the US have put the event in plainer terms. Downtown Wicheta's website invites people to "[t]urn a blank space into a people place during PARK(ing) Day" (last accessed December 3, 2017). In Philadelphia, the event "re-imagines the possibilities of 170 square feet of public space" to celebrate parks and other public spaces to raise the "need for more pedestrian-friendly spaces in our urban areas" (parkingdayphila.org, last accessed December 3, 2017). The Nashville Civic Design Center website promotes its event to prompt "critical debate around how public space is created and allocated" and to improve the quality of urban human habitat (last accessed December 3, 2017). Organizers in the Jefferson Park neighborhood in Milwaukee argue for PARK(ing) Day to show "just how much of our community's space is being taken up by the movement and storage of vehicles" and to highlight issues of pedestrian safety and other users of the street and "the

range of possible activities that can be done instead on a piece of real estate otherwise devoted to cars" (www.jeffersonparkforward.org, last accessed December 3, 2017).

PARK(ing) Day represents both an incisive critique of the current allocation of public streets and way to inspire different ways of thinking and using roadway space. Confronting not only our dominant understanding of streets for vehicular mobility and storage of motor vehicles, but also of streets as circulation space, it imagines entirely different and nonmobile uses. Such installations are temporary, and do not immediately affect how streets are legally defined or engineered. But in their tactical use of play, and even absurdity, they squarely confront the equally absurd notion that public spaces—nearly the size of hotel rooms—ought to be dedicated to storing cars. It thus highlights inequities in the allocation and use of streets, seeks to maximize their use for non-motorized and even non-transportation functions, and reanimates public streets for diverse public uses. Like critical mass it uses artistic and political expression instead of engineering techniques, but contributes meaningfully to an ongoing rethinking of the public street.

Taking the Mobility Justice Fight to the Street

The hegemony of the automobile on the American street took decades to establish, as evolving societal norms were reflected and reinforced through traffic law, roadway engineering, and changing streetscapes built and used in their image. The reclaiming of the public space of the street for more diverse uses, including not only intermodal transportation but also dwelling, is likewise a stepwise process unfolding over decades. But as the transformation of the public street into vehicular thoroughfare was slow and uneven, so too will be its return to more balanced use. Building streets for vehicular throughput and speed maximizes their utility for some users, but produces undeniable inequities. The techniques reviewed here each in their own way recalibrate the street to maximize use among both transportation and non-transportation users, better balance access among diverse modes, and protect the vulnerable through decision-making that is democratic and transparent. In sum, these various efforts to reimagine the street—and reconfigure its spaces accordingly—represent diverse but interconnected fronts in the struggle to produce a more just American street, city by city, block by block.

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CHAPTER 10

Toward an Equitable and Livable Street

We might conclude this book where it began, with a basic yet profound truth. Despite its complexity as transportation infrastructure, the American roadway is public space, perhaps the city's most essential and extensive. Streets have a critical role as both networked infrastructure for circulation and public sphere for social interaction. They are conduits for dynamic flows of people and goods and energy, as well as a central stage where our lives and experiences converge and intersect. Comprising a majority of public space in many areas, and a surprisingly large proportion of urban land, streets are those public places where we typically encounter each other. For their ubiquity and centrality, however, we often take streets—and our social relations upon them—for granted. We use roads and sidewalks every day, but don't always really *see* them.

How these public spaces are governed, designed, and shared are critically important questions. But we have internalized and taken for granted the "rules of the road," and unless we get a ticket or have an accident we have little reason to question them. And calling streets infrastructure, we defer to experts in their design and operation. How many of us have ever touched a roadway engineering manual? Such systems—and the structures of thought and action they represent—seem inevitable or commonsensical, but they are not. The rules for how streets are designed, and for how we move about them, are historically and culturally specific. The codification of social assumptions as legal norms, translation into engineering standards, and ultimately manifestation in street spaces presents an important

and fascinating topic for social scientists (and geographers especially). And given the immense power of streets to shape the urban landscape and its social relations, this is an even more important topic for policymakers (and especially planners). Really seeing the city and imagining alternatives requires rethinking the street in theory *and* practice.

