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Keystone Avenue Corridor Study

November 2014


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Acknowledgements

This report is sponsored by the Regional Transportation Commission of Washoe County (RTC). The study provides a comprehensive examination of the existing vehicular, transit, pedestrian, and bicycle infrastructure of the Keystone Avenue corridor. It also examines opportunities for improving safety and providing better multimodal connectivity throughout the corridor.

The principal author of this study is Jacobs Engineering Group Inc. with assistance from Traffic Works and CA Group. The alternatives and recommendations of this study result from the dedicated efforts of the technical team and the project stakeholders. Without their help, this study would not have been possible. The RTC and project team are grateful for their enthusiastic input and participation and take this opportunity to thank all those who have contributed to the development of this study. It is the ambition of RTC staff and the authors of this report that stakeholders and members of the public continue the collaborative approach in the future development of proposed concepts and enhancements for Keystone Avenue.

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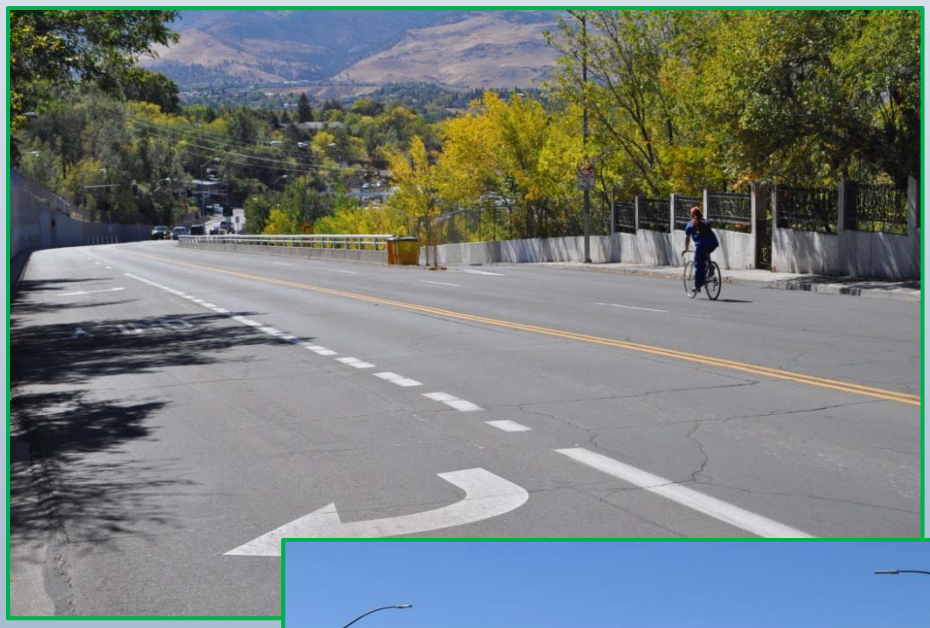

Executive Summary

The Keystone Avenue Corridor Study identifies, evaluates, and recommends potential multimodal (vehicular, transit, pedestrian, and bicycle) transportation improvements along Keystone Avenue from California Avenue to North McCarran Boulevard in an effort to improve safety for all users of the corridor. The recommendations presented in the study will be included in the Regional Transportation Plan 2013-2035 for implementation.

Keystone Avenue is a mature corridor with two distinctive areas; 1) the southern segment between California Avenue and West 7th Street consists mostly of commercial businesses and shopping areas, 2) the northern segment from West 7th Street to North McCarran Boulevard is predominantly residential in nature. These two distinct areas have unique challenges and require different approaches to development of recommendations.

Public participation was a key aspect in the development of the study goals and selection of the recommended improvements. A technical advisory committee consisting of agency representatives, and a stakeholder working group consisting of residents, business owners, and advisory groups were assembled to guide and provide input on the alternatives selected. Four public meetings were held to present information gathered and solicit input regarding potential alternatives. Recommendations made for the Keystone Corridor draw from suggestions, ideas, and guidance provided from the representatives of these various groups and from members of the public.

Goals developed for the corridor are listed below.

- Improve pedestrian, ADA, bicycle safety, and connectivity to businesses, residences, and existing facilities.
- Balance improvements for all modes.
- Foster meaningful community participation for the entire corridor by reaching out to the public.
- Coordinate improvements with development and business needs.
- Identify logical and buildable phases of improvements to maintain progress over time.
- Improve aesthetics and user experience in the corridor.

