City of Temecula

Coordinated Signal Timing Report

August 2023

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1.0 INTRODUCTION

The City of Temecula received funding from the Federal Highway Safety Improvement Program (HSIP) Cycle 7 to upgrade the communication and traffic signal system on three primary arterials: Winchester Road, Rancho California Road, and Temecula Parkway. The new system provides consistent, reliable, and modern communications and control and enables proactive traffic signal management and response to real time traffic conditions. Ultimately the goal of the project is to improve public safety, shorten commute time, reduce greenhouse gas emission, and increase mobility for all modes of travel.

The project included signal timing and coordination program development and optimization along the three corridors. The new signal timing and coordination were made possible and utilizes the newly implemented systems. The purpose of this report is to summarize the optimized signal timing and coordination plan development for the intersections along the three corridors and document the new programs system performance.

2.0 PROJECT AREA

The project area consists of 46 traffic signals, which include seven Caltrans signals. The project area is summarized below in **Table 2-1** and shown geographically in **Figure 2-1** on the following page.

Table 2-1 Project Area

Corridor	Limits	Number of Intersections
Winchester Rd	Diaz Rd to Nicholas Rd	11 (2 Caltrans signals)
Rancho California Rd	Business Park Dr to Butterfield Stage Rd	17 (2 Caltrans signals)
Temecula Pkwy	Old Town Front St - I-15 SB Ramp to Butterfield Stage Rd	15 (3 Caltrans signals)
Margarita Rd	• Margarita Road & Rancho Vista Road • Margarita Road & De Portola Rd • Margarita Road & Dartolo Rd	

3.0 VOLUME DATA

Traffic volume data was provided by the City which was obtained from Streetlight Data application. Streetlight Data is a web-based data service company which uses location records from smart phones and navigation devices, and processes them into intersection turning movement counts, Annual Average Daily Traffic (AADT) volumes, travel trip origin-destination, etc. The service has several years of historical data from which the user can aggregate data for a specific period.

Figure 3-1: Project Area Map

The data was averaged for the months of March, April, September, and October. Monday through Thursday data was averaged for weekday volumes and Saturday and Sunday data was averaged for weekend volumes. The data was processed to calculate the weekday AM, Mid-Day, PM, and weekend Mid-Day peak period volumes and the peak hour factor (PHF). The weekday peak periods are 6:30 AM-9:30 AM, 11:00 AM-1:00 PM and 2:30 PM-6:00 PM. The weekend peak period is 11:00 AM-2:00 PM. Schematic diagrams of the peak hour volumes are included in Appendix A.

4.0 EXISTING SIGNAL TIMING

The existing corridor coordination plans, limits and intersections included and not included in the plan, peak period, and cycle length are summarized in **Table 4-1**. The three intersections along Margarita Road are currently operating free (non-coordinated).

Table 4-1 Existing Coordination Plans

Corridor	Time Period	Cycle Length (sec)	Limits /Intersections	Free Operation (Non-coordinated) Intersections
Winchester Rd	AM	120	Diaz Rd to Roripaugh Rd	Nicolas Rd
	MD	120	Diaz Rd to Roripaugh Rd	Nicolas Rd
	PM	120	Enterprise Circle to Ynez Rd	Diaz Rd and Nicolas Rd
		130	Promenade Mall W to Roripaugh Rd	
	WE MD	120	Jefferson Ave to Ynez Rd	Remaining intersections
Rancho California Rd	AM	100	I-15 SB Ramp to Ynez Rd and Asteroid Wy-Yukon Rd to Margarita Rd	Remaining intersections
	MD	100	I-15 SB Ramp to Ynez Rd and Asteroid Wy-Yukon Rd to Margarita Rd	Remaining intersections
	PM	100	I-15 SB Ramp and I-15 NB Ramp	Remaining intersections
		120	Ynez Rd and Asteroid Wy-Yukon Rd to Margarita Rd	
	WE MD	100	I-15 SB Ramp to Ynez Rd	Remaining intersections
Temecula Pkwy	AM	100	Bedford Ct to Mahlon Vail Rd	Butterfield Stage Rd
	MD	110	Bedford Ct	Butterfield Stage Rd
		100	La Paz Rd to Mahlon Vail Rd	
	PM	110	Bedford Ct to Pachanga Pkwy	Butterfield Stage Rd
		120	Jedediah Smith Rd to Mahlon Vail Rd	
	WE MD	100	Bedford Ct	Mahlon Vail Rd and Butterfield Stage Rd
		110	La Paz Rd to Meadows Parkway	

5.0 EXISTING TRAFFIC CHARACTERISTICS

The trip attracting land uses in the project area consist of industry, commercial, office and institution and are located along most parts of Winchester Rd and Temecula Pkwy and the areas near Interstate 15 (I-15). Most trips to these land uses originate from outside the City and access the area through the interchanges on the three project corridors. Traffic from within the City also access I-15 through these interchanges. In general traffic flow is dominant in the westbound direction in the morning and in the eastbound direction in the evening. Other times of day are more balanced. Based on the volume data, the generalized peak direction of travel on each corridor by peak period is summarized in **Table 5-1**.

Table 5-1 Peak Travel Direction

Corridor	Time Period	Peak Travel Direction
Winchester Rd	AM	Westbound
	MD	Both
	PM	Eastbound
	WE MD	Both
Rancho California Road	AM	Westbound
	MD	Both
	PM	Both
	WE MD	Both
Temecula Pkwy	AM	Westbound
	MD	Both
	PM	Eastbound
	WE MD	Both
Margarita Rd	AM	Both
	MD	Both
	PM	Northbound
	WE MD	Both

6.0 CORRIDOR SYNCHRONIZATION

Corridor synchronization plans were developed through a stepwise process utilizing the data collection and existing conditions assessment. First, signal timing parameters were reviewed, and values determined to create uniform baseline operations for the project intersections. Next, traffic models were created and optimized based on data and analysis. The last step is defining the schedule and time periods of operation for each plan. Each of these steps and the results are further detailed in the following subsections.

6.1 SIGNAL TIMING PARAMETERS

As part of this project, the following signal timing parameters were reviewed and determined based on California MUTCD guidelines and City practice: walk, flashing don't walk, minimum green, vehicle extension, max gap, max limit, yellow change, and red clearance. These parameters were calibrated onto the model to reflect updated standard timing values.

Additionally, a new timing parameter was implemented, an advanced walk interval, on all project pedestrian signal approaches. Assembly Bill AB-2264 Pedestrian Crossing Signals, was introduced to amend Section 21450.5 of the Vehicle Code, relating to pedestrians, which requires all pedestrian signals

to be programmed with a leading pedestrian interval (LPI) that advances the walk signal while the red signal halting vehicular traffic continues to be displayed on parallel through or turning movements.

6.2 COORDINATION PLAN OPTIMIZATION

Synchro analysis software was used to develop optimized signal timing and coordination. A traffic model was created, and the updated base signal timing and lead pedestrian interval parameters were input. The cycle length along a corridor was determined based on the minimum cycle length required at the most constrained intersections with high pedestrian crossing times and traffic demand. Winchester Road/Ynez Road, Rancho California Road/Jefferson Avenue, and Temecula Parkway/Margarita Road are examples of constrained intersections. Movement splits at each intersection were set based on the traffic demand. The phase sequence (lead/lag) at intersections along was set to establish a wide green band along the corridor. Some side streets heavy left turn movements were lagged so that they arrive at the downstream signal at the end of red or begin of green interval and merge with the platoon along the corridor. Offsets were adjusted to provide progression along the corridor and generally favor the peak direction of travel. If traffic volumes in both directions are more balanced, offsets were adjusted to provide progression in both directions of travel.

Multiple cycle length alternatives were tested at the ramp signals along the three corridors to determine the optimum cycle length and splits that would improve the intersection condition and queuing compared to the exiting condition. The optimal ramp cycle lengths were determined to be either 100- or 120-seconds dependent on location and time of day. Corridor zones were established for the ramp signals and City signals near the ramps and adjacent groupings of signals. The Synchro files and ramp signal timing plans were submitted to – and reviewed and approved by Caltrans and the City.

6.3 TOD SCHEDULE DETERMINATION

Coordination plan time of day schedules were determined through review of daily traffic volume data at select locations along the corridors. The following time ranges were set for the peak period coordination plans based on the traffic volumes and patterns.

