



BIKE & PEDESTRIAN PATH SHADE STUDY



JUNE 2019

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INTRO- DUCTION



FIGURE 1-1: STATEMENT OF DIRECTION - GOODYEAR BALLPARK ENTRY



FIGURE 1-2: GOODYEAR BALLPARK ENTRY

WHY THIS STUDY?

This study supports two City Council priorities identified in the Goodyear Strategic Plan FY19-21: "Create a Sense of Community" and "Quality of Life". The study provides guidance for increasing shade and comfort for bicyclists and pedestrians in the city of Goodyear.

The study's focus was twofold:

- 1 Better understand the existing shade canopy of bicycle and pedestrian facilities in representative areas and corridors of the city
- 2 Identify gaps in the bicycle and pedestrian network in those areas.

With this information, the city can make informed decisions to close the gaps and increase the level of shade for these and other areas. With these improvements the city will gain the benefits of shade; reducing the heat island effect, reducing storm runoff, and a more livable and comfortable city.

A more comfortable and accessible bicycle and pedestrian environment

will also encourage greater use of the city's existing active transportation network (bicycle and pedestrian) helping to build a healthier and stronger community.

The landscape of the city of Goodyear is diverse. It reflects a city in a state of flux as it remains grounded in its agricultural roots but shifts towards development at numerous scales from infill to large master-planned communities. The addition of shaded active transportation facilities will serve to reinforce the identity of Goodyear as a great place to live and highlight a commitment to healthy lifestyles and the environment.

The Study is comprised of:

- Best Practices (potential goals) for a desirable percentage of shade coverage for bicycle and pedestrian corridors
- An inventory of existing trees and shade structures within representative study areas and corridors
- Shade coverage percentages and quantitative values for the existing tree canopies for the

representative study areas and corridors

- Benchmarking of several comparable and aspirational communities
- A toolbox for establishing a shade canopy through the use of native and drought-adaptive trees and built structures
- Typologies for how and where to increase shade along pedestrian and bicycle facilities
- A project prioritization methodology for selecting projects with the greatest community impact
- Estimates of probable cost for achieving desirable shade percentages
- A map identifying gaps in the active transportation system within the study boundaries
- Tree maintenance guidelines for private and public use
- Budgeting and funding guidance
- Ideas on planning for the future

BENEFITS OF A HEALTHY TREE CANOPY

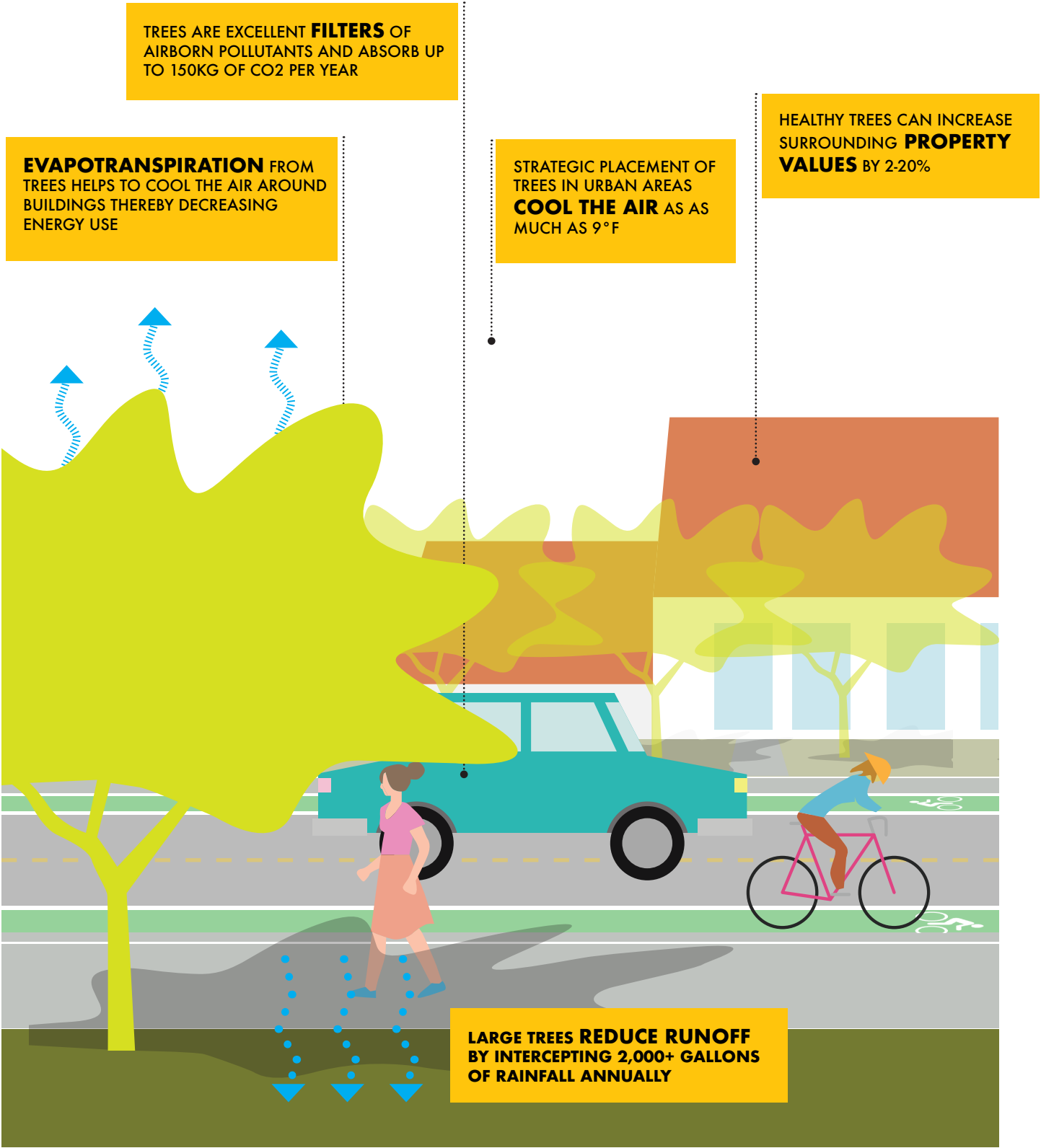


FIGURE 1-3: BENEFITS OF A HEALTHY TREE CANOPY



FIGURE 1-4: RECCOMENDED GOALS OVERVIEW

* Based on 2019 iTree Eco data reports from collected tree information in the study boundary



FIGURE 1-5: PISTACHE TREE AT BALLPARK



FIGURE 1-6: CENTERRA DRIVE NORTH OF HARRISON ST

EXISTING CONDITIONS

This study focused on documenting active transportation shade coverage in two categories, corridors and focus areas. Ten corridors were documented for shade coverage along active transportation facilities (sidewalks, bike lanes and multi-use paths/trails), totaling 30 miles along arterial and collector roadways. Five focus areas were documented for overall shade coverage and shade coverage along active transportation facilities (sidewalks, bike lanes and multi-use paths/trails); all public roadways and parks within the focus areas were included. The five focus areas were selected to be representative of the existing conditions throughout Goodyear and includes the following areas:

- a linear park
- a commercial/mixed-use area
- a contemporary residential neighborhood
- a historic residential neighborhood
- the Goodyear Ballpark

Collectively, these corridors and focus areas give a representative

snapshot of existing shade coverage for pedestrian and bicycle corridors on public lands and rights of way throughout the city.

A total of 6,626 trees were documented. Only five shade-producing structures were documented, three within the Bullard Wash Park and two on the corner of Estrella Pkwy and Van Buren St. The documented trees and structures were separated into the previously mentioned categories of corridors and focus areas. Both categories are focused on the shade coverage of active transportation facilities within them. The average estimated shade coverage of the developed bicycle and pedestrian facilities within the ten corridors and five focus areas are as follows:

- Corridors - **22%**
- Focus Areas - **10%**
- Combined - **16%**

The full descriptions and coverage percentages are expanded upon by corridor and area starting on page 12.

This study will work to counteract a number of existing conditions within Maricopa County including the 11% rise in heat-related fatalities between 2016 and 2017. According to a 2019 report from Climate Central, these heat-related deaths in the Phoenix area have come with longer periods of temperatures above 100° degrees Fahrenheit, overall average temperatures rising over 4.35° degrees since 1970, and around an 8° degree rise in nighttime averages *. This put the Phoenix area at number four in the top cities with reported temperature changes. Four of the top five affected cities are in the southwest.

The information derived from shade coverage data was used to develop shade-producing typologies for these typical bicycle and pedestrian corridors in the city of Goodyear.

Tree, shrub, turf and other coverage percentages for the entire acreage within the five representative study areas is included in Appendix A.

U.S. FOREST SERVICE: I-TREE

This study utilized a state-of-the-art, peer-reviewed software package from the USDA Forest Service called the i-Tree Suite, with a heavy focus on i-Tree Streets, i-Tree Eco V6, and i-Tree Canopy. These tools use data that was collected through a canopy inventory of the study area, which included trees and structures, to calculate and analyze the benefits and coverage provided by the urban forest along pedestrian and bicycle corridors.

The data was analyzed along 35' wide bicycle and pedestrian corridors within public right of way and park land. Trees were documented within that 35' corridor in order to determine overall benefits of the shade canopy impacting the bicycle and pedestrian facilities. Along streets, the 35' was measured from back of curb. In public parks the 35' was centered on the path.

The software used data to calculate the benefits of the urban tree canopy along bicycle and pedestrian corridors. The software and data used are outlined below.

See appendix for additional information.

i-Tree Streets

i-Tree Streets was used to quantify the benefits of the tree canopy along all corridors and roadways within the study area. It uses tree data to estimate the economic benefits the trees provide on local Energy (Electric/Gas), Carbon, Air Quality, Stormwater, and Aesthetics/other within the corridor.

i-Tree Eco Version 6

i-Tree Eco Version 6 was used to analyze the data gathered from the trees and produce a report that:

- estimates canopy coverage
- estimates economic benefits to air quality and stormwater
- estimates structural value of the existing trees
- estimates tree canopy
- provides an overview of the species and size of the trees collected.

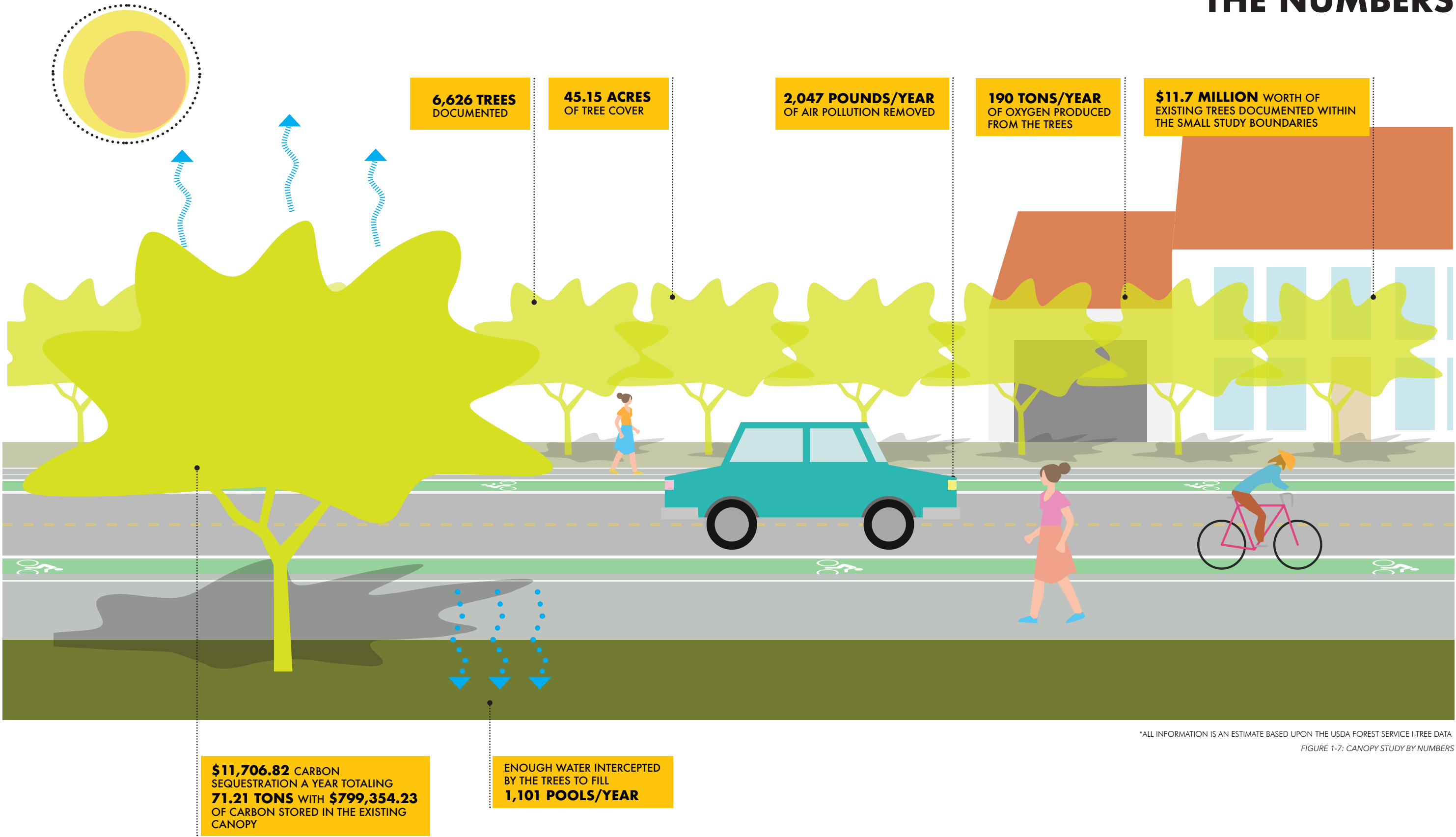
i-Tree Canopy

i-Tree Canopy is a randomized point collector used to estimate the total coverage of a selected area. It was used to estimate the coverage of trees, buildings, hardscapes (roads, sidewalks, etc.), shrubs/grass, bare ground, and water within selected areas. This was used to check the data produced by Eco to ensure the ranges of canopy coverage in the 35' corridors were correct.

* 2019 American Warming: The fastest-warming cities and states in the U.S. - Climate Central

EXISTING CONDITIONS
i-TREE DATA

**STUDY BY
THE NUMBERS**



EXISTING CONDITIONS

STUDY BOUNDARIES

Staff identified 15 representative geographies of the city whose study findings could yield replicable solutions for the greater community. The geographies are broken into ten corridors and five focus areas.

The five selected focus areas represent broad and diverse sections of the city. The information found

in these areas are representative of other areas of the community developed in similar timeframes. The ten selected corridors serve as connections to areas of the city that have the greatest potential for walking and biking to residential, commercial and entertainment uses. These corridors also connect our future Civic

Square at Estrella Falls and McDowell Road Corridor to Estrella Parkway, the Goodyear Ballpark, West Goodyear neighborhoods and our historic communities.



LEGEND

AREAS

- 1 LINEAR PARK
- 2 COMMERCIAL/MIXED-USE
- 3 CONTEMPORARY RES.
- 4 HISTORIC RESIDENTIAL
- 5 BALLPARK

AREAS

- 1 MONTE VISTA RD & 150TH DR
- 2 VIRGINIA AVE/ENCANTO BLVD
- 3 BULLARD AVE (NORTH)
- 4 McDOWELL RD
- 5 ROOSEVELT ST

CORRIDORS

- 6 VAN BUREN ST
- 7 YUMA RD
- 8 CITRUS RD
- 9 ESTRELLA PKWY/PEBBLECREEK PKWY
- 10 BULLARD AVE (SOUTH)/ELWOOD ST

FIGURE 1-8: STUDY BOUNDARY

EXISTING CONDITIONS

STUDY BOUNDARIES

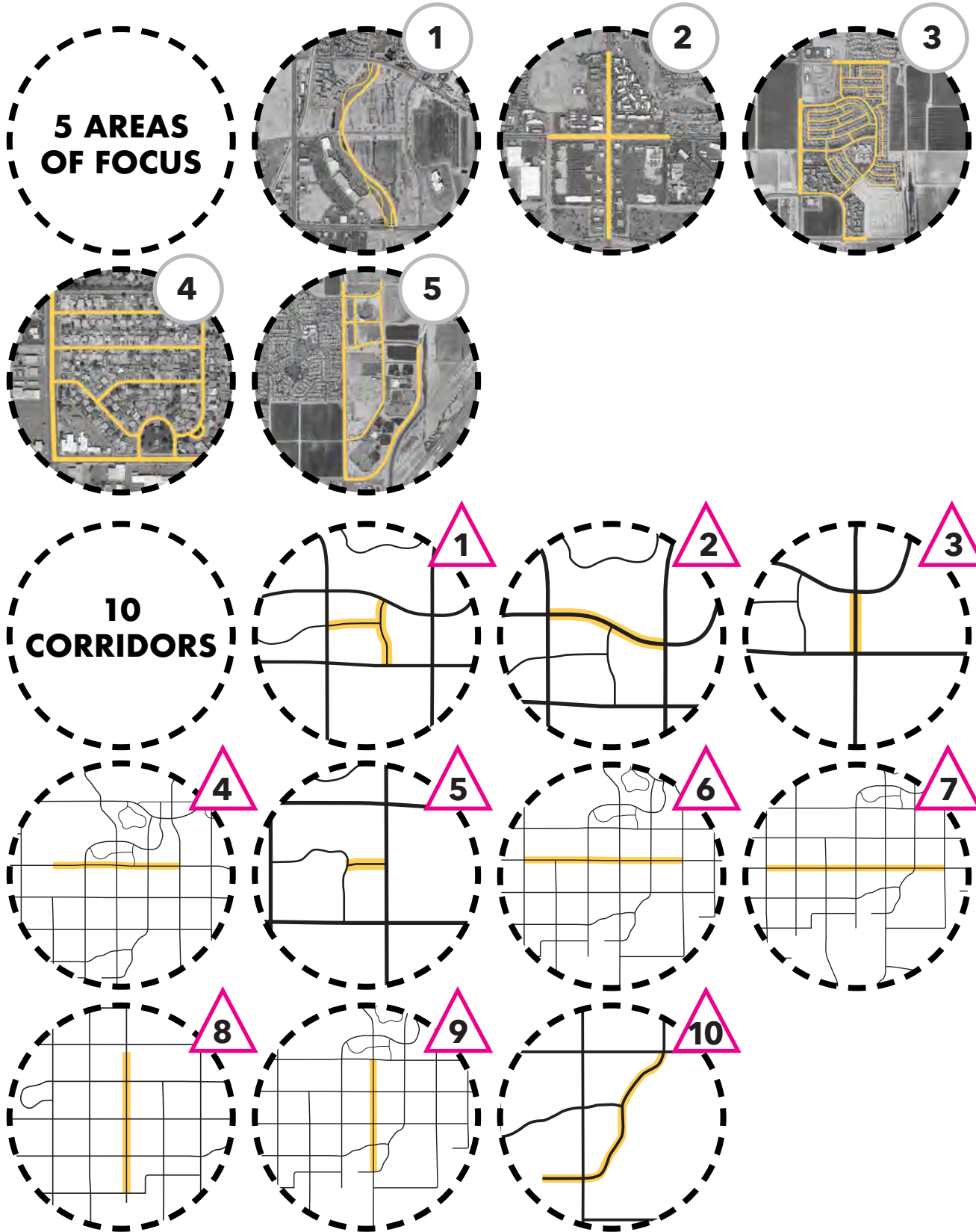


FIGURE 1-9: STUDY FOCUS AREAS AND CORRIDORS OVERVIEW



FIGURE 1-10: AREA 1 - LINEAR PARK - LOCATION MAP

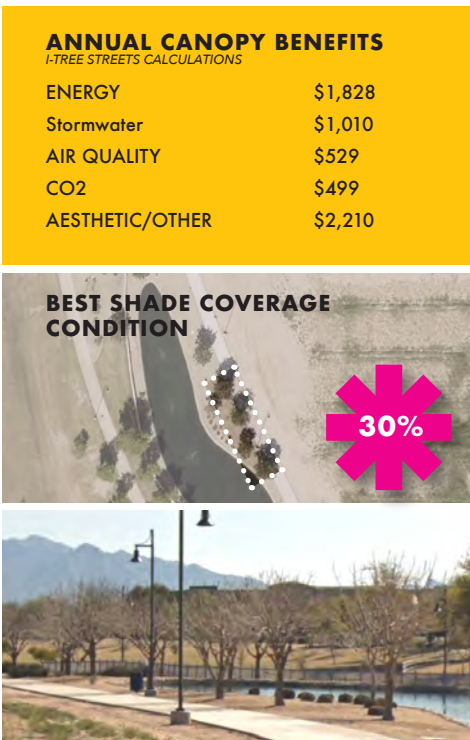


FIGURE 1-11: AREA 3 - LINEAR PARK - BENEFITS/BEST CONDITIONS

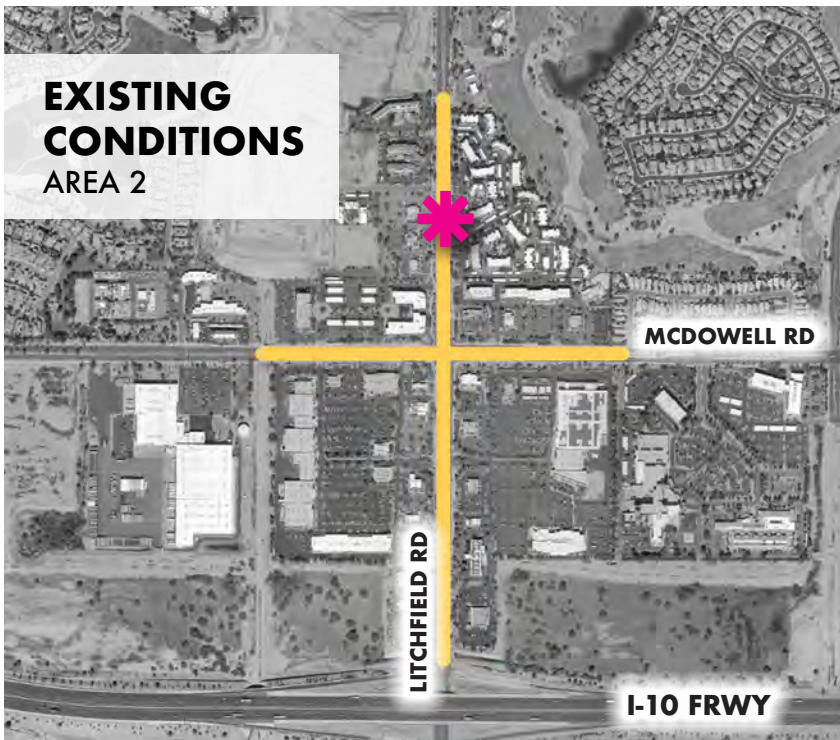


FIGURE 1-12: AREA 2 - COMMERCIAL/MIXED-USE - LOCATION MAP

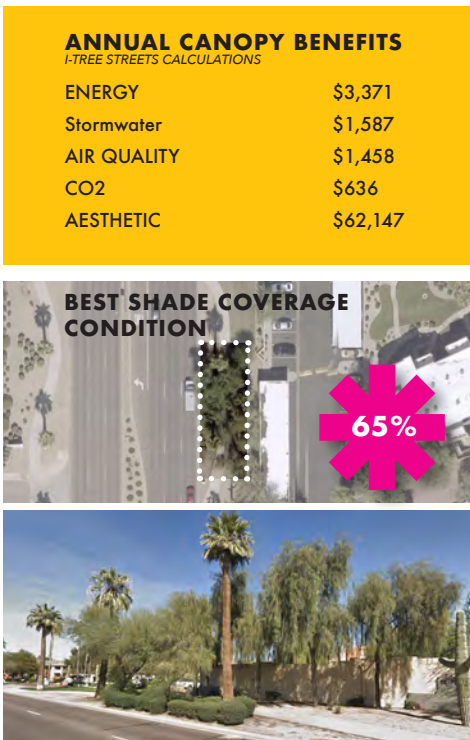


FIGURE 1-13: AREA 2 - COMMERCIAL/MIXED-USE - BENEFITS/BEST CONDITIONS

1 LINEAR PARK

OVERVIEW

Bullard Wash between McDowell Rd and Virginia Ave is representative of existing and proposed multi-use corridors throughout Goodyear. Paved paths and trails are typically a major component of these drainage corridors. These corridors will continue to be a focus of parks, recreation and open space activities and amenities.

The shade coverage documentation for Area 1 addresses only the paved path corridors (35' width centered on each pathway).

Much of the pedestrian and bicycle elements have minimal shade with widely spaced trees when present at all. As trees mature, more shade will benefit the path and trail users. Long distances along the paths along the corridor's eastern side are

nearly shade-less with little to no tree canopy. Maturing trees will eventually provide some shade in other areas of the park.

Bullard Wash Park provides a unique constraint in that it functions as a major wash and must retain a wide area of drainage through the park with limited restrictions, including trees. Thus, the pathways that cross the center of the wash cannot be tree lined, if at all, in order to retain that water flow during storm events.

OPPORTUNITIES

Increased shade along the paved pathways will increase their use and importance to Goodyear's citizens and visitors. Tree planting and shade structures should be focused at park entrances, nodes, and intersections.

SHADED DEVELOPED AREA



2 COMMERCIAL/MIXED-USE

OVERVIEW

The corner of McDowell Rd and Litchfield Rd is a major commercial center combining big box stores, strip commercial and free-standing businesses, restaurants, and multi-family. The shade coverage documentation for Area 2 addresses the arterial streets:

- Litchfield Rd
- McDowell Rd

This 4-corner commercial site, replicated in commercial sites throughout Goodyear, represents the arterial road landscape requirements resulting from the city's Design Guidelines. These guidelines, further discussed in the Appendix D, address internal pedestrian circulation and other site issues relevant to Area 2.

