Making U.S. Cities Pedestrian-and Bicycle-Friendly

Susan Handy

Introduction

The benefits to individuals and to society of walking and bicycling as health promoting, environmentally benign, and financially beneficial modes of travel are by now well documented and increasingly accepted (e.g. Cavill, et al., 2008; Götschi and Mills, 2008; Oja, et al., 2011; Flusche, 2012; Litman, 2013; Xia, et al., 2015; Götschi, et al., 2016; Gu, et al., 2016; Loong, et al., 2017). Many cities in the U.S. have embraced these modes, inspired by the pedestrian and bicycle friendliness of European cities. Cities such as Copenhagen, Paris, and Barcelona demonstrate how investments in walking and bicycling contribute to healthy, sustainable, affordable, equitable, and vibrant communities. These pedestrian-and-bicycle-friendly (PBF) cities are, first and foremost, people-friendly cities.

Creating PBF cities in the U.S. is a tall order. U.S. cities lack the “good bones” of European cities for at least two reasons. First, they are newer than European cities, with much of the growth in U.S. cities occurring after the advent of streetcar systems and the automobiles that followed shortly thereafter. Only a small share of the total urbanized area of the U.S. originated at a time when the population was largely dependent on walking; according to the American Community Survey, over 82% of housing units in 2016 were built since 1949. Second, they reflect nearly a century of planning practice that prioritized private vehicles over other modes of transportation. Private vehicles, not surprisingly, now account for over 83% of all trips made in the U.S. (Santos, et al. 2011). U.S. cities are vastly more car-friendly than they are pedestrian- or bicycle-friendly.

Although European cities have also invested substantial amounts in automobile infrastructure, they did so in only a limited way until well after World War II. Even then they continued to make substantial investments in their transit systems and they quickly realized the value of preserving pedestrian-oriented cores (Pucher, 1988). Northern European cities recognized the importance of bicycling infrastructure decades before all but a few U.S. cities (Pucher and Buehler, 2008; Jordon, 2013). European countries supported the efforts of their cities by imposing taxes on gasoline and car purchases at far higher rates than in the U.S. (Pucher, 1988). European cities, as a result of these deliberate policies, are far more pedestrian- and bicycle-friendly – and far less car-friendly – than their U.S. counterparts, with mode shares to match (Figure 1; Buehler et al., 2017).

U.S. cities aiming to become PBF cities have much work to do. In this paper, I focus on three important challenges for U.S. cities and other cities like them: reworking car-friendly cities, unleashing the potential of bicycling, and elevating walking and bicycling in regional planning. These are not the only challenges these cities face, and success in overcoming them does not guarantee success in increasing walking and bicycling. But cities must confront these challenges on their way towards becoming PBF cities.
Reworking Car-Friendly Cities

In few places in the U.S. is it possible to meet all of one’s daily needs on foot or bicycle: the distances to destinations are simply too far given limits of time and/or physical ability. Public transit and private vehicles thus fulfill the need to reach more distant destinations. They also, however, can make walking and bicycling less safe, less comfortable, and generally less feasible. The challenge for planners is to create a city where walking and bicycling live safely and comfortably with faster, longer-distance modes. Three key principles are essential to creating a pedestrian- and bicycle-friendly city: distances, protection, and integration.

These principles, summarized in Table 1, hold across cities, though the specifics of successfully applying them will vary by context. The roles that walking and bicycling can play in the transportation system differ from one city to another, as does the appropriate balance between walking and bicycling. In high-density city centers, for example, walking may be more important than bicycling, while in lower-density suburban areas, the reverse may be true. Even when planners successfully apply these principles, the potential for walking and bicycling as a mode of transportation depends on local conditions such as weather, topography, and culture.
Table 1. Principles for Pedestrian- and Bicycle-Friendly Cities

