PRICE ROAD FLEXIBLE TRANSIT STUDY

Final Study Report

NOVEMBER 2021

VALLEY METRO

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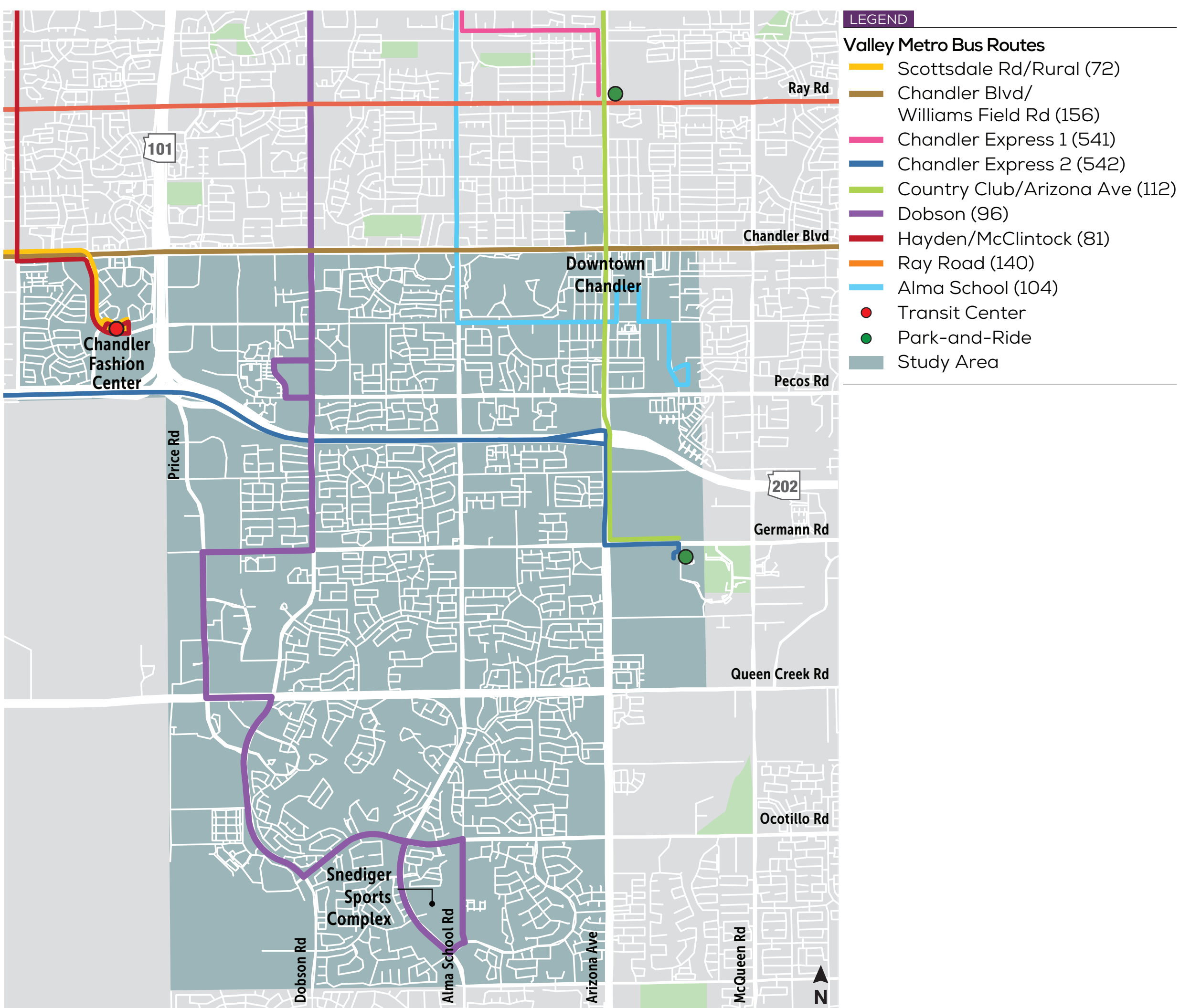
SECTION 1

CHANDLER FLEXIBLE TRANSIT STUDY: EXISTING CONDITIONS TECHNICAL ANALYSIS

To better serve those who live and work in the City of Chandler's Price Road corridor with public transportation, this study will analyze the area's existing land use, demography and transit service. This analysis will form the foundation of recommendations for flexible transit options, such as microtransit or flexible bus routes. These services would complement the fixed route network and cost effectively expand service offerings into low-density residential suburbs and office parks with reasonable productivity and a high level of convenience.

To better understand the people and places of the roughly 18 square mile study area (outlined in Figure 1), it is important to review the city zoning, census, employer and other data available. These sources will reveal the distributions of populations, the makeup of the built environment, trip generating hotspots, valuable linkages, etc.

Figure 1. Chandler Flexible Transit Study Area



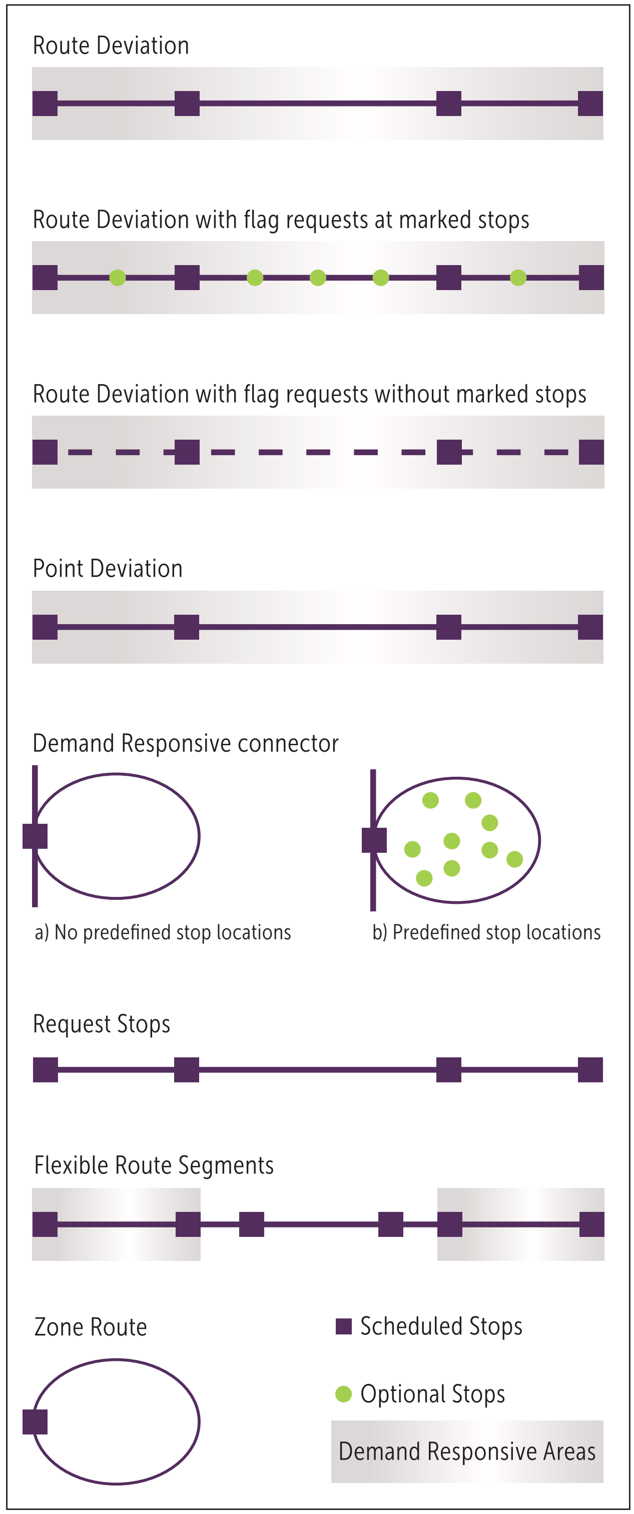
POTENTIAL ALTERNATIVE SERVICE DELIVERY MODELS

Figure 2 demonstrates there are many variations of flexible transit. They operate along a rough spectrum ranging from a simple flex route, where a fixed route offers on-demand deviations, all the way to microtransit with open zone curb or corner service without scheduled stops. Intermediate variations include point deviation service where scheduled timepoints are serviced regularly, though no defined route connects them. Also, part of a fixed route can offer flexible service within a set distance of the alignment, though this may have negative impacts for the fixed portion's on-time performance.

Common features of most current flexible transit services are on-demand routing, fixed fares on par with local bus fares and smartphone apps for hailing, navigation, real-time tracking and payment. These services offer conveniences like a minimal walk time to pickup locations, short waits with real-time vehicle tracking, in app fare pay and more direct routing to a destination. These services are intended to supplement a larger regional fixed transit system by filling in areas of a city where travel demand is high but less dense development and dispersed populations make traditional transit relatively unproductive. They have also been used to syphon off dial-a-ride demand as flexible transit tends to be a more cost-effective service and provides comparable convenience and accessibility that can accommodate most ADA individuals.

The different facets analyzed here will focus broadly on local characteristics related to ridership propensity, and how certain aspects of the built environment pose challenges to fixed route services that flexible transit options solve. This will demonstrate whether flexible transit services would be a good fit in the study area, and if so what areas and service models merit further service planning.

Figure 2. Main Variations of Flexible Transit

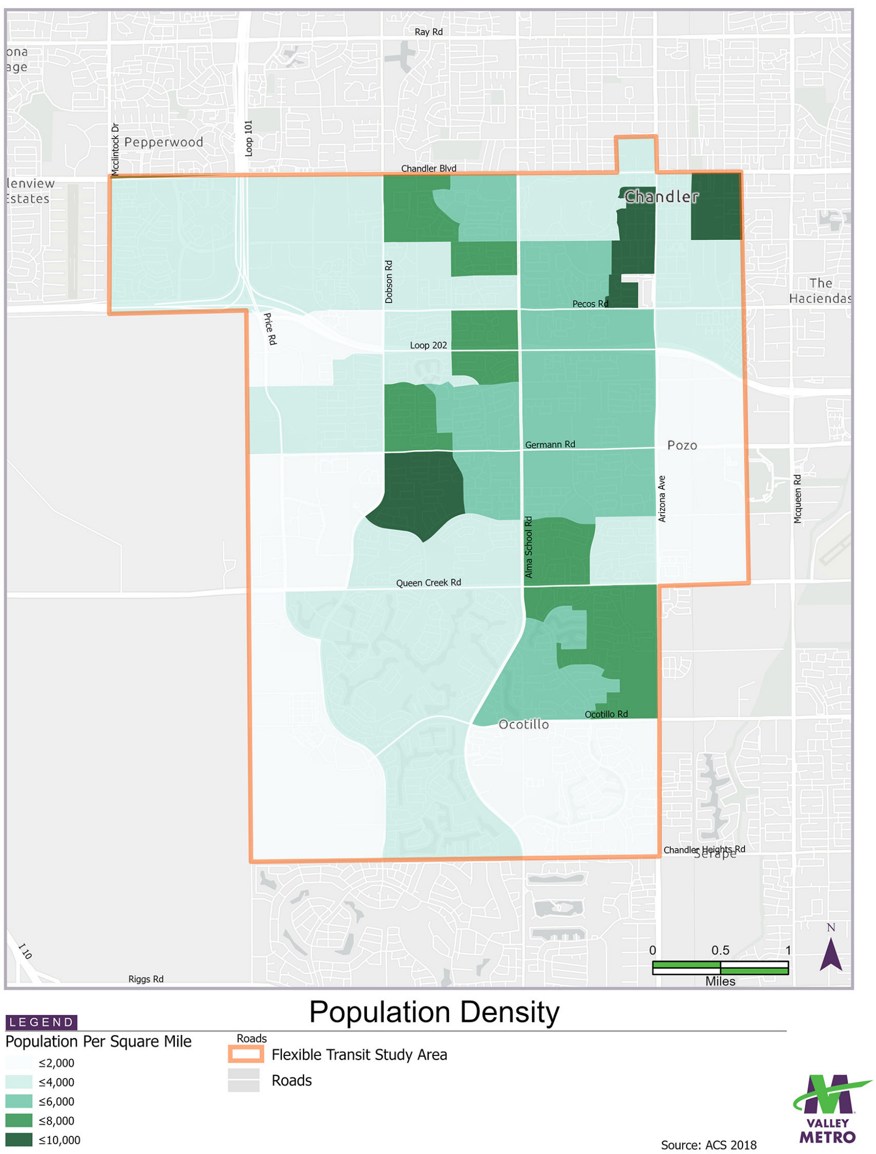


DEMOGRAPHIC & LAND USE ANALYSIS

Population Density

Traditionally, the more densely populated an area is, the better suited it is for transit service. However, with flexible transit, clusters of moderately dense populations can enjoy transit access with reasonable walk distances and vehicle tracking that reduces excess wait time. Figure 3 shows population densities in the study area peak at about 8,000-10,000 people per square mile around downtown Chandler and southeast of the Dobson Road/Germann Road intersection. Moderate population density between Arizona Avenue and Dobson Road stretch north and south through nearly the entire study area. While this stretch may not support productive fixed route service, it does show potential for productive flexible service. Residential populations along the western and southern edge of the study area by contrast may result in low ridership demand relative to demand seen in downtown Chandler and along Chandler Boulevard.

Figure 3. Population Density



Land Use

The key destinations of the study area are shown in Figure 4. A cluster of city buildings around downtown include the library, community center, city office buildings, City Hall and the Chandler Center for the Arts. Intel, PayPal, Walgreens and Wells Fargo campuses sit along the western edge, representing the largest of many office buildings in this stretch. Chandler Fashion Center and Tumbleweed Park are popular public destinations that also function as transit hubs.

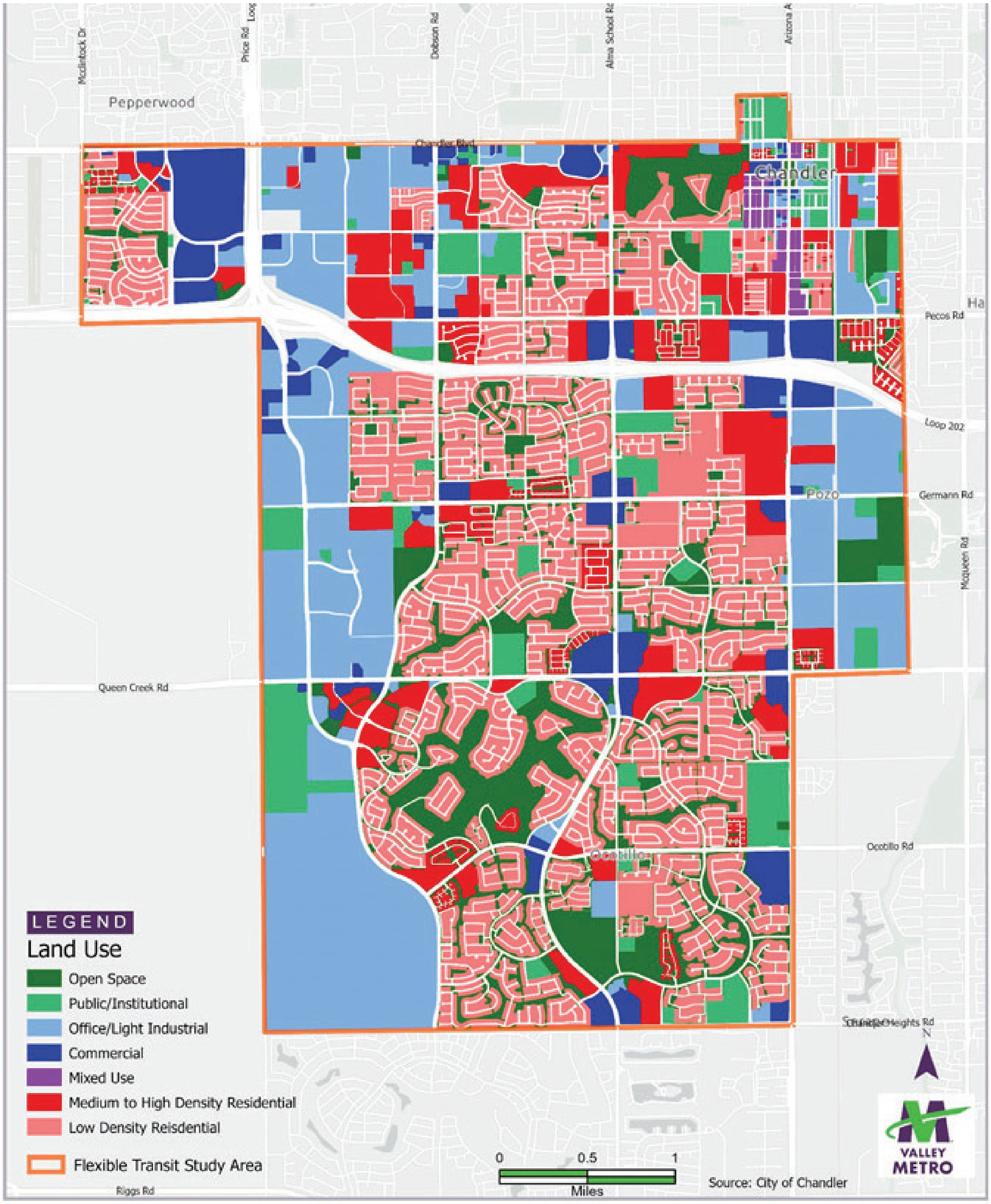
Figure 5 shows that single family residential land use makes up much of the study area and is concentrated largely between Arizona Avenue and Dobson Road. Office and light industrial uses are the second most common land use and frame the residential corridor on either side, concentrated mainly between Dobson Road and Price Road. However, as Table 1 shows most of the building square footage is under commercial use, indicating robust, concentrated commercial centers. Also, comparing the high proportion of residential land cover and the low proportion of residential building square footage indicates relatively low-density residential development and underscores the importance of serving commuters and consumers as well as residents. Notably, the main land uses of office parks and single-family housing typically have auto-oriented networking that produce long walks to major corridors. Flexible transit options like microtransit are better suited to serve these networks than traditional fixed routes, offering significantly reduced walks to pickup locations and shorter wait times as well.

Figure 4. Key Study Area Destinations

Table 1. Study Area Building Square Foot Totals by Land Use Type

LAND USE TYPE	BUILDING SQ. FT.	% AREA
Residential	1,158,320	4.9%
Commercial	12,234,648	51.5%
Industrial	6,028,854	25.4%
Agricultural	8,545	0.0%
Institutional	2,287,644	9.6%
Government	2,059,646	8.7%
Total	**23,777,657**	**100%**

Figure 5. Study Area Land Use



Employment

Available employment data shows that the study area hosts twice as many employees as residents with more than 60,000 employees working in the area. Table 2 shows the breakdown of how many residents work in the study area, how many work outside, and how many employees commute in. These figures come from the latest available LEHD (Longitudinal Employer-Household Dynamics) commuting data which combines federal, state and Census Bureau data on employers and employees. The high proportion of those commuting in and out emphasizes the need to establish services with connectivity to many transit lines to optimize the number of trips to outlying areas.

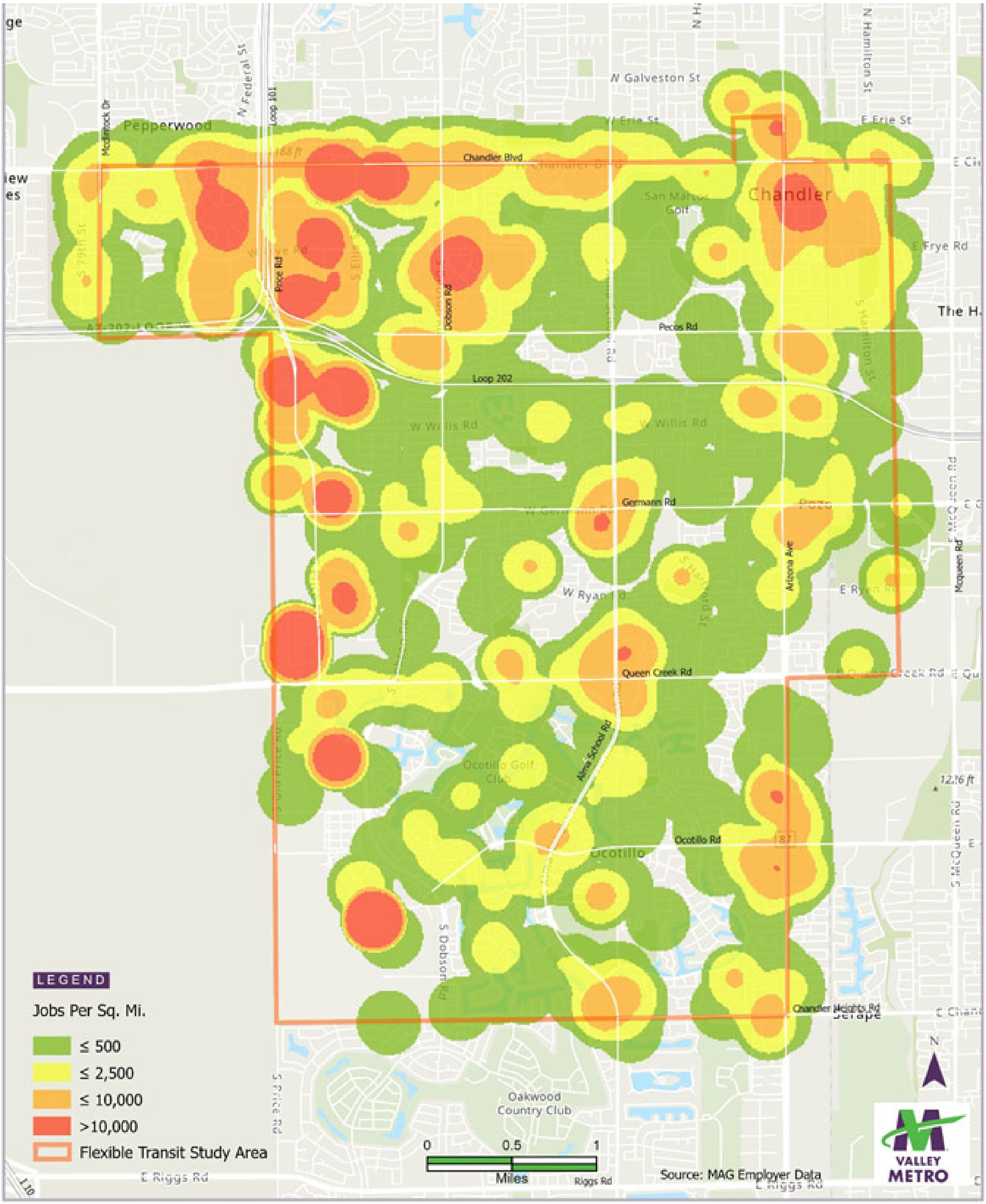
The employment within the study area is concentrated mostly along the western side of Price Road (shown in Figure 6). Key employers include Intel, Wells Fargo, PayPal and Chandler Fashion Center. Other notable hotspots include the Regional Medical Center and Downtown Chandler. Overall, employment in the center of the study area is relatively low, as expected in a residential zone, but is also punctuated with areas of moderate commercial employment along Alma School Road.