Meandering sidewalks are present along both sides of Litchfield Rd and

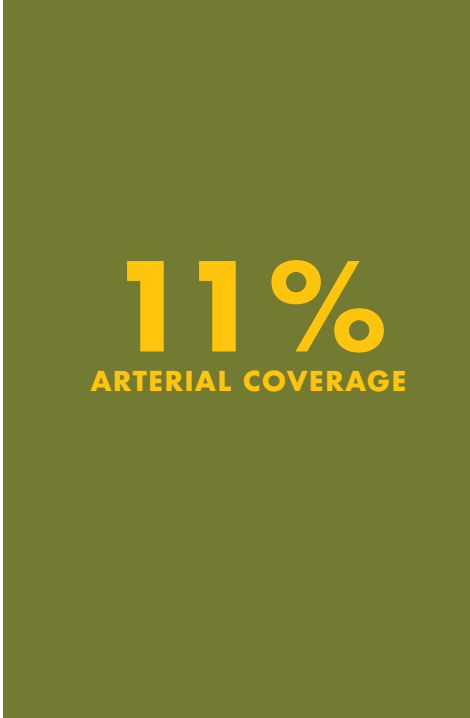
McDowell Rd except the east side of Litchfield Rd south of McDowell Rd which is considered a 'path with wide shoulder' according to the Goodyear Transportation Master Plan: 10-ft multi-use paved path with an attached 4-ft unpaved trail.

Well-placed and interspersed trees provide some shade to pedestrians primarily on the south side of McDowell Rd and the west side of Litchfield Rd. Goodyear's signature California Fan Palms line both sides of Litchfield Rd the entire length of the focus area. Though visually striking, their height provides little shade on nearby sidewalks.

OPPORTUNITIES

Trees could be added within the existing generous landscape areas around pedestrian facilities along both streets.

SHADED DEVELOPED AREA



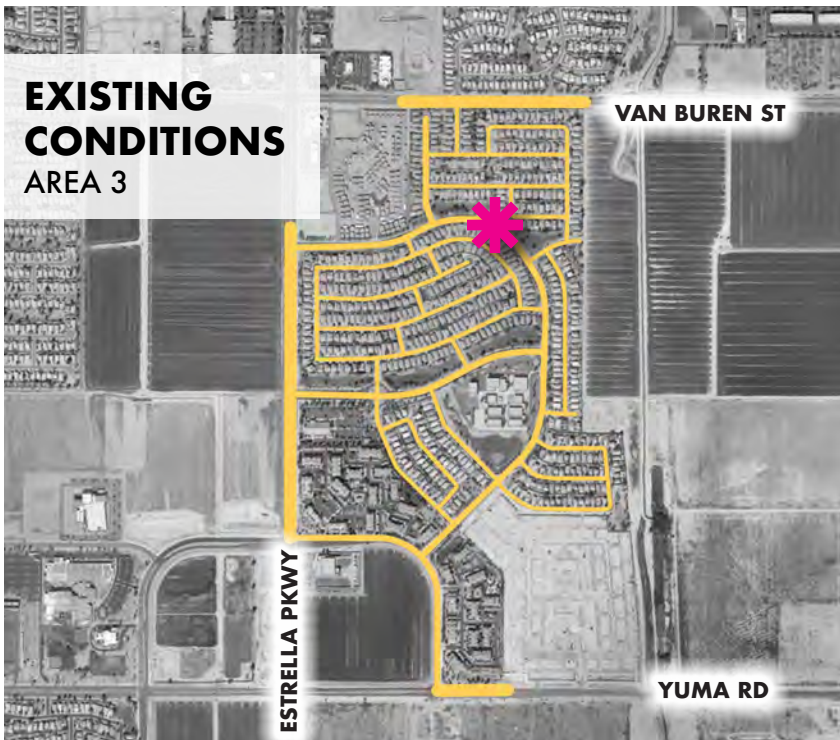


FIGURE 1-14: AREA 3 - CONTEMPORARY RESIDENTIAL - LOCATION MAP

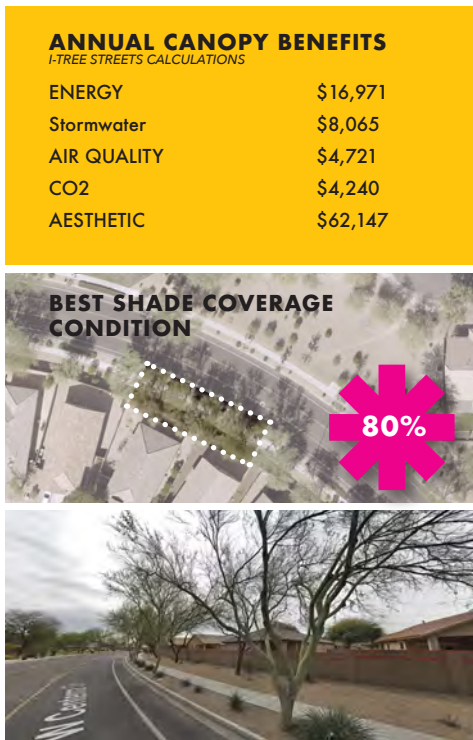


FIGURE 1-15: AREA 3 - CONTEMPORARY RESIDENTIAL - BENEFITS/BEST CONDITIONS



FIGURE 1-16: AREA 4 - HISTORIC - LOCATION MAP

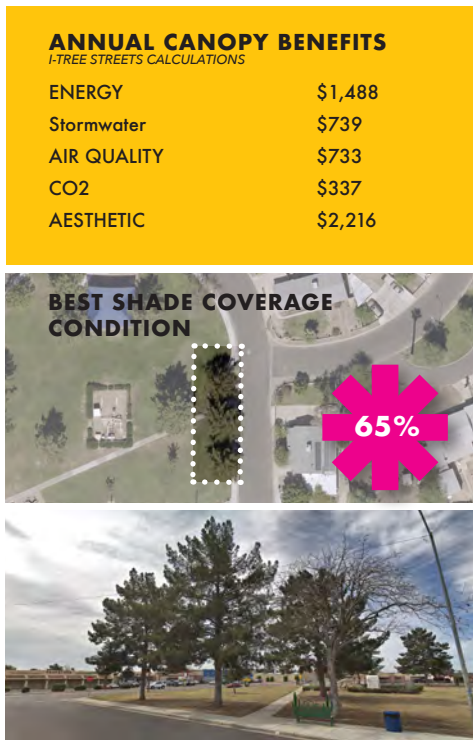


FIGURE 1-17: AREA 4 - HISTORIC - BENEFITS/BEST CONDITIONS

3 CONTEMPORARY RESIDENTIAL

OVERVIEW

Master-planned communities are the dominant residential development pattern in Goodyear. The Centerra community is representative of this development, however street landscape standards have been updated since Centerra's construction. The shade coverage documentation for Area 3 addresses:

- Arterials (Estrella Pkwy, Van Buren St, Goodyear Blvd East, Goodyear Blvd North)
- Collectors (Harrison St, Centerra Dr)
- Local Streets

Shade and access are a centerpiece of Centerra's development, as sidewalks exist on both sides of every street. Most sidewalks are separated from the back of curb giving space for trees and landscaping. In most locations however, the width of the planter is only 1'6" to 2'6". This narrow planting space makes it difficult to have both sustainable and maintainable trees: limited

soil/space causes the trees to die prematurely and tree roots to lift sidewalks. The city's updated street and landscape standards have widened this planting strip for future development.

Bike lanes only exist on Centerra Dr, Goodyear Blvd East, and Goodyear Blvd North with only Centerra Dr having bike lanes on both sides. The main four lane entry on Harrison St from Estrella Pkwy does not have bike lanes.

OPPORTUNITIES

Space between sidewalks and curbs is often narrow. If public R.O.W. is not available behind the sidewalk, there is potential to encourage tree planting on the private property side of the sidewalks. Small shrubs, accents or perennials could be considered for the narrow planting spaces between the sidewalk and curb.

SHADED DEVELOPED AREA

39%
ARTERIAL COVERAGE

24%
COLLECTOR COVERAGE

10.5%
LOCAL COVERAGE

12%
AVERAGE COVERAGE

4 HISTORIC RESIDENTIAL

OVERVIEW

As Goodyear continues to grow and develop it is important to preserve and reinvest in the city's historic areas to ensure they remain a part of Goodyear's future. The shade coverage documentation for Area 4 addresses:

- Arterials (Western Ave, Litchfield Rd)
- Local Streets

Visible in historic aerials, this neighborhood was built with unpaved roads and no sidewalks. Over time roads were paved, but no sidewalks were added. This pattern remains today except along the Western Ave corridor.

As with many historic neighborhoods in the Phoenix area, Goodyear's historic downtown's well-developed tree canopy has been declining.

Within Palmateer Park the trees are in good condition. The trees within the private lands continue to decline.

Recent streetscape improvements at the commercial site on the northeast corner of Litchfield Rd and Western Ave added more trees. Other improvements include diagonal parking, a widened sidewalk, and plantings to encourage pedestrian movement and economic development.

OPPORTUNITIES

Palmateer Park could be a priority pilot project for a denser canopy of trees planted along sidewalks in public parks. R.O.W. is available throughout the neighborhood to implement sidewalk installations combined with a possible public/private partnership for a street tree planting program.

SHADED DEVELOPED AREA

4%
ARTERIAL COVERAGE

27%
PARK PATHS COVERAGE

1%
LOCAL COVERAGE

3.3%
AVERAGE COVERAGE



FIGURE 1-18: AREA 5 - BALLPARK - LOCATION MAP

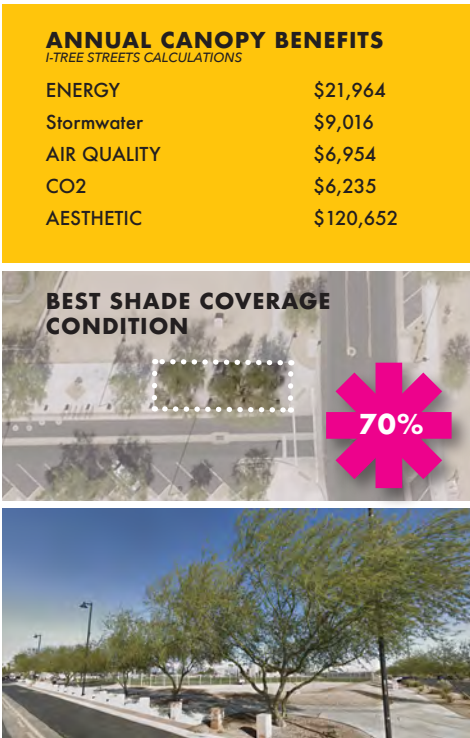


FIGURE 1-19: AREA 5 - BALLPARK - BENEFITS/BEST CONDITIONS



FIGURE 1-20: CORRIDOR 1 - EXISTING CONDITIONS - MONTE VISTA RD & 150TH DR

5 BALLPARK

OVERVIEW

The Goodyear Ballpark is a one-of-a-kind facility and can provide an example of how to provide a shaded walking and biking environment within large parks. The shade coverage documentation for Area 5 addresses:

- Arterials (Estrella Pkwy, Bullard Ave, Lower Buckeye Pkwy, Goodyear Blvd South)
- Collectors (Wood Blvd, Festival Way, Ballpark Way)

The Ballpark's surrounding and internal streets have sidewalks on both sides, excluding Bullard Ave which only has a sidewalk on the west side, and Wood Blvd which has 8-ft paths on both sides south of Lower Buckeye Pkwy, and an 8-ft path on the west side and sidewalk on the east side north of Lower Buckeye Pkwy.

Wood Blvd and Bullard Ave have a fair number of trees though many will not shade sidewalks and paths at the hottest times of the year.

An 8-ft multi-use path, primarily used for maintenance loops, surround the northwesternmost practice field. There are no trees along this loop.

Bike lanes exist along both sides of Estrella Pkwy, but nowhere else.

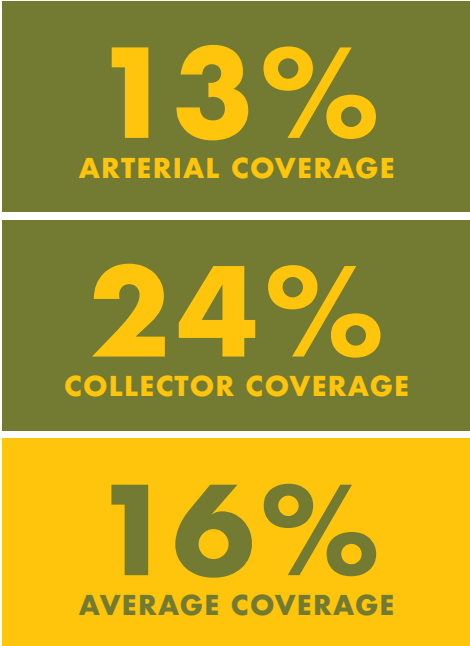
Ballpark Way and Festival Way were designed with an excellent shady pedestrian environment; however, many Desert Museum Palo Verdes have been lost to storms. Recent Mulga tree plantings are a good choice for a sustainable tree.

Goodyear Blvd South has substantial trees on its north/west sides and very little shade on the south/east side. Lower Buckeye Pkwy has little to no trees. The west side of Bullard Ave's recently planted trees will eventually provide significant shade. Estrella Pkwy's tree canopy is fairly sparse but will improve with time. The pedestrian plazas at the main ballfield are generously planted.

OPPORTUNITIES

More attention to tree planting within existing generous planting spaces will better shade sidewalks and paths in and around the Ballpark. A shade structure would be appropriate for the main entrance to the main stadium. These improvements would help to make the site more of a multi-use destination and create a more comfortable environment for Ballpark visitors.

SHADED DEVELOPED AREA



1 MONTE VISTA RD & 150TH DR

OVERVIEW

Two corridors are included in the shade coverage data: Monte Vista Rd from PebbleCreek Pkwy to 150th Dr, and 150th Dr from Virginia Ave/ Encanto Blvd to McDowell Rd. Shade coverage percentages refer only to developed portions of each side of each roadway.

Monte Vista Rd: .5-mile corridor

- North: 12% developed (.06 mi)
- South: 42% developed (.21 mi)

150th Dr: .7-mile corridor

- West: 0% developed (0 mi)
- East: 94% developed (.66 mi)

There are limited sidewalks which relates directly to the lack of development. Sidewalks exist on the east side of 150th Dr and the south side of Monte Vista Rd between

the Bullard Wash and PebbleCreek Pkwy. There are continuous bike lanes on both side of each corridor that connect to bike lanes on the surrounding streets.

The developed portions of each road have some street trees that, with age, will provide some pedestrian shade.

OPPORTUNITIES

The tree shade canopy will increase as development continues along both of these corridors. Ample space allows for the ideal scenario of trees planted on both sides of pedestrian facilities that are separated from the roadway. This is an optimal sense of comfort and streetscape aesthetics.

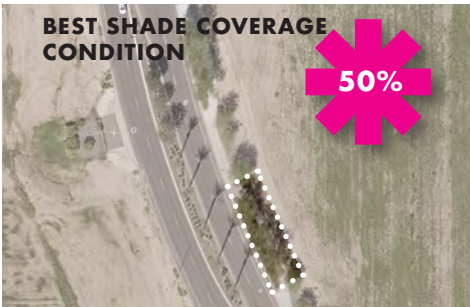
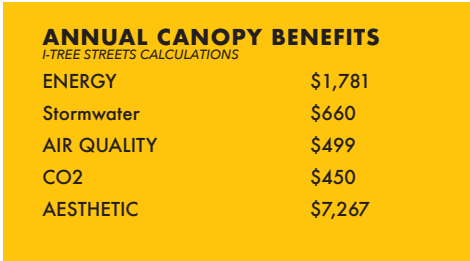
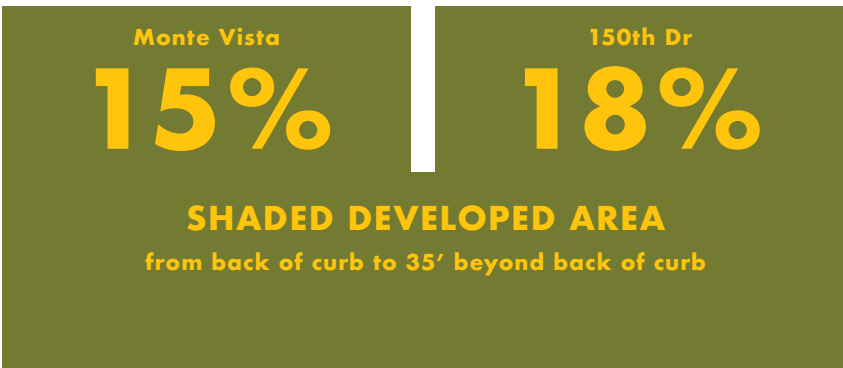


FIGURE 1-21: CORRIDOR 1 - MONTE VISTA RD & 150TH DR - BENEFITS/BEST CONDITIONS



EXISTING
CONDITIONS
CORRIDOR 2

FIGURE 1-22: CORRIDOR 2 - EXISTING CONDITIONS - VIRGINIA AVE /ENCANTO BLVD

2 VIRGINIA AVE / ENCANTO BLVD

OVERVIEW

Virginia Ave/Encanto Blvd shade coverage data extends from PebbleCreek Pkwy to Bullard Ave. Shade coverage percentage refers only to developed portions of each side of the roadway.

1.05-mile corridor

- North: 97% developed (1.02 mi)
- South: 73% developed (.77 mi)

There are pedestrian and bicycle facilities located on both sides of the roadway. There is an existing tree canopy for much of the corridor, but the majority is planted on the north side of the sidewalk casting minimal shade on the facilities.

The best portion of the corridor is the newly constructed portion on

the north side between PebbleCreek Pkwy and the Roosevelt Canal with Chinese Pistache planted between the curb and the sidewalk casting the best pedestrian shade.

OPPORTUNITIES

Along the south side of the road, where development has yet to occur, there is a great opportunity to require trees on the south side of the sidewalk to cast additional shade and increase comfort for pedestrians and bicyclists.

On the north side a program can be established to plant trees in-between the sidewalk and the back of curb.

ANNUAL CANOPY BENEFITS I-TREE STREETS CALCULATIONS	
ENERGY	\$4,285
Stormwater	\$1,872
AIR QUALITY	\$1,520
CO2	\$1,207
AESTHETIC	\$29,409

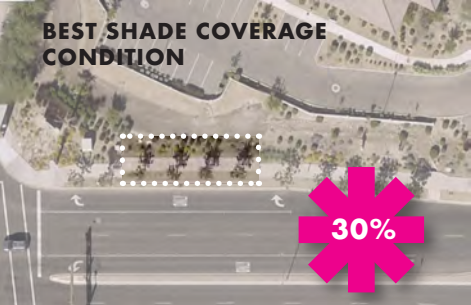


FIGURE 1-23: CORRIDOR 2 - VIRGINIA AVE /ENCANTO BLVD - BENEFITS/BEST CONDITIONS

24%

SHADED DEVELOPED AREA

from back of curb to 35' beyond back of curb



EXISTING
CONDITIONS
CORRIDOR 3

FIGURE 1-24: CORRIDOR 3 - EXISTING CONDITIONS - BULLARD AVE (NORTH)

3 BULLARD AVE (NORTH)

OVERVIEW

Bullard shade coverage data extends from McDowell Rd on the south to Encanto Blvd on the north. Shade coverage percentage refers only to developed portions of each side of the roadway.

.5 mile-corridor

- West: 96% developed (.48 mi)
- East: 46% developed (.23 mi)

Sidewalks exist along both sides of Bullard Ave. There are bike lanes on both sides of the road.

There are generous tree plantings on the east side of the road between Encanto Blvd and Granada Rd (developed area) though it is on the east side of the sidewalk minimizing

shade in the hot afternoon. There are pockets of tree plantings on the west side providing some morning shade to the sidewalk.

OPPORTUNITIES

Limited development has occurred along this corridor which allows for the future addition of a shade producing tree canopy and shade structures. The future Civic Square site can be pilot project for a densely shaded public space.

Where the tree canopy is existing, implement a program to add trees on the appropriate side to best shade the active transportation users.

ANNUAL CANOPY BENEFITS I-TREE STREETS CALCULATIONS	
ENERGY	\$1503
Stormwater	\$585
AIR QUALITY	\$553
CO2	\$431
AESTHETIC	\$4852

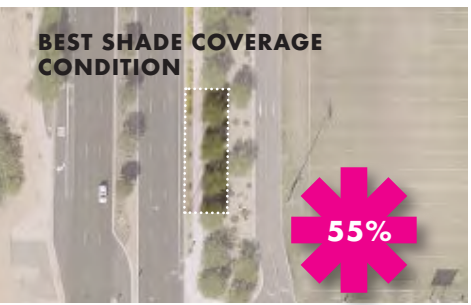


FIGURE 1-25: CORRIDOR 3 - BULLARD AVE (NORTH) - BENEFITS/BEST CONDITIONS

19%

SHADED DEVELOPED AREA

from back of curb to 35' beyond back of curb

EXISTING
CONDITIONS
CORRIDOR 4

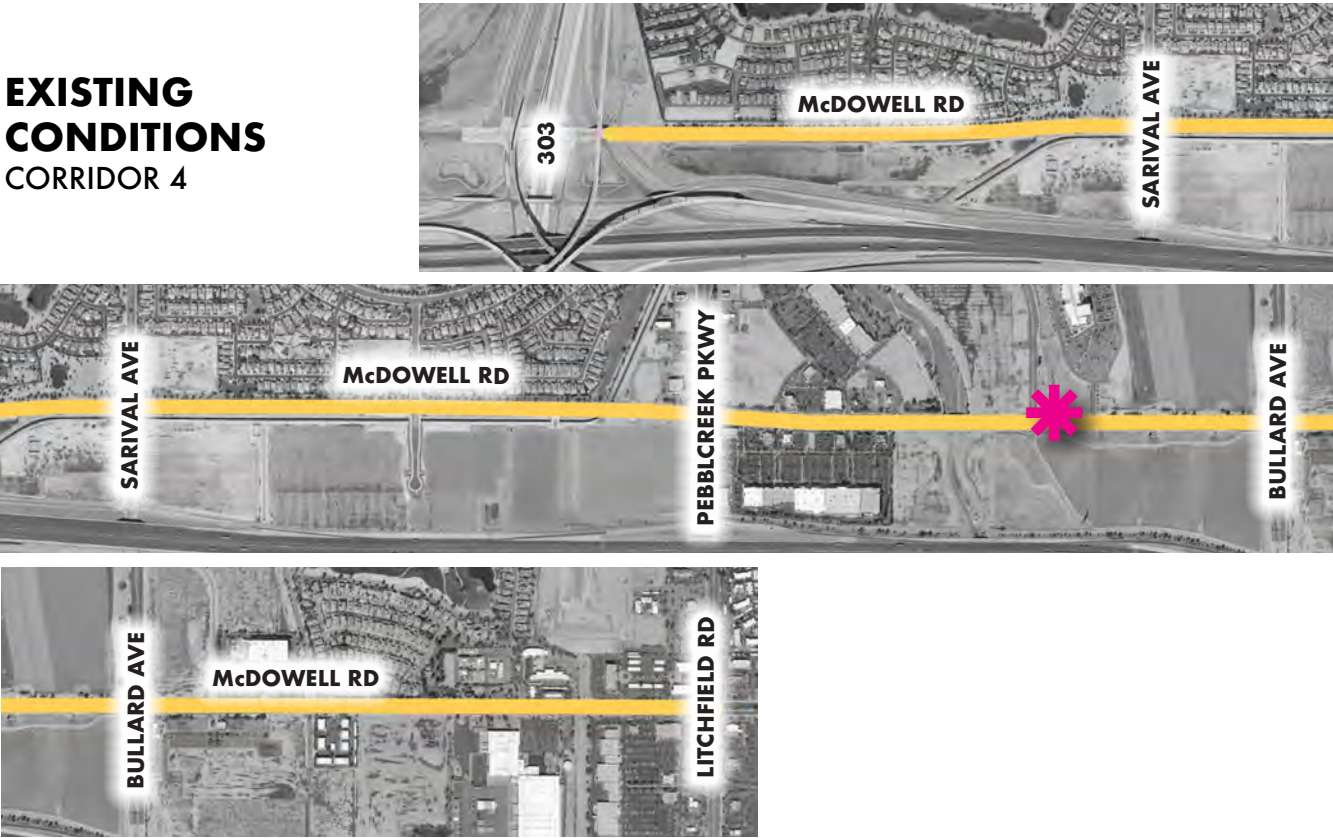


FIGURE 1-26: CORRIDOR 4 - EXISTING CONDITIONS - MCDOWELL RD

4 McDOWELL RD

OVERVIEW

McDowell Rd shade coverage data extends from Citrus Rd on the west to Litchfield Rd on the east. Shade coverage percentage refers only to developed portions of each side of the roadway.

5-mile corridor

- North: 89% developed (4.46 mi)
- South: 41% developed (2.05 mi)

Sidewalks extend from the Loop 303 to Litchfield Rd with only 2 gaps on the south side east of Bullard Ave. Bike lanes go from just east of the Loop 303 to the 142nd Ave alignment.

A tree canopy is established along the north side of McDowell with occasional breaks in development,

with the majority being on the north side of the sidewalk providing limited shade. The south side only has trees where development has occurred with the majority being undeveloped.

OPPORTUNITIES

As both the north and south sides of McDowell Rd continue to develop, paths, trees and shade structures should be included on the appropriate side of the sidewalk to best shade the bicyclists and pedestrians.

Where the tree canopy is existing, implement a program to replace trees on the appropriate side to best shade the active transportation users.

ANNUAL CANOPY BENEFITS I-TREE STREETS CALCULATIONS	
ENERGY	\$21,964
Stormwater	\$9,016
AIR QUALITY	\$6,954
CO2	\$6,235
AESTHETIC	\$120,652

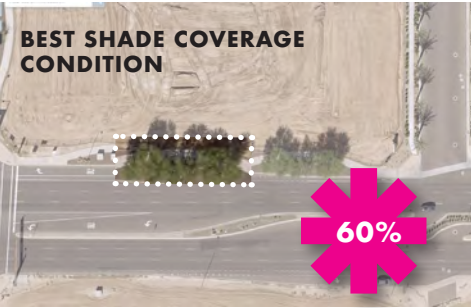


FIGURE 1-27: CORRIDOR 4 - McDOWELL RD - BENEFITS/BEST CONDITIONS

29%

SHADED DEVELOPED AREA

from back of curb to 35' beyond back of curb



FIGURE 1-28: CORRIDOR 5 - EXISTING CONDITIONS - ROOSEVELT ST

5 ROOSEVELT ST

OVERVIEW

Roosevelt St shade coverage data extends from Estrella Pkwy to 157th Ln/158th Ave. Shade coverage percentage refers only to developed portions of each side of the roadway.

.33-mile corridor

- North: 94% developed (.31 mi)
- South: 73% developed (.24 mi)

There are continuous pedestrian facilities along both sides of the street. Bike lanes exist on both sides of the road except as the eastbound lanes approach Estrella Pkwy. They connect to bike lanes on the east and west side.

