Chapter 4

Disrupting the Direction

Transportation systems throughout the world are continually reshaped by disruptions in technology, demographics, and other emerging issues in society. Innovations including Transportation Network Companies (TNCs), bike and scooter rental programs, and the first stages of car automation are becoming more prevalent, requiring changes in how transportation systems must operate and how decision-making can influence a community's adaptability. Across the country, an aging and migrating population poses new challenges for physical and economic accessibility in transportation.

Many of the disruptions identified above have already reached the Anderson MPA. This chapter will examine existing and potential disruptions to the transportation system and identify some critical concerns that must be acknowledged and incorporated into this plan's recommendations.

Transformative Technologies

Transportation Network Companies (TNC)

TNCs like Uber and Lyft match passengers with vehicles and drivers to arrange rides on short notice. Since 2012, these companies have developed mobile phone applications to connect users with rides, which has had a dramatic impact on mobility. TNCs are convenient for users for whom driving is not an option. Vehicles arrive on demand and passengers can choose any pick-up or drop-off location instead of walking to a station like traditional mass transit options. TNCs can supplement the coverage of public transportation and serve as a "first mile, last mile" solution in cases where transit stops are far from the desired destination.

However, the trade-off for convenience is cost. The average cost-per-mile for a passenger using a TNC is between $0.65 and $2.00, compared to $0.26 for public transportation[4]. TNCs cannot currently be considered equitable replacements for public transportation, even though shared autonomous vehicles may reduce fares in the future.

The impact of TNCs on traffic is often debated because some research suggests that they reduce traffic by encouraging ridesplitting or ridesharing. This practice is like carpooling where rides are shared, and costs are divided among passengers. However, ridesplitting only accounts for a portion of TNC trips. Other research finds that TNCs increase traffic, especially in city centers. One study found that between 2010 and 2016, hours of traffic delay increased 62% compared to 22% in a hypothetical scenario without TNCs[5]. Another factor contributing to traffic is deadheading or out-of-service movement between trips. In San Francisco, 20% of TNC traffic is out of service[5].

TNCs, like taxi services, also disrupt traffic flow in curb lanes during pick-ups and drop-offs.

TNCs may not impact the Anderson MPA on the same level as larger cities like New York and San Francisco, but it is still important to plan for these changes. Some governments regulate or ban the networks, but infrastructural changes can help accommodate them better. These changes may include designated areas for pick-up and drop-off or expanding existing public transportation as a competitive travel alternative.

Connected and Autonomous Vehicles

Though not yet available in commercial markets, Connected and Autonomous Vehicles (CAVs) may significantly affect the transportation system's future. Autonomous vehicles are commonly referred to as self-driving cars; however, automation can occur at different levels of capability. There are currently many newer model vehicles used throughout the US with low levels of automation in the form of driver-assist features. While the highest level of automation would be a system that can drive a car independently in all conditions, no model currently being tested is fully automated in all locations and conditions. CAVs are expected to improve safety as well as efficiency, since most crashes are caused by human error[6].

It is less clear how CAVs will impact land use. Shared autonomous vehicles could reduce the need for parking, because after dropping off one passenger, a car could simply move on to pick up another. If this occurs, communities could eliminate or reduce parking requirements, which in turn allows for densification and infill of downtown areas. Conversely, eliminating the need to drive would enable commuters to live further away from home,

Level 0
The human driver is in complete control of all functions of the car.

Level 1
The human driver controls the car, aside from some assist features.

Level 2
More than one function is automated, but the driver must remain attentive.

Level 3
Driving functions are automated, but the driver must sometimes take back control.

Level 4
The car itself can drive with no human intervention in certain environments.

Level 5
The automated system can perform all tasks under all conditions.

therefore incentivizing sprawl development. In addition, CAVs could contribute to increases in traffic with "deadheading" or idle travel between passengers like TNCs. Since CAVs have yet to appear on the market, their overall impact is uncertain; however, planners and policymakers should acknowledge the likelihood that CAVs will drastically affect the urban landscape.

Personal Rapid Transit

Personal Rapid Transit (PRT) combines desirable aspects of both public transportation and personal vehicles. Like many public transit systems, PRT follows a relatively fixed route along a track network. However, PRT trips are specialized by the requests of individuals or small groups of passengers. A fleet of low capacity "podcars" offers a more private, less congested alternative to conventional mass transit. Ideally, the low weight of individual pods makes both the vehicles and their supporting infrastructure less expensive and visually obtrusive to build.