As shared public spaces, streets are inevitably contested. Streets are political. But if such politics seem mundane, their stakes could hardly be higher. Different users have distinct and deep interests in the roadway and its configuration, representing needs both specific to individuals and inherent in their mode of travel. Indeed, entire industries and economic sectors are built around particular forms of transportation and access. The remaking of the American street around the motor vehicle was the work of decades, and not without help from the auto industry. Resulting structures and patterns of access and mobility have great economic, political, cultural, and (not least) environmental import. Our driving patterns help explain America's inordinately high per capita carbon emissions. What's more, the mass and speed of much social interaction make the consequences always potentially perilous and sometimes fatally catastrophic. Tens of thousands of Americans are killed or injured every year in roadway crashes, with staggering costs. And these social relations—and their bodily consequences—are marked by stark asymmetries, for example, between children on foot and adults in 6000-pound trucks, cyclists pedaling at 10 mph, and tractor trailers speeding at 60 mph. The politics of the street are a serious business.

And while all users of the street may be equally human, they do not necessarily start from what Rawls (1971) would call "an initial position of equality." Traffic law and design are not separate from these power relations, but are central to them. How these rule systems allocate the space of the street, assign access among its users, and mediate competing demands and adjudicate subsequent accidents are inescapably questions of rights and equity, with major import for individuals and society. This book endeavored to reveal how exactly traffic laws and design standards shape the geography of everyday streets. That alone is an important task, too important to be left to lawyers or traffic engineers alone. But equally, if not more, important are questions both basic and profound. Who really has a "right to the street"? And what might constitute a more "just street?"

This book provided a broad introduction to the legal and design standards that shape street spaces, helping explain why streets look and function the way they do. But the book also critically examines these standards from the perspective of mobility rights and justice. Such analysis confirms

what is anecdotally obvious to any pedestrian or cyclist. There is pervasive auto-centric bias in the laws that govern streets and engineering standards that guide their design and control. The biases built into traffic law and roadway design are reflected and reinforced in the physical streets we travel. These enable and constrain our rights to the street, in ways that are inequitable in theory and practice. The American roadway is, by law and design, a place of injustice. These inequities pose a staggering challenge, but also invite a thorough reimagining of a more just, livable, and sustainable street. And knowledge of these systems—long obscured behind the veil of legal and technocratic expertise—provides a powerful tool for reimagining roadways. Traffic statutes and engineering standards are, after all, written in relatively plain English. Their application requires neither a legal degree nor even knowledge of geometry; often a more just street is a matter of simple arithmetic. Broadening democratic engagement with these systems can enable people to articulate a different set of assumptions about the street and translate them via design of more accessible and just "streets for everyone." The transformative power of this shift can be found on streets across America, in a historical reconsideration of what streets are for and who they should serve.

THE BOOK (IN RETROSPECT)

To reimagine the street, we must begin with our concepts of roadway spaces and their role not only in everyday mobility, but also in rights-based struggles for a more just city. In Part I we explored what, in theory, might constitute "A Right to a More Just Street." Dynamic debates today look beyond the functionality of transport to mobility politics to help us reconsider mobility on the public street as a question of rights, and critically assess the role of law in defining both rights and responsibilities upon the roadway. Furthermore, diverse writings on social justice help conceive of the street as a space of justice (or its absence). Confronted by both technocratic approaches like transportation engineering and abstract theories of the "right to the city," I propose that we consider mobility as a right, defined by claims both broad and actionable within institutional frameworks like the law. And we might aim for a just street that fairly distributes the rights and responsibilities of mobility in the public sphere, maximizing access for all while reducing inequity between people and the modes they choose to travel, produced through transparent and democratic decision-making, while enhancing the capabilities of diverse individuals to enjoy a good life without depriving present or future generations (human and nonhuman) of theirs. These are standards at once conceptually robust and practically actionable. Articulating a theory of mobility rights/just streets is, I believe, necessary to reimagining the street and its role in our democratic right to a more just and sustainable city.