The Shade canopy is minimal throughout the corridor with the

majority existing along the north side of the north side walk providing little benefits to the pedestrian and bicycle facilities.

OPPORTUNITIES

Where the tree canopy is existing, implement a program to replace trees on the appropriate side to best shade the active transportation users.

Where the development is yet to occur on the southwest portion, include trees to create a comfortable canopy for bicyclist and pedestrians. Consider major tree plantings on the north side of Roosevelt St east of 157th Ln.

ANNUAL CANOPY BENEFITS I-TREE STREETS CALCULATIONS	
ENERGY	\$733
Stormwater	\$332
AIR QUALITY	\$277
CO2	\$222
AESTHETIC	\$5,409

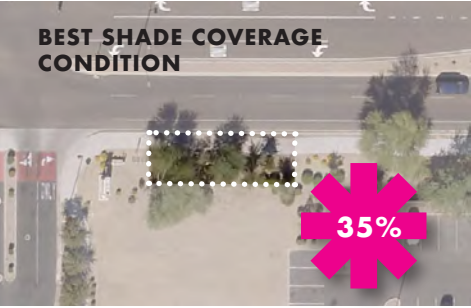


FIGURE 1-29: CORRIDOR 5 - ROOSEVELT ST - BENEFITS/BEST CONDITIONS

12%

SHADED DEVELOPED AREA

from back of curb to 35' beyond back of curb

EXISTING
CONDITIONS
CORRIDOR 6

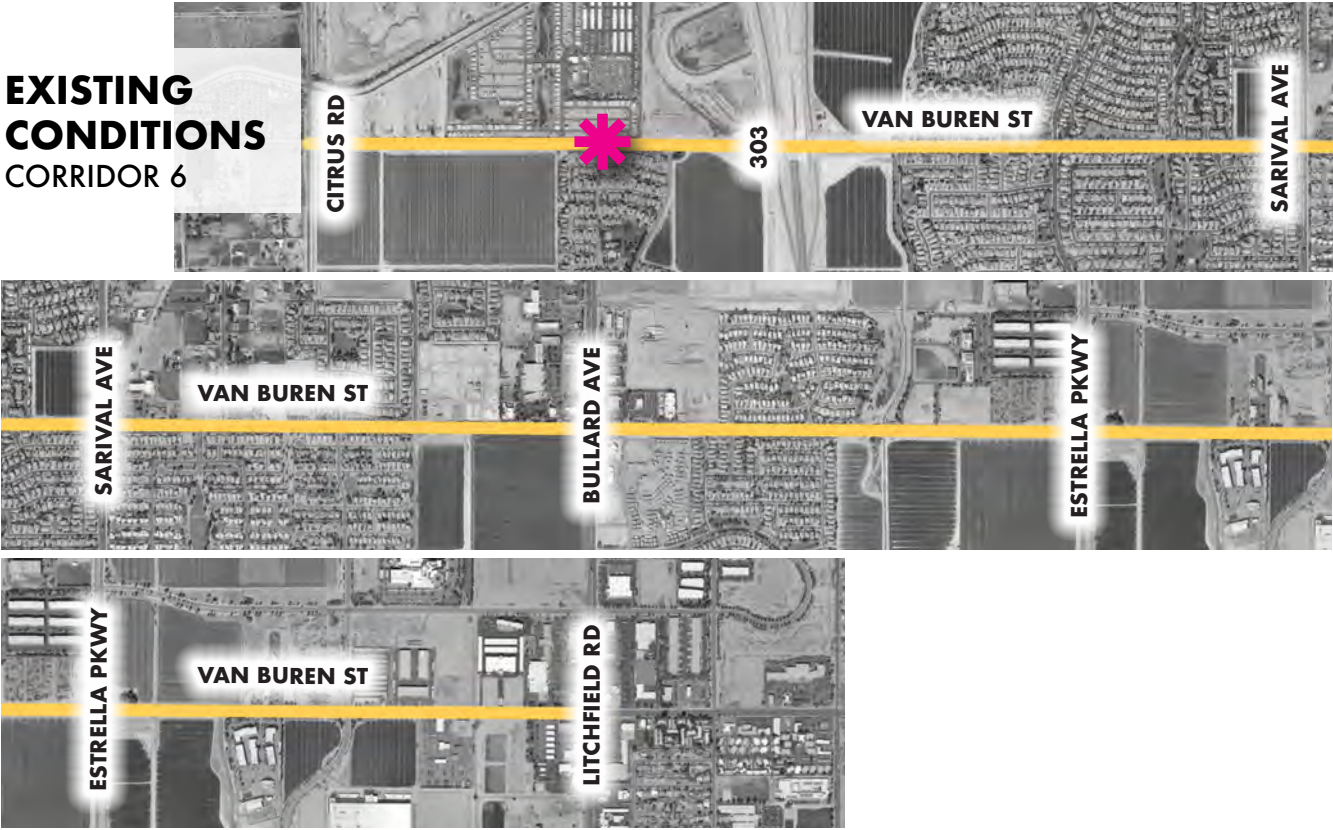


FIGURE 1-30: CORRIDOR 6 - EXISTING CONDITIONS - VAN BUREN ST

6 VAN BUREN ST

OVERVIEW

Van Buren St shade coverage data extends from Citrus Rd on the west to Litchfield Rd on the east. Shade coverage percentage refers only to developed portions of each side of the roadway.

6-mile corridor

- North: 56% developed (3.36 mi)
- South: 62% developed (3.13 mi)

There are multiple gaps in the pedestrian facilities on both the north and south side of the corridor, as well as large gaps in the bicycle facilities. (shown in the Pedestrian and Bicycle Facility Gaps maps in Chapter 3)

Where developed, the shade canopy is well-established although it is most

often placed where the bicycle and pedestrian facilities see little benefit as it mostly shades the landscape area.

OPPORTUNITIES

As both the north and south sides of Van Buren St continue to develop, trees and shade structures should be included and placed on the appropriate side of the facilities to best shade the bicyclists and pedestrians. Pedestrian and bicycle facilities should be completed either before or during adjacent development.

ANNUAL CANOPY BENEFITS I-TREE STREETS CALCULATIONS	
ENERGY	\$14,347
Stormwater	\$6,454
AIR QUALITY	\$4,649
CO2	\$4,288
AESTHETIC	\$86,821

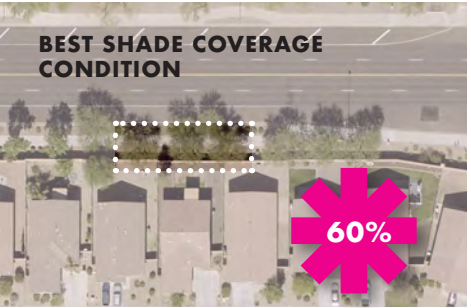


FIGURE 1-31: CORRIDOR 6 - VAN BUREN ST - BENEFITS/BEST CONDITIONS

29%
SHADED DEVELOPED AREA
from back of curb to 35' beyond back of curb

EXISTING
CONDITIONS
CORRIDOR 7

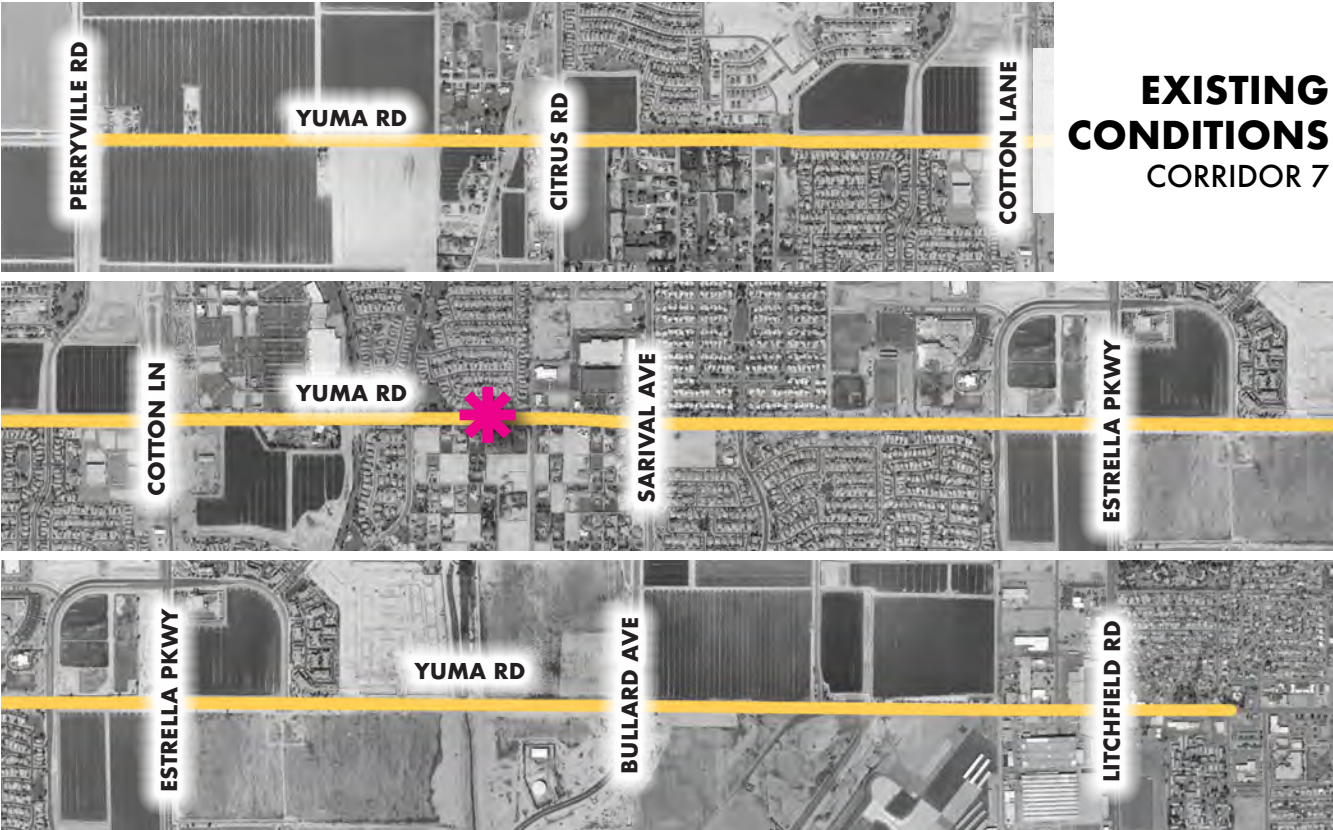


FIGURE 1-32: CORRIDOR 7 - EXISTING CONDITIONS - YUMA RD

7 YUMA RD

OVERVIEW

Yuma Rd shade coverage data extends from Perryville Rd on the west to Litchfield Rd on the east. Shade coverage percentage refers only to developed portions of each side of the roadway

6.2-mile corridor

- North: 53% developed (3.3 mi)
- South: 35% developed (2.19 mi)

Pedestrian facilities are fragmented along the corridor with bike lanes only along a few portions and sometimes only on one side or the other.

The tree canopy follows the development of the road and is well-established in older portions, but the trees are often placed where the

pedestrians and bicyclists see little benefit.

OPPORTUNITIES

As both the north and south sides of Yuma Rd continue to develop, trees and shade structures should be included and placed on the appropriate side of the facilities to best shade them. Pedestrian and bicycle facilities should be completed either before or during adjacent development.

Where the tree canopy is existing, implement a program to replace trees on the appropriate side to best shade the active transportation users.

ANNUAL CANOPY BENEFITS I-TREE STREETS CALCULATIONS	
ENERGY	\$9,575
Stormwater	\$4,366
AIR QUALITY	\$2,822
CO2	\$2,880
AESTHETIC	\$56,643

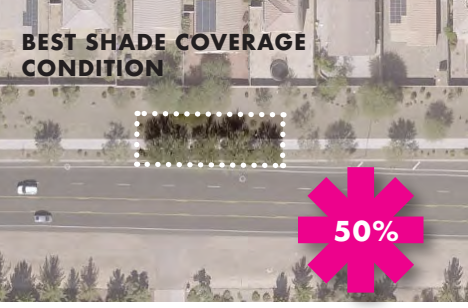


FIGURE 1-33: CORRIDOR 7 - YUMA RD - BENEFITS/BEST CONDITIONS

19%
SHADED DEVELOPED AREA
from back of curb to 35' beyond back of curb

EXISTING
CONDITIONS
CORRIDOR 8

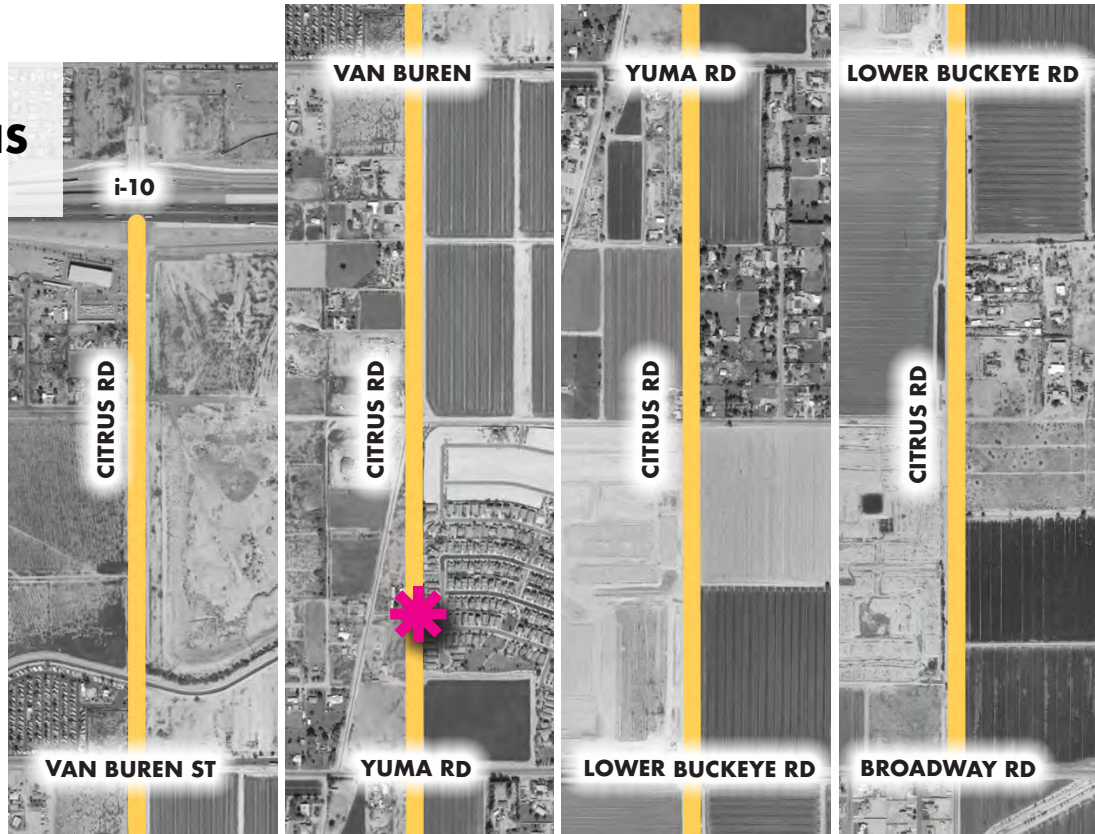


FIGURE 1-34: CORRIDOR 8 - EXISTING CONDITIONS - CITRUS RD

8 CITRUS RD

OVERVIEW

Citrus Rd shade coverage data extends from Broadway Rd on the south to I-10 on the north. Shade coverage percentage refers only to developed portions of each side of the roadway.

3.75-mile corridor

- West: 17% developed (.32 mi)
- East: 22% developed (.60 mi)

Sidewalks and trees exist on the east side of Citrus Rd between Harrison St and Yuma Rd (subdivision development) and short segments on both sides of the I-10 freeway. The rest of the corridor mainly consists of agriculture or undeveloped land.

OPPORTUNITIES

As both the east and west sides of Citrus Rd further develop, trees and shade structures should be included and placed on the appropriate side of the facilities to best shade them. Pedestrian and bicycle facilities should be completed either before or during adjacent development.

There are numerous one to five-acre properties that have a lower likelihood of further development in the near term and the city may choose to develop the roadways in front of these areas.

ANNUAL CANOPY BENEFITS	
I-TREE STREETS CALCULATIONS	
ENERGY	\$646
Stormwater	\$340
AIR QUALITY	\$200
CO2	\$207
AESTHETIC	\$5,692

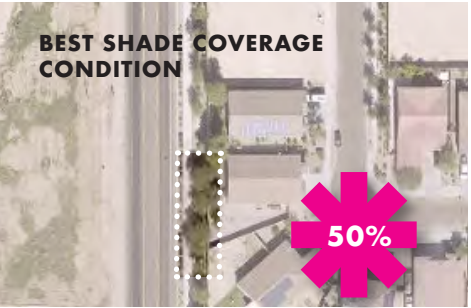


FIGURE 1-35: CORRIDOR 8 - CITRUS RD - BENEFITS/BEST CONDITIONS

11%

SHADED DEVELOPED AREA

from back of curb to 35' beyond back of curb

EXISTING
CONDITIONS
CORRIDOR 9

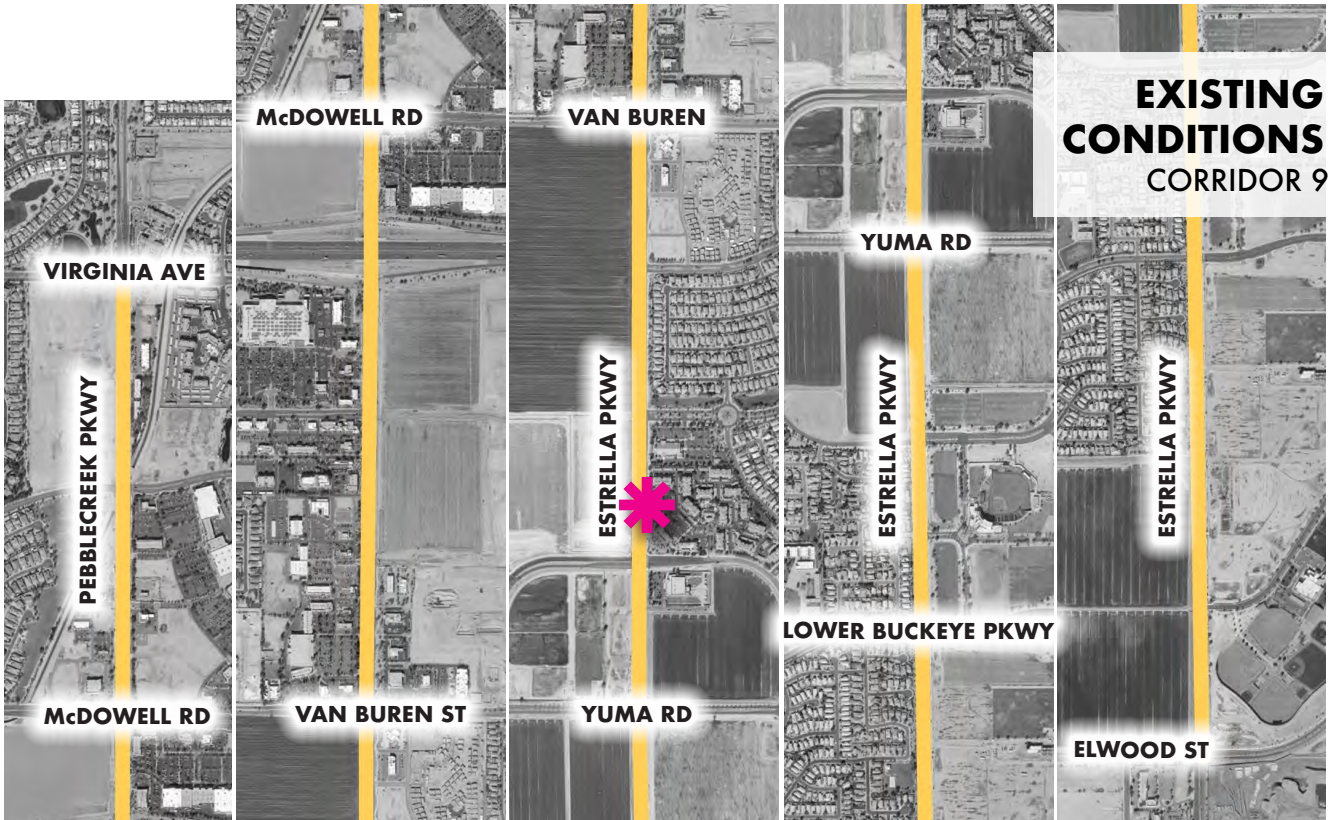


FIGURE 1-36: CORRIDOR 9 - EXISTING CONDITIONS - ESTRELLA PKWY

9 ESTRELLA PKWY / PEBBLECREEK PKWY

OVERVIEW

Estrella/PebbleCreek Pkwy shade coverage data extends from Elwood St on the south to Virginia Ave on the north. Shade coverage percentage refers only to developed portions of each side of the roadway.

4.26-mile corridor

- West: 40% developed (1.71mi)
- East: 77% developed (3.3 mi)

There are large swaths of the corridor yet to be developed, hence pedestrian and bicycle facilities are fragmented with no north/south through-options.

The tree canopy is fragmented and often placed on the opposite side of

where users would receive the best shade coverage.

OPPORTUNITIES

As both the east and west sides of the corridor continue to develop, trees and shade structures should be included and placed on the appropriate side of the facilities to best shade them. Pedestrian and bicycle facilities should be completed either before or during adjacent development.

Where the tree canopy is existing, implement a program to replace trees on the appropriate side to best shade the active transportation users.

ANNUAL CANOPY BENEFITS	
I-TREE STREETS CALCULATIONS	
ENERGY	\$13,077
Stormwater	\$4,909
AIR QUALITY	\$3,089
CO2	\$3,067
AESTHETIC	\$42,740

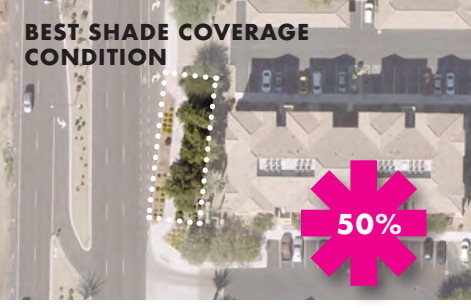


FIGURE 1-37: CORRIDOR 9 - ESTRELLA PKWY- BENEFITS/BEST CONDITIONS

14%

SHADED DEVELOPED AREA

from back of curb to 35' beyond back of curb

EXISTING
CONDITIONS
CORRIDOR 10

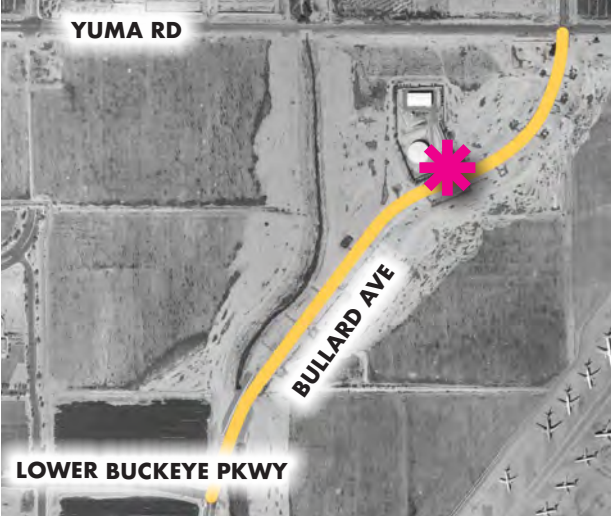
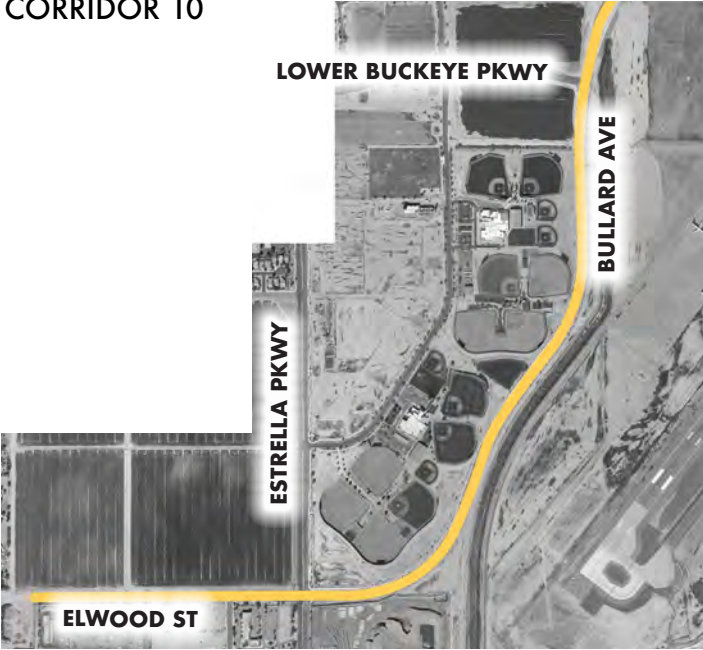


FIGURE 1-38: CORRIDOR 10 - EXISTING CONDITIONS - BULLARD AVE

10 BULLARD AVE (SOUTH) / ELWOOD ST

OVERVIEW

Bullard Ave/Elwood St shade coverage data extends from the approx. 159th Ave alignment on the south to Yuma Rd on the north. Shade coverage percentages refer only to developed portions of each side of the corridor.

Bullard Ave: 3.2-mile corridor

- West: 36% developed (1.15 mi)
- East: 34% developed (1.1 mi)

Elwood St: .5-mile corridor

- North: 0% developed (0 mi)
- South: 88% developed (.44 mi)

The sidewalk along the west side of Bullard south of Lower Buckeye Pkwy will eventually be shaded (approx. 30% within 10 years) by the generous new tree planting. Sidewalks exist

along the south side of Elwood. Planting for about half of the Elwood corridor will eventually provide some shade to the sidewalk. Bike lanes exist on Bullard between Lower Buckeye Pkwy and Estrella Blvd.

OPPORTUNITIES

Future development provides the opportunity to add more bicycle and pedestrian facilities along with generous tree plantings.

Where the tree canopy exists, implement a program to plant trees on the appropriate side of bike and pedestrian facilities to best shade active transportation users.