<table>
<thead>
<tr>
<th>Distance</th>
<th>Proximity</th>
<th>Land-use mix through zoning and redevelopment Population density if it enables land-use mix</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Connectivity</td>
<td>High density of streets and intersections Elimination of barriers to peds and bikes</td>
</tr>
<tr>
<td>Proximity and connectivity</td>
<td></td>
<td>Direct connections to destinations</td>
</tr>
<tr>
<td>Perceived distances</td>
<td></td>
<td>Quality of walking and bicycling environment</td>
</tr>
<tr>
<td>Protection</td>
<td>From cars</td>
<td>Allocation of street space to peds and bikes</td>
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<td></td>
<td>Development of low-stress networks</td>
<td>Traffic management to lessen conflicts</td>
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<td></td>
<td>Vehicle automation to lessen conflicts?</td>
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<td></td>
<td>From transit</td>
<td>Separation without creating barriers?</td>
</tr>
<tr>
<td>Integration</td>
<td>With transit</td>
<td>Access and egress modes for transit</td>
</tr>
<tr>
<td></td>
<td>As a complement to ride-sharing?</td>
<td></td>
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<tr>
<td></td>
<td>With each other</td>
<td>Management of conflicts through design</td>
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Distances
Walking and bicycling as modes of transportation depend first and foremost on having destinations within acceptable distances from home and other places from where trips originate, such as work sites or schools (Saelens and Handy, 2008; Handy and Xing, 2011; Emond and Handy 2011). For walking, planners often aim for 0.25 miles, but median walking distances in the U.S are closer to 0.5 miles, and walks as long as a mile are not uncommon (Yang and Diez-Roux, 2012). For bicycling, with its faster speeds, the median trip distance is over 1 mile, according to the National Household Travel Survey, though bicycle commuters often travel much farther. Average walking and bicycling distances are similar for Canadians (Larsen, et al., 2010).

Distances to destinations depend first on proximity: the nearness of destinations to home or other origins, as the crow flies. Proximity to destinations depends on land use mix, and land use mix generally depends on population and employment density, as densities determine the number of potential customers within a given distance. Density has ambiguous implications for walking and bicycling, however. High density areas without a mix of land uses, as can result from restrictive zoning policies, do not put destinations within close proximity and thus do nothing support walking and bicycling. Ever higher densities, even with a good mix of land uses, may have a counter-productive effects for walking and bicycling as the concentration of all types of traffic increases. Density is important to walking and biking as a means of ensuring of nearby destinations but is not important in and of itself. Distances also depend on network connectivity, defined as the directness of the possible routes to destinations along the transportation network. A denser network, with more intersections and roads per square mile, generally means better connectivity (Handy, et al. 2003).

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1 All NHTS statistics reported in this paper are the author’s calculations based on data extracted using the NHTS extraction tool, available [http://nhts.ornl.gov/det/Default.aspx](http://nhts.ornl.gov/det/Default.aspx)
Neither proximity nor connectivity on its own ensures short distances to destinations. A high-density network provides relatively direct connections from one point to another but would be of little benefit to pedestrians or bicyclists if coupled with a homogenous land use pattern containing none of the important destinations. Similarly, nearby destinations may lie beyond walking or bicycling distance if the network provides only roundabout connections, as is common in suburban subdivisions (Handy, et al. 2003). Discontinuities in the network, often created by man-made barriers such as freeways and railroads or natural barriers such as rivers, are especially problematic for pedestrians (Handy, 2003; Tirachini, 2015). Pedestrian and bicycle bridges or tunnels help to alleviate the barrier effect, though pedestrians and bicyclists often choose not to use such facilities if crossing at-grade is not physically impossible (Räsänen et al., 2007). In rare cases, pedestrians and bicyclists have a denser network and better connectivity than cars (Tal and Handy, 2012); Davis, California and Houten in the Netherlands are examples. The key to pedestrian and bicycle friendliness from a utilitarian standpoint is to have good connectivity to destinations in close proximity for those types of destinations that residents most need and desire.