To ground the struggle for mobility rights and an equitable street, however, we must confront the "Traditional Traffic Law and Design" that actually shape American streets. Part II began with those key legal standards defining the purpose, spaces, and proper use of American streets. Once a relatively undifferentiated space for diverse public uses, changing conceptions of the roadway as vehicular space became legally redefined in the Uniform Vehicle Code (UVC) and state traffic statutes, which partitioned and segregated street spaces by mode, with the automobile at the center. Such laws furthermore define the purpose of the street and allocate rights and obligations to different roadway spaces among different users. Central to traffic law is the concept of right-of-way or the "right to proceed in a lawful manner in preference to another vehicle or pedestrian" (NCUTLO 2000). But equally important, though less well understood, is the so-called "duty of care" to yield. At first blush, such statutes suggest everyone has a right to some portion of the public street. But the allocation of street spaces, and rights and duties within them, reveals fundamental inequities. Humans in cars are entitled to broader rights to more spaces, and their obligations to yield limited. Humans afoot or on bicycles have access and preferential rights only to subsets of the roadway which are often absent, and must assume a greater duty of care for their own safety within them. The law thus reinforces rather than mitigates power asymmetries and inequities among modes, giving larger and faster vehicles right-of-way, and forcing pedestrians and cyclists to the roadway margins (for their own safety). Such a system of traffic laws may produce order and efficiency, but their allocation of rights and duties is conceptually and practically unjust.

Engineering standards are the next key piece of the puzzle, taking cultural and legal assumptions and translating them through design, modeling, and engineering into physical roadways. A review and critical reading of American Association of State Highway and Transportation Officials' (AASHTO) *Policy on Geometric Design* reveals how geometric design guidelines are unabashedly "intended to provide operational efficiency, comfort, safety, and convenience for the motorist" (2011, p. xlii), which imagine the roadway as a geometric space designed around the operational requirements of motor vehicles. Simultaneously, measurements of street performance and

quality are defined by the Transportation Research Board's (TRB) *Highway Capacity Manual*, primarily in terms of vehicular speed and throughput. And the Manual of Uniform Traffic Control Devices (MUTCD) literally inscribes social order defined by law onto the asphalt to "promote highway safety and efficiency by providing for the orderly movement of all road users" (FWHA 2012, p. 1), using text and symbols to inform, warn, guide, and control the roadway primarily for vehicular flow, while detailing (mostly optional) design practices for sidewalks, crosswalks, bike lanes, and so on. All such standards accept the premise of the shared street, but they model and design and control roadways so thoroughly for vehicular mobility that drivers can't be blamed for mistaking the street as theirs. And while such manuals increasingly incorporate multimodal standards, these hegemonic engineering interpretations remain cramped in their worldview, framed by assumptions of automobility, and tend to produce streets where inequity is quite literally built in.

Fortunately, however, these assumptions and practices are coming under increasing scrutiny. In Part III, "Reimagining and Redesigning the Street," I explored emerging critiques of auto-centrism and the inequities of standard roadway design, and how these have promoted a policy movement toward "Complete Streets," development of intermodal design standards, and manifest in block-by-block struggles to retake streets for active transportation and broader public use. This begins with the complete streets movement, which critiques auto-centric engineering and offers a normative vision of "integrated, connected networks of streets that are safe and accessible for all people, regardless of age, ability, income, ethnicity, or chosen mode of travel" (National Complete Streets Coalition 2013, p. 6). Complete streets policies challenge political leaders to embrace (or reject) hard-to-argue principles of inclusivity, and to transform decision-making to ensure intermodal equity is norm rather than exception. But different streets require different design practices, so we explored how emerging standards—including AASHTO bicycle and pedestrian manuals, and the National Association of City Transportation Officials (NACTO) urban streets and bikeway guides are envisioning and designing different street spaces, whose performance is no longer measured by vehicular standards alone but by new and quite different Federal Highway Administration bike/pedestrian performance metrics. These not only forcefully articulate arguments for a more just street, but offer detailed designs for making streets more equitable in practice.

Ultimately, imagining a different street is one thing, but making a different roadway another. Thus the last chapter reviewed how this struggle for more just streets is waged on the ground in cities across the US. For

