

SUN SYSTEMS

COMPREHENSIVE OPERATIONAL ANALYSIS

MILESTONE ONE REPORT
MARCH 2023

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Introduction

The Sun Systems Comprehensive Operational Analysis (COA) is an opportunity to improve transit options in the Greater Tucson area to create a more equitable, effective, and efficient transit network. It will review and evaluate the Sun Tran, Sun Link, Sun Express, and Sun Shuttle services to determine potential improvements. Coming out of the COVID-19 pandemic, travel patterns have changed, and it is important for the transit network to respond to these changes to ensure it continues to meet the mobility needs of the local community. The COA is broken down into three steps, or Milestones. This report covers the items listed in Milestone One.

- **Milestone One**

- **System Background** – overview of the services, fare structures, and capital assets of the Sun Systems;
- **Review of Relevant Planning Projects** – understanding of recent projects that may inform the COA;
- **Market Analysis** – understanding of population, employment, and demographic patterns that may affect transit demand; understanding of regional travel patterns; analysis of the built environment and its impact on transit service.

- **Milestone Two**

- **Service Assessment** – understanding of the performance of current Sun Systems services; review of ridership trends, route-level performance, community transit access, and strengths and weaknesses of current service delivery.

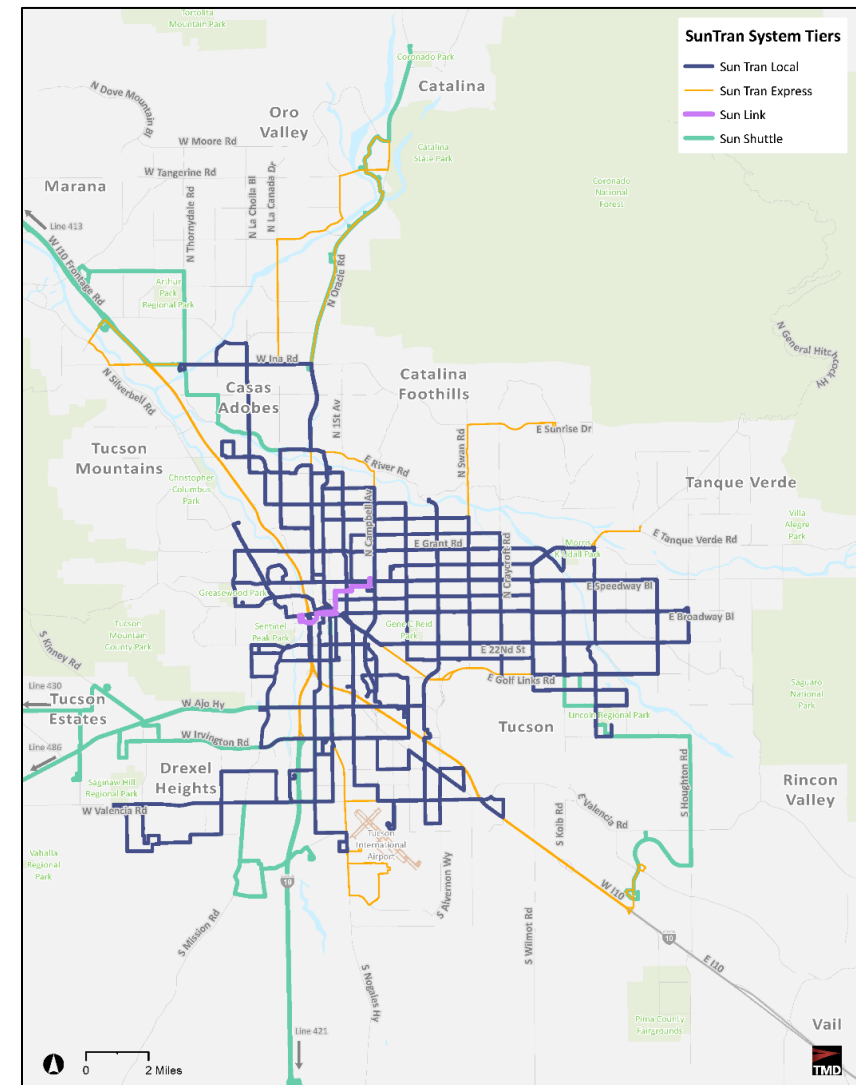
- **Milestone Three**

- **Public Involvement** – outreach to the public, riders, and stakeholders to solicit input on potential service changes and receive feedback on draft recommendations;
- **Service Recommendations** – draft and final service plan developed based on findings from Milestone One and Two as well as input from the public involvement effort.

Data for this Milestone One report primarily came from the U.S. Census American Community Survey from 2020 and Replica, an online platform

aggregating location-based services, credit card transactions, and census data into comprehensive regional travel pattern dashboards for use in transportation planning projects. Other data sources include on-board and general public surveys conducted in 2022 as well as information available on Sun Tran’s website.

Figure 1: Sun Systems Map



System Background

The Tucson Metropolitan area is served by several public transportation services that are managed by the City of Tucson (City) and Pima Association of Governments (PAG)/Regional Transportation Authority (RTA). These services operate throughout the urban area of Tucson with rural services also provided and funded by RTA in some of the outlying areas. A list of these transportation services is presented below.

Sun Tran: The City of Tucson provides 29 local fixed-route buses, with daily service to City of Tucson, City of South Tucson, Town of Marana, Town of Oro Valley, the Tohono O’odham Nation, the Pascua Yaqui Tribe, and unincorporated Pima County.

Sun Express: There are 12 express routes that provide quick access to major destinations. These routes operate during peak weekday commuting hours with limited stops along the route, meaning riders can get their destinations quicker. Some key workplace destinations include: the University of Arizona, Banner-University Medical Center, Downtown Tucson, the Aero Park Complex, UA Science & Tech Park, and multiple locations in Oro Valley. In Downtown Tucson the offices for City of Tucson, Pima County, State of Arizona, United States Federal courts and agencies, and many downtown businesses are served. The Aero Park Complex includes aerospace industry employers such as Raytheon, FlightSafety International, and Bombardier.

Sun Link: Sun Link is a streetcar that operates along a 3.9-mile loop with 23 stops that serve the Mercado District, Downtown Tucson, 4th Avenue, Main Gate Square, and the University of Arizona. Sun Link shares a travel lane with other vehicles and allows on-street parking. The streetcars accommodate bicycles and have easy roll-on access for mobility devices and strollers.

Sun On Demand: In November 2020, Sun Van launched a micro transit pilot program in two zones. This service provides curb-to-curb access to and from any address within the zones. Riders can make reservations one to seven days in advance, and same day when possible. Reservations are accepted on a first come first serve basis. If a rider’s trip extends outside of the zone, they can be dropped off at one of the transfer bus stops inside the zone to make their trip elsewhere.

Sun Shuttle: The Sun Shuttle is a neighborhood connector serving suburban and more rural communities. Sun Shuttle connects North Oracle and Catalina, Thornydale and Dove Mountain, Marana, Green Valley and Town of Sahuarita, Tucson Estates, San Xavier District of Tohono O’odham Nation, and Southeast Tucson and Rita Ranch to Sun Tran routes. Sun Shuttle is a service that is managed and funded by PAG/RTA.

Sun Shuttle DAR: Provides transportation to persons with disabilities with special needs eligibility in parts of unincorporated Pima County, Central Tucson, and portions of Marana, Sahuarita and Oro Valley on an on-demand basis.

Sun Van: Provides ADA compliant paratransit services to eligible residents in Tucson, Tohono O’odham Nation, Pascua Yaqui Tribe, South Tucson, and parts of unincorporated Pima County. Unlike the Sun On Demand, Sun Van service is only available to persons with disabilities that have been certified as eligible based on their ability to use the Sun Tran fixed route service. Individuals are determined to be ADA paratransit eligible with a current ADA Eligibility letter from the City of Tucson ADA Paratransit Eligibility Office.

Figure 2 presents the frequency and span for all the Sun Tran, Sun Express, Sun Shuttle, and Sun Link routes which are the focus of this study.

Figure 2 Route Summary

Route Name	Service Type	Weekday Span	Weekday Frequency	Saturday Span	Saturday Frequency	Sunday Span	Sunday Frequency
1 Glenn/Swan	Sun Tran	6am-10pm	30	6am-8pm	60	7am-7pm	60
2 Pueblo Gardens	Sun Tran	6am-9pm	30	6am-7pm	60	8am-5pm	60
3 6th St/Wilmot	Sun Tran	5am-10pm	30	5am-7pm	60	6am-6pm	60
4 Speedway	Sun Tran	5am-11pm	15	6am-9pm	30	7am-7pm	30
5 Pima/West Speedway	Sun Tran	6am-6pm	30	6am-6pm	60	7am-6pm	60
6 Euclid/N 1st Ave	Sun Tran	5am-10pm	20	6am-8pm	30	6am-6pm	60
7 22nd St	Sun Tran	6am-10pm	20	6am-8pm	60	7am-7pm	60
8 Broadway	Sun Tran	5am-10pm	12	5am-7pm	12	6am-7pm	15
9 Grant Road	Sun Tran	5am-10pm	20	6am-8pm	60	7am-7pm	60
10 Flowing Wells	Sun Tran	6am-9pm	30	5am-7pm	60	6am-7pm	60
11 Alvernon Way	Sun Tran	5am-10pm	15	5am-8pm	30	5am-7pm	30
12 10th/12th Ave	Sun Tran	5am-11pm	20	6am-8pm	30	6am-7pm	30
15 Campbell Ave	Sun Tran	5am-10pm	30	6am-8pm	60	7am-7pm	60
16 Oracle/Ina	Sun Tran	5am-11pm	15	7am-8pm	15	6am-7pm	20
17 Country Club/29th	Sun Tran	5am-9pm	30	6am-8pm	60	7am-7pm	60
18 S 6th Ave	Sun Tran	5am-11pm	15	6am-8pm	15	6am-7pm	20
19 Stone Ave	Sun Tran	5am-10pm	30	7am-8pm	30	7am-7pm	60
21 Congress/Silverbell	Sun Tran	6am-9pm	30	6am-8pm	30	7am-7pm	30
22 El Rio/W. Speedway	Sun Tran	5am-10pm	30	6am-8pm	60	7am-8pm	60
23 Mission Road	Sun Tran	5am-10pm	30	7am-7pm	60	7am-6pm	60
24 S 12th Ave	Sun Tran	4am-8pm	30	6am-8pm	60	7am-7pm	60
25 S Park Ave	Sun Tran	5am-10pm	30	6am-8pm	30	7am-7pm	30
26 Benson Highway	Sun Tran	5am-10pm	30	7am-8pm	60	6am-6pm	60
27 Midvale Park	Sun Tran	5am-9pm	20	7am-8pm	60	7am-6pm	60
29 Valencia	Sun Tran	5am-10pm	30	6am-9pm	60	7am-8pm	60
34 Craycroft/Ft Lowell	Sun Tran	5am-10pm	20	6am-8pm	60	7am-7pm	60
37 Pantano	Sun Tran	5am-7pm	30	7am-7pm	60	7am-7pm	60
50 Ajo Way	Sun Tran	5am-8pm	30	6am-6pm	60	8am-6pm	60
61 La Cholla	Sun Tran	6am-7pm	30	6am-6pm	60	7am-6pm	60
101X Golf Links-Downtown	Sun Express	6am-4pm	60				
102X Northwest-UA	Sun Express	6am-4pm	60				
103X Northwest-Downtown	Sun Express	7am-5pm	60				
104X Marana-Downtown	Sun Express	6am-4pm	60				
105X Foothills-Downtown	Sun Express	6am-4pm	60				
107X Oro Valley-Downtown	Sun Express	7am-4pm	60				
108X Broadway-Downtown	Sun Express	7am-4pm	60				

Route Name	Service Type	Weekday Span	Weekday Frequency	Saturday Span	Saturday Frequency	Sunday Span	Sunday Frequency
109X Catalina-Downtown	Sun Express	6am-4pm	60				
110X Rita Ranch-Downtown	Sun Express	5pm-7am	60				
201X Eastside-Aero Park	Sun Express	5am-3pm	60				
203X Oro Valley-Aero Park	Sun Express	6am-3pm	60				
204X Northwest- Aero Park	Sun Express	6am-3pm	60				
401 N Oracle/Catalina	Sun Shuttle	6am-4pm	60				
412 Dove Mountain	Sun Shuttle	6am-7pm	60	9am-2pm	60		
413 Marana/I-10	Sun Shuttle	7am-5pm	60	9am-2pm	60		
421 Green Valley/Sahuarita	Sun Shuttle	6am-5pm	60				
430 Tucson Estates	Sun Shuttle	6am-7pm	60				
440 San Xavier	Sun Shuttle	6am-6pm	60	6am-5pm	60		
450 SE Tucson/Rita Ranch	Sun Shuttle	6am-5pm	60				
700 Sun Link	Sun Link	7am-10pm	10	8am-2am	12	8am-8pm	15

Fare Structure

In spring 2020, the City of Tucson suspended fares on its system to prevent crowding at the farebox and promote the health and safety of both its passengers and operators. Fares will be free at least through June 30, 2023, and the City of Tucson may decide to extend free fares even further.

Based on information from the August 2019 Ride Guide, most fares could be paid with cash or with SunGO cards and tickets. Cash is not accepted aboard Sun Link. SunGO cards are needed for transfers. A description of fares and fare media available prior to the suspension of fares is listed below.

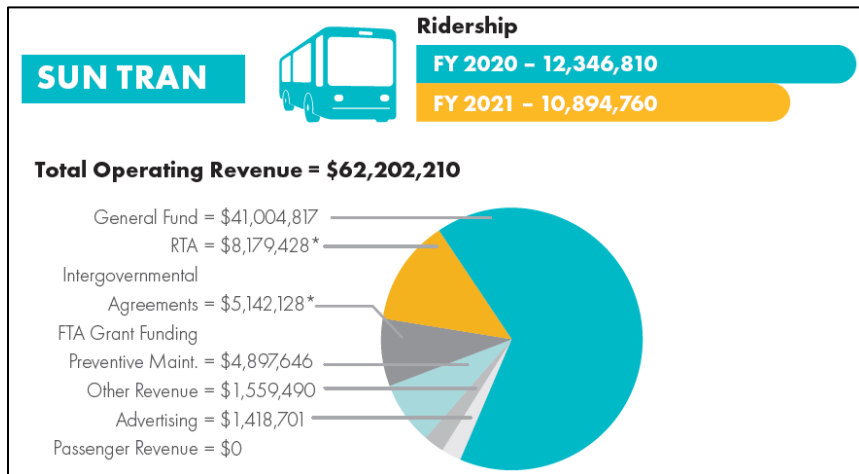
Figure 3: Fare Structure Overview from August 2019 Ride Guide

Fare Type	Price
Full Fare Cash (Routes 1-99)	\$1.75
Stored Value on SunGO Card* (Routes 1-99)	\$1.60
Economy Fare Cash (Routes 1-99; ID required)	\$0.75
Stored Value on SunGO ID & Card* (Routes 1-99)	\$0.75
Express (Routes 101X-204X)	\$2.35
Kids 5 & under Free (Accompanied by paying adult)	\$0.00
1-Day Pass - Unlimited rides 24 hours once activated.	\$4.00
3-Day Pass - Unlimited rides for 72 hours once activated.	\$10.00
30-Day Pass - Unlimited rides for 30 days once activated.	\$48.00
30-Day Economy Pass - Available to SunGO ID & Card holders only. Unlimited rides for 30 days once activated.	\$22.50
Annual Pass - Unlimited rides for 365 days once activated.	\$480.00

Funding Structure

The FY 2021 Annual Report showed the following revenue breakdown for Sun Tran operation.¹ Two-thirds of system funding comes from the City's General Fund. The City's General Fund contribution has increased since fares were eliminated. As a contrast, in FY 2019, passenger fare revenue was \$10.9 million, approximately 20% of systemwide revenue while the City's general fund contribution was approximately half of the system funding.

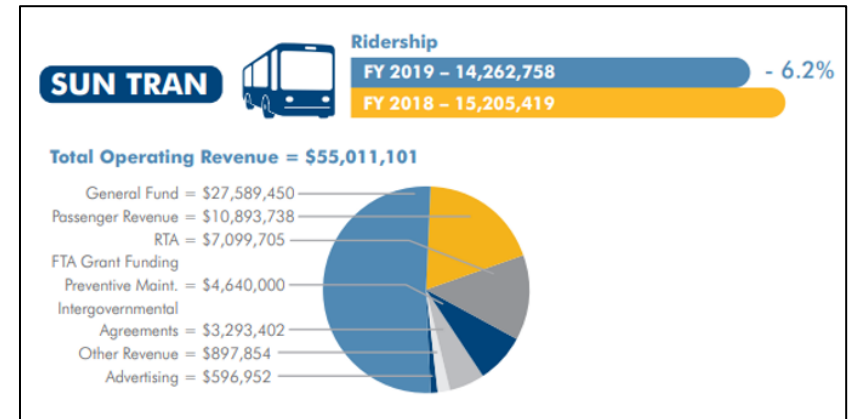
Figure 4 2021 Operating Revenue



In 2006, residents of Pima County voted on the Regional Transportation Authority (RTA) Plan to implement a 20-year half-cent sales tax to fund regional transportation projects. Approximately 27% of the sales tax revenue (roughly half a billion dollars) was dedicated to the “Transit Element” to fund expanded evening and weekend service, additional frequency, more express services, the Sun Link streetcar, and urban circulator services.² With the sales

tax set to expire in 2026, Sun Tran will face a significant gap in available revenue unless another measure is passed, or the General Fund contributions increase to cover the deficit.³

Figure 5 2019 Operating Revenue



Capital Assets

The Sun Tran capital assets are primarily made up of vehicles and facilities. The vehicles include the buses operated for Sun Tran local and express services, the vans operated for Sun Van and Sun Shuttle services, and the streetcars operated for the Link services, along with non-revenue vehicles that are used to support service. Facilities include park & ride facilities, transit centers, and the operating and maintenance facilities. The capital assets are described below.

Vehicle Fleet

The vehicle fleet is made up of revenue vehicles and non-revenue vehicles. The revenue vehicles are presented in Figure 6.