Weekday

- Plan 1 – AM Peak period: 06:30 – 10:00
- Plan 2 – MID-DAY Peak Period: 10:00 – 15:00
- Plan 3 – PM Peak Period: 15:00 – 19:00

Weekend

- Plan 4 – 10:00 – 19:00

The optimized coordination timing plans schedules, cycles, and limits are summarized in **Table 6-1**. Corridor traffic characteristics and detailed coordination plan operations are described in **Table 6-2** through **Table 6-5**.

Table 6-1 Optimized Coordination Plans

Corridor	Time Period	Cycle Length (sec)	Free Operation (Non-Coordinated) Intersections
Winchester Rd	All Time Periods	120 – Diaz Rd to NB Ramp	None
			None
		140 – Ynez Rd to Nicolas Rd	None
			None
Rancho California Rd	AM	100 – Ramps Signals 150 – City Signals	Business Park Dr, Tee Dr, Meadows Pkwy and Butter Stage Rd
	MD		Business Park Dr, Tee Dr, Meadows Pkwy and Butter Stage Rd
	PM		Business Park Dr, Tee Dr, Meadows Pkwy and Butter Stage Rd
	WE MD		Business Park Dr, Diaz Rd, Tee Dr, Meadows Pkwy and Butter Stage Rd
Temecula Pkwy	AM	120	SB Ramp-Old Town Front St
	MD	120	SB Ramp-Old Town Front St
	PM	120-NB Ramp to Pechanga Pkwy 140 – Jedediah Smith Rd to Butterfield Stage Rd	SB Ramp-Old Town Front St
	WE MD		SB Ramp-Old Town Front St
Margarita Rd	AM	120	None
	MD	120	None
	PM	140	None
	WE MD	140	None

Table 6-2 Winchester Road Coordinated Operation Description

General
• For all time periods, due to change in cycle length between NB Ramp and Ynez Rd, traffic in either direction will experience progression variation. • Jefferson Ave, Ynez Rd, and Margarita Rd are utilized as a bypass for NB freeway traffic from Temecula Pkwy and Rancho California Rd.
AM
• Favors WB traffic. • High volume SB left turn at Jefferson Ave and NB left turn at Ynez Rd were lagged so that traffic can arrive at the end of red or begin of green interval at the adjacent intersection. • Narrow green band at Jefferson Ave, Ynez Rd, Margarita Rd, and Nicolas Rd due to high side street traffic. • The WB platoon may arrive at the end of red interval at Ynez Rd and Jefferson Ave and may experience brief delay. Due to high volume and/or narrow green band the WB thru traffic may not clear within the same cycle at Enterprise Cir, Jefferson Ave, Ynez Rd, Margarita Rd and Roripaugh Rd, and may experience congestion and backup.

• EB and WB platoons may experience congestion and traffic backup at both Nicolas Rd and Roripaugh Rd due to high pedestrian volumes from the nearby high school. Review possible removal of one EB or WB pedestrian movement from both intersections.
Mid
• Balanced plan, no favor in either direction. • To provide a wide green band WB left turn lag at Margarita Rd and Ynez Rd and EB left turn lag at Margarita Meadows. • High volume NB left turn at Ynez Rd and Nicolas Rd was lagged so that the traffic can arrive at the end of red or begin of green interval at the adjacent intersection. • Narrow green band at Jefferson Ave, Ynez Rd, and Margarita Rd due to high side street traffic. • The EB platoon may arrive at the end of the red interval at Jefferson Ave, Margarita Rd, and Nicolas Rd and may experience brief delay. Due to high volume and/or narrow green band, the EB thru traffic may not clear within the same cycle at Enterprise Cir, Jefferson Ave, I-15 NB Ramp, Ynez Rd, and Margarita Rd. • The WB platoon may arrive at the end of the red interval at Enterprise Cir, Margarita Meadows, and Margarita Rd and may experience brief delay. At Ynez Rd, part of the WB platoon may arrive on red. Due to high volume and/or narrow green band, the WB thru traffic may not clear within the same cycle at Jefferson Ave, Ynez Rd, and Margarita Rd. • The NB and SB movements at Margarita Rd experience heavy volume due to neighboring school traffic, creating delays for EB and WB platoons. • EB and WB platoons may experience congestion and traffic backup at both Nicolas Rd and Roripaugh Rd due to high pedestrian volumes from the nearby high school. Review possible removal of one EB or WB pedestrian movement from both intersections. • Due to high volume, major parts of the corridor may experience congestion and traffic backup.
PM
• Generally, favors the EB traffic, as the EB traffic is higher than the WB traffic. • To provide a wide green band WB left turn lag at Jefferson Ave, Promenade Mall W and Margarita Rd and, EB left turn lag at Margarita Meadows and Nicolas Rd. • NB left turn at Ynez Rd and Nicolas Rd lags so that the traffic can arrive at the end of red or begin of green interval at the adjacent intersection. • Narrow green band at Jefferson Ave, Ynez Rd, and Margarita Rd. • Heavy WB volume from Margarita Rd to the NB on-ramp causes vehicle staging in the #3 lane. • The EB platoon may arrive at the end of red interval at Jefferson Ave and Margarita Meadows and may experience brief delay. Due to high volume and/or narrow green band the EB thru traffic may not clear within the same cycle at Jefferson Ave, Ynez Rd, Margarita Meadows, Margarita Rd, and Nicolas Rd. At Nicolas Rd, part of the EB platoon may arrive on red. • WB platoon may arrive on red at Ynez Rd, Margarita Meadows and Margarita Rd and may experience delay. Due to high volume and/or narrow green band the WB thru traffic may not clear within the same cycle at Ynez Rd and Margarita Rd. At Margarita Rd, the later part of the WB platoon may arrive on red. • Due to high volume, major parts of the corridor may experience congestion and traffic backup.
WE MID

• Balanced plan, no favor in either direction. • To provide a wide green band, WB left turn lag at Jefferson Ave, Promenade Mall W and Margarita Rd and, EB left turn lag at Ynez Rd and Margarita Meadows. • High volume NB left turn at Ynez Rd was lagged so that the traffic can arrive at the end of red or begin of green interval at the adjacent intersection. • Narrow green band at Jefferson Ave, Ynez Rd, and Margarita Rd due to high side street traffic. • Platoons in both EB and WB directions may arrive early (at end of red) and experience a brief delay at several intersections. • Due to high volume and/or narrow green band, both the EB and WB thru traffic may not clear within the same cycle at intersections.

Table 6-3 Rancho California Road Coordinated Operation Description

General
• Due to a different cycle length at the ramp signals, traffic may experience full corridor progression on alternate cycles. • Side-street delay is experienced for signals between Moraga Rd and Margarita Rd.
AM
• Favors the WB traffic. • SB left turn at Diaz Rd was lagged so that the traffic can arrive at the end of red or begin of green interval at the adjacent intersection. SB left turn at Jefferson Ave was lagged to minimize delay at the adjacent intersection. • EB platoon may arrive on red at Lyndie Ln and Yukon Rd and experience delay. • WB thru traffic may not clear within the same cycle at Ynez Rd, Moraga Rd and Margarita Rd and may experience congestion and traffic backup. • The heavy SB left turn traffic from I-15 SB Ramp may get progression at the downstream signals.
Mid
• Balanced plan, no direction favored. • To provide a wide green band, WB left turn lag at Diaz Rd, Jefferson Ave, and I-15 SB Ramp. • SB left turn at Diaz Rd, Jefferson Ave and Moraga Rd, and NB left turn at Margarita Rd was lagged so that the traffic can arrive at the end of red or begin of green interval at the adjacent intersection. • Narrow green band at I-15 SB Ramp, Ynez Rd, and Margarita Rd due to high side street traffic. • EB platoon may arrive at the end of red interval at Lyndie Ln and Yukon Rd and may experience a brief delay. Due to high volume and/or narrow green band, the EB thru traffic may not clear within the same cycle at I-15 SB Ramp and Margarita Rd. • WB platoon may arrive at the end of red interval at Via Las Colinas and Town Center and may experience a brief delay. Due to high volume and/or narrow green band, the WB thru traffic may not clear within the same cycle at Ynez Rd.
PM
• Balanced plan, no direction favored. • To provide wide green band, WB left turn lag at I-15 SB Ramp, Ynez Rd, Lyndie Ln, and Moraga Rd and, EB left turn lag at Portofino, Humber Dr and Margarita Rd.

