INTERSECTION IMPROVEMENT MASTER PLAN

Final Report

Prepared for Town of Gilbert

Prepared by Ayres Associates

September 2012

Intersection Improvement Master Plan

Final Report

August 2012

GILBERT
ARIZONA

Prepared for the Town of Gilbert

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I. INTRODUCTION

The Town of Gilbert, incorporated in 1920, is a relatively new community that has seen tremendous growth the past three decades. As shown in Figure 1, the Town of Gilbert is located in the southeast portion of metropolitan Phoenix. Today, Gilbert encompasses 76 square miles and has grown from a population of 5,717 in 1980 to 208,453 in 2010. Even during the most recent decade between 2000 and 2010, the population growth was 90 percent. For the purpose of this study, the population is projected to increase another 47 percent by the year 2031. The Town has experienced a rapid transition from an agricultural based community to an economically diverse suburban center located in the Southeast Valley. The Town has evolved into a highly educated and affluent community supporting high-wage jobs in life science and health services, high technology, clean and renewable energy, and corporate and regional offices in advanced business services.

A. Study Area

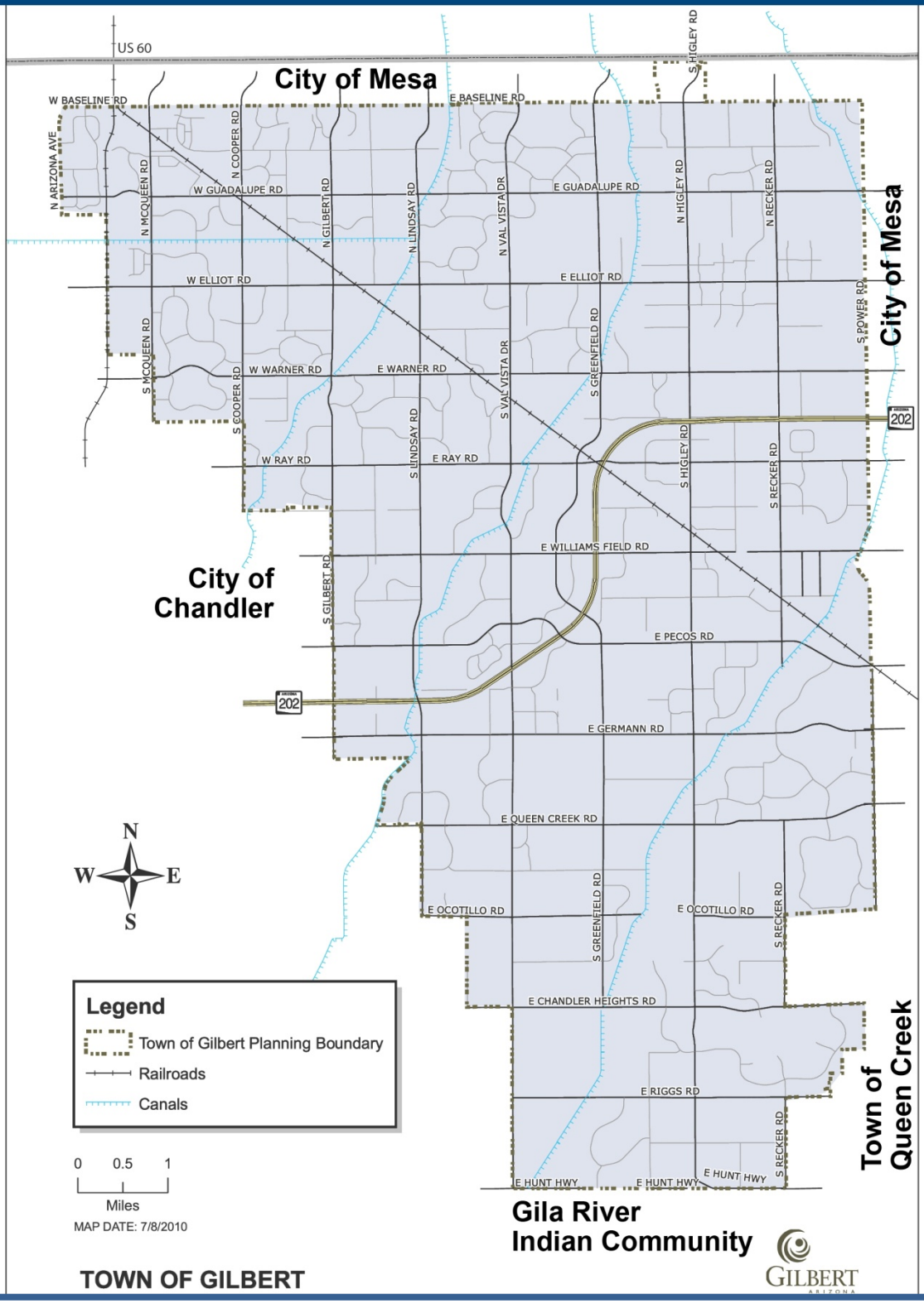
The study area, which is the Gilbert planning area, is shown in Figure 2. The Town of Gilbert is bounded on the west by the cities of Mesa and Chandler; on the north by Mesa; on the east by Mesa and the Town of Queen Creek; and on the south by the Gila River Indian Community. The Town of Gilbert has a street system comprised of section line (mile) arterial streets as well as mid-section collector streets. Within the corporate limits is one regional freeway, SR 202, which generally extends in an east-west direction. The Town is also served by US 60, an east/west freeway just one-half mile north of the Town limits.

B. Study Purpose

This study was undertaken because of the continued high rate of growth within the Town, the southeast valley, and Pinal County; which places an increasing burden on the Town's transportation system. The purpose of this study was to evaluate the existing and projected demand at the major arterial intersections within the Town, recommend improvements to address level of service and safety deficiencies, and prioritize the implementation of the improvements.

Intersection Improvement Master Plan
Town of Gilbert Vicinity Map
Figure #1

Intersection Improvement Master Plan
Study Area
Figure #2



Because of limited resources available for capital improvements, major arterial street widening projects will be less frequent in the future and there will be more emphasis on intersection improvements. The results of this study will provide staff with a blueprint for implementing intersection improvements. This study will examine the arterial street system intersections within the Town of Gilbert planning area. The Gilbert planning area includes all the incorporated areas of the Town as well as county land within the Gilbert planning area.

II. TRAVEL FORECASTING MODEL

The Maricopa Association of Governments (MAG) is the designated Metropolitan Planning Organization (MPO) for transportation planning for Maricopa County. MAG is also the designated Air Quality Planning Agency for the region. The MAG membership consists of the 25 incorporated cities and towns within Maricopa County, the Gila River Indian Community, the Salt River Pima-Maricopa Indian Community, Fort McDowell Yavapai Nation, Maricopa County, the Arizona Department of Transportation and the Citizens Transportation Oversight Committee. MAG maintains a travel forecasting model for estimating future travel demand. The travel forecasting model includes portions of Pinal County to account for travel between the two counties.

The Arizona Department of Economic Security (DES) prepares the state and county resident population projections, but authorizes Councils of Governments to prepare projections below the county level that are consistent with the County control totals developed by DES. The Maricopa Association of Governments has been preparing sub-regional population projections since the mid 1970's.

The corporate boundaries of a city or town define the area over which the jurisdiction exercises its authority. Because MAG projects future conditions, there is a need to define the future corporate boundaries of each city and town and maintain a constant geography over the projection horizon. As a result, MAG prepares its projections by Municipal Planning Area (MPA). An MPA represents a jurisdiction's area of planning concern and is based upon the anticipated future corporate boundaries of a city or town. This is the area shown in Figure 2.

Socioeconomic projections are crucial to sound regional planning. Projections of population and employment are used as inputs to forecast vehicle trips and air quality emissions. The MAG socioeconomic models consider the transportation system accessibility in the allocation of population and employment to smaller geographic areas. Socioeconomic projections are a collaborative effort between

MAG staff and the staff of its member agencies. The MAG Regional Travel Forecasting Model can provide traffic data to validate existing conditions as well as forecasts of future traffic volumes. The transportation modeling area currently contains 1,995 traffic analysis zones (TAZ), 147 regional analysis zones (RAZ), and covers approximately 6,500 square miles. Traffic analysis zones are generally one square mile in size in developed areas, but can be larger in developing and rural areas. There are 72 traffic analysis zones and 5 regional analysis zones within the Gilbert planning area. The latest calibration of the transportation models was completed in early 2009, using data from the *2001 Household Travel Survey,* the *2007 Transit On-Board Survey, 2007 Internal Truck Travel Survey* and the *2008 External Travel Study*.

The travel forecasting model is a mathematical representation of travel behavior. The model utilizes land use data, observed travel behavior, and roadway network information to estimate traffic volumes on the street system. The model process starts with two distinct sets of tasks. One set of tasks involves the compilation of land use data, including population and employment, and trip generation rates for the area. Using this information, the number of trips produced and attracted in each traffic analysis zone is calculated. The second set of tasks includes the identification of the street system to be modeled. The street system is simulated by a network of links (street segments) and nodes (intersections). Network data includes street segment lengths, travel speeds, roadway types, and street capacities. Generally, the section line arterial streets and freeways comprise the network.

Using these data, the minimum time paths between zones are calculated. Generally, MAG highway networks will include only the one-mile grid system of streets, plus freeways; however, this network includes all streets classified as arterials, as well as some collectors. Traffic on collectors and local streets not

explicitly coded on the highway will be simulated in the models by use of abstract links called —centroid connectors. These represent collectors, local streets and driveways which connect a neighborhood to a regionally-significant roadway. Centroid connectors will also include travel occurring on public and private unpaved roads.

The trips calculated in the first set of tasks are distributed between zones based on the relative attractiveness of one zone to another. The zone-to-zone trips are then assigned to the network to obtain traffic volumes. The transportation models perform capacity-restrained traffic assignments based on successive iterations of travel time between zones. The model-simulated volumes for the year 2011 are compared to the existing traffic volumes to determine how well existing conditions are being simulated. Based on the analysis of the 2011 model volumes adjustment factors are developed and used later in the study process to refine the 2031 traffic forecasts produced by the model.

III. EXISTING CONDITIONS

Information on existing conditions was collected and documented as part of the study. The existing conditions data collected included population and employment data, roadway system characteristics, and traffic volumes. A brief description of each is provided in the following sections.

A. Population and Employment

The existing population and employment data for the Town of Gilbert, used in the travel forecasting model are based on the existing land use in the Gilbert planning area. The 2011 population and employment data was obtained from MAG and reviewed by Town staff for verification. Town staff suggested modifications to various TAZ's to better represent existing conditions. The resulting population and employment by TAZ are included in the appendix. The TAZ population and employment data was summarized by RAZ. The RAZ boundaries are shown in Figure 3 and the existing data is presented in Table 1.

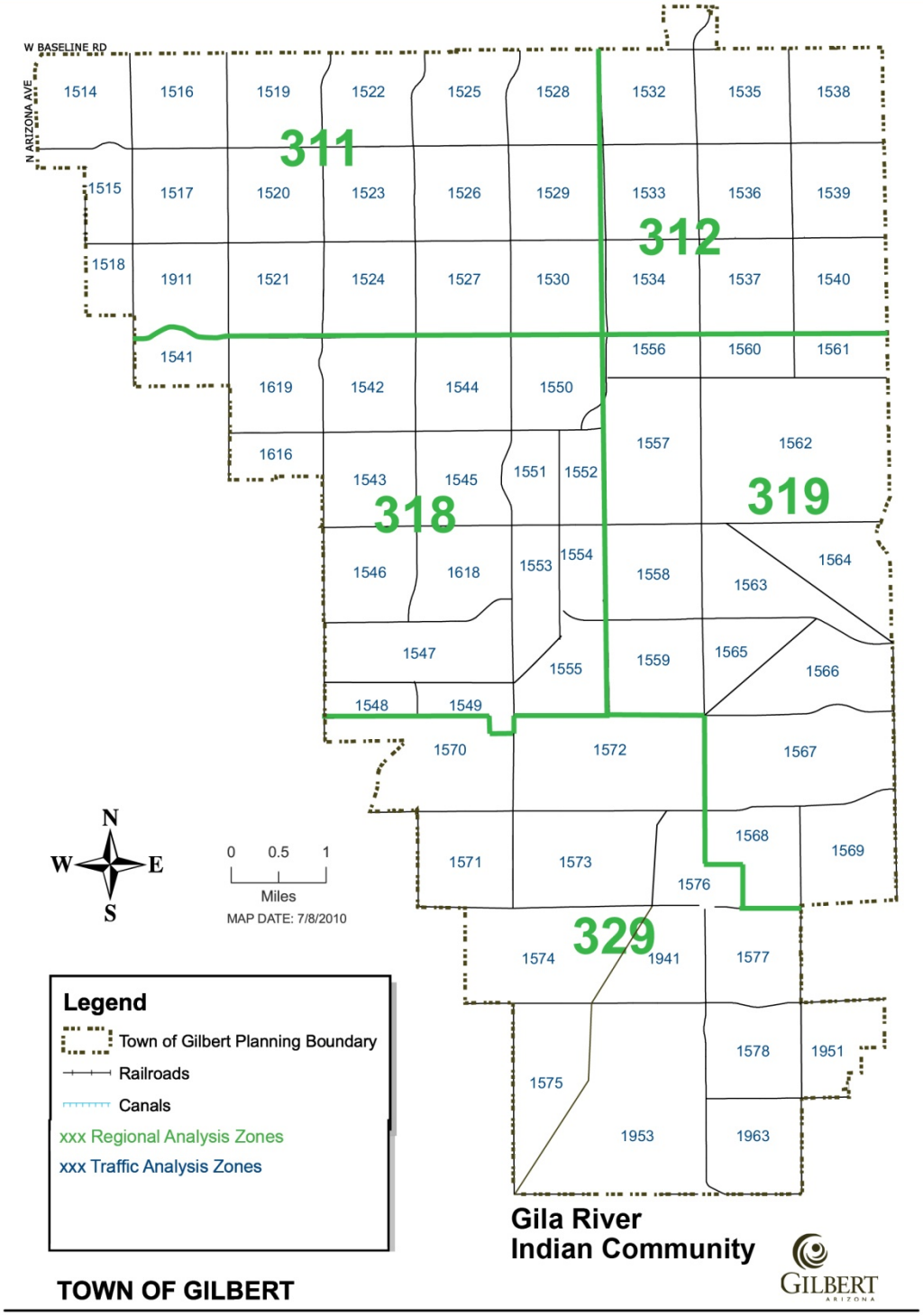
TABLE 1: 2011 SOCIOECONOMIC DATA

RAZ	Population	Employment
311	80,078	38,540
312	24,363	7,333
318	43,711	16,272
319	49,204	6,135
329	21,268	3,515
TOTAL	**218,624**	**71,795**