some this is a battle in the arena of policy, seeking to systematically and materially transform state and local structures of decision-making. The explosion of complete streets policies across the US not only challenges assumptions about who streets are for but also wrests exclusive control of the roadway from engineers to share decision-making more transparently with planners, bike and pedestrian advocates, and the public. Likewise, the "Vision Zero" movement to eliminate all traffic injuries and fatalities is forcing a reconsideration of the costs of speed on our streets, making safety and equity primary goals in order to drive systemic change in the regulation and design of roadways. Other movements focus on the direct transformation of individual street spaces, with locally limited but more immediate material results. Cities are removing highways and replacing them with boulevards and parks and transforming busy vehicular streets into Bus Rapid Transit corridors that prioritize alternative modes. Looking beyond intermodalism, planners and activists and artists increasingly experiment with turning vehicular spaces into public "places ... destinations for culture, creativity, and community" (www.pps.org/about, last accessed December 2, 2017) such as remaking alleys from potholed service lanes to sustainable and walkable networks that connect homes with schools and other public places. And last, but not least, this struggle increasingly takes shape in ephemeral installations and demonstrations, which take over the public ROW. These include "ghost bike" memorials to prompt somber reflection on the human costs of automobility, critical mass bicycle rides to temporarily displace cars as the dominant user, open/ free street events that temporarily turn street corridors into spaces of active transport and cultural expression, and "PARK(ing) Day" installations that transform leased parking spaces into places of public recreation and dwelling. Together these interconnected movements reveal citizens retaking their streets in a multifront struggle, which ranges from structural policy shifts to ephemeral but symbolically powerful gatherings and installations. Each is limited in its scope, but together they suggest a fundamental reconsideration of the street is (quite literally) afoot.

NEXT STEPS?

The streets that define our cities and structure our daily interactions were not built—and will not be remade—in a day. The physical and social shape of today's street evolved over centuries, particularly through twentieth-century battles to build urban environments around the car. Though streets

are historically specific social products, their materiality makes them highly durable, shaping our lives long after those who imagined and designed them are gone. And while traffic laws are not made of asphalt or steel, their power to shape our lives is hardly less powerful for it. Reimagining and remaking the American roadway will thus be an ongoing project of vast historical and geographical scope.

This project begins by critically reexamining our assumptions about the public ROW: who it should serve, how it should be shared, and what shape it should take. And it continues by translating a different conception of the street—one which embraces the wider role of streets as public spaces, to which all citizens have a right—into regulation and design that promote a just street. This book offers one modest contribution to that multifaceted struggle. By articulating mobility as a question of politics and rights, and the street as space of justice (or its absence), I hope this book helps us think differently and more critically about traffic regulation and roadway engineering. But more than a critique of injustice, I hope its overview of relevant laws and design standards can provide tools for more democratic engagement with the policy processes that shape streets, today and into the future. And inspired by the struggles and successes of others, sometimes waged at risk of their own lives and limbs, we might be emboldened to demand our right to a more just public street.

So where do we go from here? Most fundamentally, we must rethink the "rules of the road" that define the purpose of the street and our right to it: the UVC and state traffic statutes drafted in its image. Few of us are lawyers, and fewer still will be legislators or judges. But many can play a role in rethinking how such statutes govern all manner of interactions among the mobile, and confronting the biases inherent in so-called "Motor Vehicle Codes." It is critical for those who advocate intermodal equity and wider access to public streets to challenge the policy biases built into the UVC and demand reform. Until these statutes better ensure that rights and duties within the public ROW are distributed fairly, and legally protect humans who are vulnerable and move slowly from those who pose dangers by dint of their mass and speed, they must be considered unjust as written. Even more radically, it is time to reconsider whether our streets should be universally designed as spaces of vehicular mobility, and whether more legal space can be opened for nontransportation uses of public streets. Furthermore, activists must continue to fight to assure greater justice in how statutes are enforced and interpreted. Policing is influenced by politics, and communities should reexamine whether their enforcement

priorities and strategies are equitable. Furthermore, when accidents occur the common law of torts provides a powerful venue for confronting the legal and practical hegemony of the car, and ensuring motorists fully assume the obligations—and liability and costs—of the eminently foreseeable dangers they bring to the roadway.

Each of us can play a meaningful role in this transformation. As pedestrians and cyclists we must assert/defend our rights to the crosswalk or travel lane, and as drivers we must take greater care to yield. As voters we must demand our legislators and judges equitably protect the rights of all roadway users. And those with legal skills must skillfully advocate for fairness in law making and enforcement, and how conflicts among the mobile are settled in (and out of court). Imagining a more just roadway will require that citizens know their rights to the street, lobby their legislators for greater equity, and work as lawyers and judges to defend against injustice on the street.