• SB left turn at Jefferson Ave and NB left turn at Ynez Rd and Margarita Rd was lagged so that the traffic can arrive at the end of red or begin of green interval at the adjacent intersection. SB left turn at Diaz Rd was lagged to minimize the delay at the adjacent intersection. • Narrow green band at Jefferson Ave, I-15SB Ramp, Ynez Rd, and Margarita Rd due to high side street traffic. • The EB platoon may arrive at the end of red interval at Lindie Ln and Margarita Rd and may experience brief delay. Due to high volume and/or narrow green band, the EB thru traffic may not clear within the same cycle at Diaz Rd, Jefferson Ave, I-15 SB Ramp, I-15 NB Ramp, Ynez Rd, and Margarita Rd. • WB platoons may arrive at the end of red interval at multiple locations and may experience brief delay. The WB platoon may arrive at the start of the red interval at Diaz Rd and may experience long delay. Due to high volume and/or narrow green band, the WB thru traffic may not clear within the same cycle at Ynez Rd, Moraga Rd, Yukon Rd, and Margarita Rd. • Due to high volume major part of the corridor may experience congestion and traffic backup.
WE MID
• Balanced plan, no direction favored. • To provide wide green band, WB left turn lag at Jefferson Ave, I-15 SB Ramp, Ynez Rd, and Moraga Rd and, EB left turn lag at Margarita Rd. • SB left turn at Moraga Rd and, NB left turn at Ynez Rd and Margarita Rd was lagged so that the traffic can arrive at the end of red or begin of green interval at the adjacent intersection. • Narrow green band at Jefferson Ave, Ynez Rd, and Margarita Rd due to high side street traffic. • Due to high volume and/or narrow green band, the EB thru traffic may not clear within the same cycle at I-15 SB Ramp, I-15 NB Ramp, Ynez Rd, and Margarita Rd. • WB platoon may arrive at the end of red interval at Lyndie Ln, Moraga Rd and Humber Dr and may experience brief delay. Due to high volume and/or narrow green band, the WB thru traffic may not clear within the same cycle at Ynez Rd, Moraga Rd, Yukon Rd, and Margarita Rd. • Major part of the corridor may experience congested condition and traffic backup.

Table 6-4 Temecula Parkway Coordinated Operation Description

AM
• Balanced plan, no direction favored. • To provide wide green band, WB left turn lag at Bedford Ct and Pechanga Pkwy and, EB left turn lag at Jedediah Smith Rd. • NB left turn at Margarita Rd was lagged so that the traffic can arrive at the end of red or begin of green interval at the adjacent intersection. • Narrow green band at Bedford Ct and Margarita Rd. • The EB platoon may arrive at the end of red interval at Pechanga Pkwy and may experience brief delay. The EB platoon may arrive at middle of red interval at Meadows Pkwy and may experience long delay. At Rancho Puenlo Rd, the later part of the platoon may arrive on red. Due to high volume and/or narrow green band the EB thru traffic may not clear within the same cycle at Bedford Ct. • At La Paz Rd, the back of the platoon may arrive on red. Due to high volume and/or narrow green band the WB thru traffic may not clear within the same cycle at Bedford Ct, La Paz Rd and Margarita Rd.
Mid
• Balanced plan, no direction favored. • To provide a wide green band, WB left turn lag at Jedediah Smith Rd and Margarita Rd. • Narrow green band at Bedford Ct, Margarita Rd, and Butterfield Stage Rd. • The EB platoon may arrive at the end of the red interval at Rancho Puenlo Rd and Margarita Rd and may experience brief delay. At Wabash Ln, the later part of the platoon may arrive on red. Due to high volume and/or narrow green band, the EB thru traffic may not clear within the same cycle at Bedford Ct. • The WB platoon may arrive at the end of the red interval at Rancho Community Wy and Country Glen Wy and experience brief delay. The WB platoon may arrive at the beginning of red at Margarita Rd and may experience long delay. At Bedford Ct later part of the WB platoon may arrive on red. Due to high volume and/or narrow green band the WB thru traffic may not clear within the same cycle at Bedford Ct and La Paz Rd.
PM
• Generally, favors EB traffic. • Due to the change in cycle length between Pechanga Pkwy and Jedediah Smith Rd, traffic in either direction may experience variation in progression, stop and delay within a multiple number of cycles. • To provide a wide green band, WB left turn lag at Margarita Rd and, EB left turn lag at La Paz Rd. • Narrow green band at Margarita Rd and Meadows Pkwy. • The EB platoon may arrive at the end of the red interval at Pechanga Pkwy, Margarita Rd and Meadows Pkwy and may experience brief delay. Later part of the WB platoon may arrive on red at Wabash Ln. Due to high volume and/or narrow green band, the EB thru traffic may not clear within the same cycle at Bedford Ct, La Paz Rd, Pechanga Pkwy and Margarita Rd and, may experience congestion and traffic backup. • The WB platoon may arrive at the end of the red interval at Rancho Community Wy, Country Glen Wy and Meadows Pkwy and may experience brief delay. The WB platoon may arrive at

the start of red interval at Camino Del Sol and may experience long delay. Due to high volume and/or narrow green band, the WB thru traffic may not clear within the same cycle at La Paz Rd.
WE MID
• Balanced plan, but generally favors WB traffic west of Pechanga Pkwy. • Due to a change in cycle length between Pechanga Pkwy and Jedediah Smith Rd, traffic in either direction may experience variation in progression, stop and delay within a multiple number of cycles. • To provide wide green band, WB left turn lag at Jedediah Smith Rd and Margarita Rd and, EB left turn lag at Meadows Pkwy. • Narrow green band at Bedford Ct, Margarita Rd, Meadows Pkwy and Butterfield Stage Rd. • The EB platoon may arrive at the end of the red interval at Rancho Puenlo Rd and may experience brief delay. The EB platoon may arrive at middle of red interval at Margarita Rd and Butterfield Stage Rd and may experience long delay. Due to high volume and/or narrow green band, the EB thru traffic may not clear within the same cycle at most intersections and may experience congestion and traffic backup. • The WB platoon may arrive at the end of the red interval at Rancho Community Wy, Country Glen Wy and Meadows Pkwy and may experience brief delay. Due to high volume and/or narrow green band, the WB thru traffic may not clear within the same cycle at most intersections and may experience congestion and traffic backup. • Later part of platoon for traffic in either direction may arrive on red at few locations.

Table 6-5 Margarita Road Coordinated Operation Description

AM
• Favors NB traffic. • NB platoon may arrive at end of red interval at De Portola Rd and may experience brief delay. • SB platoon may arrive at middle of red interval at Temecula Pkwy.
Mid
• Favors NB traffic. • SB platoon may arrive at middle of red interval at Temecula Pkwy and may experience long delay.
PM
• Favors NB traffic. • SB platoon may arrive at start of red interval at Temecula Pkwy and may experience long delay. • The corridor in both directions may experience congestion and traffic backup.
WE MID
• Favors NB traffic. • SB platoon may arrive at start of red interval at Temecula Pkwy and may experience long delay. • The corridor in both directions may experience congestion and traffic backup.

7.0 PERFORMANCE METRICS

Travel time runs were performed before and after the signal timing implementation to evaluate the performance of the corridor with optimized traffic signal coordination timing. The travel time runs were performed by driving in a car along the corridor with a laptop running Tru-Traffic software and connected with a GPS device. The travel time runs record live positioning, timing, speed, and number of stops. A minimum of five runs in each direction of travel were performed during the AM (7AM – 9AM), MID (11AM-1PM) and PM (4PM-6PM) peak periods. The before travel time runs were performed on Tuesday (November 15th, 2022), Wednesday (November 16th, 2022) and Thursday (November 17th, 2022), to establish the baseline operations before the implementation of the optimized signal timing. The after travel time runs were performed on Tuesday (July 27th, 2023), Wednesday (July 28th, 2023), and Thursday (July 29th, 2023) after the implementation of the optimized signal timing. The data was post-processed and analyzed for travel time, average speed, and number of stops. An average of five runs was used for the analysis. Tru-Traffic data is provided in **Appendix B**.

Travel Time is the duration of time taken by a vehicle to travel from one end of the corridor to the other end. Travel time includes the running time between the intersections and the signal delay.