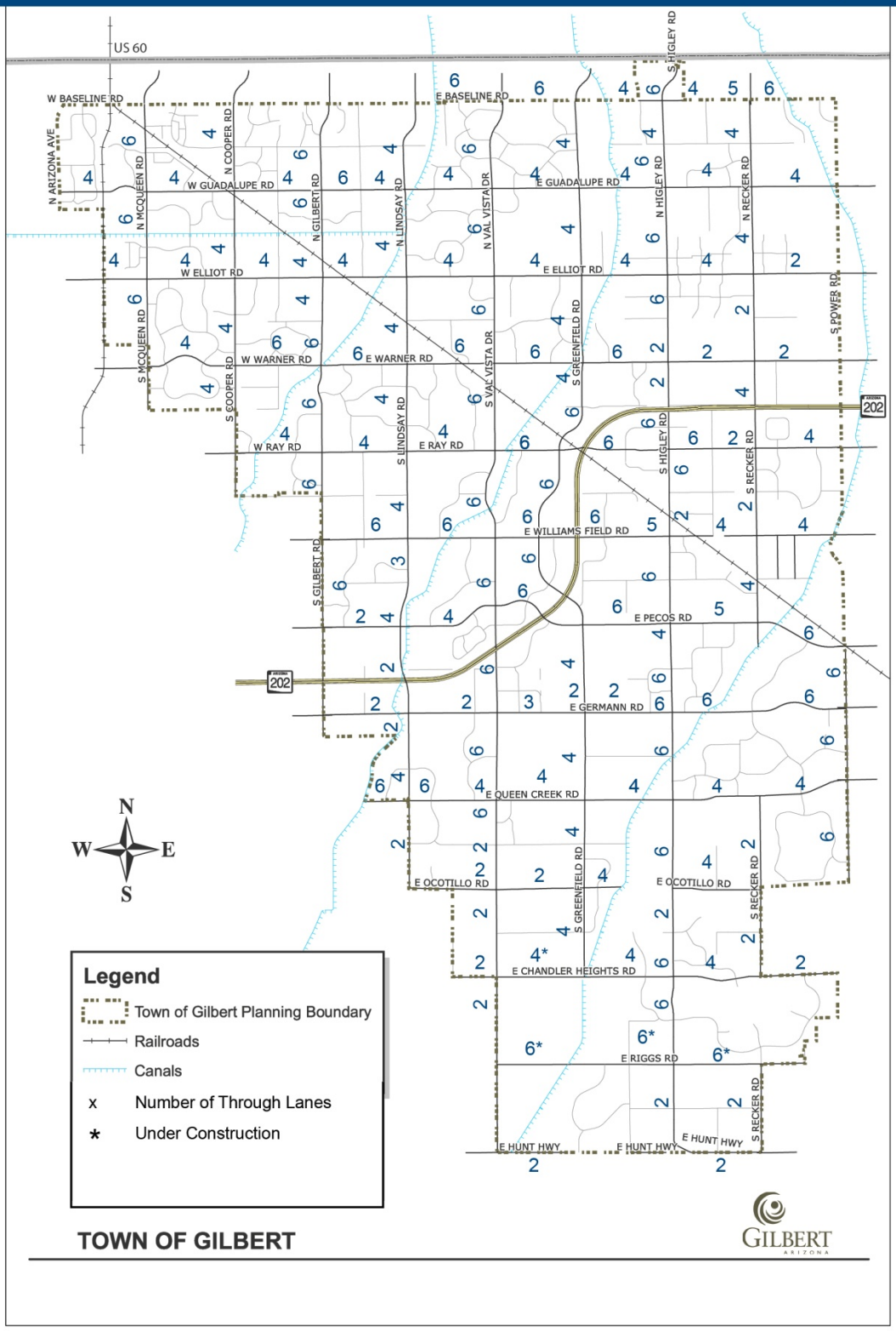
B. Number of Travel Lanes

The number of lanes provided on the arterial streets currently varies from one through lane in each direction to three through lanes in each direction. The existing number of through lanes on the arterial street system is shown in Figure 4. It should be noted that Figure 4 represents the general number of through lanes on each mile segment. There may be short sections of more through lanes where development has occurred or less through lanes in a county island. The number of lanes provided at individual intersections also varies. There are locations where additional through and/or turn lanes are provided to improve intersection capacity.

Intersection Improvement Master Plan
Regional Analysis Zones
Figure #3



Intersection Improvement Master Plan
Existing Number of Through Lanes
Figure #4



C. Study Intersections

This study focuses on the existing arterial/arterial intersections that are controlled by traffic signals plus the intersection of Williams Field Road and Market Street because of its proximity to SanTan Village. These locations are shown in Figure 5. There are 64 signalized intersections under the jurisdiction of the Town included in this study. Except for a few locations in the southeast portion of the Town, all the arterial/arterial intersections within the planning area are signalized. The signals are operated from the Town's traffic control center. This central control center monitors the operation of the signals and maintains the signal progression along the major arterial streets. With a few exceptions, the Town operates all of the traffic signals with lagging left turn phase operation. It should be noted that the signalized intersections at the SR 202 interchanges are not included in this analysis since it was assumed that those locations were built to their ultimate configuration as part of the freeway construction and no additional improvements would be made.

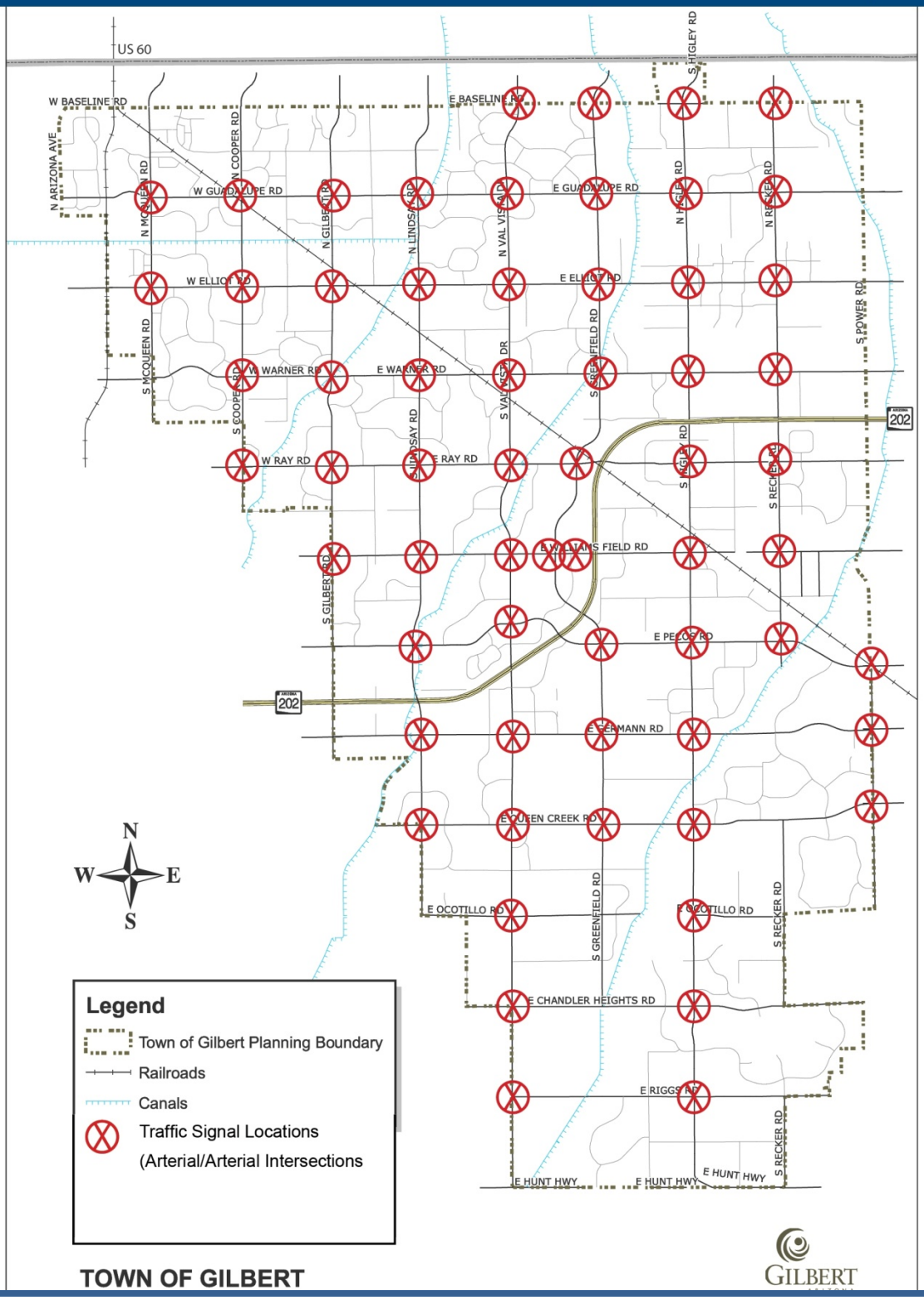
D. Traffic Volume

Traffic volumes provide an indication of the vehicular demand on the street system. Common traffic volume measures are daily volumes and intersection peak hour turning movement volumes. Daily volumes typically show the hourly distribution of traffic during a 24-hour period. This helps to define peak periods and duration and also provides a comparative measure between streets. Intersection turning movement volumes document specific movements at an intersection, can be an indicator of the need for additional turn lanes, and are used to determine intersection level of service during the peak hours. The existing traffic volumes were obtained from the Town as part of the study. The data collected included daily traffic volumes on street segments and peak hour traffic counts at intersections. Each of these is described in more detail below.

1. Daily Traffic Volumes

The Town of Gilbert conducts an annual traffic count program on its major streets. The Town conducts 24-hour volume counts at the mid-mile segment for each of the arterial streets. The daily traffic volumes are shown in Figure 6 and include volumes from 2008, 2009, and some from adjacent cities. Table 2 summarizes the ten street segments with the highest traffic volumes.

Intersection Improvement Master Plan
Study Intersections
Figure #5



Intersection Improvement Master Plan
Existing Daily Traffic Volumes (in thousands)
Figure #6

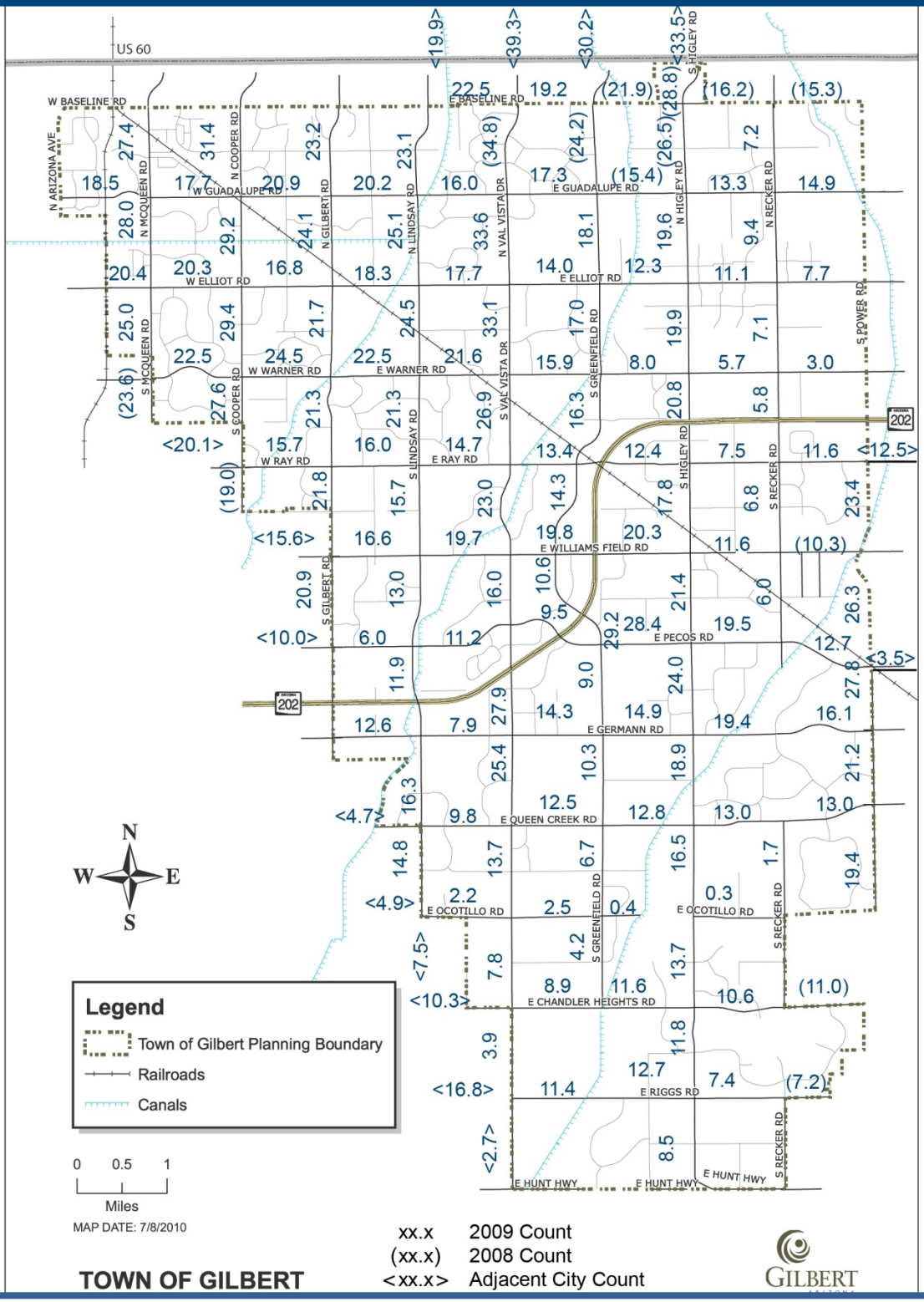


TABLE 2: HIGHEST EXISTING VOLUME LOCATIONS

STREET	FROM	TO	VOLUME (vehicles/day)
Val Vista Drive	Baseline Road	Guadalupe Road	34,800
Val Vista Drive	Guadalupe Road	Elliot Road	33,600
Val Vista Drive	Elliot Road	Warner Road	33,100
Cooper Road	Baseline Road	Guadalupe Road	31,400
Cooper Road	Elliot Road	Warner Road	29,400
Cooper Road	Guadalupe Road	Elliot Road	29,200
Greenfield Road	SR 202	Pecos Road	29,200
Higley Road	US 60	Baseline Road	28,800
Pecos Road	Greenfield Road	Higley Road	28,400
McQueen Road	Guadalupe Road	Elliot Road	28,000

As can be seen in Table 2, the highest volume street segments are mostly north-south segments between Baseline Road and Warner Road as well as two segments adjacent to SR 202 and Greenfield Road.

2. Turning Movement Volumes

The Town of Gilbert maintains a Synchro traffic analysis model to examine intersection capacity and arterial progression. The Town provided the Synchro data files, which included intersection turning movement volumes for each of the study intersections to be used in this study. It is commonly accepted that intersections are the constraint point in a street system and are often analyzed to document current operations as well as potential improvements. A volume of 600-800 vehicles per through lane is considered the capacity at a major intersection. A left turn volume of 250-300 vehicles is a practical limit for a single left turn. A right turn volume of 150-200 vehicles can be an indicator of the need for a separate right turn lane.

E. Operating Conditions

In order to assess the functional quality of a street system, level of service is analyzed. Level of service (LOS) is a term used to describe the traffic operation of a street system and can be calculated for the various elements of the system including road segments, signalized intersections, and unsignalized intersections.

The various levels of service, which range from A to F, are generally defined as follows:

Level of Service A represents free flow.

Level of Service B is in the range of stable flow, but the presence of other users in the traffic stream begins to be noticeable.

Level of Service C is in the range of stable flow, but marks the beginning of the range in which the operation of individual users becomes significantly affected by others.

Level of Service D represents high-density but stable flow. Speed and freedom to maneuver are severely restricted, and the driver or pedestrian experiences a generally poor level of comfort and convenience.

Level of Service E represents operating conditions at or near the capacity level. All speeds are reduced to a low but relatively uniform value.

Level of Service F represents forced or breakdown flow. This condition exists wherever the amount of traffic approaching a point exceeds the amount, which can traverse the point.

Level of service D is generally considered the threshold of acceptable conditions in an urban area.

For this study, the level of service at the major signalized intersections was the analysis measure. The level of service analysis for signalized intersections was performed using the Town's Synchro model

which incorporates the operations methodology presented in the Highway Capacity Manual 2000. Synchro is a software package for modeling and optimizing traffic signal timing and operation by performing capacity analysis in accordance with the Highway Capacity Manual.

