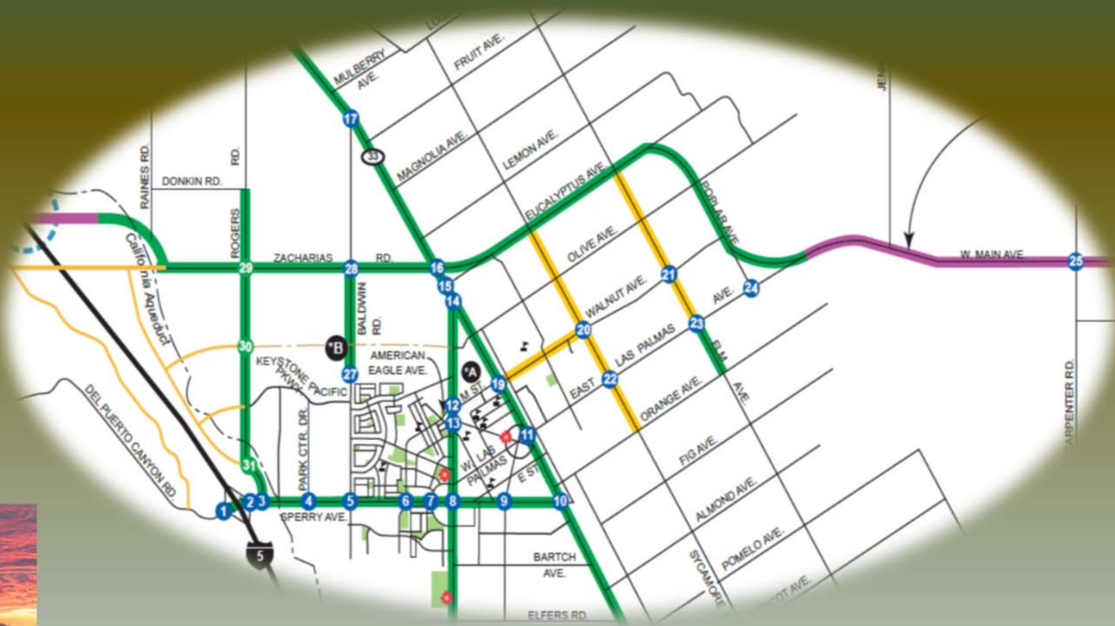
Final Report

City of Patterson Transportation Infrastructure Master Plan

In the City of Patterson, CA

March 6, 2020



City of Patterson Transportation Infrastructure Master Plan

Final Report

Prepared for:
The City of Patterson

Prepared by:
Advanced Mobility Group

March 6, 2020

Table of Contents

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

1.0 INTRODUCTION AND EXECUTIVE SUMMARY

INTRODUCTION

The purpose of this study is to document the process and recommendations of the Patterson Transportation Infrastructure Master Plan (TIMP). The Patterson TIMP was started in late 2011. However, the project was put on hold several times due to unforeseen events and challenges.

A substantial amount of technical work was completed before the project was put on hold in 2013. As a part of the 2011 scope, traffic forecasts were completed for two scenarios:

- Short Range10-year and
- Long Range Buildout scenarios.

Similar to the 2010 General Plan Update project, a long-range traffic-forecasting model was used to assess the impact of the future 10-year and Buildout developments. The StanCOG (Stanislaus County Council of Governments) countywide gravity-based model was used in the study.

The TIMP provides a short-term and long-term basis to guide the City on infrastructure improvements by anticipating and accommodating growth in a way that maintains an acceptable quality of life for Patterson residents, businesses, and visitors alike.

The goal of the TIMP is an attempt to identify Patterson's existing and future roadway infrastructure problem areas and potential solutions that may occur through a combination of public and private infrastructure investments.

With an adopted TIMP, its findings can be used as a tool to help the City plan for anticipated growth in the future based on its adopted General Plan and approved projects. The TIMP would be flexible and readily updatable as new information emerges regarding development plans on specific parcels and will assist the City in evaluating parcel development plans as they come on line.

Study Scenarios

Based on consultation with project coordinator at that time, two land use scenarios were used in the model forecasts and analysis:

- 10-Year Scenario - assumed a population of approximately 28,900 and 21,980 jobs.
- TIMP Master Plan Buildout Scenario - assumed a population of approximately 66,300 and 81,300 jobs.

SUMMARY

The following conclusions are based on the results of the TIMP Analysis:

Existing Conditions
Overall, key intersections in the City operates relatively well for the most part as shown in Table 2. The exception includes the I-5 Southbound Off- Ramps at Sperry Avenue which operate at LOS F during the PM peak hour and the intersections of Sperry Avenue/SR 33 and Rogers Road/SR 33 which operate at LOS E during the PM peak hour.

Near-Term 10-Year Scenario
The 10-Year Scenario assumed a population of approximately 28,900 and 21,980 jobs. Conceptual intersection improvements for all study intersections that require improvements were identified along with potential improvement measures.

The estimated total improvement cost for 17 intersections is estimated to be approximately $26.5 million. The cost to improve the Sperry Avenue and I-5 interchange was estimated separately by the Interstate 5 / Sperry Ave Interchange Improvements Project at between $11.3 million and $14.6 million.

Buildout Assumptions
The assumed population and jobs at master plan buildout is approximately 66,300 residents and 81,300 jobs. Compared to the existing land use, this would be approximately a threefold increase in population and nearly 12-fold increase in jobs.

It is estimated that major roadway improvements would be required to accommodate the projected traffic growth due to buildout of land use in the future. In general, it could be assumed that major four-lane roads for all the major north-south and east-west arterials would be required. Improvements in general will be roadway widening to add lanes, new traffic signal installations (or roundabouts), and additional improvements to promote pedestrian and bicycle use. Preliminary buildout roadway improvement cost estimates for buildout projects were estimated.

In addition, it is also assumed that major improvements would be required at the Sperry Road & I-5 interchange and a new interchange in the vicinity of I-5 & Zacharias Road would be necessary. The proposed South County Corridor is assumed to be aligned generally along W Main Avenue/Eucalyptus Avenue/Zacharias Avenue route. It would be in line with the recommended alternative in the recently completed South County Corridor Feasibility Study.[1]

Advance Technology
Based on projected population and job growth at buildout, it is anticipated that at least 50-60 signals could be installed and operated. To effectively facilitate the smooth flow of traffic and safely accommodate pedestrians and bicycles, the City of Patterson should adopt a plan for an Advanced Traffic Management System (ATMS) and develop a Traffic Signal Master Plan.

[1] *South County Corridor Feasibility Study, May 18, 2016*

2.0 EXISTING CONDITION

The City of Patterson is located approximately 35 miles south of the junction of I-205 and I-5. Like most cities in the Central Valley, it was originally built to support the agricultural economic development of the surrounding area.

The City has seen steady population growth in the last 35 years. Substantial growth occurred between 1980 and 1990, with an annual population growth rate of approximately 12 percent, from approximately 3,908 to 8,626 in 1990. Growth slowed somewhat after 1990, with an annual rate of approximately 3-5 percent to a population of approximately 20,437 in 2010. The current population is approximately 24,000, reflecting substantial growth in the past 25 years as shown in **Table 1**.

Table 1: City of Patterson Population Growth

Year	Population
2015	20,639
2010	20,437
2005	15,418
2000	11,606
1995	9,475
1990	8,626
1980	3,908

Period	Ave. growth per Yr. =
1990-2015	6%
2000-2015	5%
1990-2000	3%
1980-1990	12%

Sources:
CA State Dept of Finance's Demographic Research Unit
United States Census Bureau

EXISTING ROADWAY NETWORK

Figure 1 shows the existing key roadways and circulation system in the city. Important roadways in the city are described below:

Interstate 5 (I-5) is a four-lane freeway near Patterson. Based on 2016 traffic counts obtained from the Caltrans website, I-5 carries between 40,000 to 48,000 vehicles per day (vpd) in the vicinity of Sperry Avenue. For regional travel, residents rely primarily on I-5, a major north-south freeway to the west of the city limits. I-5 connects to I-580, approximately 15 miles to the north of Patterson. I-5 and I-580 provide access to regional employment centers in Pleasanton, San Ramon, and the rest of the San Francisco Bay Area.

State Route 33 (SR-33) is located approximately three miles to the east of I-5. SR-33 provides north-south access to Westley to the north and the City of Newman to the south. Its ADT is approximately 6,000 vpd. It is the main north-south roadway in Patterson.

Sperry Avenue is a two- to four-lane major arterial roadway that serves as the primary east-west route of travel between I-5 and the City of Patterson. Sperry Avenue terminates at SR-33, three miles east of I-5. Near the freeway, its ADT is approximately 12,000 to 14,000 vpd. A recent count to the east of Rogers Road showed the ADT to be approximately 15,040 vpd.

City of Patterson - Transportation Infrastructure Master Plan

Existing Key Roadways and Circulation System

Figure 1

LEGEND

- Schools
- Community Destinations
- Parks and Recreation Facilities

AMG ADVANCED MOBILITY GROUP

P1811154 - 2/19/19 CT

Rogers Road is a north-south two to four lane roadway with a posted speed limit of 25 mph within the City of Patterson and provides connectivity to Sperry Road and California State Route 33 to the north. The average weekday daily traffic along Rogers Road is approximately 2,400 vpd.

East Las Palmas Avenue is a three-lane major east-west arterial including a center two-way left-turn lane between SR-33 and Sycamore Avenue, where it narrows to a two-lane road. To the west of SR-33, four streets form a roundabout at Las Palmas Avenue. Most traffic destined for Modesto currently uses Las Palmas Avenue. Its ADT is approximately 11,800 vpd.

Ward Avenue is generally a two-lane north-south collector street that connects SR-33 in the north to Sperry Avenue in the south. The road extends further south and connects with Fink Road. Its ADT is approximately 5,000 vpd north of Sperry Avenue.

LEVEL OF SERVICE ANALYSIS METHODOLOGY

Level of Service is a qualitative index of the performance of an element of the transportation system. Level of Service (LOS) is a rating scale running from A to F, with A indicating no congestion of any kind, and F indicating intolerable congestion and delays during a peak hour.

The *2000 Highway Capacity Manual (HCM)* is the standard reference published by the Transportation Research Board, and contains the specific criteria and methods to be used in assessing LOS. There are several software packages that have been developed to implement HCM. In this study, the Synchro software was used to calculate the LOS at the study intersections. A detailed description of the methodology is provided in **Appendix A**.

STANDARDS OF SIGNIFICANCE

The City's 2010 General Plan policy states that "The City shall endeavor to maintain a Level of Service (LOS) "D", as defined by the 2000 Highway Capacity Manual (HCM) or subsequent revisions, on all streets and intersections within the City."

OTHER STANDARDS

The minimum acceptable level of service standard for Stanislaus County roadway segments is LOS C. Therefore, this report uses LOS C as the minimum acceptable standard and mitigation measures are recommended where service levels are below LOS C along roadways within the unincorporated areas of Stanislaus County.