Reducing distances to destinations within existing cities is a challenge. Ensuring proximity to destinations is more easily done from the start. For the last century, since the advent of exclusionary zoning, U.S. cities have expanded at relatively low densities with relatively homogenous land use patterns. Efforts to retrofit these areas through infill development and various forms of redevelopment often meet resistance from current residents and pay off slowly over time in the best of circumstances (Farris, 2001). Still the potential is great: a 2005 study estimated that infill development could accommodate as much as 25% of California’s projected need for new housing over 20 years (Landis and Hood, 2005). Ensuring connectivity to destinations is also more easily done from the start, but sometimes the strategic installation of a new link in the network can have a substantial impact on walking and bicycling distances. Davis, for example, purchased and removed a private home in the 1990s to create a short cut-through for bicyclists and pedestrians that significant improved connectivity to a junior high school and an elementary school. In 2015, Portland, Oregon opened a new bridge across the Willamette River for bicyclists, pedestrians, and transit service that connects the southeast quadrant of the city to a major health center and to downtown.

Residents will walk or bicycle only if they perceive destinations to be within a reasonable distance: perceived distances matter more than actual distances (Emond and Handy, 2011). The quality of the walking or bicycling experience along the route may lead the traveler to perceive a shorter or longer distance than the reality. Aesthetic qualities can influence enjoyment of the experience and thus perceived distances (Handy, 2003; Handy, 2005). Pedestrians may prefer routes with a greater sense of enclosure, a more interesting and varied streetscape, and a more extensive tree canopy (Ewing, et al., 2006) and find routes with these characteristics to feel shorter. Less is known about the effects of such qualities on bicyclists, though evidence suggests that they are also important (Forsyth and Krizek, 2011; Muhs and Clifton, 2016). Also influencing the quality of the experience for pedestrians and bicyclists is exposure to vehicle traffic: routes with high exposure may feel longer than those that are separated from traffic, owing to higher safety risks, noise levels, and fumes. For this reason and others, protection from traffic is a second key principle after distances.

Protection
Facilities that protect pedestrians and bicyclists from vehicle traffic are also essential to a PBF city (Saelens and Handy, 2008; Pucher, et al., 2010; Winters et al., 2017). Separation from traffic is especially important for older and younger travelers who may be more vulnerable. Sidewalks are common in U.S. cities, even in suburban areas, but they are often too narrow, close to traffic,
obstructed, and disconnected for pedestrians to feel comfortable. Sidewalk retrofit programs, spurred by the Americans with Disabilities Act, have improved conditions for all pedestrians. At the same time, U.S. cities are increasing their miles of bike lanes at a rapid rate, with measurable effects: Boston installed 92 miles of bike lanes over seven years, resulting in a doubling in the share of workers commuting by bike (Pedroso, et al., 2016). Several cities, including Los Angeles and New York, have now installed buffered bike lanes and cycle tracks that give bicyclists more protection than traditional bike lanes and that can increase both the safety and amount of bicycling (Lusk, et al., 2011; Teschke, et al., 2012). Such projects are possible because streets in the U.S. are often far wider than they need to be (e.g. Listokin and Walker, 2012), enabling “road diet” projects in which street space is reallocated from cars to bicycles or other users. Wide streets are a deterrent to walking and bicycling but they also represent an opportunity for cities aiming for pedestrian and bicycle friendliness.

Protected facilities are most effective when they form a continuous network (Buehler and Dill, 2016). This is a challenge for cities, in that they may have funding for only a few segments of the planned network in any given year. Critical segments can have a significant impact on their own, particularly if they connect important destinations, but their impact is likely to increase as the extent of the network increases (Pucher, et al., 2010). Many cities are using the concept of bicycling level-of-stress to analyze the connectivity of their bicycling networks while accounting for the level of stress that a bicyclist is likely to feel riding on each segment (Mekuria, et al., 2012). Low-stress routes include segments with protected bicycle facilities but also streets with low levels of traffic. Intersections present an especially challenging obstacle to the creation of low-stress networks, in that pedestrians and bicycles are at their most vulnerable when crossing intersections. Copenhagen has employed a continuous-network strategy to great success (Pucher and Buehler, 2007); another notable success story is Sevilla, Spain (Marqués et al., 2014; Marqués et al., 2015). The success of bicycle-friendly cities in the U.S., such Davis, California, Boulder, Colorado, and Portland, Oregon also stems from the extensiveness of their low-stress network as well as special protections for bicyclists at intersections.