Average Speed is the length of the corridor divided by the travel time. It factors in the speed of travel between the signals and deceleration traversing through the signal.

Number of Stops is the average number of stops experienced by motorists traveling along the corridor. Stops are recorded when the vehicle is at a standstill position and when the speed drops below 5mph after exceeding 15mph.

7.1 WINCHESTER ROAD PERFORMANCE MEASURE

Winchester Road travel time comparison is summarized in **Table 7-1, Figure 7-1,** and **Figure 7-2.**

Table 7-1 Winchester Road Before and After Travel Time Comparison

Travel Time (min)	AM	MID	PM
EB Direction			
Before	7.2	9.2	13.1
After	7.1	6.1	8.8
% Change	-1%	-33%	-32%
WB Direction			
Before	8.7	7.9	8.3
After	6.9	6.4	7.0
% Change	-20%	-19%	-16%

Figure 7-1: Winchester Road Before and After Travel Time Comparison (Eastbound)

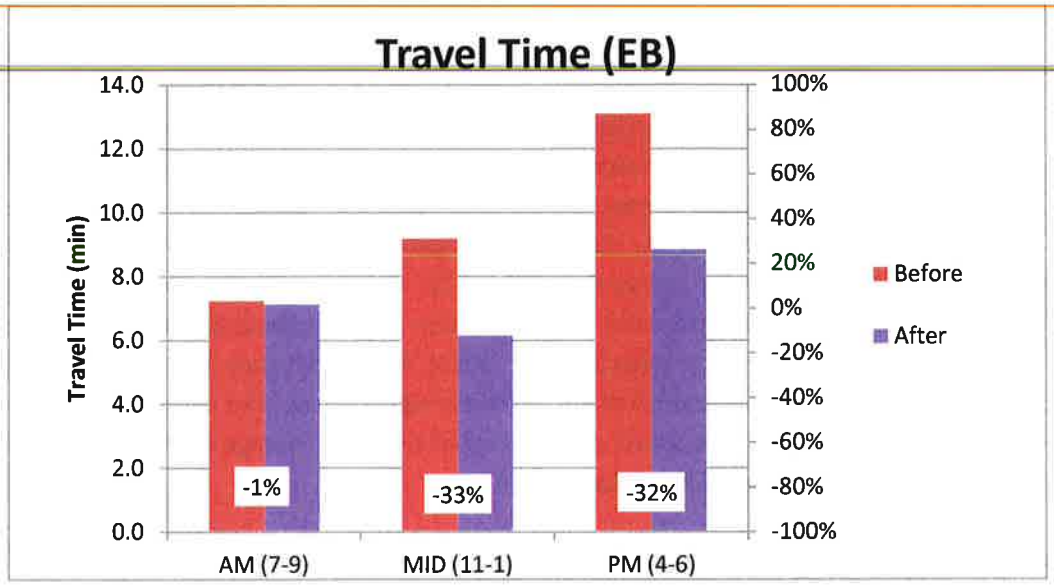
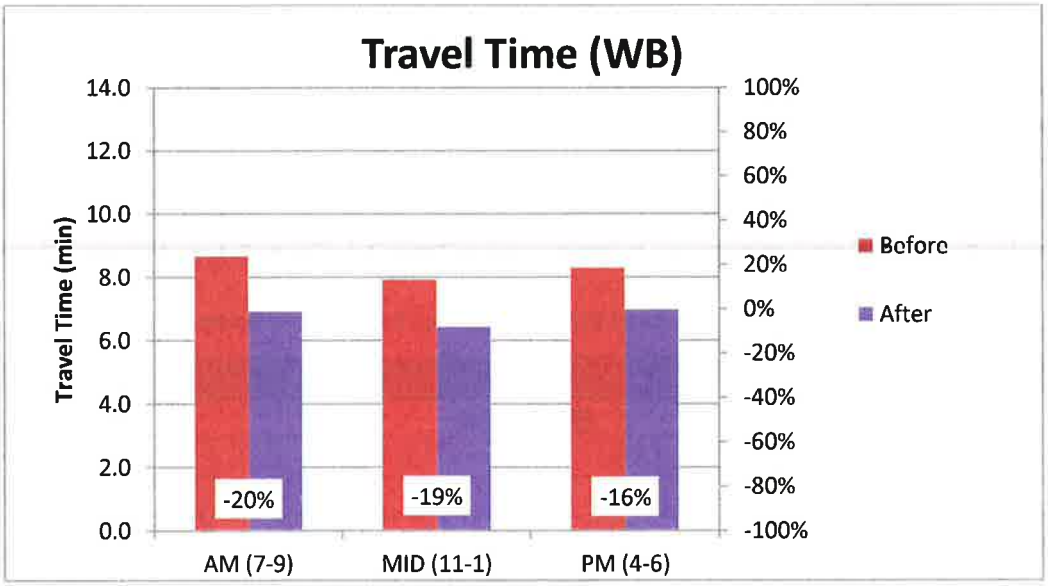


Figure 7-2: Winchester Road Before and After Travel Time Comparison (Westbound)



Winchester Road average speed comparison is summarized in **Table 7-2, Figure 7-3,** and **Figure 7-4.**

Table 7-2 Winchester Road Before and After Average Speed Comparison

Average Speed (mph)	AM	MID	PM
EB Direction			
Before	19.1	11.8	11.1
After	19.8	21.7	17.3
% Change	4%	85%	56%
WB Direction			
Before	16.9	13.7	13.0
After	20.1	21.9	19.7
% Change	19%	60%	52%

Figure 7-3: Winchester Road Before and After Average Speed Comparison (Eastbound)

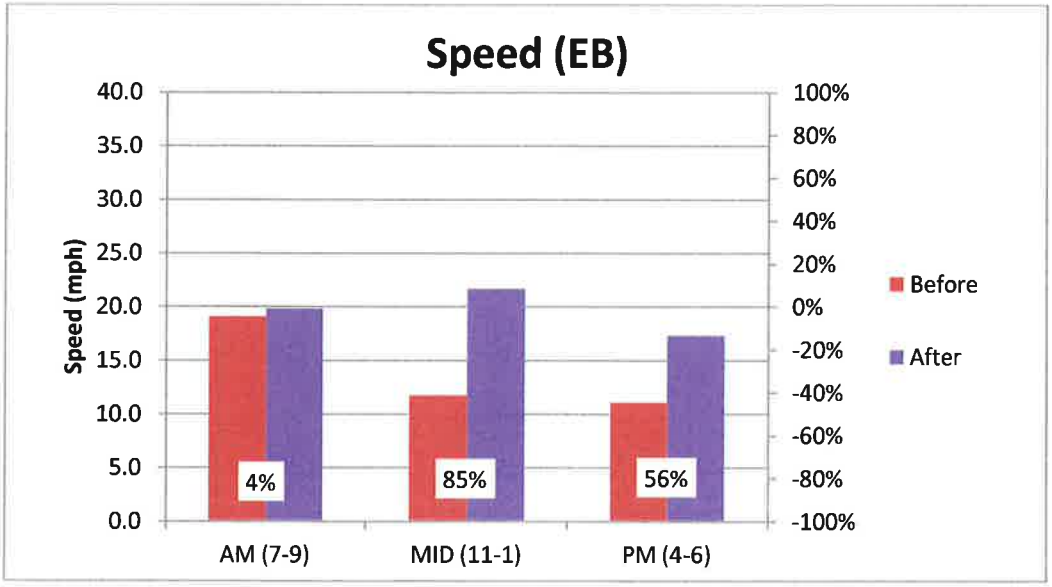
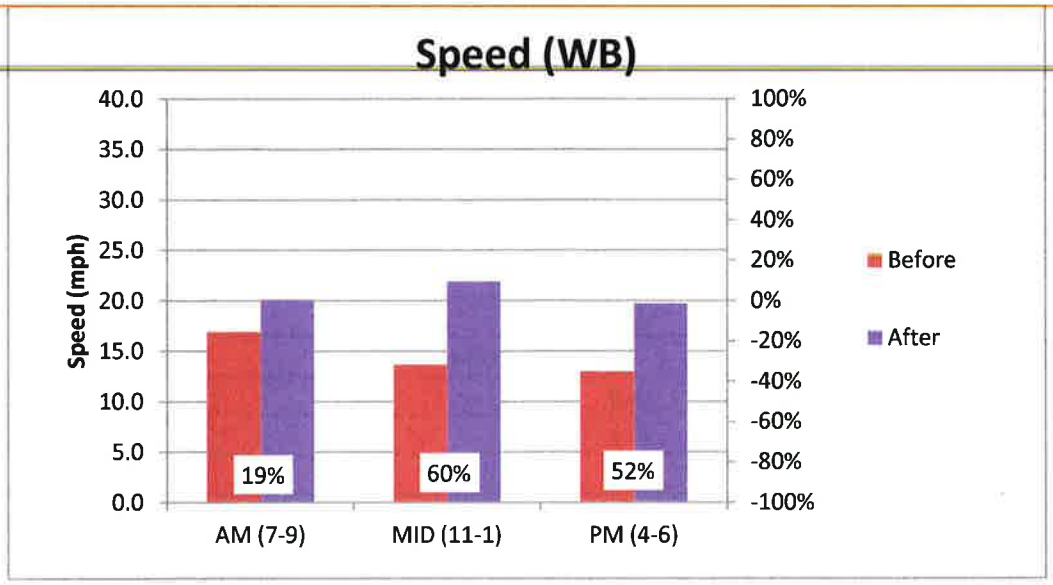


