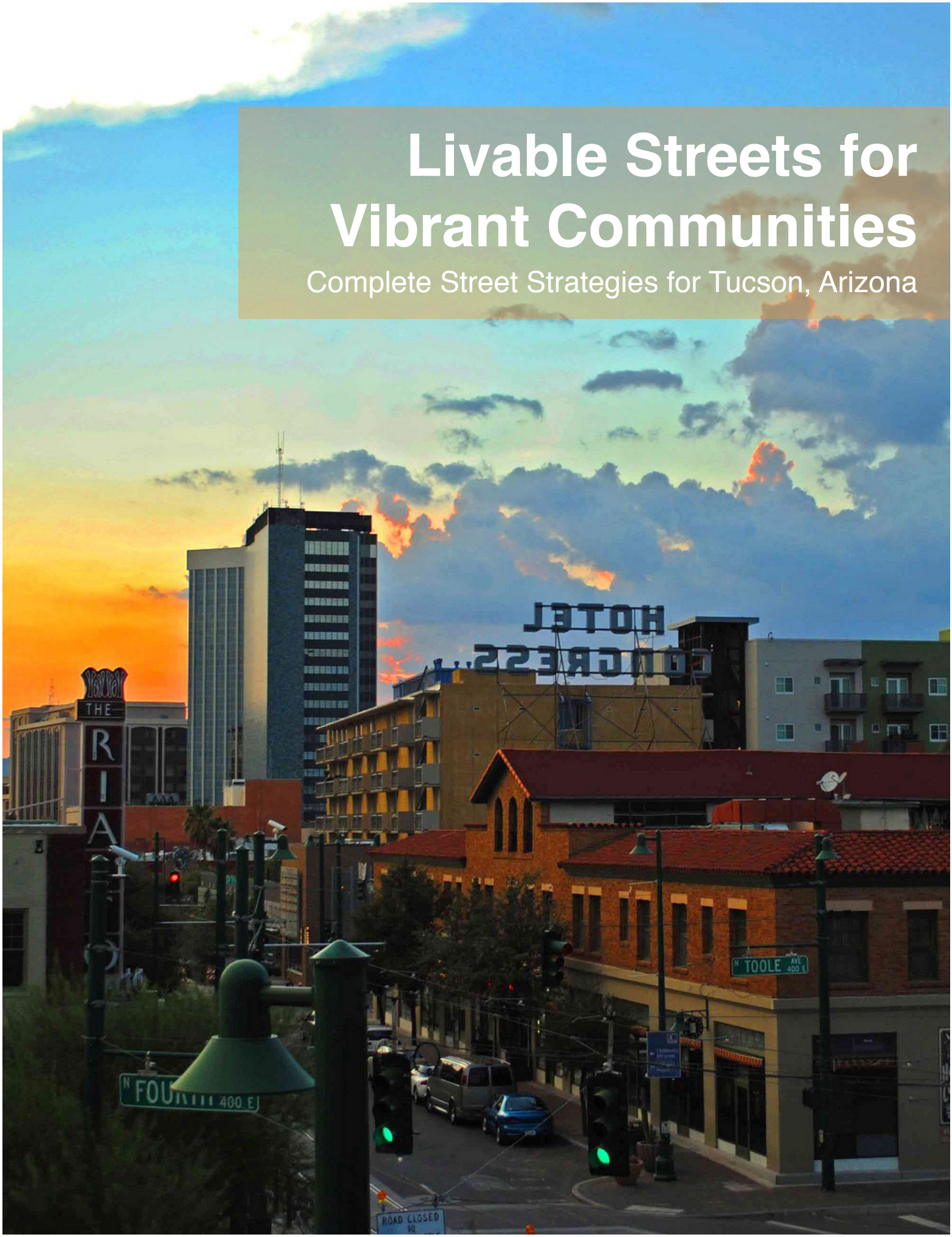

Livable Streets for Vibrant Communities

Complete Street Strategies for Tucson, Arizona

A collaborative, interdisciplinary project of the College of Architecture, Planning, and Landscape Architecture at the University of Arizona.

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Purpose and Scope

Figure 1: 4th Avenue, Tucson, Arizona

Nationally, people are shifting how they commute. Between 2005 to 2011, public transit use increased 10% and the number of vehicle miles traveled (VMT) plateaued since 2004 (Baxandall & Dutzik, 2013). The transportation shift is largely connected to the Millennial generation, who tend to prefer urban walkable areas with more transportation options, as reflected in the 23% decrease in Millennials' VMT from 2001 to 2009 (Baxandall & Dutzik, 2013). Overall, Millennials have increasingly become more drawn to multi-modal transportation options due to the cost and convenience of those options (Sakaria & Stehfest, 2013). Since Millennials have grown into the largest generation, the City of Tucson should strongly consider these new trends to help guide the City's transportation planning, and implement innovative policy and design strategies, such as complete streets.

Complete street policies are prevalent across the United states, with over 1,100 policies currently in use. However, policies do not necessarily translate into practice, nor do they always consider the community context. The purpose of this project is to identify and propose community-oriented complete street policies and design guidelines to be applied throughout Tucson, as well as provide visual examples of a complete streets framework applied to a "high priority" corridor. The design examples of the study corridor will portray how the proposed complete streets policy and design guidelines apply to different street typologies and land-use characteristics. Living Streets Alliance (LSA) and the City of Tucson have been major proponents of integrating complete streets concepts into the design of Tucson's roadways, and served as community partners for this project.

Historically, the City of Tucson has developed as an auto-centric, suburban community where the needs of automobile drivers have been prioritized over the people walking, biking, and taking public transit. While Tucson has recently started to cultivate community support for streets that accommodate all road users through events, such as Cyclovia, and the creation of advisory committees, such as the Bicycle and Pedestrian Advisory Committee, no policy is in place to formally support and advance a complete streets agenda.

The Regional Transportation Authority (RTA) is a special taxing district approved by Pima County voters in 2006 to fund the implementation of a variety of transportation improvements. Over twenty years, the half-cent sales tax was anticipated to generate $2.1 billion in revenues. The RTA Plan scheduled these revenues to fund four categories of regional improvements: $1.17 billion for roadways, $533 million for public transit, $180 million for safety, and $115 million for environment and economic vitality.

There have been several controversial RTA projects, including the Broadway Boulevard and Grant Road widening. The Broadway Improvement Project was particularly contentious

because the original 8-lane project proposal was based on projected traffic counts from the 1989 Major Streets & Routes Plan, which have not been realized, and a design previously approved by the Mayor and Council. The original proposal required adding a third traffic lane in each direction, a dedicated transit lane in each direction, and a large median, which would have arguably induced more vehicle traffic and required the demolition of almost every structure along the north side of the street, including historic and mid-century moderne buildings. Additionally, the public participation processes

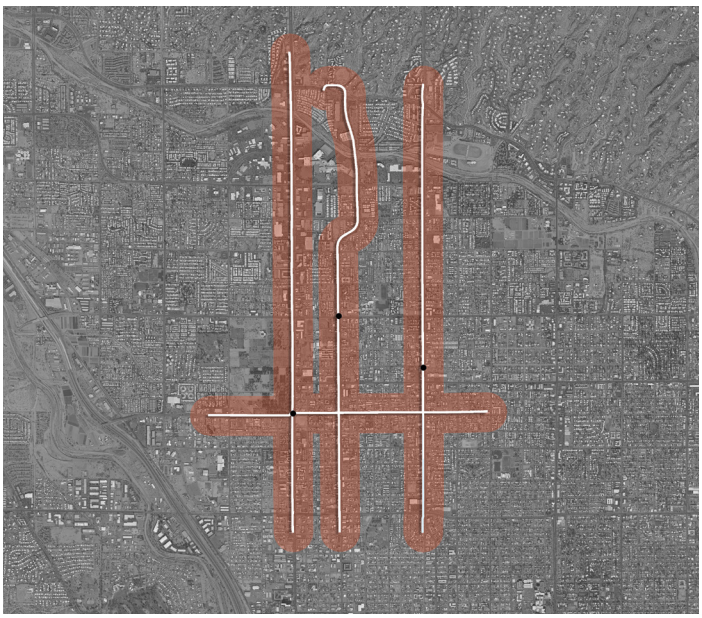

Figure 2: Corridor Overview Map

resulting in the 1989 project design, the 2006 RTA ballot project scope, and RTA Plan were criticized by community stakeholders for being incomplete.

In response to these critiques, there is an interest in identifying alternative right of way (ROW) improvement strategies and designs to build on the lessons learned from the Broadway Improvement Project. Since 1st Avenue between Grant Road and River Road is slated for an RTA improvement by the year 2021, it was selected as one of three study corridors for this report to help visualize alternative design opportunities to the RTA's current project scope. The other two corridors include Oracle Road and Stone Avenue, between Grant Road and River Road. The decision for these three corridors is to ultimately provide an example of a complete streets network, as well as provide examples of complete street treatments that could be applied to other similar roadways in Tucson.

The RTA's current expansionary approach to alleviate traffic congestion through road widenings does little to reduce traffic congestion over time due to induced travel. Induced travel is based on the economic principle of supply and demand. Induced travel argues that by expanding roadways the "price" of driving is decreased, which in turn results in an increase of drivers and ultimately the need for future roadway expansions (California DOT, 2015). This expensive cyclical model is an unsustainable approach for the Tucson community, which should be broken and replaced with design strategies that increase road capacity with minimal or no ROW expansion on Tucson's roadways.

Accordingly, this report aims to present policy and roadway design ideas that can cost less and create new value in the community through streetscape improvements, instead of large-scale widenings. For example, both the Broadway Boulevard and 1st Avenue improvement projects, that include road-widening, are expected to each cost around $71 million. In contrast, the Arizona Avenue enhancement in Chandler, Arizona is expected to cost $60 million, which includes streetscape improvements, development of parks, and utility relocation and enhancements, but no addition of traffic lanes.

Based on other RTA projects, the Broadway Boulevard and 1st Avenue widenings will include ADA-compliant sidewalks, landscaping, most likely 5-foot striped bike lanes, crosswalk improvements, as well as new bus stops with shelters. These features support multiple modes and are additions to the current ROW that might require purchasing land. However, the costs are

relatively minimal in comparison to the amount of new land needed to add two 11-foot traffic lanes, turn lanes, and at least a 6-foot median. In both the Broadway Boulevard and 1st Avenue projects, property acquisitions are about 30% - 40% of the project budgets. The consolidation of driveways and reduction of property sizes might result in the city needing to purchase entire properties - beyond what is needed for the roadway footprint - due to property owner protections in eminent domain situations. Accordingly, streetscape improvements and multi-modal designs associated with complete street strategies can cost less than outright roadway widenings, while still supporting the community's transportation needs, expressed through public planning processes such as Plan Tucson. Such financial savings would benefit both the RTA and the City of Tucson considering both organizations are currently financially strained (McNamara, 2015).

A final motivation behind this project is to provide a framework for policy and decision-makers to use when developing a plan for projects to be funded by an extension of the half-cent sales tax, which is the future RTA plan. These projects could provide an opportunity to integrate the proposed complete streets policies and design strategies to flip the paradigm that most investment dollars are distributed to multi-modal projects that create complete street networks, rather than investment dollars being mainly distributed to projects that prioritize auto use.

Figure 3: Santa Cruz River Trail Tucson, AZ

The outcomes of this report are to:

1. Identify and synthesize complete streets best policies and design practices, as well as their shortcomings;
2. Identify the various street and neighborhood typologies found in Tucson;
3. Recommend complete streets policies and design practices that are Tucson-oriented and address the previously identified shortcomings of complete street strategies; and
4. Apply the recommended policies and design guidelines to a study corridor, which includes Oracle Road, Stone and 1st Avenues between Grant and River Road.

After taking into consideration the main principles and goals of complete streets, as well as the major community concerns identified in Plan Tucson and by community-partners, the Project Vision and Mission were developed.

Project Vision

To create safe, equitable, and healthy streets that encourage economic growth within districts throughout the City of Tucson. Each of these districts would have distinct, context-sensitive design aspects that enhance the area's walkability and livability.

Project Mission

Develop a complete streets policy and design standard that addresses public health, safety, and equity within the context of Tucson, Arizona. The intention of the proposed standard is to serve as a guide for the planning and design process of future road improvements projects. However, specific policies and design approaches should be dependent and unique to the project area.

Relevant Planning Documents Overview

To enact a complete streets policy in the City of Tucson, it is important to understand the relevant planning documents that are applicable to such an initiative. The following section will introduce the main planning documents that are relevant to complete streets, as well as the plans that are not conducive for complete street strategies.

Plan Tucson

Plan Tucson is the City's General and Sustainability Plan that was ratified by voters in 2013. It is an Arizona state-mandated long-range policy document intended to guide decisions affecting different variables that shape the City. The general plan is the result of an intensive public participation process that took input and feedback from the public and key stakeholders to guide the development of goals and policies that outline how the City of Tucson will grow in the future. The plan differs from the normative framework outlined by Arizona State Statutes by integrating many of the required plan elements to ensure that the interconnectedness of the plan elements is acknowledged.

The "Land Use, Transportation, and Urban Design" chapter of Plan Tucson is the primary chapter that supports complete street strategies. This chapter discusses the need for less auto-centric developments by promoting infill development that utilizes existing infrastructure in order to create more livable communities. The plan identifies building blocks for development that embody a more connected and integrated land-use pattern. Some of these future growth building blocks provide a road-map for implementing context sensitive complete street strategies, which are congruent with the recommendations of this report (Appendix A).

Apart from the "Land Use, Transportation and Urban Design" chapter, the plan includes many other policies that support the development and implementation of complete street policies and designs. Appendix B lists the policies that are congruent with complete streets concepts and can be used to garner the political support necessary to develop a complete streets initiative.

Figure 4: Scott Ave Downtown Tucson, AZ

Regional Mobility and Accessibility Plan

The Pima Association of Governments (PAG) 2045 Regional Mobility and Accessibility Plan (2045 RMAP) is a pertinent planning document that provides a blueprint for transportation solutions in the Tucson region for the next three decades. As the federally designated metropolitan planning organization (MPO) for the Tucson transportation management area, PAG is required to update its long-range transportation plan every four years to maintain a 30-year outlook of the region's transportation needs. This document delivers a vision for the future transportation network, including goals and implementation strategies to achieve the vision. PAG member jurisdictions must be identified in the 2045 RMAP in order to access federal monies for priority transportation projects. These projects must also be identified in PAG's short-range transportation plan and the Transportation Improvement Program (TIP). The TIP is the annually updated mechanism through which the RMAP is implemented based on local needs and priorities.

The development of the 2045 RMAP included a public involvement process that engaged members of the public, jurisdictions' staff and elected officials, as well as a task force comprised of key public and private stakeholders

who considered multiple factors and conditions ranging from anticipated congestion levels to demographic changes. Other considerations included, infrastructure conditions, economic opportunities, population growth, changing transportation needs, air quality and funding challenges. The resulting vision statement promotes a regional transportation network that is interconnected and integrated with sustainable land-use patterns to support a livable, healthy, safe, and economically vibrant region. The goals and policies expressed in the 2045 RMAP are congruent with policies found in Plan Tucson, which aim to enhance safety, increase multi-modal choices, support environmental stewardship, and to ensure complementary land-use and transportation decisions.

Regional Transportation Authority Implementation Plan

The RTA was enabled in 1985 by the State of Arizona legislature. The RTA permitted Pima County to receive voter authorization to levy and collect a half-cent sales tax for transportation projects. In 1990, the legislature enacted legislation that effectively made PAG the Regional Transportation Authority for Pima County, which offered municipalities in Pima County membership, as well as the Tohono O'odham Nation and the Pascua Yaqui Tribe.

Figure 5: Sun Link

Figure 6: Bike Lane with Bollards

The current Regional Transportation Authority Implementation Plan was put to vote by the public in May of 2006, which allowed a half-cent transportation sales tax to be collected to overcome a nearly $5 billion budget shortfall over 20 years. The half-cent sales tax was estimated to generate $2.1 billion during the life of the RTA plan; however, due to the 2008 recession and the slow recovery, the tax revenues are below the original projections. The RTA allocates funding to the long-range transportation plan in various proportions. They are: The Roadway Improvement Element (58%), the Transit Element (27%), the Safety Element (9%), and the Environmental and Economic Vitality Element (6%).

The 20-year comprehensive transportation plan was created by a Technical/Management Committee (TMC) overseen by a Citizens Advisory Committee (CAC). Charged with preparing draft plans and project costs for the long-range transportation plan, the TMC established three initial guidelines to assist in identifying potential RTA projects:

- The project should expand or meet the needs of existing residents.
- The project should meet and facilitate regional mobility rather than neighborhood-specific transportation concerns.
- The project should, to a limited extent, accommodate long-range planning for

new transportation corridors, but that are not primarily intended to serve new growth or development.

Additional considerations to supplement the initial guidelines were:

- Projects should be limited in number and maximized in regional scope and impact.
- Projects should improve access or mobility across the core of the region.
- Projects should improve access or mobility between communities and/or activity centers.
- Projects should enhance transit accessibility in the region.
- Projects should provide funding for needs that may not have access to or be eligible for other funding sources.

Projects should consider emerging growth areas based on these stipulations along with a considerable public engagement and outreach program the RTA membership approved a list of 51 roadway improvement and accessibility projects that were to be completed by 2026.

Major Streets and Routes Plan

Passed in November of 1982, the City of Tucson's Major Streets and Routes Plan (MS&RP) set out to identify street classifications, width of public rights-of-way (ROW), designate special routes, and guide future land use decisions. The MS&RP was created in a time of rapid population growth and when an auto-centric planning model dominated mainstream thought. The plan set a precedence for the prioritization of vehicle traffic, acknowledging that the City's development pattern required major arterials that span the extent of the urban area, and that as the city grew it would need to expand the public ROW to increase capacity. Since the adoption of the MS&RP, the City of Tucson has amended the plan several times with resolutions and ordinances to include roadway projects that were not described in the original plan.

The functional classification of roads was based on a hierarchy of importance based on how the streets serve through travel rather than local travel. At the top of the hierarchy are freeways, followed by arterials, and collectors. Local neighborhood streets were excluded from the scope of this plan because their purpose is to provide access to property and not through movement. Streets were classified to provide direction for matching land-use designations with street character and capacity, to serve as a guide for future street improvements and expansions, and to determine the type of cost sharing between property owners and the City in improvement districts.

The MS&RP defines that the public ROW can generally accommodate 6,000 vehicles per day per travel lane at a "C" level of service. "C" level

Figure 7: Broadway Blvd. Tucson, AZ

of service describes a stable traffic flow with little congestion. The future ROW widths outlined in the MS&RP represent the required width for the number of lanes needed to accommodate future growth projections at a "C" level of service. However, it's important to note two things about level of service:

1. A "C" level of service is appropriate for only some urban arterials, but mostly rural highways, not necessarily busy shopping corridors in the middle of a weekday, which is a common feature of Tucson streets. Busy shopping corridors would be categorized as a "D" level of service and

mean that there is an expected larger number of roadway users than a “C” level of service.

2. The traditional definition of level of service used in the MS&RP does not pertain to multi-modal transportation. This definition is quickly becoming outdated since the 2010 Highway Capacity Manual incorporates multi-modal level of service for all users on urban streets.

Zoning setbacks were established to prevent construction in the future ROW area which would allow the City to acquire land for road expansions without demolishing structures. The ROW could also be acquired through dedication of land at the time of a rezoning or it could be purchased at the time of the street improvements.

Other Planning Documents

There are many other planning documents that are relevant to complete streets policies. These include the Bike Boulevard Master Plan, which describes a network of residential streets to receive road enhancements that prioritize bicycling and walking, and PAG’s Regional Pedestrian Plan, which defines policies and goals for an active transportation network in eastern Pima County. Both of these documents support the 2045 Regional Mobility and Accessibility Plan. Additionally, the Mayor’s Challenge for Safer People, Safer Streets, PAG’s resolution in support of complete streets, and the City of Tucson’s Active Practice Guidelines - Green Streets create a comprehensive set of policies and guidelines that promote the philosophy of complete streets.

In summary, the aforementioned plans contain the most relevant material for the City of Tucson to implement a complete streets policy and design guideline. Plan Tucson sets forth broad policies and goals that are designed to help the city achieve an overall vision for the future. PAG’s RMAP establishes the 30-year outlook of the region’s transportation needs, as well as delivering a vision for the future transportation network that includes goals and implementation strategies. The Regional Transit Authority Implementation plan which illustrates the 20-year transportation plan for roadway improvements and expansions to meet future population growth needs. Finally, the MS&RP which established the public ROWs and zoning setbacks for future road improvements based on 30-year population growth projections.

Figure 8: Downtown Tucson, AZ

Complete Streets Policy Review

Since the inception of complete streets in 2004, over 1,060 agencies have adopted 1,100 complete street policies at the state, county, and local levels resulting in a wide array of policies (Smart Growth America, 2017) In an effort to understand the strengths and weaknesses of complete streets policies, a subsample of policies and associated documents were reviewed, then the differences in the following areas were compared:

- Geographic scale;
- Documented impacts/outcomes;
- Identification of specific community needs;
- Integration of design principles, including specific street typologies;
- Context sensitivity;
- Collaboration across sectors; and
- Implementation challenges.

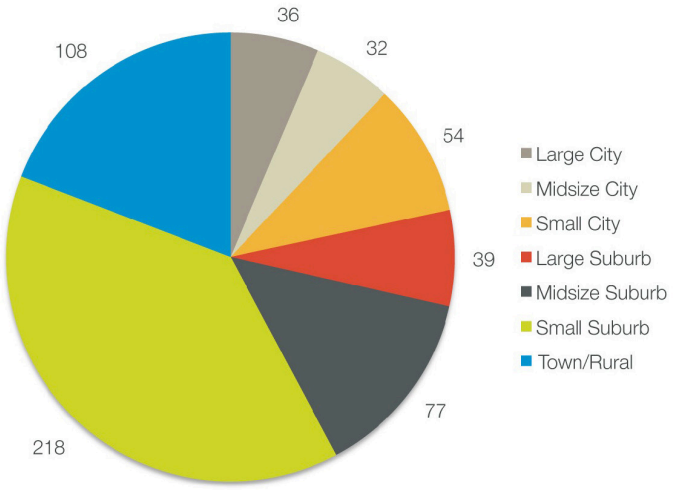

Figure 9: Complete Street Policies by Municipality Size

A comprehensive review of 12 complete street case studies was completed that represented a diverse geography and scale. Two of the case studies were statewide policies (Tennessee and Oregon); two policies were at the county level (Arlington County, VA, Schoharie County, NY) and eight were city-level policies (Reading, MA; Reading, PA; Louisville, KY; DeCatur, GA; New Orleans, LA; Chicago, IL; Phoenix, AZ; Minneapolis, MN; Lansing, MI).