Today, there are less than a dozen PRT systems worldwide, including examples in The United Kingdom, South Korea, and the United Arab

Emirates. There are no city-wide examples yet, but the largest example in the country is located at the University of West Virginia.

Electric Vehicles

The first electric cars were produced as early as the 1880s, but they were soon replaced by gasoline-powered vehicles. In recent decades, electric vehicles have returned and are now more popular and accessible than ever. As of 2019, despite higher upfront costs than diesel or petrol cars, electric cars are cheaper to own and run. Local and federal governments across the globe have pushed legislation to incentivize electric vehicle use. In California in 2017, Governor Jerry Brown signed an executive order aiming for 5 million electric vehicles to be on the state's roads by 2025. In Norway, electric cars consist of 22% of the market share due to incentives like toll exemptions and free parking.
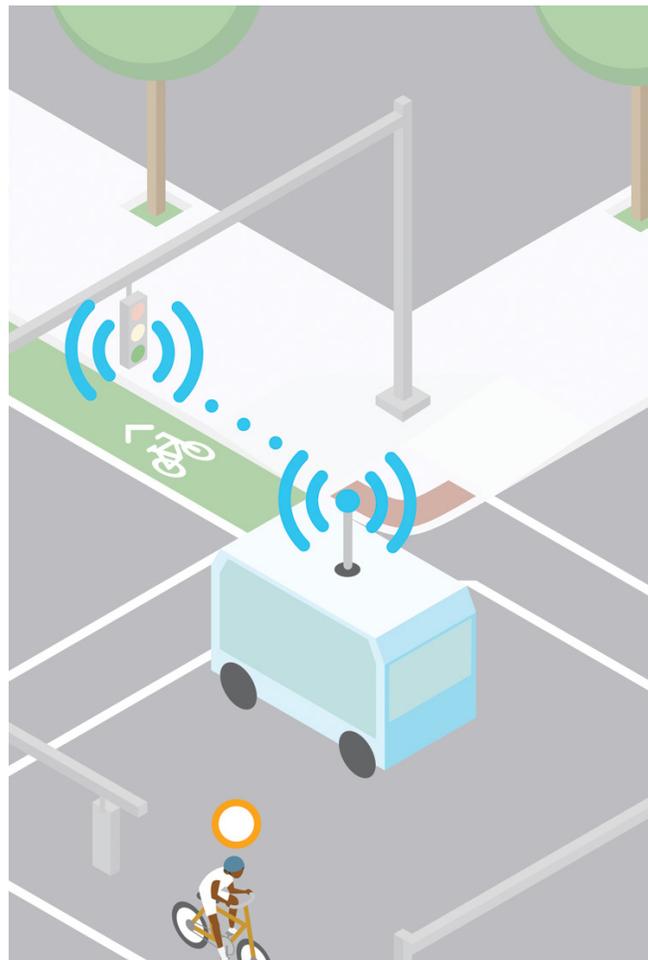
**Indiana Energy Consumption Estimates, 2018**
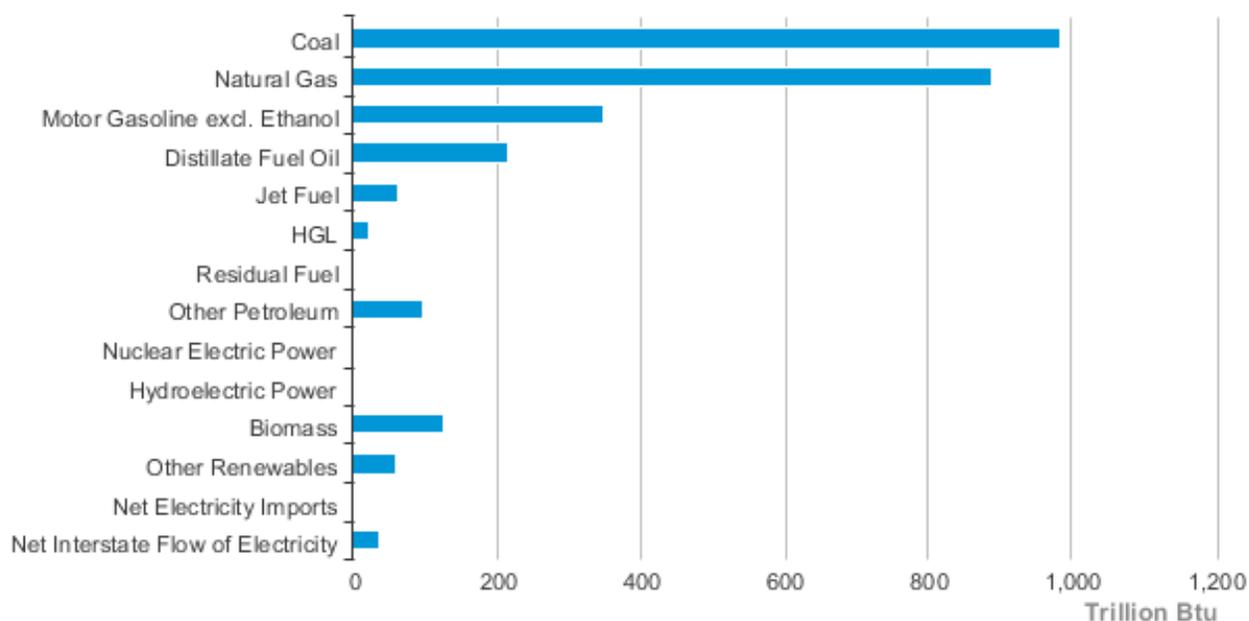
Source: Energy Information Administration, State Energy Data System