Figure 7-4: Winchester Road Before and After Average Speed Comparison (Westbound)



The Winchester Road number of stops comparison is summarized in **Table 7-3, Figure 7-5,** and **Figure 7-6.**

Table 7-3 Winchester Road Before and After Stop Comparison

Stops (numbers)	AM	MID	PM
EB Direction			
Before	4.6	7.0	9.0
After	4.8	3.7	5.0
% Change	4%	-48%	-44%
WB Direction			
Before	6.4	5.8	5.8
After	5.0	3.4	4.2
% Change	-22%	-41%	-27%

Figure 7-5: Winchester Road Before and After Number of Stops Comparison (Eastbound)

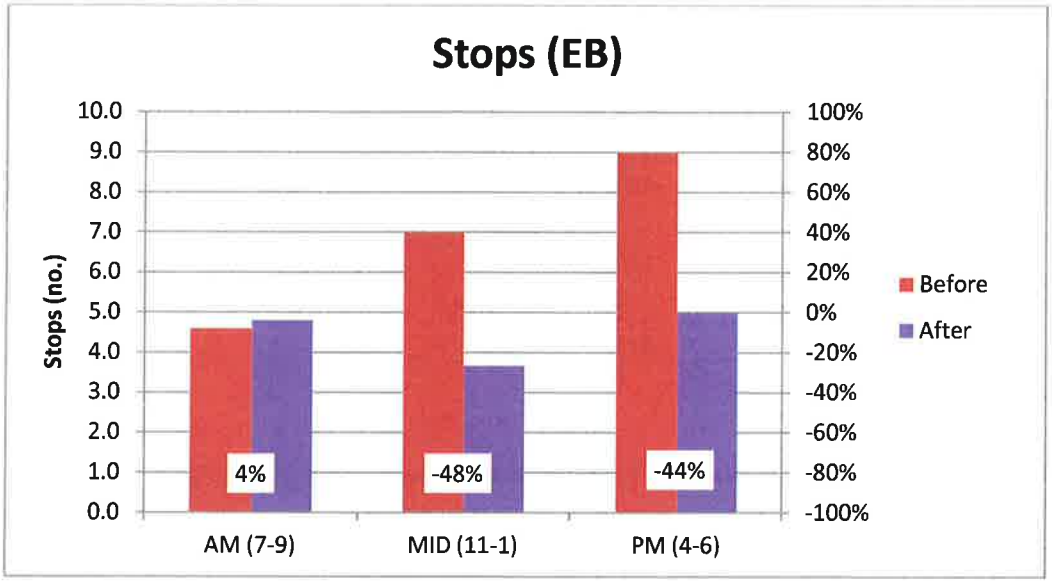
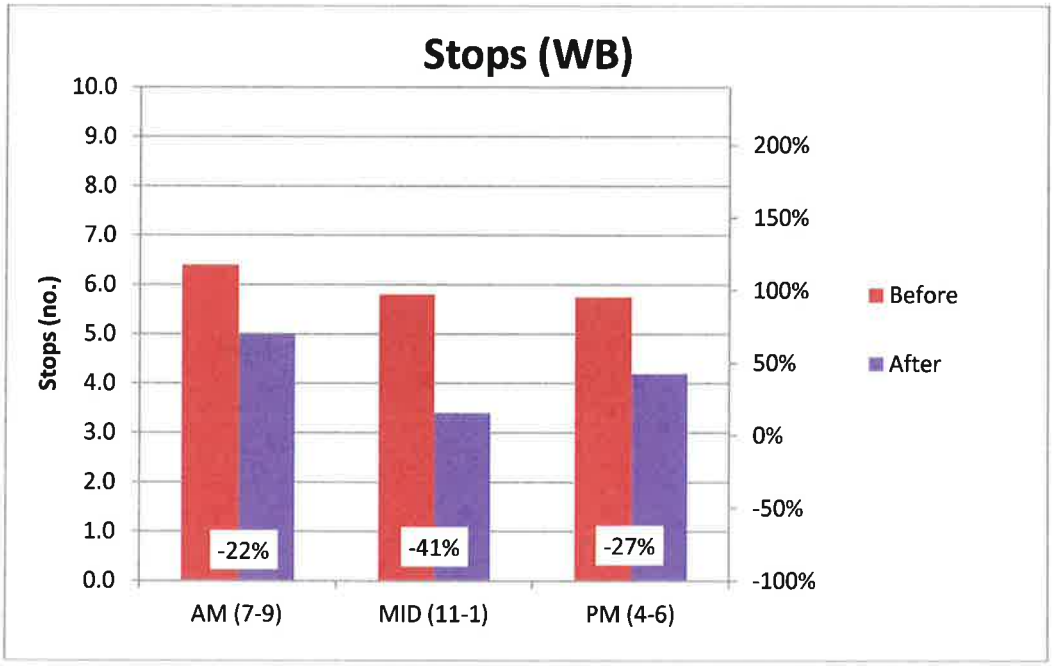


Figure 7-6: Winchester Road Before and After Number of Stops Comparison (Westbound)



7.2 RANCHO CALIFORNIA ROAD PERFORMANCE MEASURE

Rancho California Road travel time comparison is summarized in **Table 7-4, Figure 7-7,** and **Figure 7-8.**

Table 7-4 Rancho California Road Before and After Travel Time Comparison

Travel Time (min)	AM	MID	PM
EB Direction			
Before	11.0	11.4	11.9
After	5.6	6.2	4.5
% Change	-49%	-45%	-62%
WB Direction			
Before	11.5	10.8	12.0
After	6.6	5.0	5.6
% Change	-42%	-53%	-54%

Figure 7-7: Rancho California Road Before and After Travel Time Comparison (Eastbound)

