Essential Factors of Active Transportation

Analysis and Recommendations for Downtown Atlanta

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I. Introduction

Goals and scope

This paper will examine the policies, procedures, and practices that government and transportation officials and bicycle and pedestrian advocates should pursue in order to effectively promote active transportation options. We will first present the case for pursuing active transportation—defined as bicycling or walking for purposes of transportation—and give an overview of the state of cycling and walking in the United States and selected nations with advanced pedestrian and bicycle systems.

We will then turn to our central purpose, which is to assist officials and advocates in prioritizing their efforts and resources through the identification of the essential elements of improving active transportation levels. This will be accomplished through a literature review, statistical analysis, and the qualitative examination and application of real-world examples. Analysis of the influence and effectiveness of aspects of active transportation will allow us to determine their relative importance in encouraging individuals to choose bicycling and walking.

We will then tailor this analysis Downtown Atlanta and its particular active transportation issues, and will use these policy recommendations to propose key aspects of potential initiatives to improve the area’s bicycle and pedestrian levels.

II. Methodology

This paper examines a variety of factors that affect bicycle and pedestrian levels, and lists each as a high, medium, or low priority for activists and officials based on the potential for each factor to sway individuals toward deciding to use active transportation. Relative potential and importance will be determined in a number of ways. We will apply
statistical analysis to certain factors in order to determine their relationship to levels of active transportation mode share. Those that show a strong correlation with mode share have a stronger case for prioritization. While the multi-faceted nature of transportation decision inputs may limit the conclusiveness of such analyses, they can help provide a general idea of which factors have ties to higher active transportation levels.

We will also consider each factor in the light of case studies and examples that help show how each has been tied to increases in mode share in various cities. This analysis will center on cities that have been among the most successful at encouraging active transportation (Copenhagen, Amsterdam, Portland) and others that have recently reversed car-dominated cycles of decreased safety and mode share (New York). We will identify the role these factors played in the success of these cities, which will help determine the relative priority each should have in places seeking similar results.

We will also use a range of academic and advocacy studies to help gauge the importance of various factors on active transportation. Through in-depth studies of particular topics or broader analysis of the active transportation inputs, these studies will provide insight into each factor’s relative priority.

Throughout this analysis, we will keep Downtown Atlanta in mind, and tie each factor to this area. We will consider how each element or the lack thereof might work to encourage or deter active transportation usage in light of Atlanta’s particular advantages and challenges.

**III. The case for active transportation**
Active transportation is worthy of promotion by officials and advocates because of its potentially significant positive impact on a range of urban and regional issues, including:

*Environment and natural resources*

Our transportation choices play a significant role in shaping environmental health. Americans have approximately twice the ecological footprint of other wealthy, industrialized nations, and according to the Environmental Defense Fund, approximately one third of carbon dioxide emissions and 80 percent of carbon monoxide emissions are transportation-related (Zheng 2008, Carbon 2002, *National* 2010). Bicycling and walking, on the other hand, produce nearly zero air pollution and consume far less in terms of natural resources than any motorized transportation mode. They reduce users’ dependence on foreign oil supplies, and increasing bicycling and walking by 3 percent of total trips could save the same amount of oil as replacing 19 million cars with hybrid vehicles (Pucher and Buehler 2010, Transportation 2009). Simply allowing for active transportation through bike- and pedestrian-friendly design can have positive effects. In Atlanta, for example, residents of walkable neighborhoods have 20 percent lower CO2 emissions than those in the least walkable areas (SMARTRAQ).

*Congestion and parking costs*

Americans living in urban areas spent an average of 46 hours sitting in traffic during the year of 2007, with an estimated cost in lost productivity and wasted fuel of $750 per traveler (America 2009). Allowing and encouraging residents to travel by means other than cars is a critical step toward reducing congestion.
These same urban areas routinely dedicate large swaths of valuable land to severely under-priced automobile parking, which, if given the choice, developers would often designate for other uses (Cowen 2010). Bicycles use far less space than cars for operation and approximately 10 percent of the parking area. Every car replaced by a bicycle or pedestrian reduces the attractiveness of this excessive parking.

Public health

America is in the midst of an obesity crisis. 72.5 million adults and between 16 and 33 percent of children and adolescents in the United States are obese, with an annual societal cost of $147 billion, or nearly $1,500 per obese person (Vital Signs 2010, Obesity 2008). The Surgeon General has called for “strong public policy” to combat obesity (Vital Signs 2010). This gives officials a strong mandate for promoting safe, convenient active transportation options, due to the clear ties between cycling and walking and reduced obesity levels.

Replacing time spent driving with active transportation is directly related to reductions in obesity. Each additional hour spent in a car per week is associated with a 6 percent increase in the chances of obesity, while an Australian study showed that men who cycle to work are around 30 percent less likely to be obese or overweight (Frank 2004, Mingwen and Rissel 2008). Additionally, active transportation has been tied to reductions in cardiovascular disease, osteoporosis, all-cause mortality, and even mental health disorders (Pucher and Buehler 2010, Boone-Heinonen et al. 2009, Godlee 1992).
There are arguments that the health risks of active transportation—especially biking—outweigh any potential benefits, and that obesity-reduction strategies should focus on safer activities. Dutch researchers addressed this question in a study measuring risks such as pollution inhalation and accidents against health benefits discussed above. They found that shifting from driving to cycling for short trips gave an estimated three to fourteen additional months of life expectancy, against five to nine days lost due to the risks (de Hartog et al. 2010). In other words, the benefits of moving from car to bicycle in terms of “life-years” gained outweigh the risks by nine times.

However, the risks of cycling in the Netherlands are far lower than in other countries, and the gap between benefits and risks would be narrowed in more dangerous places. For this reason, the study was extended to the United Kingdom, where cyclists’ potential for death is 250 percent higher than in the Netherlands. The results showed that the benefits of cycling were still seven times higher than the associated risks (de Hartog et al. 2010).

The even higher associated risks in the United States are not enough to justify moving away from supporting active transportation initiatives. The Netherlands study, rather, shows that the key to reaping the significant public health benefits of bicycling and walking is not to avoid these activities, but rather to work toward reducing the associated risks of traffic accidents and pollution inhalation.

**Equality**

Promoting active transportation is of great importance for achieving equality of mobility for the 80 million Americans—approximately one third of the population—who
are too young, too old, or too poor to drive (Duany et al. 2000). In the absence of reasonable bicycling and walking options, these “bored teenagers, stranded elderly, and immobile poor” who cannot bike or walk safely are fully dependent on others for mobility, or, in the absence of such support, lack access to jobs, shopping, schools, and health facilities.

The average yearly cost of owning a car is $9,055, which amounts to 18 to 19 percent of an average household’s income—a percentage that increases with decreasing income levels (Motavalli 2009, National 2010, Pucher et al. 2009). At the same time, an average person could use and operate a bicycle for as little as $120 a year (National 2010). The costs of walking are limited to whatever special shoes, clothing, or accessories the pedestrian desires—none of which are truly essential in a safe walking environment.

Access to transit is also dependent on active transportation. In 2004, 44 percent of transit users did not have access to a car, 43 percent earned under $20,000 a year, and a majority earned under $30,000 (2004 Conditions 2008). As 84 to 87 percent of transit trips begin or end with walking, making pedestrian activity safe and convenient increases the viability of transit and increases the mobility and economic opportunity of low-income residents, while usable bicycle facilities can be a low-cost strategy for increasing the catchment area of transit routes beyond that within walking distance.

Studies have also shown Hispanic and African-American residents to be disproportionately affected by unsafe walking conditions. African Americans walk 50 percent more than whites, and Hispanics walk nearly 40 percent more. Disparities in
fatalities, however, were even greater, with Hispanics and African Americans 62 percent and 70 percent more likely than whites to be killed while walking (Transportation 2010).

**Low cost and job creation for municipalities**

Active transportation infrastructure should be attractive to budget-conscious municipalities and government agencies, as it costs far less than car-based road infrastructure and public transit projects, both in terms of private costs and government investments (Pucher and Buehler 2010). The United States Department of Transportation (US DOT) has touted the comparatively low cost of investments in active transportation infrastructure development, particularly in comparison to road expansion, and a recent study showed that on-street bicycle and pedestrian infrastructure projects create more local jobs than road building (LaHood 2010, Garrett-Peltier 2010).

**Popular demand**

According to a 2010 Transportation for America survey, 57 percent of respondents said they would like to drive less, and 66 percent want increased transportation options. 73 percent said they had no choice but to drive as much as they do, while 59 percent said they saw increasing transportation options—including bike and pedestrian access—as preferable to road construction for congestion reduction. All these pro-active-transportation numbers are even stronger in urban areas (Transportation 2010).
IV. The state of active transportation

Usage levels

In the United States, active transportation accounts for a small minority of trips. In 2009, the National Household Travel Survey (NHTS) reported that 10.9 percent of all trips were by foot, with an additional 1 percent by bicycle. For trips to work, the combined mode share was far smaller at only 3.5 percent, or less than half of what it was in 1970 (National 2010, Pucher and Buehler 2010, Census 1970 and ACS 2010).

There is some disagreement as to the trajectory of active transportation mode share. According to the US DOT, the statistics are actually far better than those from just 20 years ago. In the 1970s and 1980s, combined mode share for to-work trips plummeted, reaching 6.7 percent in 1980 and just 4.4 percent in 1990—the year that the Federal Highway Administration (FHWA) declared bicycling and walking to be the “forgotten modes” (National 2010).

However, the exact mode share of cyclists and pedestrians can be hard to pin down, due to changes in definitions and collection methods over the decades. While the percentages of people who describe themselves as “walking commuters” or “bicycling commuters” have increased in the last decade, from 2.48 to 2.82 percent and from .4 to .55 percent, the number of people who walk to work has decreased 12 percent since 1990 despite 21 percent population growth (National 2010, Bicycling 2010). Surveys also indicate that the total number of walking trips has increased greatly, from 18 billion in 1990 to 35 billion in 2001 to 42.5 billion in 2009, which, in light of other statistics, may indicate that much of this increase is due to recreational walking (Zeeger et al. 2010).
These numbers reflect the lack of consensus on the trajectories of bicycling and walking over the last 40 years. Some suggest increases since 2001, when changes were made to survey methodology, while others such as the American Community Survey (ACS) shows clear reductions in walk-to-work mode share. In the end, it is clear that active transportation levels have fallen since 1970, and while there appears to have been a moderate rebound since around 1990, the impact of non-recreational trips on these more positive numbers is in debate.

One thing that is certain about active transportation levels in the United States is that they vary greatly from city to city. While the country’s 50 largest cities have an average combined mode share of approximately 4.7 percent, Boston, Washington, San Francisco, New York City, Seattle, and Minneapolis all have to-work combined bike-pedestrian mode shares of over 10 percent, while Indianapolis, Charlotte, Dallas, Arlington, Jacksonville, Nashville, Fort Worth, and Oklahoma City fail to reach 2 percent (Bicycling 2010).

In spite of any growth in recent years, active transportation in the United States still lags far behind most other wealthy, industrialized nations, with northern Europe being especially noteworthy. Mode shares for walking and cycling are 24 and 10 percent in Germany, 16 and 18 percent in Denmark, and 25 and 26 percent in the Netherlands (Pucher and Buehler 2010). In cities such as Copenhagen and Amsterdam, cycling rates are high for all groups—men, women, all ages, all incomes—and it is seen as “a perfectly normal way to get around the city, and cyclists are a permanent part of the scene on virtually every street”. Amsterdam’s bicycle mode share was a full 35 percent in 2007, while Copenhagen’s was 20 percent (Pucher and Buehler 2007).
Safety

As bicycle mode share in many parts of the United States inches upward, there are also signs that active transportation is slowly and modestly increasing in safety. Pedestrian and bicycle deaths have decreased 22.3 percent and 12 percent, respectively, from 1993 to 2008 (National 2010). It is important to note, however, that these decreases have not been steady, and bicycle deaths in 2004 were nearly the same as in 1993.