Facilities under Caltrans jurisdiction include freeway segments, ramps, ramp terminals, and arterials. Caltrans standards strive to maintain acceptable traffic operations on state facilities between LOS C and LOS D. Mitigation measures are recommended where service levels exceed this LOS C/D transition.

EXISTING TRAFFIC VOLUMES AND LEVEL OF SERVICE ANALYSIS

The existing intersection levels of service analysis results for selected study intersections are shown in **Table 2**. Results indicated that the existing stop-controlled Sperry Avenue & I-5 SB Ramps is operating at LOS F during the PM peak hour. In addition, the intersections of Sperry Avenue/SR 33 and Rogers Road/SR 33 operate at LOS E during the PM peak hour. All other intersections are operating at LOS D or better.

Table 2: Intersection Levels of Service – Existing Conditions

ID	Intersection	Existing Control	A.M.		P.M.	
			Delay	LOS	Delay	LOS
1	Sperry Avenue/I-5 SB Ramps	OWSC	15.3	C	**67.9**	**F**
2	Sperry Avenue/I-5 NB Ramp	OWSC	10.6	B	15.8	C
3	Sperry Avenue/Rogers Road	Signal	17.4	B	14.4	B
4	Sperry Avenue/Park Center Drive	Signal	9.2	A	12.4	B
5	Sperry Avenue/Baldwin Road	Signal	19.9	B	20.0	B
6	Sperry Avenue/American Eagle Drive	Signal	17.5	B	13.3	B
7	Sperry Avenue/W. Las Palmas Avenue	Signal	29.1	C	30.3	C
8	Sperry Avenue/Ward Avenue	Signal	33.0	C	30.3	C
9	Sperry Avenue/S Del Puerto Avenue	Signal	8.1	A	7.0	A
10	Sperry Avenue/SR-33	TWSC	27.7	D	35.1	**E**
11	SR-33/E. Las Palmas Avenue	Signal	18.6	B	17.4	B
12	Ward Ave/American Eagle Ave/M St	Signal	36.7	D	29.6	C
14	Ward Avenue/SR-33	OWSC	16.3	C	19.0	C
15	Eucalyptus Ave/SR-33	OWSC	14.4	B	16.2	C
16	Zacharias Road/SR-33	OWSC	10.6	B	12.9	B
17	Baldwin Road/SR-33	OWSC	17.5	C	18.8	C
18	Rogers Road/SR-33	OWSC	18.4	C	36.6	**E**
19	Walnut Ave/M Street/SR-33	Signal	30.2	C	22.8	C
22	E. Las Palmas Ave/Sycamore Avenue	Signal	16.5	B	17.5	B
23	E. Las Palmas Ave/Elm Avenue	Signal	9.7	A	12.0	B
24	Poplar Avenue/Las Palmas Avenue	OWSC	12.5	B	19.2	C
25	Carpenter Road/West Main Avenue	AWSC	12.9	B	21.2	C

Note: *Analysis based on available 2017, 2018 or 2019 counts and estimates.*
OWSC - One-Way Stop; TWSC - Two-Way Stop; AWSC - All-Way Stop

EXISTING CONSTRAINTS

Overall, key intersections in the City operates relatively well for the most part as shown in Table 2. The exception is the I-5 Southbound Off- Ramps at Sperry Avenue which operate at LOS F during the PM peak hour. The off-ramp is currently stop control and it is the major gateway into the city from I-5. All traffic at the southbound off-ramp needs to stop which contributes to LOS F condition.

A Project Report and Project Approval & Environmental Documentation (PA & ED) is currently underway and the final design is estimated to be completed soon. [2]

EXISTING BICYCLE PLAN

Caltrans classifies bicycle facilities as documented in Chapter 1000: Bikeway Planning and Design of the Highway Design Manual (5th Edition, California Department of Transportation, January 2015). The Caltrans standards provide for four distinct types of bikeway facilities, as generally described below:

- *Class I Bikeway (Bike Path)* – Provides a completely separate right-of-way and is designated for the exclusive use of bicycles and pedestrians with vehicle and pedestrian cross-flow minimized.
- *Class II Bikeway (Bike Lane)* – Provides a restricted right-of-way and is designated for the use of bicycles with a striped lane on a street or highway. Vehicle parking and vehicle/pedestrian crossflow are permitted.
- *Class III Bikeway (Bike Route)* – Provides for a right-of-way designated by signs or pavement markings for shared use with pedestrians or motor vehicles.
- *Class IV Bikeway (Separated Bikeways)* – Separated bikeway for the exclusive use of bicycles and includes a separation required between the separated bikeway and the through vehicular traffic. The separation may include, but is not limited to, grade separation, flexible posts, inflexible posts, inflexible barriers, or on-street parking.

[2] *Based on Interstate 5 / Sperry Ave Interchange Improvements Project, April 20, 2017*

Table 3 outlines the existing bike network facilities and is illustrated in **Figure 2**. Class II facilities are generally found along the downtown portion of the existing urbanized area. These facilities are found along parts of Las Palmas Avenue, Baldwin Road, American Eagle Avenue and 'M' Street.

The Class III Bike Route network is most prevalent in the Central Patterson area. However, there are gaps in the bike routes. Because of these gaps, it is not possible to fully traverse the city traveling north-to-south or east-to-west using the designated bicycle network.

Journey to work data obtained from the 2010 US Census for the City of Patterson, Stanislaus County, California, and the United States are shown in **Table 4**. As shown, only 23 Patterson residents commuted by bicycle. This equates to a bicycle mode share of 0.3% and is below the national, state and county averages of 0.5%, 1.0% and 0.5% respectively. This means that Patterson has a below average bicycle mode share of commuting purposes.

Table 3: Existing City of Patterson Class II & Class III Bikeways

Segment Name	From	To	Bikeway Class	Length (Miles)
American Eagle Ave.	Sperry Ave.	SR-33	II	1.5
Baldwin Rd.	Sperry Ave.	City Limit	II	0.99
E Las Palmas Ave.	S 1st St.	County Line/Ash Ave.	II	2.9
Henley Pkwy.	Baldwin Rd.	Shearwater Dr.	II	0.46
I St.	N Salado Ave.	SR-33	II	0.24
James Burke Ave.	Red Robin Dr.	Pipit Dr.	II	0.34
K St.	N Salado Ave.	SR-33	II	0.39
N 9th St.	Sperry Ave.	Ward Ave.	III	0.68
N Salado Ave.	Ward Ave.	N El Circulo Ave.	II	0.51
New Forest Wy.	Jersey Ln.	Hackney St.	II	0.22
S Del Puerto Ave.	Sperry Ave.	S El Circulo Ave.	III	0.38
Shearwater Dr.	Baldwin Rd.	Henley Pkwy.	II	0.32
Shearwater Dr.	American Eagle Dr.	James Burke Ave.	II	0.37
W Las Palmas Ave.	N 9th St.	S El Circulo Ave.	II	0.33
W Las Palmas Ave.	Sperry Ave.	Ward Ave.	II	0.3
Walker Ranch Pkwy.	Sperry Ave.	Henley Pkwy.	II	0.31
Ward Ave.	N Salado Ave.	Lilac Ave.	II	0.15
			Total	**10.39**

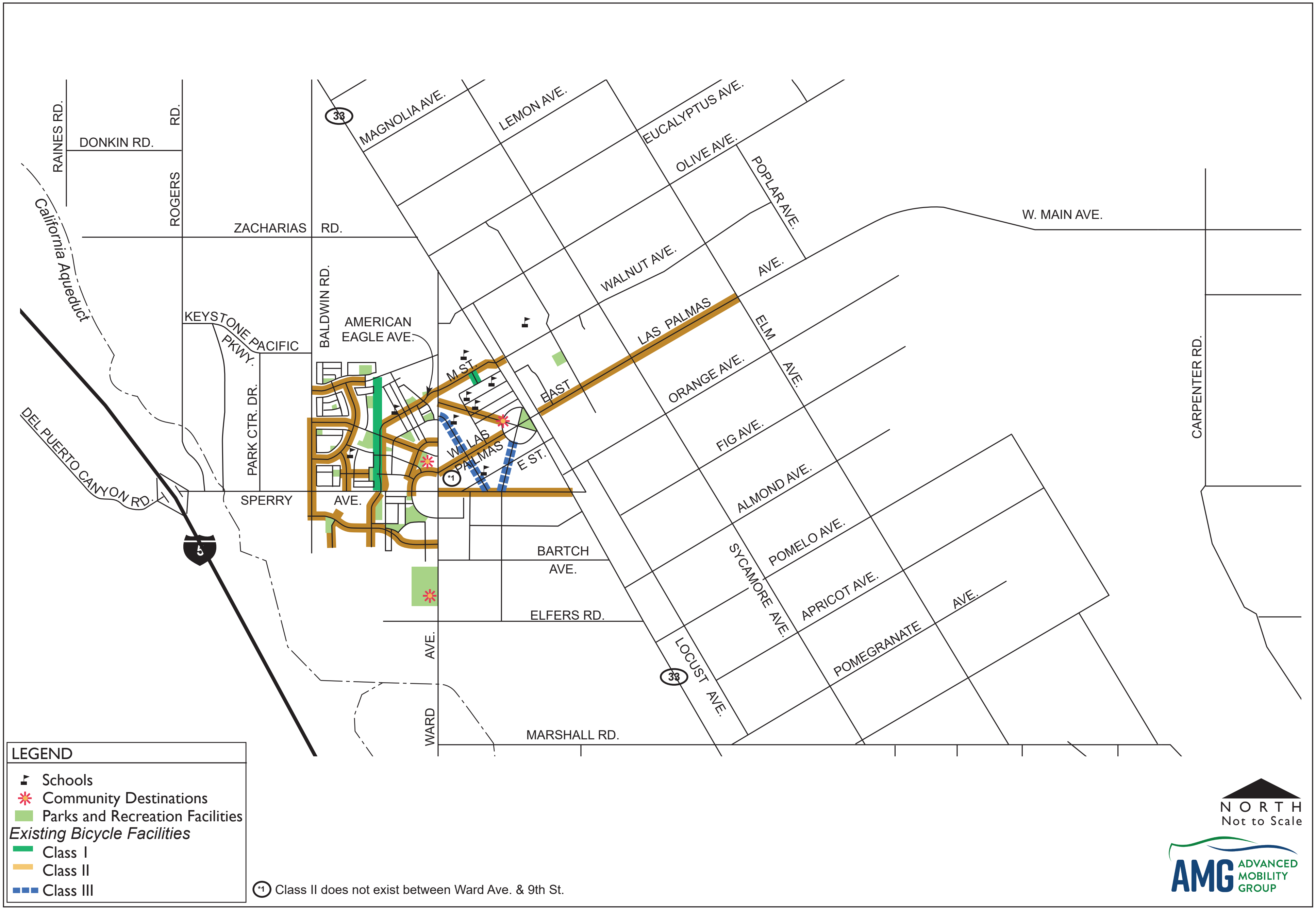
Table 4: Journey to Work Data

Mode	*United States*	*California*	*Stanislaus County*	*City of Patterson*	
				Number	**Percent**
Bicycle	0.5%	1.0%	0.5%	23	0.3%
Drive Alone	79.3%	76.8%	83.4%	5,049	74.3%
Carpool	10.8%	12.5%	11.7%	1,621	23.8%
Public transportation	5.1%	5.4%	0.9%	14	0.2%
Taxicab	0.1%	0.0%	0.0%	0	0.0%
Motorcycle	0.2%	0.4%	0.2%	0	0.0%
Walked	3.0%	2.9%	2.0%	81	1.2%
Total	**100.0%**	**100.0%**	**100.0%**	**6,797**	**100.0%**