Figure 10: Case Studies Reviewed

In addition to the complete street case studies listed above, bus rapid transit (BRT) and placemaking case studies were also reviewed since providing reliable public transit and creating vibrant, inviting streets are key aspects of complete streets. BRT is a bus system that has a specialized design, services, and infrastructure to create a more efficient and safer way for passengers to move around a city or corridor. Although other high capacity transit systems could be considered, a BRT system is less expensive than rail systems, and could be more financially feasible for the city to implement.

Overall, the policy case studies highlight opportunities and shortcomings of complete streets, while the BRT case studies highlight intersection prioritization, ridership, riding costs, and design elements.

Tucson should consider the overarching recommendations drawn from the policy opportunities and shortcomings and BRT best designs practices during the development process of a complete street policy; these recommendations were also used to provide direction for this report's content.

Emphasis on Pedestrian Safety

Pedestrian safety is a common theme throughout complete street policies. Jurisdictions have a variety of approaches to increase pedestrian safety. Decatur, GA, and Oregon established safe routes to school programs, which work at a grassroots level to promote walking and biking, provide support for infrastructure improvements, and instill a culture of pedestrian safety. Other cities reframed who is prioritized on the streets. Chicago, IL, completed five complete street projects and has 10 ongoing projects that prioritize pedestrians over bicyclists, transit and vehicles. Chicago also includes a visualization of the hierarchy of travel modes in their complete streets guidelines, making it clear to engineers and other project personnel which mode should be emphasized over others. To further support their complete streets policy, the Chicago policy aims to eliminate all pedestrian fatalities within 10 years. Minneapolis, MN, also enforces a similar travel mode hierarchy, prioritizing pedestrians first, then public transit, bicyclists, and finally vehicles.

Improved Health and Social Disparities

Some complete streets policies draw on the connection between place and health, and state a commitment to resolving health and social disparities. For instance Decatur, GA, focuses on improved health through complete streets for low-income, older adults and people with physical, mental or financial challenges. Shown in Figure 11, Phoenix, AZ aims to improve public health, and quality of life for disabled pedestrians, and those with other types of disabilities. Reading, PA's, policy states that the city will work with Latino populations when planning for new roadway projects because of unique health and social barriers that population faces. Similarly, Minneapolis, MN's, policy emphasizes the health of its residents through livable, walkable, bikeable, green, and accessible neighborhoods.

While most policies reviewed either state a commitment to a specific under served community or makes the connection between health and complete streets, few provide details on the action steps associated with implementing equity-oriented policies. This is discussed further in the "shortcomings" section.

Figure 11: Phoenix, AZ Walking Path

Creative Funding Tactics

A few jurisdictions that have passed complete streets policies have also identified creative funding streams to support the implementation of complete streets. In New Orleans, LA, the city used post-hurricane Katrina dollars for road repairs to implement complete streets designs. Cities and towns that have already implemented complete streets recommend increasing funding for transportation as a whole, rather than having a separate pool of funding for just complete streets projects. Furthermore, it is recommended that complete streets are incorporated throughout all projects, rather than envisioned as separate projects (Thrun, Perks & Chriqui, 2016).

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Character of the Right of Way

In all cities, the ROW, or the area between property lines, is the most abundant type of public space. The Department of Transportation for every city owns the greatest amount of real estate, thus the character of the ROW has a great influence on the function and make-up of a city. Accordingly, when implementing a complete streets policy within an urban area, there is great potential and opportunity to influence the character of the street and the encompassing ROW.

The Minneapolis, MN, complete streets policy specifically references the character of the street and how elements of a complete street policy can greatly influence the ROW. These design elements can change the width of roads, sidewalks, bike lanes, and vegetation areas that not only improve circulation and access within an area, but also encourage future public and private development projects along complete street corridors. The Chicago, IL, policy includes different realms representing the various sections of the ROW. In these realms there are different elements that help form complete streets, which also help create the character of the area. Overall, complete streets policies are the driving force in defining the character of the ROW.

Mobility

A key goal related to all complete street policies is efficiently moving people from one place to another more efficiently and safely than what is currently in place. Policy creation that emphasizes alternative transportation and access for all transportation modes makes it clear that mobility is an important component of complete streets. The Decatur, GA, policy prioritizes transportation design using a variety of traffic calming and alternative transportation ideas, which effectively change the way people move from one place to another. Decatur also identifies travel mode demand in each corridor for placemaking and prioritization of travel modes, which in turn creates a more efficient corridor. Figure 12 shows a segregated bike path from the street. In the State of Oregon, the legislature passed a 'bike bill', which mandates bicycle and pedestrian facilities on all roadway projects. This law will effectively change the mobility of corridors so that they are less automobile-centric, and more bicycle and pedestrian friendly.

Figure 12: Decatur, GA Bike Path

Complete Streets Policy Shortcomings

The case studies reviewed highlight the need for complete streets policies to be specific in terms of how they will consider equity, the types of design standards to be used, road exemptions, and the expected degree of cross-sector collaboration.

Lack of Action for Equity-Oriented Policies

Equity is discussed in the policies to varying degrees, ranging from making a simple statement about creating streets for "all users" to the specifics of a community outreach program. For some policies, it is unclear exactly how "equity" efforts will be implemented. For example, most policies clearly state a specific user, such as pedestrians or the disabled, but it is not clear how these policies will implement an equity framework.

Including language about equity in a policy or plan is an essential first step for showing a city's commitment to under served communities. It is important that all stakeholders are involved in the development of a policy or plan, and that there is a clear definition of what equity means. One strategy to ensure equity is part of complete streets implementation is to prioritize projects based on equity metrics like poverty rate, violent crimes and other types of metrics (Thrun, Perks & Chriqui, 2016).

Limited Detail for Design Implications

Some policies are explicit about the design guidelines associated with different street typologies. For example, Louisville, KY, created in a complete streets ordinance in addition to a separate design policy manual. In their design manual, they included the complete street ordinance language to show the relationship between the policy and guideline. On the contrary, Reading, MA, adopted a complete streets policy that simply lists external best practice manuals that the town will lean on to implement their ordinance. Lansing, MI, Chicago, IL, Decatur, GA, Louisville, KY, and Phoenix, AZ, all redefine local street typologies to connect transportation to land use and to clearly depict the types of design elements that should be incorporated for certain street types. Figure 13 highlights the downtown character class design elements. These elements change based on the street type.

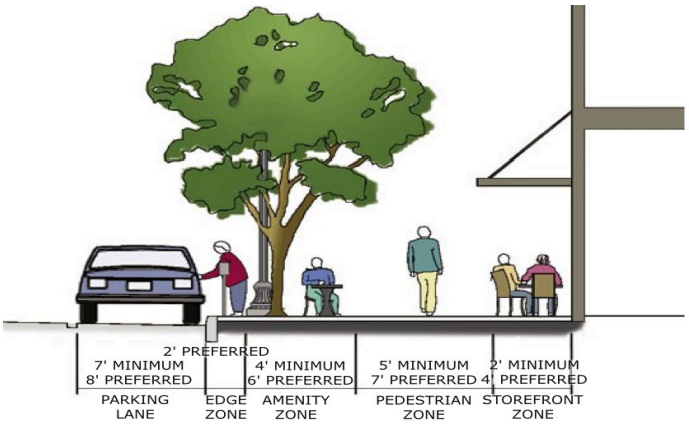


Figure 13: Louisville, KY Street Type Design

Creating new street types based on complete street goals, street characteristics and land use is one way to develop a complete street system that is context sensitive and incorporates performance measures (Smart Growth America, 2016). Additionally, street typologies can emphasize different users depending on the street type in an effort to create a complete street network. Some streets might still emphasize cars, while others are more cognizant towards pedestrians and bicyclists, and while another street might prioritize transit riders (Smart Growth America, "Complete Streets Network," n.d).

Varying Inclusivity

It is important for complete streets policies to recognize that there may be special circumstances that require exceptions to the policy, in which case-specific parameters that define when a street can be exempted need to be outlined. Reading, PA, outlined a policy used for determining when a street can be exempt from the complete streets policy which requires data to justify the exceptions and the approval from top officials. Reading requires that all supporting documents for complete street exemptions are publicly available, which provides another layer of transparency and accountability for the jurisdiction. Other policies, like Chicago's,

Figure 14: Community Stakeholder Engagement

have a compliance committee that oversees the implementation of complete streets, which forces consensus among the committee members in matters concerning the implementation of the policy.

There should be clear, accountable exceptions to the complete streets policy. All of these exceptions should be specified in the policy and approved by a high-level official (Smart Growth America, 2014). A policy should provide a clear process for when an exception is eligible. Exemptions that address increases in a project's budget due to complete street strategies should not outline specific percentages.

Varying Degrees of Cross-Sector Engagement

The more sectors engaged in developing a complete street policy will result in greater inter-agency collaboration for such efforts. Of the policies reviewed, there is evidence that a few policies had extensive public engagement and involved specific stakeholders throughout the policy creation process:

- DeCatur, GA,created an "active living" division in the City, and New Orleans created an "Equity Initiative".
- Chicago and Phoenix both have robust complete streets committees that represent multiple sectors, including community organizations.

No policy, design implications, or related documents clearly identified how the jurisdiction worked with developers prior to passing the policy or plan, which would be another important group of stakeholders to reach out to prior to the passage of a complete streets policy. The state of Oregon mandated that builders and developers pay for complete streets infrastructure, but did not clarify exactly how builders should or could pay for complete streets elements. This is often pointed as a barrier for complying with their complete streets law.

BRT is a public transportation system that

Figure 15: Sun Link in Downtown Tucson, AZ

provides faster, more efficient service than an ordinary bus line. General design features that most BRT systems implement include level bus stops for boarding, multiple, wide boarding doors, some type of prioritized signalization at intersections, a BRT dedicated lane in the ROW, and off-vehicle pay stations. BRT can be a design element of complete streets, and is incorporated throughout this complete street study.

Eleven different BRT systems were reviewed, which included seven cities in the U.S. (Cleveland, OH - HealthLine, Honolulu, HI - Express!, Kansas City, MO - MAX line, Eugene, OR - Emerald line, Fort Collins, CO - MAX line, Los Angeles, CA - Orange line, and the Boston, MA Silver line), and four international cities (Bogota, Colombia - Transmilenio, Mexico City, Mexico - Metrobus, Johannesburg, South Africa - Rea Vaya (shown in Figure 16), and Istanbul, Turkey - Metrobus.)

Figure 16: Rea Vaya BRT line in Johannesburg, South Africa

Research was divided into four different categories; intersections, ridership, costs, and design features. The international case studies demonstrate that BRT can provide certain benefits for an area that a standard bus line cannot achieve. This includes positive changes in travel times, changes in vehicle operating costs, reduction of CO2 emissions, road safety benefits (a reduction of fatalities and injuries), changes in physical activity, increased property values and higher-density land uses.

Intersection Prioritization

BRT at street intersections present a difficult issue of how to protect the flow of traffic, while keeping the BRT system as efficient as possible. Most case studies note that signal prioritization is a good design element, however few examine the steps for achieving certain designs.

The Kansas City, MO, MAX line study explains that signal priority may be effective in reducing congestion, and the line uses the ITS application, which is a computer generated program that conveys passenger information in a variety of venues and controls many factors regarding infrastructure and transportation. The ITS application uses this information to prioritize signals for the BRT system in an efficient way. Another solution to the intersection prioritization is for the BRT to be in a raised or lowered BRT lane that essentially skips the intersection altogether; however, this would be an expensive, time-intensive design solution. The international case studies emphasize that the more successful and efficient systems allow the BRT to quickly move through intersections.

Ridership

Ridership of BRT lines fluctuates due to three factors: 1) the length of the line; 2) the number of stops; and 3) the population of the city. The ridership data found in this context is insignificant due to the differences in these three factors for each of the case studies. However, in every case study, besides the Honolulu, HI, Express! line, the ridership significantly increased in each BRT corridor compared to the regular bus route it replaced. In Johannesburg, South Africa, the Rea Vaya phase 1 ridership is at 40,000 people per day. While 30% of people use public transit in a 4.4 million city population, only 8% use BRT of that 30%. What is significant however, is that this line is a relatively new service, and taxi use - which is considered the primary form of public transit - has decreased 7% since the BRT system was introduced.

For context in the U.S., the HealthLine in Cleveland, OH, which is 6.8 miles long and has 58 stops, has ridership of 15,000 - 18,000 users per day. A typical HealthLine station can be seen in Figure 17. In Kansas City, MO, the MAX line has increased ridership overall by 30% since operation began, and 15% of passengers did not use public transportation prior to the BRT's installation. The Emerald line in Eugene, OR, has a 50% increase in ridership since it replaced the traditional bus system. Considering that Tucson's SunTran ridership is fairly low, increases in ridership similar to that seen in the case studies would greatly help alleviate traffic congestion and reduce the city's reliance on private vehicles.

Figure 17: Cleveland, OH HealthLine Station

Figure 18: Fort Collins, CO MAX Line

Riding Costs

BRT fare prices can vary by city; however, cities aim to keep costs low in order to improve ridership overall. All the BRT case studies reviewed utilize some form of an off-vehicle pay system, which can help reduce wait times for people boarding the bus. As far as actual costs, the average user fares for the U.S. are $0.80 per trip; however, that statistic is skewed since systems with fares below $0.40 per trip either received subsidies or were financially strained. Other systems such as the MAX line in Fort Collins (shown above) have fare cards offering discounts for buying many trips at once, while the Emerald line in Eugene offers special incentives and discounts for students and public workers.

The city must also consider the impact of BRT fares on a community. Depending on the BRT pricing structure and whether the BRT system is outright replacing the local bus service, BRT systems can impact the overall cost of the public transit system. Accordingly, the city will need to ensure that the BRT fare is financially feasible and does not cause an excessive burden on low-income individuals, who heavily rely on public transit.

Design Features

There are several key design features in each BRT line that help distinguish the BRT from a normal bus service. Most BRT systems include station platforms for level boarding, which will decrease boarding times and create ADA-accessible stations. The international case studies also promote high-capacity buses with boarding through multiple, wide doors and exclusive, separated BRT lanes. The HealthLine in Cleveland emphasizes frequent service while using specialized buses that run on diesel-electric, so while there are many buses running at once, the environmental impact is reduced. The HealthLine runs every 5-10 minutes between 5:00 am and 7:00 pm, and every 15-30 minutes overnight. This reliability, and 24-hour service has attracted high volumes of riders. In addition to these features, the HealthLine dedicated bus lane can be seen in Figure 19.

The Boston Silver line uses 220-foot-long platforms to provide ample space for riders, as well as social and interactive amenities to engage riders as they wait for their bus. Similarly, the Eugene, OR, Emerald line utilizes automatic vehicle location and passenger counting systems to alert riders when the next bus is coming and how crowded the bus is. The Kansas City, MO, MAX line has experimented using temporary bus lanes, as well as curbed bus lanes. The temporary bus lanes can be used in high-congestion areas to allow some roadway flexibility, while curbed bus lanes are used in lower traffic areas and create a permanently designated BRT lane.

BRT bus lengths are significantly longer than normal buses - typically 60 feet - to accommodate high volumes of riders. The Fort Collins MAX line includes features such as dedicated BRT lanes, frequent service (every 10 minutes), free wifi on its buses, and a walking and biking path directly along the BRT lane. The Los Angeles, CA, Orange line has designed signal controlled pedestrian crossings for additional passenger safety near BRT stops, as well as bus pullouts, medians and shoulders to separate the BRT system.

Figure 19: Cleveland, OH HealthLine

Placemaking Case Reviews

Placemaking is a philosophy that integrates designs that transform spaces into public places with a unique identity. Placemaking design tactics center around bringing community together and relying on community expertise. Placemaking can: 1) increase social cohesion by promoting interconnected communities; 2) improve the environment and make spaces more habitable for everyone; and 3) increase economic development by increasing foot traffic and window-shopping. Placemaking is a mechanism that can help shift the paradigm from streets that are solely intended to quickly move vehicles from one point to another, to the complete streets' concept that streets are destinations for people to gather, socialize, and shop. Below are local and national examples of placemaking in-action.

Placemaking and Community Creation

Parklets, an innovative placemaking strategy, typically take the form of an extended platform over a parking space that can include benches, tables, chairs, landscaping, and bike parking. Cities have been able to encourage social interaction and creativity by transforming underutilized streetscape into gathering spaces. Parklet spaces can also be implemented in residential areas where large parks and public social spaces are distant or absent.

Both the City of San Francisco and the City of Vancouver provide successful examples of parklet implementation. San Francisco's "Pavement to Parks" program aims to reclaim underutilized space in roads to create more public parks throughout the city. Vancouver's "VIVA Vancouver" program aims to create vibrant public spaces through the installation of parklets. Figure 20 shows a parklet designed from previously underutilized space of the ROW. Vancouver refers to parklets as "people places" and are designed to give residents "extra space to walk, bike, dance, skate, sit, hang out with friends, and meet neighbors."

Beyond the social and economic benefits of parklets, they can provide an environmental benefit by offering shade and rainwater harvesting. These ecological amenities can have a profound effect on mitigating the urban heat island effect and recharging and filtering groundwater. Parklets can also enhance an area's safety by serving as a traffic-calming feature.

Figure 20: Vancouver, CA Parklet

Placemaking and the Environment

The award winning "Green and Complete Street" project along 21st Street in Paso Robles, CA, transformed five blocks of residential and business roadways into ecological streets that serve all users. The project had four main design goals, which included mitigating a 10-year storm event, increasing groundwater recharge, improving bicyclist and pedestrian mobility, and reducing sedimentary runoff into Salina River.

Design strategies included daylighting an existing stream and engineering the water flow to resemble the movement of a stream. Green infrastructure and stormwater management strategies, such as the installation of porous pavers, bioretention basins with native species, and eighty native oaks, were used to improve runoff quality and quantity while also creating a more habitable, shaded environment. The stormwater infrastructure is designed to process 500,000 gallons of water during a 0.5 inch rainfall event, thus reducing pollutants and sediments entering the Salinas River ecosystem.

In Tucson, many of the roadways are used as washes to move urban runoff into the Santa Cruz river and other natural washes. However, this stormwater management system negatively impacts Tucson's natural systems by carrying various pollutants and high volumes of runoff from the city into washes. The flooding of roadways can also pose a safety concern for drivers and other roadway users. Accordingly, there is great potential for the City of Tucson build on Green Streets policy and incorporate green infrastructure and stormwater management strategies, as seen in Paso Robles, into the design of local complete streets to increase the ecological functionality and the livability of spaces.

Figure 21: Paso Robles, CA

Figure 22: St. Louis, MO

Placemaking and Economic Development

South Grand Boulevard in St. Louis, MO, provides a successful example of using complete streets, public participation, and placemaking strategies to create a vibrant destination for pedestrians to safely shop, eat, and gather. The city used public input and metrics that addressed the area's environmental, social, economic, and aesthetic conditions to inform the streetscape conceptual designs.

The main outcomes from this process include, the need to improve walkability, stormwater management, and the integration of placemaking to emphasize the local community's character. The design solutions used to address these themes include, a reduction in the road's width and speed, as well as the installation of porous

paving materials and native vegetation. The first year after the completion of the roadway and placemaking improvements the sales tax revenue increased 14%, which surpassed many economic development expectations.

The South Grand Boulevard project demonstrates that well-thought-out infrastructure improvements, placemaking, and public involvement can result in an area's economic development. Since economic development is a major priority for the City of Tucson, this example illustrates that a balance of traffic flow, pedestrian accessibility and safety, and a livable environment can help create a vibrant commercial district.

Figure 23: Chandler, AZ

Placemaking in Southern Arizona

Chandler, Arizona recently undertook a major planning and urban design project to update and activate Arizona Avenue. The resulting report includes specific policies and design guidelines to inform the area's transformation.

The design guidelines are organized into three sections including design standards for public and private spaces, and design standards for specific parcels in the area. This breakdown provides designers and planners a framework for approaching different scales and site conditions along the roadway. Additionally, these standards promote design cohesion by providing recommendations that foster a sense of place and convey identity. The design guidelines promote the use of sidewalks, crosswalks, intersections, paving materials, awnings, facades, signage, and building heights to further create a sense of identity. Finally, the guidelines identify plant materials and design aesthetics that are easily translatable and relevant to Tucson. These include native plant materials and durable structural materials, like steel and concrete, that can persist in the desert.

Ultimately, the design guidelines articulate reasonable aesthetics developed by and for the community. These design guidelines provide both developers and designers clear instructions for how to enhance an area's sense of place.

Complete Streets Policy and Design Framework

Figure 24 : University of Arizona Campus Entrance

As seen in Plan Tucson, the City of Tucson is approaching many planning topics through the lens of sustainability. Accordingly, a sustainability framework was developed to help evaluate and organize complete street strategies, as well as the selection of project sites. The sustainability framework is oriented around the social, economic and environmental impacts of complete streets to inform the types of policies and design guidelines recommended for the City of Tucson to implement.

The social, economic and environmental legs of the sustainability framework can be aligned into relevant Plan Tucson policies. The social constructs are aspects of complete streets policy and design that impact how community members use streets. The economic constructs shape complete street networks which are conducive for diverse businesses and local economic growth. The environmental constructs mitigate and alleviate the impacts that urban areas and transportation systems have on the environment.

The following section presents the rationale for considering social, economic and environmental policies. Each rationale is followed by example policy language and design guidelines that serve as a basis for complete streets policies. That said, many policies and design guidelines are interrelated and connect to multiple pillars of sustainability. Therefore, the city must approach complete streets in a comprehensive manner, rather than simply piecemealing policies and design strategies. (Note: The following policies and conceptual design standards are intended to provide a framework for creating a detailed design standard in the future.)