Comparing this employment distribution with the previous land use map shows employment in the area primarily occurs in office parks. These concentrations produce promising travel flows that could fuel productive transit service even with a very small percentage of overall travelers. While office parks present many obstacles to fixed route transit service, like private access agreements, tight turning radii and long walks to centralized stops, flexible transit could effectively serve these travelers while avoiding such concerns.

Table 2. LEHD Commuter Statistics

STUDY AREA COMMUTE FLOW STATISTICS		
Residential and Employment Population	**COUNT**	**SHARE**
Employed in the Study Area	60,453	100.0%
Living in the Study Area	30,973	51.2%
Net Job Inflow (+)	29,480	-
Study Area Residents	**COUNT**	**SHARE**
Living in the Study Area	30,973	100.0%
Living and Employed in the Study Area	5,338	17.2%
Living in the Study Area but Employed Outside	25,635	82.8%
Study Area Employees	**COUNT**	**SHARE**
Employed in the Study Area	60,453	100.0%
Employed and Living in the Study Area	5,338	8.8%
Employed in the Study Area but Living Outside	55,115	91.2%

Figure 6. Employment Density



Equity

To ensure equity in potential new service offerings, data on minority and low-income populations was analyzed to reveal the proportion and distribution of these populations in the study area. Figure 7 shows the highest concentration of minority populations are around downtown Chandler, with other majority minority populations residing in areas north of Queen Creek Road to the west and east of the study area.

Figure 8 shows that the low-income population proportions are relatively low in the area as most neighborhoods have less than 20% of households classified as such. However, notable concentrations between Pecos Road and Chandler Boulevard form a block stretching across the top of the study area. Comparing these maps shows the area south of Chandler Boulevard, and between Arizona Avenue and Alma school Road both have relatively high populations of minorities and low- income individuals. Including these areas in future flexible transit zones will ensure these key populations receive the benefit of these new investments as well.

Figure 7. Minority Population Distribution

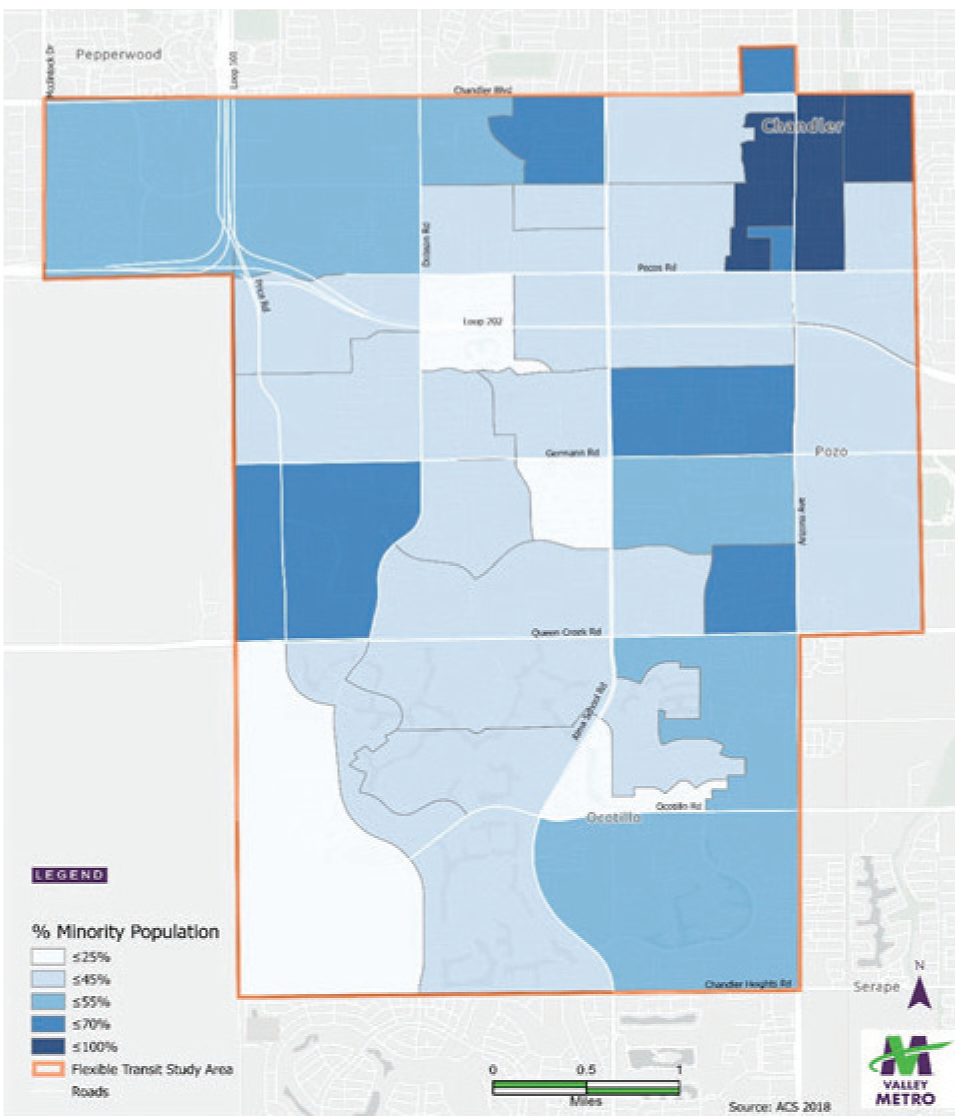
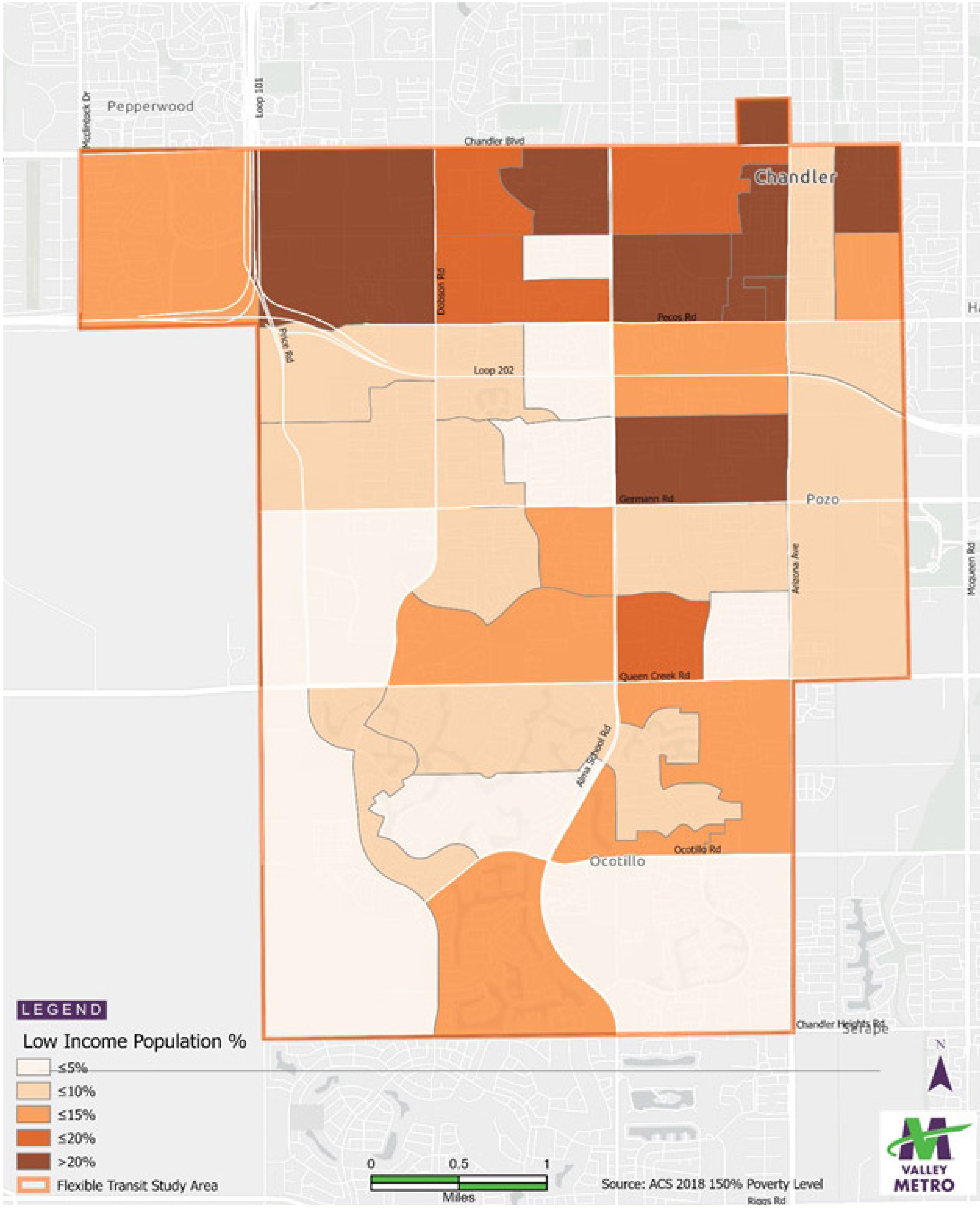


Figure 8. Low Income Population Distribution



TRANSIT SERVICE ANALYSIS

Current Transit Operating Characteristics

Several regional bus routes operate within the study area. Overall, there are six local bus routes and one commuter express route. Table 3 shows the general operating characteristics of these routes specifically within the study area. Many of the local routes operate at 30-minute frequency on and off peak and have stop spacing of roughly a quarter mile on average. Table 4 shows the mileage by day type associated with each route. Most routes offer Saturday or 7-day service in the area. The total annual operating cost for the services provided in this area total over $2.8 million.

Table 3. Transit Service Characteristics within the Study Area

ROUTE	ROUND TRIP LENGTH (MILES)	PEAK HEADWAY (MIN)	OFF PEAK HEADWAY (MIN)	AVERAGE SPEED (MPH)	STOPS SERVED	AVG. STOP SPACING (FT)
72-Scottsdale Rd/Rural Rd	2.5	20	30	20.1	7	1,678
81-McClintock Dr/Hayden Rd	2.7	30	30	19.1	7	1,710
96-Dobson Rd	15.2	30	30	20.2	48	1,619
104-Alma School Rd	6.0	30	30	16.5	18	1,674
112-Arizona Ave/Country Club Rd	6.2	15	30	14.0	18	1,638
156-Chandler Blvd/Williams Field Rd	9.4	30	30	14.0	34	1,496
542-Chandler Express	11.0	8 Trips	N/A	25.5	1	N/A
Total	**53.1**	**N/A**	**N/A**	**16.9**	**134**	**1,636**

Table 4. Transit Mileage and Cost within the Study Area

ROUTE	WEEKDAY REVENUE SERVICE MILES	SATURDAY REVENUE SERVICE MILES	SUNDAY REVENUE SERVICE MILES	GROSS FY20 ANNUAL OPERATING COST	PERCENT OF ROUTE LENGTH
72-Scottsdale Rd/Rural Rd	120.6	80.4	60.8	$260,000	4.1%
81-McClintock Dr/Hayden Rd	79.1	36.7	0.0	$149,000	4.4%
96-Dobson Rd	291.3	64.2	0.0	$524,000	27.3%
104-Alma School Rd	184.3	0.0	0.0	$317,000	23.0%
112-Arizona Ave/Country Club Rd	375.5	198.0	162.0	$779,000	25.1%
156-Chandler Blvd/Williams Field Rd	311.7	269.7	226.3	$720,000	21.8%
542-Chandler Express	88.0	0.0	0.0	$151,000	19.9%
Total	**1406.6**	**649.0**	**449.1**	**$2,825,000**	**14.4%**

Source: GTFS/ Valley Metro

Transit Ridership

Currently, the highest ridership routes in the area are Route 156-Chandler Boulevard and Route 112-Arizona Avenue which provide more trips than the rest of the routes combined. Figure 9 shows the alignments of the transit routes in the study area as well as the ridership concentrations in and around the study area associated with these routes. High activity areas include Chandler Boulevard intersections at Alma School Road and Dobson Road, the park-and-ride at Tumbleweed Park and the transit center at Chandler Fashion Center. Notably, the Route 96 along Dobson Road operates only during weekday peak periods which partially accounts for its relatively lower performance.

Figure 9. Transit Routes and Ridership

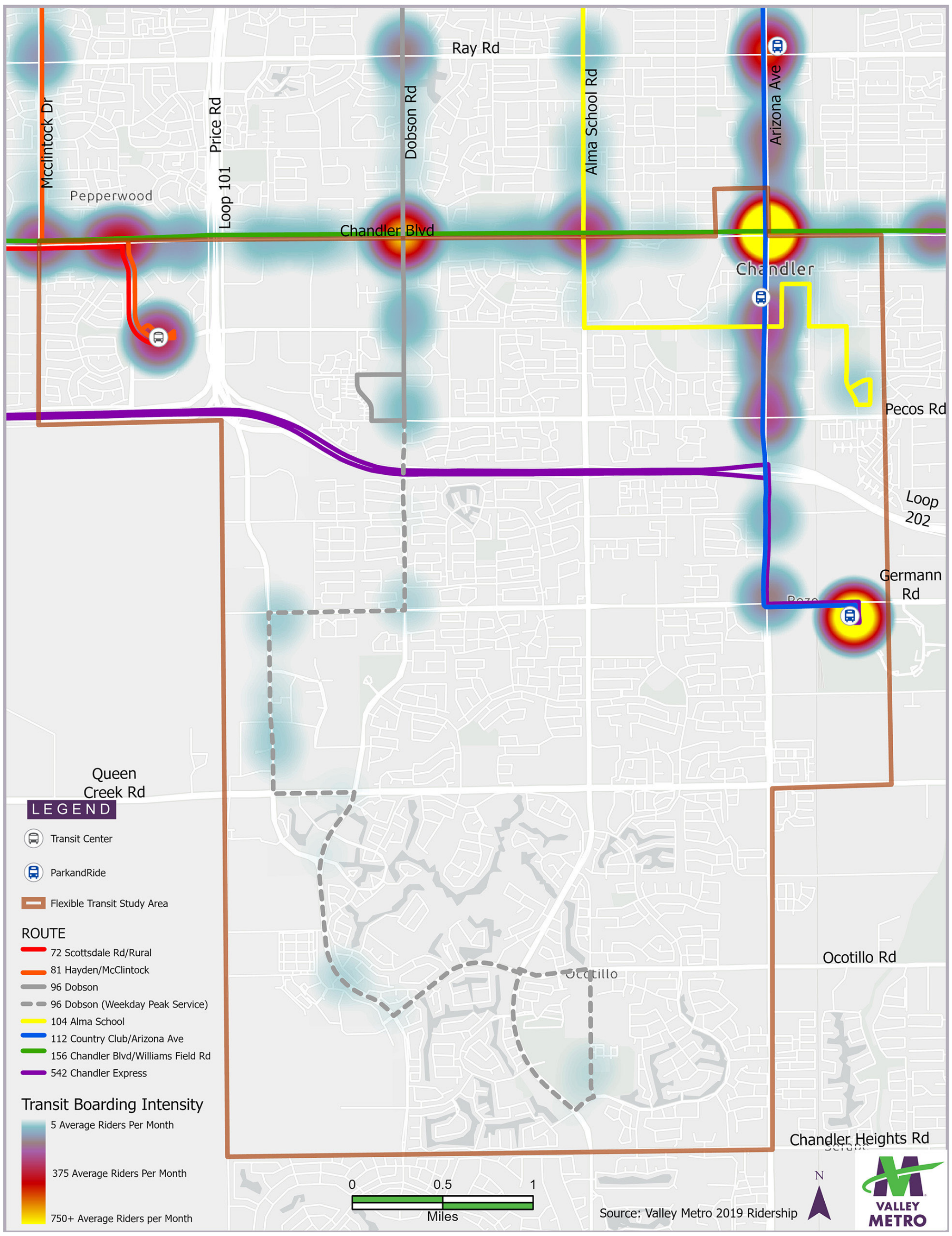
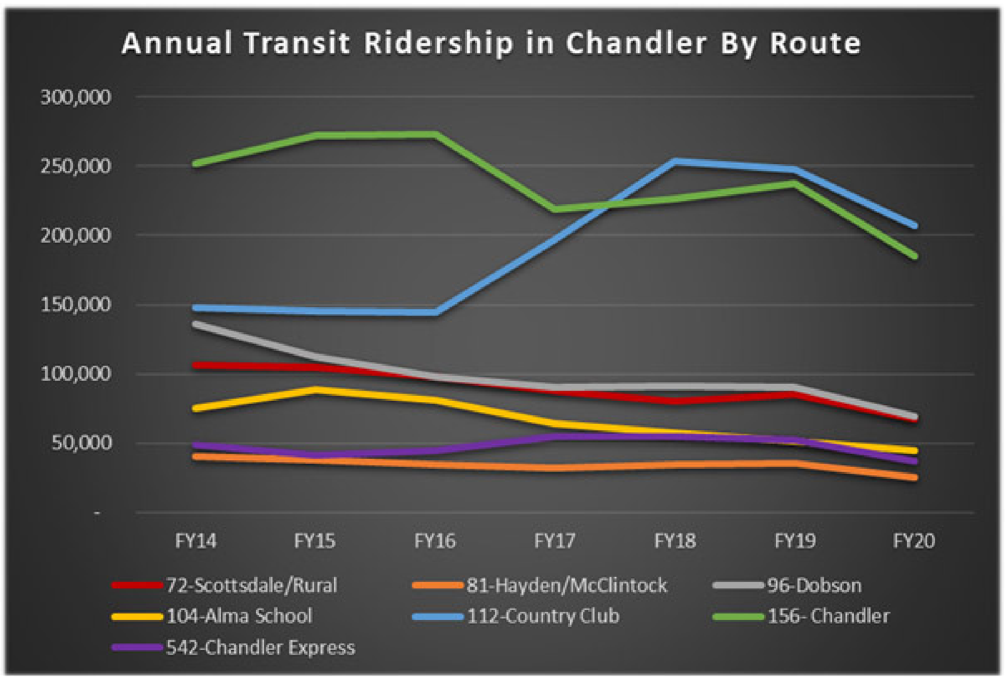


Figure 10 shows the ridership for these routes in the City of Chandler over the last seven fiscal years. As in the map, Chandler Boulevard and Arizona Avenue are the most active corridors with around 200,000 trips/year. The rest of the routes hover between 40,000-80,000 trips/year. Ridership has been down slightly compared to five years ago, except for the 112 which received service increases in FY16 and FY17.

This data shows that the transit activity all along the northern portion of the study area is fairly high, while the Dobson Road alignment does not produce as much activity despite it serving the most stops and the longest stretch of any other route. This area might benefit from flexible transit service covering the Price Road and Dobson Road corridors in place of Route 96 as these alternatives can provide shorter walk distances for users at a lower per user cost. This option could provide direct connections to Chandler Fashion Center, Downtown Chandler and Chandler Boulevard.

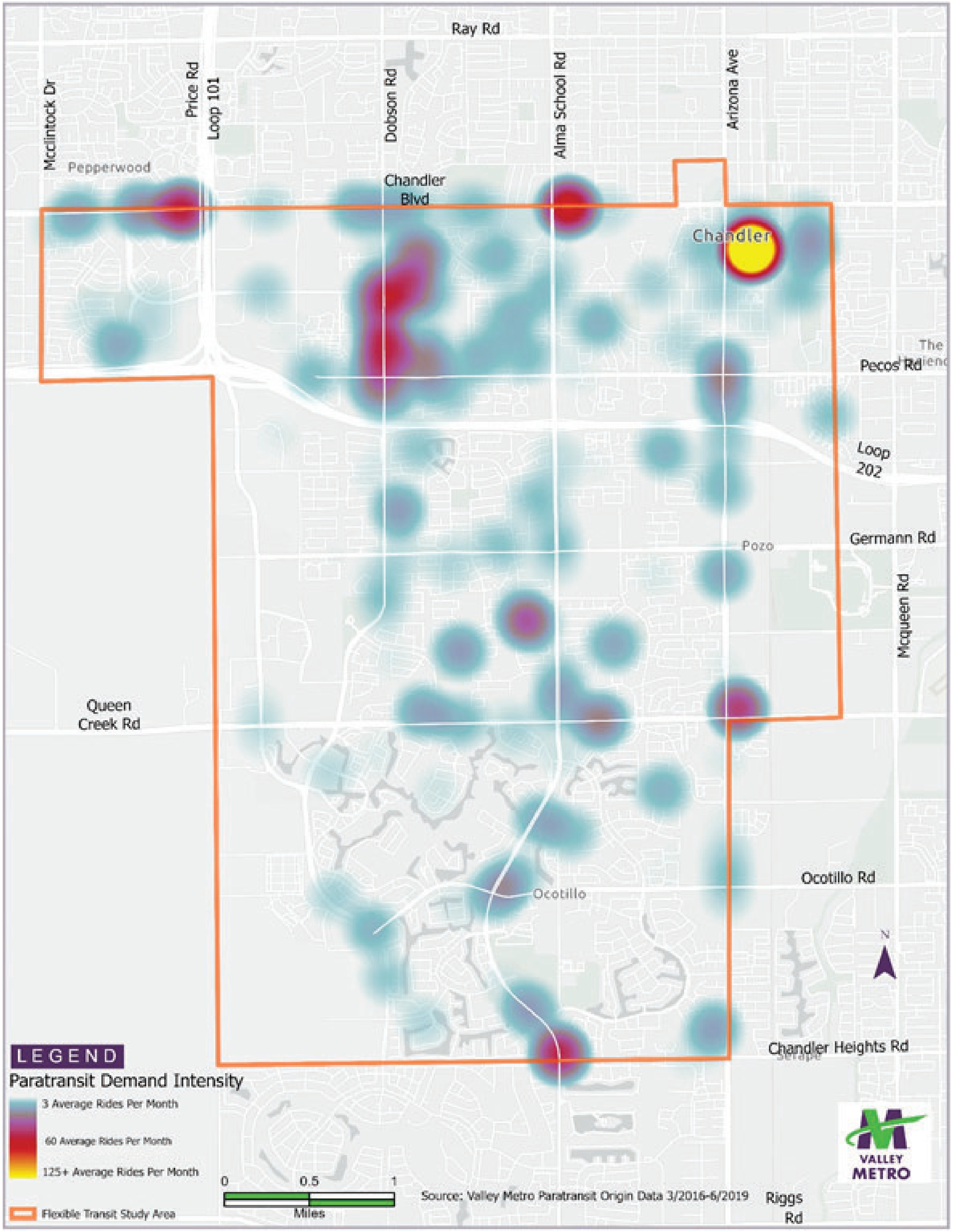
Figure 10. Annual Transit Ridership in Chandler by Route



Paratransit Service

Every month, several hundred paratransit trips are made in the study area, and their magnitude and distribution can be an indicator of demand for new service. It can also indicate what future flexible transit zones would be most ideal if the City wanted to displace its paratransit ridership to a comparably convenient, more cost-effective mode. Between 2017 and 2019, there were an average of 280 trips per month completely within the service area, trips which could easily be served by accessible microtransit. Figure 11 shows the distribution of paratransit trip origins over the last several years. Downtown Chandler is the clearest hotspot, but high activity is also seen in the northern portion of Dobson Road, and Chandler Boulevard intersections at Alma School Road and Price Road. While all these spots have current fixed-route transit services, several hotspots by the southern portion of the zone remain unserved. Providing flexible transit services to these areas with connections to downtown, the Chandler Regional medical center, the Fashion Center and other key destinations could reduce the paratransit demand by hundreds of trips every month.