Equally important is the task of transforming how our streets are designed. The world needs more progressive traffic engineers, a new generation of which is coming up as we speak. But each of us, including nonexperts, can play a greater role in remaking the American street. The right to a more just city is premised on meaningful participation of citizens in decision-making. For too long roadways were designed by technocratic experts insulated to a remarkable degree from democratic processes and input, guided by standards found in expensive and intimidating manuals that few citizens could access or afford, and answerable only indirectly to users. But a primary goal of this book has been to show that some of the most important standards—for example how roadway spaces should be allocated—are simpler to interpret than most would suspect. Any citizen with access to a public library, and knowledge of the English language and arithmetic, can read and understand much of AASHTO's Green Book. Planners certainly can. And today NACTO guides provide a free and easy-to-use alternative, helping citizens imagine and justify different kinds of roadways.

Planners and activists can and should use engineering standards to engage traffic engineering experts in their own terms, questioning—and challenging when appropriate—their underlying assumptions and design decisions. Furthermore, we should all demand that citizen engagement and transparency be made part of the roadway design process. Certainly, much of the design process *is* highly technical, and best left to experts. But the design of roadways is of too great social import to be left outside the

democratic process. Wishing for a more just roadway is not enough. Nor is it enough to critique traditional engineering. We must, in our own ways, advocate—as users, voters, and participants in the design process—for the development and application of standards that maximize access for all, protect the vulnerable, and produce streets that are not merely conduits but quality places.

And while the ponderous processes of reforming laws and engineering are essential, we must not forget the power of direct action. The street is a public space where any resident can confront its banal yet monumental inequities of automobility with our bodies and voices. Here we may find inspiration in the movements described in the preceding chapter, which find especial power in their ephemerality and performativity. Some are organized events: To challenge core assumptions about the street, cyclists and pedestrians can collectively organize critical mass rides or open/free streets events. These are temporary, but no one quickly forgets the exhilarating feeling of walking or biking a car-free street. And neighbors can hardly fail to appreciate how differently people-powered streets look and sound and smell from the motor vehicle thoroughfares we have sadly come to accept as public spaces. Some are installations: Creative and community activists can help transform streets with public art, whether somber memorials like "Ghost Bikes" or playful "PARK(ing)" spaces, to remind us that streets are not merely infrastructure but are meaningful public places.

Lastly, we should not forget our enormous individual and collective power to remake streets in how we use them every day. By choosing to move with human instead of motor power, we transform the street one trip at a time. Claiming the public ROW with our shoes and wheelchairs and bikes, we relate differently with the city and each other, bringing relative slowness and quietude and safety to our cities. The street of course remains contested, as it always will. And too often these forms of transport are quite literally transgressive acts, made so by the inequities of autocentric roadway engineering. But we can embrace that transgression, viewing the mere fact of how we move through the city as the political acts they are. It can be a very lonely and often dangerous business. But when we opt for alternative modes, we literally open space for the mobility and rights of others. We pose less of a physical threat to other beings (human and nonhuman) and less harm to present and future environments. And as more people use active transportation and transit, such uses will become more undeniably visible to both roadway users and policymakers. And taken in aggregate, such social change will transform streets as less and less space is needed for travel lanes and parking, and more is demanded for other modes and other broader public uses. Alone and together we can reimagine and remake streets by changing how we move through them, the kind of claims we make upon them, and how we relate to each other and the spaces themselves. We need not wait for perfect streets before using our bodies to make the street—and by extension our cities—better. Existing sidewalks in many cities have much room for additional pedestrians, and streets much more room for bikes.

Ultimately, ensuring the rights of diverse peoples to share equitably in the city's public "rights-of-way" will require all the above: new laws, engineering standards, and street spaces that guarantee access for all. "Think of a city and what comes to mind?" Jane Jacobs asks, answering "Its streets" (1961, p. 29). If those streets are unjust by regulation and design, so too is the city. Imagining and constructing more just and sustainable American "streets for everyone" is thus a task as historically pivotal as it is daunting. A century of auto-centrism built into our streets makes that no mean task. And the inevitability of conflict among competing rights claims, including among the nonmotorized, makes justice an elusive goal. But if "[u]topia is impossible," Don Mitchell reminds us, "the ongoing struggle toward it is not" (2003, p. 235). Such an epochal struggle for the American street is now well under way.

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