Traffic management is another important strategy for protecting pedestrians and bicyclists. Slowing cars yields significant improvements in safety: the risk of severe injury for a pedestrian is 75% when hit by a car traveling at 39 mph, 25% at 23 mph, and just 10% at 16 mph (Tefft, 2011). Restricting cars from pedestrian- or bicyclist-dense areas can also increase safety and improve the quality of the public space. San Francisco, for example, restricts private vehicles from a busy section of Market Street; such restrictions are common on college campuses. Parking management is another important tool available to cities: strategic decisions about where to put parking and how to price it can reduce driving associated with searching for parking, create buffers between moving traffic and sidewalks or bike lanes, and redirect the flow of traffic away from pedestrian areas (Shoup, 1997). As an added bonus, reducing the amount of parking in a city can increase residential and employment densities and make for a more aesthetically pleasing environment. Management of truck traffic in urban areas is especially important: In London in 2014 and 2015, trucks were connected to over half of bicycling deaths and nearly a quarter of pedestrian deaths (Walker, 2016).

Innovations in car technology may help to protect pedestrians and bicyclists but may also put them at higher risk. Hybrid electric and battery electric vehicles are much quieter than conventional ICE vehicles, making walking or bicycling near traffic more pleasant but raising concerns about risks to pedestrians and bicyclists who do not hear these vehicles approaching (e.g. Wogalter, et al. 2001). In one study, the odds of being in a pedestrian crash were 22 percent greater for hybrid electric vehicles than ICE vehicles (Wu, et al. 2011). Autonomous vehicles (AVs) represent an opportunity for improving the safety of active travel. Autonomous vehicles and precursor technologies such as connected vehicles
help to compensate for driver inattention and error, a common cause of vehicle-pedestrian and vehicle-
bicycle crashes. The protection of road users outside of vehicles has been an important goal in the
development of AV technologies, but these efforts must address a long list of questions about the
interactions between vehicles and active travelers (Parkin, et al. 2016). Automated recognition of
bicycles has been a particular challenge, and current technologies are cause for concern: Uber’s first
automated vehicles did not correctly handle “right-hook” turns (Wiedenmeier, 2016), and self-driving
Mercedes were reportedly programmed to save the driver at the expense of bicyclists or pedestrians
(Sorell, 2016).

Cities must also carefully consider the relationship between transit and walking and bicycling. Transit
systems can be better for walking and biking than private cars are, in that they carry more passengers
using less space. On the other hand, transit vehicles are much bigger than cars and often travel just as
fast, posing a safety hazard for pedestrians and bicyclists (Edminster and Koffman, 1979). Rail or bus-
rapid transit systems operating in dedicated rights-of-way reduce safety hazards but create physical
barriers that can put destinations beyond walking or biking distance (Anciaes, et al., 2012). Below-
ground metro systems alleviate the problem but are vastly more expensive than at-grade systems.
Many European as well as U.S. cities have had success mixing light-rail systems with pedestrians in their
central business districts. Integrating walking and bicycling with transit and other services more
generally is the third key principle.

Integration
The most effective transportation systems are those in which slow modes and fast modes are
complementary components of an integrated transportation system. The slow modes need the fast
modes, but the fast modes also need the slow modes. Most notably, walking is the primary means of
access and egress for transit. A 2010 transit user survey in Atlanta found that 72.4% of riders walked to
get to the bus stop or rail station, with 80% walking ¼ mile or less (ETC Institute, 2010). LA Metro’s 2015
user survey found that 83% of bus riders and 68% of rail passengers walked to transit (LA Metro, 2015).
In other words, a city must be pedestrian-friendly to be transit-friendly.