Figure 11. Paratransit Demand



Planned Transit Service Adjustments

In the current regional inventory of proposed transit service changes in Valley Metro's most recent Short Range Transit Plan there are ten proposals relevant to the study area over the next several years. Table 5 details these changes, showing by route the overall scope of changes, their timeline and funding. Note that these proposals are likely to change somewhat due to unfolding funding developments related to Covid-19.

Short-term frequency increases on Routes 72 and 156 would have regional funding carved out, increasing their likelihood of implementation. These changes would likely increase the transit travel in these corridors as similar changes did to Route 112 over FY16-18 (Figure 12). These increases would also enhance the convenience of potential transfers to and from flexible transit services, listed for the next service change cycle, and the transit grid. Other significant changes include the extension of service along Arizona Avenue several miles south to Hamilton High School, and a new express route to downtown Tempe from the Chandler Park and Ride.

Table 5. Valley Metro FY21 Short Range Transit Plan Proposed Service Change Inventory

ROUTE	ROUTE NUMBER	SERVICE TYPE	IMPACTED CITY/TOWN	OPERATOR	CHANGE TYPE	CHANGE MONTH	CHANGE YEAR	FISCAL YEAR	POTENTIAL SERVICE CHANGE CONCEPT	FUNDING SOURCE
Chandler Blvd	156	Local	Chandler, Phoenix	Valley Metro	Service Increase	October	2022	FY23	Extend Route 156 to 40th St and increase peak frequency to 15 minutes to Gilbert Rd.	Local & PTF
Gilbert Rd	136	Local	Chandler, Gilbert	Valley Metro	Service Increase	October	2023	FY24	Extend evening service weekdays and Saturdays to Chandler.	PTF
Country Club/ Arizona Ave	112	Local	Chandler	Valley Metro	Route Extension	April	2024	FY24	Extend Route 112 to Hamilton High School or Snedigar Sports Center.	PTF
Dobson	96	Local	Chandler	Valley Metro	Service Increase	October	2024	FY25	Weekday, improve service in Chandler by extending current service to add one evening round trip.	PTF
Alma School	104	Local	Chandler	Valley Metro	Service Increase	October	2024	FY25	Add Saturday service until 9pm in Chandler.	PTF
Price Corridor Microtransit	New	Micro Transit	Chandler	Valley Metro	New Route	October	2024	FY25	Explore options to serve Price Corridor. Pending the results of the Transportation Master Plan in January 2020, potential eliminate 96 south of Pecos and replace with Micro/Flex Transit per TMP.	Local
Ray Rd	140	Local	Chandler, Phoenix, Gilbert	Valley Metro	Service Increase	October	2025	FY26	Add Sunday service.	Local
Chandler Express	542	Express	Chandler	Valley Metro	Service Increase	April	2025	FY26	Add one morning trip and one evening trip to service	Local

PEER CITY ANALYSIS

The nation's many flexible transit service offerings operated over the last several years provide insights into how these services might perform, and what options would best suit the study area. Four peer cities were analyzed to for this study: Glendale, Arizona, Salt Lake City, Utah, Hanford, California and Sacramento, California. The services provided in these three municipalities are summarized below.

Glendale OnDemand Pilot

The City of Glendale began its Glendale OnDemand pilot in Spring 2020 to provide microtransit service to a 17 square mile area in northern Glendale (Figure 12). This pilot was intended to provide more robust transportation service to an area of the City that had less transit service than other portions, while accommodating the low-density residential land uses that have prevented transit services from expanding there. Fares for the service are $2.00 per ride, the same as a local bus trip, and could be handled in the complementary smartphone application along with ride-hailing and real-time vehicle tracking. The pilot is currently scheduled to extend through the end of 2020. The city reduced costs by operating with their own vehicles and operators, essentially subscribing to the routing software service and utilizing it on tablets provided to operators.

Figure 12. Glendale On Demand Service Area

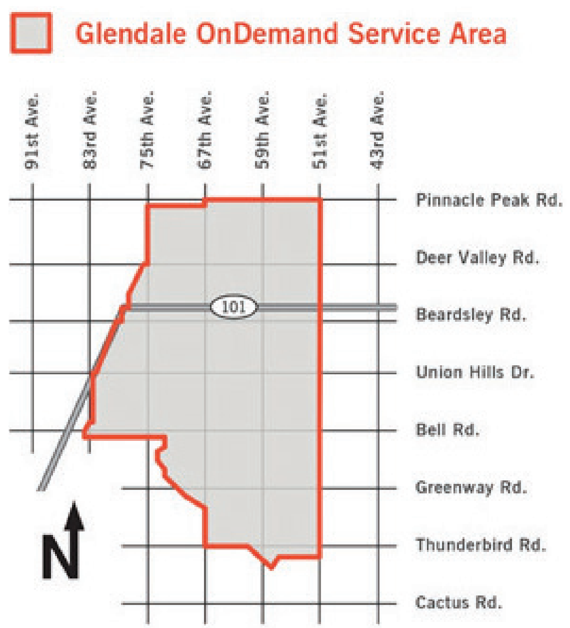


Figure 13. Glendale OnDemand Average Wait Times by Hour

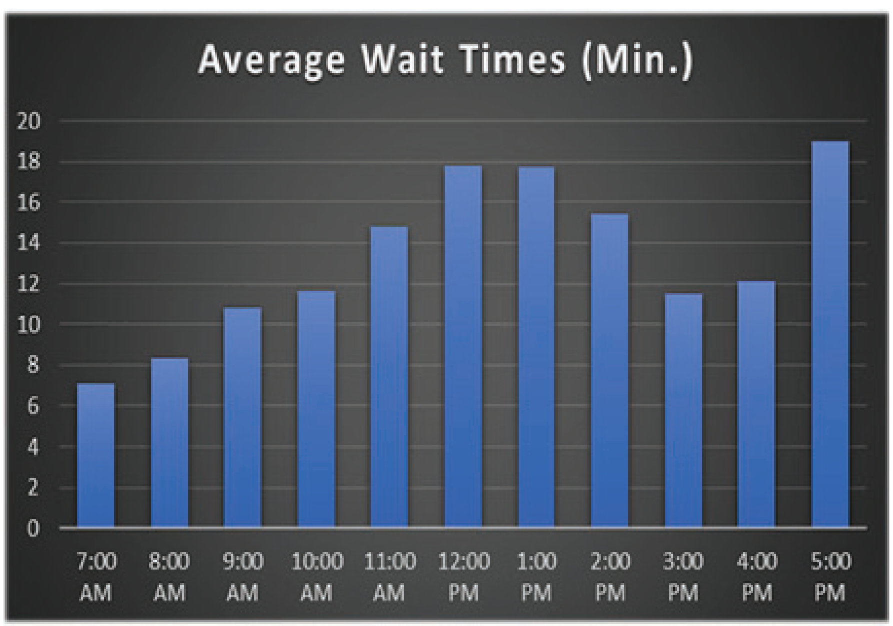
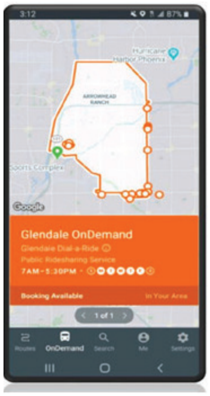


Figure 14



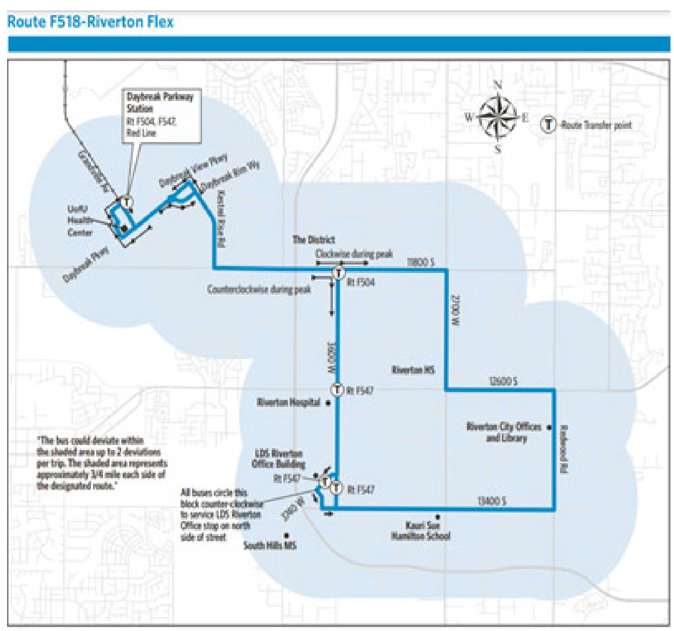
The most popular destinations for system users are commercial centers like grocery stores, Walmart and Arrowhead Mall. A local medical center and some senior centers also show high use. Figure 13 shows the varying wait times experienced over its typical weekday span of service, with off peak service showing 7-12 minute waits and peak waits around 18 minutes. These times are achieved with two vehicles off-peak and three vehicles on peak, or about one vehicle every 5.5 square miles to accommodate peak demand. Most rides are short, lasting just ten minutes or less. While the COVID -19 pandemic has depressed ridership productivity since the pilot's inception, demand continues to grow with most days seeing about 50 boardings. The growing ridership shows even in this challenging environment flexible transit services can provide reasonable productivity and do so while minimizing empty vehicle runs that a similar circulator service would likely produce.

Salt Lake City Flex Route Network

Salt Lake City has a robust network of local routes that provide flexible on-demand deviations that can be requested by phone. Deviations can be up to 3/4 mile away from the route, as shown in the route map in Figure 15. Eleven regional routes within Salt Lake County provide curb-to-curb service for $1.25 per person to deviate, and up to two deviations per trip are allowed. Deviations can be ordered same-day unless they are for early-morning pickups. This service is open to the public and ADA populations alike but does not provide additional ADA accommodations beyond the wheelchair boarding capabilities of a typical local bus route.

These routes serve to fill gaps in Salt Lake City's regional transit system, providing lifeline service in areas that lack the density to sustain local routes and would otherwise remain underserved. As expected, these flex routes see higher per rider costs than fixed routes in the broader system. However, these routes compliment the broader regional grid by feeding into these core services and are not intended to supplant or be as productive as typical local service. Also, their 0.2 passenger per mile median surpasses the weekday productivity of several local routes in jurisdictions across the Valley Metro region. Valley Metro's experience with its current flex route, the 685 Rural Connector, is similar. This route provides lifeline service that offers flexible routing to accommodate lower density land uses. While flexible boardings make up a majority of all route boardings, the need to also hit timepoints on a defined alignment and schedule leads to more empty vehicle miles operated.

Figure 15. Sample Flex Route Map from Salt Lake County Network



Sacramento SmaRT Ride

Figure 16. Electric Vehicle used in Sacramento's Microtransit

Sacramento's regional transit authority has had great success with its on-demand transit offerings which now span nine different zones. Most zones provide corner-to-corner service instead of curb-to-curb service, which reduces vehicle travel distances and waiting time with a minor increase in walking for customers. This effectively turns every corner in the zone into a virtual bus stop in a grid that is served on-demand. Customers schedule rides in the branded smartphone app where they can virtually pay the $2.50 fare and track their ride in real-time. Vehicles in some areas are even electric (Figure 16), where vehicles wait in a central charging location within the zone, using downtime to charge. Kids up to 18 can ride free with valid student ID.

This program has proven to be one of the most successful of its kind in the United States, as evidenced by the regular addition of new zones to the network. Even during the COVID-19 pandemic, the ridership for the program hit a monthly high of 12,000 rides in July 2020. Even the record setting heat and wildfire-related smoke in the month of August 2020 pushed the ridership down only slightly to 11,500 rides that month. At the beginning of the pandemic, ridership dropped only 15% from March to April, a time when many transit services across the nation saw drops between 50-75% across all modes. This demonstrates the relative resilience of this service to cope with hardships that have plagued fixed-route transit performance. The reduced walk and wait times compared to these traditional offerings may explain this resilience.

Figure 17. The North Sacramento Microtransit Zone, One of Nine in the Region

KART Flex Routes

The City of Hanford, California, south of Fresno, has two flexible transit routes that serve neighborhoods similar to the study area. These flex routes drop off or pick up at designated stops and fares cost the same as any other local bus ride. Figure 18 shows a map of one route, with the designated stops users must begin or end at. Users are required to make reservations at least 30 minutes prior to their requested time but can reserve a ride up to 7 days in advance. Users can reserve rides by calling, texting, on an app or at the bus terminal. Service is offered 7:00AM-5:30PM Monday through Friday.

The city introduced the second flex route in the summer of 2019 after running a similar service successfully in another part of the city. This first route replaced two existing routes, and transit customers in the area praised the replacement on-demand service as faster than the previous offering.

Figure 18. KART Flex Route Stop Map

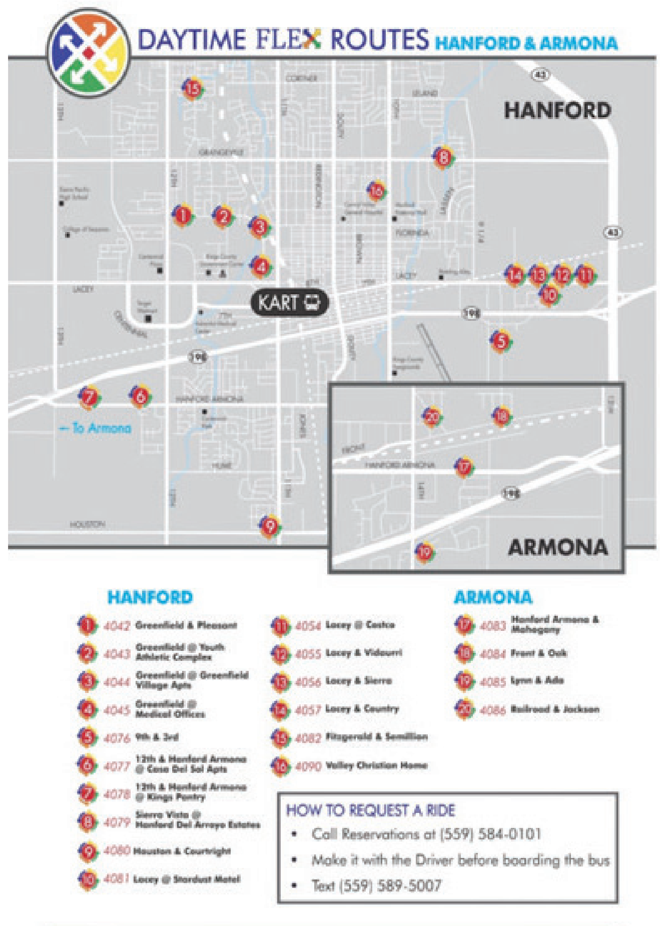


Table 6. Peer City Program Summary Overview

PILOT NAME	CITY	SERVICE MODEL	VEHICLE	SMARTPHONE APP HAILING & TRACKING	FARE	RIDERSHIP PRODUCTIVITY
Glendale OnDemand	Glendale, AZ	Microtransit (Curb-to-Curb)	Cut-Away Bus	Yes	$2.00	~1,000 Rides/Month
Salt Lake City Flex Route Network	Salt Lake City, UT	Flexible Transit Routes (Curb-to-Curb)	Cut-Away Bus	No	$3.75 ($1.25+ Local bus fare)	~2,000 Rides/Month/ Route (Over 15 route network)
Sacramento SmaRT Ride	Sacramento, CA	Microtransit (Corner-to-Corner)	Electric Vans, Cut-Away Bus	Yes	$2.50	~1,000 Rides/Month/ Zone (Average across 9 Zones)
KART Flex Route	Hanford, CA	Flexible Transit Routes (Stop-to-Stop)	Cut-Away Bus	Yes	$1.25	~850 Rides/Month/Route

SUMMARY

Many facets of the study area show promise for productive flexible transit service. Fixed route service along Chandler Boulevard and Arizona Avenue provide valuable connections to the regional bus grid and likely both will be high frequency routes in the near future. Large employers and commercial centers producing thousands of trips a day would likely drive a good amount of use, especially along the western part of the study area where the largest employers reside. Examples of service in cities like Sacramento show that, even in times of unprecedented transit ridership declines, flexible transit services can be productive and resilient. There is even a sizable amount of paratransit traffic that could be geographically targeted with flexible services to reduce the cost associated with these trips.

In reviewing the land use patterns and transit characteristics there are a few viable flexible transit options that would likely work well within the study area:

- Flexible Transit (route based)
- Flexible Transit (point based)
- Zone Based Microtransit

While many options are available, these seem most complementary to the existing area and service offerings. They would provide the flexibility of access to the central residential neighborhoods and the busy but sprawling business centers to the west where long walking distances to key corridors stifle fixed route transit productivity. These options will also not have negative impacts on the overall performance of the existing network as some would. For example, turning a portion of a fixed route into flexible service, like Route 96 south of Pecos Road, may provide better access to the service that would bolster ridership in the area. Yet, it would likely cause on-time performance issues along the route's fixed section and could even reduce the overall route productivity because of cascading travel-time reliability issues.

In the next stage of the study these three options will be analyzed in greater detail. A thorough look at different service scenarios will better detail how these services might operate, who they would target and what they might cost. Input from local stakeholders and the public will guide these efforts and provide a check on some of the assumptions drawn from the data analysis. After running through several potential scenarios and presenting the candidates to the broader public the work will culminate in a report on the strongest potential alternatives for flexible transit service in the study area.

SECTION 2

SERVICE ANALYSIS REPORT

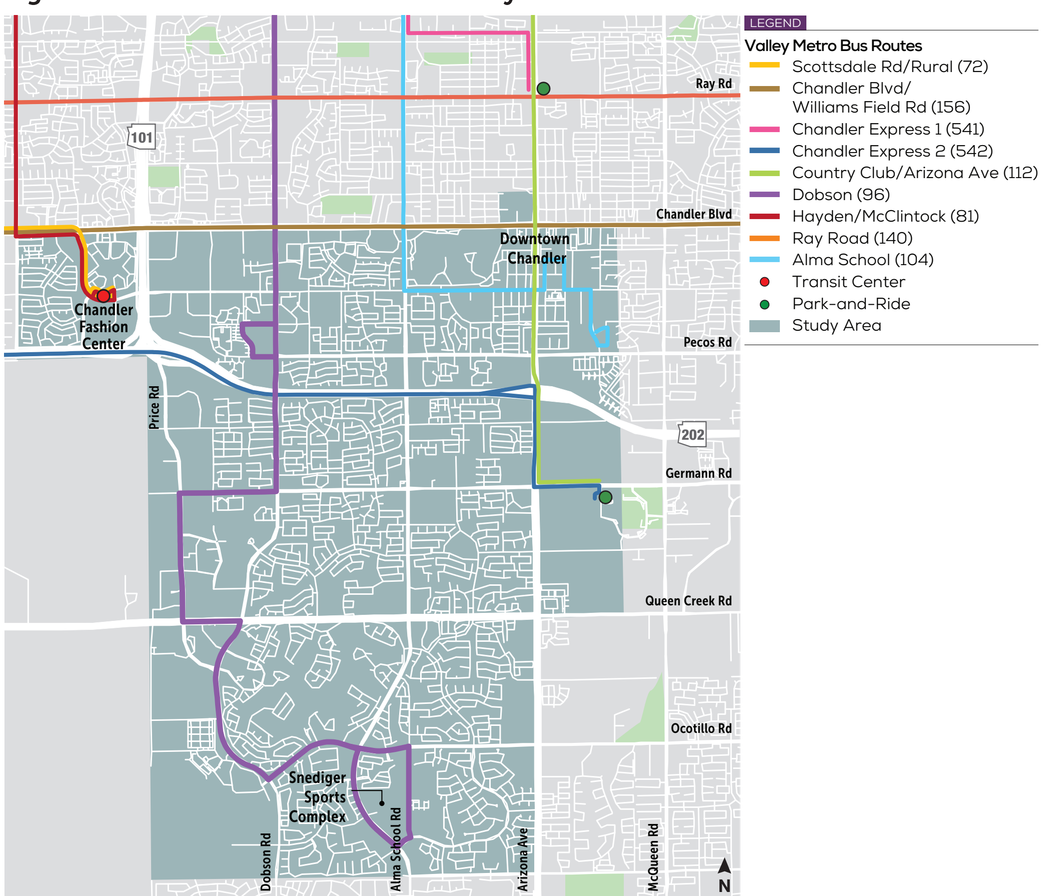
INTRODUCTION

Based on the analyses and the findings from the existing conditions, the project team has analyzed a series of flexible transit service options for the City of Chandler and local stakeholders. Study recommendations are designed to meet current community needs/priorities, and the regional Transit Standards and Performance Measure (TSPM) where applicable. The following information was identified for the transit service concepts:

- Optimal service coverage area
- Operating characteristics (span of service, days of operation, etc.)
- Estimated annual revenue hours
- Key performance indicators and targets
- Estimated fleet requirements
- Operating and capital cost estimates
- Fare structures
- Transit stop requirements
- Marketing and branding recommendations

This portion of the study also includes a description of the role of technology in the service offering, with discussion on the use of mobile devices, software needs, advanced technologies, and other key considerations.