ANNUAL CANOPY BENEFITS
I-TREE STREETS CALCULATIONS

ENERGY	\$4,939
Stormwater	\$1,895
AIR QUALITY	\$1,192
CO2	\$1,455
AESTHETIC	\$42,390

BEST SHADE COVERAGE
CONDITION

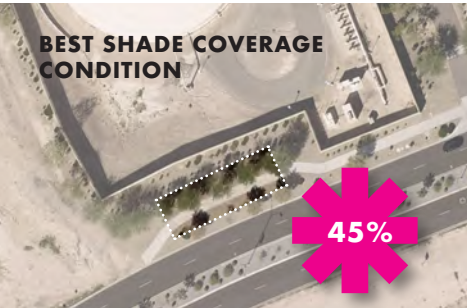


FIGURE 1-39: CORRIDOR 10 - BULLARD AVE- BENEFITS/BEST CONDITIONS

18%

SHADED DEVELOPED AREA
from back of curb to 35' beyond back of curb



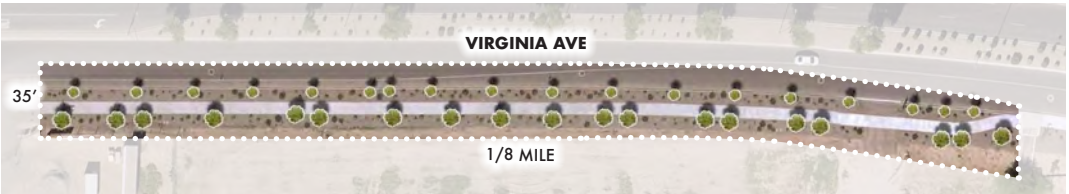
FIGURE 1-40: VIRGINIA AVE EAST OF THE ROOSEVELT CANAL- SOUTH SIDE

PROJECTED SHADE COVERAGE OF YOUNG EXISTING TREES

The illustration below shows the projected increase of canopy coverage of the newly planted trees along an 1/8 mile corridor on the south side of Virginia Ave, directly east of the Roosevelt canal. The project shows the estimated growth projected over the next 5 and 10 years with the assumption of a 90% living rate at 5 years and 80% at 10 years. There are 3 varieties of trees along the 1/8-mile corridor; Palo Verde's, Mesquites, and Chinese elms.

Current Coverage

The existing canopy along Virginia Ave assumes the following; Mesquite trees at a 7' canopy, Palo Verde's at a 7' canopy, and Chinese Elms at a 5' canopy. The trees today provide 5% shade along the bicycle and pedestrian corridor.



5%
SHADE COVERAGE

5-Year Projected Coverage

The 5-year canopy along Virginia Ave assumes the following; Mesquite trees at a 17' canopy, Palo Verde's at a 17' canopy, and Chinese Elms at a 12' canopy. The assumption is a 10% death rate (90% of today's trees) of the trees due to storms, poor maintenance, and lack of water. The trees in 5 years have a projected 25% shade coverage along the bicycle and pedestrian corridor.



25%
SHADE COVERAGE

10-Year Projected Coverage

The 10-year canopy along Virginia Ave assumes the following; Mesquite trees at a 25' canopy, Palo Verde's at a 25' canopy, and Chinese Elms at a 20' canopy. The assumption is an additional 10% death rate (80% of today's trees) of the trees due to storms, poor maintenance, and lack of water. The trees in 10 years have a projected 45% shade coverage along the bicycle and pedestrian corridor.



45%
SHADE COVERAGE

FIGURE 1-41: PROJECTED SHADE COVERAGE OF YOUNG EXISTING TREES

COVERAGE RANKINGS OF DEVELOPED AREAS

1. CONTEMP. AREA ARTERIALS	39%	9. MONTE VISTA	18%	17. LINEAR PARK AREA PATHS	11%
2. VAN BUREN	29%	10. 150TH	15%	19. CONTEMP. AREA LOCALS	7%
3. MCDOWELL	29%	11. BULLARD	14%	20. HISTORIC AREA ARTERIALS	4%
4. HISTORIC AREA PARK PATHS	27%	12. ESTRELLA/PEBBLECREEK	14%	21. HISTORIC AREA LOCALS	1%
5. VIRGINIA/ENCANTO	24%	13. BALLPARK AREA ARTERIALS	13%		
6. CONTEMP. AREA COLLECTORS	24%	14. ROOSEVELT	12%		
7. BALLPARK AREA COLLECTORS	24%	15. CITRUS	11%		
8. YUMA	19%	16. COM./MIXED-USE AREA ARTERIALS	11%		

FIGURE 1-42: COVERAGE RANKINGS FOR CORRIDORS AND AREAS

SHADE COVERAGE PERCENTAGE PROTOTYPE

The site below (1/8 mile stretch on the south side of Encanto Blvd midway between 149th Ln and Bullard Ave) was used to document existing shade coverage (15% coverage) and project how many trees it would require to get to 30%, 40%, 50% and 60% shade coverages from the existing shade coverage. The maps below illustrate a 35' wide x 1/8-mile corridor consisting of both public right of way and private land with a sidewalk running through its entire length.



FIGURE 1-43: SHADE COVERAGE % PROTOTYPES

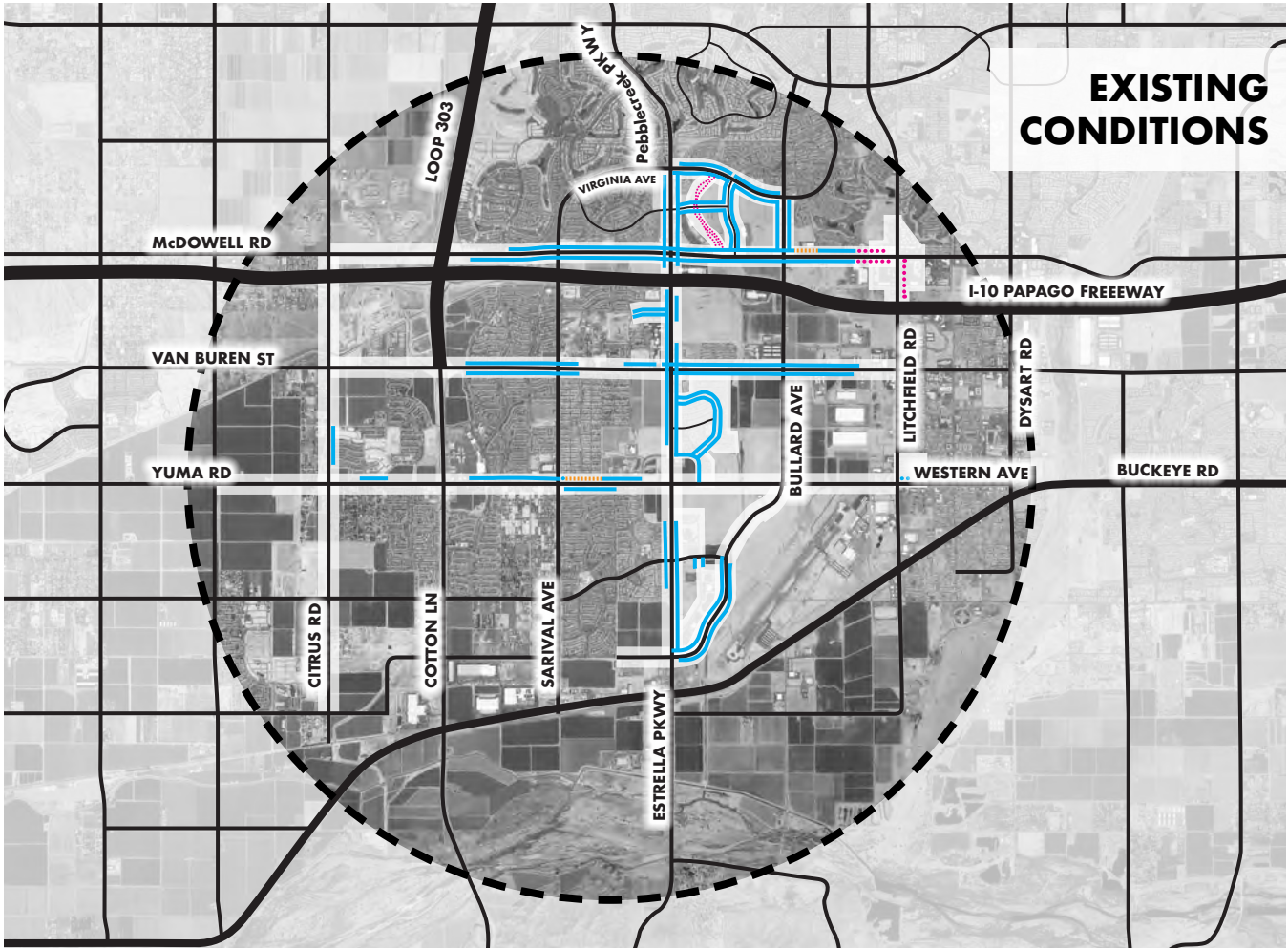


FIGURE 1-44: EXISTING CONDITIONS - BICYCLE FACILITIES

STUDY AREA - EXISTING BICYCLE FACILITIES

Goodyear has begun to expand their bicycle network in the years since the adoption of the 2014 Goodyear Transportation Plan and the 2014 Goodyear Parks, Recreation, Trails, and Open Space Plan. Although the system has expanded, existing bicycle facilities within the study area are currently fragmented and not continuous. This occurs in 2 ways, 1) incomplete loops/access to destinations and 2) incomplete facilities.

Disconnected segments of facilities prohibit the opportunity for riding loops. Many recreational riders prefer not to see the same place twice on their rides and therefore prefer loops.

There are a number of bicycle facilities within the study area that only have facilities (bike lanes) on one side of the street, such as on Yuma Rd to the west of Sarival Ave. This lack

of facilities makes it more difficult for bicyclists to reach their destination.

With a fragmented system, cyclists are exposed to greater risk due to the lack of bike lanes or other bike facilities. As a result, they will often use sidewalks or ride in vehicular travel lanes on arterial and collector streets with speed limits between 35-45 mph. According to the American Journal of Public Health (2012) bike lanes reduce the risk of injury by 50%.

The 2014 Transportation Plan calls for a number of the gaps in the facilities to be included in short, mid, and far term implementation. Moving forward it may be recommended to move some facility projects to a shorter time frame within areas that have high current or projected usage.

LEGEND

STUDY AREA BOUNDARIES

Corridors

Areas

BICYCLE FACILITIES

Bike Lane

Multi-use Path

Path & Bike lanes

34.2
MILES OF
EXISTING
BIKE
FACILITIES
within the study boundary

EXISTING CONDITIONS

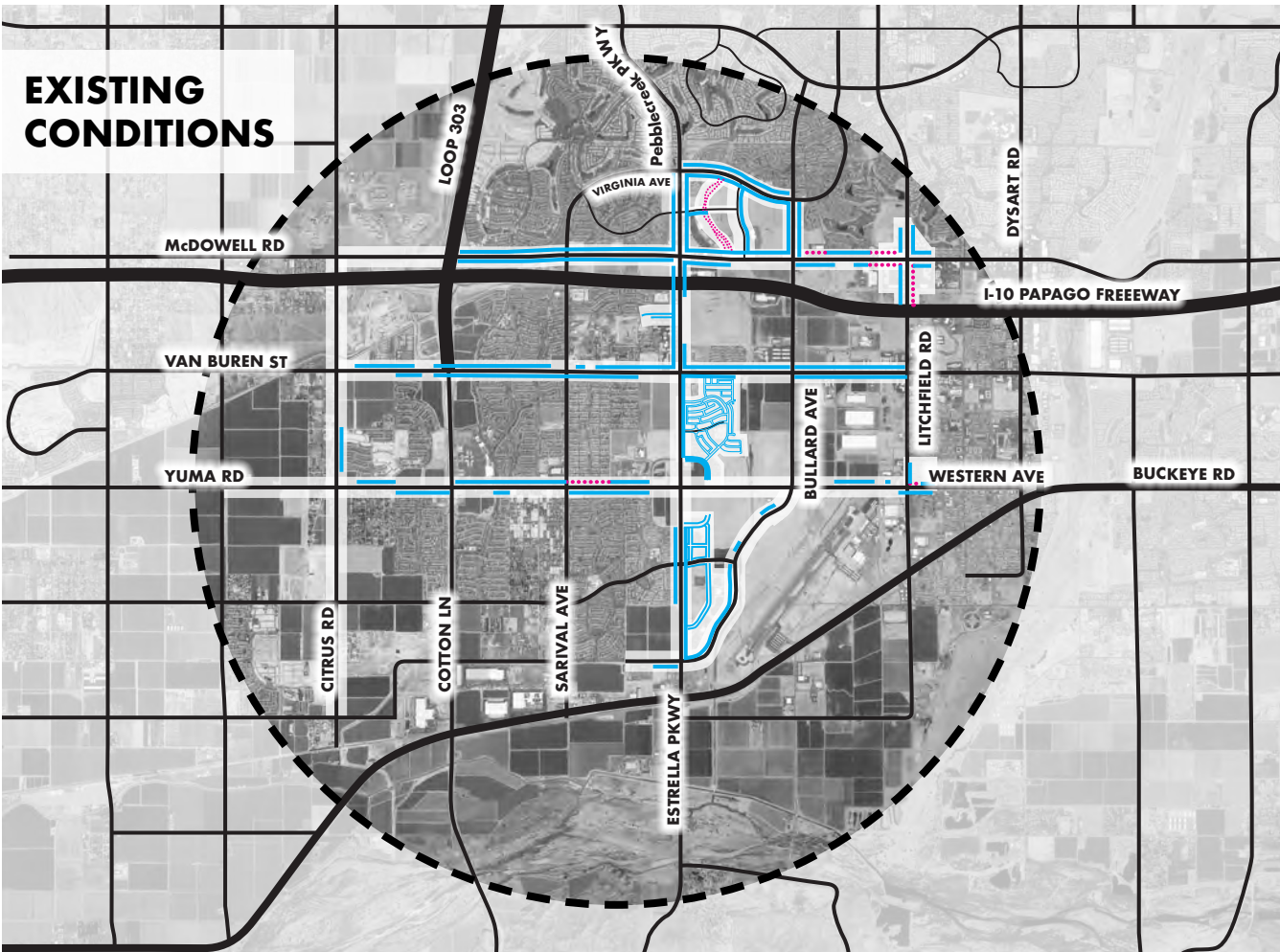


FIGURE 1-45: EXISTING CONDITIONS - PEDESTRIAN FACILITIES

STUDY AREA - EXISTING PEDESTRIAN FACILITIES

Goodyear has continued to expand its pedestrian network as they have expanded and redeveloped their roadways, parks and greenways as outlined in the 2014 Transportation Plan and the 2014 Parks, Recreation, Trails, and Open Space Plan. Although the system has expanded in recent years the existing pedestrian facilities within the study area are still a fragmented network. Scattered development has created fragmentation of the existing pedestrian network.

As development has continued, sidewalks have been built to existing city standards. The majority of sidewalks within the city are a minimum of 6’ wide with the exception of residential streets, averaging 4’ to 5’ wide. There are wider 8’ sidewalks along more recently developed major arterial streets, 10’ wide paths along and through Bullard Wash Park and some stretches of arterials, and 16’ wide paths in the Historic area at Litchfield Rd and Western Ave.

Accessibility for everyone within the city is hampered by not having through pedestrian facilities, forcing pedestrians to either walk in the soil, in streetscape landscaping, or in the street when in a wheelchair. The pedestrian facilities along some major arterials, in the study area, do not have facilities along both sides of the road as shown in the map on Yuma Rd, Van Buren St, McDowell Rd, Bullard Ave, Elwood St, Estrella Pkwy, Monte Vista Rd, and 150th Dr.

Although Goodyear ranks low in reported pedestrian accidents within the study boundary, Arizona continues to rank as one of the least pedestrian friendly states in the U.S. according to the United States Department of Transportation. This outlines a clear need for additional facilities to close gaps and complete facility loops, both for recreation and transportation.

LEGEND

STUDY AREA BOUNDARIES

CORRIDORS

AREAS

PEDESTRIAN FACILITIES

SIDEWALK

PATH

52.5 MILES OF EXISTING PEDESTRIAN FACILITIES within the study boundary



FIGURE 1-46: FESTIVAL WAY IN GOODYEAR BALLPARK

BENCHMARKING

Goodyear was benchmarked against five cities that were selected by the technical advisory committee and the consultant team. Each selected city is currently designated as a “Tree City USA”. The designation was selected as the basis for the benchmarking due of its wide range of requirements to create a dedicate resources to a shaded city.

There are four base requirements for a Tree City USA Designation;

Tree Board or Department, Tree Care Ordinance, a Community Forest program with an annual budget of at least \$2 per capita, and an Arbor Day Observance and Proclamation. In addition to the Tree City requirements, benchmarking looked at city-wide canopy coverage, planning strategies, planting standards and policies, and more.

Information pertaining directly to bicycle and pedestrian shade studies

was lacking as it is still uncommon to combine these issues into one plan. It is more common that shade plans and policies are separate from bike and pedestrian policies and plans.

The following table provides a brief overview of the city of Goodyear Study Area compared to the six benchmarked cities. For additional information on all categories, please see the appendix.

	GOODYEAR STUDY AREA	TEMPE	PHOENIX	GILBERT	SCOTTSDALE	TUCSON
CURRENT COVERAGE	16% of developed corridors within study area	13.4%	6%	6.8%	9%	8%
GOAL COVERAGE	MAG recommended 60% of pedestrian facilities	20% Total Tree Canopy	25% 2030 Total Canopy Coverage	N/A	N/A	20% 2030 Total Canopy Coverage
TREE CITY	No	Yes	Yes	Yes	Yes	Yes
BUDGET PER CAP	\$3.94 on Tree maintenance and replacment	Undeclared	\$3.48 as of 2010	Undeclared	Undeclared	Undeclared
POLICIES	• Parks, rec, trails + open space M.P. • Transportation plane • Water conservation committee development services design guidelines • Engineering design standards • AZ dept. water resources	• Urban forestry M.P. • Desert Lush Treebate Program • Tree Care Guidelines • Landscape Regulations	• Tree & Shade M.P. • Citizen Tree & Shade committee ordinance Guidelines • Landscape Regulations	• Park, recreation, and trails MP • Landscape regulations - artical 4.3	• Native Plan Ordinance • Residential Landscape Revitalization workbook • Landscape regulations	• Parks and Recreation system M.P. • Green Streets Policy • Landscape regulations
TREE COUNCIL	Non Established	Inactive, assisted by Arizona Community tree Council	Citizen foresters & Citizen free+shade com-mittee	Arizona Community tree Council	Inactive, assisted by Arizona Community tree Council	Inactive, assisted by Arizona Community tree Council
OTHER SUPPORTERS		Arizona State University		Gilbert Parks & Rec Foundation		Tucson Clean & Beautiful Inc.
CONTACT	Christopher Baker, Director of Development Services, Christopher. Baker@goodyearaz.gov	Craig Hayton, Parks Manager, 480-350-5234.	Cindy Salazar, Secretary III, Office of Environmental Programs, 602-256-5669	None listed	Sunny Nak-agawa, Parks and Recreation Manager, 480-312-6655	Irene Ogata City of Tucson Department of Urban Planning & Design (520)791-4505

FIGURE 1-47: BENCHMARK SUMMARY 1 of 2

BENCHMARKING - PLANTING STANDARDS

	COMMERCIAL			RESIDENTIAL		PARKING LOTS
	LOCAL	COLLECTOR	ARTERIAL	SINGLE	MULTI	
TEMPE	- Tree Ratios: Street trees are required along all street frontages, public & private. Min. 1 tree for every 30 ft. lineal street frontage (ratio applies to vacant lots too). - Tree Type & Size: See Section 4-702 General Landscape Standards, F. Trees on tree specifications and prohibited trees. All must be a min. 1.5 inch caliper. - Pathways & Access Ways: Min. 1 tree for every 25 ft. lineal pathway. - Land Use Buffer: Uses adjacent to single-family residential - trees should be spaced max. 20 ft on center, see Section 4-706 Screens, Walls, and Access Control Landscapes, D. Land Use Buffers for more specifics.					Two Options: 1) Min. 1 tree per twelve parking spaces, evenly distributed around lot perimeter and between parking bays. Landscape on 10% surface area. 2) Tree/shade canopy above surface parking at min. is 20% shaded based on expected tree size in 5 yrs. Tree Size & Ratios: Each landscape island has min. 1 tree w/ min. caliper 1.5 inches. Must be 20+ ft from light source.
	Between 15 and 30% landscaping required, depending on use.				Between 15 and 30% landscaping required, depending on use.	
PHOENIX	- Minimum Tree Size: Generally, landscaping requires 15-gallon + trees. - Downtown Code: Min. 30% tree canopy cover, min. caliper 2-in., min. radius clear of hardscape. See also Chapter 1207, H. Tree Species Guidelines.					Tree Size & Ratios: Min. 2-inch caliper (60%), Min. 1-inch caliper (40%) Minimum Count: A min. of one 2-inch caliper shade tree should be provided for every ten vehicular parking spaces, and 20 feet on center or equivalent grouping within setbacks.
	Tree Size & Ratios: Streetscape: Min. 2-inch caliper (50% of required trees), Min. 3-inch caliper or multi-trunk tree (25%), Min. 4-inch caliper or multi-trunk tree (25%). Perimeter + Building Adjacent: Min. 2-inch caliper (60%), Min. 1-inch caliper (40%)			SF: Trees spaced min. 20-30 ft. apart on center or equiv. grouping for perimeter. 50% 1.5 in. caliper, 25% 2 in., 25% 3 in.	Street Adjacent: 1 min. 15-gallon (2-inch caliper) drought resistant tree for each 500 sq. ft. required setback area Interior Prop Lines: 1 min. 15-gallon tree per 20 ft. linear distance	
GILBERT	- Minimum Tree Size: Tree height - 6 feet, Palm tree species - 5 feet, Trunk caliper - .75 inches - Tree Type: See Chapter 1, Article 4.305 Streetscape Theme Tree, min. 50% arterial must be theme trees. Right-of-way trees shall be selected from AZ Dept. Water Resources Low Water Use / Drought Tolerant Plant List for Phoenix Active Management Area.					Minimum Count: 1 tree for every 8 spaces, distributed. Tree Size: “The minimum trunk size of parking lot trees shall have a minimum trunk height of 6 feet and a minimum of a 2 inch single trunk caliper measurement (or a 1.5 inch average)” (p. 19). “The minimum trunk height of parking lot trees shall be 6 feet”
		Requirements: 1 tree per 25 feet of lineal street frontage, excluding driveways. Min. 50% trees must be 24 inch box size or larger.			Common Open Space Landscaping: 1 tree/unit, 25% shall be 24-inch + Perimeter & Public Street Frontages: 1 tree/20 linear ft	
SCOTTSDALE	- Requirements: Most zoning districts simply state “Street trees shall be provided based on an approved landscape plan”. Landscape plans are required to be submitted with other required site improvement and building plans at time of app. for a building permit. - Tree Size & Ratios: All trees must have min 15-gallon container, 50% min. must be mature trees. Multi-story buildings require min. 50% 12 ft. tall palms, 3-in. single truck and 1.5-in. avg. multi-trunk trees.					Development Review Board application calls for emphasis on shading of at least 50% of all parking, walkway, and patio surfaces by mature trees or shade structures.
	Requirements: Min. 1 tree per 500 sq. ft. open space. Downtown: Type 2 Area - 1 mature tree per 400 sq. ft. landscaping.				Med. Density: Min. 1 tree in commonly held landscape area. R-3 & R-4 - Min. 3 trees per unit. R-5 - 1.5 trees per 900 sq. ft. open space.	
TUCSON	Requirements: 1 canopy tree for every 33 linear ft. on all landscape borders (street & interior), a min. of 1 tree per required landscape border. See Article 7.7 for specifics on native plant preservation which applies to all areas.					Article 7.6.4: 1 canopy tree for every 4 spaces, distributed. Every space must be located within 40 ft. of a canopy tree trunk. Min. of 34 sq. ft. in area and 4 ft. width must be provided for each canopy tree.
	Sidewalks: Landscaping will include canopy trees which w/ other shade structures provide 65-75% shade cover for large retail establishments.			1 canopy tree every 40 ft. of pedestrian circulation systems - see Article 8.7.3 G		

FIGURE 1-48: BENCHMARK SUMMARY 2 of 2



THE TOOLBOX

This toolbox is designed to help guide the decision-making process of implementing shaded and connected bicycle and pedestrian facilities as well as a better shaded community as a whole. Comfort and safety are guiding factors. The Toolbox includes typologies for a wide array of uses including residential, commercial, public, and streets. There are four separate but corresponding pieces to the Toolbox:

- Elements
- Trees
- Structures
- Typologies

ELEMENTS

The Elements are comprised of individual interventions that, when combined with one another, compose entire typologies. Elements are organized into the following categories:

- Pedestrian
- Bicycle
- Supporting

TREES

Trees provide a multitude of benefits beyond shading bicycle and pedestrian facilities, making them an invaluable addition to the community. Trees have the ability to cool the climate around them, reduce urban heat island effect, absorb water and carbon, absorb/catch pollutants, produce oxygen, reduce heating/cooling bills and more. They are more economical than built shade structures and provide more community-wide benefits. When trees are planted and maintained appropriately they add aesthetic value as well, creating an asset for the community to enjoy for generations.

Each element and typology are based on the standards and best practices from local entities such as the city of Goodyear, Maricopa County, and Maricopa Association of Governments as well as national and international resources such as the National Association of City Transportation Officials (NACTO) and the American Association of State Highway and Transportation Officials (AASHTO). The trees are based on regional knowledge as well as information gathered from public resources, including the *Low Water use Drought Tolerant Plant List for the Phoenix Active Management Area*.

Each element includes information about appropriate use, typical placement, tree placement, and other useful information. When possible, elements are based on sections used in the Goodyear Parks and Recreation Master Plan, among other standards. Each element corresponds to a specific colored symbol with initials. These symbols will be used in each

The trees described in this study are meant for inclusion in the city's right of way, parks, and landscape setbacks as well as within private developments. Each tree has a brief overview including:

- Height X Width
- Planter Width Minimum
- Min. Distance from Sidewalk
- Min. Distnce from Back of Curb
- Planting Distance
- Distance from Building
- ADWR Approved
- Notes

Trees are not called out or indicated individually for each typology, but include the information needed to

The guidelines for structures aim to create the greatest amount of shade for gathering spaces while bringing art, culture, and character through structures that support and enhance the city's identity.

typology to indicate where each element is appropriately used.

(eg: if under the elements section in a typology, a pink circle with the initials 'MP' appears - that indicates that a Multi-Use Path can be used in that typology.)

make the decision process as easy as possible. When choosing a tree, it is most important to consider planter width requirements, size, and the tree-specific notes.

