Policy Brief: Tempe’s 20-Minute City

Gold Team

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**Problem Description & Introduction**

Public transit is essential to creating a more sustainable city and reducing emission outputs from private vehicles. However, studies show that residents might be afraid to reduce private transportation in place of public transit due to either “hot weather, surrounding safety factor[s], inefficient public transport services, and unsatisfactory pedestrian condition[s]” (Nasrudin, 2013). Despite these fears, the City of Tempe desires to step towards a sustainable future by the year 2040 (City of Tempe General Plan, 2013). To realize this vision, the City of Tempe recognizes the importance of public transit. They conclude that to achieve a sustainable community, the city must reduce its traffic congestion and increase residential mobility community (City of Tempe General Plan, 2013). Tempe must decrease its number of individual’s use of private transportation as Rural Road currently services between 35,000-45,000 cars daily (Tempe Department of Transportation, 2016). This equates to at peak times almost 60 cars per lane per mile (Tempe Department of Transportation, 2016). To accomplish this, Tempe is redeveloping its public transportation system to increase its efficiency to entice the public to use public transit systems. The City of Tempe hopes to achieve efficient public transit through expanding public transit to connect northern and southern Phoenix while also implementing bus rapid transit systems.

Currently, Valley Metro is running the busses on fifteen-minute intervals during rush hour and thirty-minute intervals the rest of the day. To investigate the efficiency of the current bus transit system in Tempe, our team conducted surveys and interviewed riders along the bus routes, specifically route 81. Through our surveys and interviews, the 81 bus transit riders strongly voiced the desire to have more buses which fit their needs, better-designed stops, and
overall increased accessibility including more efficient headways and flexible schedules. After collecting this qualitative research from the 81 riders and conducting in-depth research on successful bus transit systems in cities such as Curitiba and New York City, we conclude that for Tempe to realize its vision of a sustainable and 20-minute city, the city must have an increase in ridership, incorporate an efficiently designed and connected transit system, and adopt a more excellent use of zoning and planning policies surrounding development along proposed transit routes.

**Stakeholder Impacts: Background Research**

According to the City of Tempe General Plan 2040, the city is projected to grow by 55,000 new residents by the year 2040 which will add roughly 75,000 new jobs to the downtown area (City of Tempe General Plan, 2013). This will significantly increase Tempe’s urban density and consequently the amount of traffic and congestion which the city currently witnesses. Tempe’s plans to reduce current and projected overcrowding through incorporating bus rapid transit systems rely heavily on extending transit infrastructure deeper into north and south Phoenix. However, this plan has seen stiff resistance from residents, concerns from small-local businesses, and has potential negative impacts on the already surrounding stressed environment. To further understand the steps Tempe needs to implement to realize their vision for a 20-minute city and a sustainable community, it is necessary to analyze bus transit systems’ impacts on residential, business, and environmental wellbeing.
Residents

Greater bus transit connectivity increases residential accessibility to public services and raises property values for homeowners. Studies emphasize that one of the most positive effects of public transit is its ability to provide greater mobility and access to social services for lower-income residents. Further, Haley et al. conclude that “neighborhood characteristics and transportation access shape unmet need for medical care” (Haley et al., 2017). Heley et al. claim that “adequate transportation is fundamental to health care utilization” and that residents “report poorer health when transportation problems impede their ability to reach care” (Haley et al., 2017). Stokenberga strengthens this observation by claiming that “high-quality public transport systems can greatly improve the accessibility of its catchment area by shortening travel time” (Stokenberga, 2014). Furthermore, for property owners, increases in property values is a positive outcome from rapid transit systems. In Beijing, asking prices of residential properties increased by roughly 1.32% and 1.39% depending on their location to an accessible public rapid transit system. Rapid transit systems increase property values indirectly through nurturing transit-oriented development (Deng et al., 2016). Despite these positive impacts on residential wellbeing, other studies emphasize that extended bus transit systems can lead to displacement caused by gentrification along routes. Stokenberga emphasizes that rapid bus transit systems can result in the gentrification of lower-income residents (Stokenberga, 2014). As public transit is extended along low-income neighborhoods in and around Tempe, this phenomenon must be observed to ensure resident wellbeing is not compromised.
In conclusion, rapid transit systems and public transit systems provide benefits and negative externalities for residents along the system’s routes. Concerns such as increasing crime rates and increasing property values for low-income residents are significant drivers as to why residents along the proposed routes might oppose Tempe’s plan for extending public transportation and implementing rapid transit systems.

