Mount Vernon Avenue Bridge
Pedestrian and Vehicular Detour Analysis

DRAFT

Prepared for
The City of San Bernardino

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J09-1638

Table of Contents

List of Tables

List of Figures

List of Appendices

Introduction

Purpose of the Report

This report presents the results of analyses performed to evaluate potential pedestrian, traffic and circulation impacts caused by the reconstruction of the Mount Vernon Avenue Bridge over the Burlington Northern Santa Fe (BNSF) rail yard in the City of San Bernardino. The potential temporary impacts associated with the construction of the project and detours are evaluated, and possible temporary circulation improvements are identified to reduce those potential impacts.

Traffic conditions are evaluated for each of the following scenarios:

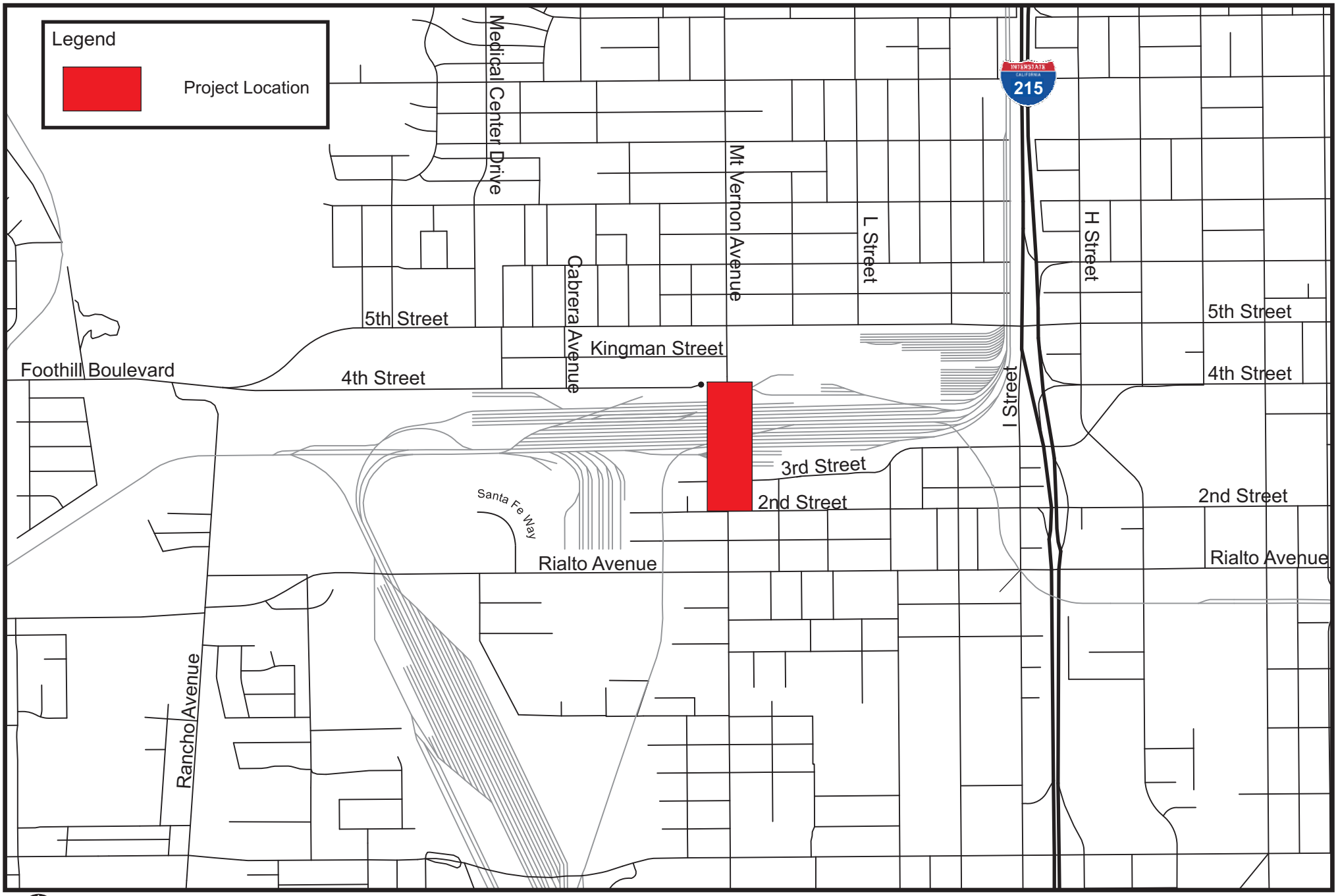
1. Existing (2009) conditions;
2. Construction year (2012) without detour; and
3. Construction year (2012) with detour.

The Pedestrian Detour Analysis included in this report was conducted in 2004 and has previously been documented in the *Pedestrian and Vehicular Detour Analysis* prepared by LSA Associates, Inc. The pedestrian information has been updated with current school attendance boundary maps provided by the San Bernardino Unified School District and updated cost estimates provided by Omnitrans. The pedestrian and bicycle analysis has not otherwise been updated because the pedestrian survey conducted in 2004 showed that the main reasons for pedestrians using the bridge were to get to shopping or work destinations. The type and location of such destinations has not changed significantly because there has been no substantial change in the amount of development in the area. The redevelopment of the Second Street Shopping Center reflected a modernization rather than a change in type or size of development; the primary tenant in this center, Superior Grocers, replaced the Mercado previously occupying the site, which was similar in terms of goods available and expected shoppers. Thus, no reasonable change in the amount of shoppers using Mount Vernon Avenue would be expected. In addition, no significant new businesses have opened within the areas located on either side of the bridge; therefore, pedestrians walking to places of employment can be reasonably assumed to be consistent since 2004 and, in fact, it might be reasonable to expect this number has decreased due to the current economic conditions. In addition, school boundaries remain unchanged from 2004; therefore, the numbers of school-aged children and their parents would not be reasonably expected to change.

Vehicular traffic patterns in the area have been modified since the traffic analyses performed in 2004 because of ongoing construction activity related to the widening of Interstate 215. Therefore, the vehicular detour analysis has been updated with more recent traffic volumes (2009) and projections.

Project Description

The Mount Vernon Avenue Bridge carries Mount Vernon Avenue over the BNSF rail yard. Mount Vernon Avenue is a major north/south arterial in western San Bernardino. The existing bridge has two travel lanes in each direction and sidewalks on both sides. The bridge provides the only arterial crossing of the BNSF rail lines between Rancho Avenue (approximately 1.1 miles to the west) and 5th Street (approximately 0.6 miles to the east). The location of the project site is illustrated in **Figure 1**.



NOT TO SCALE

Mount Vernon Avenue Bridge Pedestrian and Vehicular Detour Analysis
City of San Bernardino

FIGURE 1
Project Location

The bridge has been determined to be structurally deficient and will be replaced with a new structure . The profile of the replacement bridge will be different from that of the existing bridge, necessitating the raising of the intersection of Mount Vernon Avenue and 2nd Street. Mount Vernon Avenue is proposed to be closed from mid 2012 to mid 2014 while the bridge is replaced. The bridge will be closed between 2nd Street and Kingman Street. The intersection of Mount Vernon Avenue and 2nd Street will be closed during the bridge replacement, although local access to the properties on the west side of the intersection will be maintained.

During construction, traffic will be detoured around the project site via Rialto Avenue, G and H Streets, and 5th Street. In addition, traffic using 2nd Street to access Mount Vernon Avenue will be detoured to Rialto Avenue. Signage will be placed along the detour route to guide motorists.

Pedestrian Detour Analysis

Methodology

Pedestrian and bicyclist counts and interviews were conducted on a Saturday and Sunday in April 2004 and on Monday, May 3, 2004. Interviews were conducted by bilingual English/Spanish speakers from 11:00 a.m. to 3:00 p.m. on Saturday, 8:00 a.m. to noon on Sunday, and 5:00 a.m. to 11:00 p.m. on Monday. Every pedestrian and bicyclist crossing the bridge was counted, with the time and direction of travel recorded. Interviewers attempted to collect information from each pedestrian and cyclist concerning the origin, destination, and purpose of his or her trip. As noted in the Introduction, pedestrian volumes would not reasonably be expected to have changed since 2004.

Results and Analysis

Tables 1, 2, and 3 summarize the results of the pedestrian and bicyclist interviews on Saturday, Sunday, and Monday, respectively. On Saturday, an average of just over 15 pedestrians and cyclists crossed the bridge each hour during the count period. The largest single share of trips was trips between traveler's home and shopping destination. Most shopping trips were to and from the Mercado and surrounding stores just south of the Metrolink station on Third Street.

