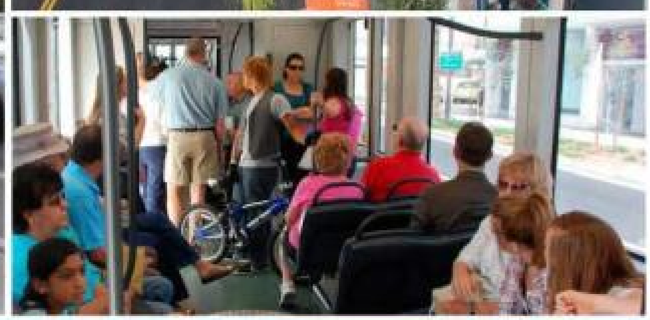
METRO

Arizona Avenue

High-Capacity Transit Long Range Study

December 2012





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Executive Summary

In response to looming growth, the communities of Chandler, Mesa, and Gilbert along with the Maricopa Association of Governments (MAG) participated in the *Arizona Avenue High-Capacity Transit Long Range Study* to evaluate alternative land use scenarios and transit service concepts that could result in sufficient transit trip generation to help make Arizona Avenue/Country Club Drive a viable candidate corridor for High-Capacity Transit (HCT). The goal of this study was to develop a well-informed understanding of the relationship between different choices for growth and the impact on various elements such as infrastructure, specifically public transportation. To achieve this goal, the study compared alternative scenarios to demonstrate the effect of choice on outcomes. Specifically, this study took a long-term (25-year) comprehensive look at four different growth/transit scenarios.

The Arizona Avenue/Country Club Drive corridor (hereafter referred to as the Arizona Avenue corridor) plays an important role in the region's transportation network. It is a major north-south arterial corridor connecting the cities of Chandler and Mesa, along with the western edge of the Town of Gilbert. The corridor serves many roles, such as a commercial thoroughfare for adjacent neighborhoods and the three communities at-large, as a regional arterial for commuting traffic, as a link between activity center destinations and major employment centers, and as a gateway to the southeast valley region. The cities of Chandler, Mesa, and the Town of Gilbert, have expressed an interest in evaluating what actions are necessary to make Arizona Avenue a candidate corridor for HCT service in the southeast valley region.

In addition to the analysis of the various land use and enhanced transit scenarios considered, this study also provides a conceptual review of capital and operating costs for implementing HCT and enhanced bus transit service within the study area. The costs presented in this report reflect "order of magnitude" cost estimates based on current unit costs and documented capital and operating assumptions. Finally, this study makes recommendations on future policy actions the project partner cities can take as part of their comprehensive general plan updates or land development zoning ordinances to encourage transit-supportive development and densities surrounding the corridor.

Study Findings

In general, the Arizona Avenue corridor is already a good candidate corridor for increased bus transit service and enhanced arterial street BRT service in the planning horizon-year of 2035. Current transit plans for the region suggest that bus service frequencies will increase along many existing routes serving the study area. The study area is already served by local and express fixed-route bus service, including arterial BRT service (LINK); but existing conditions present constraints to the implementation of enhanced transit services. These constraints include (but may not be limited to) the preponderance of vacant or underutilized parcels, relatively low population and employment densities surrounding the corridor, and low availability of public funding for service and infrastructure enhancements.

In spite of these challenges, the Arizona Avenue corridor is poised for significant future growth in most major forms of land use including residential, commercial, industrial, and public institutions. The corridor and study area represent an area of the southeast metropolitan region ideally suited for urban growth that maintains the existing character of the surrounding communities. With increases in population and employment densities, particularly surrounding major intersections of the corridor where HCT stations are most-likely to be located, the development of vacant land areas and/or redevelopment of underutilized parcels can create a vibrant transit corridor capable of supporting an investment in an HCT technology such as light rail.

To help determine the corridor's viability as a candidate for a future HCT investment, the potential performance of LRT in the corridor was measured against the performance of LRT corridors and systems in several western U.S. peer cities. Table ES-1 illustrates the boardings per corridor mile for the peer cities selected, and the results of the land use scenarios tested for the Arizona Avenue corridor. The results show that the Optimized Land Use Scenario achieves a boardings per corridor mile above the peer region average, suggesting the implementation and achievement of the strategies and density goals of the Optimized Land Use Scenario will help position the Arizona Avenue corridor to be a competitive candidate corridor for HCT.

Table ES-1. Comparison of Development Scenarios and Peer Region LRT Performance

Peer City	Corridor Miles	Boardings per Corridor Mile
Salt Lake City	19.7	2,250
Seattle	17.2	1,390
Portland	56.2	2,300
Denver	35.0	1,870
Dallas	48.6	1,230
San Diego	54.2	1,690
Sacramento	36.9	1,400
Peer Region Average		**1,730**
Baseline (w/Enhanced Transit)	10.5	1,460
Enhanced Land Use	10.5	1,620
Optimized Land Use	**10.5**	**1,740**

Source: Valley Metro, 2012

Summary of Recommendations

A successful HCT corridor requires proactive planning actions on the part of local jurisdictions to plan and execute transit-supportive land uses, and the regional Metropolitan Planning Organization (MPO) to help provide vision and direction for the region's future transportation system. Using a scenario planning approach, planners are able to test alternative land use and transportation scenarios to help determine the future course of a potential project with local and regional significance. The results of the analysis contained herein are intended to provide local and regional planners with an indication of what actions are necessary to help make the Arizona Avenue corridor a viable candidate corridor for HCT service, particularly light rail transit.

The findings of this study suggest several steps each project partner city may take to help create transit-supportive land uses surrounding the Arizona Avenue corridor and improve the viability of HCT service being effective in serving the corridor and study area. Specifically, the study findings strongly encourage the following actions:

Increase Transit Service in the Corridor

- **New Bus Routes:** The addition of new east-west bus routes serving Guadalupe Road, Warner Road, Pecos Road, Frye Road, and Germann Road, with direct connections to Arizona Avenue will help ensure future LRT stops will be served by local bus routes, extending the reach of transit to destinations beyond the corridor.
- **Enhance Peak Period Frequency:** Provide 15-minute peak period headways on routes that connect with a future LRT stop.
- **Implement Chandler Boulevard BRT:** Adding LINK bus rapid transit service along Chandler Boulevard will provide an expedient, high-quality transit connection between downtown Chandler, Mesa Gateway Airport, and LRT stops in downtown.

Land Use Planning and Urban Development

- **Density:** Increase residential, commercial, office and institutional densities along the corridor consistent with the densities determined in the Optimized Land Use Scenario.
- **General Plan:** Amend current General Plans to strongly encourage (if not require) transit-oriented development (TOD) and prohibit/ strongly discourage new auto-oriented developments.
- **Area Plans:** Actively develop area plans to specify target densities and development patterns in station areas.
- **Zoning:** Utilize zoning tools such as form-based codes, TOD Overlay zoning, and/or mixed use zoning to affect desired land uses.

Improvements to Infrastructure and Public Space

- **Road Narrowing:** Reduce the number of travel lanes on Arizona Avenue to help narrow the corridor, improve the pedestrian quality of the surrounding streetscape, and reduce auto speeds.
- **Complete Streets:** Study a complete streets proposal for Arizona Avenue to incorporate more non-motorized attributes, including wide sidewalks and bicycle lanes.
- **Open Space:** Incorporate open space as part of the surrounding corridor aesthetic.

1.0 Study Background and Existing Corridor Conditions

Chandler, Gilbert, and Mesa are communities on the move. Where cotton fields, citrus groves, and native desert terrain once stretched for miles, housing subdivisions, shopping centers, and industrial parks now stand. Major employment centers including the Chandler Airport, the Fiesta Mall district, downtown Mesa, and downtown Chandler are driving economic generators located within the study area. The Arizona Avenue corridor is the spine that connects these districts and communities.

However, the rapid pace of growth does not come without challenges. The continued growth of communities places greater pressure on public infrastructure and services. With limited financial resources, and in the face of greater demands being placed on the existing transportation system, determining the best means for improving the transportation system and meeting future demand is challenging. The framework for making decisions about the future of the region's transportation system has become increasingly complex. As residential population and employment grow, congestion will continue to rise, increasing the cost of travel and reducing the efficiency of the region's roadway network. Without more transportation choices than exist today, the proportion of drive alone auto trips will increase while the proportion of alternative mode use would decrease.

The ease by which people can move between desired travel destinations such as home and school, work, medical services, and shopping opportunities is dependent upon the efficiency and effectiveness of the region's transportation system. Land use plays an important role in the demand for travel within and across a region. In general, transportation corridors that include higher population and employment densities, along with a range of land use types, create an urban environment that supports the use of multiple travel modes. This can spread the demand for travel across a variety of modes, reducing the stress and wear on roads and bridges, and decrease travel times between destinations. At the same time, corridors that support integrated transportation systems provide residents and employees greater access to jobs, goods and services, and recreational opportunities, connecting people within and beyond the corridor and study area. Land use and transportation are key contributors to the quality-of-life and economic vitality of the Arizona Avenue corridor, the three communities, and the southeast valley region.

Purpose of the Study

In response to looming growth, the cities of Chandler and Mesa, and the Town of Gilbert partnered with Valley Metro to sponsor the *Arizona Avenue Long Range Transportation Study*. The goal of the study was to develop a well-informed understanding of how targeted public transportation investments and land use development patterns can support a future HCT investment in the corridor. To achieve this goal, the study compared alternative scenarios to demonstrate the effect of choice on outcomes. Specifically, this study took a long-term (25-year) comprehensive look at four different growth/transit scenarios within the study area to identify reasonable, feasible and fiscally responsible transportation and land uses strategies.

The need for this study is based on present and projected future land use and transportation deficiencies and opportunities, as well as regional and local economic sustainability. The

Arizona Avenue corridor is poised for significant growth in most major forms of land use including residential, commercial, industrial, and public institutions.

The recommendations made in this report are intended to help inform project stakeholders in making decisions on future land uses and local transit investments that can complement the implementation of an HCT service operating along Arizona Avenue. These recommendations focus on more efficient land use choices, expanded public transit services, and maximizing the efficiency of existing transportation infrastructure serving the study area.

Description of the Study Area

The project's study area is bounded to the north by University Drive in Mesa, Queen Creek Road in Chandler to the south, the Loop 101/Price Freeway to the west, and Gilbert Road to the east, encompassing an area of approximately 66 square miles and including the communities of Chandler, Gilbert, and Mesa. The study area was determined by the project's Technical Review Committee as the land area reflective of development potential around an HCT network serving the Arizona Avenue corridor. The proposed Arizona Avenue HCT corridor would link Main Street in Mesa on the northern end with Germann Road in Chandler on the southern end, a distance of approximately 10.5 miles.

Figure 1-1 illustrates the study area, described above. The bold yellow line represents the Arizona Avenue corridor, while the study area is approximately 6 miles wide (from east to west). Project partner cities felt that the introduction of HCT service along Arizona Avenue would influence land development patterns within this entire study area.

Historic Growth of the Study Area

The growth and maturation of Chandler, Gilbert, and Mesa generally parallels the post-war suburbanization development patterns experienced in most major metropolitan regions. While all three communities trace their roots to the early settlement years of the State of Arizona, the post-war suburban building boom accelerated the growth of the East Valley region. The popularity and affordability of private automobiles, along with investments in roads and highways, opened previously inaccessible land areas to the real estate marketplace and fueled the growth of the suburbs and exurbs for over 60 years. Today all three communities are poised to continue their trend of substantial population and employment growth in the future.

The rapid expansion of residential and commercial development can have significant implications on community travel patterns and infrastructure costs. Despite recent national and regional economic trends that have tempered the pace of growth locally, regional population and employment forecasts continue to project robust growth over the next twenty-five years. With commitments from major academic and health care institutions, along with the growth of high-tech industries in the southeast valley region, the need to plan for the future mobility of residential populations and employees is vital. A balanced and integrated approach to land use and transportation will help the communities of Chandler, Gilbert, and Mesa better manage future travel demand. While roadway congestion will always be a factor to contend with, the region is quickly realizing that it is cost-prohibitive to follow traditional notions of "building out of congestion." The centralization of the residential population and employment centers in Chandler, Gilbert, and Mesa will be a key catalyst to the population and economic growth of each city. Offering a mix of land use types and transportation services can attract new growth that is focused in specific locations to encourage greater densities, more pedestrian oriented areas, and support major transit capital investments.

1.1 Current Land Use Conditions

Existing land use conditions within the study area may be generally characterized as suburban uses, with commercial establishments surrounding the arterial thoroughfares, behind which residential neighborhoods are located. Commercial uses cater to the residential neighborhoods, and include local convenience stores, strip developments, supermarkets, gasoline stations and automobile repair shops, and large, "Big Box" retailers. As shown in Table 1-1 and Figure 1-2, a substantial amount of the developed land within the project study area is used for residential purposes. Single-family detached housing is the predominant form of housing stock, while some apartment complexes, townhome, or condominium developments are located within the study area. Agricultural lands constitute the second largest percentage of total land use, with most agricultural fields located to the south and west of the study area. Following these land uses, vacant parcels represent the third largest category of land use.

Table 1-1. Study Area Land Use by Category

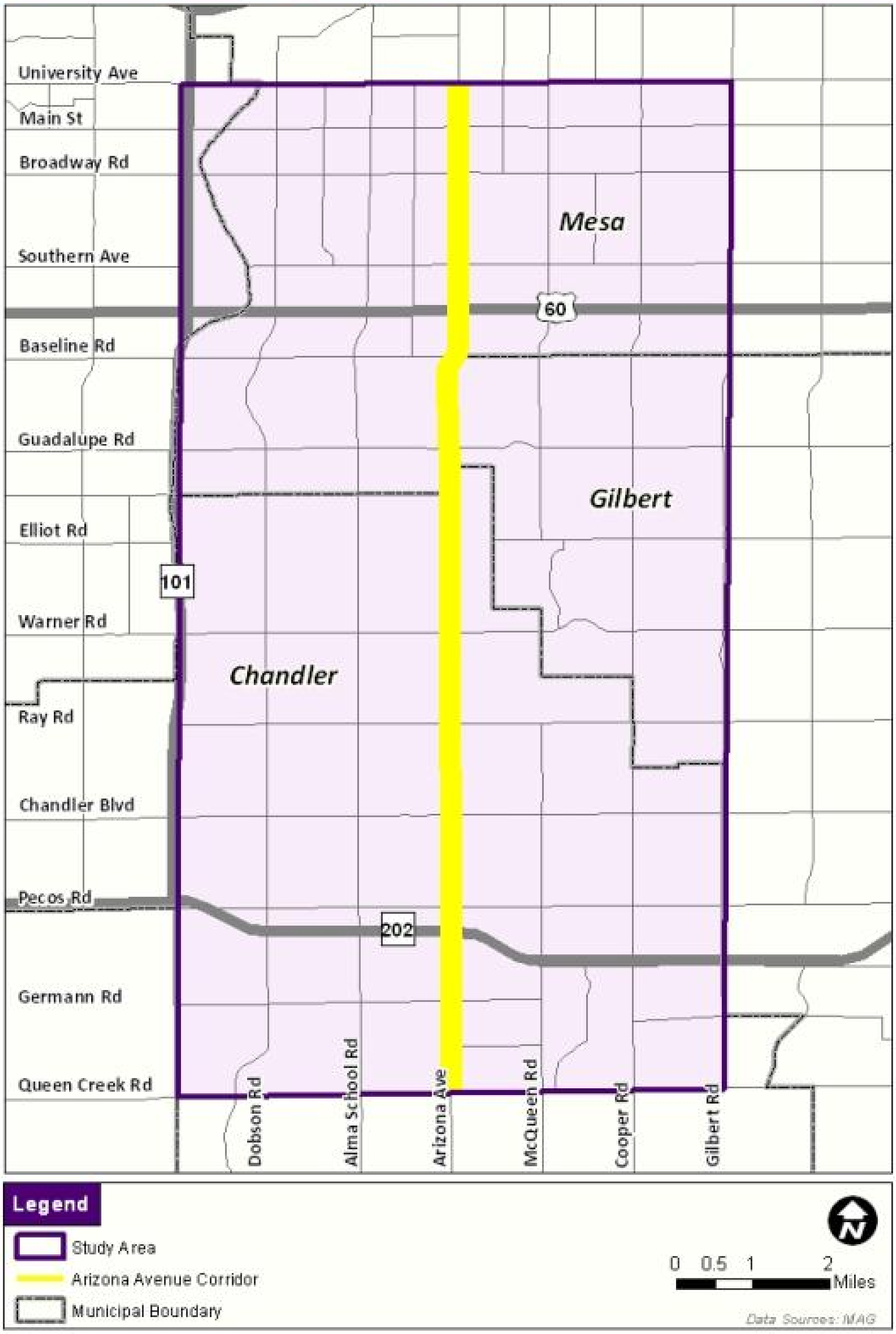
Land Use Category	Acreage	Percentage of Total Land Use
Agricultural Lands	5,419.7	13.1
Residential (Attached & Detached Housing) Lands	21,203.7	51.1
Commercial (Office and Retail) Lands	3,113.8	7.5
Industrial Lands	1,908.8	4.6
Public/Institutional Lands	2,653.9	6.4
Open Space/Recreational Lands	1,598.7	3.9
Business Park (PUD)	1,082.4	2.6
Transportation Infrastructure	670.5	1.6
Water or Waterways	306.6	0.7
Vacant Land	3,561.2	8.6
Total	**41,519.4**	**100.0**

Source: Maricopa Association of Governments (MAG), 2009

Vacant and undeveloped parcels are a noticeable land use characteristic of the Arizona Avenue corridor. Large open lots sporadically separate developed parcels. While vacant lots may be an open canvas for developers that require minimal clearing for construction, these properties are a constant reminder of economic stagnation, a drain of city resources, and can affect the quality-of-life for surrounding populations. Vacant lots have been shown to reduce nearby property values and create a less favorable prospective of an area to potential homebuyers or commercial developers. The separation vacant parcels create between developed properties also reinforces the need to drive rather than to walk between developed properties. Land development policies and strategies that focus on transforming vacant properties through urban infill development can be a catalyst for rejuvenating and completing an urban corridor.