Environment

Despite bus transit’s positive impact on traffic reduction and fuel consumption, bus transit systems degrade urban sound acoustics and increase noise pollution. Stokenberga observes that a central concern for the public on extending transit systems is an increase in noise and pollution. Although Stokenberga concludes that evidence for such effects is inconclusive (Stokenberga, 2014), Mejia- Dugand emphasizes that rapid transit systems have a positive side effect of improving “environmental conditions” (Mejia- Dugand, 2013). Further research, however, argues that rapid transit systems increase the level of “vibration transmitted to buildings in close proximity” and degrade the acoustics of urban areas (Kassomenos et al., 2016). These studies suggest that although more research is required to understand mass transit effects on noise and pollution, as suggested by Stokenberga and Mejia- Dugand (Stokenberga, 2014; Mejia-Dugand, 2013), Kassamenos et al conclude that “transportation systems need a comprehensive environmental noise and vibration management” to control their activities in urban and residential areas (Kassomenos et al., 2016). For Tempe to realize their vision of a sustainable community, it is necessary that proposed bus transit be designed for the urban environment and wellbeing of residents.
Business

Along with impacting residential and environmental wellbeing, bus rapid transit and increased transit infrastructure have negative and positive impacts for businesses and local economies along proposed corridors. Studies observed that companies are unwilling to invest in public transit over concerns about consistent underperformance. Despite these concerns, it is reported that when business do invest up to $10 million in capital investment for public transportation, there is a yield of “$32 million in increased business sales” (APTA, 2016). The Economic Development Research Group supports this report by claiming that these financial yields come from impacts such as the reduction in travel time, an increases in travel efficiency, an increase in jobs along routes, an overall increase in residential income, and the ease of access residents have to businesses (Economic Development Research Group, 2014). Although investments in extending public transit yield greater economic flourishing along primary corridors and thus lead to neighborhood gentrification, studies emphasize that these highly focused transit systems can cause displacement of residents and local businesses. Stokenberga highlights that Rapid Transit and improved transit increases property values and often can result in the gentrification of lower-income residents (Stokenberga, 2014).

Extending bus system can positively and negatively impact businesses along primary transit corridors. To achieve a sustainable community, it is essential that Tempe recognize these impacts and plan accordingly to maximize economic health and mitigate results such as displacement through gentrification.
Conclusion

In conclusion, bus system extension and bus rapid transit systems have lasting impacts on residential wellbeing, the environment, and economic health. Although Tempe desires to create a sustainable community through extending connectivity in the current bus system and by implementing a bus rapid transit system, research emphasizes the high levels of complexity between the built environment, transit infrastructure, and public who these systems are intended. To ensure residential, environmental, and economic wellbeing and overall urban sustainability, Tempe must look at its current bus riders and look towards examples of successful bus systems when planning the policies and actions surrounding extending bus infrastructure.

Riding the 81: Interviews & Personal Experiences

Our team interviewed roughly 75 commuters along the 81 bus route to accurately analyze Tempe’s current bus system and to magnify the changes current riders desire. The focus of the project was on current transit users on the 81; however, our team also conducted interviews which included residents who never or rarely use the system. Through this process, our team gained a complete understanding of the aspects which shape Tempe’s bus transit infrastructure. We conducted interviews by personally dedicating time to ride the full length of the 81 bus route from Chandler Fashion Square up to Shea Boulevard in Scottsdale. The majority of the interviews were taken in the mid-afternoon/evening time frame. Because of time restraints and
trouble scheduling, we recognize that a flaw in this study is that interviews were only taken in the second half of the day.