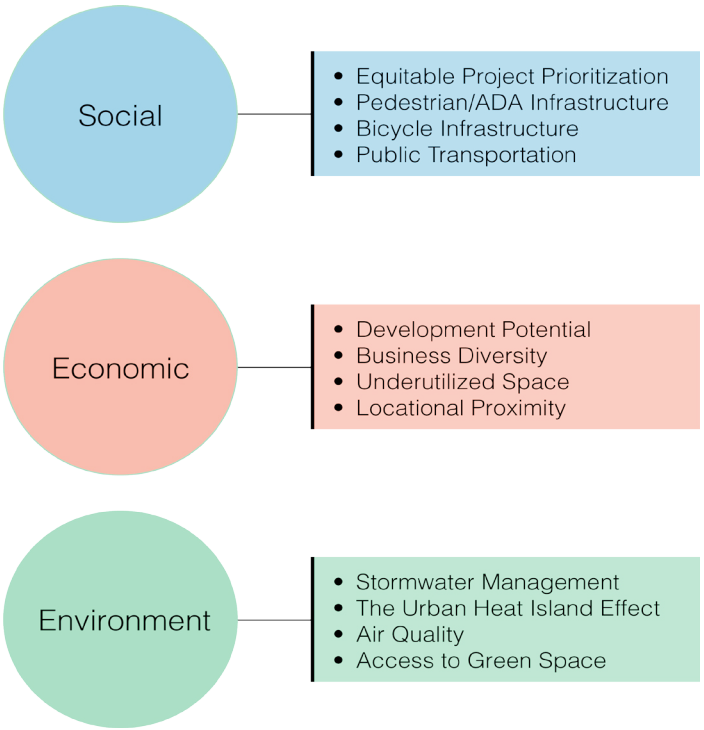


Figure 25: Policy & Design Framework

Figure 26: Plan Tucson Chapters

Social

Equitable Project Prioritization

Tucson neighborhoods face different challenges and vary greatly in characteristics that indicate a high quality of life, such as household income, educational achievement, access to healthcare, and access to transportation. To ensure that all Tucsonans have the opportunity to lead healthy, happy and successful lives, it is essential that the city prioritizes complete street networks in underserved communities.

Example Policy: "Complete streets networks and projects shall be prioritized based on equity and improving locations that are home to underserved populations. The city shall prioritize all complete street networks and projects based on vulnerability indices, such as the Southwest Fair Housing Opportunity Index. Areas in the city that are more vulnerable shall be locations prioritized for complete street improvements."

Sidewalk Accessibility

Tucson's sidewalk conditions are inconsistent, and in some cases non-existent. While all residents benefit from sidewalks, certain populations, such as those in wheelchairs, require access to sidewalks to safely navigate their daily routines. Safe, wide, level, and consistent sidewalks ensure that all community members can comfortably access their destinations.

Example Policy: To create walkable environments for pedestrians, the city will focus street improvements that meet the most stringent ADA practices. The stringent ADA accessibility practices will be incorporated on every street undergoing infrastructure change and include: curb ramps at intersections, curb ramps at bus stops, bus shelters, sidewalks with cross slopes less than 1:48 and 1:20 running slope, and continuous sidewalks throughout all complete street networks (ADA Standards).

Bike infrastructure

Tucson has a reputation for being a bike-friendly city. Therefore, it is essential to have a policy specific to bike infrastructure that further demonstrates Tucson's commitment to providing bicyclists a safe environment.

Example Policy: Bicycle facilities shall be a part of roadway design and construction throughout all complete streets networks. These facilities may include: shoulders shared lanes, wide curb lanes, bicycle lanes, and shared use paths. Bicycle lanes designate a portion of the roadway with preferential use for bicyclists. Bicycles are permitted on all streets (except as prohibited by law such as riding on freeways) as a vehicle (Louisville, KY).

Transit

In 2015, there were over 19 million SunTran passenger trips. Whether these trips were made out of necessity or choice, research has shown that transit improves health through greater physical activity, and less air pollution. Consistent transit services, and comfortable transit stations, will help ensure that transit users enjoy their

journey with dignity (APTA).

Example Policy: Transit facilities will be a part of all future roadway improvements and private developments. Transit facilities shall accommodate people of all abilities including children, the elderly, and persons with disabilities. Transit facilities will provide, at a minimum, a bench, shade, signage indicating the location of the bus stop, and a posted bus schedule with a phone number to reach SunTran.

Figure 27: Shaded Bus Stop

Streetscape Design Guidelines

Intent: Streetscapes should be designed to maximize pedestrian comfort through human-scale design, adequate shade, and the use of materials and textures that fit the unique identity of the streetscape and surrounding areas. The architectural character of buildings is to be used as an unifying element throughout the streetscape. Streetscape elements, such as benches, lighting, wayfinding signs, vegetation, etc., are to be used to establish a corridor's identity. These unifying design elements and architectural character must work to create a unique, context-sensitive place that is visually attractive and comfortable for users (Chandler, AZ).

Guidelines:

1. Streetscapes should provide as much space as possible to pedestrians, and encourage pedestrian use throughout the entire corridor.
2. Streetscape design should support the variety of users and land uses throughout the corridor, and address the specific guidelines for the street typology.
3. Materials and design elements used in the design must be easy to maintain by municipal agencies.
4. Streetscape design must include traffic calming features to discourage speed and cut through traffic.
5. Streetscape elements should be pedestrian friendly, and include, but not limited to the following: benches, trash receptacles, bicycle racks, drinking fountains, shade elements.
6. Streetscape elements should be durable, high-quality materials that are easy to maintain by municipal agencies.
7. Streetscape elements should be located in primary pedestrian gathering spaces, including, but not limited to, building entrances, plazas, open spaces, and intersections.
8. Do not allow for street closures that would create larger block sizes.
9. Where large blocks exist, retrofit blocks with new streets, alleys, and pedestrian/bicycle connections.
10. Driveways should be consolidated when possible to reduce conflicts between vehicles, pedestrians, bicyclists, and public transportation.
11. When possible, replace center turn lanes with


Figure 28: Streetscape Design

raised medians to further reduce conflicts between roadway users, while still providing accessible, safe crossings for pedestrians.

12. When possible, strip mall parking areas should be rearranged as on-street parking facilities to allow for pedestrian facilities to be situated along business storefronts.

Street Furniture Design Guidelines

Intent: Street furniture should enhance the pedestrian environment with coordinated street elements that create a unified, functional, and aesthetically appealing corridor (Chandler, AZ).

Guidelines:

1. Street furniture should be used to create a pedestrian friendly environment by increasing safety, pedestrian circulation, and corridor identity.
2. Street furniture should be located to encourage pedestrian activity and interactions, as well as contribute to the overall livability of the corridor.
3. Street furniture must be high quality, durable, and easily maintained.

Figure 29: Bike Rack Ballards

Crosswalk and Intersection Design Guidelines

Intent: To create a safe crossing space for pedestrians, bicycles, and vehicles that is attractive and promotes the walkability and bikeability of the street (Chandler, AZ).

Guidelines:

1. Crosswalks should be clearly identified, and ample space and traffic light phasing should be provided to allow groups of pedestrians to cross.
2. There should be reduced exposure distances for pedestrians and bicyclists by:
    - Providing curb extensions
    - Providing pedestrian safety islands
    - Incorporating protected intersections design concepts
3. Provide adequate nighttime street lighting in pedestrian crossing areas.
4. Pedestrian ramps must be entirely contained within a crosswalk, and the ramp must be aligned with the crosswalk to ensure users are not led into the intersection.
5. Allow pedestrian crossings around all sections of the intersection to provide direct routes and to minimize exposure.
6. When possible, use tighter curb radii to reduce pedestrian crossing distances and to slow vehicle traffic.

Figure 30: Pedestrian Median Refuge

Lighting Design Guidelines

Intent: Lighting should be used to create a safe, welcoming environment during the evening and night, while still preserving Tucson's dark skies. Lighting features should be used to create an ambiance that will draw people to the corridor and encourage them to spend time (Chandler, AZ).

Guidelines:

1. Lighting should be an element of consistency along the street - located in a standard linear arrangement, set back from the curb.

2. Lighting within the public rights of way should not cast light onto neighboring properties, and should use cut-off fixtures.
3. The impact of lighting on the night sky shall be minimized by a variety of techniques, including cut-off fixtures, and downward facing fixtures.
4. Spacing between lights may range from 60 - 100 feet on center and should be coordinated with street tree layout and other overhead features.
5. Lighting fixtures should be pedestrian-scale and compatible with the design style of the corridor.

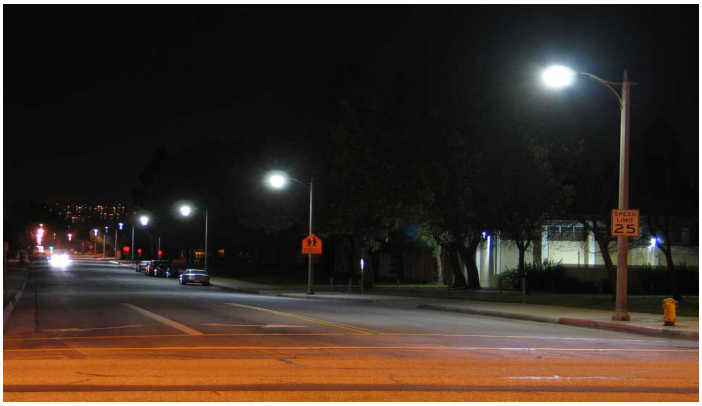


Figure 31: Uniform Street Light Spacing

Storage, Equipment, and Loading Design Guidelines

Intent: To minimize the negative visual and noise impacts of loading areas, trash storage, and mechanical equipment on adjoining streets and public spaces (Chandler, AZ).

Guidelines:

1. Loading docks, trash storage, and mechanical equipment should not be visible from the public right-of-ways.
2. Loading docks, trash storage, and mechanical equipment should be buffered by architectural or landscape features to create a visual screen.

Gathering Spaces and Open Space Design Guidelines

Intent: To create well-planned gathering spaces and open space that serve as organizing elements and focal points of development (Chandler, AZ).

Figure 32: Non-ROW Trash Storage

Guidelines:

1. Gathering spaces and open space should be used to increase the amenity of surrounding development by creating a unique, attractive environment.
2. Gathering spaces and open space should be publicly accessible and located to attract a variety of users.
3. Gathering spaces should be divided into subspaces to encourage use of the space.
4. Gathering spaces and open spaces should be perceived as an extension of public space with at least two sides exposed to the public right-of-way.
5. A variety of climate conditions should be considered and planned for in the design of gathering spaces and open spaces.
6. Gathering spaces and open space should be situated adjacent to public streets, central to neighborhoods or commercial areas.

Economic

Development potential

The city should align the complete streets network policy with Plan Tucson. The Land Use, Transportation and Urban Design Policy in Plan Tucson supports infill development where there is public transit, opportunity for multimodal transportation choices, and where parking management can encourage transit or multimodal

Figure 33: Traffic Calming Roundabout

transportation. Accordingly, these considerations should be applied to help create a complete streets network that revitalizes Tucson's streets.

Example Policy: Mitigating household costs through equitable transportation and land-use choices can help lift people out of poverty and bolster positive economic development. The city will support diverse business environments that serve surrounding neighborhoods, by prioritizing development on underutilized and/or vacant parcels in complete street networks that is located in commercial zoning.

Complete Streets Network Design Guidelines

Intent: To create a complete street system of varying street typologies to support the circulation of all roadway users and to create safe, comfortable links to adjacent neighborhoods and destinations. This street system must include well-designed and maintained pedestrian and bicycle facilities, including, but not limited to, well-marked crosswalks, sidewalks, bike routes, shade structures, vegetation, and contextual design elements (Chandler, AZ).

Guidelines:

1. The complete street network should provide extended access to destinations that attract pedestrian and bicycle travel, such as shopping and dining areas, parks, neighborhoods, transit stops, schools, and other public facilities.
2. Sidewalks and bicycle routes should form a connected network that provides users to choose the most direct routes and access to destinations.
3. Sidewalks should be wide enough to comfortably accommodate all pedestrian users.
4. Intersections should have well-designed curb ramps on all corners.
5. Traffic signal phasing should allow adequate time for pedestrians to cross.
6. Sidewalk surfaces should be kept as level as possible, while supporting stormwater management systems.
7. Build network capacity and redundancy through a dense, connected network of small streets, instead of massively-wide arterials with high capacities.
8. Expand the definition of collector arterials to recognize their role in connecting local origins and destinations, instead of just connecting local streets to major arterials.

Figure 34: Inviting Building Design

Building Design Guidelines

Intent: To provide an organized system of entrances, driveways, and parking areas that are integrated with pedestrian circulation. To use buildings to shape street space by placing building frontages at or behind property lines, and by modulating building massing to provide comfortable, human-scale buildings with contrasts in form, color, and materials. To use storefronts as active spaces that showcase shops and contribute to a high-quality pedestrian environment (Chandler, AZ).

Guidelines:

1. Primary building entrances should be oriented directly toward the street and sidewalk to enhance the pedestrian environment and encourage pedestrian interaction.
2. Parking entrances should be secondary to pedestrian entrances and pedestrian traffic.
3. Building setbacks should reinforce pedestrian activity, circulation, the existing urban structure, and pedestrian network.
4. Setback areas created behind the property lines should be used for outdoor dining, building entries, small patios, or other active outdoor uses.
5. Long, uninterrupted wall surfaces should be broken down into shorter segments of wall with offsets creating shadow lines and a more articulated building elevation.
    - Balconies and terraces should be integrated where possible.
6. Areas with high pedestrian activity should have human-scaled architectural features.
7. Buildings on the corner of street intersections should be enhanced through special corner treatments, such as towers, special roof shapes, and taller building sections.
8. Storefront designs should vary to create an interesting pedestrian environment.
9. Storefronts should be continuous along the street and adjacent to sidewalks.

Environmental

Flood Potential

Tucson has an arid climate where a majority of Tucson's annual rainfall occurs during the monsoon, between June and September. The major storm events during the monsoon often result in flash floods and hazardous conditions due to the high volumes of rainfall over a short period of time. Since Tucson is fairly sprawling, the large amount of impervious surfaces contributes to stormwater runoff and negatively impacts water quality. Congruent with Plan Tucson, the city should integrate TDOT's Green Street policy into complete streets policies to better manage stormwater runoff, improve runoff quality, and mitigate hazardous street conditions, while also improving the aesthetic quality of the streetscape.

Figure 35: Bioswales for Stormwater Management

Example Policy: The city shall incorporate low-impact development into complete streets as a way to maintain pedestrian, bicycle, and vehicle safety by managing stormwater runoff. City streets are important channels for stormwater flowing to the sewer system and washes. Incorporating low-impact development to manage runoff volumes, such as bioswales, will improve water quality, alleviate the amount of stormwater flowing through the sewer system, and increase safety for all roadway users.

The Urban Heat Island Effect

The Urban Heat Island is a phenomenon describing warmer temperatures in urban areas compared to the surrounding rural areas due to the built environment's capacity for retaining heat retention due to the large quantities of impervious surfaces (i.e. sidewalks, roads, parking lots, etc.). The UHI can have multiple negative impacts, including increased electricity use for cooling, which contributes to greenhouse gas


Figure 36: Roadway Vegetation for Shade

emissions and increased water consumption, as well as public health risks, such as "heat stress, aeroallergen-related respiratory illnesses, and vector-borne diseases" (Plan Tucson, 2013). Accordingly, the provision of shade, pervious surfaces, and vegetation will increase the comfort and safety of bicycle, pedestrians and transit users, while also working to mitigate the Urban Heat Island.

Example Policy: The City of Tucson shall create complete street networks that incorporate pervious surfaces and green infrastructure, with the goal of providing shade in key locations, such as along sidewalks, near transit stops, and at intersections. All vegetation will be native to Arizona and the city will be accountable to maintaining all vegetation in the complete streets network. The city may work with local nonprofits, businesses or neighborhood groups to help maintain the vegetation.

Parking Lot Design Guidelines

Intent: To design surface parking lots in a manner and configuration that allows buildings to be closer and more integrated with one another. To soften and mitigate the visual and environmental impacts of large paved areas (Chandler, AZ).

Guidelines:

1. Surface parking lots should be located so that they do not increase the space between buildings or diminish the pedestrian-scale.
2. Surface parking lots should be separated from buildings and public sidewalks with a landscape buffer.
3. The surface of large parking lots should be frequently broken up with trees and other landscaping.
4. Landscaping should be used to distinguish access points and define pedestrian access to surface parking lots.
5. Ecological methods of reducing and treating stormwater runoff from parking lots should be explored.

Street Trees Design Guidelines


Figure 37: Landscaped Parking Lot

Intent: Street trees should be used to enhance the pedestrian experience and the overall urban environment by providing shade and stormwater management, mitigating the Urban Heat Island, and beautifying the area (Chandler, AZ).

Guidelines:

1. Tree species should be drought-tolerant and compatible with the local climate conditions.
2. The size and scale of trees should be appropriate to their placement, which should be considerate of adjacent properties and should not interfere with pedestrian or vehicular movement, site lines, or utilities.
3. A variety of tree species should be used to mitigate the negative effects of disease or insect infestation.
4. Trees should be located to maximize pedestrian and building shading.
5. Street trees should be sensitive to the existing character of the corridor.

Other Elements

Smart Growth America recommends several best practices when creating a complete streets policy. Each best practice listed below includes a brief rationale followed by an example policy adopted by a town, or provided as an example by Smart Growth America.

Project Vision

It is recommended that an inspirational introduction and vision is developed to establish a clear, unified purpose and outcome for the community's complete street policy (Smart Growth America).

Example Policy: To create safe, equitable, and healthy streets that encourage economic growth within suitable districts throughout the City of Tucson. Each of these districts would have distinct, context-sensitive design aspects that enhance the area's walkability and livability.

Users and Mode

There should be a policy that establishes that pedestrians, bicyclists, and transit users are legitimate users of the transportation system, and the policy must acknowledge that each of these group's needs may overlap and vary at an individual level.

Example Policy: Develop as many street projects as possible in an affordable, balanced, responsible, and equitable way that accommodates and encourages travel by motorists, bicyclists, public transit vehicles and their passengers, as well as pedestrians of all ages and abilities. (Dubuque, Iowa)

Projects and Phases

There should be a policy that incorporates complete streets into all phases of new or retrofit projects, rather than create separated "complete street" projects. This means that even small projects can result in change to safely accommodate all users.

Example Policy: Complete streets may be achieved through single projects or incrementally through a series of smaller improvements or maintenance activities over time. It is the Mayor and City Council's intent that all sources of transportation funding be drawn on to implement complete streets. The city believes that maximum financial flexibility is important to implement complete streets principles. (Seattle, Washington)

Exceptions

There should be a policy that acknowledges circumstances that make a street exempt from complete streets standards. The best practice for street exceptions is to ensure that a high-ranking official needs to approve any exceptions, and to ensure that the reasoning for the street's exemption is publicly available and supported by data.

Example Policy: Facilities for all users will be considered in the construction, reconstruction, retrofit, repaving, and rehabilitation of City streets, except under one or more of the following conditions:

1. An affected roadway prohibits, by law, use by specified users, in which case a greater effort shall be made to accommodate those specified users elsewhere, including on roadways that cross or otherwise intersect with the affected roadway; or
2. The costs of providing accommodation are excessively disproportionate to the need or probable use; or
3. The existing and planned population, employment densities, traffic volumes, or level of transit service around a particular roadway as documented by [appropriate city plan or department] is so low that future expected users of the roadway will not include pedestrians, public transportation, freight vehicles, or bicyclists.

Documentation shall be publicly available and exceptions for city projects shall be granted by [accountable person or committee, e.g. City

Manager, Director of Public Works, Complete Streets Advisory Committee]. For private projects, the owner shall document the exception and approval shall be granted by [accountable person or committee, e.g. City Council, Director of Planning] (Smart Growth America).

Complete Street Network

There should be a policy that focuses on creating complete street networks to increase accessibility, rather than solely focusing on improvements in individual corridors.

Example Policy: The city will design, operate, and maintain a transportation network that provides a connected network of facilities accommodating all modes of travel. The city will actively look for opportunities to repurpose rights-of-ways to enhance connectivity for pedestrians, bicyclists, and transit. The city will focus non-motorized connectivity improvements to services, schools, parks, civic uses, regional connection and commercial uses. The city will require large new developments and redevelopment projects to provide interconnected street networks with small blocks (Baldwin Park, California).

Context Sensitivity

Context sensitivity means that any complete streets or complete street network projects are flexible and adaptable to the surrounding community's character, culture, and unique needs. Context-sensitive project designs also promote a robust public engagement throughout the process since it would require a strong understanding of the surrounding community.

Example Policy: Context-sensitive design allows roadway design decisions to be more flexible and sensitive to community values, and to better balance economic, social, and environmental objectives. Outreach and involvement of the community is essential to ensuring context sensitivity. As implementation begins, community engagement and education efforts shall accompany tactical pilot projects. Institutional

Figure 38: Grand Avenue, Phoenix, Arizona

stakeholders that develop their own master plans must be included, and the school district in particular must be coordinated with, which may be best done through the Safe Routes to School program. Other stakeholders shall be identified and engaged, as well, with a special effort made to incorporate the Latino population. To facilitate this engagement activity, a Complete Streets Task Force shall be established. The mayor shall appoint members of the task force, with each contributing towards the group's need for diverse representation of the stakeholders recognized above. There will be no limits to the terms and seats of members of the task force at this time. The purpose of the Complete Street Task Force shall be to promote and advance both the broader vision and implementation details of this Complete Streets policy, while ensuring that the needs of all users and all modes are addressed throughout the planning and design process (Reading, PA).

Performance Measures

There should be a policy that specifies how complete streets success is defined and will be evaluated. The policy can identify specific performance measures that the city will monitor.

These measures might include:

- Miles of new or re-striped on-street bicycle

Figure 39: Curb Extension and Bioswales, NACTO

facilities,
- Number of new or reconstructed curb ramps,
- Decreased travel time by income group,
- Increased access to employment by income group,
- Number of new street trees or percentage of tree canopy coverage, or
- Decrease in the number of traffic incidents.

Example Policy: Performance measurements will be based on, but not limited to, the miles of bicycle routes created; new linear feet of pedestrian accommodation; increase in use of public transportation, bicycling and walking; the miles of connection added between trails; the increased efficiency of traffic flow through the use of sophisticated traffic control devices, turn lanes, traffic circles, and the leveling or decrease of transportation related accidents (Bellevue, Nebraska).

Design

The design guidance in the policy can refer to current best practices from external sources, such as AASHTO standards, but should be flexible and acknowledge that streets can accommodate different modes to different degrees.

Example Policy: The city shall follow accepted or adopted design standards and use the best and latest design standards, policies, principles, and guidelines available. Principles and strategies of good street and bikeway designs offered by the National Association of City Transportation Officials (NACTO) shall be utilized first and foremost in decision making. Guidelines and standards may include, but not be limited to, Federal Highway Administration (FHWA), American Association of State Highway and Transportation 16 Officials (AASHTO), the Institute of Transportation Engineers (ITE), the Americans with Disabilities Act (ADA), the Public Right-of-Way Accessibility Guidelines (PROWAG), and the American Society of Landscape Architects (ASLA). In recognition of various context, public input, and the needs of many users, a flexible, innovative, and balanced approach that follows other appropriate design standards may be considered, provided that a comparable level of safety for all users can be achieved (South Bend, OR).