Table 1: Trip Purpose by Time of Day (Saturday)

Time Interval	Direction		Purpose							Total
	North	South	H-W	H-S	H-M	H-O	M-O	O-O	W-O	
11:00 AM to 12:00 PM	17	9	4	7	1	8	5	1	0	26
12:00 PM to 1:00 PM	6	7	0	6	0	5	0	1	1	13
1:00 PM to 2:00 PM	6	6	5	1	1	1	2	2	0	12
2:00 PM to 3:00 PM	9	3	2	8	1	1	0	0	0	12
Total	38	25	11	22	3	15	7	4	1	63
Percentage	60%	40%	17%	35%	5%	24%	11%	6%	2%	100%

Legend

Symbol	Purpose
H-W	Home-Work
H-S	Home-Shopping
H-M	Home-Metrolink
H-O	Home-Other
M-O	Metrolink-Other
O-O	Other-Other
W-O	Work-Other

Table 2: Trip Purpose by Time of Day (Sunday)

Time Interval	Direction		Purpose									Total
	North	South	H-W	H-S	H-M	H-O	H-Sc	S-O	M-O	O-O	NR	
8:00 AM to 9:00 AM	3	7	1	3	4	0	0	0	0	1	0	10
9:00 AM to 10:00 AM	22	10	2	9	10	9	0	1	0	1	0	32
10:00 AM to 11:00 AM	4	4	0	2	0	3	0	0	1	1	1	8
11:00 AM to 12:00 PM	11	3	1	1	1	9	1	0	1	0	0	14
Total	40	24	4	15	12	25	1	1	2	3	1	64
Percentage	63%	38%	6%	23%	19%	39%	2%	2%	3%	5%	2%	100%

Legend

Symbol	Purpose
H-W	Home-Work
H-S	Home-Shopping
H-M	Home-Metrolink
H-O	Home-Other
M-O	Metrolink-Other
O-O	Other-Other
NR	No Response

Table 3: Trip Purpose by Time of Day (Monday)

Time Interval	Direction		Purpose											Total
	North	South	H-W	H-S	H-M	H-O	H-Sc	S-O	M-W	M-O	O-O	W-O	NR	
5:00 AM to 6:00 AM	1	8	9	0	0	0	0	0	0	0	0	0	0	9
6:00 AM to 7:00 AM	3	7	4	0	0	2	0	0	0	1	1	2	0	10
7:00 AM to 8:00 AM	8	10	6	0	1	3	5	0	1	0	2	0	0	18
8:00 AM to 9:00 AM	6	4	3	2	1	1	1	0	0	1	1	0	0	10
9:00 AM to 10:00 AM	9	14	5	8	0	5	3	0	0	1	1	0	0	23
10:00 AM to 11:00 AM	4	4	3	2	0	2	0	0	0	0	0	0	1	8
11:00 AM to 12:00 PM	4	8	2	5	0	0	1	0	0	0	0	0	4	12
12:00 PM to 1:00 PM	5	8	4	2	0	0	2	0	0	0	2	0	3	13
1:00 PM to 2:00 PM	9	9	3	0	0	3	1	0	0	0	5	0	6	18
2:00 PM to 3:00 PM	8	6	4	2	1	2	1	0	0	0	1	0	3	14
3:00 PM to 4:00 PM	8	7	3	0	4	2	3	0	0	0	2	1	0	15
4:00 PM to 5:00 PM	10	16	1	3	0	11	5	0	1	0	1	0	4	26
5:00 PM to 6:00 PM	6	7	3	1	4	1	3	0	0	1	0	0	0	13
6:00 PM to 7:00 PM	6	14	7	3	0	3	0	0	0	1	0	0	6	20
7:00 PM to 8:00 PM	7	5	1	6	0	1	1	0	0	0	0	0	3	12
8:00 PM to 9:00 PM	6	4	1	1	0	1	0	1	0	0	0	0	6	10
9:00 PM to 10:00 PM	3	5	0	1	0	1	0	0	0	0	0	0	6	8
10:00 PM to 11:00 PM	1	2	0	0	0	1	0	0	0	0	0	0	2	3
Total	104	138	59	36	11	39	26	1	2	5	16	3	44	242
Percentage	43%	57%	24%	15%	5%	16%	11%	0%	1%	2%	7%	1%	18%	100%

Legend

Symbol	**Purpose**
H-W	Home-Work
H-S	Home-Shopping
H-M	Home-Metrolink
H-O	Home-Other
H-Sc	Home-School
S-O	Shopping -Other
M-W	Metrolink-Work
M-O	Metrolink-Other
O-O	Other-Other
NR	No Response

On Sunday, an average of just over 15 pedestrians and cyclists also crossed the bridge each hour during the court period. The largest single share of trips was trips between the traveler's home and a non-shopping, non-working destination. Most of these trips were to church, although some were social visits to friends or relatives.

On Monday, 242 pedestrians and cyclists crossed the bridge, with the greatest number of trips occurring between 4:00 and 5:00 p.m. The largest number of trips during the day was between traveler's home and place of work, although there was substantial numbers of shopping, church, and social trips throughout the day as well.

Table 4 presents some additional information concerning the nature of the pedestrians and cyclist trips across the Mount Vernon Bridge. The vast majority of pedestrian and cyclist trips were home-based trips (i.e., has as their origin or destination the traveler's home). The area that was the origin or destination of the largest share of trips was the Metrolink Station and the adjacent Mercado, although this area's share of trip was much larger on the weekend than on Monday. Pedestrians accounted for the majority of trips during the count periods.

Alternatives

During the approximately two years that the bridge will be closed, there will be no pedestrian access across the BNSF rail yard at the bridge location. The shortest alternative pedestrian route is approximately two miles in length. Therefore, it will be necessary to provide alternative, motorized means for pedestrians to travel across the rail yard. Four feasible and potentially cost-effective alternative means of providing pedestrian and bicyclist mobility are evaluated in this report. These four alternatives are described below:

1. Dedicated Shuttle. In this alternative, a dedicated shuttle (most likely a van) would be provided to transport pedestrians along a designed route serving popular origins and destinations on both sides of the bridge.
2. Bus Passes for Area Residents. In this alternative, the City of San Bernardino would make arrangements to provide bus passes to residents of the area surrounding the bridge. These passes would be valid for travel on Omnitrans buses that serve the area.
3. Free Ridership on Area Bus Routes. In this alternative, arrangements would be made with Omnitrans to allow passengers boarding or alighting in the area surrounding the bridge to travel for free. Passes would not be required.
4. Extend Omnitrans Routes 3 and 4. This alternative was considered for implementation in conjunction with Alternative 3. In this alternative, Omnitrans Routes 3 and 4 would be extended from the Fourth Street Transit Mall to serve the Metrolink Station/Mercado area to provide more convenient transit service between the north and south sides of the bridge.

Evaluation of Alternatives

Each of the alternatives was evaluated to assess its feasibility. The following summarizes the results of the evaluation of each alternative.

1. **Dedicated Shuttle.** A shuttle is most useful if many pedestrian and cyclist trips share common origins and destinations. However, as shown in **Table 4**, the single most common origin/destination was the area near the Metrolink Station and the Mercado, which accounted for only 16 percent of weekday trips.

   Omnitrans was contacted as the most likely provider of the dedicated shuttle because, as a transit provider, Omnitrans has the necessary equipment and personnel to provide such service.

Table 4: Trip Characteristics by Day of Week

	Monday			Saturday			Sunday		
	Number of Trips	**As % of all Trips**	**As % of Responses**	**Number of Trips**	**As % of all Trips**	**As % of Responses**	**Number of Trips**	**As % of all Trips**	**As % of Responses**
Home-based trips	171	71%	86%	51	81%	81%	57	89%	90%
Trips to/from Mercado/Metrolink Station	32	13%	16%	31	49%	49%	21	33%	33%
Trips to/from Bus Stop	6	2%	3%	9	14%	14%	3	5%	5%
Bicycle trips	28	12%	14%	2	3%	3%	8	13%	13%

Omnitrans indicated that the cost of providing a shuttle service would be at least $100 per hour. To provide service 18 hours per day would therefore cost approximately $54,000 per month. Based on 242 pedestrians and cyclist who crossed the bridge during the eighteen-hour count period on Monday, the average cost per trip of providing a shuttle service for that period of the day would be $7.44. Average per-trip costs would be even higher on weekends because of lower ridership.