As a percentage of total traffic fatalities, active transportation has decreased from 15 percent in 1990 (11 percent for pedestrians and 4 percent for bicycles) to 13.6 percent in 2008, even as total traffic fatalities decreased by 10.8 percent (National 2010). At the same time, total pedestrian injuries have decreased by 17 percent since 1995 (Zeeger et al. 2010). When this is considered in light of the increases in total active transportation trips, it seems that while there are still major improvements that must be made, safety has likely improved over the last 20 years.

Still, active transportation deaths—especially pedestrian deaths—continue to be a leading cause of traffic fatalities, and there is substantial variation in safety levels among different cities and metro areas (Zeeger et al. 2010). An extensive 2009 study rated metro area pedestrian risks through the calculation of a “Pedestrian Danger Index” that takes into account fatality rates and walking mode shares. According to this index, when fatality rates were adjusted for mode share, the most dangerous metro area (Orlando, FL) is ten times as dangerous as the safest (Minneapolis-St. Paul, MN). Nine of the ten most dangerous metro areas are in the South—the top four are all in
Florida—and are marked by low-density, car-oriented development and high-speed urban arterials (Ernst and Shoup 2009).

Although safety has increased in the United States, it still lags far behind those countries with the most advanced active transportation systems, where safety has improved much more dramatically since 1970 than in the United States (Pucher and Buehler 2010). For example, the number of bicycle and pedestrian fatalities per 100,000 people is quite similar in the United States and the Netherlands, at 2.1 and 1.9, respectively. However, this does not take into account the far higher mode share found in northern Europe (Jacobsen 2003). In fact, cycling has been shown to be over five times safer in the Netherlands than in the United States, and Denmark is a full three to four times safer than the United States (Pucher and Buehler 2007).

There is significant room for improvement for active transportation usage in the United States. With this current state of affairs in mind, we will next explore which factors advocates and officials should pursue to have the most significant impact on active transportation usage in cities such as Atlanta.

V. Factors leading to active transportation

In determining which factors play the most important roles in increasing active transportation mode share, it is important to first consider how mode share is increased: by individuals deciding to walk or bicycle. Therefore, our consideration of how much of an impact factors can have on bicycle and pedestrian levels will focus on their potential for encouraging people to make this decision.
In this analysis, we will organize the “essential factors” that go into active transportation use according to three broad categories that are central to people’s transportation decisions: safety, convenience, and physical comfort. Without each of these being sufficient, individuals are unlikely to choose to use active transportation. This section will examine the elements that make up each of these, and determine which should be high, medium, or low priority for advocates and officials.

We will also discuss two “secondary factors”, which include institutional and implementation capabilities that can influence potential shifts in safety, convenience and comfort, as well as the influence of active transportation culture. These secondary factors can be important elements of active transportation policies and initiatives, but will not be able to influence bicycling and walking levels directly. Rather, they are important in that they have the potential to influence levels of safety, convenience, and physical comfort, which in turn can encourage more people to choose active transportation.

**Essential Factor 1: Safety**

Safety is the most important factor affecting active transportation usage. Many studies have shown that individuals will not choose active transportation if they feel unsafe doing so, regardless of convenience or physical comfort level. It is the most essential factor, and without it other factors will fail to make a significant impact.

The goals of active transportation policy—high mode share and safety—are mutually reinforcing. John Pucher writes, “Whatever the direction of causation, there is a strong correlation between walking and cycling levels and safety rates” (Pucher and
Buehler 2010). The Alliance for Biking and Walking 2010 survey showed statistical correlations between high levels of bicycling and walking and safety, and studies have demonstrated that collisions decrease when pedestrians and cyclists are in greater numbers (Bicycling 2010, Jacobsen 2003). The same idea holds overseas, as fatality rates are far lower in countries with high usage levels (Pucher and Buehler 2007).

Whatever the reason for this correlation—increased visibility, motorist familiarity with bicycle and pedestrian behavior, or higher percentages of drivers also being cyclists or pedestrians—it is evident that increased safety and mode share form a self-reinforcing feedback loop leading to better and better outcomes for active transportation users and advocates (Pucher and Buehler 2010, Jacobsen 2003). Cities seeking to break the mirror-image cycle of dwindling numbers of cyclists and pedestrians and ever more dangerous roads would need an influx of either safety measures or active transportation users. Because of the unwillingness of large segments of society to walk or cycle in what they see as unsafe conditions, it is unlikely that mode share will dramatically increase without first addressing safety. Without safety, no educational, enforcement, coordination, recruitment, or organizational inputs are likely to have success in attracting high numbers of users. Portland, New York City, and northern Europe all show that changes in policy can lead to increases in safety, which in turn lead to increased mode share.

There are several factors that advocates and officials might pursue in order to improve safety conditions, including infrastructure networks, traffic calming, designing for vulnerable and hesitant users, vehicular cycling classes, and helmet laws. In the
end, the first three of these should be of the highest priority, while the latter two should be relegated to low-priority status.

**High priority (Safety): High-quality, networked active transportation infrastructure**

Activists and officials should think of active transportation safety in both real and perceived terms. In real terms, the absence of even basic infrastructure has been a major contributor to high fatality rates in the United States. For example, 41 percent of pedestrian fatalities occur where no crosswalk was available, 15 percent more occur were crosswalk data was not available, and two-thirds of fatalities occur in places with inadequate lighting (Transportation 2009, Zeeger et al. 2010). Cycling is also safest in cities and countries with the most advanced infrastructure systems, with The Netherlands and Denmark leading in both areas (Pucher and Buehler 2008).

At the same time, potential active transportation users do not make their modal decisions based on safety statistics. Instead, they do so based on the perception of safety (Zeeger et al. 2010, Noland 1995). If individuals do not feel that walking or cycling is safe, they will not walk or cycle. Therefore, advocates and officials seeking higher levels of active transportation must work to ensure high levels of perceived safety, which is best done through the construction of high quality networks of dedicated safety infrastructure.

This connection between perceived safety and infrastructure is most clearly illustrated by the modal choices and preferences of female cyclists. In the United States, Canada, and the UK, women make only one fourth of bicycle trips, compared to roughly half of all trips in Germany, Denmark, and the Netherlands (Pucher and Buehler 2010).
In the Netherlands, some studies have shown women to make up 55 percent of all cyclists (Baker 2009). These substantial differences are directly tied to relative perceived safety levels. Multiple studies have shown that women are deeply affected by the perception of safety while cycling, and strongly prefer separate, protected facilities (Baker 2009, Garrard 2007). Cycling rates among women are higher in cities with protected facilities, as well as specific areas of cities that are more protected. For example, in New York City, there are three times as many male cyclists as female, but on Central Park’s protected paths, 44 percent of cyclists are women (Baker 2009, Garrard 2007).

Clearly, active transportation infrastructure is tied to both real and perceived safety, and plays a vital role in encouraging people to decide to cycle or walk. The question, then, is what such infrastructure entails. A good place to start in answering this question is to look at cities that have successfully shifted momentum toward active transportation through infrastructure improvements: Amsterdam, Copenhagen, Portland, and New York.

Amsterdam and Copenhagen have been installing active transportation infrastructure since the 1960s and 1970s (Pucher and Buehler 2007). In the Netherlands, pedestrian infrastructure has included pedestrian zones (which make up significant parts of the city center), raised zebra crosswalks with lighting, pedestrian-activated traffic signals, refuge islands, and ample sidewalks with street furniture (Pucher and Dijkstra 2000). Additionally, Dutch bicycle facilities are “massive and ever-expanding”, and are integrated, coordinated, and serve practical, everyday destinations. These networks include bicycle streets, two-way bicycle access to one-way streets,
bicycle access to bus lanes, bicycle-only cut-throughs, intersection bike boxes, bicycle-only advance green lights, and cyclist-activated traffic signals (Pucher and Dijkstra 2000).

In Copenhagen, the bicycle network is strongly focused on separate facilities, with 2.2- to 3-meter-wide bike paths on both sides of the street. These paths are typically between the road and the sidewalk, and are raised 7 to 12 centimeters above the roadway. At intersections and crossings, they are typically painted bright blue for increased visibility. Additionally, many intersections provide advance stop lines and traffic signal priority. This network has been incredibly successful, with some congested paths handling over 2,300 cyclists an hour, while citywide mode share is 20 percent and rising (Pucher and Buehler 2007).

Portland, Oregon, has become the United States’ top large city for bicycling largely through a decades-long program of building networked safety infrastructure. The city currently has over 600 miles of bikeways, with plans for over 300 more miles by 2030. The city’s first bicycle plan was adopted in 1973, which focused on laying the groundwork for a comprehensive bicycle network. A 1996 follow-up plan continued this initiative, with the primary goal of creating an “interconnected bicycle network supported by innovative policies and programs to encourage bicycling”. Over the last two decades, an over 300 percent increase in this network’s size has occurred along with an over 500 percent increase in daily ridership (Portland 2010).

Even as usage has risen, a 2010 study showed that the vast majority of Portland residents’ attitude on cycling was “interested but concerned”, in that they would like to bicycle more, but had significant worries about safety. The city’s most recent plan aims
to address this concern of less experienced, more hesitant riders first and foremost through improving the extent and quality of infrastructure.

Portland’s plan calls for “low-stress” bikeways within every 800 feet that allow for bicycling with minimal safety risks for all users. The city is especially committed to expanding its network of “bicycle boulevards” along residential streets, which are designed to minimize non-local auto traffic, to greatly reduce auto speeds, and to minimize cyclists’ need to stop along the route. While currently only one percent of Portland’s network, these boulevards make up 10 percent of the city’s bicycle use. This popularity has led to the call for over 200 new miles of bicycle boulevards by 2030 (Portland 2010).

While residential-street bicycle boulevards have proven effective in attracting cyclists, major roads are often necessary for connecting essential areas of the city. Because of this, Portland is not limiting its network expansion to so-called “back street” routes, and is working to improve safety and comfort for users along main thoroughfares. These efforts include dedicated protected infrastructure along key routes and special safety and signalization provisions at intersections (Portland 2010).

New York City is another example of a city that has used extensive infrastructure improvements to rapidly improve active transportation safety measures and mode share. The more than 100 percent increase in cycling since 2000 has been accompanied by “vastly improved cycling infrastructure, including innovative treatments such as cycle tracks, buffered bike lanes, special bike signals, bike boxes…and bright green lane markings”. This expansion has been followed by improvements in safety, with declining injuries and fatalities in spite of rising volumes (Pucher et al. 2010).
The City’s network of bicycle facilities grew from 119 miles in 1997 to 561 miles in 2009, with 134 miles of physically separate paths, 282 miles of on-street bike lanes, and 146 miles of bike routes with no dedicated provisions (Pucher et al. 2010). There is a wide range of quality in these facilities, from 4.9 miles of fully separate cycle tracks that provide traffic signal protection from turning cars to over 100 miles of simple on-street painted lanes. Although the bulk of the network is made up of on-street treatments without physical separation, these lanes’ quality has improved, with better protection through expanded painted buffers from two to eight feet wide (Pucher et al. 2010).

Safety has continued to be a major issue at intersections, where 89 percent of fatalities and 70 percent of serious injuries take place. New York City has responded with the installation of special traffic signals and bike boxes at some intersections (Pucher et al. 2010). At the same time, the City’s intersections lag behind those of cities such as Portland, Copenhagen, and Amsterdam, and the NYC DOT Street Design Manual largely focuses on mid-block roadway and path treatments.