The Highway Capacity Manual method uses the critical volumes passing through the intersection in one hour and compares those volumes to the capacity of the intersection and calculates an associated delay. The analysis incorporates the effects of traffic volumes, geometry, traffic signal operation, truck and local bus volumes, bicycles, pedestrian activity, and peaking characteristics during the peak hour. The result is a level of service determination for each approach and for the intersection as a whole. The capacity criteria, defined in terms of average vehicle delay, are presented in Table 3.

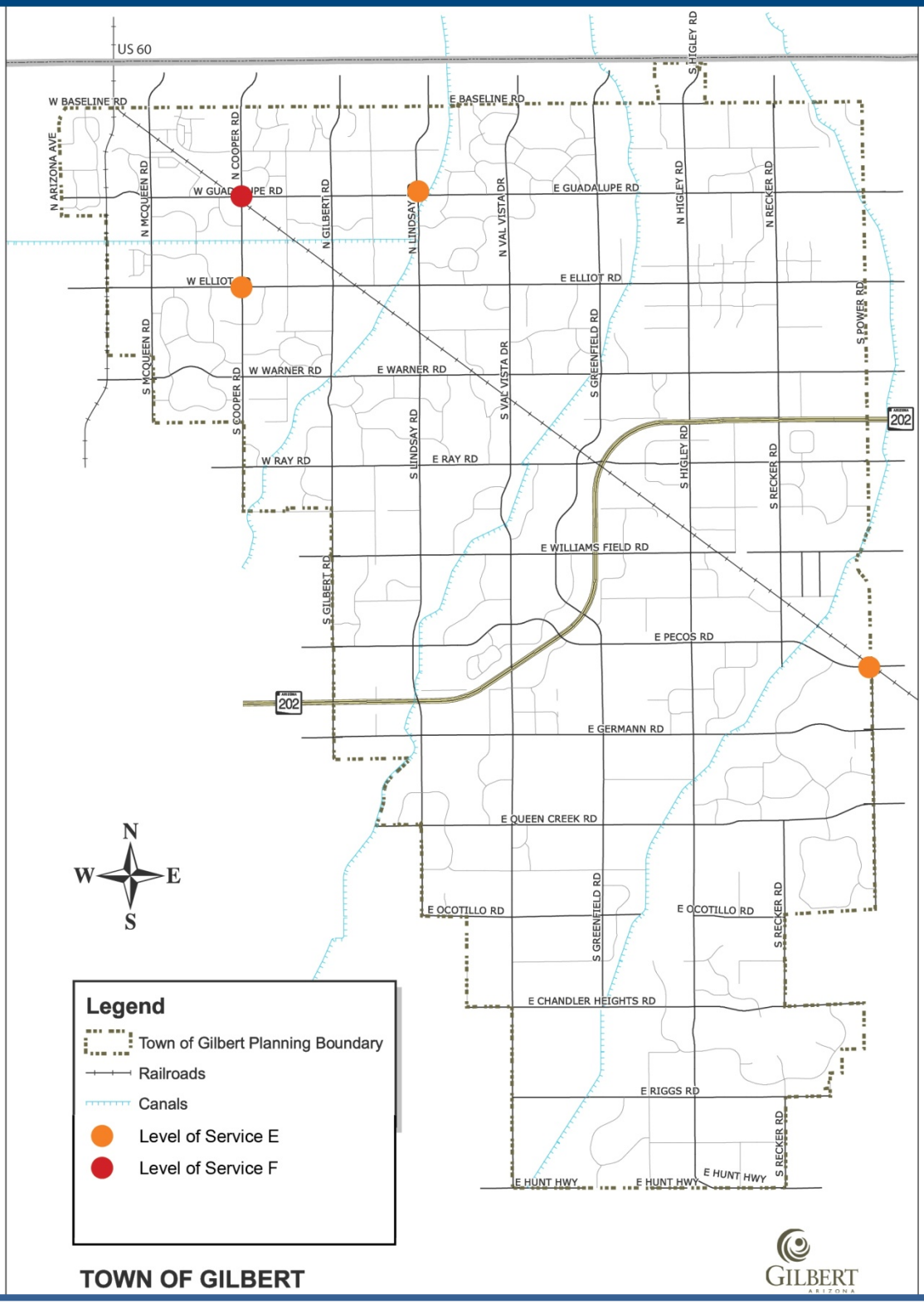
TABLE 3: DELAY CRITERIA FOR SIGNALIZED INTERSECTIONS*

Level Of Service (LOS)	Average Vehicle Delay (sec/veh)
A	less than 10
B	10.1-20
C	20.1-35
D	35.1-55
E	55.1-80
F	Over 80

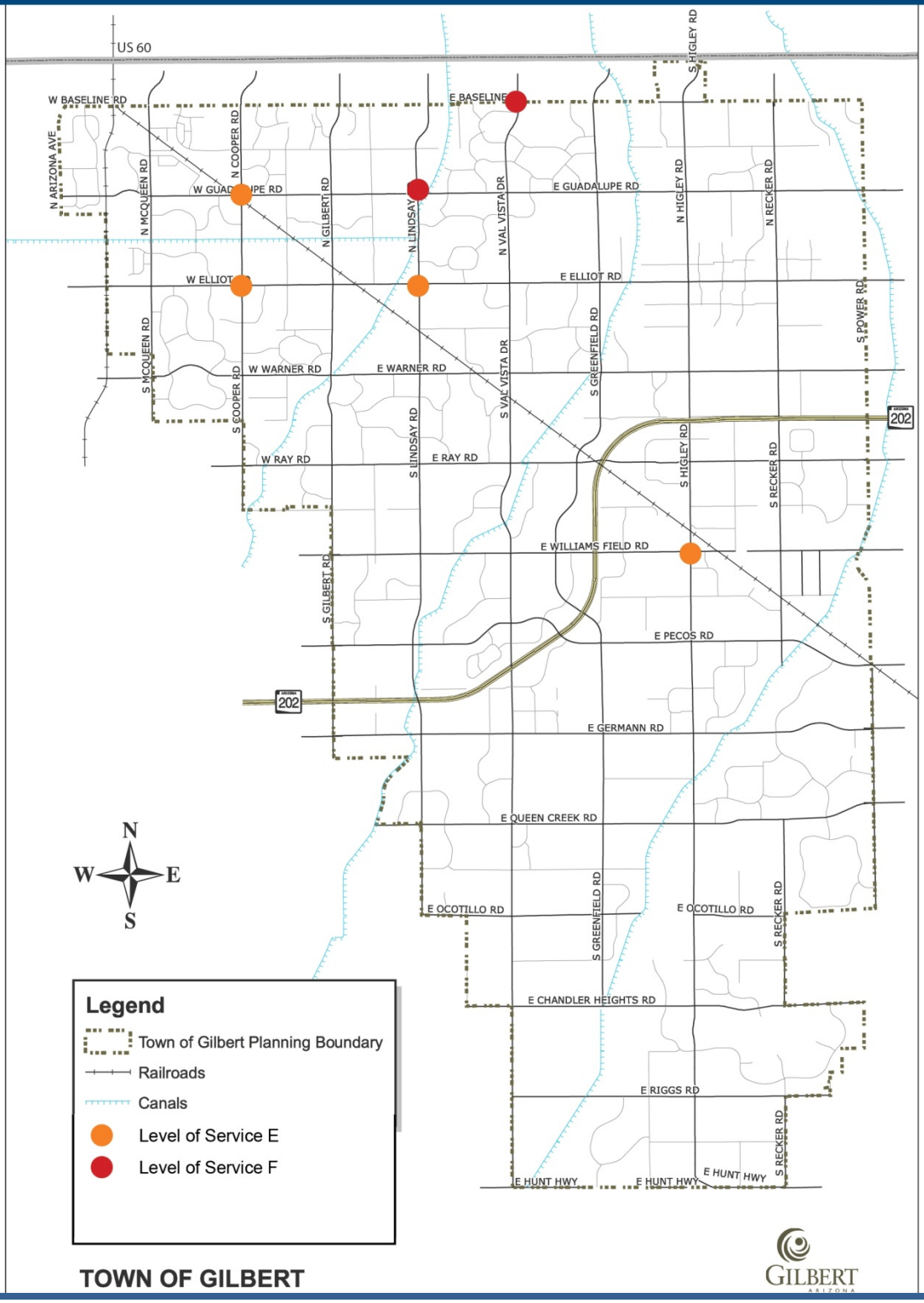
*Source: Highway Capacity Manual 2000

Existing turning movement volumes and intersection geometry have been previously input to the Synchro model for the study intersections. This existing information was used to determine level of service and delay for existing conditions in the AM and PM peak hours. The AM and PM peak hour level of service and delay for the major signalized intersections was calculated and the results are included in the appendix. The locations that have either 'E' or 'F' level of service are shown in Figures 7 and 8 for the AM and PM peak periods. The level of service and delay represents an average for the intersection. One or more approaches or individual turning movements may be worse than the average during the peak hours. Additionally, this represents the two peak hours of the day and other hours are expected to operate at a better level of service. There are currently four

Intersection Improvement Master Plan
Existing Level of Service AM Period
Figure #7



Intersection Improvement Master Plan
Existing Level of Service PM Period
Figure #8

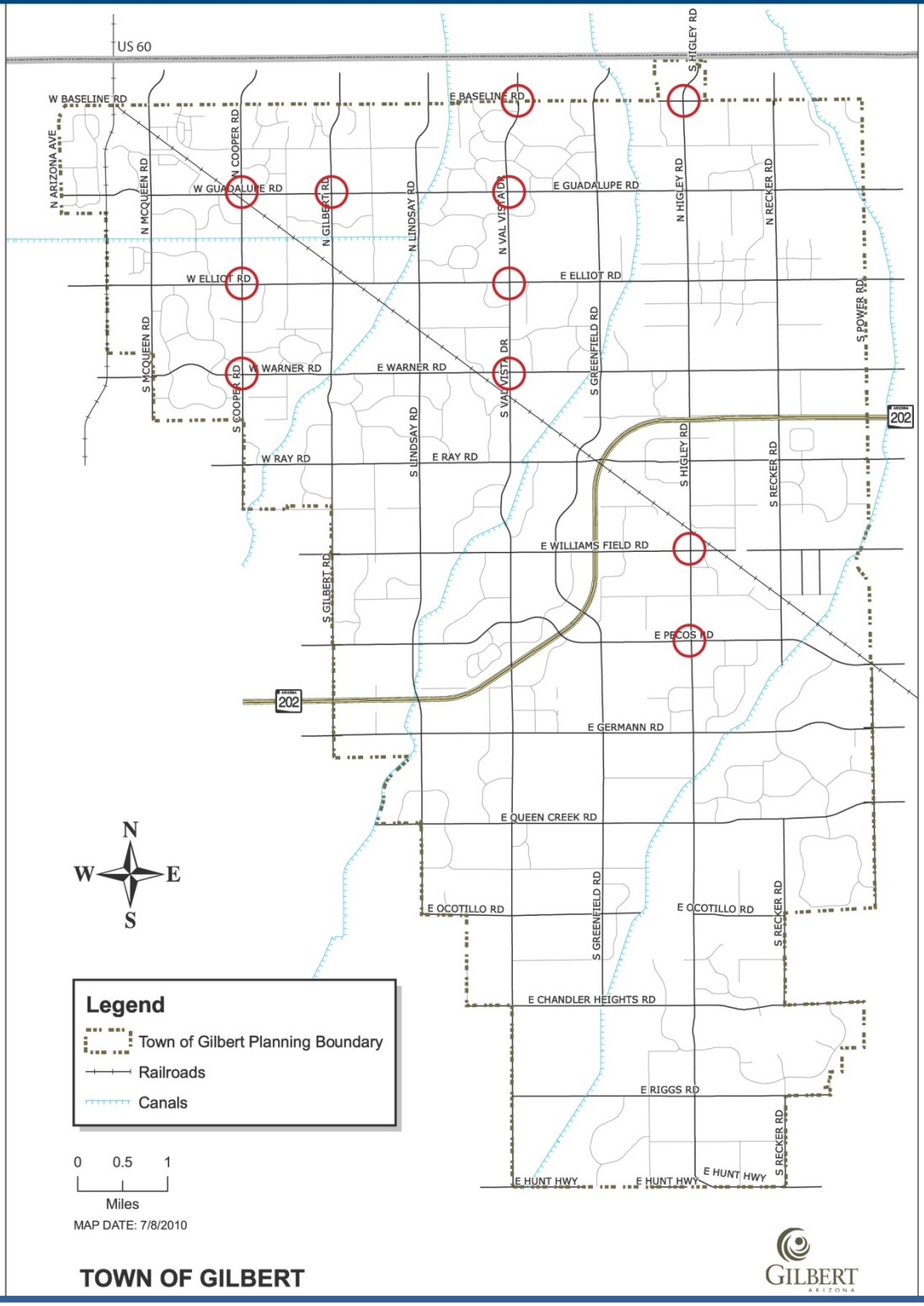


intersections operating at level of service E or F during the AM peak hour and six intersections operating at level of service E or F during the PM peak hour.

F. Crash Analysis

Crash data was obtained from the Town of Gilbert for the study intersections for the five year period from January 2007 to December 2011. The average number of crashes per year was calculated for each location. Figure 9 presents the 11 locations with the highest number of crashes. While the number of crashes can be an indicator of intersection safety, traffic volume is also a factor. It is not unusual for locations with higher traffic volumes to experience more crashes. Another measure of intersection safety is the crash rate. The intersection crash rate is calculated as the number of crashes per million vehicles entering the intersection. Figure 10 shows the ten locations with the highest crash rate. As can be seen by comparing the two figures, five of the intersections are among the highest for both number of crashes and crash rate. It should also be noted that some locations, such as Greenfield Road and Germann Road, have recently been improved and it is likely that the number of crashes at these locations will decrease. Additional summary statistics were developed for type of crash and severity of crash for the year 2011 for the 16 intersections with the highest number of crashes or crash rate. This is presented in Tables 4 and 5 below. As can be seen in Table 4, the majority of crashes at the high crash locations are non-injury and only one location had a fatal crash. As shown in Table 5, the most common crash type was same direction, which is not unusual at signalized intersections.