¹ <https://www.suntran.com/wp-content/uploads/2021/09/ST-SL-SV-Annual-Report-21.pdf>

² <https://rtanext.com/wp-content/docs/2020/07/RTA-Administrative-Code-1.pdf>

³ [ST SL SV Annual Report 19 \(suntran.com\)](https://www.suntran.com/wp-content/uploads/2019/09/ST-SL-SV-Annual-Report-19.pdf)

Figure 6 Revenue Vehicle Fleet

Model Year	Make-Model	Vehicle Length	Fuel Type	Seats/Wheelchair	Number of Vehicles
<i>Sun Tran</i>					
2007	Gillig-Low Floor	40 Foot	Biodiesel	38/2	11
2011	Gillig-Low Floor	40 Foot	Biodiesel	34/3	16
2012	Gillig-Low Floor	40 Foot	Biodiesel	34/3	47
2014	Gillig-Low Floor	40 Foot	Compressed Natural Gas	34/3	24
2015	Gillig-Low Floor	35 Foot	Compressed Natural Gas	30/3	5
2015	Gillig-Low Floor	40 Foot	Compressed Natural Gas	34/3	16
2018	Gillig-Low Floor	40 Foot	Compressed Natural Gas	34/3	23
2020	Gillig-Low Floor	40 Foot	Compressed Natural Gas	34/3	20
2021	Gillig-Low Floor	40 Foot	Electric	38/3	5
2022	Gillig-Low Floor	40 Foot	Compressed Natural Gas	34/3	18
Total Sun Tran Buses					185
<i>Sun Shuttle/Sun Shuttle Paratransit</i>					
2013	Champion Defender	35 Foot	Diesel	30/2	2
2013	Starcraft Supreme	24 Foot	Gasoline	9/0 or 5/1	1
2014	El Dorado Amerivan	17 Foot	Gasoline	5/0 or 3/1	3
2014	El Dorado Amerivan	17 Foot	Gasoline	6/0 or 3/1	1
2014	Starcraft Starlite	22 Foot	Gasoline	9/0 or 5/1	2
2015	Starcraft Allstar	22 Foot	Gasoline	10/2	3
2015	Starcraft Allstar	22 Foot	Gasoline	11/2	1
2015	Starcraft Supreme	24 Foot	Gasoline	14/0 or 8/3	5
2016	Elkhart Ciagc	21/24 Foot	Gasoline	8/0 or 4/3	4
2016	Starcraft Supreme		Gasoline	14/0 or 12/1	3
2017	El Dorado Entervan	17 Foot	Gasoline	4/1	3
2017	Starcraft Allstar	26 Foot	Gasoline	21/2	3
2017	Starcraft Allstar 22	22 Foot	Gasoline	14/0 or 8/3	1
2017	Startrans President	33 Foot	Diesel	24/2	3
2018	Starcraft Allstar	26 Foot	Gasoline	15/2 or 21/0	4
2019	Starcraft Allstar	22 Foot	Gasoline	10/2 or 14/0	4
2019	Starcraft Allstar	26 Foot	Gasoline	15/2 or 21/0	3
2019	Startrans President	33 Foot	Diesel	24/2	1
2021	Starcraft Allstar	26 Foot	Gasoline	15/2 or 21/0	1
2021	Starcraft Allstar	22 Foot	Gasoline	11/2 or 15	4
2021	Startrans PS/2	34 Foot	Diesel	28/2	2
Total Sun Shuttle/Sun Shuttle Paratransit					54
<i>Sun Link Streetcar</i>					
2013	United Streetcar 200	66 Foot	Electric	29/2	8

Non-revenue vehicles are used to support the transit service. These include maintenance vehicles, administration vehicles, vehicles used for street supervision, and driver relief vehicles. The non-revenue vehicle fleet is presented in Figure 7. All but six of the most recently purchased vehicles are beyond the FTA useful life in terms of age; however, many of these vehicles have fewer than 100,000 miles, or 500,000 miles in the case of the Gillig buses, therefore they are still cost efficient to operate. 21 of the 47, or about 45 percent, of the non-revenue vehicles are beyond their useful lives in term of miles.

Figure 7 Non-Revenue Vehicle Fleet

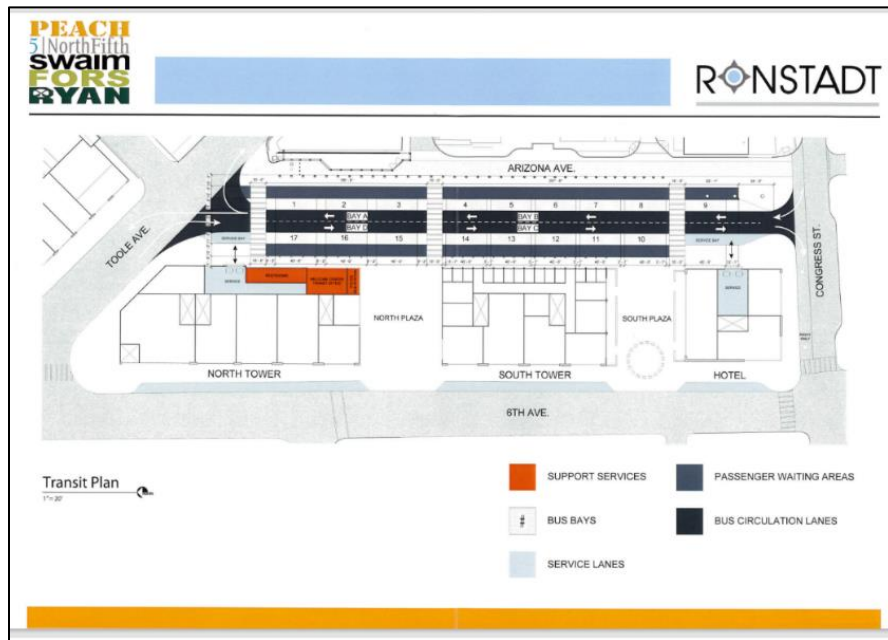
Model Year	Make-Model	Number	FTA Useful Life (years)	FTA Useful Life (miles)	Vehicles Beyond Useful Life (Based on Mileage)
2004	Ford F-550	1	4	100,000	0
2006	Ford Explorer	1	4	100,000	1
2008	Ford F-450	1	4	100,000	1
2008	Ford Escape	1	4	100,000	1
2008	Gillig Low-Floor	6	12	500,000	0
2009	Toyota Prius	3	4	100,000	3
2009	Ford Escape	1	4	100,000	0
2012	Toyota Prius	2	4	100,000	2
2012	Ford F-450	2	4	100,000	1
2013	Ford Taurus	1	4	100,000	1
2013	Ford F-250	3	4	100,000	0
2013	Ford Econ	1	4	100,000	1
2013	Ford F-450	1	4	100,000	0
2014	Ford F-450	1	4	100,000	0
2014	Ford Explorer	2	4	100,000	2
2015	Ford Taurus	2	4	100,000	0
2015	Ford F-450	1	4	100,000	1
2015	Chevrolet Traverse	5	4	100,000	5
2016	Ford Taurus	6	4	100,000	2
2019	Ford Transit	2	4	100,000	0
2021	Ford F-150	2	4	100,000	0
2021	Ford F-150	2	4	100,000	0

Transit Centers and Park & Rides

There are 25 Park & Ride lots and three major transit centers as part of the Sun Tran system. The Park & Ride lots are located throughout the city and are all served by one or more Sun Tran routes, as shown in Figure 13. The transit centers are located where multiple Sun Tran bus routes converge and allow for transfers between bus routes. The Ronstadt Transit Center (RTC), which is presented in Figure 9, is in Downtown Tucson. The Roy Laos Transit Center (LTC), which is presented in Figure 10, is in south Tucson. The Tohono T'adai Transit Center (TTC), which is presented in Figure 11, is in north Tucson near the Tucson Mall. Park & Ride lots are presented in Figure 13.

A proposal to redevelop the Ronstadt Transit Center was awarded in 2015. The redevelopment will include development of mixed-use retail, office space, live/work lofts, public spaces, a public market alongside the new transit mall, and a parking garage. It will include mixed use residential, commercial, and hotel uses. This redevelopment will increase the transit center capacity from 14 bus loading positions to up to 18 bus loading

Figure 8 Ronstadt Transit Center Redevelopment Plan



positions. Changes to the transit center include converting the three lanes and on-street positions to a two-lane transit plaza. A site diagram is presented in Figure 8.

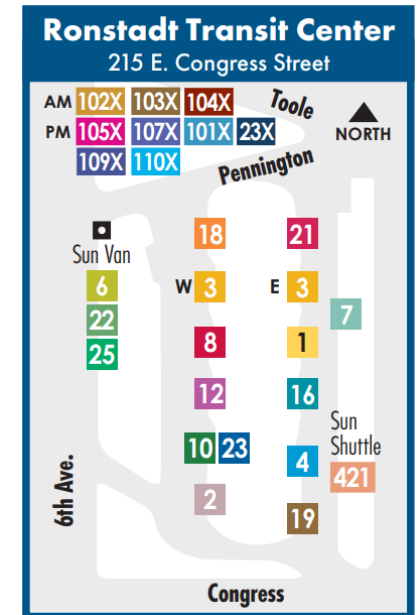


Figure 9 Ronstadt Transit Center



Figure 10 Roy Laos Transit Center

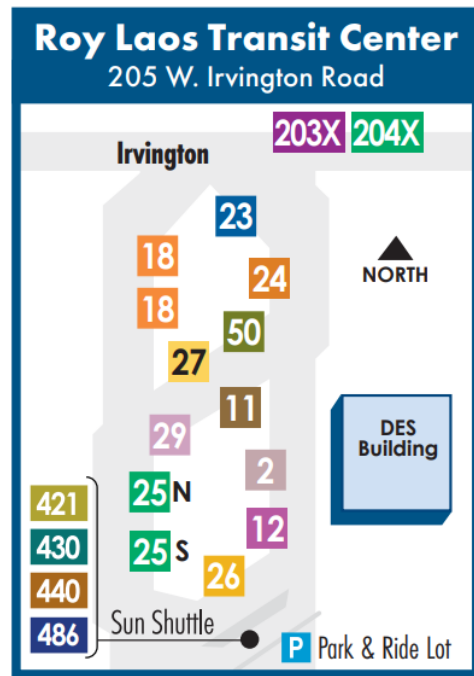


Figure 11 Tohono T'adai Transit Center

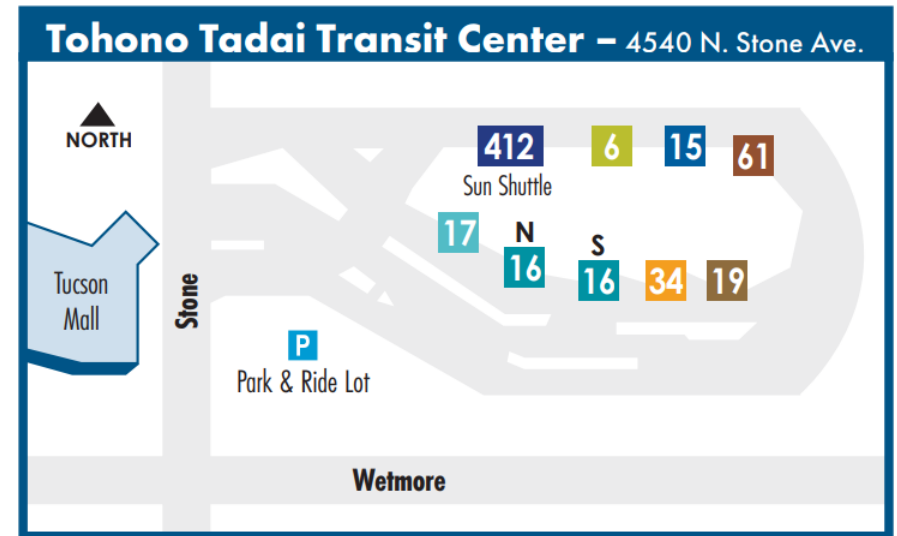
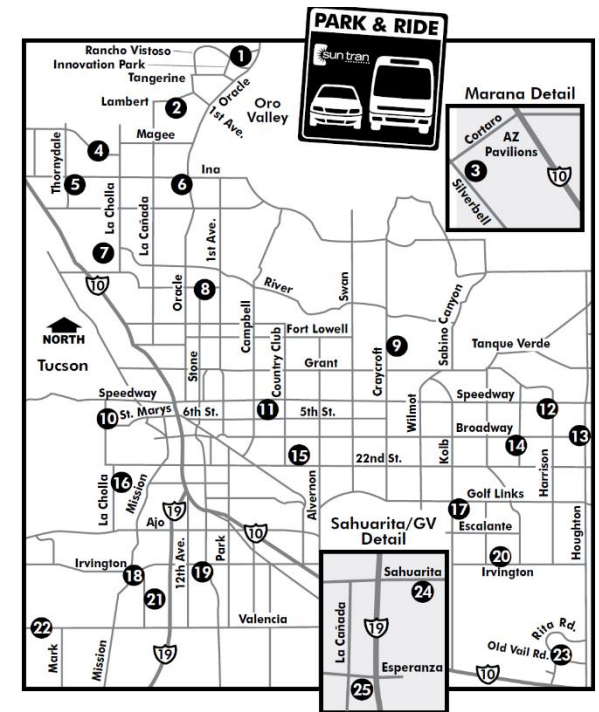


Figure 12 Park and Ride Locations

Lot Name	Location	Routes Available
Ronstadt Transit Center	215 E Congress Street & 6 th Street	1, 2, 3, 4, 6, 7, 8, 10, 12, 16, 18, 19, 21, 22, 23, 23X, 25, 101X, 102X, 103X, 104X, 105X, 107X, 109X, 110X, 421, Sun Link
Rancho Vistoso	Innovation Park & Ranch Vistoso	107X, 203X, 401
Riverfront Park	Lambert & Riverfront Park	102X, 203X
Marana	Southeast corner of Cortaro & Silverbell	104X, 203X
PCC Northwest Campus	Shannon & Campus Park Way, NW Lot	61
North Pima Center	SE corner of Ina & Thornydale	16, 102X, 103X, 203X, 412, 413
Ina & Via Ponte	SW corner on Ina 1 block west of Oracle	16, 103X
Victory Assembly of God Church	2561 W. Ruthrauff & Plane	17
Tohono T'adai Transit Center	Stone & Wetmore	6, 10, 15, 16, 19, 34, 61, 412
Fort Lowell Park	2900 N Craycroft & Glenn	34
PCC West Campus	Greasewood & Anklam, NW Lot	3, 5, 9
Himmel Park	1000 N Tucson & 1 st Street	4
Speedway & Harrison	Sun Tran Lot SW Corner	4, 201X
Houghton Park & Ride	Broadway & Houghton, NW corner	4, 7, 8, 17, 108X
Broadway Parking Lot	8740 Broadway & Camino Seco	8, 108X
Reid Park	22 nd Street & Randolph Way	7
Archer Neighborhood Center	1665 S La Cholla & San Marcos	23
Golf Links & Kolb	South side east of Kolb	4, 17, 101X, 450
Irvington & Santa Cruz River	City of Tucson lot at SW corner	23
Laos Transit Center	6 th Ave & Irvington	2, 11, 12, 18, 23, 24, 25, 26, 27, 29, 50, 203X, 204X, 421, 430, 440, 486
PCC East Campus	Fred Enke Drive & Irvington	3, 37, 450
PCC Desert Vista Campus	Drexel & Calle Santa Cruz	27
AVA Park & Ride	AVA Amphitheater parking & Valencia	27, 29
Rita Ranch	Old Vail Road near Rita Road	110X, 450
Sahuarita Town Hall	375 W Sahuarita Center Way	421, Dial-a-ride
Green Valley Village	101 S La Canada	421, Dial-a-ride

Figure 13 Map of Park and Ride Locations



Operating and Maintenance Facilities

The operating and maintenance facilities are the locations where transit vehicles are stored when they are not in passenger service and where maintenance is performed on the vehicles. There are four facilities located throughout the City of Tucson. Two of the facilities are where Sun Tran vehicles are stored and maintained, one facility is for Sun Van, and the final facility is for Sun Link.

The Northwest Garage is located at 3920 North Sun Tran Boulevard. This facility is the storage and maintenance facility for biodiesel, hybrid, and electric buses. Currently 79 buses are stored and maintained at this facility. A site overview of the Northwest Garage is presented in Figure 14.

The Sun Tran south garage is located at 4220 South Park Avenue. This facility is the storage and maintenance facility for Compressed Natural Gas (CNG) buses. Currently 106 buses are stored and maintained at this facility. A site overview of the South Garage is presented in Figure 15.

Figure 14 Sun Tran Northwest Garage



Figure 15 Sun Tran South Garage



Sun Link streetcars are stored and maintained at a facility 290 East 8th Street. This facility is the storage and maintenance facility for the entire streetcar fleet. Currently eight streetcars are stored and maintained at this facility. A site overview of the Sun Link operations and maintenance facility is presented in). Finally, all Sun Shuttle buses and paratransit vans are operated out of the Total Ride facility located at 829 W Silverlake Road (Figure 18).

Figure 16.

All Sun Van vehicles are stored and maintained at a facility that is located at 3401 East Ajo Way (Figure 17). Finally, all Sun Shuttle buses and paratransit vans are operated out of the Total Ride facility located at 829 W Silverlake Road (Figure 18).

Figure 16 Sun Link Operation and Maintenance Facility

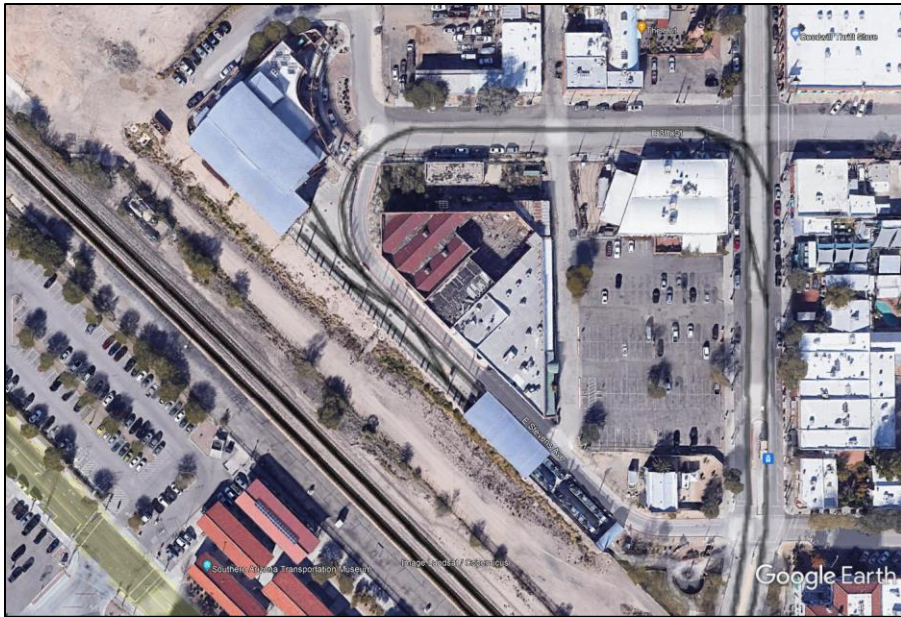
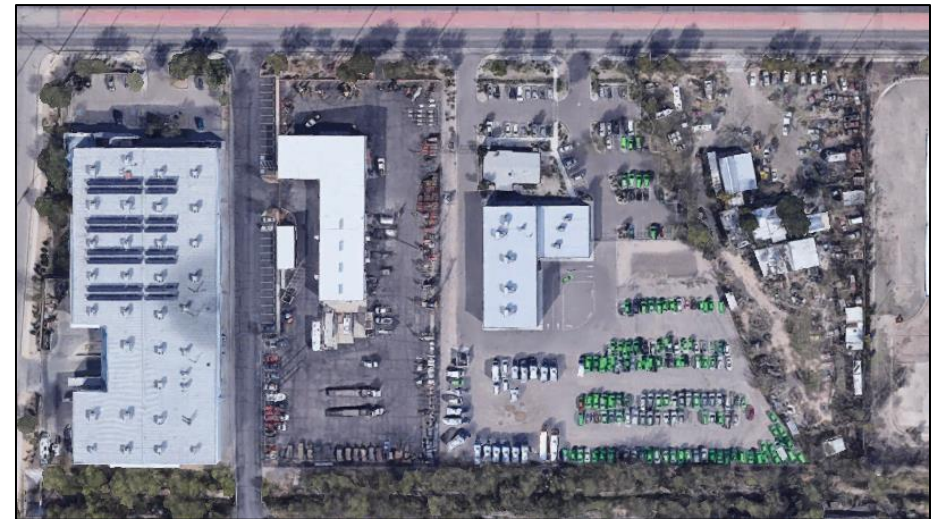


Figure 17 Sun Van Facility



Figure 18: Sun Shuttle Total Ride Facility



Planning Context and Review of Relevant Projects

A literature review of previous planning studies identifies important projects that may impact the COA. It is important to understand what transportation projects are already underway to ensure that the COA recommendations compliment those projects. This literature review includes the following documents:

- 2017 PAG High-Capacity Transit Implementation Plan
- 2017 PAG Short Range Transit Program Implementation Plan
- 2020 Long Range Regional Transit Plan
- 2045 Regional Mobility and Accessibility Plan (RMAP) Update 2020
- 2021 Move Tucson Report
- 2021 Tucson's Equitable Transit-Oriented Development Strategic Plan 2021

2017 PAG High-Capacity Transit Implementation Plan

In 2017, the Pima Association of Governments (PAG) put together a High-Capacity Transit Implementation Plan. The plan outlined six viable high-capacity corridors after an in-depth, multi-tiered analysis of various performance metrics. Ultimately, 3 Bus Rapid Transit and 3 Streetcar corridors were proposed along the following segments:

- Bus Rapid Transit
 - Oracle Road: Downtown (Ronstadt Transit Center) to the Tucson Mall (Tohono T'adai Transit Center)
 - Speedway Boulevard: Main Avenue to Kolb Road
 - Broadway Boulevard: Downtown (Ronstadt Transit Center) to Wilmot Road
- Streetcar
 - 6th Avenue: Downtown (Ronstadt Transit Center) to Irvington (Roy Laos Transit Center)
 - Broadway Boulevard: Downtown (Ronstadt Transit Center) to Alvernon Road (El Con/Reid Park)
 - Stone Avenue: Fourth Avenue at University to Tucson Mall (Tohono T'adai Transit Center)

It will be important to remember the assessment and endorsement of these corridors when completing our service evaluation and making recommendations.