2. **Bus Passes for Area Residents.** Under this alternative, the City would provide bus passes to provide mobility for the area residents. As shown in **Table 4**, over 80 percent of pedestrians and bicycle trips across the bridge are made by residents in the area. Therefore, this alternative would serve the large majority of current bridge users.

   Existing Omnitrans bus routes that serve the area (Routes 1, 3, and 4) run on headways of approximately 15 minutes from before 5:00 a.m. until the end of the evening rush hour, and then approximately 30 minute headways until after 10:00 p.m. Therefore, waiting times for pedestrians and cyclists to use the existing service would be reasonable. Omnitrans buses are fitted with bicycle racks, so that they would also be useable for those traveling by bicycle.

   A 31-day pass on Omnitrans costs $47 at retail, although it is expected that a lower bulk rate would be negotiated. At the retail rate, if 300 area residents received free bus passes, the monthly cost would be $14,100.

3. **Free Ridership on Area Bus Routes.** This alternative potentially offered the advantage of serving all travelers to the area, not just local residents. However, this alternative was found to be impractical because of the difficulty of confirming which riders would be alighting in the designated area. Fares are typically collected at the time of boarding, and bus drivers are not able to monitor individual passenger's destinations.

4. **Extend Omnitrans Routes 3 and 4.** This alternative would offer the benefit of more convenient transit service between the north and south sides of the bridge. Onmitrans was contacted concerning the feasibility of extending these routes. Omnitrans indicated that such an extension would not be feasible because of the tight headways that already exist on these routes. There is simply not time in each bus's schedule to lengthen the route.

School Trips

If large numbers of school children would need to travel from one side of the BNSF rail lines to the other during the bridge closure, then coordination would be required with the San Bernardino City Unified School District (SBCUSD) to ensure the appropriate transportation would be provided. The SBCUSD was contacted to obtain information concerning the attendance areas of the District's schools in the area. Attendance maps are included in **Appendix A**. No SBCUSD schools have an attendance area that crosses the rail lines in the vicinity of the bridge. Therefore, no additional coordination is required.

Recommendation

Since there will be no pedestrian access across the BNSF rail yard at the bridge location during the approximately two years that the bridge will be closed, it is necessary to provide alternative, motorized means for pedestrians to travel across the rail yard during that time. Based on the data and analyses presented above, it is recommended that Alternative 2 be implemented in order to replace the pedestrian access that will be eliminated by the closure of the bridge during construction. Free bus passes for travel on existing Omnitrans routes, provided by the City, will provide mobility to area residents affected by the bridge closure. The alternative is the most practical and cost effective means for providing such mobility.

Vehicular Detour Analysis

Study Area

The study area for the analysis of potential impacts from the traffic detour during construction includes the following intersections that will be affected by detoured or diverted traffic:

1. Foothill Boulevard and Rancho Avenue
2. 5th Street and Medical Center Drive
3. 5th Street and Cabrera Avenue
4. 5th Street and Mount Vernon Avenue
5. 5th Street and L Street
6. 5th Street (Foothill Boulevard) and 4th Street
7. 5th Street and H Street
8. 4th Street (I-215 On Ramps) and H Street
9. 3rd Street and I Street
10. 3rd Street and H Street
11. 2nd Street and Mount Vernon Avenue
12. 2nd Street and K Street
13. 2nd Street and I Street
14. 2nd Street and I-215 SB On Ramp
15. 2nd Street and I-215 NB On Ramp
16. 2nd Street and G Street
17. Rialto Avenue and Rancho Avenue
18. Rialto Avenue and Santa Fe Way
19. Rialto Avenue and Mount Vernon Avenue
20. Rialto Avenue and K Street
21. Rialto Avenue and I Street
22. Rialto Avenue and G Street

Traffic Forecasts

Existing Volumes

A detailed inventory of the intersection geometrics and control type was conducted in October 2009 at the 22 study intersections. The lane geometry and control type of the study intersections are illustrated in **Figure 2**. Vehicle turning movement counts were conducted during the AM peak period (7:00 AM to 9:00 AM) and the PM peak period (4:00 PM to 6:00 PM) at the 22 study intersections in October 2009. The hour with the highest total traffic volume at each intersection was taken to be the peak hour for that peak period. Detailed vehicle turning movement data are included in **Appendix B**. Vehicle classification counts (e.g., passenger vehicle, 2-axle truck, 3-axle truck, and 4 or more axle truck), were conducted at the following four study intersections: 5th Street / Mount Vernon Avenue, 2nd Street / Mount Vernon Avenue, 3rd Street / H Street, Rialto Avenue / Mount Vernon Avenue. It should be noted that heavy trucks are currently restricted from using the Mount Vernon Bridge. Therefore, heavy truck volumes on the bridge are relatively low.

The traffic counts for these intersections were converted to passenger car equivalent (PCE) volumes using PCE factors of 1.5, 2.0, and 3.0 for 2-axle, 3-axle, and 4-axle trucks, respectively. Truck percentages for the remaining intersections for which classification counts were not collected were developed from the percentages at adjacent intersections. Volume development worksheets are included in **Appendix C**. Existing 2009 PCE volumes for the weekday peak hours are illustrated in **Figure 3.**

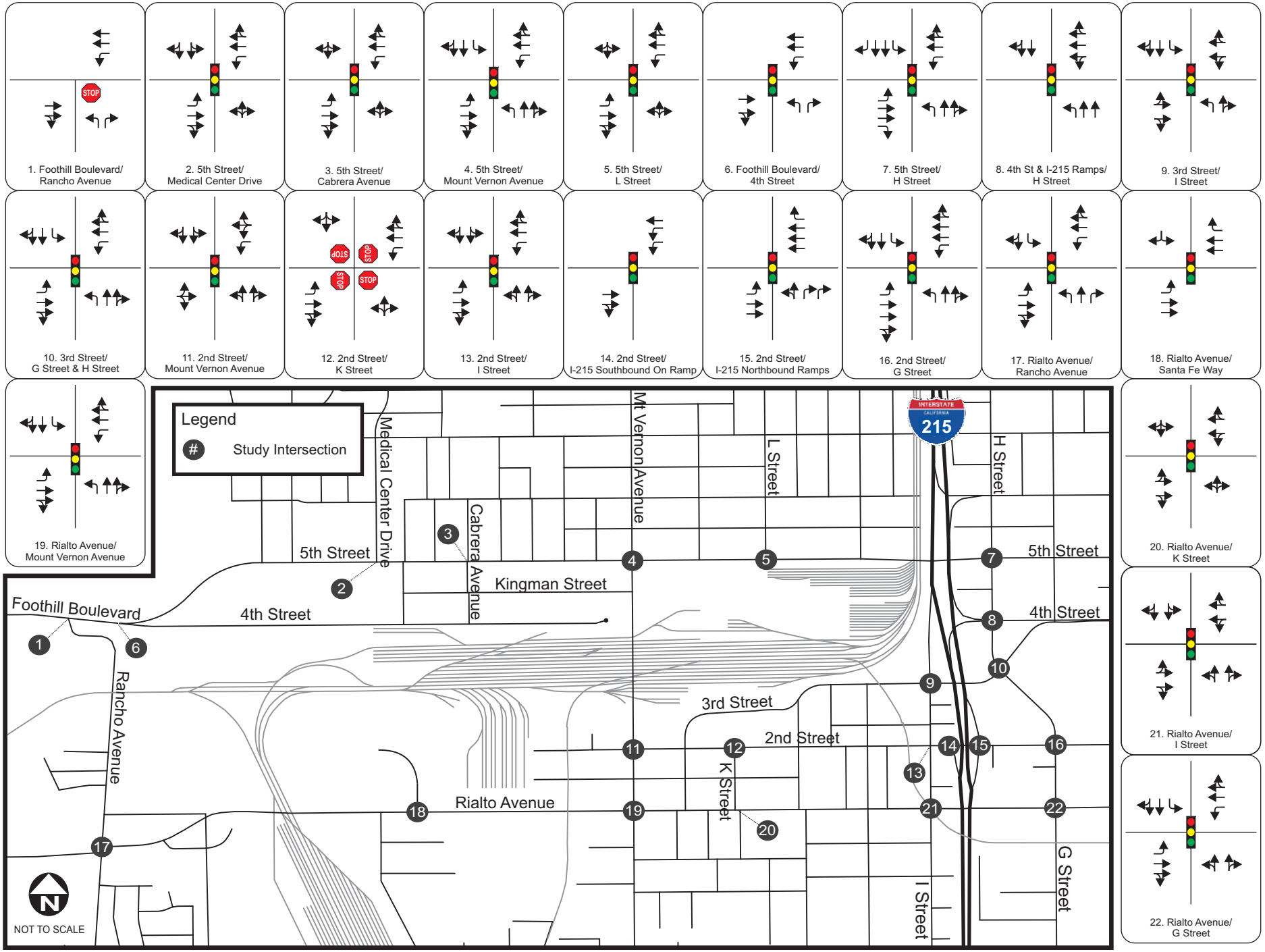
In addition, a 24-hour directional volume count was conducted for the Mount Vernon Avenue Bridge in October 2009. Approximately 14,700 vehicles per day cross the bridge. **Table 5** and **Table 6** summarize the 2009 peak hour and daily traffic volumes. The 24-hour directional volume counts are documented in **Appendix D**.