(eg: if considering trees for a 10' planter, focus on any tree with a planter width minimum equal to or less than 10'. From there, consider what size canopy is appropriate for the location. Notes can help further determine if the tree is a good choice for the location.)

Refer to the Appendix B for full tree specification sheets.

STRUCTURES

Shade structures provide multiple benefits, but at a greater cost than trees. They can make a visual statement while also making the pedestrian environment more comfortable. They can be designed at any scale to respond to an area's existing character or to help determine that area's character. They can be as simple or extravagant as the site warrants being a small node or the central gathering space along a pedestrian corridor.

They can exist within existing right of way or take advantage of easements or additional property. Shade structures should respond to their directional relationship to the pedestrian corridor or gathering space in order to cast shade on the greatest number of pedestrian and bicyclists at the hottest time of the day and year: vertical side panels should be located on south and/or west sides of the structure and roofs angled towards the south and/or west.

Shade structure options can be broken down into the following types:

- Art Shade Structures
- Conventional Shade Structures
- Fabric Shade Structures

Refer to the appendix for more shade structure samples.

TPOLOGIES

The following breakdown explains each section of each typology and how they relate to the other tools in the toolbox:

1. Typology Title

2. This section describes the typology in detail including useful information like tree locations, elements used and any other helpful tips.

3. This section gives the minimum right-of-way required to implement the typology.

4. Each symbol corresponds to an element found in the Elements section, indicating that those elements can potentially be used in the typology.

RESIDENTIAL: NORTH + EAST SIDES

To best shade the pedestrian and bicycle facilities on the North and East Sides of a typical street corridor trees should be:

- placed between the back of curb and the walkway
- for best coverage plant the backside of the walkway and encourage residents and property owners to plant the spaces as well.

MINIMUM RIGHT OF WAY
10' - back of curb to back of sidewalk

ELEMENTS:

pedestrian

SW (sidewalk)

bicycle

BL (bike lane)

supporting

CC (curb cut)

MULTI-USE PATH **MP**

This paved facility is used by walkers, bicyclists, pedestrians, joggers, strollers, wheelchair users, in-line skaters, other non-motorized users, and anyone wanting a smooth and consistent surface. Paths are signed for various users, are ADA accessible (when grades of 5% or less), and may also be used by small maintenance and emergency response vehicles. Paths include an adjacent two-foot unpaved shoulders on each side.

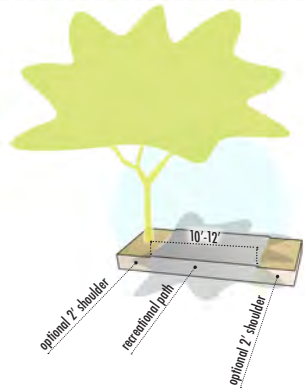


FIGURE 2-1: TOOLBOX - MULTI-USE PATH

SIDEWALK **SW**

This paved facility is used by walkers, pedestrians, joggers, strollers, wheelchair users, in-line skaters, other non-motorized users, and anyone wanting a smooth and consistent surface. Sidewalks are signed for various users, are ADA accessible (when grades of 5% or less). Sidewalks are constructed of poured in place concrete and include an adjacent two-foot unpaved shoulder on each side. These are typically detached with a 4' min. planter between back of curb to the edge of the concrete sidewalk while also existing within parks and open spaces.

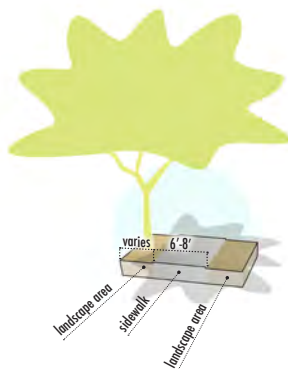


FIGURE 2-2: TOOLBOX - SIDEWALK

ATTACHED SIDEWALK **AS**

This paved facility is used by walkers, pedestrians, joggers, strollers, wheelchair users, in-line skaters, other non-motorized users, and anyone wanting a smooth and consistent surface. Sidewalks are signed for various users, are ADA accessible (when grades of 5% or less). Sidewalks are constructed of poured in place concrete and include an adjacent two-foot unpaved shoulders the non-street side e. These are attached to the back of curb and typically have a planting space on the opposite side.

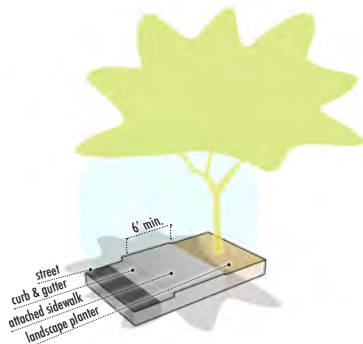


FIGURE 2-3: TOOLBOX - ATTACHED SIDEWALK

TRAIL **T**

Trails are used by multiple user groups such as mountain/recreational bicyclists, walkers, runners, hikers, equestrians, and others who prefer a soft, natural surface rather than a hard-paved surface. Trails connect local and regional destinations and neighborhoods within a larger trail network. They are located in all types of situations: along roadways, washes, utility corridors, and within small and large open space areas. They may be used by small maintenance and emergency response vehicles.

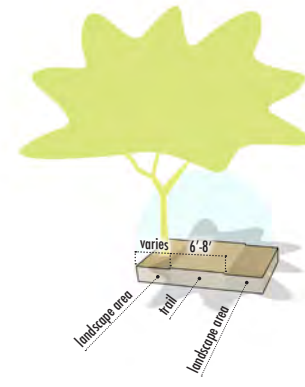


FIGURE 2-4: TOOLBOX - TRAIL

PROTECTED BIKE LANE **FP**

This asphalt paved facility is used by bicyclists and other non-motorized wheeled users such as scooters. Fully protected bike lanes are signed for non-motorized use only and have full separation from the motorized vehicular travel lane with either a landscape planter or other vertical implementations. The width of the bike lane should be no less than 6' of paved asphalt surface with curb and gutter on each side or a fully integrated 8' concrete pan from curb face to curb face. Bicycle lanes should be colored green to detonate bicycle and non-motorized use only. It is recommended that the green coloring be applied through thermoplastic, Durable Liquid Pavement Markings, or Embedded pigment.

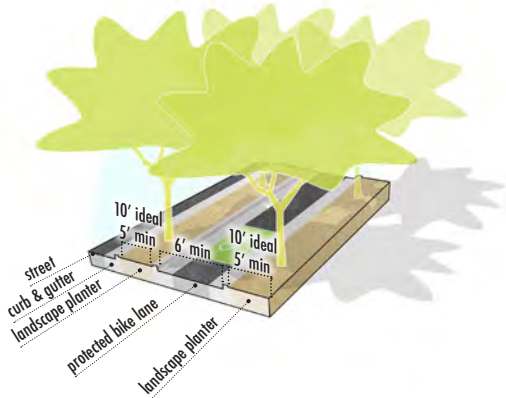


FIGURE 2-5: TOOLBOX - PROTECTED BIKE LANE

BUFFERED BIKE LANE **BB**

This asphalt paved facility is used by bicyclists and other non-motorized wheeled users such as scooters. Buffered bike lanes are signed for non-motorized use only and have additional separation from the motorized vehicular travel lane. They should be painted or painted with a textured 2' minimum buffer. The width of the bike lane should be no less than 4' of paved asphalt surface not including the gutter pan or may have a fully integrated gutter pan and the bike lane should be minimum 5'. Bicycle lanes should be colored green to detonate bicycle and non-motorized use only. It is recommended that the green coloring be applied through thermoplastic, Durable Liquid Pavement Markings, or Embedded pigment.

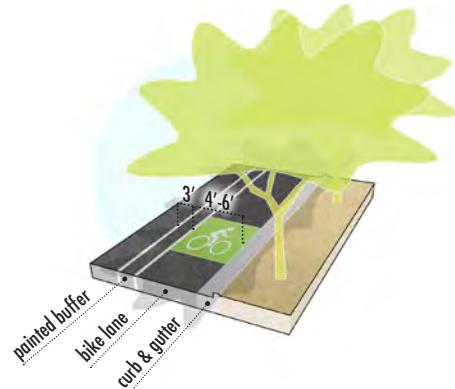


FIGURE 2-6: TOOLBOX - BUFFERED BIKE LANE

BIKE LANE **BL**

This asphalt paved facility is used by bicyclists and other non-motorized wheeled users such as scooters. Bike lanes are signed for non-motorized use only, separate from the motorized travel lane. The width of the bike lane should be no less than 4' of paved asphalt surface not including the gutter pan or may have a fully integrated gutter pan and the bike lane should be minimum 5'. Bicycle lanes should be colored green to detonate bicycle and non-motorized use only. It is recommended that the green coloring be applied through thermoplastic, Durable Liquid Pavement Markings, or Embedded pigment.

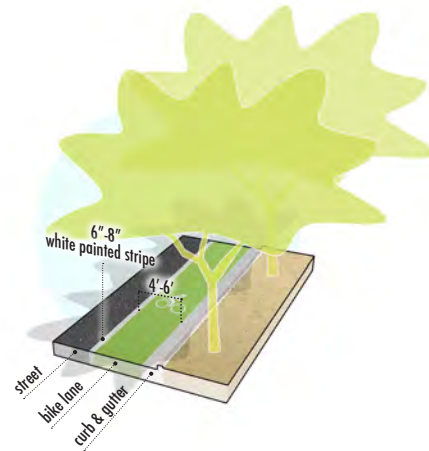


FIGURE 2-7: TOOLBOX - BIKE LANE

ELEMENTS
BICYCLE & SUPPORTING

GRADE-SEPARATED
BIKE LANE GS

This paved facility is used by bicyclists and other non-motorized wheeled users such as scooters. Grade-separated bike lanes are signed for non-motorized use only and have full separation from the motorized vehicular travel lane. They should also be placed 6" above travel lane at the top of curb. The width of the bike lane should be no less than 5' of paved surface. The pavement surface should be asphalt with a flush curb on the back side for ease of maintenance. Bicycle lanes should be colored green to denote bicycle and non-motorized use only. It is recommended that the green coloring be applied through thermoplastic, Durable Liquid Pavement Markings, or Embedded pigment.

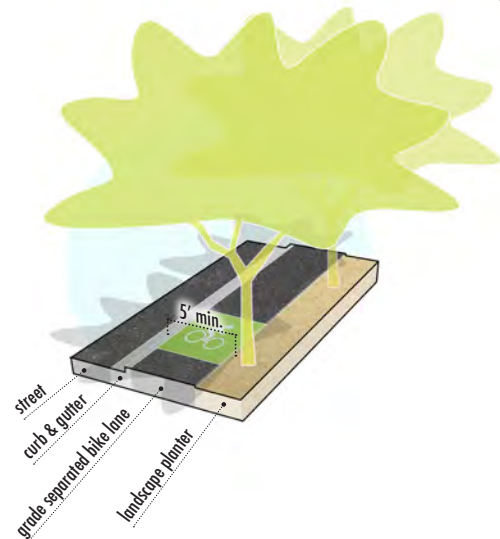


FIGURE 2-8: TOOLBOX - GRADE-SEPARATED BIKE LANE

SUPPORTING

CURB CUT CC

Curb cuts along street and parking lot curbs should be used in conjunction with bioswales to capture water and retain water on-site. The curb cut must have a catchment basin behind it (bioswale) to ensure that the curb cut is functioning as intended. The curb cut is a minimum of 2' wide to ensure that water is able to be captured as the water moves along the curb face.

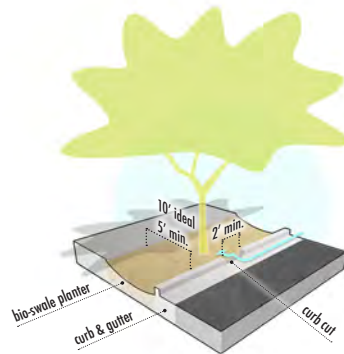


FIGURE 2-9: TOOLBOX - CURB CUT

BIO-SWALE/
BIORETENTION BS

Bioswales/bioretention basins should be implemented as a standard for all planting areas. This assures as much water as possible can be captured onsite. Ensure all planting spaces have a minimum 6" depression from the surrounding hardscape, e.g. sidewalks, pathways, streets, parking lots, and more. Bioswales and bioretention basins assist in catching the first flush run-off during storm events.

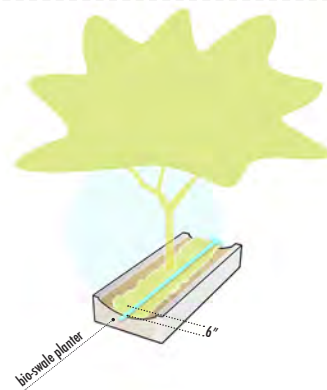


FIGURE 2-10: TOOLBOX - BIO-SWALE BIORETENTION

ELEMENTS
SUPPORTING

TREE GRATE TG

A tree grate is a metallic grating installed at the same level as the pavement surrounding a tree; they allow the soil underneath to stay uncompacted and for pedestrians to walk near the tree without stepping onto soil. When utilized along a curb face, a curb cut should be utilized to allow for water to enter into the trees root zone and act as additional water catchment. In addition to the tree grate, the use of a permeable pavement, such as pavers, is recommended surrounding the trees; this will ensure water and oxygen infiltration to the trees drip zone.

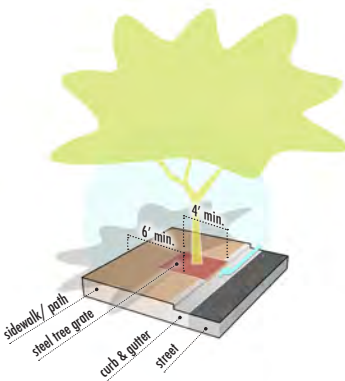


FIGURE 2-11: TOOLBOX - TREE GRATE

TRENCH GRATE TR

Trench grates are to be used in conjunction with sidewalks that must cross over small bioswales and bioretention areas. These areas should be no deeper than 8" without proper bumpers and rails to ensure safety while crossing.

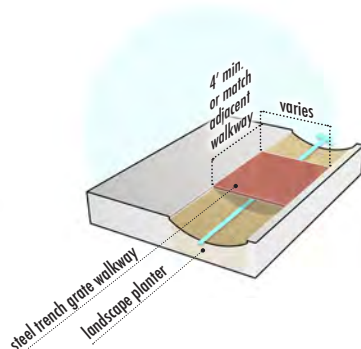


FIGURE 2-12: TOOLBOX - TRENCH GRATE

PARKING
BUMPER STOPS BU

Bumper stops and curbs should be placed a minimum of 3' from any tree that is to be placed within a planting space that adjoins a parking area. This ensures that cars do not inadvertently drive into trees causing damage to either the vehicle or the tree.

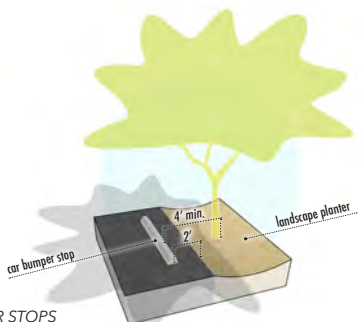


FIGURE 2-13: TOOLBOX - PARKING BUMPER STOPS

FLUSH CURB FC

Flush curbs provide a hard edge for asphalt while allowing for drainage to flow into adjacent landscape areas. Flush curbs provide a clear visual distinction to the edge of asphalt and help to maintain pavement edge.

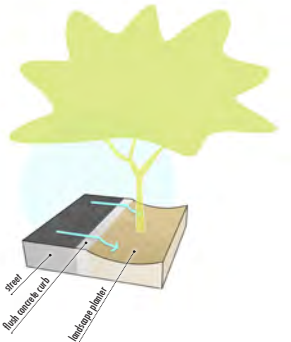


FIGURE 2-14: TOOLBOX - FLUSH CURB



PHOENIX MESQUITE

Prosopis X Phoenix®

Height X Width: 30' x 30'
Ideal Planter Width Minumum: 10'
Min. Distance From Sidewalk: 5'
Min. Distance From Back of Curb: 6'
Planting Distance: 24' O.C.
Distance From Building: 10' Minimum
ADWR Approved: Yes

Notes:
Semi evergreen shade tree best used in larger planters to avoid truck trimming and to prevent branches from growing the the way of bicyclist and pedestrians. Seed pods may be difficult to maintain as they fall to the ground. Is drought tolerant with occasional watering once established.



SEEDLESS MESQUITE

Prosopis seedless hybrid

Height X Width: 30' x 30'
Ideal Planter Width Minumum: 10'
Min. Distance From Sidewalk: 5'
Min. Distance From Back of Curb: 6'
Planting Distance: 24' O.C.
Distance From Building: 10' Minimum
ADWR Approved: Yes

Notes:
Semi evergreen shade tree best used in larger planters to avoid truck trimming and to prevent branches from growing the the way of bicyclist and pedestrians. This varity is seedless. Is drought tolerant with occasional watering once established.



IRONWOOD

Olneya tesota

Height X Width: 25' x 25'
Ideal Planter Width Minumum: 12'
Min. Distance From Sidewalk: 7'
Min. Distance From Back of Curb: 5'
Planting Distance: 20' O.C.
Distance From Building: 8' Minimum
ADWR Approved: Yes

Notes:
Medium size tree with lots of thorns. This tree can be difficult to maintain near traffic lanes and sidewalks due to its growth habits and thorns. Has light pink-purple blooms in spring. Is drought tolerant with occasional watering once established.



PALO BREA

Parkinsonia praecox

Height X Width: 25' X 25'
Ideal Planter Width Minumum: 10'
Min. Distance From Sidewalk: 5'
Min. Distance From Back of Curb: 5'
Planting Distance: 20' O.C.
Distance From Building: 8' Minimum
ADWR Approved: Yes

Notes:
Excellent at providing filtered shade, needs additional room along roadways to avoid truck trimming due to multi-trunk habit. profuse blooming of yellow flowers can cover the ground when in season. Is drought tolerant with occasional watering once established.



PALO VERDE DESERT MUSEUM

Prosopis seedless hybrid

Height X Width: 25' X 25'
Ideal Planter Width Minumum: 10'
Min. Distance From Sidewalk: 4'
Min. Distance From Back of Curb: 5'
Planting Distance: 20' O.C.
Distance From Building: 8' Minimum
ADWR Approved: Yes

Notes:
Excellent at providing filtered shade, needs additional room along roadways to avoid truck trimming due to multi-trunk habit. profuse blooming of yellow flowers can cover the ground when in season. Is drought tolerant with occasional watering once established.



CACALACO

Caesalpinia cacalaco

Height X Width: 18' x 18'
Ideal Planter Width Minumum: 8'
Min. Distance From Sidewalk: 4'
Min. Distance From Back of Curb: 4'
Planting Distance: 14.4' O.C.
Distance From Building: 4' Minimum
ADWR Approved: Yes

Notes:
A small tree that wants to be a bush until it is trained with uptrimming into a tree form. Does not provide much shade for pedestrians or bicyclists, but can once it has reached full size. This semi-evergreen works best as an accent plant until it can provide some shade. Works well in small spaces. Semi drought tolerant.



SHOESTRING ACACIA

Acacia stenophylla

Height X Width: 40' X 30'
Ideal Planter Width Minumum: 10'
Min. Distance From Sidewalk: 5'
Min. Distance From Back of Curb: 5'
Planting Distance: 24' O.C.
Distance From Building: 8' Minimum
ADWR Approved: Yes

Notes:
Large ever-green tree that provides ample shade. Has a heavy amount of litter from blooms and leaves. Is drought tolerant with occasional watering once established.



SWEET ACACIA

Vachellia farnesiana

Height X Width: 30' x 30'
Ideal Planter Width Minumum: 12'
Min. Distance From Sidewalk: 7'
Min. Distance From Back of Curb: 5'
Planting Distance: 24' O.C.
Distance From Building: 8' Minimum
ADWR Approved: Yes

Notes:
Medium size tree with lots of thorns. This tree can be difficult to maintain near traffic lanes and sidewalks due to its growth habits and thorns. Profuse yellow blooms have a smell.



MULGA

Acacia aneura

Height X Width: 20' X 15'
Ideal Planter Width Minumum: 10'
Min. Distance From Sidewalk: 5'
Min. Distance From Back of Curb: 5'
Planting Distance: 12' O.C.
Distance From Building: 5' Minimum
ADWR Approved: Yes

Notes:
Small Tree that is excellent for small planters and under powerlines where space is limited. Is extremely stable with wind damage being rare. Is drought tolerant with occasional watering once established.



WILLOW ACACIA

Acacia salicina

Height X Width: 40' x 30'
Ideal Planter Width Minumum: 10'
Min. Distance From Sidewalk: 5'
Min. Distance From Back of Curb: 5'
Planting Distance: 24' O.C.
Distance From Building: 10' Minimum
ADWR Approved: Yes

Notes:
Large ever-green tree that provides ample shade. Has a heavy amount of litter from blooms and leaves. Is drought tolerant with occasional watering once established.



CHINESE PISTACHE

Pistacia chinensis

Height X Width: 30' x 25'
Ideal Planter Width Minumum: 10'
Min. Distance From Sidewalk: 5'
Min. Distance From Back of Curb: 5'
Planting Distance: 20' O.C.
Distance From Building: 10' Minimum
ADWR Approved: Yes

Notes:
Medium deciduous tree with a splash of fall/winter color of oranges, reds, and yellows. Has a very uniform growth habit from a single trunk with limited pruning. Will tolerate less water, but thrives with a regular water schedule.



CHINESE ELM

Ulmus parvifolia

Height X Width: 40' x 30'
Ideal Planter Width Minumum: 10'
Min. Distance From Sidewalk: 5'
Min. Distance From Back of Curb: 5'
Planting Distance: 24' O.C.
Distance From Building: 10' Minimum
ADWR Approved: Yes

Notes:
Large deciduous tree that provides ample shade in the warmer summer months. Has a very uniform growth habit from a single trunk with limited pruning. Will tolerate less water, but thrives with a regular water schedule.

TREES



GHOST GUM
Eucalyptus papuana

Height X Width: 40' x 25'
Ideal Planter Width Minumum: 8'
Min. Distance From Sidewalk: 4'
Min. Distance From Back of Curb: 4'
Planting Distance: 20' O.C.
Distance From Building: 4' Minimum
ADWR Approved: Yes

Notes:
Large ever-green tree that will grow and establish in small spaces. Unlike most eucalyptus, the growth and structure tend to be much less wind damaged. Unique and beautiful white bark. Semi drought tolerant



LIVE OAK
Quercus virginiana

Height X Width: 40' x 30'
Ideal Planter Width Minumumm: 10'
Min. Distance From Sidewalk: 5'
Min. Distance From Back of Curb: 5'
Planting Distance: 24' O.C.
Distance From Building: 8' Minimum
ADWR Approved: Yes

Notes:
An evergreen tree that may feel like small tree when you plant it, but has the ability slowly to become one of the largest in the region. Extremely slow growing, especially in poor growing conditions. Has a very uniform growth habit from a single trunk with limited pruning.



CALIFORNIA FAN PALM
Washingtonia filifera

Height X Width: 50' x 15'
Ideal Planter Width Minumumm: 10'
Min. Distance From Sidewalk: 5'
Min. Distance From Back of Curb: 5'
Planting Distance: 12' O.C.
Distance From Building: 5' Minimum
ADWR Approved: No

Notes:
California Fan Palms have a wide base that should be thought of when planting as they can reach 3' - 4' in diameter. They require regular maintenance. Are semi-drought tolerant.



DATE PALM
Phoenix dactylifera

Height X Width: 80' x 20'
Ideal Planter Width Minumum: 10'
Min. Distance From Sidewalk: 5'
Min. Distance From Back of Curb: 8'
Planting Distance: 16' O.C.
Distance From Building: 5' Minimum
ADWR Approved: No

Notes:
The Date Palm provides a unique look with its diamond cut trunk and large cascading fronds. It requires regular maintenance to trim palm fronds and flowers before seeds form. can provide shade when planted closely together. Requires additional water during summer months.