2017 PAG Short Range Transit Program Implementation Plan

The PAG Short Range Transit Program (S RTP) Implementation Plan's main function is to coordinate regional transit planning by describing 5-year transportation planning and funding efforts across the region. The report also contextualizes the S RTP within the long-range planning recommendations.

Three short-term goals are as follows:

1. Monitor service standards and system benchmarks for Sun Shuttle.
2. Program regional federal funding by publishing a "call for projects" that will be eligible for federal transit funding.
3. Evaluate and implement RTA service expansion, including service enhancements, new services to underserved communities and paratransit expansion.

The Tucson and Pima County region receives its transit funding in five ways: Jurisdictional Maintenance of Effort Intergovernmental Agreements or MOEs, RTA funding, Federal Transit Administration grants, farebox revenue and advertisement revenue. In 2017 the City of Tucson five-year transit operating forecast expected a total budget of \$483,517,190.

2020 Long-Range Regional Transit Plan

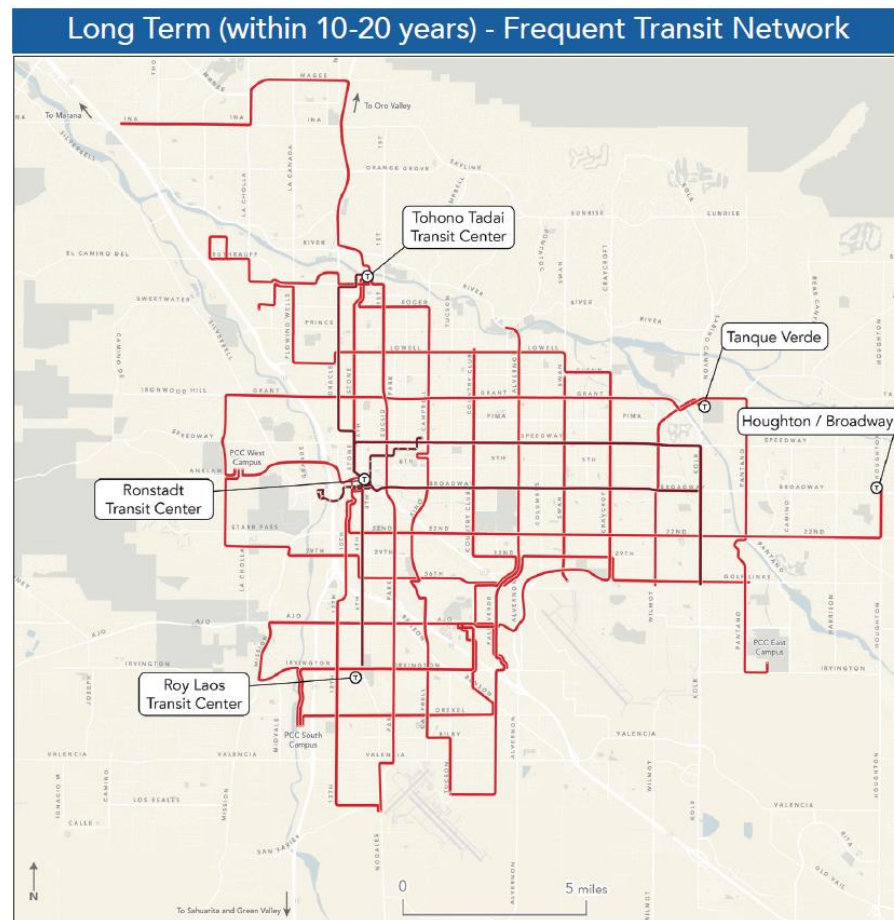
The Long-Range Regional Transit Plan published in January of 2020 identified three medium-term and four longer-term improvements for the Tucson Region. The medium-term (2020-2030) improvements included:

- Increase and expand weekend and evening service to more routes.
- Expand the current Frequent Transit Network (FTN) to include additional routes especially to the south side and Flowing Wells.
- Invest in infrastructure improvements that will improve bus stop quality, speed, and reliability.

The total cost of the new service, above and beyond existing revenue sources, in the medium-term improvements would be between \$235 million and \$285

million and would increase access to job opportunities by 23% on weekdays, 25% in the evenings, and 170% on Sundays. These benefits would be greater for minority and low-income residents.

Figure 19 Proposed Frequent Transit Network



JARRETT WALKER + ASSOCIATES

The long-term improvements (2030-2040) included:

- Expand the FTN east of Craycroft, to the Northwest, and west of Downtown to ensure frequent service closer to more Tucsonans as seen in Figure 19
- Increase frequency to every 30 minutes or less on all Sun Tran routes, 6:00 am to midnight, every day of the week.
- Implement transit prioritization measures at over 100 intersections and 50 miles of bus lanes, especially focusing on Broadway Boulevard, Speedway Boulevard, Oracle Road, and S. 6th Avenue.
- Improve over 800 bus stops and introduce new, larger vehicles.

The total cost of the long-term improvements would be an investment of \$630 million and will increase access to job opportunities by 50% on weekdays, 91% in the evenings, and 229% on Sundays. Again, these benefits would be even greater for minority and low-income residents.

2045 Regional Mobility and Accessibility Plan Update 2020

This long-range regional transit plan, which was developed by PAG, focuses on expanding night, and weekend service throughout the network, and adds new bus routes to the suburbs. The expansions would be in the northwest to Oro Valley and Marana, the southwest with more direct service to San Xavier and Drexel Heights, and service from the southside to Amazon and the UA Tech Park. This increased service will provide access to more jobs for more people, along with other necessary and discretionary travel.

This report provides an updated framework for the investment of federal, state, and local funds on transportation solutions based on needs and regional goals. A key aspect of this report was recognizing the shifting growth patterns in the region. In 2020, they were predicting a population of 1.22 million people, 488,000 homes, and 506,300 jobs by 2045. This update comes as a change from the initial 2016 report, where population was projected to grow to 1.47 million residents and job opportunities to grow to around 600,000 jobs in 2045.

Move Tucson 2021 Report

The Move Tucson 2021 Report is a transportation master plan which identifies the transportation needs and priorities for the City of Tucson. The report provides network improvement recommendations, and program, policy, and project strategy recommendations, while following the vision and guiding principles. These guiding principles are to be authentic, connected, optimized, safe, equitable and resilient. The report highlights seven key focus areas:

- Elevate transportation equity as a key process and outcome goal.
- Develop a complete streets policy implementation framework.
- Establish mobility performance measures to track progress.
- Identify next steps for citywide green infrastructure and climate resilience.
- Adapt to and incorporate new mobility and emerging technology.
- Plan for safer, multi-modal streets.
- Refine policy recommendations to codify complete streets policy and design standards.

Tucson's Equitable Transit-Oriented Development Strategic Plan 2021

Tucson's Equitable Transit-Oriented Development Strategic Plan coordinates policies, plans, and programs for land-use around the North-South corridor from Tohono T'adai Transit Center south to the Tucson International Airport, along N. Oracle Road and S. 6th Avenue. This corridor was selected because it connects the region's three biggest transit centers to the airport, along with many historic neighborhoods, businesses, and destinations. The area has also been identified by other plans as viable for high-capacity transit, as well as having other kinds of developmental projects in the works. In conjunction, these projects will result in community development and improvement along the entire corridor.

Market Assessment

The Market Assessment analyzes the key characteristics of the physical environment and customer demand. Attributes like where people live, work, shop, and play, shape the mobility needs of the Tucson Region. Understanding these needs will shape the recommendations of this study. There four key components of the market assessment:

1. **Physical Environment** - The built environment, influenced by density, land use, and street design, directly affects transit's ability to be useful and efficient.
2. **Population and Employment Trends** – At its core, transit connects people to where they need to go, so it is important to understand where people live and work within the region.
3. **Demographic Analysis and Customer Demand** - By understanding who rides transit, Sun Systems can better allocate transit service to where those populations live.
4. **Regional Travel Behavior** – Where and when people travel through Greater Tucson across all modes can give an indication of where there may be unmet need for more transit service.

Physical Environment

Transit use is greatly affected by land use and the built environment. This portion of the market assessment looks at the built environment and land use to understand where the transit supportive land uses exist and where the built environment is less conducive to transit use.

Street and Roadway Design

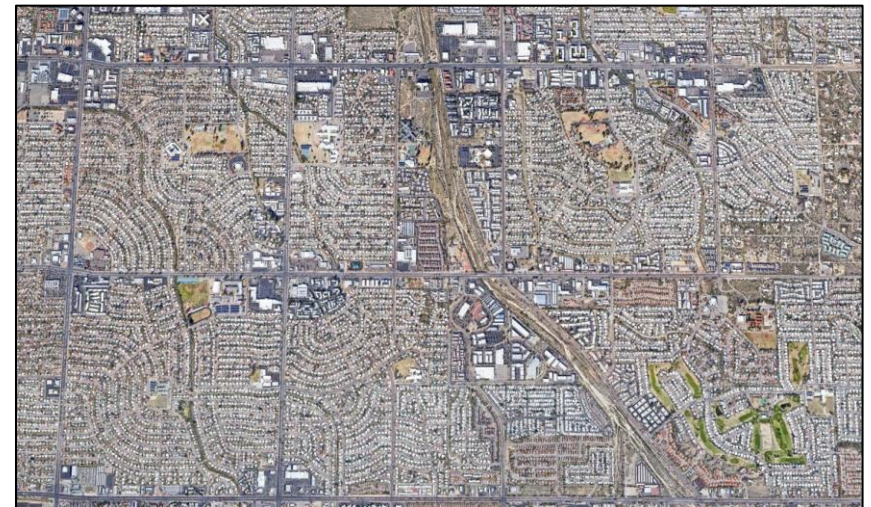
When analyzing bus route efficiency, it is important to note how a city's geography can affect transit use, affecting such factors as travel times and access to the transit network. Tucson was first developed in the late 1700s to early 1800s. In 1872, Sidney W. Foreman laid out a map for the development of Tucson, and to this day this street plan can be seen. Closer to downtown the street grid is laid out with major streets every half mile, with smaller neighborhood roads within the half-mile squares, seen in Figure 20. This grid format is great for bus service. Buses can operate along the major arterials, and any rider is at most a quarter mile (five-minute walk) away from

a bus route. Outside the city center, development still follows a half-mile grid, but the intervening streets are more circuitous with less direct pathways out to the arterials Figure 21. Transit can still be efficient on the major streets, but the circuitous street network creates longer walks for riders to access the stops, and riding transit may be less convenient.

Figure 20: Blocks between E. Elm St. and Lowell Rd.



Figure 21: Blocks Between Broadway and Golf Links



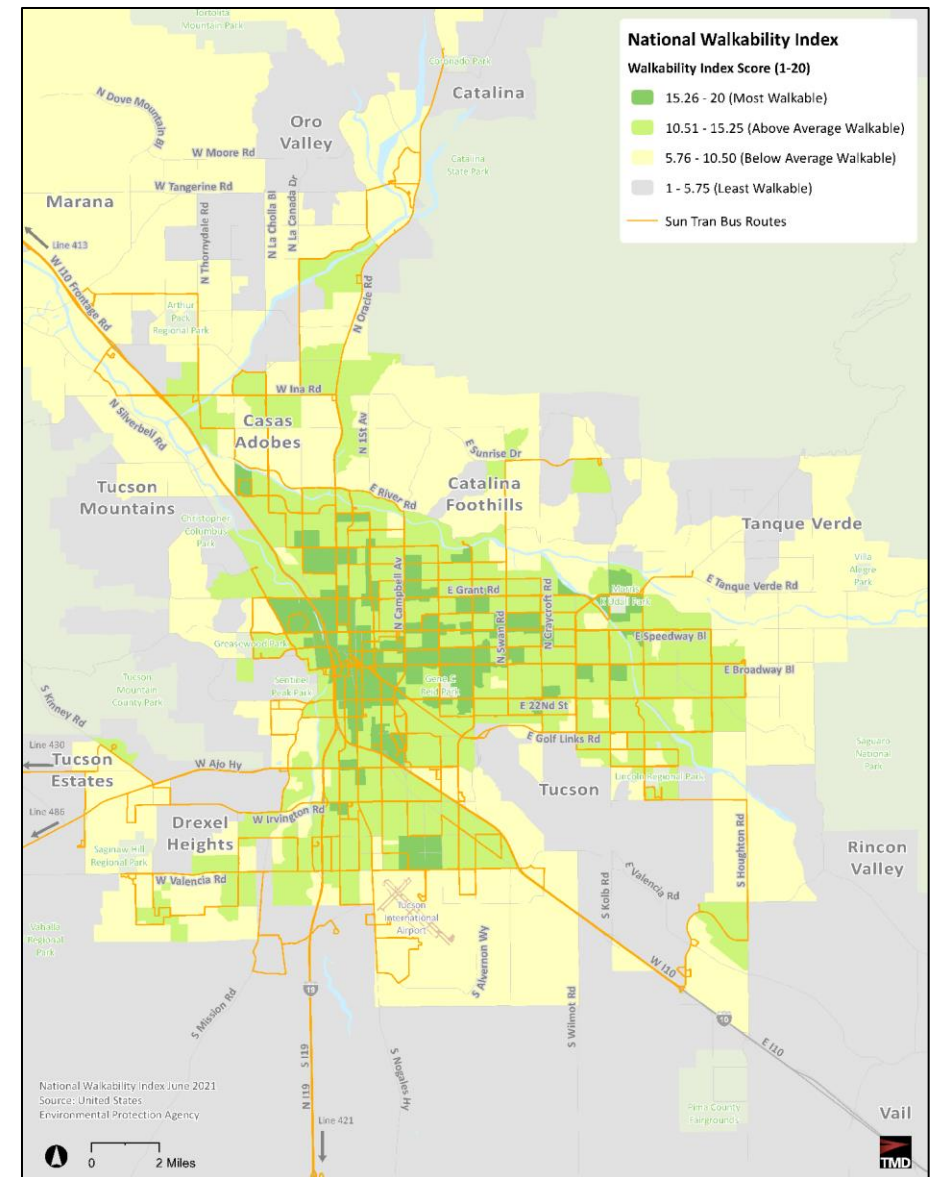
Other parts of the service area, like the Catalina Foothills (shown in Figure 22) are not suited for fixed-route transit service. The lack of major streets, low density of development, and discontinuous streets makes it difficult to provide a fixed route that adequately serves the population.

Figure 22: Catalina Foothills



The National Walkability Index developed by the Environmental Protection Agency creates a walkability score based on intersection density, proximity to transit stops, and diversity of land uses. Figure 23 shows which areas of Greater Tucson are considered walkable based on this index. Many of the areas served by Sun Tran Bus Routes are “Above Average” or “Most” Walkable. The high walkability score is good news for transit, since 95% of riders access their first transit stop and destination by walking. In areas where walking is more convenient, taking transit becomes more convenient as well. While Sun Tran should still provide transit service in less walkable areas, it is important to understand the limitations that lower walkability places on being able to generate higher levels of ridership.