Table 5: Existing 2009 AM and PM Peak Hour Traffic Volume at the Mount Vernon Avenue Bridge

Location	AM Peak Hour Volume			PM Peak Hour Volume		
	Northbound	Southbound	Total	Northbound	Southbound	Total
Mount Vernon Avenue Bridge	494	537	1,031	655	592	1,247

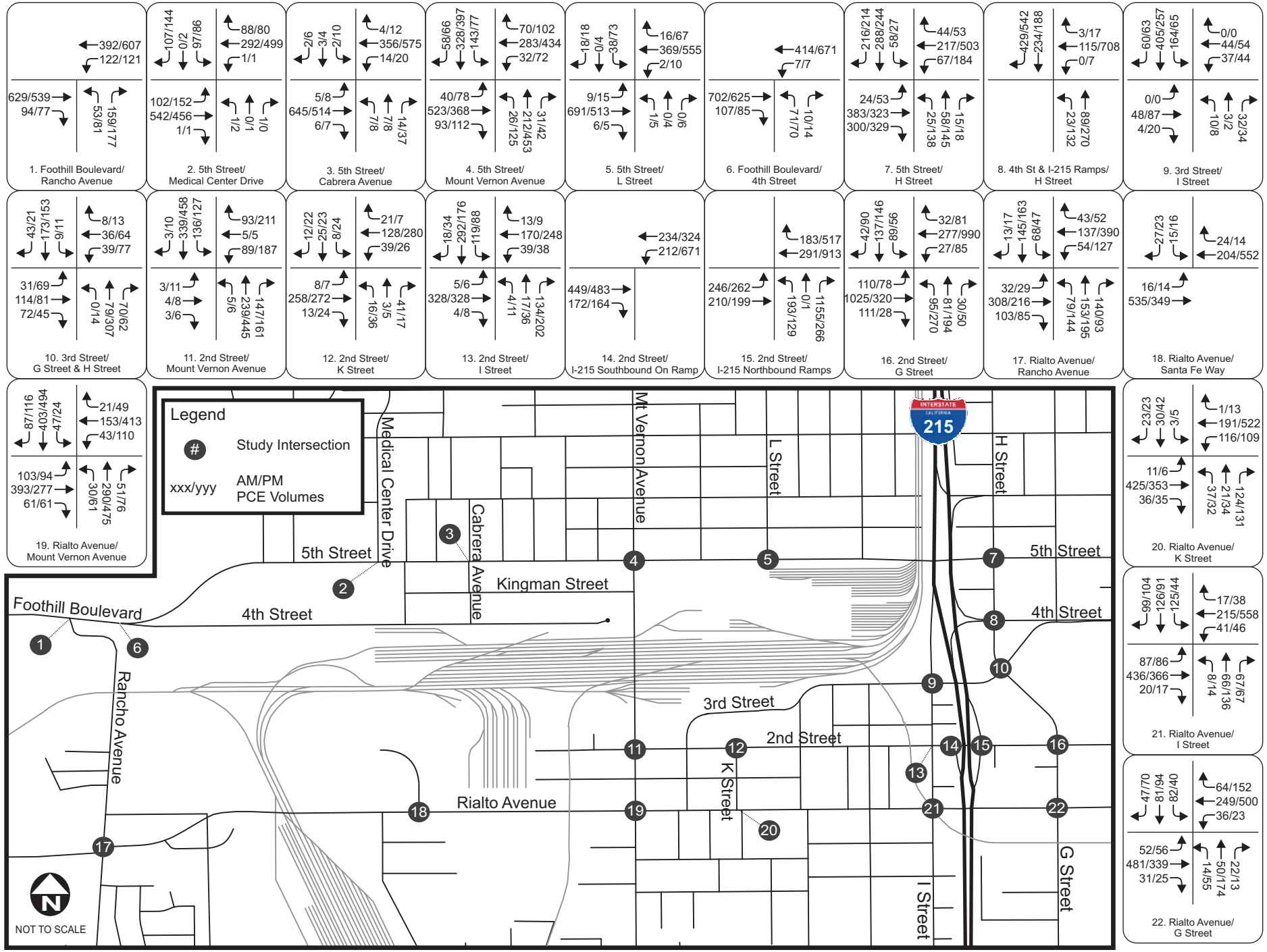
Table 6: Existing 2009 Daily Traffic Volume at the Mount Vernon Avenue Bridge

Location	Daily Traffic Volume		
	Northbound	Southbound	Total
Mount Vernon Avenue Bridge	7,519	7,158	14,677



Mount Vernon Avenue Bridge Pedestrian and Vehicular Detour Analysis
City of San Bernardino

FIGURE 2
Existing (2009) Intersection Lane Geometry and Control Type



Mount Vernon Avenue Bridge Pedestrian and Vehicular Detour Analysis
City of San Bernardino

FIGURE 3
Existing (2009) PCE Volumes

Year 2012 Volumes

Background Traffic Volumes

Construction of the new bridge is scheduled to begin in June 2012 and to be completed in July 2014. The bridge closure will be closed for the duration of the project construction, since the existing bridge will be used for construction staging to build the new bridge. Because the initial construction will take place in 2012, traffic conditions during that year are analyzed in this report. Traffic impacts are most likely to occur during the initial period of construction, because drivers will adjust their routes and destinations as time goes on, reducing traffic volumes in the project area. Forecast year 2012 without detour traffic volumes were developed by applying a growth factor of 3% to year 2009 volumes (1% per year). Since the truck restrictions on the bridge that are currently in place will remain in effect until the new bridge is opened, year 2012 truck traffic patterns will remain the same as under existing conditions.

At the time the traffic counts were collected for this study (October 2009), the I-215 northbound and southbound on-ramps from 4th Street were still open. During the course of the study, the on-ramps were closed to vehicular traffic and detour routes were designated for freeway traffic. Initial observations of the traffic in the area suggested that significant portions of the traffic that had previously used the 4th Street interchange was not following the detour route, but had diverted out of the area completely. To assess the increase in traffic at the 2nd Street interchange due to the detour routes, spot turning movement counts (one half-hour counts during AM peak hour and PM peak hour) were conducted at 2nd Street / I-215 Southbound On-Ramp in April 2010 (included in **Appendix B**). The increase in volume at this location over pre-detour volumes was taken as an indication of the amount of traffic actually following the detour route. The projected 2012 without construction traffic volumes were adjusted to reflect the change in traffic patterns based on these spot counts. This adjustment was made by assuming that a similar amount of traffic would continue to follow the freeway detour route in 2012, and increasing the appropriate turning movements along the freeway detour route by that amount. **Figure 4** shows the adjusted year 2012 without bridge detour (but with freeway ramp detour) AM and PM peak hour volumes at the study intersections.

Detour Condition Traffic Volumes

Detour condition traffic volumes were developed by manually reassigning turning movement traffic affected by the detour of Mount Vernon Avenue traffic based on the expected detour route. During construction, the northbound and southbound traffic currently using Mount Vernon Avenue will be detoured between Rialto Avenue and 5th Street. The detour routes are depicted in **Figure 5.** Since the truck restrictions on the bridge that are currently in place will remain in effect until the new bridge is opened, detour conditions truck traffic patterns will remain the same as under existing conditions (i.e., trucks do not use the bridge).