The city has also made a concerted effort to improve safety and comfort conditions for pedestrians in ways that may improve safety for all active transportation users. The Street Design Manual prioritizes projects that focus on traffic calming and pedestrian comfort efforts. Areas such as Times Square, Herald Square, and Union Square along the Broadway corridor have been transformed from traffic-dominated places to pedestrian-friendly, traffic-calmed plazas. The City’s official policy states that such projects will receive streamlined, prioritized approval and implementation so long as they continue to promote infrastructure for all users (NYCDOT 2009).
Overall, New York City has made dramatic strides in terms of active transportation safety and mode share in only the last decade. A strong push from the City’s government has promoted bicycle and pedestrian infrastructure with official policies that give priority to non-motorized users. This has helped begin what could become a self-reinforcing cycle of increasing safety and mode share.

At the same time, the City has a long way to go before it reaches the levels of active transportation found in places such as northern Europe. Much of the recent increase in mode share could be due to the high levels of latent demand in place simply due to New York’s uniquely favorable circumstances, including density, terrain, transit access, and lack of car dependency. As the city’s bicycle infrastructure is often of middling quality, a more concerted effort to improve safety will be needed to truly transform New York into a world-class cycling city. Expansion of fully protected lanes along major thoroughfares could help in approaching active transportation levels seen in northern Europe.

It is worth noting that the mere existence of dedicated infrastructure does not seem to be tied to overall active transportation levels (Bicycling 2010). The Alliance for Biking and Walking compared total length of bicycle networks in large American cities and did not find a strong correlation to mode share. There is a simple explanation for this finding (besides the unreliability and lack of standardization of reporting mentioned in the report): the quality of infrastructure has a significant influence on its success. Bike lanes or sidewalks that do not make users feel safe are unlikely to attract significant usage.
The unequalled importance of safety infrastructure can be illustrated by the case of Odense, Denmark, where a full, comprehensive array of policies and initiatives were adopted to increase active transportation levels and safety, resulting in some of the highest cycling levels in the world. Through years of programs focusing on education, promotion, information, training, and so on, Odense residents were most thankful for “actual improvements in cycling conditions” and primarily “praised infrastructure improvements”. Although the full range of factors for bicycling and walking were considered, pursued, and implemented by local advocates and officials, it was the “improvements in actual conditions”—infrastructure—that residents saw as most important (Pucher and Buehler 2007).

High priority (Safety): Traffic calming

In addition to providing protective infrastructure for cyclists and pedestrians, safety improvements should also focus on reducing the real and perceived danger of speeding traffic, which is a serious deterrent to choosing active transportation. Putting traffic calming measures in place to reduce speeds can play a significant role in making cycling or walking a more likely choice among hesitant potential users.

The connection between vehicle velocity and potential injury or death is clear and demonstrated. Pedestrians are 2.3 times more likely to die from a crash in rural areas than in urban areas as a result of rural roads having higher typical vehicle speeds (Zeeger et al. 2010). Low vehicle speeds are important for two reasons: motorists’ increased ability to avoid collisions and cyclists’ or pedestrians’ ability to survive crashes that occur. The latter is crucial, as the risk of pedestrian death rises from only 5 percent
in 20mph crashes to 45 percent at 30mph and 85 percent at 40mph (Pucher and Buehler 2010, Zeeger et al. 2010, W.H.O. 2008b). Traffic calming is a key component in addressing these problems, as multiple studies have shown it to significantly decrease injuries and fatalities (Pucher and Buehler 2010, Bunn 2003).

The central component of most traffic-calming plans is narrowing the auto-dominated part of roadways. Active transportation users are much safer on narrower roads, as the risk of pedestrian injury increases substantially on roads over 24 feet in width, while wide urban arterials are the location of the highest percentage (26.15 percent) of pedestrian crashes (Transportation 2009, Zeeger et al. 2010). Narrowing overly wide roads or redesigning arterials as boulevards can substantially increase the real and perceived safety of active transportation users.

At the same time, many northern European cities have gone beyond simply narrowing roadways. Amsterdam, for example, has adopted a wide range of traffic calming tools and techniques, such as 19mph speed limits and physical barriers such as raised crossings, traffic circles, road narrowing, zigzags, speed humps, artificial dead ends, wooners (shared, pedestrian-priority streets), and Spielstrasse (streets that require cars to move at walking speed) (Pucher and Dijkstra 2000). Northern European neighborhoods with these advanced traffic calming elements have seen cycling injuries fall by an average of 53 percent (Pucher and Buehler 2010).
In the United States, both Portland and New York City have official plans for traffic calming in place. Portland’s 2030 bicycle plan specifically states that speed reduction is a key component in encouraging hesitant potential users to choose active transportation, while New York City’s new Street Design Manual declares that streets should be designed with low target speeds “appropriate to target uses”. The Manual has an extensive selection of traffic calming techniques and tools, including raised speed reducers, traffic diverters, forced turns, half-closures, chicanes, traffic circles, raised crossings, and raised intersections (NYCDOT 2009).
In the end, traffic calming can be a key element of encouraging people to become active transportation users. The fear of being injured or killed by an automobile is a major deterrent to choosing to bike or walk, and traffic speed is the single biggest determinant of car-bicycle or car-pedestrian injury severity (Portland 2010). Traffic calming has been shown to lessen these risks, which in turn promotes what Portland’s 2030 Plan calls “stress-free” travel.

**High priority (Safety): Design infrastructure for vulnerable and hesitant users**

These perceived and real safety risks are especially strong deterrents for segments of the population that have the potential to cause significant increases in active transportation usage: vulnerable and hesitant users. In designing safety and traffic-calming infrastructure, advocates and officials should work to ensure that their efforts allow and encourage use by children, the elderly, women, and inexperienced or
nervous cyclists and pedestrians. If infrastructure is constructed to a standard that these “least likely” groups feel safe enough to decide to bicycle or walk, it is likely that other users will, too.

As non-drivers, children make up a significant proportion of active transportation trips. People under 16 comprise 24 percent of the population, but make 28 percent of walking and 58 percent of bicycle trips in the United States. At the same time, trips to school (a child’s equivalent of commuting to work) are less and less frequently made by active transportation. In 1969, half of trips to school were made by bike or foot—a number that fell to only 13 percent thirty years later (National 2010). The perceived safety of the trip to school has been cited as one of the most important factors behind this precipitous drop (McDonald 2008).

Elderly residents of the United States are especially unlikely to use active transportation. At 15 percent of the country’s total population, only 9 percent of pedestrians and 4 percent of cyclists are 65 or older. This is largely due to an exceptionally high level of real and perceived danger. 19 percent of pedestrian fatalities and 9.3 percent of bicycle fatalities are over 65, even as older pedestrians’ traffic avoidance and safe walking practices lead to fewer accidents than most age groups. Nearly 50 percent of adults over 50 reported that they could not cross main roads near their house safely (Bicycling 2010, Zeeger et al. 2010, Transportation 2009). In short, older people are far more vulnerable to the real and perceived dangers of traffic than other groups, and therefore avoid bicycling and walking.

Many studies have shown that it is indeed the lack of safety, rather than physical limitations, that prevents senior citizens from choosing active transportation. In fact,
medical research has shown that 99 percent of men and 87 percent of women are physically able to ride a bicycle, and even more can walk short distances (Godlee 1992, Heinen et al. 2010). In fact, in many places where safety infrastructure and traffic calming measures are far more advanced than in the United States, walking and cycling increase with age. In the Netherlands, Germany, and Denmark, active transportation accounts for around 50 percent of all trips for the elderly, as opposed to only 10 percent in the United States (Pucher and Buehler 2010). This is in no small part due to the fact that American cities’ transportation infrastructure largely ignores the safety needs of older users (Transportation 2009). Northern Europe, on the other hand, benefits from the increased mode share of large numbers of non-driving elderly residents, the increased safety in numbers they provide, and the fact that elderly-focused infrastructure is likely to encourage other hesitant and vulnerable groups to decide to bicycle or walk as well.

Finally, as discussed above, women are also highly sensitive to issues of the perceived safety of transportation alternatives. Studies have shown that their decision whether or not to use active transportation is heavily influenced by the opportunity to use high-quality safety infrastructure. This is especially important for those trying to increase overall bicycle usage, as some researchers have suggested that women are an “indicator species” when it comes to cycling, in that “where many women cycle, it means that cycling is safe and convenient for everyone, leading to a high overall bike share” (Baker 2009, Pucher and Buehler 2010). Paying special attention to the needs of women—specifically in terms of providing high-quality separated facilities that give
strong feelings of safety—should then be near the top of the list of difference-makers for active transportation advocates and officials.

In the end, then, focusing on the development of active transportation networks on a scale and level of safety that children, the elderly, and women find to be convenient, safe, and comfortable enough to use is an excellent strategy for promoting cycling and walking at a city-wide scale.

**Low priority (Safety): Vehicular cycling courses, mandatory helmet laws**

These vulnerable and hesitant users can help increase their own safety through taking vehicular cycling courses and using helmets. However, while both expertise in vehicular cycling and consistent helmet usage can improve individual cyclists’ safety, neither have been shown to have significant positive effects on overall levels of perceived or real safety, nor on mode share.

*Vehicular cycling* is based on theory that “all cyclists be forced to cycle on the roadway and learn to operate their bikes as they would motor vehicles” (Pucher 2001). This idea, popularized by advocates such as John Forester, strongly opposes separate bicycle facilities, arguing that they are slow, unnecessary, and ultimately dangerous (Forester 2001).

Vehicular cycling advocates focus on the fact that most car-bike collisions—89 percent in Forester’s analysis—occur at intersections and crossings, which they believe are made more problematic by bicycle infrastructure. Forester derides the performance of separate Dutch bikeways at intersections, as at every crossing “the straight-through cyclist is at the right of right-turning motor vehicles, whose drivers don't see him until the
moment of collision” and “if the cyclist wants to turn left, he must make his left turn from far to the right of all the motor traffic”. Navigating such intersections, he says, constitutes “a situation that is beyond any, let alone just normal, human capability, because we don’t have eyes in the backs of our heads and the brain system to comprehend all-around vision” (Forester 2001).

Along with their rejection of separate facilities, vehicular cycling advocates promote “proper” and “skilled” on-street bicycling through education and training, and present data showing that experienced, well-trained cyclists have fewer crashes than novices (Forester 2001). Therefore, they believe that those wishing to increase bicycle mode share and safety should focus their efforts on vehicular cycling education programs.

Forester’s argument fails in several regards. First, his version of “proper cycling” requires courses in on-road safety and maneuvering that few Americans would consider taking. Forester argues that with fifteen hours of training, children as young as 13 can ride in fast traffic on large streets. However, this leaves anyone under 13 or unwilling or unable to invest 15 hours in a cycling course unfit to cycle properly and safely on arterial roads. On the other hand, northern European countries where bicycling is safest and most popular use dedicated cycling infrastructure to ensure that cycling not be reserved for those “trained, fit, and daring enough to navigate busy traffic on city streets” (Pucher and Buehler 2009).

Furthermore, real-world examples such as Copenhagen and Amsterdam show that bicycling is far safer and more popular in cities with dedicated bike facilities. Even in the United States, cities such as Davis, California; Boulder, Colorado; and Portland,
Oregon are all leaders in separate bicycle facilities, and all enjoy high mode shares and strong safety records (Pucher and Buehler 2009). Forester rejects this argument by saying that “correlation does not equal causation”, and that these cities did not necessarily become safe and full of cyclists through dedicated infrastructure.