Intersection Improvement Master Plan
Highest Crash Locations Based on Number of Crashes
Figure #9



Intersection Improvement Master Plan
Highest Crash Locations Based on Crash Rate
Figure #10

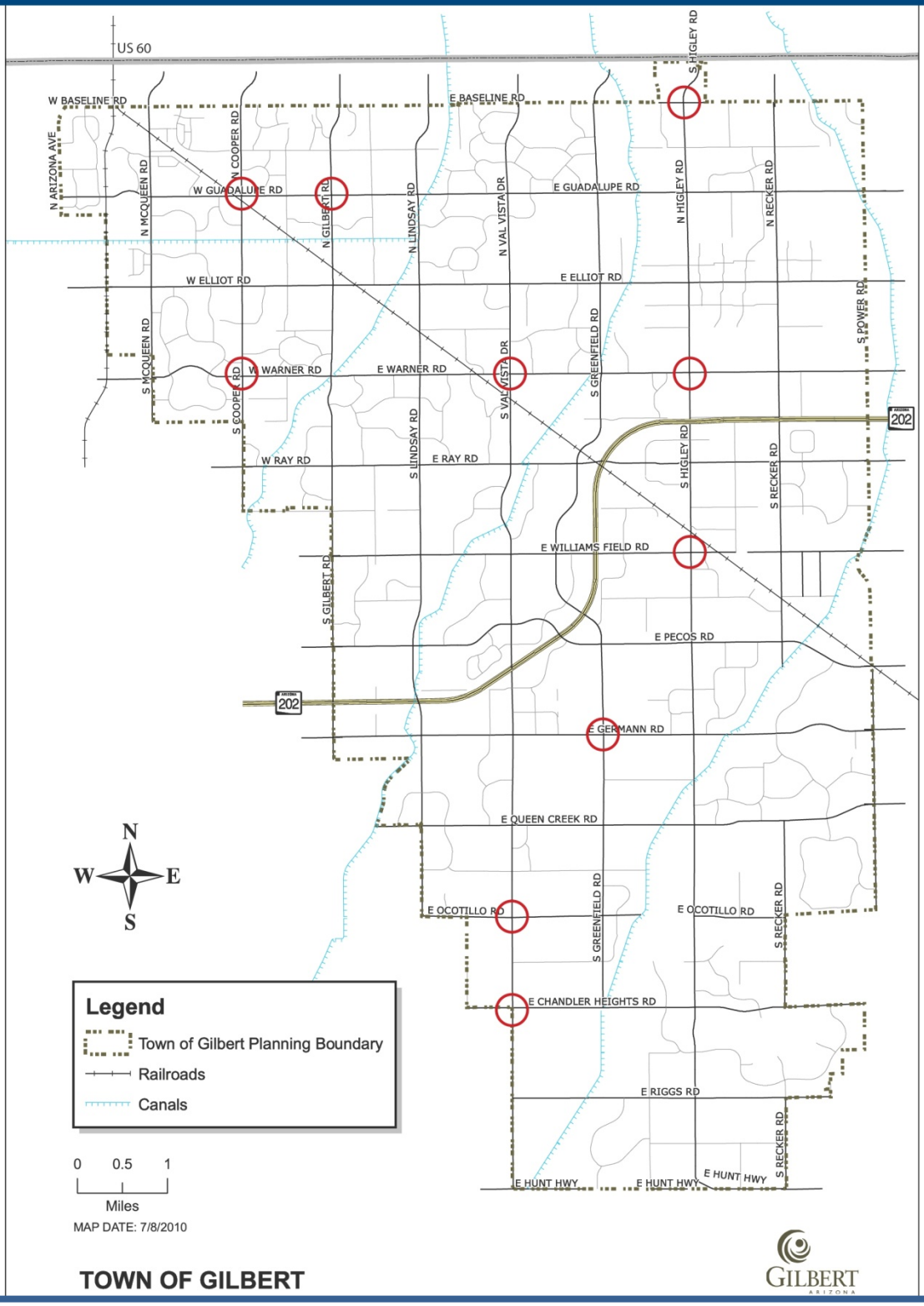


TABLE 4: CRASH SEVERITY SUMMARY

	SEVERITY			
INTERSECTION	**NON-INJURY**	**INJURY**	**FATAL**	**UNKNOWN**
Cooper & Elliot	85%	12%	0%	3%
Cooper & Guadalupe	78%	17%	0%	5%
Cooper & Warner	80%	12%	0%	8%
Gilbert & Guadalupe	75%	25%	0%	0
Greenfield & Germann	69%	31%	0%	0
Higley & Baseline	69%	29%	0%	2%
Higley & Pecos	64%	33%	0%	3%
Higley & Warner	68%	32%	0%	0
Higley & Williams Field	83%	17%	0%	0
Val Vista & Baseline	64%	33%	0%	1%
Val Vista & Chandler Heights	91%	9%	0%	0
Val Vista & Elliot	72%	24%	3%	1%
Val Vista & Guadalupe	85%	15%	0%	0
Val Vista & Ocotillo	69%	31%	0%	0
Val Vista & Warner	61%	37%	0%	2%

TABLE 5: CRASH TYPE SUMMARY

	CRASH TYPE					
INTERSECTION	**SINGLE VEHICLE**	**ANGLE**	**LEFT TURN**	**SAME DIRECTION**	**OPPOSITE DIRECTION**	**UNKNOWN**
Cooper & Elliot	0%	12%	12%	65%	8%	4%
Cooper & Guadalupe	0%	8%	3%	89%	0%	0%
Cooper & Warner	0%	16%	8%	72%	0%	4%
Gilbert & Guadalupe	3%	19%	19%	47%	3%	8%
Greenfield & Germann	0%	6%	13%	81%	0%	0%
Higley & Baseline	2%	16%	13%	64%	2%	2%
Higley & Pecos	3%	21%	15%	58%	3%	0%
Higley & Warner	4%	8%	12%	68%	4%	4%
Higley & Williams Field	2%	20%	15%	56%	2%	5%
Val Vista & Baseline	0%	17%	19%	58%	0%	6%
Val Vista & Chandler Heights	0%	9%	27%	55%	9%	0%
Val Vista & Elliot	0%	28%	14%	55%	0%	3%
Val Vista & Guadalupe	0%	22%	19%	52%	4%	4%
Val Vista & Ocotillo	15%	0%	8%	69%	8%	0%
Val Vista & Warner	13%	34%	24%	21%	3%	5%

G. Signal Warrant Analysis

Several intersections were evaluated to determine if the installation of a new traffic signal was warranted. The installation of traffic signals is governed by the Manual on Uniform Traffic Control Devices (MUTCD), a document approved by the Federal Highway Administration (FHWA) and adopted by the Arizona Department of Transportation (ADOT). According to the MUTCD, an engineering study of traffic conditions, pedestrian characteristics, and physical characteristics of the location shall be performed to determine whether installation of a traffic control signal is justified at a particular location. The engineering study shall include an analysis of factors related to the existing operation and safety at the study location and the potential to improve these conditions, and the applicable factors contained in the traffic signal warrants stated in the MUTCD. However, the MUTCD also notes that the satisfaction of a traffic signal warrant or warrants shall not in itself require the installation of a traffic control signal. A traffic control signal should not be installed unless an engineering study indicates that installing a traffic control signal will improve the overall safety and/or operation of the intersection and a traffic control signal should not be installed if it will seriously disrupt progressive traffic flow.

The following locations were examined with regard to traffic volume, crashes, and physical conditions to identify if any traffic signal warrants were satisfied.

- Higley Rd & Coldwater Blvd
- Warner Rd & Concord St
- Higley Rd & Seville Blvd
- Chandler Heights Rd & Seville Blvd
- Higley Rd & Agritopia Loop N
- Lindsay Rd & Mesquite St
- Cooper Rd & Madera Park Dr

Based on the results of the initial traffic signal warrant analysis, further study should be conducted at the following locations to verify if traffic signals should be installed according to the requirements of the MUTCD.

- Higley Rd & Coldwater Blvd
- Warner Rd & Concord St
- Higley Rd & Seville Blvd
- Chandler Heights Rd & Seville Blvd
- Higley Rd & Agritopia Loop N
- Lindsay Rd & Mesquite St

IV. FUTURE CONDITIONS

The year 2031 was selected as the horizon year for the future analysis. Future conditions analysis included population and employment estimates, traffic forecasts, and operational analysis. Each is discussed in the sections below.

A. Population and Employment

The population and employment projections for the year 2031 were obtained from MAG. The projected population and employment forecasts for each TAZ were reviewed with Town staff to verify that the forecasts represented the growth areas expected for the next 20 years. Based on staff review, the projections for several TAZ's were modified. The 2031 population and employment forecasts by TAZ are included in the appendix. The forecasts by RAZ are presented in Table 6 along with the projected percent growth in population and employment by RAZ. Refer to Figure 3 for the RAZ boundaries.

TABLE 6: 2031 SOCIOECONOMIC DATA

RAZ	Population	change from 2011	Employment	change from 2011
311	81,568	2%	47,721	24%
312	37,800	55%	13,345	82%
318	52,312	20%	39,617	143%
319	87,643	78%	13,859	126%
329	46,298	118%	6,306	79%
TOTAL	**305,621**	**40%**	**120,848**	**68%**

B. Travel Forecasts

The revised socio-economic data file was provided to MAG to prepare the 2031 traffic forecasts for the region. Although the forecasts are identified as 2031, they are more accurately defined as the traffic forecasts expected when the population reaches 305,621 and employment is 120,848.

The raw traffic numbers obtained from the traffic model runs were adjusted to account for estimation errors in the model determined based on a comparison of the 2011 model validation run and actual counts. The technique used to analyze the 2011 model volumes and traffic counts is known as "screenline comparison".

Screenlines are a tool used to examine changes in traffic volume across multiple streets. A screenline is an imaginary line that bisects several streets and provides an indication of general travel demand in an east-west or north-south direction as opposed to just one street. A north-south screenline examines east-west demand and an east-west screenline examines north-south demand. For this study, there were three east-west screenlines and two north-south screenlines. The east-west screenlines were between Baseline and Guadalupe, Ray and Williams Field, and Queen Creek and Ocotillo. The north-south screenlines were between Gilbert and Lindsay and Greenfield and Higley.

In the initial step, the 2011 model volume on the streets that cross the screenline are summed and compared with the actual traffic counts across the same screenline. This provides an indication whether the travel forecasting model is over-estimating, under-estimating, or within reasonable limits. If the model is over-estimating traffic demand, then factors are developed to reduce the traffic forecasts across the screenline. Likewise, if the model is under-estimating, then factors are developed to increase the traffic forecasts across the screenline. Then the forecasts are adjusted further to "smooth" out the volumes along a street. The resulting forecasts for 2031 are shown in Figure 11.

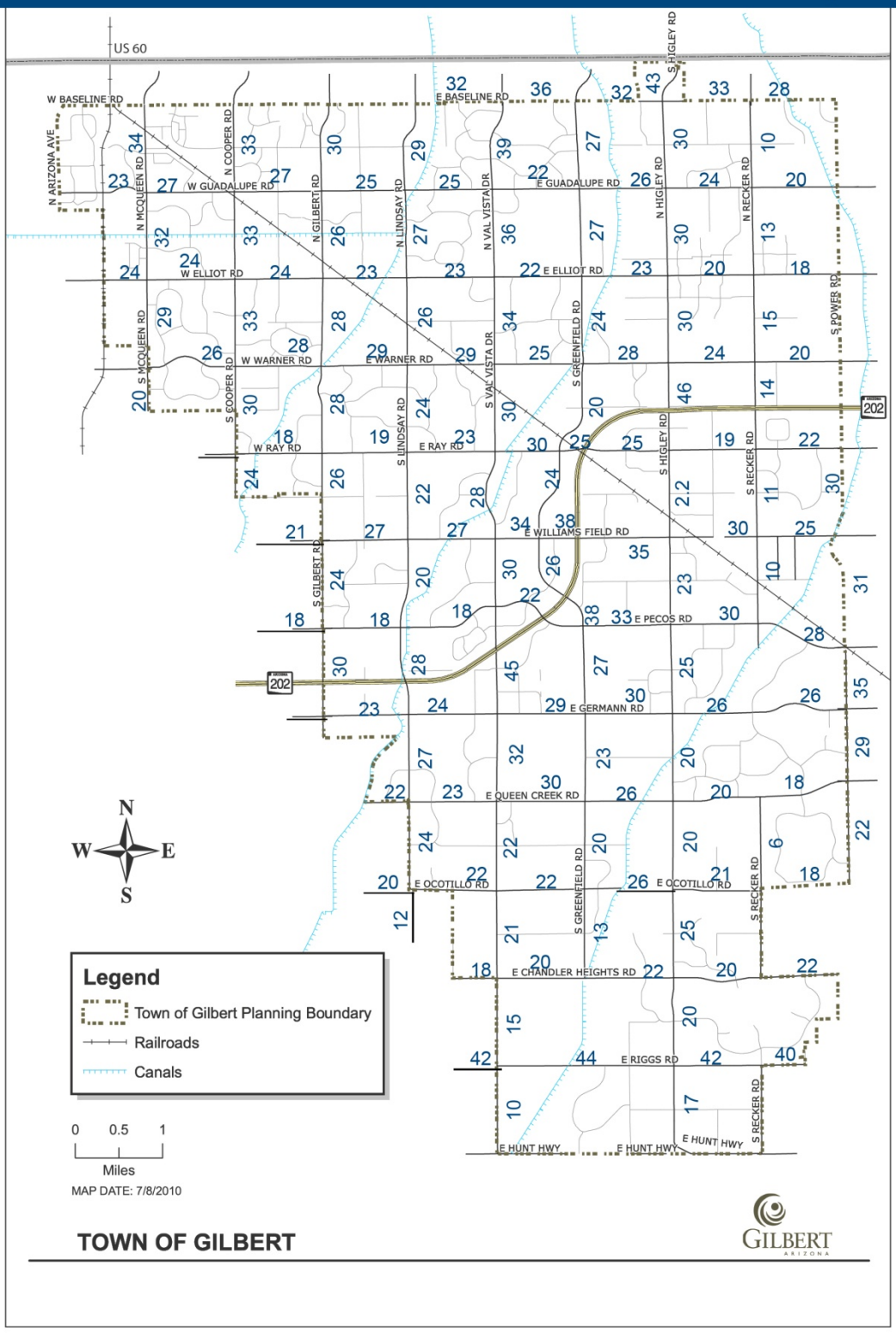
It must be noted that the MAG travel forecasting model includes portions of Pinal County. Since Pinal County is still a relatively high growth area, the amount of growth included in the model is somewhat speculative. If growth would occur more rapidly or is higher than what is included in the model, the traffic forecasts particularly in the southeast portion of the planning area could be higher. Conversely, if growth occurs more slowly or is less intense than what is included in the model, the traffic forecasts particularly in the southeast portion of the planning area would be lower.

The 2031 traffic forecasts were used to develop the turning movement volumes used in the future conditions Synchro analysis. Several different techniques were used to estimate the peak hour turning volumes. First, the

Intersection Improvement Master Plan

2031 Traffic Forecasts (daily volume in thousands)

Figure #11



traffic volume growth for each intersection was calculated. This was done by summing the daily forecast volume for each of the intersection legs and dividing it by the sum of the existing daily volume for each of the intersection legs to calculate a growth factor for the overall intersection. Next, a growth factor was calculated for each intersection movement. This was done by summing the daily forecast for the two legs that comprise a movement and dividing by the sum of the existing counts for the same two legs. For example, the northbound left turn movement growth factor would be determined by summing the forecast for the south and west legs and dividing it by the sum of the counts for the same two legs. Then, the growth factor for each individual movement was compared to the intersection growth factor. If the growth factor for the individual movements did not vary from the intersection growth factor by more than 100 percent, then the overall growth factor was used to increase all the turning movements. If any turning movement growth factor varied by more than 100 percent from the overall intersection growth factor, then the individual turning movement growth factors were used to increase the respective volumes. These factors were input directly to the future Synchro data files.

There was one other condition that affected the growth factor. Synchro only allows a growth factor of 3 or 200 percent. As a result, if the overall intersection or any individual movement growth factor was more than 3, then the future turning movements were developed manually using the following method. For the AM peak hour, a K factor of eight percent was used to determine the two-way AM peak hour volume on each intersection leg, than a directional distribution of 55 percent for the northbound and westbound directions was used to determine the one-way approach flow. Turn percentages of 13 percent right and 13 percent left were used to develop the individual turning movements. The same process was used for the PM peak, except a K factor of nine percent was used and the peak directions were southbound and eastbound. Finally, in a few instances such as at "T" intersections and locations where Town staff knew of non-typical turning movement patterns, further manual adjustments were made.

C. Operating Conditions

Using the future volume techniques described in the previous section, the future turning movement volumes were input into the Synchro model for the AM and PM peak hours.

Three different intersection lane conditions were evaluated:

- Future base lanes – this represents existing intersection geometry plus under construction or recently completed improvements
- CIP lanes – this is the future base plus all improvements included in the 2012-2017 Capital Improvement Program that are not under construction.
- Improved lanes– this is the CIP lanes plus additional lanes developed in this study needed to improve any "CIP" level of service of E or F to D or better.