Northbound traffic will be rerouted as follows:

- East on Rialto Avenue
- North on G Street/H Street
- West on 5th Street

Southbound traffic will be rerouted as follows:

- East on 5th Street
- South on H Street/G Street
- West on Rialto Avenue

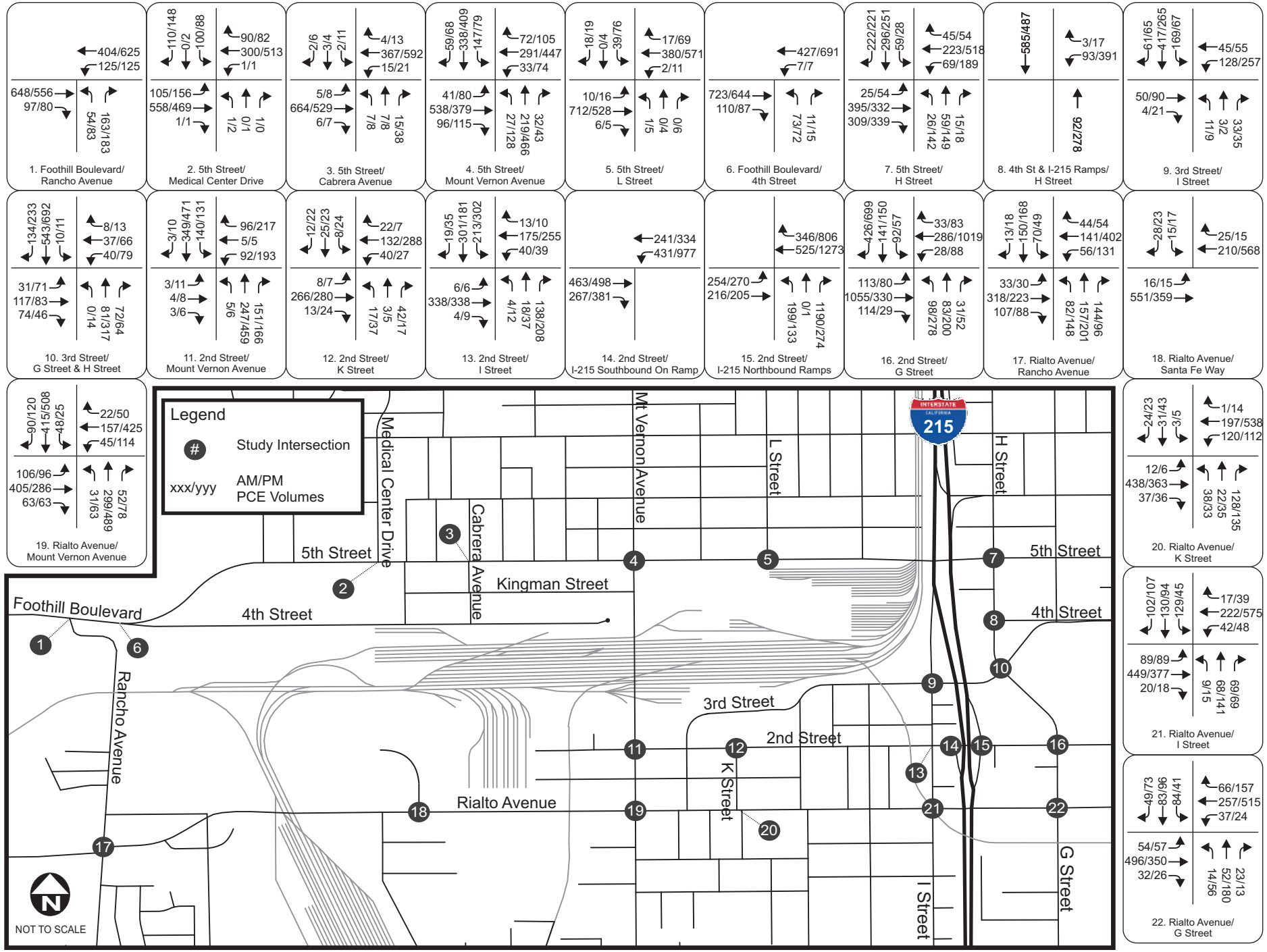
Not all drivers will follow the posted detour. Drivers with local destinations who are familiar with the area may follow other routes. Based on the locations of destinations in the project vicinity, the following assumptions were also made to derive the detour traffic volumes:

- Ten percent of northbound traffic with destinations to the west of Mount Vernon Avenue will not follow the detour route and will instead travel to the west via Rialto Avenue, to the north via Rancho Avenue and continue to the west on Foothill Boulevard.

- Westbound traffic on 2nd Street that currently turns left at the Mount Vernon Avenue and 2nd Street intersection will instead turn left at K Street to reach Rialto Avenue and go west on Rialto Avenue.

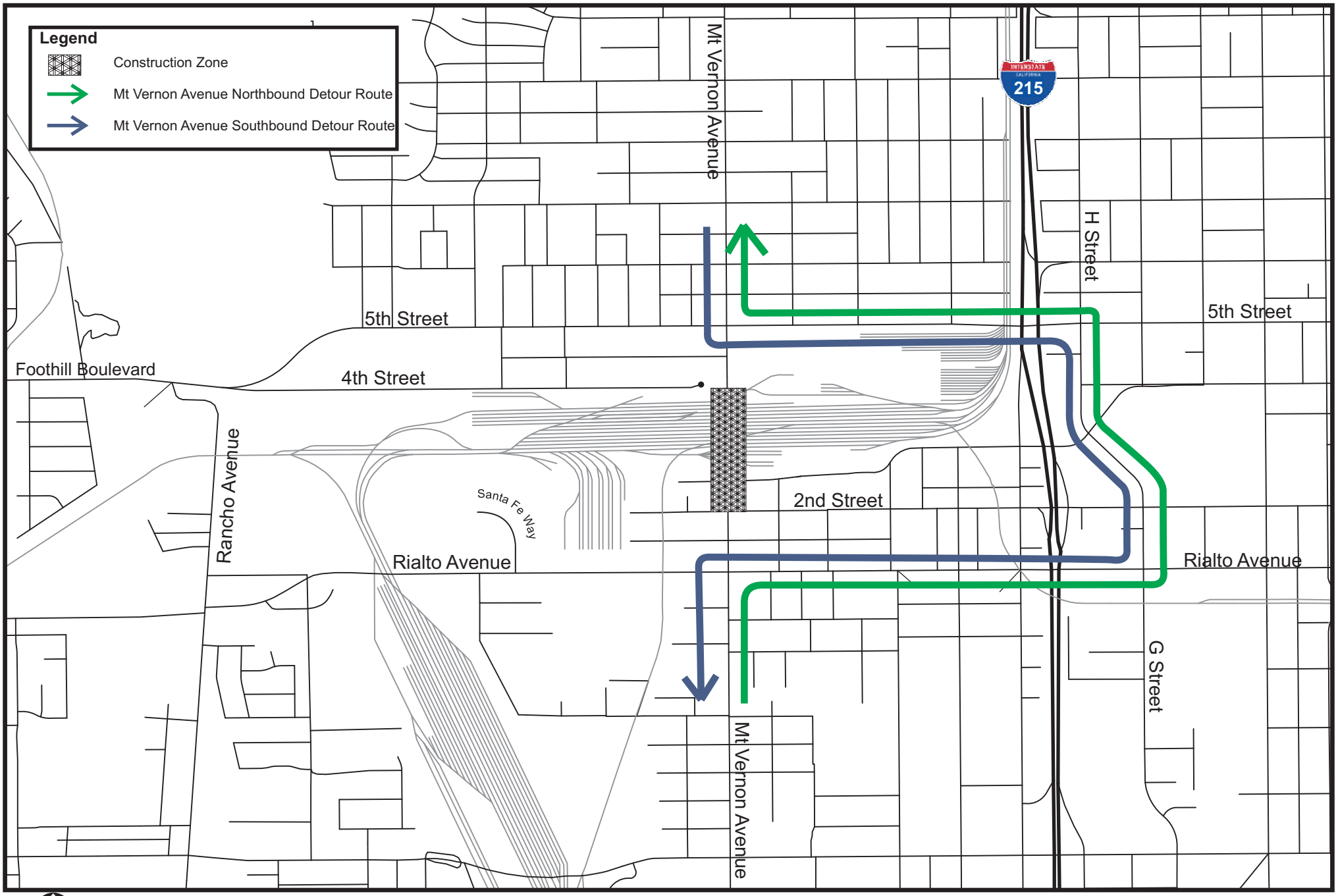
- Ten percent of existing traffic turning from Mount Vernon Avenue onto 2nd Street travels to destinations west of I-215, thirty percent travels north on I-215, thirty percent travels south on I-215, and the remaining thirty percent travels east to downtown San Bernardino.