Source: *U.S. Census 2010. Percentages reflect percent of workers who do not work from home.*

Existing Bikeways

Figure 2



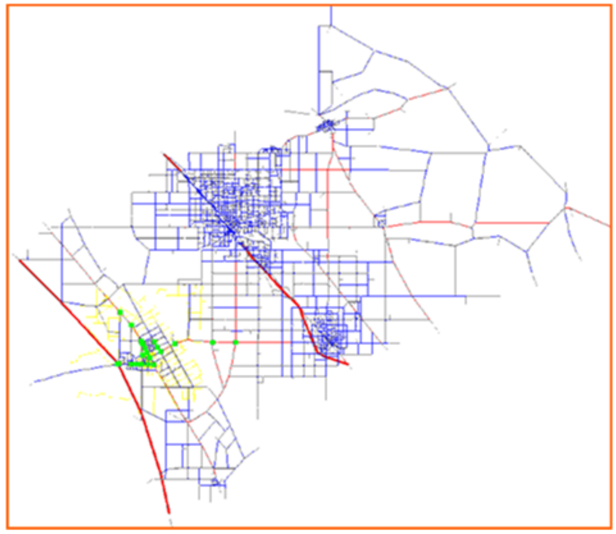
AMG ADVANCED MOBILITY GROUP

P1811154 - 2/19/19 CT

3.0 TRAFFIC DEMAND MODEL

A long-range traffic-forecasting model was used to assess the impact of the proposed Patterson General Plan Update. The StanCOG (Stanislaus County Council of Governments) countywide gravity-based model was used in the study.

The most current StanCOG model[3] at that time was used in the study. The StanCOG model is used for the Stanislaus County Regional Transportation Plan (RTP). The StanCOG modeling area is the whole region where the StanCOG model operates as shown in the figure to the right. It is assumed that this model provides a reasonable travel pattern including the Origin-Destination (OD) demands and the route choices among the different areas within the modeling areas.



An AM and PM peak hour model was developed and validated from the StanCOG model for the City of Patterson. A detailed model calibration was made based on the counts collected at the study intersections and study roadway segments. Detailed Traffic Analysis Zones (TAZs) are used to represent geographical locations in the model.

The most recent land use information was obtained from City staff and the model TAZ updated. Trips are generated at the TAZ level and distributed onto the roadway network.

[3] *StanCOG model was based on a one county model in 2012. It has since incorporated a three-county model*

NEAR-TERM 10-YEAR TRAFFIC CONDITIONS

TRAFFIC FORECAST AND METHODOLOGY

The City of Patterson Model land use and network assumptions were used for the traffic projections. The City provided the land use data and the appropriate Traffic Analysis Zones (TAZs) in the City of Patterson model were modified. As mentioned earlier, the 10-Year Scenario assumed a population of approximately 28,900 and 21,980 jobs.

The peak hour intersection turning movement volumes from the model were used for the near-term 10-year scenario. The projected near-term 10-year peak hour volumes for 29 intersections are shown in **Figure 3**. The results of the LOS analysis with the required near-term intersection improvements are shown in **Table 5**.

Conceptual intersection improvements for all study intersections that require improvements were identified along with potential improvement measures. The conceptual improvement plans are shown in **Appendix B**. Unit cost used in the estimates for improvements at each intersection were estimated based on Caltrans, typical unit cost for the area and consultation with city staff. [4] Detailed cost assumptions based on various categories or items associated with near-term improvements for each intersection are shown in **Appendix C**. Some assumptions include:

- Typical intersection improvements are assumed for 300 feet from each approach to the intersection.
- 10-foot bike lane/shoulders assumed.
- Generally12-foot travel lane.
- Land acquisition assumed based on unit cost provided.

A summary of estimated costs associated with intersection improvements are shown in **Table 6**.

[4] City staff inputs on cost estimate, 2013

Table 5: Near-Term (10-Year) Projection Peak Hour LOS

	Intersection	Existing Control	A.M.		P.M.		Mitigated Control	A.M.		P.M.	
			Delay	LOS	Delay	LOS		Delay	LOS	Delay	LOS
1	Sperry Ave/I-5 SB Ramps	OWSC	15.3	C	67.9	**F**	**Signal** [A]	14.5	B	21.2	C
2	Sperry Ave/I-5 NB Ramps	OWSC	10.6	B	15.8	C	**Signal** [A]	6.4	A	5.9	A
3	Sperry Ave/Rogers Rd	Signal	17.4	B	14.4	B	Signal	12.9	B	13.8	B
4	Sperry Ave/Park Center Dr	Signal	9.2	A	12.4	B	Signal	17.3	B	23.7	C
5	Sperry Ave/Baldwin Rd	Signal	19.9	B	20.0	B	Signal	23.5	C	19.2	B
6	Sperry Ave/American Eagle Dr	Signal	17.5	B	13.3	B	Signal	19.1	B	15.7	B
7	Sperry Ave/W. Las Palmas Ave	Signal	29.1	C	30.3	C	Signal	31.0	C	43.2	D
8	Sperry Ave/Ward Ave	Signal	33.0	C	30.3	C	Signal	46.7	D	34.8	C
10	Sperry Ave/SR-33	TWSC	27.7	D	35.1	**E**	**Signal**	27.7	D	24.3	C
13	Ward Ave/ N. Salado Ave	OWSC	28.8	D	31.2	D	**Signal**	24.8	C	16.6	C
14	Ward Ave/SR-33	OWSC	16.3	C	19.0	C	**Signal**	7.3	A	10.6	B
16	Zacharias Rd/SR-33	OWSC	10.6	B	12.9	B	OWSC	15.2	C	27.1	D
17	Baldwin Rd/SR-33	OWSC	17.5	C	18.8	C	**Signal**	13.2	B	9.7	A
18	Rogers Rd/SR-33	OWSC	18.4	C	36.6	**E**	**Signal**	9.5	A	18.5	C
24	Poplar Ave/Las Palmas Ave	OWSC	12.5	B	19.2	C	**Signal**	3.7	A	7.9	A
25	Carpenter Rd/West Main Ave	AWSC	12.9	B	21.2	C	**Signal**	26.1	D	26.8	D
28	Baldwin Rd/Zacharias Rd	AWSC	8.0	A	7.8	A	**Signal**	23.5	C	18.0	C
29	Zacharias Rd/Rogers Rd	TWSC	10.3	B	10.5	B	**Signal**	26.0	D	24.1	C
30	Keystone Pacific Pkwy/Rogers Rd	OWSC	10.7	B	10.6	B	**Signal**	11.8	B	11.7	B

Note:
[A] – Current on-going project, I-5/Sperry Avenue PAED Study Report, February 2016
OWSC - One Way Stop control, TWSC - Two Way Stop control, AWSC - All Way Stop control

Table 6: Near-Term (10-Year) Intersection Improvement Cost Estimates

ID	Intersections	Cost Estimates
1	Sperry/I-5 Southbound Ramps	$11.3 to $14.6 M
2	Sperry Avenue/I-5 Northbound Ramps	
3	Sperry Avenue/Rogers Road	$1,883,330
4	Sperry Avenue/Park Center Drive	$1,595,006
5	Sperry Avenue/Baldwin Road	$1,441,184
6	Sperry Avenue/American Eagle Way	$118,030
7	Sperry Avenue/Las Palmas Avenue	$107,590
8	Sperry Avenue/Ward Avenue	$77,430
10	Sperry Avenue/Highway 33	$1,852,027
13	Salado Avenue and Ward Avenue	$1,117,428
14	Highway 33/Ward Avenue	$2,005,130
16	Highway 33/Zacharias Road	$1,968,985
17	Highway 33 /Baldwin Road	$1,989,470
18	Highway 33/Rogers Road	$2,374,300
24	Las Palmas Avenue and Poplar Avenue	$1,616,408
25	West Main Avenue and Carpenter Road	$2,405,968
28	Zacharias Road/Baldwin Road	$2,439,028
29	Zacharias Road/Rogers Road	$2,680,690
30	Rogers Road and Keystone Pacific Parkway	$852,890
	Total	***$26,524,892***

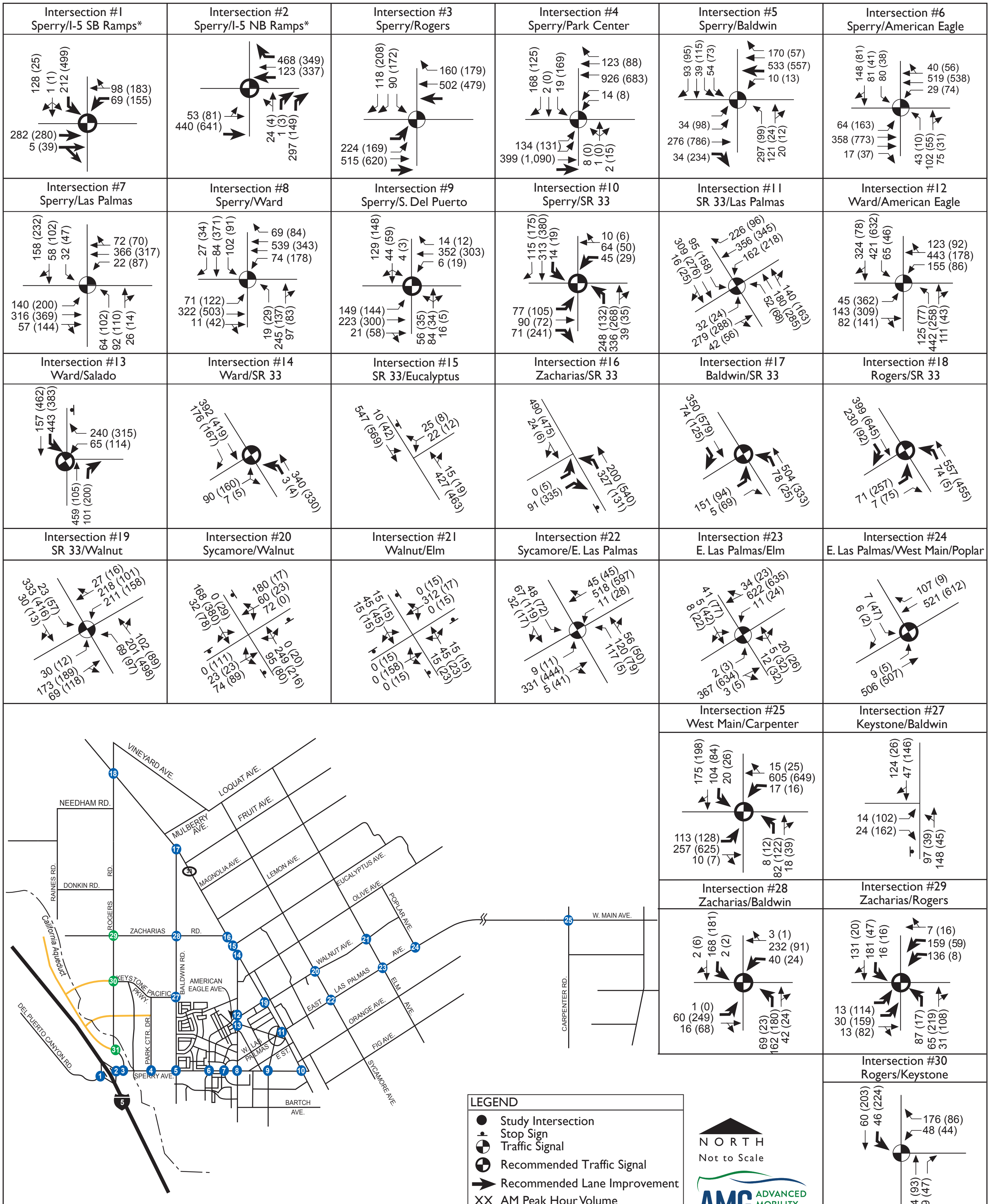
Note:
Interstate 5 / Sperry Ave Interchange Improvements Project, April 20, 2017