Figure 4.02: Indiana Energy Consumption[7]

Electric cars produce little to no air pollution when running, and thus will reduce dependence on fossil fuels. However, reduction depends on which resources are used to produce energy in the existing power grid. While Madison County has expanded its renewable energy yield in recent years, Indiana is still one of the top five states in the share of energy produced from coal. Coal accounted for 70% of the state's energy use in 2018[7]. For electric vehicles to reach their greatest environmental potential, their use must be paired with renewable energy production.

Bike & Scooter Share Systems

Bikeshare systems are gaining popularity in cities across the globe. In 2017, the number of shared bikes in the US doubled. These programs, which have existed in some form since 1965, let users rent bikes and dock them in stations across a given area. Recent innovations include anti-theft technology in the docking stations and dockless bikes unlocked using mobile applications.
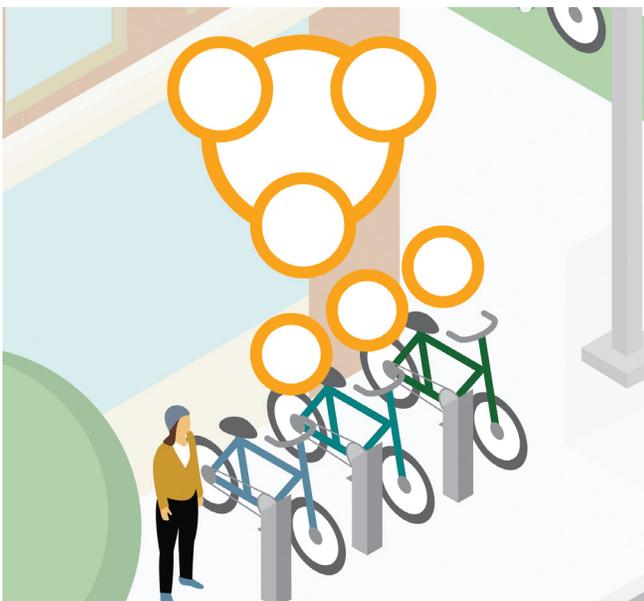
While dockless bikeshares do not exist in central Indiana, dockless electric scooter services are available. These programs rapidly appeared in cities across the US in 2018. However, these dockless systems are controversial because those bikes and scooters are often left in sidewalks and other public rights-of-way obstructing pedestrian and parking spaces, as well as limiting Americans with Disabilities Act (ADA) accessibility. In November 2018, 37 electric scooters were found in the Indianapolis Canal, which raised concerns of theft and vandalism.

Nevertheless, bikeshare programs are a vital opportunity to expand mobility options and reduce car emissions. To accommodate these systems, cities have implemented new bike infrastructure like bike lanes and docking stations in public right-of-way space. As of 2019, the Indianapolis Pacers Bikeshare Program had 525 bikes and 52 docking stations. Increasing the number of docking stations expands the number of commuters who could use them for travel.