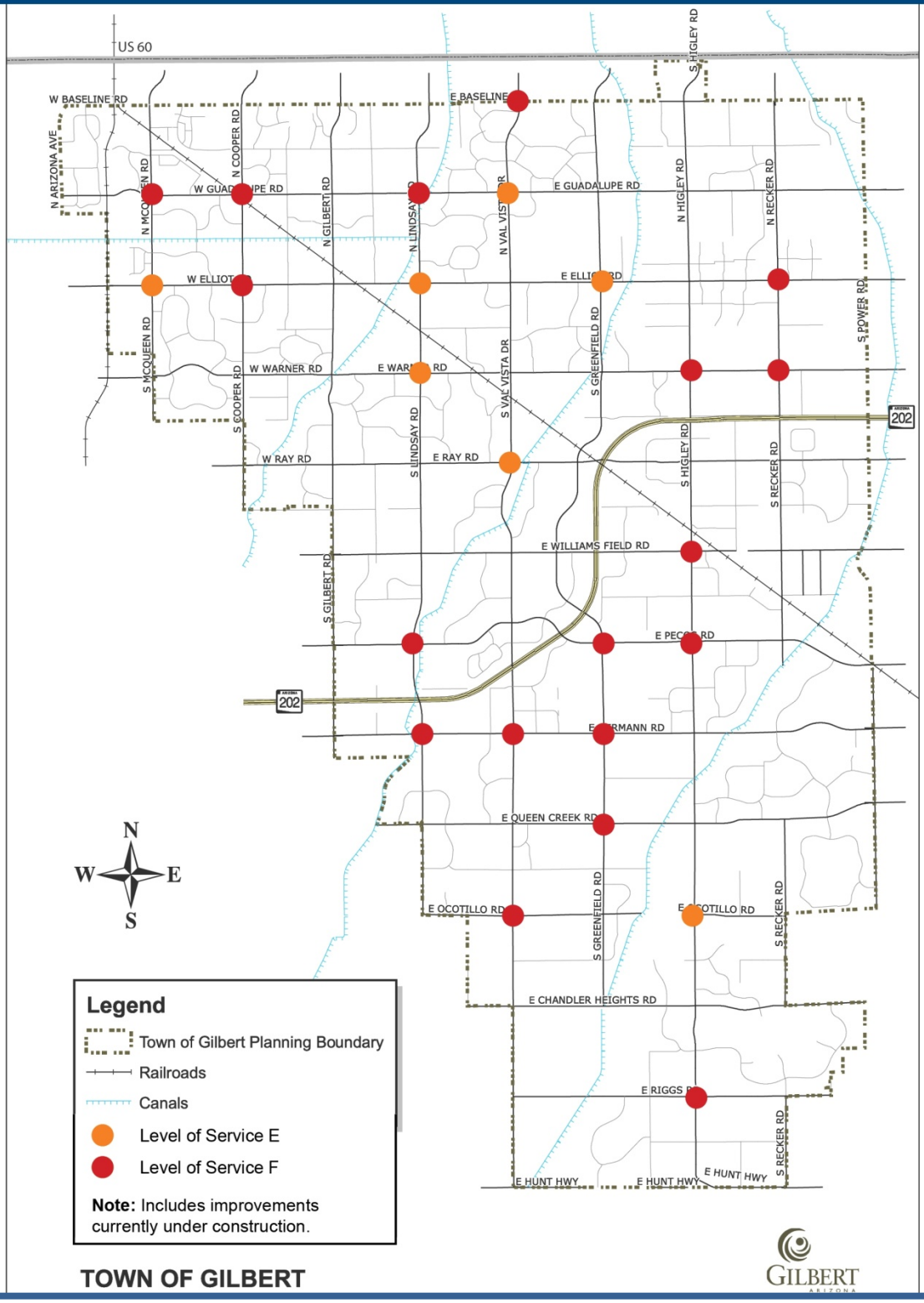
1. Future Base Lanes

The AM and PM peak hour level of service and delay for the future base lanes condition was calculated and is included in the appendix. The locations with level of service E or F are shown in Figures 12 and 13 for the AM and PM peak periods. The level of service and delay represents an average for the intersection. One or more approaches or individual turning movements may be worse than the average during the peak hours. There are 25 intersections expected to operate at level of service E or F with the future base condition during the AM peak hour and 37 intersections expected to operate at level of service E or F during the PM peak hour.

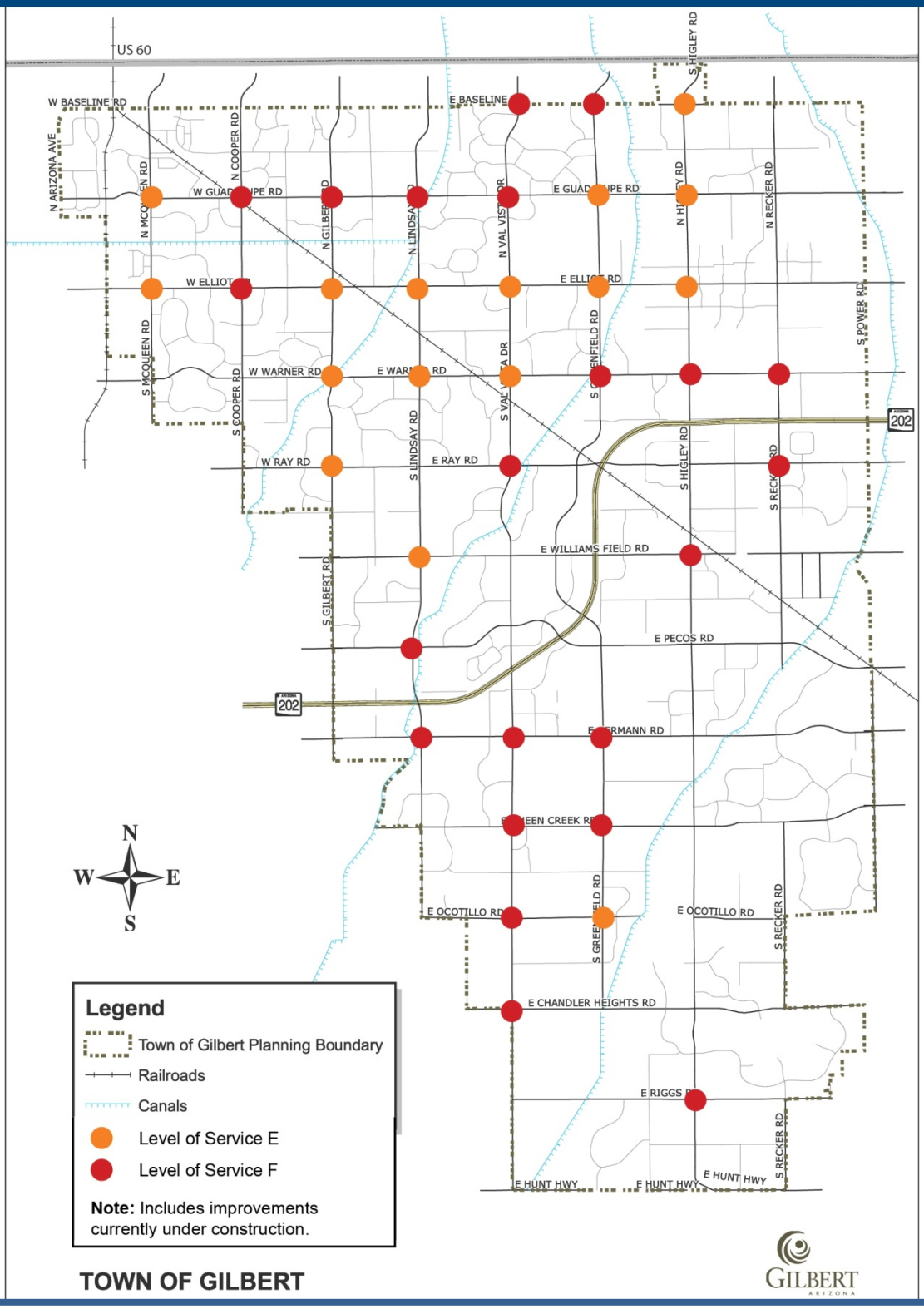
2. CIP Lanes

The CIP lanes are a combination of the future base lanes and the intersection improvements included in the 2012-2017 CIP. For reference, the additional CIP lanes are included in the appendix. The AM and PM peak hour level of service and delay for the CIP lanes condition was calculated and is included in the appendix. The locations with level of service E or F are shown in Figures 14 and 15 for the AM and PM peak periods. The level of service and delay represents an average for the intersection. One or more approaches or individual turning movements may be worse than the average during the peak hours. There are 18 intersections expected to operate at level of service E or F with the future base condition during the AM peak hour and 30 intersections expected to operate at

Intersection Improvement Master Plan
Future Base Level of Service AM Period
Figure #12



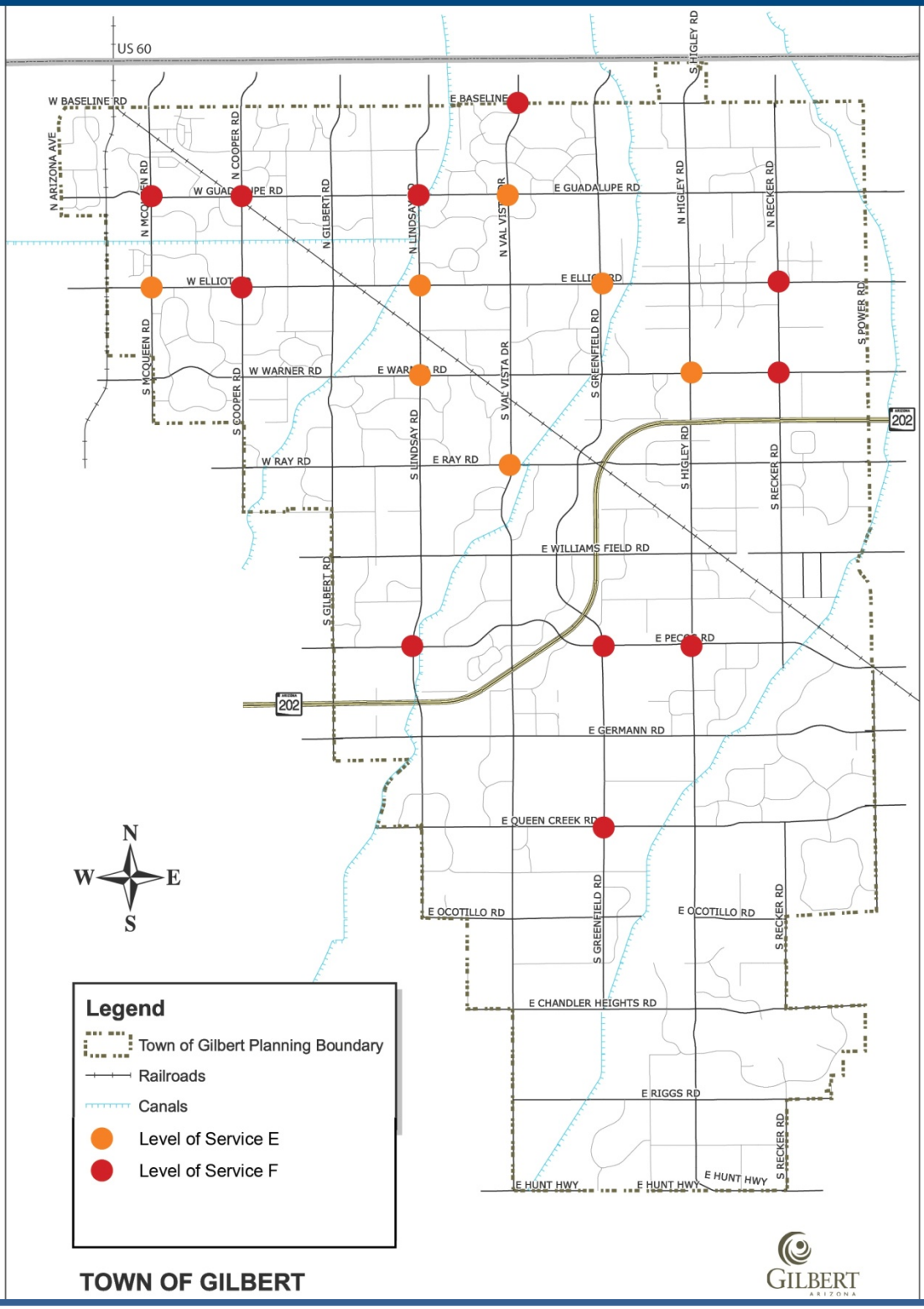
Intersection Improvement Master Plan
Future Base Level of Service PM Period
Figure #13



Intersection Improvement Master Plan

Future Level of Service with Planned CIP AM Period

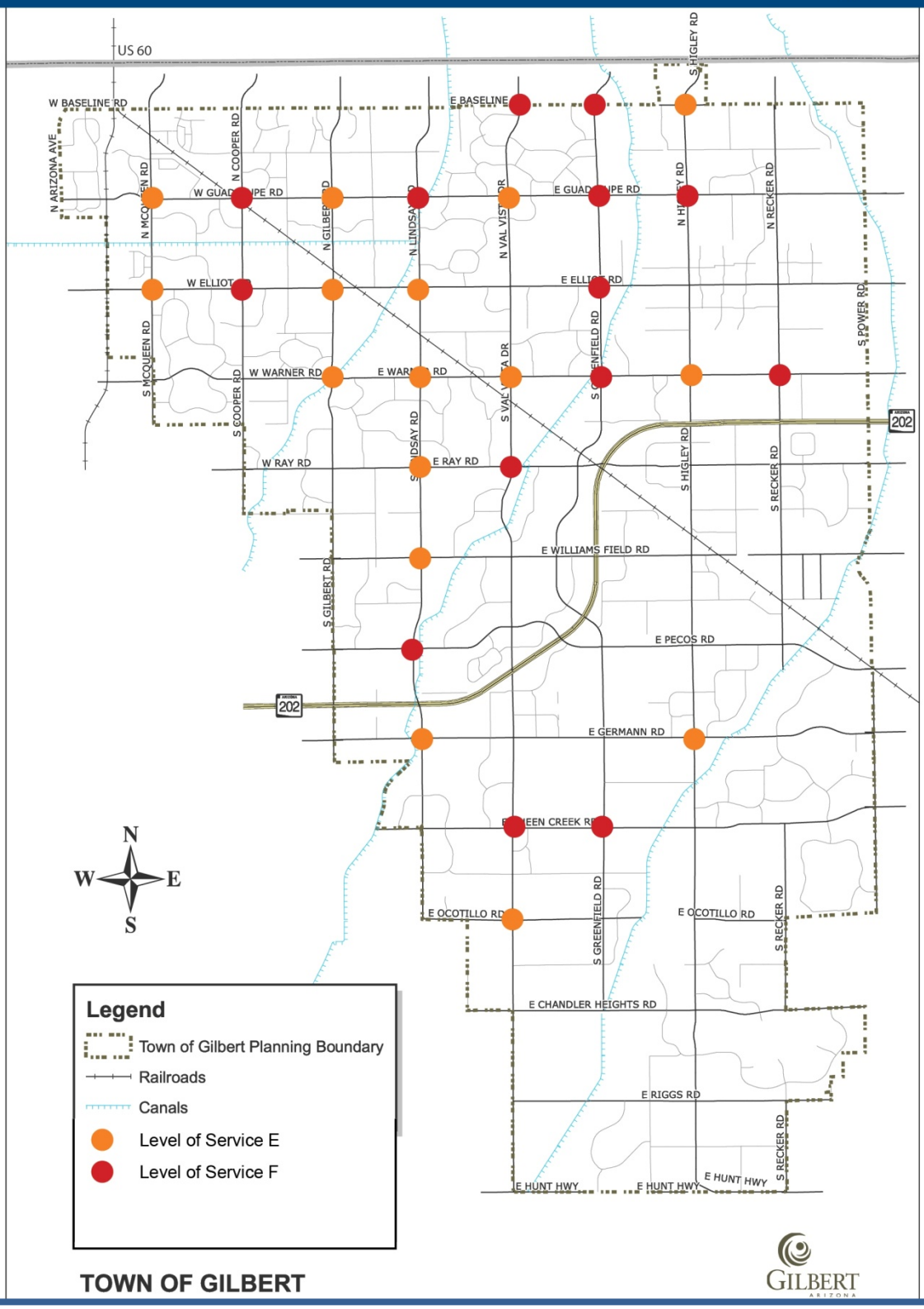
Figure #14



Intersection Improvement Master Plan

Future Level of Service with Planned CIP PM Period

Figure #15



level of service E or F during the PM peak hour.