The estimated total improvement cost for 17 intersections is approximately $26.5 million. The cost to improve the Sperry Avenue and I-5 interchange was estimated separately by the Interstate 5 / Sperry Avenue Interchange Improvements Project at between $11.3 million and $14.6 million.

City of Patterson – Transportation Infrastructure Master Plan

Projected 10-Year Peak Hour Turning Movement Volumes, Lane Geometry & Controls

Figure 3



Note: * Final improvements to be determined by PAED underway

4.0 FUTURE MASTER PLAN BUILDOUT CONDITIONS

METHODOLOGY

The estimated existing population (2012) consists of approximately 21,100 residents and approximately 6,980 jobs. Therefore, with a projected master plan buildout population of approximately 66,300 and 81,300 jobs, it is estimated that there would be a threefold increase in population and nearly 12-fold increase in jobs.

The Patterson Model land use and network assumptions were updated and used for traffic projections.

APPROVED PROJECTS AND REGIONAL DEVELOPMENT

Previously approved and reasonably foreseeable developments anticipated in the region surrounding the City that will contribute traffic to the cumulative impacts were added. Some of the major approved project includes the West Patterson Business Park, Villages of Patterson, Diablo Grande Planned Residential/Resort Community, and the West Patterson Business Park Expansion – approximately 11 million square feet (sf) light industrial, 839 thousand square feet (ksf) business park and 198 ksf business park.

OTHER MAJOR PROJECTS

One of the largest land use development projects in the County of Stanislaus is the Crows Landing Project. The Crows Landing Project includes the former National Aeronautics and Space Administration (NASA) Crows Landing Air Facility (CLAF). The project site is located south of the City of Patterson between I-5 and the California Aqueduct and SR-33.

Stanislaus County has initiated an environmental review of for the Crows Landing Industrial Business Park for industrial, business park and public use.

The City is currently in the process of evaluating potential impacts of the proposed Zacharias Master Plan / Baldwin Master Plan Project. The proposed Master Plans consist of the annexation of the planning areas into the City of Patterson and the development of residential, mixed use, commercial, industrial, school, parks, and open space uses.

MAJOR TRAFFIC FLOWS

The projected buildout peak hour roadway volumes indicated substantial traffic increases on all roadways and particularly large increases could be expected on key arterials. Major increases are anticipated on all key east-west routes such as W Main Street, Sperry Avenue, E Las Palmas, and Zacharias Road. Additionally, anticipated major traffic growth could be expected on key north-south arterials such as SR-33, Rogers Road, Ward Avenue, and Baldwin Road.

A key traffic flow map is shown in **Exhibit I** below. A summary of major traffic flows observed entering or exiting the City during the peak hours are as follows:

- W Main Street (crossing San Joaquin River) - approximately 35 to 40 percent of total traffic
- I-5 (north of Sperry Avenue) – approximately 15 percent entering/exiting Patterson
- I-5 (south of Sperry Avenue) – approximately 10 percent entering/exiting Patterson
- Traffic from the north (SR-33, Baldwin Road and Rogers Road) – approximately 30 percent
- Traffic from the south (SR-33) – approximately 10 percent

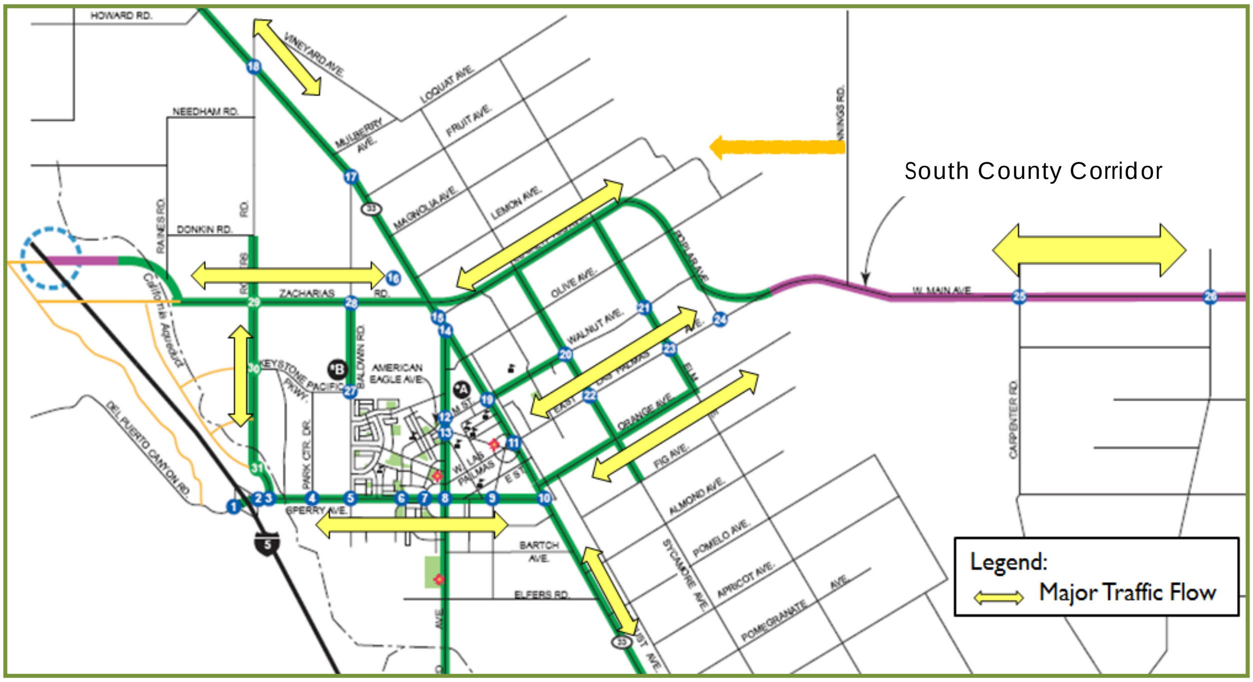


Exhibit I: Master Plan Buildout Major Traffic Flow

POTENTIAL BUILDOUT LANE REQUIREMENTS

It is estimated that major roadway improvements would be required to accommodate the projected traffic growth due to buildout land use in the future. In general, it could be assumed four-lane roads would be required for all the major north-south and east-west arterials. The assumed roadway improvements are illustrated in **Figure 4**.

Improvements in general will be roadway widening to add lanes, new traffic signal installations (or roundabouts), and additional improvements to accommodate pedestrian and bicycle use. Preliminary buildout roadway improvement conceptual plans and order of magnitude cost estimates are contained in **Appendix D**. A summary of 13 major roadway order of magnitude improvement cost estimates for buildout projects are shown in **Table 7**.

In addition, it is also assumed that major improvements contemplated for the Sperry Road & I-5 interchange would be completed in the next few years and a new interchange in the vicinity of I-5 & Zacharias Road would also be implanted in the future. The proposed South County Corridor is assumed to be aligned generally along W Main Avenue & Eucalyptus Avenue & Zacharias Avenue. It would be in line with the recommended alternative in the adopted South County Corridor Feasibility Study.[5]

