Regional Transportation Commission
of Washoe County

NORTH VALLEYS
Multimodal Transportation Study

February 20, 2017

Increase Safety
Improve Traffic Operations
Encourage Alternate Modes

Prepared for:

RTC

Prepared by:

Traffic Works LLC

EXECUTIVE SUMMARY

As the Reno-Sparks region recovers from the Great Recession, employment and residential growth has expanded in the North Valleys. Traffic volumes have been increasing with resurgence in development and pressure on some major arterials and interchanges was now evident. Tremendous new residential and industrial development energy now, and for the next decade, will be centered in the North Valleys where the developable land is located.

This North Valleys Multimodal Transportation Study focuses on regional roadways and the most critical intersections on these arterials. Separate from, but concurrently with this study, the Nevada Department of Transportation (NDOT) is preparing the Reno-Sparks Freeway Traffic Study which addresses US 395 through the North Valleys and south to I-80, the Spaghetti Bowl, and the freeway related congestion and safety issues. Both studies have been prepared collaboratively with regular communication between the Regional Transportation Commission, NDOT, local agencies, and the consulting teams, to prepare a cohesive overall transportation improvement plan.

The resulting recommendations for regional road and intersection improvements are listed in the **Table A** and will be included in the 2040 Regional Transportation Plan for implementation.

Two themes are central to this study. First, the Lemmon Drive interchange is the "bullseye" for most traffic in the North Valleys area. Nearly every trip west or north of this location must travel through the interchange. A more detailed interchange alternatives analysis should be conducted in partnership with NDOT.

Second, widening of US 395 cannot be the single solution to managing all travel from the North Valleys to the greater Reno/Sparks urban area. Another major connection is needed in the long-term plan and a solution is presented within this study. The North Valleys Connector concept presented within this report will relieve both Pyramid Highway and US 395, the two most congested roadways in the region to further support the traffic reduction benefit of the Pyramid – US 395 Connector project.

Location	Limits	Type	Description	Planning Level Cost
Package 1 Improvements				
Stead Blvd/Silver Lake Rd		Intersection	Safety and Capacity Improvements	$ 300,000.00
Stead Blvd Pedestrian Signal Upgrade		Pedestrian Crossing	Pedestrian and Safety Improvements	$ 50,000.00
Silver Lake Road Crossing		Pedestrian Crossing	Pedestrian and Safety Improvements	$ 125,000.00
Ural Street Crossing		Pedestrian Crossing	Pedestrian and Safety Improvements	$ 125,000.00
Lemmon Dr/Surge St		Pedestrian Crossing	Pedestrian and Safety Improvements	$ 175,000.00
N Virginia St/Golden Valley Dr		Intersection	Safety Improvements	$ 225,000.00
Sky Vista Pkwy Crossing		Pedestrian Crossing	Pedestrian and Safety Improvements	$ 30,000.00
Package 2 Improvements				
Red Rock Rd/Moya Blvd		Intersection	Capacity Improvements	$ 3,500,000.00
Lemmon Dr Interchange		Interchange	Capacity Improvements	$ 1,500,000.00
Long Term Improvements				
Parr Boulevard	Ferrari McLeod to Raggio Pkwy	Roadway	Road widening - Widen to 4 lanes	$ 7,700,000.00
Lemmon Drive	Sky Vista Pkwy to Military Rd	Roadway	Road Widening - Widen to 6 lanes	$ 5,300,000.00
Lemmon Drive	Fleetwood Dr to Deodar Way	Roadway	Road Widening - Widen to 4 lanes	$ 4,300,000.00
Military Road	Lemmon Dr to Echo Ave	Roadway	Road Widening - Widen to 4 lanes	$ 17,700,000.00
Buck Drive	Lemmon Dr to North Hills Blvd	Roadway	Road Widening - Widen to 4 lanes	$ 1,300,000.00
Sky Vista Pkwy	Vista Knoll Dr to Silver Lake Rd	Roadway	Road Widening - Widen to 4 lanes	$ 6,900,000.00
Moya Boulevard	Red Rock Rd to Echo Ave	Roadway	Road Widening - Widen to 4 lanes	$ 13,700,000.00
Red Rock Road	US 395 to Evans Ranch	Roadway	Road Widening - Widen to 4 lanes	$ 40,700,000.00
Lemmon Dr / Sky Vista Pkwy		Intersection	Major Intersection Improvements	$ 5,000,000.00
N. Virginia St / Lemmon Drive		Intersection	Capacity Improvements	$ 2,000,000.00
N. Virginia St / Golden Valley		Intersection	Capacity Improvements	$ 2,000,000.00
Stead Blvd / Silver Lake Road		Intersection	Long Term Capacity Improvements	$ 1,000,000.00
Red Rock Road/Silver Lake Road		Intersection	Intersection Improvements	$ 1,500,000.00
Parr Boulevard Interchange	Ramp intersections	Interchange	Interim Capacity Improvements	$ 5,000,000.00
Lemmon Drive Interchange	Ramp intersections	Interchange	Reconstruction	$ 35,000,000.00
North Valleys Connector	Echo Avenue to Eagle Canyon	Roadway	Construct New Roadway	$ 47,500,000.00
			TOTAL	**$ 196,600,000.00**

Table A. Recommendations for Regional Road & Intersection Improvements

ACKNOWLEDGEMENTS

The North Valleys Multimodal Transportation Study was funded and administered by the Regional Transportation Commission of Washoe County (RTC), for the benefit of current North Valleys region residents, and every community member who will walk, cycle, ride a bus, or drive in the North Valleys over the next 20 years and beyond. Long-range planning for numerous regionally significant major arterial roadways and intersections is no easy task. The project team is therefore sincerely grateful to every citizen, stakeholder, technical advisor, and agency representative that gave of their personal time and knowledge, to guide the study process and identify a set of well rounded multi-modal improvements that will serve our community well into the future. Thank you for helping shape the future of the North Valleys!

Technical Advisory Committee:

Member	Agency
Lee Gibson	RTC Executive Director
Amy Cummings	RTC Director of Planning
Jeff Hale	RTC Director of Engineering
Xuan Wang	RTC Project Manager
Debra Goodwin	RTC
Michelle Dennis	RTC
Clara Lawson	Washoe County
Kelly Mullin	Washoe County
Hoang Hong	NDOT
Janelle Thomas	NDOT
Jeff Lerud	NDOT
Mark Wooster	NDOT
Randy Travis	NDOT
Nick Johnson	NDOT
Steve Bunnell	City of Reno
William Gall	City of Reno

Consulting Team:

Loren Chilson	Traffic Works
Uday Maripalli	Traffic Works
Rich Pettinari	Traffic Works
Chad Anson	CA Group

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1 INTRODUCTION

1.1 Purpose and Goals

The purpose of this multimodal study is to identify needs and long-term transportation improvements for regional roads and intersections in the North Valleys area. This study focuses on traffic operations analysis and capacity improvements, safety improvements, pedestrian and bicycle connectivity, and transit service needs.

The main objective of this study is to plan and program short-term and long-term multimodal transportation improvements within the study area. The study identifies a strategy for developing transportation improvements that are coordinated with adjacent planned and existing land uses. This work has been conducted in coordination with the Nevada Department of Transportation (NDOT) *Reno-Sparks Freeway Traffic Study*.

1.2 Vision Statement

The following vision statement was developed through a comprehensive community involvement program.

"Develop a program of short and long-term improvements that increase safety, improve traffic operations and freight movement, encourage travel by alternate modes, and support future residential, commercial, and industrial development."

The analysis, recommendations, and action plans in this study are all aimed at achieving this community guided vision.

1.3 Study Area

The study area consists of numerous regional roadways, key intersections, and ramp junctions in the North Valleys Region, as defined in **Figure 1-1**. The intersections and roadways highlighted in red are part of the NDOT *Reno-Sparks Freeway Traffic Study*. The intersections and roadways highlighted in blue are included in this report. This study includes analysis of the most significant arterials in the North Valleys region. The study roadways include:

- Parr Boulevard
- Golden Valley Road
- Lemmon Drive
- Military Road
- Sky Vista Parkway
- Stead Boulevard
- Silver Lake Road
- Moya Boulevard
- Red Rock Road
- North Virginia Street

The study includes the following intersections:

- Parr Boulevard/US 395 NB Ramps
- Parr Boulevard/US 395 SB Ramps
- Golden Valley Road/N. Virginia Street

- Lemmon Drive/N. Virginia Street
- Lemmon Drive/US 395 NB Ramps
- Lemmon Drive/US 395 SB Ramps
- Lemmon Drive/Sky Vista Parkway
- Lemmon Drive/Military Road
- Stead Boulevard/Silver Lake Road
- Red Rock Road/Silver Lake Road
- Red Rock Road/Moya Boulevard

The locations of all these study intersections and roadway corridors are shown in **Figure 1-1**.

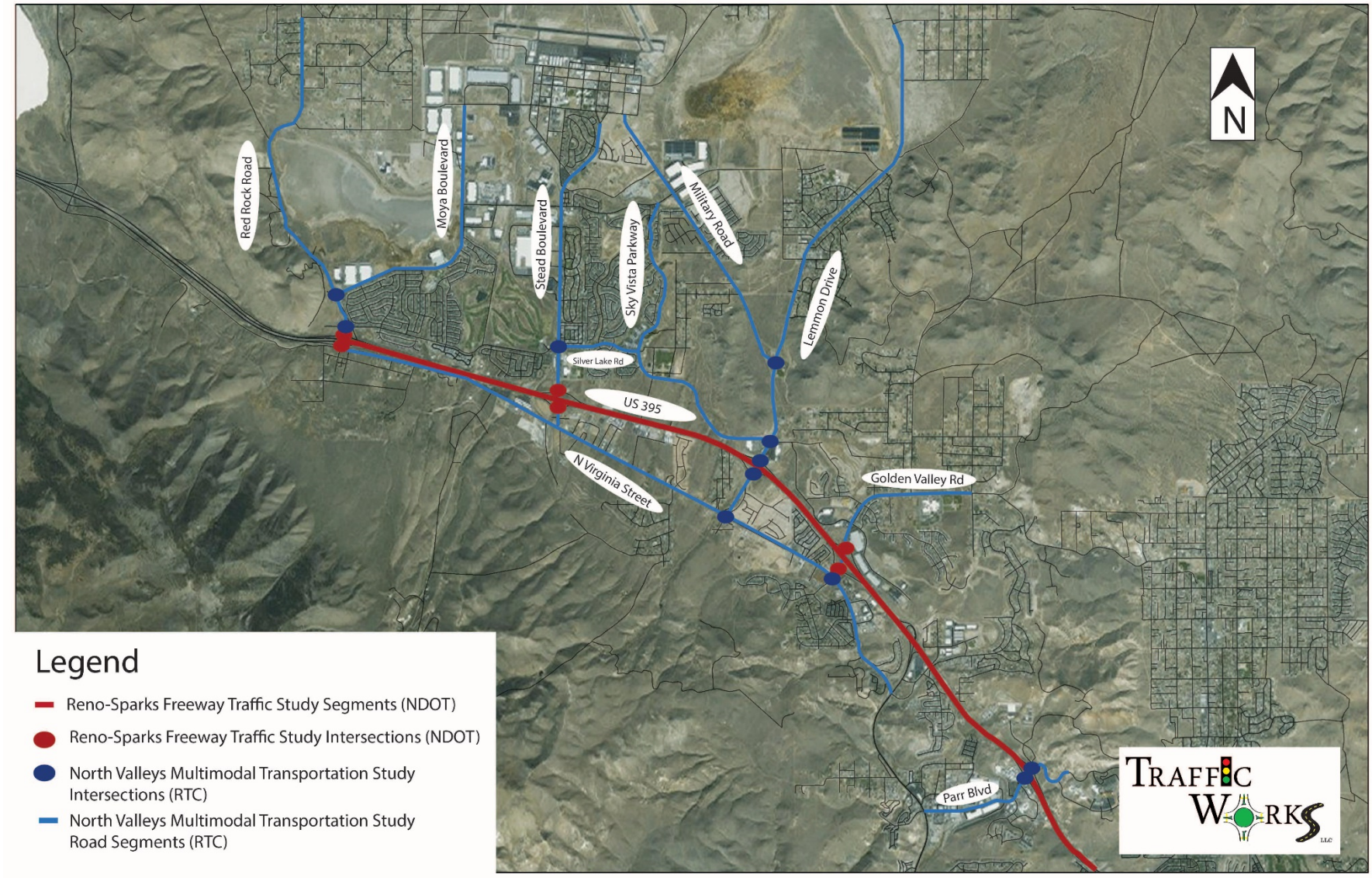


Figure 1-1. Study Area

2 EXISTING CONDITIONS

This portion of the report discusses existing conditions for all travel in the North Valleys region.

2.1 Functional Classification and Roadway Characteristics

Roadway functional classification is the foundation for planning roadway improvements and setting appropriate standards (e.g., right-of-way requirements, roadway width, design speed, multimodal facilities, etc.,) that apply to each roadway facility. A brief description of the major roadways within the study area is provided below. These descriptions are for the portions of the roadways within the study area only.

- Parr Boulevard – is a 2-lane (north of US 395) to 3-lane (south of US 395) roadway that is classified as a "Low Access Control Arterial" according to the RTC's 2035 Regional Transportation Plan (RTP). The posted speed limit is 35 mph.
- Golden Valley Road – to the north of N. Virginia Street is a 2-lane (south of US 395) to 4-lane (north of US 395) roadway that is classified as a "Medium Access Control Arterial" according to the RTC's 2035 Regional Transportation Plan (RTP). The posted speed limit is 35 mph.
- Lemmon Drive – is classified as a "Medium Access Control Arterial" according to the 2035 RTP. The number of lanes on Lemmon Drive varies throughout the study area. It is a 2-lane roadway south of US 395, a 6-lane roadway between US 395 and Sky Vista Parkway, a 4-lane roadway between Sky Vista Parkway and Fleetwood Drive, and a 2-lane roadway north of Fleetwood Drive. The posted speed limit varies between 35 mph and 45 mph.
- Military Road – is classified as a "Medium Access Control Arterial" according to the 2035 RTP. It is a 2-lane roadway with a posted speed limit of 35 mph.
- Sky Vista Parkway – is classified as a "Medium Access Control Arterial" between Silver Lake Road and Lemmon Drive and as a "Low Access Control Collector" north of Silver Lake Road. It is a 2-lane roadway west of Vista Knoll Parkway and a 5-lane road between Lemmon Drive and Vista Knoll Parkway. The posted speed limit is 35 mph.
- Stead Boulevard – is classified as a "Medium Access Control Arterial" according to the 2035 RTP. It is a 4-lane roadway north of Silver Lake Road, a 5-lane roadway between Silver Lake Road and US 395, and a 2-lane road south of US 395. The posted speed limit is 35 mph.
- Silver Lake Road – is classified as a "Low Access Control Collector" according to the 2035 RTP. It is a 2-lane road with a posted speed limit of 35 mph.
- Moya Boulevard – is classified as a "Low Access Control Arterial" according to the 2035 RTP. It is a 2-lane roadway with a posted speed limit of 35 mph.
- Red Rock Road – is classified as a "Medium Access Control Arterial" according to the 2035 RTP. It is a 4-lane road between

US 395 and Moya Boulevard and a 2-lane road elsewhere. The posted speed limit is 35 mph.

- N. Virginia Street – is classified as a "Medium Control Arterial" according to the 2035 RTP, within the study area. It is a 2-lane roadway with a posted speed limit of 35 mph.

2.2 Existing Non-Motorized Facilities

Non-motorized travel, such as walking and cycling, are important elements of the transportation system and the provision, extent, and quality of non-motorized facilities affect mode choice. **Figure 2-1** and **Figure 2-2** summarize the existing pedestrian facilities and bicycle facilities, respectively, within the study area.

As shown in **Figure 2-1**, there are currently many gaps in the sidewalk infrastructure. There are also many gaps in the bicycle facilities and long-term improvements are needed to enhance travel for both modes.

2.3 Public Transit

This section documents the existing public transportation infrastructure that serves the North Valleys region.

The RTC fixed-route services consist of RTC RIDE (23 routes), RTC RAPID (bus rapid transit service), RTC INTERCITY, and the SIERRA SPIRIT (downtown Reno circulator). RTC also provides complimentary ADA paratransit service, RTC ACCESS, and has a growing vanpool program, RTC VANPOOL, with over 100 van pools in operation. RTC RIDE is the public transit bus system for the greater Sparks, Reno, and Washoe County areas. The fixed-route system operates in a 90 square-mile service area, based on a 0.75 mile distance from each fixed route (excluding RTC INTERCITY).The fixed-route system includes a fleet of 72 buses with more than 1,000 bus stops.

In addition to fixed-route service, the RTC also provides ACCESS service within the North Valleys Region. RTC ACCESS is the para-transit service that provides door-to-door, prescheduled, trips for individuals with access and functional needs who meet eligibility criteria. Trips are reserved from one to three days in advance and the service operates 24 hours a day, seven days a week.

Fixed Routes in North Valleys

Routes 7, 15 and 17 are the fixed routes serving the North Valleys region. Route 7 travels along Golden Valley Road, Sky Vista Parkway, Stead Boulevard to provide connectivity between Downtown Reno and Reno Stead Airport. Route 15 travels along Dandini Boulevard providing connectivity between Downtown Reno and Truckee Meadows Community College. Route 17 provides connectivity between Downtown Reno and Lemmon Valley via N. Virginia Street and Lemmon Drive. **Figure 2-3**, shows the three RTC fixed-routes providing service in the study area. RTC RIDE is the only fixed-route bus service operating within the study area.

Figure 2-1. Existing Pedestrian Facilities

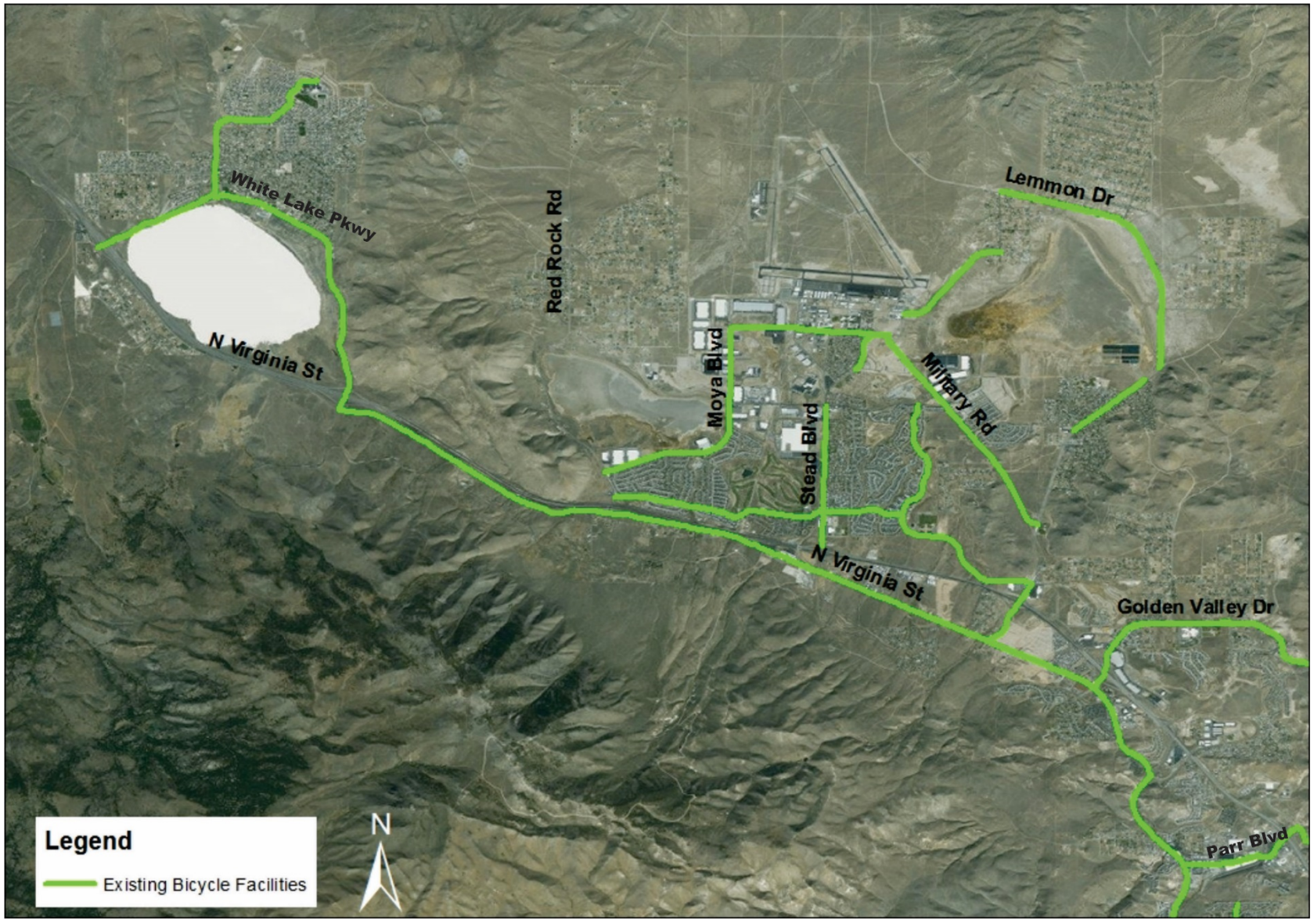


Figure 2-2. Existing Bicycle Facilities

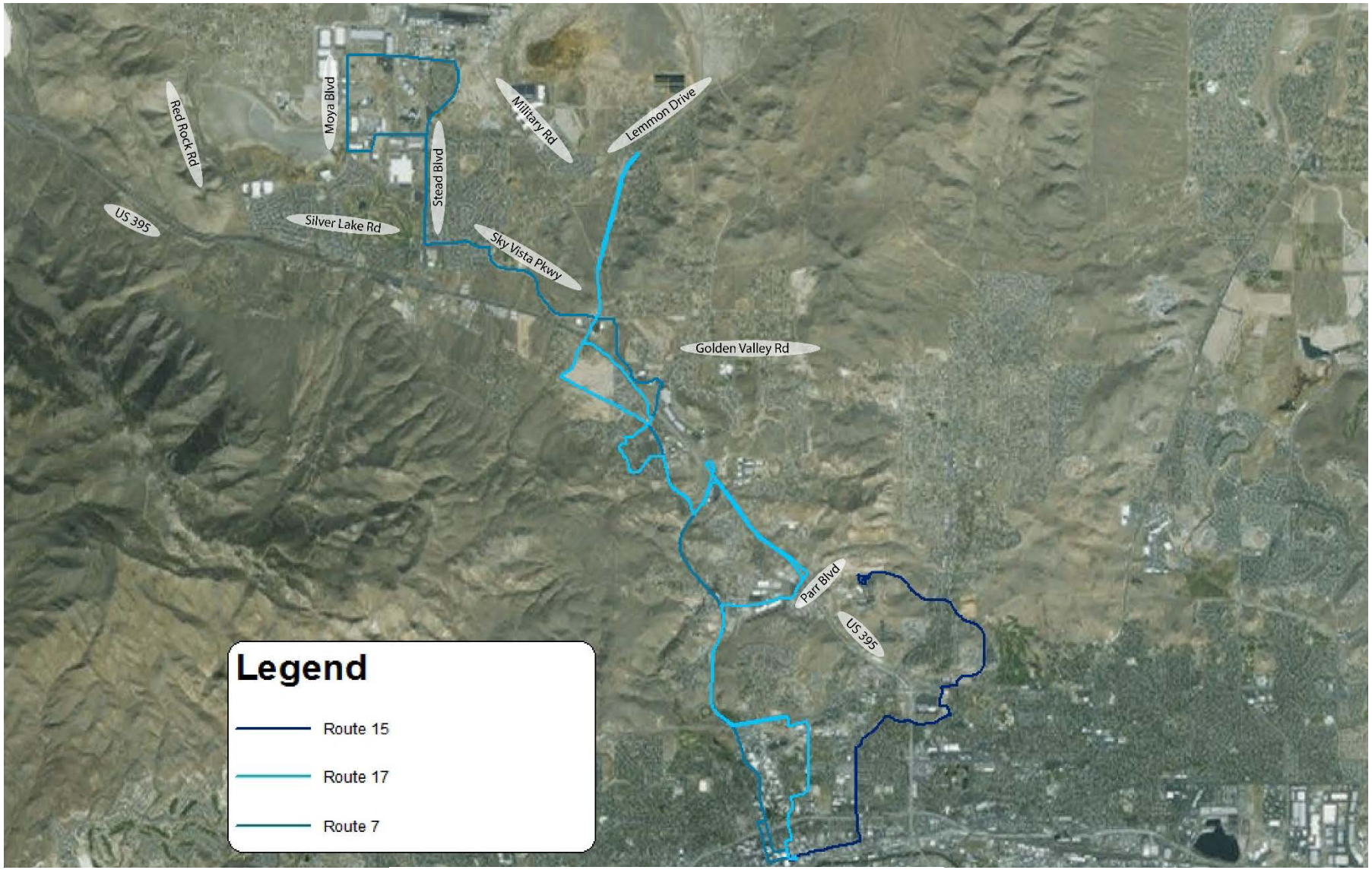


Figure 2-3. Transit Routes Serving The North Valleys

2.4 Collision History

Crash data obtained from the Nevada Department of Transportation (NDOT) for the previous five year period (August 2010 to August 2015) was used to help identify high-crash locations and attempt to identify trends. Crash data was obtained for each study intersection. Identifying crash types can assist in the choice of safety countermeasures and in evaluations of countermeasure effectiveness. **Table 2-1** shows the summary of crashes at each intersection during the past five years.