The new vision of an integrated system of mobility options now includes walking, bicycling, and transit
along with vehicle sharing services in the form of both car-sharing and ride-sharing. These services help
to fill the travel needs that walking and bicycling cannot, but they are less likely to engender reliance on
driving than private car ownership (Martin et al. 2010). In addition, because vehicle sharing services
have the potential to reduce overall vehicle travel in a community, they can help to improve conditions
for pedestrians and bicyclists. On the other hand, ride-sharing has the potential to replace some
bicycling and transit trips, leading to more driving overall and negatively affecting public health. Recent
research shows that walking and bicycling increase for some ride-sharing users but decrease for others
(Circella et al., 2016).

Cities must also carefully integrate walking with bicycling. Differences in speed mean that walking and
bicycling don’t always mix well (Graw and König, 2002; Chong et al., 2010), leading to a number of high
profile incidents in which pedestrians were injured or killed by bicyclists (e.g. Wollan, 2012). Bicyclists
and pedestrians are often separated, as is the case when a city provides both sidewalks and on-street
bike lanes or designates separate lanes for pedestrians and bicyclists on off-street trails. So-called
Dutch-style intersections separate and channel bicycles, pedestrians, and cars so as to minimize
potential conflicts within the intersection. Car-free areas tend to also be bicycle-free areas, though
sometimes cities provide a bicycle lane through the area, as New York City does through Times Square.
In most such areas in the U.S., pedestrians far out-number bicyclists, a situation that helps to manage
the faster bicycle traffic; areas where bicycle counts equal or exceed pedestrian counts (e.g. the UC Davis campus, bridges in Portland, trails in Boulder) may need more aggressive traffic calming measures for bicyclists to safely integrate the two modes.

Unleashing the potential of bicycling

Although often lumped together, walking and bicycling differ in important ways (Schoner and Lindsey, 2015). One way they differ is with respect to their potential use, as summarized in Table 2 (Handy, 2010). First, walking is possible for a greater share of people than bicycling is. Many adults in the U.S. have not bicycled since they were children, and somewhere around 6% to 8% have never learned to bicycle (Chalabi, 2015; PeopleForBikes, 2015). Bicycling requires access to equipment, namely a functioning bicycle with inflated tires. For these reasons, walking has more “people potential” than bicycling does. On the other hand, bicycling is generally faster than walking: average speeds for bicycling as a mode of travel are on the order of 10 mph, while average walking speeds are around 3 mph. Given its faster speed, bicycling has more “trip potential” than walking, as bicyclists can reach more destinations in a given amount of time than pedestrians can. Both modes are critical to cities, now and into the future, but the trip potential of bicycling represents an important opportunity that merits attention.

Table 2. People versus trip potential of walking and bicycling

<table>
<thead>
<tr>
<th></th>
<th>People potential</th>
<th>Trip potential</th>
</tr>
</thead>
<tbody>
<tr>
<td>Walking</td>
<td>No equipment needed</td>
<td>Only 2-5 mph so not many destinations</td>
</tr>
<tr>
<td></td>
<td>Most people are able to do it</td>
<td>within time available</td>
</tr>
<tr>
<td>Bicycling</td>
<td>Bicycle needed</td>
<td>Faster at 5-15 mph so more destinations</td>
</tr>
<tr>
<td></td>
<td>Many people don’t have skills or confidence to do it</td>
<td>within time available</td>
</tr>
</tbody>
</table>