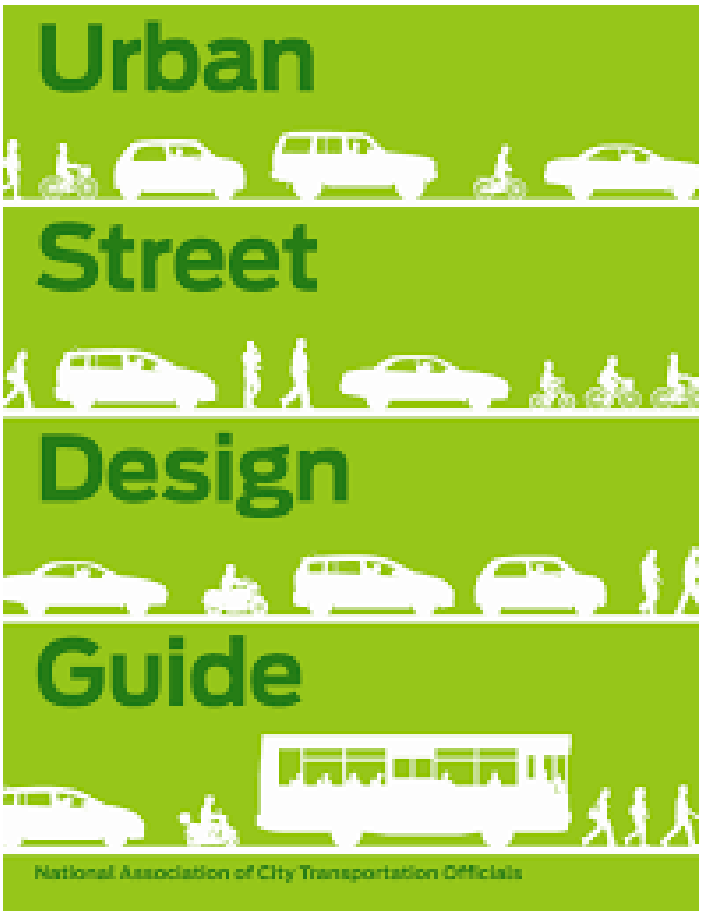


Figure 40: NACTO Urban Street Design Guide

Street Typology Matrix

The following complete streets typology matrix is intended to identify common types of roadways found in Tucson, as well as to describe the conditions of those roadways with complete streets policy applied to them. When identifying a corresponding street typology, all variables outlined in the matrix should be considered, as well as the surrounding context, such as land use and streetscape. The process for developing the matrix included a review of case studies to extrapolate various features and characteristics that influence street design to promote a safe, healthy, and accessible transportation system for all users. Then, each typology was considered within the context of Tucson to develop context sensitive design guidelines for each street-type feature. Please note that not all of Tucson's roadways will fit into the typologies outlined in the matrix. As such, other innovative street types, like an Urban Alley, should be considered for certain contexts.

While the street typology sets forth best practices to be implemented, unique situations may warrant a different approach to implementing complete streets. For instance, while the matrix recommends a five-foot sidewalk along neighborhood streets, in some instance, it might be unfeasible to retrofit a street with sidewalks so other design strategies will need to be explored to accommodate pedestrians. In lieu

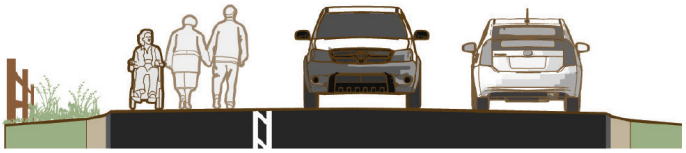


Figure 41: Separated Pedestrian Lane

of sidewalks, a more feasible approach for some neighborhood street projects could be to create a visually separated pedestrian lane on a street. The matrix also aims to acknowledge that roadway characteristics are not the same throughout the extent of the street and can change based on the surrounding context. Likewise, context-sensitive design strategies need to be considered to maximize the effectiveness of roadway improvements. For this reason, a placemaking component was added to the matrix to ensure that specific design strategies need to be used to create a sense of place that signals to roadway users that they've entered a new activity corridor. Activating different corridor sections in this way can build upon a larger city-wide aesthetic that harmonizes street transitions throughout Tucson.

At the start of this project, the team worked with community partners to decide 1) which street corridors should be visualized to show the impact of complete streets policy within Tucson's roadway network; and 2) what specific locations within those corridors - activity nodes - should be visualized to demonstrate how complete streets policy can be paired with placemaking strategies to create a cohesive character specific to that node.

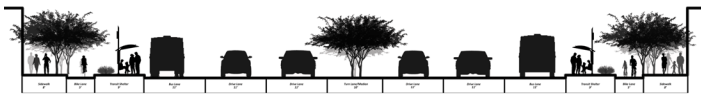


Figure 42: Major Arterial

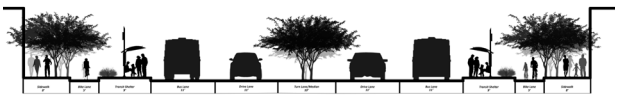


Figure 43: Minor Arterial

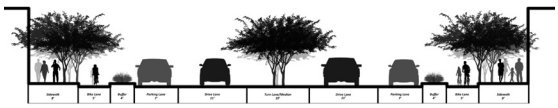


Figure 44: Activity Corridor

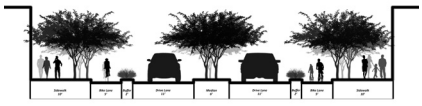


Figure 45: Prime Connector

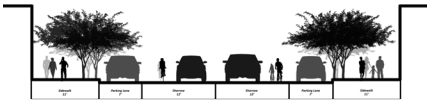


Figure 46: Bicycle Boulevard

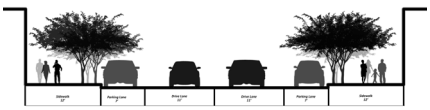


Figure 47: Neighborhood Street

Study Corridor & Activity Nodes

Primary Considerations

The study corridor selected to help visualize the proposed policies and design strategies includes 1st Avenue, Stone Avenue and Oracle Road, between Grant Road and River Road. This corridor connects the northwest metropolitan area to the University of Arizona and Downtown Tucson and is home to different types of land-use and community assets. This area was identified as the study corridor primarily due to apparent inequities and major opportunities for improvement.

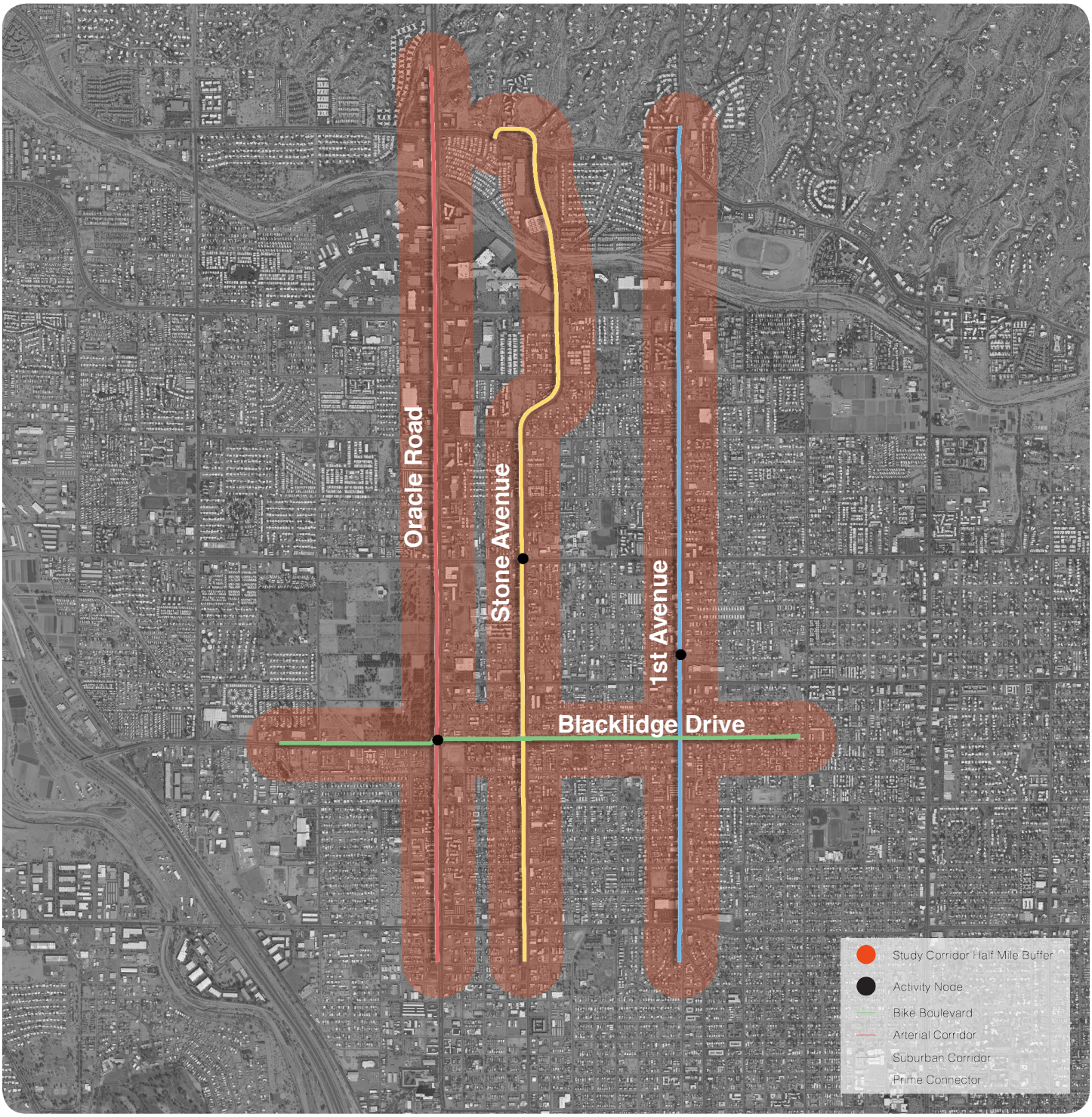


Figure 48: Study Corridor

Study Corridor & Activity Nodes

Since equity is a cornerstone of this project's vision, the Southwest Fair Housing Council's (SWFHC) Opportunity Index was used as a tool to identify areas in Tucson facing equity issues. SWFHC Opportunity Index is a cost-surface model that integrates 22 variables into an index identifying areas that have high or low opportunity to improve. Low-opportunity areas correspond to areas that are underserved; there is less opportunity for community members to lead a high quality of life. The variables that comprise the index are categorized as either education, housing and neighborhood, economy, transportation, or health and the environment (Opportunity Index Metrics, Appendix C) variables. The results of the SWFHC analysis indicate that, compared to other areas in town, Oracle, 1st Avenue and Stone, between Grant and River, have a moderately low opportunity. The table below highlights a few key demographic differences between the study corridor and the City of Tucson.

Table 1: Key Demographics	Study Corridor	Tucson
Below Poverty Level (%)	35%	19%
Median Household Income	$22,200	$37,100
Drives Alone (Commute)	68%	75%
Public Transit (Commute)	7%	4%
Walks or Bikes (Commute)	13%	9%

Pertinent Planning Documents

Jarrett Walker + Associates previously completed a public participation and analysis in the Oracle, 1st Avenue and Stone corridors, as part of a workshop sponsored by PAG. Jarrett Walker + Associates identified 1st Avenue as a priority for "frequent [transit] network development," and both Oracle Road and 1st Avenue as optimal street segments for future high-capacity transit investment (Jarrett Walker + Associates, 2015).

As previously mentioned, the RTA has slated to expand 1st Avenue, from Grant Road to River Road, from its current condition of four travel lanes to six travel lanes, plus a center median, by 2021. Accordingly, the proposed expansion of 1st Avenue provides an opportunity to revise the roadway design as an asset to the surrounding community that fits their unique needs, and creates a safe, comfortable environment for all roadway users. Likewise, Stone Avenue and Oracle Road were included in the analysis corridor to demonstrate the need for complete street networks throughout Tucson.

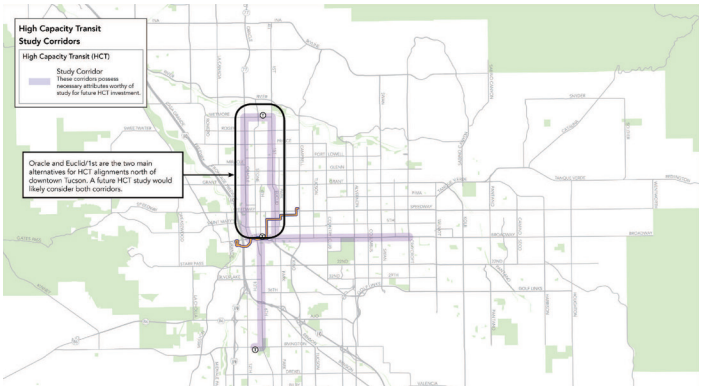


Figure 49: High Capacity Transit, Jarrett Walker

Vehicle Demand & BRT Analysis

The team analyzed theoretical road capacity, current road capacity during peak travel periods, and, depending on the street typology, ability for the road to support BRT.

Capacity is the maximum number of vehicles per hour that can be expected to traverse a point or uniform segment of a lane. One method for calculating capacity is to determine the saturation flow rate for the number of vehicles per hour of green (vphg), and to factor in key determinant

methods, such as the percent of time that the signal is actually green. This calculation estimates the number of vehicles per hour that could cross an intersection if the light remained green (Courage, 2015). On average in a metro area, the capacity of an arterial is roughly 1,800 vphg/lane. Using this value as a general rule of thumb, the theoretical capacity was determined by the following equation for each corridor:

1,800 vphg/hour x percent light is green in one hour x number of travel lanes = Road Capacity

To determine the percent of time that a light remains green, the team observed intersections at the midsection of the study corridor on Oracle, Stone and First for three light cycles. The team then calculated the percent of time the light remained green across all three light cycles, and used this percent as a proxy for the percent of time a light is green in one hour.

The team compared the theoretical capacity to the average number of vehicles per travel lane during the peak travel period, from turning movement count (TMC) data. If this number was less than the theoretical capacity, then the team determined that the roadway is being underutilized, and could potentially handle a road-diet.

Based on the street typologies, Oracle and 1st are considered suitable for high-capacity transit. To validate this hypothesis, the team calculated average daily ridership (normalized by the length of the study corridor, or 2.5 miles) in three western US BRT systems (MAX-Fort Collins, Orange Line-Los Angeles, and Emerald Express, Eugene, OR) to the average daily number of vehicles in one travel lane, and, more specifically, in one travel lane during peak travel hours. This allowed the team to understand whether there is enough traffic in one travel lane to support a mode shift to BRT.

The following table shows the total average daily ridership, and average daily ridership per direction for the MAX (Fort Collins, CO), Orange Line (Los Angeles, CA) and the Emerald Express (Eugene, OR).

Table 2: Ridership	Total Average Daily Ridership (normalized by length of study corridor)	Average Daily Ridership, per direction (normalized by length of study corridor)
MAX (Fort Collins)	1,925	963
Orange Line (Los Angeles)	4,142	2,071
Emerald Express (Eugene)	4,125	2,063
Average	3,397	1,699

If a corridor's average daily traffic per travel lane is equal to or greater than the average daily ridership for all three BRT systems, normalized by the length of the study corridor, the team determined that the corridor might be able to support a BRT system.

Please note that all calculations are preliminary and used solely for estimations.

Oracle Road
Road capacity: The team observed the length of the green light and the red light at the Oracle and Prince intersection. The light remained green for about 58% of the observation window. The theoretical capacity is therefore:

1,800 vphg/h x .58 x 6 lanes = 6,264 vehicles/hour

Comparing this theoretical capacity to the capacity of the road during peak travel time data, the Oracle corridor experiences, on average, 2,506 vehicles per hour. So, even during the heaviest travel hour, Oracle is almost 2.5 times lower than the theoretical capacity of a road that has similar characteristics to Oracle.

Support for BRT: The average daily vehicle traffic on Oracle in the study corridor is 37,629 vehicles. This equates to approximately 6,271 vehicles traveling per lane. Assuming that these are all single-occupancy vehicles, the vehicles traveling per lane on Oracle is over 3.5 times the ridership of the studied BRT systems. A total of two travel lanes (one in each direction) could support a BRT.

Stone Avenue
Road capacity: The team observed the length of the green light and the red light at the Stone and Ft. Lowell intersection. The light remained green for about 57% of the observation window. The theoretical capacity is therefore:

1,800 vphg/h x .57 x 4 lanes = 4,104 vehicles/hour

Comparing this theoretical capacity to the capacity of the road during peak travel time data, the Stone corridor experiences, on average, 1,246 vehicles per hour. So, even during the heaviest travel hours, Stone is almost 3.5 times lower than the theoretical capacity of a road that has similar characteristics to Stone Avenue.

First Avenue
Road capacity: The team observed the length of the green light and the red light at the 1st and Ft. Lowell intersection. The light remained green for about 67% of the observation window. The theoretical capacity is therefore:

1,800 vphg/h x .67 x 4 lanes = 4,824 vehicles/hour

Comparing this theoretical capacity to the capacity of the road during peak travel time data, the 1st Avenue corridor experiences, on average, 2,166 vehicles per hour. So, even during the heaviest travel hours, 1st is almost 4.5 times lower than the theoretical capacity of a road that has similar characteristics to 1st Avenue.

Support for BRT: The average daily vehicle traffic on 1st in the study corridor is 23,366 vehicles. This equates to approximately 5,841 vehicles traveling per lane, on the four lane road. Assuming that these are all single-occupancy vehicles, the vehicles traveling per lane on 1st is just less than 3.5 times the ridership of the studied BRT systems. A total of two travel lanes (one in each direction) could support a BRT.

Study Corridor & Activity Nodes

Activity Node Considerations

The team used the following criteria to identify specific activity nodes in the study corridor to further analyze and visualize.

1. Social conditions: Which locations in the study corridor could benefit from increased ADA accessibility, consistent and safe bicycle infrastructure, improved transit access, and could improve underserved environments?
2. Economic Conditions: Which locations in the study corridor can provide greater economic support to surrounding neighborhoods, and is underutilized space available to support infill projects?
3. Environmental Conditions: Which locations in the study corridor are in areas with a high flood potential, and where are pedestrian and bicyclists most exposed to the urban heat island effect due to minimal vegetation?

In addition to relying on secondary data to identify general locations within the study corridor that met the above criteria, the team completed several window observations along the study corridor to document community assets (i.e. schools, libraries, open space, etc.) to determine the location for the three activity nodes.

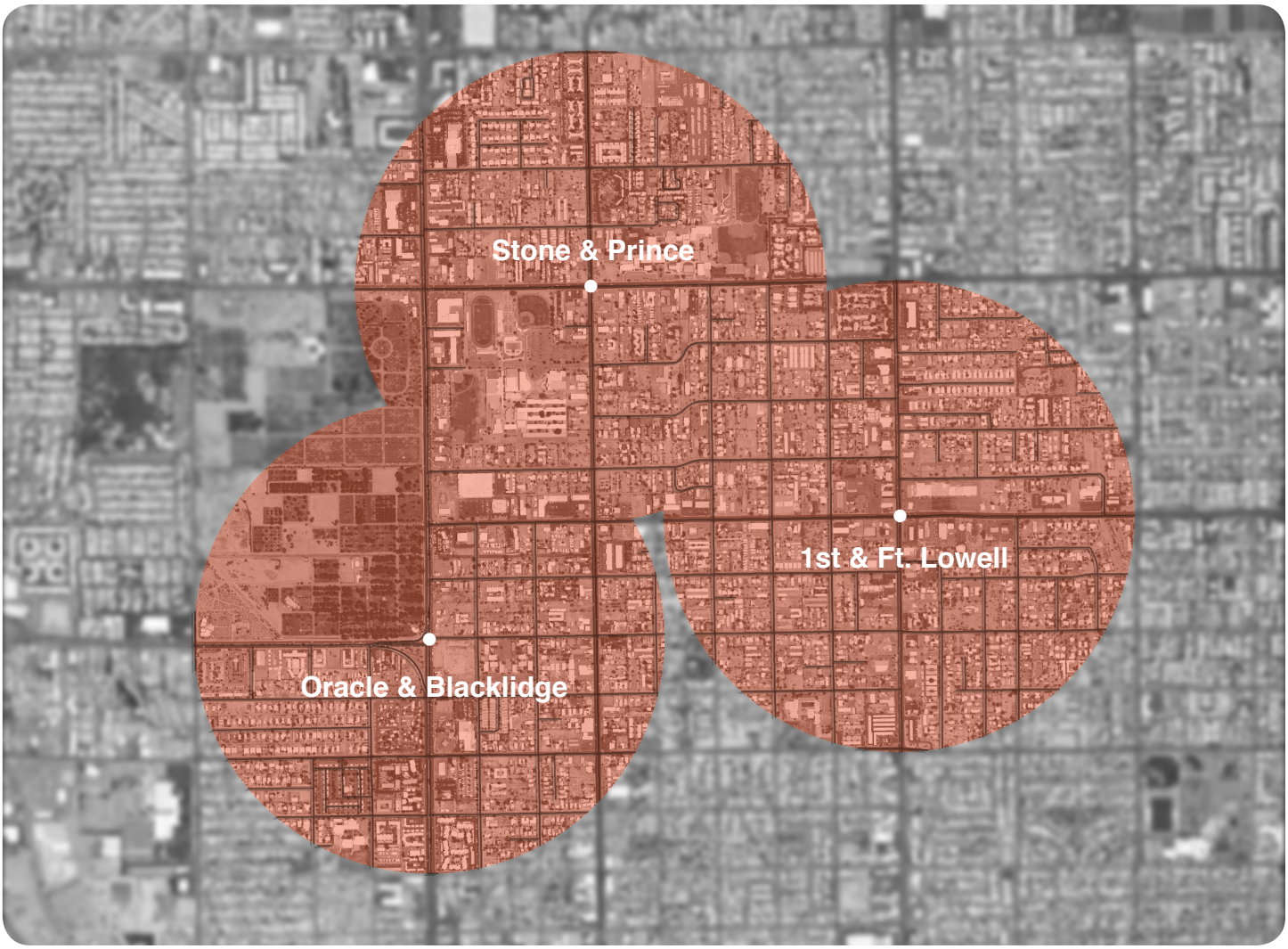


Figure 50: Activity Nodes

Amenities

This map shows that there are six schools within the half mile buffered area, possibly indicating a high density of households with children. The map also illustrates a general lack of open space that is easily accessible to the public. The juxtaposition of these two amenities describes a deficiency in access to open space for a predominantly residential area.