Based on the data obtained, a total of 173 crashes were reported between August 2010 and August 2015. The majority of the crashes were Property Damage Only (PDO) crashes, accounting for 57% of the total crashes. 42% of the crashes resulted in injuries and 1% resulted in a fatality. About 8% of the crashes (14 out of 173) involved cyclists or pedestrians. The location with highest bicycle and pedestrian crashes is the Stead Boulevard/Silver Lake Road intersection. The Stead Boulevard/Silver Lake Road intersection was evaluated further and is discussed in the following section. **Figure 2-4** shows the relative distribution of crashes at the various intersections.

Table 2-1. Crash Summary from August 2010 to August 2015

Intersection	Mode Involved			Severity			Total
	Vehicle	Bicycle	Pedestrian	Fatality	Injury	Property Damage	
Parr Blvd/US 395 Ramps	9				3	6	9
N Virginia St/Golden Valley Rd	17	1			9	9	18
N Virginia St/Lemmon Dr	5				1	4	5
Lemmon Dr/395 Ramps	15	1			5	11	16
Lemmon Dr/Sky Vista Pkwy	26		2		11	17	28
Lemmon Dr/Military Rd	18				8	10	18
Stead Blvd/Silver Lake Rd	46	3	7	2	29	25	56
Red Rock Rd/Silver Lake Rd	11				3	8	11
Red Rock Rd/Moya Blvd	12				3	9	12
TOTAL	**159**	**5**	**9**	**2**	**72**	**99**	**173**

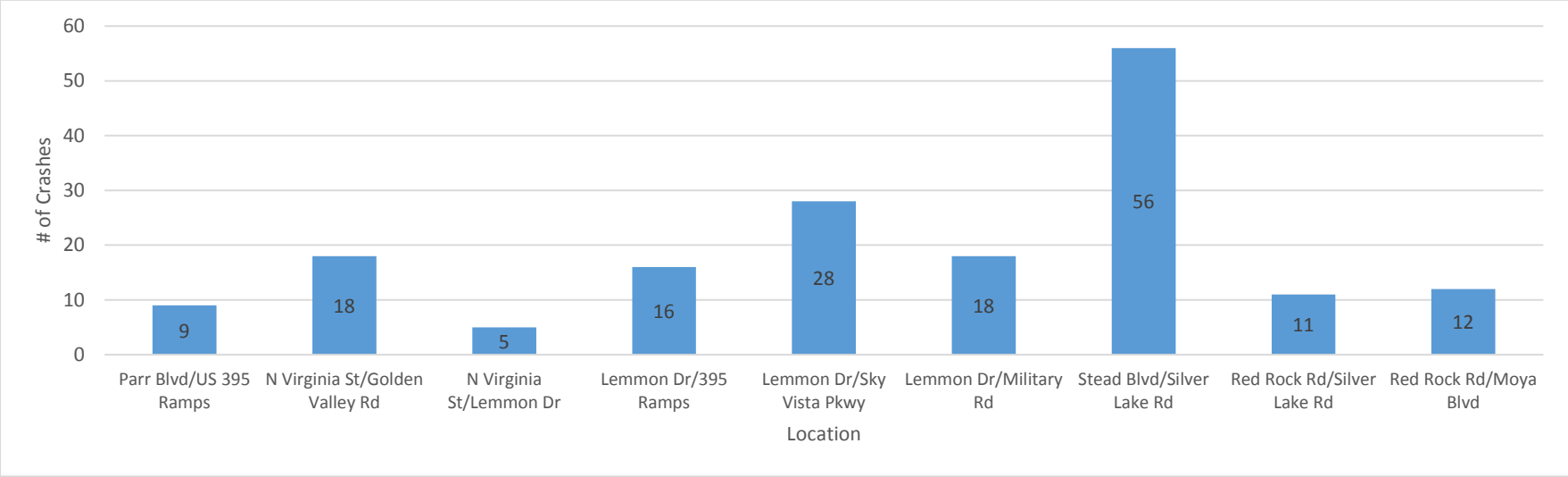


Figure 2-4. Summary of Crashes from August 2010 to August 2015

Stead Boulevard/Silver Lake Road

Any intersection with over 30 crashes in a 3 year period is considered by NDOT to be a "High Crash Location". The Stead Boulevard/Silver Lake Road intersection is the only intersection that experienced over 30 crashes in a 3 year time period, making it a high crash location. 56 crashes were reported at the Stead Boulevard/Silver Lake Road intersection between August 2010 and August 2015. **Table 2-2** summarizes all the reported crashes at this location.

Based on the data obtained, of the 56 crashes at this location, 4 were reported in 2010, 11 were reported in 2011, 10 were reported in 2012, 10 were reported in 2013, 13 were reported in 2014, and 8 crashes were reported in 2015. The historic trend shows that the number of crashes has generally remained constant every year over the past five year period.

Table 2-2. Summary of Crashes at Stead Blvd/Silver Lake Rd from Aug 2010 to Aug 2015

Crash Type	Number	PDO	Injury	Fatality	Ped/Bike
Angle	24	9	13	2	3
Head-on	2	0	2	0	0
Non-Collision	12	3	9	0	7
Rear-End	15	10	5	0	0
Sideswipe/Overtaking	2	2	0	0	0
Unknown	1	1	0	0	0

A majority of the crashes were angle collisions accounting for 43% of all the crashes, followed by rear-end crashes (27%), non-collision (single vehicle incident) crashes (21%), sideswipe/overtaking crashes (4%), head-on crashes (3%) and the rest 2% were reported as "unknown". Of all the reported crashes, the majority of them were property damage only crashes that contributed to 55% of the total.

Of the 56 crashes at this location, 7 crashes involved a pedestrian and 3 involved a bicycle. All three bicycle related crashes occurred on the east leg of the intersection. According to the reports, of the seven pedestrian related crashes, five of them resulted due to "Failure to yield right-of-way", one due to "improper crossing", and one due to "unknown" reasons. **Figure 2-5** shows the number of crashes by type of crash.

The majority of the angle collisions are related to drivers failing to yield right of way and ignoring traffic signs, signals or markings. Rear-end collisions are common at signalized intersections and the majority of these are reported as following too closely. To address the higher than normal incidence of collisions, safety improvements are proposed for the Stead Boulevard/Silver Lake Road intersection and are described in Chapter 5.

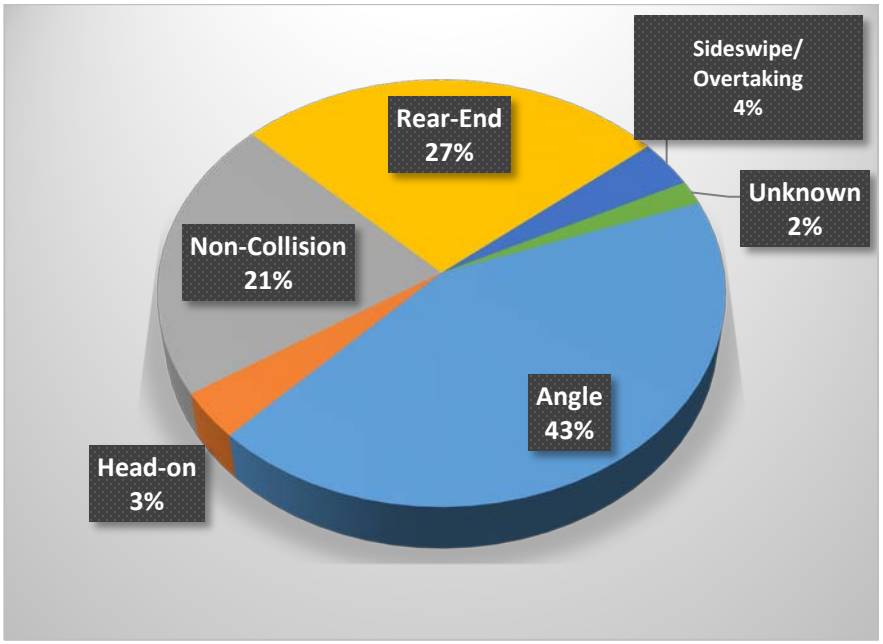


Figure 2-5. Crashes by Type at Stead Blvd/Silver Lake Rd

2.5 Existing Traffic Operations

Existing Traffic Volumes

Existing daily traffic volume data for all the study roadways within the North Valleys study region were obtained from the Nevada Department of Transportation (NDOT) Annual Traffic Report. Turning movement counts were collected at all the study intersections on a typical weekday, from 7:00 AM to 9:00 AM and from 4:00 PM to 6:00 PM. This data was used to identify the heaviest morning and evening traffic conditions. At each of the study intersections, the one-hour period with the heaviest traffic volumes (referred to as the peak hour) was determined from the morning and evening data. The existing AM and PM peak hour traffic volumes are shown in **Figure 2-6.**

Level of Service Methodology

Level of Service (LOS) is an estimate of the quality and performance of the transportation system operations. The industry standard for evaluating traffic conditions is the Transportation Research Board's (TRB) methodology outlined in the Highway Capacity Manual (HCM), Special Report 209 (TRB 2010). Using this methodology, traffic conditions are assessed with respect to the average intersection delay (seconds/vehicle). The letter "A" is used to describe the least amount of congestion and best operations, and the letter "F" indicates the highest amount of congestion and worst operations. The HCM LOS criteria for signalized and un-signalized intersections are shown in **Table 2-3**.

Table 2-3. LOS Criteria for Signalized & Un-signalized Intersections

LOS Rating	Brief Description	Average Delay for Signalized Intersections (seconds/vehicle)	Average Delay for TWSC Intersections (seconds/vehicle)
A	Free flow conditions.	0-10	0-10
B	Stable conditions with some affect from other vehicles.	>10-20	>10-15
C	Stable conditions with significant affect from other vehicles.	>20-35	>15-25
D	High density traffic conditions still with stable flow.	>35-55	>25-35
E	At or near capacity flows.	>55-80	>35-50
F	Over capacity conditions.	> 80	> 50

Source: HCM 2010; TWSC: two-way stop control; LOS ratings for TWSC and three-legged stop-control intersections are based on the worst movement average delay; LOS is not defined for the overall intersection

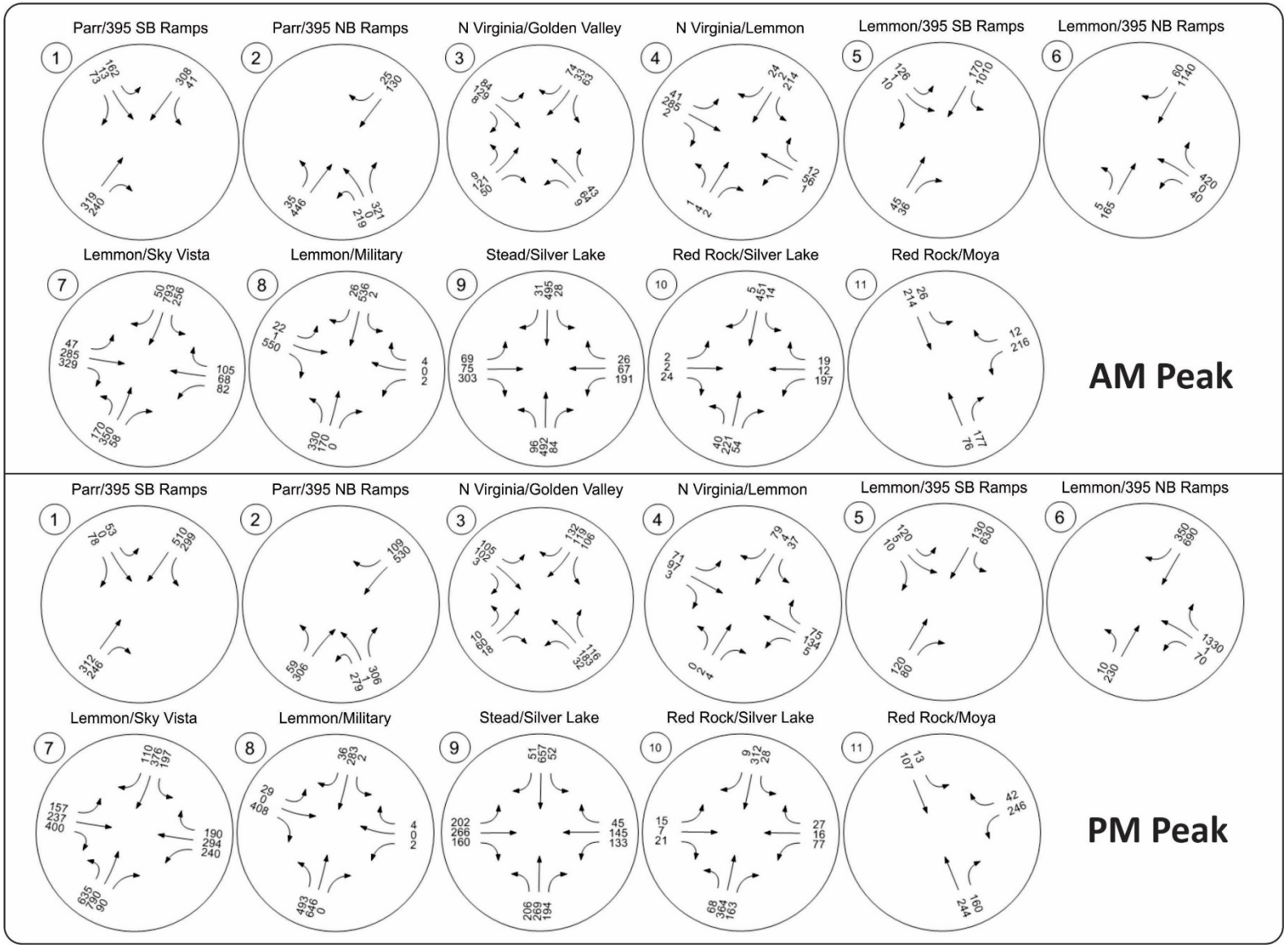


Figure 2-6. Existing AM and PM Peak Hour Turning Movement Volumes

Roadway segments were analyzed using the Average Daily Traffic Thresholds outlined in RTC's 2035 Regional Transportation Plan. Using this methodology, level of service is determined by comparing average daily traffic volumes to the LOS threshold values shown in **Table 2-4**.

The 2035 Regional Transportation Plan (2035 RTP) establishes level of service criteria for regional roadway facilities in Washoe County, the City of Reno, and City of Sparks.

The current Level of Service policy is:

- All regional roadway facilities projected to carry less than 27,000 ADT at the latest RTP horizon – LOS D or better.
- All regional roadway facilities projected to carry 27,000 or more ADT at the latest RTP horizon – LOS E or better.
- All intersections shall be designed to provide a level of service consistent with maintaining the policy level of service of the intersecting roadways.

Table 2-4. Average Daily Traffic LOS Thresholds by Facility Type

Facility Type	Maximum Service Flow Rate (daily for given service level)				
# of Lanes	LOS A	LOS B	LOS C	LOS D	LOS E
Freeway					
4	≤ 28,600	42,700	63,500	80,000	90,200
6	≤ 38,300	61,200	91,100	114,000	135,300
8	51,100	81,500	121,400	153,200	180,400
10	63,800	101,900	151,800	191,500	225,500
Arterial-High Access Control					
2	n/a	9,400	17,300	19,200	20,300
4	n/a	20,400	36,100	38,400	40,600
6	n/a	31,600	54,700	57,600	60,900
8	n/a	42,500	73,200	76,800	81,300
Arterial-Moderate Access Control					
2	n/a	5,500	14,800	17,500	18,600
4	n/a	12,000	32,200	35,200	36,900
6	n/a	18,800	49,600	52,900	55,400
8	n/a	25,600	66,800	70,600	73,900
Arterial/Collector-Low Access Control					
2	n/a	n/a	6,900	13,400	15,100
4	n/a	n/a	15,700	28,400	30,200
6	n/a	n/a	24,800	43,100	45,400
8	n/a	n/a	34,000	57,600	60,600
Arterial/Collector-Ultra-Low Access Control					
2	n/a	n/a	6,500	13,300	14,200
4	n/a	n/a	15,300	27,300	28,600
6	n/a	n/a	24,100	41,200	43,000
8	n/a	n/a	33,300	55,200	57,400
Source: Washoe County RTP Table 3-4.					

Level of Service Analysis

The existing average daily traffic volumes were compared to the daily volume thresholds (**Table 2-4**) to determine existing roadway segment level of service. The results are shown in **Table 2-5**. Each of the studied roadway segments is currently operating at an acceptable level of service based on NDOT's reported 2014 AADTs.

Table 2-5. Existing Road Segment Level of Service

Roadway Segment	Location	Class	Lanes	Access Control	2014 AADT	
					AADT	LOS
Parr Boulevard	N/O 395	Arterial	2	LAC	7,500	D
Parr Boulevard	S/O 395	Arterial	2	LAC	10,500	D
Golden Valley Road	N/O 395	Arterial	4	MAC	13,500	C
Golden Valley Road	S/O 395	Arterial	2	MAC	6,800	C
Lemmon Drive	N/O Military Road	Arterial	4	MAC	9,800	B
Lemmon Drive	S/O Sky Vista Pkwy	Arterial	4	MAC	25,000	C
Military Road	W/O Lemmon Drive	Arterial	2	MAC	8,300	C
Sky Vista Parkway	W/O Lemmon Drive	Arterial	4	MAC	14,500	C
Stead Boulevard	N/O Silver Lake Road	Arterial	4	MAC	8,500	B
Stead Boulevard	S/O Silver Lake Road	Arterial	4	MAC	18,000	C
Silver Lake Road	E/O Stead Boulevard	Collector	2	LAC	6,800	C
Silver Lake Road	W/O Stead Boulevard	Collector	2	LAC	6,500	C
Red Rock Road	N/O Moya	Arterial	4	MAC	3,900	B
Moya Boulevard	E/O Red Rock Road	Arterial	3	LAC	4,000	C
Silver Lake Road	E/O Red Rock Road	Collector	2	LAC	3,300	C
N Virginia Street	E/O Stead Boulevard	Arterial	2/3	MAC	1,900	B
N Virginia Street	E/O Lemmon Drive	Arterial	2/3	MAC	4,100	B
N Virginia Street	W/O Golden Valley Rd	Arterial	2	MAC	4,700	B

N/O = North of, S/O South of, etc.

The study intersections were analyzed using the HCM modules for signalized intersections in Trafficware's software program, Synchro 9.0. Level of service calculations were performed using the existing lanes, intersection configurations, and traffic volumes collected. The intersection Level of Service and delay results are presented in **Table 2-6**.

Table 2-6. Existing Intersection Level of Service

Intersection		Control	2015 Existing	
			AM Peak	PM Peak
Parr Blvd and US 395 SB Ramps	LOS	TWSC	E	F
	Delay		39.5	65.9
Parr Blvd and US 395 NB Ramps	LOS	TWSC	F	F
	Delay		59.2	149.3
N. Virginia St and Golden Valley Rd	LOS	Signal	A	A
	Delay		7.1	8.4
N. Virginia St and Lemmon Dr	LOS	AWSC	C	A
	Delay		17.8	9.0
Lemmon Dr and US 395 SB Ramps	LOS	TWSC	F	F
	Delay		>200	>200
Lemmon Dr and US 395 NB Ramps	LOS	TWSC	D	C
	Delay		29.3	15.0
Lemmon Dr and Sky Vista Pkwy	LOS	Signal	C	D
	Delay		22.6	38.1
Lemmon Dr and Military Rd	LOS	Signal	B	B
	Delay		10.7	10.1
Stead Blvd and Silver Lake Rd	LOS	Signal	B	C
	Delay		15.9	20.3
Red Rock Rd and Silver Lake Rd	LOS	TWSC	D	D
	Delay		33.8	28.2
Red Rock Rd and Moya Blvd	LOS	TWSC	B	B
	Delay		11.0	12.4

As shown in **Table 2-6**, 3 of the 11 study intersections currently operate at unacceptable level of service conditions. The following intersections currently operate worse than the policy LOS:

- Parr Boulevard and US 395 SB Ramps
- Parr Boulevard and US 395 NB Ramps
- Lemmon Drive and US 395 SB Ramps

Warrant Analysis at Golden Valley Rd/Beckwourth Drive

A signal warrant study was performed in order to determine whether or not a traffic signal is currently justified at the Golden Valley Road/Beckwourth Drive intersection. The warrant analysis was performed based on nationally accepted standards outlined in the current edition of the Manual on Uniform Traffic Control Devices (MUTCD) published by the Federal Highway Administration (FHWA). Warrants 1, 2, 3, 4, 5, 7, and 8 were analyzed. Warrant 6, Coordinated Signal System and Warrant 9, Intersection Near a Grade Crossing were deemed not applicable to the subject intersection. The conclusion of this study was that a traffic signal is not justified or appropriate at the Golden Valley Road/Beckwourth Drive intersection at this time as none of the signal warrants are met. The full report is attached in **Appendix A**.

3 PUBLIC OUTREACH

A critical part of any successful regional planning study is interweaving community and stakeholder input throughout the duration of the study. The project team sought to engage interested citizens and key stakeholders whenever possible and incorporate their feedback within the study process. The project team reached out to key stakeholders including adjacent neighborhood associations, neighborhood advisory boards, citizen advisory boards, and numerous public agencies, in an effort to identify current and future needs as well as gauge favorability of potential alternatives. The project team has also engaged key local agencies throughout the study process by meeting multiple times with the Technical Advisory Committee (TAC) established for this project. Two TAC meetings, one stakeholder meeting, and two community-wide public meetings were held during the study process.

Committee members attended TAC meetings to review documents and material presented to them and provided their input. The committee included staff from the Washoe County Regional Transportation Commission (RTC), the Nevada Department of Transportation (NDOT), the City of Reno, Washoe County, and the Federal Highway Administration. The RTC is the lead agency for this study. Other agencies and organizations provided significant input throughout the study. In addition to conducting TAC meetings, the consulting team met multiple times with RTC staff to discuss specific issues and find consensus based solutions to various challenges.

The study process included a significant public outreach effort to identify key issues and concerns from the public's perspective, and have the public shape potential improvements. Public involvement was sought primarily via participation at two public meetings that were conducted on February 04, 2016 and June 30, 2016 at O'Brien Middle School, which is located on Stead Boulevard in the heart of the North Valleys study area.

3.1 TAC and Stakeholder Meetings

TAC Kick-Off Meeting

At the beginning of the project, the consultant team organized a Kickoff Meeting, which was attended by staff members from the Regional Transportation Commission (RTC), City of Reno, Nevada Department of Transportation (NDOT) and Washoe County, to discuss the overall project priorities, schedule, timeline, public involvement process, client needs, preliminary interests, and study goals. The study purpose and goals identified during the kick-off meeting were:

- Identify near & longer term transportation Improvements
- Address opportunities for transit, walking, & cycling
- Identify and position a near-term project for construction in the 2016 season
- Focus on regional roads and local issues

This meeting finalized the intersections and roadway segments that are included in this study. This meeting also identified the stakeholders

for the project, which included the Golden Valley Home Owners Association, RTC Citizens Multimodal Advisory Committee, Ward 4 Neighborhood Advisory Board, N. Valleys Neighborhood Advisory Board, and the N. Valleys Citizens Advisory Board.

TAC & Stakeholder Meeting 1

The first TAC/stakeholder meeting was held on December 8, 2015. The meeting began with a presentation by the project consulting team, followed by a question-and-answer session. This meeting served as an introduction between the consulting team staff, lead agency staff, the TAC members, and the stakeholders. The main purpose of this meeting was to introduce the project to the committee members and inform them of the start of the study. While introducing the project, the attendees were presented with the project overview, study area, scope of work of the project, the overall vision for the project, study approach, primary goals, public engagement and outreach process, and the project timeline.