Table 7: Buildout Improvement Cost Estimates

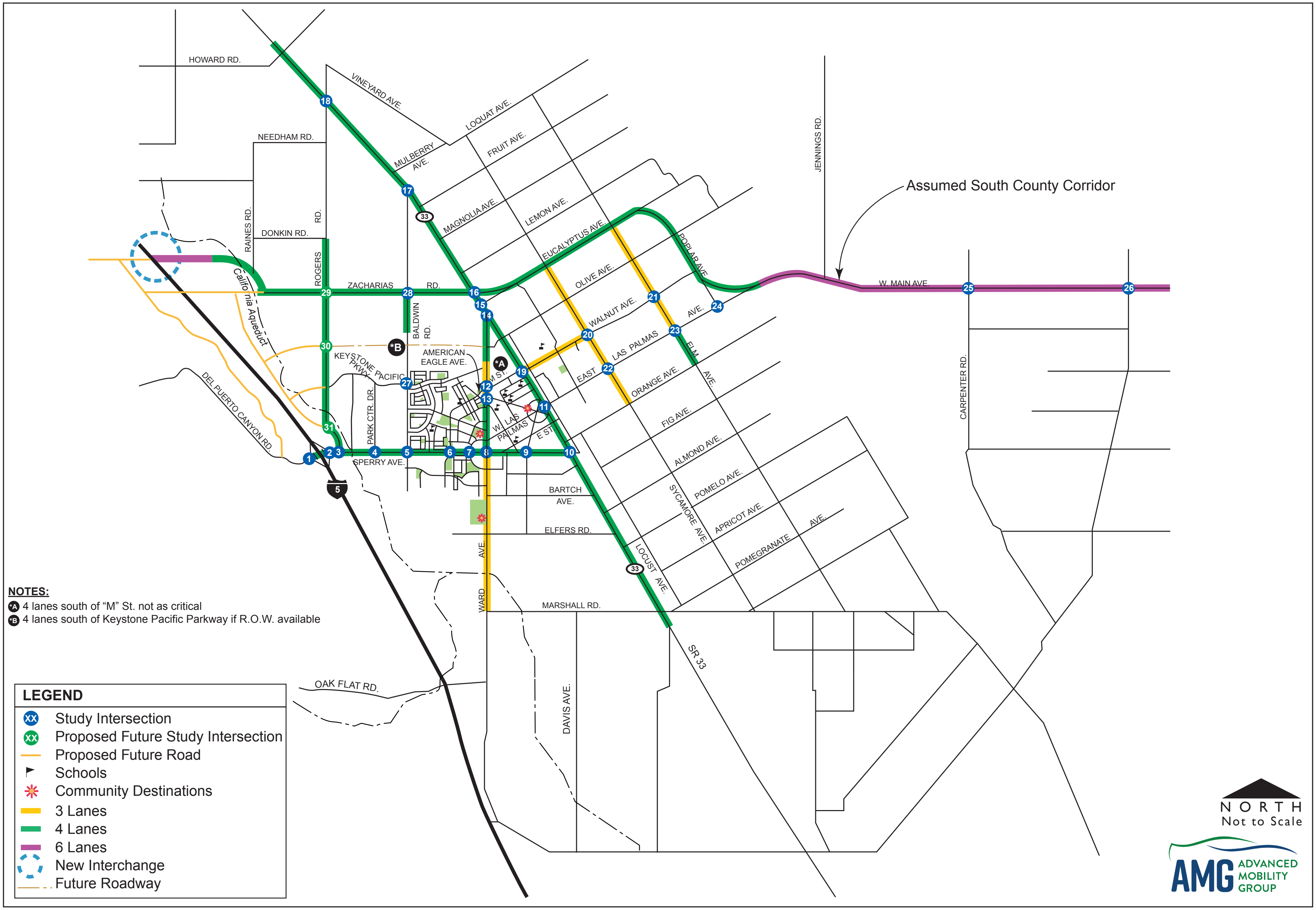
	Roadway	Segment	Length (mi)	Cost Estimate
	I. Local Segments			
1	Sperry Ave	I-5 NB Ramps to Baldwin Road	1.21	$12,610,440
2	Sperry Ave	Ward Avenue to SR 33	0.85	$7,188,200
3	Ward Ave	Sperry Avenue to American Eagle Way	0.80	$5,402,895
4	Ward Ave	American Eagle Way to SR 33	0.91	$5,775,968
5	Ward Ave	Sperry Avenue to Marshall Road	2.00	$17,853,476
6	Baldwin Road	Keystone Pacific Way to SR 33	2.65	$22,505,650
7	Rogers Rd	Sperry Avenue to SR 33	4.55	$41,482,900
8	Zacharias Rd	Rogers Road to SR 33	1.89	$17,233,500
9	SR 33	Rogers Road to Walnut Avenue	4.36	$37,945,500
10	SR 33	Sperry Avenue to Pomelo Avenue	1.40	$12,105,040
11	Walnut Ave	SR 33 to Sycamore Avenue	1.04	$6,952,725
13	Sycamore Ave	Eucalyptus Avenue to Orange Avenue	2.08	$12,911,700
14	Elm Ave	Eucalyptus Avenue to Orange Avenue	2.08	$13,858,575
		Total		**$213,826,569**
	II. Interchange & Regional Roadway			
1	Sperry Ave/I-5 Interchange			$11.3 to $14.6 M [A]
2	Zacharias Ave/I-5 Interchange			$75 M [B]
3	S. County Corridor - Sperry Avenue Alignment			$266M [C]

Note:
[A] – *Based on Interstate 5 / Sperry Ave Interchange Improvements Project, April 20, 2017*
[B] - *Information provided by city staff based on estimates*
[C] - *South County Corridor (SCC) Feasibility Study (Study), May 18, 2016*

[5] *South County Corridor Feasibility Study, May 18, 2016*

City of Patterson - Transportation Infrastructure Master Plan
Recommended Buildout Roadway Improvements

Figure 4



P1811154 - 1/30/20 CT

ASSUMPTIONS AND TRIGGERING OF IMPROVEMENTS

Ideally, roadway infrastructure modifications should be installed prior to the opening of major traffic generators. It is assumed that implementation of improvements discussed will occur over time as needs arise.

Many variables could affect the actual need for a roadway improvement as more is learned about the specific nature of the City's development activity. The intent of the TIMP analysis is to serve as a long-term guide to plan for and accommodate traffic from new development as it occurs but before any major significant traffic congestions or constraints develop. The analysis conducted can be modified over time to reflect actual development proposals as they come online. The schedule for private sector investments and the ability and schedule of public sector funding for enhancing the public roadway infrastructure to accommodate private sector investments are significant variables that will shift over time. As in any infrastructure enhancement program, it makes sense to conduct underground and overhead utility upgrades simultaneous with roadway infrastructure investments, if possible.

Table *7* summarizes potential major roadway improvement projects in the city and associated implementation costs by location. The 14 roadway segments are shown in **Figure 5**. Three distinct components affect infrastructure enhancement costs: existing traffic, growth in background traffic unrelated to new development; and new development traffic.

Generally, individual private sector developers should be responsible for accommodating their specific traffic impacts, but not the impacts due to existing traffic or background traffic growth unrelated to their development (AB1600). As appropriate the City could use a model and develop a select link analysis procedure for estimating the proportion of traffic anticipated from new development to assist in identifying the amount of traffic generated by new development through critical intersection.

Improvements Trigger

As indicated earlier, the results of the traffic forecasts showed that under future scenarios, Sperry Avenue near the I-5 interchange should be improved to four-lane road and it is our understanding that improvements to the Sperry Avenue/I-5 NB &SB on/off-ramps could be underway shortly.

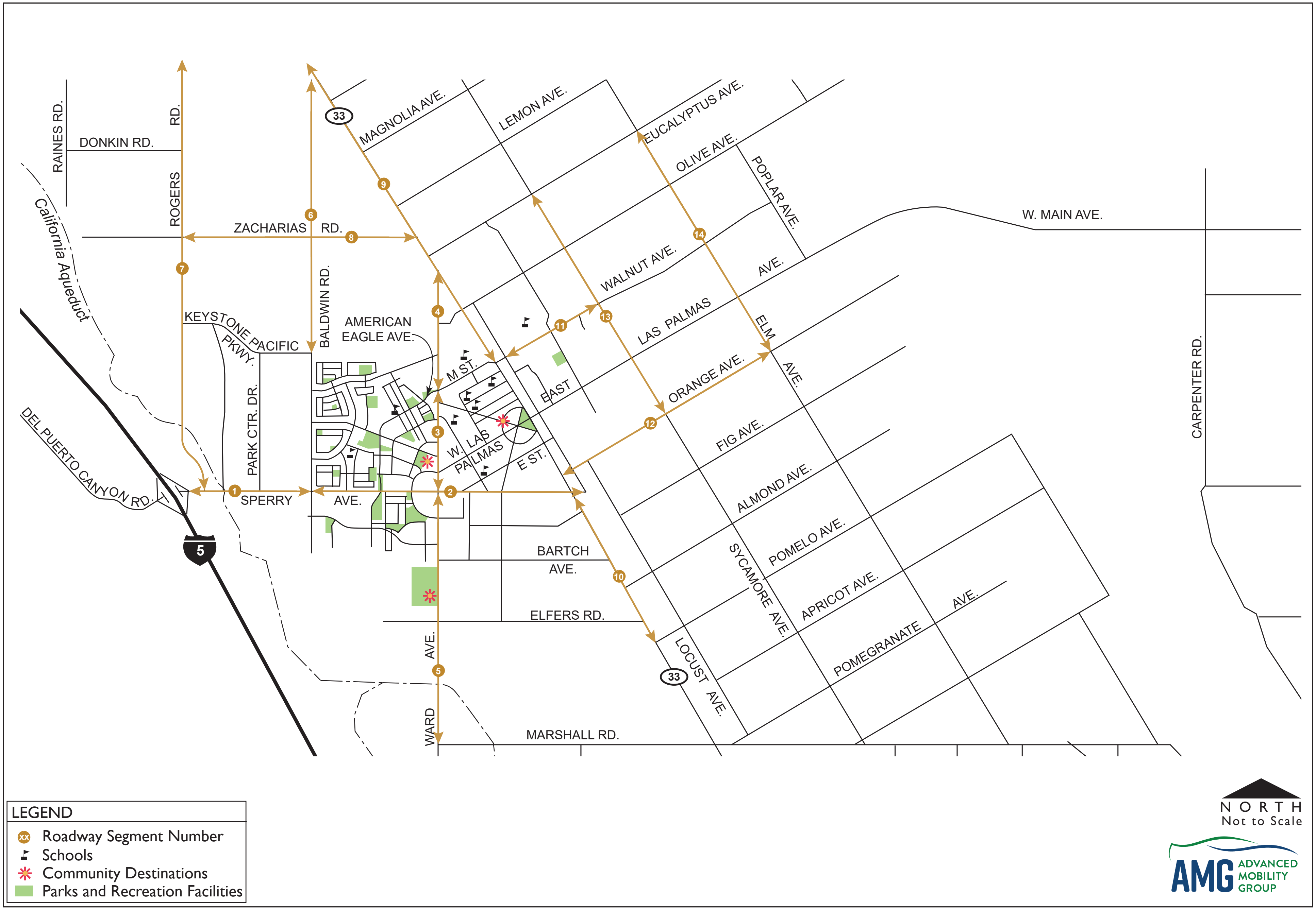
An improved four-lane Sperry Avenue and I-5 interchange would likely be able to accommodate a significant amount of land use developments in the future. Depending on the level of other developments in the area and regional traffic, it is estimated that a new interchange at Zacharias Road might not be triggered for a few decades.

For a typical two-lane urban roadway to be triggered for four lanes widening consideration, generally two-way peak hour volumes of approximately 1,500 or Average Daily Traffic (ADT) of approximately 15,000 vehicles are commonly used for planning level considerations[6]. It is recommended that traffic monitoring be conducted periodically for key roadways so that appropriate actions could be taken based on results of the traffic volumes.

[6] *2009 FDOT Quality/Level of Service Handbook & Table 3-12 of the Stanislaus County Standards, 2014 Edition were consulted*

City of Patterson - Transportation Infrastructure Master Plan
Buildout Roadway Segments

Figure 5



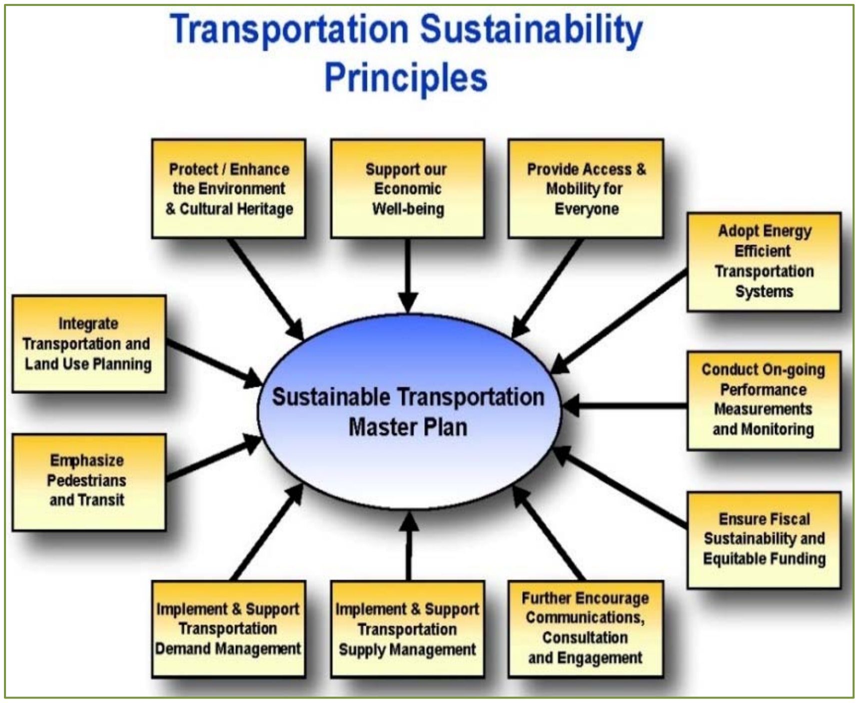
P1811154 - 2/19/19 CT

5.0 COMPLETE STREETS

BACKGROUND

Too often in the past, roadway projects were developed and planned with only autos in mind. Instead, the planning and design of any successful roadway projects should consider livability and include access for all modes of travel, including pedestrians and bicyclists.