Figure 6 shows the change in traffic volumes during the AM and PM peak hours at the study intersections due to traffic diversion resulting from construction activities. **Figure 7** shows the year 2012 with detour conditions AM and PM peak hour volumes at the study intersections.



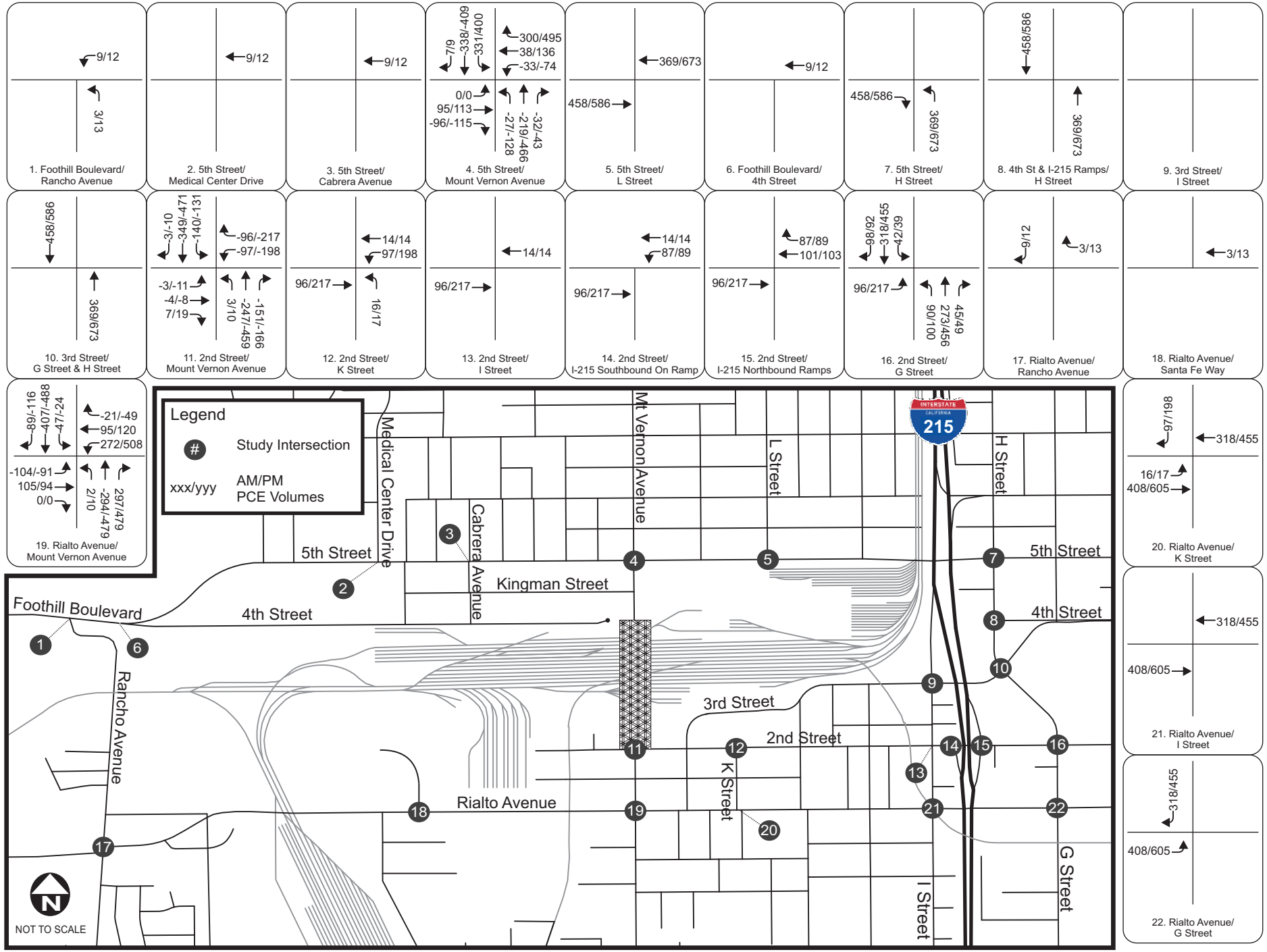
Mount Vernon Avenue Bridge Pedestrian and Vehicular Detour Analysis
City of San Bernardino

FIGURE 4
Year 2012 Without Detour Peak Hour PCE Volumes



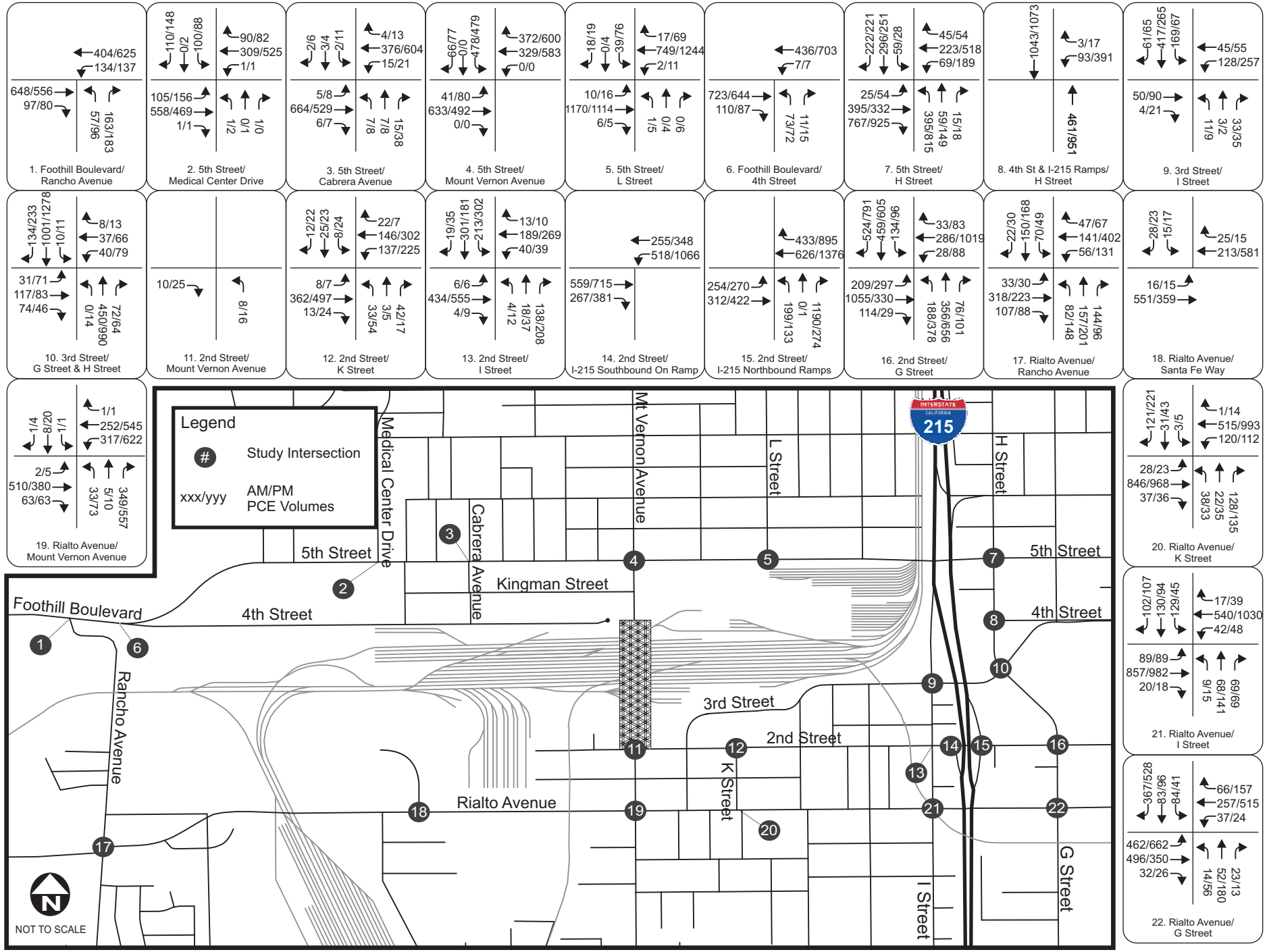
Mount Vernon Avenue Bridge Pedestrian and Vehicular Detour Analysis
City of San Bernardino

FIGURE 5
Detour Routes



Mount Vernon Avenue Bridge Pedestrian and Vehicular Detour Analysis
City of San Bernardino

FIGURE 6
Change in Peak Hour PCE Volumes During Detour



Mount Vernon Avenue Bridge Pedestrian and Vehicular Detour Analysis
City of San Bernardino

FIGURE 7
2012 Peak Hour Detour PCE Volumes

Intersection Level of Service

The efficiency of traffic operations at a location can be described in terms of Level of Service (LOS). The level of service concept is a measure of average operating conditions at an intersection during an hour. It is based on vehicle delay and volume-to-capacity (V/C) ratio. Levels range from A to F, with A representing excellent (free-flow) conditions and F representing extreme congestion.