Figure 23 National Walkability Index Map

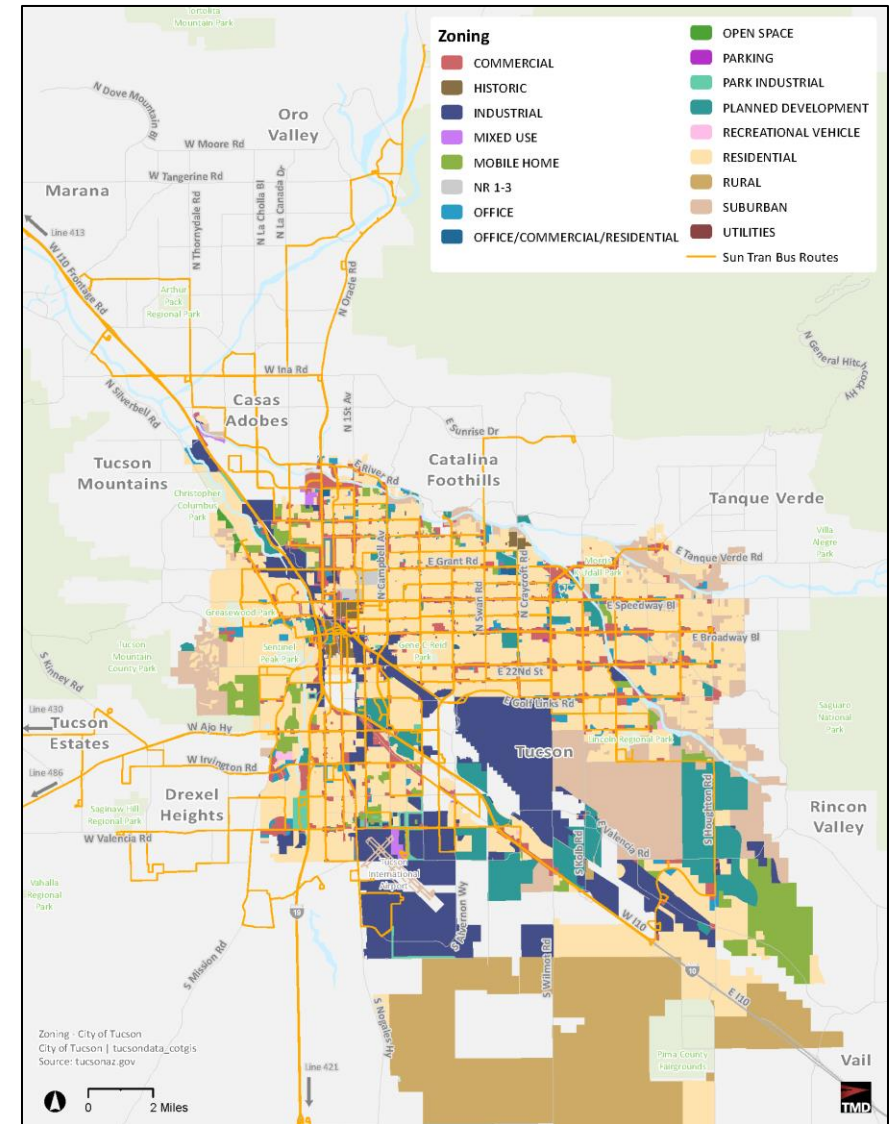


Zoning

The zoning of Tucson shows that much of the city is zoned for residential uses (Figure 24). Much of the industrial land uses are located along or near the interstate highways, the airport area, along the railroad tracks and near Davis-Monthan Air Force Base. The Downtown area and many transportation corridors leading into the area have overlay zones designed to incentivize housing and mixed-use redevelopment projects of higher density than the underlying zoning would allow. This has led to increased housing and mixed-uses along the streetcar corridor and other transit-oriented development in the Main Gate and Sunshine Mile corridors. Additional office and commercial zoning can be found along Interstate 10 near major interchanges such as Kolb Road and near the airport, along with office zoning along Houghton Road in the southeast. The land adjacent to most of the major intersections throughout the city are zoned for commercial uses, as indicated by the proliferation of shopping areas. The zoning of Tucson is consistent with many similar cities with most of the offices located downtown, a historic older core of the city, and newer residential areas outside of the city.

The Sun Tran network needs to respond to new development areas within the city. An analysis of the building permits granted between April and October 2022 shows the locations where development, or redevelopment, is occurring. The map of building permits shows residential growth along the North 1st Avenue corridor and in the south along Interstate 19 near the interchanges of Valencia Road and Ajo Way. Commercial development pockets are in the southeast part of the city in the Rita Ranch area, near the Tucson Mall north of Downtown, and the Tucson Marketplace near the interchange of Interstate 10 and Ajo Way.

Figure 24 Zoning



Density

Denser areas have more people concentrated together, and the more people there are, the larger the potential rider base. Denser areas are ideal for transit because many people are located within a small geography, so the bus does not have to travel as far to find riders. The Tucson metropolitan region has a population of 839,158 and is spread across approximately 300 square miles. As shown in Figure 26, the highest densities can be found downtown and near the University of Arizona, north of the Tucson International Airport and the neighborhoods between Grant Road and the Rillito River. The locations of jobs and higher education are the main drivers of population density in the city. As development decreases on the outskirts of the city and into the foothills, there is a dramatic and obvious drop in population density. Creating an efficient transit network in these outer areas is more difficult, since potential riders are more spread out, and there are fewer destinations.

Population and Employment Trends

In the last census, Pima County had a population of just over 1 million people (Figure 25). Population projections indicate that the region will grow by 17% and the City of Tucson by 11% over the next 25 years. The City of Tucson Planning and Development Services Department uses special districts to incentivize redevelopment, which will help distribute future population growth across the City, including the downtown core and farther away from the city center.

Figure 25 From the Arizona Commerce Committee

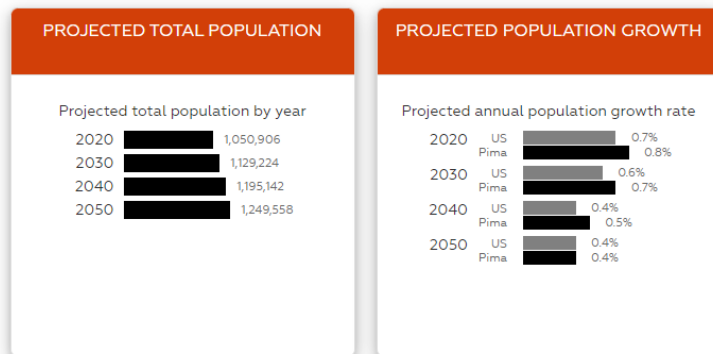
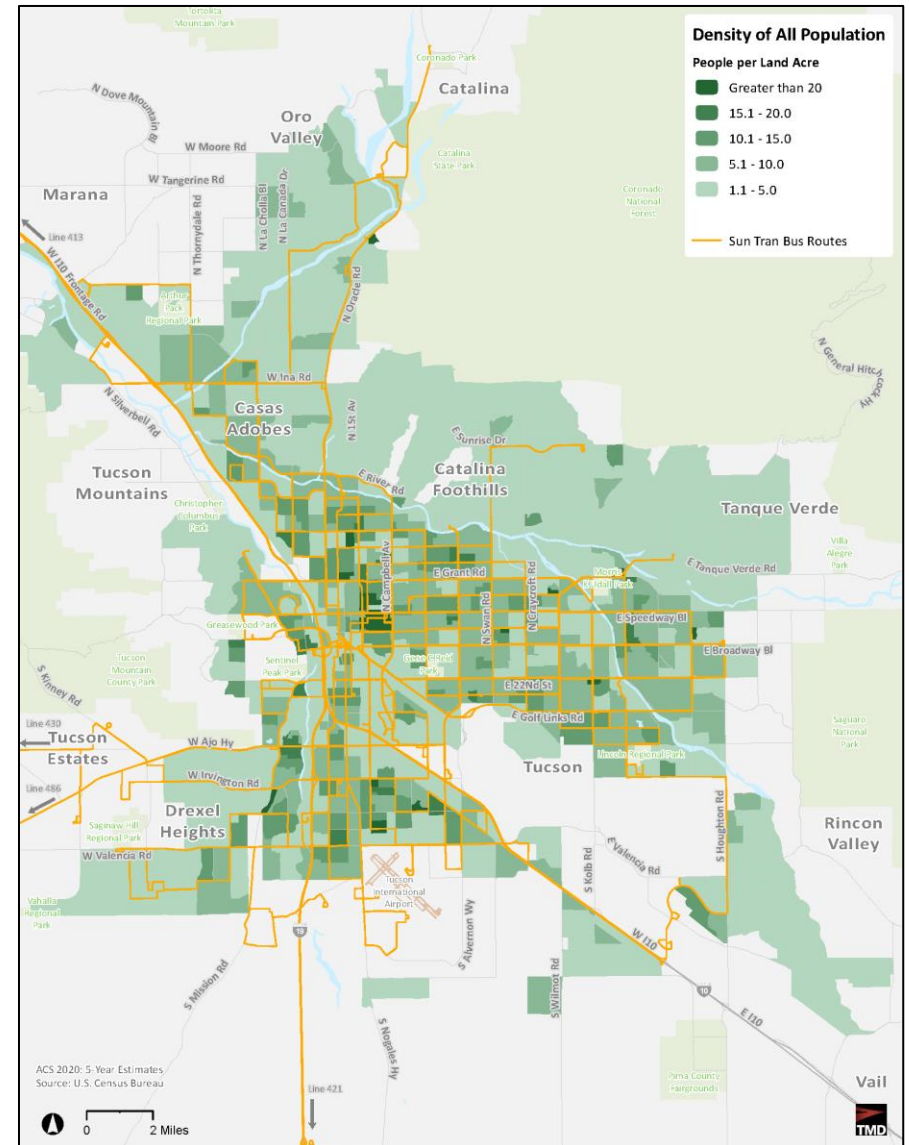


Figure 26 Density of All Population



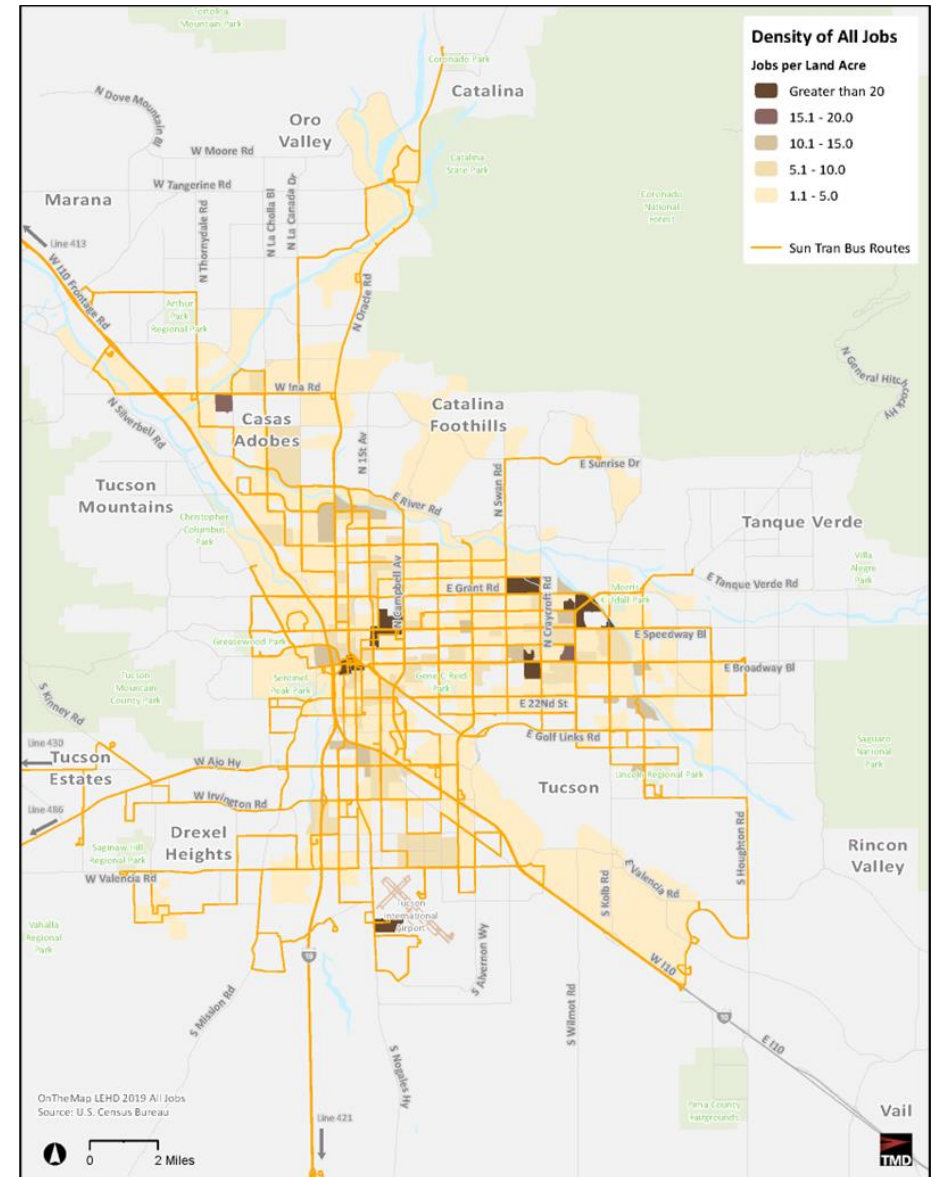
Employment and Potential Destinations

In 2019 there were a total of 341,000 people employed in the Tucson area. While 85,000 people travel out of Tucson for work, 114,000 travel into the city, increasing the daytime population by 25%. The number of jobs per land acre is highest in Downtown Tucson, near the University of Arizona, and at the intersection of Tanque Verde, Kolb, and Grant Roads. These areas offer a broad range of employment opportunities, including retail stores like Target, medical centers and hospitals, and insurance agencies. After reviewing Figure 28, it is evident that hospitals and other medical facilities, such as St. Joseph's Hospital, El Dorado Medical Campus, and Tucson Medical Center, are among the densest employment tracts. The University of Arizona is the largest single employer in Tucson (Figure 27) and is located northwest of downtown, which also contains the densest population and employment areas. The fixed route system in Tucson is effective in providing transportation for residents to commute to work, with some of the top employment and education destinations served by multiple fixed routes and accessible from various parts of the city. These destinations include Texas Instruments, the El Dorado Health Campus, the Tucson Medical Center, and the Ina Corporate Park, all of which can be reached by bus in Tucson.

Figure 27 Top 10 Employers

Employer	Number of Employees ⁴
Raytheon Missile & Defense (3 Sites)	13,318
University of Arizona Main Campus Staff	13,230
Banner – University Medical Center	8,818
TUSD Morrow Education Center	6,790
Pima County	6,717
US Davis-Monthan Air Force Base	6,000
Tucson Medical Center	4,706
The City of Tucson	4,465
Amazon Fulfilment Center	4,303
US Southern AZ VA Health Care System	2,800

Figure 28 Density of All Jobs



⁴ [Travel Reduction Program FY 2021-22 PAG Annual-Report](#)

Demographic Analysis and Customer Demand

Over the last decade, the emergence of comprehensive travel data provided through location-based services and online platforms has provided transit agencies with new tools for understanding regional travel behavior. Replica is an online data platform that aggregates location-based services data, credit card transactions, and U.S. Census data to deliver detailed but anonymized information on regional trip-making. For this project, the study area was divided into 19 different analysis zones (shown in Figure 29), defined by major cross-streets, freeways, neighborhoods, and geographic barriers (rivers). Demographic indicators by zone show where there are concentrations of populations who are more likely to use transit.

Figure 30 shows the demographic indicators by zone based on the Replica zones established for this project. The numbers highlighted in blue in each table refer to the five zones that have the highest percentage of the population for each population category. Figure 30 also demonstrates that the zones that have a greater than average percent share of the population that is more likely to use transit are in areas that are in or close to Downtown Tucson, the University of Arizona, or near the airport. Meanwhile, areas that are located further away and, in the foothills, tend to have a higher percentage of the population that is likely to use transit. Below is an analysis of each indicator. Additionally, it is important to note that the Zone 9 and 10 populations are very small compared to the other zones because they mostly encompass Tucson International Airport and Davis-Monthan Air Force Base. Zones with high population-to-job ratios have more people than jobs, meaning that people must travel to other zones in search of employment opportunities. On the other hand, zones with low ratios (Downtown, the Airport, Davis-Monthan AFB, and University of Arizona) have small populations but are major employment centers and therefore will have an inflow of people throughout the day.

Figure 29 Sun Tran System Map with Zones

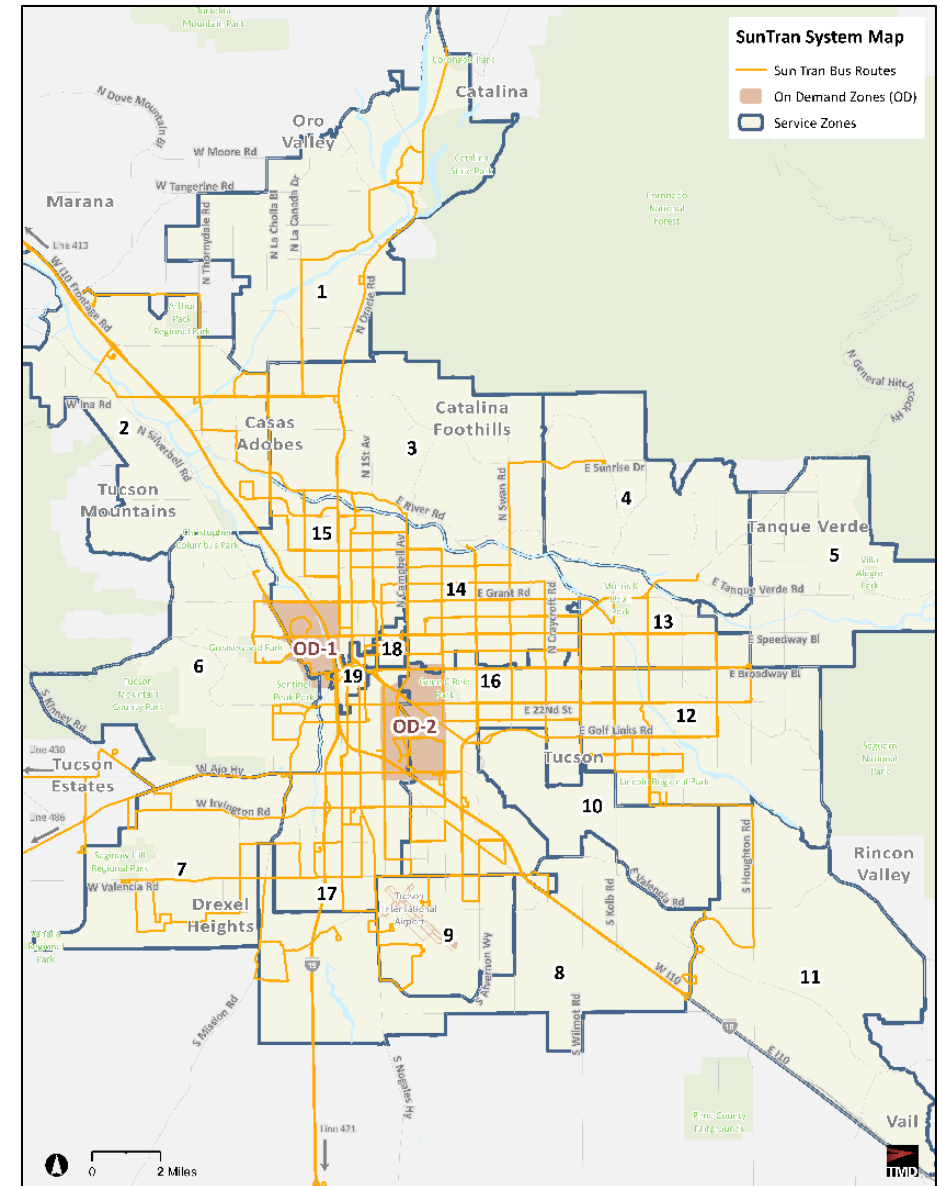


Figure 30 Demographic Summary Table

Zone		Total Population	Percent of Total Trips	Population to Jobs Ratio	Under 18	Young Adults (18-24)	Seniors (65+)	Zero Vehicle Households	Income Less than \$24,999	Disabled	Minority
Oro Valley and Catalina	1	51,862	5%	5.34	17%	7%	34%	4%	11%	12%	24%
Flowing Wells and Marana	2	66,849	8%	3.54	23%	12%	15%	4%	14%	14%	44%
Casas Adobes and Catalina Foothills (West)	3	50,583	7%	1.95	15%	7%	29%	6%	15%	13%	30%
Catalina Foothills (East)	4	34,129	3%	6.12	16%	8%	31%	3%	12%	12%	20%
Tanque Verde	5	12,677	1%	7.22	17%	9%	28%	2%	9%	16%	21%
Tucson – Westside	6	38,974	3%	7.69	18%	16%	15%	6%	21%	11%	67%
Drexel Heights and Valencia West	7	38,007	3%	10.42	30%	11%	13%	4%	18%	12%	85%
San Xavier, Summit, and DM AFB South	8	32,106	2%	1.53	21%	9%	12%	4%	13%	8%	64%
Tucson International Airport and vicinity	9	1,840	1%	0.15	31%	2%	5%	0%	5%	27%	90%
Davis-Monthan Air Force Base and vicinity	10	717	0%	0.68	0%	91%	0%	-	-	0%	43%
Tucson – Southeast, Vail	11	30,802	3%	6.84	31%	8%	9%	1%	5%	9%	34%
Tucson – Eastside	12	85,097	9%	5.89	21%	9%	19%	7%	20%	16%	41%
Tucson – Northeast	13	43,905	6%	2.09	17%	9%	26%	10%	21%	17%	32%
Tucson – Midtown North	14	78,927	11%	1.99	16%	13%	19%	15%	31%	16%	38%
Tucson – Northwest	15	82,591	12%	1.82	17%	22%	13%	16%	40%	17%	60%
Tucson – Midtown South	16	79,752	11%	1.87	28%	14%	12%	9%	28%	15%	70%
Tucson – Southside	17	93,421	12%	3.37	27%	13%	13%	13%	34%	15%	89%
University of Arizona and vicinity	18	11,982	3%	0.86	2%	84%	1%	15%	45%	10%	43%
Downtown and vicinity	19	4,937	2%	0.19	11%	23%	11%	18%	40%	17%	49%
Service Area Average					21%	13%	18%	9%	23%	14%	42%

Seniors are more likely to be transit dependent; they may no longer be able to drive, or they may choose not to, meaning they are more likely to take the bus for their mobility needs. The 2045 RMAP population projections show a double in the number of senior-aged residents in the Tucson metropolitan region. Tucson will need to keep up with the needs and demands of their aging population. Seniors make up 18% of the population of Tucson but only 6% of riders. The routes that are most frequented by seniors serve nursing homes, shopping centers and medical facilities. The best solutions for senior mobility are most often direct services connecting residential areas to medical services and socialization opportunities. Unlike other rider groups, recreation and sightseeing are among the top 5 destinations for seniors, according to the 2022 surveying efforts. Shown in Figure 31, routes where seniors make up over 8% of riders are Routes 24, 2, 23, 19 and 25, all concentrated in central and south Tucson. The maps show some pockets of senior activity in the far east end of town where service is less dense. The home locations of senior populations are also indicative of destinations that home health aides may need to travel to assist seniors. Most concentrations of the senior citizen population are well served by the current network.