Figure 1. Chandler Flexible Transit Study Area



SERVICE CONCEPTS

Flex Routes

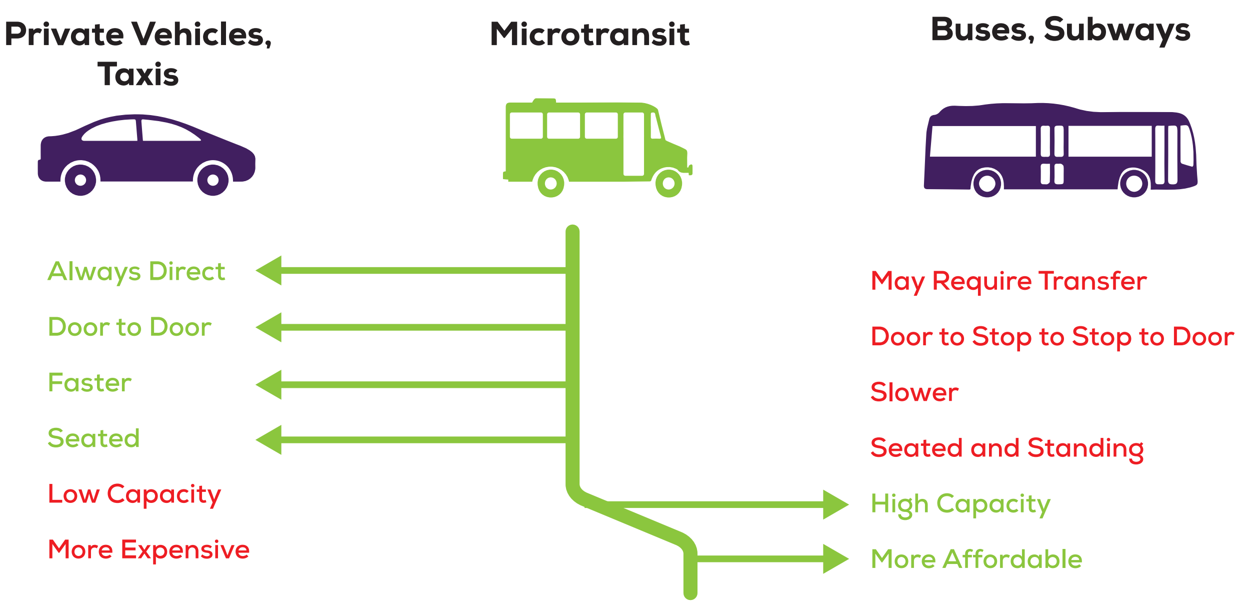
Flex routes are like typical fixed transit routes that have static timepoints and a default routing. Unlike fixed routes, flex routes deviate from their default corridors to pick up riders on-demand within a fixed distance of the route, typically around ¾ mile. While this is a viable potential solution for the area, the study suggestions will focus solely on microtransit. Flex routes would improve service access in the area, but because they are tied to timepoints they may not offer the consistently low wait times an open-zone service would provide. It would also provide service in a smaller zone for the same amount of financial investment than a microtransit service. And with the rise of Transportation Network Company (TNC) services like Uber and Lyft, open-zone, on-demand models are generally better understood and liked by the public than the hybrid flex route model. For these reasons, we will focus on microtransit concepts and forego flex route analysis.

Microtransit

Microtransit is a mode of public transportation providing on-demand service anywhere within a specific zone, like a rideshare service. Rides can be hailed by an app or over the phone shortly before a ride is needed. Relative to traditional fixed route transit, microtransit service reduces walking time and distance by providing pickup at the nearest corner or right to the rider's door. In addition, in-app or mobile fare payment, and real-time vehicle tracking provide further convenience.

Microtransit services are designed so regional trips are served by connecting with the regional transit system. Vehicles like passenger vans or minibuses provide shared trips that reduce traffic and optimize the efficiency of the service. Fares are typically low, usually on par with the cost of local bus fare. Work for the remainder of the study will focus on this mode for further analysis and investment.

Figure 2.



Microtransit provides many benefits of taxis and private vehicles while providing greater capacity with shared trips and more affordable service like traditional transit options.

Operational Analysis, Alternatives Modeling, and Service Recommendations

Different microtransit operating characteristics offer different tradeoffs for riders and the service provider. For example, larger zones offer broader regional access and fewer potential transfers, but smaller zones offer shorter wait times and lower costs to implement. In assessing the possible alternative operational characteristics of a new microtransit service, different scenarios were analyzed for the study area showing how these tradeoffs affect the quality and cost of service. Potential demand levels were estimated using a variety of sources, including current travel patterns, land use data, comparable microtransit service ridership, and demographics.

From this information a simulation of a typical day's use was derived for different scenarios. These models show how demand varies spatially and temporally, what demand level is feasible to expect and the investments in fleet and labor required to maintain adequate service. The next several sections will explore the options available for a variety of key operational characteristics. The study will provide recommendations among these options based on the modeling and operational analysis, the existing conditions analysis, the public feedback received and the needs of the City of Chandler.

SERVICE CONCEPT ATTRIBUTES

Service Zone Location and Coverage

One of the most fundamental elements of a microtransit service is the shape and location of its coverage area. This decision dictates the land uses and transit connections that are available to prospective riders. Within the study area there were several locations of regional importance identified in the existing conditions analysis. These locations include Downtown Chandler, Chandler Fashion Center, the businesses of the Price Road corridor and the Chandler Regional Medical Center. Note these locations on Figure 3.

In addition to these locations, a large residential population resides in the center of the study area with limited if any transit access that would benefit from the addition of flexible transit alternatives. Important community land uses such as high schools and community parks lie primarily in the eastern portion of the study area. The importance of many of these land uses has been noted in public outreach as well. We have received input to bolster access to nearly all these locations for the community.

Several zone alternatives were analyzed through the service alternatives analysis process, shown mapped in Figure 4. The tradeoffs of these zones were considered with the needs of the City of Chandler and the input of the public. Beyond the location specific considerations noted, overall size of the zone also affects service quality and operations. The tradeoffs of the various alternatives are outlined in Figure 5.

Figure 3. Key Study Area Destinations

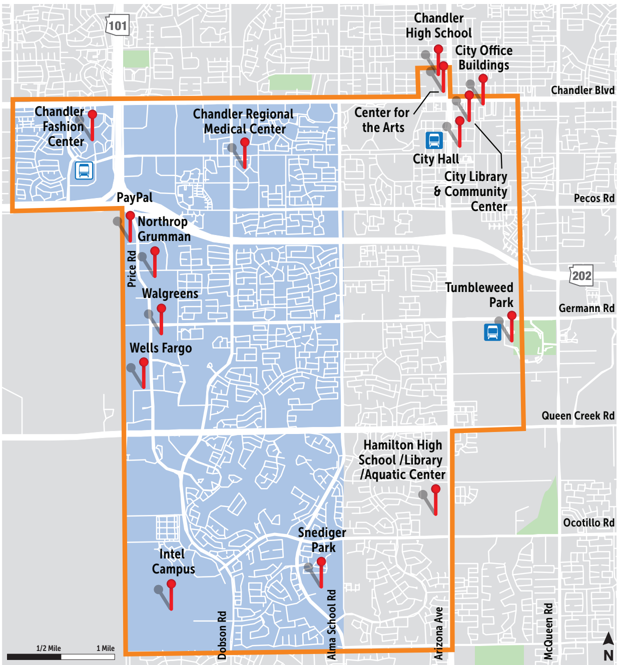
LEGEND

Flexible Transit Studies

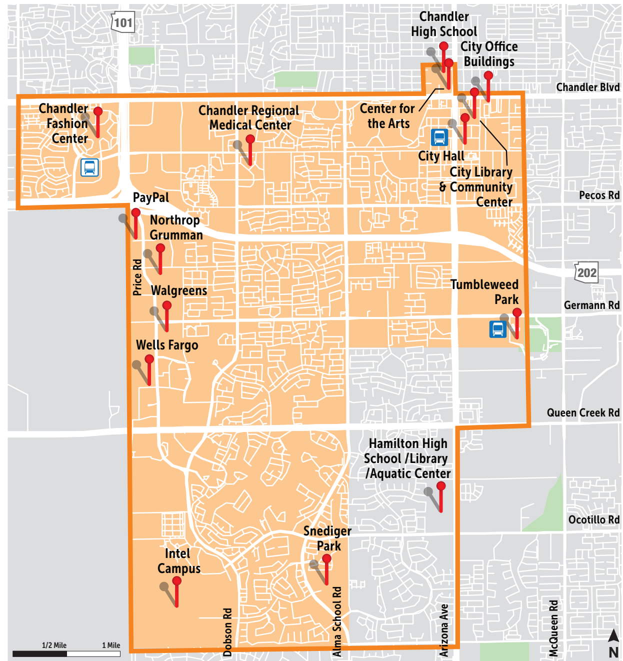
Key Destinations

Figure 4. Alternative Zone Maps

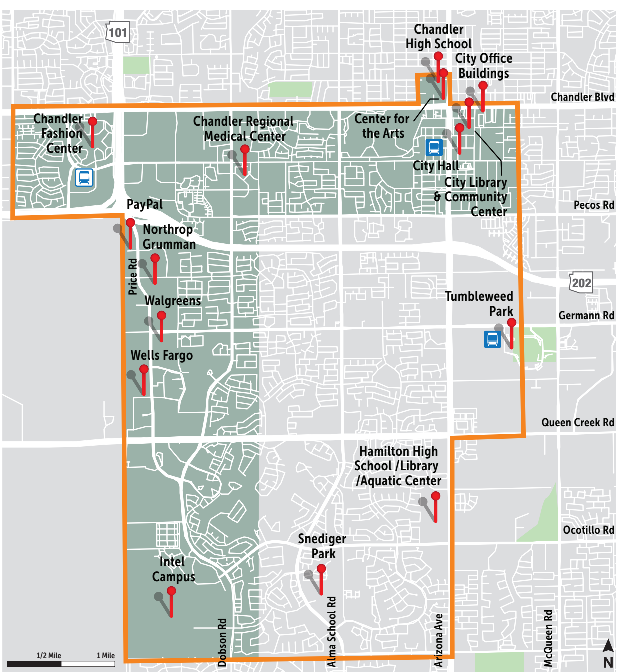
Alternative Zone 1



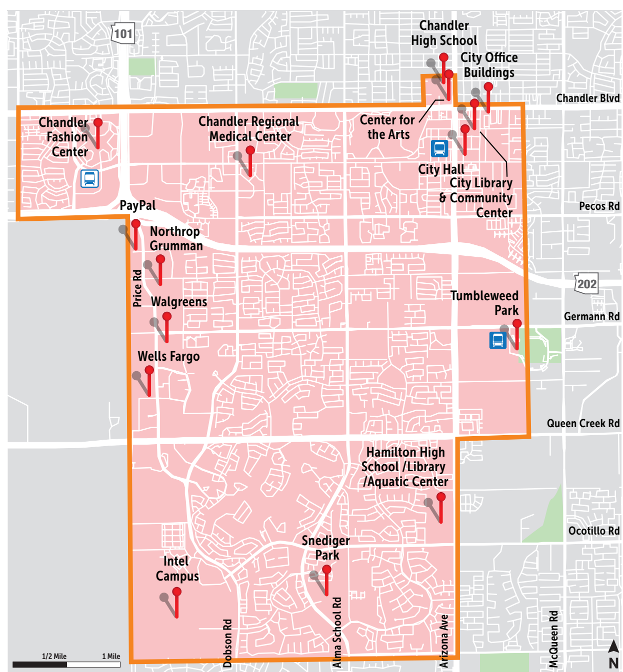
Alternative Zone 2



Alternative Zone 3



Alternative Zone 4



LEGEND

Flexible Transit Studies
Key Destinations
Transit Center
Park-and-Ride
Alternative Zone 1
Alternative Zone 2
Alternative Zone 3
Alternative Zone 4

Figure 5. Zone Alternatives Benefits and Constraints

BENEFITS	CONSTRAINTS
ALTERNATIVE ZONE 1 TRADEOFFS	
• Affordable to implement • Shorter wait times • Includes Price Road Corridors and Chandler Fashion Square travel	• Lacks access to downtown Chandler and several schools • Increases transfers • Lacks connection to key transit routes • Limited access to residential areas
ALTERNATIVE ZONE 2 TRADEOFFS	
BENEFITS	**CONSTRAINTS**
• Includes Price Road Corridor and Chandler Fashion Square travel • Expands access to downtown Chandler • Connects with all available transit • Extends access to residential areas	• Increased cost to implement • Longer wait times • Lacks access to Hamilton High School and community resources in the southeast
ALTERNATIVE ZONE 3 TRADEOFFS	
BENEFITS	**CONSTRAINTS**
• Affordable to implement • Shorter wait times • Includes Price Road Corridor, downtown Chandler and Chandler Fashion Square Travel • Concentrates on highest demand locations	• Lacks access to express route 542 • Minimal service for residential areas • Lacks access to Hamilton High School, Tumbleweed Park and community resources in the southeast
ALTERNATIVE ZONE 4 TRADEOFFS	
BENEFITS	**CONSTRAINTS**
• Provides access to all key locations and residents in the study area • Provides access to all available transit routes • Reduced frequency of transfers	• Most expensive to implement • Longer wait times

Travel demand modeling used for the study predicted future travel patterns for potential microtransit service. The model discerns three basic characteristics of travel related to the study area: demand scale, demand geographic distribution and mode share. First, the model established a level of travel within and across study boundaries based on existing travel data. It drew specifically from the latest available LEHD (Longitudinal Employer-Household Dynamics) commuting data, fixed route and paratransit ridership, ACS (American Community Survey) demographics and county land use data.

Once the magnitude of travel was established, land use and travel data was used to estimate how demand for travel would likely be distributed across the service area. Travel data provided more coarse grain information about historical travel patterns, and parcel data provided fine grained trip generation estimates by lot to provide more nuisance to the estimated demand distribution.

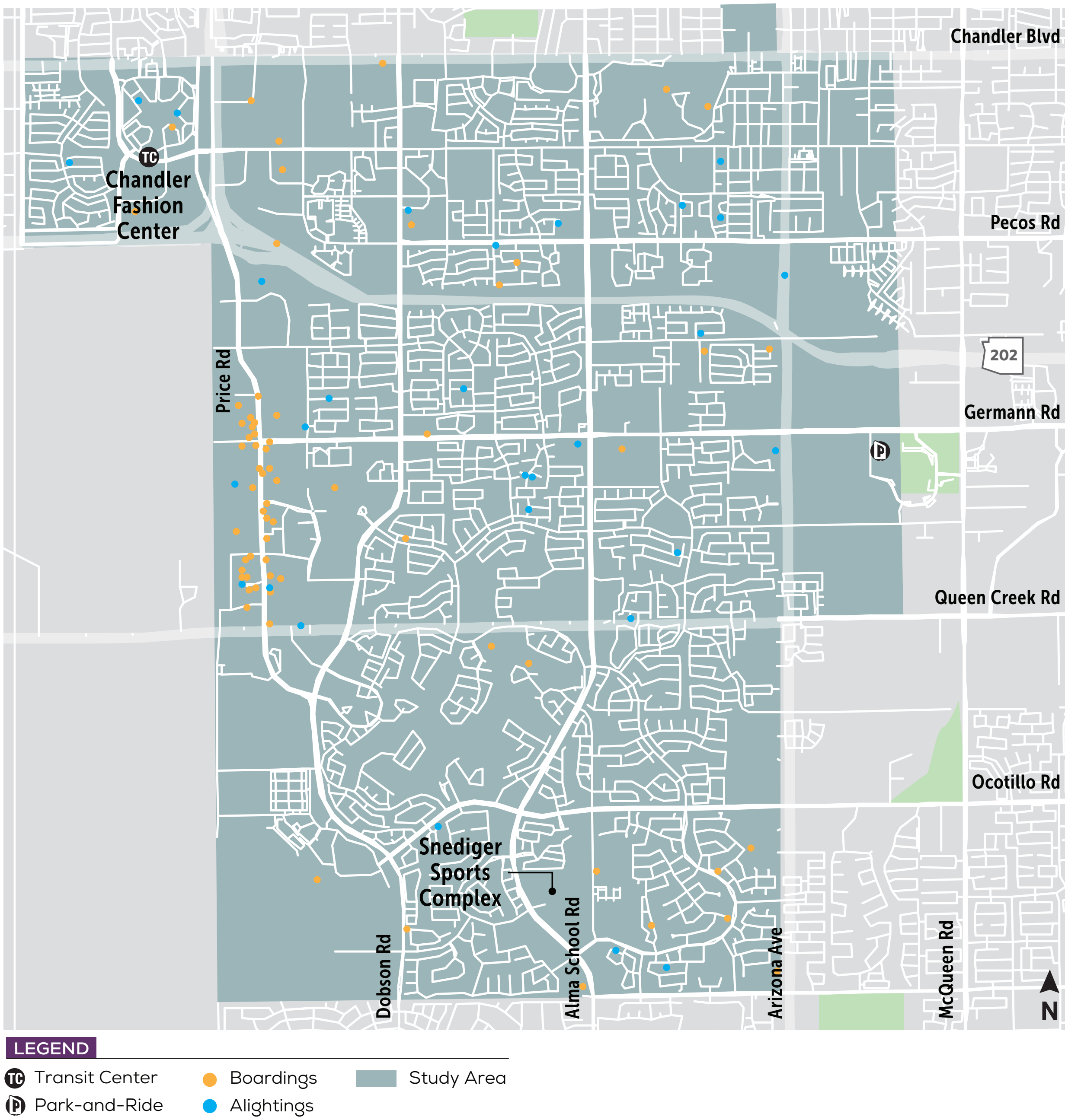
To discern a reasonable mode split range the model drew from transit data, and commuting data from census sources. Mode split is also derived from how time and cost competitive new service would be relative to driving, biking or walking for various trips across the service area.

A sample of modeling results simulating ridership throughout the PM peak are shown in Figure 6. This shows most demand likely lies along the western and northern portions of the study area, centered around the Price Road corridor, Chandler Fashion Center and Downtown Chandler.

However a good amount of activity was logged in the central and south east portion as well. About 15-20 rides were estimated in this south east corner during this PM peak period. By comparison, the PM peak average ridership of the Route 96 in its weekday peak service south to Snedigar averaged 12 daily riders in 2019. Additionally, many of the trips in the higher trafficked northern and western portions have their origin or destination within this central and southern area.

The study recommends a microtransit service zone covering the full 18 square mile study area. This is a manageable size for a microtransit service zone and retains the critical locations requested in public input. It also makes available several transit connections, and the broadens transit access to the residential and employee community alike.

Figure 6-Boarding and Alighting Locations of Microtransit Modeling (PM Peak)

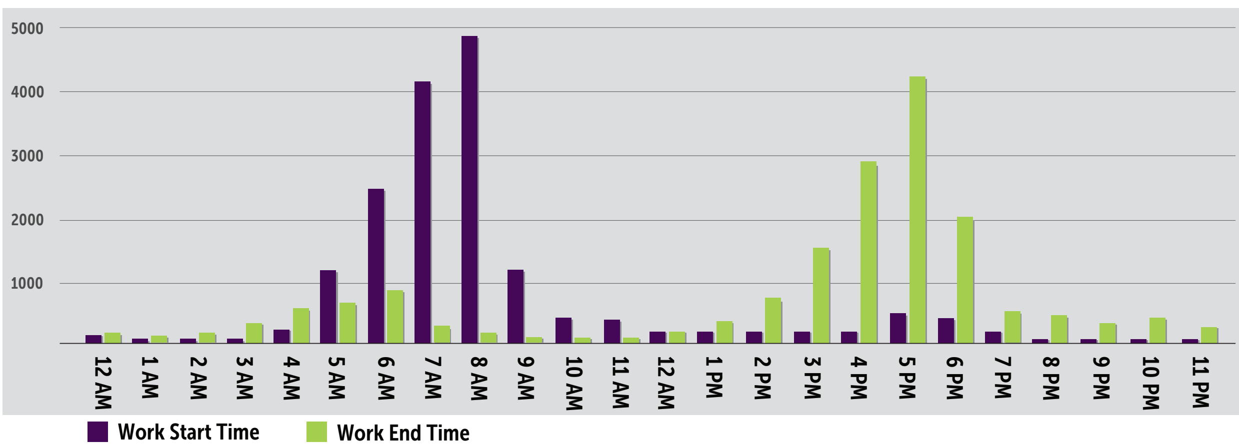


Span of Service & Days of Operation

What time a transit service runs is as much a reflection of community need as where it runs. Business work shifts, residential travel patterns and commercial traffic are just some of many factors affecting travel demand variance over hours of the day, and the days of the week.

With the area hosting many key regional employers and bringing in twice as many workers as it sends out, commute patterns dominate the overall travel patterns. Drawing on feedback from thebusiness community in the area we see that shifts for employees form a morning peak period from 5:00AM to 10:00AM and an evening peak period from 3:00PM to 7:00PM. Similarly, the shift times of residents within the study area form peak periods that follow a similar pattern. Figure 7 shows Trip Reduction Program Survey data from 2019 that illustrates these windows. Outreach surveys and focus groups for our stakeholders and the broader public provided feedback reinforcing the importance of these time windows for local commuting.

Figure 7. Study Area Employee Start & End Work Hour (2019)



Beyond commuting, several commercial and non-work residential trips fill in the midday, evening and weekend times when commuting trips dip. In addition, the many special use properties in the area including schools, hospitals, public parks and public service buildings generate trips regularly through the day and/or on weekends.

Some microtransit services have experimented with running augmented zones during certain days like weekends to expand access selectively. While this is not recommended initially, it's a viable option as the system becomes more established for testing new areas around the service zone for demand and potential full-time expansion. It can also be a tool for reducing a low-performing area's days of service within the current zone to just higher demand days to improve operational efficiency.

The study recommends running service from 5AM-8PM, Monday to Saturday. This span meets the needs of the business community, serves off-peak trips for many residents, shoppers, students etc., and concentrates service cost-effectively to the highest demand times.