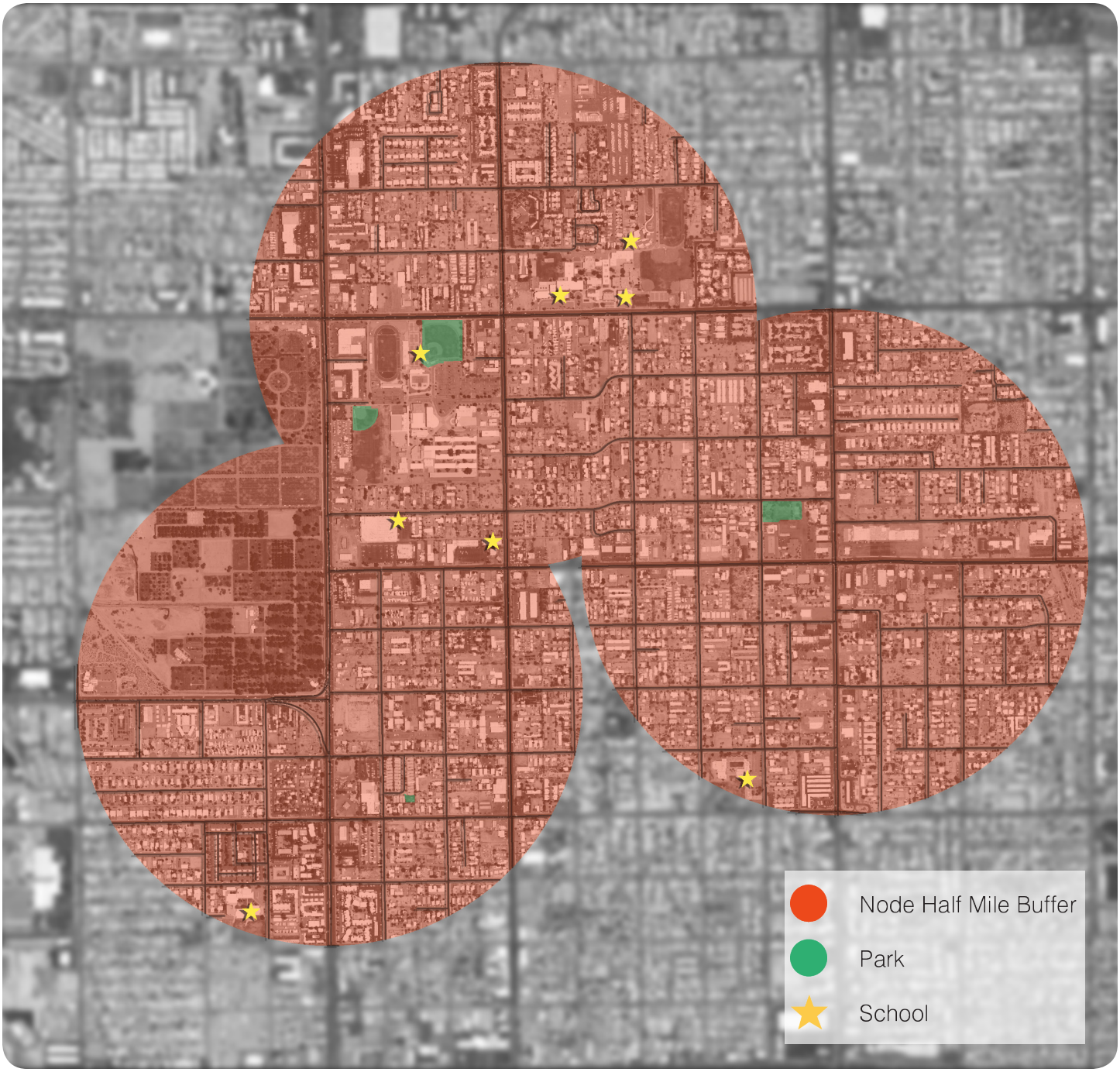


Figure 51: Activity Node Amenities

Vegetation

Most of the vegetation that is not concentrated in the cemetery are trees located on private properties away from the major roadways. This map demonstrates a need for more shade canopy along streets to improve the pedestrian experience.

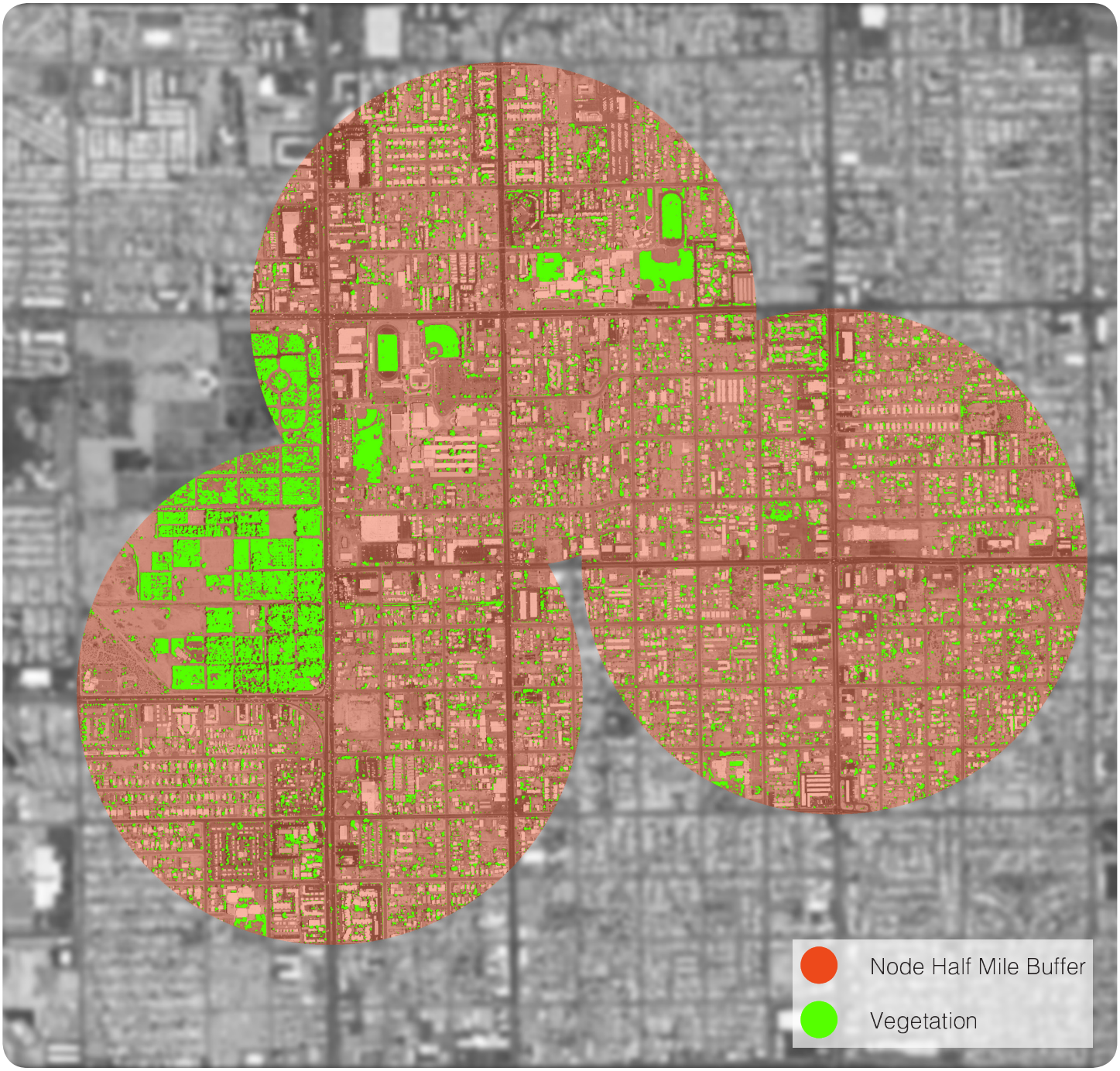


Figure 52: Activity Node Vegetation

Circulation

This map shows a highly-disconnected network of sidewalks along the majority of streets within the buffered area, signaling a considerable need for sidewalk improvements. However, upon final buildout of all the currently proposed bike boulevards, there will be a fairly comprehensive network of bicycle friendly routes with HAWK crossings at the intersections with major streets.

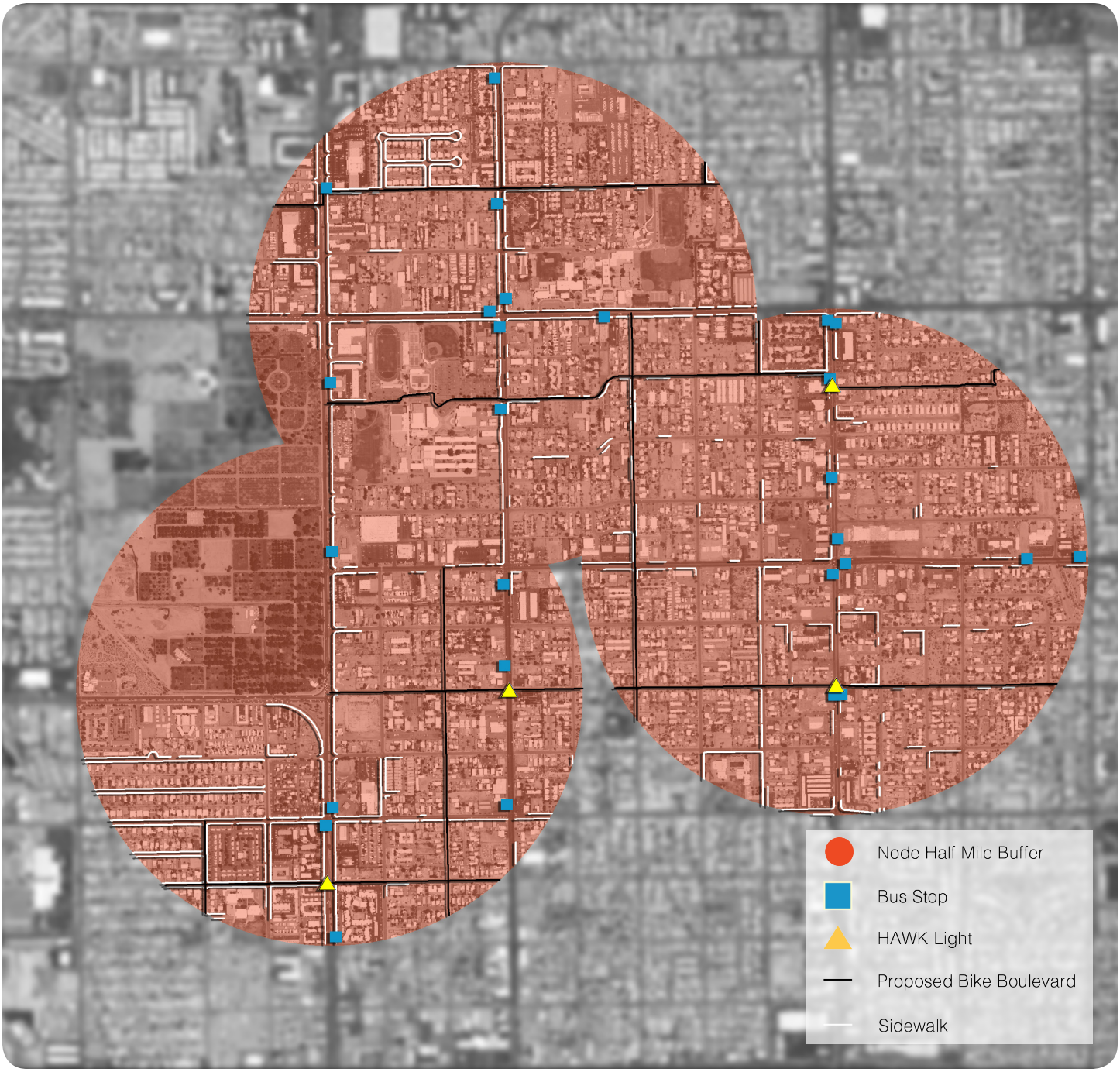


Figure 53: Activity Node Circulation

Bus Demand

The map uses proportionally sized circles to describe bus stops with higher daily ridership demonstrating areas of high demand.

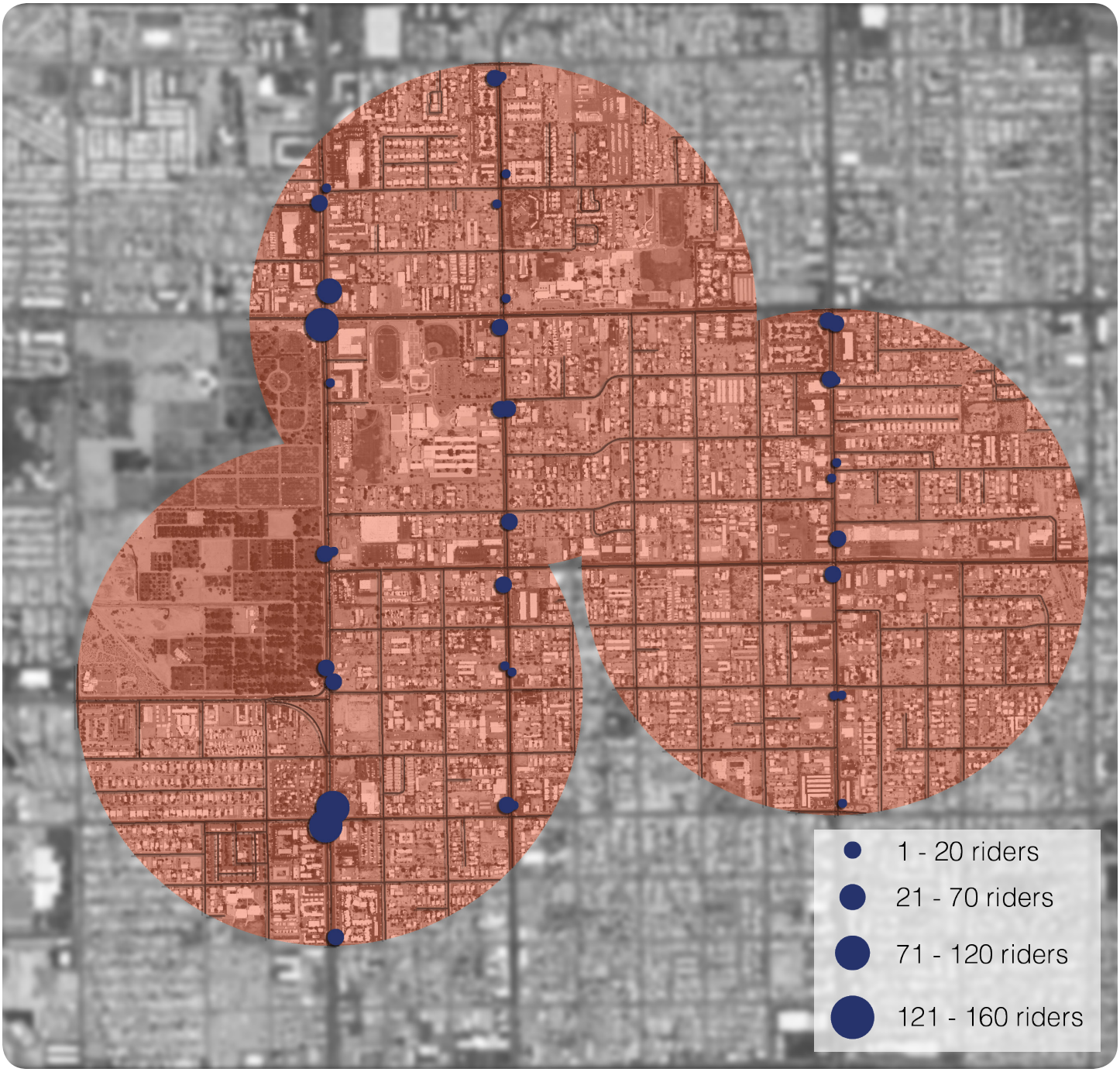


Figure 54: Activity Node Bus Demand

Opportunity Index

The SWFHC Opportunity Index map showcases areas from high to low opportunity along each complete street corridor using a half-mile buffer. High opportunity areas exist on the southern corridors of Stone Avenue and Oracle Road, while mid to low opportunities exist on the 1st Avenue corridor, as well as the northerly corridors of Stone Avenue and Oracle Road.

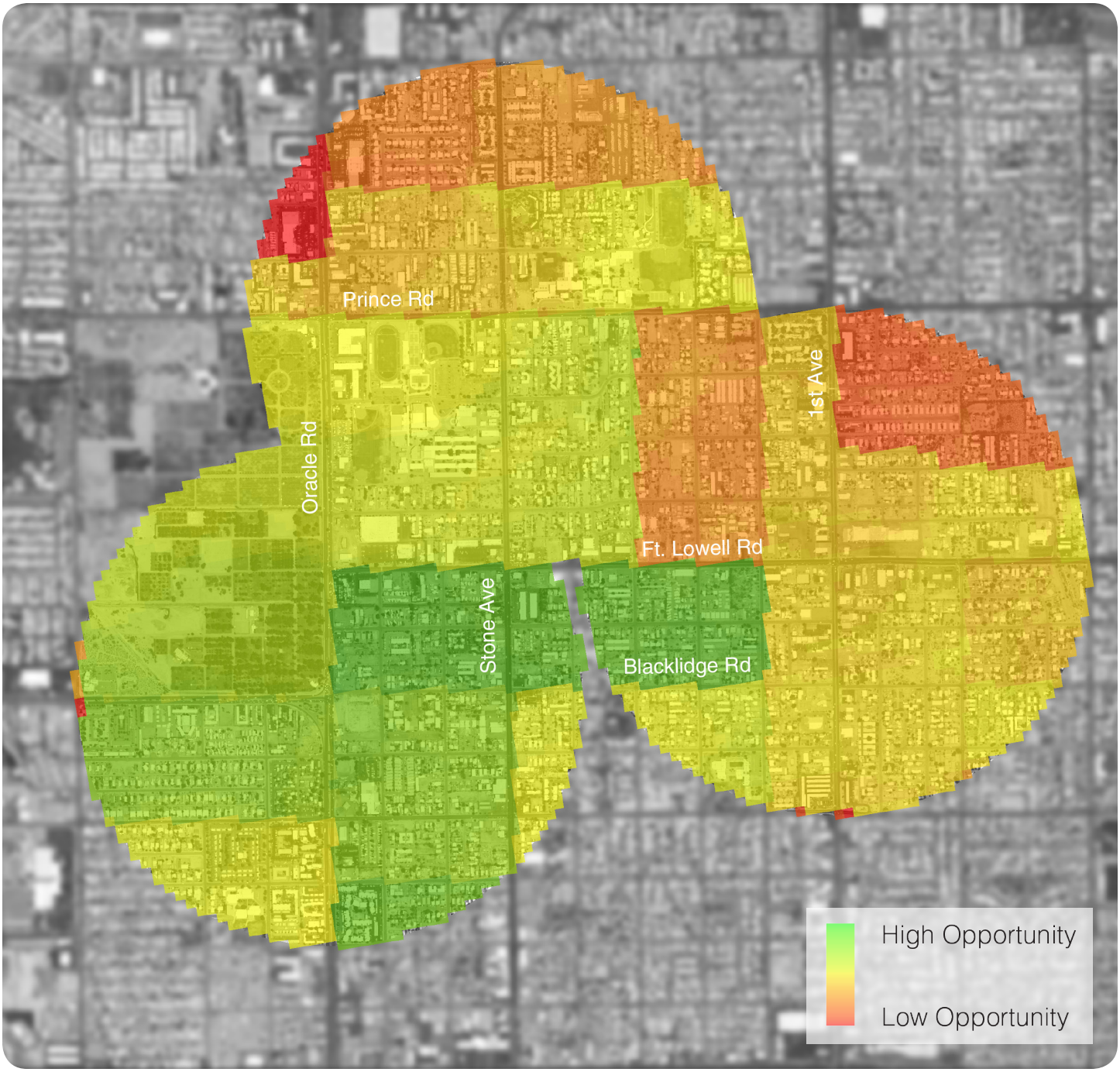


Figure 55: Activity Node Opportunity Index

Traffic Incidents

Traffic incidents related to automobile interactions with bicyclists and pedestrians are important to understand the unsafe areas of a corridor. The map shows incidents from 2012 to January 2017 within the half-mile buffer along Oracle Road, Stone Avenue, and 1st Avenue.

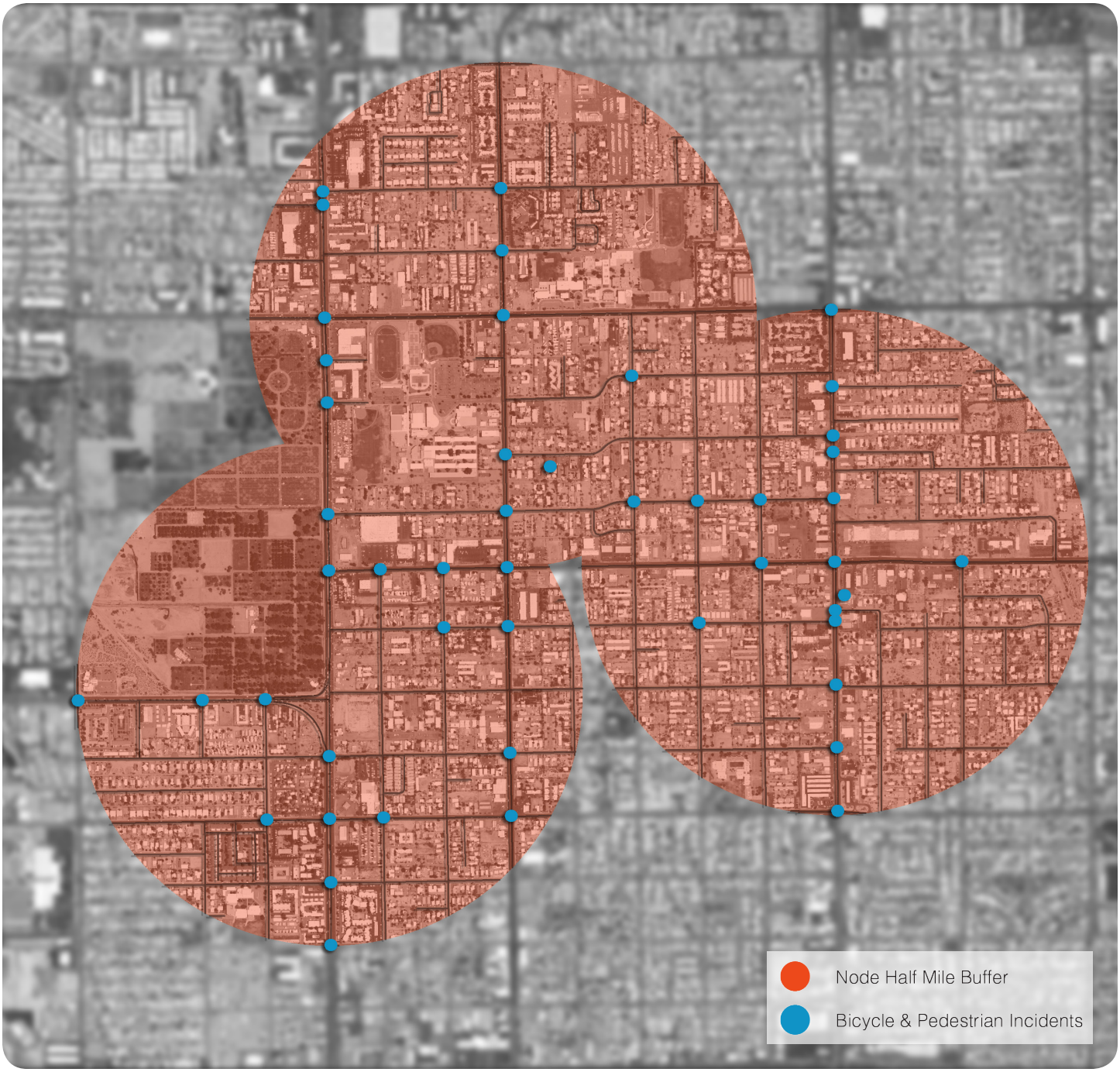


Figure 56: Activity Node Traffic Incidents

Zoning

The zoning map highlights the current zoning for each complete street corridor using a half mile buffer. Vacant parcels are also included in this map to show areas where future development could occur with the implementation of complete streets.