Density of Senior Residents (Ages 65+)

People per Land Acre

- Greater than 5
- 4.1 - 5.0
- 3.1 - 4.0
- 2.1 - 3.0
- 1.1 - 2.0

Routes with the Highest Percent of Senior Riders (24, 2, 23, 19, 25, 27)

Sun Tran Bus Routes

ACS 2020: 5-Year Estimates
Source: U.S. Census Bureau

0 2 Miles

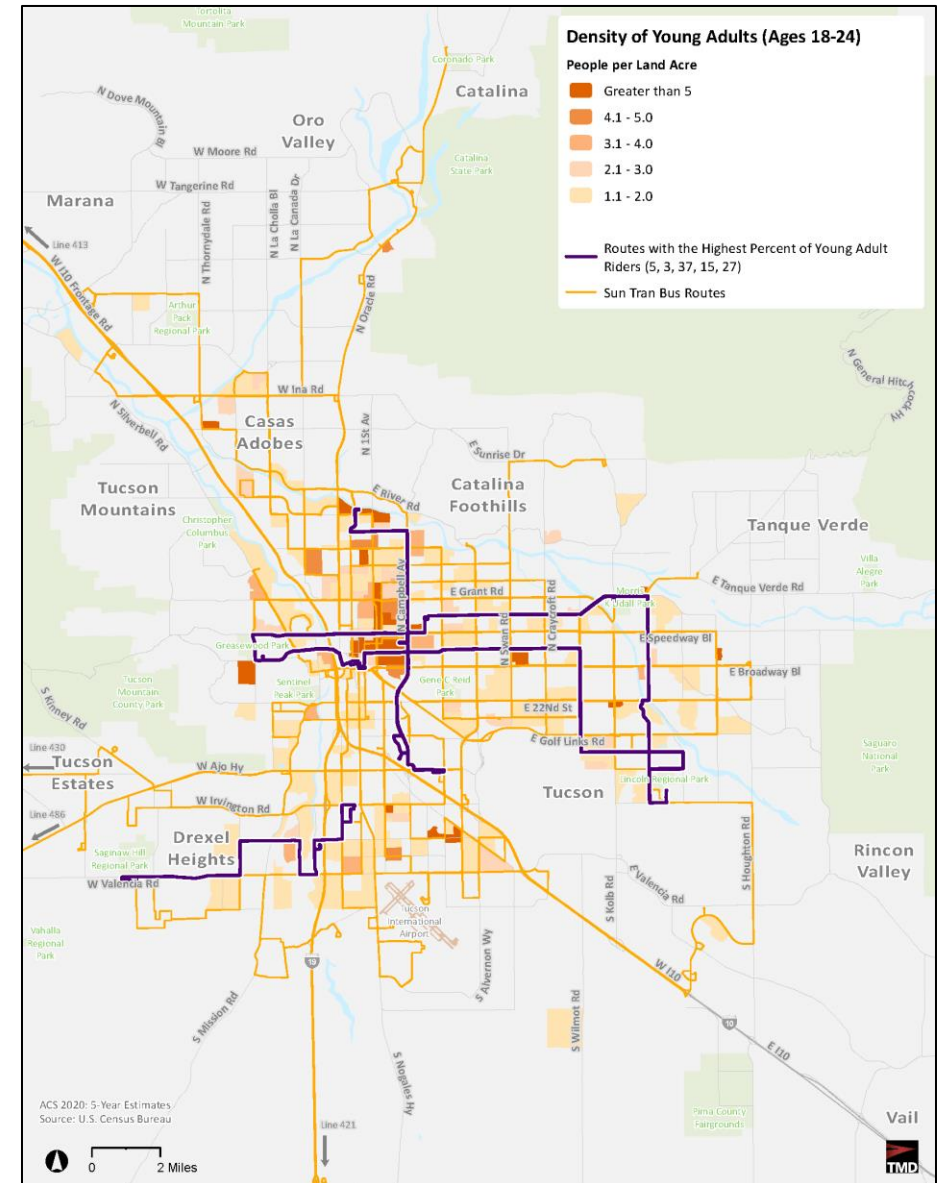
Vail TMD

Young Adults (18-24)

Of the young adult population in Tucson, many are enrolled in local colleges and universities. College students are more likely to take transit due to on-campus parking restrictions or because they are from out of state. According to the 2022 on-board survey data, college students are under-represented in Sun Tran ridership compared to the study area, accounting for 13% of the population and 7% of transit riders. However, college students account for 73% of Sun Link ridership which connects the University of Arizona with Downtown Tucson. The college-aged population in Tucson is located, unsurprisingly, around the major colleges and universities in the region. Specifically, the area around The University of Arizona, in the core of Tucson, has a high concentration of college-aged individuals. Pima Community College (PCC) has campuses across Tucson, with students concentrated around those campuses as well. Over 50% of riders on Route 5 identify as students, as the route serves PCC's West campus and Downtown campus, along with the University of Arizona. Additionally, over 20% of riders on routes 15, 37, 3, and 27 are college students. They use public transportation to get them to and from home, college, work, to dine out and to meet up with friends.

The university market has been decreasing due to COVID-19 as many universities have moved to online and distance learning. The college-age student's population is concentrated in the vicinity of the University of Arizona campus or between the campus and downtown. Many of these college-aged residents are walking or taking the streetcar to their college campus or downtown. Concentrations further from downtown are still well connected to the University of Arizona campus through existing routes.

Figure 32 Density of Young Adult (Ages 18-24)

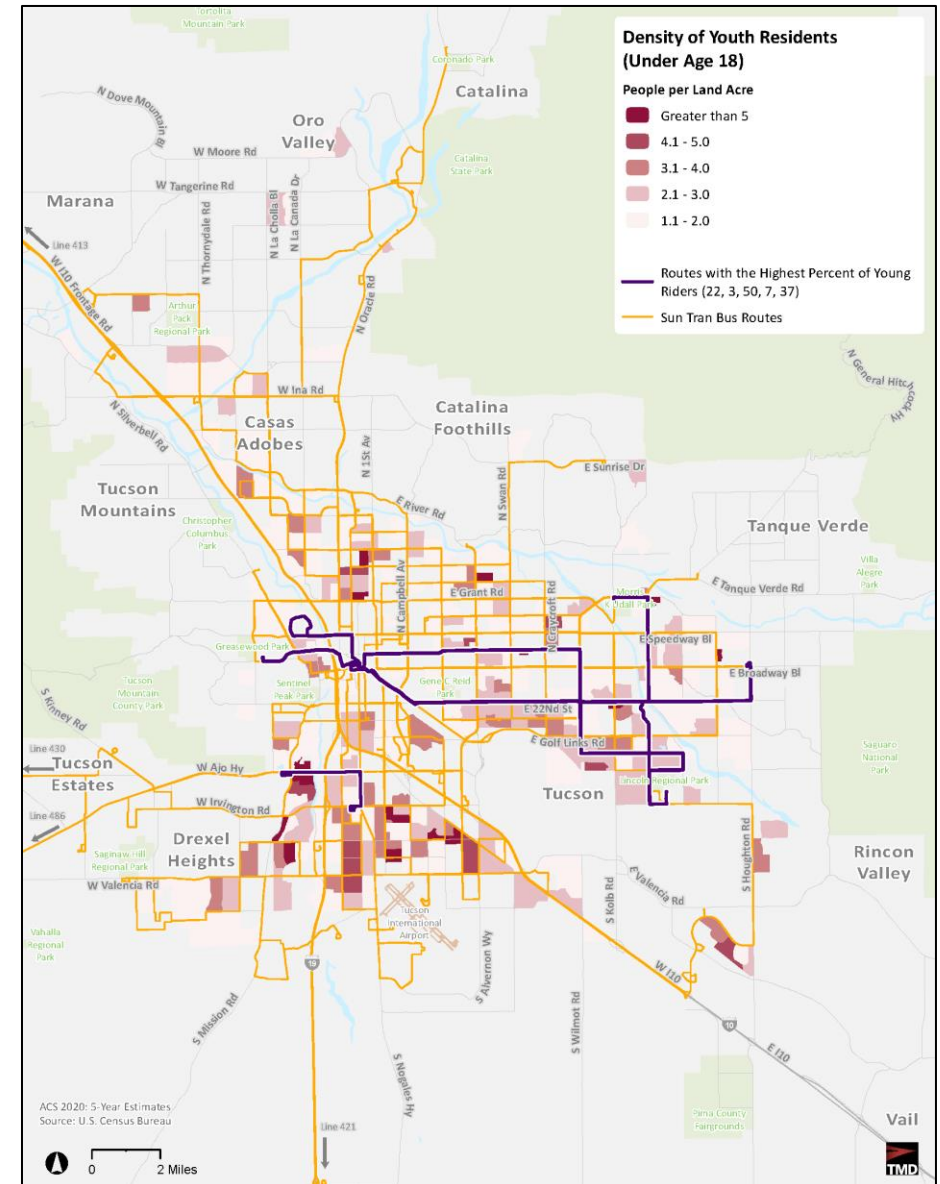


Youth Population (Under 18)

The under-18 population can also be more transit-reliant, as they may not have access to a car or are too young to drive but still want to travel independently. Furthermore, the Tucson Unified School district has restrictive eligibility for school bus service, with access to public bus service a reason to make someone ineligible for school bus service. In Tucson, trends and concentrations can be seen in the youth population. Where there is a higher density of youth under 18, a school is also nearby. Children under 18 years old make up 21% of the population of Tucson. A more typical pattern of less specific concentration can be found just north of Tucson International Airport, between route 19 and route 10. According to the 2022 on-board rider survey, the top destinations for people under 18 are their home, school, meeting up with friends, and shopping. Routes where over 12% of riders are under the age of 18 include route 22, 3, 50, 7, and 37.

Implication: A lot of the youth population is using services east of downtown or crosstown services. Routes that connect residential areas to schools serve this population very well. One consideration is that ridership does surge on routes connecting to schools based on bell times at the school. Routes serving schools should have a span that is wide enough to allow for students to return home after student activities.

Figure 33 Density of Youth Residents (Under Age 18)



Age is an important indicator for the need for transit services as many seniors are unable or unwilling to drive, while the youth population does not have driver's licenses. Many college-aged students may have driver's licenses but do not have full-time access to an automobile if living on or near campus. The elderly population is most concentrated in the edge neighborhoods in the 1-Oro Valley and Catalina zone and 4-Catalina Foothills (East) zone. The youth population, under age 18, is most concentrated in the 7-Drexel Heights and Valencia West zone, 9-Tucson International Airport and vicinity zone, and 11-Tucson Southeast, Vail zone, representing close to one-third of the overall population in these zones. The college-aged population, ages 18 through 24, is most concentrated in the 10-Davis-Monthan Air Force Base and vicinity zone and the University of Arizona and vicinity zone. There are also high concentrations in 15-Tucson-Northwest and 6-Tucson-Westside which both include Pima Community College campuses.

Figure 34 Age Summary

Zone		Median Range	Under 18	18-24	25-34	35-44	45-54	55-64	Over 65
Oro Valley and Catalina	1	45-54	17%	7%	8%	9%	11%	15%	34%
Flowing Wells and Marana	2	35-44	23%	12%	13%	12%	12%	14%	15%
Casas Adobes and Catalina Foothills (West)	3	45-54	15%	7%	13%	10%	10%	15%	29%
Catalina Foothills (East)	4	45-54	16%	8%	7%	8%	14%	17%	31%
Tanque Verde	5	45-54	17%	9%	5%	8%	14%	20%	28%
Tucson – Westside	6	35-44	18%	16%	16%	12%	13%	11%	15%
Drexel Heights and Valencia West	7	25-34	30%	11%	12%	12%	11%	12%	13%
San Xavier, Summit, and DM AFB South	8	35-44	21%	9%	18%	18%	14%	9%	12%
Tucson International Airport and vicinity	9	25-34	31%	2%	27%	16%	10%	10%	5%
Davis-Monthan Air Force Base and vicinity	10	18-24	0%	91%	9%	0%	0%	0%	0%
Tucson – Southeast, Vail	11	25-34	31%	8%	12%	15%	16%	9%	9%
Tucson – Eastside	12	35-44	21%	9%	14%	11%	11%	14%	19%
Tucson – Northeast	13	35-44	17%	9%	15%	11%	9%	15%	26%
Tucson – Midtown North	14	35-44	16%	13%	17%	11%	12%	13%	19%
Tucson – Northwest	15	25-34	17%	22%	15%	12%	10%	10%	13%
Tucson – Midtown South	16	25-34	28%	14%	14%	12%	11%	11%	12%
Tucson – Southside	17	25-34	27%	13%	15%	12%	10%	9%	13%
University of Arizona and vicinity	18	18-24	2%	84%	8%	2%	1%	1%	1%
Downtown and vicinity	19	25-34	11%	23%	23%	14%	8%	10%	11%
Service Area Average			21%	13%	14%	11%	11%	12%	18%

Low-Income Populations

Low-income populations are a demographic that is more likely to take transit. Because car ownership is expensive, low-income households generally have fewer cars and therefore may rely on other modes to meet all their mobility needs. Households that make under \$25,000 annually represent a large part of the study area's transit ridership - they constitute 23% of the area's population and 58% of Sun Tran riders. The areas with the lowest median income encompass the northwestern and southwestern areas of Tucson. Median household incomes are generally higher in the eastern and suburban areas of Tucson. Low-income riders use public transportation to get home, go to work, visit friends, shop, and other personal business trips. On routes 22, 25, 19, 10 and 50, two thirds of riders have a household income of less than \$25,000 per year. These routes generally follow a north-south pattern on the western side of Tucson through Downtown. Additionally, riders that make less than \$25,000 annually are overrepresented on the Sun Shuttle routes, making up 75% or more of the 401, 412, 413 and 430.

Populations that have a lower median income tend to be more likely to use transit. The zones that have the lowest income are 18-University of Arizona and vicinity, 19-Downtown and vicinity, and 15-Tucson-Northwest. These are all zones located near the center of the Sun Tran service area, near downtown Tucson. The zones that have the highest income are located on the edge of the service area and include 5-Tanque Verde, 11-Tucson Southeast, Vail, and 4-Catalina Foothills (East). High densities of low-income populations are currently well-served by Sun Tran bus routes except for one pocket of relatively low density in Oro Valley between N La Cholla Blvd. and N La Canada Road.