Figure 1-1. Arizona Avenue Study Area

Arizona Avenue High Capacity Transit Long Range Study



1.2 Transportation Facilities

Roadways and Traffic

The Arizona Avenue corridor is identified in the MAG Regional Transportation Plan (RTP) as an urban arterial, part of the region's expansive roadway grid network, with up to six general purpose traffic lanes (three lanes in either direction), left turn pockets, and right turn lanes at signalized intersections. Intermittent paved and landscaped medians separate the northbound and southbound travel lanes and left turn pockets. In addition to the arterial and collector roadways that provide access to the study area, two major freeways cross perpendicularly through the study area. US Highway 60 (US 60) is identified by MAG as a principal arterial roadway carrying over 200,000 vehicles daily within the limits of the study area.[1] The other major freeway that perpendicularly crosses the study area is SR-202 (SanTan Freeway). Principal urban arterial roads serving the study area are identified in Figure 1-1.

Transit Services, Facilities, and Operating Characteristics

Transit services currently operating within the study area primarily consist of fixed-route local and express bus services, connecting the communities of Chandler, Gilbert, and Mesa, and providing service to regional employment centers such as downtown Phoenix and Tempe. Arizona Avenue is served by one of Valley Metro's two LINK arterial Bus Rapid Transit (BRT) routes; however, the other LINK service (Main Street) also serves the northern portion of the study area. This service operates at 30 minute frequencies throughout the day, while express bus services operate only during the peak periods. Local fixed-route buses provide the underlying transit network, with more frequently spaced stops serving residential neighborhoods, commercial nodes, and public institutions within the study area. Table 1-2 identifies the current transit routes serving the study area, along with basic operating characteristics.

Table 1-2. Existing Transit Services and Operating Characteristics

Route	Service Operating Characteristic[a]						
	Roadway	Service Type	Peak[b]	Off-Peak	Evening[c]	Saturday	Sunday
30	University Drive	Local	30	30	30	60	N/A
40	Main Street (Mesa)	Local	30	30	30	30	30
45	Broadway Road	Local	30	30	30	60	N/A
61	Southern Avenue	Local	15	30	30	30	60
104	Alma School/Frye Road	Local	30	30	N/A	60	N/A
108	Elliot Road	Local	60	60	N/A	N/A	N/A
112	Country Club/AZ Ave	Local	30	30	60/30	60	60
136	Gilbert Road	Local	30	30	N/A	30	N/A
156	Chandler Boulevard	Local	30	30	30	30	30
531	Mesa/Gilbert	Express	30	N/A	N/A	N/A	N/A
541	Chandler/Phoenix	Express	30	N/A	N/A	N/A	N/A
542	Chandler/Phoenix	Express	20	N/A	N/A	N/A	N/A

[1] Source: Arizona Department of Transportation, State Highway Traffic Log, 2009

Route	Service Operating Characteristic[a]						
	Roadway	Service Type	Peak[b]	Off-Peak	Evening[c]	Saturday	Sunday
METRO	Phoenix/Tempe/Mesa	LRT	12	20	20	15	20
LINK	Arizona Avenue	BRT	30	30	60	60	60
LINK	Main Street (Mesa)	BRT	15	30	30	N/A	N/A

Source: Valley Metro, 2012
[a] All headway times shown are approximate and based on the current Valley Metro route schedules.
[b] Weekday Rush Hour or "Peak" Hours: Weekdays 6-9 am and 3-7:00 pm
[d] Evening service refers to the off-peak period on weekdays only between 7-12:00am

Pedestrian and Bicycle System

The non-motorized transportation network serving the study area is predominantly comprised of pedestrian sidewalks flanking all major roads in the study area and most neighborhood streets. Most sidewalks appear to be constructed to current design standards, while adjacent property owners have constructed property build lines or parking facilities up to the sidewalk's edge. Some properties have constructed decorative fencing or short sidewalk walls as part of the property facade.

Striped on-street bicycle lanes are available along portions of select urban arterial roadways, including Arizona Avenue south of Chandler Boulevard, and along some neighborhood collector streets. These facilities link neighborhoods with local parks and some shopping centers; however, the core of the project study area does not contain bicycle lanes or off-street bicycle facilities. Furthermore, bicycle networks are fragmented, with a limited number of bicycle lanes or facilities that connect with one another or that provide a direct, expedient path of travel between downtowns or major activity centers.

Parking Facilities

Several park-and-ride lots are scattered throughout the study area. Dedicated park-and-ride lots are available near freeway entrances and exits, and in downtown Gilbert (refer to Figure 1-2). Smaller "handshake" agreement park-and-rides (informal agreements between property owners and the city to allow shared day-time parking) are also available to commuters, and served by the existing transit network.

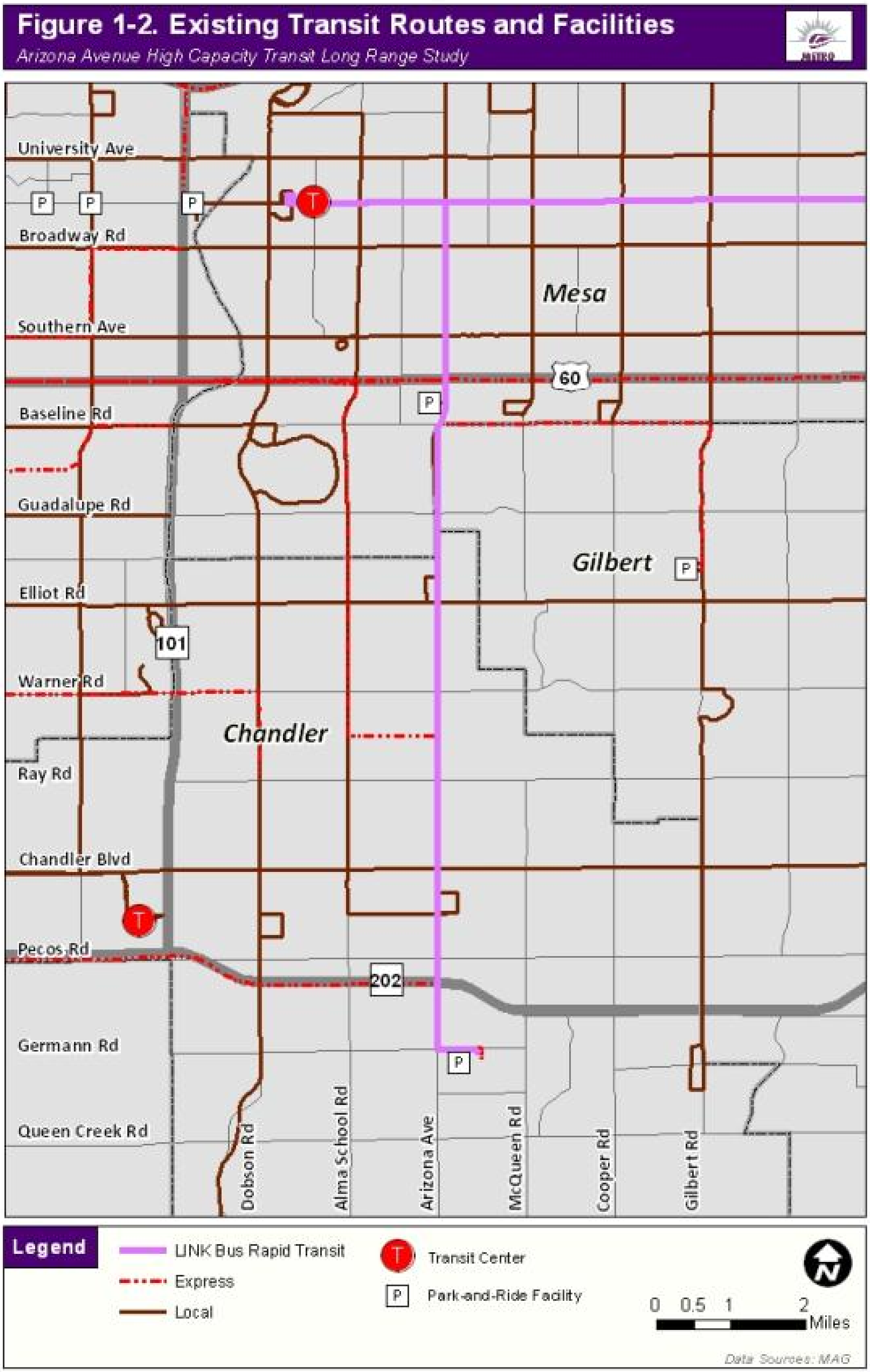


Figure 1-2. Existing Transit Routes and Facilities
Arizona Avenue High Capacity Transit Long Range Study
University Ave
Broadway Rd
Southern Ave
Baseline Rd
Guadalupe Rd
Elliot Rd
Warner Rd
Ray Rd
Chandler Blvd
Pecos Rd
Germann Rd
Queen Creek Rd
Dobson Rd
Alma School Rd
Arizona Ave
McQueen Rd
Cooper Rd
Gilbert Rd
Mesa
Gilbert
Chandler
60
101
202
Legend
LINK Bus Rapid Transit
Express
Local
Transit Center
Park-and-Ride Facility
0 0.5 1 2
Miles
Data Sources: MAG

2.0 Land Use and Transportation Scenario Planning

Predicting the future development of an urban corridor with any degree of certainty is extremely difficult given the number of variables that must be considered and the rate at which variables change over a typical 20- to 30-year planning time frame. Often, a key to predicting the future development of a corridor rests with an understanding of past trends and current corridor conditions. This information is a valuable asset when constructing different scenarios to forecast future growth.

Scenario planning offers a method for the communities of Chandler, Gilbert, and Mesa to explore various land use and transportation alternatives and how each could affect the performance of the local transportation system. Land use changes typically refer to increases in population, households, or employment within a designated geographic area. In the case of the Arizona Avenue corridor, the scenario planning process can help stakeholders and city leaders visualize the interaction between land use and transportation investments (specifically public transportation) when considering the tradeoffs and opportunities between competing development scenarios. Scenario planning is a useful tool to plan for anticipated growth and to develop strategies or growth management policies to optimize outcomes while comparing different choices and potential consequences. Though the scenarios constructed and tested are theoretical representations of possible future conditions, the scenario planning process helps inform participants and can lead to mutually beneficial outcomes when making decisions on future land use developments and transportation investments.

2.1 Growth Scenarios

There are a number of different ways in which the Arizona Avenue study area could grow over the next 25 years. Current forecasts suggest robust population, household, and employment growth within the study area. While recent development trends have favored commercial retail and office building developments along Arizona Avenue surrounded by single-family neighborhoods, both the cities of Chandler and Mesa are anticipating dense growth in and around their downtown core districts. Simultaneously, the Town of Gilbert is expecting strong employment growth along the Arizona Avenue corridor. The purpose of this study was to develop a set of scenarios for the study area that represent different ways of thinking about growth and development over a 25-year period.

Four scenarios were developed and evaluated for the Arizona Avenue corridor and study area. These included a Baseline Scenario, Enhanced Transit Network Scenario, Enhanced Land Use Scenario, and an Optimized Land Use Scenario. The model results are derived from average population and employment densities across TAZs (typically one square mile), and do not account for densities on individual parcels. Descriptions of each scenario developed are as follows:

> **Baseline Scenario** – This scenario is based on current population and employment forecasts approved by MAG for use in planning the year 2035 transportation network. It

is also based on the 2031 MAG Regional Transportation Plan.[2] The Baseline Scenario serves as the control scenario by which the performance of the other scenarios is evaluated against.

Enhanced Transit Network Scenario – The Enhanced Transit Network Scenario applied the planned transit network outlined in the MAG Regional Transportation Plan for 2031, as well as additional transit service enhancements, and the model evaluation was conducted using this network over the 2035 socioeconomic data used for the Baseline scenario analysis. Enhancements to the local bus network were made, including modified service frequencies, the addition of new bus routes, or the re-instatement of previously suspended bus routes. Most importantly, this scenario included the addition of LRT and stations along Arizona Avenue. This scenario also included the addition of two circulator routes to provide transit service in areas deemed to be underserved by the future RTP transit network, and the addition of one new park-and-ride facility at Germann Road. It is important to note that many of the bus route modifications made in this scenario were consistent with the future transit network identified in the MAG RTP. Furthermore, it is important to note that no conceptual alignment drawings or engineering for LRT were conducted during this study, and it was assumed that LRT would operate within RTP planned roadway network. Figure 2-1 illustrates the Enhanced Transit Network developed for this study.

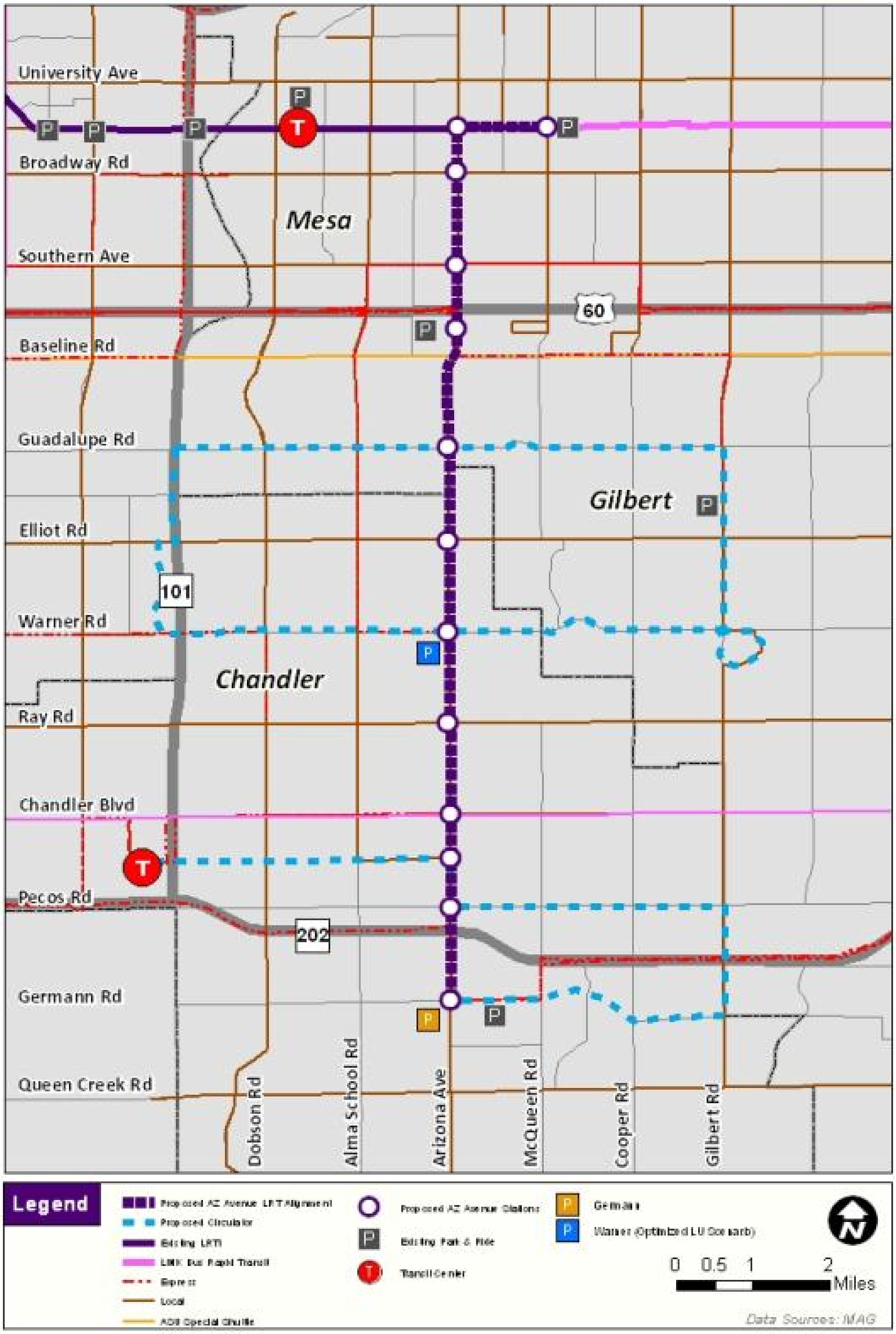
Enhanced Land Use Scenario – This scenario is based on the general plan updates for Chandler and Mesa. The Town of Gilbert did not provide any general plan update data to the project team. The Enhanced Land Use Scenario modifies the MAG 2035 population, employment, and enrollment forecasts by using the higher densities called for in Chandler and Mesa's general plans. This scenario applied the Enhanced Transit Network as the future transit network serving the corridor and study area.

Optimized Land Use Scenario – This scenario represents an optimal TOD build-out scenario for each of the project partner communities. The cities of Chandler and Mesa, along with the Town of Gilbert, each provided optimum TOD build-out population, employment, and enrollment forecasts building on the growth rates of the Enhanced Land Use Scenario. This scenario was also modeled with the Enhanced Transit Network serving the corridor and study area. In addition to the park-and-ride facility at Germann Road, this scenario also considered the implementation of a park-and-ride at Warner Road and Arizona Avenue.

[2] The current MAG Regional Transportation Plan outlines a future transit network for the region with a planning horizon year of 2031. For the purposes of this analysis, it was assumed that a similar transit network would be operational in 2035.

Figure 2-1. Enhanced Transit Network Scenario

Arizona Avenue High Capacity Transit Long Range Study



The Enhanced Transit Network served as the underlying transit network for both the Enhanced Land Use and Optimized Land Use scenarios. Table 2-1 provides further detail on the Enhanced Transit Network, and the specific modifications made to bus routes (e.g. service frequency changes), and the addition of new transit routes or modes serving the project study area.