There may be some truth to this argument, as there are certainly a variety of factors that make Portland and Boulder safer places to cycle than Dallas and Tampa. Additionally, well-trained vehicular cyclists may indeed be safer than most other active transportation users. However, the evidence is clear: people feel safer and are more likely to choose to cycle if dedicated infrastructure is in place. While a novice cyclist in a bike lane might be less safe than a well-trained vehicular cyclist in traffic, the bike lane’s existence is far more likely to encourage people to start cycling than a training course. In turn, this leads to increasing safety in numbers, which in turn leads to more cyclists. The evidence shows that vehicular cycling courses are unable to sway reluctant cyclists at anywhere near the level of safety infrastructure. While vehicular cycling training may be ideal for bold, fit cyclists, advocates and officials trying to encourage active transportation as a viable choice for all users should instead focus on those factors that make hesitant cyclists feel more confident: dedicated safety infrastructure and traffic calming.

Likewise, many well-intentioned bicycle advocates have pushed mandatory helmet laws as a way to make cycling safer and more attractive. FHWA literature has unofficially argued in favor of mandatory helmet laws, as riders with helmets have an 85 percent reduction in head injuries, and one recent study showed 58 percent more helmet usage in children under 14 where helmet laws were in place (Zeeger et al.)
However, while helmets are certainly helpful in protection against injury, making their use mandatory can lessen the positive effects of safety in numbers. This is illustrated by the example of the Netherlands—the safest cycling country in the world—where less than one percent of adult cyclists wear helmets, along with only three to five percent of children (Pucher and Buehler 2007).

It could be argued that helmets are not necessary in the Netherlands precisely because it is already the safest cycling country in the world, and that their value in increasing safety would be greatly improved in more dangerous nations. However, studies in New Zealand, Canada, and Australia (which have cycling numbers much closer to the United States’ than to the Netherlands’) determined that helmet laws did not have a significant effect on overall head injuries, but instead discouraged cycling. The lack of impact on overall head injuries may have been due to riskier behavior on the part of helmet-wearers, incorrect usage, or reduced safety in numbers (Robinson 2006).

Like vehicular cycling training, helmets typically lead to increased safety in individual users. However, these well-intentioned activities fail to recognize the safety impact of large numbers of cyclists being an everyday sight on roadways. While vehicular cycling education does little to encourage new cyclists, mandatory helmet laws can have a detrimental effect. Therefore, advocates and officials should focus on safety measures that both protect individual cyclists and encourage new ones to start using active transportation.
Essential Factor 2: Convenience and competitiveness

Few people would choose to use active transportation on unsafe roads, regardless of convenience or competitiveness. However, if sufficient levels of safety are reached, convenience and competitiveness can become a significant decision-making factor. If active transportation cannot compete with driving in terms of the time, hassle, and cost involved, it is unlikely that it will gain significant mode share.

The key elements that factor into active transportation convenience levels are competitiveness with driving, density and connectivity, sufficient bicycle parking, and coordination with transit. The first two of these should be considered high priority, while the latter two, while certainly desirable and beneficial, should be considered medium priority.

High priority (Convenience and Competitiveness): Allow active transportation to compete with driving

There is a strong inverse relationship between car ownership and active transportation levels, which suggests that these modes are competing with each other for users’ trips (Bicycling 2010). In most cities in the United States, it is difficult for active transportation to compete with the appeal of driving, largely due to issues of convenience. Activists and officials, then, can help tilt the playing field toward active transportation by making it more convenient, while considering ways to make motorists begin to “pay the true social, economic, and environmental costs of driving” (Pucher et al. 2009).
Car ownership in the United States currently costs only one third to one half of what it does in Europe, where gas prices, car purchase prices, registration, license, training, operation, and parking fees are all significantly higher (Pucher and Buehler 2010). Through these measures, driving becomes a much less attractive transportation choice. Copenhagen, for example, followed its early infrastructure-based pedestrian and bicycle initiatives with gradual changes specifically aimed at making driving and parking more difficult in the city center. This led to a corresponding shift in attitude toward the notion that it was “too complicated” to drive in the city (What the Pedestrian 2006).

Additionally, Europe has far more stringent traffic policies and enforcement than the United States. Roadway and parking supply is deliberately kept to a minimum, especially in city centers, while low speed limits, through-traffic prohibitions, and turn restrictions all serve both to make cycling and walking safer and to discourage unnecessary and excessive driving (Pucher and Buehler 2008, Pucher and Buehler 2010). Enforcement is strong, and regulations favor pedestrians and cyclists. As they are expected to be mindful of vulnerable road users at all times, motorists are almost always found to be at least partially at fault in pedestrian or cyclist incidents, and completely at fault when the elderly or children are involved (Pucher and Buehler 2010).

In short, European countries have consciously adopted policies that aim to make driving more expensive and less convenient. Their taxation, infrastructure, parking, and enforcement policies and practices are all geared toward making active transportation a more reasonable and less costly choice that it is in the United States. In cities that are dedicated to improving their active transportation mode share, advocates and officials might consider emulating these European policies, at least in the long term.
At the same time, the implementation of policies that are seen as restricting or discouraging driving are likely to be extremely difficult to implement in the United States. Given Americans’ preference for technological solutions over those that require behavioral change, advocates and officials looking to promote active transportation would likely face serious political opposition against initiatives that levy significantly increased costs or reduce the convenience of driving. This is especially true in places where safe alternative transportation infrastructure and networks are not in place. In such cases, advocates and officials should focus on improving the underlying necessary conditions for cycling and walking before embarking on serious restrictions to driving.

Additionally, even if driving is restricted or infractions are more strictly enforced to a level at which active transportation becomes competitive, land use and urban design policies can still undermine any improvements in convenience. The following section will discuss how this high-priority issue can be addressed through planning for direct connections between nearby destinations.

**High priority (Convenience and Competitiveness): Density and connectivity**

Connectivity and density are important elements of convenience because of their critical role in determining trip distances. Sprawling, single-use, disconnected land use and street layout patterns force potential active transportation users to travel much farther than they would otherwise have to. On the other hand, compact, mixed-use, well-connected cities and neighborhoods establish an “ideal long-term framework” for shorter, pedestrian- and bicycle-scaled, more convenient trips (Pucher and Buehler 2010).
Studies in the United States and around the globe have repeatedly and convincingly shown that sprawling, disconnected land use patterns discourage active transportation. A comparison of to-work mode share by bicycle or foot and population density in large American and Australian cities have shown that denser cities have, in general, higher rates of bicycling and walking (Bicycling 2010, Giles-Corti et al. 2008). While there is no consensus about maximum “walkable” or “bikeable” trip distances, it is clear that distance matters, and that having more potential destinations nearby and having more direct, convenient routes to them encourages people to choose to use active transportation.

The impact of density and connectivity on convenience is illustrated by northern Europe, where active transportation has thrived in cities that tend to be more compact and mixed-use than their North American counterparts. While single-use Euclidian zoning and connection-severing subdivision regulations continue to dominate land use policies in many parts of the United States, northern Europe has shifted its land use policies to ones that foster development that allows shorter, more bikeable and walkable trips (Pucher and Buehler 2010, Pucher and Buehler 2007, Pucher et al. 2009).

Connectivity is especially important for younger cyclists and pedestrians. Studies have shown that in the United States, distance it is the single strongest determinant on whether or not to walk or bicycle to school. With distances to school growing longer, travel times in many places are too great to overcome with safety enhancements (McDonald 2008). In Switzerland, on the other hand, where the average trip to school is only 500 meters, 77.8 percent of children walk or cycle to school (Bringolf-Isler 2007). While the average Swiss child can walk to school in under ten minutes, American
parents are increasingly unlikely to allow their children to spend the long stretches of
time necessary to bicycle or walk to schools that are often separated from their homes by disconnected street grids and low-density, single-use development.

At the same time, it is important to remember that while connectivity and density are directly tied to convenience levels, they do not tell the whole story of whether or not people choose to use active transportation. For example, Europeans make a far higher percentage of trips by active transportation, even when controlling for distance. Even if Americans were provided the same convenience of short, direct trips, we would likely still use active transportation at levels far below those in Europe. This suggests that while connectivity and density are valuable factors that should certainly be pursued, there are others that may be of more pressing concern for activists and officials. From the discussion above, we can surmise that ensuring safety must still be the highest priority.

Medium priority (Convenience and Competitiveness): Coordination with transit, parking

Coordinating bicycle infrastructure with transit systems can be a significant strategy for increasing the convenience of active transportation. Many people live too far from work, school, shopping, or other destinations to rely on bicycling alone, while others who would like to use mass transit live beyond convenient walking distance to a bus stop or train station. In this way, coordination can be mutually beneficial, as it increases the “catchment area” of transit systems and puts more cyclists on the road. While bicycling to distant destinations or walking to transit is often too inconvenient to
be competitive with driving, the combination of bicycling and transit can be an attractive option.

Key components of bicycle-transit integration include provision of parking at all bus and rail stops, multi-functional bike stations featuring a range of services, bike racks on buses, permission to bring bikes on board trains, and bike routes to transit (Pucher and Buehler 2009b). Those that allow efficient integration of modes without time-wasting hassles should be the most effective in improving convenience levels.

Unsurprisingly, the Dutch have led the way in bicycle-transit integration, with an official policy of providing bicycle parking at all train stations and many regional bus stops. Studies have shown that this has been directly responsible for increased bike-and-ride usage, including convincing many former drivers to switch to bicycling. This trend has been especially pronounced for residents living or working outside of convenient walking distance to transit (Martens 2007).

While sufficient parking is certainly beneficial, those transit riders who want to use their bicycles on both ends of their trip must be able to carry them on trains and buses. Copenhagen allows bicycles on all suburban and intra-city trains, some of which have special bicycle cars, while Portland’s trains and streetcars have bicycle hooks that can be used without fees or restrictions (Pucher and Buehler 2007, Pucher and Buehler 2009b). This helps make up for what is generally regarded as a significant lack of sufficient bicycle parking at transit stations in both cities.

New York City, however, has made almost no effort to increase coordination between bicycling and transit systems. There is no bicycle parking at any public transportation terminal in Manhattan or at any of the city’s 467 subway stations. While
bicycles are allowed on trains, only 16 percent of stations are ADA accessible, meaning cyclists often must carry their bikes up and down long sets of crowded stairs (Pucher and Buehler 2009b). In terms of bike racks on buses, New York City is tied for worst in the world, with zero racks on its 5,929 buses (Pucher and Buehler 2009b). Even in the United States, this is an extremely low level of coordination, as nearly 90 percent of the country’s largest cities have racks on 100 percent of buses (Bicycling 2009).

Evidence suggests that coordination with transit might be especially important in less dense cities like where walking to and from transit is a difficult or time-consuming task. If transit network coverage is insufficient or pedestrian routes are inadequately direct, an easy and seamless bicycle trip to and from transit can have a significant impact. At the same time, dense, walkable, transit-rich New York City has seen a rapid increase in bicycling rates without any coordination with transit. While the City certainly has relatively few areas that are not within convenient walking distance to transit and thus might benefit somewhat less from coordination with transit, there is no evidence to suggest that the increases in mode share over the last decade could not have been even greater if it had been accompanied by sufficient bicycle parking, transit access, and network coordination.

In conclusion, it is worth remembering that it is unlikely that any level of coordination with transit will have a significant effect on bicycling levels if appropriate safety measures are not in place. No matter how convenient, seamless, and hassle-free transitions between modes may be, all but the most daring potential cyclists will still choose the safety of driving if cycling is deemed dangerous.
Essential Factor 3: Limiting physical exertion and improving comfort

Just as individuals are unlikely to choose active transportation if they perceive it to be unsafe or if it is too inconvenient to compete with driving, they can also be dissuaded by high levels of physical exertion or discomfort. Extremes of distance, heat, cold, precipitation, and terrain can cause potential active transportation users to opt for more the more comfortable option of driving. At the same time, activists and officials should be glad to hear that none of these potential obstacles is insurmountable.