TAC Meeting 2

This meeting was held on January 27, 2016. Similar to the December 8 session, this meeting began with a presentation by the project consulting team, followed by question-and-answer session. The primary purposes of this meeting were to update the TAC on the progress of the project, present the existing conditions technical analysis, present potential short-term improvements, and have the TAC comment on those potential short-term improvements. Detailed technical information presented during this meeting included:

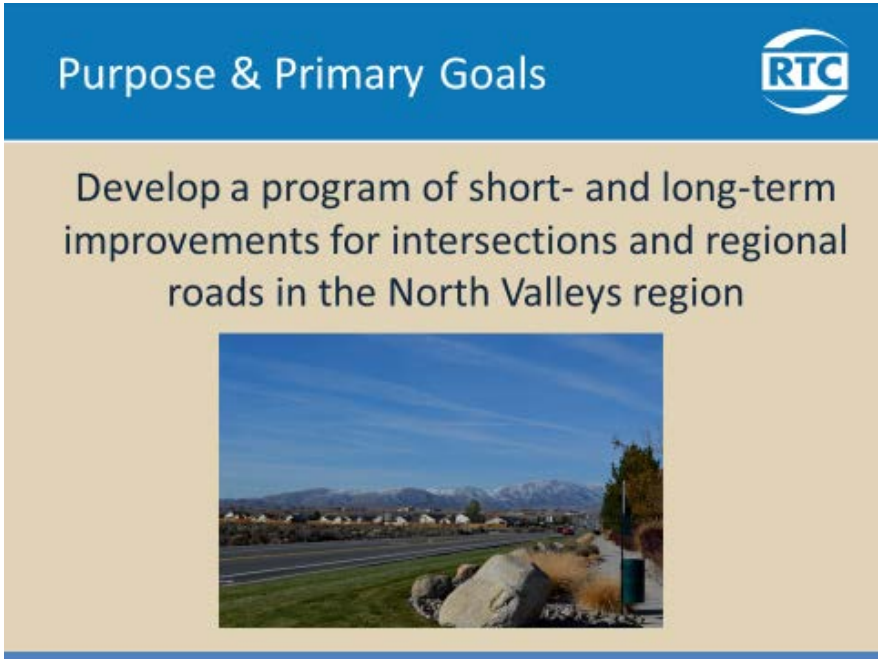


Figure 3-1. A Sample Slide from the Meeting #1 Presentation

- Preliminary Vision Statement for the study
- Existing conditions roadway and intersection Level of Service analysis
- Analysis of the crash history summaries and trends along the corridor
- Development projects to be included in the travel demand model for future traffic forecasting
- Potential short-term improvements

Post presentation, the TAC was asked to comment on the potential short-term improvements and offer new ones. The TAC was also

informed about the first public meeting where the material from TAC Meeting 2 would be presented to the community for comments.

TAC & Stakeholder Meeting 3

A third TAC and joint Stakeholder meeting was conducted on June 21, 2016, after the first public meeting. The first part of the presentation included a recap of the materials presented in the first two meetings and the summary of outcomes and comments from the first public meeting.

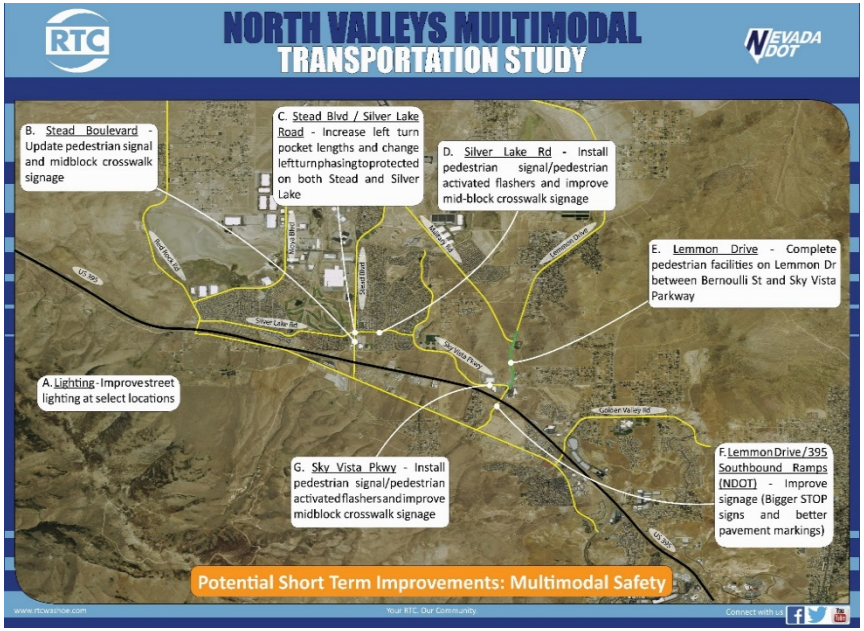


Figure 3-2. A Sample Slide from the Meeting #3 Presentation

The second half of the presentation informed the TAC about the:

- Package 1 Short term improvement concepts (planned for construction in 2016)
- Contemplated Package 2 Short term improvements (to be constructed in 2017)
- Methodology used to develop future horizon year 2035 traffic volumes using the outputs obtained from the RTC regional travel demand model
- Horizon year 2035 traffic volumes and operations
- Year 2035 deficiencies (both motorized and non-motorized)
- Potential long-term improvements

The primary goal of this meeting was to solicit feedback from the TAC and stakeholders on the various short term and long term improvements and to potentially eliminate the ones that do not meet the goals and priorities of the project. The presentation was followed by a question and answer session and discussion to select appropriate short term and long term improvements.

3.2 Public Meetings

This section provides a summary of the activities undertaken to directly engage local residents and the general public. Community supported plans cannot be established without a free exchange of information and public input at all stages of the planning process. In order for the public input process to be effective, the project team organized proactive public meetings and provided complete information for public review and comment. Timely public notices were sent to ensure the public's awareness of these meetings. Citizens were encouraged to

provide input toward decisions: an approach that began early and continued throughout the process, and ultimately created the improvement packages.

The project team engaged the community through two open house format public meetings. These meetings enabled the public to interact with the project team, voice questions or concerns about the current or future state of roadways in the North Valleys region, and submit comments. Questions and concerns were gathered through public comment cards. Interactive tools such as stickers and sticky notes were used to gain input and guide decisions. Attendees were also asked to write comments on display maps that showed the entire North Valleys region.

Public Meeting 1

The first public meeting was held on February 4, 2016 at O'Brien Middle School. The meeting was attended by approximately 70 community members.

The purpose of this public meeting was to introduce the study purpose, solicit feedback from the public on their concerns regarding the issues in North Valleys, and to gather feedback on various proposed short term improvements. The project team presented the details of the study including study limits, study roadways and intersections, project goals and objectives, existing traffic volumes and traffic operations, existing non-motorized infrastructure deficiencies, and existing challenges. In addition to presenting information, this meeting was designed to encourage attendees to provide feedback on various issues and questions posed to them on the display boards.

For example, at a station dedicated to the project goals and priorities, attendees were asked to define their two most important priorities for this corridor. **Figure 3-3** shows the question that was posed to the attendees and **Figure 3-4** shows their collective preferences.

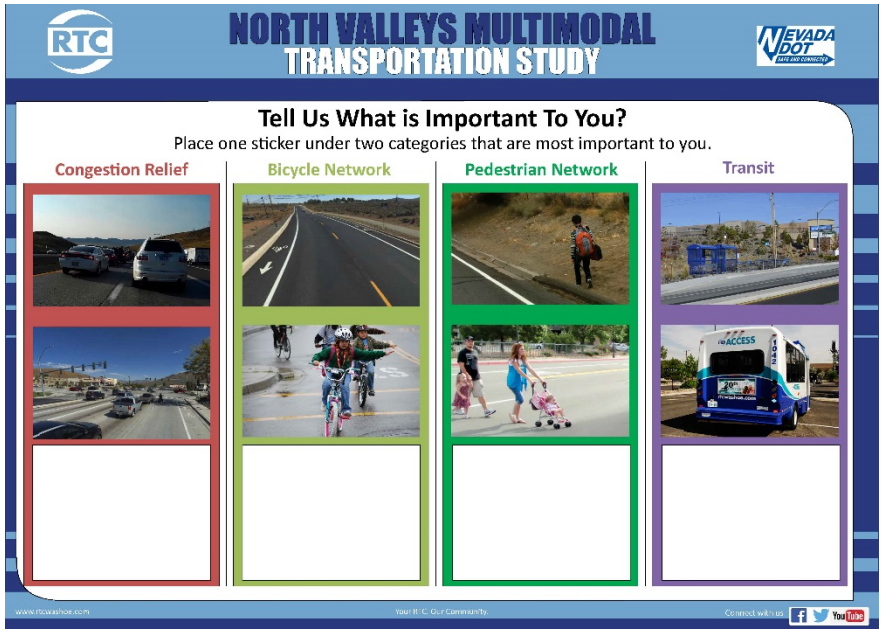
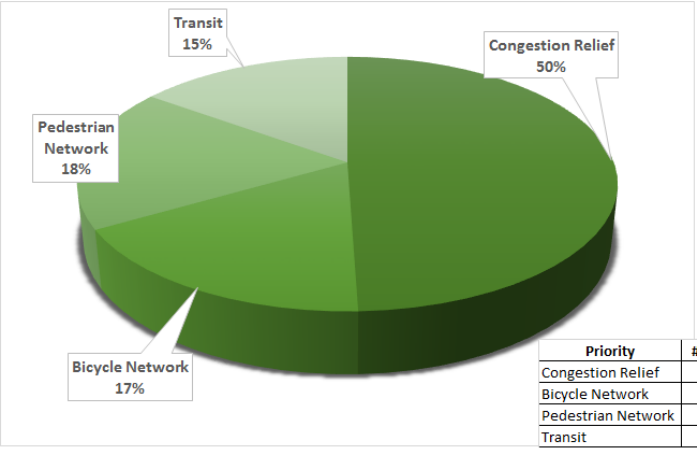


Figure 3-3. Display Seeking Public Input on Priorities

At another station, participants were presented with various potential short-term solutions that were proposed based on existing conditions traffic operations analysis and existing deficiencies. The attendees were asked to pick the three highest propriety short-term improvements. The feedback on these options was collected and the outcome is shown in **Figure 3-5**. **Table 3-1** shows the outcome of the preference voting by the participants.



Priority	# Votes
Congestion Relief	46
Bicycle Network	16
Pedestrian Network	17
Transit	14

Figure 3-4. Community Priorities Results

The majority of participants picked the Lemmon Drive/US 395 Interchange improvements, followed by intersection improvements at the Red Rock Road/Silver Lake intersection, closing the sidewalk gaps on Lemmon Drive, and the Parr Boulevard/US 395 Interchange improvements. **Table 3-1** shows the number of votes each improvement received.

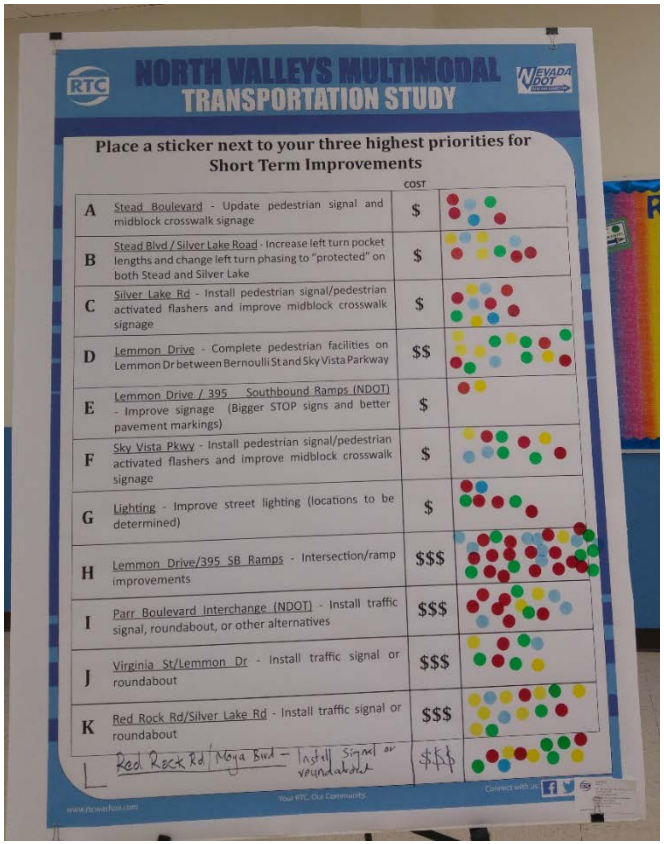


Figure 3-5. Display Seeking Public Preferences for Short Term Improvements

It should be noted that the community added the Red Rock Road/Moya Boulevard intersection and then gave it a significant number of votes. This location was carried forward to the Package 2 improvements and is a great example of how community input was incorporated through the outreach program.

Table 3-1. Public Preferences for Short Term Improvements

Short-Term Improvement	# Votes	Percentage
Lemmon/395 SB Ramps Intersection	31	23%
Ped facilities-Lemmon Dr	14	10%
Red Rock/Silver Lake Intersection	14	10%
Parr Blvd Interchange Intersection	13	10%
Red Rock/Moya Intersection	11	8%
Silver Lake Ped Signal	10	7%
Sky Vista Pkwy Ped Signal	10	7%
Stead/Silver Lake Intersection	9	7%
Virginia/Lemmon Intersection	8	6%
Street Lighting	7	5%
Stead Blvd Ped Signal	6	4%
Lemmon/395 SB Ramps (Signing & Striping)	2	1%

Figure 3-6. Public Meeting 1 Presentation

Public Meeting 2

The second public meeting was held on June 30, 2016 at O'Brien Middle School. Approximately 47 community members attended. Similar to the first public meeting, the second was also an open house format with a presentation and various interactive displays.

The purpose of this meeting was to present the community with the list of short-term and long-term improvements. The attendees were shown the list of proposed short-term improvements to be designed and constructed in 2016/17. These short term improvements were selected based on the community input received in Public Meeting 1. The attendees were also presented with a list of various proposed long-term (10 Year timeframe) improvements (discussed later in this report).

Within the long term improvements, the public was presented with a preliminary North Valleys Connector Concept that would potentially provide a connection between the Lemmon Valley and Spanish Springs areas. The attendees were asked to comment on the concept by writing comments on sticky notes and placing them on the board or by filling out the comment card. The North Valleys Connector Concept generally received positive comments and the public expressed interest in the need for such a connector. **Figure 3-7** shows the North Valleys Connector Concept that was shown to the public and **Figure 3-8** shows sample comments received.

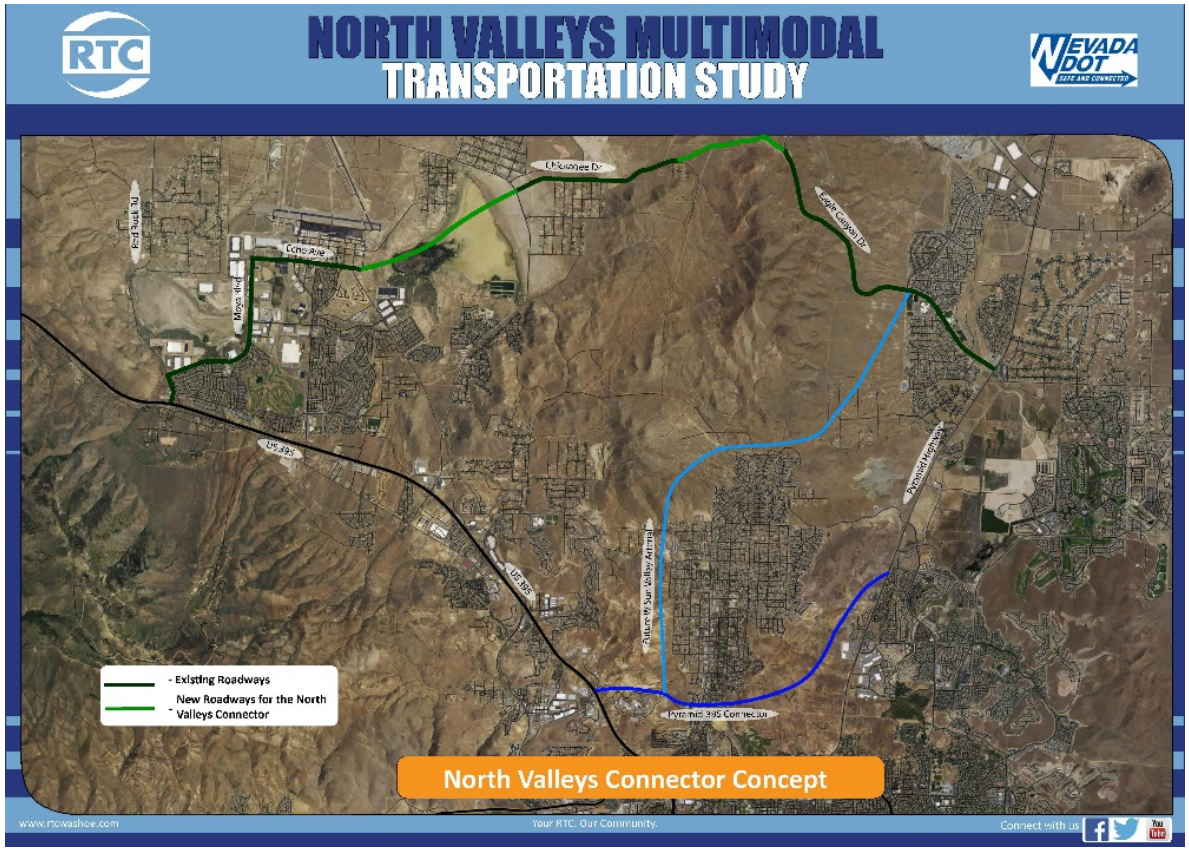


Figure 3-7. Display Showing North Valleys Connector Concept

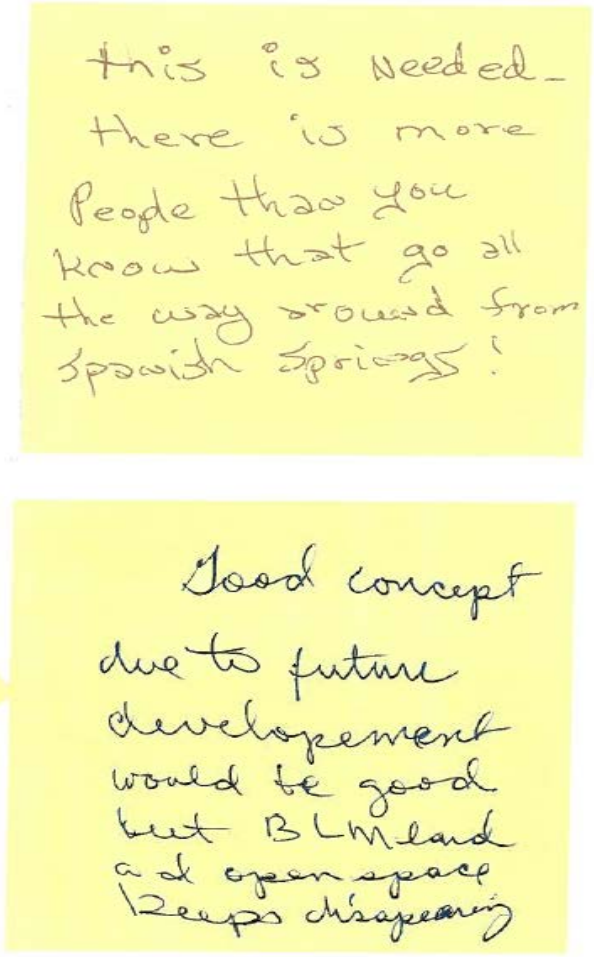


Figure 3-8. Sample Comments By The Attendees

4 2035 Future Traffic Conditions

This section of the report describes the future horizon year (2035) projected traffic volumes and anticipated traffic operations if no improvements were made. A 20-year horizon was chosen for future conditions analysis as this is the furthest horizon scenario in the RTC travel demand model and projecting realistic turn movements at intersections would be difficult beyond this time frame.

4.1 Functional Classifications and Roadway Characteristics

Depending on the amount of growth and development within the North Valleys area, it is possible that some roadways could warrant a change in functional classification to be consistent with capacity needs and community expansion. Substantial increases in traffic volumes could result in minor designations being changed to major classifications. However, land use in the study area is expected to generally remain consistent with current land uses. Moreover, future residents are expected to utilize the transportation system in a similar fashion as occurs today. Since the need for substantial capacity improvements would likely be limited to arterial roadways, it is unlikely that the very many functional classifications would require changes.

The nature of roadways within the study area are also expected to generally remain similar. However, numerous roadway widening projects are anticipated on major roadways in the study area. Elements of these projects generally consist of road widening, signalization, pedestrian and bike improvements, and transit enhancements. As such, these projects should generally improve the safety and comfort of the local roadway system.

4.2 2035 Daily Traffic Volumes

With significant continued development and land use intensification, traffic volumes in the North Valleys region are anticipated to substantially increase in the future. The current Washoe County RTC travel demand model was used to estimate future traffic volumes for the 2035 horizon year. With tremendous growth anticipated, the travel demand model is the only source for travel forecasts that can accurately predict significant shifts in traffic flow.

For this study, a scenario was analyzed in the 2035 RTC travel demand model that includes all the potential and known development projects in the North Valleys region. Traffic Works staff worked interactively with the RTC, TMRPA, City of Reno, Washoe County and NDOT staff while developing the methodology for including development projects and for estimating 2035 volumes. A consensus and approval was obtained with the project TAC regarding the projects to be included, the traffic forecasting methodology and the resulting traffic volumes.

Year 2035 daily traffic volumes were developed using the following approach:

Step 1: Determine the existing (2014) daily traffic volumes (AADT) from NDOT's Traffic Records Information Access (TRINA) database.

Step 2: Obtain RTC's travel demand model daily traffic volume outputs for the 2015 and future year (2035) scenarios.

Step 3: Apply the "Difference Adjustment Method" prescribed in NCHRP Report 255 procedures (as specified in NDOT's Traffic Forecasting Guidelines).

Step 4: Calculate the growth difference between the 2014 and 2035 daily traffic volumes. Determine the percent change, and percent per year change, over the 21-year model range, by roadway segment.

Step 5: Review the growth trends and make adjustments for general consistency throughout the roadway segments.

Step 6: The growth rates from Step 5 were compared to growth rates calculated from NDOT's historic counts.

Step 7: Apply the growth factors from Step 5 to 2014 AADT to obtain 2035 AADT.

The final 2035 AADT's and growth rates/factors are shown in **Table 4-1** and **Table 4-2**. The 2035 design volumes are shown in the column titled "2035 Adjusted AADT".

Table 4-1. Estimation of 2035 Daily Traffic Volumes and Growth Rates (Part 1)

Location -->	Parr Blvd	Parr Blvd	Golden Valley Rd	Golden Valley Rd	Golden Valley Rd	Lemmon Dr	Lemmon Dr	Lemmon Dr	Lemmon Dr	Lemmon Dr	Military Rd	Sky Vista Pkwy
	N/O 395	S/O 395	N/O 395	S/O 395	S/O Virginia	N/O Military	S/O Military	S/O Sky Vista	b/w Ramps	S/O 395	W/O Lemmon	W/O Lemmon
2014 NDOT AADT	7,500	10,500	13,500	6,800	2,600	9,800	17,500	25,000	15,565	4,339	8,300	14,500
2014 NDOT AWDT	7,867	11,014	14,161	7,133	2,727	10,280	18,357	26,224	16,327	4,551	8,706	15,210
Demand Model Volumes												
2015 RTC AWDT	6,311	12,459	14,981	11,409	3,507	12,502	18,789	21,839	10,887	578	8,184	3,587
2035 RTC AWDT	22,544	21,907	23,740	20,452	5,901	37,480	52,497	55,791	30,371	6,936	20,134	20,401
Model Difference 2035-2015	16,233	9,448	8,759	9,043	2,394	24,978	33,708	33,952	19,484	6,358	11,950	16,814
Difference Adjustment Method												
20 Years Increase	16,233	9,448	8,759	9,043	2,394	24,978	33,708	33,952	19,484	6,358	11,950	16,814
2035 Adjusted AADT	**22,975**	**19,507**	**21,850**	**15,421**	**4,882**	**33,612**	**49,634**	**57,367**	**34,139**	**10,400**	**19,692**	**30,529**
2035 Adjusted AWDT	24,100	20,462	22,920	16,176	5,121	35,258	52,065	60,176	35,811	10,909	20,656	32,024
2035 Adjusted AADT-2014 NDOT AADT	15,475	9,007	8,350	8,621	2,282	23,812	32,134	32,367	18,574	6,061	11,392	16,029
% Change	206%	86%	62%	127%	88%	243%	184%	129%	119%	140%	137%	111%
% per year	9.8%	4.1%	2.9%	6.0%	4.2%	11.6%	8.7%	6.2%	5.7%	6.7%	6.5%	5.3%
21 years growth factor	**3.1**	**1.9**	**1.6**	**2.3**	**1.9**	**3.4**	**2.8**	**2.3**	**2.2**	**2.4**	**2.4**	**2.1**

Table 4-2. Estimation of 2035 Daily Traffic Volumes and Growth Rates (Part 2)

Location -->	Buck Dr	Stead Blvd	Stead Blvd	Silver Lake Rd	Silver Lake Rd	Red Rock Rd	Red Rock Rd	Red Rock Rd	Moya Blvd	Silver Lake Rd	N Virginia St	N Virginia St	N Virginia St
	E/O Lemmon	N/O Silver Lake	S/O Silver Lake	E/O Stead	W/O Stead	N/O Moya	S/O Moya	S/O Silver Lake	E/O Red Rock	E/O Red Rock	E/O Stead	E/O Lemmon	E/O Golden V
2014 NDOT AADT	8,000	8,500	18,000	6,800	6,500	3,900	10,190	13,794	4,000	3,300	1,900	4,100	4,700
2014 NDOT AWDT	8,392	8,916	18,881	7,133	6,818	4,091	10,689	14,470	4,196	3,462	1,993	4,301	4,930
	Demand Model Volumes												
2015 RTC AWDT	2,444	17,346	19,410	1,089	5,871	4,723	5,081	11,834	2,087	6,907	1,562	5,132	4,776
2035 RTC AWDT	16,588	32,424	34,286	6,189	6,518	27,062	25,794	33,083	14,389	8,253	7,887	17,012	16,619
Model Difference 2035-2015	14,144	15,078	14,876	5,100	647	22,339	20,713	21,249	12,302	1,346	6,325	11,880	11,843
	Difference Adjustment Method												
20 Years Increase	14,144	15,078	14,876	5,100	647	22,339	20,713	21,249	12,302	1,346	6,325	11,880	11,843
2035 Adjusted AADT	**21,484**	**22,874**	**32,182**	**11,662**	**7,117**	**25,196**	**29,936**	**34,051**	**15,728**	**4,583**	**7,930**	**15,425**	**15,990**
2035 Adjusted AWDT	22,536	23,994	33,757	12,233	7,465	26,430	31,402	35,719	16,498	4,808	8,318	16,181	16,773
2035 Adjusted AADT-2014 NDOT AADT	13,484	14,374	14,182	4,862	3,700	21,296	19,746	20,257	11,728	1,283	6,030	11,325	11,290
% Change	169%	169%	79%	71%	57%	546%	194%	147%	293%	39%	317%	276%	240%
% per year	8.0%	8.1%	3.8%	3.4%	2.7%	26.0%	9.2%	7.0%	14.0%	1.9%	15.1%	13.2%	11.4%
21 years growth factor	**2.7**	**2.7**	**1.8**	**1.7**	**1.6**	**6.5**	**2.9**	**2.5**	**3.9**	**1.4**	**4.2**	**3.8**	**3.4**

4.3 2035 Peak Hour Intersection Volumes

2035 peak hour turning movement volumes were estimated by combining the methodology described in Section 4.2 with NCHRP Report 255 procedures. *NCHRP Report 255, Highway Traffic Data for Urbanized Area Project Planning and Design*, is a document published by the Federal Highway Administration that discusses post processing of travel demand model outputs and developing turning movement volumes. NCHRP 255 has standardized procedures to translate travel demand outputs into information to support project development decisions. These procedures account for variance in the detail and precision of forecasts and uncertainty in land-use forecasts by improving consistency and analytic quality of input data and output forecasts. The growth rates (bottom lines of **Table 4-1** and **Table 4-2**) obtained through the methodology described in Section 4.2, were further refined by applying these principles in developing peak hour turning movement counts. To develop 2035 peak hour turning movements, Turns W32, a turning movement volumes balancing tool that incorporates NCHRP 255 procedures, was used. 2035 peak hour turning movements were developed based on existing turning movement counts and the growth rates obtained through the daily volume forecasts. Turns W32 calculates future year turning movement volumes and balances future turning movement distribution based on current turning movement counts and the growth rates on all the approaches of intersection. A screenshot of the Turns W32 input page is shown in **Figure 4-1**. The 2035 AM and PM peak hour turning movement volumes are shown in **Figure 4-2**.