Surveys

Surveys contained a few central questions with yes/no answers and also a few short answers to gain an understanding of riders’ opinion about the system and for them to suggest improvements. The main age range of bus riders was above 30, and the majority of passengers were using the bus to commute to work or about once or twice per week for non-essential activities. One main takeaway from speaking with riders was the average time that they wait for connecting buses. Most people our team surveyed waited, on average, about 20 minutes for the bus. We also received responses that indicate some riders inconsistently wait from 5 minutes to over an hour for their bus to arrive.

We found an overwhelming majority of riders walking to and from bus stops. In combination to the average wait time variety, stops and headway times can be very harmful to residential wellbeing, especially in Arizona’s summer months. With the open-ended short answer questions on the survey, we asked what the main thing about the bus system they would like to see change. The most popular answer was ‘bus stops.’ Supported by our team’s personal observations, we concluded that many stops along the 81 line are unsuitable for Arizona’s weather patterns with little to no seating, bike parking, information about the buses and their schedules. Furthermore, we noticed that the absence of pull-aways for buses greatly hindered
their headways. These overall observations indicate that Tempe’s current bus stops are not conducive to the communities they serve.

**Personal Experiences**

While riding the bus for this project, there were a few encounters that became uncomfortable to our team relatively quickly. Before our team personally rode the 81 bus line, we asked residents who do not ride the bus to detail reasons why they do not ride the bus. The most common answers were: perceptions of demographics who make up the current majority of riders and lack of convenience. When our team rode the 81 bus line, we found that the buses are well maintained, clean and have a pleasant, cool temperature. One drawback we noticed was the method of buying tickets. We realized that there is a $2 upcharge for purchasing a ticket on the bus rather than somewhere else and ticket kiosk locations were inconspicuous along the 81 route. However, after further research, tickets could be purchased from a gas station or at light rail stations. The other aspect of the bus that makes it less than convenient than private transportation is the frequency of buses. By getting off the bus at different stops and waiting for the next one (the next bus that showed up, not necessarily an 81 bus) it can take a long range of times for a bus to get there. At some stops, there is a note card that lists a number to text to find out what time the next bus is scheduled to arrive. However, these numbers did not always work or they were not accurate to the real-time the bus would show up. These factors make it difficult to depend on the bus when it is necessary to arrive at work or appointments at a specific time.
During our team’s experience on the 81 bus, there were instances of inappropriate and invasive behaviors from other passengers. These instances made it difficult to respond and understand our level of safety on the bus and at the stops. Many interviewees highlighted frequent accounts of witnessing or experiencing harassment of different kinds throughout their time riding the bus as well. For these reasons, being a young female, in particular, makes it more intimidating to depend on the bus for transportation day to day.

**Interview Takeaways**

In conclusion, through our collected measurements of public opinion and personal interactions with the 81 route, our team developed conclusions on the buses efficiency and were able to magnify the voice of the riders. One of the first things that we noticed is that riders who routinely rode two or more routes in their daily transportation were frustrated by the wait times between transfers. Many riders felt like the bus system is inconvenient and significantly hinders their transportation because they would have to wait long times to catch the other busses they needed. Another prevalent feeling that was expressed by many riders was that there was not access to real-time data for effective transportation planning. Passengers did not know about an application they could use to track buses and felt like this contributed to their long wait times. Greater education could be put forward by the city about current options for monitoring busses as many residents did not seem aware of the Ridekick app.

Residents also had ideas for how to make more structural changes to the bus to improve the speed and convenience of using the transit system. Many residents expressed concern about the time busses spent at each stop and the state of those stops. Riders felt like the bus took too
long getting into and out of bus stops in part because of disabled people getting on the bus but also because the flow of traffic meant buses had to wait long times to rejoin the flow of traffic. Residents also expressed opinions that the bus stops themselves were not safe or clean, and many female riders said they had been harassed or felt unsafe at a bus stop. Passengers desired to see improvements to these two structural aspects of the bus routes by either having a bus-only lane or better disability boarding.