In California, Complete Streets Policy Legislation was passed at the state level with AB1358 (2008), requiring cities and counties to include complete streets policies. Therefore, a key priority of future planning for streets in Patterson is to ensure that they are more bikable and walkable. This approach to urban design will bring an understanding for the streetscape that is based on servicing the needs of all modes of travel, as well as improving the character of the streetscape in Patterson.



FUTURE BIKEWAYS

The bicycle is a low-cost and effective means of transportation that is quiet, non-polluting, extremely energy-efficient, versatile, healthy, and fun. Bicycles also offer low-cost mobility to the non-driving public. Bicycling as a means of transportation has been growing in popularity as many communities work to create more balanced transportation systems by giving bicyclists a greater share in use of the roadway networks. In addition, recent national surveys find that more people are willing to cycle more frequently if better bicycle facilities are provided.

Based on information provided in U.S. Census 2010, **Table 8** shows the average travel time to work pattern. Travel time is important because it gives an indication of the number of potential new bicycle commuters. As discussed earlier, the existing bike to work is less than 0.5% of the total modes of travel. With the estimates of total travel time to work of 10 minutes or less at approximately 20%, it means that there is much opportunity to increase the bike modes of travel.

Table 8: Travel Time to Work Data

Mode	*United States*	*California*	*Stanislaus County*	*City of Patterson*	
				Number	**Percent**
Less than 10 minutes	14.1%	11.4%	17.4%	1,311	19.3%
10 to 14 minutes	14.5%	13.8%	16.1%	474	7.0%
15 to 29 minutes	36.2%	35.8%	35.3%	663	9.8%
30 to 59 minutes	27.2%	29.0%	20.0%	2,345	34.5%
60 minutes or more	8.0%	10.0%	11.2%	2,004	29.5%
Total	**100.0%**	**100.0%**	**100.0%**	**6,797**	**100.0%**

Source: *U.S. Census 2010. Percentages reflect percent of workers who do not work from home.*

General Plan Bike Policies

The City of Patterson's General Plan was updated on November 30, 2010. The General Plan serves as a "local constitution" that outlines the City's environmental, social and economic goals, objectives and policies and guides all future decisions about development within the City. The plan is comprehensive, long-range, and general.

Bicycle-related policies and strategies can be found in the Circulation Element within the Patterson General Plan.

Circulation Element

The Circulation Element contains the following policies and goals that relate to bicycles and bicycling. Policy and goal numbers have been retained from the Circulation Element.

Goal T-1: To create and maintain a roadway network that will ensure the safe and efficient movement of people and goods throughout the city.

Goal T-7: *To promote pedestrian, bicycle, and rail travel as alternatives to automobile use.*

Policies

- **T-7.1 Safe pedestrian and bike pathways.** The City shall create and maintain a safe and convenient system of pedestrian and bicycle pathways that encourages walking and bicycling as an alternative to driving. New development shall be required to pay its fair share of the costs for development of this pathway system.

- **T-7.3 Bike routes.** The City shall establish a safe and convenient network of identified bicycle routes connecting new residential areas by the shortest possible routes with recreation, shopping, and employment areas within the city. The City shall cooperate with surrounding jurisdictions in designing and implementing an area-wide bikeway system.

- **T-7.4 Separation of bike routes from motor vehicles.** Bicycle routes shall emphasize paths separated from vehicle traffic (Class I) to the maximum extent possible, but shall also include bicycle lanes within public streets (Class II and III). The City shall limit on-street bicycle routes to those streets where the available roadway width and traffic volumes permit safe coexistence of bicycle and motor vehicle traffic.

- **T-7.5 Include pathways in open space.** To the extent practicable, bicycle and pedestrian pathways shall be included within open space areas.

- **T-7.6 Bike storage.** The City shall require the inclusion of bicycle parking facilities at all new major public facilities and commercial and employment sites and shall encourage large employers to provide showers for employees.

- **T-7.7 Bicycle-automobile conflicts.** The City shall promote the safe "sharing" of roads between automobiles and bicyclists.

- **T-7.8 Bike safety.** Bicycle safety shall be considered when implementing improvements for automobile traffic operations.

- **T-7.9 Coordination with schools.** The City shall collaborate with the School District to promote bike use and shall actively pursue Safe Route to School grants to fund programs that facilitate safe bike routes.

- **T-7.10 Coordination with other agencies.** The City shall coordinate1 with Stanislaus County, the Stanislaus Council of Governments, Caltrans, and other agencies to improve bicycle and pedestrian circulation region-wide.

To further promote and implement some of these bike policies from the General Plan, potential future bicycle routes have been developed and are shown in **Figure 6**. A list of the future Class I, II and III bike lanes are shown in **Table 9**.

Some policies and action items which could help implement bike friendly objectives include:

- Encourage future commercial development to provide bicycle access to surrounding residential areas.
- Require future commercial development to place bike racks near entrances for employees and customers.
- As appropriate require future development to construct bikeways included in the proposed system as a condition of development.
- Meet the requirements of the Americans with Disabilities Act when constructing facilities contained in the proposed system, where applicable.
- Encourage future development to consider schools as important destinations for bicyclists when designing circulation systems within new developments.

Table 9: Proposed Future Bike Facilities

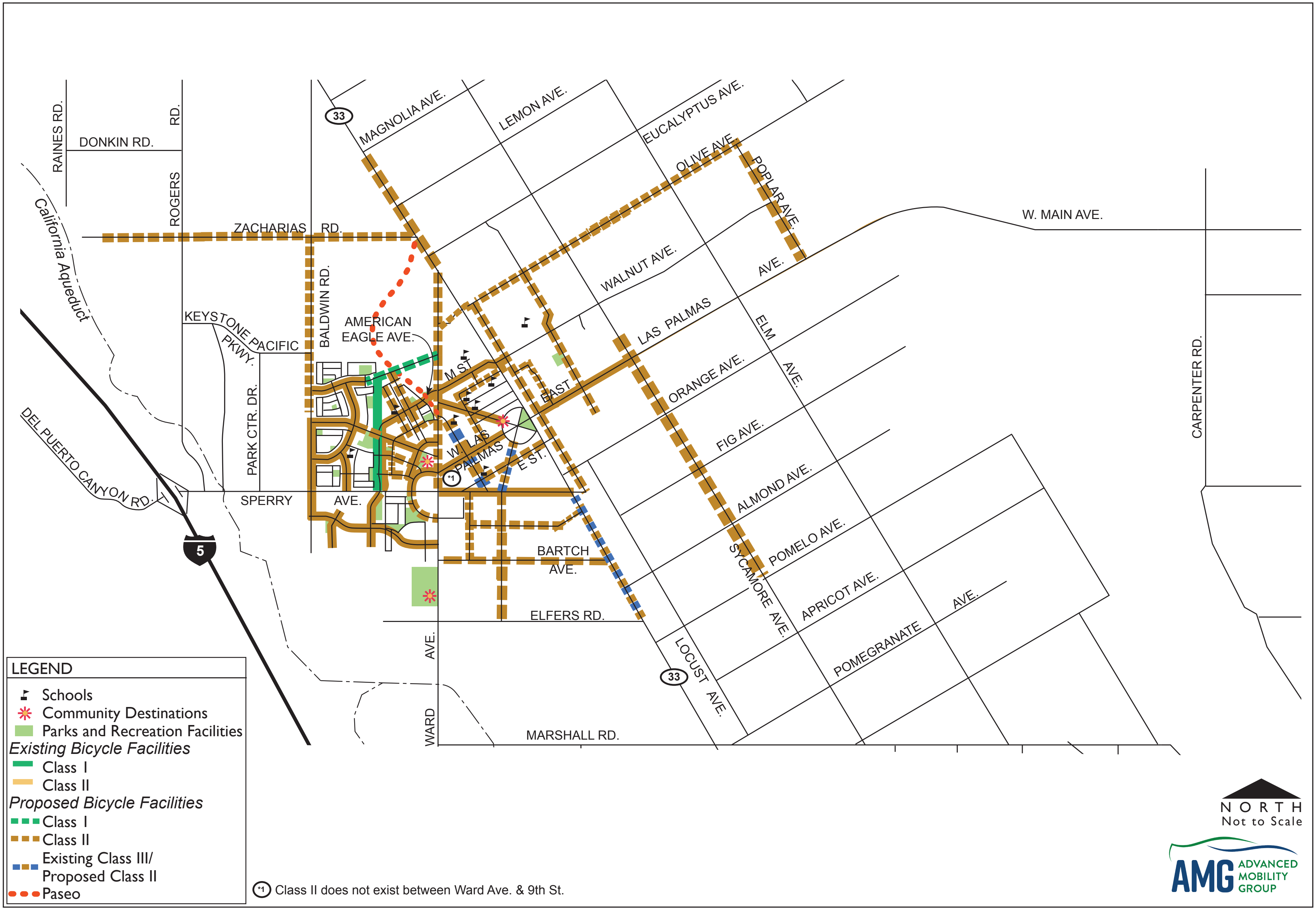
ID	Segment Name	From	To	Bikeway Class	Length (Miles)	Cost Estimates
1	American Eagle	Sperry Ave.	Sweet Briar Dr.	II	0.44	$ 11,616
2	Sperry Ave.	Del Puerto	Ward Ave.	II	2.21	$ 58,344
3	N 1st St.	Olive Ave.	E Las Palmas Ave.	II	1.00	$ 26,400
4	N 9th St.	Ward Ave.	Sperry Ave.	III/II	0.68	$ 17,952
5	N Hartley St.	Walnut Ave.	Chesterfield Dr.	II	0.72	$ 19,008
6	Peregrine Dr.	Flicker Ln.	Heartland Ranch Ave.	II	0.41	$ 10,824
7	Pipit Dr.	American	W Las Palmas Ave.	II	0.32	$ 8,448
8	S 1st St.	E Las Palmas	Patterson City Limits	II	0.66	$ 17,424
9	S Del Puerto	S El Circulo.	Poppy Ave.	III/II	0.64	$ 16,896
10	S El Circulo.	All	All	II	0.54	$ 14,256
11	Clover Ave.	Sperry Ave.	Bartch Ave.	II	0.49	$ 12,936
13	Ward Ave.	SR 33	Sperry Ave.	II	1.69	$ 44,616
14	Calvinson Pkwy.	Baldwin Rd.	Ward Ave.	II	1.04	$ 27,456
15	W Las Palmas	Sperry Ave.	Ward Ave./Mackilhaffy	II	0.33	$ 8,712
16	Roadrunner Dr	Cliff Swallow	Heartland Ranch Ave.	II	0.52	$ 13,728
17	Baldwin Rd.	Sperry Ave.	Calvinson Pkwy.	II	0.19	$ 5,016
18	Baldwin Rd.	Zacharias Rd.	Existing Class II	II	0.49	$ 12,936
19	Cliff Swallow Dr.	Snake Creek	Baldwin Rd.	II	0.4	$ 10,560
20	Heartland Ranch	Pipit Dr.	Ward Ave.	II	0.62	$ 16,368
21	Kestrel Dr.	Heartland	W. Las Palmas Ave.	II	0.25	$ 6,600
22	Eucalyptus Ave.	Rt. 33	Sycamore Ave.	II	0.49	$ 12,936
23	Olive Ave.	Rt. 33	Poplar Ave.	II	2.52	$ 66,528
24	Poplar Ave.	Olive Ave.	Las Palmas Ave.	II	0.49	$ 12,936
25	Washburn St.	1st St.	Weber Ave.	II	0.11	$ 2,904
26	Weber Ave.	Washburn	E. Las Palmas Ave.	II	0.35	$ 9,240
27	E St.	Rt. 33	9th St.	II	0.52	$ 13,728
28	L St.	Rt. 33	7th St.	II	0.38	$ 10,032
29	Hartley Ave.	Olive Ave.	Walnut Ave.	II	0.49	$ 12,936
30	7th St.	L St.	W. Las Palmas Ave.	II	0.45	$ 11,880
31	Scarlet Ln	Horizon Ln	Daisy Dr	II	0.24	$ 6,336
32	SR 33	Ward Ave.	Bartch Ave.	II	2.54	$ 67,056
34	SR 33	Magnolia Ave.	Ward Ave.	II	1.19	$ 31,416
35	Sycamore Ave.	Marshall Rd.	Walnut Ave.	II	3.8	$ 100,320
37	Bartch Ave.	Ward Ave.	Rt 33	II	1.27	$ 33,528
38	S Del Puerto	Poppy Ave.	Elfers Road	II	0.74	$ 19,536
39	Poppy Ave.	Clover Ave.	Rt 33	II	0.86	$ 22,704
40	Zacharias Rd.	Existing	Rt. 33	II	2.76	$ 72,864
41	Cliff Swallow Dr.	Snake Creek	Ward Ave.	I/II	0.64	$ 861,696