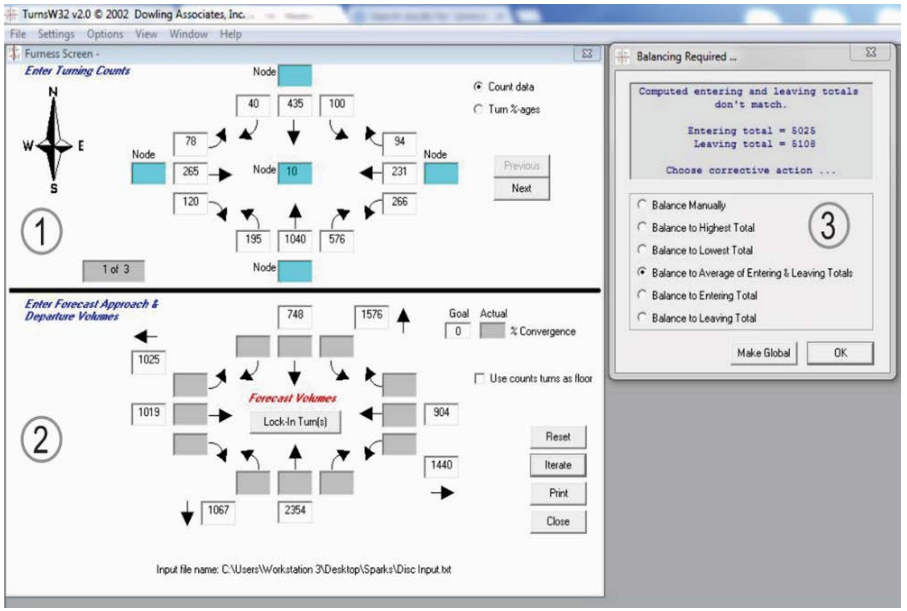


Figure 4-1. Example Screenshot of Turns W32

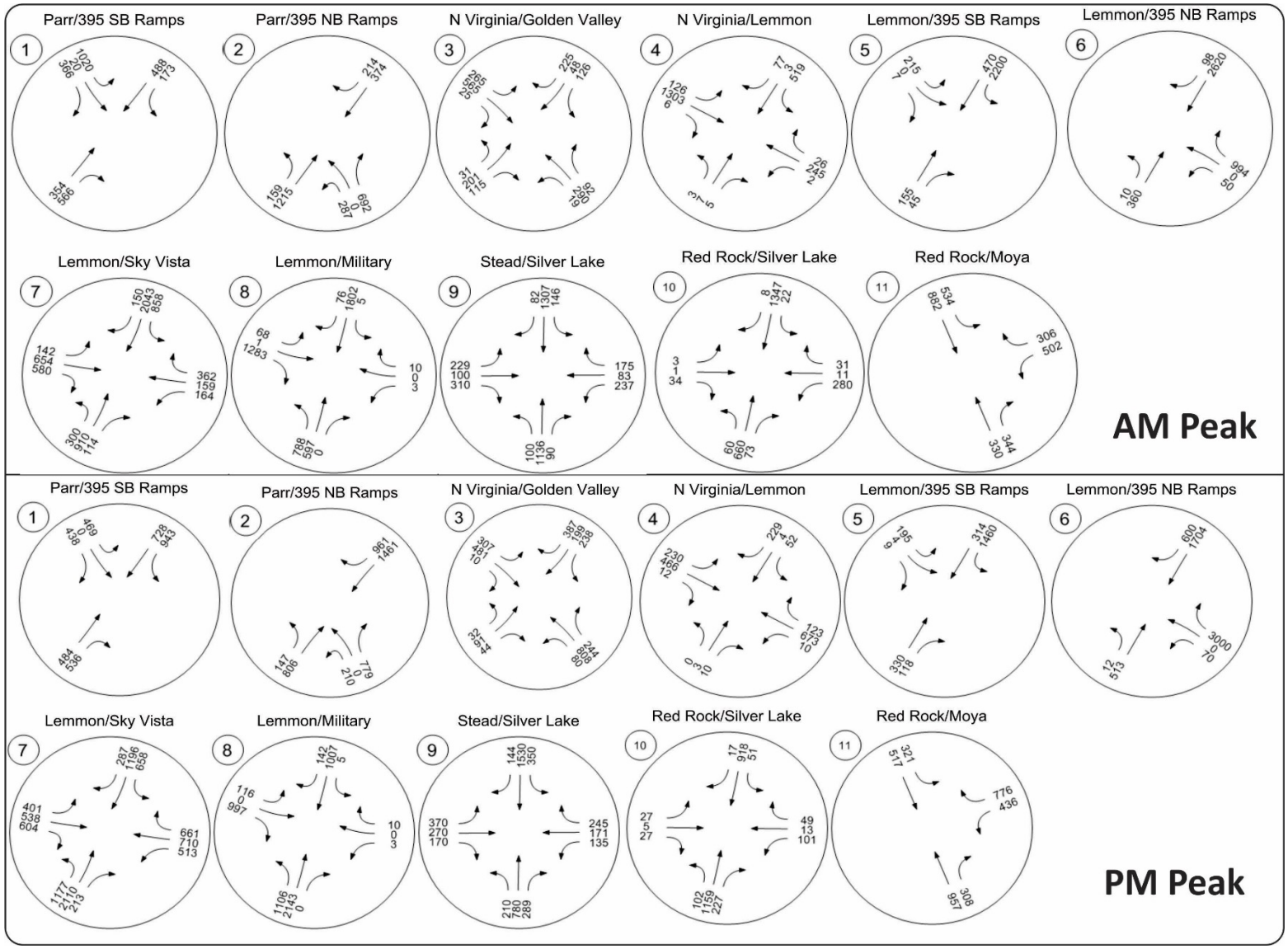


Figure 4-2. 2035 AM and PM Peak Hour Turning Movement Counts

4.4 Year 2035 Traffic Operations

Roadway Segment Level of Service

The projected 2035 average daily traffic volumes were compared to the daily volume thresholds (**Table 2-4**) to determine the 2035 roadway segment level of service. The results are shown in **Table 4-3**, based on existing lane configurations.

By the year 2035, many of the major roadway segments in the North Valleys region will operate at LOS "F". Portions of Parr Boulevard, Lemmon Drive, Military Road, Buck Drive, Red Rock Road, and Moya Boulevard are all anticipated to operate at LOS "F" in the year 2035, if no improvements are made. Additional capacity (travel lanes) will be needed in these segments to provide acceptable levels of service.

Table 4-3. 2035 Roadway Segment Level of Service Summary

Roadway Segment	Location	Class	Access Control	2035	
				AADT	LOS
Parr Boulevard	North of US 395	Arterial	LAC	22,975	F
Parr Boulevard	South of US 395	Arterial	LAC	19,507	F
Golden Valley Road	North of US 395	Arterial	MAC	21,850	C
Golden Valley Road	South of US 395	Arterial	MAC	15,421	D
Golden Valley Road	South of Virginia St	Arterial	MAC	4,882	B
Lemmon Drive	North of Military Rd	Arterial	MAC	33,612	D
Lemmon Drive	Between Military Rd and Sky Vista Pkwy	Arterial	MAC	49,634	F
Lemmon Drive	Between Sky Vista Pkwy and US 395	Arterial	MAC	57,367	F
Lemmon Drive	South of US 395	Arterial	MAC	10,400	C
Military Road	West of Lemmon Dr	Arterial	MAC	19,692	F
Sky Vista Parkway	West of Lemmon Dr	Arterial	MAC	30,529	C
Buck Drive	East of Lemmon Dr	Arterial	MAC	21,484	F
Stead Boulevard	North of Silver Lake Rd	Arterial	MAC	22,874	C
Stead Boulevard	South of Silver Lake Rd	Arterial	MAC	32,182	C
Silver Lake Road	East of Stead Blvd	Collector	LAC	11,662	D
Silver Lake Road	West of Stead Blvd	Collector	LAC	7,117	D
Red Rock Road	North of Moya Blvd	Arterial	MAC	25,196	F
Red Rock Road	Between Moya Blvd and	Arterial	MAC	29,936	F
Red Rock Road	South of Silver Lake Rd	Arterial	MAC	34,051	F
Moya Boulevard	East of Red Rock Rd	Arterial	LAC	15,728	F
Silver Lake Road	East of Red Rock Rd	Collector	LAC	4,583	C
N Virginia Street	Between Stead Blvd and Lemmon Dr	Arterial	MAC	7,930	C
N Virginia Street	Between Lemmon Dr	Arterial	MAC	15,425	D
N Virginia Street	East of Golden Valley Rd	Arterial	MAC	15,990	D

Intersection Level of Service

Using the land use development assumptions, and traffic volume forecasts, the year 2035 AM and PM peak hour traffic operations were analyzed in detail. As a result of significant traffic volume growth, existing peak hour factors (PHF) below 0.92 were adjusted to 0.92, or assumed to remain the same if currently above 0.92. The 2035 intersection Level of Service and delay results, with existing lane configurations, are presented in **Table 4-4**.

The 2035 peak hour LOS and delay at all the study intersections is shown to deteriorate compared to existing conditions. As shown in **Table 4-4**, all the study intersections will operate at unacceptable levels of service except for the Lemmon Drive/Military Road intersection, which was recently signalized. The number of intersections operating at unacceptable levels of service is shown to increase from three in 2016 to ten in 2035. The intersections that can be expected to operate below the LOS standards (all at LOS "F") and require capacity increasing improvements include:

- Parr Boulevard Interchange Intersections
- N. Virginia Street/Golden Valley Road
- N. Virginia Street/Lemmon Drive
- Lemmon Drive Interchange Intersections
- Lemmon Drive/Sky Vista Parkway
- Stead Boulevard/Silver Lake Roads
- Red Rock Road/Silver Lake Road
- Red Rock Road/Moya Boulevard

Table 4-4. 2035 Intersection Level of Service Summary

Intersection		Control	2035 Baseline Conditions	
			AM Peak	PM Peak
Parr Blvd and US 395 SB Ramps	LOS	TWSC	F	F
	Delay		>500	>500
Parr Blvd and US 395 NB Ramps	LOS	TWSC	F	F
	Delay		>500	>500
N. Virginia St and Golden Valley Rd	LOS	Signal	B	F
	Delay		13.5	>100
N. Virginia St and Lemmon Dr	LOS	AWSC	F	F
	Delay		61.5	52.5
Lemmon Dr and US 395 SB Ramps	LOS	TWSC	F	F
	Delay		>500	>500
Lemmon Dr and US 395 NB Ramps	LOS	TWSC	F	D
	Delay		>100	26.0
Lemmon Dr and Sky Vista Pkwy	LOS	Signal	F	F
	Delay		>100	>300
Lemmon Dr and Military Rd	LOS	Signal	D	C
	Delay		50.6	27.4
Stead Blvd and Silver Lake Rd	LOS	Signal	F	F
	Delay		>100	>300
Red Rock Rd and Silver Lake Rd	LOS	TWSC	F	F
	Delay		>500	>500
Red Rock Rd and Moya Blvd	LOS	TWSC	F	F
	Delay		>500	>500

Delay reported in average seconds per vehicle.

5 PROPOSED MULTIMODAL IMPROVEMENTS

As discussed in Section 4.4, numerous intersections and roadway segments will operate at unacceptable level of service conditions unless improvements are made. Several intersections are anticipated to operate at LOS "F" with peak hour intersection delay averaging greater than 500 seconds per vehicle. To put that in perspective, if no improvements are made, a vehicle arriving at one of these intersections would experience a delay on an average of over eight minutes. In addition, several key roadway segments are shown to exceed capacity. The 2035 future year traffic operations analysis clearly shows a need for a variety of capacity improvements in the North Valleys Region.

Throughout the public outreach process, stakeholders and community members have expressed their need for improved pedestrian and bicycle facilities and public transit enhancements within the North Valleys region. Balanced transportation improvements that accommodate all modes of transportation are important in overall community development. Improved pedestrian and cycling conditions can benefit everybody in the community regardless of how much they use non-motorized travel modes. Hence, this planning study incorporated improvements for non-motorized modes and connectivity to transit in addition to vehicular capacity improvements.

The project team developed a substantial list of short term and long term potential improvements to address the future vehicular capacity, bike-pedestrian, and transit needs. All these potential improvements were proposed to the RTC, TAC members, and stakeholders, and they were thoroughly reviewed before offering them to the public. Public opinion was gathered to fine-tune and finalize the lists of short term and long term improvements.

5.1 Short Term Multimodal Improvements

A variety of short term improvements were developed to address the immediate capacity, bike, pedestrian, and safety needs in the North Valleys region. These improvements include:

- Bicycle and Pedestrian Improvements
- Capacity Improvements
- Safety Improvements

Extensive public input was collected before finalizing the short term improvements. Short term improvements were selected based on the FY 2016 funding availability, public input, thorough review by the RTC and the TAC, and feasibility of construction within a short period of time. The following short term improvements were divided into two packages due to timing and permit constraints.

Package 1 Improvements

Package 1 improvements were approved by the RTC Board on February 19, 2016. The first group of improvements were constructed in late 2016. Specific locations of the Package 1 improvements are shown in **Figure 5-1** and mainly consist of bike, pedestrian, and safety improvements.

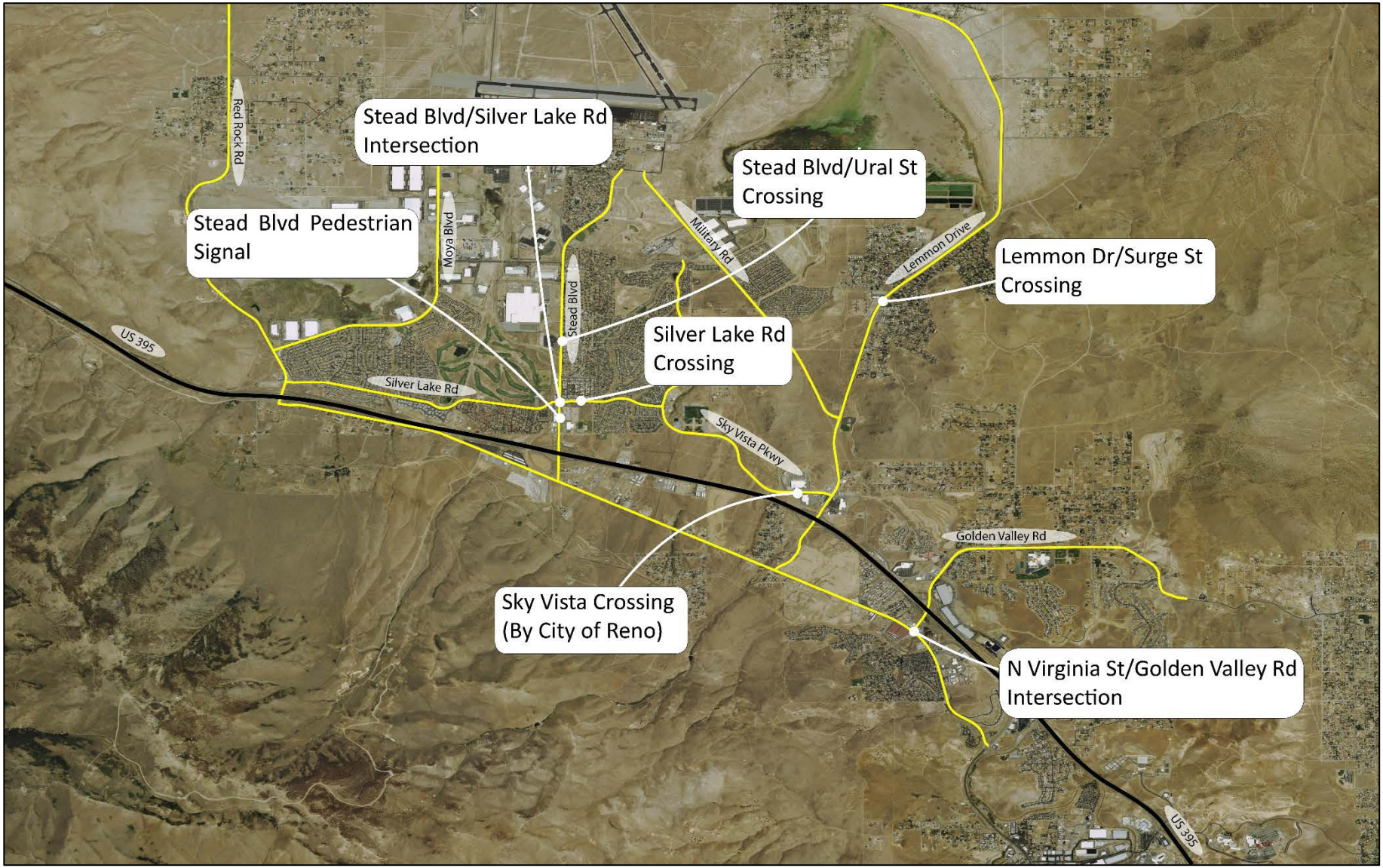


Figure 5-1. Package 1 Short Term Improvements

Package 1 improvements include the following:

- Stead Boulevard/Silver Lake Road: Many comments regarding pedestrian safety at this intersection were received during the public meetings. The improvements at this intersection include:
    - Convert permissive left turn phasing on the Stead Boulevard approaches to protected phasing.
    - Increase the left turn pocket lengths to add more storage space.
    - Install a bulb-out on the southeast quadrant to extend the sidewalk, increase pedestrian/student standing space, and reduce the pedestrian crossing distance.
- Stead Boulevard Pedestrian Signal: Install additional signal heads for improved visibility.
- Silver Lake Road Crossing: Install a Rectangular Rapid Flash Beacon (RRFB) system to enhance pedestrian safety at the school crossing on Silver Lake Road.
- Ural Street Crossing: Install a cross walk and Rectangular Rapid Flash Beacon (RRFB) system to enhance pedestrian safety at the Ural Street on Stead Boulevard.
- Lemmon Drive/Surge Street: Improvements at this location include:
    - Construct a new pedestrian path through the median.
    - Install RRFB systems on northbound and southbound Lemmon Drive (divided roadway).
    - Improvements to pedestrian ramps to meet ADA requirements.
    - Sidewalk extension to the RTC bus stop.
- N. Virginia Street/Golden Valley Drive: Modify the northwest quadrant curb return for more efficient and safe truck maneuvering.
- Sky Vista Parkway crossing: RRFB system by City of Reno.

Package 2 Improvements

The second group of improvements are anticipated to be constructed in late 2017. Specific locations of the Package 2 improvements are shown in **Figure 5-2** and mainly focus on vehicular capacity. Bike and pedestrian improvements will be made in conjunction with the following intersection modifications:

- Red Rock Road/Moya Boulevard: This is one of the intersections which is anticipated to experience increases in traffic due to Airport Masterplan development and other approved developments along Red Rock Road. The proposed improvements at this intersection (shown in **Figure 5-3**) include:
    - Signalizing the intersection and increasing the overall capacity by adding turn lanes and through lanes on all three approaches.
    - Install intersection safety lighting.
    - Install pedestrian activated count-down pedestrian signal heads and marked crosswalks on all three approaches.
    - Provisions for future bicycle lanes on Red Rock Road.

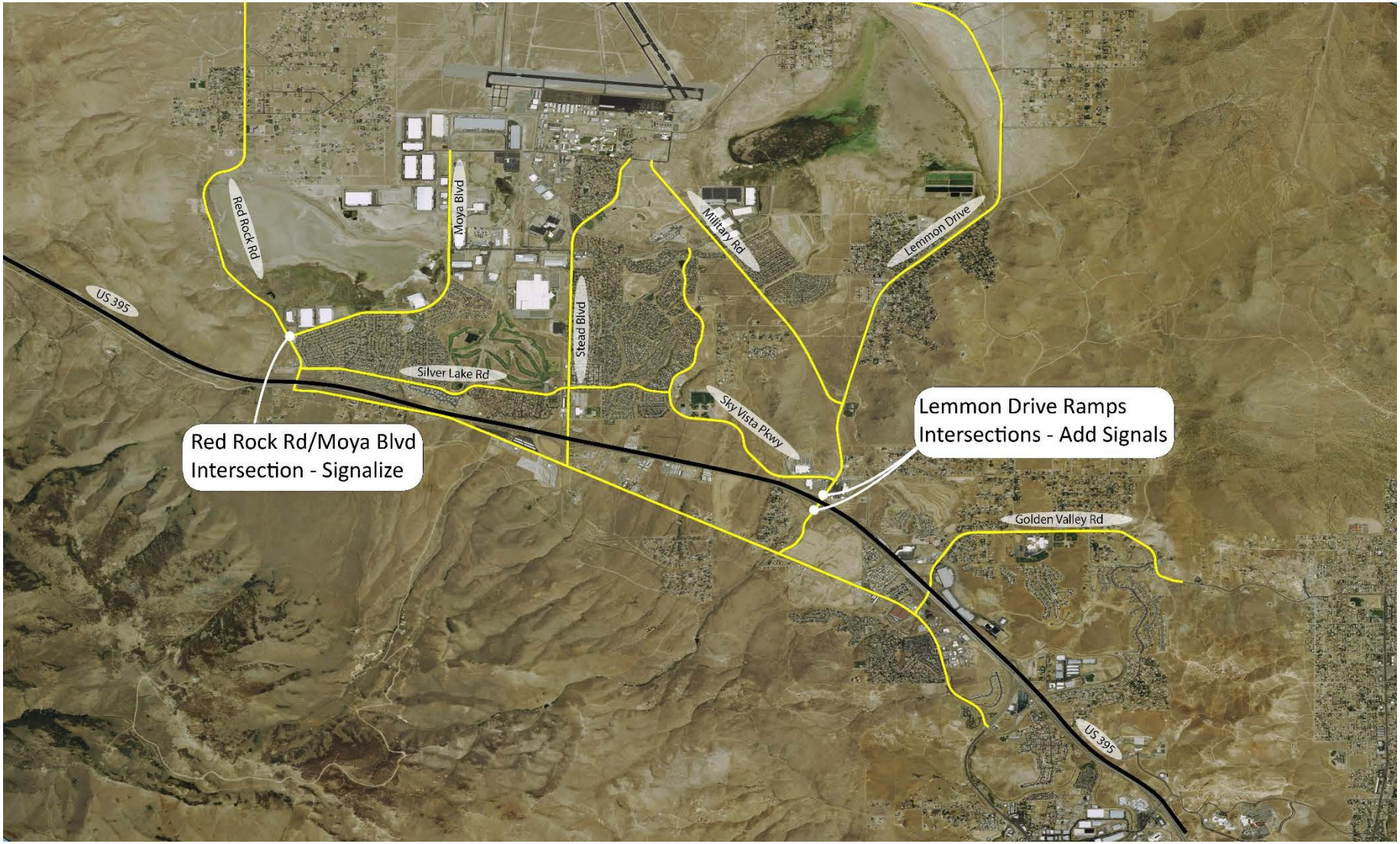


Figure 5-2. Package 2 Short Term Improvements

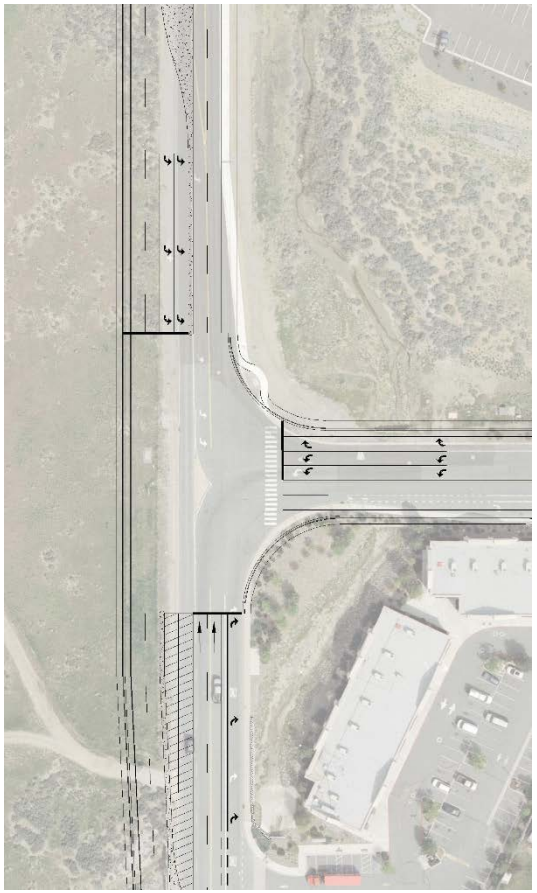


Figure 5-3. Red Rock/Moya Improvements

- Lemmon Drive Interchange: This is the highest priority location based on community input. The proposed short term improvements at the Lemmon Drive Interchange include:
    - Signalizing both the Northbound Ramps and Southbound Ramps intersections.
    - Signal interconnect to the Sky Vista Parkway signal.