1. Improved Lanes

The improved lanes scenario begins with the CIP lanes and then further analysis was conducted at those locations that remain level of service E or F after the CIP improvements. The methodology used for this portion of the analysis is as follows. If an intersection level of service was projected to be E or F with the CIP improvements, then additional improvements were evaluated on an iterative basis. The first series of improvement were evaluated for the AM peak period. First, the addition of a right turn lane on one or more approaches was evaluated. This was generally at locations where the projected right turn volume was at least 150 vehicles, but there were locations with less volume where a right turn lane was added.

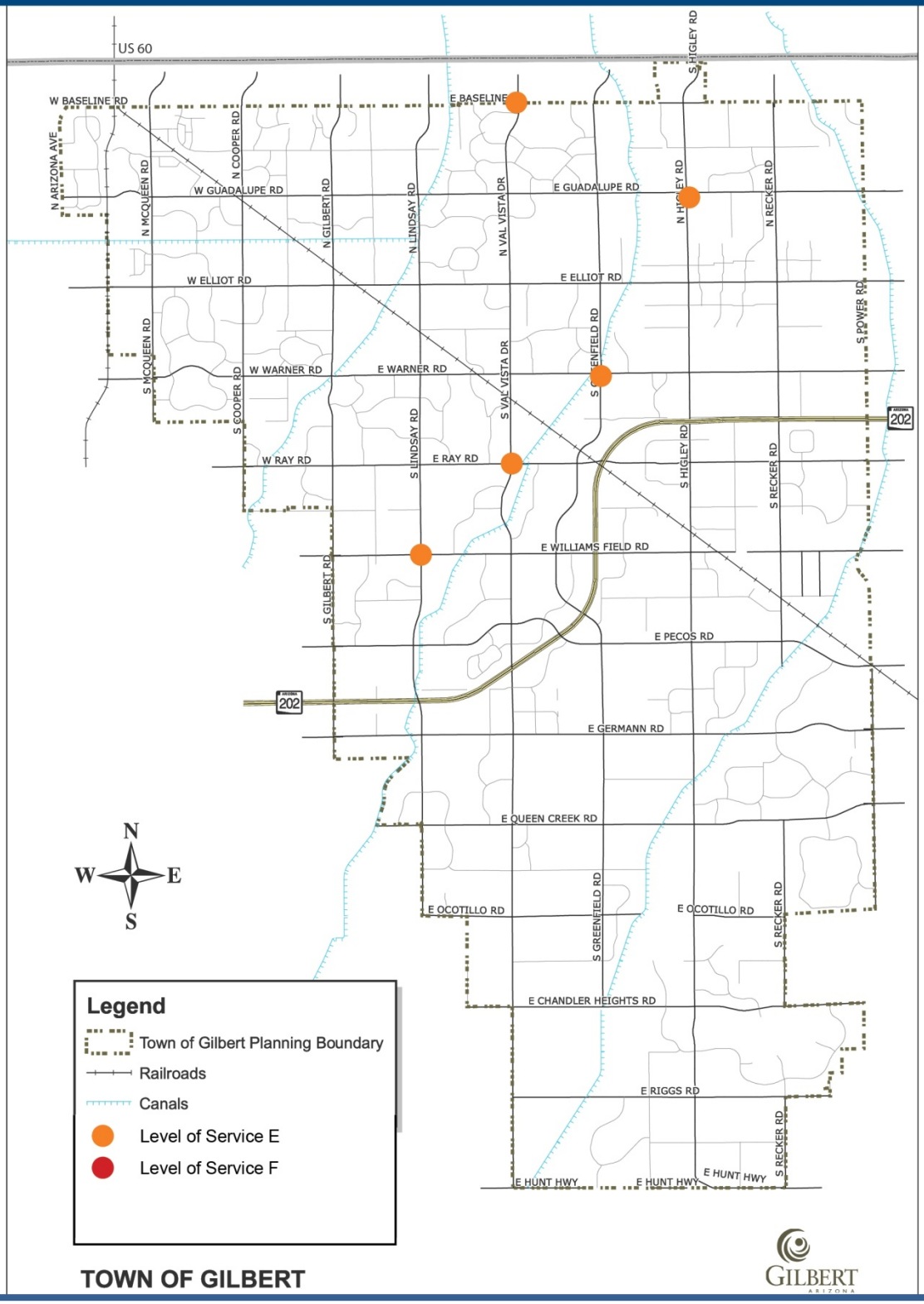
If the level of service was still E or F, the addition of dual left turn lanes on opposing approaches for one street was evaluated. This was generally at locations where the projected left turn volume was at least 250 vehicles, but there were locations with less volume where dual left turn lanes were added. If the level of service was still E or F, then additional through lanes on opposing approaches on one street were evaluated, however, no more than three through lanes were included on an approach. During this iterative process, once the level of service improved to D or better, than no further improvements were evaluated for the AM period.

The improvements identified in the AM analysis were added to the PM Synchro file and the updated level of service was calculated. At those locations where the PM level of service was still E or F, the same iterative process was completed until the PM level of service was D or better. Based on the improvements evaluated, all the study intersections were improved to level of service ‘D’ or better in the AM period. However, even after evaluating all the improvements options discussed here, there are five locations where the improved level of service was still E in the PM period and those are shown on Figure 16.

Intersection Improvement Master Plan

Future Level of Service with Improvements PM Period

Figure #16



V. COST

Planning level cost estimates were prepared for each type of improvement analyzed. The following sections describe the improvement and the construction planning cost estimate in 2012 dollars. Right of way cost estimates are not included. An improvement project can include more than one improvement, for example, dual left turn lanes and one right turn lane can be the recommended improvement and the costs shown below would be added.

A. New Intersection

This category of improvement assumes that the existing intersection is unimproved. The intersection would be completely reconstructed to provide single left turn lanes in all directions and either two through lanes or three through lanes on each street. The completed intersection includes bike lanes, curb, gutter, and sidewalk and a new traffic signal. The limits of construction are 1000 feet on each approach. The estimated construction cost with four through lanes on both streets is $3 million, with four through lanes on one street and six through lanes on the other is $3.5 million, and with six through lanes on both streets is $4 million.

B. Right Turn Lane

This category of improvement assumes that the existing intersection is improved and includes curb and gutter. A right turn lane would be added on a single approach. The construction would include removal and replacement of existing curb, gutter, and sidewalk; and addition of a new right turn lane 200 feet long with a 180 foot taper. The cost estimate is based on a 200 foot long right turn although the actual length will vary depending on volume. The estimated construction cost is $200,000.

C. Dual Left Turn Lanes

This category of improvement assumes that the existing intersection is improved and includes curb and gutter. A second left turn lane would be added on opposing approaches on one street. The construction would include removal and replacement of existing curb, gutter, and sidewalk; and addition of a second left turn lane 250 feet long with a 300 foot taper assuming the widening is symmetrical about the centerline. The cost estimate is based on 250 foot long left turn lanes although the actual length will vary depending on volume. The estimated construction cost is $600,000.

D. Through Lanes

This category of improvement assumes that the existing intersection is improved and includes curb and gutter. A third through lane would be added on opposing approaches. The construction would include removal and replacement of existing curb, gutter, and sidewalk; and addition of a third through lane 500 feet long with a 750 foot taper. The estimated construction cost is $1,250,000 for a third through lane on opposite approaches on one street.

VI. IMPLEMENTATION

A method to prioritize the implementation of improvements at individual intersections was developed based on future level of service and crash data. The future base level of service was sorted from highest delay to lowest delay for the AM and PM period and a number ranking was assigned with highest delay ranked number 1 for each time period. The numerical rank for AM and PM were added together and a combined ranking was assigned. The same methodology was used for crashes. Intersections were ranked according to crash rate and number of crashes, with the highest rate and highest number of crashes ranked number 1. The numerical rank for crash rate and number of crashes were added and a combined ranking was assigned. Finally, the overall level of service ranking and crash ranking were combined and a final ranking assigned. The result of this priority evaluation is included in the appendix. The overall highest ranked ten locations are presented in Table 7 along with the remaining intersections that represent the top ten level of service or top ten crash locations. The planning level cost estimate for the identified improvements is also shown. It should be noted that this cost is just for the intersection improvements and does not include right of way or other arterial street improvements.

TABLE 7: IMPROVEMENT PRIORITY

INTERSECTION	LOS RANK	CRASH RANK	OVERALL RANK	COST IN MILLIONS*
HIGHEST OVERAL RANK				
Higley & Warner	1	6	**1**	$5.5
Higley & Williams Field	5	4	**2**	$10.0
Cooper & Guadalupe	8	5	**3**	$10.1
Cooper & Elliot	10	10	**4**	$6.8
Greenfield & Germann	9	14	**5**	$2.5
Val Vista & Baseline	13	12	**6**	$2.1
Gilbert & Guadalupe	25	1	**7**	$5.6
Val Vista & Guadalupe	17	11	**8**	$5.6
Val Vista & Ocotillo	2	27	**9**	$3.0
Val Vista & Ray	16	13	**10**	$1.0
HIGHEST LEVEL OF SERVICE RANK				
Recker & Warner	**3**	57	32	$3.0
Lindsay & Germann	**4**	48	27	$8.9
Lindsay & Pecos	**7**	50	28	$3.6
Lindsay & Guadalupe	**6**	28	12	$3.1
HIGHEST CRASH RANK				
Higley & Baseline	43	**2**	21	$3.3
Val Vista & Warner	38	**3**	16	$0.2
Cooper & Warner	39	**7**	22	NA
Val Vista & Elliot	36	**8**	20	$5.2
Higley & Pecos	29	**9**	14	$0.6

*includes CIP cost plus additional improvements

APPENDIX

EXISTING POPULATION & EMPLOYMENT BY TAZ A-1

EXISTING LEVEL OF SERVICE & DELAY B-1

2031 POPULATION & EMPLOYMENT PROJECTIONS BY TAZ C-1

2031 BASE LEVEL OF SERVICE & DELAY D-1

2012-2017 CIP PROJECT SUMMARY E-1

2031 LEVEL OF SERVICE & DELAY WITH CIP PROJECTS F-1

2031 LEVEL OF SERVICE & DELAY WITH SUGGESTED IMPROVEMENTS .G-1

PRIORITY RANKING H-1

ADDITIONAL IMPROVEMENT SUMMARY I-1

APPENDIX

EXISTING POPULATION & EMPLOYMENT BY TAZ A-1

EXISTING POPULATION AND EMPLOYMENT BY TAZ

TAZ	RAZ	POP HH	POP GQ	TRANS POP	SEAS POP	TOTAL POP	OTH EMP	PUB EMP	RET EMP	OFF EMP	IND EMP	TOTAL EMP
1514	311	2932	0	59	12	4266	383	226	1125	188	3211	5133
1515	311	745	0	229	2	1357	19	5	881	322	1420	2647
1516	311	1212	0	18	1	1620	6	25	1427	199	4906	6563
1517	311	5876	0	96	20	8082	16	207	523	109	5	860
1518	311	584	0	9	1	787	2	432	409	440	450	1733
1519	311	6218	3	99	11	8478	3	192	1039	170	200	1604
1520	311	4101	0	64	9	5784	98	236	2013	196	3131	5674
1521	311	5971	15	89	11	8019	24	1839	420	13	0	2296
1522	311	4225	0	65	5	5699	151	450	2019	0	4	2624
1523	311	5749	0	88	12	7726	7	129	1255	290	6	1687
1524	311	4843	0	66	5	6398	0	161	311	144	5	621
1525	311	5882	21	93	24	8026	15	0	730	505	0	1250
1526	311	6083	1	92	5	8150	121	555	37	0	0	713
1527	311	3591	0	49	0	4713	24	535	733	20	3	1315
1528	311	5086	0	83	91	7098	0	95	1637	76	432	2240
1529	311	3774	0	49	10	4909	26	246	309	0	0	581
1530	311	5642	0	83	7	7508	0	322	238	0	5	565
1531	312	735	0	3	3	1119	428	0	441	572	178	1619
1532	312	3626	0	48	1	4730	259	159	543	0	214	1175
1533	312	1339	0	22	1	1853	0	234	0	0	77	311
1534	312	2310	0	19	5	3166	32	228	59	0	12	331
1535	312	4685	0	58	2	6319	67	115	201	58	234	675
1536	312	4477	25	66	1	5991	7	150	178	0	0	335
1537	312	623	0	1	2	935	64	0	1089	107	0	1260
1538	312	4839	0	71	11	6446	0	207	676	78	0	961
1539	312	4136	0	38	7	5812	50	396	0	0	0	446
1540	312	209	0	0	0	292	16	0	33	0	171	220
1541	318	3031	0	48	1	4113	0	21	533	0	0	554
1542	318	5642	0	82	12	7622	7	1313	337	0	0	1657
1543	318	1092	0	15	79	1557	47	146	133	0	158	484
1544	318	5537	0	85	6	7506	145	0	796	64	0	1005
1545	318	4132	0	60	8	5483	8	30	537	183	0	758
1546	318	3565	0	52	61	4899	0	0	343	0	5	348
1547	318	241	0	4	1	334	29	0	552	860	255	1696
1548	318	23	0	0	0	29	29	0	803	395	200	1427
1549	318	418	0	3	0	560	20	0	63	171	120	374
1550	318	2168	0	30	2	2854	16	53	167	0	123	359
1551	318	2805	0	44	2	3779	0	83	102	0	0	185
1552	318	754	0	4	1	1070	0	0	1846	0	0	1846
1553	318	1331	0	1	3	1966	549	0	369	91	0	1009
1554	318	190	0	1	0	262	29	0	977	0	0	1006
1555	318	766	0	11	0	1033	64	0	0	267	107	438
1556	319	1965	0	32	5	2691	21	0	0	0	0	21

EXISTING POPULATION AND EMPLOYMENT BY TAZ (CONTINUED)

TAZ	RAZ	POP HH	POP GQ	TRANS POP	SEAS POP	TOTAL POP	OTH EMP	PUB EMP	RET EMP	OFF EMP	IND EMP	TOTAL EMP
1557	319	5596	0	63	9	7779	13	196	149	0	0	358
1558	319	2100	0	21	4	2900	6	90	128	0	21	245
1559	319	655	0	4	1	892	48	0	0	0	4	52
1560	319	1106	0	1	2	1571	23	85	11	0	0	119
1561	319	1104	0	3	3	1543	11	0	42	45	332	430
1562	319	11466	0	100	21	16003	154	128	1125	0	447	1854
1563	319	3848	0	46	7	5379	0	366	29	1	0	396
1564	319	85	0	0	0	114	62	0	0	44	0	106
1565	319	5105	0	86	5	7068	0	57	343	0	0	400
1566	319	4417	0	38	7	6240	0	317	434	137	37	925
1567	319	6341	0	108	11	8861	6	488	311	13	0	818
1568	319	0	0	0	0	0	0	0	0	0	0	0
1569	319	4733	0	63	43	6681	109	104	198	0	0	411
1570	329	2765	0	18	4	3803	0	0	106	0	0	106
1571	329	1885	0	12	3	2583	152	91	264	0	0	507
1572	329	777	0	11	1	1074	0	8	0	57	4	69
1573	329	1693	0	12	2	2331	114	207	251	0	5	577
1574	329	829	0	8	1	1131	35	28	53	0	0	116
1575	329	234	0	2	0	320	46	0	0	0	0	46
1576	329	0	0	0	0	0	0	9	0	0	0	9
1577	329	2424	0	23	3	3337	21	15	145	0	0	181
1578	329	3623	0	24	5	4955	1	525	59	0	0	585
1616	318	2183	0	35	2	2965	0	0	356	0	0	356
1618	318	4644	0	45	4	6294	35	69	962	576	29	1671
1619	318	4410	0	69	8	5960	9	80	1007	3	0	1099
1911	311	5809	0	103	55	8216	1	1	432	0	0	434
1945	329	2009	0	2	2	2712	69	0	173	0	0	242
1951	329	1846	0	26	3	2559	31	31	104	0	0	166
1953	329	2442	0	24	4	3383	7	34	537	0	40	618
1963	329	544	0	6	1	746	0	0	186	0	107	293
TOTAL					**POP**	**298441**					**EMP**	**71795**