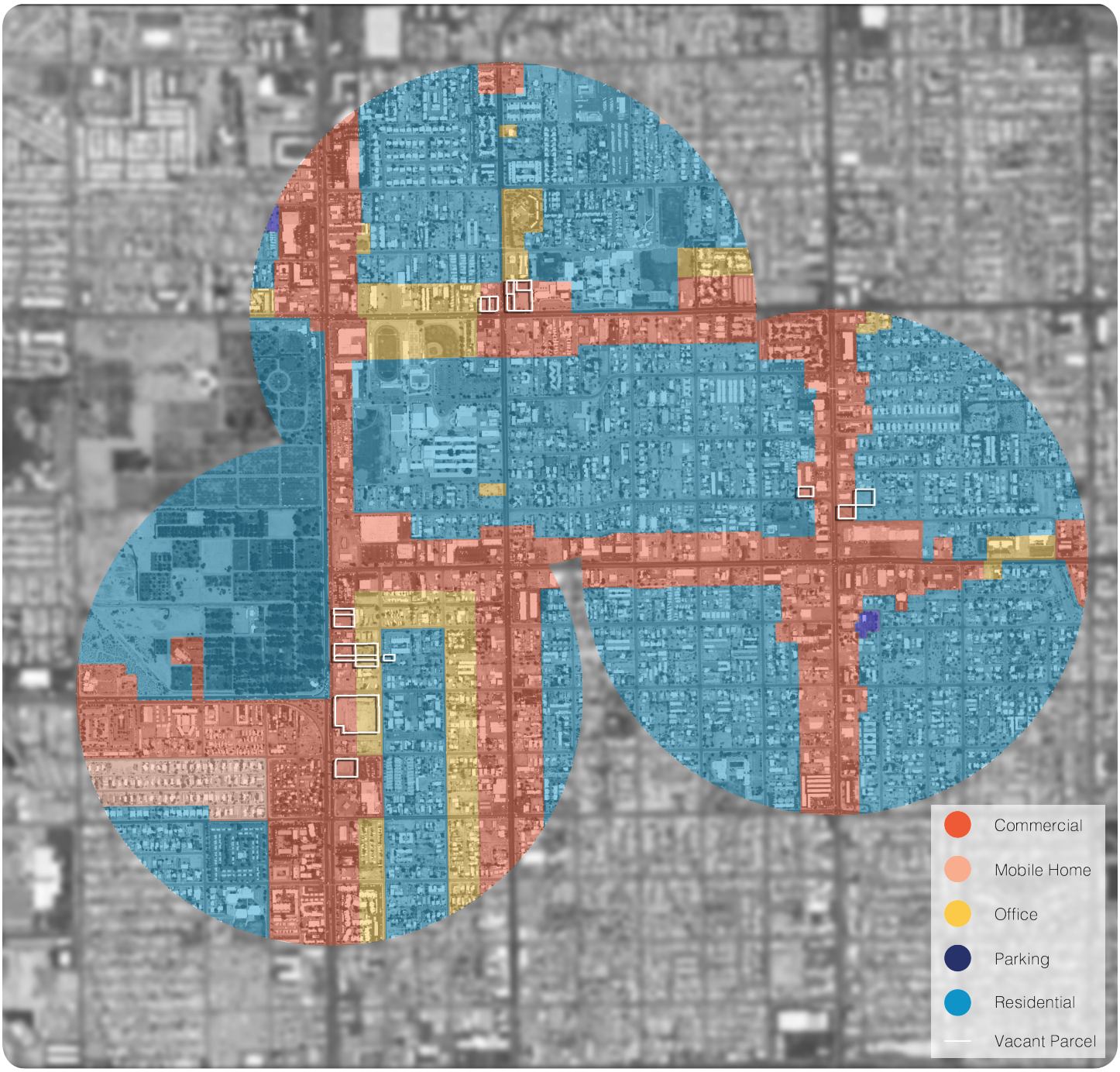


Figure 57: Activity Node Zoning

Design Program

Based on the analysis of the corridor and activity nodes, the following design program was developed to guide the design process for proposed complete street improvements to the area.

Social Goal: Create improved transit corridors that are safe, comfortable, and convenient for all users.

Objective 1 - Address areas of low opportunity based on the SWFHC Opportunity Index
Objective 2 - Ensure that the transit corridor includes ADA best practices
Objective 3 - Create a transit corridor that provides a safe, low stress experience for bicyclists and pedestrians.

Economic Goal: Create transit corridors that support infill development and improve business accessibility and diversity.

Objective 1 - Prioritize underutilized parcels for new development opportunities.
Objective 2 - Create diverse cross sections of businesses that meet the daily needs of nearby residents.

Environment Goal: Create transit corridors that mitigate the Urban Heat Island, reduce stormwater runoff, and help reduce greenhouse gases emissions.

Objective 1 - Incorporate green infrastructure to improve walkability and mitigate negative environmental impacts.

Site Photos

1st Avenue

Figure 58: 1st Ave Site Photos

Stone Avenue

Figure 59: Stone Ave Site Photos

Oracle Road

Figure 60: Oracle Ave Site Photos

Activity Node 1

1st and Fort Lowell

Activity Node number one runs the length of 1st Ave between Fort Lowell and E Prince Rd. A large portion of site analysis and design work was performed at the intersection of 1st Ave and Navajo.

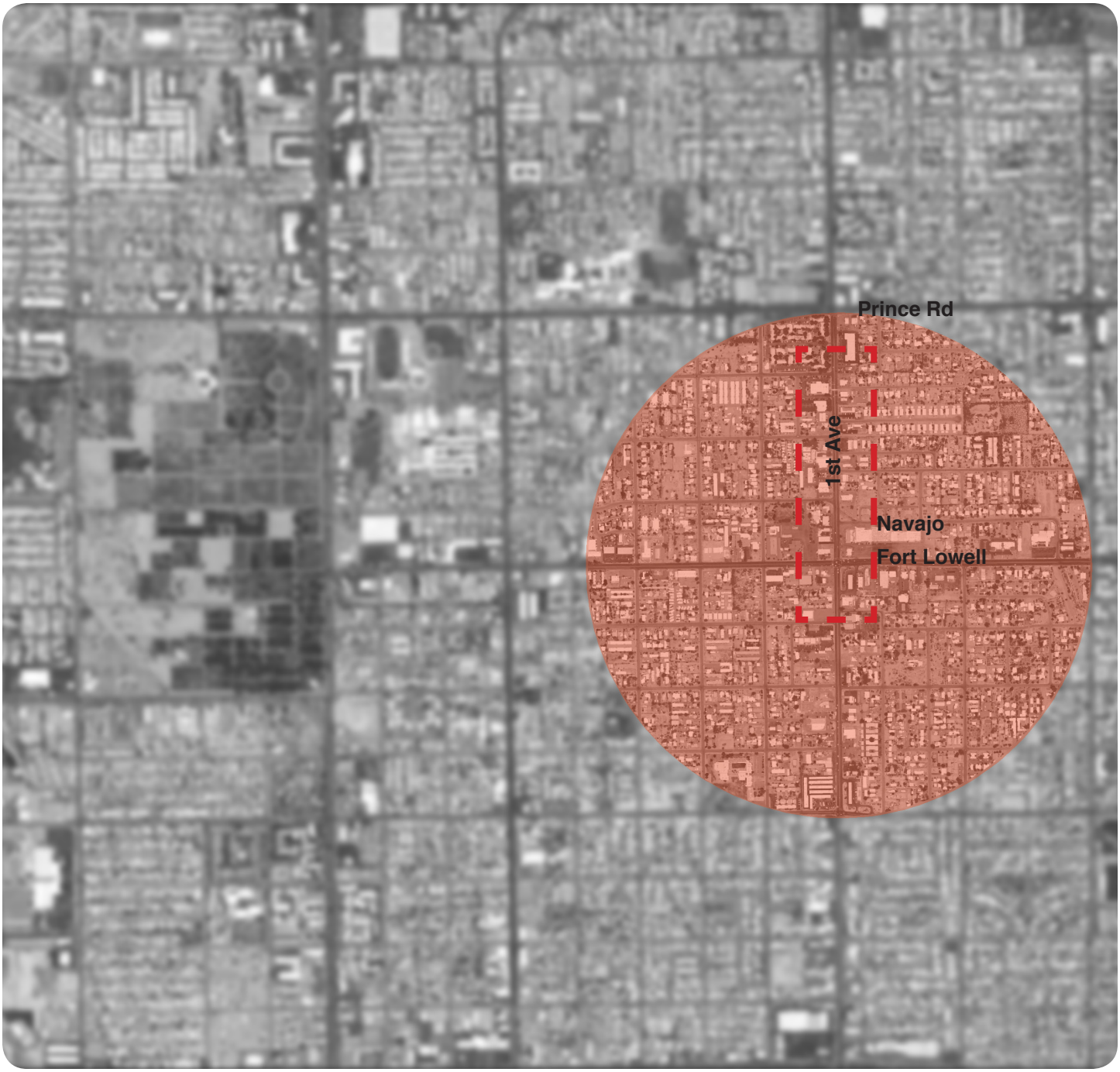
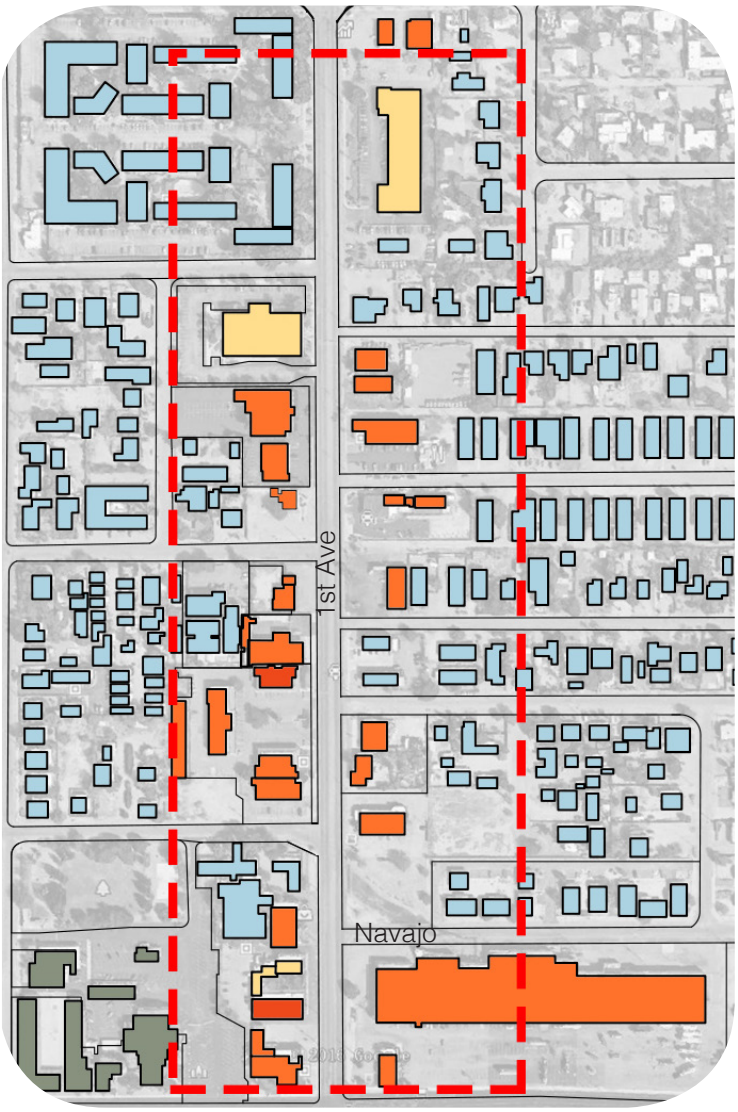


Figure 61: 1st and Navajo Activity Node

Site Analysis - 1st Ave

A refined site analysis of building uses along the 1st Ave shows a mixture of commercial and residential along the corridor. Additionally, non-profit and local government offices are present and provide library and health services to area residents.



Commercial

Residential

Government

Religious

Non-Profit

Figure 62: 1st and Navajo Site Analysis

Site Panorama

1st Avenue exhibits multiple opportunities for social, economic, and ecological improvement.

Figure 63: 1st and Navajo Site Panorama

Proposed Street Typology - 1st Avenue

Utilizing the Complete Streets Typology Matrix, 1st Avenue is considered a Minor Arterial with a proposed 100 foot right of way. The road exhibits Bus Rapid Transit lanes and protected bike lanes. Native vegetation and stormwater run-off detention basins are integrated into large 8' planting strips.

Minor Arterial

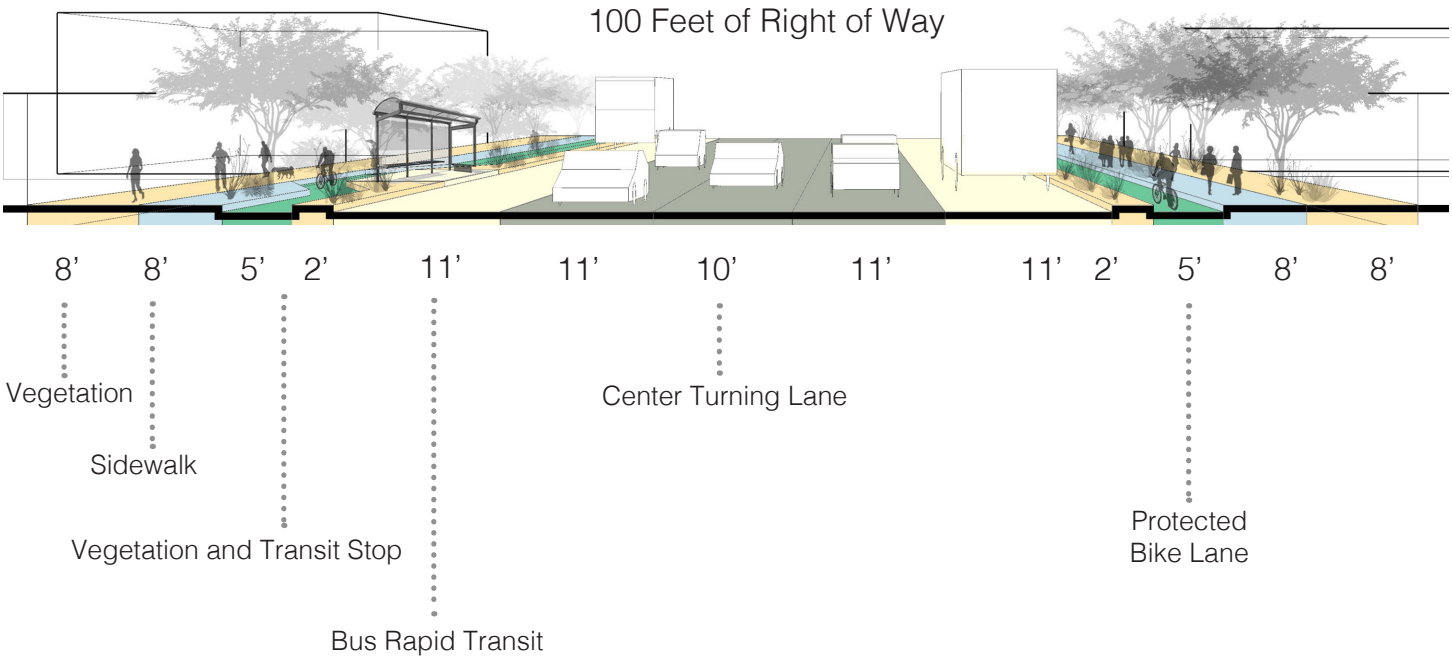


Figure 64: Street Typology

Site Plan

The design plan for 1st Avenue proposes activating the space with pedestrian amenity, economic opportunity and green infrastructure. Design awareness to these site objectives will improve accessibility, equity, and neighborhood identity.

Figure 65: Site Plan

Design Perspective

Activity development along 1st Ave. incorporates detention basins within existing topography and uses the feature to encourage native vegetation and social interaction.

Figure 66: Perspective

Design Perspective

Bus Rapid Transit along 1st Avenue encourages mobility with dignity by incorporating creative infrastructure with multi-modal forms of transportation.

Figure 67: Perspective

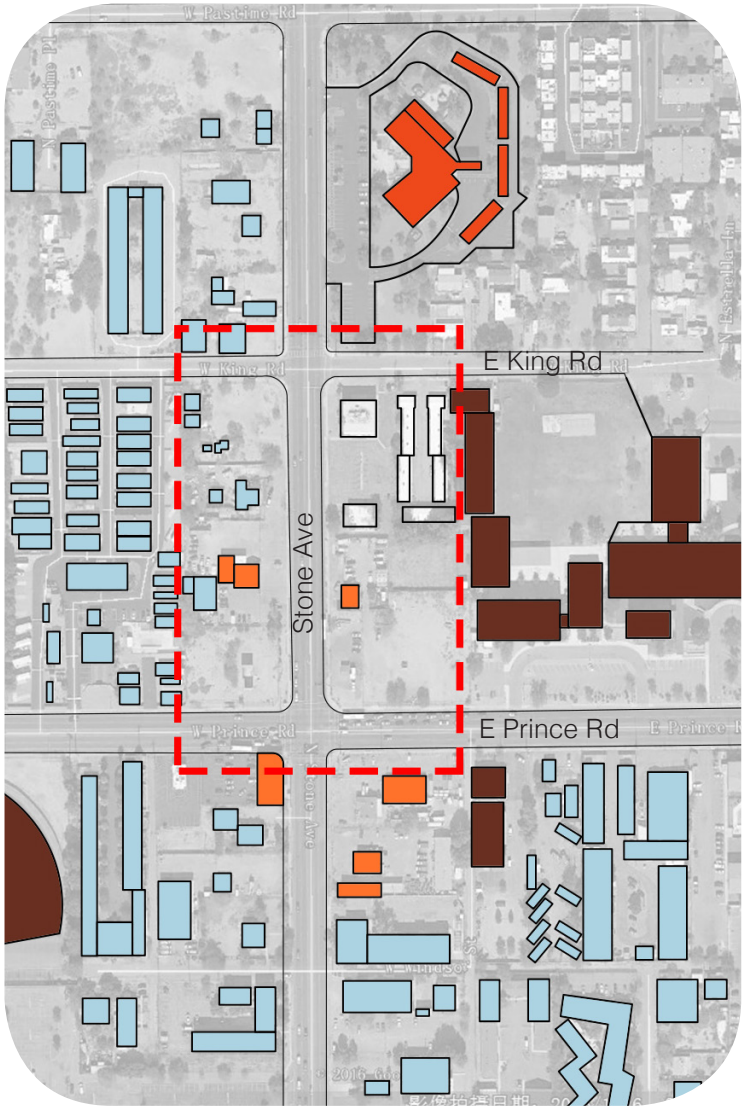
Activity Node 2

Stone Ave and Prince Rd
Activity Node number two runs the length of Stone Ave between E Prince Rd and E King Rd.

Figure 68: Context Map

Site Analysis - Stone Ave

A refined site analysis of building uses along the Stone Ave reveals that much of the current site contains sizable vacant and empty commercial properties. There are also several residential properties along the corridor with larger neighborhoods directly adjacent to the node. The site is also heavily influenced by the presence of local schools, including Prince elementary and Amphitheater middle and high school.



Commercial

Residential

School

Non-Profit

N

Figure 69: Site Analysis

Site Panorama

Stone Avenue exhibits vacant buildings, fences, and large areas of pavement that disconnect neighborhoods and economic activity.

Figure 70: Stone Ave Panorama

Proposed Street Typology - Stone Ave

Utilizing the Complete Streets Typology Matrix, Stone Avenue is considered a Prime Connector with a proposed 80 foot right of way. The road features protected bike lanes lined with native vegetation that shade pedestrians and cars parallel parked in the 7' designated parking lane.