Even with its low-density development patterns, a substantial share of daily trips in the U.S. are short enough to be bike-able. According to the 2009 National Household Travel Survey (NHTS), 17% of daily trips are less than 1 mile, more than 28% are under 2 miles, and half are under 4 miles, as shown in Figure 2. Yet bicycling accounts for just about 1% of all daily trips in the U.S. Even a small shift in the share of short-distance trips from driving to bicycling could have substantial benefits for U.S. cities in the form of reduced emissions and noise, improved public health, and lower infrastructure costs. Recognition of such benefits has motivated substantial investments in bicycle infrastructure over the last decade. Portland, OR has served as a model for cities such as San Francisco, Los Angeles, Chicago, New York, and Washington, DC, all of which have invested heavily in bicycle infrastructure and have seen measurable increases in bicycle commuting as a result (Pucher and Buehler, 2016).
But infrastructure only goes so far, as a growing body of evidence suggests (Willis, et al., 2015; Forsyth and Oakes, 2016; Song, et al., 2017; Winters et al., 2017). Those cities that have been most successful in increasing bicycling have also invested in “soft” measures such as promotional and educational programs (Pucher, et al., 2010). Such programs aim to increase comfort with bicycling, liking of bicycling, and other psychological aspects of bicycling that studies show are key predictors of whether an individual chooses to bicycle or not (e.g. Miller and Handy, 2012; Handy and Xing, 2011; Emond and Handy, 2011). These programs are especially important for women, who tend to be less comfortable bicycling, worry more about their safety and security, and simply like bicycling less than men (Garrard, et al., 2012). According to the 2009 NHTS, women account for under 25% of all bike trips, and biking represents just 0.5% of trips made by women compared to 1.6% of trips made by men. The League of American Bicyclists launched its “Women Bike” campaign in 2012 with the goal of getting more women on bikes (League of American Bicyclists, 2015). Success in getting more people onto bicycles is, in turn, likely to generate more favorable attitudes towards bicycling (Kroessen et al., 2017).

Bicycling can fill important gaps in the transportation system, particularly in suburban areas. One gap is described as the “first-mile, last-mile” problem for transit. As noted above, walking is the overall dominant mode for accessing transit. But in suburban areas, few residents live within walking distance of transit; just 11% of residents of the larger metro area of Los Angeles do (Marks, 2016). In these areas, commuters are more likely to drive to rail stations, where they require ample space to park. At the work end of the trip, long distances from the rail station to the office park may discourage transit use altogether. Bicycling, with its faster speeds, can increase the viability of transit while reducing the use of private vehicles in conjunction with transit. Currently, bicycling is the access mode for just 3 to 4% of daily transit trips in Los Angeles, but still this represents a substantial number of trips (LA Metro, 2015). Another gap stems from temporally and spatially sparse transit service in suburban areas. In relatively low-density areas, transit agencies cannot afford to provide high-frequency service on a dense network. In these areas, bicycling can be substantially faster than taking the bus, after accounting for wait times, and considerably more flexible, at least for trips that are a reasonable distance for bicycling, not to mention cheaper. Bicycling may be an especially attractive alternative in small cities, where distances
are too long for walking but still relatively short and where transit service is sparse and infrequent (Handy, Krizek, and Heinen, 2012).

New technologies are expanding the potential for bicycling to fill these gaps. First, bike-sharing systems facilitate bicycle use without ownership. The number of bike share systems with at least 10 stations and 100 bikes in U.S. cities grew from four in 2010 to 55 in 2016 (National Association of City Transportation Officials, 2017), with yet more systems to come. These systems expand access to bicycles, especially if designed to be accessible to lower-income residents, and they may help to build a bicycling culture (Shaheen et al. 2010). Although most systems so far are in large cities, bike-share providers are now targeting small cities as well. Second, electric pedal-assist bicycles (“e-bikes” or “pedelec” bikes), widely used in China, are growing in popularity in the U.S. (Navigant Research, 2017; LEED Bicyclology, 2017). Through higher speeds and/or less energy expenditure, they expand the viability of bicycling as a mode of transportation to more people, more trips, and more places (Popovich et al. 2014). E-bikes are of particular interest for communities with hilly terrain, for older citizens, and for lower-density communities where destinations are a longer distance from home, though their high cost and weight may prove prohibitive for some users. As an added bonus, to the degree that they reduce car travel (Fishman et al. 2014), bike-sharing systems and e-bikes improve the environment for walking and conventional bicycling.