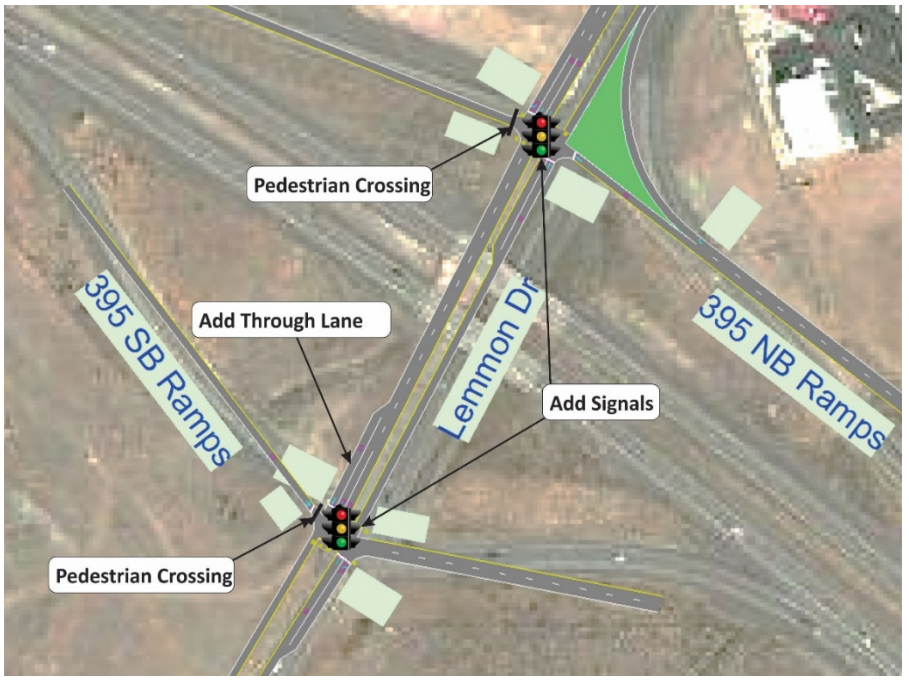


Figure 5-4. Short Term Improvements at Lemmon Dr. Interchange

- Adding a southbound through lane at the Lemmon Drive/US 395 SB Ramps intersection to maintain dual left turn lanes with signalization.
- Coordinating signal timings between both the ramp intersections and the Lemmon Drive/Sky Vista intersection.
- Signalized pedestrian crossings and ADA accessible ramps.
- A FASTLANE grant application was submitted in December 2016 to fund longer term improvements at this location (See **Appendix B**, **Exhibit B-1**).

5.2 Long Term Improvements

By the year 2035, traffic volumes are anticipated to increase by considerable amounts throughout the North Valleys Region. Some of the arterials and collectors connecting US 395 and the North Valleys neighborhoods are anticipated experience close to or more than a 200% increase. While the short term improvements discussed in Section 5.1 will help improve pedestrian safety and address some immediate capacity needs, other long term regional improvements such as roadway widenings and intersection improvements are also needed to accommodate the future anticipated traffic volume growth. The long term capacity expansion improvements proposed in this study are shown in **Figure 5-5**. Note that the future freeway widening and interchange improvements are being identified in the *Reno-Sparks Freeway Traffic Study* by NDOT.

Long term improvements are subdivided into the following six categories:

- Roadway Capacity Improvements
- Intersection Capacity Improvements
- Pedestrian and Bicycle Improvements
- Transit Improvements
- Lemmon Drive Interchange Improvements
- North Valleys Connector

Roadway Capacity Improvements

Roadway widening is proposed on the following roadway segments:

- Parr Boulevard - Ferrari McLeod to Raggio Pkwy: Widen to 4 lanes
- Lemmon Drive - Sky Vista Pkwy to Military Rd: Widen to 6 lanes
- Lemmon Drive - Fleetwood Dr to Deodar Way: Widen to 4 lanes
- Military Road - Lemmon Dr to Echo Ave: Widen to 4 lanes
- Buck Drive - Lemmon Dr to North Hills Blvd: Widen to 4 lanes
- Sky Vista Pkwy - Vista Knoll Dr to Silver Lake Rd: Widen to 4 lanes
- Moya Boulevard - Red Rock Rd to Echo Ave: Widen to 4 lanes
- Red Rock Road - US 395 to Evans Ranch: Widen to 4 lanes

With the above improvements, the only roadway segment that is anticipated to operate at LOS "F" in 2035, but is not recommended for widening, is the portion of Lemmon Drive between Sky Vista Parkway and US 395. The 2035 RTP process identified the concern that widening roadway segments beyond 6 lanes can have adverse effect on community character and pedestrian safety. This Lemmon Drive segment already has 6 lanes and hence is not specifically recommended for widening. The improvements for this Lemmon Drive segment should be addressed in conjunction with future Lemmon Drive/US 395 Interchange improvements. **Table 5-1** shows the 2035 roadway segment LOS with the proposed widenings. In addition to the above specified roadway capacity improvements, we suggest that access management be improved on Buck Drive by installing a center median and by constructing a roundabout at the Buck Drive/North Hills Boulevard intersection.

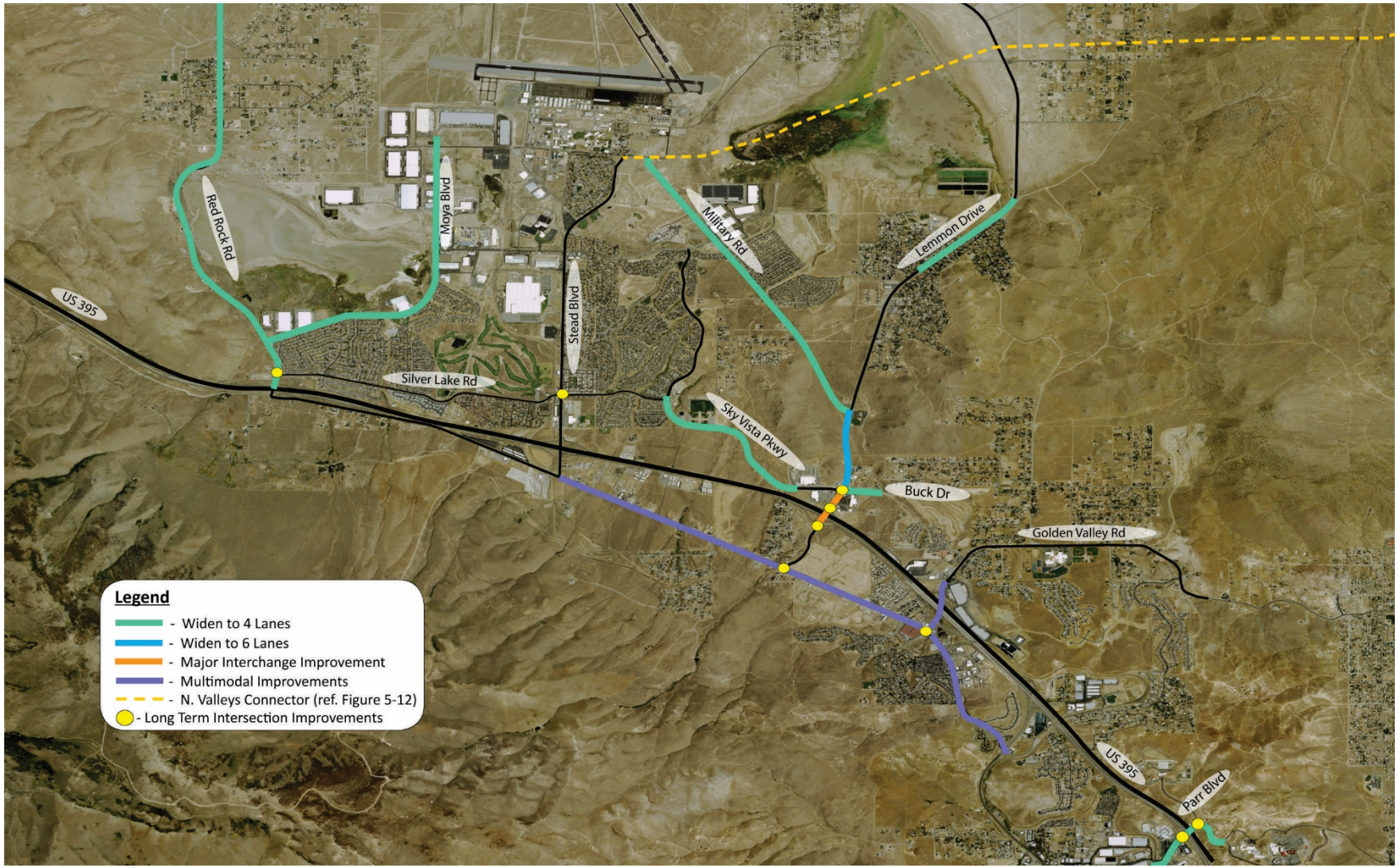


Figure 5-5. Long Term Improvements

Table 5-1: 2035 With Improvement Roadway LOS Summary

Roadway Segment	Location	AADT	2035 No Improvements LOS	2035 With Improvements LOS
Parr Boulevard	North of US 395	22,975	F	D
Parr Boulevard	South of US 395	19,507	F	D
Golden Valley Road	North of US 395	21,850	C	
Golden Valley Road	South of US 395	15,421	D	
Golden Valley Road	South of Virginia St	4,882	B	
Lemmon Drive	North of Military Rd	33,612	D	
Lemmon Drive	Between Military Rd and Sky Vista Pkwy	49,634	F	D
Lemmon Drive	Between Sky Vista Pkwy and US 395	57,367	F	Interchange Improvements
Lemmon Drive	South of US 395	10,400	C	
Military Road	West of Lemmon Dr	19,692	F	C
Sky Vista Parkway	West of Lemmon Dr	30,529	C	
Buck Drive	East of Lemmon Dr	21,484	F	C
Stead Boulevard	North of Silver Lake Rd	22,874	C	
Stead Boulevard	South of Silver Lake Rd	32,182	C	
Silver Lake Road	East of Stead Blvd	11,662	D	
Silver Lake Road	West of Stead Blvd	7,117	D	
Red Rock Road	North of Moya Blvd	25,196	F	C
Red Rock Road	Between Moya Blvd and Silver Lake Rd	29,936	F	C
Red Rock Road	South of Silver Lake Rd	34,051	F	D
Moya Boulevard	East of Red Rock Rd	15,728	F	C
Silver Lake Road	East of Red Rock Rd	4,583	C	
N Virginia Street	Between Stead Blvd and Lemmon Dr	7,930	C	
N Virginia Street	Between Lemmon Dr	15,425	D	
N Virginia Street	East of Golden Valley Rd	15,990	D	

Intersection Capacity Improvements

As shown in **Table 4-4**, most of the studied intersections are anticipated to operate at LOS "F" by the year 2035. In order to minimize delay and avoid creating bottle necks, improvements should be made at intersections in conjunction with roadway widening. These improvements at key intersections will include a combination of measures such as:

- Adding additional through lanes
- Adding additional turn lanes
- Lengthening existing turn pockets
- Upgrading intersection control
- Signal timing optimization and coordination
- Roundabouts
- High capacity interchange configurations

Long term intersection capacity improvements are needed at the following locations (see **Figure 5-5**):

- N. Virginia Street/Lemmon Drive
- N. Virginia Street/Golden Valley Road
- Stead Boulevard/ Silver Lake Road
- Red Rock Road/Moya Boulevard (if not entirely completed in Package 2)
- Red Rock Road/Silver Lake Road
- Parr Boulevard/US 395 SB Ramps
- Parr Boulevard/US 395 NB Ramps
- Lemmon Drive/Sky Vista Parkway

- Lemmon Drive/US 395 SB Ramps
- Lemmon Drive/US 395 NB Ramps

Pedestrian and Bicycle Improvements

Improving conditions and safety for bicycling and walking creates an integrated, intermodal transportation system that provides travelers with a real choice of transportation modes. New and improved transportation facilities should be planned, designed, and constructed with this in mind. Providing a high quality bicycle and pedestrian network is one of the key goals of this study and the community has expressed its desire to maintain and further improve bicycle and pedestrian facilities throughout the North Valleys region.

The comprehensive plan for bicycle and pedestrian facilities in the North Valleys region is guided by the following three planning documents:

- *North Valleys Multimodal Transportation Study (this report)*
- *Complete Streets Masterplan (July 2016)*
- *Reno Sparks Bicycle & Pedestrian Plan (October 2011)*

Study Recommendations

RTC includes bicycle and pedestrian improvements to the extent possible with all roadway widening and capacity expansion projects. Therefore, all the roadway segments that are proposed to be widened (listed in the *Roadway Capacity Improvements* section above) will include complete streets improvements such as the construction of bike lanes, sidewalks and/or shared-use paths, and linkages to public transit stops. Crosswalks and pedestrian ramps are installed where deemed appropriate during the design process.

The following roadway segments outlined for capacity expansion in this study are also anticipated to include bike lanes and sidewalks or other multimodal improvements:

- Parr Boulevard - Ferrari McLeod to Raggio Pkwy
- Lemmon Drive - Sky Vista Pkwy to Bernouli St
- Lemmon Drive - Fleetwood Dr to Deodar Way
- Military Road - Lemmon Dr to Echo Ave
- Buck Drive - Lemmon Dr to North Hills Blvd
- Sky Vista Pkwy - Vista Knoll Dr to Silver Lake Rd
- Moya Boulevard - Red Rock Rd to Echo Ave
- Red Rock Road - US 395 to Evans Ranch

All the intersections that are being improved (listed in the *Intersection Capacity Improvements* section above) will also include pedestrian and bicycle enhancement features such as pedestrian activated count-down signals, ADA accessible crosswalks, and bike lane connections. The proposed bicycle and pedestrian improvements are shown in **Figure 5-6**.

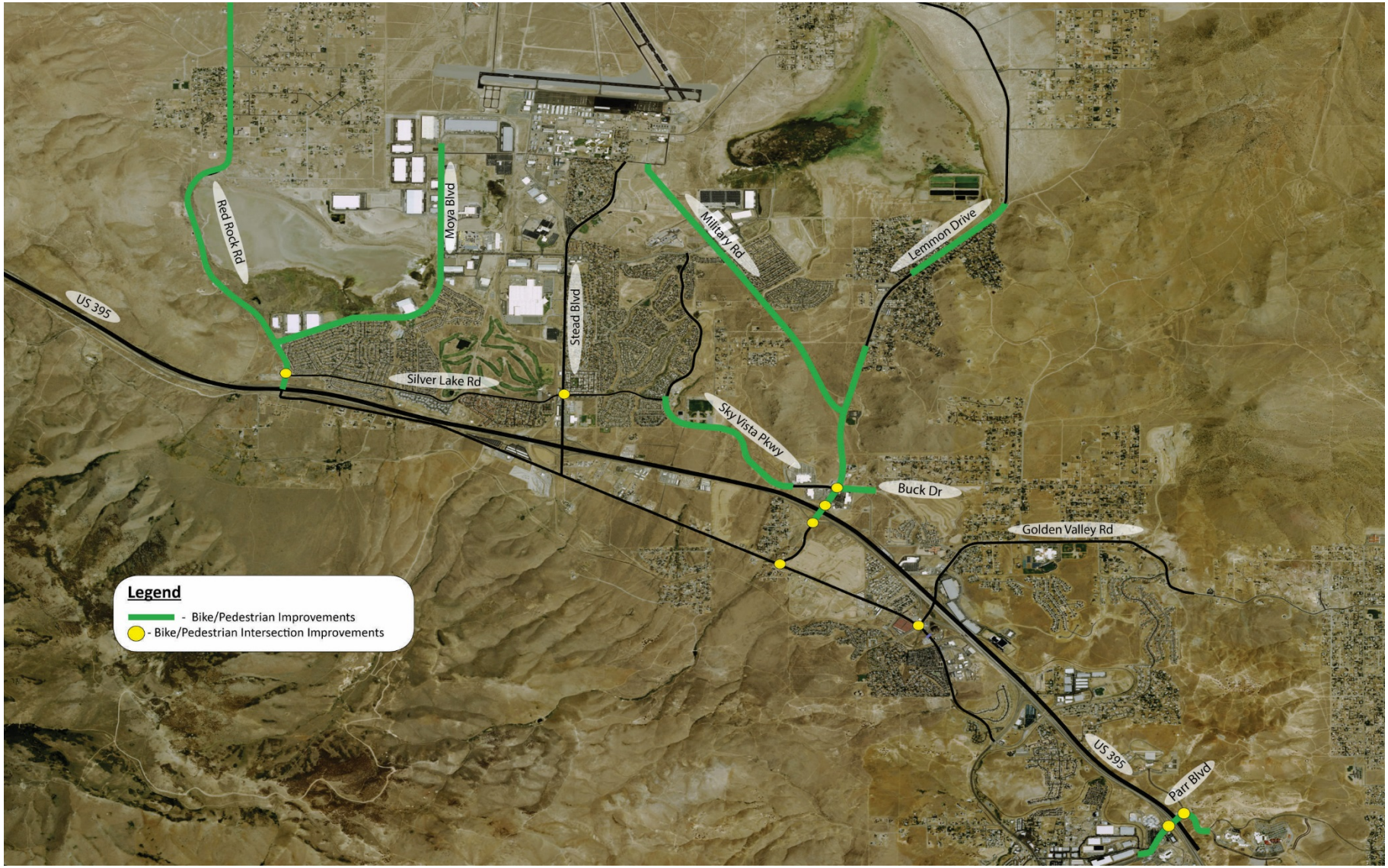


Figure 5-6. Proposed Bike-Pedestrian Improvements

Complete Streets MasterPlan

The RTC recently adopted a Complete Streets MasterPlan outlining which roadways in the greater Reno-Sparks metropolitan area are best suited for multimodal enhancement. Two roadways (North Virginia Street and Golden Valley Road) in the North Valleys study area are listed as top candidates in that report.

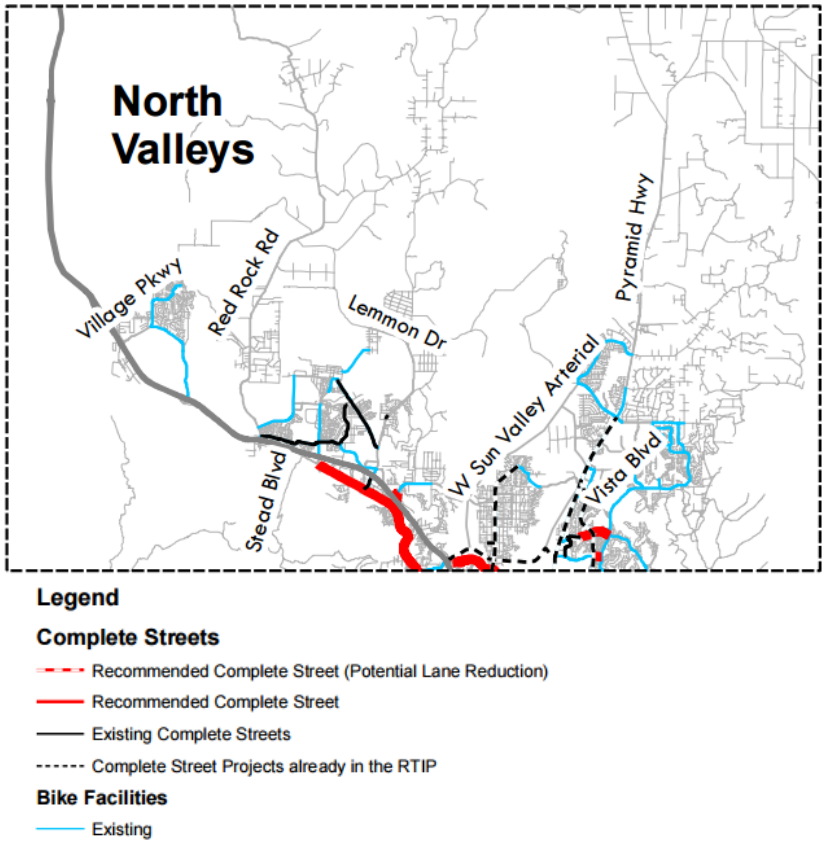


Figure 5-7. Complete Streets Improvements in North Valleys

Figure 5-7 shows the recommended complete streets improvements within the overall North Valleys region and **Figure 5-8** provides a closer view of the road segments within the limits of this study.

As shown in **Figure 5-8**, the *Complete Streets Master Plan* includes constructing sidewalks and bike lanes along N. Virginia Street from Stead Boulevard to McCarran Boulevard. An off-street shared-use path is also being considered on this segment. The master plan also includes constructing bike lanes on Golden Valley Road from N. Virginia Street to North Hills Boulevard.

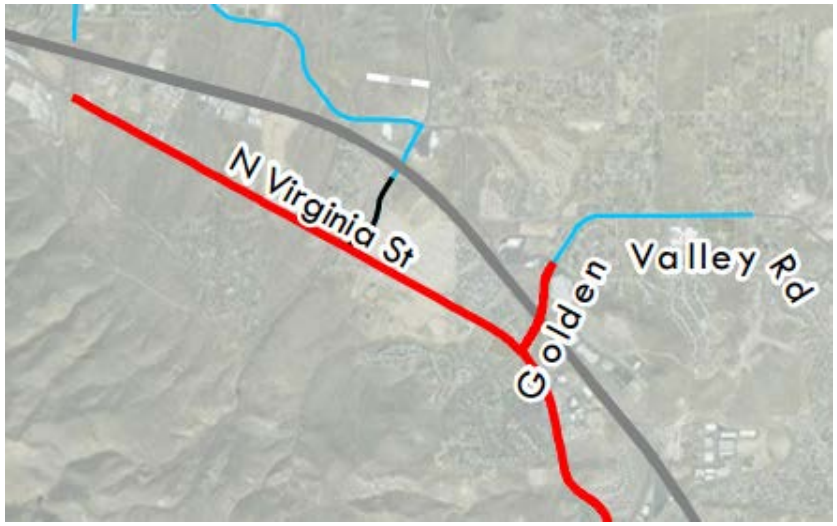


Figure 5-8. Complete Streets Improvements within Project Study Area

Reno-Sparks Bicycle & Pedestrian Plan

In 2011, the RTC adopted a masterplan for the implementation of bicycle and pedestrian focused projects to enhance multimodal travel throughout the region. Bike/pedestrian focused projects are prioritized relative to each other (based on proximity to schools, community centers, transit routes, ease of implementation, continuity/gap closure, etc.) with each update of the Regional Transportation Plan (RTP) and the highest ranking projects are implemented as funds become available. The most recent bicycle and pedestrian project lists, developed as part of the 2040 RTP update (in progress during the writing of this report), include numerous enhancements as shown in **Table 5-2** and **Figure 5-9**.