Total Proposed	Length (Miles)	Cost Estimates
Total Proposed	33.48	$ 1,728,672

City of Patterson - Transportation Infrastructure Master Plan

Existing and Future Bikeways

Figure 6



P1811154 - 01/02/20 CT

CALTRANS - INTERSECTION CONTROL EVALUATION (ICE) & ROUNDABOUT

In August 23, 2013, Caltrans issued Traffic Operations Policy Directive, Intersection Control Evaluation (ICE) 13-02. Based on Caltrans guidelines,[7] an engineering study of traffic conditions, pedestrian characteristics, and physical characteristics of the location should be performed to determine whether installation of a traffic control signal is justified at a location. It stated that on local streets and State highways, the engineering study should include consideration of a roundabout (yield control). If a roundabout is determined to provide a viable and practical solution, it should be studied in lieu of, or in addition to a traffic control signal. If a roundabout is determined to provide a viable and practical solution, it should be studied in lieu of, or in addition to a traffic control signal. Details of Intersection Control Evaluation (ICE) 13-02 are shown in Appendix E.

The results of numerous studies[8] demonstrated that roundabouts can provide substantial traffic flow benefits compared with conventional intersections. They bring conflicting traffic streams into a steady flow and allow vehicles to safely merge without the stop-and-go conditions caused by stop signs and traffic signals. And by eliminating left turns, roundabouts eliminate delays caused by left-turning vehicles waiting for safe gaps in oncoming traffic.

Negative effects of traffic signals, including increased vehicle queuing, delays, fuel consumption, and crashes, can be expected to last for many years. In addition to operational and safety benefits, roundabouts eliminate the expense of installing and maintaining traffic signals; installation of a traffic signal costs an estimated $300,000. Roundabouts also eliminate the electricity consumption and routine maintenance required to operate traffic signals, estimated at $5,000 annually. There also are costs associated with roundabout construction; however, because costs for building roundabouts vary widely based on site-specific factors, it is not possible to make generalized cost comparisons between roundabouts and traffic signals. However, unless there is extensive right-of-way take it could be assumed that the cost would be less than $300,000.

According to research done by the Insurance Institute for Highway Safety (www.iihs.org), at locations (23 locations studied) where roundabouts have replaced stop signs and/or traffic signals crashes:

- Decreased 39%
- Involving injuries decreased 76%
- Involving fatalities and/or incapacitating injuries decreased 90%
- Vehicle delay was reduced by 62 – 74% resulting in (10 locations studied)
- Saving 325,000 hours of motorists' time annually
- Reduction in fuel consumption of 235,000 gallons annually
- Environmental benefit of reduction in vehicle emissions
- Saved $5,000 per year per intersection in electricity and maintenance costs

Despite their benefits, roundabouts may not be the best solution at all locations. Roundabouts may not be feasible at locations where topographic or site constraints limit the ability to provide appropriate geometry. Also, intersections with very unbalanced traffic flows (i.e., very high traffic volumes on the main street and very light traffic on the side street) may preclude roundabouts for reasons of traffic flow.

---

[7] *California MUTCD 2014 Edition*

8 *Roundabout vs. Signals, When, Where & How to Decide What's Best, Ben Jetta L. Johnson, P.E., August 21, 2008*

However, as the proportion of minor street traffic volumes increase, roundabouts typically become more feasible and provide greater reductions in vehicle delays compared with traffic signals. Error! Reference source not found. provides a comparison of traffic signals vs. roundabout in several areas including safety, traffic operations, right of way impacts, community impacts and costs.

POTENTIAL LOCATIONS FOR ROUNDABOUTS AT BUILDOUT

Since roundabouts can provide substantial traffic flow benefits compared with conventional signalized intersections, it might be appropriate for the City of Patterson to carefully weigh merits of considering roundabouts at some of the future signalized intersections which might require a signal at buildout.

Table 10: Comparison of Traffic Signals vs. Roundabout

		Signal	Roundabout
Safety	Crash Frequency	*Higher than a roundabout*	*Lower than a traffic signal*
	Crash Severity	*Higher due to higher speeds and higher speed differential*	*Lower due to lower speeds and lower speed differential. Elimination of high-speed T-bone (angle) crashes.*
	Number of conflict points between vehicles	*32*	*Reduced to 8*
	Number of driver decisions.	*Higher than a roundabout since drivers need to be aware of vehicles to the left, right and straight ahead.*	*Reduced since drivers only need to be aware of vehicles to their left at entry.*
	Severity of driver errors	*Higher due to higher speeds and larger speed differentials.*	*Reduced since overall speeds are lower and the relative differences in speeds are also lower.*
	Traffic Calming	*Not effective as a traffic calming measure.*	*Entering and circulating geometry constrains the speed to 18 – 30 mph. Geometrics ensure lower speeds.*
Traffic Operations	Trucks (turning movements)	*May encroach on adjacent lanes while turning*	*May encroach on adjacent lanes while turning. May require the use of the truck apron on the inside of the roundabout when making a left turn.*
	Capacity	*Constrained by green time in cycle length*	*Generally greater capacity than a traffic signal.*
	Operational Benefits	*More delay to all vehicles than a roundabout.*	*Less delay.*
	Traffic Signing	*Typical Intersection Signing*	*Same signing as signalized intersection except YIELD signs are used to control the traffic entering the roundabout.*
	Traffic Speed	*Not limited by geometrics. Speed on side roads, which previously had stop signs, will increase.*	*Geometric features ensure slow entering and circulating speeds. Speed is restrained to 18- 30 mph by the geometrics.*
	User Familiarity	*Drivers are very familiar with using intersections with separate left turn and right turn lanes.*	*Roundabout is already available in Patterson.*
Community Impacts	Community Enhancements	*Community enhancements are available on the perimeter of the intersection.*	*In addition to the perimeter the central island may be developed as a "gateway" to the community.*
	Environmental Benefits	*Increase in fuel consumption and emissions due to stopped and riding vehicles during red light phases.*	*Overall reduction in fuel consumption and vehicle emissions since delay at the intersection is reduced.*
Right of Way	Overall	*Typically requires additional area on the approaches to the intersection.*	*Typically require more area at the junction of the roadways but not as much area on the approaches*
Cost	Maintenance	*Signals are susceptible to care and trucks hitting them, power outages and malfunctions. Routine signal head repair, and replacement, loop repair, and maintenance required.*	*Pavement markings and landscaping. No impact on intersection due to power outages*

ADVANCE TECHNOLOGY

As Patterson continues to develop and grows, so will its signal system. The assumed Master Plan Buildout of Patterson is projected to include approximately 66,300 residents and 81,300 jobs. By that time, the City's land use development will include much more residential, retail, and commercial developments. Based on the projected population and job growth, it is anticipated that at least 50-60 signals could be installed and operated in the city by that time. To effectively facilitate the smooth flow of traffic and safely accommodate pedestrians and bicycles, it is important to leverage the use of the latest technology to manage traffic flow.

Therefore, the first step for the City of Patterson is to plan for an Advanced Traffic Management System (ATMS) as it develops a Traffic Signal Master Plan.

Communications Equipment-Signal Interconnect

For traffic signals to consistently work together and be coordinated, they require interconnect. Interconnect usually is in the form of a fiber optic cable or copper wire that is located in underground conduit and used to connect several signals along a roadway.

In some cases, interconnect may also utilize wireless technologies. In Patterson, interconnected signals will ultimately communicate with a local traffic management center (TMC), which is a centralized communication hub for those intersections, similar to how a network server is connected to individual desktop computers.

It is likely that all future 50-60 signals ultimately will be interconnected via underground conduit and report to a TMC. There is a significant advantage in having a signal system centrally connected to a TMC in that it allows a city maximum flexibility in grouping traffic signals for coordination according to various combinations of intersections, days, and time periods. This flexibility is greater when compared to master-controlled signals, which have hard wire connections only to their master controller. While signal timing coordination plans can be reprogrammed within a given zone under a master controller, these signals are not physically integrated with signal zones in other areas of a city and thus timing plans cannot be customized between zones. Under a TMC-controlled signal system, however, timing plans can be customized as needed for day-to-day operations, as well as for special events.