APPENDIX

EXISTING LEVEL OF SERVICE & DELAY B-1

EXISTING LOS & DELAY

INTERSECTION	AM		PM	
	LOS	DELAY	LOS	DELAY
McQueen & Guadalupe	D	40	D	41
McQueen & Elliot	D	44	D	54
Cooper & Guadalupe	F	91	E	70
Cooper & Elliot	E	73	E	75
Cooper & Warner	E	58	E	58
Gilbert & Guadalupe	C	34	D	54
Gilbert & Elliot	D	39	D	48
Gilbert & Warner	C	29	C	28
Gilbert & Ray	D	36	C	28
Gilbert & Williams Field	C	27	C	22
Lindsay & Guadalupe	E	77	F	93
Lindsay & Elliot	D	40	E	61
Lindsay & Warner	D	45	D	45
Lindsay & Ray	C	22	C	29
Lindsay & Williams Field	B	16	C	27
Lindsay & Pecos	C	27	C	32
Lindsay & Germann	C	30	C	25
Lindsay & Queen Creek	B	20	C	25
Val Vista & Baseline	D	41	F	89
Val Vista & Guadalupe	D	37	D	45
Val Vista & Elliot	D	37	D	47
Val Vista & Warner	C	34	D	39
Val Vista & Ray	C	27	D	36
Val Vista & Williams Field	C	25	C	31
Val Vista & Pecos	C	24	C	26
Val Vista & Germann	B	14	C	31
Val Vista & Queen Creek	C	27	C	29
Val Vista & Ocotillo	B	20	C	21
Val Vista & Chandler Heights	D	48	C	24
Val Vista & Riggs	B	17	B	20
Greenfield & Baseline	C	31	D	43
Greenfield & Guadalupe	C	26	D	42

EXISTING LOS & DELAY (CONTINUED)

INTERSECTION	AM	AM	PM	PM
	LOS	DELAY	LOS	DELAY
Greenfield & Elliot	C	30	C	23
Greenfield & Warner	C	21	C	29
Greenfield/Santan Village & Ray	C	29	B	20
Greenfield/Santan Village & Williams Field	B	14	C	29
Greenfield/Santan Village & Pecos	C	24	C	25
Greenfield & Germann	C	21	C	21
Greenfield & Queen Creek	C	21	B	18
Greenfield & Chandler Heights	B	12	B	15
Market & Williams Field	B	12	C	31
Higley & Baseline	D	40	C	34
Higley & Guadalupe	B	17	C	31
Higley & Elliot	C	26	B	20
Higley & Warner	C	23	B	20
Higley & Ray	B	18	C	21
Higley & Williams Field	D	47	E	57
Higley & Pecos	D	51	D	44
Higley & Germann	C	23	C	29
Higley & Queen Creek	C	29	C	26
Higley & Ocotillo	A	4	A	5
Higley & Chandler Heights	C	30	C	24
Higley & Riggs	C	24	B	20
Recker & Baseline	C	27	B	19
Recker & Guadalupe	B	20	C	25
Recker & Elliot	D	36	C	24
Recker & Warner	B	13	B	13
Recker & Ray	B	19	B	16
Recker & Williams Field	C	22	C	26
Recker & Pecos	B	15	B	19
Power & Guadalupe	C	27	B	14
Power & Pecos	E	69	D	37
Power & Germann	C	24	C	21
Power & Queen Creek	C	32	C	21

APPENDIX

2031 POPULATION & EMPLOYMENT PROJECTIONS BY TAZ C-1

2031 POPULATION & EMPLOYMENT PROJECTIONS BY TAZ

TAZ	RAZ	POP HH	POP GQ	TRANS POP	SEAS POP	TOTAL POP	OTH EMP	PUB EMP	RET EMP	OFF EMP	IND EMP	TOTAL EMP
1514	311	2953	0	66	14	3033	383	226	1134	188	3770	5701
1515	311	750	0	267	2	1019	19	5	881	697	2307	3909
1516	311	1220	0	20	1	1241	6	25	1427	199	6645	8302
1517	311	5916	0	109	31	6056	16	207	583	693	5	1504
1518	311	588	0	11	1	600	2	432	409	982	1323	3148
1519	311	6259	5	112	18	6394	10	608	1075	914	200	2807
1520	311	4749	0	75	21	4845	98	276	2053	647	3348	6422
1521	311	6011	21	100	13	6145	24	1839	549	13	0	2425
1522	311	4253	0	74	8	4335	151	450	2086	105	4	2796
1523	311	5797	0	99	19	5915	7	129	1271	290	6	1703
1524	311	4875	0	75	9	4959	0	196	379	144	5	724
1525	311	5921	30	105	28	6084	15	0	730	505	0	1250
1526	311	6156	1	104	9	6270	121	1554	37	51	0	1763
1527	311	3623	0	56	2	3681	24	535	768	20	3	1350
1528	311	5119	0	94	104	5317	0	150	1662	76	432	2320
1529	311	3799	0	56	12	3867	26	246	309	0	0	581
1530	311	5679	0	94	7	5780	0	322	247	0	5	574
1531	312	739	0	5	11	755	1410	0	698	1067	178	3353
1532	312	3650	0	54	3	3707	259	159	778	0	214	1410
1533	312	1357	0	25	5	1387	0	234	0	0	77	311
1534	312	2665	0	25	13	2703	32	236	88	0	12	368
1535	312	4716	0	67	6	4789	67	115	572	58	234	1046
1536	312	4532	36	75	3	4646	7	223	178	0	0	408
1537	312	5921	0	15	27	5963	64	0	1276	107	0	1447
1538	312	4870	0	80	15	4965	0	207	718	78	0	1003
1539	312	4537	0	49	30	4616	100	475	178	591	225	1569
1540	312	4242	0	9	18	4269	55	111	385	735	1144	2430
1541	318	3051	0	54	3	3108	0	21	644	0	0	665
1542	318	6520	0	96	23	6639	7	1624	549	0	0	2180
1543	318	1252	0	17	79	1348	47	304	201	0	158	710
1544	318	5574	0	96	10	5680	145	0	796	64	0	1005
1545	318	4188	0	68	30	4286	8	30	626	183	0	847
1546	318	3613	0	59	65	3737	0	0	567	0	5	572
1547	318	243	0	4	3	250	244	1169	2016	2932	603	6964
1548	318	23	0	0	0	23	102	180	1632	1355	1180	4449
1549	318	734	0	5	2	741	20	160	264	775	870	2089
1550	318	2197	0	34	4	2235	16	53	214	0	123	406
1551	318	2805	0	50	5	2860	0	83	261	0	0	344
1552	318	758	0	6	5	769	419	0	2395	2330	0	5144
1553	318	3360	0	12	28	3400	826	0	1265	1639	0	3730
1554	318	1579	0	6	4	1589	29	0	1487	0	0	1516
1555	318	3379	0	18	4	3401	471	491	379	3359	305	5005
1556	319	1988	0	36	13	2037	51	227	134	436	0	848

2031 POPULATION & EMPLOYMENT PROJECTIONS BY TAZ (CONTINUED)

TAZ	RAZ	POP HH	POP GQ	TRANS POP	SEAS POP	TOTAL POP	OTH EMP	PUB EMP	RET EMP	OFF EMP	IND EMP	TOTAL EMP
1557	319	6400	0	78	36	6514	21	204	287	94	0	606
1558	319	3458	0	28	15	3501	6	90	175	0	21	292
1559	319	3977	0	13	17	4007	48	0	0	0	4	52
1560	319	3598	0	10	15	3623	43	280	78	0	0	401
1561	319	1669	0	7	11	1687	11	0	716	74	674	1475
1562	319	23881	0	160	140	24181	221	241	1496	743	904	3605
1563	319	3990	0	55	28	4073	24	472	77	57	27	657
1564	319	7196	0	14	25	7235	202	0	320	1274	356	2152
1565	319	5140	0	97	21	5258	0	64	352	0	0	416
1566	319	8514	0	59	49	8622	0	409	526	228	628	1791
1567	319	6404	0	123	38	6565	7	566	312	13	0	898
1568	319	5355	0	13	22	5390	0	79	142	0	0	221
1569	319	4810	0	74	66	4950	117	110	218	0	0	445
1570	329	4192	0	27	22	4241	0	0	139	0	0	139
1571	329	4648	0	23	22	4693	306	220	615	0	0	1141
1572	329	4145	0	19	17	4181	0	33	138	57	4	232
1573	329	2396	0	17	11	2424	155	241	374	0	5	775
1574	329	5025	0	18	19	5062	264	223	573	0	0	1060
1575	329	5417	0	12	22	5451	46	0	78	0	0	124
1576	329	0	0	0	0	0	0	20	69	0	0	89
1577	329	3369	0	30	16	3415	21	15	211	0	0	247
1578	329	3693	0	33	19	3745	1	562	71	0	0	634
1616	318	2197	0	39	2	2238	0	0	463	0	0	463
1618	318	5388	0	57	17	5462	41	69	1161	610	29	1910
1619	318	4456	0	78	12	4546	9	80	1526	3	0	1618
1911	311	5848	0	116	63	6027	3	3	436	0	0	442
1945	329	2362	0	7	9	2378	69	7	173	0	0	249
1951	329	1879	0	30	12	1921	33	33	110	0	0	176
1953	329	7543	0	39	34	7616	7	224	872	0	40	1143
1963	329	1157	0	8	6	1171	0	4	186	0	107	297
TOTAL					**POP**	**305621**					**EMP**	**120848**

APPENDIX

2031 BASE LEVEL OF SERVICE & DELAY D-1

2031 BASE LOS & DELAY

INTERSECTION	AM		PM	
	LOS	DELAY	LOS	DELAY
McQueen & Guadalupe	F	99	E	67
McQueen & Elliot	E	71	E	72
Cooper & Guadalupe	F	137	F	133
Cooper & Elliot	F	129	F	100
Cooper & Warner	D	50	D	48
Gilbert & Guadalupe	D	46	F	98
Gilbert & Elliot	D	49	E	74
Gilbert & Warner	D	46	E	78
Gilbert & Ray	D	43	E	56
Gilbert & Williams Field	C	35	D	51
Lindsay & Guadalupe	F	166	F	139
Lindsay & Elliot	E	57	E	67
Lindsay & Warner	E	71	E	79
Lindsay & Ray	D	47	D	54
Lindsay & Williams Field	D	40	E	68
Lindsay & Pecos	F	137	F	192
Lindsay & Germann	F	288	F	156
Lindsay & Queen Creek	D	33	C	35
Val Vista & Baseline	F	83	F	117
Val Vista & Guadalupe	E	60	F	82
Val Vista & Elliot	D	47	E	57
Val Vista & Warner	D	40	E	64
Val Vista & Ray	E	56	F	99
Val Vista & Williams Field	D	41	C	35
Val Vista & Pecos	C	32	C	31
Val Vista & Germann	F	122	F	112
Val Vista & Queen Creek	D	49	F	86
Val Vista & Ocotillo	F	479	F	566
Val Vista & Chandler Heights	D	53	F	114
Val Vista & Riggs	C	31	D	41
Greenfield & Baseline	D	52	F	91
Greenfield & Guadalupe	D	38	E	78

2031 BASE LOS & DELAY (CONTINUED)

INTERSECTION	AM		PM	
	LOS	DELAY	LOS	DELAY
Greenfield & Elliot	E	80	E	79
Greenfield & Warner	D	41	F	127
Greenfield/Santan Village & Ray	D	37	D	48
Greenfield/Santan Village & Williams Field	C	29	D	41
Greenfield/Santan Village & Pecos	F	99	D	43
Greenfield & Germann	F	107	F	156
Greenfield & Queen Creek	F	101	F	117
Greenfield & Ocotillo	D	41	E	71
Greenfield & Chandler Heights	C	35	C	21
Market & Williams Field	B	15	C	31
Higley & Baseline	D	40	E	62
Higley & Guadalupe	D	39	E	80
Higley & Elliot	C	32	E	58
Higley & Warner	F	3311	F	2246
Higley & Ray	D	39	D	45
Higley & Williams Field	F	160	F	176
Higley & Pecos	F	90	D	51
Higley & Germann	D	39	D	51
Higley & Queen Creek	C	33	D	41
Higley & Ocotillo	E	59	D	55
Higley & Chandler Heights	D	53	D	50
Higley & Riggs	C	33	D	36
Recker & Baseline	C	34	C	27
Recker & Guadalupe	D	46	D	39
Recker & Elliot	F	139	D	45
Recker & Warner	F	245	F	1358
Recker & Ray	D	41	F	131
Recker & Williams Field	C	31	D	42
Recker & Pecos	C	34	D	36
Power & Pecos	C	33	D	47
Power & Germann	D	49	D	37
Power & Queen Creek	C	30	C	34

APPENDIX

2012-2017 CIP PROJECT SUMMARY E-1

2012-2017 CIP PROJECT SUMMARY

	AM		PM	
Intersection/Improvement	**LOS**	**Delay**	**LOS**	**Delay**
Cooper/Guadalupe	F	137	F	133
CIP-dual left all approaches	F	155	F	108
Cooper/Elliot	F	129	F	100
CIP-dual left all approaches	F	109	F	111
Val Vista/Guadalupe	E	60	F	82
CIP-dual left all approaches	E	63	E	71
Greenfield/Elliot	E	80	F	79
CIP-dual left all approaches	E	75	F	88
Higley/Warner - add left turn phases	F	3311	F	2246
CIP-3 thru 1 left all approaches	E	77	E	63
Gilbert/Guadalupe	D	46	F	98
CIP-dual left all approaches	D	39	E	59
Gilbert/Elliot	D	49	E	74
CIP-dual left all approaches	D	52	E	62
Lindsay/Germann	F	288	F	156
CIP-3thru E/W 2 thru N/S	D	53	E	57
Val Vista/Ocotillo	F	479	F	566
CIP-2thru WB 2 thru N/S 1 left all approaches	C	32	E	62
Greenfield/Guadalupe	D	38	E	78
CIP-dual left all approaches	D	40	F	86
Greenfield/Warner	D	41	F	127
CIP-dual left all approaches	D	38	F	119
Gilbert/Ray	D	43	E	56
CIP-dual left all approaches	D	42	D	51
Val Vista/Elliot	D	47	E	57
CIP-dual left all approaches	D	39	D	52

2012-2017 CIP PROJECT SUMMARY (CONTINUED)

	AM		PM	
Intersection/Improvement	**LOS**	**Delay**	**LOS**	**Delay**
Val Vista/Germann	F	122	F	112
CIP-dual left, 3 thru all approaches, right N/S	D	47	D	44
Greenfield/Germann	F	107	F	156
CIP-3 thru E/W	C	30	D	35+
Higley/Elliot	C	32	E	58
CIP-dual left N/S	D	42	D	55
Higley/Williams Field	F	160	F	176
CIP-3 thru 2 left all approaches	D	43	D	45
Higley/Ocotillo	E	59	D	55
CIP-2 thru WB 3 thru NB	D	36	D	42
Recker/Ray	D	41	F	131
CIP-3 thru E/W 2 thru SB	C	24	D	39