Developing Demographics

Factors that shape the landscape of mobility involve technology as well as people. The US has witnessed economic and cultural changes in education, workforce participation, and housing trends. The youngest generations are now slower to enter the job market and have children, leaving gaps in the job market. Retiring Americans, soon to outnumber youth, have pressing concerns for physical accessibility in transportation. Demographic and population shifts pose unique challenges and opportunities for the Midwest. Culturally, there is a shift in how Americans view and participate in mobility, because there is less dependence on cars for both financial and environmental reasons. To adapt transportation resources for the future, there is a consistent, fundamental need for effective, accessible options in the way people move.

Generational Trends

Two recent generations, Millennials (born between 1981 and 1996) and Generation Z (born between 1997 and 2013), have entered the job market and impacted the landscape of mobility. These generations face unique challenges, such as the Great Recession of 2008, which left Millennials the most indebted generation. These issues make young adults more reluctant to have children, purchase cars, or own homes than prior generations at comparable ages.

This economically precarious situation has changed the state of housing in the US and consequently, the needs of a transportation system. In 2017, nearly a third of American households were burdened by the cost of housing, meaning that housing costs consumed more than 30% of their household income. A populace with trouble finding affordable housing is more likely to commute further to get to work. In addition, as housing prices continue to rise in the City of Indianapolis, people are incentivized to move further from the central city into exurban communities to secure affordable housing. In recent years, this exurban expansion has directly affected the population growth of the Southwest subregion of the Anderson MPA.

Teenagers are increasingly delaying applying for drivers' licenses, as well as foregoing their application altogether[8]. Younger generations are more likely to favor a car-free lifestyle. During the *inMotion 2050* public engagement process, stakeholders and respondents were chiefly interested in greater pedestrian and bicycle amenities like multi-use trails.

Nationwide Migration Patterns

In the past few years, national trends have shown the fastest population growth in the southern states of Texas, Florida, North Carolina, Georgia, and Virginia. Among the 15 fastest-growing cities in the US, eight were in the South and six were in the West[9]. This geographic range represents the Sun Belt, a region that has steadily grown in population since the 1960s. However, Midwestern cities have not seen the same rates of growth. Columbus, Ohio is the only Midwestern city to rank among the top 15 fastest growing. Within Indiana, the fastest-growing counties are those in or surrounding major cities including Indianapolis, Carmel, Fort Wayne, and Lafayette, which shows that people are increasingly favoring urban areas over rural areas.

Aging Populations

The average population age is expected to increase nationwide. According to 2019 Census population estimates, growth for the past decade peaked in 2014-2015, but it is now decreasing. As fewer children are born, the average age is shifting higher. This is true in Indiana as well, especially since trends point to population increase slowing or stagnating in the Midwest as compared to other regions in the country.

In the coming years, it is expected that the population of the MPA will continue to be older. The growth of grand families or kinship families, in which children are primarily raised by grandparents, creates further need for older adults to be mobile so they can access a variety of resources to support childcare.

In addition, strengthening pedestrian infrastructure and expanding ADA compliance in pedestrian rights-of-way must become a priority to support these aging populations. The American Association of Retired Persons (AARP) recommends that local governments adopt a Complete Streets policy to ensure that considerations are made for pedestrians, bicyclists, and other vulnerable road users in transportation projects[10]. These policies are important for older users, as many older adults will reach a stage in which they can no longer drive, and safe pedestrian access will provide alternative transportation options and support independence.

In addition, improving transit including the City of Anderson Transportation System (CATS) and Transportation for Rural Areas of Madison County (TRAM) can connect those who cannot drive or walk to resources outside their neighborhood. The National Science and Technology Council advocates that transit be made more age-friendly both through the design of infrastructure and route navigation considerations[11]. For example, adopting a real-time bus app can alleviate the confusion of using the CATS system for residents and visitors. CATS system users have cited their unfamiliarity with the schedule as a primary barrier to utilizing transit.

Older adults who drive may also have reduced vision and/or a slower reaction time. To support their mobility, the Federal Highway Administration (FHWA) recommends a set of specific design guidelines known as the *Handbook for Designing Roadways for the Aging Population*. These guidelines identify design alterations that can make roads easier for older adults to use, such as preferred lane widths or increased visibility of striping and signage.