Riders passionately expressed concerns with coordination and efficiency as opposed to the ineffective running of the current system. In conclusion, through these interviews, our team was able to deduce that Tempe must implement a method to listen to current rider’s needs and improve the current system while designing extensions to increase the connectivity between surrounding cities. To achieve a sustainable 20-minute city through expanded bus infrastructure, it is also necessary to look at successfully implemented bus transit infrastructure.

Case Studies: Curitiba, Brazil & New York City, U.S.A.

To better understand how to successfully incorporate Bus Rapid Transit and improve transit efficiency in Tempe, it is necessary to analyze cities the cities in which these systems flourish. Two example of cities which accomplished this successfully are Curitiba, Brazil and New York City, in the United States.

Case study 1: Curitiba, Brazil

Curitiba, a population of around 1.8 million inhabitants, is one of the largest cities in Brazil and Latin America. Unlike Tempe, the dense metropolitan population has increased 9.3
times over the last 50 years. Along with a growth in population, Curitiba experienced rapid growth in private transportation and individual vehicles. The city became known as one of the largest urban areas in Brazil to have the highest car ownership rates. To respond to this, Curitiba became one of the most important examples of a well-integrated transportation system and sustainable development (Lindao et al., 2010). Curitiba is currently known as the cradle of the Bus Rapid Transit concept and its approach to transit and development became key to realizing this concept for other cities within Brazil and internationally. Critical elements in Curitiba’s Bus Rapid Transit system are free services for the elderly, children, disabled, and public service workers, cheap off-board fares, raised boarding platforms, bus-only center lanes, centralized traffic lights, unlimited transfers, and direct access to public services such as hospitals and community centers (Lindao et al., 2010). Due to this implemented system, Curitiba has seen an increase of over 70% commuter ridership from when it was first implemented in and currently has roughly 90-second headways between stops. However, zoning, transit district overlays, private-to-public business partnerships, and connectivity between other webs of transit are identified to be the supporting infrastructure which helped residents and businesses flourish along the BRT corridors (Lindao et. al, 2010). Despite the increased accessibility, this system provided the city of Curitiba, mobility is still an issue for the city. To combat this issue, the city has included over 400K miles of protected bikeways to complement and better interconnect their current bus transit systems (Reed, 2015).

Case Study 2: New York City, U.S.A.
The city of New York recently made some significant changes to the physical infrastructure of its bus lanes that had direct application to plans for Tempe. Like Curitiba, the City of New York added bus lanes to the right side of each direction of traffic, designating the current lane for bus-only traffic. The city also coordinated with the management of traffic lights and signals to ensure that busses spend the minimum amount of time necessary at red lights and standing still time at intersections. These overall changes led to a 12% increase in ridership and a 19% reduction in travel time. The improved system also included increased street space for bicycles, gave pedestrians greater access to the sidewalk and other pedestrian realms, and further allowed the city to create pedestrian safe islands (New York City Department of Transportation). However, one major deterring issue with New York’s improved bus systems is that the bus lanes are located to the far right of the roads. This means that right turning cars in both directions still use the lane resulting in driver confusion and decreases in headway times (Young, 2013). Although this infrastructure design slows down headways, the city also has successfully reduced wait times at bus stops by creating an off-bus fare system and purchasing buses with three doors allowing for people to enter and exit faster (New York City Department of Transportation). New York executed these changes without significant investments in center bus lanes or designing the system. This large U.S. city displays that substantial changes in bus transit can occur through minor reforms.