SHADE STRUCTURES

STRUCTURE ORIENTATION

- Shade structures should be placed to:
- take advantage of the sun’s angles at the hottest parts of the day and year
 - orient the lower overhang to face either the south or the west providing the highest amount of shade possible for pedestrian spaces
 - consider the structure’s height so the shade cast benefits the gathering spaces and not far beyond
 - Consider the height so it is not climbable and thereby avoids injury and potential structural damage

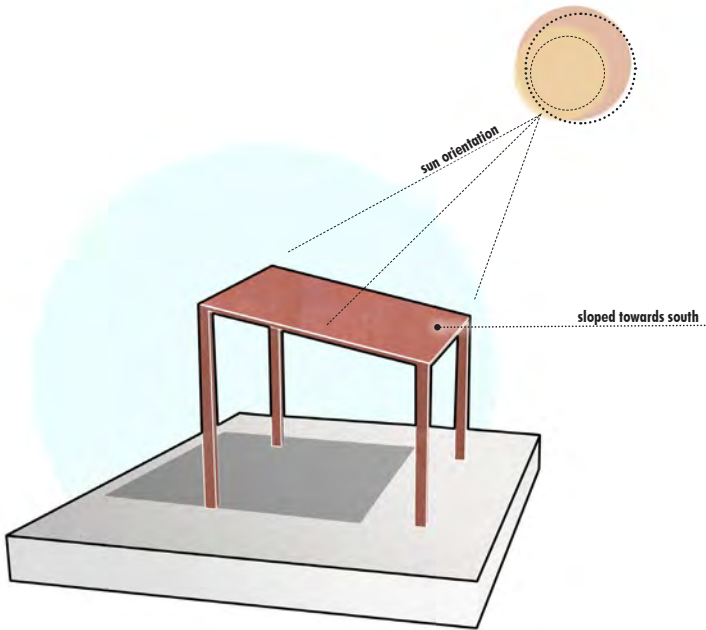


FIGURE 2-15: TOOLBOX - STRUCTURE ORIENTATION

PANEL ORIENTATION

- Shade panels should be placed to:
- take advantage of the sun’s angles at the hottest parts of the day and year
 - be oriented to face either the south or the west to provide the highest amount of shade possible for pedestrian spaces
 - consider the height and visual aspect of the panel
 - ensure the panel does not create a hidden space - perforated or slatted panels preferred

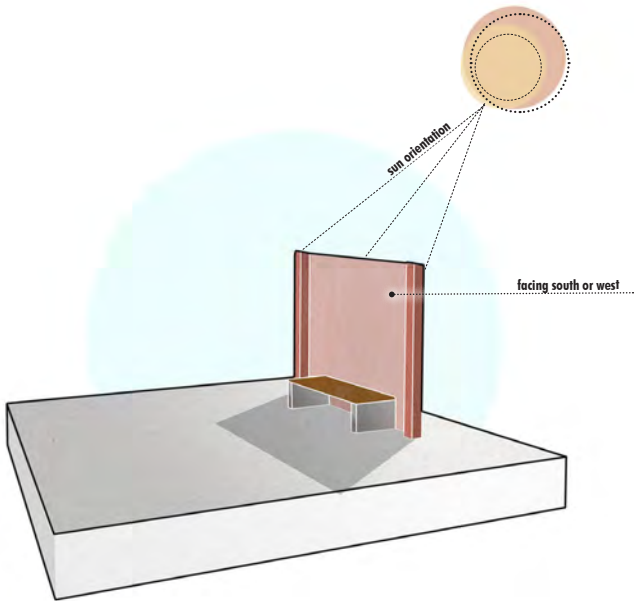


FIGURE 2-16: TOOLBOX - PANEL ORIENTATION

EXAMPLE STRUCTURES*



ART



CONVENTIONAL



FABRIC

*SEE APPENDIX FOR ADDITIONAL EXAMPLES

TPOLOGIES
STREETS

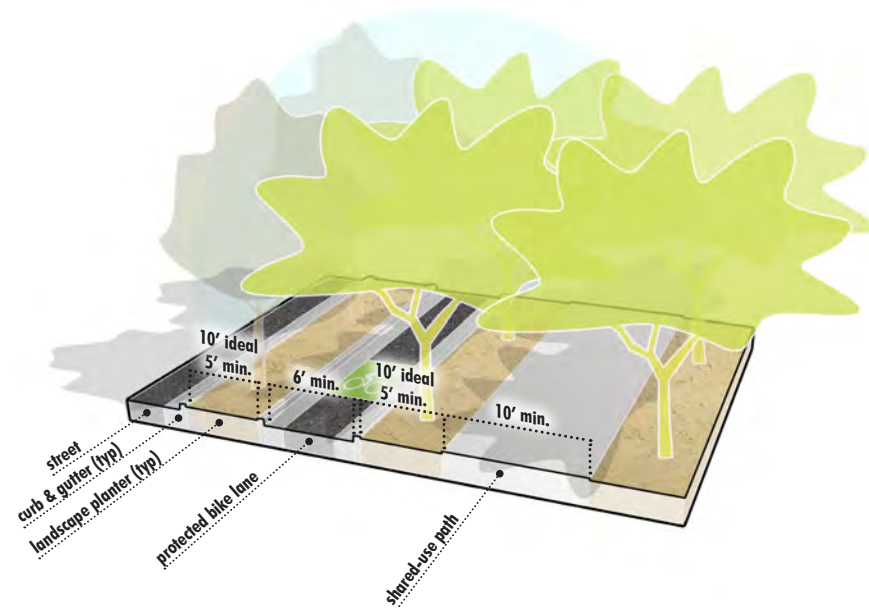


FIGURE 2-17: TOOLBOX - HIGH-USE ACTIVE TRANSPORTATION CORRIDOR

HIGH-USE ACTIVE
TRANSPORTATION
CORRIDOR

Used on arterials or major collectors that either have a high active transportation demand/forecasted and accidents.

- trees are placed within each of the three planting spaces to provide optimal shade coverage of all facilities.
- vehicular site lines must be considered.

MINIMUM RIGHT OF WAY
32' - from back of street curb

ELEMENTS:

pedestrian



bicycle



supporting



ARTERIAL/MAJOR
COLLECTORS:
NORTH + EAST SIDES

To best shade the pedestrian and bicycle facilities on the North and East Sides of a typical street corridor trees should:

- be placed between the back of curb and the walkway.
- for best shade coverage, ensure trees are planted on both sides of the walkway.

MINIMUM RIGHT OF WAY
17' - edge of vehicular lane to back of path

ELEMENTS:

pedestrian



bicycle



supporting



FIGURE 2-18: TOOLBOX - ARTERIAL/MAJOR COLLECTORS: NORTH + EAST SIDES

TPOLOGIES
STREETS

ARTERIAL/MAJOR
COLLECTORS: SOUTH +
WEST SIDES

To best shade the pedestrian and bicycle facilities on the North and East Sides of a typical street corridor trees should:

- be placed behind the back of the walkway
- for best shade coverage, ensure trees are planted on both sides of the walkway

MINIMUM RIGHT OF WAY
17' - edge of vehicular lane to edge of planter

ELEMENTS:

pedestrian



bicycle



supporting

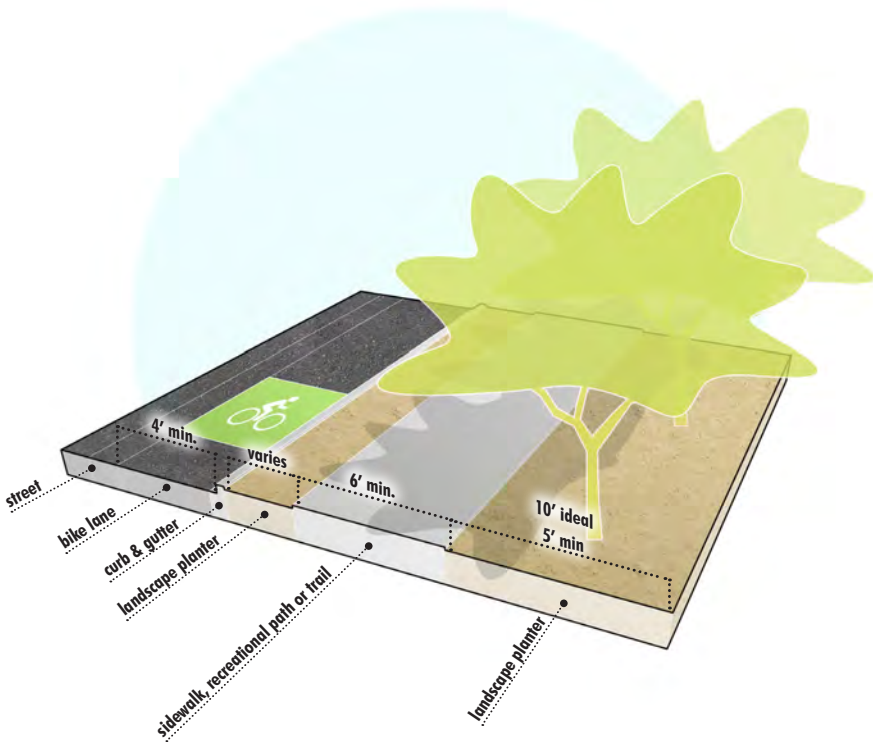


FIGURE 2-19: TOOLBOX - ARTERIAL/MAJOR COLLECTORS: SOUTH + WEST SIDES

RESIDENTIAL:
NORTH + EAST SIDES

To best shade the pedestrian and bicycle facilities on the North and East Sides of a typical street corridor trees should:

- be placed between the back of curb and the walkway
- for best coverage plant the backside of the walkway and encourage residents and property owners to plant the spaces as well

MINIMUM RIGHT OF WAY
11' - back of curb to back of sidewalk

ELEMENTS:

pedestrian



bicycle



supporting

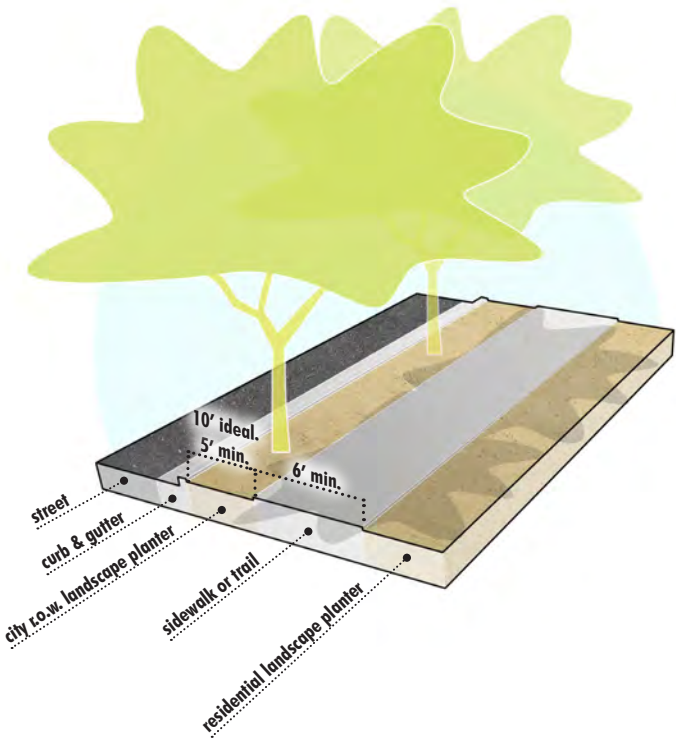


FIGURE 2-20: TOOLBOX - RESIDENTIAL: NORTH + EAST SIDES

TYPOLOGIES
STREETS & URBAN

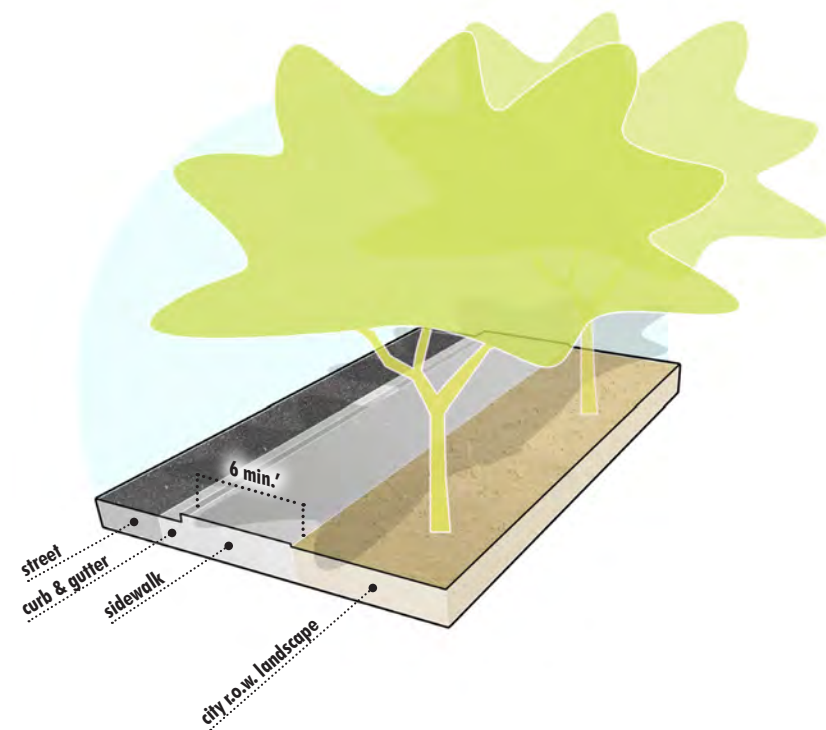


FIGURE 2-21: TOOLBOX - RESIDENTIAL: SOUTH + WEST SIDES

RESIDENTIAL:
SOUTH + WEST SIDES

To best shade the pedestrian and bicycle facilities on the North and East Sides of a typical street corridor trees should:

- be placed behind the back of the sidewalk
- for best coverage plant the front side of the walkway and encourage residents and property owners to plant trees beyond the ROW

MINIMUM RIGHT OF WAY
11' - from back of curb to edge of planter

ELEMENTS:

pedestrian



bicycle



supporting



ART & SHADE:
THE CORNER NODE

Implement a shade requirement as part of the monument art:

- on private and public development along the active transportation system
- include places for respite from the sun
- Include bike racks, water fountains and other amenities

MINIMUM RIGHT OF WAY
Will likely require public private partnership

ELEMENTS:

pedestrian



bicycle



supporting

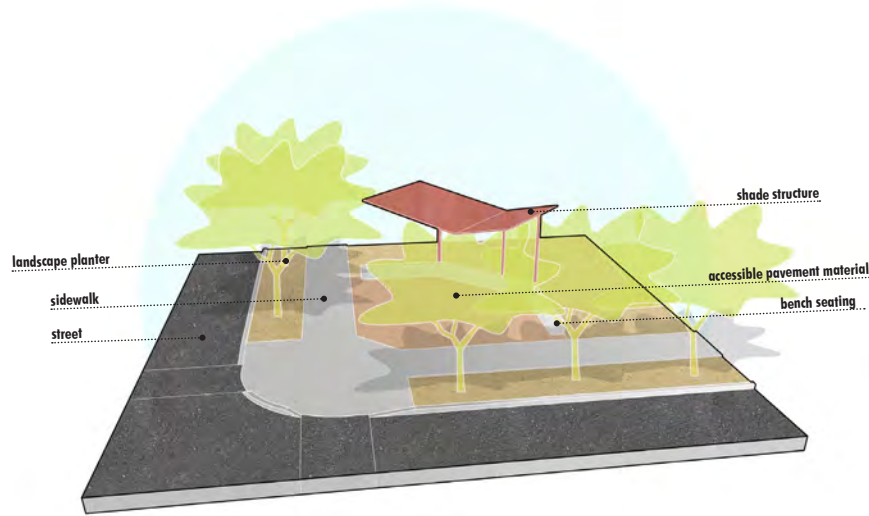


FIGURE 2-22: TOOLBOX - ART & SHADE - THE CORNER NODE

TYPOLOGIES
URBAN & PARKING

URBAN DEVELOPMENT

In urban development areas and within commercial developments shade structures should:

- be attach to the buildings with ample sidewalks/paths and trees.
- for best coverage include both structures and trees to increase the comfort of the spaces and encourage additional foot traffic along store and building fronts

MINIMUM RIGHT OF WAY
10' - building to back of curb

ELEMENTS:

pedestrian



bicycle



supporting

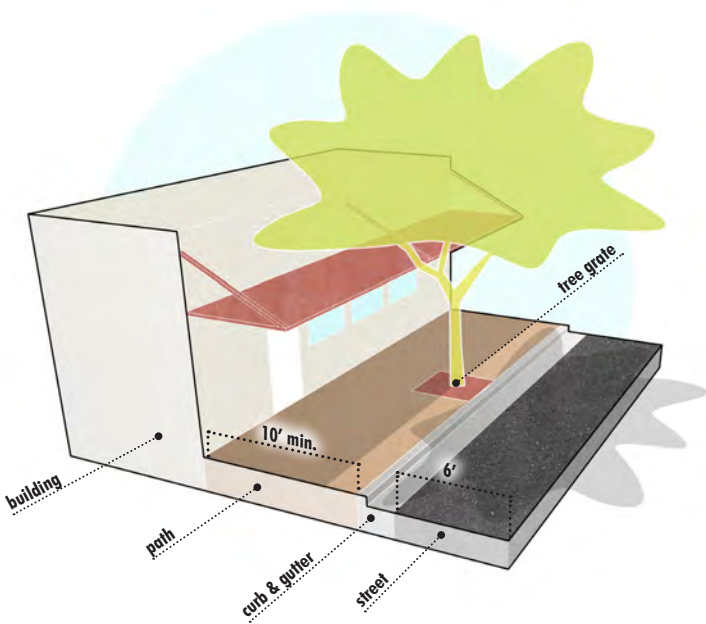


FIGURE 2-23: TOOLBOX - URBAN STREET DEVELOPMENT

45° & 60° DEGREE
PARKING

Within parking facilities either on-street or within parking lots that include 45° or 60° parking include:

- at grade planters in front of each parking space to provide room for green infrastructure bioswales and tree placement
- connections to attached sidewalks should be made to provide ease of access

ELEMENTS:

pedestrian



supporting

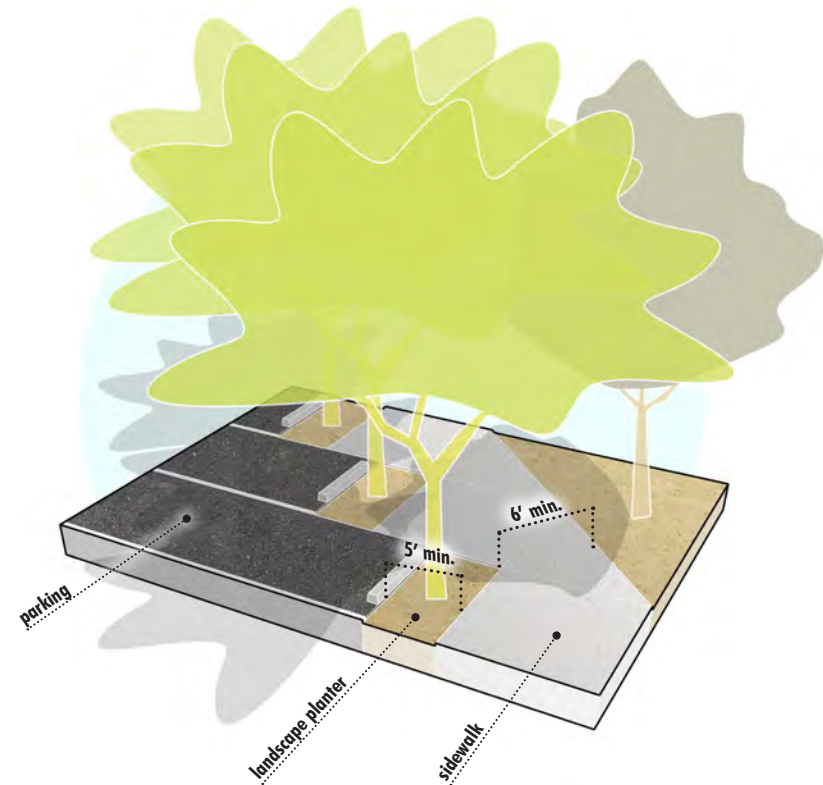


FIGURE 2-24: TOOLBOX - PARKING- 45 & 60 DEGREE

TYPOLOGIES
PARKING

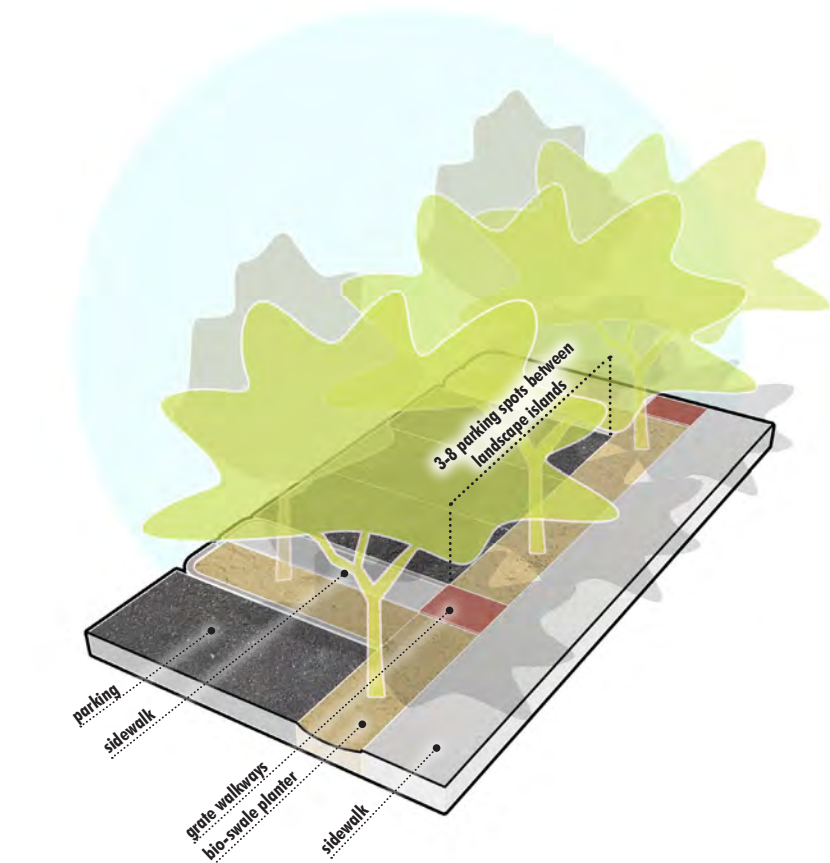


FIGURE 2-25: TOOLBOX - PARKING- 90 DEGREE

90° DEGREE PARKING

Within parking facilities that are on-street or within parking lots that include 90° parking include:

- planting islands every three to eight parking spots
- access to a center walkway with access to adjacent amenities such as business and public amenities.
- parking spaces with flush curbs for access to bioswales along landscape plantings as shown.
- access walkways and grates over bioswales

ELEMENTS:

pedestrian



supporting

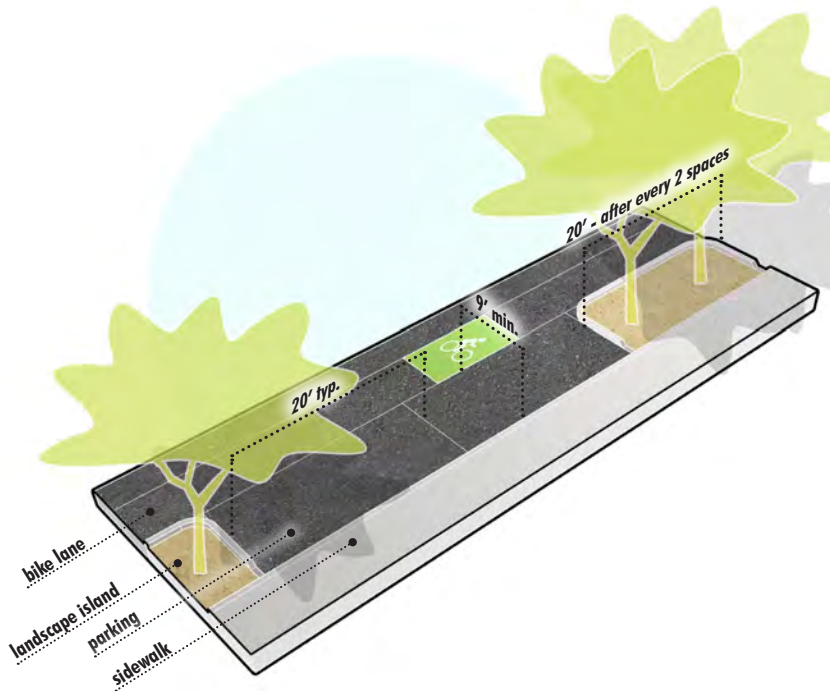


FIGURE 2-26: TOOLBOX - PARKING- PARALLEL

PARALLEL PARKING

Within parking facilities that provide parallel parking:

- planting islands should be placed every 2 spaces
- curb cuts should be included along curb-face for water to be flushed and infiltrate into the bioswales within the planter spaces.
- a minimum of one tree should be placed within each planter with a minimum width of 8'

ELEMENTS:

pedestrian



bicycle



supporting



TYPOLOGIES
RESIDENTIAL

RESIDENTIAL

Within residential and privately-owned properties utilize the following diagram for placing trees throughout the property:

- distance from buildings are shown in the tree elements portion of this document as well as distances from sidewalks/hardscapes.
- utilizing i-Tree on itreetools.org to guide planting the perfect tree for every location and the benefits of each planted tree

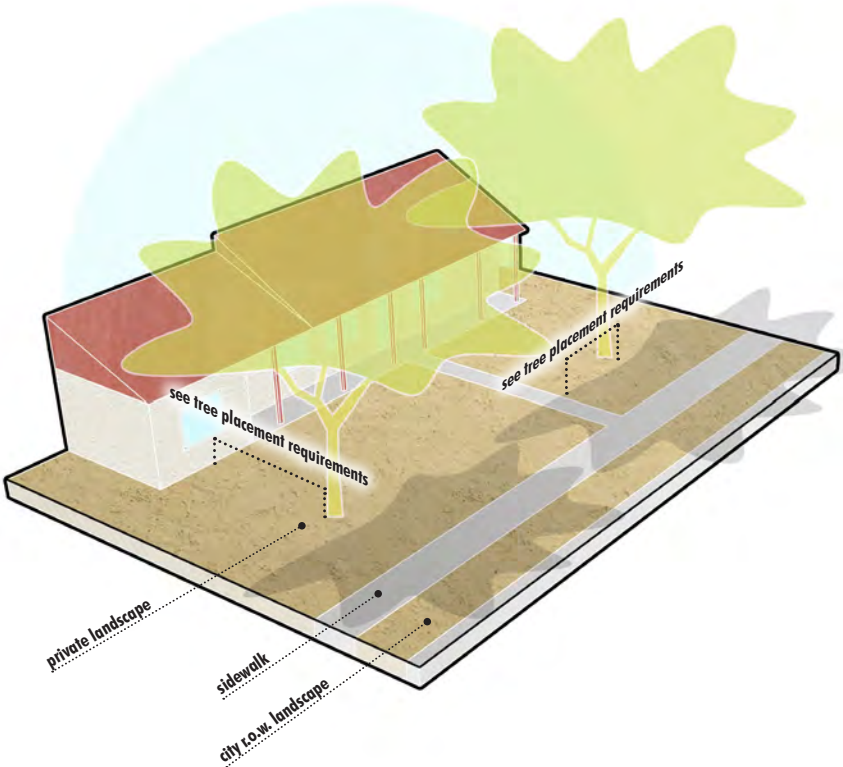


FIGURE 2-27: TOOLBOX- RESIDENTIAL AND BUILDING PLACEMENT

3

MOVING FORWARD



FIGURE 3-1: CENTERRA DRIVE NORTH OF HARRISON ST

MOVING FORWARD

This chapter provides information on how the city can move towards a potential goal of 60% shade coverage for bicycle and pedestrian facilities as recommended in the Maricopa Association of Governments (MAG) pedestrian guidelines. The Chapter is organized as follows:

Prototypes

Several representative site-based examples illustrate how to incorporate more shade into the built environment

Gap Analysis

Gaps in the existing bicycle and pedestrian network are mapped for the all roadway classifications in the five study areas and ten roadway corridors studied

Project Prioritization

A prioritization process is offered for evaluating projects that implement a shaded bicycle and pedestrian network

Estimates of Probable Costs

To assist with creating project budgets, estimates of probable cost are presented for the different components of a shaded bicycle and pedestrian network

Budget Issues

Several items are identified which should or are already included in a comprehensive tree program budget

Funding/Implementation Sources

Options are presented for funding/ implementing tree programs that can be covered from the city's annual budget or derived from external sources such as donations and grants

Recommendations

A broad range of ideas are presented that would help to implement 60% bicycle and pedestrian corridors shade coverage.