Extreme Weather Events

Average temperatures are expected to rise across the State of Indiana in the coming years. While this may seem like a positive change in some ways, there are many negative implications. In a public heath context, warmer temperatures raise concerns about more extreme heat events and heat-related death. Furthermore, deteriorating local air quality can exacerbate individual health problems. Transportation infrastructure may experience more wear due to increased annual precipitation and higher temperatures, which increases maintenance costs. Finally, as floods become more frequent, it will be important to plan for alternative routes and other safety considerations.

Temperature

Extreme heat events threaten public health because they result in fatalities either due to the heat itself, or due to preexisting conditions worsened by the heat. For example, those who have asthma or allergies may have their health worsened by the increased pollen that accompanies a longer allergy season, and increase in ground-level particulate matter can trigger asthma or heart attacks. In addition to heat, greater rainfall is expected, which may create conditions that promote pathogens and disease vectors like mosquitoes[12]. The immediate health effects of excessive heat and poor air quality are problematic because they could also discourage road users from choosing to walk or bike to their destinations. Reducing car trips is an important part of lowering emissions but deteriorating outdoor conditions could counteract governmental and community efforts to reach this goal.
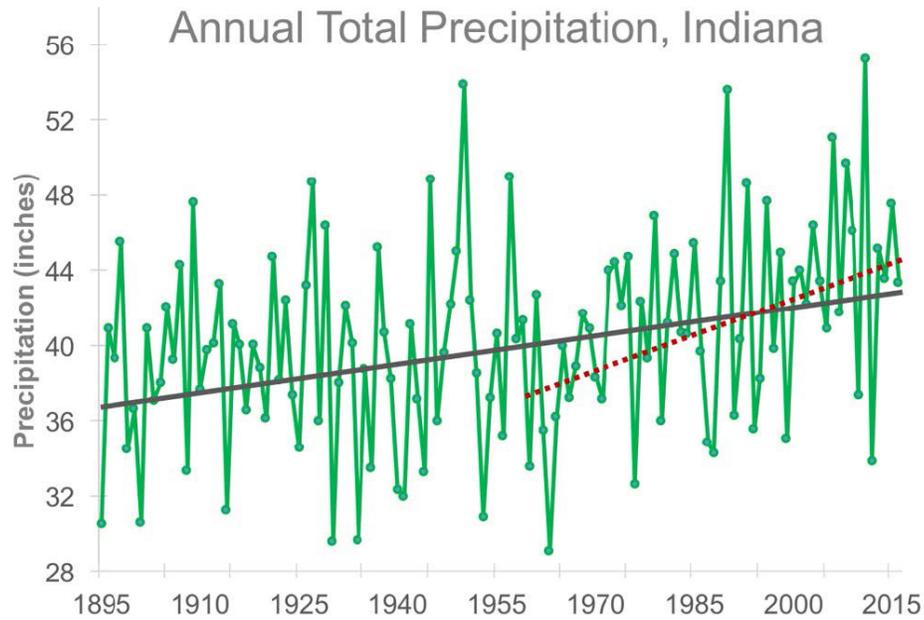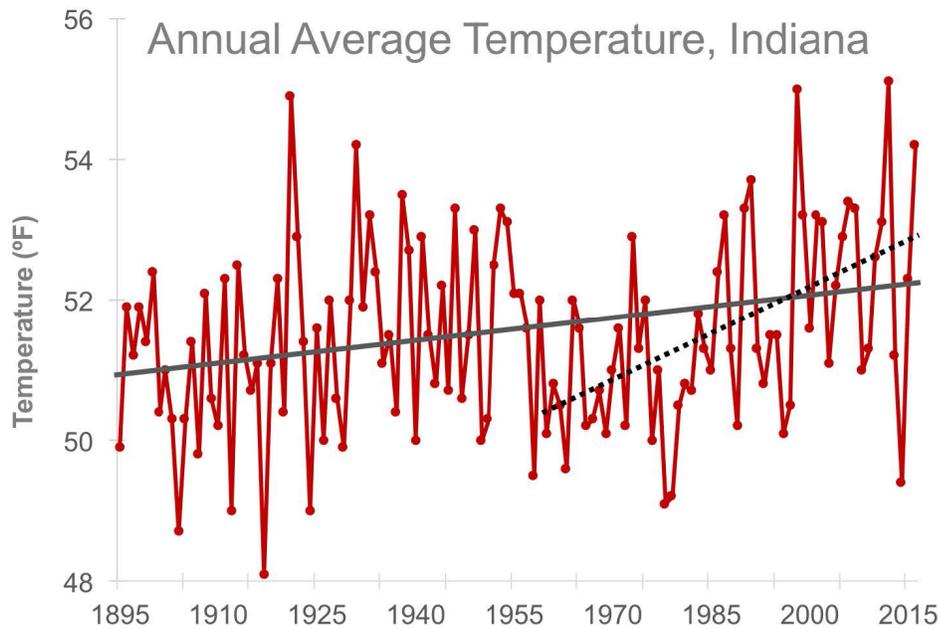
Figure 4.03: Past Rise in Precipitation[13]