Table 2-1. Enhanced Transit Network Operating Characteristics

Route[a]	Description	Baseline[b]	Enhanced	Notes
		Peak/Off-Peak	Peak/Off-Peak	
4112	AZ Ave LINK	15/-	-/-	Route Eliminated
TBD	AZ Ave LRT	-/-	10/10	New Route
45	Broadway Road	30/60	15/30	Enhanced Frequency
77	Baseline Road	30/30	15/30	Enhanced Frequency
108	Elliot Road	30/60	15/30	Enhanced Frequency
204	Ray Road	60/60	15/30	Enhanced Frequency
156	Chandler Blvd	15/15	30/30	Reduced Frequency
4156	Chandler Blvd LINK	-/-	15/30	New Route
TBD	Pecos/Germann Circulator	-/-	15/30	New Route
TBD	Warner/Guadalupe Circulator	-/-	15/30	New Route

Source: Valley Metro, 2012

[a] Routes listed as TBD represent new transit routes added as part of the Enhanced Transit Network, and are not officially part of the region's existing transit system, nor are they planned for implementation in the RTP.

[b] Route frequency is consistent with Proposition 400 transit service plan.

The four scenarios are not intended to provide a formulaic approach to land use, or to define the type or intensity of land uses surrounding the project corridor. Rather, each scenario is intended to inform a growing discussion among local and regional leaders on the direction of future development, and the level of development and population density that is necessary to sustain HCT service along the Arizona Avenue corridor. For more detailed information on the enhanced transit and land use scenarios, please refer to Technical Memorandum 2. Figures 2-2 through 2-4 display the changes in population, employment, and enrollment between the Baseline and Optimized Land Use scenarios.