**Case Studies’ Main Takeaways**

Both Curitiba and New York offer solutions that could be applied to Tempe’s public transportation system. Curitiba, a more developed and involved rapid transit system, offers a
city-wide view at public development. Following in the footsteps of Curitiba, if the City of Tempe makes major infrastructure upgrades to the bus system, the city should integrate these upgrades while planning for high-density zoning, ensuring high mobility between public service destinations city nodes, and emphasize policies which keep housing equitable along the bus rapid transit routes. In comparison to Curitiba’s system, New York City provides a more fundamental lesson in bus transit improvement planning. While Curitiba’s highly developed system of raised platform boarding, 90-second headways, and dozens of unique routes may be cost ineffective and cumbersome for Tempe to integrate, the City of New York displays a rapid transit system in which the bus infrastructure could be more easily transferred to Tempe. New York’s bus-only lanes, and off-bus boarding system could allow Tempe to reduce one of the largest complaints residents have in the current bus route. While conducting the 81 bus interviews, riders complained about lack of connectivity and inefficient bus travel times. While looking at New York’s bus transit system improvements, these reforms could reduce wait times at bus stops and allow the busses to run more seamlessly. In the end, this would increase the coordination riders would have between other transit and routes.

In conclusion, our team noticed several potential strategies Tempe could implement from observing bus transit systems in cities like Curitiba and New York. We cross-analyzed the data we received from surveying and interviewing riders along Tempe’s 81 line, the background research we conducted on stakeholder impacts, and the information we collected from these two transit case studies and came to the conclusion that Tempe must have a flexible approach to designing a transit system to nurture a sustainable community. From interviewing riders along the 81, many residents expressed concerns surrounding headway times, accessibility for disabled
passengers, and issues with transit connectivity and coordination. Curitiba and New York provide examples of how to implement a system which addresses these concerns. For example, both cities integrate the city’s traffic signal management into the bus routes, which allow the busses to coordinate better how routes intersect (Lindao et al., 2010; New York City Department of Transportation). This characteristic also provides riders with more effective transferring options between other forms of transit, decreases headways, and reduces wait times at uncomfortable stops. Both cities, through transportation and stop design, also have increased accessibility for the elderly and disabled through the use of raised platforms, off-board fare payment methods, and more pedestrian friendly stops (Lindao et al., 2010; New York City Department of Transportation). Through observing these two case studies’ key bus transit features, Tempe can move towards their vision of a 20-minute city and an equitable, sustainable community.

**Concluding Recommendations: Tempe Moving Forward**

As stated in the City of Tempe 2040 plan, the city desires to nurture a more sustainable community through primarily implementing and designing more efficient public transit infrastructure. The city is currently working on realizing this vision through the idea of a 20-minute city (City of Tempe General Plan, 2013). This idea requires that transportation in Tempe’s urban area and surrounding City of Chandler and Scottsdale are connected in a seamless and coordinated design. Given the urban densities and the proximity of these three cities within the Metropolitan Phoenix area, an efficient public transit system is imperative to connect the rapidly growing communities, increase the accessibility of public services, and
strengthen their local economies. To move Tempe forward to realize its vision of a sustainable community and a 20-minute city, our team recommends that the city first re-analyze and improve its current bus transit system to meet the needs of the riders they service. Secondly, our team suggests that Tempe embrace complete streets as incorporated in Curitiba’s design and increases the busses connectivity to other forms of transit such as the light rail. Lastly, through our experiences interviewing riders of the 81 line, our team recommends that Tempe includes more mechanisms for riders to voice their opinions and visions for their transit experiences. Such mechanisms, like a bus riders union, would ensure residential and ridership equity and wellbeing are properly represented in planning for current and future infrastructure improvements.

**Improving the Current Bus Transit System**

Our team recommends that the city first re-analyze and improve its current bus transit system to meet the needs of the riders they service. Firstly, many riders expressed concerns over poorly designed stops and buses complaining that stops did not provide adequate safety, coverage from weather, or enough information on the routes. To ensure that riders’ needs are met, we recommend designing stops to increase public wellbeing and equitable access. By observing Curitiba, increased equitable accessibility can by raising the boarding platforms and offering more services to disabled and elderly riders (Lindao et al., 2010). Furthermore, the addition of pedestrian level illumination and other design, as seen in New York, could alleviate these concerns (New York City Department of Transportation). Lastly, to increase information about the bus routes, more on-bus advertisements about transit tracking apps should be utilized. Currently, Tempe’s routes can be monitored through the Ridekick app. However, from
interviewing riders on the 81 bus route, our team concluded that knowledge and advertisement of this feature are inadequate as the majority of passengers were unaware of its existence.