Figure 4.04: Past Rise in Temperature[13]

Rainfall

Extreme rainfall and flooding can lead to water contamination due to the combined sewer overflow systems common to the area. Many rural residents rely on wells for drinking water, which can become contaminated during heavy precipitation. Since some communities in the Anderson MPA are located within or directly adjacent to floodplains, this is a primary concern. Average annual precipitation in the state is expected increase by 6-8% by mid-century, with most precipitation expected to occur in winter and spring[13]. Increased rainfall and snowfall lead to more flooding, a risk which should not be ignored. Floods may cut off transportation routes, affecting the mobility of private road users, commercial freight, and first responders. Communities must gauge

their level of risk and plan detour and evacuation routes as appropriate, as well as prepare systems of effective communication so the public receives warnings about local hazards.

Trees & Plants

The role of the urban treescape is not often considered in conversations about walkability, but it may become more important in the future. An extensive urban forest can provide shade and combat the urban heat island effect that renders urban populations most vulnerable to heat events. However, certain tree species may be threatened. Plant populations are expected to shift, and some tree species including those commonly planted in Midwestern urban contexts are expected to die off or migrate out of the region over time due to changes in temperature and precipitation[14]. Urban foresters and park managers should be prepared for this scenario by taking into consideration what amount and in which locations the treescape is most at risk, what steps must be taken to mitigate that risk, and whether alternate tree species should be considered for new plantings.

Infrastructure Maintenance

The possibility of more extreme weather cycles, including increased heat as well as snow and rain indicates that there will be greater wear on infrastructure[15]. Bridge structures are especially sensitive to extreme rainfall. Overloaded streams and rivers can cause erosion, or bridge scour, around piers, which is a common cause of bridge failure. A simple preparatory step that communities can take to address these potential issues is creating an inventory of transportation assets. Communities can decide which corridors are the most critical, the most vulnerable, or in need of protection.

COVID-19 Impacts

From mid-March to August 2020, the State of Indiana was under a stay-at-home order because of COVID-19. During these months, the public was advised to remain at home and avoid contact with others except for performing essential tasks. As a result, many workers began telecommuting and many more were furloughed or lost their jobs altogether.

Travel during this period was greatly reduced because of these limitations and provides a unique opportunity for further study on disruptive trends. A COVID-19 study could provide additional insight and understanding of the transportation system effects from a widespread state of emergency. In this case the disruption was a public health issue but similar reductions in travel might occur in any emergency scenario where people are advised to shelter in place. For example, if people are required to shelter in place because of deteriorating outdoor conditions, their travel might be affected in a similar manner.

In addition to gaining insight for situations where people are advised to shelter in place, COVID-19 travel levels could be used to adjust analysis assumptions for future scenarios with population losses and reductions in commuting due to increased telecommuting. By studying the effects of COVID-19, decision makers could be better informed about conditions in a wide range of scenarios and be further prepared if a similar crisis occurs again.

Summary

Extrapolating past trends can form a basis for what to expect in the future, but the MPA must be prepared for novel disruptions as well. In most cases, the extent of their effects or their exact impacts on the transportation system are uncertain. However, based on current

knowledge, communities should consider some likely outcomes to prepare for those impacts.

For example, the availability and use of autonomous vehicles will likely increase significantly over the next five to ten years. In combination with TNC services, these new technologies may drastically change the future of the transportation system. In the future, the automobile may evolve from being chiefly personal property that sits idle most of the time into a shared, continuously running service, though it remains to be seen whether shared autonomous vehicles can compare with public transit in terms of affordability and access.

As the population's average age increases, more care must be taken to ensure access for older adults. Mobility for all ages can be better supported by investing in trails and pedestrian infrastructure, adopting Complete Streets policies, ensuring ADA compliance, and designing roadways to increase pedestrian safety. Consequently, many of these changes also support a climate that attracts amenities that younger generations prefer.