Figure 2-2A: Baseline Land Use Scenario - Population

Arizona Avenue High Capacity Transit Long Range Study

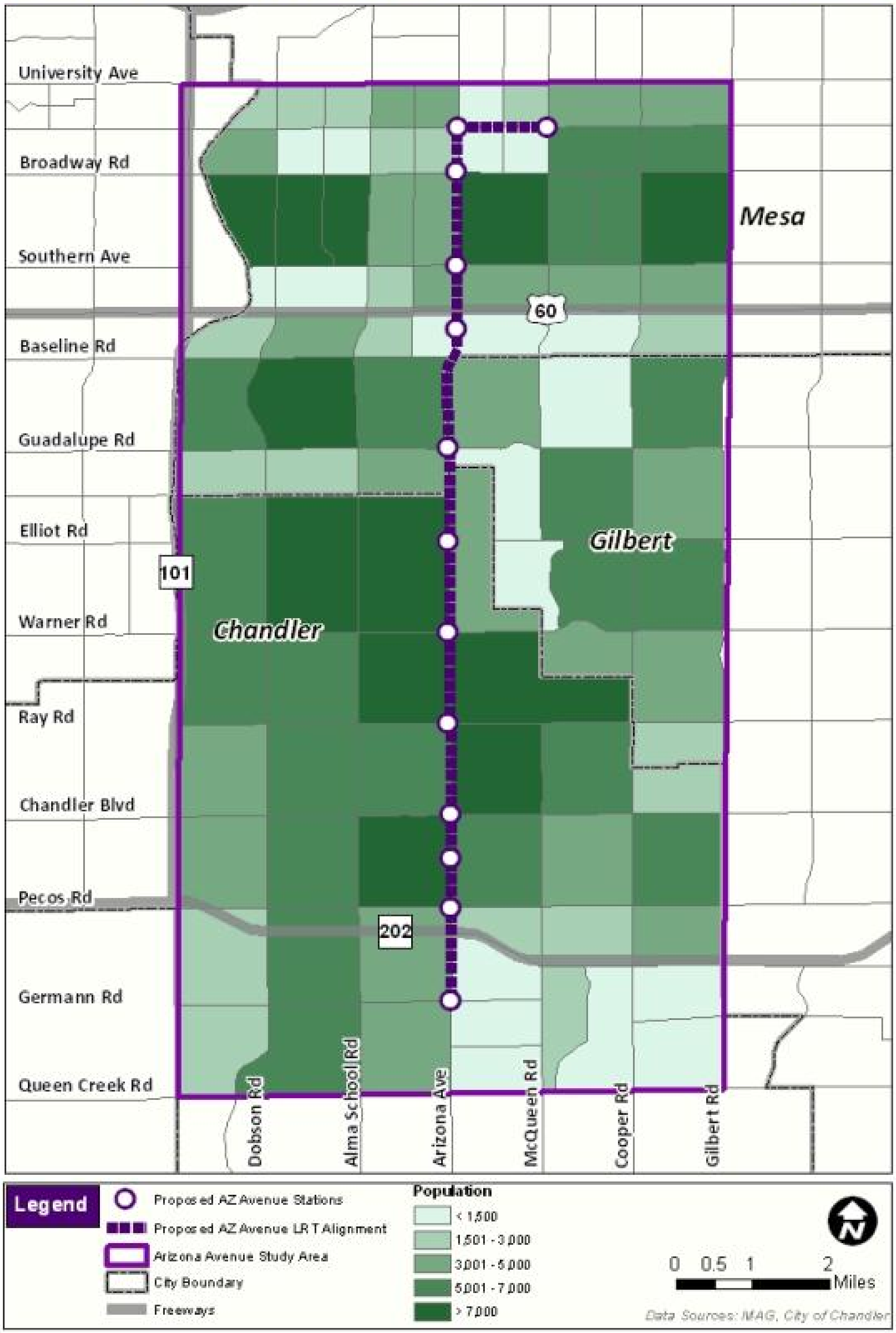


Figure 2-2B: Optimized Land Use Scenario - Population

Arizona Avenue High Capacity Transit Long Range Study

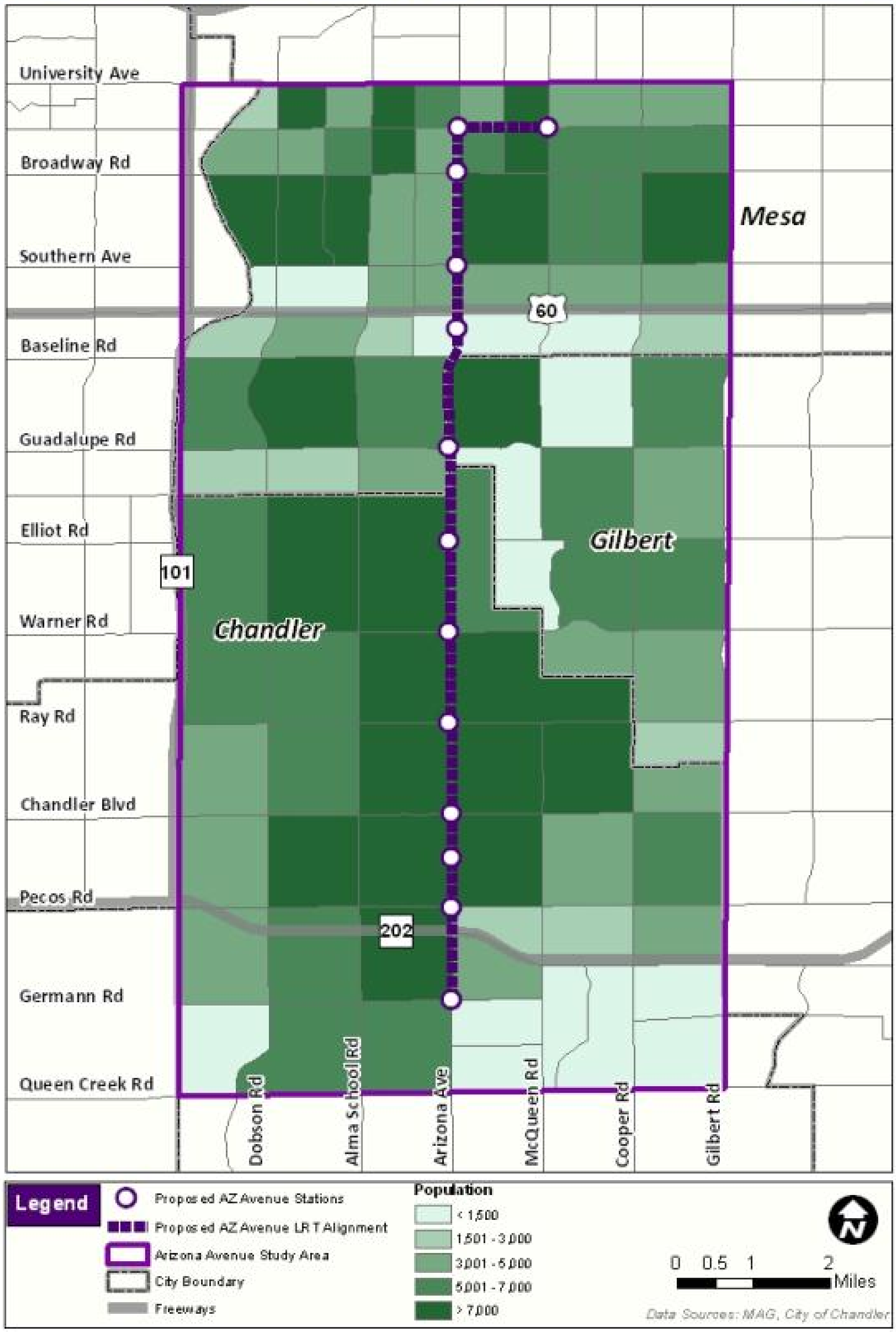


Figure 2-3A: Baseline Land Use Scenario - Employment

Arizona Avenue High Capacity Transit Long Range Study

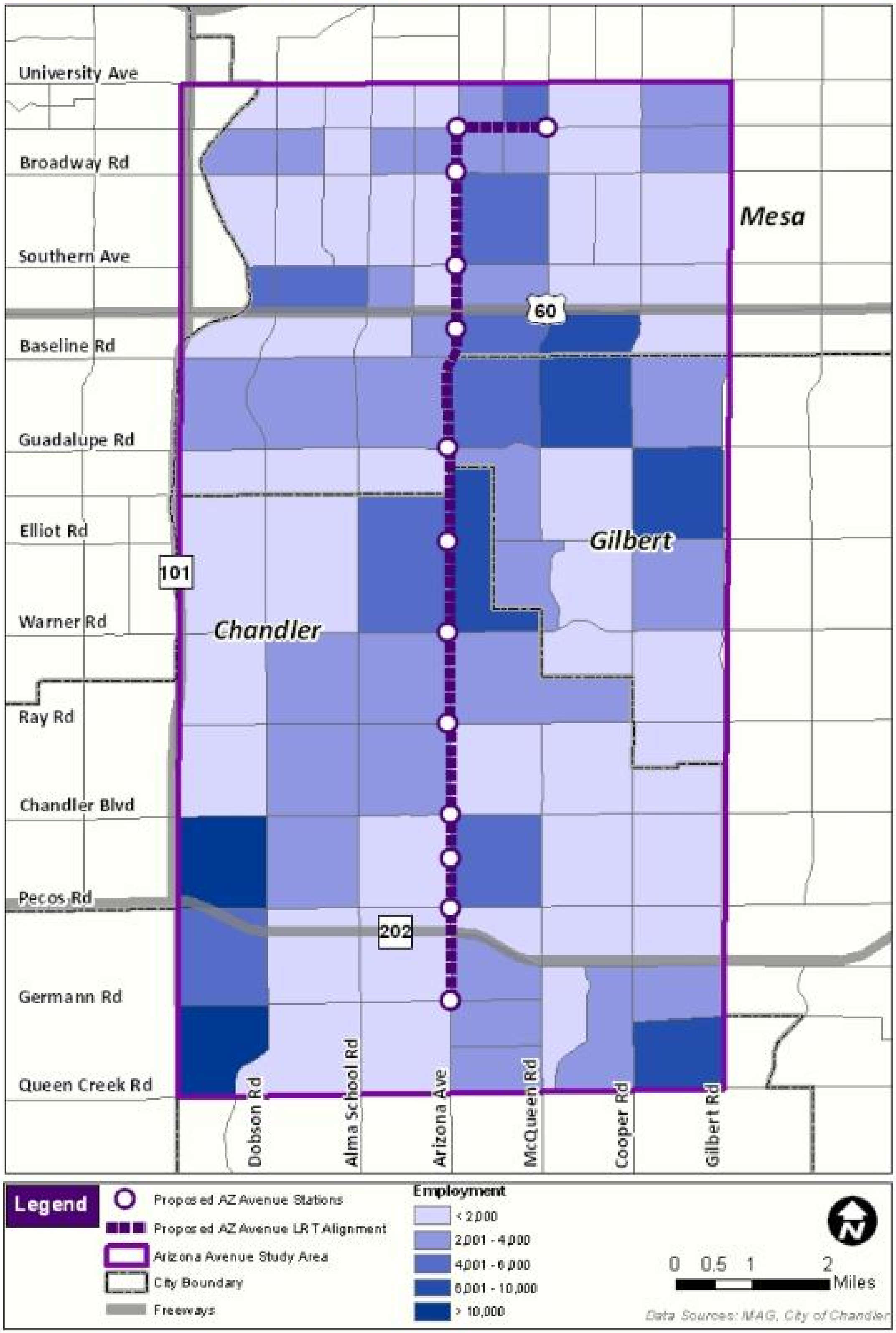


Figure 2-3B: Optimized Land Use Scenario - Employment

Arizona Avenue High Capacity Transit Long Range Study

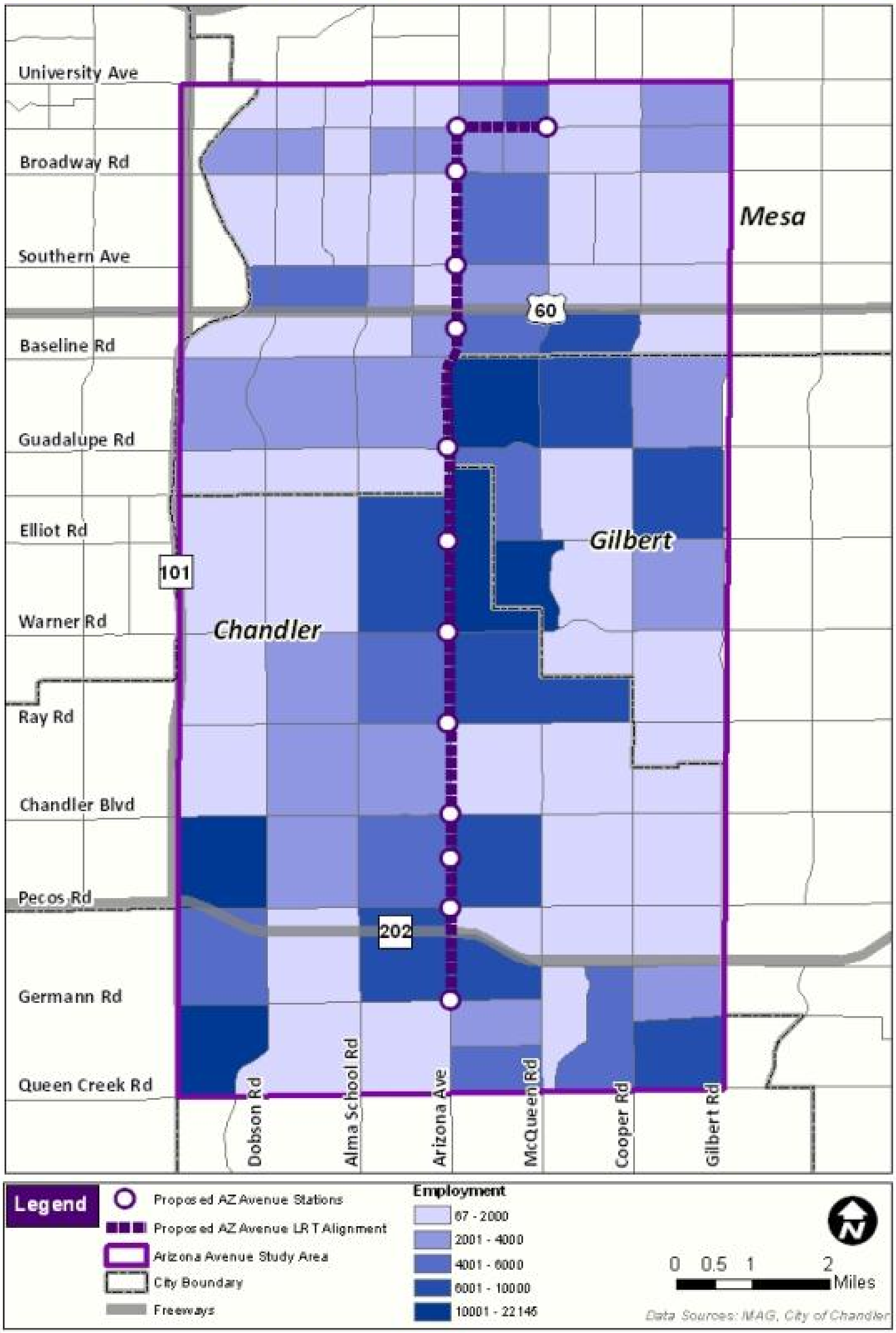


Figure 2-4A: Baseline Land Use Scenario - Enrollment

Arizona Avenue High Capacity Transit Long Range Study

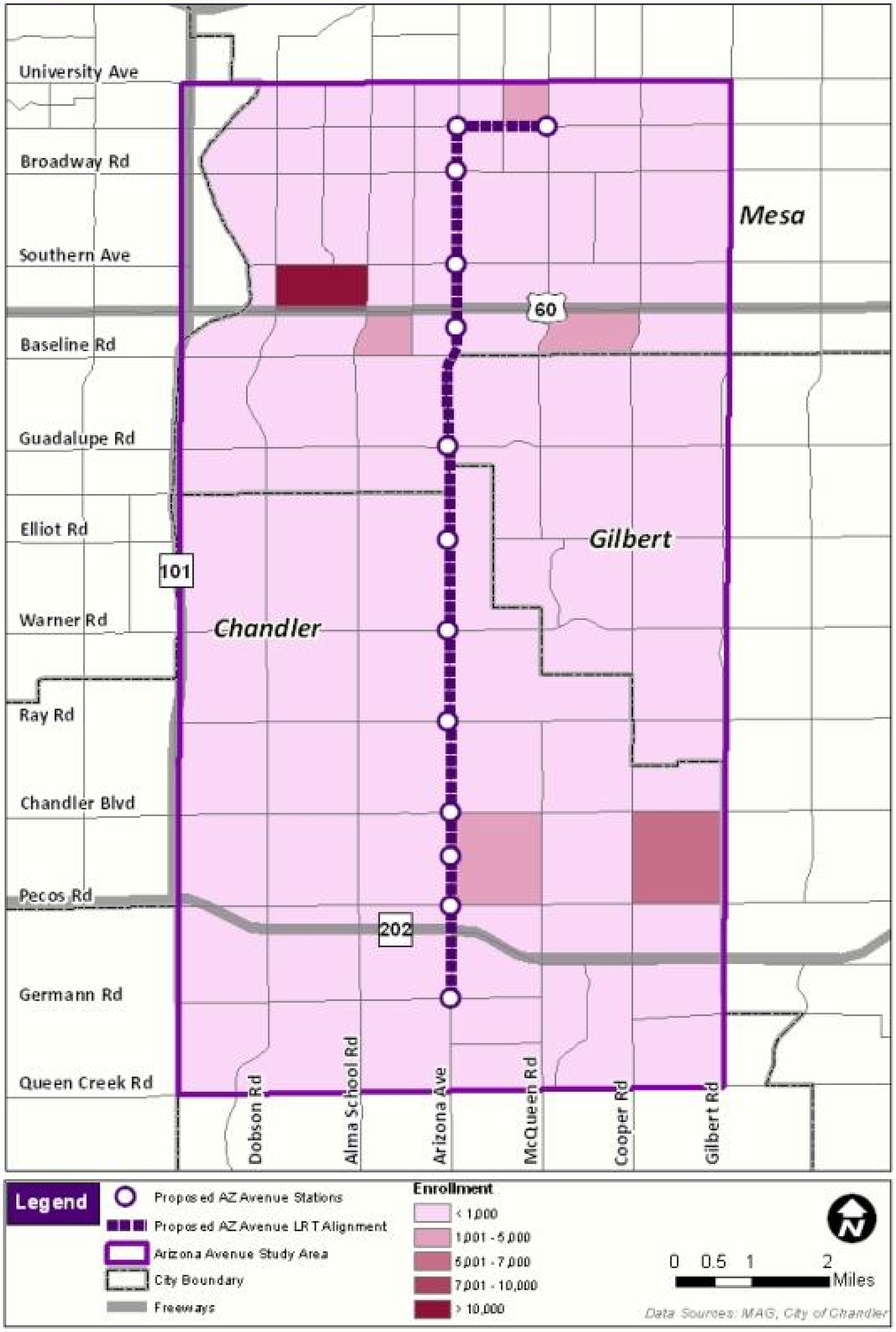


Figure 2-4B: Optimized Land Use Scenario - Enrollment

Arizona Avenue High Capacity Transit Long Range Study

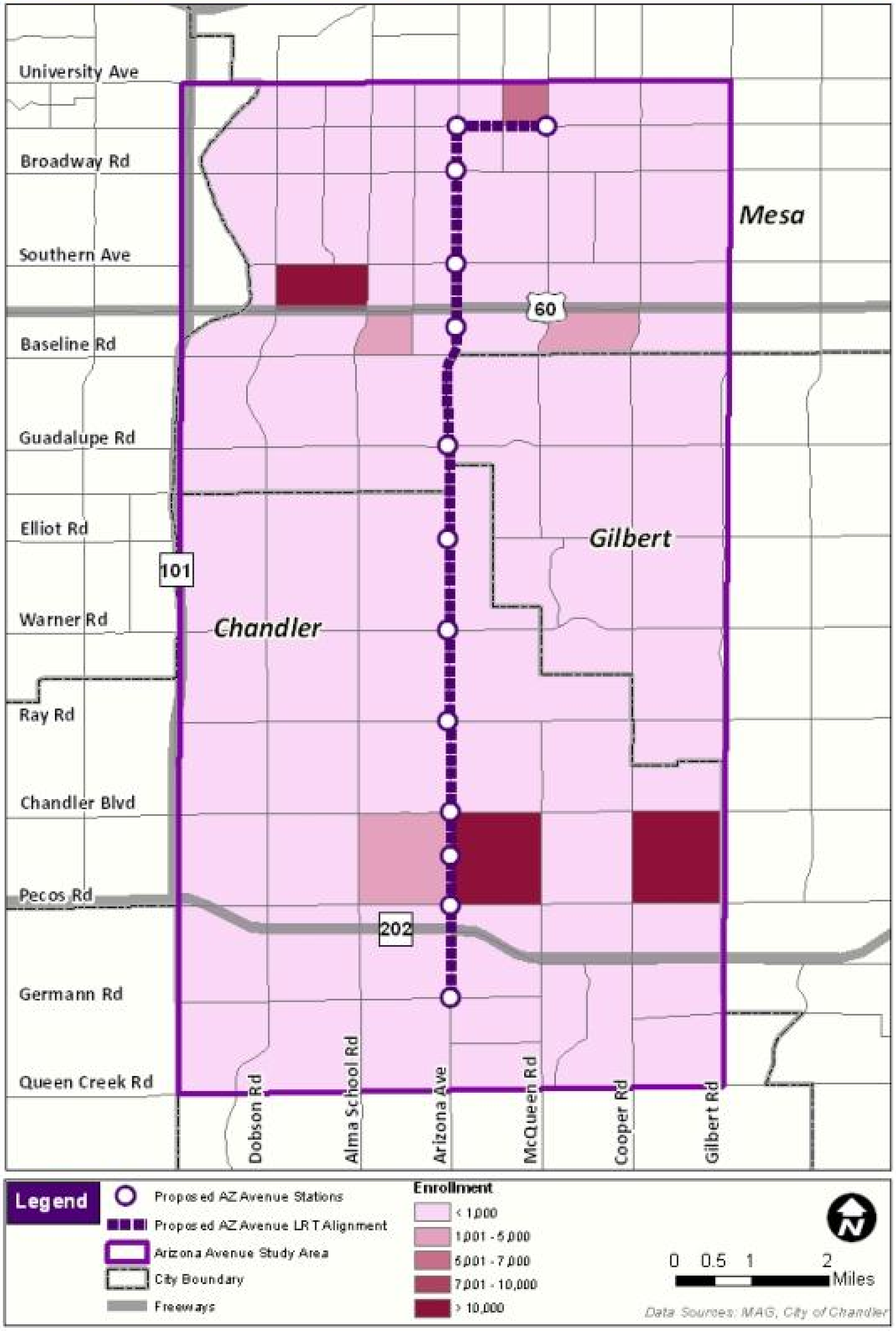


Table 2-2 displays the four scenarios developed for the study and the socioeconomic/land use data used to test and evaluate the performance of each scenario. As noted, the Enhanced Transit Network Scenario was applied to each of the alternative land use scenarios developed. The Baseline Scenario was based on 2035 socioeconomic/land use data provided by MAG and applied the planned 2035 transit network as outlined in the MAG RTP.

Table 2-2. Analysis Scenarios

Scenario	Socioeconomic/Land Use Data	Transit Service
Baseline	2035 MAG Socioeconomic	MAG RTP Transit
Enhanced Transit	2035 MAG Socioeconomic	Enhanced Transit
Enhanced Land Use	Chandler and Mesa General Plan Update	Enhanced Transit
Optimized Land Use	Chandler, Mesa, and Gilbert	Enhanced Transit

Source: Valley Metro, 2012

The Baseline Scenario served as the control scenario by which the other three scenarios were compared. This allowed project planners to compare and contrast performance differences between the scenarios sequentially as the project advanced. The Enhanced Land Use and Optimized Land Use scenarios focused principally on increases in population, employment, and post-high school enrollments. Of the population and employment attributes built into the regional travel demand model, these three attributes were deemed to be most likely to influence transit ridership within the corridor and study area in the future. Each scenario represents possible future land use and transit conditions that might occur based on the existing corridor conditions, emerging trends, and regional goals or community values expressed by the agencies participating in the study. The essential requirement for each development scenario was that it be plausible and within the realm of what exists and what could be developed.

2.2 Regional Travel Demand Model Application

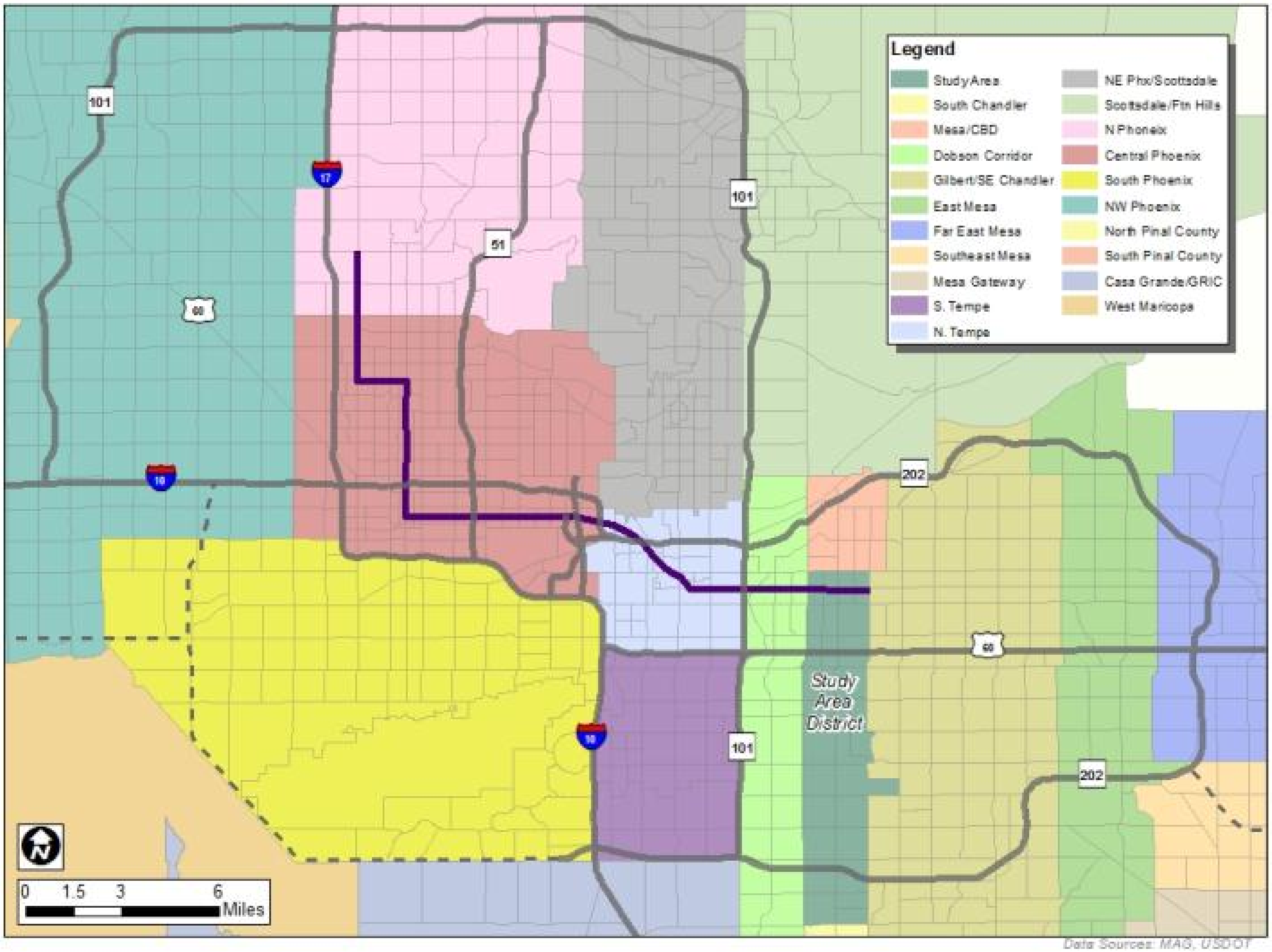
Increasing transit use, reducing the need to drive, and promoting urban growth along the Arizona Avenue corridor formed the context and motivation for this scenario planning study. The primary goal of the study was to develop an understanding of what land use development strategies and actions would be necessary to support an investment in HCT service operating along the Arizona Avenue corridor. In order to test the performance of each scenario, the project employed the MAG Regional Travel Demand Model. The goal of the travel demand analysis for this study was to obtain “order of magnitude” transit ridership numbers for comparison between alternative land development scenarios. The MAG Regional Travel Demand Model is a classic four-step modeling process consisting of the following basic procedures: trip generation, trip distribution, mode choice, and network assignment.

Several modeling assumptions were made during the course of this study. Given the differences between scenarios, different assumptions were made for each scenario. The assumptions made when testing each scenario with the regional travel demand model are described in full below. For all of the scenarios, the AM peak and PM peak periods were assumed to be from 6:00 AM to 9:00 AM and 3:00 PM to 7:00 PM, respectively. All other hours were assumed to be off-peak. The MAG regional travel demand model was designed to estimate the travel demand for an average weekday. However, LRT service would also be provided on the weekends and holidays, commensurate with demand. Additionally, the modeling process adopted for this study did not consider the qualitative (or non-measurable) attributes of individual travel behaviors/biases such as passenger comfort, convenience, or presumed safety associated with a specific mode. The forecasting process assumed an identical fare structure and level between the base and future years.

The project team developed twenty-one transportation analysis districts comprised of Transportation Analysis Zones (TAZs) to evaluate travel demand within the region and the corridor, and to understand general trip-making behavior between districts within the greater metropolitan region. Each of the four scenarios used TAZ data obtained from MAG to model anticipated travel behavior and to determine potential transit service utilization. The MAG 2035 socioeconomic data related to population and employment, as well as forecasted person and transit trips, were aggregated to the district level for further analysis. Figure 2-5 displays the TAZ districts developed for the project. While not all of the districts are shown, each is listed in the figure legend. This was done to focus attention on the study area district and surrounding districts where transportation trips to and from the corridor are most frequently made.

Figure 2-5. Travel Forecasting Districts

Arizona Avenue High Capacity Transit Long Range Study



3.0 Model Analysis and Results

As noted, the primary goal of the study was to develop an understanding of how targeted public transportation investments and land use development patterns can support a future HCT investment in the corridor. A secondary goal of the study was to obtain "order of magnitude" transit ridership and travel demand numbers for comparison between land use development scenarios using the regional travel demand model. Results of the travel demand model runs for each scenario are detailed below.

3.1 Land Use Scenario Results

Peer Region Analysis

Analysis of the three scenarios began with a basic transit performance analysis of peer metropolitan region light rail systems. The peer region average provides a performance benchmark of the approximate number of LRT boardings per corridor mile necessary to justify an HCT investment. While it is appropriate to note that numerous differences exist between each system, most notably the difference in total corridor miles, the boardings per corridor mile for each peer city was averaged to provide a common threshold. Table 3-1 details the boardings per corridor mile for each peer city selected, along with the peer region average. It should be noted that the boardings per corridor mile and the peer region average shown are not reflective of any Federal Transit Administration (FTA) requirements or minimum threshold that could determine whether a project will be positioned to receive federal funding.

Table 3-1. Peer Region Light Rail Performance

Peer City	Corridor Miles	Boardings per Corridor Mile
Salt Lake City	19.7	2,250
Seattle	17.2	1,390
Portland (OR)	56.2	2,300
Denver	35.0	1,870
Dallas	48.6	1,230
San Diego	54.2	1,690
Sacramento	36.9	1,400
Peer Region Average		**1,730**

Source: Valley Metro, 2012

Among the peer cities considered, an average of 1,730 boardings per corridor mile was determined as the target for an ideal number of boardings per corridor mile for successful implementation of a HCT system serving the Arizona Avenue corridor. The results of the peer region analysis show that boardings per corridor mile are highest among those cities with relatively high population and employment densities. Portland, Oregon had the most boardings per corridor mile, followed by Salt Lake City, Utah, and Denver, Colorado. On the contrary, cities with lower population and employment densities generally had fewer boardings per corridor mile. These included Dallas, Texas, and Sacramento, California. Interestingly, the City of Seattle had a relatively low number of boardings per corridor mile; however, portions of Seattle's

Central Link LRT system operate either below ground or on an aerial guideway where the system cannot serve a land area, thereby reducing access to the service.

Land Use Growth Analyses

With an understanding of the average boardings per corridor mile, the project team began to assess the different land use growth scenarios developed for the project. The MAG regional travel demand model contains several socioeconomic data attributes that influence travel demand. Among all of the model attributes, the project team determined that population, employment, and post-high school enrollments (hereafter referred to as enrollments) are the three attributes that can influence transit ridership specifically in the MAG model. In general, areas of the metropolitan region with higher population, employment, or enrollment totals tend to be more supportive of, and warrant, a higher level of transit service operating continuously throughout the day. A good local example of this is downtown Tempe and the Arizona State University (ASU) campus area.

Table 3-2 displays the population, employment, and enrollment totals used in the evaluation of each land development scenario considered. The totals were divided into two categories, the corridor and the region. The corridor refers to the area bounded by one mile on either side of Arizona Avenue, while the region refers to the entire Phoenix metropolitan region.

The Baseline Scenario reflects the current MAG socioeconomic forecast for 2035. The Enhanced Land Use Scenario reflects the future forecasts for population, employment, and enrollments as outlined in each community's general plan. Following the analysis of the Enhanced Land Use Scenario, the project partner cities were asked to further increase population, employment, and enrollments to a level that would be capable of supporting transit ridership that matches the average productivity of peer region systems. As discussed, the Enhanced Transit Network Scenario was tested with the same socioeconomic data used to test the Baseline Scenario; therefore, the Enhanced Transit Network Scenario is not shown in Table 3-2.