PROTOTYPES



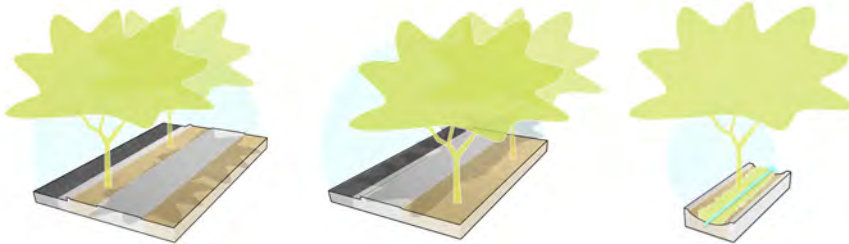
FIGURE 3-2: PROTOTYPE- CONTEMPORARY RESIDENTIAL

CONTEMPORARY RESIDENTIAL

CONCEPT:

The use of both attached and detached sidewalks in the contemporary neighborhoods allows for connections to nearby parks, trails, and other important facilities while minimizing the need for users to cross streets frequently. These facilities serve local residents of each neighborhood and create a comfortable walk to parks and other local connections when available.

- Implementing attached sidewalks on the south side of the road, and detached sidewalks to the north proves the most efficient use of available right of way space. This way, trees can be planted on the south side of each sidewalk, providing the most effective amount of shade for pedestrians based on sun orientation and intensity throughout the day.
- Making sure neighborhood trees are maintained appropriately limits the need for residents to take liberties to alter the effectiveness of the trees' shade.
- Planning for adequate planter widths and healthy maintenance practices benefit tree health and condition greatly.
- The addition of bioswales and curb cuts (in raised curb conditions) contributes to the collection and use of stormwater runoff to further benefit the shade canopy of the neighborhood while combating conventional drainage issues.



PROTOTYPES



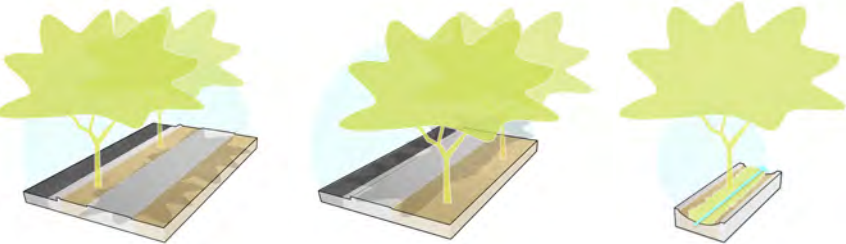
FIGURE 3-3: PROTOTYPE- HISTORIC RESIDENTIAL

HISTORIC RESIDENTIAL

CONCEPT:

Limited right of way ownership and established conditions make for unique constraints in historic regions of Goodyear. Transportation facilities serve local residents and provide connections to the neighborhood park, as well as other important pedestrian networks outside the neighborhood.

- Right of way space is best used by implementing attached sidewalks on the south side of the road, along with trees to provide shade.
- Existing trees contribute to the shade quality of these new facilities.
- Since new trees will be in residents' yards, the best trees have minimal litter and maintenance requirements.
- Making sure neighborhood street trees are maintained appropriately limits the need for residents to take liberties to alter the effectiveness of the trees' shade.
- If detached sidewalks are used on the north or east sides of the road, bioswales can be used to contribute to the collection and use of stormwater runoff to further benefit the shade canopy of the neighborhood while combating conventional drainage issues. If attached sidewalks are used on the south or west sides of the road, bioswales can be used behind the sidewalk.



PROTOTYPES



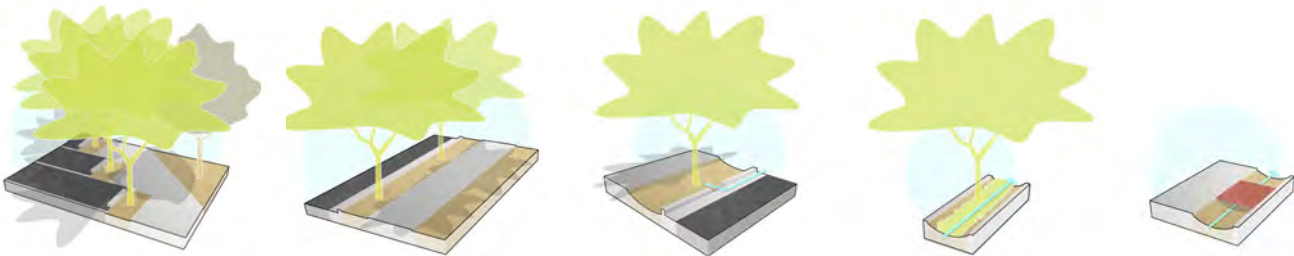
FIGURE 3-4: PROTOTYPE- BALLPARK

BALLPARK

CONCEPT:

The existing design of streets in the heart of the ballpark lend themselves well to improving pedestrian comfort. Planting on the south side of the facilities and parking provides the most effective amount of shade for users based on sun orientation and intensity throughout the day.

- The current center turn lane provides a great opportunity for the addition of occasional median planters to increase shade coverage, while still allowing adequate room for pulling into and backing out of the angled parking.
- The existing pedestrian facilities would benefit from the addition of trees to provide more shade for users.
- The addition of center medians, bioswales and curb cuts contribute to the collection and use of stormwater runoff to further benefit the shade canopy of the ballpark while combating conventional drainage issues.
- Incorporating trench grates at strategic points allows for easier sidewalk access for using the angled parking.
- The use of larger native shade trees like Palo Breas and Palo Verdes along pathways and parking stalls require less maintenance to accommodate vertical clearances.
- Tree varieties with a tighter canopy (Mulgas and Chinese Pistache) are good for center medians as they require little maintenance to accommodate vehicular traffic clearance.



PROTOTYPES



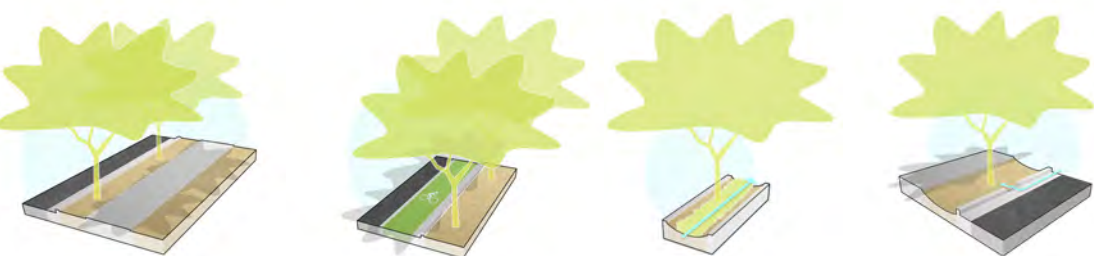
FIGURE 3-5: PROTOTYPE- COMMERCIAL

COMMERCIAL ARTERIAL

CONCEPT:

Including both pedestrian and bicycle facilities along commercial areas allows for maximum accessibility for all users. These facilities service a large portion of local residents with connections from nearby neighborhoods to destinations.

- Introducing trees along the street and behind sidewalks helps to provide ample shade to both networks.
- The existing center turn lane creates opportunities for center medians, which provide both shade and added safety and protection for all users of the road.
- The addition of bioswales and curb cuts contribute to the collection and use of stormwater runoff to further benefit the shade canopy of the neighborhood while combating conventional drainage issues.
- The use of larger shade trees like Palo Breas and Palo Verdes along pathways require less maintenance to accommodate pedestrian clearance.
- Tree varieties with a tighter canopy such as Mulgas and Chinese Pistache are good for center medians as they require little maintenance to accommodate vehicular traffic clearance.
- Focusing dense shade on bicycle and pedestrian facilities allows for the most comfortable use, while roadways and medians may require less dense shade.
- Improved cross walks create a safer and more comfortable user experience.



PROTOTYPES



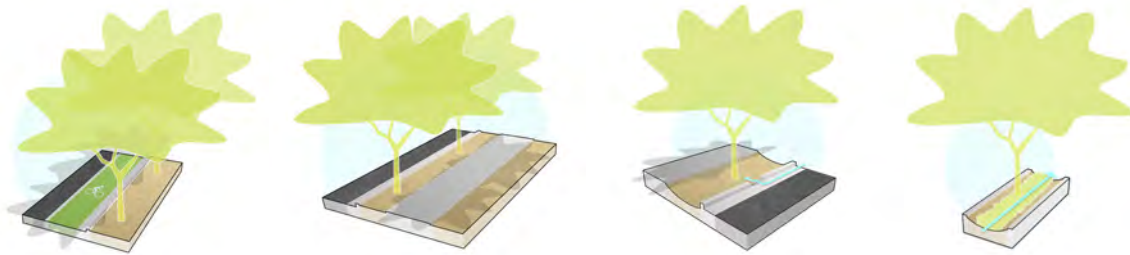
FIGURE 3-6: PROTOTYPE- PARK CROSSING

PARK CROSSING

CONCEPT:

A grade-separated crossing provides path continuity along a drainage corridor where it intersects a roadway. A drainage corridor occasionally floods however, limiting use of the path. A pedestrian-activated at-grade signal provides additional connectivity options and retains path access during flood events.

- Introducing more shade from trees along the street as well as the existing median contributes to the comfort and safety of all users.
- The inclusion of bike lanes creates more transportation options.
- The addition of bioswales and curb cuts contribute to the collection and use of stormwater runoff to further benefit the shade canopy of the park while combating conventional drainage issues.
- The use of larger shade trees like Palo Breas and Palo Verdes along pathways requires less maintenance to accommodate pedestrian clearance.
- Tree varieties with a tighter canopy (Mulgas and Chinese Pistache) are good for center medians as they require little maintenance to accommodate vertical clearances.
- Lighting the crosswalk allows for pedestrians and bicyclists to feel more comfortable among vehicular traffic, creating a safe environment for all users.



PROTOTYPES

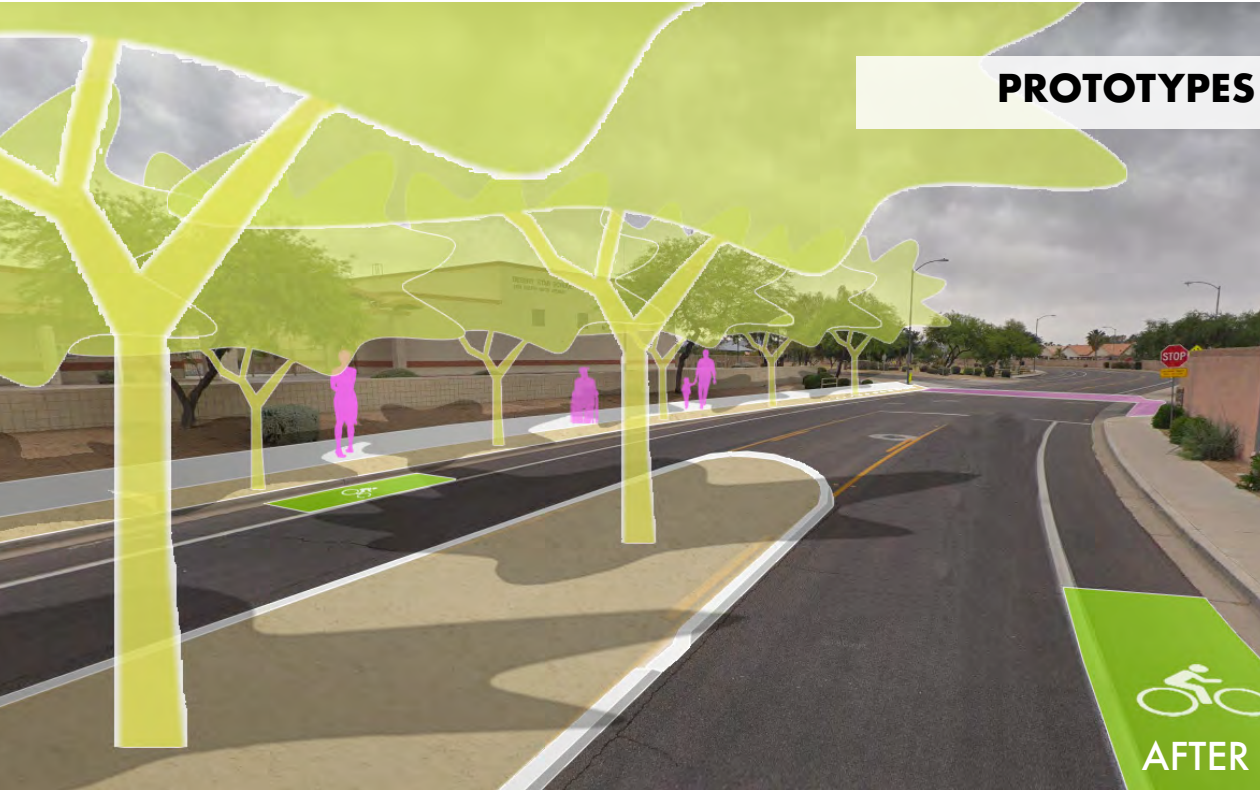


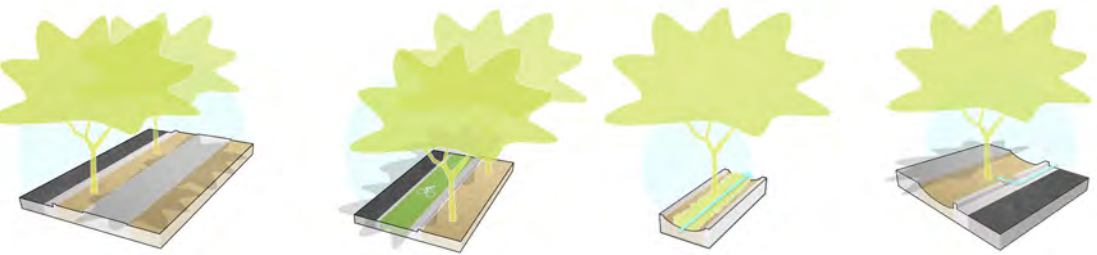
FIGURE 3-7: PROTOTYPE- SCHOOL

SCHOOL

CONCEPT:

Including both pedestrian and bicycle facilities along school routes allows for maximum accessibility for all users. These facilities service a large portion of local residents with connections from nearby neighborhoods to the school.

- Introducing trees along the street on the north side of the road helps to provide ample shade to both networks.
- Introducing center medians where appropriate further contributes to the comfort and safety of both networks.
- The addition of bioswales and curb cuts contribute to the collection and use of stormwater runoff to further benefit the shade canopy of the area while combating conventional drainage issues.
- The use of larger shade trees like Palo Breas and Palo Verdes along pathways and roadways with low traffic and speeds require less maintenance to accommodate pedestrian and minor vehicular traffic clearance.
- Improved cross walks create a safer and more comfortable user experience, and eliminate gaps in school routes.



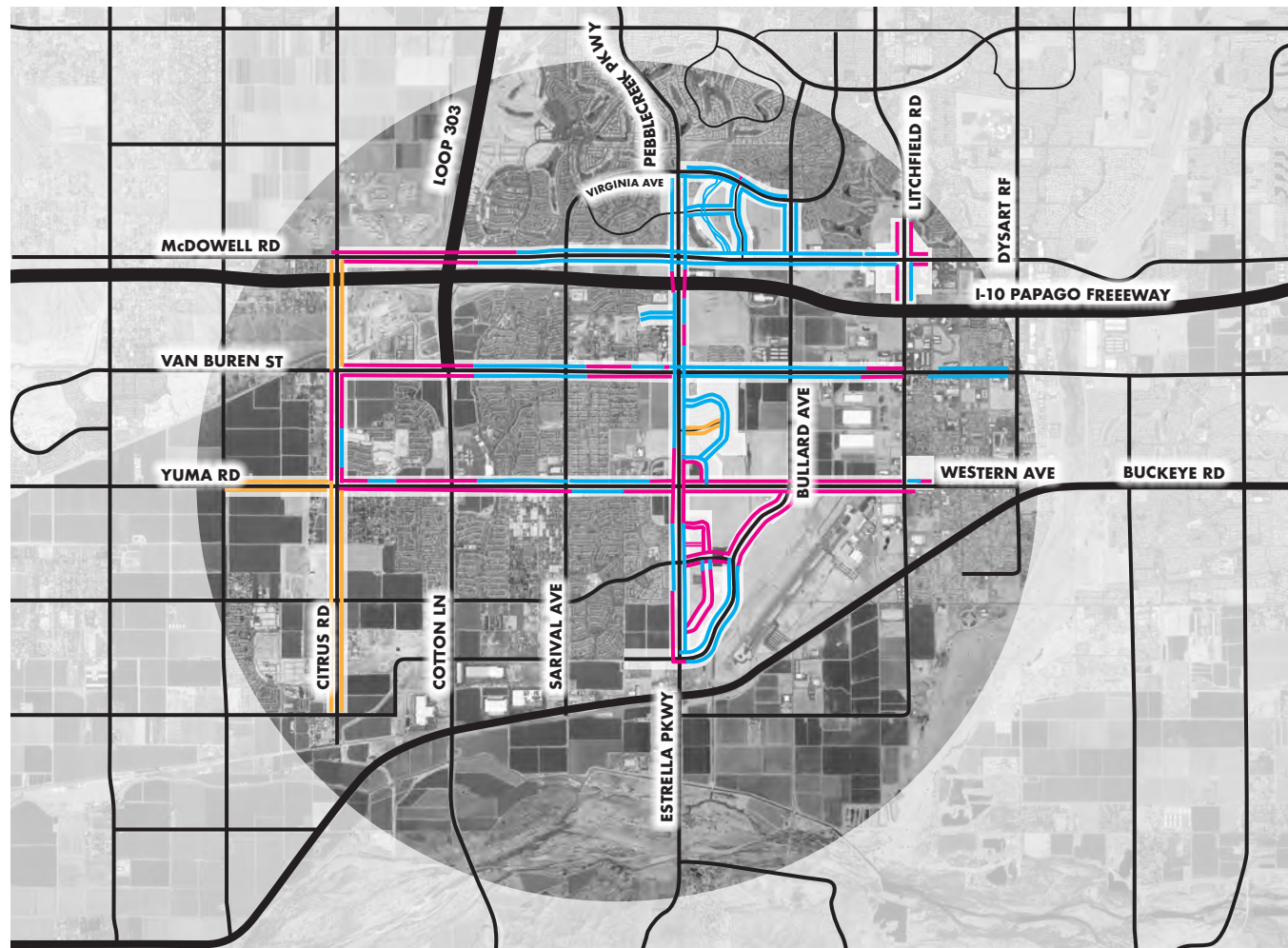


FIGURE 3-8: GAP ANALYSIS - BICYCLE FACILITIES

GAP ANALYSIS - BICYCLE FACILITIES

Goodyear has begun to establish a bicycle network, but gaps remain as the built network has often been implemented through a combination of public projects and dispersed private development. The map above shows the existing network within the study areas and corridors. This system is comprised of bike lanes and multi-use paths. This network focuses on bike lanes along arterial and collector streets and multi-use paths wherever they may exist.

Closing the gaps should focus on two things:

1. Long linear corridors
2. Loops of various lengths

Ideally, a project should both create loops and complete a long corridor.

An example of this would be to complete the bike lanes on McDowell Rd west of Clubhouse Dr to Citrus

Rd and along Citrus Rd between McDowell Rd and Van Buren St and along Van Buren St between Citrus Rd and east of Cotton Ln. By completing loops similar to this, multiple parts of the community would be connected while also providing a loop for recreational use.

The gaps are broken into two categories:

1. Near Term (PINK) - occurs in areas where development has either already occurred or is in progress, where the need for the facilities may already exist or the need is projected to increase as the areas continue to develop.
2. Mid Term (YELLOW) - happens in areas that may not have much development occurring but is projected to increase in three to five years

LEGEND

STUDY AREA BOUNDARIES

CORRIDORS



AREAS



BICYCLE FACILITIES

EXISTING



GAP (NEAR)



GAP (MID)

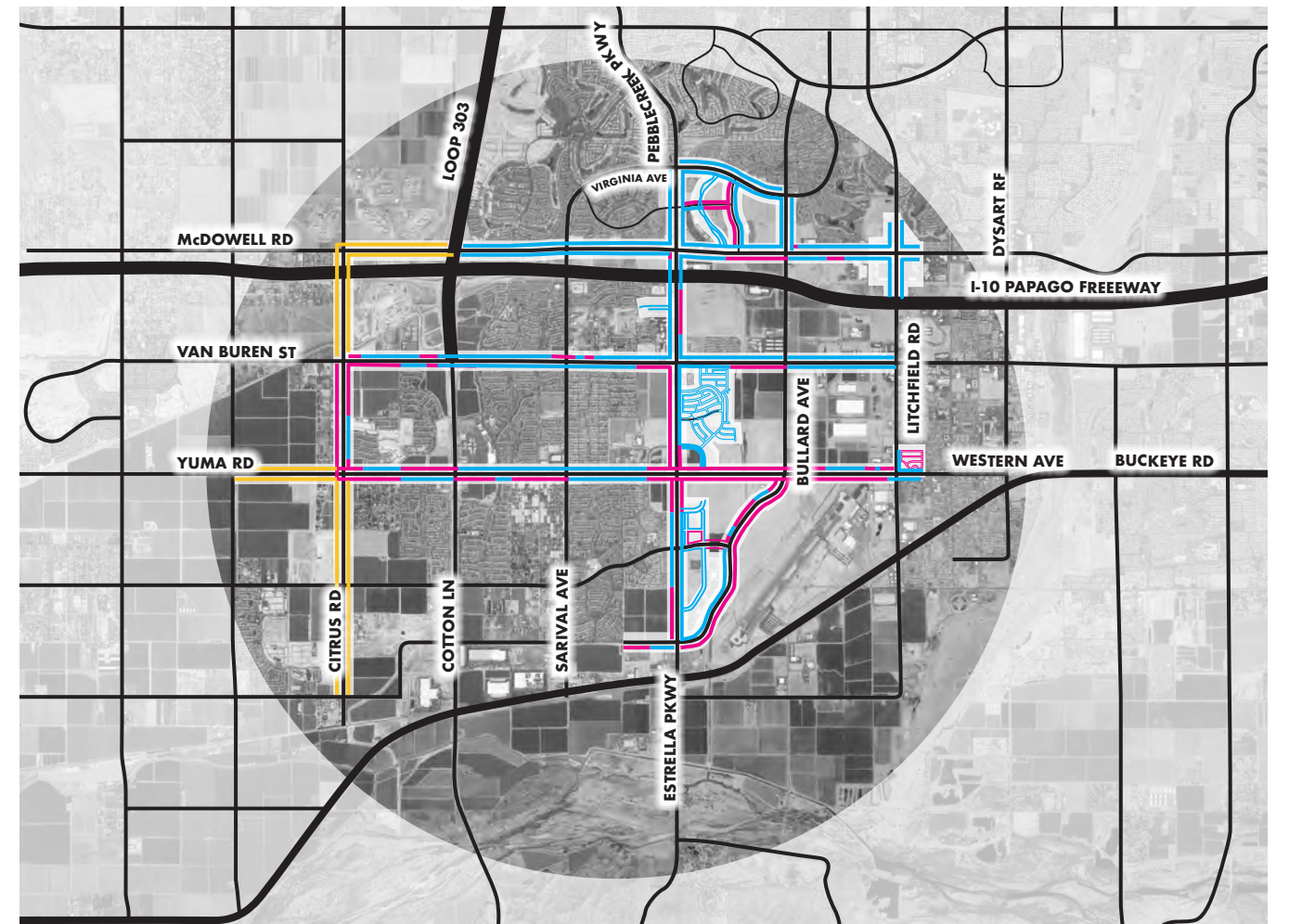


FIGURE 3-9: GAP ANALYSIS - PEDESTRIAN FACILITIES

GAP ANALYSIS - PEDESTRIAN FACILITIES

Goodyear has begun to establish a strong pedestrian network, but overall development patterns have created a fragmented system. The map above shows the existing network within the study areas and corridors. This system is comprised of sidewalks and multi-use paths. This network focuses on all street classifications and multi-use paths wherever they may exist.

Closing the gaps should focus on two things:

1. Linear corridors
2. Loops of various lengths

Ideally, a project should both create loops and complete a corridor that links local and regional destinations.

An example of this would be to complete the sidewalks along 150th Dr between McDowell Rd and Virginia Ave/Encanto Blvd, and Monte Vista Rd from 150th Dr to

PebbleCreek Pkwy. Another example of this would be to complete the sidewalks on McDowell Rd west of Clubhouse Dr to Citrus Rd and along Citrus Rd between McDowell Rd and Van Buren St and fill the gaps along Van Buren St between Citrus Rd and Cotton Ln. By completing loops similar to this, multiple parts of the community would be connected while also providing a loop for recreational use.

1. Near Term (PINK) - occurs in areas where development has either already occurred or is in progress, where the need for the facilities may already exist or the need is projected to increase as the areas continue to develop.
2. Mid Term (YELLOW) - happens in areas that may not have much development occurring but is projected to increase in three to five years

LEGEND

STUDY AREA BOUNDARIES

CORRIDORS



AREAS



PEDESTRIAN FACILITIES

EXISTING



GAP (NEAR)



GAP (MID)





FIGURE 3-10: EXISTING LOS ROBLES DR NORTH OF LAS FLORES AVE

PROJECT PRIORITIZATION

This study strives to create a safe and cohesive network of shaded bicycle and pedestrian facilities. Much of the network is in place, yet many corridors need to be completed and/or improved.

All potential projects, however, do not have the same level of importance in completing the system. The following criteria will help to evaluate potential projects and determine the implementation sequence. Since not all criteria holds the same level of importance some criteria were weighted heavier. Each potential

project can be scored using this prioritization process.

Cost was not used as an evaluation criterion based upon the idea that a project should first be evaluated on its merits. It will ultimately be a Council decision to decide if the project expenditure is worth the benefits it will provide. For instance, the Council could decide to fund one more expensive project rather than two less expensive projects.

HOW TO USE:

To score a project, multiply the weight by the category improvement score (0-2) to find the value. Once each category has been assigned a value, combine all category values to find the total score for the individual project.