Figure 35 Density of Low-Income Individuals

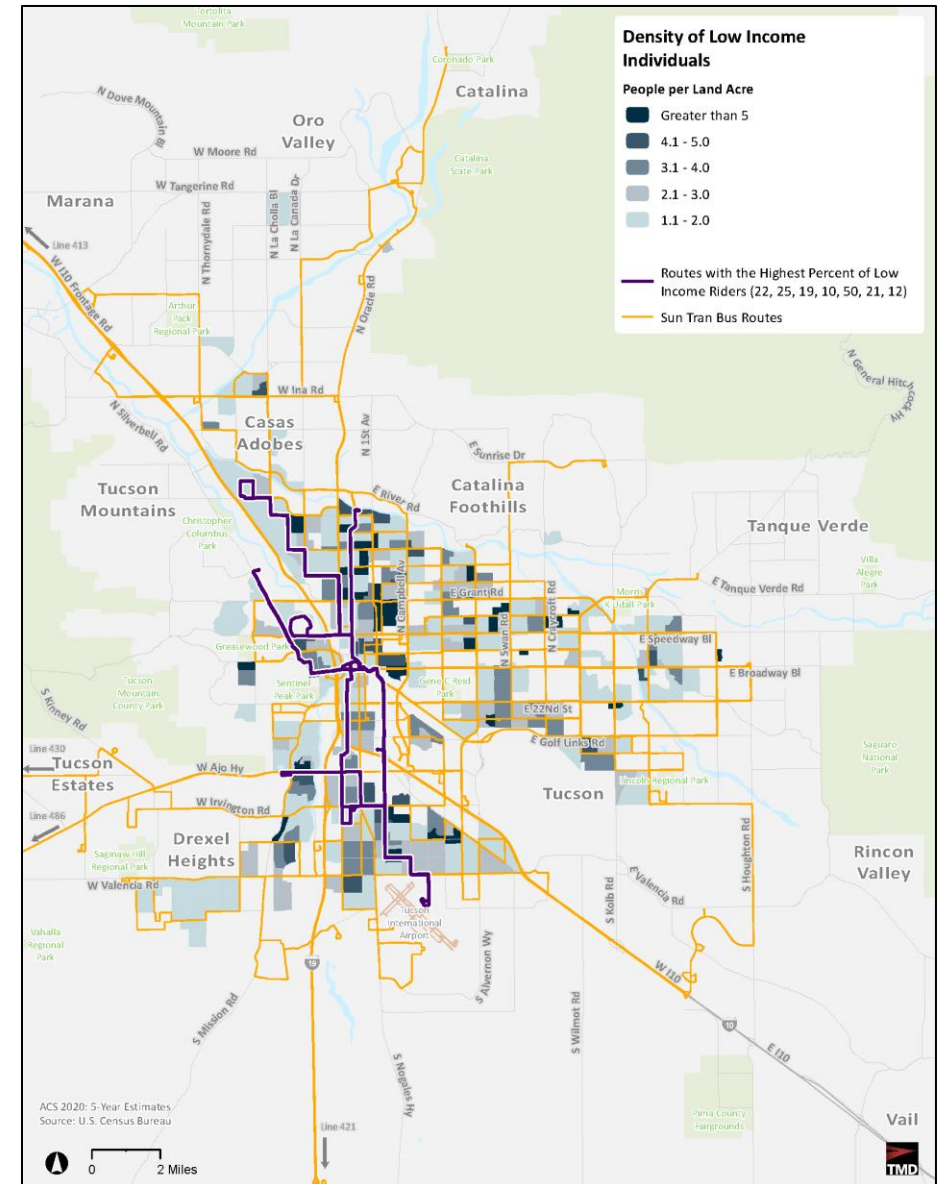


Figure 36 Income Summary

Zone		Median Household Income	<\$24,999	\$25,000-\$49,999	\$50,000-\$74,999	\$75,000-\$99,999	\$100,000 or More
Oro Valley and Catalina	1	\$75,000 - \$99,999	11%	18%	17%	17%	38%
Flowing Wells and Marana	2	\$50,000 - \$74,999	14%	22%	18%	17%	29%
Casas Adobes and Catalina Foothills (West)	3	\$75,000 - \$99,999	15%	18%	15%	10%	42%
Catalina Foothills (East)	4	\$75,000 - \$99,999	12%	15%	19%	12%	42%
Tanque Verde	5	\$100,000 - \$149,999	9%	11%	14%	15%	50%
Tucson – Westside	6	\$50,000 - \$74,999	21%	24%	20%	13%	22%
Drexel Heights and Valencia West	7	\$50,000 - \$74,999	18%	27%	21%	16%	19%
San Xavier, Summit, and DM AFB South	8	\$50,000 - \$74,999	13%	22%	27%	12%	26%
Tucson International Airport and vicinity	9	\$75,000 - \$99,999	5%	19%	25%	22%	30%
Davis-Monthan Air Force Base and vicinity	10	-	-	-	-	-	-
Tucson – Southeast, Vail	11	\$75,000 - \$99,999	5%	12%	15%	19%	49%
Tucson – Eastside	12	\$50,000 - \$74,999	20%	27%	20%	14%	19%
Tucson – Northeast	13	\$50,000 - \$74,999	21%	26%	16%	16%	21%
Tucson – Midtown North	14	\$35,000 - \$49,000	31%	28%	17%	10%	14%
Tucson – Northwest	15	\$25,000 - \$34,999	40%	29%	16%	6%	8%
Tucson – Midtown South	16	\$35,000 - \$49,000	28%	29%	20%	11%	13%
Tucson – Southside	17	\$35,000 - \$49,000	34%	29%	17%	10%	11%
University of Arizona and vicinity	18	\$25,000 - \$34,999	45%	35%	13%	3%	5%
Downtown and vicinity	19	\$35,000 - \$49,000	40%	21%	13%	7%	19%
Service Area Average			23%	25%	18%	12%	22%

Minority Populations

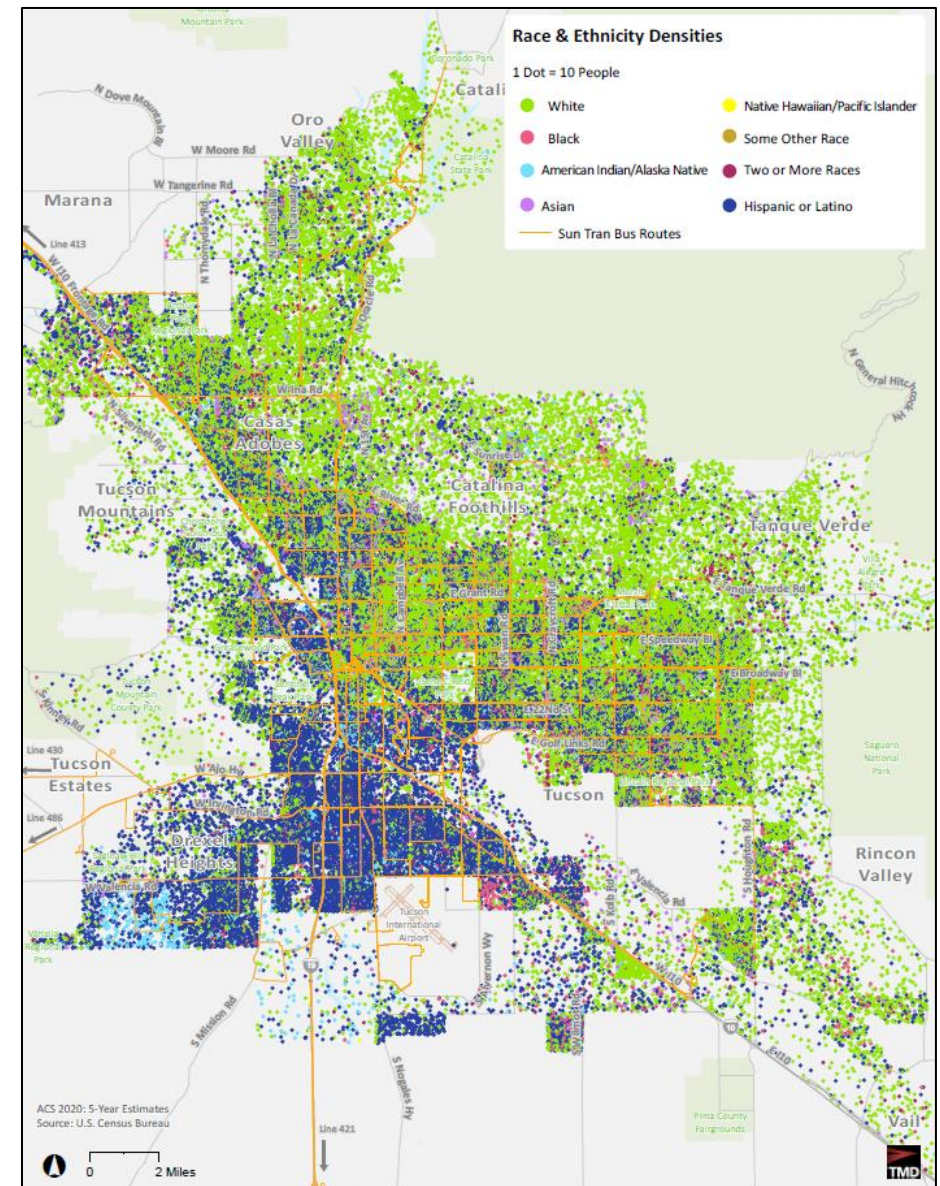
While identifying as a minority household is not a direct indicator of higher transit use, it is important to pay close attention to the concentration and distribution of minority households in the service area for two reasons. The first is Sun Tran is committed to providing equitable transit service. The second is to protect these communities from Title VI implications. Title VI of the Civil Rights Act of 1964 prohibits discrimination based on race, color, or national origin by an entity that receives funding from the federal government, including transit agencies. When transit agencies make service changes, they must ensure that service changes do not place a disparate impact on minority populations.

About half of Tucsonans identify as non-white, totaling 52% of residents in the region. On Sun Tran routes however, they make up a slightly smaller proportion of Sun Tran riders, totaling 45% of riders. Routes 12, 24, 26, 29 and 50 have the highest minority ridership – totaling over 78% - and all five routes, provide service the southwestern corner of the Tucson area.

Figure 37 shows the clear separation of population by race and ethnicity in Tucson. Hispanic and American Indian/Alaska Native populations are concentrated south of I-10.

Many of the areas that have a high density of non-white people living in them are located close to downtown, with many neighborhoods north and south of downtown having a high density of non-white persons. Due to proximity, many of the routes that serve the downtown area are serving the areas that have a high non-white population density and have a high non-white ridership. However, regional travel patterns result in many routes having a high percentage on non-white riders even if the neighborhoods themselves have a low density of non-white residents.

Figure 37 Race and Ethnicity Dot Densities



Areas that have a high percent of minority residents tend to be zones that have a higher propensity to use transit service. The zones with the greatest non-white share of the population are in the 17, 16, 9, 7, and the 6. These zones are in the southwest corner of the service area. Forty-six percent of the Tucson International Airport and vicinity zone is African American while about a quarter of the Davis-Monthan Air Force Base Zone is African American. Over half of the 17-Tucson-Southside, 7-Drexel Heights and Valencia West, 16-Tucson-Midtown South, and 6-Tucson-Westside are Hispanic or Latino. The zones that have the highest percentage of non-minority population include the zones at the edge of the service area and include 4-Catalina Foothills (East), 5-Tanque Verde, and 1-Oro Valley and Catalina.

Figure 38 Race and Ethnicity Summary

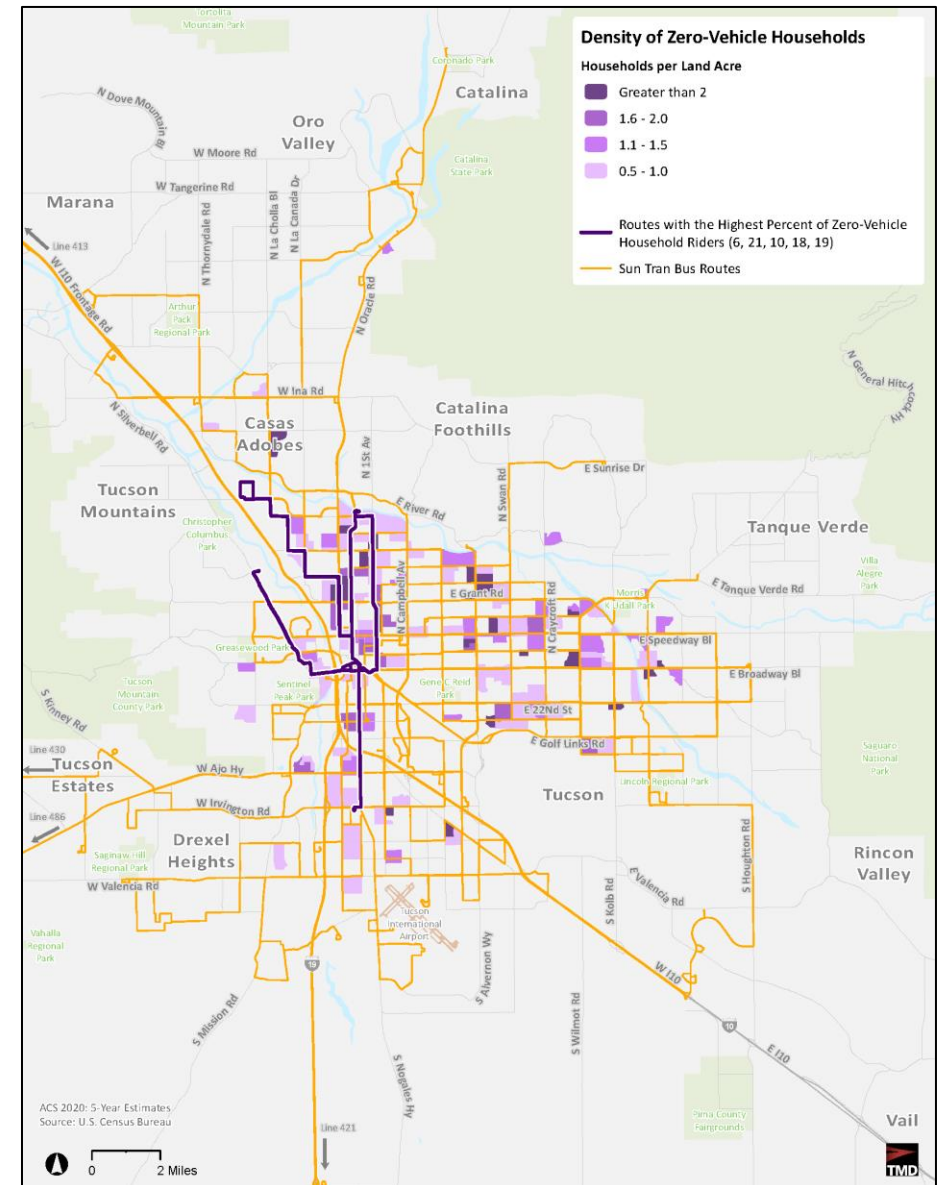
Zone		Minority	Non-Minority (White)	African American	Hispanic or Latino	Asian	Native Hawaiian or Pacific Islander	American Indian or Alaska Native	Two or More Races	Other
Oro Valley and Catalina	1	24%	76%	1%	17%	2%	0%	0%	3%	< .1%
Flowing Wells and Marana	2	44%	56%	3%	32%	3%	< .1%	1%	5%	0%
Casas Adobes and Catalina Foothills (West)	3	30%	70%	2%	17%	8%	0%	1%	3%	0%
Catalina Foothills (East)	4	20%	80%	2%	9%	4%	0%	0%	4%	0%
Tanque Verde	5	21%	79%	1%	12%	2%	0%	0%	5%	< .1%
Tucson – Westside	6	67%	33%	3%	57%	3%	0%	2%	2%	0%
Drexel Heights and Valencia West	7	85%	15%	1%	74%	0%	< .1%	9%	1%	0%
San Xavier, Summit, and DM AFB South	8	64%	36%	8%	44%	3%	0%	5%	3%	0%
Tucson International Airport and vicinity	9	90%	10%	46%	44%	0%	0%	0%	0%	0%
Davis-Monthan Air Force Base and vicinity	10	43%	57%	25%	14%	1%	0%	0%	3%	0%
Tucson – Southeast, Vail	11	34%	66%	5%	23%	2%	< .1%	1%	3%	0%
Tucson – Eastside	12	41%	59%	5%	28%	3%	0%	1%	4%	0%
Tucson – Northeast	13	32%	68%	4%	22%	2%	0%	0%	3%	0%
Tucson – Midtown North	14	38%	62%	5%	26%	2%	1%	1%	3%	0%
Tucson – Northwest	15	60%	40%	3%	46%	5%	0%	3%	3%	0%
Tucson – Midtown South	16	70%	30%	5%	59%	2%	0%	2%	2%	0%
Tucson – Southside	17	89%	11%	2%	82%	1%	0%	3%	1%	< .1%
University of Arizona and vicinity	18	43%	57%	7%	21%	8%	0%	3%	4%	1%
Downtown and vicinity	19	49%	51%	4%	34%	4%	0%	2%	5%	0%
Service Area Average		51.62%	48.38%	3.62%	39.94%	3.04%	0.16%	1.95%	2.75%	0.17%

Zero-Vehicle Households

Lack of access to a private vehicle is one of the top indicators of someone's likelihood to utilize transit. Zero-vehicle households represent 3% of regional households, but 51% of transit riders do not have access to a car at home. An additional 29% had access to only one vehicle in their household. In the Tucson region, zero-vehicle households are more concentrated in the area south of the Rillito River, with higher concentrations in the eastern and western edges of the city. Once out of the city, there is a stark line and dramatic shift in the concentration of zero-vehicle households. These concentrations follow a similar pattern to that of the low-income map. Zero vehicle households use Sun Tran to go home, get to work, visit friends, shop, and get to college. Routes where over 60% of riders do not have access to a vehicle at home include Routes 6, 21, 10, 18, and 19. These routes primarily operate between Downtown and the Rillito River, just east of I-10. Also, Sun Shuttle routes 401 and 430 have over $\frac{3}{4}$ of their riders living in zero-vehicle households.

The density of households that do not own a car is exceptionally low throughout the entire metro area. There are individual census block groups that average more than two households per acre without an automobile, all of them being within a proximity of multiple bus routes. Many of the bus routes that have a high percentage of people living in households without access to an automobile are routes serving neighborhoods immediately north or south of downtown.

Figure 39 Density of Zero Vehicle Households

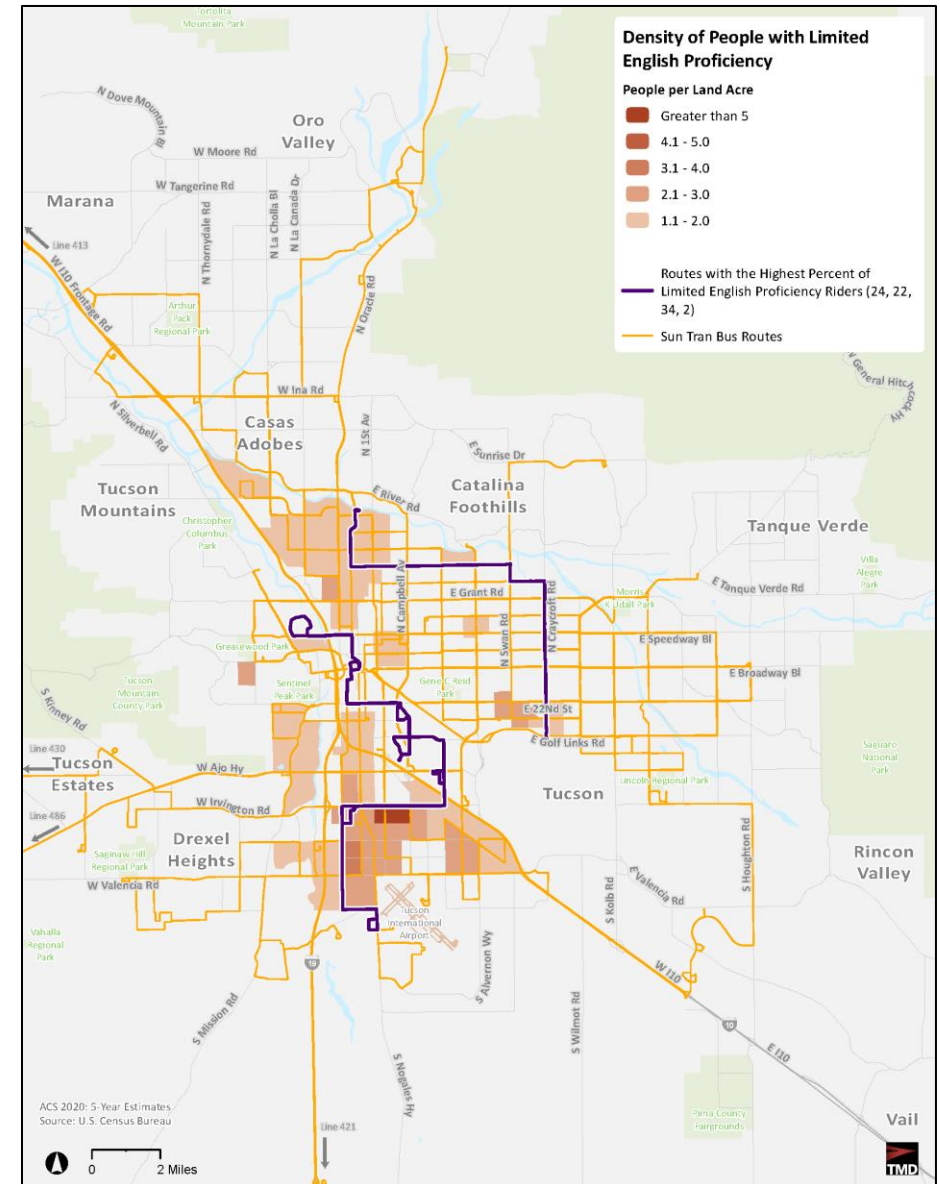


Limited English Proficiency

Like race, English ability is not a direct indicator of higher transit use; however, it is important to pay close attention to the concentration and distribution of people who identify their English-speaking ability as less than very well. Sun Tran is committed to providing equitable transit service, and so it is important to protect these communities from Title VI implications. People who speak English less than very well make up 8% of the Tucson population while on Sun Tran routes they make up 11% of riders. Higher concentrations of people who speak English less than very well can be found in southern and western Tucson. This trend can be seen in the routes that they frequent. Routes 24, 22, 34, and 2 have at least 9% of riders with limited English ability and provide access from the south to downtown Tucson.