Table 3-2. Study Area Socioeconomic Forecasts by Land Development Scenario

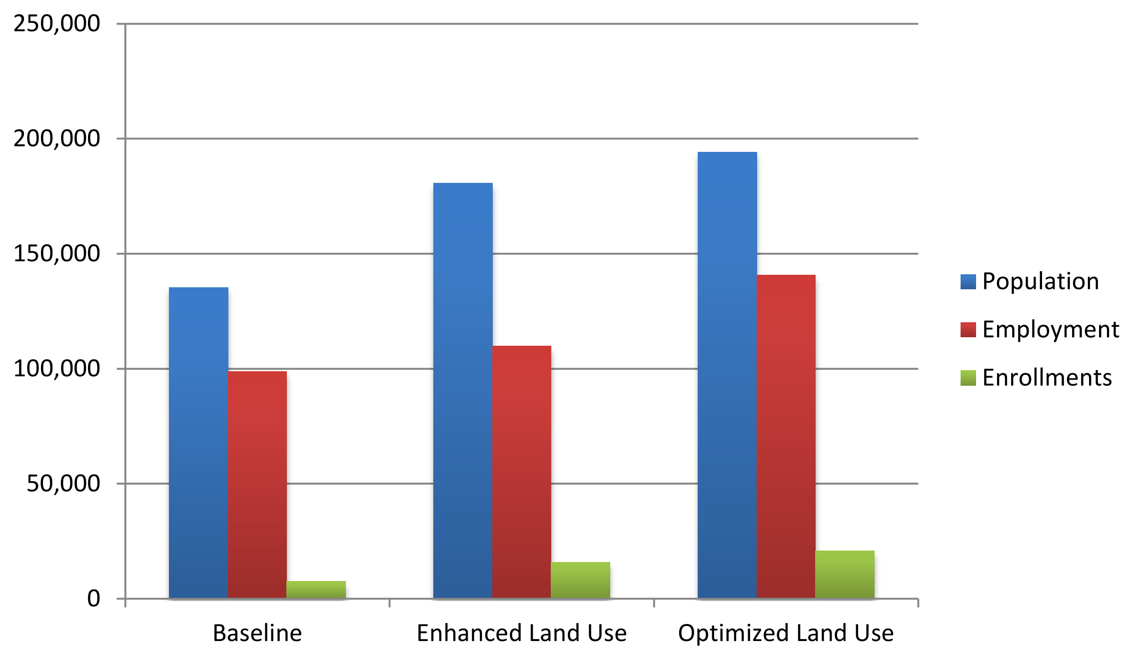
Characteristic	Baseline (2035 MAG Land Use)		Enhanced Land Use		Optimized Land Use	
	Corridor	Region	Corridor	Region	Corridor	Region
Population	135,400	7,942,500	180,800	8,012,100	208,900	8,040,100
Employment	98,800	3,551,100	109,900	3,570,800	140,660	3,601,600
Enrollments	7,600	276,100	15,900	289,500	20,900	294,500
Jobs per Resident Ratio	0.73	0.45	0.61	0.45	0.67	0.45

Sources: MAG, City of Mesa, City of Chandler, Town of Gilbert, 2012

In addition to the three principal model attributes considered, project planners calculated the jobs per resident ratio. Values closer to 1 suggest that there is at least one job available for every resident within the geographic area measured. This proportional measure provides an indication of the number of intra-corridor trips that may be made; in other words, values closer to 1 suggest a greater likelihood that more trips will be made to destinations within the corridor.

The bar chart displaying the data shown in Table 3-2 illustrates how population, employment, and enrollments changed between each land use scenario. Visualizing the data is important toward understanding the analysis results, and how growth in population, employment, and enrollments may contribute to the changing transportation conditions and encourage transit ridership within the corridor and region.

Figure 3-1. Study Area Socioeconomic Forecasts by Land Development Scenario



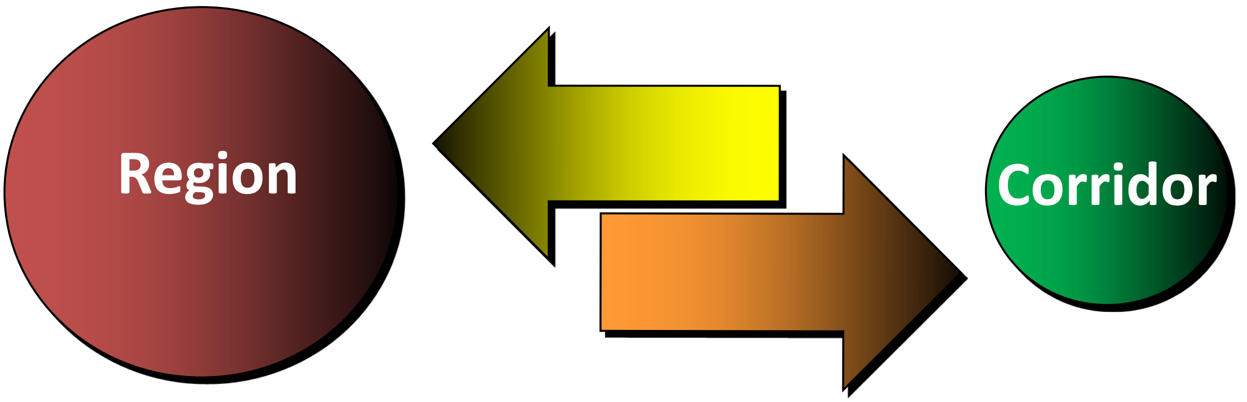
Sources: Valley Metro, 2012; Cities of Chandler, Mesa, 2012; Town of Gilbert, 2012; MAG, 2012

As shown in Table 3-2 and Figure 3-1, population growth (34%) dramatically outpaced employment growth (11%) in the Enhanced Land Use Scenario as compared to the Baseline Scenario. Enrollments were doubled within the study area (an increase of 109%), mostly in anticipation of the Arizona State University/University of Arizona joint campus currently planned for downtown Chandler.

Population and employment grew at substantially greater rates in the Optimized Land Use Scenario over the Baseline Scenario. Population grew by 43%, while employment grew by 42%. Additionally, enrollments were approximately 175% above the Baseline Scenario. Furthermore, this growth focused almost entirely around the corridor as opposed to TAZs in the greater study area. As noted, the Optimized Land Use Scenario was constructed to maximize the population, employment, and enrollments allowable within the corridor given reasonable development patterns that may be acceptable to each respective community.

The growth of population, employment, and enrollments in the corridor was subsequently evaluated on a regional travel demand basis in order to understand travel demand both within the corridor and the greater metropolitan region. Figure 3-2 illustrates the travel demand relationship between the corridor/study area and the greater Phoenix metropolitan region. As population, employment, and enrollments were increased within the corridor/study area, the total number of trips between the corridor and the region increased.

Figure 3-2. Travel Demand Relationship



Source: Valley Metro, 2012

Referring back to Table 3-2, the Jobs per Resident Ratio helps inform the flow between these two geographic areas. According to year 2035 Baseline Scenario data, of the total number of person trips made in the region daily, over 284,000 trips are made using public transportation services daily. Approximately 9,150 trips are made from the region to the corridor, as compared to approximately 8,700 trips made from the corridor to the region currently. Therefore, adding population, employment, and enrollments will increase the total number of person trips and the total number of trips made by transit. According to year 2035 baseline conditions, the corridor is a net importer of transit trips (e.g. more people take transit to access corridor destinations as compared to persons who take transit to access regional destinations).

As population, employment, and enrollments grew in each scenario, the growth of these attributes contributed directly to greater trip production both within the corridor and the metropolitan region. Table 3-3 details the findings of the regional person trip demand analysis. The "Corridor Characteristic" column illustrates whether a predominant number of trips are made to or from the corridor. A greater number of trips made from the region to the corridor results in the corridor being a net "importer" of trips; conversely, if a greater number of trips were made from the corridor to the region, the corridor was deemed to be a net "exporter" of trips. Interestingly, both the Baseline and Enhanced Land Use scenarios resulted in the corridor being a net importer of trips.

Table 3-3. Comparison of Trips between the Study Area and Metropolitan Region

Scenario	From Region to Study Area	From Study Area to Region	Study Area Characteristic
Baseline (w/Enhanced Transit)	591,200	462,200	Importer
Enhanced Land Use	598,700	558,200	Importer
Optimized Land Use	601,260	619,210	Exporter

Source: Valley Metro, 2012

Despite the significant population growth of the Enhanced Land Use Scenario, the demand for travel from the rest of the region to the study area surpassed the number of trips leaving the corridor destined for points throughout the region. Typically, an increase in population would be expected to result in the corridor exporting trips from the study area to the region. This is also particularly interesting given the minimal growth of employment between the Baseline Scenario and the Enhanced Land Use Scenario. However, the addition of the Enhanced Transit Network did create greater balance between the number of trips from the corridor to the region, and the number of trips from the region to the corridor, as compared to the Baseline Scenario.

Following analysis of the Enhanced Land Use Scenario, the project team modeled the Optimized Land Use Scenario. Paired with the Enhanced Transit Network, the more balanced growth in population and employment resulted in the study area sending a greater number of trips to the region, resulting in the Arizona Avenue corridor becoming a net exporter of trips. This is likely due to the added parking capacity created by two hypothetically planned park-and-ride facilities. The park-and-ride facility at Germann Road was included as part of the Enhanced Transit Network Scenario modeled for each land use scenario (except Baseline Scenario). The added population and employment of the Optimized Land Use Scenario, above the increases made in the Enhanced Land Use Scenario, likely contributed to a greater number of trips utilizing these parking facilities in order to access destinations outside of the study area.

Daily transit trips within the corridor increased by nearly 9,000 boardings over the Baseline Scenario. Table 3-4 illustrates the growth in projected transit ridership by scenario. The Enhanced Transit Network was applied to each land use scenario shown in Table 3-4.

Table 3-4. Project Transit Demand by Growth Scenario

Direction	Scenario		
	Enhanced Transit (Baseline Land Use)	Enhanced Land Use	Optimized Land Use
North – South	19,880	21,410	23,390
East – West	140,350	144,880	145,810
Total	160,230	166,290	169,200

Source: Valley Metro, 2012

The transit ridership forecast results were refined to isolate LRT ridership, along with boardings and alightings (passengers exiting the train) at each planned station. Table 3-5 displays the projected transit ridership for LRT serving the Arizona Avenue corridor by land development scenario.

Table 3-5. Forecasted LRT Ridership

Scenario	LRT Ridership	Boardings per Corridor Mile
Enhanced Transit (Baseline Land Use)	15,380	1,460
Enhanced Land Use	17,030	1,620
Optimized Land Use	18,280	1,740

Source: Valley Metro, 2012

The growth in population, employment, and enrollments for both the Enhanced Land Use and Optimized Land Use scenarios (refer to Table 3-2) contributed to increased LRT ridership shown in Table 3-5. Subsequently, the Optimized Land Use Scenario achieved a boardings per corridor mile average above the peer region average shown in Table 3-1.

While the regional travel demand model is only capable of producing results to a certain scale, the model is capable of delineating between modes of access to stations. Light rail boardings at planned stations were refined by mode of access. Table 3-6 shows LRT boardings based on the Optimized Land Use Scenario by station and mode of access. Two park-and-ride facilities are planned as part of proposed transit station locations, one at Germann Road and a second at Warner Road. Both facilities were assumed to have sufficient space for 500 vehicles, increasing total parking capacity within the corridor by 1,000 spaces. The travel demand model shows that the presence of these facilities would dramatically increase the drive access boardings at these two stations.

Table 3-6. Optimized Land Use LRT Boardings and Mode of Access by Station

Station	Boardings	Drive Access	Walk Access	LRT Transfers	Bus Transfers
Germann	2,480	1,670	500	0	310
Pecos	120	30	70	0	20
Fry	750	0	750	0	0
Chandler	1,460	60	640	0	770
Ray	1,090	20	730	0	340
Warner	1,340	1,190	0	0	150
Elliot	1,230	40	860	0	320
Guadalupe	1,010	20	660	0	330
Baseline	1,220	880	320	0	20
Southern	1,860	20	930	0	900
Broadway	440	10	370	0	70
Main/AZ Ave	3,220	40	640	5,540	100
Main/Mesa	2,060	650	910	0	500
Total	**18,280**	**4,630**	**7,380**	**5,540**	**3,830**

Source: Valley Metro, 2012

Table 3-7 shows the number of alightings by mode of egress at proposed station areas. The high number of alightings and bus transfers at the Chandler Boulevard Station is likely due to the implementation of arterial street BRT service along Chandler Boulevard linking downtown Chandler with the Chandler Fashion Center, Arizona State University Polytechnic Campus, and Mesa-Gateway Airport.

Table 3-7. LRT Alightings and Mode of Egress by Station

Station	Total Alightings	Walk to Destination	LRT Transfers	Bus Transfers
Germann	970	510	0	460
Pecos	110	110	0	0
Fry	600	600	0	0

Station	Total Alightings	Walk to Destination	LRT Transfers	Bus Transfers
Chandler	1,940	380	0	1,560
Ray	840	580	0	260
Warner	200	0	0	200
Elliot	2,090	1,660	0	430
Guadalupe	1,590	960	0	630
Baseline	1,200	1,130	0	70
Southern	1,970	1,100	0	870
Broadway	290	190	0	100
Main/AZ Ave	5,900	290	5,540	70
Main/Mesa	580	460	0	120
Total	**18,280**	**7,970**	**5,540**	**4,770**

Source: Valley Metro, 2012

Overall, results of the three land use scenarios indicate that the Optimized Land Use Scenario will achieve a boardings per corridor mile average slightly above the peer region average of cities with modern light rail systems in the western U.S. Under this scenario, the Enhanced Transit Network would be implemented, and would include significantly higher population, employment, and enrollment densities within the corridor.

Table 3-8. Comparison of Development Scenarios and Peer Region LRT Performance

Peer City	Corridor Miles	Boardings per Corridor Mile
Salt Lake City	19.7	2,250
Seattle	17.2	1,390
Portland	56.2	2,300
Denver	35.0	1,870
Dallas	48.6	1,230
San Diego	54.2	1,690
Sacramento	36.9	1,400
Peer Region Average		**1,730**
Baseline (w/Enhanced Transit)	10.5	1,460
Enhanced Land Use	10.5	1,620
Optimized Land Use	**10.5**	**1,740**

Source: Valley Metro, 2012

3.2 North Tempe District Comparison

In addition to the peer region comparison of major metropolitan areas, a local region of comparison was also established to analyze the results of each scenario. The North Tempe TAZ district was identified as a comparable local peer region based on several characteristics that are shared with the study area. As shown in Table 3-9, both the North Tempe District and the study area district are similarly sized geographically, with similarlly sized population bases (when comparing the baseline conditions of both districts). While the North Tempe district includes distinct differences in land use types, total employment, and post-high school enrollments, the underlying demographic characteristics are generally comparable with those of the study area. Furthermore, a robust, mixed-mode transit network currently serves the North Tempe district, and the project team sought to compare the characteristics of this network with what could operate within the study area district in the future.

Table 3-9. TAZ District Comparison – Study Area and North Tempe

Characteristic	Study Area District			North Tempe District
	Baseline	Enhanced Land Use	Optimized Land Use	Baseline
Area (Sq. Miles)	22.7	22.7	22.7	20.4
Population	135,400	180,800	194,130	121,000
Employment	98,900	109,900	140,660	151,400
Enrollments	7,600	15,900	20,900	56,000
Trip Production Density	31.8	38.4	46.1	35.8
Trip Attraction Density	40.7	41.2	44.7	53.2

Source: Valley Metro, 2012

Table 3-7 illustrates the similarities and differences between the two districts, one of which currently receives a steady, high-volume of transit service daily, and the other that receives substantially less transit service. The North Tempe district contains a dense mixture of residential, commercial, and institutional land uses that contribute to a high volume of transit trips and strong transit productivity. Local areas with high transit utilization are characterized by their enhanced walkability, high percentage of transit captive markets (including enrollments, and high employment densities), and a de-emphasis on automobile access. This de-emphasis takes shape in multiple forms, including fees for parking, reduced street capacity, the presence of multi-modal options, and pedestrian-oriented land uses.

In general, establishing a market to support HCT service is the product of several factors that, in combination with one another, may contribute to sustained transit productivity. The North Tempe district exhibits several of the following characteristics:

- **Higher Residential Densities** – Areas with higher residential densities are often more productive transit markets as compared to areas with lower residential densities because of the potential to serve and capture a greater portion of the population.
- **Higher Employment Densities** – As with residential densities, land areas with greater employment densities often increase the productivity of transit service since transit resources can be targeted toward a critical mass of people.
- **Parking and Parking Fees** - Limiting parking availability, or restrictions on parking (time limits, fees, or permit restrictions) can encourage the use of transit by increasing the burden of travelling by automobile.
- **Access to Destinations/Connectivity** – Also referred to as connectivity, access to destinations refers to the number of places people can reach within a one seat ride (or at least minimal transfer requirement) between two points.

- **Areas of Income Variability** – While persons of limited financial means are typically more likely to use transit as a lower cost travel option, areas that display a range of income levels are often transit-supportive.
- **Small Area/Transit Oriented Development Plans and Policies** – Transit-oriented development plans and land development policies can encourage transit use by identifying barriers to transit facilities, encouraging dense development, and creating a pedestrian-oriented environment.

4.0 Fiscal and Financial Implications of the Enhanced Transit Network

The vision for an enhanced transit network serving the Arizona Avenue corridor represents an ambitious goal for expanding public transportation services in the southeast valley. In spite of current national and regional economic trends, recent updates to the land use and transportation plans for southeast valley communities describe bold visions for future transit service. These plans are predicated in part on the forecasted population and employment growth of each community. Ensuring the continued financial stability of a transit program is critical to the system's success in attracting new transit riders, and to ensure the highest level of investment return possible.

Policy decisions governing the provision of transit services are made as part of comprehensive strategies developed by each community to deliver a broad range of public services. Decisions on transit service are made in an effort to operate an integrated transportation network that meets the mobility needs of residents, visitors, and businesses. As discussed, the communities of Chandler, Gilbert, and Mesa each contract with Valley Metro to provide fixed-route local bus, express bus, and ADA-compliant paratransit services. Each community primarily funds transit services through a combination of local appropriations, regional transportation funds, and revenues collected from transit fares. These funding mechanisms cover the operation of bus routes, management of the existing bus fleet, and the replacement of vehicles for its base system.

Current city, town, and regional transportation plans support increased transit service frequencies, improved weekday and weekend spans of service, and the addition (or re-instatement) of new bus routes serving arterial roadways that currently do not have transit service (e.g. Warner Road). Each community has also established several policies and goals for the intensification of land uses surrounding Arizona Avenue that can contribute to increased transit ridership. As each community further defines the timing and costs to pursue these initiatives, and as the development of an HCT facility is refined, it will be important to identify funding and financing options to support the implementation of the plans and programs for transit in each community.