High priority (Comfort and Exertion): Connectivity

Connectivity can improve physical exertion and comfort levels in the same way it can add to convenience: it plays a critical role in determining trip distances. While there are certainly some cyclists and pedestrians—especially those interested in active transportation for exercise—who enjoy and seek out long-distance trips, the average commuter undoubtedly would prefer a shorter, less physically strenuous trip. Connected street patterns that allow more direct routes can play an important role in reducing the physical stress endured by active transportation users.

Medium priority (Comfort and Exertion): Terrain

Just as with increasing distances, active transportation could be made a less attractive choice for many users if it involves climbing significant uphill slopes. There are differing opinions on the effects of terrain on active transportation, in particular for bicycling. While cycling rates are generally higher where the topography is flatter, there are many exceptions. While the Netherlands, Denmark, and northern Germany are flat,
Switzerland and Austria are not, and all enjoy high cycling levels. In the United States, Seattle and San Francisco are both quite hilly and bike-oriented (Pucher and Buehler 2010). Additionally, while most studies suggest that there is a decrease in cycling levels with increasing hilliness, others show little effect. There is evidence that personal factors can supersede terrain’s potential effects on cycling levels. For example, more experienced cyclists are less likely to be affected by hilly terrain, and may even be drawn to it. At the same time, average or less experienced cyclists tend to be put off by steep climbs (Heinen et al. 2010). This is likely due to the fact that more experienced cyclists would tend to be more physically fit than their novice counterparts, and therefore require less physical exertion and experience less discomfort.

While many hilly cities have healthy bicycling levels, the evidence shows that they could also add more inexperienced cyclists if the effects of terrain were mitigated. While planners cannot make a hilly city flat, they do have a number of options for reducing the effort and discomfort involved in uphill cycling. First, they should prioritize streets along ridgelines for bicycle routes, as such streets can minimize extreme changes in elevation. Second, they should work to ensure that cyclists can take advantage of downhill momentum along bike routes by removing downhill stop signs and timing downhill stop lights to bicycle speeds. Traffic laws could also be changed to allow the “Idaho stop”, in which cyclists are permitted to maintain momentum by treating stop signs as yield signs. Finally, in extreme situations, special up-hill infrastructure could be considered, such as Trondheim, Norway’s “Trampe” bicycle lift, which allows cyclists to be pushed up a large hill by a motorized elevator system. While this might
seem unnecessary, surveys of lift users report that 41 percent claim to cycle more because of its presence (Trampe).

Image 3: Trampe Bicycle Lift (World's 2008)

Low priority (Comfort and Exertion): Climate

Bad weather such as rain, snow, ice, wind, heat, or cold can make walking and cycling unattractive, inconvenient, and even unsafe (Pucher and Buehler 2010). However, there is evidence that the impact on active transportation levels is relatively small and not insurmountable. For example, a recent survey showed that only 11
percent of respondents said that weather kept them from cycling more than they do (Bicycling 2010).

Climate’s minor role can be seen in examples of places with extreme weather that maintain strong active transportation systems. Northern Europe and the Pacific Northwest are notable for dreary, chilly, rainy weather, and yet both regions have strong bicycle and pedestrian numbers. Helsinki, Stockholm, Montreal, Ottawa, Minneapolis and Boston all combine harsh, cold winters and high cycling rates (Pucher and Buehler 2010, Bicycling 2010). Furthermore, a 2010 study that compared average summer and winter temperature to bicycle mode share across the United States “did not find any compelling evidence that weather is a major influence” (Bicycling 2010).

At the same time, officials and advocates can work to help persuade climate-affected potential active transportation users by doing what they can to mitigate these effects through limiting users’ exposure to harsh weather elements. This may include bus stop and bicycle shelters, adequate tree canopy, using lighter-colored paving instead of blacktop on sidewalks and bicycle routes, and, on a larger scale, working to limit trip distance through density, mix of uses, and connectivity.

*Secondary Factor 1: Institutional and implementation capabilities*

While safety, convenience, and comfort are the three central factors that go into an individual’s decision whether or not to use active transportation, there are a number of institutional and implementation elements that can play a significant role increasing bicycle and pedestrian mode share. These include groups of people (advocates, official staff, traffic engineers) and funding policies. Having these elements working in favor of
bicycling and walking can help bring about improvements, so long as they are able to help sway individuals’ transportation mode decisions through their roles in improving safety, convenience, and comfort.

Institutional and Implementation: Advocates, official staff, transportation engineers

Studies have shown that there is a link between the strength of local advocacy groups and levels of active transportation. The Alliance for Biking and Walking measured advocacy groups’ per capita funding and staffing and found correlations with overall active transportation levels (Bicycling 2010). Charts 1 and 2 below show the relationship between total mode share and the Alliance for Biking and Walking’s overall advocacy ranking. While better advocacy is loosely tied to higher mode shares, there is also likely to be reverse causation, as cities with large bicycling and pedestrian populations would naturally attract more advocacy group members and income.

![Chart 1: Advocacy Ranking & Mode Share Data from Bicycling 2010](image)

**Chart 1: Advocacy Ranking & Mode Share Data from Bicycling 2010**

- y1 (red) = Alliance for Biking and Walking advocacy ranking
- y2 (blue) = combined bicycle and pedestrian mode share
Advocacy organizations can affect active transportation levels in several ways. First, they can work to improve safety through educating drivers, police, transportation officials, cyclists, and pedestrians. Second, they can improve safety, convenience, and comfort through working with officials to change physical conditions on the ground. This could include consulting on official plans; pushing for safety infrastructure, traffic calming, and climate- or terrain-mitigating measures; or promoting connectivity and density in land-use plans. Finally, as we will discuss below, they can help create a pro-bicycle and pro-pedestrian culture through changing perceptions of active transportation among the general public.

In the same way, maintaining professional active transportation staff can help improve cities’ bicycling and pedestrian mode share. For the 51 largest United States cities, there is a modest correlation between high active transportation mode share and
the number of bicycle and pedestrian staff per capita. As seen in Charts 3 and 4 below, nearly all of the cities with the most official staff rank near the top in terms of active transportation mode share.

Chart 3: Active Transportation Staff and Mode Share (Bicycling 2010)
y1 (red) = staff per 1,000,000 residents
y2 (blue) = combined bicycle and pedestrian mode share

Chart 4: Active Transportation Staff and Mode Share (Bicycling 2010)
x = bicycle and pedestrian mode share
y = active transportation staff per 1,000,000 people
Official staff can work to improve active transportation levels in many of the same ways as advocates. They can promote safety through prioritizing traffic calming and dedicated infrastructure in road redesigns, design manuals, and official plans. They can push for increased convenience by influencing zoning ordinances and subdivision regulations and by working with transit and public works agencies to improve bike-transit coordination. They can improve comfort levels through working with planners to minimize travel distances, mix uses, and mitigate negative effects of climate and terrain.

The final group of people that can have significant influence over active transportation initiative implementation is transportation engineers, who have the dominant voice in determining the physical shape of roads and sidewalks. If they focus their efforts on traffic calming and active transportation infrastructure rather than high-speed automobile “throughput”, they can fundamentally affect users’ safety and comfort levels.

Transportation authorities at the federal level have officially begun to pursue engineering strategies that take active transportation needs into account. In 2009, the Federal Highway Administration began the process of “creating a national strategic highway safety plan” which explicitly recognizes the safety issues faced by pedestrians and cyclists (Zeeger et al. 2010). At the same time, US DOT policy now states, “every transportation agency, including the DOT, has the responsibility to improve conditions and opportunities for walking and bicycling and to integrate walking and bicycling into their transportation systems” (Zeeger et al. 2010).

FHWA researchers have several suggestions for how engineers can re-focus their efforts on active transportation users. First, they should revise the American
Association of State Highways and Transportation Officials (AASHTO) guides to improve standards for bicycle and pedestrian safety and comfort (Zeeger et al. 2010). Second, they should revise the Manual on Uniform Traffic Control Devices (MUTCD) to better serve pedestrians through a renewed focus on HAWK signals, separate left-turn phasing, exclusive pedestrian phasing, lighting, pavements, and parking restrictions. Finally, the FHWA report suggests increasing pedestrian and cycling education and training for engineers nationwide.

Institutional and Implementation: Funding

Without adequate funding, no active transportation initiatives can take place. This is true on the federal level, where there is a historical connection between national funding levels and overall active transportation rates. In 1990, when cycling and walking had fallen far enough to be labeled the “forgotten modes”, federal non-motorized transportation funding totaled only $6 million. This rose to $238 million in 1997, $427 in 2004, and $1.2 billion in 2009. As we have seen, there are indications that active transportation levels and safety statistics rose right along with funding (National 2010).

The key federal programs for active transportation funding began in 1991, when the Intermodal Surface Transportation Efficiency Act (ISTEA) authorized the use of billions of dollars in funding for transportation, which could be used for walking and bicycling projects. This was followed by 1999’s TEA-21, which authorized sustained recreational trails funding, and the larger SAFETEA-LU in 2005, which established such programs as Safe Routes to School and the Non-motorized Transportation Pilot
Program. 2009’s American Recovery and Reinvestment Act also provided $400 million in supplemental funding (National 2010).

However, despite these significant improvements in federal funding, active transportation still accounts for only 2 percent of total transportation expenditures (National 2010). This is likely due at least in part to the fact that less than 1.5 percent of SAFETEA-LU funds have been used for bicycle and pedestrian safety projects, and the fact that, on average, states spend just 1.2 percent of their federal funding on active transportation projects (Transportation 2009, Bicycling 2010).

These low percentages are possible because state and local governments have great leeway and a large role in determining how transportation funds are spent—a fact that is reflected in the large discrepancies of per-capita funding from area to area. New Hampshire spends 3.1 percent of its federal dollars on active transportation, while West Virginia allocates only .2 percent. Discrepancies are even greater among cities, with a range from 8.2 percent in Portland to .05 percent in El Paso, with per capita spending in recent years (as shown in Charts 5 and 6 below) ranging from $10.14 in Atlanta to $.04 in El Paso (Transportation 2009, Bicycling 2010).
These charts show a weak correlation between per capita funding and active transportation mode share. This is likely due to a number of factors, including the fact
that projects funded in recent years would take time to improve safety, convenience, and comfort to the point that overall mode share would be affected. Additionally, funding is used differently in different places, with certain cities putting money to better use than others. Finally, many cities’ funding may simply be too small to have discernable effects.

The situation is different in northern Europe, where cities have enjoyed long-term, sustained funding for high-quality initiatives at levels far higher than in the United States. In fact, there is a direct correlation in Europe between bicycle infrastructure funding and mode share (Gotschi and Mills 2008). Copenhagen spends $13 per capita annually with plans to double this amount, while Amsterdam spends a full $39 per year per resident (Pucher and Buehler 2007, Gotschi and Mills 2008). This is higher than any city in the United States, where per capita federal funding averages $1.49 annually (Bicycling 2010).

Sustained access to and wise use of funding can have significant effects, as active transportation infrastructure is not terribly expensive. For example, while a four-lane urban highway can cost $80 million, bicycle and pedestrian facilities can cost from a few thousand dollars to, at most, $1,000,000 per mile. Portland’s entire 300-mile bikeway network cost only $57 million, and the city expects to spend only $100 million more to reach a minimum 20 percent bicycle mode share (Transportation 2009).