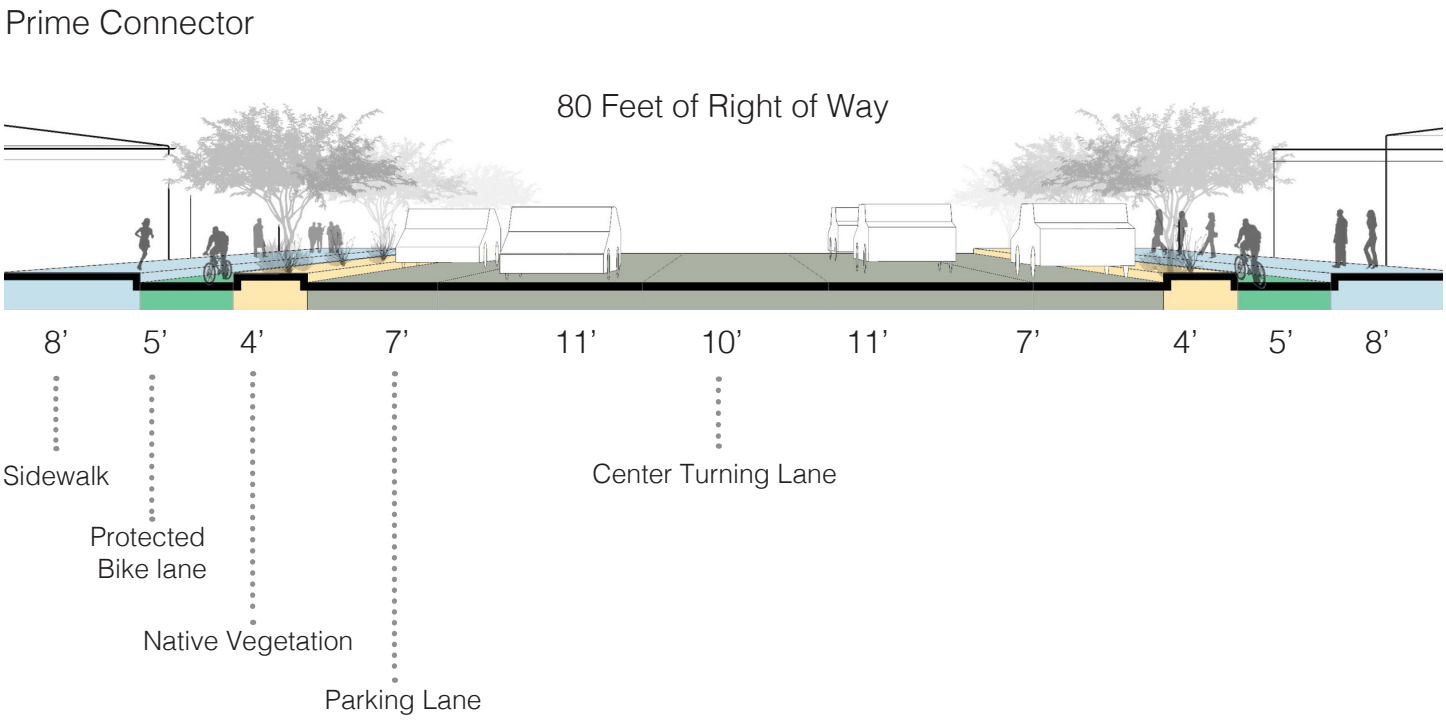


Figure 71: Street Typology

Site Plan

The Design Plan for Stone and Prince activates the area by connecting neighborhoods and area schools with public pedestrian infrastructure and traffic calming features. Commercial space is incorporated into the design for potential local restaurants and shops.

Figure 72: Site Plan

Design Perspective

Stone Ave re-imagines building orientations to create public pedestrian space and neighborhood connections from nearby schools. Colorful surfacing at crosswalks encourages pedestrian awareness and neighborhood identity.

Figure 73: Perspective

Design Perspective

Access to interior public space is made from both Stone and Prince, creating a corner of activity and pedestrian accessibility. This space also serves as opportunity for socializing, play, and local commercial development.

Figure 74: Perspective

Activity Node 3

Oracle Rd and Blacklidge Dr
Activity Node number three runs the length of Oracle Ave between Glenn St and Fort Lowell Rd.

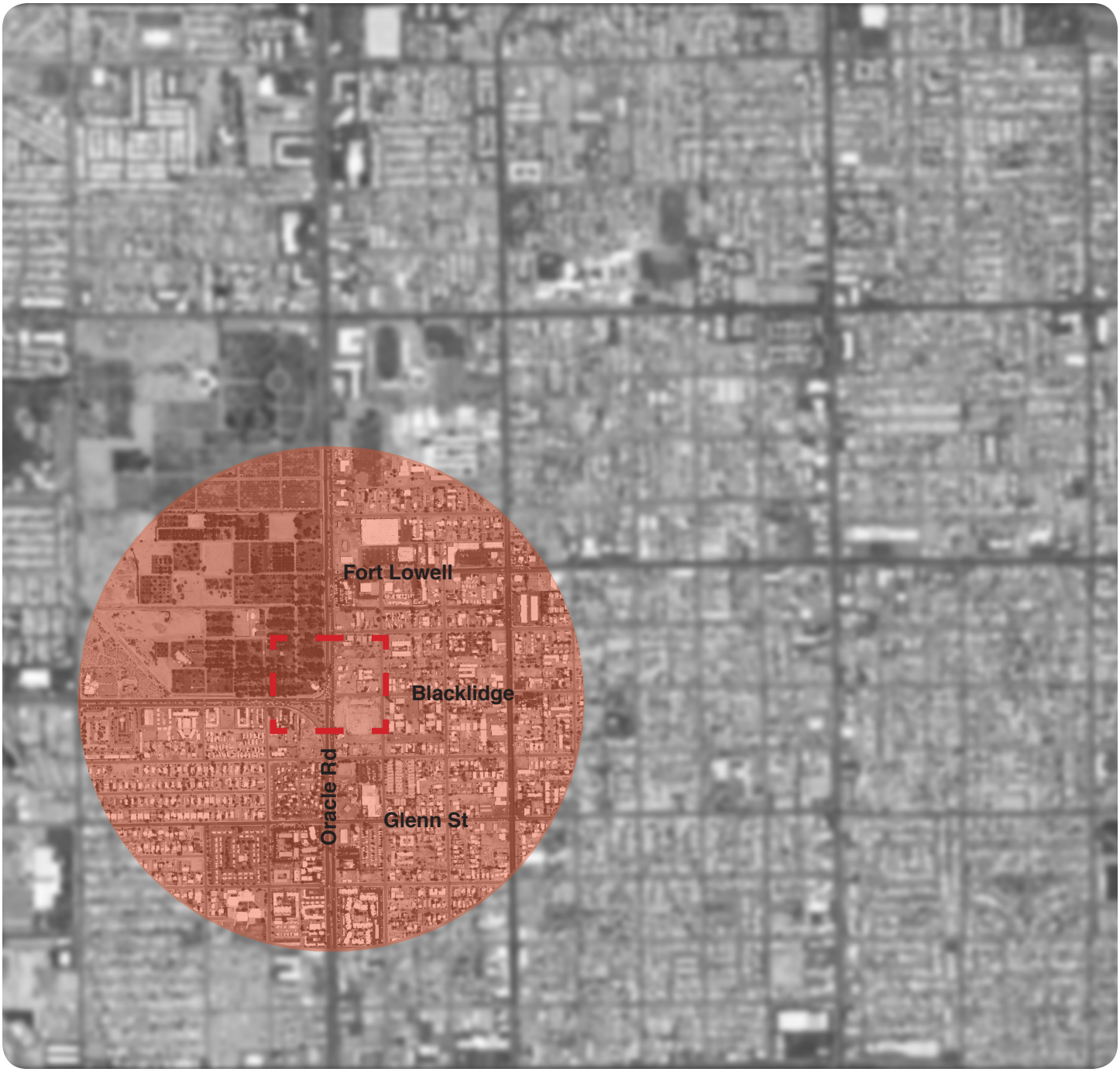
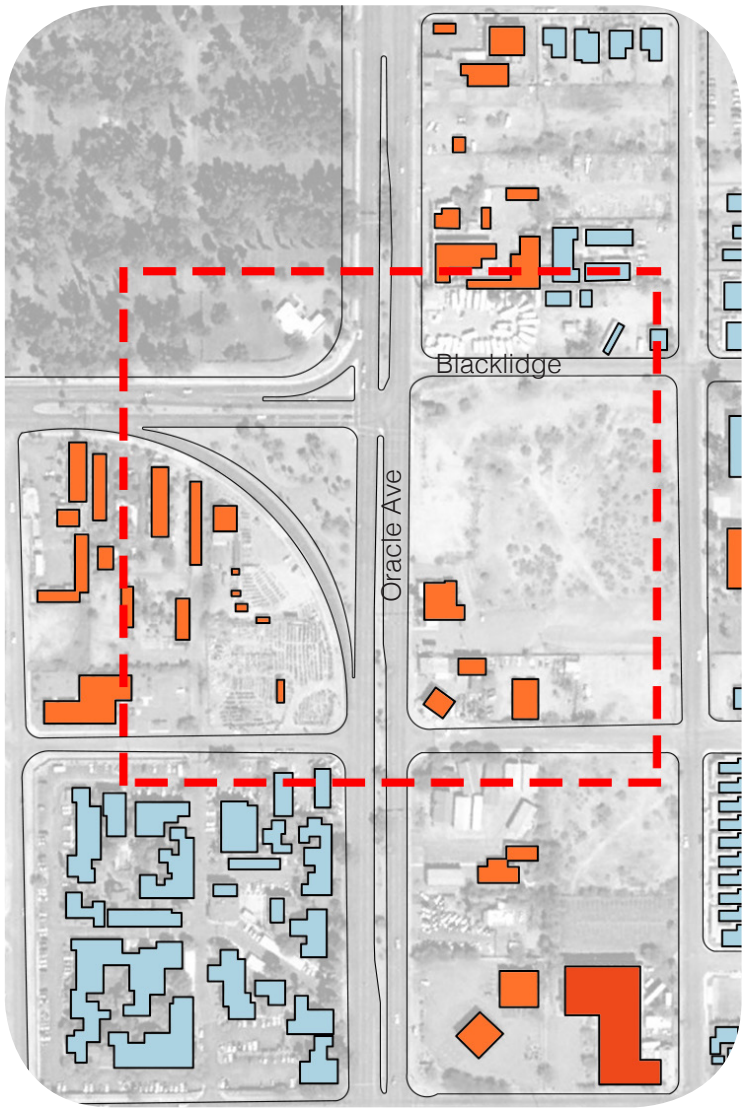


Figure 75: Site Context

Site Analysis - Oracle Rd

A refined site analysis of building uses and properties along the Oracle Rd reveals that much of the current site contains sizable vacant lots and isolated commercial properties. The intersection with Miracle Mile contains a large swath of property cut irregular to allows car to turn south onto Oracle Rd. The Holy Hope Cemetery takes up a large part of the west side of Oracle Rd after the Miracle Mile intersection. Additionally, there are residential properties located on three sides of the activity node.



Commercial

Residential

Non-Profit

Figure 76: Site Analysis

Site Panorama

Large vacant properties along Oracle and Blacklidge streets present opportunities for large scale development.

Figure 77: Oracle Site Panorama

Proposed Street Typology - Oracle Rd

Utilizing the Complete Streets Typology Matrix, Oracle Ave is considered a Major Arterial with a proposed 120 foot right of way. The road integrates Bus Rapid Transit lanes in addition to protected bike lanes and large pedestrian friendly sidewalks that are shaded with native vegetation.

Major Arterial

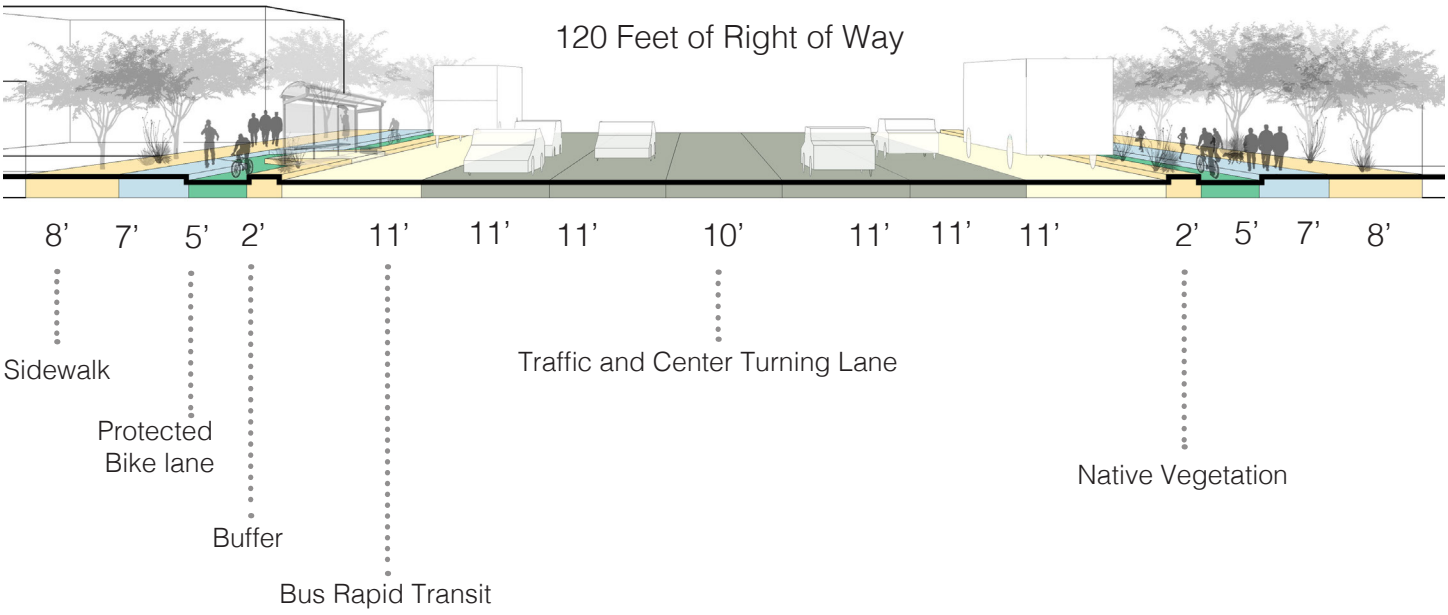


Figure 78: Street Typology

Site Plan - Oracle Activity Node

Oracle Road design development emphasizes the use of vacant lots to create new public recreation and commercial amenities while also connecting high traffic volumes to Bus Rapid Transit and improved street design. The Blacklidge bike boulevard features prominently in the design and connects all three activity nodes east/west with safe bike friendly infrastructure.

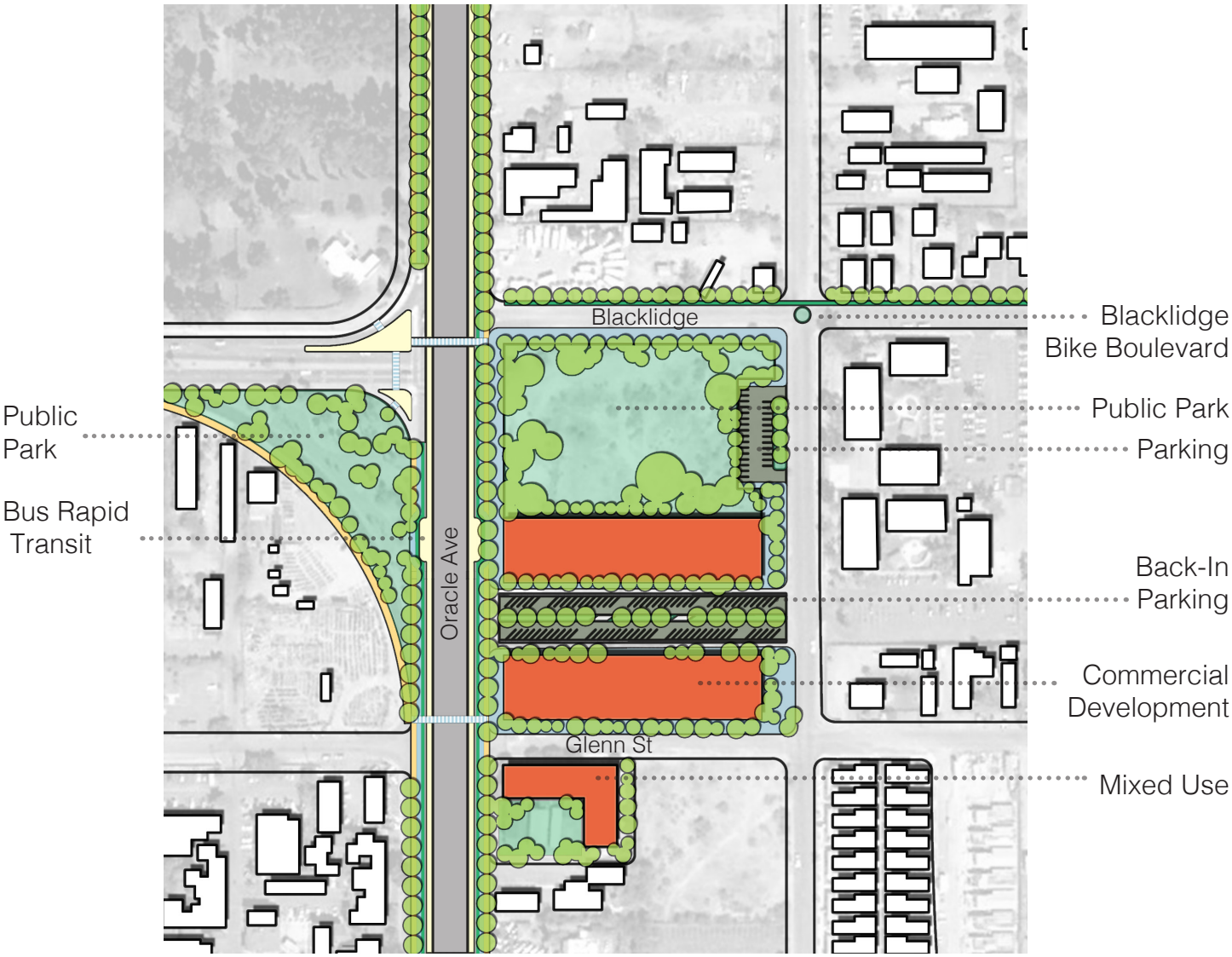


Figure 79: Site Plan

Oracle Rd

The Oracle Rd activity node incorporates economic development and recreational opportunities through the redevelopment of current vacant lots.

Figure 80: Perspective

Bike Boulevard

The Blacklidge Bike Boulevard connects all three Complete Street corridors through a safe and cyclist orientated east/west connection.

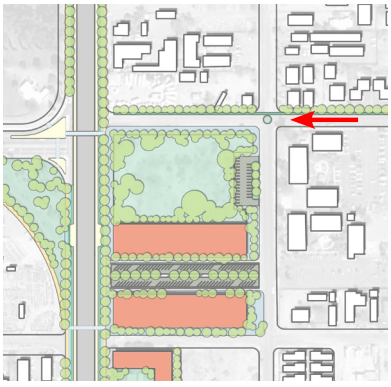


Figure 81: Perspective

Design Precedent

Precedent Images

These images provide built precedent and inspiration for several of the proposed design elements within the activity nodes. They incorporate opportunities for social, economic, environmental, and recreational development.

Figure 82: Precedent Images

Future Considerations

Figure 83 : Santa Clara Valley Complete Streets

Following the adoption of complete street strategies, it is important for the City of Tucson to outline a clear implementation and monitoring approach. In particular, the city must recognize how the complete streets policy and its design guidelines are affected by the Unified Development Code (UDC). This is because developers who will be responsible for aspects of construction seek to conform to the UDC as a standard. Therefore, if the complete street design guidelines are not congruent with certain codes, it is likely they will not be implemented. An example of such a discrepancy is between complete street sidewalk design for arterial corridors that calls for 6-foot-wide sidewalks with at least a 3-foot furniture zone that includes green infrastructure features. In contrast, the UDC states: "All sidewalks must be a minimum of four feet wide and installed to avoid any obstruction which decreases the minimum width to less than four feet" (Technical Standards Manual 7-01.4.3). Because complete street design is founded upon the reallocation of space for pedestrians this disagreement between code and policy could undercut the efficacy of complete street implementation.

Since transportation and land use are intricately connected aspects of the urban environment, improvements made to the roadway can have a substantial effect on the surrounding land uses. In the case of this complete streets policy, the implications would incentivize new mixed-use and transit-oriented development, creating a setting that is more walkable and revitalizes economically disadvantaged areas. However, the zoning in many instances may not permit this type of development. Accordingly, the use of an urban overlay zone would allow for all current land uses, while also permitting and incentivizing the new anticipated development. The City of Tucson has had significant success with overlay zones to achieve a desired urban form that emphasizes density and higher intensity uses. An example that has shown considerable success is the Main Gate Square Overlay Zone.

Public Participation Strategies

Public participation is not only required by planning projects, but is an essential aspect for the success of a project. Public participation grounds technical data in practical application and a community's experience. The public

should be brought into a project early during the planning phases to ensure that all stakeholders are included in early conversations; this can avoid negative outcomes for contentious decisions, and added costs in the future if a project fails to meet a community's needs causing the project to be retrofitted. Public participation can fall on a spectrum of citizen engagement, from non-participatory to more empowerment approaches, as illustrated in appendix D (Arnstein, 1969).

While the citizen control level of engagement might not be applicable for all projects, moving from a tokenism to citizen-power approach is beneficial for complete streets projects since these projects are based on an equity model and should meet the needs of the surrounding community. While bicycle, pedestrian, and traffic data can help identify where or what type of improvements are needed, so too can hearing community concerns and learning about their experiences.

The Appendix D outlines examples of public participation efforts that the city can use to capture the concerns of community members, as well as collect and provide meaningful information to the public. As the City of Tucson considers implementation of complete street strategies, they will need to prioritize

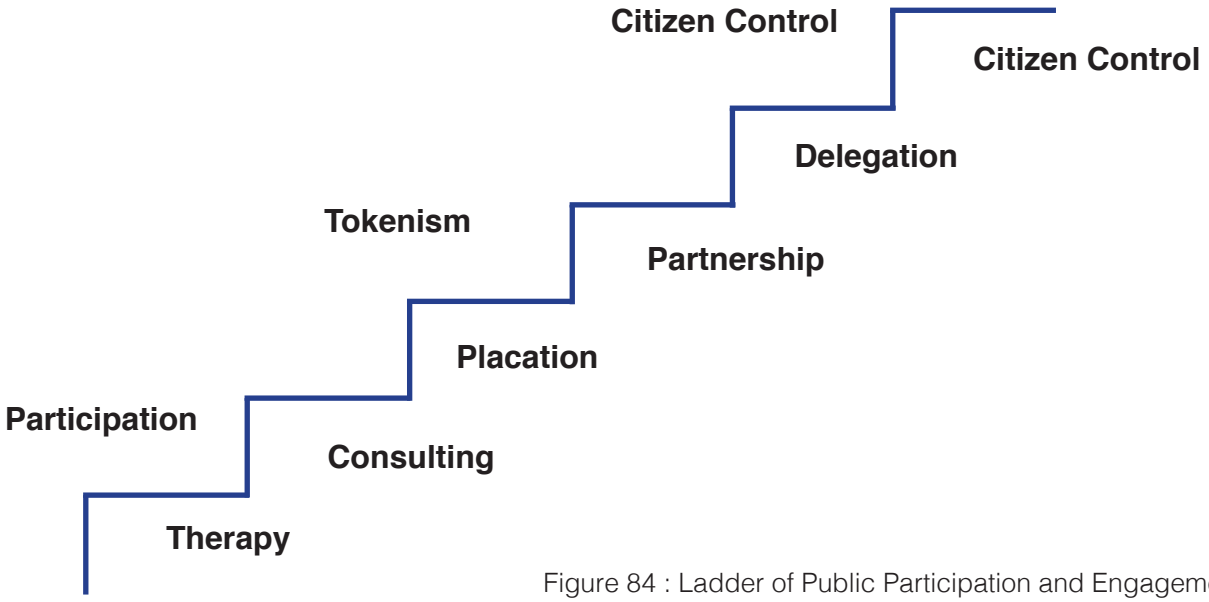


Figure 84 : Ladder of Public Participation and Engagement

projects and networks. Many variables should be considered when planning for future project locations, equity must be at the forefront of the conversation. Low-income communities can benefit greatly from complete street strategies since such communities rely on public transportation, and bicycle and pedestrian infrastructure for their day-to-day lives. Accordingly, it is recommended that the city uses tools like the SWFHC's Opportunity Index to help identify and inform priority areas.