4.1 Capital and Operating Costs

Expenditures represent the estimated costs associated with implementing, developing, purchasing, operating and maintaining the transit system serving the study area. Because costs change over time, the costs shown represent "order of magnitude" cost estimates, and should not be considered a formal estimate of capital or operating costs. Valley Metro utilizes current industry standard unit costs in order to anticipate and forecast future system costs for a range of elements that are part of major capital investments. Capital cost expenditure estimates were calculated for individual expense categories using unit cost variables. The unit cost approach allows for costs to be categorized by transit technology or facility, and for comparison purposes to assist in the planning of the future system. Capital costs of the Enhanced Transit Network were derived from earlier unit cost estimates for current LRT projects. Where available, unit costs have been developed from local data (e.g. comparable recent Valley Metro projects). The unit costs used to estimate the capital cost expenditures were also reviewed against current industry standard cost elements using cost data obtained from the National Transit Database.

It is important to distinguish capital costs from operating costs. Capital costs are normally one-time expenditures for land acquisition and clearance, construction, equipment purchases or rentals, labor, and professional services for design and permitting. Capital costs are typically paid during the period of a project's construction (if a project pursues a financing or phasing strategy for implementation, loans may be used to spread capital construction payments out over time).

Operating costs represent recurring expenses related to the operation and maintenance of the capital investment. Operating costs for LRT include ongoing operations and maintenance of the trackway, passenger stations, and costs for vehicles, spare parts, vehicle propulsion, lighting at stations, insurance, and vehicle operators, among other costs.

Capital Costs

Capital costs for the Enhanced Transit Network have been identified for four principal categories: transit vehicles, passenger facilities, operations and maintenance facilities, and the design and construction of transit corridor elements. Table 4-1 provides an order of magnitude unit cost summary of the capital cost requirements needed to provide the recommended new or expanded services of the enhanced transit network. As part of the enhanced transit network, it is assumed that some routes will be replaced by new service (e.g. LRT will replace the AZ Avenue LINK route).

Table 4-1. Estimated Capital Costs of the Enhanced Transit Network

Capital Elements	Estimated Net Capital Cost ($2012)
Construction and Materials Subtotal	$597,450,000
Vehicles and Maintenance Facility Subtotal	$97,650,000
Contingency	$82,950,000
LRT Total	**$778,050,000**
Bus Passenger Facilities	$13,970,000
Fleet (bus only)	$12,323,000
Bus Total	**$26,293,000**
Total	**$804,343,000**

Sources: Valley Metro Rail, Inc., 2011/2012

A preliminary estimate of the fleet requirement suggests that a total of 53 additional transit vehicles are needed to meet the peak revenue service for the service adjustments identified in the Enhanced Transit Network. Please note that the additional fleet requirements only include the net-additional vehicles needed. For example, only three vehicles are needed to operate the Route 45 (Broadway Road) inset service. These are vehicles needed to operate the services above the current vehicle requirements for service assumed in the MAG 2031 RTP baseline transit network.

Table 4-2 summarizes the estimated unit costs for implementation of an HCT corridor on a cost per corridor mile basis. The costs presented in Table 4-2 are summarized for the specific capital construction cost elements, and reflect an investment in LRT technology only. As with all unit costs identified above, costs for individual projects will vary. As an HCT project planned for Arizona Avenue moves into later stages of engineering design, refined capital cost estimates will be produced that provide a more accurate picture of anticipated capital costs. The cost elements shown reflect only the unit costs, and do not include construction contingencies. Transit vehicles, and an allowance for project expenditures contributing to the expansion of an operations and maintenance facility, are separated from construction costs.

Table 4-2. Estimated Unit Costs per Corridor Mile by Mode

Cost Elements	Unit Cost per Corridor Mile ($2012)
Guideway/Track Elements[a], LRT Stations, and Systems	$33,000,000
Sitework and Special Conditions[b]	$22,000,000
Park-and-Ride Facilities[c]	$1,900,000
Construction and Materials Subtotal	**$56,900,000**
Vehicles	$6,900,000
Operations and Maintenance Facility	$2,400,000
Vehicles and OMC Facility Subtotal (Corridor Mile)	**$9,300,000**
Total Unit Cost per Corridor Mile	**$66,200,000**
12% Contingency (per Corridor Mile)	**$7,900,000**
Total for 10.5 Corridor Miles (including contingency)	**$778,050,000**

Sources: Valley Metro Rail, Inc., and National Transit Database, 2011/2012

[a] Includes the cost of a basic bridge over US Highway 60

[b] Includes costs for design and engineering

[c] Includes an allowance of $12.0 million dollars per corridor mile for potential right-of-way costs. A formal determination of right-of-way needs will need to come after technical design is determined. This cost category includes funds for utility relocations, as applicable.

[d] Includes park-and-ride facility cost. The Tumbleweed Park-and-Ride, constructed in 2009, cost approximately $9.3 million. This project assumes the construction of two new park-and-ride facilities, one at Germann Road and a second at Warner Road.

Operating Costs

Using current Valley Metro operating cost data, operating cost expenditures were estimated for providing the Enhanced Transit Network. For purposes of this analysis, if a route currently exists, the actual FY 2011 net operating cost per revenue mile for that route was used to determine the additional operating cost of extending that service or increasing the service frequency. If the route is planned for the future, but does not exist today, the FY 2013 contract rates were applied to determine the estimated additional cost of adding that route.

Table 4-3 summarizes the estimated annual operating costs for the Enhanced Transit Network. Future operating costs were only defined for routes and service levels that went above and beyond the service level specified in the MAG 2031 RTP. For those routes that maintain the existing or RTP planned headways and alignment, operating costs were assumed to remain unchanged. In all cases, the costs shown reflect seven day a week operating costs. Full seven day a week operating costs were derived by calculating weekday revenue miles, which were then multiplied by an annualization factor (300 days).[3] Furthermore, it is important to note that as some of these routes are programmed to change according to MAG's 2031 RTP, it should be assumed that certain routes may be implemented or modified prior to the introduction of HCT service on Arizona Avenue. It should also be noted that the costs shown in Table 4-3 represent the additional costs above what is in operation today or planned as part of the MAG 2031 RTP. The costs shown are what would need to be contributed to expand transit service in today's dollars.

Table 4-3. Estimated Annual Operating Costs of the Enhanced Transit Network

Route	Description	Estimated Net Operating Cost ($2012)
4112	AZ Avenue LINK	-$1,191,000
LRT	AZ Avenue LRT	$8,777,000
45	Broadway Road	$414,000
77	Baseline Road	$397,000
108	Elliot Road	$499,000
204	Ray Road	$670,000
156	Chandler Boulevard	-$2,285,000
TBD	Chandler Blvd BRT	$2,888,000
TBD	Pecos/Germann Circulator	$2,146,000
TBD	Warner/Guadalupe Circulator	$2,971,000
	Total	**$15,286,000**

Source: HDR, Inc., 2012
[a] Based on average Fare Revenue contained in FY2011 Valley Metro Transit Performance Report, 2012

The estimated expenditures identified above provide a general estimate of the financial obligations project partner cities and/or agencies would incur by implementing an HCT system and the recommended fixed-route bus transit service enhancements. It is important to note that estimated expenditures are subject to fluctuation due to natural market forces. Similarly, sources of funding are also subject to change over time. Potential alternative funding sources that may help meet the estimated additional operations and capital expenditures are outlined below.

4.2 Potential Funding Sources

Transit service capital and operating needs are funded within the context of the City of Chandler, Town of Gilbert, and City of Mesa annual budgets. Each community's contribution to Valley Metro's operating budget is predominantly derived from their respective portion of the regional Public Transportation Fund (PTF); however, local general funds and transit fares collected within city limits also contribute toward covering the capital and operating costs of the city's transit system. Decisions on transit investments, either through capital or operations funding, are subject to the policies of each respective community.

[3] An annualization factor of 300 days is a standard FTA accepted methodology for the proportional number of service days to account for weekend service (at a lower frequency than weekday service).

While policy-makers, city staff, and the public recognize the importance of a long-term, sustainable funding source to support transit operations, it is unlikely that a dedicated funding source will be provided exclusively for transit in the near-term given the continued economic challenges and vast demands for public services confronting cities across the metropolitan region. However, as an initial step towards identifying available funding to implement an enhanced transit network, the study area cities have expressed an interest in identifying options for selective funding that can diversify the revenue stream, help preserve the baseline transit network, and support service enhancements.

Potential sources of funding may come from the following resources:

- **Local Property Taxes -** Property taxes are a primary form of city revenue that contribute to the provision of publicly-provided services. While property tax increases may be politically unpopular, there are other means of increasing property tax revenue beyond simply increasing tax rates. Instituting city land development policies that encourage higher housing or commercial unit densities around transit facilities can foster growth in property tax revenues. Actual development of residential or commercial properties and the leasing of space is subject to natural market forces.
- **Local Sales Taxes -** Municipalities in Arizona and across the country have instituted new or modified existing sales taxes to generate capital and operating revenues to fund transit-specific improvements. While sales tax revenue is dependent on commodity purchases, and recent experience with sales taxes have shown the volatility of financing public infrastructure projects through sales tax initiatives alone, the region is still anticipating robust population growth in the future, suggesting continued growth in the sales tax base for goods and services.
- **Parking Fees -** Some transit agencies collect parking revenues from the operation of bus and rail park-and-ride facilities. While revenues generated provide supplemental funding, it is important that parking fees together with transit fares do not detract from the competitiveness of (and accessibility to) transit services.
- **Debt Financing -** Debt financing mechanisms refer to bonds, notes, leases and other forms of debt which are supported by a pledge of future revenues from one or more funding source. Public entities use debt financing because it provides the ability to access capital markets and secure sufficient resources to implement capital projects within an optimal time period. Without debt financing, public entities are limited to a pay-as-you-go approach where only annual revenues generated from taxes, user fees, advertising revenues, or other financial sources could be used to fund a project.
- **TIFIA Credit Assistance -** TIFIA is a federal credit assistance program designed to help finance large transportation projects by loaning funds to cities, metropolitan regions, or states where future revenue sources may be uncertain. These loans are meant to attract non-federal investment and accelerate projects which may not be scheduled in the immediate future or even constructed because of the size and scale of the project.

- **Value Capture -** While the State of Arizona does not currently permit value capture initiatives, renewed attention is being focused on this mechanism of public financing. Value capture tools capitalize on the increased value of private lands created by public infrastructure investments. Increasingly, cities and states across the country are employing this financing strategy to help recoup the capital cost of constructing major transit facilities, and to help offset operating expenditures for a set period of time. Value capture strategies are still relatively new in their application for transportation projects, and it is recommended that cities wishing to employ these types of strategies undertake market assessment studies to determine the viability of adjacent land to support the desired level of development in order to maximize potential returns on investment.
- **Public Private Partnerships -** Increasingly, transit providers and cities across the country are looking to leverage their limited financial resources by forging partnerships that can bring non-traditional sources of support (including cash, facilities and equipment, in-kind services, and financing mechanisms) that pay partially or fully for new services or facilities where they would otherwise not be feasible. Local governments and transit agencies are expanding their list of partners to include developers, major employers, colleges and universities, non-profit social service agencies, utilities, property managers, and various other entities.
- **State Funds -** Available funding from the State of Arizona, such as the state Local Transportation Assistance Fund II (LTAF II) which uses lottery proceeds, are available as a financial resource to help pay for capital construction and operating costs.
- **Federal Aid Discretionary Grants -** Funds for capital improvements are available from the federal government, typically in the form of discretionary grants, such as the New Starts Program offered through the Federal Transit Administration. These discretionary grant programs are highly competitive among cities and regions looking to implement major capital investments in high-capacity transit technologies. The Central Phoenix/East Valley and Central Mesa Extension projects are direct recipients of federal aid funds for high-capacity transit capital improvements.
- **Other Revenue –** Advertising sales on transit vehicles or at transit facilities, or other non-traditional forms of revenue collection, could also contribute to the capital costs for construction of a transit facility.

The identification of a preferred set of funding options to meet the capital and operating costs identified in this memo are contingent upon each community's ability to meet several key objectives. The funding strategies selected to implement an Enhanced Transit Network must yield the necessary revenues, and have the required legal framework, to cover the costs of the enhanced network while maintaining sufficient funds for the existing network. The funding strategy must also be acceptable to the community at-large. As plans for an Enhanced Transit Network progress forward, it may be necessary to conduct an evaluation of the funding options presented in this report (or other options) to identify a short list of strategies for further study as part of the development of a comprehensive financial plan for transit.

For revenues derived from intergovernmental grant contributions, it is important that the level of funding sought is within the financial capacity of the entity expected to provide the resources. While each revenue option is subject to economic cycles, the preferred strategy should be based on a revenue source that is not subject to significant volatility (or assumes the least volatility risk possible) in order to protect each community's financial operations. In addition, the options should have the support of the community and elected officials, in part by demonstrating that those contributing the funding will be beneficiaries of improved transit services. Finally, the administrative burdens to impose and collect the revenues should be as low as possible and represent a reasonable incremental cost to collect existing taxes or fees.

5.0 Study Recommendations

For a number of reasons including livability, cost, health, and the environment, a growing number of Americans are interested in having a variety of transportation options available to them, whether it be walking, bicycling, public transportation, or driving. People make trips daily for a variety of reasons; for work, school, shopping, or recreation. The potential for people to use travel modes other than private automobiles generally relies on each person's proximity to their desired destination, typically the distance between their home and work location. Beyond distance alone, land use density and urban form have been proven to influence how people travel, and travel can also be influenced by individual circumstances, such as age or disabilities.

In general, the Arizona Avenue corridor is already a good candidate corridor for increased bus service and enhanced arterial BRT service in the planning horizon-year of 2035. Current transit plans for the region suggest that bus service frequencies will increase along many existing routes serving the study area. The study area is already served by local and express fixed-route bus service, including arterial BRT service (LINK); but constraints to expanded transit service exist that can inhibit the implementation of enhanced transit services. These constraints include (but may not be limited to) the preponderance of vacant or underutilized parcels, relatively low population and employment densities surrounding the corridor, and low availability of public funding for service and infrastructure enhancements.

The following recommendations are made for the Arizona Avenue corridor to achieve the densities necessary to sustain high-capacity transit service:

- Amend current General Plans to identify areas that can be adjusted to strongly encourage (if not require) TOD and prohibit auto-oriented/ suburban developments along the corridor
- Actively develop area plans to specify target densities in station areas
- Utilize zoning tools such as form-based codes, TOD overlay zoning and/or mixed use zoning to affect desired land uses
- Promote economic development strategies to help attract employment to the corridor and encourage mixed-use development to help promote intra-corridor travel
- Consider a reduction in the number of traffic lanes on Arizona Avenue/Country Club Drive to help create a pedestrian-friendly environment
- Apply complete streets principles that promote urbanism while helping to maintain traffic flow
- Incorporate open space as part of future development

Many communities across the United States are acutely aware of how inefficient land uses effect individual mobility and transportation policy. In effort to begin a dialogue on how to change previous land development trends in the southeast valley region, this study reviewed alternative land development and enhanced transit network scenarios to assess what land use changes would be necessary to support and sustain an investment in an HCT mode. The study findings provide a starting point for the communities of Chandler, Gilbert, and Mesa to begin a conversation on coordinated land use and transportation strategies to employ an effort to make the Arizona Avenue corridor a viable candidate for HCT service.

In spite of the observed challenges described above, the Arizona Avenue corridor is poised to experience significant future growth of most major forms of land use including residential, commercial, industrial, and public institutions. The corridor and study area represent an area of the southeast metropolitan region ideally suited for urban growth that maintains the existing character of the surrounding communities. With increases in population and employment densities, particularly surrounding major intersections of the corridor where HCT stations are most-likely to be located, the development of vacant land areas and/or redevelopment of underutilized parcels can create a vibrant transit corridor capable of supporting an investment in an HCT technology such as light rail.

The recommendations developed from this study are are offered to provide more efficient land use choices, expand public transit services, and maximize the efficiency of the existing roadway transportation system. It is important to note that the land use, transit, and roadway improvement strategies are intended to work together in order to provide the desired results. Coordinated implementation of all three strategies is integral to the study recommendations.

The recommendations presented in this report are based on the following key questions defined in the project scope of services.

- What land use and planning tools are applicable to Arizona Avenue to encourage, promote, or require development patterns that support or promote transit utilization?
- What opportunities exist to modify the configuration of Arizona Avenue to become more transit friendly?
- What is the reasonable “order of magnitude” of development intensity and density within the Arizona Avenue corridor in order to create the critical mass necessary for a successful LRT Corridor?

5.1 Planning, Density, and Transit Service Recommendations

What land use and planning tools are applicable to Arizona Avenue to encourage, promote, or require development patterns that support or promote transit utilization?

In recent years, land use planning tools have been successful in helping communities achieve development patterns that can help support or sustain investments in HCT. Two approaches, appropriate for the study area, include leveraging each community’s land use zoning designations to guide desirable land use patterns and applying development codes/ordinances to encourage the application of TOD design principles.

Figure 5-1. Example of Transit-Oriented Development in Tempe, AZ

Source: http://www.grigiometro.com/gallery.php

The relationship between land use and transportation facilities is well established, and if not properly managed, can lead to undesirable and unsustainable development patterns. Past experience with uncoordinated land use decisions and transportation improvements can lead to sprawling land development patterns, loss of productive agricultural land and undisturbed open space, and increased traffic congestion, all of which have economic costs to cities and metropolitan regions. TOD projects have direct social, environmental, and financial benefits that can create lasting places enjoyed by the public but that also benefit both developers and local governments financially. Nationally, best practices in TOD suggest that developments encourage a mixture of land uses, limit parking availability and price parking appropriately, be served frequently by transit, and provide pedestrian amenities. Such TOD's are desirable places to live, work, and recreate.

Traditional Euclidean zoning codes are often a barrier to transit-supportive, mixed-use developments. Today, cities implementing LRT or other HCT modes are applying area specific land use controls such as form-based zoning codes, transit mixed-use zoning districts, and planned area developments (PAD). These tools allow communities to better enable TOD development. It is recommended that the communities in the study area consider the formation of zoning policies that will help achieve TOD goals or actively promote the advantages of existing TOD friendly policies such as PAD or form-based zoning to developers and community organizations that may influence development.