In the end, funding can have a significant effect on active transportation levels so long as certain conditions are met. First, localities must ensure that significant portions of eligible funds are applied to bicycle and pedestrian projects. Second, localities should follow the example of northern European cities and Portland in committing to long-term
funding streams. Finally, local officials should work to ensure that funds are prioritized for high-quality initiatives that promote safety, convenience, and comfort.

All of these institutional and implementation factors can have positive effects on active transportation levels. However, the impact of each of them alone is questionable. Advocacy capabilities may be higher in places with high mode shares, but the direction of causation is not clear. The same can be said for professional bicycle and pedestrian staff and pro-active-transportation engineers, who are more likely to be found in cities with more of an existing demand for bicycle and pedestrian infrastructure. While funding is undeniably important, it is only likely to have a significant impact if it is sustained and directed toward high-quality projects.

In short, advocates and officials should seek to strengthen these groups and policies. However, they should keep in mind that none of these will be capable of increasing active transportation levels directly. No one will decide to bike or walk because funding is increased or because additional professional staff is hired. They can, however, be swayed if this new funding or manpower is applied toward the key priorities of improving real and perceived safety, making active transportation more convenient and competitive, and reducing the physical exertion and discomfort that comes with bicycling or walking.

Secondary Factor 2: Active transportation culture

Car-dominated culture is often cited as a key factor holding back higher levels of active transportation in American cities. The lack of a history of pedestrian and bicycle use, the argument goes, makes it unlikely that many people will choose to start using
active transportation, as these are not seen as “normal” modes of transportation. While
it is true that this can be a difficult obstacle, one need only look to the examples of
Copenhagen, New York City, and other cities to see how the car culture versus active
transportation culture dynamic can shift.

In the late 1960s, Copenhagen was fully immersed in a deepening cycle of car
domination in the city center, with a corresponding diminishment of the role of active
transportation. Beyond this, the city had “literally no culture of public space and life”. When local activists and officials began to take measures to shift toward pedestrian-
and bicycle-focused development and transportation patterns, the sentiment of residents was one of disbelief that their culture could be changed. Copenhagen
professor Lars Gemzøe remembered the general feeling that city residents “are not
Italians, we are Danes. It will never work here” (What the Pedestrian 2006). And yet,
through four decades of gradual, systematic changes, Copenhagen is now one of the
most bicycle- and pedestrian-friendly cities in the world.

This shift in culture is not limited to Europe. As recently as 1999, New York City
was seen as a disappointment for active transportation advocates, largely due to its
untapped potential for being a world-class cycling city. The city was known for its “torn
and treacherous pavement”, “substandard and often closed” bike paths, heavy traffic,
pollution, and poor safety. Anti-social ”kamikaze” riders who brazenly flouted safety
precautions for themselves and others dominated the less than 2 percent of residents
who were regular cyclists. “Politically marginal” cyclists were seen as “unglamorous”
and seemed to “inspire scorn”. Only 12 years ago, it was said that the vision of New
York embracing a culture of cycling was only “the dream of embattled cycling advocates” (Pucher et al. 1999).

And yet this anti-bicycle culture has been rapidly deteriorating over the last decade, to the point that to-work bicycle mode share more than doubled from 1990 to 2008, with especially accelerated growth since 2000. Cyclist injuries relative to trips have also fallen (Pucher et al. 2010). Through new infrastructure and educational and promotional events, the culture in both City Hall and New York City as a whole has been shifting toward active transportation. This is evidenced by the fact that in 2009 alone, cycling rates rose by 28 percent (*Bring on 2010*).

Other cities have similar stories. Portland and Minneapolis raised cycling levels by more than 500 percent from 1990 to 2008, while San Francisco and Washington, DC, more than tripled theirs. While culture and history are certainly important, the above examples show that they are not insurmountable obstacles, and that policy interventions can successfully move cities toward increased levels of active transportation usage (Pucher and Buehler 2010).

At the same time, advocates and officials should aware that changes in active transportation culture will likely follow, rather than precede, more concrete improvements in safety, convenience, and comfort. Cities cannot have improvements in active transportation culture without more people using active transportation. As we have seen, increases in usage are unlikely without the basic framework in place to allow and encourage individuals to choose active transportation. Therefore, while culture is similar to safety in that it too can form a self-reinforcing loop with usage levels, it is
unlike safety in that it itself is unlikely to be able to begin this cycle of improvement on its own.

Conclusions: Essential factors of active transportation

Active transportation is prone to self-reinforcing cycles of increasing or decreasing usage and safety. Much of the United States has long been in a negative cycle of decreasing safety and active transportation levels, which in turn leads to the diminishment of active transportation as a “normal” way to travel. Several decades of engineers’ and transportation officials’ prioritization of automobile speed and convenience has played a role in decreasing safety and comfort, while sprawling, disconnected development has made active transportation less convenient.

At the same time, lessons from the United States and abroad show that there is significant pent-up demand for active transportation. If advocates and officials can break the negative cycle of decreasing active transportation, there is great potential to reverse this momentum. The key element, then, should be policies and practices that allow and encourage individuals to choose active transportation in greater numbers. As we have seen, this can be accomplished only through improving the safety, convenience, competitiveness, and physical comfort of bicycling and walking.

Evidence suggests that the first priority should be promoting safety, without which improvements in other areas are likely to be for naught. Safety has been repeatedly and directly tied to improvements in mode share, and the countries and cities that have done the most in this area have typically seen the healthiest active transportation scenes. The most successful of these cities have focused on high-quality, networked, dedicated
infrastructure for traffic calming and bicycle and pedestrian protection. This should be the primary focus of advocates and officials in cities that lack this underlying framework. Convenience, competitiveness, and physical comfort are all important factors that go into active transportation levels, and all three should be actively promoted and pursued. Policies that bolster these areas are likely to lead to increased chances that individuals will choose active transportation over driving. At the same time, however, they are unlikely to have a significant effect if potential cyclists and pedestrians feel unsafe.

Institutional and implementation capabilities including advocacy groups, official professional staff, engineers, and funding are also important factors to consider. Each of these can work to help bolster safety, convenience, competitiveness, and physical comfort. At the same time, they are unlikely to do so directly. Each of them must be viewed not as goals in themselves, but in light of what they can do to help reach these more fundamental objectives.

Finally, it is clear that the lack of active transportation culture is not an insurmountable obstacle. At the same time, it is unlikely that promoting culture in itself will lead to successful results. Rather, culture should be promoted as a complement to increasing levels and improving conditions for cyclists and pedestrians.

In short, those hoping to see improvements in levels of active transportation should focus on those factors that most heavily influence individuals’ travel choices: convenience, physical comfort, and, most importantly, safety. Advocates and officials in cities that have been unable to start self-reinforcing cycles of safety, culture, and usage should focus their attention on the first of these, as it has the most potential to get more
people using active transportation. The most important factor that improves safety—high-quality active transportation infrastructure—should be the first priority of such cities.

V: Application: Downtown Atlanta

This section presents an application to Downtown Atlanta of the previous conclusions concerning the key factors that influence and encourage active transportation. First, we will discuss several of the area's existing features that give it significant potential for achieving high levels of active transportation. We will then examine the four key deterrents to bicycling and walking in the area, which are directly linked to insufficient levels of the essential factors discussed in Section IV above. These deterrents are: lack of safety, lack of convenience, lack of comfort, and lack of competitiveness. For each of these, we will focus on one or two specific challenges that the area faces, and present proposals to help Downtown deal with these issues.

Downtown Atlanta active transportation opportunities

As we will discuss below, Downtown Atlanta in 2011 is not a particularly inviting area for active transportation users, as it has a number of characteristics that make bicycling and walking unsafe, inconvenient, and uncomfortable. At the same time, however, the area has great potential and many unique opportunities for the rapid improvement of conditions, including density, transit access, internal grid connectivity, and popular or important destinations.
In 2008, Downtown Atlanta had 26,700 residents, 140,000 workers, 30,000 students, over 1.5 million conventioneers, and 12 million attendees of area attractions, sporting events, and concerts (Central Atlanta 2008). This high concentration of people is surrounded by residential neighborhoods and includes universities, nine transit stations, and over a dozen bus lines (Interactive 2010). This density and richness of transit means Downtown has less inherent car dependency than more isolated neighborhoods.

The area also features a dense gridded street network, with typical block perimeters of less than 2,000 feet. Although, as we will discuss below, the area suffers from lack of connectivity to surrounding neighborhoods, active transportation users can generally take direct routes to their destinations within Downtown. Additionally, the dense street network means that local automobile traffic is dispersed onto enough streets that cars, cyclists, and pedestrians are not competing for space on a few essential routes.

Downtown Atlanta also features excellent transit connections, as it is a point of convergence for all of the city’s MARTA subway lines and over a dozen bus routes. This results in high numbers of commuters whose trips begin, end, or include a transfer Downtown. This presents a great opportunity for encouraging hesitant active transportation users to combine bicycling and walking with transit. If Downtown can make transferring between modes as seamless and hassle-free as possible, it may convince those living or working outside convenient, comfortable walking distance of transit to choose a combined bicycle and transit trip instead of driving.
Finally, the area is home to several major destinations that could help drive active transportation levels, including sports facilities, parks, large office and government buildings, and tourist attractions. The most important destination is possibly Georgia State University, which makes up the bulk of the area’s 30,000 students. University students are especially likely to travel via active transportation, and working to make GSU’s campus as bicycle- and pedestrian-friendly as possible could lead to significant bicycle and pedestrian numbers.

**Downtown Atlanta active transportation deterrents, challenges, and proposals**

With the potential afforded by these opportunities and existing advantages in mind, we can next consider the deterrents of cycling and walking in Downtown Atlanta. We will consider the four most elemental of these, which all stem from the lack of sufficient levels of the essential elements of active transportation: lack of safety, lack of convenience, lack of comfort, and lack of competitiveness. For each of these we will discuss particular challenges that Downtown must overcome, including unsafe high-speed streets (lack of safety), connectivity issues (lack of convenience and comfort), incomplete bicycle-transit coordination (lack of convenience), hilly terrain (lack of comfort), and unfettered car access (lack of competitiveness).

For each challenge, we will present proposals for how it can be met, with an emphasis on previous discussion of which factors can have the greatest impact on convincing people to choose active transportation, including improved safety infrastructure (with a discussion of the particular challenges and opportunities posed by
the area’s major street types), extensive traffic calming, ensured connectivity, hassle-free coordination with transit, terrain mitigation, and competitiveness with driving.

**Downtown Atlanta Deterrent 1: Lack of safety**

The first and most significant deterrent to active transportation Downtown is the area’s poor safety conditions. The preponderance of narrow, unprotected sidewalks and nearly complete lack of dedicated bicycle infrastructure do little to give users any real or perceived protection from traffic. In fact, Transportation for America rated the Atlanta area as the 10th most dangerous in the nation for pedestrians, while the Alliance for Biking and Walking ranks Atlanta 34th out of 50 large cities in terms of bicycle safety (Ernst 2009, Bicycling 2010).

There is very little in terms of bicycle infrastructure in the area, and that which is in place is limited to a small number of on-street, bufferless painted lanes. These are typically of low quality, and are generally five to seven feet wide and are sometimes in dangerous car door zones. There are no physically separated bicycle lanes, bike boxes, bicycle advance signals, or similarly advanced infrastructure.

Downtown often also suffers from wide-lane, high-speed, one-way automobile traffic. Cars tend to treat the area’s streets as at-grade highways, and speeding is a major issue. At the same time, traffic-calming infrastructure is virtually non-existent. That which is in place is limited to a number of curb extensions and signs reminding drivers of the presence of pedestrians and bicyclists.