The team recommends that the city prioritize implementing complete streets in the corridors illustrated on the following map. These corridors, illustrated by the red lines, are deemed high or moderately high priority areas because they intersect low-opportunity areas based on the SWFHC Opportunity Index, and because they create north-south and east-west connections across Tucson. Along these axes there are community assets, including the Tucson International Airport, Reid Park, the University of Arizona, Downtown Tucson, and the Tucson Mall. Projects along these axes would provide economic development opportunities near these major destinations, as well as increase the accessibility and dignity of the surrounding communities.

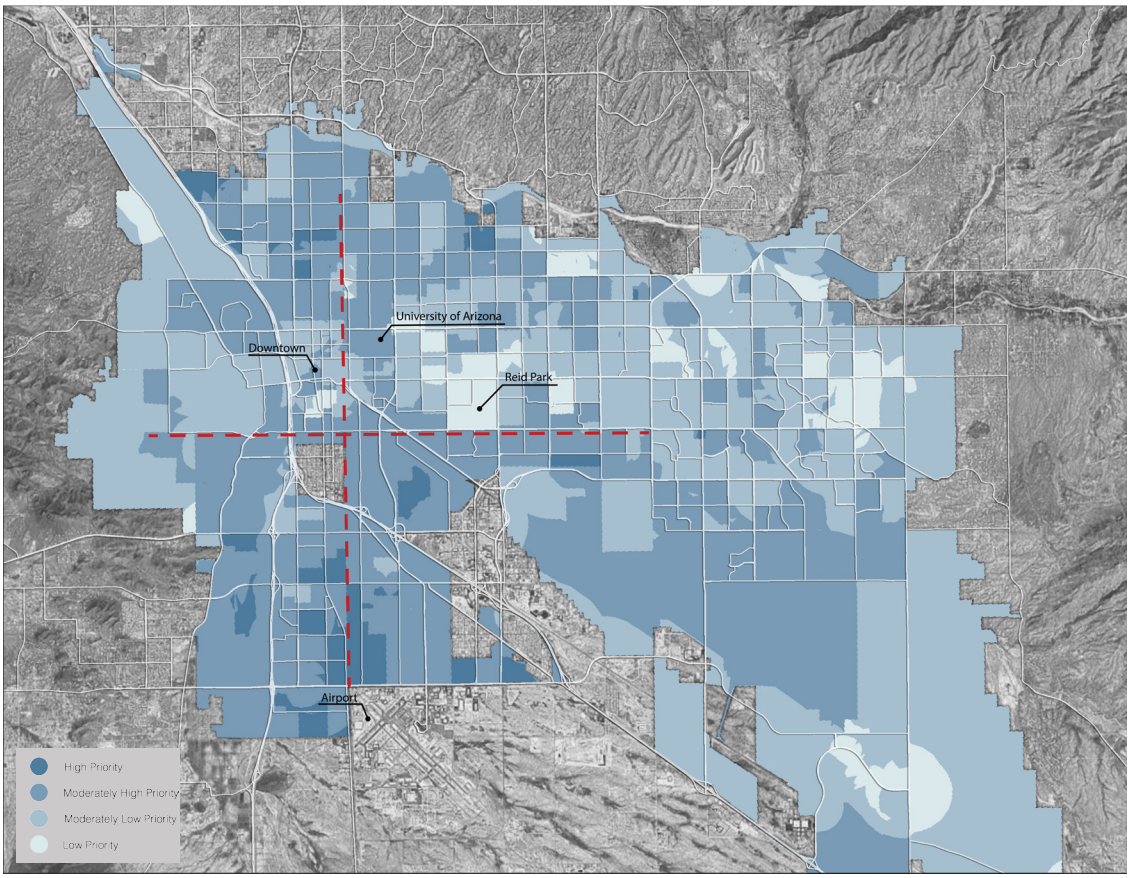


Figure 85 : Priority Areas, SWFHC Opportunity Map

Monitoring and Evaluation

In accordance with the policy recommendations, design guidelines, and design concepts of complete streets, the team developed recommended strategies to monitor the impact that complete streets have on roadway users, placemaking, and high capacity transit ridership (if and when implemented). Monitoring and evaluation can provide justification for future complete street enhancements to the ROW, in addition to providing insight into the types of design features that result in the most positive outcomes, as well as which complete street implementation strategies are the most effective. In order to accurately perform any type of monitoring and evaluation activity, the city must first collect baseline data before complete street improvements occur. The following tables display qualitative and quantitative monitoring and evaluation indicators that the team recommends the city uses to track the impacts to roadway users, placemaking, and high capacity transit ridership.

The transportation monitoring strategies outlined in Appendix E are designed to collect quantitative and qualitative data that will indicate if the design concepts and policy recommendations are supporting all modes of transit. The city should compare this data to the previous auto-centric corridor data and highlight any changes. The goal of the monitoring strategies is to track if there is an increase in the number and the mode share of transit riders, pedestrians, and bicyclists, while tracking if automobile usage decreases. The table also outlines other monitoring strategies designed to collect qualitative data from the public to determine their perceived safety and satisfaction of the corridor. The monitoring system considers each transportation mode which allows for unique data to be collected that can inform future improvements throughout each complete street corridor.

Future Considerations

The following placemaking monitoring strategies (Appendix F) are intended to monitor and evaluate the overall design and improvements to the corridor. Placemaking is critical to creating comfortable and inviting spaces which can determine the success of a project. Placemaking is especially important in Tucson to get people to stay and participate in a corridor, rather than just drive through it, by providing shaded, well-maintained, unique and attractive spaces that enhance an area's overall walkability. Since Tucson has a vibrant, unique culture and heritage and requires new developments to allocate 1% of the project budget to public art, the maintenance and inclusion of cultural elements and public art throughout corridors will continue to enhance an area's sense of place.

Business and land-use development are an indirect benefit of complete streets that can influence mode shares across each corridor and provide new destinations for the community. In the process of creating complete streets and complete street networks, underutilized and vacant parcels along corridors should be redeveloped to support complete street concepts and reactivate spaces. The development of unique overlay zones for corridors can help facilitate redevelopment and allow for unique design strategies that will contribute to the sense of place. The city can monitor the success of these strategies by tracking the usage of the overlays, new permits issued, and sales tax gains along the corridor.

The accessibility strategy (Appendix G) is designed to monitor safety hazards to ensure that corridors are accessible to all users. In particular, the maintenance of pedestrian infrastructure needs to be monitored and maintained to ensure that an area remains ADA compliant and free of obstacles that could prevent certain users from accessing and enjoying a space.

The runoff efficiency monitoring strategy is intended to track improvements to stormwater management throughout a corridor, compared to runoff volumes and quality prior to the streetscape improvements. Monitoring variables can include runoff captured by street trees, rainwater harvesting elements, bioswales, as well as the volume of runoff in streets, channels and washes. Runoff quality should also be monitored to determine if there is a decrease in pollutants entering the environment.

High capacity transit is an important design element of arterial and suburban corridors, as shown in the renderings of Oracle and 1st. Each of the following monitoring strategies are key components that distinguish high capacity transit systems from normal bus systems, and should be monitored to evaluate the impact of high capacity transit on the surrounding community.

The travel time monitoring strategy is designed to ensure that high capacity transit buses are arriving frequently and in accordance with the proposed schedule. Reliability influences ridership, thus it is important to track that each bus arrives on time to each stop to gain the trust of riders. Safety and security also influences ridership, thus traffic incidents and crime data will be analyzed and compared to the conditions with the traditional SunTran system. Customer satisfaction is a public input monitoring tool that can help the city understand riders' experience on the high capacity transit system. Ridership is a quantitative data measurement intended to show the overall performance of the high capacity transit system in contrast is the old SunTran service. Land development is a factor of high capacity transit , as the system can bring economic growth, and increased interest in development. This strategy will monitor the actual impact of any land use changes or development connected to new high capacity transit system. The environmental quality measure will compare air quality and fuel consumption of the new high capacity transit system to the previous SunTran system.

Appendix A

Plan Tucson
Future Growth Scenario Building Blocks

Existing Neighborhoods
Existing neighborhoods are primarily developed and largely built-out residential neighborhoods and commercial districts in which minimal new development and redevelopment is expected in the next several decades. The goal is to maintain the character of these neighborhoods, while accommodating some new development and redevelopment and encouraging reinvestment and new services and amenities that contribute further to neighborhood stability.

Neighborhoods with Greater Infill Potential
Neighborhoods with greater infill potential are residential neighborhoods and commercial districts for which there is potential for new development and redevelopment in the next several decades. In some areas, entire new neighborhoods may be built. These neighborhoods are characterized by an urban scale that allows for more personal interaction, while providing safe and convenient access for all ages and abilities to goods and services needed in daily life. These neighborhoods include a mix of such uses as a variety of housing types, grocery stores and other retail and services, public schools, parks and recreational facilities, and multi-modal transportation choices.

Neighborhood Centers
Neighborhood centers feature a mix of small businesses surrounded by housing and accessed internally and from nearby neighborhoods by pedestrian and bike friendly streets and by transit.

Downtown
Downtown Tucson acts not only as a regional employment and administrative center, but also as a major hub for public transit services and connections (light and commuter rail, regional buses, streetcar). It is a vital pedestrian-oriented urban area that provides higher-density housing, retail, art and culture, and entertainment for its residents and those of greater Tucson.

Business Centers
Business centers are major commercial or employment districts that act as major drivers of Tucson's economy. These centers generally contain corporate or multiple-use office, industrial, or retail uses. Existing examples in Tucson include the University of Arizona Science and Technology Park, Tucson Mall, and the Tucson International Airport area.

Mixed-Use Centers
Mixed-use centers combine a variety of housing options, retail, services, office, and public gathering places, located close to each other, providing occupants of the center and the residents and workers in the surrounding neighborhoods with local access to goods and services. Public transit, bicycles, and walking will get priority in these areas although cars will still play an important role. Existing examples in Tucson include Williams Centre, Gateway Centre, and the Bridges.

Campus Areas
Campus areas include and surround large master-planned educational, medical, or business facilities. A fully-realized campus area serves the local workforce and student population and includes a range

of housing, a variety of retail opportunities, and convenient transit options. Campus areas often accommodate businesses that are the spin-off of economic development opportunities generated by the primary employers. Existing examples include the University of Arizona, Pima Community College, Tucson Medical Center, Saint Joseph's Hospital, Saint Mary's Hospital, University Physicians Hospital, and the Veterans Affairs Medical Center.

Industrial Areas
Industrial areas are strategically located for efficient handling of intermodal freight movements. These areas support national and international freight movement through Tucson by connecting existing major regional commercial transportation routes, including railway, major highways, and the airports

Houghton Corridor Area
Development in the Houghton Corridor Area is to be master planned with a cohesive system of mixed-use centers and neighborhoods, providing a variety of housing types and densities, a compact development pattern, a transportation and circulation system that offers alternatives for mobility, and a regional open space system. A phased approach to development will provide for increased efficiency of infrastructure and services for residents.

Southlands
Southlands is a long-term growth area, formed predominantly by large tracts of undeveloped land located at the southeastern and southern perimeters of the city. A large portion of this area is administered by the State Land Department. Prior to releasing these lands for development, the State will initiate planning efforts to promote orderly phased development that reflects sustainable and innovative community design.

Potential Annexation Areas
Potential Annexation Areas are areas that the City of Tucson may be pursuing for annexation within the next decade, working with other local jurisdictions with the ultimate goal of having urban commercial and residential areas located within incorporated cities and towns.

Appendix B

Plan Tucson
Policies congruent with Complete Streets

Public Safety (PH)

- PS 3- Reduce potential harm to life and property in natural hazard areas and from hazards resulting from human activities and development through preventive measures.

Parks and Recreation (PR)

- PR 2- Prioritize repairing, maintaining, and upgrading existing recreational facilities.
- Public Health (PH)
- PH 1- Pursue land use patterns; alternate mode transportation systems, including multipurpose paths; and public open space development and programming that encourage physical activity, promote healthy living, and reduce chronic illness.
- PH 4- Increase access to healthcare services through provision of reliable, affordable transportation options.
- PH 8- Support streetscape and roadway design that incorporates features that provide healthy, attractive environments to encourage more physical activity.

Jobs and Workforce Development (JW)

- JW 1- Recognize and enhance the three interrelated building blocks of a strong economy: a high quality of life and vibrant urban environment, a skilled and talented workforce, and a diversified, high-wage job market.

Business Climate (BC)

- BC 5- Foster the success of commercial areas, including downtown; major corridors; and arts, entertainment, and business districts through targeted investment, incentives, and other revitalization strategies.
- BC 6- Enhance the community attributes that are mutually beneficial to the business climate and quality of life for residents, including a safe environment, recreational opportunities, multi-modal transportation, a vibrant downtown, distinctive neighborhoods, excellent education, primary and secondary employment opportunities, and arts and entertainment venues.
- BC 8- Support a safe, distinctive, well-maintained, and attractive community with neighborhoods made up of residences and businesses that contribute to Tucson's quality of life and economic success.

Tourism and Quality of Life (TQ)

- TQ 4- Recognize the importance of well-maintained and attractive roadways and gateways in establishing an initial impression for visitors and generating pride among residents.
- TQ 5- Promote Tucson as a premier healthy lifestyle, outdoor, and recreational destination for cycling, hiking, bird watching, astronomy, nature, desert ecology, golf, spas, wellness, and healthcare.

Energy and Climate Readiness (EC)

- EC 4- Increase the use of low carbon and renewable energy sources, high fuel efficiency vehicles, and non-motorized transportation.

Appendix B

Green Infrastructure (GI)

- GI 1- Encourage green infrastructure and low impact development techniques for stormwater management in public and private new development and redevelopment, and in roadway projects.

Historic Preservation (HP)

- HP 4 - Identify historic streetscapes and preserve their most significant character- defining features.

Public Infrastructure, Facilities, & Cost of Development (PI)

- PI 3- Expand the use of State-of-the-art, cost-effective technologies and services for public infrastructure and facilities.

Land Use, Transportation, & Urban Design Policies (LT)

- LT 1- Integrate land use, transportation, and urban design to achieve an urban form that supports more effective use of resources, mobility options, more aesthetically-pleasing and active public spaces, and sensitivity to historic and natural resources and neighborhood character.
- LT 3- Support development opportunities where:
    - residential, commercial, employment, and recreational uses are located or could be located and integrated there is close proximity to transit,
    - multi-modal transportation choices exist or can be accommodated there is potential to develop moderate to higher density development,
    - existing or upgraded public facilities and infrastructure provide required levels of service, parking management and pricing can encourage the use of transit, bicycling, and walking.
- LT 4- Ensure urban design that:
    - is sensitive to the surrounding scale and intensities of existing development,
    - integrates alternative transportation choices, creates safe gathering places, and fosters social interaction,
    - provides multi-modal connections between and within building blocks,
    - includes ample, usable public space and green infrastructure that takes into account prominent viewsheds.
- LT 9- Locate housing, employment, retail, and services in proximity to each other to allow easy access between uses and reduce dependence on the car.
- LT 12- Design and retrofit streets and other rights-of-way to include green infrastructure and water harvesting, complement the surrounding context, and offer multi-modal transportation choices that are convenient, attractive, safe, and healthy.
- LT 13- Continue to explore and monitor opportunities to increase the use of transit, walking, and bicycles as choices for transportation on a regular basis.
- LT 14- Create pedestrian and bicycle networks that are continuous and provide safe and convenient alternatives within neighborhoods and for getting to school, work, parks, shopping, services, and other destinations on a regular basis.
- LT 16- Reduce required motor-vehicle parking areas with increased bike facilities for development providing direct access to shared use paths for pedestrians and bicycles.

Appendix C

Southwest Fair Housing Council Opportunity Index Metrics

Education	Housing & Neighborhood	Economy	Transportation	Health & Environment
Adult Education Attainment - % Population 25 and over with Associates degree or higher(+)	**Vacancy Status - % of housing units vacant (-)**	**Poverty Rate- % population below poverty line (-)**	**Commute Time- % of HH with commute time 30 minutes or greater**	**Healthcare Access- % population uninsured (-)**
1 - Low %	1 - Low %	1 - Low %	1 - Low %	1 - Low %
5 - High %	5 - High %	5 - High %	5 - High %	5 - High %
Early Childhood Education - % Ages 3-5 in school (+)	**Median Home Value (+)**	**Income - Median HH income (+)**	**Public Transit Access - % of communities using public transit (+)**	**Proximity to Healthcare Facilities (+)**
1 - Low %	1 - Low %	1 - Low %	1 - Low %	1 - Low %
5 - High %	5 - High %	5 - High %	5 - High %	5 - High %
High school Dropout Rate - % of students 16-19 whose educational attainment is less that HS diploma(-)	**Rental Housing Affordability - % of household spending 30% or more of HH income on rent (-)**	**Unemployment Rate - % of population 16 & over unemployed (-)**	**Car Access - % of commuters using personal vehicle (+)**	**Proximity to grocery stores/ farmer's markets (+)**
1 - Low %	1 - Low %	1 - Low %	1 - Low %	1 - Low %
5 - High %	5 - High %	5 - High %	5 - High %	5 - High %
Schools Proficiency Index - (standardized reading & math scores) (+)	**Public Housing Developments - # of Subsidized housing developments(-)**	**Public Assistance- % of population on public assistance (-)**		**Proximity to parks, trails, and open space (+)**
1 - Low %	1 - Low %	1 - Low %		1 - Low %
5 - High %	5 - High %	5 - High %		5 - High %
	Public Investment- # of CDBG projects (-)	**Jobs Proximity - (distance to all jobs in the CBSA) (+)**		**Proximity to Toxic Waste Sites (-)**
	1 - Low %	1 - Low %		1 - Low %
	5 - High %	5 - High %		5 - High %

Appendix D

Public Participation Recommendations

Public Participation	Description	Outcome	Resources
Every Experience Counts	This is an activity that can be facilitated by city staff or community leaders. It is a low-cost activity that uses hard candy's and plastic cups to help participants understand equity, transportation and the transportation decision-making process. A series of statements are read and participants put one hard candy in their cup if they have experienced a statement. For example, one of the statements read is "Drop a candy in your cup if it takes you more than 15 minutes to drive to the nearest grocery store."	Facilitator and participants understand the breadth of experiences that affect the community's transportation decisions.	https://ntl.bts.gov/lib/60000/60600/60685/EPCLA_FacilitatorGuide.pdf
LSA Walkability Assessment	LSA facilitates walkability assessments with neighborhoods to document current walking conditions and to generate ideas about possible improvements. This includes both a walkability presentation and a neighborhood walk and talk. These assessments can be used as a tool to gain traction in neighborhoods to advocate for change and can be a way to show quantitative, systematically collected data to compare walkability across neighborhoods.	Participants and city understand neighborhood assets, shortcomings and how complete streets can address community needs.	https://www.livingstreetsalliance.org/our-work/programsservices/neighborhood-=walking-assessments/
Community Field Trips	Community field trips are useful public participation tools after a site has been selected. These events require leading community members in groups of 8-10 by foot to sites that are under consideration and may be unfamiliar to community members. Stations can be set up at these sites that provide a chance for community members to give feedback, as well as learn more about possible future enhancements.	City understands community assets, pros and cons of specific locations along project study corridors, and informs community members about the project.	http://www.useful-community-development.org/community-engagement.html
Interactive Website	Once a project is underway, creating a project website is a great way to spread information to communities. What's even more useful, is the ability to extract information from the community through a website. Interactive websites, such as Social Pinpoint, allows community members to post locations that they would like to see improvements or locations where they've identified particular issues. Feedback can be aggregated and used to systematically create change.	Qualitative data is collected to help direct complete streets projects. The community has easy access to project(s) information and status.	https://www.socialpinpoint.com/

Transportation Monitoring Recommendations

Transportation Monitoring Strategy	Pedestrians	Bicyclists	Automobile Users	Public Transit Riders
Users Counts	Numeric (Counts)	Numeric (Counts)	Numeric (ADT)	Numeric (Ridership)
Traffic Incidents	Numeric (accidents with automobiles, bikes, public transit)	Numeric (accidents with automobiles, pedestrians, public transit)	Numeric (accidents with other automobiles, pedestrians, public transit, bicyclists)	Numeric (accidents with automobiles, pedestrians, bicyclists)
Mode Share	Numeric (accidents with automobiles, bikes, public transit)	Numeric (accidents with automobiles, pedestrians, public transit)	Numeric (accidents with other automobiles, pedestrians, public transit, bicyclists)	Numeric (accidents with automobiles, pedestrians, bicyclists)
Perceived Safety	Public Participation Rating System	Public Participation Rating System	Public Participation Rating System	Public Participation Rating System
User Satisfaction (live, work, play)	Public Participation Rating System	Public Participation Rating System	Public Participation Rating System	Public Participation Rating System

Appendix F

Placemaking Monitoring Recommendations

Placemaking Monitoring Strategy	Description
Sidewalk Shade	Increases in tree canopy - ensure adequate shade is available for pedestrians and bicyclists using street trees.
Landscaping & Street Furniture	Maintain green spaces and furniture areas (benches, trash cans, signage) that enhance the experience of all users.
Parcel Development	Support the development of empty or underutilized parcels.
Accessibility	Ensure all areas of the corridor are ADA accessible, and free of all other safety hazards.
Runoff Efficiency & Quality	Monitor new runoff volumes and quality to pre-project data.
Culture & Public Art	Maintain sculptures and murals along the corridors while facilitating the installation of new art features that represent the community and Tucson as a whole.

Appendix G

High Capacity Transit Monitoring Recommendations

High Capacity Transit Monitoring Strategy	Description
Travel Time	Comparing average travel times to the current SunTran service.
Reliability	Tracking the arrival time of the High capacity transit to ensure it is closely aligned with the posted schedule.
Safety & Security	Comparing pedestrian, passenger, and bike crash data, as well as crime date in the surrounding data, before and after implementation.
Customer Satisfaction	Understanding the public perception of the High capacity transit system compared to old SunTran service. Could include a public survey or other public participation element.
Ridership	Increases or decreases in ridership per mile of a route, compared to SunTran service. This strategy could also be compared to other cities' High capacity transit ridership.
Land Development	Factors include economic growth, permits issued, and the creation of higher density areas.
Environmental Quality	Comparing fuel consumption of new High capacity transit buses to SunTran buses, and measuring the air quality of corridors.

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