Bicycling may prove to be especially important for lower-wage workers, though their use of bicycles as a mode of transportation is not well studied. According to the 2009 NHTS data, bicycling mode share is highest among the lowest income workers: 1.17% of commute trips by workers with household incomes under $20,000 are by bicycle, compared to 0.64% of commute trips by workers with household incomes over $20,000. Programs like the Bike Campaign in Woodland, CA aim to increase access to bicycles among low-income households, provide training on riding and maintaining a bicycle, and put on promotional events to increase interest in bicycling (The Bike Campaign, 2017). Advocates are pushing to increase access to bike sharing system in low-income areas, led by the Better Bike Share Partnership (2017). The City of Philadelphia used grant funding to install 20 bike share stations in low-income in 2015, and the PeopleForBikes Foundation is administering $900,000 in grants over three years to promote more equitable bike-sharing systems in other cities.

**Elevating Pedestrians and Bicyclists in Regional Planning**

Cities throughout the U.S. are making the investments necessary to enhance the roles of walking and bicycling as low-cost, low-polluting, health-inducing modes of travel. But much of the activity is concentrated within central cities lying at the heart of their metropolitan regions; outside of the center, attention to the needs of bicyclists and pedestrians is spottier, reflecting the different priorities of each local government. In Europe, by contrast, pedestrian and bicycle friendliness typically extends throughout the metropolitan region, enabling easy car-free travel through a combination of walking, bicycling, and transit for short as well as long-distance trips. A PBF region, where the efforts of the cities within the region knit together to create an interconnected system of bike facilities and uniformly good pedestrian access to and from transit stations, would help to maximize the benefits from these modes.

Responsibility for regional transportation planning in the U.S. lies with Metropolitan Planning Organizations (MPOs), required under federal law to develop long-range transportation plans for the region and to allocate federal funding to projects within the region (Sciara and Handy, 2017). Bicycle and
pedestrian projects have been eligible for federal funding since 1991, but MPOs have differed in the degree to which they have taken advantage of this opportunity (Handy and McCann, 2011). Even when plans highlight the role of these modes in the regional transportation system, the criteria by which MPOs allocate funding may disadvantage these projects, and projects are only considered for funding in the first place if proposed by local governments. Regional efforts, such as the San Francisco Bay Trail (Bay Trail, 2017), often depend on coalitions of local governments and non-profit organizations.

Part of the problem is that data on pedestrian and bicycle activity are far more limited than data on transit and driving (Schneider, et al., 2005; Ryus, et al., 2014); this is generally true throughout the world, not just in the U.S. Travel diary surveys, which are the foundation for regional planning, have traditionally done a poor job of capturing walking and bicycling trips: separating utilitarian from recreational trips can be a challenge, and surveys may especially undercount short walking trips and the walking components of driving and transit trips (Schneider, et al., 2012). Many cities have implemented count programs, often focusing on bicycle counts to measure the effectiveness of infrastructure investments. But such programs provide limited data as to who is and isn’t bicycling. Crowd-sourced data may help to fill the gaps (Smith, 2005), and smartphone applications now provide data on routes used by bicyclists. These data generally come from non-representative samples, but a study by the Centers for Disease Control and Prevention suggests that user-tracked data from apps like Strava provide similar estimates of the share of commuting by active modes at a neighborhood level (Whitfield, et al., 2016). Crash data are notoriously problematic, and planners cannot be sure what the numbers mean in the absence of good data on the amount of walking and bicycling activity by area. Efforts such as the National Bicycle and Pedestrian Documentation Project (2016) aim to improve the situation.