Ride Hailing

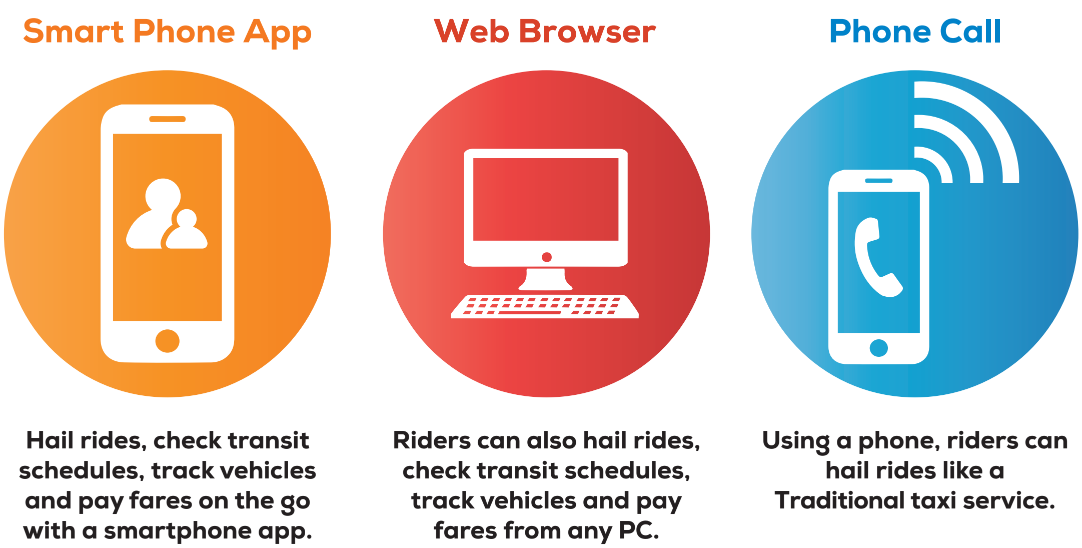
In contrast to traditional fixed route transit, microtransit provides service on-demand and can be hailed in a variety of ways. Most commonly riders hail service with a smartphone via a complementary smartphone application. This allows individuals to not only request a ride at home or on-the-go but track their ride in real-time and pay fares.

Riders may also request and schedule rides on a web browser from any internet connected computer. Sites facilitating ride hailing also allow for ride tracking to avoid excessive wait times outdoors. This site can be made available through the regional transportation agency website, the city website, and other platforms to provide easy access to the public and promote ridership productivity all on existing online platforms. While hailing microtransit in this way is less common than by smartphone, this option makes the service more broadly accessible to those without smartphones while providing many of the same information and conveniences.

To broaden access further the service can provide ride hailing by phone. This provides riders with the ability to access the service without the internet or a computer. This maintains equity in the system and does not exclude or discriminate against users without access to certain devices. While approximate wait times can be given over the phone once a ride is hailed, riders will not have access to the same real-time information if circumstances change. This kind of ride hailing is less common. As a result, if the city or Valley Metro took on the service operation calls can likely be taken at Valley Metro's existing transit agency call center with little, if any, expansion of facilities or workforce. Costs for this service would be rolled into the usual administrative costs associated with providing transit service. If the service is contracted out to a microtransit provider, those calls would be handled in their centralized call center and the cost for that would automatically be incorporated into their inclusive annual service rate.

To provide broad access to potential microtransit service, the study recommends using all three methods of ride hailing discussed here. This will allow riders to access the service on-the-go or at home, with internet or without. It also costs relatively little to establish and maintain the parallel ride hailing options within the existing infrastructure of the transit agency.

Figure 8. Ride Hailing Methods



Fare Structure

One key distinction between TNCs and microtransit is a more affordable fare. Typically, fares are kept similar to fares of comparable transit services. In the Valley Metro system, fares for local bus rides are currently $2.00 each and neighborhood circulators are typically free, except for the Avondale ZOOM which charges $0.50 per ride (Figure 9). Considering circulator service provides a similar neighborhood transportation option, these fares may be the most applicable for comparison.

Fare free service offers benefits to both riders and service providers. Not handling fares and tracking revenue streamlines operations and makes using the service easier as riders do not have to worry about handling fares. It also promotes increased ridership productivity because it eliminates cost for users.

Alternatively, collecting fares serves several purposes, most notably defraying the costs of service. The regional transit system's local bus routes have a farebox recovery around 12-15%, with FY19 fares equaling 13.8% of the operating cost for local service. While this is not a large proportion, it does contribute to the financial sustainability of the service by reducing the cost burden to the operating agency.

Fares can be used to incentivize behavior as well. Giving lower fares to or from a transit stop can encourage transit use and makes transferring more affordable. Fare credits can also be earned through the app for consistent patronage, or for referring friends and family. Fares can also deter abuse of the system. Without a fare, riders have no barrier to entry, do not directly invest in the service and do not bear any cost for personal system use. As a result, they may make less efficient use of the system, and not feel as invested in the service.

As Valley Metro modernizes its fare collection system the region will move away from magnetic stripe cards and more toward fare media like tap cards and in-app payments. These media can be accepted on microtransit vehicles with small fare validators that can fit easily inside a passenger van. Accepting cash on board is optional as cash can be loaded on a card at a fare outlet. Credit and debit card payments can be processed at these same outlets, as well as in the app, or on a web browser where rides are hailed. The cost of processing fares is incorporated into Valley Metro administrative fee, which is discussed in the service cost section along with the upfront cost of fare collection devices.

The study suggests setting a nominal fare at or below the cost of local bus service. This would help avoid the downsides of a fare free service without greatly inhibiting access and would bring in roughly $50,000-$100,000 annually for every 10 rides per service hour that could be achieved (assuming a $1-$2 fare).

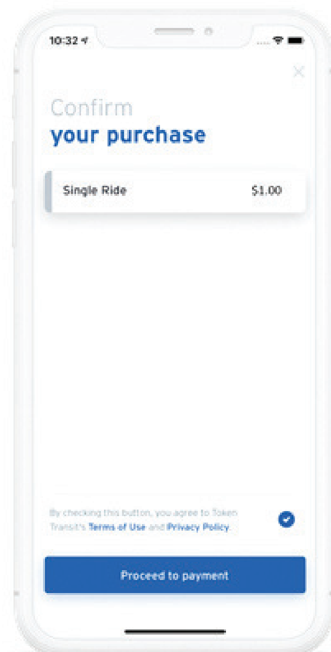


Figure 9.

Local Bus & Light Rail

1-Day
$4.00

1-Ride
$2.00

Neighborhood Circulators

Most Neighborhood Circulators are
FREE

1-Ride
$2.00

In addition to traditional fare tap cards, many microtransit services make fare payment available on their service's smart phone app. Here is an example of in app fare payment from King County Metro in Seattle, WA.

Fleet

The vehicles used to provide microtransit service affect the passenger capacity, operating cost, and flexibility of the service. Smaller vehicles like minivans or passenger vans are more affordable to purchase, operate and maintain and are more maneuverable. They are quieter and less conspicuous on neighborhood streets, easier to navigate through parking lots and require less fuel and expertise to maintain. These vehicles have a capacity of four to eight riders and typically cost between $50,000 and $65,000.

However, these smaller vehicles lack the capacity of larger vehicles like cutaway buses and may require a greater number of vehicles to handle peak demands. These small buses have a capacity of around 8-12 riders and typically start at $200,000 each. This higher end capacity is important in high demand systems. However, cutting costs by substituting lower capacity vehicles for fewer high-capacity vehicles for the same overall fleet capacity will raise wait times and vehicle loads while reducing service quality.

Figure 10. Vehicle Types & Tradeoffs

To better understand the potential fleet needs in the study area the study team relied on demand models. These models allowed for an estimation of how those different demand levels would correlate with the fleet needs and average wait times within the service zone. Figure 11 shows the varying levels of demand modeled, as well as the fleet required to maintain average wait times at or below 15 minutes. Demand is assumed to start at the lower end around 25 rides per hour, and over time would likely grow to the medium level of demand of 50+ riders an hour.

Typically, the peak demand level sets the level of needed fleet investment. Because the site is assumed to generate about 25 riders per hour at peak, and the model has demonstrated reasonable average wait times with five vehicles of around 10-15 minutes, the study suggests having this level of fleet to start the service. As a rule, a vehicle can typically cover at most five square miles, so this level is within that range for an 18 square mile zone. This rule can help to manage fleet size during future zone changes. One additional spare vehicle to maintain service consistently through vehicle repairs is required as well, producing a total of five vehicles. The full fleet will run during peaks, and outside of these times the fleet will be scaled down to better match estimated demand and manage costs. Providing a mix of passenger vans and cutaway buses will allow for flexibility in capacity for demand surges.

Accessibility also plays a role in fleet procurement and management. Microtransit providers suggest a 10% minimum level of wheelchair accessible fleet to maintain comparable wait times for individuals with disabilities and provide a service that does not require duplicative ADA paratransit service. This would require one of the five peak fleet vehicles be accessible. It is also recommended that the spare be accessible so it can replace either type of vehicle, for a total of two of six accessible vehicles to start. Accessibility considerations will be discussed in greater detail in a later section.

Figure 11

	LOW DEMAND		MEDIUM DEMAND		HIGH DEMAND
Peak Rides per Hour	25		50		75
Peak Fleet Size*	4	5-6	7	8	9
Average Wait Time (Minutes)	14-15	10	14-15	9-10	11

*Not including spare vehicles

Fleet can be parked and stored in several locations depending on how the service is run. If the service is fully contracted through a microtransit provider, vehicle storage would be part of the overall services contracted. Vehicles would be stored at a garage site provided by the microtransit company in or near the service area, and the cost would be folded into their overall rate. That provider may also choose to contract through Valley Metro's current East Valley contractor, First Transit and the vehicles would be parked at the East Valley Bus Operations and Maintenance (EVBOM) facility at the corner or Rio Salado Pkwy and 52nd St.

If the city chose to run the service itself, it could also work with First Transit and have vehicles operate from EVBOM. Alternatively, municipally owned properties closer to or within the service area could be used, such as downtown Chandler parking garages. Figure 11a shows garage and parking lot locations throughout downtown Chandler. Chandler City Hall presents the most optimal combination of covered parking and adjacent office space if needed for operations and operator relief.

Figure 11a. Map of Downtown Chandler Parking Garages and Lots

App Integration

Most microtransit services come with complementary mobile apps that provide additional conveniences for riders. These conveniences can be used to appeal to choice-riders and transit dependent populations alike, and capitalize on widespread access to data-enabled smartphones.

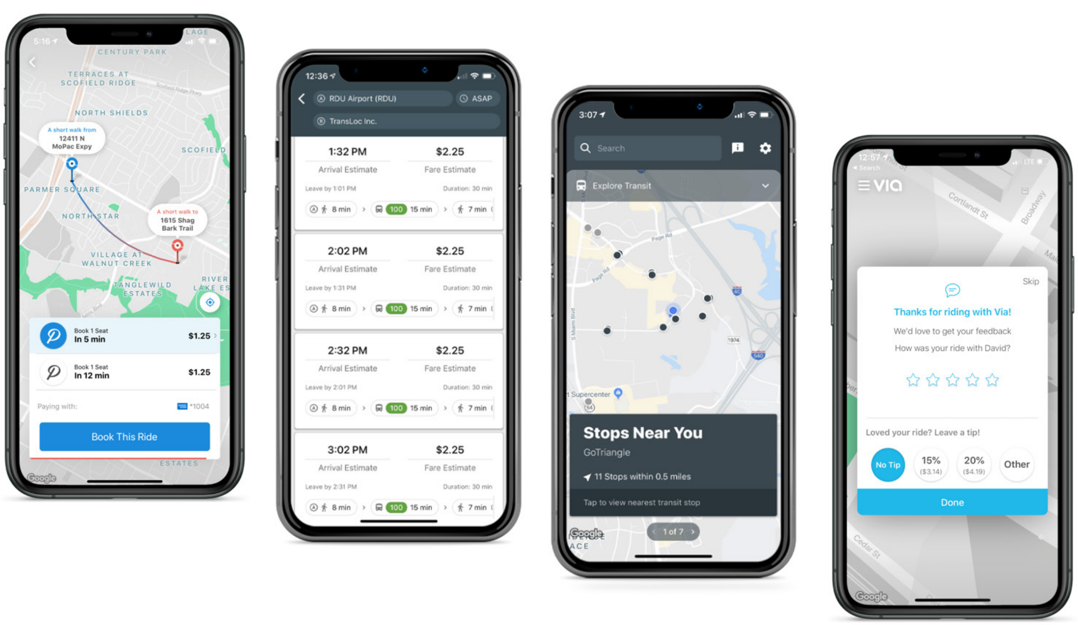
Riders can hail rides on their smartphone on-the-go through the mobile app and track their vehicle in real-time. App based ride hailing is far more commonly used by microtransit riders, indicating a preference for this quick, more visual method over phone hailing.

Riders can pay fares through the app quickly and easily without having to go to fare outlets or handle cash. This streamlines operations as it reduces the time taken to accept fares onboard, and allows operators to forgo the added investment of installing fareboxes. In some regions fare payment is integrated into the broader regional transit e-fare payment system so riders can use one app and pay one fare for a trip across multiple transit modes. Valley Metro is currently developing such an e-fare system, and future multimodal fares would likely be incorporated to make transfers more seamless.

Apps also provide information on the broader regional transit network to facilitate easier use of fixed route transit to complete trips beyond the service zone. Real-time fixed route vehicle locations, schedules, service maps and trip planners can shorten transfers, make the transit system more accessible and bolster transit ridership in the microtransit zone.

The app can also gather customer feedback on the service. Considering riders can be automatically or randomly prompted to provide feedback and providing feedback through an app already open for ride-hailing is relatively easy, feedback would likely increase with this simple app feature.

For these reasons the study suggests an app that provides the features mentioned here to improve rider experience and operations of the microtransit service.



Here are varying examples of microtransit apps being used to hail a ride, make fare purchases, plan transit travel, and leave feedback.

Boarding and Alighting Location Parameters

In a microtransit system, riders can be limited to boarding and alighting at specific locations to improve the efficiencies of the system or promote transit network use without making further investments in fleet, labor or technology. For example, in place of service directly to their door, riders can board and alight at the nearest street corner. While this increases distance traveled to the service for the rider, it also provides better operational efficiency by streamlining how rides are routed. When a rider is at a more difficult to access spot, looping around blocks and navigating through parking lots increases overall ride and wait time for riders relative to a corner-to-corner system. Travel distances are still typically much shorter than the distance to a fixed route stop as this option will always provide access at the closest intersection anywhere in the zone. At best a fixed route can match this proximity, though for most locations in the study area this is not the case.

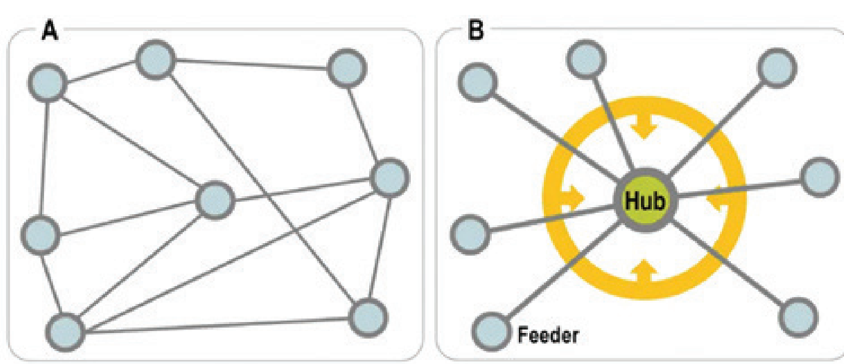
However, door-to-door service is preferred by riders for its simplicity and convenience. Riders are typically more familiar with this model of service used by other modes like taxi and rideshare services. Also, the predicted levels of initial productivity do not suggest this kind of streamlining would provide much efficiency or change fleet requirements for this service. This study suggests using a door-to-door model of service for these reasons, though a corner-to-corner model can be easily adopted down the road to manage high demand if needed.

Another possibility for streamlining service operations concerns just where passengers can alight. Typically, microtransit services are point-to-point services, meaning that the rider can travel to any location within their zone from wherever they are. Alternatively, in a busy zone rides can be managed into a hub-and-spoke system where riders must travel to one or more central locations from their origin and continue on to their destination from the hub, as seen in Figure 13. While this is more indirect and may require a transfer for the rider, at high levels of demand this restriction can streamline system use and more efficiently utilize an existing fleet by grouping rides more often.

While these hubs can be grocery stores, community centers, employment hubs, etc, they can also be the collection of stops within the transit network, essentially creating a first/last mile microtransit system. While this may promote transit access, it will also undermine the mobility among areas not served by fixed route transit and will partially perpetuate limited transit access in these areas.

The study suggests operating the service point-to-point for many of the same reasons it suggests curb-to-curb pickup. Primarily, this style of service is preferred by riders for its simplicity and convenience and riders are typically more familiar with this model of service. And again, the predicted levels of initial productivity do not suggest this kind of streamlining would provide much efficiency or change fleet requirements for this service. The hub-and-spoke model can be easily adopted down the road to manage high demand if needed.

Figure 13. Point-to-point Vs Hub-and-spoke Service Model Diagram



Stop Signage and Infrastructure

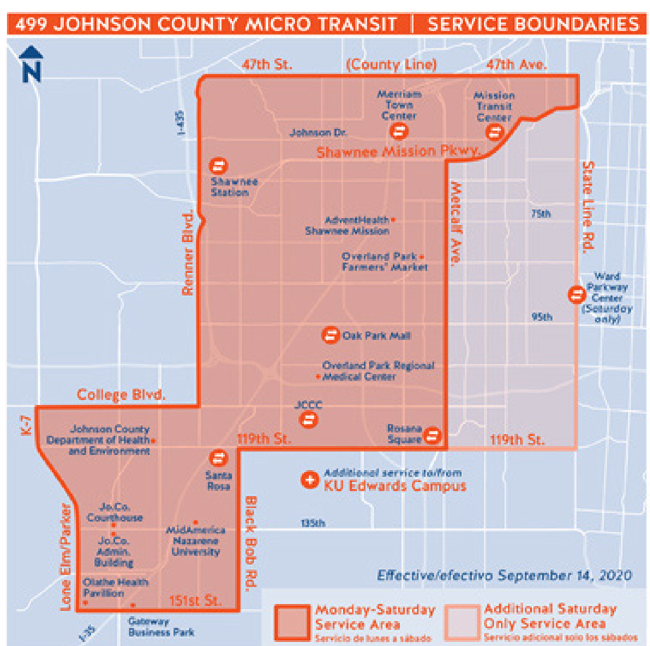
Considering riders can hail microtransit service at any corner or address, each square mile of a microtransit zone can contain hundreds of potential pickup locations. This can make it difficult to discern where signage and infrastructure are to be added or updated. A transit stop on a fixed route will require at least a sign and a concrete pad that is wheelchair accessible, if not a bench, shelter and amenities. Providing this treatment within a microtransit zone for every potential stop is neither necessary nor feasible.

Along the flag zones of Valley Metro circulators, though riders may be picked up at countless locations, intersections along these corridors rarely have physical stop signage. No additional ramps or concrete pads are required, and riders rely on the underlying pedestrian network for needed ADA accommodations. Wayfinding and other signage can be found at heavily used stops. In a similar way, signage in a microtransit system can be limited to key locations where riders can refer to physical wayfinding signage, as seen in Figure 14, for zone boundaries, key destinations and transfer opportunities. Even stops that no longer feature fixed route service can be retained and repurposed for microtranit for shelter, wayfinding and marketing. This information is especially useful for riders without smartphones who lack on-demand access to service information for this and other transit services.

The study suggests posting such signage initially at major transit stops, in addition to key destinations within the service zone. These would include Chandler Fashion Center, Downtown Chandler Public Library, Snedigar Sports Center, the Chandler Regional Medical Center and similar locations. If additional high demand intersections or locations become apparent in usage data, new signage and pads can potentially be placed to accommodate riders as needed on an ongoing basis.

Microtransit can likely be implemented without added pullouts in the study area. Many of the roads feature low volumes, moderate speeds and passing lanes that accommodate microtransit vehicles stopping in traffic. When road conditions do not permit this operators can likely pull into side streets and parking lots. Operators on this service will have more discretion than fixed route operators on when it is appropriate to stop in the street and when they need to pull off the street. The smaller vehicle will allow this kind of flexibility, and unusual stopping activity can be noted on the vehicle to alert drivers.

Figure 14.



This sample wayfinding signage from Kansas City's microtransit service shows zone boundaries, key destinations and transfer opportunities.

Vehicle stopping locations present another infrastructure related concern. Stopping a microtransit vehicle in an active traffic lane to pickup or drop off a passenger may present issues for traffic flow and safety. Again, while it is not feasible or desirable to place several new pullout locations within a microtransit zone to avoid these issues, some considerations are necessary for operations.

These conflicts can more readily be avoided in a curb-to-curb system as more stops will be made out of roadways and in parking lots and other less active roadways. Also, considering the relatively low frequency of stopping at any one location, as seen in modeling and usage patterns from similar systems, the impact to traffic flow should be relatively negligible in any one area. Higher usage areas in the data tend to be areas like office parks, hospitals, shopping centers and other areas with appropriate space and low vehicle activity which mitigates these concerns as well. And unlike fixed route transit, microtransit vehicles do not need an area to stage along a major arterial and can be flexibly staged. As a result, the study does not recommend adding new areas for boarding, alighting and staging.

However, with the rise of TNC use among the public many highly trafficked land-uses such as airports, malls, hospitals, etc. have designated areas for such services to use. To maintain the privilege of accessing these facilities for the riding public it will be important to direct users to these areas carved out by private land holders. These locations include: Chandler High School, Chandler Center for the Arts, Chandler Senior Center, Intel, Wells Fargo, Northrup Grumann, Paypal, Hamilton High School, and Hamilton Library.

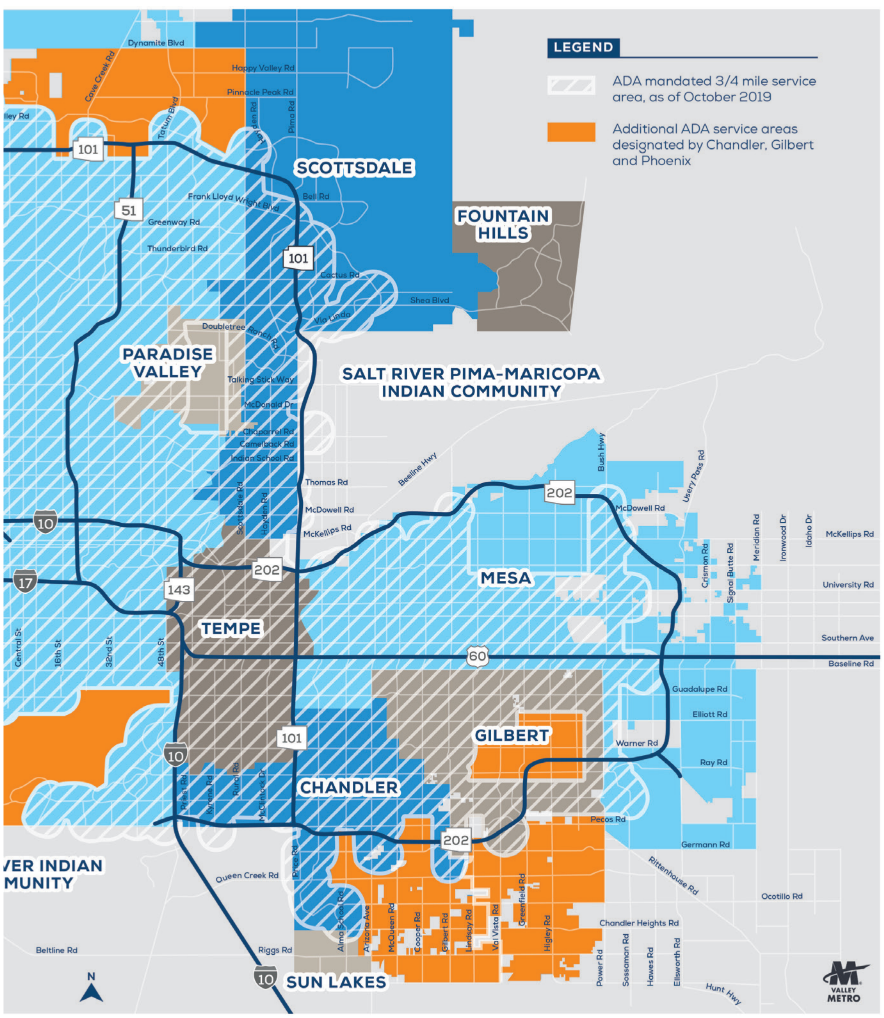
Figure 15. Example Rideshare Designated Spot Signage

ADA Service Accommodations

Accommodating individuals with disabilities in a microtransit system not only maintains equity in transportation access but is also more cost effective. Typical fixed routes require parallel accessible dial-a-ride service within 3/4mi to fulfil the requirements of the ADA for transit operations. With microtransit, if the service is accessible and comes within a reasonable distance to the individual (either door-to-door or curb-to-curb) then no duplicative paratransit service is required.