While many parts of the metro area have a high number of people that have limited English proficiency (LEP), the highest concentrations of people with LEP are located south of Downtown Tucson. This closely matches many other socio-economic indicators presented in this report. The routes with the highest percentages of riders with LEP align with the highest concentrations of those populations.

Figure 40 Density of People with Limited English Proficiency

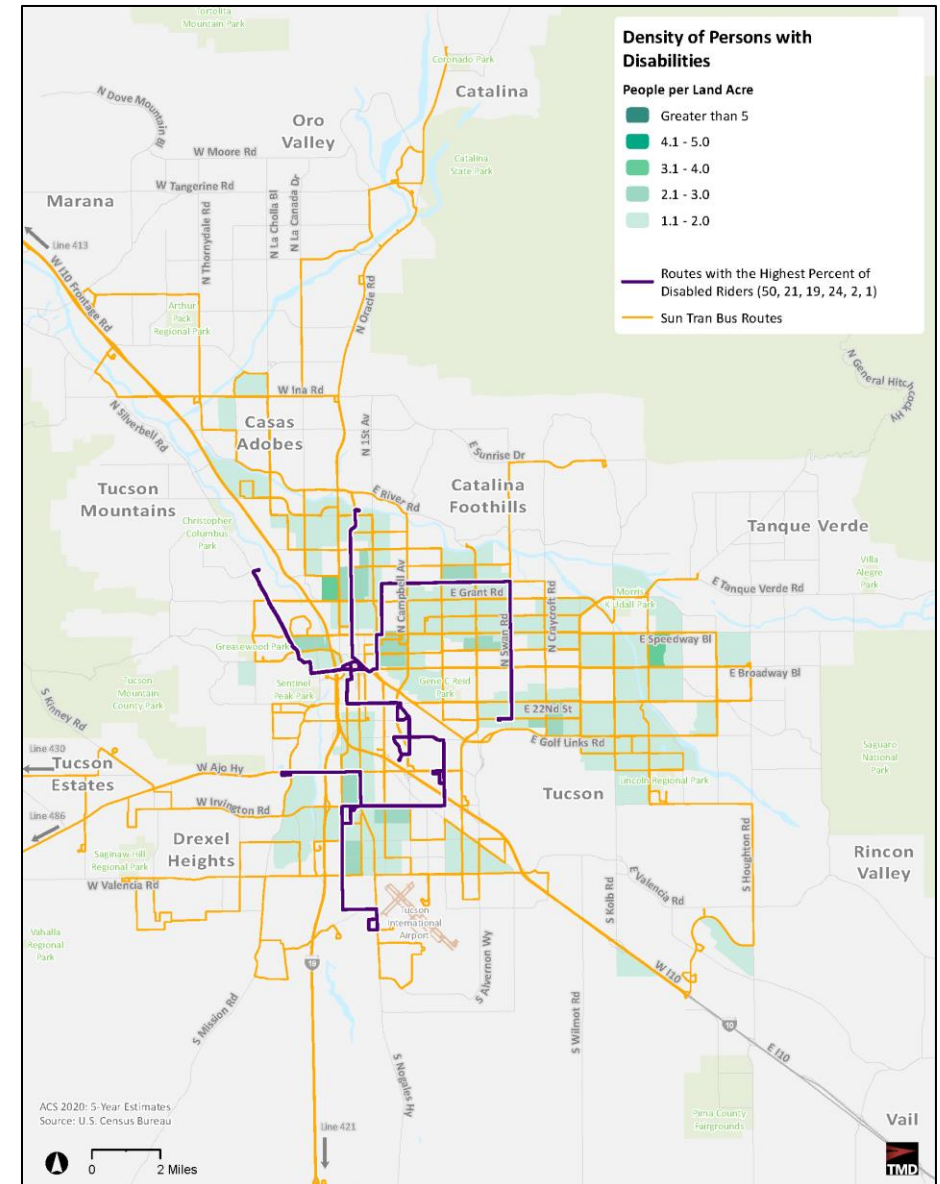


Persons with Disabilities

Persons with disabilities are more likely to be reliant on transit, as they may not be able to or choose not to drive. While complementary paratransit service is available, many people with disabilities routinely ride fixed-route services. In Tucson, 14% of residents have a disability, and they make up 10% of Sun Tran riders. Key trip generators and destinations on frequented routes including shopping, medical appointments, and social visits. On Routes 50, 21, 19, 24, 2, and 1, people with disabilities make up over 15% of riders.

While there are a handful of routes where more than 15% of riders are disabled, the population of persons with disabilities is spread out throughout the metropolitan area. Areas that have a higher population density of disabled persons include the Miracle Manor and the San Rafael neighborhoods.

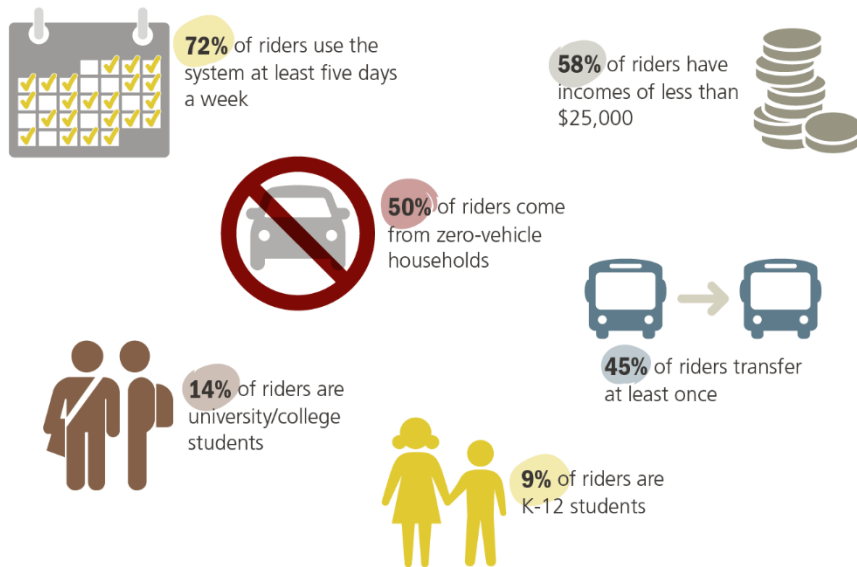
Figure 41 Density of Persons with Disabilities



On-Board – Rider Survey

From January to March 2022, The City of Tucson, PAG and ETC Institute conducted an on-board rider survey, and the results were weighted and expanded to be reflective of Sun Tran, Sun Van, and Sun Link system ridership. Figure 42 shows the general profile of Sun Tran riders from the survey.

Figure 42: Key Takeaways from On-Board Rider Survey

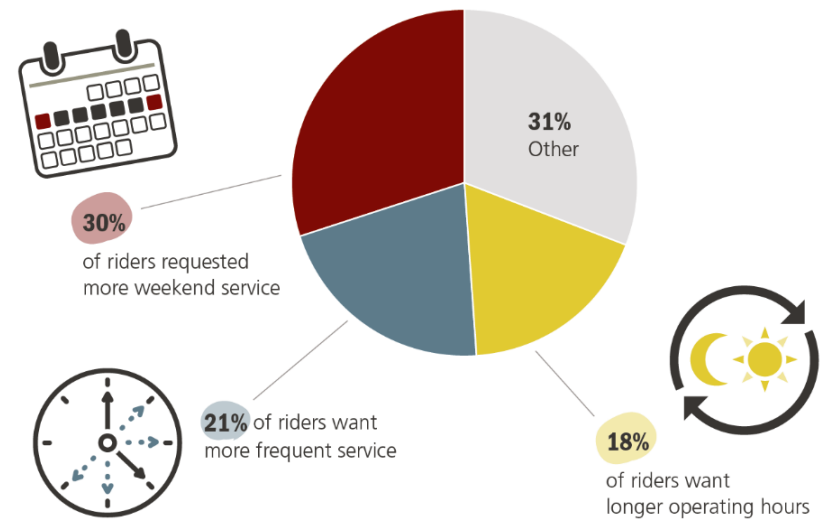


In addition to the high percentage of riders who do not have a vehicle, 73% of respondents who do have a vehicle in their household said that it was not available for their transit trip. This suggests that vehicle availability is a huge contributing factor to why people use transit.

There are significant differences in Sun Tran and Sun Link rider attributes. While 14% of Sun Tran riders are university students, 73% of Sun Link riders are university students. Additionally, while 45% of Sun Tran riders transfer, only 15% of Sun Link riders transfer as part of their trip. When asked about potential service improvements, 30% of Sun Tran riders requested additional weekend service, 21% more frequent service, and 18% longer operating hours. The categories were the same for Sun Link riders.

Figure 43: Top Service Improvements Requested by Riders

Service Improvements



Non-Rider Survey

ETC also conducted a non-rider survey between May and July 2022 that sampled 417 participants in the study area.

The top factor that would be most likely to encourage non-riders to begin using transit are if travel times on transit were comparable to travel times by car (19%), if buses operated every 10 minutes (18%), and if transit stops were located closer to their homes (14%).

For non-riders who said they would consider using public transit, their top considerations were safety (37%), cost (18%), and frequency of service (15%).

As part of the COA, Sun Tran will look at ways to make transit travel times more competitive, whether that involves streamlining routes on major corridors without deviating into neighborhoods, consolidating stops to allow for faster travel, or providing more direct routes between destinations. It will also look at the potential for investing additional frequency on major corridors where demand is highest.

Regional Travel Patterns

Overall, 2.9 million trips take place in the service area across all modes on an average weekday. Of these trips, 37% remain internal to their district, while 63% are between multiple zones. Zones 15 and 17 account for the most daily trips at about 350,000 trips each. Zones 1, 2, and 11 have the highest shares of internal trips with 50% or more of their trips occurring within their zone. Some of these zones are further from downtown and some are more central neighborhoods of Tucson.

The intra-zone travel patterns show that most travel within the Tucson area is intra-zone (63%). Of the 19 zones, eight of the zones have over 50,000 internal trips. The seven zones that have less than 25,000 internal trips are the zones that encompass Downtown Tucson, University of Arizona, Davis-Monthan Air Force Base, the airport, and residential areas. The zones that have fewer internal trips are the zones that typically have either origins or destinations, but not both, necessitating interzone travel.

The interzone travel patterns show that no single zone-to-zone combination has greater than 51,000 trips. The zones that have the interzone travel tend to be located along major corridors that are more central to Tucson. Downtown Tucson and the University of Arizona zones are not zones that have the highest individual zone-to-zone travel and an important reason may be the overall size of these two zones as compared to the rest of the zones in the region. Much of the individual zone-to-zone travel that has high volume are zones that have both origins and destinations as well as mixed or varied land uses, allowing for different types of trips to occur, including home-based trips, work trips, shopping trips, and other trips.

Figure 44 Internal Trips by Study Area Zone

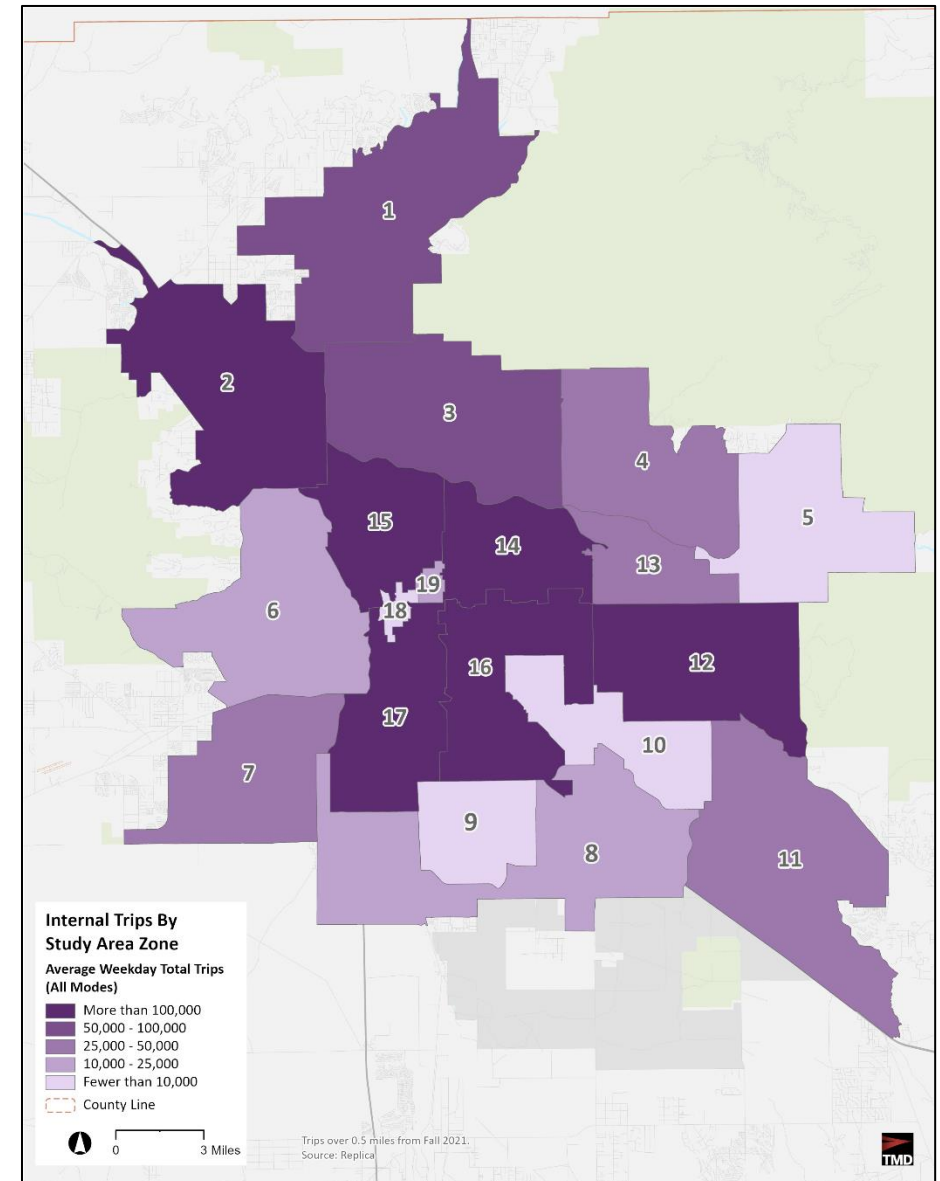
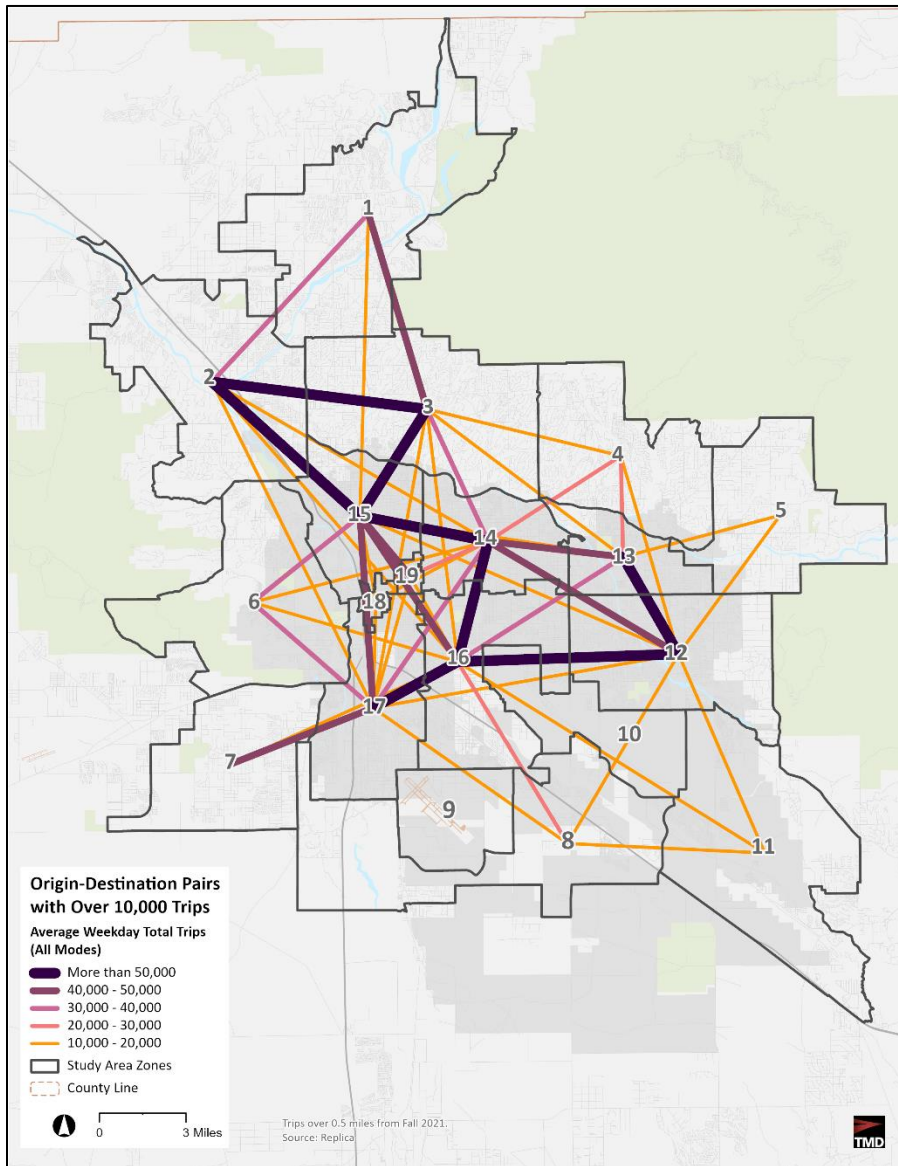


Figure 45 Origin-Destination Pairs with Over 10,000 Trips



The zone-to-zone trips that have the highest volumes are presented in the following table (Figure 46). The zones that have the most trip activity outside of their own zone are 2, 3, 12, 13, 14, 15, 16, and 17. These eight zones with their pairs have a total of about 50,000 trips or more each day. For example, there are 100,693 trips made between zones 16 and 17 in a day, contributing to 18% of all trips in both zones, respectively. Zones 2, 14, and 17 which are zones that have a lot of intra-zone trips, all have major shopping destinations. Tucson Medical Center is a major generator in Zone 14. Major generators in Zone 13 include El Dorado Medical Center and Commerce Park. Texas Instruments is a major generator located in Zone 16. Most of the highest origin-destination pairings are directly connected by one or more Sun Tran routes.