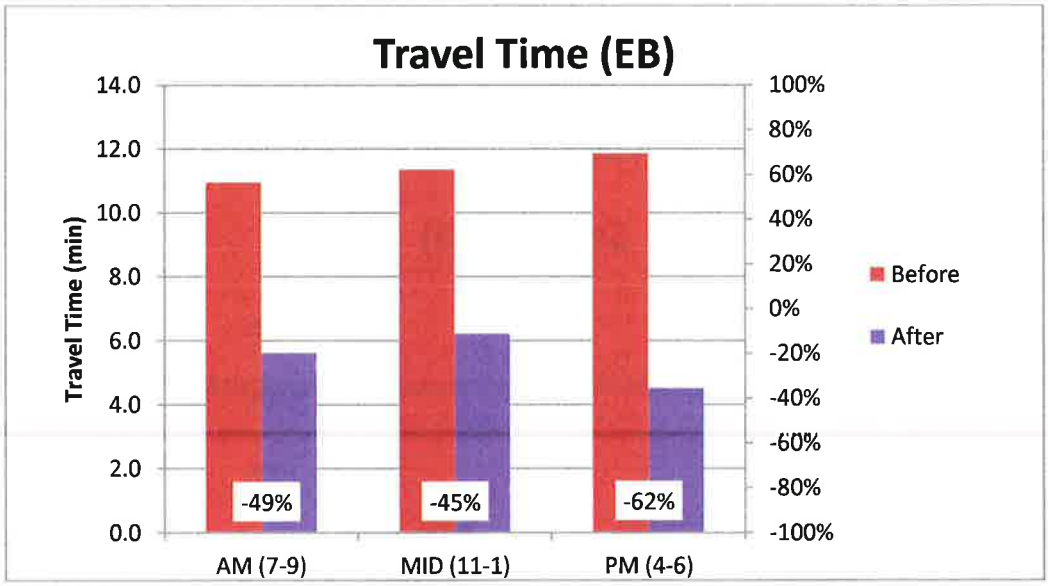
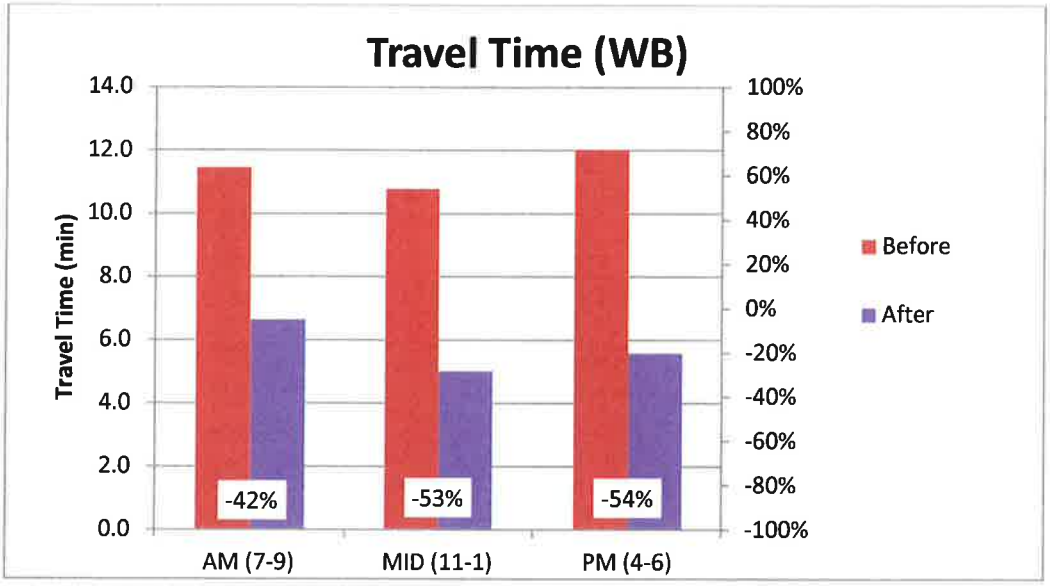


Figure 7-8: Rancho California Road Before and After Travel Time Comparison (Westbound)



Rancho California Road average speed comparison is summarized in **Table 7-5, Figure 7-9,** and **Figure 7-10.**

Table 7-5 Rancho California Road Before and After Average Speed Comparison

Average Speed (mph)	AM	MID	PM
EB Direction			
Before	23.8	23.0	22.0
After	28.8	26.1	35.6
% Change	21%	14%	62%
WB Direction			
Before	22.8	24.2	21.6
After	24.0	31.7	31.1
% Change	5%	31%	44%

Figure 7-9: Rancho California Road Before and After Average Speed Comparison (Eastbound)

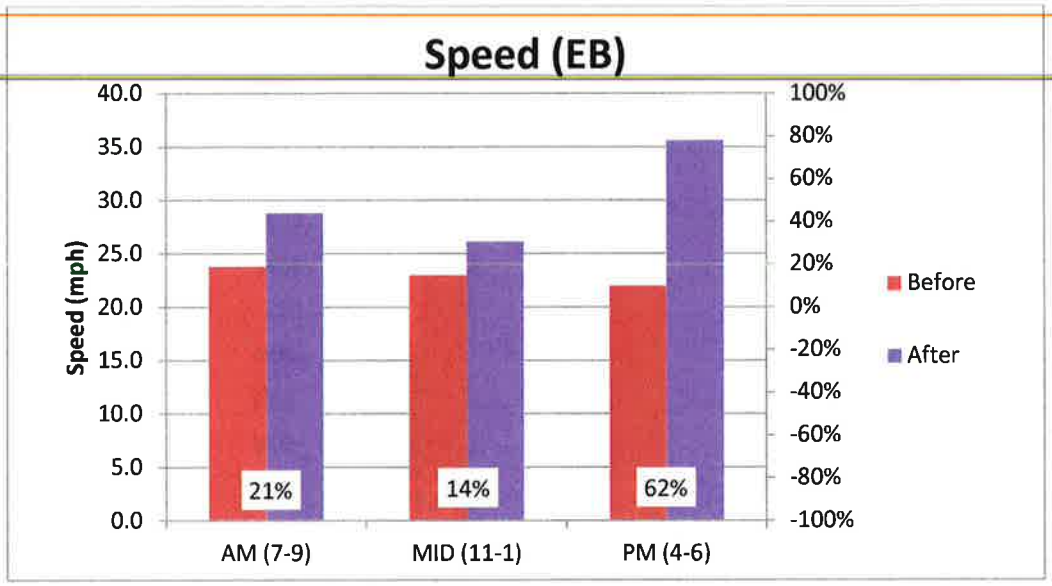
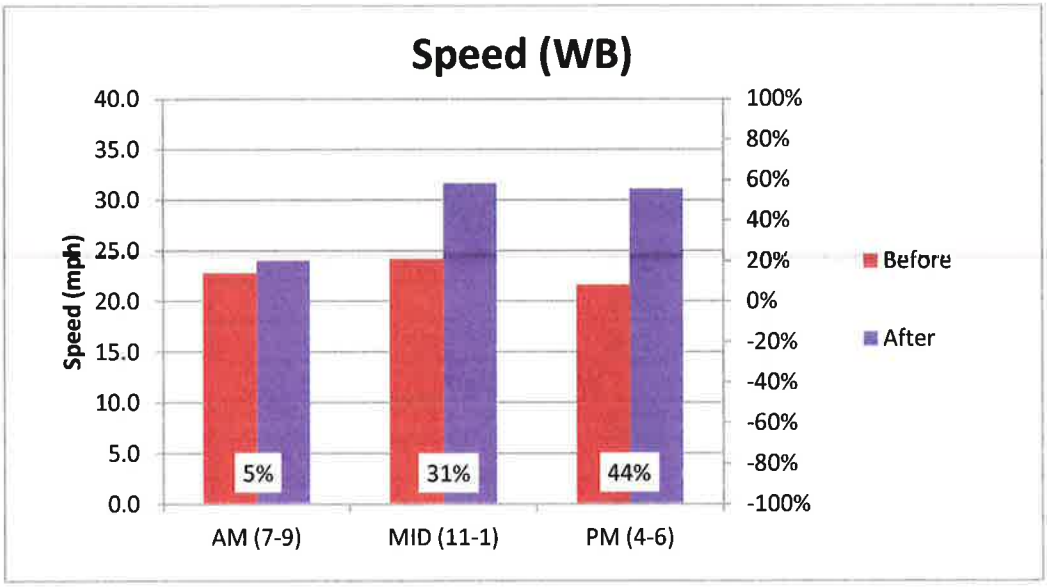


Figure 7-10: Rancho California Road Before and After Average Speed Comparison (Westbound)



Rancho California Road number of stops comparison is summarized in **Table 7-6, Figure 7-11,** and **Figure 7-12.**

Table 7-6 Rancho California Road Before and After Stops Comparison

Stops (numbers)	AM	MID	PM
EB Direction			
Before	7.4	7.4	7.6
After	2.4	4.0	1.4
% Change	-68%	-46%	-82%
WB Direction			
Before	7.6	7.8	7.8
After	4.3	1.4	2.2
% Change	-44%	-82%	-72%

Figure 7-11: Rancho California Road Before and After Number of Stops Comparison (Eastbound)