TOD principles include the consideration of appropriately scaled densities, parking, and building/site design. It is further recommended that the study area communities consider strategic refinements to local subdivision and land development ordinances/codes that minimize building setbacks, provide density bonuses for developers, scale building heights based on development intensity/density, and set parking maximums, among other actions. Adopting land development policies that incorporate a community's desired TOD principles do not have to be rigid and difficult to implement. In contrast, they can be formulated to offer developer flexibility.

Recommendations

It is strongly encouraged that the following actions be supported by the communities within the study area to actively promote transit-supportive development policies:

- Amend current General Plans to identify areas that can be adjusted to strongly encourage (if not require) TOD and prohibit auto-oriented/ suburban developments along the corridor
- Actively develop area plans to specify target densities in station areas
- Utilize zoning tools such as form-based codes, TOD overlay zoning and/or mixed use zoning to affect desired land uses
- Promote economic development strategies to help attract employment to the corridor and encourage mixed-use development to help promote intra-corridor travel

What opportunities exist to modify the configuration of Arizona Avenue to become more transit friendly?

Successful HCT services, such as LRT, function as an integral part of the transportation corridor that the service is operated within. The relationship between transit service and other transportation modes is a critical element in building and retaining passengers and community support.

Recommendations

Three opportunities that the study area communities should consider in regards to modifying the configuration of Arizona Avenue to become more transit friendly include:

- Consider a reduction in the number of traffic lanes on Arizona Avenue/Country Club Drive to help create a pedestrian-friendly environment
- Apply complete streets principles that promote urbanism while helping to maintain traffic flow
- Incorporate open space as part of future development

It is encouraged that the study area communities reduce the number of traffic lanes in the Arizona Avenue corridor, particularly between Broadway Road and Chandler Boulevard. Reducing the number of traffic lanes can have multiple benefits. First, reduced traffic lanes will result in reduced ROW acquisition and related costs. Second, reduced lanes will serve as one element in helping to create a more pedestrian friendly environment, which is an important consideration for attracting transit users, who will be pedestrians at their access or egress points (or both). Figure 5-2 illustrates a conceptual lane configuration near Arizona Avenue and Ray

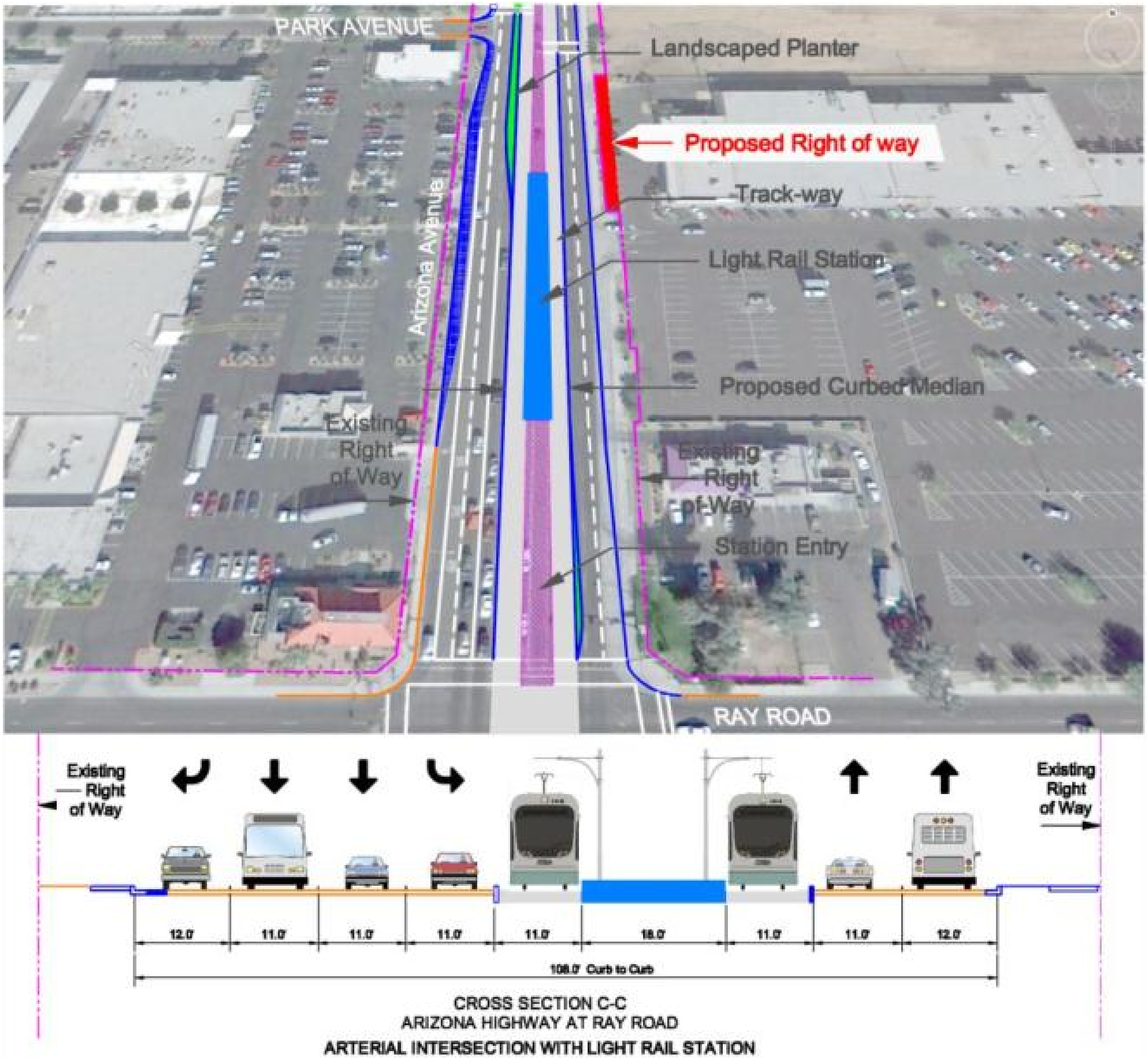
Road. This illustration includes LRT in the center of the roadway, with a reduction of auto lanes within the roadway corridor to minimize ROW acquisition.

Complete streets principles includes the development of safe and wide sidewalks with natural shade, bike lanes, a protected transit way, and adequate auto traffic capacity. These principles may only be applicable in sections of the corridor, but will help promote the type of environment conducive to attract and retain transit patrons.

Finally the incorporation of public and semi-public open space elements in the corridor will help provide pedestrian relief areas and retain an element of each community's suburban development character despite the potential increase in land use intensity throughout the corridor. Open space elements do not need to include traditional community parks, but could include mini-parks, linear desert greenways along pedestrian ways, and semi-public courtyards in commercial developments. These elements can be incorporated as part of the community design guidelines that are typically associated with the design and construction of an HCT corridor or included as private development stipulations.

Figure 5-2 provides an illustrative example of what Arizona Avenue could potentially look like with the implementation of several complete streets guidelines: dedicated transit guideway, enhanced landscaping, and consistent pedestrian pathways. Additional streetscape elements such as bicycle lanes will be determined as the project progresses into the later phases of engineering design.

Figure 5-2. Conceptual Lane Configuration in the Study Corridor



What is the reasonable "order of magnitude" of development intensity and density within the Arizona Avenue Corridor in order to create the critical mass necessary for a successful LRT Corridor?

The intended outcome of this study was the identification of appropriate land use and transportation strategies that can be implemented to support an HCT investment in the Arizona Avenue corridor. The results are intended to provide communities with an indication of what actions are necessary to help make the study corridor a competitive candidate for future regional and/or federal funding.

The Institute of Transportation Engineers (ITE) has identified general transit supportive density thresholds based on population and employment densities. The ITE guidelines, which are summarized in Table 5-1, indicate typical densities which have been shown to support different transit service levels. Please note that the density guidelines are provided for both population and employment, but generally only one, not both of the thresholds need to be met. The ITE guidelines for transit supportive densities associated with HCT or at-grade LRT assumes a minimum population density of 8,000 persons per square mile, 8-15 dwelling units per acre, and total minimum calculated employment of 26,100 jobs per square mile.

Table 5-1. ITE Transit Supportive Densities

Transit Service	Transit Frequency	Minimum DU/Acre	Minimum Population Density (pop/sq mi)	Minimum Employment Density (jobs/sq mi)[a]
Low Frequency Bus	60 min	4 - 5	3,000 – 4,000	6,500 - 10,500
Medium Frequency Bus	30 min	7	5,000 – 6,000	10,500 - 26,100
High Frequency Bus	10 min	8 - 15	8,000+	26,100+
At-Grade LRT	10 min+	8 - 15	8,000+	26,100+

Source: HDR Engineering Inc. based on Institute of Transportation Engineers, "A Toolbox for Alleviating Traffic Congestion", 1989
[a] Based 766 sq ft. per job

Throughout this study, population and employment has been analyzed at the TAZ level. These zones are relatively large, but the optimized land use scenario developed as part of this study by the Chandler, Mesa and Gilbert generally achieves a residential population of greater than 8,000 persons per square mile along the conceptual HCT corridor. On the other hand, employment densities considered as part of the optimized land use scenario are not high compared to the ITE guidelines, but represent reasonable employment figures for a corridor with significant existing residential population. Figures 5-3 and 5-4 represent the study area population and employment densities respectively.

Figure 5-3. Optimized Land Use Scenario - Population Density

Arizona Avenue High-Capacity Transit Long Range Study

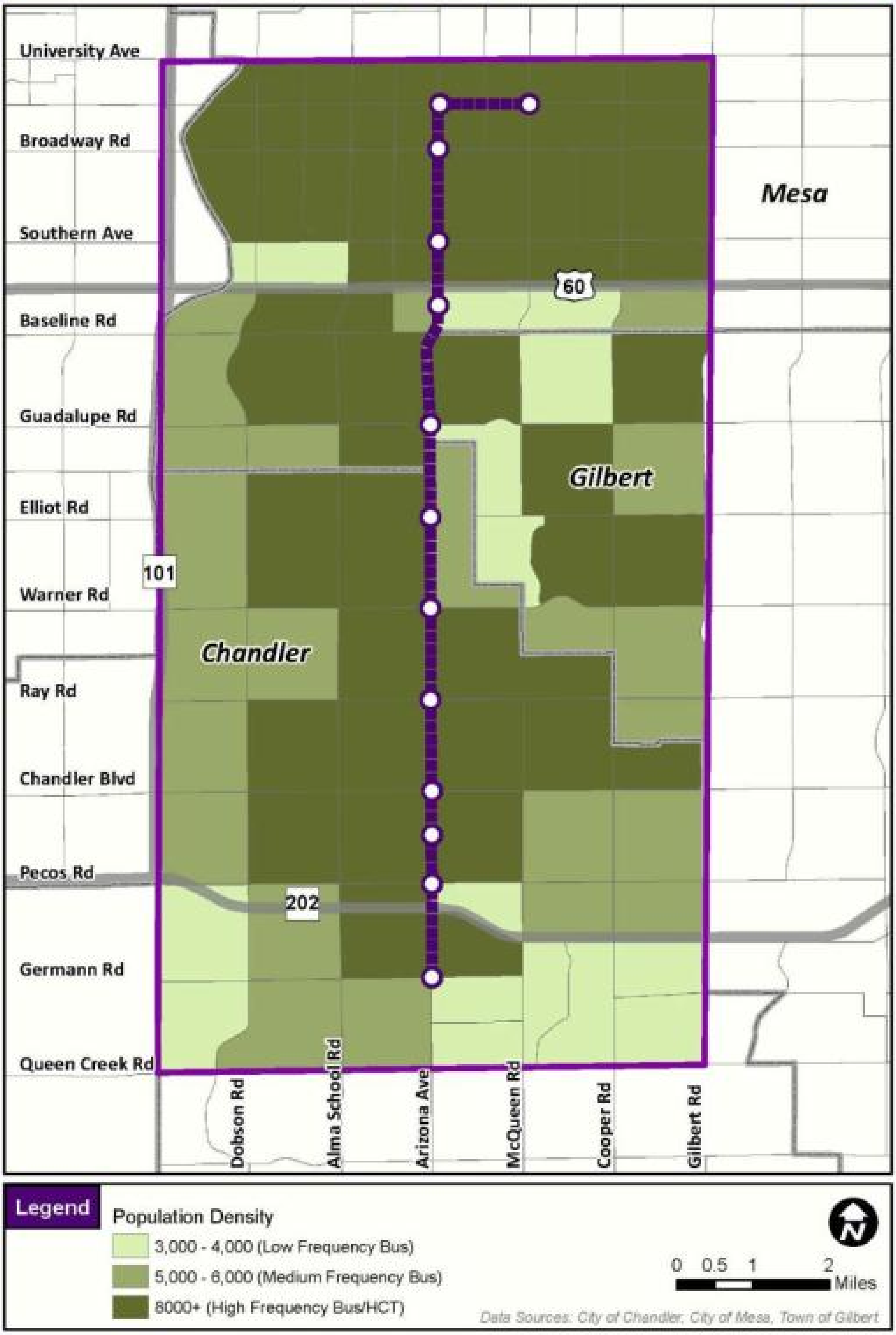
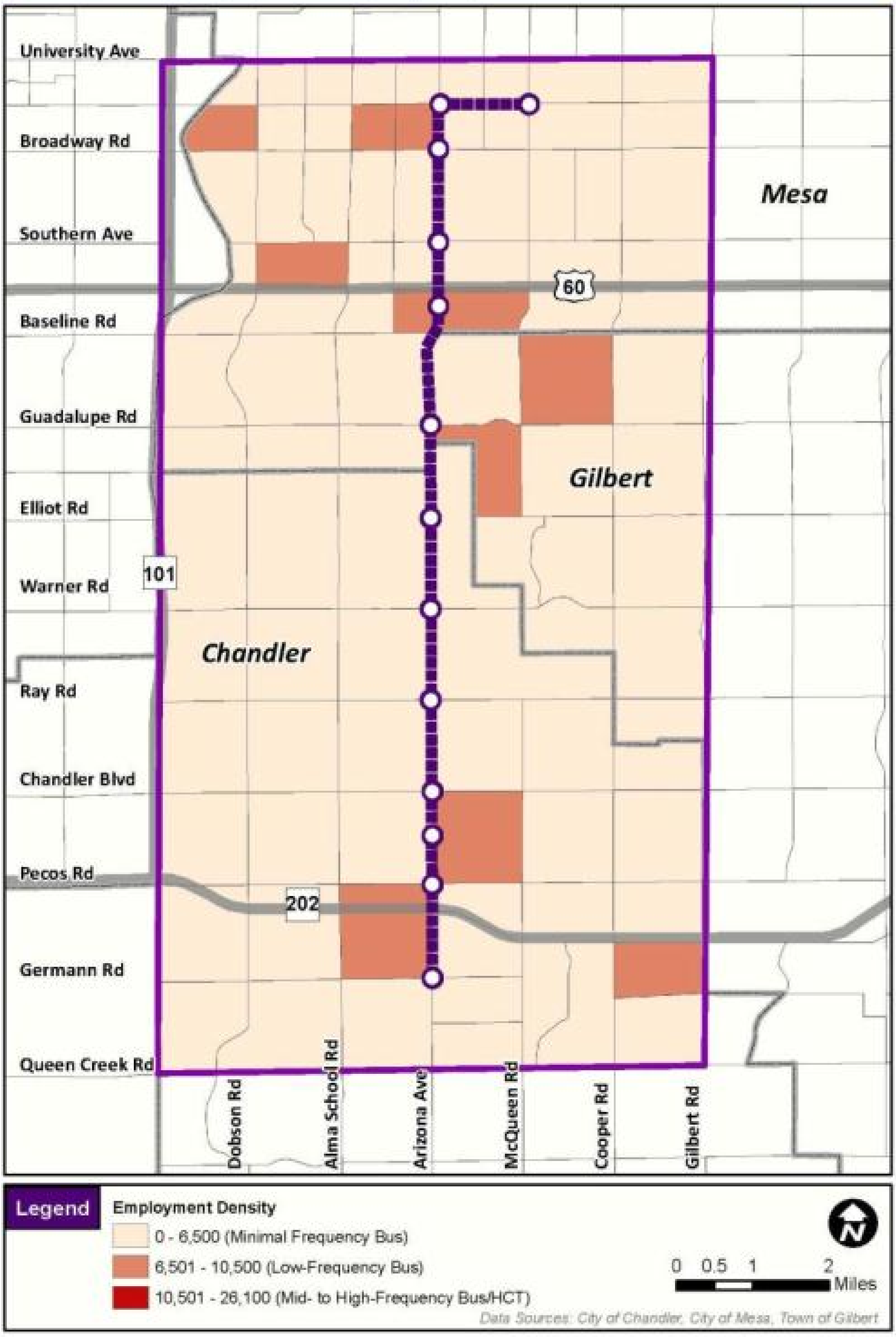


Figure 5-4 Optimized Land Use Scenario - Employment Density

Arizona Avenue High-Capacity Transit Long Range Study



Results of the travel demand modeling efforts indicate that a peer average level of transit ridership per corridor mile (approximately 1,740 daily passenger boardings per corridor mile) is achievable with the increased population, employment, and educational density levels identified in the Optimized Land Use Scenario. It is important to note that the buildout densities associated with the Optimized Land Use Scenario are significantly greater than each of the communities' General Plan land use densities. Increases in development densities above General Plan levels would undoubtedly change development patterns in the corridor; however, the densities associated with the Optimized Land Use Scenario can be achieved without losing the general character that makes each of the communities within the study area unique.

A more detailed description of the City of Chandler General Plan buildout scenario and Optimized Land Use Scenario follows:

Enhanced Land Use Scenario

According to the Chandler *General Plan*, developments along Arizona Avenue may include mixed use and residential developments over 18 dwelling units per acre. No maximum density is specified in the plan, but factors such as surrounding land uses, traffic generation and water/ sewer infrastructure capacity will establish unique maximum allowable densities for each proposed development. Additionally, the *General Plan* refers to the *Downtown-South Arizona Avenue Corridor Area Plan* for areas along Arizona Avenue between Chandler Boulevard and Pecos Road. This area plan calls for a mixture of uses, including high-density mixed use and residential developments with allowable densities of 18 – 40 dwelling units per acre.