Another advantage of a TMC-controlled system is to segment signalized intersections into zones that correspond with levels of development. This is particularly applicable to Patterson as its several different neighborhoods will develop in the future including Villages of Patterson. Signal zones under a TMC-controlled system are easily scalable and can be revised as development priorities change over time.

AMG recommends that Patterson consider establishing a City-owned network of conduit that can use fiber, copper, and possibly wireless technologies to communicate with all Intelligent Transportation System (ITS) field devices via a common Ethernet protocol. Additional details and recommendations on communications technologies for the Patterson system will be based on the ultimate ITS plans for the community, since the interconnect system will also serve as the community's communications backbone.

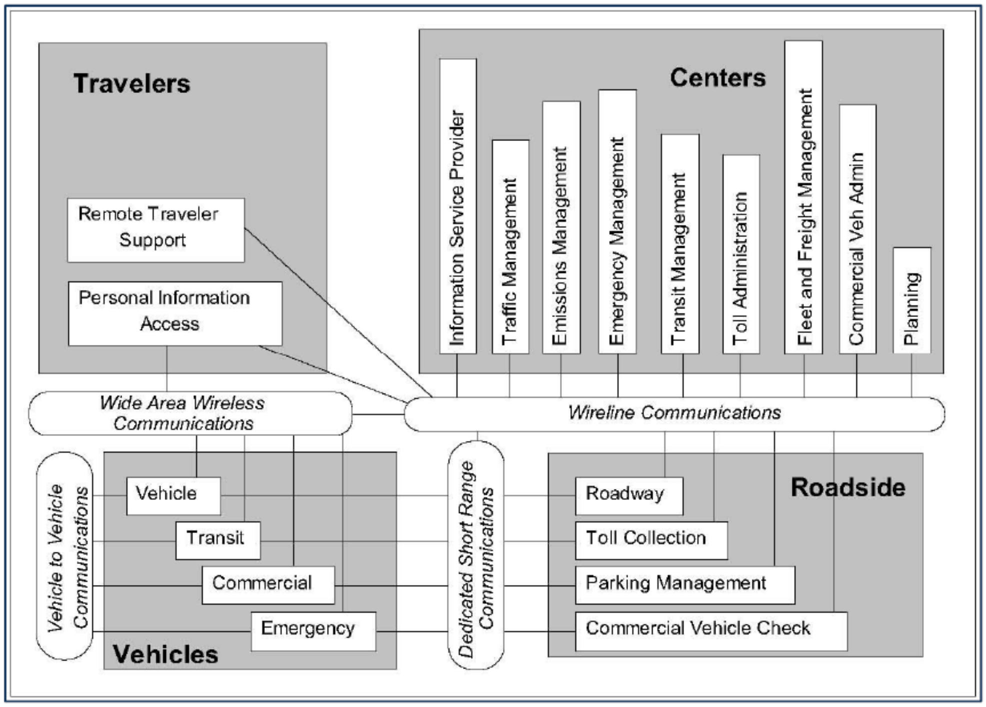
Communications Layer

This layer of the physical architecture depicts the flow of information and data transfer for transportation layer components. It shows all of the communications that are needed for transferring data and information among transportation agencies, traveler information and emergency service providers, and other service providers such as towing and recovery. The communications layer clearly defines system interface points where national standards and communications protocols can be used.

It is important to note that although agencies technically are not part of the physical architecture of a signal system, it is necessary to determine the jurisdictional structure and working relationships in order to fully define the physical architecture. Determining these interactions provides a framework for system planning and implementation, including how information is communicated and between which agencies.

In this regard, **Figure 7** shows a high-level view of the National ITS Architecture, showing how the transportation and communications layers of the physical architecture can be connected. In all, the physical architecture includes 19 transportation subsystems (white rectangles) and four general communication methods (ovals) that are used to exchange information between the subsystems.

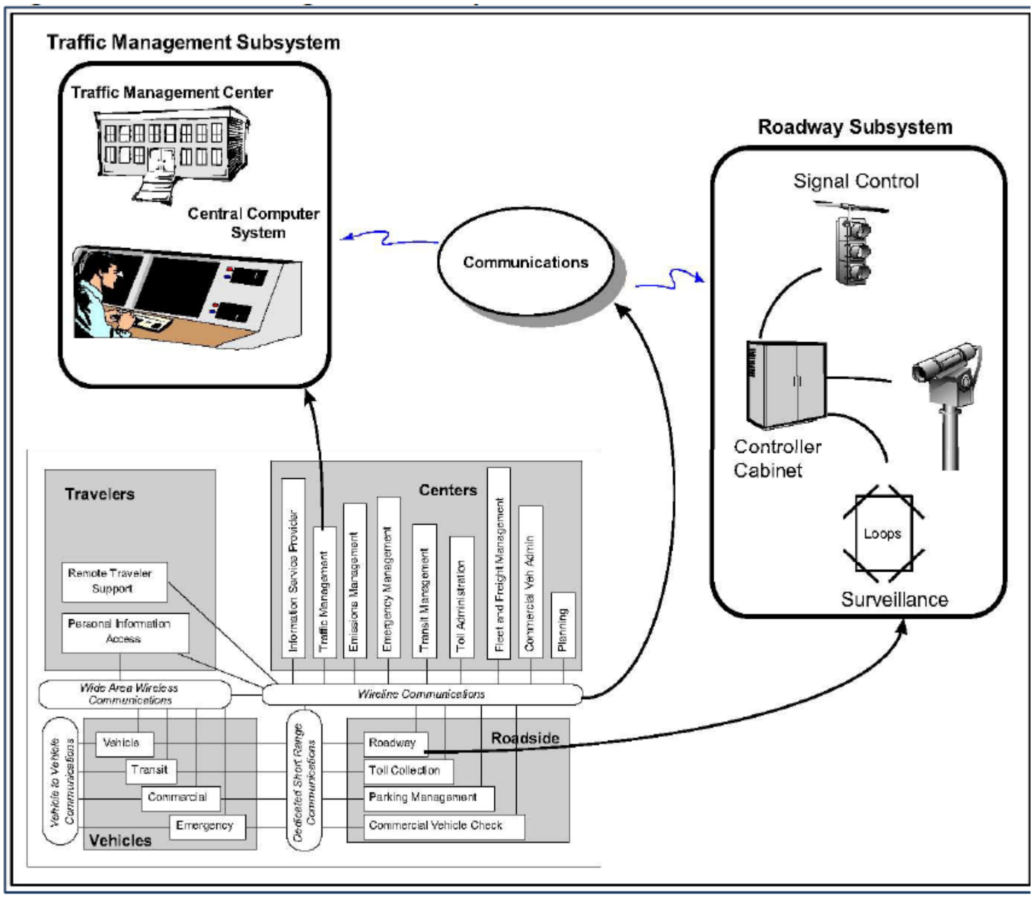
The transportation subsystems are further grouped into four overall classes that are roughly based on the physical elements of transportation management systems (gray rectangles). These classes are: Centers, Roadside, Vehicles, and Travelers.



Source: U.S. DOT, ITS-JPO

Figure 7: High-Level View of the National ITS Architecture

Figure 8 shows how basic traffic signal control systems such as the future Patterson system fit within the overall physical architecture. Signal systems are represented by two transportation subsystems: Traffic Management (under the Centers classification) and Roadway (under the Roadside classification). Figure 8 further illustrates the specific functions contained within these subsystems. The Traffic Management subsystem includes traffic management center and central computer system elements, while the Roadway subsystem includes signal control, surveillance (loops and/or cameras), and controller cabinet elements. In terms of communications, wireline is used to connect these Traffic Management and Roadway subsystem functions. In Patterson, the future traffic signal system could ultimately include these elements and functions at buildout.



Source: U.S. DOT, ITS-JPO

Figure 8: Traffic Management and Roadway Subsystem Functions

The Traffic Management and Roadway subsystems identified in Figure 8, together with the necessary communications that are used to exchange surveillance and control information, provide the following capabilities that are typically associated with traffic signal control systems:

- Arterial network traffic conditions
- Area-wide signal coordination
- Range of adaptive traffic control strategies
- Integration with other subsystem functions, such as emergency and incident management,
- freeway management, and transit management.

Implementation of the traffic management functions occurs at traffic management center (TMC), where central equipment is located, including computers, video display and switching systems, and traffic control consoles. For Roadway subsystem functions, implementation occurs in the field with such equipment as traffic signal controllers and heads, vehicle detectors (video, radar, inductive loop), and video cameras.

6.0 RECOMMENDATIONS

Based on the results of the study, the following are some of our recommendations in order of priorities:

- Complete Interstate 5 / Sperry Avenue Interchange Improvements – a comprehensive evaluation under Caltrans process is currently underway. An improved interchange would provide very significant improvement to the City's major gateway to the I-5 freeway.
- Improve Sperry Avenue to four lanes – currently several segments are two lanes including east of Ward Avenue to SR 33 and west of Baldwin Road. A complete four-lane Sperry Avenue would add significant capacity to the major east-west arterial street in the City.
- Create an Advanced Traffic Management System (ATMS) and develop a Traffic Signal Master Plan – an ATMS system would allow the city to effectively manage the city's traffic signals, services other modes of travel and improve safety.
- Whenever it is feasible, use roundabout in place of traffic signal.
- Establish and provide Complete Street policies for all future roadways. Adopt recommended bike facilities plan and provide future funding for its construction. Creation of more continuous bike lanes at key destinations would encourage more people to use bikes instead of autos.
- Focus on redesign of downtown streets based walkable and livable principles.
- Initiate process to plan and fund the future I-5/Zacharias Interchange

REFERENCES

1. City of Patterson, 2010 General Plan Policy Document and land use Diagram.
2. Caltrans, 2012, Traffic Volumes Annual Average Daily Traffic (AADT) on California State Highways.
3. Patterson Community Design Guidelines, October 2002
4. Patterson Strategic Plan (2017-2021), November 2016
5. Interstate 5 / Sperry Ave Interchange Improvements Project, Meeting Agenda, April 20, 2017
6. Final South County Corridor Feasibility Study, May 18, 2016

Advanced Mobility Group

Christopher Thnay, PE, AICP
Joy Bhattacharya, PE, PTOE
Steve Au, PE
Chris K.S. Higbee, PE

Persons Consulted

Mike Willett	Director of Public Works, City of Patterson
Joel Andrews	City Planner, City of Patterson
Fernando Ulloa, PE	Director of Engineering, City of Patterson
David James, AICP	Community Development Director, City of Patterson

Appendix A LEVEL OF SERVICE METHODOLOGY

Appendix B NEAR-TERM (10-YEAR) CONCEPTUAL PLAN

Appendix C NEAR-TERM (10-YEAR) IMPROVEMENTS COST ESTIMATE

Appendix D MASTER PLAN BUILDOUT ROADWAY IMPROVEMENTS COST ESTIMATES

Appendix E INTERSECTION CONTROL EVALUATION (ICE) 13-02