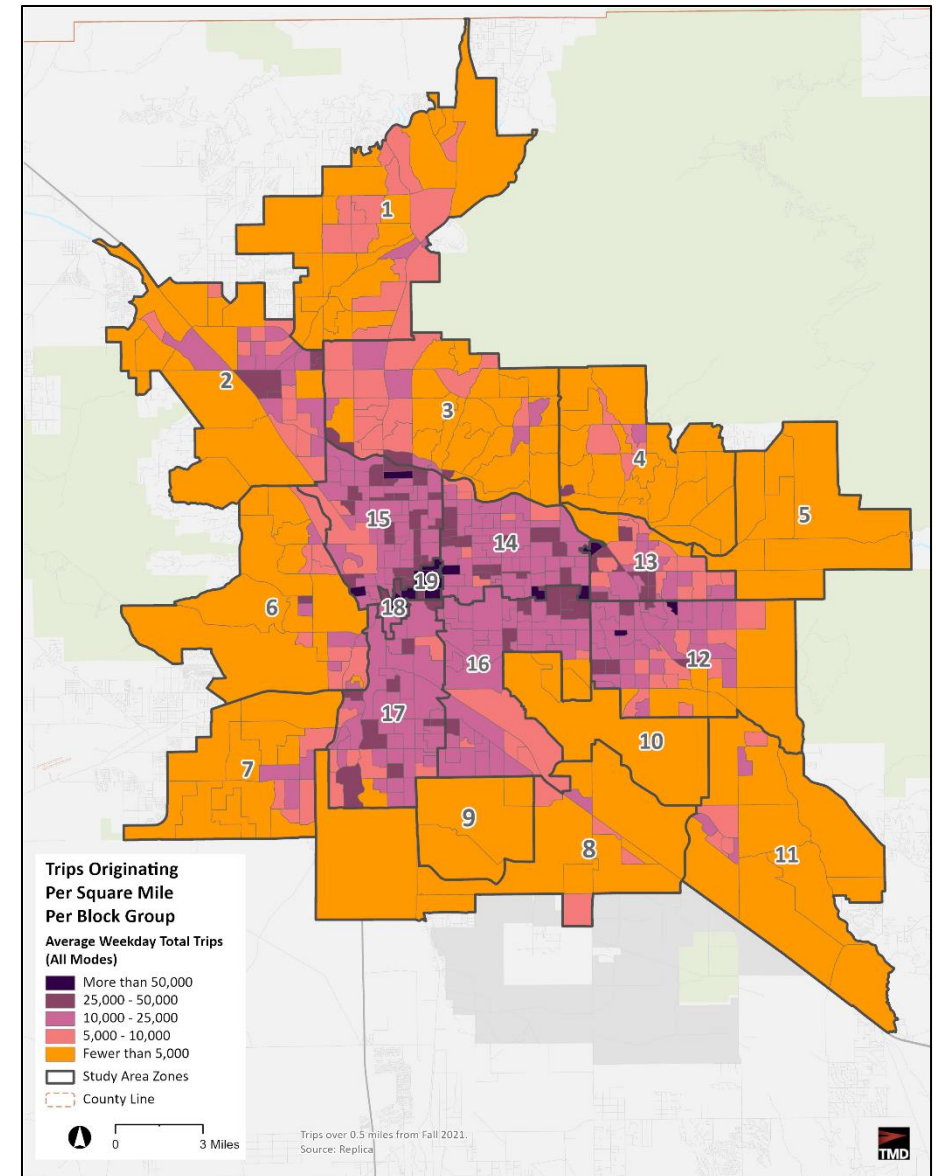
Figure 46 Top 10 Origin-Destination Pairs

Origin – Destination Zone Pair		Total Trips per Day Between Zone Pairs	Percent of All Trips that Go to Zone (X)	
Zone A	Zone B		Zone A	Zone B
16	17	100,693	18%	18%
14	16	84,620	15%	15%
14	15	72,155	13%	13%
13	12	67,408	23%	17%
3	15	60,887	18%	11%
16	12	59,982	11%	15%
15	2	51,035	9%	15%
3	2	50,083	15%	15%
17	15	49,512	9%	9%
13	14	49,497	17%	9%

The Figure 47 map illustrates the total number of trip origins by zone and Census Block Group, normalized by square mile. It reveals that the highest number and densities of origins are situated closer to Downtown Tucson. These block groups closely align with the findings from the intra-zone and zone-to-zone travel analyses, which identified the highest concentrations of trips. This consistency is likely due to the correlation between population density, work locations, and trip generators in the region. It is worth noting that the areas with a high number of origins also tend to have a larger number of transit routes and services.

The darkest purple shade indicates that more than 50,000 trips take place on an average weekday to these block groups. In zone 15, the Barrio Hollywood and Menlo Park neighborhoods along W. St Marys Road is a popular destination for grocery shopping and other non-work errands. Zone 16 features the Park Place mall on Broadway Blvd; one Sun Tran bus route, the 8, serves this plaza, which is located near Saint Joseph's Hospital. In nearby zone 12, the block group containing Palo Verde High School and Fry's Food is a notable destination for generating a large number of trips. As the city continues to grow and areas like these become more populated, it will be increasingly important to ensure that public transit meets the needs of these areas.

Figure 47 Trips Originating Per Square Mile Per Block Group



Impact of COVID-19

The COVID-19 pandemic greatly disrupted general travel behavior. Overall trip making is down, with more people working from home or working flexible schedules, attending online courses, or shopping online. In the greater Tucson region, overall weekday travel declined from 3.2 million trips in 2019 to 2.9 million trips in 2021, a 9% decrease.

The Replica data shows that there has been very little change in the distribution of trips throughout the day between 2019 and 2021 (Figure 48). The slight change in trips over time from 2019 to 2021 can be seen in the shift in the trip starting hours. In 2019 there was a larger share of daily trips occurring during the peak hours as compared to the share of peak hour trips in 2021. This could be attributed to shifting work hours due to the COVID – 19 pandemic, with fewer people working in the office five days a week. There is an equal decrease in the share of evening peak trips completed in 2021 compared to 2019. One place where the share of daily trips has increased is in the evening and late evening. More people are opting for these later trips in 2021 compared to 2019.

On the weekends, overall travel declined from 2.8 million trips in 2019 to 2.6 trips in 2021, a 7% decrease. This is less of a reduction than the weekday decline. Travel on weekends follows a solid curve, with trips gradually increasing in the morning until 2:00 pm, plateauing in the afternoon, and starting a general decline around 7:00 pm. Overall, there are 90% as many trips being made on weekends as on the weekdays. However, Sun Systems only operates at 54% of weekday service levels on Saturdays and at 43% of weekday service levels on Sundays. With so many more trips happening on weekends, there may be an opportunity for Sun Systems to operate more weekend service to increase ridership.

Trip Lengths

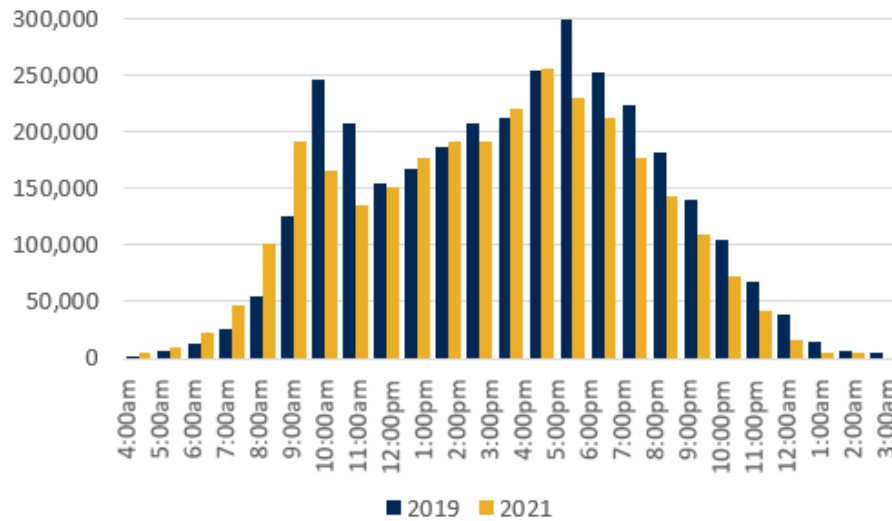
Figure 49 and Figure 50 show how trip length varies by trip purpose and time period, respectively. Overall, almost half of all trips (47%) are less than four miles, reiterating the finding from the travel flow section that many trips stay relatively close to home. Work trips are the longest, with 39% of trips over eight miles. However, they are a relatively small portion of overall trip making, accounting for only 10% of all trips. Trips for shopping are the most common, accounting for just under one-third (31%) of all trips. Transit service historically focuses on service work and school trips, but combined, these represent only 15% of all trips being made. They are the most regular trips people make as they are typically made every day. Trips for shopping, running errands, or visiting friends are more discretionary, and these trips are harder to plan on transit because they tend to be more spontaneous and are to different locations every time. While someone may regularly use transit to get to work and school because they only need to plan this trip out once, they may not use it for discretionary trips because of the inconvenience of having to plan out their trip. These trips are also much shorter distances since people have multiple destinations to choose from (rather than work or school which is a fixed location).

There is not too much variation in trip length by time of day. Earlier morning trips do tend to be the longest, but these also account for a relatively small fraction of all trips being made throughout the day.

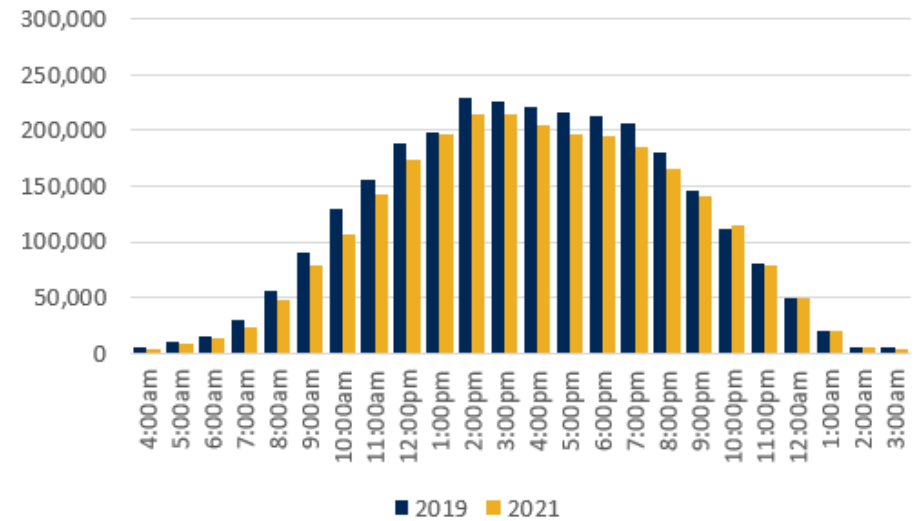
To better serve shorter trip lengths and discretionary trip purposes, Sun Systems should focus on operating frequent service to make transit travel time more comparable to driving time in an automobile. Someone traveling a mile down the street (a 20-minute walk or a 3-minute drive) will not want to wait 30 minutes for the next bus trip. Adding frequency, including on weekends where there is more discretionary travel, will help make transit a more competitive travel option for shorter distance and non-work or school-based trips.

Figure 48: Charts Comparing Weekday and Weekends Trips by Hour between 2019 and 2021

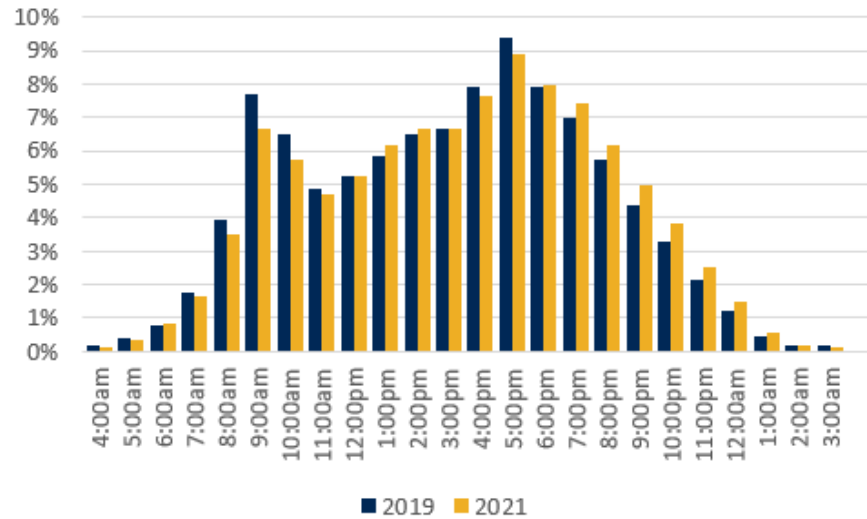
2019 to 2021 All **Weekday** Trips - Total Volume



2019 to 2021 All **Weekend** Trips - Total Volume



2019 to 2021 All **Weekday** Trips - Percent of Trips



2019 to 2021 All **Weekend** Trips Change Over Time

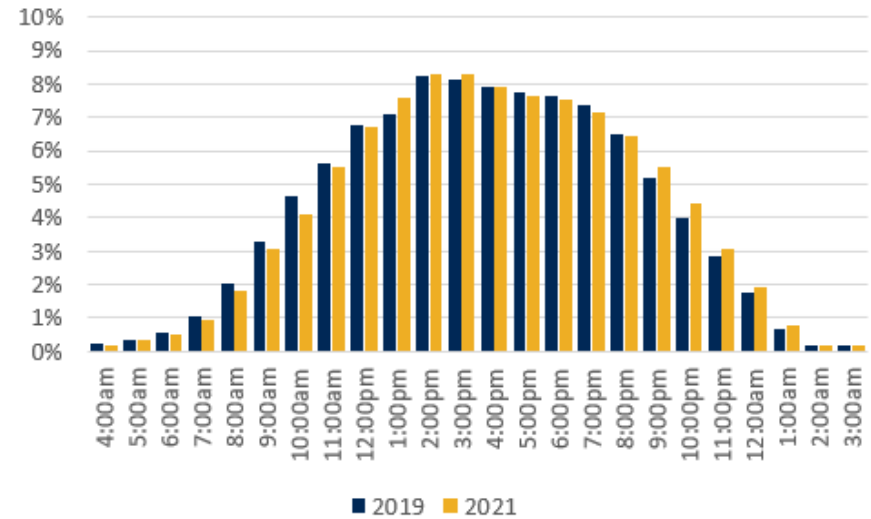


Figure 49: Trip Length by Trip Purpose

Trip Purpose	Under 0.5mi	0.5-1mi	1-2mi	2-4mi	4-8mi	8-16mi	16+ mi	Total
Home	10%	8%	13%	20%	25%	19%	5%	25%
Shop	4%	7%	13%	21%	27%	22%	7%	31%
Eat	7%	6%	12%	22%	27%	21%	6%	12%
Work	4%	4%	9%	17%	27%	29%	10%	10%
Social	12%	6%	10%	17%	25%	23%	7%	6%
Errands	20%	8%	9%	14%	20%	21%	8%	7%
School	7%	11%	16%	21%	25%	17%	3%	5%
Recreation	8%	6%	11%	18%	26%	23%	7%	3%
Lodging	7%	6%	12%	17%	23%	23%	11%	0%
Total	8%	7%	12%	20%	26%	22%	5%	

Figure 50: Trip Length by Time Period

Time Period	Under 0.5mi	0.5-1mi	1-2mi	2-4mi	4-8mi	8-16mi	16+ mi	Total
Early AM	13%	7%	10%	15%	22%	24%	9%	0.3%
AM Peak	9%	6%	8%	14%	22%	28%	13%	2%
Midday	8%	7%	12%	19%	26%	22%	6%	34%
PM Peak	9%	6%	12%	20%	26%	21%	6%	25%
Evening	7%	7%	12%	20%	26%	22%	6%	23%
Late Evening	7%	7%	12%	21%	26%	21%	6%	15%
Total	8%	7%	12%	20%	26%	22%	5%	

Conclusion and Key Findings

The following key findings summarize the main takeaways from Milestone One. Milestone Two will examine each of the Sun System routes in detail, seeking to understand where rider demand is the greatest, which routes are working well and which may warrant improvement, and how rider travel patterns compare to the regional travel patterns reviewed in Milestone One.

- **Built Environment:** The City of Tucson has a strong half-mile major street grid which presents an ideal environment for transit service. Straight, direct routes spaced a half-mile apart minimize walking distance to transit while allowing for direct routes to major destinations. A grid structure means anyone can get anywhere in the city with, at most, one transfer. Developments outside of the core grid are more difficult to serve efficiently with transit – walking distances are longer, destinations are more spread out, and Sun Systems must make choices in which major streets should be served. As the population grows and development moves outwards, Sun Systems will have to make an increasing number of decisions on how to effectively provide transit service in these areas.
- **Transit Propensity:** The current Sun Systems network provides good coverage to densities of populations more likely to use public transit. However, transit service does decrease south of I-10, with lower service frequencies and less direct routes. This is an area with a very high minority (predominantly Hispanic) population that is likely underserved by the current transit system.
- **Areas of Potential Demand:** Potential locations that should be explored further for transit demand potential are the Tanque Verde

Professional Plaza (emerging jobs hub), Irvington Rd near Drexel Heights, and major shopping destinations on the eastside.

- **Need for More Weekend Service:** The topmost requested service improvement in the on-board rider survey was more weekend service. Regional demand on weekends as shown by Replica travel pattern data is 90% of weekday levels; however, Sun Systems operates only 50% as much service, indicating a large discrepancy between the relative drops in demand and available transit service.
- **Downtown and University of Arizona:** While Downtown Tucson and the University of Arizona are the focus of many Sun System routes, these zones only generate 5% of overall trips made throughout the region. Increased transit connections outside of the central downtown area may allow for more direct travel between major trip generators.
- **Majority of Trips are Discretionary:** Transit has historically focused on serving work and school trips, but these only account for 15% of all trips being made in the region, only half the amount of shopping trips. Work and school trips are the easiest to complete using transit – these trips are the same every day, and they are often the longest trips people make since there is little choice in their location. Discretionary trips for shopping, dining out, or socializing are harder to complete on transit because they tend to be more spontaneous and have different destinations each time, which generally requires advance planning. Sun Systems can work to attract more riders for discretionary travel by improving frequencies to make transit options more convenient and more time-competitive with other modes.