Regional travel demand forecasting models, used in the development of the long-range plan, largely ignore bicycle and pedestrian activity. These models were originally designed to assess the need for additional highway capacity given expected population growth. Over time, they were adapted to also forecast transit ridership. Concerns over the exclusion of walking and bicycling from these models and thus their disadvantage in the planning process relative to motorized modes arose at least two decades ago (Replogle 1995; Porter, et al., 1999), but progress has been slow. MPOs have taken different approaches to addressing this problem (Singleton and Clifton, 2013; Aoun, et al., 2015): developing separate models for forecasting walking and bicycling; “post-processing” to derive forecasts of walking and bicycling from the outputs of the travel demand model; and adapting their model to include walking and bicycling in mode choice and other stages. The shift to activity-based models may help to facilitate the incorporation of walking and bicycling into the regional model, but data limitations, described above, are a significant impediment for all three approaches. Whether incorporating bicycle and pedestrian activity into the regional models will lead to more investments in these modes remains to be seen.

At the same time, these models may be declining in importance as goals beyond congestion reduction come to the fore (Handy, 2008). MPOs are putting increased emphasis on goals related to the environment, social equity, and public health, not all of which are easily assessed using travel demand models. This broader range of goals requires performance measures beyond the traditional level-of-service measure. A federal requirement that MPOs adopt a performance-based planning approach is also fueling the development of new ways to assess the performance of the system and the ability of the plan to meet the region’s goals. These developments should help the cause of regional pedestrian and bicycle investments, which have a limited impact on congestion in the best of circumstances but could have many other benefits for the region.
New developments in project-level impact assessment could also elevate bicycle and pedestrian investments. Health impact assessments (HIAs) are becoming more common as a complement to the traditional environmental impact assessments carried out for transportation projects (Dannenberg, et al., 2008). Active modes fare well in HIAs given that they increase health-beneficial physical activity and reduce health-harming emissions. In line with its climate change policy, California is replacing level-of-service with vehicle miles of travel (VMT) as the key consideration in impact assessments under the California Environmental Quality Act (Office of Planning and Research, 2017). Although the state is still developing guidance on the methods for estimating VMT impacts, the new approach is likely to disfavor projects that increase vehicle capacity. Evaluating the impact of these developments on pedestrian and bicycle investments is a critical research need.

Conclusions

U.S. cities have embraced walking and bicycling as important modes of transportation and as essential ingredients for economic and social vibrancy (Cohen, 2017). An integrated transportation system in which the slower active modes complement the faster motorized modes and vice versa offers residents of the region a broader array of choices and improved quality of life. The specifics of such systems will differ across regions, and the degree to which residents take advantage of these choices will vary, but the core principles for achieving pedestrian and bicycle friendliness apply everywhere. Achieving PBF status is particularly challenging in regions, whether in the U.S. or elsewhere, built largely during a time when auto-friendliness took precedence in planning.

Current and coming transportation challenges work both for and against PBF cities. Autonomous vehicles, for example, could improve bicycle and pedestrian safety by reducing driver error. On the other hand, they may increase total driving, thereby degrading the pedestrian and bicycle environment. Inadequate levels of transportation funding coupled with growing maintenance needs could make it easier to direct funding toward pedestrian and bicycle projects that are much cheaper than road projects. On the other hand, justifying the extra funding needed to accommodate pedestrians and bicycles as a part of road projects could become much harder. How these possibilities play out depends on the strength of the commitment for pedestrian- and bicycle-friendliness.

It is not inevitable that U.S. cities will become true PBF cities in the coming decades, but it is likely that they will become more pedestrian- and bicycle-friendly over time. Decision makers, planners, and citizens alike increasingly recognize and value the benefits of PBF qualities, while a growing appreciation of the limitations of car-friendly cities is adding to the impetus. Much work – more research, better data collection, new planning tools – is needed to support this movement, but it is well on its way.

References