APPENDIX

2031 LEVEL OF SERVICE & DELAY WITH CIP F-1

2031 LOS & DELAY WITH CIP

INTERSECTION	AM		PM	
	LOS	DELAY	LOS	DELAY
McQueen & Guadalupe	F	98	E	67
McQueen & Elliot	E	71	E	72
Cooper & Guadalupe	F	155	F	108
Cooper & Elliot	F	109	F	111
Cooper & Warner	D	51	D	48
Gilbert & Guadalupe	D	39	E	59
Gilbert & Elliot	D	52	E	62
Gilbert & Warner	D	45	E	77
Gilbert & Ray	D	42	D	51
Gilbert & Williams Field	D	37	D	52
Lindsay & Guadalupe	F	166	F	139
Lindsay & Elliot	E	57	E	67
Lindsay & Warner	E	71	E	79
Lindsay & Ray	D	47	E	56
Lindsay & Williams Field	D	39	E	68
Lindsay & Pecos	F	139	F	183
Lindsay & Germann	D	53	E	57
Lindsay & Queen Creek	D	36	C	34
Val Vista & Baseline	F	83	F	117
Val Vista & Guadalupe	E	63	E	71
Val Vista & Elliot	D	38	D	52
Val Vista & Warner	D	42	E	65
Val Vista & Ray	E	56	F	99
Val Vista & Williams Field	D	41	C	35
Val Vista & Pecos	C	32	C	31
Val Vista & Germann	D	47	D	44
Val Vista & Queen Creek	D	51	F	86
Val Vista & Ocotillo	C	32	E	62
Val Vista & Chandler Heights	C	25	C	29
Val Vista & Riggs	C	30	D	39
Greenfield & Baseline	D	51	F	93
Greenfield & Guadalupe	D	40	F	86

2031 LOS & DELAY WITH CIP (CONTINUED)

INTERSECTION	AM		PM	
	LOS	DELAY	LOS	DELAY
Greenfield & Elliot	E	75	F	88
Greenfield & Warner	D	38	F	119
Greenfield/Santan Village & Ray	D	37	D	48
Greenfield/Santan Village & Williams Field	C	29	D	41
Greenfield/Santan Village & Pecos	F	101	D	44
Greenfield & Germann	C	30	C	35
Greenfield & Queen Creek	F	102	F	121
Greenfield & Ocotillo	C	35	D	39
Greenfield & Chandler Heights	A	10	B	17
Market & Williams Field	B	15	D	48
Higley & Baseline	D	40	E	62
Higley & Guadalupe	D	40	F	81
Higley & Elliot	C	35	D	52
Higley & Warner	E	77	E	63
Higley & Ray	D	39	D	41
Higley & Williams Field	D	43	D	45
Higley & Pecos	F	90	D	51
Higley & Germann	D	38	E	57
Higley & Queen Creek	D	36	D	42
Higley & Ocotillo	D	36	D	42
Higley & Chandler Heights	D	54	D	51
Higley & Riggs	C	34	D	36
Recker & Baseline	C	34	C	26
Recker & Guadalupe	D	46	D	39
Recker & Elliot	F	140	D	50
Recker & Warner	F	249	F	1356
Recker & Ray	C	24	D	39
Recker & Williams Field	C	32	D	39
Recker & Pecos	C	34	D	36
Power & Pecos	C	33	D	47
Power & Germann	D	49	D	37
Power & Queen Creek	C	30	C	34

APPENDIX

2031 LEVEL OF SERVICE & DELAY WITH SUGGESTED IMPROVEMENTS .G-1

2031 LOS & DELAY WITH SUGGESTED IMPROVEMENTS

INTERSECTION	AM		PM	
	LOS	DELAY	LOS	DELAY
McQueen & Guadalupe	D	51	D	47
McQueen & Elliot	D	53	D	54
Cooper & Guadalupe	D	50	D	45
Cooper & Elliot	D	43	D	46
Cooper & Warner	D	52	D	47
Gilbert & Guadalupe	C	33	D	54
Gilbert & Elliot	D	47	D	49
Gilbert & Warner	C	32	D	54
Gilbert & Ray	D	42	D	52
Gilbert & Williams Field	D	37	D	52
Lindsay & Guadalupe	D	47	D	50
Lindsay & Elliot	D	38	D	48
Lindsay & Warner	D	51	D	48
Lindsay & Ray	D	41	D	50
Lindsay & Williams Field	D	39	E	58
Lindsay & Pecos	D	44	D	48
Lindsay & Germann	D	53	D	53
Lindsay & Queen Creek	D	37	C	35
Val Vista & Baseline	D	40	E	59
Val Vista & Guadalupe	D	49	D	54
Val Vista & Elliot	D	39	D	53
Val Vista & Warner	D	42	D	53
Val Vista & Ray	D	50	E	62
Val Vista & Williams Field	D	40	C	35
Val Vista & Pecos	C	32	C	31
Val Vista & Germann	D	47	D	44
Val Vista & Queen Creek	D	45	D	54
Val Vista & Ocotillo	C	30	D	53
Val Vista & Chandler Heights	C	25	C	30
Val Vista & Riggs	C	30	D	40
Greenfield & Baseline	D	41	D	49
Greenfield & Guadalupe	D	39	D	53

2031 LOS & DELAY WITH SUGGESTED IMPROVEMENTS (CONTINUED)

INTERSECTION	AM		PM	
	LOS	DELAY	LOS	DELAY
Greenfield & Elliot	D	37	D	54
Greenfield & Warner	D	35	E	57
Greenfield/Santan Village & Ray	D	39	D	51
Greenfield/Santan Village & Williams Field	C	30	D	41
Greenfield/Santan Village & Pecos	C	33	D	46
Greenfield & Germann	C	30	D	36
Greenfield & Queen Creek	C	30	D	39
Greenfield & Ocotillo	C	35	D	37
Greenfield & Chandler Heights	A	10	B	16
Market & Williams Field	B	15	C	31
Higley & Baseline	D	41	D	53
Higley & Guadalupe	D	37	E	62
Higley & Elliot	D	42	D	55
Higley & Warner	D	49	D	55
Higley & Ray	D	39	D	41
Higley & Williams Field	D	44	D	48
Higley & Pecos	D	42	D	43
Higley & Germann	D	38	D	54
Higley & Queen Creek	C	35	D	41
Higley & Ocotillo	D	36	D	42
Higley & Chandler Heights	D	54	D	52
Higley & Riggs	C	34	D	36
Recker & Baseline	C	35	C	32
Recker & Guadalupe	D	47	D	39
Recker & Elliot	D	45	D	38
Recker & Warner	C	35	D	37
Recker & Ray	C	24	D	42
Recker & Williams Field	C	29	D	42
Recker & Pecos	C	21	D	36
Power & Pecos	C	33	D	47
Power & Germann	D	49	D	37
Power & Queen Creek	C	30	C	34

APPENDIX

PRIORITY RANKING H-1

PRIORITY RANKING

INTERSECTION	LOS RANK	CRASH RANK	LOS + CRASH RANK
Higley & Warner	1	6	**1**
Higley & Williams Field	5	4	**2**
Cooper & Guadalupe	8	5	**3**
Cooper & Elliot	10	10	**4**
Greenfield & Germann	9	14	**5**
Val Vista & Baseline	13	12	**6**
Gilbert & Guadalupe	25	1	**7**
Val Vista & Ray	15	13	**8**
Val Vista & Guadalupe	17	11	**8**
Val Vista & Ocotillo	2	27	**10**
Val Vista & Germann	11	21	**11**
Lindsay & Guadalupe	7	28	**12**
McQueen & Elliot	21	16	**13**
Val Vista & Chandler Heights	14	24	**14**
Higley & Pecos	29	9	**14**
McQueen & Guadalupe	20	22	**16**
Lindsay & Elliot	26	17	**17**
Lindsay & Warner	18	26	**18**
Val Vista & Elliot	36	8	**18**
Higley & Baseline	42	2	**18**
Cooper & Warner	38	7	**21**
Val Vista & Warner	43	3	**22**
Greenfield/Santan Village & Pecos	32	15	**23**
Greenfield & Baseline	19	30	**24**
Gilbert & Warner	30	20	**25**
Lindsay & Germann	4	48	**26**
Greenfield & Elliot	16	37	**27**
Recker & Ray	22	33	**28**

PRIORITY RANKING (CONTINUED)

INTERSECTION	LOS RANK	CRASH RANK	LOS + CRASH RANK
Lindsay & Pecos	6	50	**29**
Higley & Guadalupe	34	25	**30**
Greenfield & Guadalupe	40	19	**30**
Recker & Warner	3	57	**32**
Gilbert & Elliot	28	34	**33**
Greenfield & Queen Creek	10	56	**34**
Val Vista & Queen Creek	24	43	**35**
Greenfield & Warner	23	45	**36**
Val Vista & Williams Field	51	18	**37**
Recker & Guadalupe	47	23	**38**
Lindsay & Williams Field	39	35	**39**
Higley & Germann	45	31	**40**
Gilbert & Ray	41	36	**41**
Recker & Elliot	27	52	**42**
Lindsay & Ray	37	42	**42**
Higley & Chandler Heights	35	47	**44**
Gilbert & Williams Field	46	38	**45**
Higley & Elliot	48	39	**46**
Higley & Riggs	56	32	**47**
Val Vista & Pecos	62	29	**48**
Higley & Ocotillo	31	61	**49**
Greenfield & Ocotillo	33	63	**50**
Power & Pecos	52	44	**50**
Greenfield/Santan Village & Wlms Field	57	40	**52**
Higley & Ray	49	49	**53**
Higley & Queen Creek	53	46	**54**
Greenfield & Chandler Heights	61	41	**55**
Greenfield/Santan Village & Ray	50	55	**56**

PRIORITY RANKING (CONTINUED)

INTERSECTION	LOS RANK	CRASH RANK	LOS + CRASH RANK
Recker & Williams Field	54	51	**56**
Power & Germann	44	62	**58**
Recker & Pecos	55	53	**59**
Recker & Baseline	60	54	**60**
Val Vista & Riggs	58	58	**61**
Lindsay & Queen Creek	59	59	**62**
Power & Queen Creek	63	60	**63**
Market & Williams Field	64	64	**64**

APPENDIX

ADDITIONAL IMPROVEMENT SUMMARY..... I-1

ADDITIONAL IMPROVEMENT SUMMARY

	AM		PM	
Intersection/Improvement	**LOS**	**Delay**	**LOS**	**Delay**
McQueen/Guadalupe	F	99	E	67
NB/SB dual left lanes	F	88		
add EB/WB third thru lanes-no EB right lane	D	51	E	56
add EB right lane	D	51	D	47
McQueen/Elliot	E	71	E	72
add NB/SB right lane	D	53		
NB/SB dual left lanes	D	53	D	54
Cooper/Guadalupe	F	155	F	108
add NB/SB right lane	F	129		
add NB/SB third thru	E	75		
add EB/WB right lane	E	59		
add EB/WB third thru lane-no right lane EB or WB	D	50	D	45
Cooper/Elliot	F	109	F	111
add NB/SB/EB/WB right lanes	E	73		
add NB/SB third thru lane-no right lane NB or SB	D	42	D	46
Lindsay/Guadalupe	F	166	F	139
NB/SB dual left lanes	F	142		
add NB/SB third thru lane	F	80		
add EB/WB third thru lane	D	47	D	50
Lindsay/Elliot	E	57	E	67
add WB right lane	D	42	E	73
add EB right lane	D	38	D	48
Lindsay/Warner	E	71	E	79
NB/SB dual left lanes	E	62		
EB/WB dual left lanes	E	57		
add NB/SB third thru-no right N/S	D	48		
remove EB/WB dual left	D	50	D	48

ADDITIONAL IMPROVEMENT SUMMARY (CONTINUED)

Lindsay/Pecos	F	137	F	182
EB/WB two thru lanes	F	93		
add WB right lane	E	58		
NB/SB two thru lanes	E	61		
add NB right lane	D	43	E	48
add SB right lane			D	48
Val Vista/Baseline	F	83	F	117
NB three thru lanes-no right lane NB	E	61		
add EB/WB right lanes	D	54	F	83
EB/WB dual left lanes			E	66
add NB right lane			E	64
NB/SB dual left lanes	D	40	E	59
Val Vista/Guadalupe	E	63	E	71
add WB right lane	D	48	E	71
add EB right lane	D	49	D	54
Val Vista/Ray	E	56	F	99
add SB right lane	D	54		
NB/SB dual left lanes			E	68
add EB right lane	D	51	E	62
(tried E/W dual left and 3 thru E/W - still not LOS D)				
Greenfield/Elliot	E	75	F	88
add WB right lane	D	48		
add SB right lane			E	66
add NB/SB third thru lanes-no right lane NB	D	37	D	54
Greenfield/Pecos	F	99	D	43
WB dual right lanes	C	33	D	46
Greenfield/Queen Creek	F	101	F	117
add WB right lane	D	36		
NB/SB dual left lanes			F	87
add EB/WB third thru lane-no right lane EB or WB	C	30	D	39
Higley/Warner - add left turn phases	E	77	E	63
NB & SB right lanes	D	48		
NB/SB dual left lanes	D	49	D	55

ADDITIONAL IMPROVEMENT SUMMARY (CONTINUED)

Higley/Pecos	F	90	D	51
NB/SB dual left lanes (no SB right lane)	D	42	D	43
Recker/Elliot	F	139	D	45
left and two thru lanes all approaches	D	46	D	38
Gilbert/Guadalupe	D	39	E	59
add WB right lane			E	58
add SB right lane	C	33	D	54
Gilbert/Elliot	D	52	E	62
add NB right lane			E	58
add EB right lane	D	47	D	49
Gilbert/Warner	D	46	E	78
add EB right lane			E	65
NB/SB dual left lanes	C	32	D	54
Lindsay/Ray	D	47	E	54
add EB&WB right lane	D	41	D	50
Lindsay/Williams Field	D	40	E	68
NB/SB dual left lanes-no right lanes NB or SB			E	64
EB/WB dual left lanes	D	39	E	58
(tried E/W right - still not LOS D)				
Lindsay/Germann	D	53	E	57
add EB right lane	D	53	D	52
Val Vista/Warner	D	40	E	64
add SB right lane	D	42	D	53
Val Vista/Queen Creek	D	49	F	86
NB/SB dual left lanes	D	45	D	54
Val Vista/Ocotillo	C	32	E	62
EB 2 thru lanes	C	30	D	53

ADDITIONAL IMPROVEMENT SUMMARY (CONTINUED)

Greenfield/Baseline	D	52	F	91
EB & WB right lanes			E	71
EB/WB dual left lanes			E	60
NB/SB dual left lanes			E	56
add NB/SB third thru lane-no right lane NB or SB	D	41	D	49
Greenfield/Guadalupe	D	40	F	86
add NB/SB third thru lane-no right lane NB or SB			E	55
add EB right lane	D	39	D	53
Greenfield/Warner	D	38	F	119
add EB right lane			F	99
add NB/SB third thru lane-no right lane NB or SB			E	59
add NB right lane	D	36	E	56
Higley/Baseline	D	40	E	62
NB/SB dual left lanes	D	41	D	53
Higley/Guadalupe	D	39	E	80
NB/SB dual left lanes			E	64
add EB/WB third thru lane & right lane EB & WB	D	37	E	62
(tried E/W dual left - still not LOS D)				
Higley/Germann	C	39	D	51
NB/SB dual left lanes	D	38	D	54
Recker/Warner - add left turn phases	F	245	F	1356
left and two thru all approaches	C	35	D	37
Val Vista/Chandler Heights	D	53	F	126
2 thru all approaches, remove WB right	C	25	C	31
Greenfield/Ocotillo	D	41	E	71
2 thru E/W N/S left remove WB right	D	35	D	38
Recker/Guadalupe	D	50	D	41
EB right lane	D	47	D	39