Corridor issues were identified through the public outreach process, field investigations, traffic analyses, and with input from NDOT. A summary of issues identified for the corridor is provided in Chapter 4; however, the major issues identified are listed below.

- There are non-ADA compliant sidewalks and bus stops throughout the corridor.
- High crash rates exist at some intersections.
- Insufficient turn pocket storage exists at intersections.
- There are limited provisions for bicycles within the corridor.
- Multiple and closely spaced driveways at several locations.
- Speed and sight distance problems persist.
- Ensure accommodation of future traffic volumes.

Several alternatives were developed for different segments of the corridor to address the identified issues at that particular location. These alternatives were then shortlisted based on engineering analysis, information received from project stakeholders, and input gathered from members of the public to a

recommended set of alternatives. Additional analysis to refine the alternatives occurred, and a final set of corridor recommendations was developed as described in Chapter 6.

From the complete menu of alternatives, a set of potential projects encompasses the recommended improvements within a particular segment of Keystone Avenue. A list of the recommended projects by segment is summarized in the table below. The table also includes a planning level cost estimate and a phasing category recommendation. These projects should be implemented based on immediate needs and funding availability. Each recommendation is consistent with the Corridor Study's goals as well as the goals of the RTC's Regional Transportation Plan. The proposed set of recommended projects will provide solutions to many of the identified issues in the corridor and will lead to improved safety for all users including motorists, pedestrians, cyclists, and transit users regardless of their age or ability.

Summary of Recommended Projects

	Project Description	Cost*	Phasing Category
California Avenue to I-80	California / Keystone Intersection Alternative F (Includes changes to the signalized intersection along with ADA ramp and bike improvements along California Ave.)	$ 1,000,000	Short-term
	Jones Street to 4th Street access management and ADA improvements	$ 500,000	Short-term
	Vine Street and Washington Street Bike Lanes	$ 500,000	Short-term
	4th Street to I-80 Access Management, roadway and sidewalk reconstruction	$ 3,000,000	Mid-term
	Replace the Keystone Avenue Bridge	$ 30,000,000	Long-term
	Jones Street to 4th Street roadway and sidewalk improvements	$ 4,500,000	Long-term
	I-80 SPUI re-construction	$ 6,500,000	Long-term
I-80 to McCarran Blvd	W. 7th Street to Coleman Drive ADA and crosswalk improvements	$ 500,000	Short-term
	Coleman Drive to McCarran Boulevard Safety Improvements	$ 500,000	Mid-term
	W. 7th Street to Coleman Drive Complete Street roadway section, access management, and transit improvements	$ 5,000,000	Mid-term

**Costs rounded to the nearest $ 500,000*

See Chapter 6 for a full description of these projects.

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1. Introduction

The Regional Transportation Commission of Washoe County (RTC) initiated the Keystone Avenue Corridor Study (corridor study) to identify and evaluate potential multimodal (automobile, pedestrian, bicycle, and transit) transportation improvements along the corridor. Focus areas for improvements include safety of all transportation modes, infrastructure for alternative modes, efficiency of traffic operations, facilities for people with disabilities, and integration with land-use plans. This corridor has come to the forefront due to numerous concerns and complaints regarding poor infrastructure and the need to better accommodate users of different modes of transportation. The overall objective is to identify strategies for developing street improvements for all users.

This planning effort builds on completed and ongoing regional efforts and existing assets. This corridor study addresses challenges and capitalizes on upcoming redevelopment opportunities to identify a set of capital improvements and provide transportation solutions that will encourage economic development and improve livability along the corridor.