The Enhanced Land Use Scenario projects land use and densities along Arizona Avenue based on these plan policies. In the downtown area, high-density mixed use developments were projected to contain 35 dwelling units per acre plus 0.5 FAR of office or commercial development. Outside of the downtown area, parcels prime for redevelopment such as East Valley Mall on the northwest corner of Arizona Avenue and Warner Road and large vacant tracts such as the 50-acre site north of the northeast corner of Ray Road and Arizona Avenue were projected to be built at densities up to 30 – 35 dwelling units per acre and sometimes include additional office/ commercial development.

Under the Enhanced Land Use Scenario, however, not all vacant parcels along the corridor are projected as urban development parcels. The plan allows for high-density development, but outside of the downtown area, there are no area plans that require or strongly encourage that high-density rather than traditional suburban developments be built on these sites. Additionally, under this scenario, a majority of developed parcels are not projected to be redeveloped at urban densities. The Enhanced Land Use Scenario includes one park-and-ride at the end of the line near Germann Road.

Optimized Land Use Scenario

The Optimized Land Use Scenario assumes much more aggressive urban development policies will be enacted by the City of Chandler. Under this scenario, planning and zoning policies would strongly encourage new urban development and redevelopment and strongly discourage/ prohibit new traditional suburban development along the corridor. Another assumption under this scenario is that planning/zoning and economic development policies facilitate multiple high-density office and commercial developments along the corridor.

Projections in the downtown area assume that the *Downtown-South Arizona Avenue Corridor Area Plan* will be amended to allow densities above 40 dwelling units per acre and replace low-density residential areas with medium density residential. As a result, downtown area projections under the optimized scenario are increased to 50 or more dwelling units per acre in addition to 1-3 stories of office/commercial development.

Outside of the downtown area, all large vacant parcels and many existing developments are projected to become medium to high-density urban developments. The densities projected under the optimized scenario include a mixture of high-density office/commercial developments and high-density residential developments. Residential densities are slightly higher than under the Enhanced Land Use Scenario and typically include some office and commercial space. Office/Commercial developments are assumed to be higher density as well, achieving floor-area ratios over 1.0 on several large tracts of land. These types of office developments may include buildings over 5 stories in height.

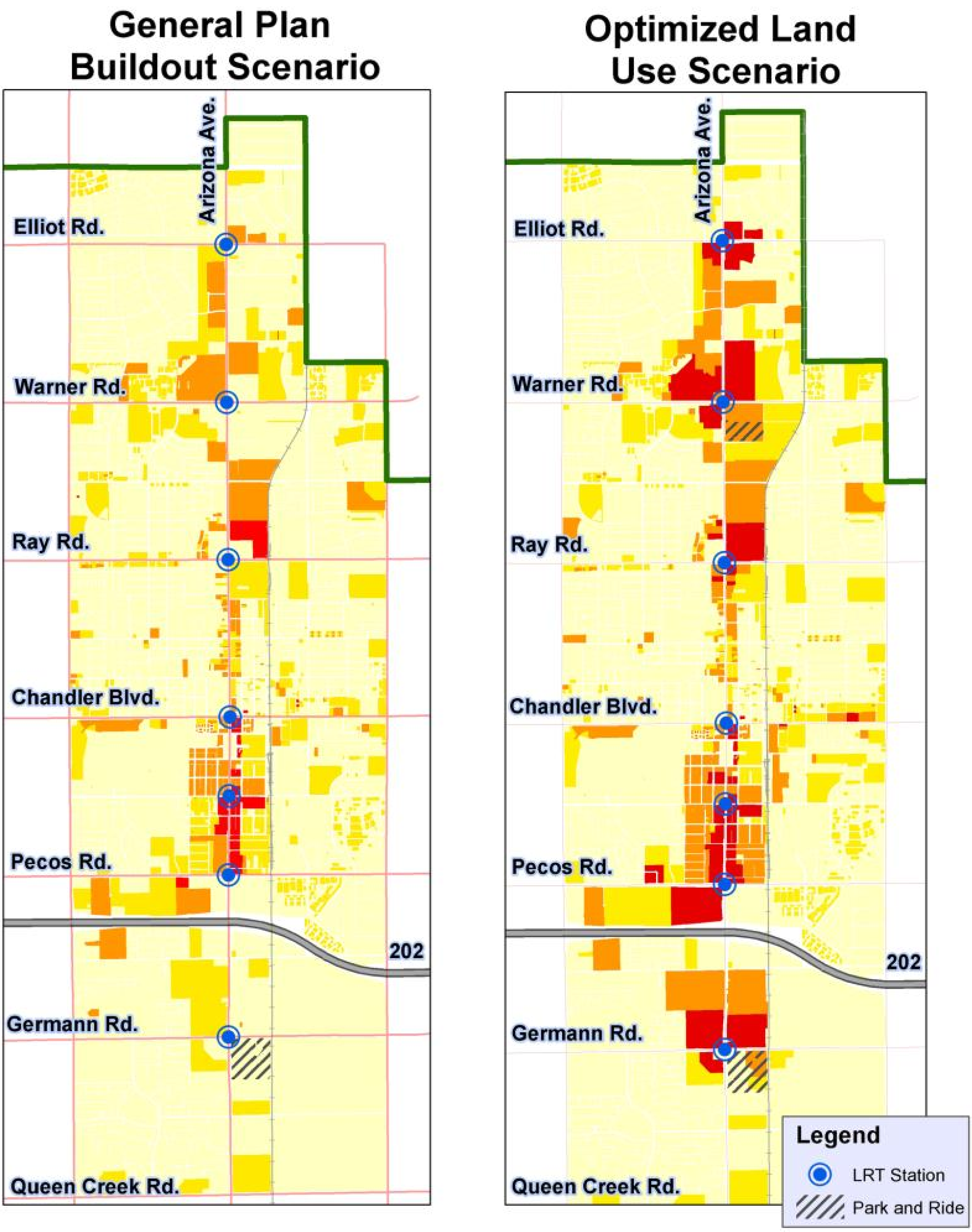
Although redevelopments and new development sites are projected to be of a slightly higher density than the redevelopment sites under the Enhanced Land Use Scenario, the key difference under the Optimized Land Use Scenario is that far more parcels are slated for new urban development and urban redevelopment. The key assumption is that urban development is not merely allowed, as is the case under existing Chandler planning policies, but rather, that urban redevelopment is strongly encouraged and traditional suburban development is prohibited or at a minimum strongly discouraged.

Figure 5-5 illustrates a more detailed comparison of land uses between the intensity of land use development in the City of Chandler *General Plan* and the conceptual Optimized Land Use Scenario.

Recommendations

It is recommended that the cities pursue more aggressive land development policies capable of achieving the densities of the Optimized Land Use Scenario. Development at greater densities and a mixture of uses will encourage . A significant amount of vacant property exists along the corridor . Examples of the desired densities and development patterns of the Optimized Land Use Scenario are show in Figures 5-8 and 5-9.

Figure 5-5. Chandler Land Use Scenario Comparison



Map Color	Density Class	Typical Height	Residential Density (Units/ Acre)	Commercial Density (Floor-Area Ratio)	Mixed Use Density
	Low Density Suburban	1 Story	0 - 9	0.0 - 0.3	NA
	Medium Density Suburban	1 -2 Stories	10 - 20	0.31 - 0.6	NA
	Medium Density Urban	3-4 Stories	21 - 37	0.61 - 1.25	10 Units/ Acre + 0.5 FAR Commercial Space
	High Density Urban	4+ Stories	38 - 55	1.26 - 3	30 Units/ Acre + 0.7 FAR Commercial Space

Note: The densities shown in this map do not construe plans for individual parcels, but are merely representative of the types of densities that were used as inputs into the transportation models conducted as a part of this study.

Map Produced by City of Chandler Transit Division
October 4, 2012

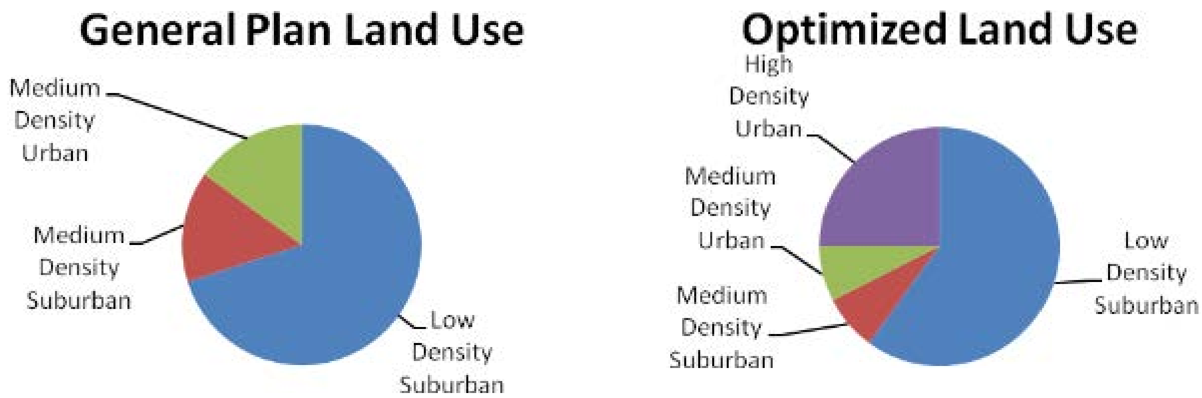
The optimized land use scenario generally includes increased (compared to the *General Plan*) population and employment densities near conceptual station areas and immediately adjacent to the conceptual HCT corridor. Areas located outside of each station's sphere of influence are generally consistent with the City of Chandler's *General Plan* and preserve the planned residential and commercial character of the community. Two specific station areas have been analyzed in more detail to provide an example of the conceptual order of magnitude of development necessary to support HCT within the study corridor. These conceptual station areas include Arizona Avenue/Elliot Road and Arizona Avenue/Warner Road.

The area near the conceptual Arizona Avenue/Elliot Road station would change modestly compared to the Enhanced Land Use Scenario. Most of the area around the station (.25 mile radius) is currently projected as either low density suburban or medium density suburban. Only a small portion of the land area is projected as medium density urban, with no areas projected as high density urban. In comparison, approximately 70% of the station area land use is projected as high density urban under the optimized land use scenario, but at least 70% of the land area is still conceived as low to medium density suburban. Based on estimates, the dwelling units per acre would increase from 7-12 under the *General Plan* guidelines to 15-20 under the optimized land use. Similarly, the commercial average FAR would increase from 0.3 to 0.7. Figure 5-6 provides a more detailed comparison of the land use differences between the General Plan land uses and optimized scenario land uses at the conceptual Arizona Avenue and Elliot Road station.

The area near the conceptual Arizona Avenue and Warner Road station would change more significantly compared to the *General Plan*. Most of the area around the station (.25 mile radius) is currently projected under the Enhanced Land Use Scenario as either low density suburban or medium density suburban; however, approximately 75% of the station area land use is projected as medium/high density urban under the optimized land use scenario. Based on estimates, the dwelling units per acre would increase from 10-15 under the *General Plan* guidelines to 30-35 under the optimized land use. Similarly, the commercial average FAR would increase from 0.4 to 1.3. Figure 5-7 provides a more detailed comparison of the land use differences between the *General Plan* land uses and optimized scenario land uses at the conceptual Arizona Avenue/Warner Road station.

Visual comparisons of what the changes in residential and employment density from the Enhanced Land Use Scenario to the Optimized Land Use Scenario translate too are provided in Figures 5-8 and 5-10. Figure 5-8 provides an illustration of a local area mixed use development that utilizes the principles of TOD descried earlier in the chapter.

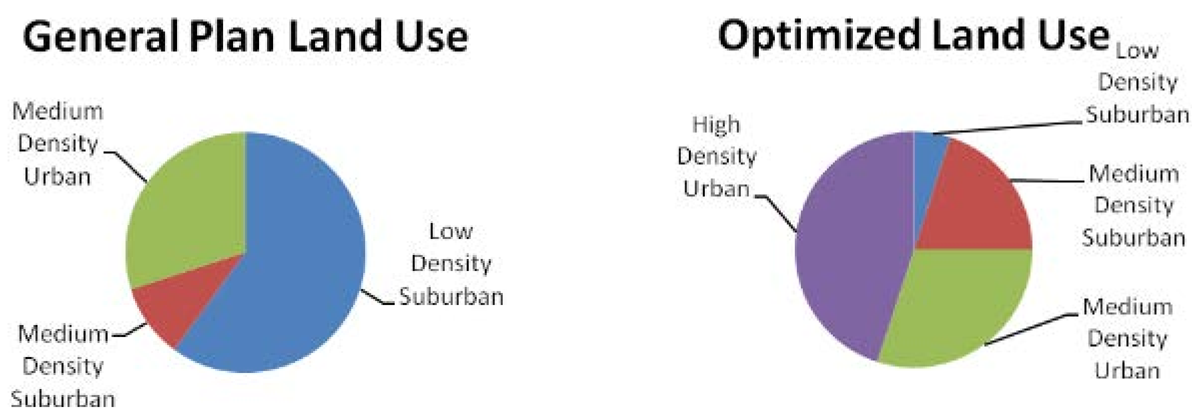
Figure 5-6. Study Area Land Use Comparison – Arizona Avenue & Elliot Road



Scenario	DU / Acre	Total DU	Jobs / Acre	Total Jobs	Average Commercial FAR[a]
General Plan	7-12	750-850	15-25	400-600	0.3
Optimized Land Use	15-20	1,150-1,350	85-105	2,200-2,400	0.7

Source: Valley Metro, 2012
[a] Weighted average commercial FAR. Average range = 0.2 – 2.1
All calculations based on approximate land areas

Figure 5-7. Study Area Land Use Comparison – Arizona Avenue & Warner Road



Scenario	DU/Acre	Total DU	Jobs/Acre	Total Jobs	Average Commercial FAR[a]
General Plan	10-15	900-1,100	32-47	900-1,100	0.4
Optimized Land Use	30-35	1,550-1,750	180-200	2,800-3,000	1.3

Source: Valley Metro, 2012
[a] Weighted average commercial FAR. Average range = 0.2 – 2.1
All calculations based on approximate land areas

Figure 5-8. Station Area Development Comparison – Residential

Residential: 15 DU/Acre
Similar to General Plan
Example: 18 DU/Acre w/Rear Parking

Residential: 30+ DU/Acre
Similar to Optimized LU
Example: 45 DU/Acre w/Limited Parking

Scenario	DU/Acre	Total DU
General Plan	10-15	900-1,100
Optimized Land Use	30-35	1,550-1,750

Source: Valley Metro, 2012
All calculations based on approximate land areas

Figure 5-9. Station Area Development Comparison – Employment

Employment: 0.5 – 0.9 FAR
Similar to General Plan
Example: 0.5 FAR / 3-Levels

Employment: 0.9 – 2.1 FAR
Similar to Optimized LU
Example: 1.5 FAR / 4-Levels

Scenario	Employees/Acre	Total Employees
General Plan	32-47	900-1,100
Optimized Land Use	180-200	2,800-3,000

Source: Valley Metro, 2012
All calculations based on approximate land areas

Figure 5-10. Station Area Development Comparison – Mixed Use

Grigio Metro - Tempe

Source: http://www.grigiometro.com/gallery.php

Acres	DU	DU/Acre	Total FAR	Commercial FAR
4.65	408	88	3.3	0.58

Source: http://onlinemediagroupproject.files.wordpress.com/2011/11/case-studies08-09-111.pdf
All calculations based on approximate land areas

5.2 Conclusions

The *Arizona Avenue High-Capacity Transit Long Range Study* sought to evaluate the long-term growth needs of Arizona Avenue/Country Club Drive in order to support the implementation of an HCT system, particularly LRT, serving the corridor. The Arizona Avenue corridor shows significant promise as a corridor capable of supporting high-capacity transit, but commitments to transit-supportive land uses must be made to recognize the corridor's true potential. Each of the scenarios considered in this planning study represent distinct ways of thinking about population, employment, and enrollment growth within the corridor, and outline land development policy steps and activities each project partner city could undertake to achieve densities capable of justifying an investment in LRT.

Given the findings of the evaluation, several important conclusions are determined. First, a shift toward more compact growth patterns would have a positive influence on the study area. Each of the land development scenarios represent a progressively intensive shift from the baseline conditions in 2035 to more compact growth at higher densities and FARs. Conducting small area planning to specify target densities or the creation of overlay districts that support greater densities surrounding Arizona Avenue will be an important step toward achieving a transit-supportive corridor. However, the shift that is advocated is relatively modest; most new residential and employment growth could occur within the corridor at densities currently supported by the cities of Chandler, Mesa, and the Town of Gilbert.

Second, connecting land uses within the corridor and enhancing mixed-use centers to promote walking and non-motorized transportation will help stimulate a transit-supportive environment. Connecting land uses and creating mixed-use developments will reduce the dependence on driving within the corridor, especially for short trips, and reduce the overall impact of automobiles (e.g. environmental and public health impacts). It is also important to remember that land conservation and promoting the establishment of civic spaces (parks and plaza areas) near residential areas. Active recreation and social spaces help create a sense of community, and can easily be incorporated in transit-oriented developments.

Finally, agency coordination and continued public outreach will be important elements in shaping the future of the corridor. Among the recommendations of this study are the creation of small area plans and/or the overlay districts to encourage growth around potential transit station locations. Involving city and regional agencies in the conversation over increased densities early will help coordinate potential future infrastructure needs for each city (e.g. water, sewer, fire, and policing). Additionally, while the benefits of compact, higher density development and growth are well established, increases in density often are met with skepticism from the public. Small area planning can be an effective way to communicate with the public that density increases do not always translate into multi-story buildings. The small area planning process also allows the public to participate in the creation of a vision for urban space that retains the surrounding area aesthetic while achieving the goals of increased density to support investments in high-capacity transit. A continued dialogue with the public will help focus the conversation on their preferences for placetypes and the significance a capital project along Arizona Avenue/Country Club Drive has for the region.