Figure 5-9. Bike-Ped Projects From Reno-Sparks Bicycle & Pedestrian Plan

Table 5-2: Bicycle & Pedestrian Projects in the North Valleys

Project Name	Length (Ft)	Length (Mi)	Project Limits	Improvements
Buck Dr	892	0.17	Lemmon Dr. to North Hills Blvd.	Minor sidewalk widening with no R/W
Carlyle Dr	2,225	0.42	Yorkshire Dr. to Yorkshire Dr.	Sidewalk reconstruction with no R/W
Echo Ave	6,367	1.21	Moya Blvd. to Military Rd.	Sidewalk construction with no R/W
Golden Valley Rd	3,874	0.73	Golden Valley Rd. to W. 7th Ave.	Sidewalk construction with no R/W
Lancaster Dr	1,978	0.37	Yorkshire Dr. to 325' east of Essex Way	Sidewalk reconstruction with no R/W
Lear Blvd	9,332	1.77	Moya Blvd. to Military Rd.	Sidewalk widening with minor R/W
Lemmon Dr	33,946	6.43	NDOT R/W to Ramsey Way	Sidewalk widening with minor R/W. Sidewalk Construction needed
Military Rd	13,923	2.64	Lemmon Dr. to Echo Ave.	Sidewalk widening with minor R/W
Moya Blvd	18,201	3.45	Red Rock Rd. to Echo Ave.	Sidewalk widening with minor R/W
Mt Charleston St	953	0.18	Stead Blvd. to Echo Ave.	Sidewalk reconstruction with no R/W
N Virginia St	38,996	7.39	Red Rock Rd. to Panther Dr.	Major construction, relocate street lighting, roadside grading, R/W needed.
North Hills Blvd	5,933	1.12	Buck Dr. to 1,200' south of Beckwourth Dr.	Sidewalk reconstruction with no R/W
Production Dr	1,908	0.36	Resource Dr. to Lear Blvd.	Sidewalk construction with R/W
Red Rock Rd	263,388	49.88	US 395 to State Border	Realign roadside ditches and culverts, construct sidewalk with no R/w
Resource Dr	1,885	0.36	Moya Blvd. to Production Dr.	Sidewalk reconstruction with no R/W
Silver Lake Rd	10,617	2.01	Red Rock Rd. to Sky Vista Blvd.	Construct retaining walls, sidewalk with R/W
Sky Vista Blvd	12,852	2.43	Lear Blvd. to Vista Knoll Pkwy.	Sidewalk construction with R/W
Stead Blvd	5,755	1.09	N. Virginia St. to Echo Ave.	Sidewalk reconstruction with no R/W
Vista Knoll Pkwy	1,221	0.23	Walmart north parking entry to Sky Vista Blvd.	Sidewalk construction with no R/W
W Golden Valley Rd	2,704	0.51	Yorkshire Dr. to N. Virginia St.	Sidewalk construction and widening with minor R/W

Transit Improvements

Public transportation is a crucial part of reducing traffic congestion and improving quality of life for a broad range of community members. This section recommends improvements that would increase safety and promote greater use of public transit services in the North Valleys region. The transit improvement concepts are intended to address existing deficiencies in the transit system, create safe, accessible infrastructure, and guide an expansion of transit services with the construction of new development.

The bike and pedestrian improvements previously discussed in this study will immensely improve connectivity to bus stops within the North Valleys region. Construction of new sidewalks in conjunction with roadway widening, ADA accessible crosswalks in conjunction with intersection improvements, and bike lanes along most of the major roadway segments in the North Valleys area will considerably improve multimodal access supporting increased public transit ridership. With future projects, this report recommends that existing transit stops be upgraded to include shelters, seating, updated bus stop signs, and related features to be determined during the design stage based on future needs and available funding. An example of a fully upgraded bus stop is shown in **Figure 5-10**. New short term transit improvements may be included in the Short Range Transit Plan, which is currently under development by the RTC.

With the build-out of North Valleys region, the RTC may deem it necessary or beneficial to enhance transit services. Currently, convenient access to transit is limited to a few major roadways in the North Valleys region. The RTC will monitor the potential for increase in ridership as the planned developments in the North Valleys are constructed. New stop locations can be determined when the need arises, however, locating stops near high density housing and high employment developments would be beneficial because of adjacent land use and population density. Proposed long term transit improvements within the North Valleys region will be discussed in the 2040 Regional Transportation Plan which is currently in development by the RTC.

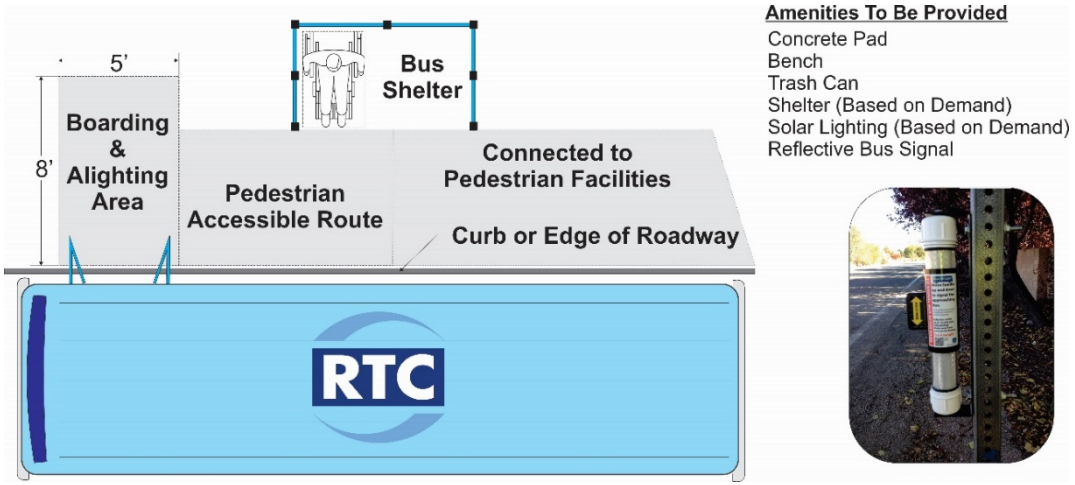


Figure 5-10. Proposed Transit Stop Layout

Lemmon Drive Interchange Improvements

Both Lemmon Drive ramp terminal intersections are anticipated to operate at LOS "F" before the year 2035. The Lemmon Drive/US 395 SB Ramps intersection is already operating at LOS "F". **Figure 5-11** shows the anticipated traffic operations issues at this interchange. The four major issues that need to be addressed at this interchange are:

- AM Peak Hour Volumes – 2,200 left turning vehicles from Lemmon Drive to the US 395 SB on-ramp during the AM peak hour.
- PM Peak Hour Volumes – 3,000 right turning vehicles from the US 395 NB off-ramp to Lemmon Drive during the PM peak hour.
- Lemmon Drive/Sky Vista Parkway intersection – Anticipated to operate at LOS "F" with an average delay greater than 300 seconds causing the queues from the intersection to spill back into the interchange area and eventually on to the freeway.
- Short distance between the US 395 NB off-ramp and the Lemmon Drive/Sky Vista Parkway intersection can cause traffic friction and create awkward weaving conditions.

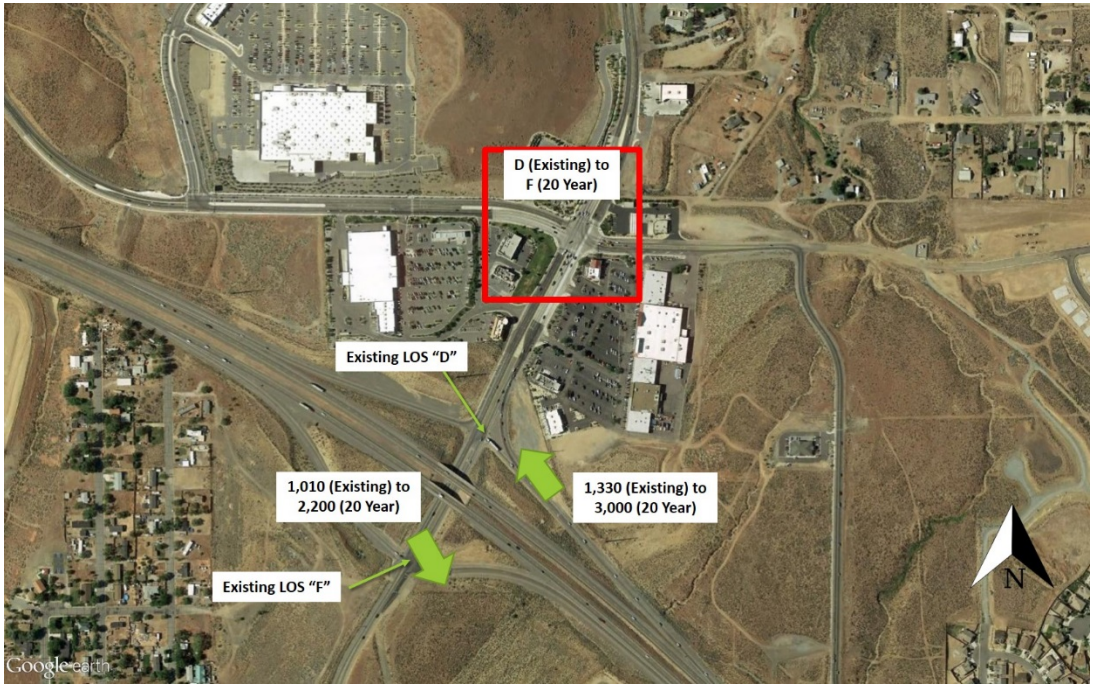


Figure 5-11. Lemmon Drive Interchange Traffic Concerns

The short term improvement of signalizing the ramp intersections, including signal timing coordination, will improve conditions for about 10 years, beyond which, major capacity improvements will be needed to accommodate future anticipated traffic volume growth. Various conceptual interchange improvement alternatives were presented to the RTC staff, TAC and stakeholders. The merits and demerits of each alternative was discussed in detail during TAC & Stakeholder Meeting 3. The concepts are provided in **Appendix B**, attached. The alternatives included redirecting/splitting some of the Lemmon Drive traffic to other existing/proposed new roadways/interchanges. Considering the cost, scale, and considerable time needed for reconfiguring the Lemmon Drive interchange, it is highly recommended an interchange alternatives study be initiated soon to determine the most effective and cost efficient alternative for solving

the long term Lemmon Drive interchange and Sky Vista intersection issues.

An application for the Fostering Advancements in Shipping and transportation for the Long-term Achievement of National Efficiencies (FASTlane) grant was submitted by RTC and NDOT requesting federal funds for Lemmon Drive interchange improvements. The grant included adding a third left turn lane on the Lemmon Drive southbound approach, constructing a third lane on the southbound on-ramp, and extending an auxiliary lane from the Lemmon Drive southbound on-ramp to Golden Valley Road (See **Appendix B**, **Exhibit B-1**).

North Valleys Connector

During Public Meeting 1, community members expressed an interest in having a roadway connection between the North Valleys and Spanish Springs areas. Considering the tremendous anticipated growth in both the North Valleys and Spanish Springs regions, a connection between these two growth centers would reroute some traffic away from US 395, Pyramid Highway, and the Spaghetti Bowl. Responding to the public comments received, a preliminary concept for a North Valleys Connector was presented to the public during Public Meeting 2 and the attendees were asked to comment on its alignment and value. The public expressed even greater interest during the second public meeting and 100% the comments received on this concept were affirmative. **Figure 5-12** shows a conceptual alignment of the North Valleys Connector. A feasibility and alignment study should be conducted in order to accurately determine the feasibility and cost benefit of this regional connector. Travel demand forecasts indicate that this roadway would attract at least 10,000 cars per day. This project would complement the Pyramid-395 Connector project which is expected to carry over 60,000 cars per day.

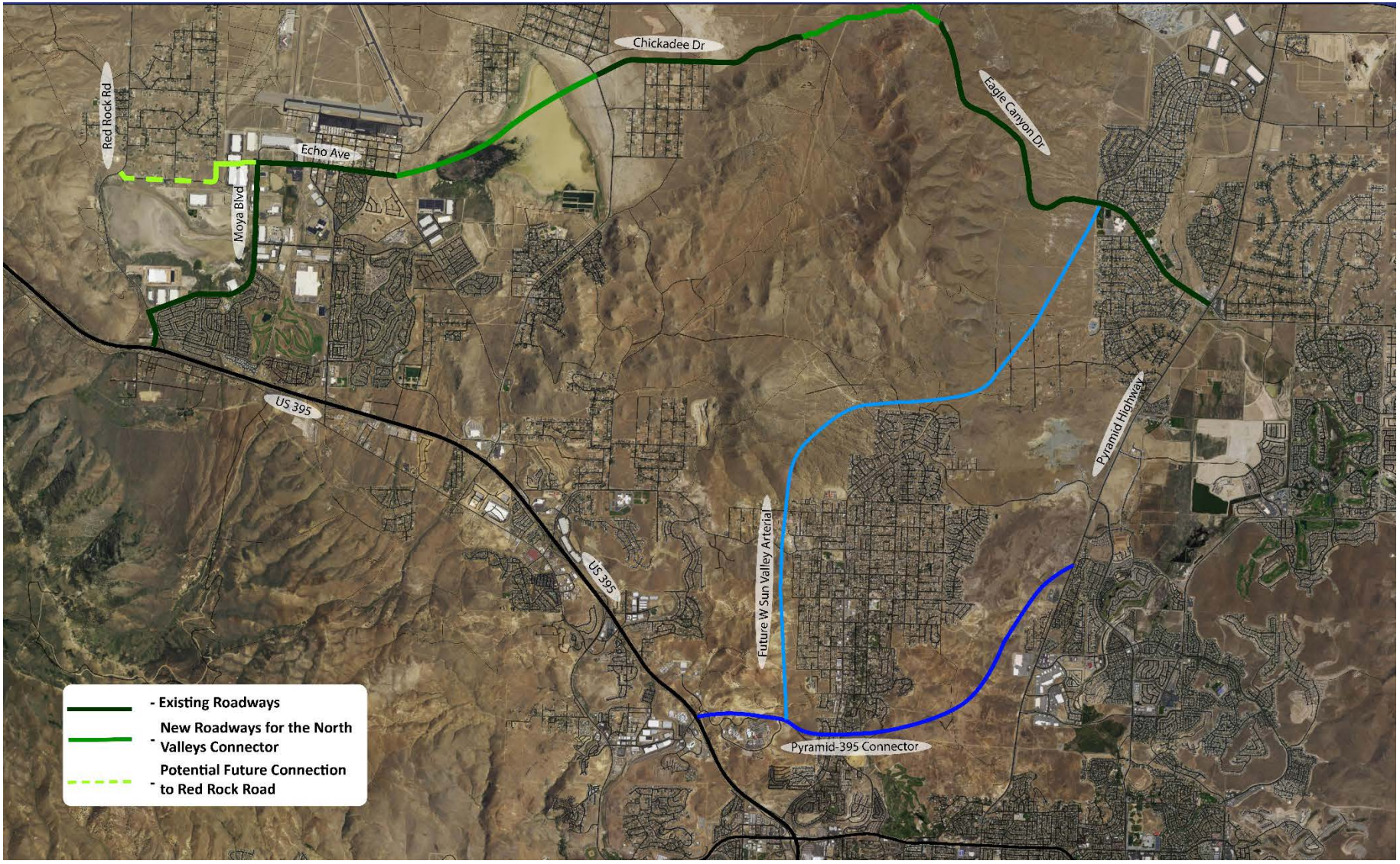


Figure 5-12. North Valleys Connector Concept

6 COST ESTIMATES

This chapter presents preliminary cost estimates for the proposed short term and long term improvements. The preliminary estimates provided throughout this chapter are presented in 2016 construction dollar values. The quantities have been generalized based on planning level conceptual designs for the long term improvements. It is not feasible at this time to address all the specific items that would be included in construction ready documents. More accurate cost estimates are presented for the Package 1 and Package 2 short term improvements as they are better defined and anticipated to be built within next couple of years.

The unit prices utilized for these estimates are founded on the standard RTC planning level estimates which have a long history of overall accuracy within the RTC Program of Projects (POP) amounts. Generally speaking, construction costs have been on the rise over the past few years, therefore many of the units costs have been increased to fall in line with the current construction environment. Soft costs (engineering, specialty consultant services, construction administration, etc.) and contingency were added to the total to complete the budget. Should these prices be extended into future years, it would be advisable to include a 3.5% per year increase to allow for inflation and other pricing fluctuations. Cost estimates for the short term improvements are shown in **Table 6-1** and planning level cost estimates for the long term improvements are shown in **Table 6-2**.

Table 6-1: Short Term Improvements Cost Estimates

Location	Type	Cost Estimate
Package 1 Improvements		
Stead Blvd/Silver Lake Rd	Intersection	$300,000.00
Stead Blvd Pedestrian Signal Upgrade	Pedestrian Crossing	$50,000.00
Silver Lake Road Crossing	Pedestrian Crossing	$125,000.00
Ural Street Crossing	Pedestrian Crossing	$125,000.00
Lemmon Dr/Surge St	Pedestrian Crossing	$175,000.00
N Virginia St/Golden Valley Dr	Intersection	$225,000.00
Total		**$1,000,000.00**
Package 2 Improvements		
Red Rock Rd/Moya Blvd	Intersection	$3,500,000.00
Lemmon Dr Interchange	Interchange	$1,500,000.00
Total		**$5,000,000.00**

Table 6-2: Long Term Improvements Cost Estimates

Location	Limits	Type	Description	Planning Level Cost
Parr Boulevard	Ferrari McLeod to Raggio Pkwy	Roadway	Road widening - Widen to 4 lanes	$ 7,700,000.00
Lemmon Drive	Sky Vista Pkwy to Military Rd	Roadway	Road Widening - Widen to 6 lanes	$ 5,300,000.00
Lemmon Drive	Fleetwood Dr to Deodar Way	Roadway	Road Widening - Widen to 4 lanes	$ 4,300,000.00
Military Road	Lemmon Dr to Echo Ave	Roadway	Road Widening - Widen to 4 lanes	$ 17,700,000.00
Buck Drive	Lemmon Dr to North Hills Blvd	Roadway	Road Widening - Widen to 4 lanes	$ 1,300,000.00
Sky Vista Pkwy	Vista Knoll Dr to Silver Lake Rd	Roadway	Road Widening - Widen to 4 lanes	$ 6,900,000.00
Moya Boulevard	Red Rock Rd to Echo Ave	Roadway	Road Widening - Widen to 4 lanes	$ 13,700,000.00
Red Rock Road	US 395 to Evans Ranch	Roadway	Road Widening - Widen to 4 lanes	$ 40,700,000.00
Lemmon Dr / Sky Vista Pkwy		Intersection	Major Intersection Improvements	$ 5,000,000.00
N. Virginia St / Lemmon Drive		Intersection	Capacity Improvements	$ 2,000,000.00
N. Virginia St / Golden Valley		Intersection	Capacity Improvements	$ 2,000,000.00
Stead Blvd / Silver Lake Road		Intersection	Long Term Capacity Improvements	$ 1,000,000.00
Red Rock Road/Silver Lake Road		Intersection	Intersection Improvements	$ 1,500,000.00
Parr Boulevard Interchange	Ramp intersections	Interchange	Interim Capacity Improvements	$ 5,000,000.00
Lemmon Drive Interchange	Ramp intersections	Interchange	Reconstruction	$ 35,000,000.00
North Valleys Connector	Echo Avenue to Eagle Canyon	Roadway	Construct New Roadway	$ 47,500,000.00
			TOTAL	**$ 196,600,000.00**

Appendix A

Golden Valley Road/Beckwourth Drive – Traffic Signal Warrant Analysis Report

Traffic Engineering, Transportation Planning, & Forensic Services

January 2, 2017

Rebecca Kapuler
Planner
Regional Transportation Commission of Washoe County
1105 Terminal Way, Suite 211
Reno, NV 89502

Golden Valley Road/Beckwourth Drive – Traffic Signal Warrant Analysis

This report documents the signal warrant analysis/engineering study performed to determine whether or not a traffic signal is justified at the Golden Valley Road/Beckwourth Drive intersection in Reno, NV. The following warrant analysis gives consideration to relevant prior actions and existing conditions.

INTRODUCTION

A traffic signal warrant study was completed for the Golden Valley Road/Beckwourth Drive intersection based on nationally accepted standards outlined in the current edition of the Manual on Uniform Traffic Control Devices (MUTCD) published by the Federal Highway Administration (FHWA). FHWA's MUTCD warrants are considered the nationally accepted standard in guiding the determination of what conditions "warrant" the installation of a traffic signal. The Manual recommends that traffic control signals should not be installed unless one or more of the signal warrants are met. This analysis utilized the set of guidelines specified in the MUTCD to evaluate the following warrants:

- Warrant 1, Eight-Hour Vehicle Volume
- Warrant 2, Four-Hour Vehicle Volume
- Warrant 3, Peak-Hour
- Warrant 4, Pedestrian Volume
- Warrant 5, School Crossing
- Warrant 7, Crash Experience
- Warrant 8, Roadway Network

Warrant 6, Coordinated Signal System and Warrant 9, Intersection Near a Grade Crossing were deemed not applicable to the subject intersection.

DATA COLLECTION

Eight (8) hours of intersection turning movement volumes were collected using video recording technology on Tuesday, December 15, 2016 (average midweek day) at the study intersection. A pneumatic tube counter was installed on Beckwourth Drive to collect 24 hours of data and to determine the eight highest volume hours. The analysis utilizes data from the following eight highest hours:

- 9:00 AM to 10:00 AM – Morning Peak
- 11:00 AM to 1:00 PM – Noon Peak
- 2:00 PM to 7:00 PM – Evening Peak

Table 1 shows the combined major street volume and the highest minor street volume used in the analysis. All turning movement data is provided in **Attachment A**.

Table 1: Major and Minor Street Volumes

Time	Combined Major Street Volume	Highest Minor Street Volume
9 AM - 10 AM	755	200
11 AM - 12 PM	927	84
12 PM - 1 PM	1098	101
2 PM - 3 PM	807	75
3 PM - 4 PM	1032	154
4 PM - 5 PM	955	162
5 PM - 6 PM	944	135
6 PM - 7 PM	771	92

We requested and obtained the most recent 3-year (May 1, 2014 to May 1, 2016) accident history data for the intersection (extending 500 feet from the intersection on each approach) from the Nevada Department of Transportation (NDOT). The NDOT crash data is provided in **Attachment B** and discussed in the Warrant 7 analysis.

EXISTING INTERSECTION CONFIGURATION

The existing configuration of the Golden Valley Road/Beckwourth Drive intersection is shown in **Exhibit 1**. For the purposes of this study, Golden Valley Road is considered a north-south roadway and Beckwourth Drive is considered an east-west roadway. Currently, the intersection operates under Two-Way STOP Control (TWSC). Vehicles on Beckwourth Drive must give right-of-way to vehicles on Golden Valley Road. The most predominant movement from Beckwourth Drive is the eastbound left-turn movement. The posted speed limit on Golden Valley Road is 35 mph. Golden Valley Road has multi-lane approaches and both Beckwourth Drive approaches are single lane.

Exhibit 1. Existing Intersection

SIGNAL WARRANT ANALYSIS

In each section below, the text in italics is the applicable guidance per the MUTCD. Location specific discussion follows in standard font.

Warrant 1, Eight-Hour Vehicular Volume

Support:
The Minimum Vehicular Volume, Condition A, is intended for application at locations where a large volume of intersecting traffic is the principal reason to consider installing a traffic control signal.

The Interruption of Continuous Traffic, Condition B, is intended for application at locations where Condition A is not satisfied and where the traffic volume on a major street is so heavy that traffic on a minor intersecting street suffers excessive delay or conflict in entering or crossing the major street.

It is intended that Warrant 1 be treated as a single warrant. If Condition A is satisfied, then Warrant 1 is satisfied and analyses of Condition B and the combination of Conditions A and B are not needed. Similarly, if Condition B is satisfied, then Warrant 1 is satisfied and an analysis of the combination of Conditions A and B is not needed.

Standard:
The need for a traffic control signal shall be considered if an engineering study finds that one of the following conditions exist for each of any 8 hours of an average day:

A. The vehicles per hour given in both of the 100 percent columns of Condition A in Table 4C-1 exist on the major-street and the higher-volume minor-street approaches, respectively, to the intersection; or

B. The vehicles per hour given in both of the 100 percent columns of Condition B in Table 4C-1 exist on the major-street and the higher-volume minor-street approaches, respectively, to the intersection.

In applying each condition the major-street and minor-street volumes shall be for the same 8 hours. On the minor street, the higher volume shall not be required to be on the same approach during each of these 8 hours.