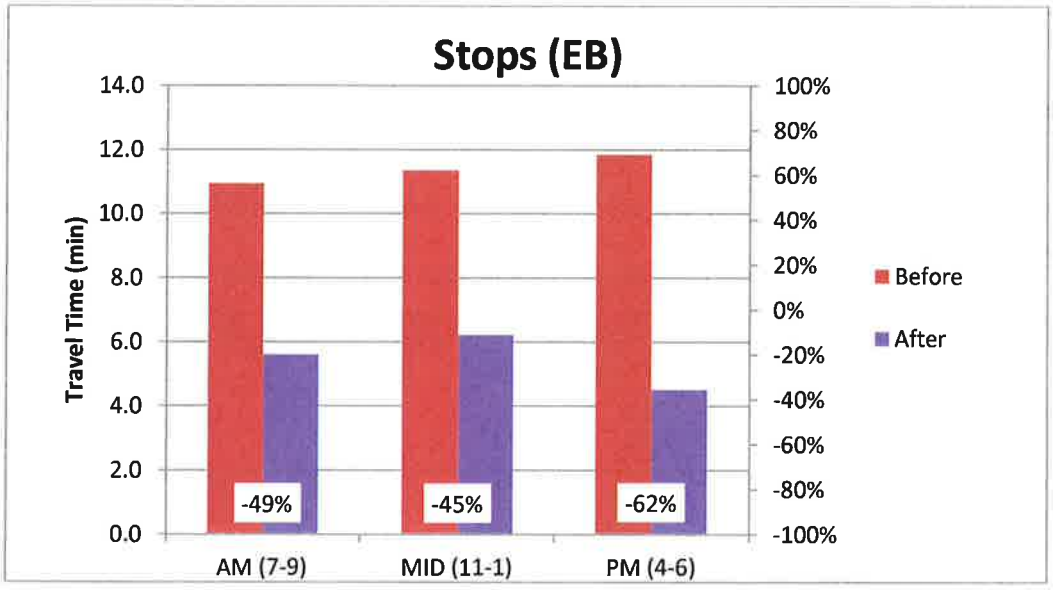
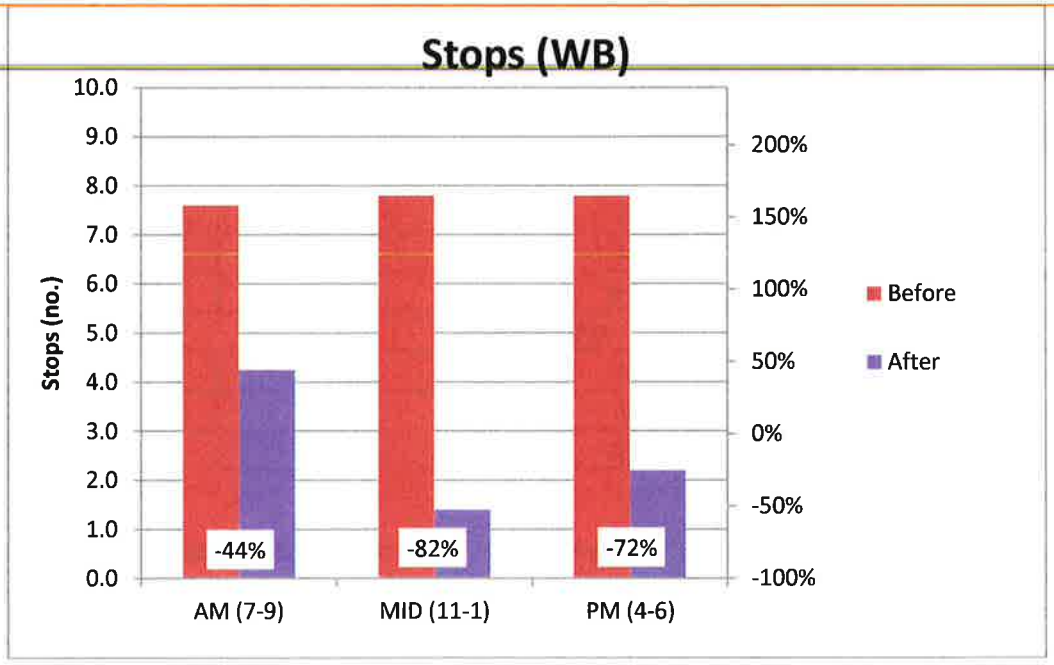


Figure 7-12: Rancho California Road Before and After Number of Stops Comparison (Westbound)



7.3 TEMECULA PARKWAY PERFORMANCE MEASURE

Temecula Parkway travel time comparison is summarized in **Table 7-7, Figure 7-13,** and **Figure 7-14.**

Table 7-7 Temecula Parkway Before and After Travel Time Comparison

Travel Time (min)	AM	MID	PM
EB Direction			
Before	8.8	9.9	11.1
After	6.8	7.7	7.7
% Change	-22%	-22%	-31%
WB Direction			
Before	9.9	9.5	10.4
After	6.5	8.8	9.0
% Change	-34%	-7%	-14%

Figure 7-13: Temecula Parkway Before and After Travel Time Comparison (Eastbound)

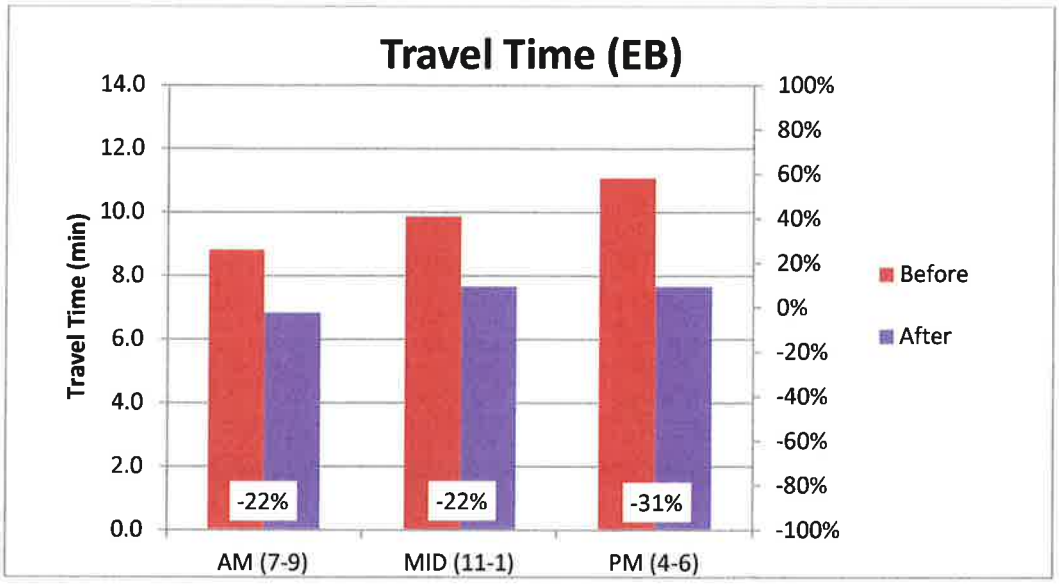
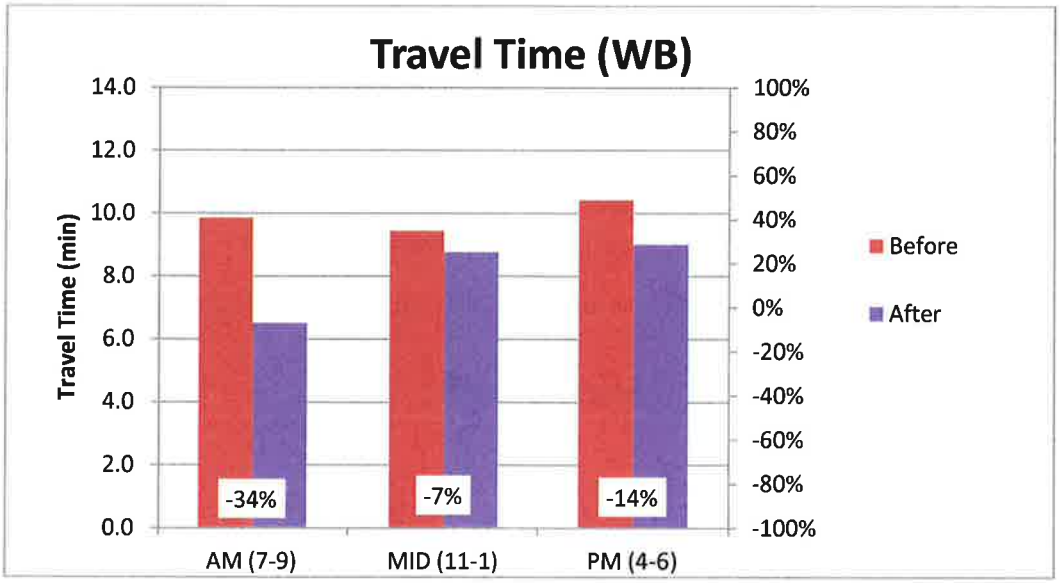