Currently paratransit for people with disabilities is offered throughout Chandler as shown in Figure 16, so changes to the transit network in the city would not alter paratransit service coverage. However, if policies change within the city regarding paratransit coverage, accessible microtransit service zones would provide accessible service to riders in those zones. Also, paratransit requests within a zone could be serviced instead by microtransit and in a more cost-effective manner. This is referred to as "comingling" microtransit into your paratransit service provider network. Customers will benefit from shorter wait times, and lower fares considering Ridechoice trips cost $3.00+ and paratransit trips cost $4.00 per ride. Referring to pre-pandemic ridership data from 2016-2019 we see that each year roughly 2,500 trips are made within the recommended service zone, representing about $75,000-$90,000 annually in paratransit trip costs.

Figure 16. Regional Paratransit Coverage Map

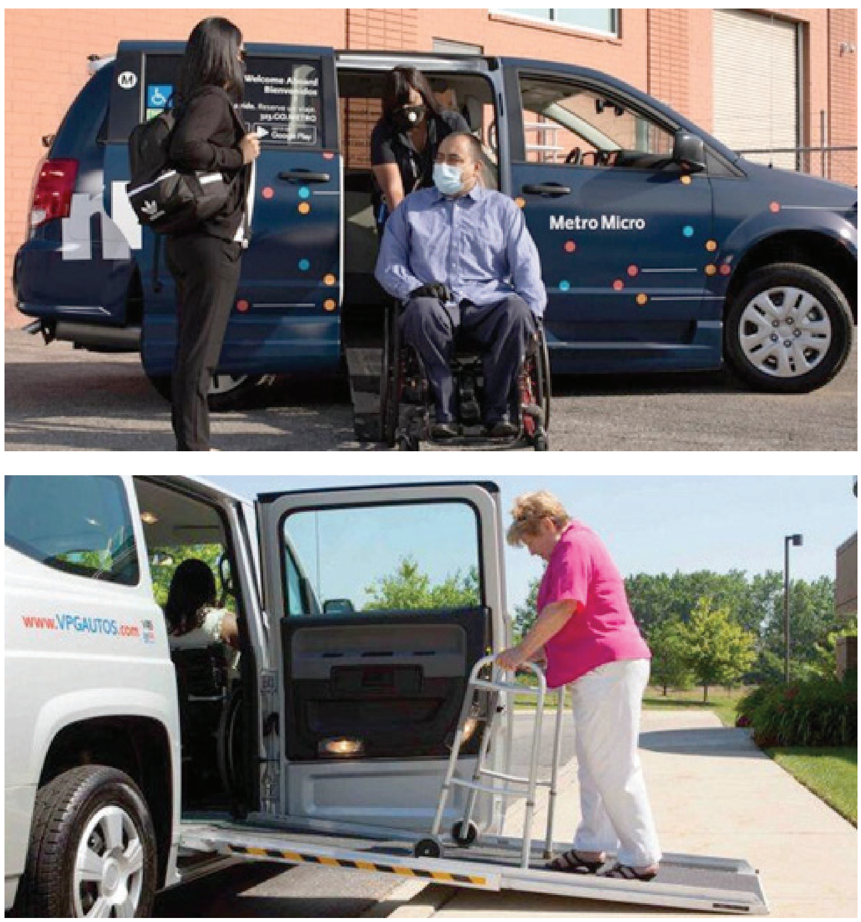


As mentioned in the section on fleet, an essential component of accessible microtransit service is providing a minimum 10% wheelchair accessible fleet, which is an industry standard. The study recommends five vehicles to run service plus one spare. To meet this ratio consistently then, one in-service vehicle and the spare should be accessible.

ADA regulations note that accessible service must be "origin-to-destination". While they do not explicitly dictate a door-to-door standard "paratransit providers must provide enhanced service on a case-by-case basis where necessary to meet the origin-to-destination requirement; some individuals or locations may require service that goes beyond curb-to-curb service."[1] Therefore, deciding between curb-to-curb vs. corner-to-corner service will impact the viability of replacing paratransit services with microtransit within the microtransit zone. Users would need to identify these needs when hailing a ride in a corner-to-corner service, which can be automated with the use of an app. Operators using the accessible vehicle should also be experienced in aiding passengers using ramps, lifts and wheelchairs. All operators should understand the needs of the vision impaired, those requiring service animals and other groups requiring minor special assistance to get from origin to destination.

1 - FTA: https://cms7.fta.dot.gov/are-paratransit-service-providers-required-provide-service-beyond-curb

Figure 17. Examples of accessible microtranist vehicles.



Service Logistics & Cost Estimates

Microtransit services are usually contracted in one of two ways. One option, Transportation as a Service (TaaS), is a turnkey offering from a microtransit software provider who typically subcontracts the labor and leases the vehicles, operating the service under the supervision of the city and/or regional transit agency. Alternatively, a municipality can opt to purchase its own fleet of vehicles, use its own labor and simply subscribe to software as a service (SaaS) that routes the vehicles dynamically, collects usage data, etc. A hybrid model may also be employed where a local transit contractor is paired by the city with a SaaS to have more direct control over service operations. This would also provide the option of not buying fleet and going through the procurement process seeking federal funding, etc. Both TaaS and SaaS have different upfront and ongoing costs, and by extension different advantages to offer. In assessing costs for prospective service, the study team worked with microtransit service providers and drew from peer agency data to improve the accuracy of our estimates. The following sections detail these different options with 2020 service costs.

Upfront Costs

With some providers, upfront costs in a TaaS agreement may be repaid across the life of the contract, though many providers charge an upfront fee. These costs go to administration and overhead like initiating leases on vehicles and property if necessary. These costs scale according to the amount and kind of fleet and labor being brought online. In estimates for our system, upfront costs ranged from $16,000 for four vehicles to $29,000 for six.

For a SaaS solution, upfront costs depend largely on the following components:

UPFRONT COSTS FOR SaaS OPERATION	
Cost Component	**Cost**
Fleet	• $50K- per Passenger Van • $65K per Wheelchair Accessible Vehicle • $100K-$150K per Cutaway Bus • Includes cost of fare validators and programing, roughly $1,000-1,500/vehicle
Tablets	$200 - $500 per device, including associated mounting gear
Operators	Costs vary depending on labor market, partnerships with local transit contractors and the ability to utilize existing municipal drivers. ADA trained drivers likely need specialized training.
Administration and Overhead	No upfront cost if using existing facilities for calls and service operations. Valley Metro call center, and either the East Valley Operations and Maintenance Facility or a Chandler Municipal garage are assumed.
Marketing	$10,000 - $25,000

For service recommended in this study upfront costs for a SaaS setup are estimated between $450,000 - $550,000.

Ongoing Costs

In a TaaS agreement ongoing costs cover everything required to operate a microtransit service: SaaS, operators, fleet and operations management. Cost estimates for hourly rates by fleet size can be seen in Figure 18a. This figure shows how hourly cost decreases as the fleet size increases. This results from fixed costs of operating being spread across a larger number of vehicle hours and some efficiencies of scale. Of these costs, the largest percent comes from operators which account for 25%+ of costs followed by vehicle costs which make up about 20%.

Figure 18a

COST ESTIMATES FOR TaaS SERVICE			
	Low Demand	Medium Demand	High Demand
Estimated Vehicle Hours	14,100	17,600	21,200
Peak Vehicles*	4	5	6
Fixed Upfront Cost	$16,000	$17,000	$29,000
Total Gross Cost	$850,000	$1,000,000	$1,170,000
Gross Cost per hour	$60.28	$56.82	$55.19

*Does not include spare vehicle count. However, spare vehicles costs are included in estimates shown.

When operating under a SaaS contract the main differences relate to vehicles, operators, and operations management. Costs vary considerably across different systems for this service model, though it can save money for those with access to the existing inhouse vehicles, labor, and facilities that can be utilized. To achieve greater cost efficiency or ease of operation the city can partner with a local transit contractor to contract some of these elements on an as-needed basis.

- Operators: Drivers would need to be hired independently on an ongoing basis, and driver pay makes up the largest ongoing cost component
- Fleet: Purchased vehicles will require ongoing maintenance, storage facilities and eventual replacement.
- Operations Management: The municipality would need personnel to act as a dispatcher, receiving phone bookings, managing driver issues, and more. These functions can likely be folded into current Valley Metro operations.
- Software costs: The ongoing software costs vary depending on provider and size of deployment. They are estimated around $25,000-$35,000 annually.

Figure 18b

COST ESTIMATES FOR SaaS SERVICE		
Cost Factor	Estimated Cost	Notes
Labor	$299,000	Assumed $17/hr, 17,600 hr/y
Benefits	$194,000	Assumed $11/hr, 17,600 hr/y
Maintenance/Fuel	$176,000	Assumed $.50/mi (FHWA), 20 MPH, 14,700 hr/y
Marketing	$10,000	
Admin/Facilities	$110,000	Assumed EVBOM Facility use, fare processing and VM call center use
Software	$30,000	
Annual Total	$709,000	Example estimate, likely cost may range ± $50K
Average Cost / Hour	$46.53	

Initiating the service as a TaaS initially would allow the city flexibility to explore the success of the service without heavy investment, while still leaving the option open for more investment and a transition to a SaaS setup in the future if service proves productive. Yet if the service is slated to run more than two years the upfront investment in a Saas operation would pay for itself, as shown in the summary table below.

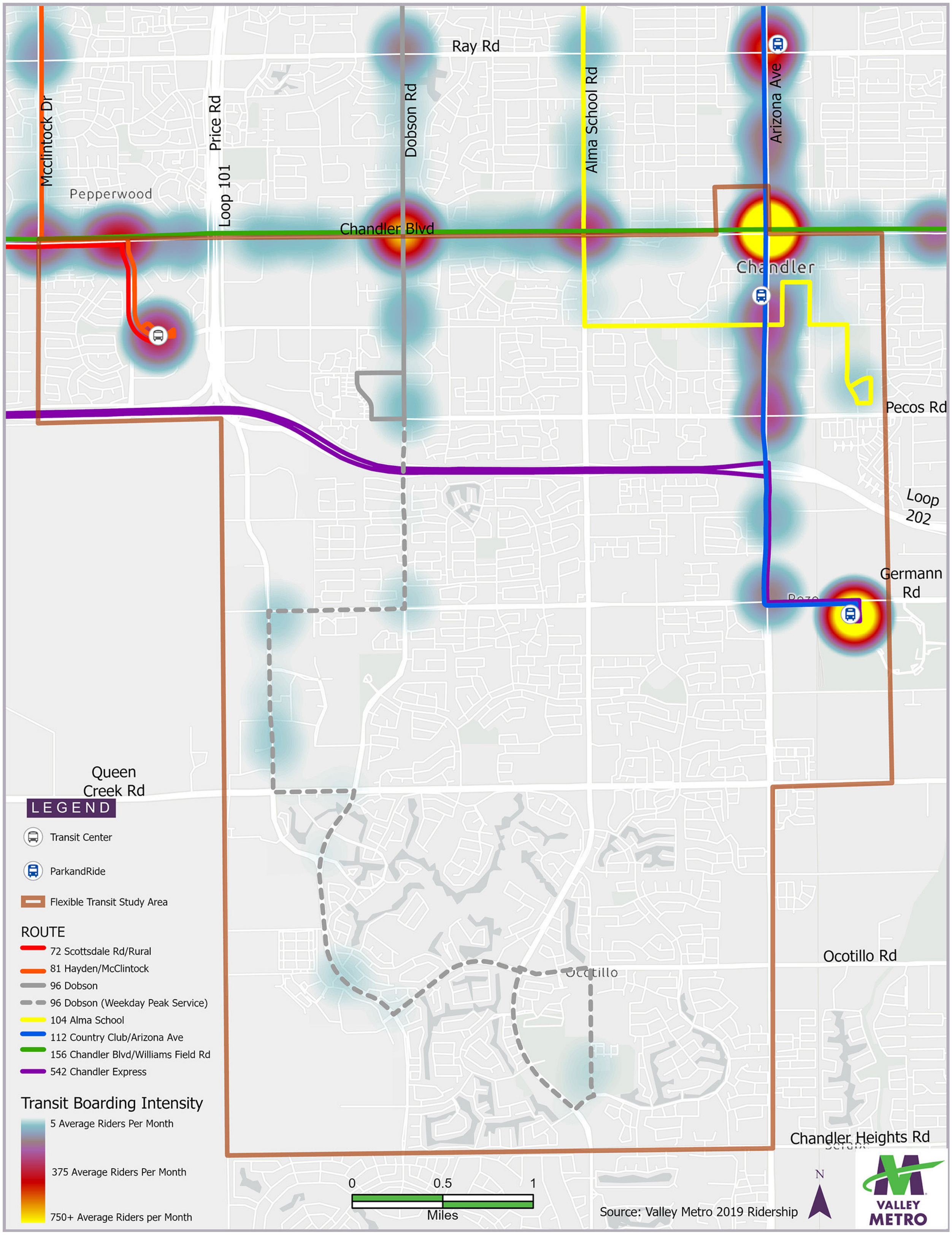
COST ESTIMATE SUMMARY TABLE TaaS		
	Cost	SaaS Cost
Estimated Vehicle Hours	17,600	17,600
Vehicles	5	5
Upfront Cost	$17,000	$450,000-$550,000
Gross Annual Cost	$1,000,000	$800,000-$850,000
Gross Cost per hour	$56.81	$45.45 - $48.30
**Includes fleet purchase of 3 passenger vans and 2 accessible vans*		

For comparison, Figure 19a shows the cost of current fixed route investment strictly within the study area to show the scale of current expenses and how this cost would compare. Additionally, the relative amount of ridership productivity is shown in Figure 19b. The cost and productivity data of these route segments directs system optimizations that can replace low performing sections with microtransit on the periphery of the regional transit network. One such section is the weekday peak extension of Route 96- Dobson Road south of Pecos Road which produces relatively little ridership in the area. The study recommends that this route alignment be removed south of Pecos Rd if replacement microtransit service is provided.

Figure 19a. Study Area Transit Service Costs and Characteristics

ROUTE	PEAK HEADWAY (MIN)	OFF PEAK HEADWAY (MIN)	STOPS SERVED	ROUTE LENGTH WITHIN STUDY AREA (MIN)	ANNUAL OPERATING COST WITHIN STUDY AREA	FY19 RIDERSHIP	COST PER BOARDING
72-Scottsdale/ Rural Rd	20	30	7	1.3	$260,000	25,228	$10.31
81-McClintock Dr/ Hayden Rd	30	30	7	1.3	$149,000	19,752	$7.54
96-Dobson Rd	30	30	48	7.6	$524,000	47,248	$11.09
104-Alma School Rd	30	30	18	2.7	$317,000	21,020	$15.08
112-Arizona Ave/ Country Club Dr	15	30	19	3.1	$779,000	108,944	$ 7.15
156-Chandler Blvd/ Williams Field Rd	30	30	34	4.7	$720,000	143,664	$5.01
542-Chandler Express	3 Trips	N/A	1	5.5	$297,000	52,040	$ 5.71
TOTAL	**N/A**	**N/A**	**134**	26.5	$2,825,000	17,896	$ 7.29

Figure 19b. Transit Routes and Ridership Density



Performance Measures and Planning Tools

Transit performance measures assess the effectiveness of transit operations in achieving the service goals and should be monitored on an ongoing basis. They also identify whether performance improvement actions taken to enhance access and productivity are effective. Planning tools also prove useful for periodic route performance and optimization analyses by providing more nuance and breadth, and are monitored only on an as-needed basis. The Board-adopted transit performance measures of Valley Metro's Transit Standards and Performance Measures (TSPM) do not provide specific guidance for microtransit, but several applicable measures can still be drawn from it. Using the guidance from this document, and the policies of similar microtransit programs, the following performance measures and planning tools are recommended for use in maintaining high quality, efficient service:

- Performance Measures-
    - Riders Per Revenue Hour- Measuring ridership productivity by hour shows demand in a way that can be compared to other services of different types and sizes. It shows how many individuals are using the system and can be compared across multiple microtransit zones. Tracking productivity is essential, especially when making changes to the system to see if they are attracting or losing riders. The study suggests setting a target of 20 riders per hour on weekdays and 15 an hour on weekends as service starts. This is a conservative threshold based on modeling analysis, as shown in the varying estimates of demand in Figure 20.
    - Average & Maximum Wait Time- Like high frequencies on fixed routes, low wait times for microtransit makes the service more convenient for and marketable to riders. Knowing on average how long riders are waiting, and what the longest waits are allows service providers to know when there is too much or too little service on the street, and how to scale their fleet to balance efficiency and quality. To provide service quality in accordance with the TSPM local bus service standard of 30-minute headways, where average wait times would presumably be 15 minutes or less, a 15 minute average wait time is suggested. To ensure low variability in wait experiences, a maximum acceptable wait of 20 minutes is suggested. In modeling the service within the recommended zone, the data suggested five vehicles would be needed to manage a peak demand of 25 riders an hour which is likely the initial peak level of demand. Figure 20 shows how increased demand would correlate with a higher fleet need if wait times are to be maintained at standard.

Figure 20 – Modeling Outcomes for Varying Levels of Estimated Demand

	LOW DEMAND		MEDIUM DEMAND		HIGH DEMAND
Rides per Hour	25		50		75
Passengers / Van Hour	5 - 5.5	4.5 - 5	6.5-7	5.5-6	8
Max Fleet Size	4	5 - 6	7	8	9
Average Wait Time (Minutes)	14 - 15	10	14-15	9-9.5	11

- Gross Cost Per Passenger-Keeping cost per passenger low and comparable to the cost of fixed route service will maintain the financial competitiveness and sustainability of the service. Measuring costs in this way allows for comparison across modes for better context in comparing investment efficiency. Given the ridership goals of 20 and 15 riders per hour on weekdays and weekends, respectively, and the estimated cost of $57.80 per vehicle hour, recommended targets are $10-12 per boarding on the weekdays and $15-$18 per boarding on weekends. This cost per boarding on microtransit would be roughly as cost effective as most current fixed routes' cost per boarding on weekdays, and moderately higher than weekend rates, as shown in Figure 21. This figure shows these costs through the city as a whole, and within the study area in particular.

Figure 21

FY19 FIXED ROUTE TRANSIT GROSS COST PER PASSENGER		
	Weekdays	Weekends
City of Chandler	$9.53	$10.59
Study Area	$8.83	$9.07

- Planning Tools:
  - Weekday Average Boardings- Gives ridership productivity by most representative day and is commonly used across the regional transit system.
  - Boardings By Time Of Day- Shows demand variability across time to manage peak demands and make efficient use of fleet and labor.
  - Service Connectivity & Transfer Frequency- Tracking transfer opportunities in a microtransit zone shows how broader network accessibility varies over time, and whether the zone is gaining or losing connectivity. Measuring transfers when possible provides data on how microtransit impacts fixed route use and vice versa to promote and replicate high performance.
  - Peak and Average Load Factor-Monitoring load factors is another tool for adjusting fleet to balance service quality and cost effectiveness. Knowing when and how often vehicles are at capacity will determine whether more or fewer are required and at what times so overcrowding and overserving can both be avoided.
  - Wait Time Reliability- While max wait time gives a high watermark of wait time experienced, reliability measured by the 90th or 95th percentile wait time gives more nuance into how much wait times vary and is less affected by outliers.

Figure 22

RECOMMENDED PLANNING TOOLS	
Weekday Average Boardings	Peak & Average Load Factor
Boardings By Time Of Day	Wait Time Reliability
Service Connectivity	Transfer Frequency
Recommended Performance Measure	Recommended Thresholds
Wait Times	Average: 10 -15 Minutes Max Acceptable: 20 minutes
Riders Per Hour	Weekday: 20 Rides /hour Weekend: 15 Rides /hour
Gross Cost Per Passenger	Weekday: $10 - $12 /boarding Weekend: $15 - $18 /boarding

Public Outreach

The study team provided opportunities to learn more about the study and submit input on proposals analyzed. An online public meeting was held from May 20, 2021 to June 11, 2021. Input opportunities included an online survey, online comment map and phone and email contact with community outreach staff. In total, the informational materials and input pages had more than 3,700 views, and 17 comments were received through the survey, the interactive map, and through email. Notifications about the open house and the study generally were posted on Chandler's and Valley Metro's websites and social media pages, and on display boards throughout the study area.

Figure 23. Twitter post for online public meeting

Highlights of the feedback are shown in Figures 24a-e. Key destinations requested for service in feedback were Chandler Fashion Center, Downtown Chandler and Chandler Regional Medical Center. Several respondents wanted to see better connectivity between local neighborhoods like Ocotillo and key destinations.

When asked what innovations would make them more interested in riding microtransit, electric vehicles appealed to more respondents than autonomous ones (39% to 26%). Most respondents viewed wait times greater than 10 minutes undesirable, though a third said the recommended standard of 15 minutes or less was acceptable. Achieving these levels of 10 minutes or better is possible but would increase the cost of service around 20%. The study team has taken these and other points of input into consideration when finalizing the suggestions presented in this report. A full summary of feedback can be found in Appendix A.

Figures 24a-e – Outreach Survey Responses

Figure 24a.