Table 4C-1. Warrant 1, Eight-Hour Vehicular Volume

Condition A—Minimum Vehicular Volume

Number of lanes for moving traffic on each approach		Vehicles per hour on major street (total of both approaches)				Vehicles per hour on higher-volume minor-street approach (one direction only)			
Major Street	Minor Street	100%[a]	80%[b]	70%[c]	56%[d]	100%[a]	80%[b]	70%[c]	56%[d]
1	1	500	400	350	280	150	120	105	84
2 or more	1	600	480	420	336	150	120	105	84
2 or more	2 or more	600	480	420	336	200	160	140	112
1	2 or more	500	400	350	280	200	160	140	112

Condition B—Interruption of Continuous Traffic

Number of lanes for moving traffic on each approach		Vehicles per hour on major street (total of both approaches)				Vehicles per hour on higher-volume minor-street approach (one direction only)			
Major Street	Minor Street	100%[a]	80%[b]	70%[c]	56%[d]	100%[a]	80%[b]	70%[c]	56%[d]
1	1	750	600	525	420	75	60	53	42
2 or more	1	900	720	630	504	75	60	53	42
2 or more	2 or more	900	720	630	504	100	80	70	56
1	2 or more	750	600	525	420	100	80	70	56

[a] Basic minimum hourly volume
[b] Used for combination of Conditions A and B after adequate trial of other remedial measures
[c] May be used when the major-street speed exceeds 40 mph or in an isolated community with a population of less than 10,000
[d] May be used for combination of Conditions A and B after adequate trial of other remedial measures when the major-street speed exceeds 40 mph or in an isolated community with a population of less than 10,000

Exhibit 2 shows the evaluation of Condition A and Condition B of Warrant 1, Eight-Hour Vehicular Volume using the existing eight highest hourly volumes.

Condition A - Minimum Vehicular Volume									
Number of lanes for moving traffic on each approach		Vehicles per hour on major street (total of both approaches)				Vehicles per hour on higher-volume minor street approach (one direction only)			
Major Street	Minor Street	100%	80%	70%	56%	100%	80%	70%	56%
1	1	500	400	350	280	150	120	105	84
2 or More	1	600	480	420	336	150	120	105	84
2 or More	2 or More	600	480	420	336	200	160	140	112
1	2 or More	500	400	350	280	200	160	140	112

Condition B - Interruption of Continuous Traffic									
Number of lanes for moving traffic on each approach		Vehicles per hour on major street (total of both approaches)				Vehicles per hour on higher-volume minor street approach (one direction only)			
Major Street	Minor Street	100%	80%	70%	56%	100%	80%	70%	56%
1	1	750	600	525	420	75	60	53	42
2 or More	1	900	720	630	504	75	60	53	42
2 or More	2 or More	900	720	630	504	100	80	70	56
1	2 or More	750	600	525	420	100	80	70	56

Condition A Evaluation			
Number of Unique Hours Met:	3	Condition A Satisfied?	No

Condition B Evaluation			
Number of Unique Hours Met:	5	Condition B Satisfied?	No

Exhibit 2. Warrant 1, Conditions A and B

As shown in **Exhibit 2**, neither Condition A or B are met.

Support:
The combination of Conditions A and B is intended for application at locations where Condition A is not satisfied and Condition B is not satisfied and should be applied only after an adequate trial of other alternatives that could cause less delay and inconvenience to traffic has failed to solve the traffic problems.

Standard:
The need for a traffic control signal shall be considered if an engineering study finds that both of the following conditions exist for each of any 8 hours of an average day:

- **A. The vehicles per hour given in both of the 80 percent columns of Condition A in Table 4C-1 exist on the major-street and the higher-volume minor-street approaches, respectively, to the intersection; and**
- **B. The vehicles per hour given in both of the 80 percent columns of Condition B in Table 4C-1 exist on the major-street and the higher-volume minor-street approaches, respectively, to the intersection.**

These major-street and minor-street volumes shall be for the same 8 hours for each condition; however, the 8 hours satisfied in Condition A shall not be required to be the same 8 hours satisfied in Condition B. On the minor street, the higher volume shall not be required to be on the same approach during each of the 8 hours.

It should be noted that adequate trial of other alternatives would need to be applied to satisfy the above standard. An evaluation of the standard for the combination of Conditions A and B was conducted in such that a case could be made that adequate alternatives have been used at the study intersection. **Exhibit 3** shows the evaluation of the combination of Condition A and Condition B of Warrant 1, Eight-Hour Vehicular Volume using the existing eight highest hourly volumes.

Condition A - Minimum Vehicular Volume									
Number of lanes for moving traffic on each approach		Vehicles per hour on major street (total of both approaches)				Vehicles per hour on higher-volume minor street approach (one direction only)			
Major Street	Minor Street	100%	80%	70%	56%	100%	80%	70%	56%
1	1	500	400	350	280	150	120	105	84
2 or More	1	600	480	420	336	150	120	105	84
2 or More	2 or More	600	480	420	336	200	160	140	112
1	2 or More	500	400	350	280	200	160	140	112

Condition B - Interruption of Continuous Traffic									
Number of lanes for moving traffic on each approach		Vehicles per hour on major street (total of both approaches)				Vehicles per hour on higher-volume minor street approach (one direction only)			
Major Street	Minor Street	100%	80%	70%	56%	100%	80%	70%	56%
1	1	750	600	525	420	75	60	53	42
2 or More	1	900	720	630	504	75	60	53	42
2 or More	2 or More	900	720	630	504	100	80	70	56
1	2 or More	750	600	525	420	100	80	70	56

Condition A Evaluation			
Number of Unique Hours Met:	N/A	Condition A Satisfied?	N/A

Condition B Evaluation			
Number of Unique Hours Met:	N/A	Condition B Satisfied?	N/A

Combination of Condition A and Condition B Evaluation	
Number of Unique Hours Met for Condition A:	4
Number of Unique Hours Met for Condition B:	8
Combination of Condition A and Condition B Satisfied?	No

Exhibit 3. Warrant 1, Combination of Conditions A and B

As shown in **Exhibit 3**, the combination of Condition A and Condition B at 80 percent is not met.

Warrant 1 is NOT MET.

Warrant 2, Four-Hour Vehicular Volume

Support:
The Four-Hour Vehicular Volume signal warrant conditions are intended to be applied where the volume of intersecting traffic is the principal reason to consider installing a traffic control signal.

Standard:
The need for a traffic control signal shall be considered if an engineering study finds that, for each of any 4 hours of an average day, the plotted points representing the vehicles per hour on the major street (total of both approaches) and the corresponding vehicles per hour on the higher-volume minor-street approach (one direction only) all fall above the applicable curve in Figure 4C-1 for the existing combination of approach lanes. On the minor street, the higher volume shall not be required to be on the same approach during each of these 4 hours.

Exhibit 4 shows Figure 4C-1 with the major/minor volumes plotted for each of the observed highest volume hours.

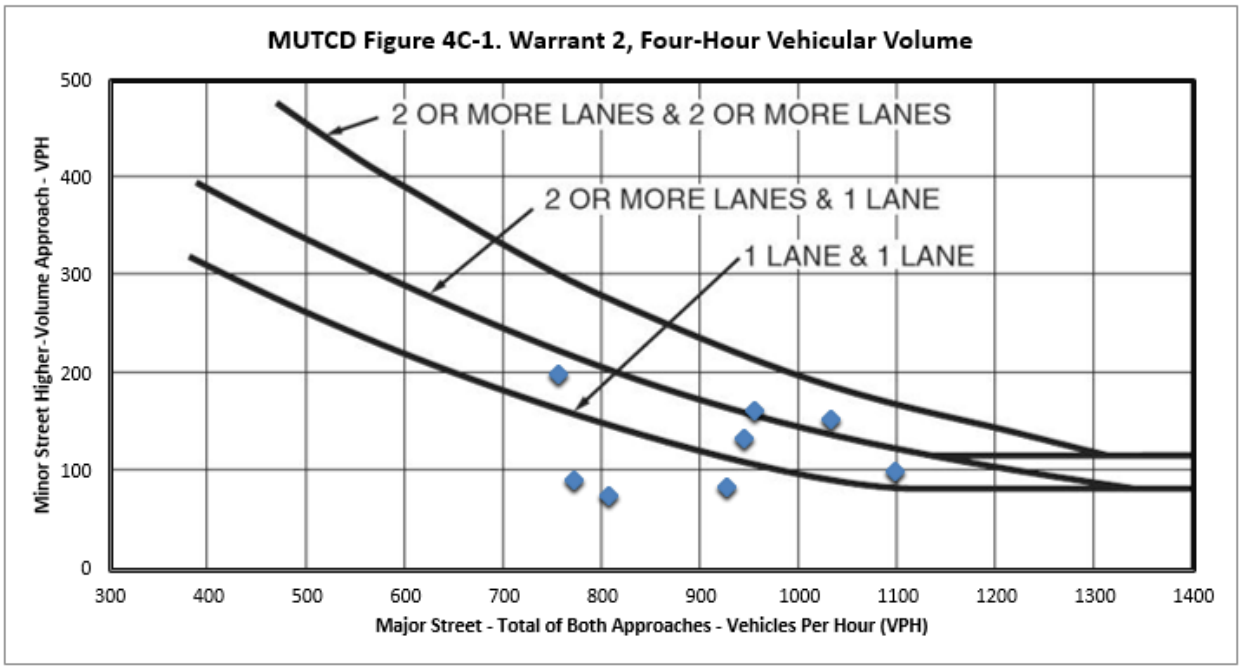


Exhibit 4. Warrant 2, Figure 4C-1

As shown on **Exhibit 4**, only two points (hours) fall above the curve (2 or more lanes & 1 lane).

Warrant 2 is NOT MET.

Warrant 3, Peak Hour

Support:
The Peak Hour signal warrant is intended for use at a location where traffic conditions are such that for a minimum of 1 hour of an average day, the minor-street traffic suffers undue delay when entering or crossing the major street.

Standard:
This signal warrant shall be applied only in unusual cases, such as office complexes, manufacturing plants, industrial complexes, or high-occupancy vehicle facilities that attract or discharge large numbers of vehicles over a short time.

The need for a traffic control signal shall be considered if an engineering study finds that the criteria in either of the following two categories are met:

A. If all three of the following conditions exist for the same 1 hour (any four consecutive 15-minute periods) of an average day:

1. ***The total stopped time delay experienced by the traffic on one minor-street approach (one direction only) controlled by a STOP sign equals or exceeds: 4 vehicle-hours for a one-lane approach or 5 vehicle-hours for a two-lane approach; and***
2. ***The volume on the same minor-street approach (one direction only) equals or exceeds 100 vehicles per hour for one moving lane of traffic or 150 vehicles per hour for two moving lanes; and***
3. ***The total entering volume serviced during the hour equals or exceeds 650 vehicles per hour for intersections with three approaches or 800 vehicles per hour for intersections with four or more approaches.***

B. The plotted point representing the vehicles per hour on the major street (total of both approaches) and the corresponding vehicles per hour on the higher-volume minor-street approach (one direction only) for 1 hour (any four consecutive 15-minute periods) of an average day falls above the applicable curve in Figure 4C-3 for the existing combination of approach lanes.

Criteria A has three parts, all of which must be met. Part 1 requires stopped time delay on one leg of the minor street to be at least four (4) vehicle-hours in this case. We performed a level of service and delay calculation using the volumes from the peak hour of the day (3:00 PM – 4:00 PM) to calculate stopped time (see **Attachment C**). The average of 21.3 seconds per vehicle was multiplied by the 154 vehicles and divided by 3600 sec/hour to obtain the total delay which is approximately 0.9 hours. Part 1 is not met. Hence, Criteria A is not met.

Criteria B was evaluated by plotting the existing volumes on Figure 4C-3, as shown below in **Exhibit 5**.

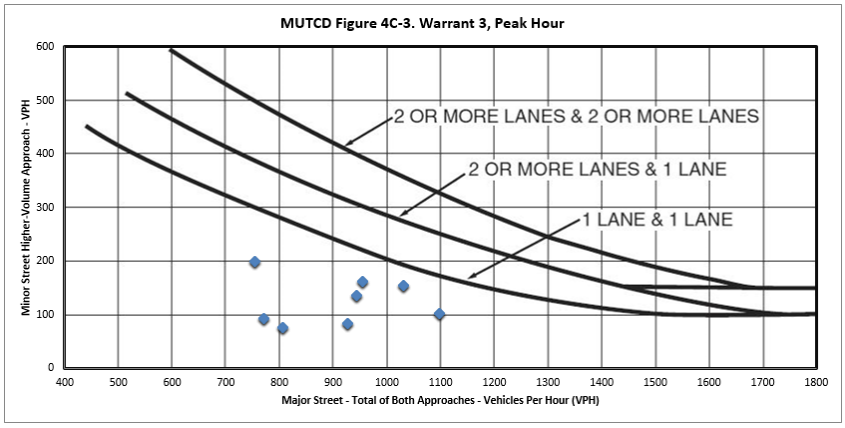


Exhibit 5. Figure 4C-4 with Volumes Plotted on the Graph

As shown in **Exhibit 5**, none of the points (hours) fall above the curve (2 or more lanes & 1 lane) in the Figure 4C-4. Hence, Criteria B is not met.

Warrant 3 is NOT MET.

Warrant 4, Pedestrian Volume

Support:
The Pedestrian Volume signal warrant is intended for application where the traffic volume on a major street is so heavy that pedestrians experience excessive delay in crossing the major street.

Standard:
The need for a traffic control signal at an intersection or midblock crossing shall be considered if an engineering study finds that one of the following criteria is met:

A. For each of any 4 hours of an average day, the plotted points representing the vehicles per hour on the major street (total of both approaches) and the corresponding pedestrians per hour crossing the major street (total of all crossings) all fall above the curve in Figure 4C-5; or

B. For 1 hour (any four consecutive 15-minute periods) of an average day, the plotted point representing the vehicles per hour on the major street (total of both approaches) and the corresponding pedestrians per hour crossing the major street (total of all crossings) falls above the curve in Figure 4C-7.

Exhibit 6 and **Exhibit 7** show Figures 4C-5 and 4C-7 with the major volumes and pedestrian crossings plotted for each of the observed highest volume hours.

As shown in Exhibit 4 and Exhibit 5, none of the points (hours) fall above the curve.

Warrant 4 is NOT MET.

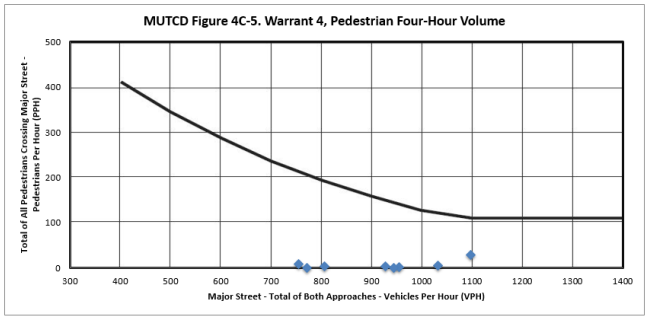


Exhibit 6. Figure 4C-5 with Volumes Plotted on the Graph

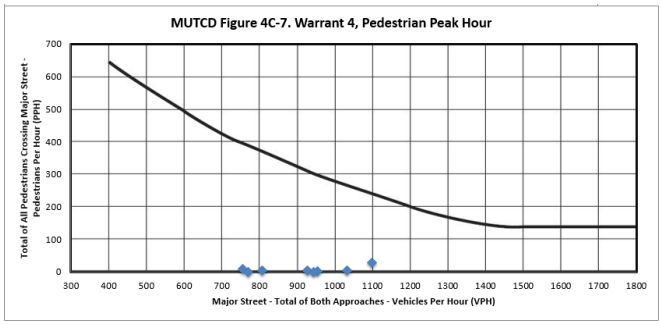


Exhibit 7. Figure 4C-7 with Volumes Plotted on the Graph

Warrant 5, School Crossing

Support:
The School Crossing signal warrant is intended for application where the fact that schoolchildren cross the major street is the principal reason to consider installing a traffic control signal. For the purposes of this warrant, the word "schoolchildren" includes elementary through high school students.

Standard:
The need for a traffic control signal shall be considered when an engineering study of the frequency and adequacy of gaps in the vehicular traffic stream as related to the number and size of groups of

schoolchildren at an established school crossing across the major street shows that the number of adequate gaps in the traffic stream during the period when the schoolchildren are using the crossing is less than the number of minutes in the same period (see Section 7A.03) and there are a minimum of 20 schoolchildren during the highest crossing hour.

Before a decision is made to install a traffic control signal, consideration shall be given to the implementation of other remedial measures, such as warning signs and flashers, school speed zones, school crossing guards, or a grade-separated crossing.

The School Crossing signal warrant shall not be applied at locations where the distance to the nearest traffic control signal along the major street is less than 300 feet, unless the proposed traffic control signal will not restrict the progressive movement of traffic.

Enhanced traffic control features are located at the Golden Valley Road/Beckwourth Drive intersection. These measures include school zones throughout the study area and Rapid Rectangular Flashing Beacons (RRFB) located at all crosswalks at the intersection. The current RRFB system is handling the current pedestrian traffic sufficiently. Drivers are yielding appropriately and enabling adequate gaps in traffic.

Warrant 5 is NOT MET.

Warrant 7, Crash Experience

Support:
The Crash Experience signal warrant conditions are intended for application where the severity and frequency of crashes are the principal reasons to consider installing a traffic control signal.

Standard:
The need for a traffic control signal shall be considered if an engineering study finds that all of the following criteria are met:

- ***A. Adequate trial of alternatives with satisfactory observance and enforcement has failed to reduce the crash frequency; and***
- ***B. Five or more reported crashes, of types susceptible to correction by a traffic control signal, have occurred within a 12-month period, each crash involving personal injury or property damage apparently exceeding the applicable requirements for a reportable crash; and***
- ***C. For each of any 8 hours of an average day, the vehicles per hour (vph) given in both of the 80 percent columns of Condition A in Table 4C-1 (see Section 4C.02), or the vph in both of the 80 percent columns of Condition B in Table 4C-1 exists on the major-street and the higher-volume minor-street approach, respectively, to the intersection, or the volume of pedestrian traffic is not less than 80 percent of the requirements specified in the Pedestrian Volume warrant. These major-street and minor-street volumes shall be for the same 8 hours. On the minor street, the higher volume shall not be required to be on the same approach during each of the 8 hours.***

The Crash Experience warrant has three conditions that must be met. Regarding Part A, we are not aware of any countermeasures or alternatives that have been tested to reduce accident frequency. Warrant 7 is technically not met at this first point.

Crash data was obtained from the Nevada Department of Transportation database for the most recent three-year period. Four (4) crashes were reported in the year 2015, and six (6) crashes were reported in the year 2014 (5 or more within a 12 month period) out of which only three crashes are potentially correctable by installing a signal. The majority of the crashes were due to improper driving or the vehicle factor causing the crash is unknown. **Part B of this warrant is not satisfied** due to lack of crash frequency evidence**.** Part C was not considered since Part A and Part B are not met.

Warrant 7 is NOT MET.

Warrant 8, Roadway Network

Support:
Installing a traffic control signal at some intersections might be justified to encourage concentration and organization of traffic flow on a roadway network.

Standard:
The need for a traffic control signal shall be considered if an engineering study finds that the common intersection of two or more major routes meets one or both of the following criteria:

- ***A. The intersection has a total existing, or immediately projected, entering volume of at least 1,000 vehicles per hour during the peak hour of a typical weekday and has 5-year projected traffic volumes, based on an engineering study, that meet one or more of Warrants 1, 2, and 3 during an average weekday; or***
- ***B. The intersection has a total existing or immediately projected entering volume of at least 1,000 vehicles per hour for each of any 5 hours of a non-normal business day (Saturday or Sunday).***

A major route as used in this signal warrant shall have at least one of the following characteristics:

- ***A. It is part of the street or highway system that serves as the principal roadway network for through traffic flow.***
- ***B. It includes rural or suburban highways outside, entering, or traversing a city.***
- ***C. It appears as a major route on an official plan, such as a major street plan in an urban area traffic and transportation study.***

Only Golden Valley Road satisfies the characteristics necessary to be classified as a “major route”. Beckwourth Drive is not a “major route” and therefore this warrant is not applicable to this intersection.

Warrant 8 is NOT MET.

CONCLUSION & RECOMMENDATION

Under current conditions, none of the signal warrants are met to justify installing a signal at the Golden Valley Road/Beckwourth Drive intersection. Hence, it is our conclusion that a traffic signal is not justified or appropriate at the Golden Valley Road/Beckwourth Drive intersection at this time.

Please do not hesitate to contact us at 775.322.4300 with any questions.

Sincerely,
TRAFFIC WORKS, LLC

Loren E. Chilson, PE
Principal

Attachments:

Attachment A – Intersection Turning Movement Data (8 hours)
Attachment B – Accident History Data (NDOT Database)
Attachment C – Peak Hour Delay Calculation

Attachment A - Intersection Turning Movement Data (8 Hours)

Vehicle Volumes

	Beckwourth Dr (WB)			Beckwourth Dr (EB)			Golden Valley Rd (NB)			Golden Valley Rd (SB)			
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	TOTAL
9 AM - 10 AM	24	14	7	50	11	139	106	267	28	2	292	60	1000
11 AM - 12 PM	38	1	7	39	6	39	34	429	44	6	342	72	1057
12 PM - 1 PM	29	6	8	55	4	42	40	400	43	8	521	86	1242
2 PM - 3 PM	24	6	10	46	5	24	39	362	57	10	290	49	922
3 PM - 4 PM	18	6	3	59	13	82	98	460	69	5	349	51	1213
4 PM - 5 PM	33	6	9	93	3	66	39	479	90	10	249	88	1165
5 PM - 6 PM	30	9	13	77	8	50	54	447	95	7	252	89	1131
6 PM - 7 PM	23	9	8	66	9	17	35	356	59	4	230	87	903

Truck Volumes

	Beckwourth Dr (WB)			Beckwourth Dr (EB)			Golden Valley Rd (NB)			Golden Valley Rd (SB)			
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	TOTAL
9 AM - 10 AM	0	2	2	1	0	11	8	13	1	1	14	2	55
11 AM - 12 PM	2	0	2	3	1	2	0	40	1	0	25	5	81
12 PM - 1 PM	0	1	2	3	0	1	1	18	0	1	23	3	53
2 PM - 3 PM	2	0	4	2	0	1	2	12	2	2	5	1	33
3 PM - 4 PM	1	0	3	0	0	8	0	11	3	1	5	1	33
4 PM - 5 PM	1	0	2	1	0	3	1	5	1	1	10	1	26
5 PM - 6 PM	0	0	1	0	0	0	0	1	0	0	3	0	5
6 PM - 7 PM	0	0	0	1	0	0	0	5	0	0	3	0	9

Pedestrian Counts

	Beckwourth Dr (WB)		Beckwourth Dr (EB)		Golden Valley Rd (NB)		Golden Valley Rd (SB)		
	EB	WB	EB	WB	NB	SB	NB	SB	TOTAL
9 AM - 10 AM	0	0	0	0	8	0	0	1	9
11 AM - 12 PM	0	0	1	3	1	2	0	1	8
12 PM - 1 PM	0	24	1	23	25	0	2	1	76
2 PM - 3 PM	0	0	0	0	1	2	0	1	4
3 PM - 4 PM	0	0	0	0	0	0	0	5	5
4 PM - 5 PM	0	0	0	2	0	2	0	0	4
5 PM - 6 PM	0	0	0	0	0	0	0	0	0
6 PM - 7 PM	0	0	0	0	0	0	0	0	0

Bicycle Counts

	Beckwourth Dr (WB)			Beckwourth Dr (EB)			Golden Valley Rd (NB)			Golden Valley Rd (SB)			
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	TOTAL
9 AM - 10 AM	0	0	0	0	0	0	0	0	0	0	0	0	0
11 AM - 12 PM	0	0	0	0	0	0	0	2	0	0	1	0	3
12 PM - 1 PM	0	0	0	0	0	0	0	0	0	1	0	0	1
2 PM - 3 PM	0	0	0	0	0	0	0	0	0	0	0	0	0
3 PM - 4 PM	0	0	0	0	0	0	0	0	0	0	1	0	1
4 PM - 5 PM	0	0	0	0	0	0	0	0	0	0	0	0	0
5 PM - 6 PM	0	0	0	0	0	0	0	0	0	0	0	0	0
6 PM - 7 PM	0	0	0	0	0	0	0	0	0	0	0	0	0

Wheelchair Counts

	Beckwourth Dr (WB)		Beckwourth Dr (EB)		Golden Valley Rd (NB)		Golden Valley Rd (SB)		
	EB	WB	EB	WB	NB	SB	NB	SB	TOTAL
9 AM - 10 AM	0	0	0	0	0	0	0	0	0
11 AM - 12 PM	0	0	0	0	0	0	0	0	0
12 PM - 1 PM	0	0	0	0	0	0	0	0	0
2 PM - 3 PM	0	0	0	0	0	0	0	0	0
3 PM - 4 PM	0	0	0	0	0	0	0	0	0
4 PM - 5 PM	0	0	0	0	0	0	0	0	0
5 PM - 6 PM	0	0	0	0	0	0	0	0	0
6 PM - 7 PM	0	0	0	0	0	0	0	0	0