As we have seen, safety is the most important factor that affects active transportation levels, and therefore should be the primary focus of Downtown Atlanta’s
active transportation officials and advocates. Advocates and officials should make a concerted effort to focus their resources on infrastructure that will calm traffic and protect active transportation users from cars, while making their trip as stress-free as possible. The focus of such plans should be on encouraging bicycling and walking for all users, thus accelerating the self-reinforcing cycle of usage and safety.

![Image 4: Pedestrian conditions in Downtown Atlanta (Google 2011). Many Downtown streets feature narrow sidewalks directly abutting high-speed roadways, deterring potential pedestrians.](image)

**Challenge and Proposals (Safety): Protective infrastructure**

The first challenge for advocates and officials is to overcome Downtown’s nearly complete lack of protective infrastructure. Planners should begin by installing wide sidewalks along all downtown streets. In dense areas like Downtown Atlanta, these
should typically be at least 10 to 15 feet in width, with a furniture zone containing trees, benches, newspaper stands, garbage cans, and other street furniture as space allows. Designers should work to ensure that pedestrians feel protected from passing traffic through adequate buffering. Pedestrian crossings on all two-way streets that are at least four lanes wide should also include median safety islands to lessen and break up distances between sidewalks.

Bicycle infrastructure in Downtown Atlanta should focus on protecting cyclists from high-speed traffic through painted buffers and physical separation. Typically, one-way painted-buffer bicycle lanes will require 8 feet of roadway, while fully separated one-way lanes take up 14 feet. Examples of such lanes are shown in images 6 and 7 below.
Downtown Atlanta should work to create a network of such lanes throughout the area. When space allows, the lanes should be fully protected, as in Image 7. In other places, they should at least feature significant painted buffers, as in Image 6, to prevent automobile encroachment and allow cyclists to avoid opening parallel-parked car doors.

In the near future, the need for political viability may make installing lanes more feasible on Downtown Atlanta streets that have excess space, so that the transfer of lanes to active transportation will not be seen as an excessive affront on automobile usage. This section presents potential redesigns of four such streets, including two wide, one-way streets (Piedmont and Centennial Olympic Park Drive), and two important east-west Downtown entryways (Ivan Allen and Martin Luther King). We will also look at a potential redesign for a comparatively narrow, two-way entryway connecting nearby neighborhoods and key Downtown destinations (Edgewood). Unlike the other four examples, this street does not have significant excess width, and its redesign requires narrowing a road from two lanes to one in each direction.

Piedmont and Centennial are both important north-south streets through Downtown, and provide key entry and exit points to surrounding neighborhoods. Both are part of the proposed bikeway network mapped later in this section, and connect
such important destinations as Centennial Olympic Park and Georgia State. Both streets are wide, one-way, and feature high speeds and no bicycle infrastructure.

Image 8: Piedmont cross-section at Freedom Parkway. Four 10’ travel lanes are reduced to 9’ each, leaving room for a new 5’ lane with a 3’ painted buffer, and a 5’ curb extension with tree buffer.

Piedmont Avenue is depicted above, with the top diagram representing the current state of affairs. Four 10-foot lanes move northbound between 11-foot sidewalks with minimal separation from moving traffic. Cyclists currently have to contend directly with high-speed traffic treating the road much like an at-grade freeway.

The lower diagram shows a street redesign focusing on improving bicycle and pedestrian infrastructure while calming traffic. The excess width of the street allows for the removal of a full traffic lane and the reduction of each of the three remaining lanes
from 10 feet to 9 feet in width. The leftover 13 feet are used both to add a 5-foot bike lane protected by a 3-foot buffer and a 5-foot sidewalk extension that can be used for street trees or street furniture. These changes will serve to calm traffic to a more reasonable rate, while helping improve the chances that hesitant cyclists or pedestrians will feel safe enough to choose active transportation.

Image 9: Centennial Olympic Park Drive at Andrew Young. Three one-way lanes are reduced by one foot in width, allowing a fully protected 14’ lane to replace the right-most travel lane.

Centennial Olympic Park Drive is similar to Piedmont in that it features four high-speed, one-way lanes. The poor bicycling conditions found on Piedmont are also found here. At the same time, however, pedestrian conditions along this street tend to be better than along Piedmont, with sidewalks on both sides protected from traffic by rows of street trees.

The top diagram shows Centennial Olympic Park Drive as it currently is. Four southbound one-way lanes of 10 to 11 feet in width move through Downtown, with a wide sidewalk to the west along Centennial Olympic Park and a narrower sidewalk to
the east. The lower diagram proposes replacing one lane with a fully protected, 14-foot lane such as the one seen in Image 7 above. This is made possible by reducing the three remaining lanes from 10 to 9 feet in width.

The next three streets are all two-way corridors that serve as entry and exit points to Downtown and connect major destinations. In some ways, these streets are more difficult to redesign for active transportation in that they typically do not feature the excessive width of the area’s one-way thoroughfares. Bicycle and pedestrian infrastructure on such streets may come into more direct conflict with free-flowing vehicular traffic. Because of this, planners in places such as Downtown Atlanta where restricting vehicular traffic can meet with political opposition may be limited in their ability to enact full-scale street redesigns. In the diagrams that follow, we attempt to strike a balance between improved safety conditions and political feasibility.
Martin Luther King, Jr. Drive between Centennial and Spring. This street serves as a protected exit-way from the Downtown neighborhood. Reducing two-way travel lane width and parallel parking with allows for an 8' bicycle lane heading west out of the area.

Martin Luther King, Jr. Drive is an important east-west thoroughfare, providing entry and exit points on both the west and east sides of Downtown, as well as access to such sites as the Georgia Dome, Georgia State, City Hall, and the State Capitol. The street is westbound-only through Downtown, but becomes two-way as it crosses a bridge heading west into nearby neighborhoods.

The diagrams above show the street as it is along this bridge. The top diagram shows the current conditions, with two-way traffic and an exceptionally wide parallel parking lane, with an 8-foot sidewalk along the south side. The bottom diagram shows a potential redesign that uses traffic calming and the removal of excessive parking lane width to provide a buffered bike lane heading westbound out of the area. This redesign
could have featured a similar lane heading eastbound along the sidewalk curb, with the 8-foot parking lane floating to the left of the bike lane. Alternatively, the parking lane or a travel lane could be removed and dual bike lanes could be installed. We chose the layout pictured above due to the political issues raised by removing large amounts of parking or full travel lanes on important two-way streets, and because of the fact that the street’s one-way, westbound path through Downtown would likely make it more important as an exit point than an entry to the area.

Image 11: Ivan Allen Boulevard at Spring Street. This two-way street is one of the few with bicycle lanes in the Downtown area. By reducing travel lanes by 1’ to 2’ in each direction, these lanes can be given 3’ painted buffers, increasing protection from traffic.

Ivan Allen Boulevard is another major east-west thoroughfare through Downtown. The street is two-way, connects with neighborhoods on both side of the area, and provides access to such places as the Georgia Aquarium and Georgia World Congress Center. Along some blocks, it also features some of the better active transportation
infrastructure in the area, as seen in the top diagram above. Both sides of the street have wide, tree-protected sidewalks and 5-foot painted bike lanes. However, these lanes are narrow and unprotected, and the wide, 11-foot-wide travel lanes allow for faster-than-necessary vehicular traffic.

The proposed redesign in the lower diagram above provides a simple way to reduce traffic speeds and increase the safety of cyclists. Lanes are reduced 1 to 2 feet each, and the extra room is re-allocated to providing 3-foot buffers for each bike lane.

Image 12: Edgewood at Piedmont: The most radical of these street redesigns, the removal of one traffic lane allows an 8’ buffered bike lane and a 12’ middle turn lane. The bicycle lane could also be moved inside of the parking lane on the left side if the Downtown network required an outbound instead of inbound route. Additionally, the median turn lane could be removed and a second bike lane added if politically feasible.

Our final two-way street redesign, Edgewood Avenue, is a crucial connector between the residential neighborhoods to the east of Downtown, Georgia State, and the busy Five Points MARTA station. The top diagram above shows the potential for
competition for road space between drivers and cyclists, as the addition of bicycle infrastructure would require lane removal or the loss of parallel parking.

In our redesign seen in the lower diagram, the importance of this road to the area’s bicycle network outweighed the need for four-lane traffic. Parallel parking was left in place to help buffer pedestrians from moving traffic, while a new one-way bike lane along the other sidewalk serves to protect pedestrians from high-speed cars. Additionally, the center lane has become a dual-way turn lane. Such dramatic redesigns should be pursued with caution and, at least at first, only proposed for streets such as Edgewood that are essential components of bikeway networks. Such redesigns could meet with substantial resistance from the large majority of Downtown commuters who are drivers, and insisting on too much too soon could serve to turn the majority of the population against designing for active transportation infrastructure.

All of these redesigns focus on giving cyclists of all skill levels the ability to ride Downtown without fearing for their safety due to speeding traffic. If these new lanes are successful in bringing increased bicycle traffic, they should benefit from the effects in safety in numbers, which in turn should further increase traffic. Eventually, more streets can be fitted with bicycle lanes until the area is served by an extensive network of protected paths connecting transit stations, neighborhood entry and exit points, and important destinations. Such a network is pictured in Image 13 below.

**Challenge and Proposals (Safety): Traffic calming**

Safety for cyclists and pedestrians downtown is currently severely compromised by the high-speed nature of most area streets. With typical lane widths of 11 to 12 feet
and frequent wide, one-way thoroughfares, there is little outside of posted speed limits to prevent speeding cars from endangering active transportation users.

Because of this, Downtown safety enhancements should also include extensive traffic calming throughout the area. In addition to the lane narrowing seen in the street diagrams above, all streets with parallel parking should include curb extensions two feet narrower than parking lanes (NYCDOT 2009). Streets without parallel parking should at least ensure that curbs extend sufficiently far into the roadway to prevent high-speed vehicular turns.

Traffic officials and engineers could also consider ways to slow down traffic at intersections, where most bicycle and pedestrian crashes occur. One possibility for Downtown is the installation of raised pedestrian crossings, especially in places with high pedestrian demand, such as Georgia State’s campus, Centennial Olympic Park, and near MARTA stations. Raised crossings can improve driver awareness that they are likely to encounter pedestrians and informs them through a physical barrier that lower speeds are appropriate, while highlighting popular pedestrian crossings (NYCDOT 2009).

Due to the high-traffic nature of Downtown Atlanta streets, traffic calming measures such as chicanes, half closures, full closures, and other measures designed for low-volume streets are unlikely to be viable. Rather, infrastructure measures should focus on allowing safe, comfortable usage for all traffic modes.
Image 13: Downtown bicycle path network. This network should grow over time to include connections between transit, neighborhood entry and exit points, and important destinations.
Downtown Atlanta Deterrent 2: Lack of convenience

The second major deterrent to active transportation in Downtown Atlanta is that several area factors work to reduce the convenience of bicycling and walking. This section will focus on the two challenges at the center of this problem: Downtown’s lack of external connectivity and the incompleteness of the area’s bicycle-transit coordination efforts.

Challenges and Proposals (Convenience): Connectivity

Despite its gridded street layout, Downtown suffers from a lack of direct access to surrounding neighborhoods due to railroad tracks and interstate highways severing street connections. This limits the potential for Portland-style “back streets” bicycle boulevards to connect important destinations, and increases the importance of entryway and exitway streets to the overall network. This challenge is compounded by the current situation of high-speed automobile traffic competing with active transportation users for use of this limited number of essential network streets.

The possibility of re-connecting the Downtown street grid with surrounding neighborhoods through new overpasses, bridges, or tunnels is beyond the scope of this paper. Instead, we will focus on proposals that ensure that the existing connections into and out of the area do not feature conditions that discourage hesitant cyclists or pedestrians. Activists and officials, then, should work to improve safety and comfort levels through each of these connections.