Figure 7-14: Temecula Parkway Before and After Travel Time Comparison (Westbound)



The Temecula Pkwy average speed comparison is summarized in **Table 7-8, Figure 7-15,** and **Figure 7-16.**

Table 7-8 Temecula Parkway Before and After Average Speed Comparison

Average Speed (mph)	AM	MID	PM
EB Direction			
Before	27.3	24.1	21.8
After	34.7	29.5	29.1
% Change	27%	22%	33%
WB Direction			
Before	24.1	25.2	23.0
After	36.6	27.1	27.7
% Change	52%	8%	21%

Figure 7-15: Temecula Parkway Before and After Average Speed Comparison (Eastbound)

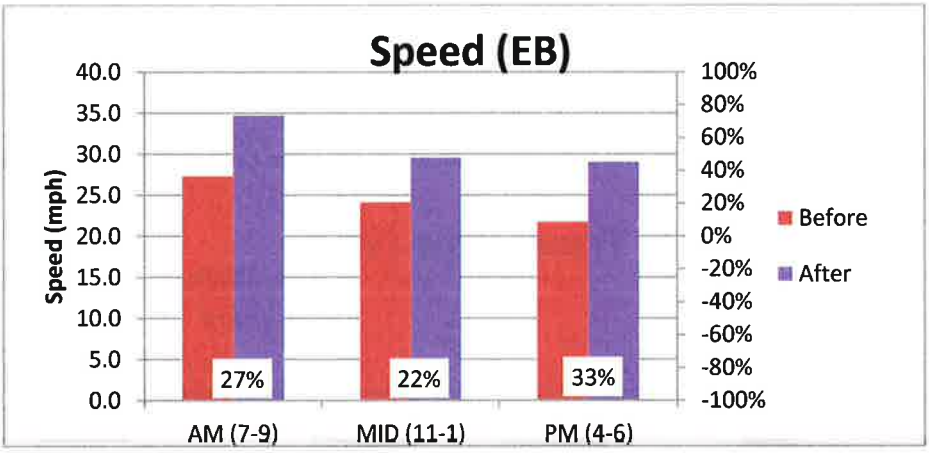
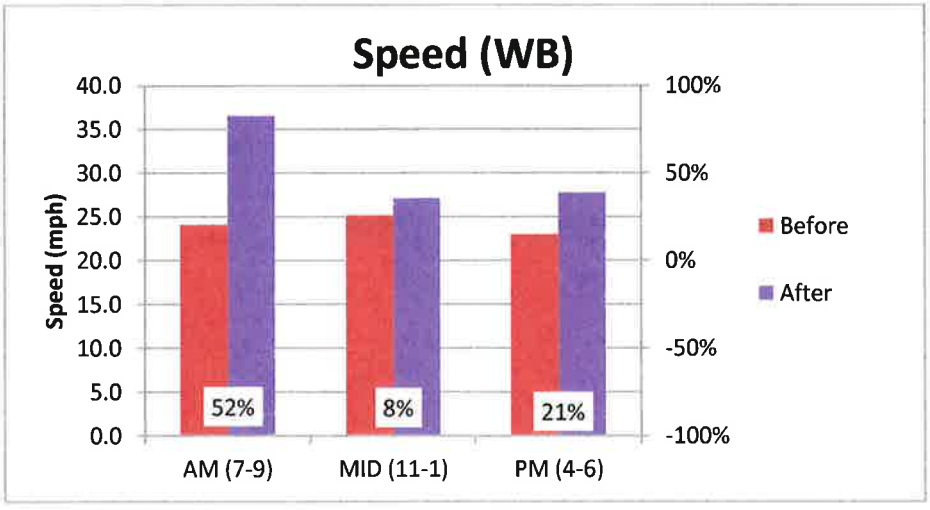


Figure 7-16: Temecula Parkway Before and After Average Speed Comparison (Westbound)



The Temecula Pkwy no. of stops comparison is summarized in **Table 7-9**, **Figure 7-17**, and **Figure 7-18**.

Table 7-9 Temecula Parkway Before and After Stops Comparison

Stops (numbers)	AM	MID	PM
EB Direction			
Before	5.0	7.0	7.6
After	3.6	3.0	2.8
% Change	-28%	-57%	-63%
WB Direction			
Before	8.2	4.6	6.4
After	2.5	4.2	4.4
% Change	-70%	-9%	-31%

Figure 7-17: Temecula Parkway Before and After Number of Stops Comparison (Eastbound)

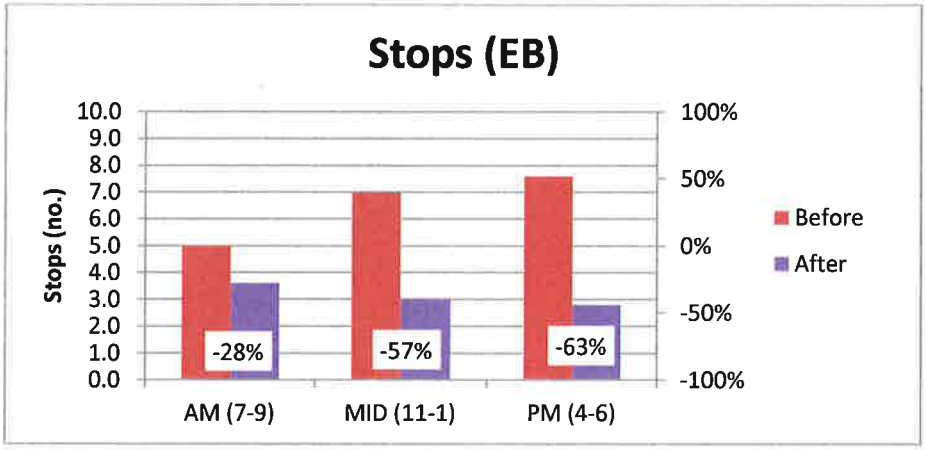
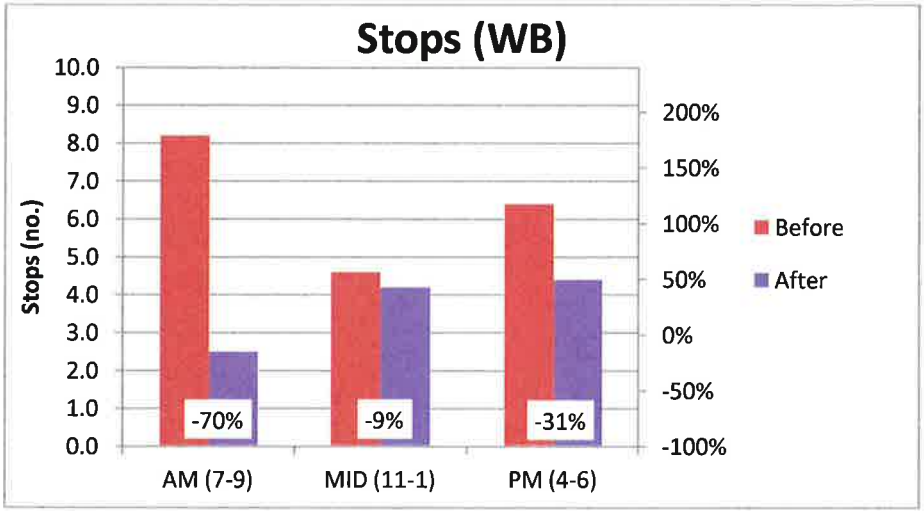


Figure 7-18: Temecula Parkway Before and After Number of Stops Comparison (Westbound)



8.0 SUMMARY

Implementation of coordinated signal timing occurred on-site over the course of three weeks on a typical Tuesday for each of the three corridors. Deficiencies in operation and general signal operation were noted and adjusted in the field during observation periods. The field notes were recorded and can be found in **Appendix C: Field Notes**.

Coordinated operation performed as expected based upon time-space diagrams and Synchro model analysis. The previous travel time measurement results show eastbound and westbound traffic performance metrics significantly improved compared to the pre-project condition.