Attachment B - Accident History Data (NDOT Database)

INTERSECTION DETAIL
GOLDEN VALLEY RD @ BECKWOURTH DR
01 MAY 13 - 01 MAY 16
COUNTY: WASHOE

Crash Severity	Crash Date	Crash Year	Crash Time	Primary Street	Distance	Dir	Secondary Street	Weather	Fatalities	Injured	Property Damage Only	Injury Type	Crash Type	Vehicles	V1 Dir	V1 Action	V1 Driver Factors	V1 Vehicle Factors	V1 All Events	HWY Factors
PROPERTY DAMAGE ONLY	23-Nov-2011	2011	02:06 PM	GOLDEN VALLEY RD	150	E	BECKWOURTH DR	CLOUDY			PDO		REAR-END	2	S	CHANGING LANES	APPARENTLY NORMAL	UNSAFE LANE CHANGE	SLOW/STOPPED VEHICLE	NONE
PROPERTY DAMAGE ONLY	20-Apr-2012	2012	08:15 AM	GOLDEN VALLEY RD		AT INT	BECKWOURTH DR	CLEAR			PDO		REAR-END	2	W	GOING STRAIGHT	APPARENTLY NORMAL	FOLLOWED TOO CLOSELY	SLOW/STOPPED VEHICLE	NONE
PROPERTY DAMAGE ONLY	27-Jun-2012	2012	08:45 PM	GOLDEN VALLEY RD	150	W	BECKWOURTH DR	CLEAR			PDO		REAR-END	2	W	GOING STRAIGHT		HIT AND RUN		NONE
INJURY CRASH	11-Sep-2012	2012	02:56 PM	GOLDEN VALLEY RD	250	W	BECKWOURTH DR	CLEAR		1		B	REAR-END	2	S	GOING STRAIGHT	APPARENTLY NORMAL	FOLLOWED TOO CLOSELY		NONE
INJURY CRASH	15-Jan-2013	2013	03:46 PM	GOLDEN VALLEY RD		AT INT	BECKWOURTH DR	CLEAR		5		C	ANGLE	2	E	TURNING LEFT	APPARENTLY NORMAL	FAILED TO YIELD RIGHT OF WAY		NONE
INJURY CRASH	14-Mar-2013	2013	09:02 PM	BECKWOURTH DR		AT INT	GOLDEN VALLEY RD	CLEAR		1		A	ANGLE	2	E	TURNING LEFT	APPARENTLY NORMAL	FAILED TO YIELD RIGHT OF WAY		NONE
PROPERTY DAMAGE ONLY	28-Aug-2013	2013	07:35 AM	GOLDEN VALLEY RD		AT INT	BECKWOURTH DR	CLEAR			PDO		ANGLE	2	S	TURNING LEFT	APPARENTLY NORMAL	FAILED TO YIELD RIGHT OF WAY		NONE
PROPERTY DAMAGE ONLY	18-Dec-2013	2013	08:03 AM	BECKWOURTH DR		AT INT	GOLDEN VALLEY RD	CLOUDY			PDO		HEAD-ON	2	E	TURNING LEFT	APPARENTLY NORMAL	FAILED TO YIELD RIGHT OF WAY: MECHANICAL DEFECTS		NONE
INJURY CRASH	29-Jan-2014	2014	06:00 PM	GOLDEN VALLEY RD		AT INT	BECKWOURTH DR	CLEAR		1		C	NON-COLLIS	2	N	GOING STRAIGHT		OBJECT AVOIDANCE	MEDIAN BARRIER	UNKNOWN
PROPERTY DAMAGE ONLY	3-Feb-2014	2014	07:10 AM	BECKWOURTH DR		AT INT	GOLDEN VALLEY RD	CLEAR			PDO		REAR-END	2	N	GOING STRAIGHT		UNKNOWN		
PROPERTY DAMAGE ONLY	4-Feb-2014	2014	02:50 PM	GOLDEN VALLEY RD	300	E	BECKWOURTH DR	CLEAR			PDO		NON-COLLIS	1	W	GOING STRAIGHT	APPARENTLY NORMAL	FAILURE TO KEEP IN PROPER LANE OR RUNNING OFF ROAD	RAN OFF ROAD RIGHT	NONE
PROPERTY DAMAGE ONLY	13-Oct-2014	2014	05:41 PM	GOLDEN VALLEY RD		AT INT	BECKWOURTH DR	CLEAR			PDO		ANGLE	2	E	TURNING LEFT	APPARENTLY NORMAL	FAILED TO YIELD RIGHT OF WAY		NONE
PROPERTY DAMAGE ONLY	16-Oct-2014	2014	04:15 PM	GOLDEN VALLEY RD		AT INT	BECKWOURTH DR	CLEAR			PDO		REAR-END	3	E	GOING STRAIGHT		UNKNOWN		
INJURY CRASH	23-Dec-2014	2014	02:58 PM	GOLDEN VALLEY RD		AT INT	BECKWOURTH DR	CLEAR		2		C	ANGLE	2	E	TURNING LEFT	APPARENTLY NORMAL	FAILED TO YIELD RIGHT OF WAY		NONE
PROPERTY DAMAGE ONLY	23-Apr-2015	2015	02:50 PM	GOLDEN VALLEY RD		AT INT	BECKWOURTH DR	CLEAR			PDO		REAR-END	2	W	GOING STRAIGHT	APPARENTLY NORMAL			INACTIVE WORK ZONE
PROPERTY DAMAGE ONLY	4-Jun-2015	2015	04:26 PM	GOLDEN VALLEY RD		AT INT	BECKWOURTH DR	CLOUDY			PDO		ANGLE	2	E	TURNING LEFT	APPARENTLY NORMAL	FAILED TO YIELD RIGHT OF WAY		NONE
PROPERTY DAMAGE ONLY	5-Jul-2015	2015	06:00 PM	BECKWOURTH DR		AT INT	GOLDEN VALLEY RD	UNKNOWN			PDO		REAR-END	2	S	GOING STRAIGHT		UNKNOWN		
PROPERTY DAMAGE ONLY	11-Dec-2015	2015	10:25 AM	GOLDEN VALLEY RD	300	E	BECKWOURTH DR	CLEAR			PDO		NON-COLLIS	1	N	GOING STRAIGHT	APPARENTLY NORMAL	OTHER IMPROPER DRIVING	RAN OFF ROAD RIGHT: LIGHT/LUMINA	NONE
INJURY CRASH	25-Jan-2016	2016	02:56 PM	BECKWOURTH DR		AT INT	GOLDEN VALLEY RD	CLEAR		1		C	ANGLE	2	W	GOING STRAIGHT	APPARENTLY NORMAL	FAILED TO YIELD RIGHT OF WAY		NONE
									Sum: 0	Sum: 11	Count: 13									
									Count: 0	Count: 6										
									Total:	19										

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Version 4.00-05

Golden Valley Rd/Beckwourth Analysis
Peak Hour LOS

Intersection Level Of Service Report
Intersection 1: Golden Valley Rd/Beckwourth Dr

Control Type:	Two-way stop	Delay (sec / veh):	30.7
Analysis Method:	HCM 2010	Level Of Service:	D
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.069

Intersection Setup

Name	Golden Valley Rd			Golden Valley Rd			Beckwourth Dr			Beckwourth Dr		
Approach	Northbound			Southbound			Eastbound			Westbound		
Lane Configuration												
Turning Movement	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Pocket	1	0	0	1	0	0	0	0	0	0	0	0
Pocket Length [ft]	125.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Speed [mph]	35.00			35.00			30.00			30.00		
Grade [%]	0.00			0.00			0.00			0.00		
Crosswalk	Yes			Yes			Yes			Yes		

Volumes

Name	Golden Valley Rd			Golden Valley Rd			Beckwourth Dr			Beckwourth Dr		
Base Volume Input [veh/h]	98	460	69	5	349	51	59	13	82	18	6	3
Base Volume Adjustment Factor	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Heavy Vehicles Percentage [%]	2.72	2.72	2.72	2.72	2.72	2.72	2.72	2.72	2.72	2.72	2.72	2.72
Growth Rate	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
In-Process Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Total Hourly Volume [veh/h]	98	460	69	5	349	51	59	13	82	18	6	3
Peak Hour Factor	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Other Adjustment Factor	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Total 15-Minute Volume [veh/h]	25	115	17	1	87	13	15	3	21	5	2	1
Total Analysis Volume [veh/h]	98	460	69	5	349	51	59	13	82	18	6	3
Pedestrian Volume [ped/h]	0			0			0			0		

Intersection Settings

Priority Scheme	Free	Free	Stop	Stop
Flared Lane			No	No
Storage Area [veh]	0	0	0	0
Two-Stage Gap Acceptance			No	No
Number of Storage Spaces in Median	0	0	0	0

Movement, Approach, & Intersection Results

V/C, Movement V/C Ratio	0.09	0.00	0.00	0.00	0.00	0.00	0.24	0.07	0.10	0.09	0.03	0.00
d_M, Delay for Movement [s/veh]	8.42	0.00	0.00	8.51	0.00	0.00	26.44	30.74	16.11	26.52	26.45	12.50
Movement LOS	A	A	A	A	A	A	D	D	C	D	D	B
95th-Percentile Queue Length [veh]	0.28	0.00	0.00	0.01	0.00	0.00	1.97	1.97	1.97	0.44	0.44	0.44
95th-Percentile Queue Length [ft]	6.97	0.00	0.00	0.37	0.00	0.00	49.29	49.29	49.29	11.02	11.02	11.02
d_A, Approach Delay [s/veh]	1.32			0.11			21.30			24.95		
Approach LOS	A			A			C			C		
d_I, Intersection Delay [s/veh]	3.98											
Intersection LOS	D											

Appendix B

Lemmon Drive Interchange Improvement Concepts

Lemmon Drive/US 395 Southbound Ramp Improvement Concept

Add Signal

US 395

Ramp Meter

3 Lanes

3 to 2 Lane Transition

2 Lanes

2 to 1 Lane Transition

Auxiliary Lane to Golden Valley Road Off-Ramp

US 395

Ramp Meter Example

Lemmon Drive

N

0 300 600 1,200 Feet

Parcel Lines

Exhibit B-1

Sky Vista Pkwy

US 395

Lemmon Dr

Major Intersection Reconstruction

Potentially:

- Superstreet
- Continuous Flow Intersection
- Widen Existing Intersection
- Grade Separation

Major Interchange Reconstruction

Potentially:

- SPUI
- Diverging Diamond
- Direct/Flyover Ramps

Legend

- Reno-Stead Airport
- Reno
- Washoe County
- Parks
- Housing Planned After 2030
- IndustrialDevelopment
- Approved Housing

Public Lands

- BIA
- BLM
- BOR
- CNTY
- FS
- NVST
- PK

N

- New Roadway
- Existing Roadway (Improved)
- Removed Roadway
- Direction of Travel
- New Overpass

Exhibit B-2

North Valleys Multimodal Transportation Study
Major Interchange Reconstruction

TRAFFIC WORKS

LEMMON DRIVE INTERCHANGE

PREPARED FOR: THE REGIONAL TRANSPORTATION COMMISSION

DIVERGING DIAMOND INTERCHANGE

TRAFFIC WORKS

5482 Longley Lane, Suite B
Reno, NV 89511
(775) 322-4300

CONCEPTUAL LAYOUT

Exhibit B-3

Project # J185

Date OCTOBER 25, 2016

Sheet # 1

- - - New Roadway
- Existing Roadway (Improved)
- Removed Roadway
- Direction of Travel
- New Overpass

Exhibit B-4

North Valleys Multimodal Transportation Study
Lemmon Dr Direct Flyover Ramp Concept

TRAFFIC WORKS

Lemmon Dr

US 395

N

Legend

- Reno-Stead Airport
- Reno
- Washoe County
- Parks
- Housing Planned After 2030
- IndustrialDevelopment
- Approved Housing

Public Lands

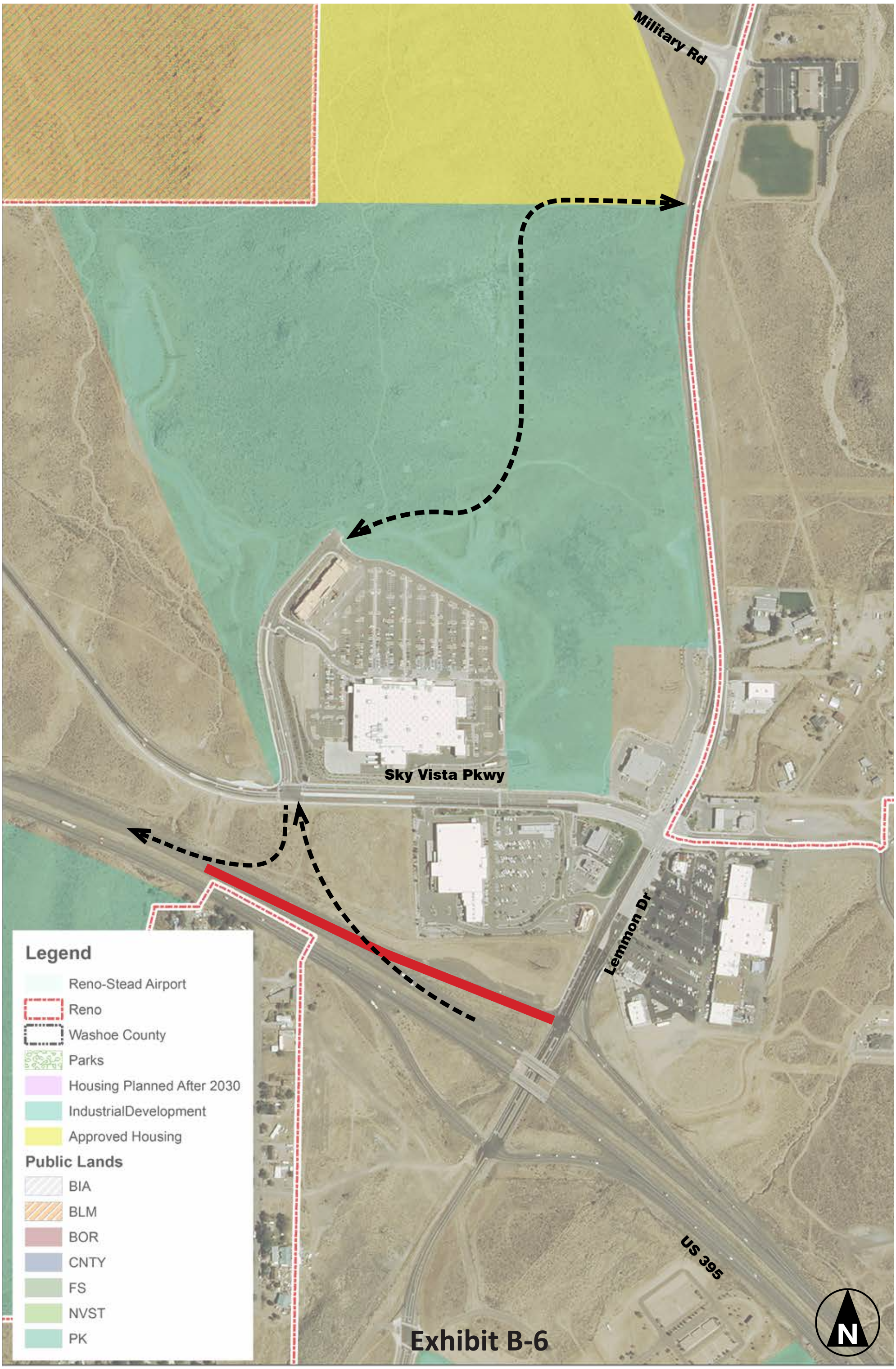
- BIA
- BLM
- BOR
- CNTY
- FS
- NVST
- PK

- - - New Roadway
- Removed Roadway
- New Overpass
- ••••••• Existing Roadway (Improved)
- Direction of Travel

Exhibit B-5

North Valleys Multimodal Transportation Study
Lemmon Dr Loop Ramp Concept

TRAFFIC WORKS



- New Roadway
- Existing Roadway (Improved)
- Removed Roadway

- Direction of Travel
- New Overpass

North Valleys Multimodal Transportation Study

Lemmon Dr Modified Interchange Concept

TRAFFIC WORKS

- - - New Roadway
- Existing Roadway (Improved)
- Removed Roadway
- Direction of Travel
- New Overpass

Exhibit B-7

North Valleys Multimodal Transportation Study
Trading Post Rd On Ramp & Off Ramp Concept

TRAFFIC WORKS

Trading Post Rd

New Interchange

Sky Vista Pkwy

Lemmon Dr

US 395

N. Virginia St

Existing interchange to remain

N

Legend

- Reno-Stead Airport
- Reno
- Washoe County
- Parks
- Housing Planned After 2030
- IndustrialDevelopment
- Approved Housing

Public Lands

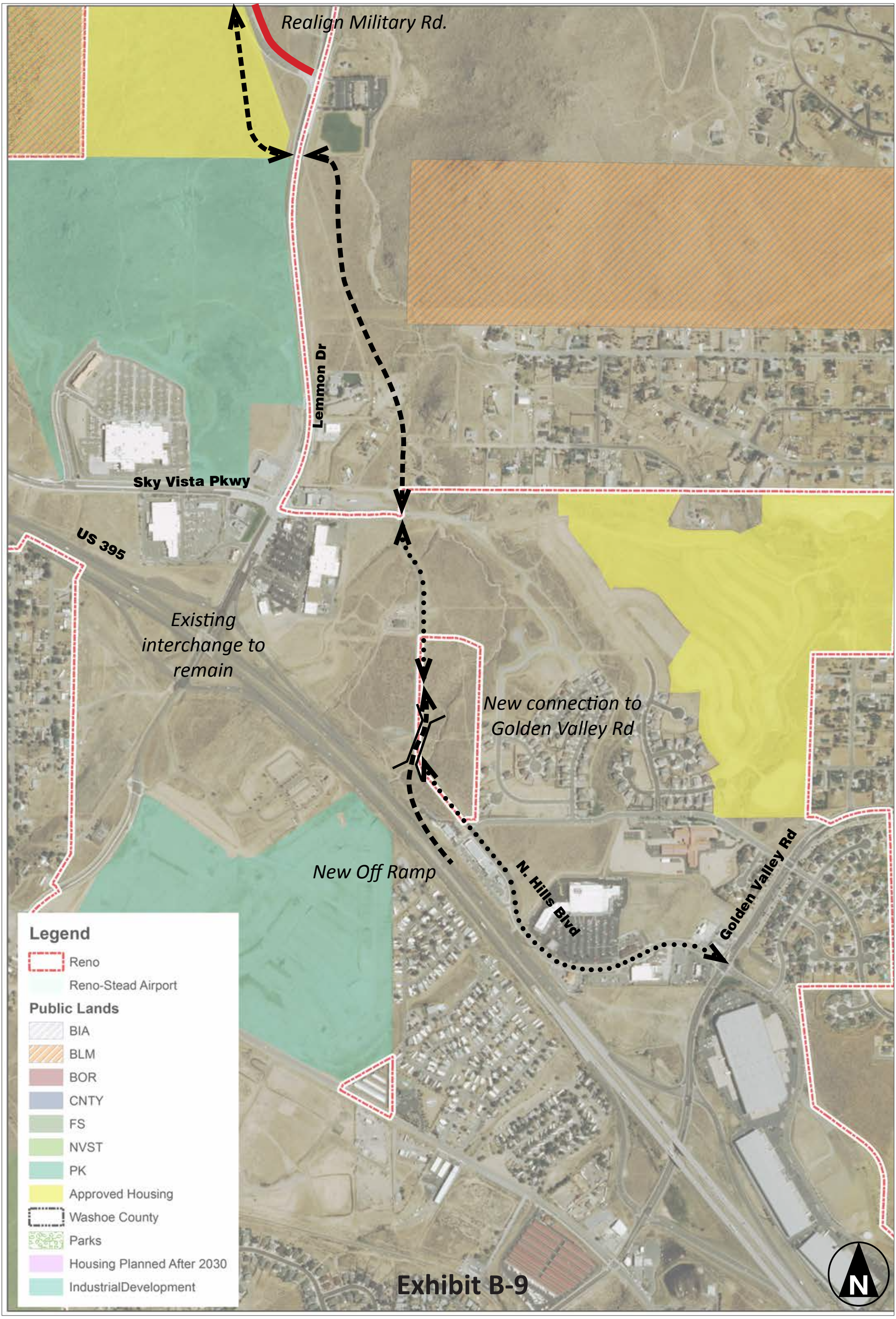
- BIA
- BLM
- BOR
- CNTY
- FS
- NVST
- PK

- New Roadway
- Existing Roadway (Improved)
- Removed Roadway
- Direction of Travel
- New Overpass

Exhibit B-8

North Valleys Multimodal Transportation Study
Trading Post Rd Interchange Concept

TRAFFIC WORKS

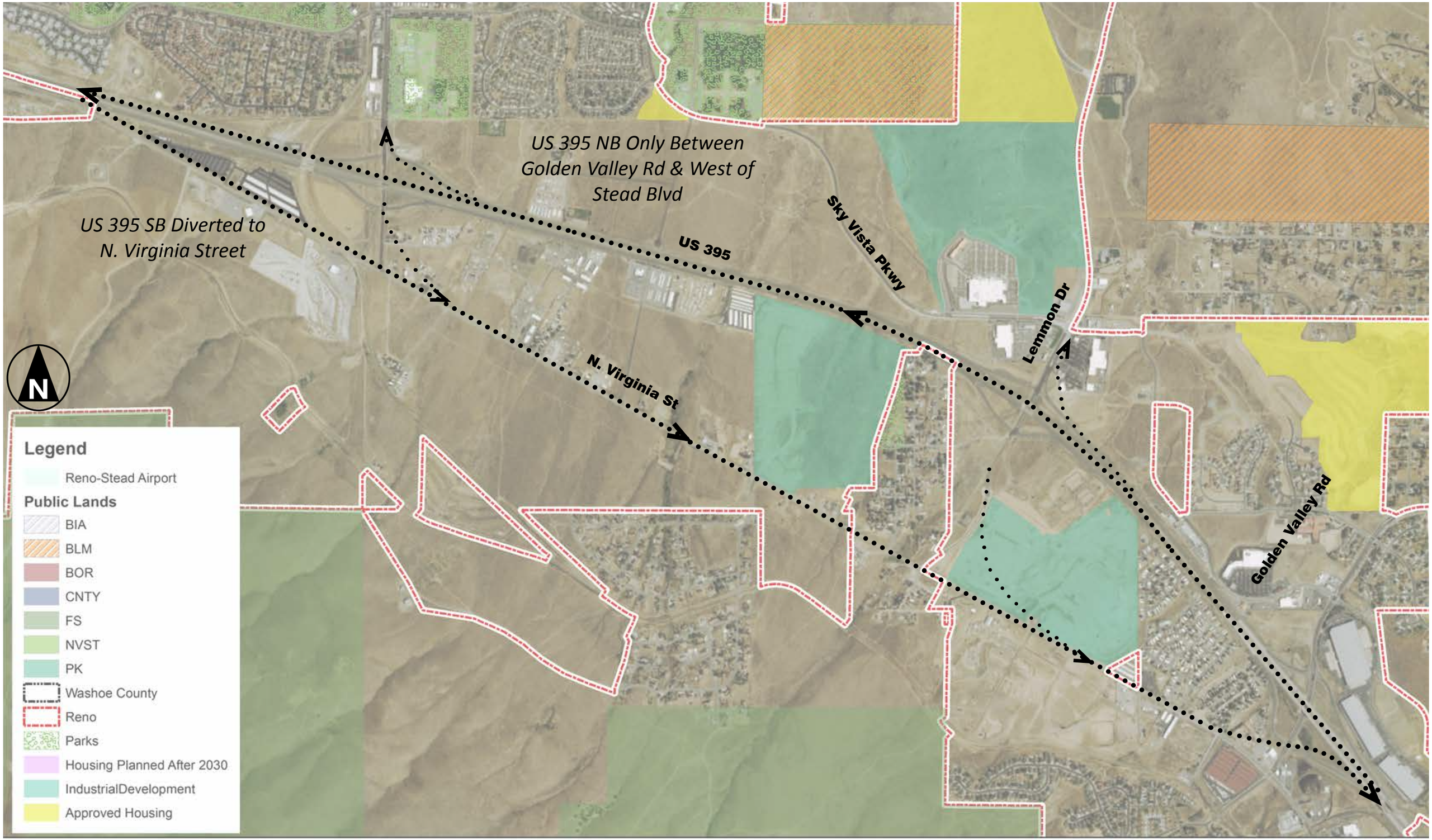


- - - New Roadway
••••••• Existing Roadway (Expanded)
——— Removed Roadway

➔ Direction of Travel
⩫ New Overpass

North Valleys Multimodal Transportation Study
Lemmon Dr Bypass Concept

TRAFFIC WORKS



- - - New Roadway
- Removed Roadway
- New Overpass
••••••• - Existing Roadway (Improved)
- Direction of Travel

Exhibit B-10

North Valleys Multimodal Transportation Study
Divided Freeway Concept

TRAFFIC WORKS