The analysis of traffic operations at intersections was conducted according to the *Highway Capacity Manual* (HCM 2000) Operations Methodology. The analysis was conducted using Synchro 6 software for signalized and two-way stop controlled intersections and Traffix 7.9 software for all-way stop controlled intersections. In this methodology, level of service (LOS) is defined by the average control delay experienced by vehicles at an intersection, taking into account the effects of intersection characteristics such as lane geometry and signal phasing. **Table 7** presents the delay associated with each LOS grade, as well as a qualitative description of intersection operations at that grade, for both signalized and unsignalized intersections.

Table 7: Intersection Level of Service Definitions

Level of Service	Description	Signalized Intersection Delay (seconds per vehicle)	Unsignalized Intersection Delay (seconds per vehicle)
A	Excellent operation. All approaches to the intersection appear quite open, turning movements are easily made, and nearly all drivers find freedom of operation.	≤ 10	≤ 10
B	Very good operation. Many drivers begin to feel somewhat restricted within platoons of vehicles. This represents stable flow. An approach to an intersection may occasionally be fully utilized and traffic queues start to form.	>10 and ≤ 20	>10 and ≤ 15
C	Good operation. Occasionally drivers may have to wait more than 60 seconds, and back-ups may develop behind turning vehicles. Most drivers feel somewhat restricted.	>20 and ≤ 35	>15 and ≤ 25
D	Fair operation. Cars are sometimes required to wait more than 60 seconds during short peaks. There are no long-standing traffic queues.	>35 and ≤ 55	>25 and ≤ 35
E	Poor operation. Some long-standing vehicular queues develop on critical approaches to intersections. Delays may be up to several minutes.	>55 and ≤ 80	>35 and ≤ 50
F	Forced flow. Represents jammed conditions. Backups form locations downstream or on the cross street may restrict or prevent movement of vehicles out of the intersection approach lanes; therefore, volumes carried are not predictable. Potential for stop and go type traffic flow.	> 80	> 50

Source: *Highway Capacity Manual*, Special Report 209, Transportation Research Board, Washington, DC, 2000.

Level of Service Standard

The City of San Bernardino's level of service standard is LOS D. Intersections operating at LOS E or F are considered unsatisfactory.

Existing Conditions

A level of service analysis using HCM 2000 methodologies was conducted to evaluate existing AM and PM peak hour traffic conditions at the study intersections. The results of the intersection level of service analysis are summarized in **Table 8**. Detailed LOS calculation worksheets are included in **Appendix E**.

Table 8: Existing (2009) Peak Hour Intersection Level of Service

Intersection	Control	AM Peak Hour			PM Peak Hour		
		V/C	Delay	LOS	V/C	Delay	LOS
1. Foothill Boulevard and Rancho Avenue	TWSC	-	18.2	C	-	18.3	C
2. 5th Street and Medical Center Drive	Signal	0.30	8.1	A	0.36	9.3	A
3. 5th Street and Cabrera Avenue	Signal	0.23	1.8	A	0.21	2.7	A
4. 5th Street and Mount Vernon Avenue	Signal	0.49	10.8	B	0.45	11.6	B
5. 5th Street and L Street	Signal	0.28	2.9	A	0.27	4.1	A
6. 5th Street (Foothill Boulevard) and 4th Street	Signal	0.34	3.4	A	0.28	3.3	A
7. 5th Street and H Street	Signal	0.33	13.0	B	0.45	17.3	B
8. 4th Street (I-215 On Ramps) and H Street	Signal	0.24	4.0	A	0.54	8.1	A
9. 3rd Street and I Street	Signal	0.18	4.3	A	0.16	5.4	A
10. 3rd Street and H Street	Signal	0.18	8.0	A	0.22	9.0	A
11. 2nd Street and Mount Vernon Avenue	Signal	0.44	15.2	B	0.57	19.6	B
12. 2nd Street and K Street	AWSC	0.20	8.5	A	0.24	9.3	A
13. 2nd Street and I Street	Signal	0.29	5.0	A	0.23	4.6	A
14. 2nd Street and I-215 SB On Ramp	Signal	0.29	3.9	A	0.48	5.9	A
15. 2nd Street and I-215 NB On Ramp	Signal	0.52	13.1	B	0.48	13.5	B
16. 2nd Street and G Street	Signal	0.43	14.4	B	0.51	18.1	B
17. Rialto Avenue and Rancho Avenue	Signal	0.25	6.3	A	0.31	6.3	A
18. Rialto Avenue and Santa Fe Way	Signal	0.21	2.8	A	0.19	2.4	A
19. Rialto Avenue and Mount Vernon Avenue	Signal	0.39	6.0	A	0.36	5.8	A
20. Rialto Avenue and K Street	Signal	0.29	8.1	A	0.39	9.3	A
21. Rialto Avenue and I Street	Signal	0.36	5.5	A	0.31	4.7	A
22. Rialto Avenue and G Street	Signal	0.30	5.6	A	0.31	5.0	A

Notes:
HCM 2000 Operations Methodology.
V/C = Volume-to-Capacity Ratio
Delay = Average Vehicle Delay (Seconds). At TWSC intersections, worst-case approach is reported
LOS = Level of Service
TWSC = Two-way Stop Control
AWSC = All-way Stop Control

An examination of the data in **Table 8** indicates that, under 2009 conditions, all 22 study intersections were operating at LOS C or better. In the 2004 *Pedestrian and Vehicular Detour Analysis* study, the intersection of Foothill Boulevard and Rancho Avenue was operating at an unsatisfactory level of service due to the closure of the Mount Vernon Avenue Bridge and the resulting redistribution of traffic through Rancho Avenue. Under current conditions, that intersection has returned to a satisfactory LOS.

Year 2012 Conditions

This section analyzes traffic and circulation conditions in the study area during the project's construction year (2012), with and without the construction-related traffic diversion.

Year 2012 Without Detour Conditions

Year 2012 traffic volumes were developed as described in the "Traffic Forecasts" section. Year 2012 without detour conditions include the change in traffic patterns due to the ongoing detour from the closure of the 4th Street ramps.

A level of service analysis using HCM 2000 methodologies was conducted to evaluate year 2012 without detour conditions at the study intersections. The results of the intersection level of service analysis are summarized in **Table 9**. Detailed LOS calculation worksheets are included in **Appendix F**.

Table 9: Year 2012 Without Detour Peak Hour Levels of Service

Intersection	Control	AM Peak Hour			PM Peak Hour		
		V/C	Delay	LOS	V/C	Delay	LOS
1. Foothill Boulevard and Rancho Avenue	TWSC	-	18.8	C	-	19.1	C
2. 5th Street and Medical Center Drive	Signal	0.31	8.1	A	0.38	9.4	A
3. 5th Street and Cabrera Avenue	Signal	0.24	2.1	A	0.22	2.7	A
4. 5th Street and Mount Vernon Avenue	Signal	0.50	11.0	B	0.47	11.8	B
5. 5th Street and L Street	Signal	0.28	2.9	A	0.28	4.1	A
6. 5th Street (Foothill Boulevard) and 4th Street	Signal	0.35	3.4	A	0.28	3.3	A
7. 5th Street and H Street	Signal	0.34	13.1	B	0.47	17.7	B
8. 4th Street (I-215 On Ramps) and H Street	Signal	0.24	4.3	A	0.33	5.3	A
9. 3rd Street and I Street	Signal	0.23	4.9	A	0.29	5.1	A
10. 3rd Street and H Street	Signal	0.37	8.4	A	0.41	9.3	A
11. 2nd Street and Mount Vernon Avenue	Signal	0.45	15.5	B	0.58	20.9	C
12. 2nd Street and K Street	AWSC	0.20	8.5	A	0.24	9.4	A
13. 2nd Street and I Street	Signal	0.35	5.4	A	0.36	5.4	A
14. 2nd Street and I-215 SB On Ramp	Signal	0.39	5.0	A	0.68	11.0	B
15. 2nd Street and I-215 NB On Ramp	Signal	0.55	16.0	B	0.64	16.7	B
16. 2nd Street and G Street	Signal	0.50	14.5	B	0.74	27.2	C
17. Rialto Avenue and Rancho Avenue	Signal	0.26	6.0	A	0.32	6.3	A
18. Rialto Avenue and Santa Fe Way	Signal	0.22	2.8	A	0.2	2.5	A
19. Rialto Avenue and Mount Vernon Avenue	Signal	0.40	6.1	A	0.37	6.0	A
20. Rialto Avenue and K Street	Signal	0.30	8.2	A	0.4	9.5	A
21. Rialto Avenue and I Street	Signal	0.38	5.6	A	0.32	4.7	A
22. Rialto Avenue and G Street	Signal	0.31	5.7	A	0.32	5.0	A