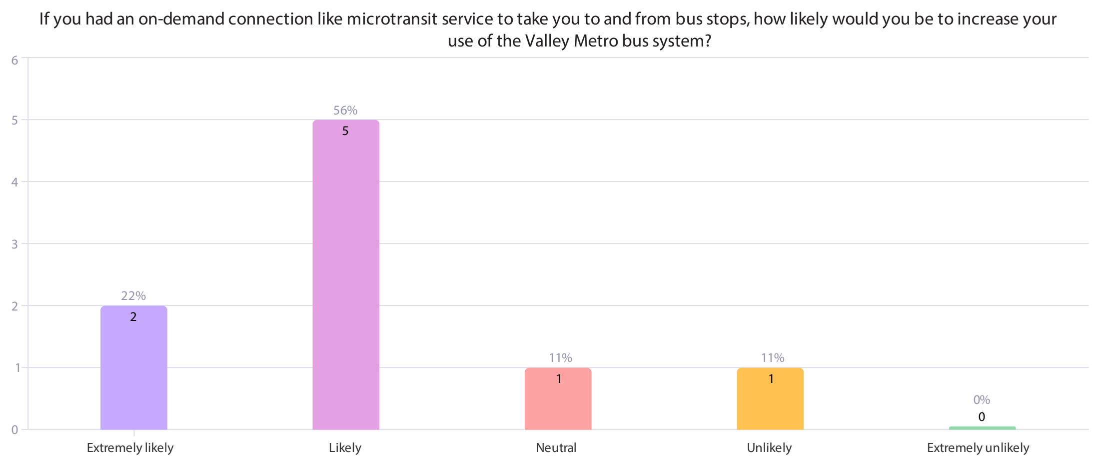


Figure 24b.

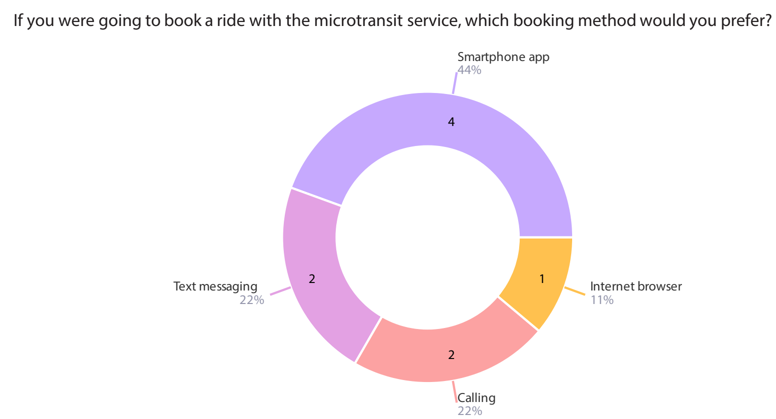


Figure 24c.

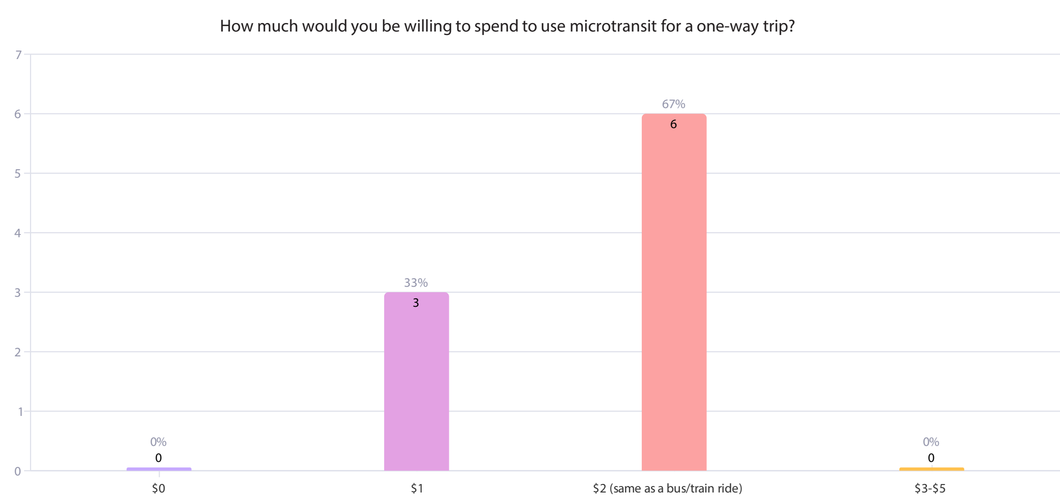


Figure 24d.

Once you request a trip, you will have to wait for the vehicle to pick you up at a nearby location. How long would you be willing to wait?

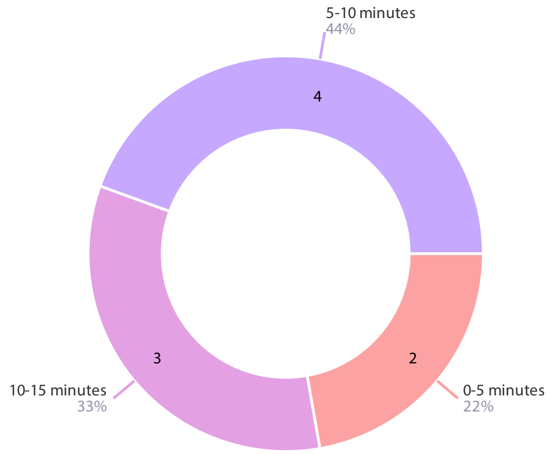
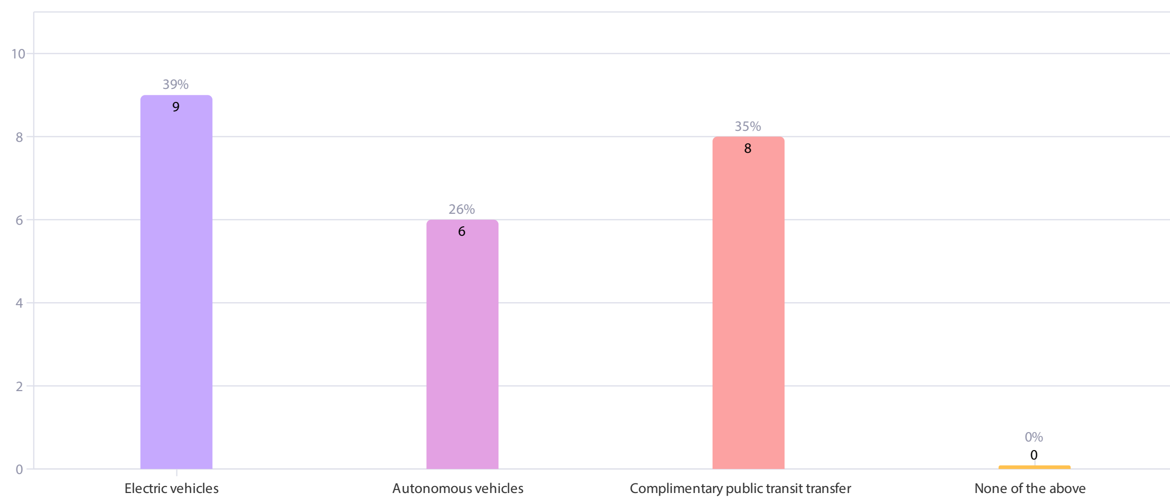


Figure 24e.

Would any of the following potential service features make you more interested in using microtransit service? Check all that apply.



Branding Recommendations

Valley Metro's marketing and design staff worked with the study team on branding recommendations for prospective microtransit services within and beyond the study area. These branding elements make the service stand out in the street, reflect the dynamics of the neighborhood and attract riders. These designs can be seen in greater detail in Appendix B.

Branding features include both city and Valley Metro branding to convey both the neighborhood nature of the service, and its relationship to the larger regional transit network. These designs feature important functional elements as well, primarily to facilitate access to the service's many ride hailing platforms. These elements include a phone number for customer service, ride hailing and a concise URL for web access. To advertise the service's smart phone application a graphic or QR code can be included to direct consumers to download the app.

Inspiration for key themes in the designs are drawn from the technology, commerce and manufacturing enterprises in the Price corridor, as well as transportation and connectivity generally. City branding colors were used as the palette for these designs and could be swapped out if new colors are adopted in the future. Complementary branding featured on a smartphone app, wayfinding signage, marketing materials etc. can draw from the design elements chosen for vehicles to reinforce the branding.

MICROTRANSIT SERVICE VEHICLE DESIGN CONCEPTS

Preferred Design

- This concept has more of a technology vibe that shows an abstract circuit board with highlighted points and racing stripes.
- City logos are more prominent, and contact info/QR code are featured to promote access.
- The bold long lines could indicate connectivity, innovation and speed.

Alternative Design 1

- The hexagon shapes chosen are associated with molecular/ chemical structure, technology and manufacturing.
- The words are angled, complimenting the flow of the hexagon shapes creating additional movement.

Alternative Design 2

- This more interpretation is less technology centric and more simplistic.
- Curved accent lines and a lowercase logo give the design a more casual feel.

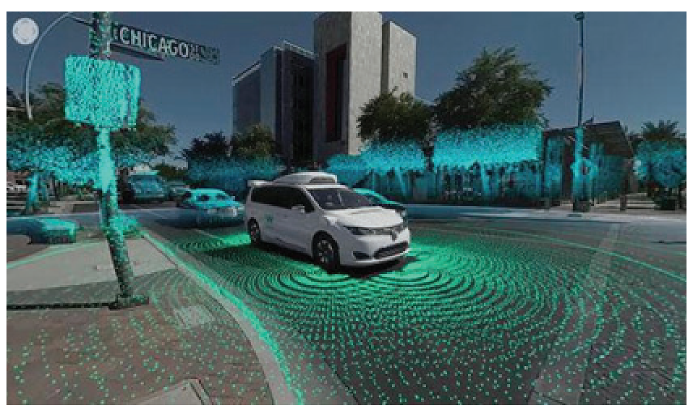
Advanced Technology Integration

While the idea of general public dial-a-ride service has existed for decades, ongoing innovations have made operating these services easier and cheaper. These innovations also benefit users by reducing waits outdoors, making fare payment easier and facilitating transfers. Some of these conveniences come from the fundamental service elements discussed previously such as the dynamic routing software and complementary smartphone app.

Beyond these elements, more advanced technologies can further increase the safety, sustainability and efficiency of operations. These elements can even provide the service with novel features that can boost marketability and productivity. This section explores three relevant technologies with a proven track record for improving microtransit systems: automation, electrification and TNC integration.

Artificial Intelligence Parking Only

A Battery Electric Passenger Van Being Plugged in to Charge



An Autonomous Vehicle Using Lidar to Map Surroundings

Automated Vehicles

The growth of autonomous vehicle research locally offers the unique prospect of automating microtransit service. The current study area lies largely within the autonomous service zone of Waymo as shown in Figure 25. Valley Metro has partnered with Waymo to better understand the prospect of integrating autonomous vehicles in public transportation.

Operating autonomous vehicles for microtransit provides several potential benefits. Considering 94% of serious crashes are caused by human error[2], a wide margin of improvement exists for making operations safer. These vehicles have an advanced ability to see around corners, through obstacles, in glaring sun and in other compromising situations. An AI driver's ability to collect experience across fleets and in simulations give these systems lifetimes more driving experience than any human driver. They also offer the prospect of more cost-effective service by reducing labor costs when vehicles are operated without in-person attendants. Lastly, autonomous vehicles can run for longer shifts than human operators, requiring relief breaks only briefly and infrequently for fueling and technical maintenance.

Yet driverless technology also offers unique limiting factors. Autonomous vehicle operations are currently limited to specific zones and a handful of companies. Currently within the study area, Waymo is the only operator of autonomous vehicles with no prospective alternative on the horizon. Also, the service zone is dictated by the autonomous provider, meaning parts of desired areas may not get coverage, and coverage may spill into other areas not planned in this or other transit studies. This may lead to a less mutually beneficial relationship with the transit network, as zone edges may extend into and compete with regional transit services. Alternatively, they may not extend into the transit deserts where coverage is most needed. And in the short-term vehicle choice will likely be dictated by the autonomous technology provider, not service needs or budget.

Figure 25. Waymo 2021 Service Zone

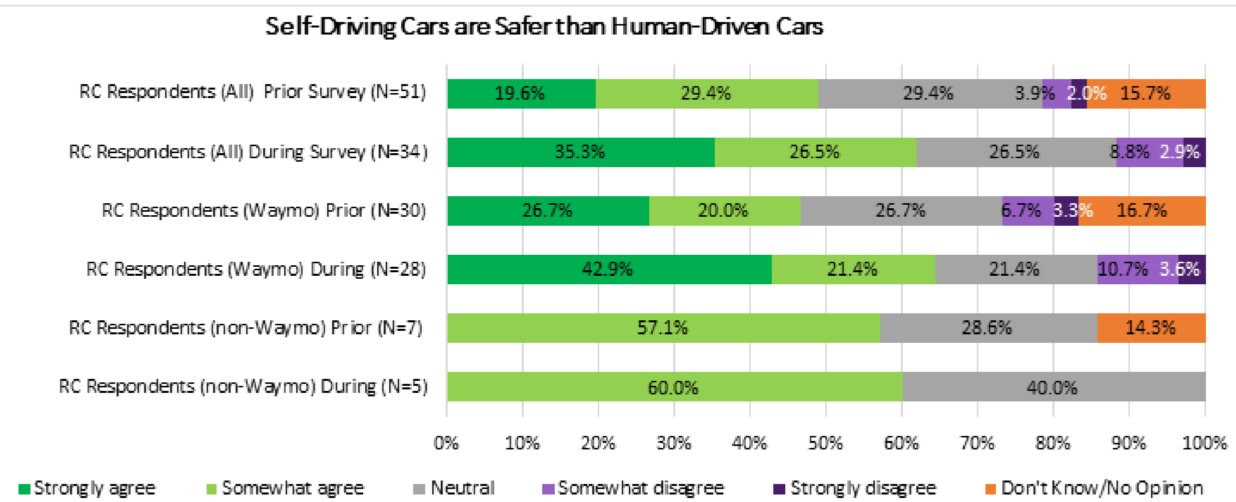
2-https://www.nhtsa.gov/technology-innovation/automated-vehicles-safety

The public perception of this technology is critical in its adoption, as many still have reservations about putting faith in a relatively new technology where minor malfunctions can lead to serious injury or death. Valley Metro's recent partnership with Waymo provided autonomous RideChoice service (for ambulatory people with disabilities) within Waymo's service zone which afforded a unique opportunity to gauge public perception on integrating this technology. Figure 26a compares riders' perceptions on AV's prior to riding in one, and during the pilot once they had ridden in one. Most people (50%+) thought self-driving cars were safer than human drivers. While experience with self-driving cars increased people's confidence with them, roughly 10-15% of people still thought they were less safe after riding in one. Figure 26b shows 15% would not feel comfortable without a safety attendant at the wheel even after using autonomous service, though a vast majority would not mind. Overall, autonomous vehicles fared better on key measures of satisfaction with users, though travel time and pick-up/drop-off location satisfaction lags likely because of cautious, restrictive operating protocols (Figure 26c). Through these responses we can assume that the public in the area is accepting of autonomous vehicles, and their use would likely improve the perception of the service.

With the prospect of greatly increasing safety and reducing operating costs long term, autonomous vehicle partnerships offer promising improvements to microtransit service. Exploring these partnerships going forward will open up these opportunities and keep the city on the forefront of how this singular technology will fundamentally change transit operations.

Valley Metro Waymo Partnership Survey Results

Figure 26a



Prior surveys refer to responses prior to riding in an AV, and during refers to responses given during the pilot once respondents had ridden in one.

Figure 26b

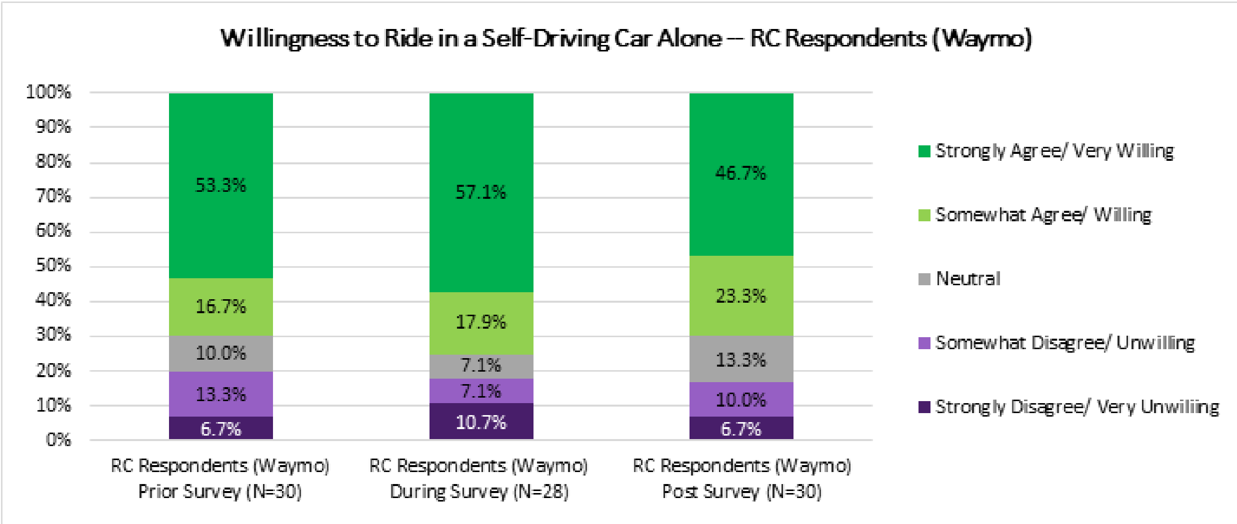
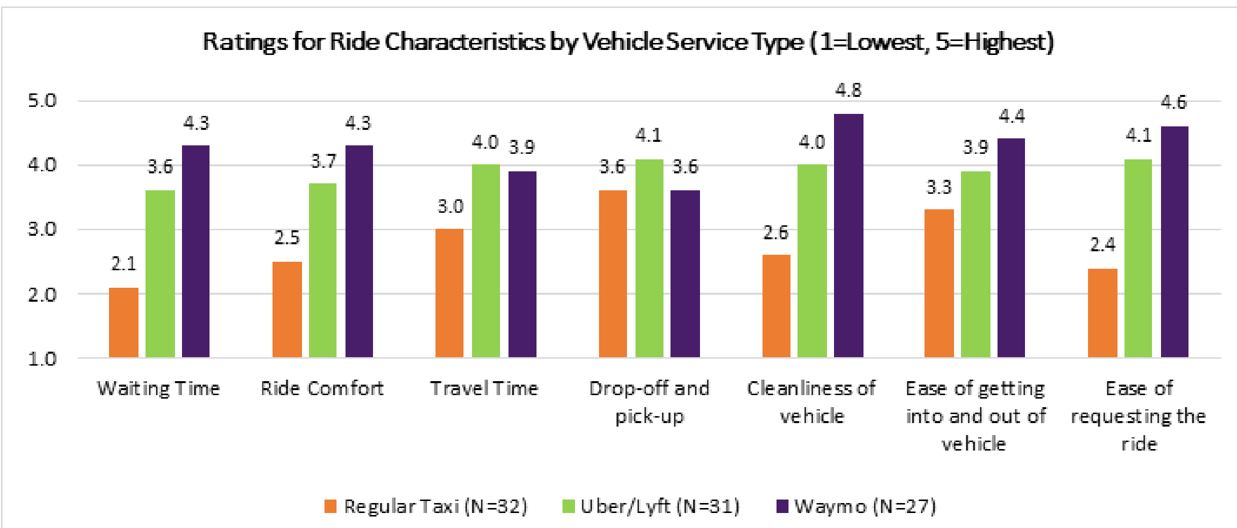


Figure 26c



Electrification

Many transit agencies nationally and globally have successfully converted some or all their fleet to electric in the past decade. Electric vehicles provide a wide range of benefits over a traditional internal combustion engine (ICE) vehicle. They run without emissions and engine noise which is appreciated by the public especially on quieter neighborhood streets. They are much more energy efficient and better for the environment, even considering the region's modest reliance on renewable, clean energy. This efficiency translates into fuel savings over time, savings which are complemented by the relatively low maintenance needs of electric engines which have few moving parts that break down and require no oil changes. An industry estimate of passenger van maintenance costs found a 40% savings over the first 100,000 miles of operations relative to the ICE alternative[3]. Additionally, at current gas and electricity price levels, fuel costs for the combustion engine vans suggested here would be about 250% higher than the electric alternative. While this technology may not have been a viable alternative even a decade ago, rapidly advancing battery technology has extended range and brought down costs for these vehicles (Figure 27) so that they can be viable for fixed and flex route service.

The microtransit service model is very conducive to electrification, especially when compared to the demands of fixed route service. In flexible service, vehicles can be swapped out if needed with less disruption to riders, they can be flexibly staged at charging stations and can be modest in size to get more distance per kWh. Electrification also has public appeal that can be leveraged in marketing. Beyond offering a quieter, cleaner ride the sustainability angle of transit is amplified with electric vehicles and would be easily adapted into the technology-related branding concepts shown earlier.

But with these added benefits come added upfront costs. While these vehicles would likely save money in the long term, their acquisition costs are higher and would require charging infrastructure which brings added cost. The added costs for passenger vans has become smaller over the years, and these vans are now only about 10% more than their non-electric alternative. Yet, an additional spare vehicle may need to be purchased if charging between fares is not an option, like if the fleet has too much demand and not enough down time. This would add an additional $50,000-$60,000 in upfront costs but would not translate into ongoing costs associated with additional vehicle miles and operator hours. Charging infrastructure at a garage would likely run between $5,000 and $10,000 for the fleet. When demand grows, chargers in the service zone could be added for charging during off peak time while remaining on-call. Local utility providers like APS provide incentives for customers to install chargers in their service area that can also reduce cost of implementation.

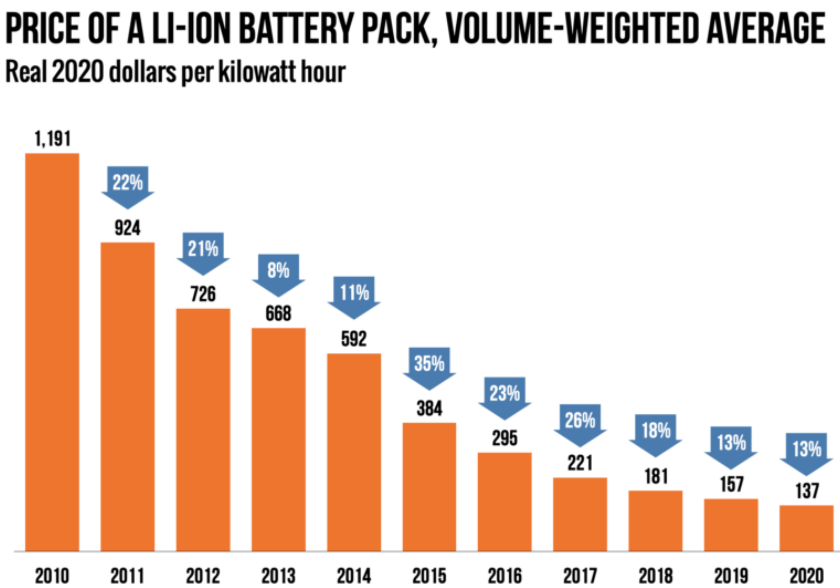
Electric Passenger Van Being Used for Microtransit

3-https://www.fleet.ford.com/showroom/commercial-trucks/e-transit/2022

Battery replacement also looms large as a long term maintenance cost of these vehicles, though as seen in Figure 27 battery prices have dropped roughly tenfold in the past decade and are predicted to continue this trend, making costs for future replacements a small fraction of what they were just a decade ago. Cost difference in a TaaS operation are more pronounced, currently quoted to add roughly 20%+ to annual costs.