Secondly, the majority of riders expressed dissatisfaction over Tempe’s public transit connectivity and coordination and reported instances of long headway times. One option to reduce headway times is to implement lanes that are solely dedicated to city buses within the Valley Metro Transit System. The buses currently share the same roads as drivers and contribute to the high congestion on major roads and highways. As portrayed through the case study examples of Curitiba and New York City, a dedicated bus lane would dramatically increase time efficiency and reliability (Lindao et al., 2010; New York City Department of Transportation). Although dedicated bus lanes would constrict street width, they would increase public transit efficiency and entice individuals to change their mode of transportation preferences. Increases in ridership numbers in both Curitiba and New York City support this claim. Both cities saw a dramatic increase in ridership number once dedicated bus lanes were implemented into the urban infrastructure (Lindao et al, 2010; New York City Department of Transportation). Furthermore, increased transit connectivity and density zoning would support this behavioral change and help Tempe realize its vision of a 20-minute sustainable city.

**Improvements for Connectivity: Complete Streets and Metro Light Rail**

Our team recommends Tempe increase transit connectivity through adopting complete street infrastructure design and high-density zoning along transit corridors. Although our focus was on the 81 bus route along Tempe, our team recognizes the Metro Light Rail as one of Valley Metro’s most valuable public transportation assets. However, the light rail provides limited
accessibility for many communities around Tempe. Surrounding residents from Chandler and Scottsdale connect to the light rail through bus or driving. However, in our interviews, many riders on the 81 line reported that bus stops and times do not coordinate well with the light rail schedule. Passengers said that they had a difficult time reaching their destination because they missed the transfer between bus and light rail. The Metro Light Rail has the potential to drastically improve efficiency within the current system. To improve Tempe’s current transit connectivity, the city must adopt the use of complete street design and zone for high density as displayed in Curitiba (Lindao et al., 2010). High-density zoning would further increase the Tempe’s walkability and reduce travel times and distance as observed in Curitiba (Lindao et al., 2010). Through implementing more bike lanes, extending the light rail, increasing bus routes, and improving the pedestrians’ sidewalk space, Tempe can enhance the coordination and achieve a more seamless public transportation system.

**Bus Riders Unions**

Lastly, one key recommendation to help transition Tempe to a 20-minute sustainable city is to include more participation of public transit riders. When conducting our interviews on the 81, our team asked the passengers; “What would you tell Tempe’s planning commission about the 81 bus?”. To our surprise, riders became even more excited to talk about their experiences on the bus. This simple question made our team realize the importance of rider engagement in planning public sustainable transportation systems. Many riders expressed they felt their needs were not met and the city was not hearing their voices. Our team and the other Tempe transportation teams recommend the riders of Phoenix’s transportation to create a
mechanism for their voices to be heard. One option our team suggests is for Phoenix bus riders to develop a Bus Riders Union. Through a union, communication to the city can be made more effective and increase overall transit ridership. In Los Angeles, a bus riders union was first created in 1994 and since then, saved public transportation within city limits. Through their solidarity Bus Rider Union, the L.A. bus system has witnessed an increase in ridership by 12% and roughly a 64% increase in student ridership, saved monthly pass elimination, has created over 800 jobs in the public sector, and has lead to one of the largest clean fuel fleet in the country (Bus Riders Union, 2017). The L.A. Bus Union is an example of how Tempe can achieve a more sustainable community through engaging the public, listening to the riders, and increasing transit ridership. Through fostering an environment where a union of passionate and consistent bus riders can comfortably unite and be proud of their city, Tempe can improve its overall bus transit ridership and ensure equitable access to their vision of a 20-minute city.
References