Notes:
HCM 2000 Operations Methodology.
V/C = Volume-to-Capacity Ratio
Delay = Average Vehicle Delay (Seconds). At TWSC intersections, worst-case approach is reported
LOS = Level of Service
TWSC = Two-way Stop Control
AWSC = All-way Stop Control

Table 9 indicates that all 22 study intersections are expected to operate at LOS C or better during year 2012 without construction conditions.

Year 2012 With Detour Conditions

Year 2012 with detour conditions include the closure of Mount Vernon Avenue between Kingman Street and 2nd Street, and the implementation of the detour as described above. Year 2012 detour traffic volumes were developed as described in the "Traffic Forecasts" section.

A level of service analysis using HCM 2000 methodologies was conducted to evaluate year 2012 detour conditions at the study intersections. The results of the intersection level of service analysis are summarized in **Table 10**. Detailed LOS calculation worksheets are included in **Appendix G**.

Table 10: Year 2012 With Detour Peak Hour Levels of Service

Intersection	Control	AM Peak Hour			PM Peak Hour		
		V/C	Delay	LOS	V/C	Delay	LOS
1. Foothill Boulevard and Rancho Avenue	TWSC	-	19.5	C	-	21.5	C
2. 5th Street and Medical Center Drive	Signal	0.31	8.1	A	0.38	9.4	A
3. 5th Street and Cabrera Avenue	Signal	0.24	2.1	A	0.22	2.7	A
4. 5th Street and Mount Vernon Avenue	Signal	0.74	18.9	B	0.82	23.0	C
5. 5th Street and L Street	Signal	0.44	2.5	A	0.49	4.0	A
6. 5th Street (Foothill Boulevard) and 4th Street	Signal	0.35	3.4	A	0.28	3.3	A
7. 5th Street and H Street	Signal	0.61	21.3	C	**0.99**	**75.9**	**E**
8. 4th Street (I-215 On Ramps) and H Street	Signal	0.40	3.5	A	0.53	6.8	A
9. 3rd Street and I Street	Signal	0.23	4.9	A	0.29	5.1	A
10. 3rd Street and H Street	Signal	0.54	9.8	A	0.60	9.4	A
11. 2nd Street and Mount Vernon Avenue	Closed						
12. 2nd Street and K Street	AWSC	0.29	9.5	A	0.45	11.9	B
13. 2nd Street and I Street	Signal	0.38	5.7	A	0.43	6.3	A
14. 2nd Street and I-215 SB On Ramp	Signal	0.47	5.9	A	0.78	15.1	B
15. 2nd Street and I-215 NB On Ramp	Signal	0.63	19.8	B	0.71	17.2	B
16. 2nd Street and G Street	Signal	0.72	19.6	B	**1.12**	**85.2**	**F**
17. Rialto Avenue and Rancho Avenue	Signal	0.26	5.9	A	0.33	6.2	A
18. Rialto Avenue and Santa Fe Way	Signal	0.22	2.8	A	0.20	2.4	A
19. Rialto Avenue and Mount Vernon Avenue	Signal	0.77	11.7	B	0.89	22.8	C
20. Rialto Avenue and K Street	Signal	0.48	10.7	B	0.71	21.6	C
21. Rialto Avenue and I Street	Signal	0.54	7.0	A	0.52	5.5	A
22. Rialto Avenue and G Street	Signal	0.80	14.4	B	**1.52**	**97.4**	**F**

Notes:
HCM 2000 Operations Methodology.
V/C = Volume-to-Capacity Ratio
Delay = Average Vehicle Delay (Seconds). At TWSC intersections, worst-case approach is reported
LOS = Level of Service
TWSC = Two-way Stop Control
AWSC = All-way Stop Control
BOLD indicates unsatisfactory level of service.

All study intersections are projected to operate at acceptable levels of service during construction, with the exception of the following:

- 5th Street / H Street
- 2nd Street / G Street
- Rialto Avenue / G Street

Temporary Intersection Improvements

During the anticipated period of construction (January 2012 through February 2014), the 5th Street / H Street, 2nd Street / G Street, and Rialto Avenue / G Street intersections are projected to operate at unsatisfactory levels of service. The following temporary circulation improvements are recommended to improve operations at these locations:

#7. 5th Street / H Street

- Restripe the northbound approach as one exclusive left-turn lane, one shared left/through lane and a shared through/right-turn lane.
- Change the phasing on the northbound and southbound approaches to split phase.

#16. 2nd Street / G Street

- Restripe the northbound approach to add an additional left-turn lane by narrowing the lanes.
- Change the northbound left-turn phasing from permitted + protected to protected.
- Restripe the southbound approach as one left-turn lane, one through lane and one exclusive right-turn lane.
- Add a southbound right-turn overlap phase.

#22. Rialto Avenue / G Street

- Restripe the eastbound approach as one exclusive left-turn lane, one shared left/through lane and a shared through/right-turn lane.
- Change the phasing on the eastbound and westbound approaches to split phase.

The above temporary improvements should be implemented prior to closure of the existing bridge and remain in place until the new bridge is opened to traffic. They should be removed and the intersections returned to their existing configurations after the new bridge is opened to traffic. A level of service analysis using HCM 2000 methodologies was conducted to evaluate year 2012 detour conditions with the temporary improvements at the study intersections. The results of the intersection level of service analysis are summarized in **Table 11**. Detailed LOS calculation worksheets are included in **Appendix H**.

Table 11: Year 2012 Detour with Temporary Improvements Peak Hour Levels of Service

Intersection	Control	AM Peak Hour			PM Peak Hour		
		V/C	Delay	LOS	V/C	Delay	LOS
7. 5th Street and H Street	Signal	0.60	21.5	C	0.90	50.5	D
16. 2nd Street and G Street	Signal	0.71	19.6	B	1.00	52.9	D
22. Rialto Avenue and G Street	Signal	0.52	15.7	B	0.67	20.1	C

Notes:
HCM 2000 Operations Methodology.
V/C = Volume-to-Capacity Ratio
Delay = Average Vehicle Delay (Seconds).

With the temporary improvements, all study intersections are projected to operate at satisfactory levels of service.

Summary and Conclusions

The Mount Vernon Avenue Bridge has been determined to be structurally deficient, and Mount Vernon Avenue will be closed between 2nd Street and Kingman Street while the bridge is being replaced. This report presents the results of the analyses performed to evaluate potential traffic and circulation impacts caused by traffic detour during the reconstruction of the bridge.

Existing Conditions

Under existing conditions, all study intersections are operating at satisfactory levels of service (LOS C or better).

Year 2012 Without Detour Conditions

Under 2012 without detour conditions, all study intersections are projected to continue operating at satisfactory levels of service (LOS C or better).

Year 2012 With Detour Conditions

During year 2012 with detour, all study intersections are projected to operate at satisfactory levels of service, with the exception of the following:

- 5th Street / H Street (PM peak hour)
- 2nd Street / G Street (PM peak hour)
- Rialto Avenue / G Street (PM peak hour)

Year 2012 With Temporary Improvements

During year 2012 with detour conditions, with the recommended temporary circulation improvements, all study intersections are projected to operate at satisfactory levels of service (LOS D or better). The temporary improvements should be implemented prior to closure of the existing bridge and remain in place until the new bridge is opened to traffic. They should be removed and the intersections returned to their existing configurations after the new bridge is opened to traffic.