Safety improvements on these streets should prioritize infrastructure improvements such as those seen in the five example streets above. Currently, bridges
and tunnels into Downtown Atlanta are generally devoid of bicycle infrastructure and feature dark, narrow sidewalks that can be quite uninviting, particularly at night. Cars typically travel at high speeds, and traffic-calming infrastructure is rare. In order to address these issues, advocates and officials should pursue improvements such as those discussed in the previous section, while concentrating on connecting these redesigned streets with more large-scale bicycle and pedestrian networks.

These improvements could take a similar form to Midtown Atlanta’s Fifth Street Bridge, seen below in Image 14 (Fifth Street 2011). This bridge crosses the I-75/I-85 Connector approximately one mile north of Downtown. This previously uninviting connection between Georgia Tech’s campus and Midtown was similar in many ways to the anti-bicycle and anti-pedestrian entry and exit points found throughout Downtown. Its redesign focused on active transportation safety and comfort, as seen in the bicycle lanes, widened sidewalks, and green pedestrian plazas on either side of the road. Advocates and officials should work to create similarly active-transportation-friendly crossings Downtown.
Challenges and Proposals (Convenience): Bicycle-transit coordination

Due to the lack of MARTA coverage in most areas of the city, people who live in neighborhoods near Downtown are likely to be without convenient walkable subway access. At the same time, many inner-city neighborhoods are within reasonable biking distance of Downtown MARTA stations, and people who ride mass transit into Downtown and work in surrounding neighborhoods could be well-served by bicycle...
access to and from the area. For all these reasons, the area is an essential part of any potential initiatives to coordinate bicycling and transit in the city, and planners should work to ensure that multi-modal passengers are able to avoid unnecessary hassle and inconvenience when switching between bicycles and transit through bicycle access to buses and trains, bicycle parking at or near stations, and safe routes to and from transit.

MARTA already does well to allow easy access to trains and buses for those riders who wish to bring their bicycles with them on their trips. All buses have two bicycle racks, and bicycles are allowed on all trains at all hours without an additional fare. Also, train stations feature wide entrance and exit gates and elevators between street and platform levels. While planners could also consider improvements such as special train cars with bicycle hooks or areas with seats removed to allow easier access, Downtown is already well on its way to fulfilling this aspect of bicycle-transit coordination.

However, the area has not done nearly as well to provide a sufficient supply of bicycle parking near bus stops and MARTA stations. There are currently 170 racks in the Downtown area, with room for over 900 bicycles (Image 15 below), which can serve only 0.6 percent of the area’s 140,000 workers (Downtown 2010, Central Atlanta 2008). A mode share of 5 percent of Downtown workers would require 7,000 parking spaces, while bike-and-ride commuters taking buses or trains out of the area would add to this total. Many of these new spaces should be clustered around transit stations and stops, and, going forward, could include such improvements as covered parking, secure facilities, and multi-use bicycle stations featuring parking, showers, repairs, and
accessories.

Finally, as discussed above, planners should work to integrate bicycle infrastructure networks with transit stops and stations. Important Downtown stations should be served by direct, well-protected bicycle routes to important destinations and neighborhood entry and exit points, such as those discussed in the sections on safety and connectivity above.

Image 15: Downtown bicycle rack locations (Downtown 2008).
Downtown Atlanta Deterrent 3: Lack of comfort

Downtown Atlanta has two characteristics that can make active transportation use require an uncomfortable level of physical exertion: lack of external connectivity and hilly terrain. The first of these can serve to greatly increase the length of trips, necessitating the increased use of energy and increasing potential exposure to heat, cold, rain, or snow. Hilly terrain can add to this physical discomfort by requiring steep or sustained uphill climbs, which are sometimes unavoidable in Downtown Atlanta. As our prescriptions for improving connectivity are found in the previous section, we can turn our attention to meeting the challenges posed by Downtown’s often daunting slopes.

Challenges and Proposals (Comfort): Hilly terrain mitigation

Active transportation in Downtown Atlanta can require significant uphill climbing, as most of the neighborhood features a rigid grid system over relatively hilly terrain. As seen in Image 20 below, Downtown generally sits on higher ground than surrounding areas, making climbs somewhat inevitable, especially when moving from east to west into the area. However, there are streets that can serve as entry and exit corridors that loosely follow ridgelines, which can serve to lessen the necessity of severe or long uphill climbs. Four such routes are marked in green on Image 20.

Unfortunately for active transportation users, there are no routes into the center of Downtown that do not feature at least some degree of climbing. Different streets, however, can entail more or less strenuous trips. For example, a bicycle trip from the northwest side of Downtown to Five Points along Techwood and Centennial Olympic Park Drive will lead to a more serious climb than a similar trip along Marietta. This
difference is illustrated in trip elevation charts from advocacy group Citizens for Progressive Transit, seen in Images 16 and 17 below. While the trip along Marietta still involves climbing, the rise in elevation is more moderate and gradual than along Centennial Olympic Park Drive.

Image 16: Climb to Five Points along Centennial Olympic Park Drive. Portions in Red are the most strenuous uphill sections (ATrain).

Image 17: Climb to Five Points along Marietta Street. Portions in Red are the most strenuous uphill sections (ATrain).

As seen in Image 21 below, any travel into Downtown from the east or northwest is sure to feature at least some uphill climbing, as the ridges in the immediate area tend to run north to south. However, prioritizing certain “high ground” routes for bicycles can still make a difference in improving user comfort. For example, Images 18 and 19 below show routes to Five Points along Martin Luther King and Peters Street, which are seen in green in Image 21. These streets include the inevitable climbs into Downtown, but not
to the extent seen in Image 20, which follows John Wesley Dobbs and pays no heed to following high ground.

**Image 18: Climb to Five Points along Martin Luther King.** Portions in Red are the most strenuous uphill sections (ATrain). Steep initial climb is broken by descent.

**Image 19: Climb to Five Points along Peters Street.** Portions in Red are the most strenuous uphill sections (ATrain). Steep descents and moderate climbs characterize this trip that rises very little from beginning to end.

**Image 20: Climb to Five Points along John Wesley Dobbs.** Portions in Red are the most strenuous uphill sections (ATrain). Short, strenuous climbs and long-range ascents make this route an unlikely choice for users averse to uncomfortable physical exertion.
In addition to prioritizing these and other relatively flat roads for bicycle infrastructure, planners should work to ensure that downhill trips out of Downtown are able to take advantage of favorable slopes. Planners should coordinate traffic signals, give signalization priority, and remove downhill stop signs along bicycle routes in order to allow cyclists to take use the significant downhill momentum that Atlanta’s hills can provide. When combined with intersection treatments such as bike boxes or advance signals, these strategies can allow cyclists to start their descents ahead of traffic and
continue unabated by unnecessary stops. Maintaining momentum also helps reduce the effort necessary to climb subsequent hills. As discussed above, such efforts to minimize physical exertion can sway the transportation decisions of inexperienced or hesitant residents toward active transportation.

**Downtown Atlanta Deterrent 4: Lack of competitiveness**

For most Downtown Atlanta commuters, it is currently difficult for active transportation to compete with the convenience of driving due to the poor implementation of bicycle and pedestrian measures and the ease of car travel. Several interstate highways and major arterial roads that are designed for maximum traffic flow and speed serve the area. Many streets are wide and one-way, while parking is plentiful and relatively inexpensive, with approximately 65,000 public parking spaces in 195 facilities (Central Atlanta 2008). These figures do not even include private garages, meaning automobile parking spaces outnumber bicycle parking by more than 70 times.

One could make the argument that this situation calls for European-style policies to disincentivize driving. This could entail removing streets from the automobile network, closing lots or raising prices on parking, and congestion fees. These measures, it could be argued, would reduce the attractiveness of driving Downtown, thus making active transportation relatively inviting by comparison.

While such measures certainly have merit in cities such as Copenhagen, London, or New York that have extremely dense centers and intense competition between modes for operating space, they make less sense in Downtown Atlanta. First of all, the wide rights-of-way that make up much of the area’s street network have more than
enough room to accommodate multiple transportation modes, including driving. There is no need to prevent cars from using Downtown streets where there is sufficient room for vehicular traffic and protected active transportation.

Second, such measures would likely face staunch political opposition, and might exhaust active transportation advocates’ and officials’ reserves of political capital. Atlanta remains a car-dominated city, and harsh restrictions against driving could prove extremely divisive.

Third, unlike single-center European cities, Atlanta’s Downtown faces competition for jobs and tenants from other regional areas such as Midtown, Buckhead, and Perimeter Center. If Downtown Atlanta alone enacted relatively strict anti-driving regulations, many businesses would likely flee to other areas that featured fewer restrictions on the region’s dominant transportation mode.

Finally, such anti-driving tactics may be unnecessary in light of the reports that show a strong pent-up demand for active transportation options (SMARTRAQ). People in the Atlanta region want more walkability than they currently have, and national reports show strong potential for growth in active transportation mode share. When combined with the already-existing disincentives caused by Atlanta traffic congestion, it is likely that making active transportation safer, more convenient, and more comfortable will allow it to compete with driving without needing to severely restrict automobile use.

**Conclusion: Downtown Atlanta**

Downtown Atlanta has the potential to be an attractive area for active transportation users, with its natural advantages of density, transit, connected internal street network, and important destinations. At the same time, it currently falls short in
terms of the presence of several of the essential factors of active transportation: safety, convenience, comfort, and competitiveness. Without improvements in these areas, it is unlikely that hesitant or vulnerable potential active transportation users will choose to venture into Downtown on foot or by bicycle.

Any plan to improve active transportation conditions Downtown should begin with the most essential of our essential factors: safety improvements, specifically through high-quality networks of protected infrastructure. As we have seen, cyclists in the United States feel safer (and actually are safer) in places with protected bike lanes and paths, and are far more likely to choose active transportation if they feel safe. Without safety, high levels of convenience and comfort are unlikely to make a significant impact on usage levels. This is certainly true in Downtown Atlanta, where high-speed, car-dominated thoroughfares tend to deter all but the hardiest of active transportation users. Because of this, Downtown officials and advocates should begin with infrastructure, including improved sidewalks, high-quality bike lanes, and a full complement of traffic-calming initiatives.

With the foundation of safety being put in place, advocates and officials could begin to see results from initiatives to improve convenience. While increasing the number of entry and exit points Downtown is a project that could take decades, making existing connections viable for active transportation can begin right away. These improvements are directly tied to safety and comfort initiatives, and Downtown should work to make sure that important connectivity points have the full complement of infrastructure needed to encourage their use by more than just drivers.
Planners should also work with MARTA to continue to improve bike-transit coordination. This should include vastly expanded supplies of bicycle parking, multi-use bicycle stations, and, of course, networks of active transportation safety infrastructure connecting MARTA stations with other important destinations.

Comfort-improving terrain mitigation initiatives should also flow directly from the installation of networked safety infrastructure. From the start, officials and advocates should work to make sure that the most important streets for reducing climbs into and out of Downtown are part of the improved bicycle network.

Finally, as discussed above, initiatives restricting car access could be started once improvements in safety, convenience, and comfort have had time to bring active transportation levels up to a point where numbers are sufficient to challenge the dominance of cars Downtown. Restricting people’s transportation choices can require significant expenditures of political capital, and doing so prematurely in Downtown could derail plans that involve more basic factors that could immediately begin improving conditions.

In the end, Downtown Atlanta would benefit from pursuing all of the initiatives discussed in this section. However, the area, like all other places where unsafe conditions and low active transportation levels continue to reinforce each other, should focus its first efforts on the one factor that can break this vicious cycle: safety for all users through high-quality protective infrastructure.
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