(ex: sample below; 3 {weight} x 2 {category improvement score} = 6 {value})

Weight	×	Improvement Categories & Criteria	Range	=	Value
3	×	Improve safety 0. Project involves no existing or potential safety problem. 1. Project prevents a potential problem. 2. Project corrects an existing problem.	(0-6)	=	6

PROJECT PRIORITIZATION
WORKSHEET

Weight	×	Improvement Categories & Criteria	Range	=	Value
3	×	Improve safety 0. Project involves no existing or potential safety problem. 1. Project prevents a potential problem. 2. Project corrects an existing problem.	(0-6)	=	
3	×	“Piggy-Back” With Other Already Planned Projects (roadway repair, traffic congestion, drainage, utilities and other public infrastructure improvements) 0. No nearby planned projects could be included. 1. At least one nearby planned private project could be included. 2. At least one nearby public project could be included.	(0-6)	=	
3	×	Provide Shade to Bicycles and Pedestrians 0. Project does not add shade to bicycle and pedestrian facilities. 1. Project adds shade to bicycle or pedestrian facilities. 2. Project adds shade to both bicycle and pedestrian facilities.	(0-6)	=	
2	×	Close a Gap 0. Project does not close a gap. 1. Project closes a gap providing up to 1 mile of usable and continuous bike or pedestrian corridor. 2. Project closes a gap providing greater than 1 mile of usable and continuous bike or pedestrian corridor.	(0-4)	=	
2	×	Link to Destinations 0. Project provides little to no improved access to destinations (e.g. City Hall, schools, parks, employment centers, trails) 1. Project somewhat or indirectly improves access to at least one destination. 2. Project provides direct access to one or more destinations.	(0-4)	=	
1	×	Focus on Heavy Use Corridors 0. Project is along a corridor with low existing or potential use. 1. Project is along a corridor with moderate existing or potential use. 2. Project is along a corridor with heavy existing or potential use.	(0-2)	=	
1	×	Address Multiple Modes 0. Project improves one mode: bicycle or pedestrian facility. 1. Project improves two modes: bicycle or pedestrian facility with connections vehicular or transit. 2. Project improves 3 modes: bicycle and pedestrian facility with connections to vehicular or transit.	(0-2)	=	
Total Score					

FIGURE 3-11: PROJECT PRIORITIZATION WORK SHEET



FIGURE 3-12: ACCENT PATH CONSTRUCTION IN DOWNTOWN CHANDLER



FIGURE 3-13: BULLARD AVE SOUTH OF YUMA RD

ESTIMATES OF PROBABLE COSTS

Cost projections for trees, irrigation, paths, sidewalks, trails, bike lanes and shade structures are included for use in upcoming and future Capital Improvement Projects (CIP) budgeting and funding. These costs are based on current 2019 municipal public procured prices. The costs are for construction and materials ONLY. Actual CIP project budgets will need to add design and administration fees, contingencies (both design and construction), project mobilization, traffic control and specific site conditions such as utility conflicts, intersecting sidewalks, driveways and roadways. The city of Goodyear typically adds these project condition costs to the project based on each project's conditions and city standards for design/administration fees and contingencies.

Cost format for "linear" elements are based on (1/4) one quarter mile segments with multipliers for roadway two side or single side elements. These 1/4-mile elements include: trees, irrigation, multi-use paths, sidewalks, trails, protected bike lanes, grade separated bike lanes, buffered bike and standard bike lanes. Irrigation meters and controller elements are a "single

item" in each 1/4 mile. Costs for the shade structure site specific elements are on an "each" basis.

In targeting the **60% shade cover goal**, options for tree/irrigation costs are provided for:

- **0 to 60%** (no existing trees or irrigation, provide all new)
- **10% to 60%** (10% existing shade coverage, existing irrigation, add trees and extend existing irrigation system)
- **20% to 60%** (20% existing shade coverage, existing irrigation, add trees and extend existing irrigation system)

To achieve the 60% shade cover goal, the basis for estimating tree count is an average of 88 trees per 1/4 mile on one side of the road. The following tree counts were used in each of the options:

- **0 to 60%** - 88 new trees
- **10% to 60%** - 73 new trees
- **20% to 60%** - 59 new trees

Complete estimates of probable costs for 1/4-mile segments can be found in Appendix E.

SUMMER 2019 SUMMARY

0% to 60% Trees	\$125,743.00
10% to 60% Trees	\$80,878.00
20% to 60% Trees	\$64,974.00
12' Multi-Use Path	\$167,040.00
8' Sidewalk	\$147,840.00
8' Trail	\$31,680.00
6' Bike Lane	\$79,920.00
6' Grade Separated Bike Lane	\$77,280.00
Protected Bike Lane	\$180,240.00
6' Bike Lane w/ 3' Painted Buffer	\$118,200.00
10'x10' Art Shade Structure	\$40,000.00
10'x20' Art Shade Structure	\$80,000.00
10'x10' Conventional Shade Structure	\$22,500.00
10'x20' Conventional Shade Structure	\$45,000.00
10'x10' Fabric Shade Structure	\$15,000.00
10'x20' Fabric Shade Structure	\$430,000.00

FIGURE 3-14: ESTIMATES OF PROBABLE COSTS SUMMARY

BUDGET ITEMS

In order to improve and sustain Goodyear's urban tree canopy, additional dedicated resources are needed to implement projects, programs and policies for public property as well as to encourage action on private property. Strategically spent public dollars could spur private donations and partnerships, thereby expanding the tree canopy beyond what the city can do on its own. The following list represents items requiring time and money to implement, however each item is a partnership opportunity. In some cases, the city is already engaged in that activity.

Tree Installation & Replacement Program

Trees are often lost through accidents, weather, or age. The city currently spends approximately \$75,000 earmarked specifically for tree and shrub replacement within public rights of way, parks and public land. There is no current budget specifically for infill planting of new trees for areas with inadequate shade. Ideally, the budget would be increased and prioritized for new and/or replacement trees for sites that provide the greatest benefit to pedestrians and cyclists.

The budget could build over time to address massive tree loss due to weather events.

Professional Expertise/Staff

The city currently provides salary and benefits for professionally trained expertise in tree care. As the urban forest expands through private and public tree planting, this staff and its budget should expand to maintain proper oversight. If not doing so currently, a certified arborist or comparably trained professional would oversee the urban forest programs, projects and budgets.

Employee Training

The city should maintain its budget for training of landscape and maintenance staff to ensure proper horticultural practices are followed as the urban canopy expands. If not done currently, there should be a line item in the annual budget for training of city and contract landscape maintenance staff.

Public Education

The urban canopy of Goodyear will not expand without the participation of residents and businesses. A periodic budget should be developed to prepare web based and distributable

'Fact sheets' regarding proper tree choices and maintenance.

School-Age Children Education

A passion for trees can develop early in a child's education. A budget should be dedicated to coordinate with local schools to prepare lesson plans and presentations to children of all ages regarding the importance of trees. These students could become future urban forest advocates.

Marketing/Promotion

The importance of trees is a compelling story that should be told through high-quality marketing and educational information in numerous formats. An annual or periodic budget for this work could be placed within the existing Public Information Office or elsewhere. The material would be geared to residents, businesses and landscape maintenance companies regarding the benefits and importance of the urban canopy and resources provided by the city and/or its partners related to tree availability, selection and care.

Incentive/Rebate Programs

All types of properties in Goodyear need to increase their shade coverage. The city could develop an



FIGURE 3-14: SHADE STRUCTURE EXAMPLE - MESA FIESTA DISTRICT

annual budget for private property owners to plant the right tree for the right place through programs including but not limited to tree planting rebates, heavy water-use

tree replacement, and invasive tree removal and replacement. The budget may also include awards programs for homeowners, business owners, neighborhood associations,

schools, property management companies, landscape maintenance companies and designers.

FUNDING/IMPLEMENTATION SOURCES

There are potentially many sources of revenue to develop and maintain a healthy tree canopy from city-funded programs to grants to public participation events. Several sources are briefly described below. Much of this information is taken directly from ‘Funding Your Urban Forest Program: A Guide for New and Seasoned City Foresters’, by the Davey Resource Group. <https://www.urban-forestry.com/assets/documents/funding-your-uf-program-jenny-gulick.pdf>

Departmental Operating Budgets

This is the most common funding source for urban forestry programs. Goodyear’s tree-related funding currently resides in the Parks and Recreation Department. The Parks Division’s operating budget is \$2,700,000, the ROW budget is

\$1,677,000 and the Community Facilities District (CFD) budget is \$411,000. A portion of these funds go towards grounds maintenance for trees, shrubs, mowing, irrigation, directly impacting the quantity and quality of the city’s urban forest.

Capital Project Budgets

Trees can be considered a capital asset. However, the city of Goodyear currently defines a CIP (Capital Improvement Project) as \$100,000 or more with an individual asset value of \$5000. Many communities consider their urban tree canopy a part of their green infrastructure, on par with drainage structures or streets in their importance to the overall health and functionality of the community. With definition changes, tree planting could be its own budget item, or it can be a supplemental part

of larger capital budgets for roads, parks, municipal facilities, stormwater control, and others.

Taxes, Assessments, and Special Tax Districts

The city of Goodyear currently uses taxes and Community Facility Districts to fund operating and capital improvement budgets. More can be done however, to create dedicated funds specifically for urban forestry. Cincinnati, Ohio’s urban forestry program is funded by a state-authorized special assessment; St. Louis, Illinois uses a combination of property tax and sales tax transfers; and Burlingame, California receives a portion of the gas tax. If increasing or adding citywide taxes is unpalatable, consideration can be given to including urban forestry projects in Landscape and Lighting Assessment

Districts, and requiring a higher tree planting requirement in CFD’s or other Special Benefit Assessment Districts.

Water/Stormwater Utility Fees

Trees can mitigate stormwater runoff; therefore it might be feasible to add a funding source for tree planting and upkeep through this fee system. Milwaukee funds its premiere urban forestry program through its stormwater utility fee. Milwaukee understands the cause and effect rationale and accept that the cost to treat 13,000 ash trees annually to prevent canopy loss and thus avert increases in stormwater runoff is a legitimate stormwater management activity that can be funded by the fee. They recently approved a small increase in the fee, and earmarked it for urban forestry. Since stormwater fees are assessed to all property owners, including those that would be exempt from taxes, the increase in the stormwater fee was relatively small compared to a tax levy increase.

Tree Work and Land Development Permit and Inspection Fees

To the extent permitted under state and municipal codes, permit and inspection fees can be a significant

source of funding a tree planting/maintenance program. Urban forestry programs should get reimbursed for the administrative time to review development permits applications, review plans, and make site inspections. The city of Pittsburgh’s program receives a proportional share of the fees collected annually, which then helps offset personnel expenses and funds urban forest improvement projects.

Compensatory Payment, Land Development Mitigation, and Environmental Fines

When trees are damaged or removed, municipalities should be compensated. Generally, this requirement and the compensation method should be codified, and should be clear about its applicability to public and/or private trees. Many cities across the U.S. have ordinances that stipulate this, and as a result have tree funds where compensatory payments, mitigation, or “in lieu of” fees and environmental fines are deposited for a variety of uses and urban forest management projects.

Arbor Day’s Energy Saving Trees Program

According to the Arbor Day

Foundation, planting trees can help save up to 20% on summer energy bills and clean the air and water in a community. Their Community Canopy Program combines trees with an interactive web experience to help homeowners and communities save energy and money by strategically planting trees to maximize their environmental benefits. energysavingtrees.orbarday.org

APS Shade Tree Program

This program provides free shade trees to APS customers who meet the requirements and attend a free shade tree workshop that will cover the planting and care of shade trees. They encourage planting the right tree in the right place including power-line friendly trees. <https://www.aps.com/en/communityandenvironment/environment/environmentalinitiatives/Pages/community-tree-stewardship.aspx>

Grants

As a public agency, urban forestry programs are in a good position to apply for and receive government and many private/non-profit grants. Grants are typically competitive and

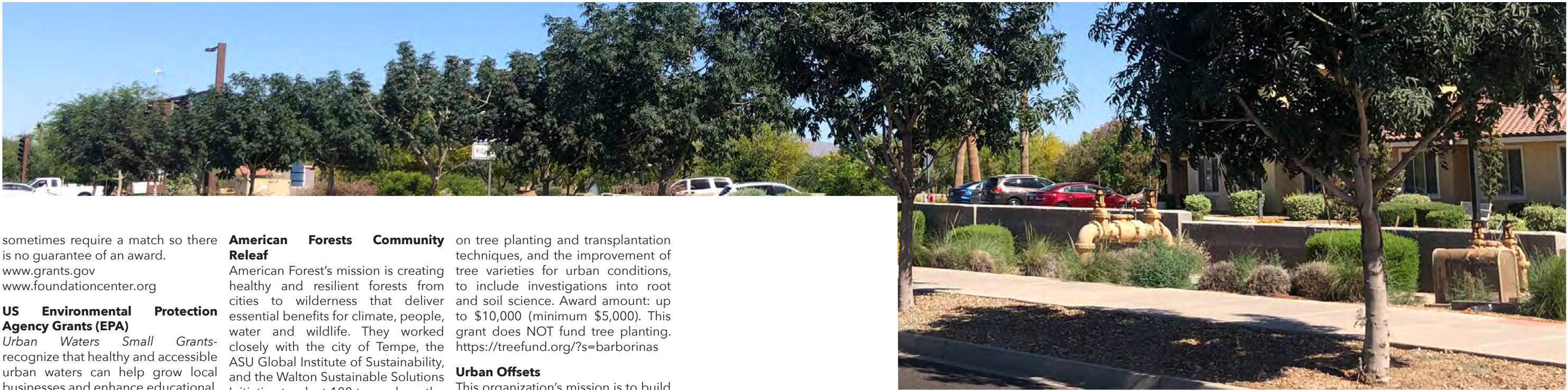


FIGURE 3-15: VIRGINIA AVE EAST OF PEBBLECREEK PKWY

sometimes require a match so there is no guarantee of an award.
www.grants.gov
www.foundationcenter.org

US Environmental Protection Agency Grants (EPA)

Urban Waters Small Grants- recognize that healthy and accessible urban waters can help grow local businesses and enhance educational, recreational, social, and employment opportunities in nearby communities. *Environmental Justice Grant Programs*- supports and empowers communities as they develop and implement solutions that significantly address environmental and/or public health issues at the local level.
<https://www.epa.gov/grants>

AZ Department of Forestry and Fire Management Grants

This department's Urban and Community Forestry Program is a cooperative forestry program, funded primarily by the USDA Forest Service, that focuses on the stewardship of urban natural resources. This program provides technical assistance, education and other resources, responding to the needs of urban areas by helping communities maintain, restore and improve urban forest ecosystems throughout Arizona. Their grant programs include:

- Community Challenge Grants
- Community Forestry Grants
- Tree Resource Enhancement and Engagement (TREE) Grant Program
- Urban and Community Forestry Events- not a funding source but a method to increase community interest and knowledge about the urban forest. These include: Arizona Arbor Day celebration, Tour de Trees, and a Poster Contest

<https://dffm.az.gov/search/node/grants>

American Forests Community Relief

American Forest's mission is creating healthy and resilient forests from cities to wilderness that deliver essential benefits for climate, people, water and wildlife. They worked closely with the city of Tempe, the ASU Global Institute of Sustainability, and the Walton Sustainable Solutions Initiative to plant 100 trees along the Rio Salado River and Tempe Town Lake. Other participants in the project included the Bank of America, Duke/Urban Offsets/ASU, the Boy Scouts, the Girl Scouts and the Tempe Rotary.
<https://www.americanforests.org/our-work/community-relief/>

Arbor Day Foundation TD Green Space Grant

This program supports green infrastructure development, tree planting, forestry stewardship, and community green space expansion as a way to advance environmental and economic benefits toward a low-carbon economy.
<https://www.arborday.org/programs/tdgreenspacegrants/>

TREE Fund's Bob Skiera Memorial Fund Building Bridges Initiative Grant Program

This program helps arborists and urban foresters communicate the value of trees and urban forests on a national basis through technology transfer and engagement with developers, builders, civil engineers, city planners, elected officials and other policymakers. The maximum award value of Skiera grants is \$25,000. This grant does NOT fund tree planting.
<https://treefund.org/researchgrants/skiera>

TREE Fund's Barborinas Family Fund Grant Program

This family-sponsored program awards grants for research focused

on tree planting and transplantation techniques, and the improvement of tree varieties for urban conditions, to include investigations into root and soil science. Award amount: up to \$10,000 (minimum \$5,000). This grant does NOT fund tree planting.
<https://treefund.org/?s=barborinas>

Urban Offsets

This organization's mission is to build climate resilient communities by creating and nurturing partnerships that sustain urban forestry and fight climate change. They partner with nonprofits to sustainably support and manage natural resources in urban areas. They work with cities to locate, invest in, and support the natural assets that will protect them against the effects of climate change. They do this through sourcing high quality carbon offsets certified by the four big exchanges that match an organization's mission, relationships, and geography.
<https://urbanoffsets.co>

Other Opportunities

Corporate Partnership

Local nurseries may want to gain the marketing advantage of providing free trees for organized tree planting events. Corporate partners who value the environmental, social and health benefits of a healthy urban forest may be willing to underwrite tree planting activities.

Memorial Tree Planting Program

A popular program in many cities is a donation program to plant trees in honor of loved ones on public lands. Hard costs for the tree, planting and commemorative plaque are typically covered by the donor. Cost to administer the program would be the city's.

RECOMMENDATIONS

Goodyear has developed an excellent shade canopy and bicycle and pedestrian facilities baseline from which to build upon. As the city moves forward in improving its interconnected and holistic network of shade, bicycle and pedestrian facilities, there are a number of ways to improve existing standards and implement best practices. The following section outlines how the city can continue to connect people to place through an enhanced community identity and by providing comfortable connections to the places people want to be.

The following recommendations also help to execute the city's Strategic Plan of: 1) increasing the "Sense of Community" and "Quality of Life", 2) focusing on the benefits that a connected and comfortable community provide to "Economic Vitality" while 3) implementing and maintaining the systems in a fiscally and responsible way. These recommendations include the following:

Tree City USA Designation

To qualify as a Tree City USA community, you must meet four

standards established by the Arbor Day Foundation and the National Association of State Foresters.

- Tree Board or Department
- Tree Care Ordinance
- A Community Forest program with an annual budget of at least \$2 per capita
- An Arbor Day Observance and Proclamation

These standards were established to ensure that every qualifying community would have a viable tree management program and that no community would be excluded because of size.

Policy Adoption/Revision

In addition to the required landscape ordinances and guidelines provided by the city of Goodyear, policies to include the implementation of shade, bicycle, and pedestrian facilities should be created. The Policies should include adoption of a complete streets policy that is focused on multimodal transportation, while still including an increased shade canopy especially for bicyclist and pedestrians.

Additional policies may include roadway redevelopment that includes increased shade, bicycle and pedestrian facilities. When implemented concurrently with existing projects, the costs of these facilities are much lower than they would be if implemented as a standalone project. An example of a similar policy is the city of Tucson's Green Streets Policy.

Examples of other areas of potential policies:

- Tree Palette - Encourages 'Right tree right place', supports biodiversity, low water-use, and context-specific planting
- Green Infrastructure - Supports the implementation of low impact development strategies, water harvesting, solar, and more
- Biodiversity - Outlines the quantity, type and percentage of species planted to ensure an increase in biodiversity to reduce the potential of complete die-off of a particular tree species
- Parking Lots - Increase the required number of trees, shade structures, and access for pedestrians and bicyclists



FIGURE 3-16: PEORIA P83 Z-CROSSING WITH SHADE SAIL STRUCTURES

Urban Forest Management Plan

An Urban Forest Management Plan (UFMP) is a roadmap that creates a vision for the future of a city's tree canopy. It is a tailored plan that guides tree care professionals to proactively and effectively manage and provide for maximum, long-term benefits to the community. The plan provides recommendations based on the analysis of detailed inventories and includes additional components or documents, such as budgets, implementation schedules, policy and procedure manuals, standards and specifications, public education and monitoring plans, and existing ordinances. Annual work plans and budgets can then be developed based on the long-term UFMP.

In general, an effective UFMP plan will include:

- A vision for the urban forest
- Inventories and assessments of the current status of the urban forest
- Strategic Plan with goals, objectives, and actions based on the information analyzed and identified needs
- Implementation Plan with

specific dates and assigned responsibilities

- Monitoring Plan with a system to check effectiveness and revise the UFMP as needed.

Full Tree Inventory

A Full Tree Inventory for the city of Goodyear gives the city the ability to track where they are, how they are doing, and allows for better planning. The Full Tree Inventory should consist of all trees within the public rights of way as well as all trees on public land such as parks, City Hall, and more. Once a city has a full tree inventory, it can begin to implement and create an Urban Forest Management Plan, use the data to learn how trees are progressing, track any issues, use it as a maintenance tool for work and tracking in the field, manage diseases, and more. An initial inventory of trees within the study area was provided as part of this project, but serves only as a peak into the health, vitality, and benefits of the entire system.

Tree Guide

This guide provides an outline of recommended trees for the public and private realm. It gives information such as canopy sizes, water

requirements, and tree placement guidance. This information is a starting point in creating a small brochure, pamphlet, booklet, or online database for encouraging tree planting. With this information, the city can institute a simple outreach effort to encourage planting more of the right trees in the right spots.

Green Infrastructure Guidelines

Green infrastructure is a cost-effective, resilient approach to managing wet weather impacts that provides numerous community benefits. While single-purpose gray stormwater infrastructure (conventional piped drainage and water treatment systems) are designed to move urban stormwater away from the built environment, green infrastructure reduces and treats stormwater at its source while delivering environmental, social, and economic benefits.

Stormwater runoff is a major cause of water pollution in urban areas. When rain falls on roofs, streets, and parking lots, water cannot soak into the ground. Stormwater moves through gutters, storm sewers, and other engineered collection systems

and is discharged into nearby bodies of water. The stormwater runoff carries trash, bacteria, heavy metals, and other pollutants from the urban landscape. Higher flows resulting from heavy rains can also cause erosion and flooding resulting in damage to property, infrastructure, and habitat.

Numerous cities and jurisdictions across the southwest and the country have adopted green infrastructure guidelines and policies including Scottsdale, Glendale, Mesa, and more. Having guidelines in place ensures the necessary facilities are implemented during initial construction, not as an after-thought

Active Transportation Plan

Active transportation is any self-propelled, human-powered mode of transportation, such as walking or bicycling. Physical inactivity is a major contributor to the steady rise in rates of obesity, diabetes, heart disease, stroke, and other chronic health conditions in the United States.

Many Americans view walking and bicycling within their communities as unsafe due to heavy traffic and a scarcity of sidewalks, crosswalks, and

bicycle facilities. Improving these elements could encourage active transportation such as children biking or walking to school and employees walking to work. Safe and convenient opportunities for physically active travel also expand access to transportation networks for people with and without cars. This also spurs investment in infrastructure to increase the comfort of the on-road experience to improve the appeal of active modes to all people.

Though bicycle and pedestrian facilities are located in both the city's Parks and Recreation Master Plan and the Transportation Master Plan, Goodyear has yet to develop its first active transportation plan. Such a plan would guide the holistic development of these facilities managed in a more centralized location for the convenience of city staff, developers, consultants and the general public. The plan would serve as the primary tool for deployment and integration of connected, comfortable facilities for bicyclists, pedestrians, equestrians, and other non-motorized modes, building upon this study and the other plans.

As the region and city continues to grow, it is critical to have a clear vision for a transportation network that meets the needs of all users, with safety and comfort of active transportation users being paramount. This includes needing to plan and address the inclusion of new alternative modes of transportation, such as electric scooter, e-bikes, and the ride share systems that are often associated with them. The guiding principles of such a network should focus on improving mobility options for all residents, regardless of age or ability, prioritize connectivity among destinations, and develop facilities that are comfortable and responsive to a wide range of user groups.

TAKEAWAYS

This study identifies a number of ways to increase the shade within the city and the benefits that shade will provide to the community as a whole. The following takeaways are a brief summary of the concepts identified.



RIGHT TREE, RIGHT PLACE
The size, species, and placement of a tree is critical. Trees placed on the west/south sides of bike and ped facilities increases shade



PLANT SOMETHING NOT NOTHING
Trees can increase property value, lower your energy costs, clean the air and water while providing relief from the summer sun.



DON'T OVER PRUNE
Over pruning trees leads to weak branching structures, less shade and eventual loss of trees while increasing trips to landfills.



INCREASE COMFORT
Increasing shade throughout the community will help to alleviate extreme heat both on the walkways and through the community.



COMMUNITY IDENTITY
Shade can help define a community through the inclusion of specific tree species and shade structures.



IT'S HOT OUT THERE! PEOPLE NEED SHADE
As sustained days over 100° rise in the Phoenix area, the community deserves equity with shaded active transportation.



MORE SHADE = MORE ACTIVE TRANSPORTATION
The more shade we have the more attractive walking and biking becomes.



TREES ARE ECONOMICAL
Trees cost a fraction of built shade structures and provide direct benefits to individual and community budgets.



WATER IS KEY
Even native trees need water in the hotter times of year to ensure a healthy tree leading to a healthy and a canopy healthy canopy



LIMIT CLUMPING OF TREES
Clumping trees along active transportation corridors leads to long shadless stretches.



FOCUS ON NATIVE & ADAPTIVE TREES
Focusing on native and adaptive trees ensure canopy longevity, low water use, and healthy habitat.



PROTECT ROOT ZONES
Protecting tree root zones helps maintain a thriving tree and limit damage to sidewalks and other hardscapes.

REVIVING A HEALTHY TREE CANOPY

The city of Goodyear's tree coverage goal highlights the need for a health tree canopy. Trees shade us on paths and walkways. Tree-lined streets relieve the eye. Planted in our yards, they guard our homes against the sun and enhance the value of our neighborhoods. Trees add beauty and benefit to our environment. The Canopy is a character-defining element of the community's quality of life.



PEOPLE APPRECIATE SHADE
Waiting, walking, running and biking. From transit to exercise, people's health and comfort need protection from heat.



TREES ARE COOL
A simple antidote to heat-related issues: trees cool the surrounding air.



TREES GIVE BACK
They are excellent air pollutant filters. Trees reduce pollution from stormwater runoff and property erosion.



RIGHT CHOICES ARE WATER WISE
Native and climate adaptive trees are low-water users and thrive in the desert.



RIGHT TREE, RIGHT PLACE
Choose well for optimal shade: tree, space and place.



MONEY DOES GROW FROM TREES
A tree costs a fraction of built shade structures. Proper maintenance ensures a long-lived investment and multiple benefits.



THE CANOPY BUILDS CHARACTER
The Litchfield Road palms and the palo verdes in Estrella Mountain Park are integral to Goodyear's identity.



APPENDIX

- A AREAS EXISTING CONDITIONS
- B TREE SHEETS
- C TREE CITY
- D BENCHMARK CITIES
- E ESTIMATES OF PROBABLY COSTS
- F GUIDE TO TREE PRUNING
- G LIST OF DIGITAL FILES