Overall, electrification is an increasingly attainable element to add into a microtransit service considering the shrinking difference in upfront costs and the considerable savings in fuel and maintenance over time. It will also demonstrate a commitment to sustainability and air quality in a way that will benefit, and appeal to, the public.

Figure 27



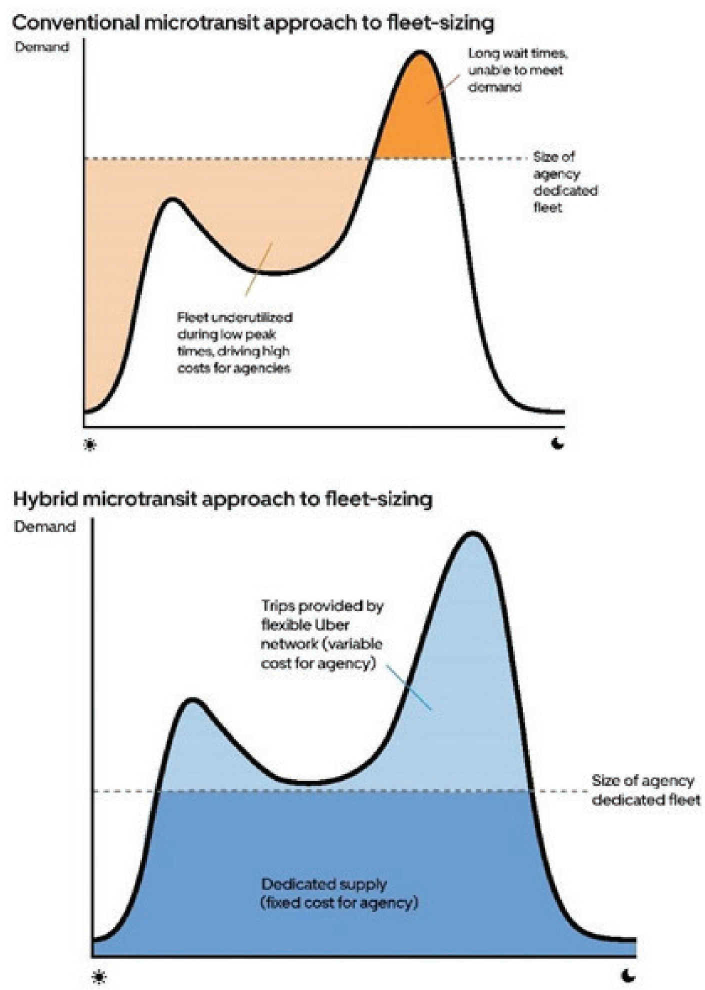
TNC Integration

Microtransit service bears many similarities to pooled TNC services such as UberPool. Because of this, microtransit and TNC services can be integrated so existing TNC drivers can provide trips within the service area to flexibly supplement the capacity of the dedicated fleet. This provides the public with more consistent service quality through peaks while reducing up-front fleet costs and ongoing labor/ maintenance costs for the service provider.

This interplay between demand-over-time and fleet capacity is illustrated in Figure 28. This shows the tension between procuring fleet and operators to meet peak demand while also trying to curtail excess capacity and cost. Limiting capacity below peak levels will likely produce long wait times at peaks and may deter ridership. Alternatively, scaling your fleet/labor up to the peak demand will likely cause wasteful spending by over-serving the area or creating lots of unused capacity. These issues can only be partially mitigated by scaling fleet to demand through the day due to limiting factors from blocking, operator needs, etc. This is where TNC integration can benefit both riders and operators. By partnering with an existing TNC network, a microtransit operator can rely on a more modest dedicated fleet and operator pool, and serve trips beyond this capacity with the TNC as needed. This keeps wait times consistently low and eliminates the need to have a one-size-fits-all fleet that is too small and/or large. Some TNC companies like Uber have even started offering their own TaaS options, which would naturally integrate with their broader driver pool

As a proof of concept, Dallas Area Rapid Transit (DART) has recently integrated UberPool into their GoLink microtransit network as seen in figure 29. They were able to negotiate a better rate for agency subsidized trips while expanding service bandwidth by offering UberPool service through their existing ride hailing app. Users can see wait times for both the dedicated microtransit fleet and the TNC option and make their choice of which to use. Uber users also see this option from the Uber app if the ride fits within the zone, and promotes the service at no cost. The GoLink system has seen strong ridership even through the pandemic and use among both TNC and dedicated fleet are strong across their 17 microtransit zones.

Figure 28



With added flexibility in capacity comes some important restrictions and considerations. Maintaining the choice between accessible dedicated fleet and TNC vehicles, and ensuring wait times are not too disparate, is important for preserving system accessibility for all users. FTA also required DART use shared service like UberPool to maintain equity and optimize the value of public subsidy. Any future partnership for Chandler or Valley Metro would similarly be restricted to shared services.

Integrated TNC service costs can also balloon beyond those of dedicated fleet service as demand grows, a dynamic shown in Figures 30 and 31. These graphics illustrate the relationship between demand and the relative cost effectiveness of fixed route transit vs TNC service. Figure 30 shows generally how fixed route cost per person goes down dramatically as demand builds, but on the lower end of demand microtransit would be more affordable per person. To specifically identify the level of demand where TNCs become more expensive Figure 31 shows actual cost per trip differences by route between TNC and fixed route services in comparable urban transit agencies. These figures demonstrate that at about 15-20 passengers per vehicle hour we expect TNC will not be a cost effective option. This data provides a benchmark for demand that should prompt reevaluation of how to serve this newly established demand more effectively.

While the study area is not predicted to experience this ridership initially, it could develop in the mid- to long-term. Because of this, TNC partnerships would be well suited for the early stages of microtransit service within the city, but would not be cost effective when demand builds beyond 12 riders per vehicle hour.

Figure 29. New DART GoLink Microtransit Zone Promotion Noting UberPool Integration

Figure 30

The economics of fixed and variable cost supply as a function of ridership

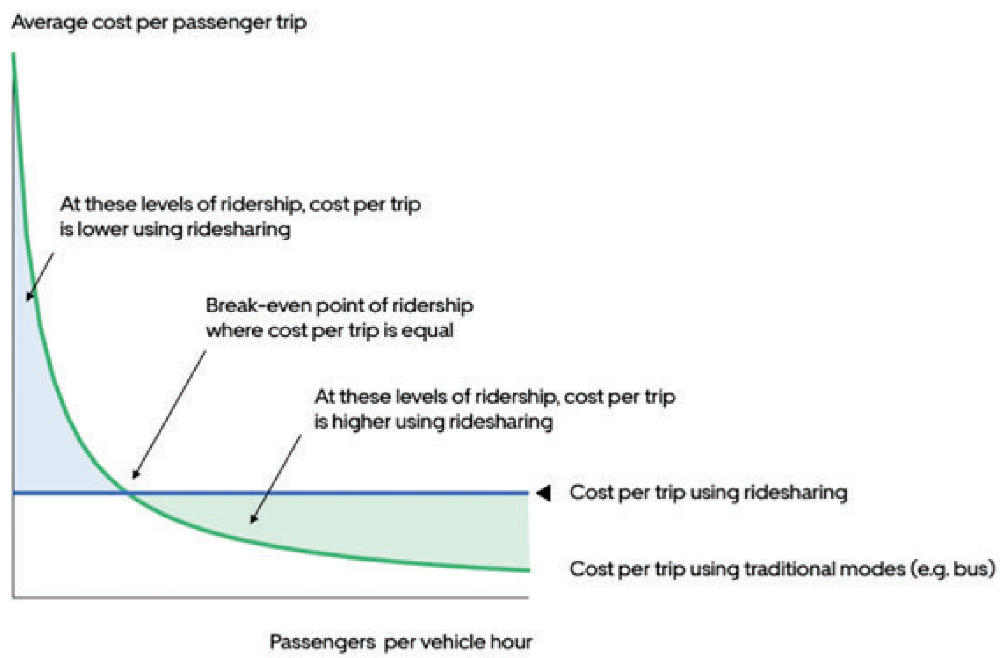
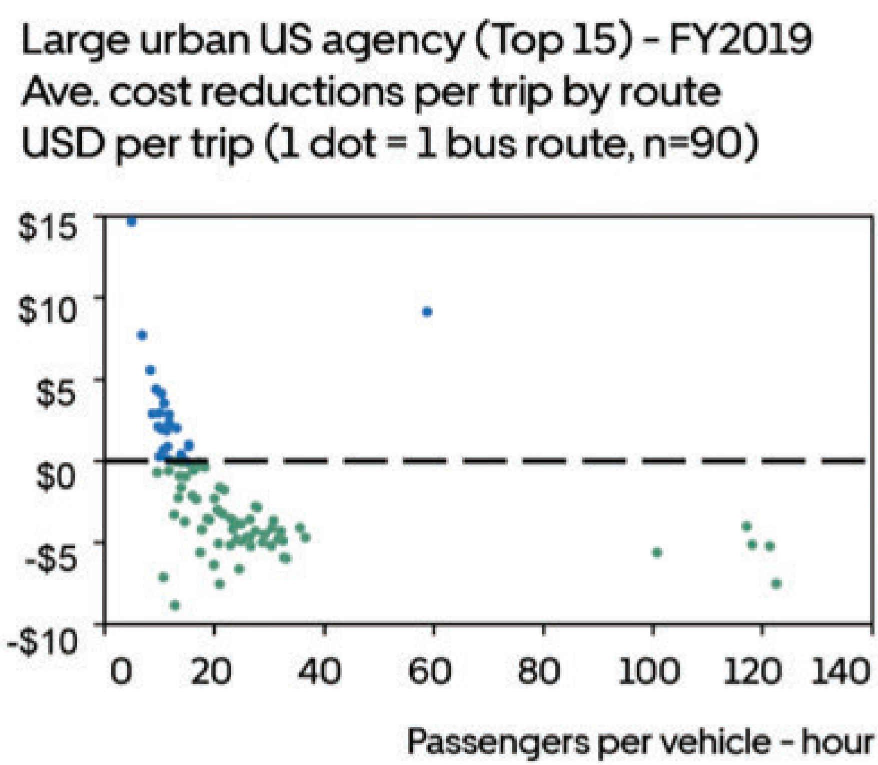


Figure 31



Implementation Timeline

Currently, the process of bringing a microtransit service to fruition is more involved than initiating typical fixed route service like a circulator or local route. It involves contracting a microtransit software company at least for their software, and possibly for operators, fleet, etc.

To illustrate the anticipated process for beginning microtransit, a general outline from scoping to operations rollout is shown in Figure 32. This chart shows the major milestones and stages involved, and the amount of time estimated to complete or achieve them. In total this process is estimated to take at least 13 months.

However, additional time should also be given for incidental occurrences. Contract negotiations, labor shortages, or months without board meetings are just some of the factors that can delay the timeline shown. It would be reasonable to provide an extra 3 months of time in planning to account for these incidentals for a realistic timeline estimate of between 13-16 months.

		MONTHS SINCE KICKOFF												
#	Task	1	2	3	4	5	6	7	8	9	10	11	12	13
1	**Draft and Finalize Scope**													
2	**Finalize Scope**													
3	**Board Memos Due** Approval to Solicit			X										
4	**RTAG** Approval to Solicit				X									
5	**TMC/RMC; RPTA Board** Approval to Solicit					X								
6	**Finalize RFP**													
7	**RFP Release /Advertise**													
8	Proposals Due							X						
9	**Selection Process** RFP Reviews, Interviews, etc.													
10	Preliminary Selection Notice								X					
12	**Board Memos Due** Approval to Execute									X				
13	**RTAG** Approval to Execute										X			
14	**TMC/RMC; Board** Approval to Execute											X		
15	**Contract Execution**													
16	**Operations Development**													

SECTION 3:
FINANCIAL OPTIONS & FUNDING STRATEGIES

Several viable funding sources exist for funding a potential service. A summary of costs detailed further in the previous cost section is shown in Figure 33.

Figure 33.

COST ESTIMATE SUMMARY TABLE		
	Cost	SaaS Cost
Estimated Vehicle Hours	17,600	17,600
Vehicles	5	5
Upfront Cost	$17,000	$450,000-$550,000*
Gross Annual Cost	$1,000,000	$800,000-$850,000
Gross Cost per hour	$56.81	$45.45 - $48.30
**Cost estimate assumes 4 passenger vans and 2 cutaway buses*		

To address these costs a review of existing funding sources for both the short- and long-term planning horizons is detailed below.

Revenue Sources:

- Local Funding- Currently, all neighborhood services like microtransit and circulators are funded locally. Regional Proposition 400 funding is limited to regional services and excludes these types of neighborhood services from funding. Locally funding service would provide the most freedom for the city in operating service. Ideally, local funds can leverage funding from other sources so local investments can be magnified. Availability of funding and willingness to fund service may change over time as revenues fluctuate and decision makers change, so it is good to diversify beyond local funding to bolster financial sustainability.
- Grant Funding- Grant funding often becomes available from different organizations, though usually from the federal government. Grants often require a match locally and will only pay for a portion of eligible service or capital expenses, though the amount varies among opportunities. Upfront capital costs are often the focus, specifically buying vehicles or other infrastructure like electric chargers. Many also include funding for further service study and ongoing operations for a set number of months/years. This funding is constrained on what expenses are eligible and when purchases can be made. These opportunities are made available through the FTA, but also agencies like the Department of Energy, and incorporating advanced technologies like electric vehicles or automation is often a way to expand eligibility for grants and increase competitiveness.
- Public Private Partnership- Local employers and businesses may be willing to support service they view as providing an important amenity to their employees or a way to bring in more customers. In the DART GoLink system discussed earlier, Amazon pays for service in a portion of the service zone around their facility. This helps reduce operating costs for the agency and likely increases use among Amazon employees who have a doubly subsidized fare. Within the study area there are many large private sector businesses and employers capable of this partnership. Also, a partnership with an autonomous vehicle provider would offer the ability to leverage partner resources like a garage, fleet, etc. at a fraction of the market rate.

- Fare Revenue- Assuming a fare of $0.50-$1.00, for every 10 rides per service hour that could be achieved the service would bring in roughly $25,000-$50,000 annually. This would reliably cover a portion of the service and would increase with demand. Collecting fares comes with costs for vendors facilitating and securing financial transactions. However handling transactions online and through apps, common among microtransit services, is less costly than traditional bus farebox operations.
- Future Regional Funding- While current Proposition 400 funding does not allow neighborhood services to use regional funding, this may not be the case for the upcoming reauthorization of Proposition 400, which currently ends in the next few years. While this funding would not be available for several years, it may be a viable funding source in the mid- and long-term and could provide sustainable funding for the service. This opportunity is still uncertain, though this study positions Chandler to readily use funding if it becomes available for microtransit service.

Diversifying revenue sources will increase the financial sustainability of service. The study recommends actively seeking grant funding over the next few years to leverage local funding most effectively. Grants become available regularly from a variety of sources and can cover a large portion of overall costs. Reaching out to local business partners who would be interested in supporting this service for their employees and customers also holds promise for reducing service costs as other microtransit providers have demonstrated. Preparing for future regional funding of neighborhood services is a good way to capitalize on this new substantial funding source, but it is still a few years off and not yet a guaranteed option. Relying on this source to sustain service in the mid- to long-term would carry some risk as a result.

Leveraging existing facilities and services also reduces costs for service implementation and operations. To facilitate phone ride-hailing and customer service calls existing customer service personnel and facilities can be used at little to no cost compared to paying for this service outright or as part of a TaaS bundle. Similarly, existing RPTA garages have ample room for a small fleet of microtransit vehicles and operators in which to base operations, instead of leasing property for this purpose. The city may also have garage or call center facilities that a TaaS contractor could use. Marketing costs can be cut down by working with city and agency resources. Social media coordinators, marketing and branding staff, and public relations personnel are all resources available for promoting services within the Valley and can provide exposure for the service at little to no added cost. Making efficient use of these in-house resources is an easy and effective way to keep costs low.

SUMMARY

Microtransit offers the ability to augment access to transit in areas that may not sustain fixed route service while offering amenities and conveniences that can attract choice-riders. The many possibilities for how to roll out service outlined here show the relative flexibility in implementing and adapting this service. The various options and suggestions for operating transit service in the study area are summarized in Figure 34. Suggested performance indicators are summarized in Figure 35.

The future of funding is promising as grant opportunities continually arise and neighborhood services may be eligible for regional funding in the upcoming Proposition 400 reauthorization. And in comparing microtransit with comparable circulator service we see microtransit provides greater access, coverage and flexibility at a lower cost. This increases the return on local dollars used to pay for service or match other sources as needed. Costs can also be curtailed by efficient use of existing inhouse resources, and the deployment of more advanced technologies like electric vehicles.

As the landscape of the study area evolves with the needs of the city, its residents and local businesses, travel demand will likely continue to rise. Yet many of the challenges to fixed route transit like long walks to major intersections and moderate density will remain in the mid- to long-term. Microtransit works best in this context by providing an accessible, convenient public transportation option that does not compete with fixed route transit, but complements and supports it. Investing in shared rides and improved transit access will optimize the efficiency of the local transportation network as travel demand grows in the coming years.

Figure 34. Recommended Microtransit Service Aspects

SERVICE ASPECT	OPTIONS EXPLORED	RECOMMENDATION	REASONING
SPAN	• Weekday vs Weekend • Peak hour service • All day service • Late night service	• 15-hour span 5AM-8PM • Weekdays and Saturdays	• Outreach and travel patterns show travel drops significantly on weekends but still important for commercial/recreational travel • Commuter travel and peak hours are also critical in those data sources • Midday service retains flexibility for commuters and residents
AMOUNT OF VEHICLES AND TYPE	Vehicles: • Mini bus • Passenger van Fleet Size: • 4-8 vehicles	• Passenger vans and Cutaway buses • 4-5 vehicles at peak • 1-2 vehicles pre-and-post-peak	• Vans are more maneuverable in tight lots • Vans are more fuel efficient • Vans provide adequate capacity for estimated demand • 4-5 vehicles estimated to provide average 15-minute waits while keeping costs low
SERVICE ZONE SHAPE	• Full study area • T shaped zone along Chandler Boulevard (DTC to CFC) and Price Road (Chandler Blvd to Intel) • East of Alma School Road	• Full 18 square-mile coverage zone	• Covers major land uses requested • Provides several north/south, east/west transit connections • Improves/creates transit access to tens of thousands of residents along Alma School Road
APP INTEGRATION	• Real-time tracking • Fare payment via app • Transit trip planning • General information on operating characteristics, personal use reports, etc. • Phone dispatch	• Implement app • Complimentary phone dispatch • Integrate with Transportation Network Company • Integrate with Valley Metro App	• Facilitates quick and convenient system use • Provides peace of mind and convenience with real-time tracking • Microtransit services rarely rolled out with just phone dispatch • Phone dispatch expands access to service
FEE STRUCTURE	• Match local bus fare ($2/trip) • Small boarding fare ($0.50) • Free Fare	• Piloted/initiated with nominal fare	• Fare will defray cost of operation • Fare will deter service abuse • Fares can be used to manage demand
TRANSIT NETWORK SERVICE ADJUSTMENTS	• Lowest ridership segment replacement • Large end of route segments overlapping study area replacement	• Remove section of Route 96 - Dobson Rd, south of Pecos Rd	• Cost savings would defray cost of microtransit implementation • Ridership currently low on existing segment • Would provide better service availability to that corridor
STOP SIGNAGE/ INFRASTRUCTURE	• Pickup/Dropoff signage • New Curbing & pads • Wayfinding/informational signage	Connected existing stops: • Wayfinding/info signage at most productive stops New key boarding locations: • Pickup/Dropoff signage • Wayfinding/info signage Virtual stops: • Nothing	• Accessible infrastructure in place at varying destinations likely sufficient for ADA accessibility • High use locations will likely benefit from designated pickup/drop-off location • Potential virtual stops too numerous to sign everywhere
ADA SERVICE ACCOMMODATIONS	Comparable ADA Accessible Service Requirement • Complimentary ADA service • ADA accessible public service (Combined Service) Integrating into ADA service provider pool (comingling)	Run ADA accessible public service (Combined Service) Comingle microtransit service into ADA	• No complimentary service required for service where WAVs are available at comparable wait times with non-WAVs (typically 20% of fleet) • Combined service more cost efficient • ADA trips served by microtransit more cost efficient
SERVICE MODEL	• Curb-to-Curb • Corner-to-Corner • Hub & Spoke • Point-to-point	• Curb-to-Curb • Point-to-point	• Most convenient, intuitive option for rider • Service area compact enough to still retain target wait times • More seamless ADA service comingling

Figure 35. Recommended Performance Indicators

KPI	TARGETS EXPLORED	RECOMMENDATION	REASONING
RIDERSHIP PRODUCTIVITY	• Weekday • 15-75 Rides/hour • Weekend • 15-50 Rides/hour	• Weekday • 20 Rides/hour • Weekend • 15 Rides/hour	• Would drive cost per rider to be roughly half that of current fixed route rider • Reasonable target given population size and commute traffic
WAIT TIMES	Target Average: 10 Minutes -30 Minutes Peak Demand Acceptable Waits: 30 minutes - 60 Minutes	Target Average: 10-15 Minutes Peak Demand Acceptable Waits: 20 minutes	• 10 minutes can be achieved with just five vehicles (25-30 ppl/hr assumed) • Average is comparable with regional frequent service standard
GROSS COST PER BOARDING	• Weekday • $5-$15/boarding • Weekend • $5-$10/boarding	• Weekday • $10-12/boarding • Weekend • $15-18/boarding	• Can be achieved with 20-24 rides/hr weekdays and 13-16 rides/hr weekend • Roughly equivalent to bottom quartile threshold for Chandler fixed route service • Productivity benchmark would produce costs of $9.40/rider weekdays and $15.70 weekends, close to these suggested marks