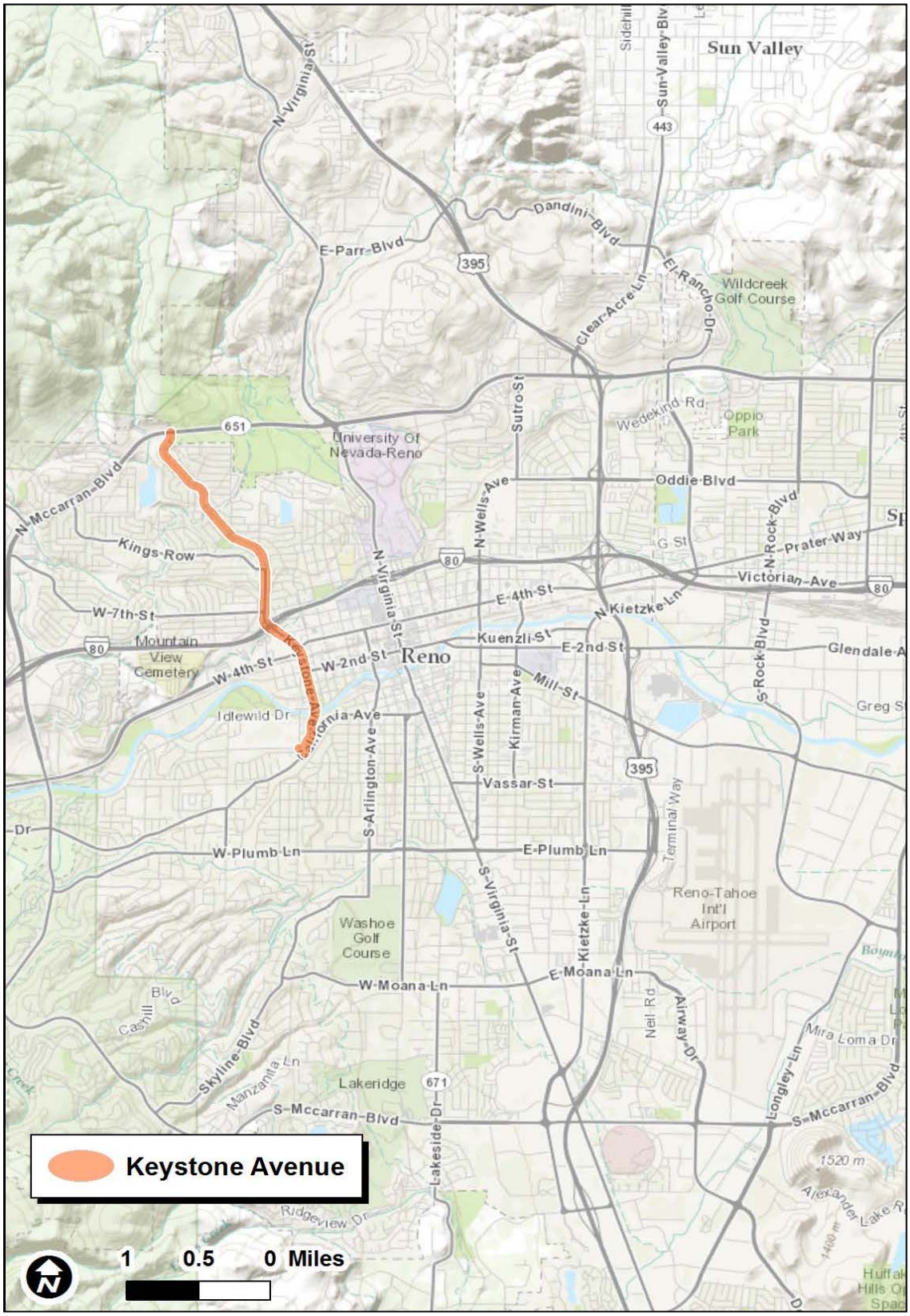
1.1. Setting

Keystone Avenue is a unique and mature corridor that serves several residential areas and commercial centers in Reno, Nevada. Keystone Avenue, classified as an urban minor arterial in the Washoe County Roadway System, extends from California Avenue in the south to North McCarran Boulevard in the north. Figure 1-1 illustrates the location of Keystone Avenue in relation to the region. Interstate 80 (I-80) bisects Keystone Avenue. The land use along Keystone Avenue north of I-80 is predominantly residential whereas the land use south of I-80 is mostly commercial.

The areas serviced by Keystone Avenue are mature. The residences that dominate the southern project limits are some of the oldest in Reno and; originally built during the 1920-1940s. North of West 7th Street, the residential were homes built between the 1940s and 1980s. The commercial area between 2nd Street and West 7th Street dates back to the 1950s-1960s when 4th Street, then known as Lincoln Highway (U.S. 40), was the primary east/west route connecting Reno to Sacramento and the economic hub of California. When I-80 was constructed in the 1970s it replaced U.S. 40 as the primary east/west route which brought economic distress to many businesses in the area.

Keystone at the Truckee River

Figure 1-1: Keystone Avenue Location Map



1.2. Corridor Study Limits

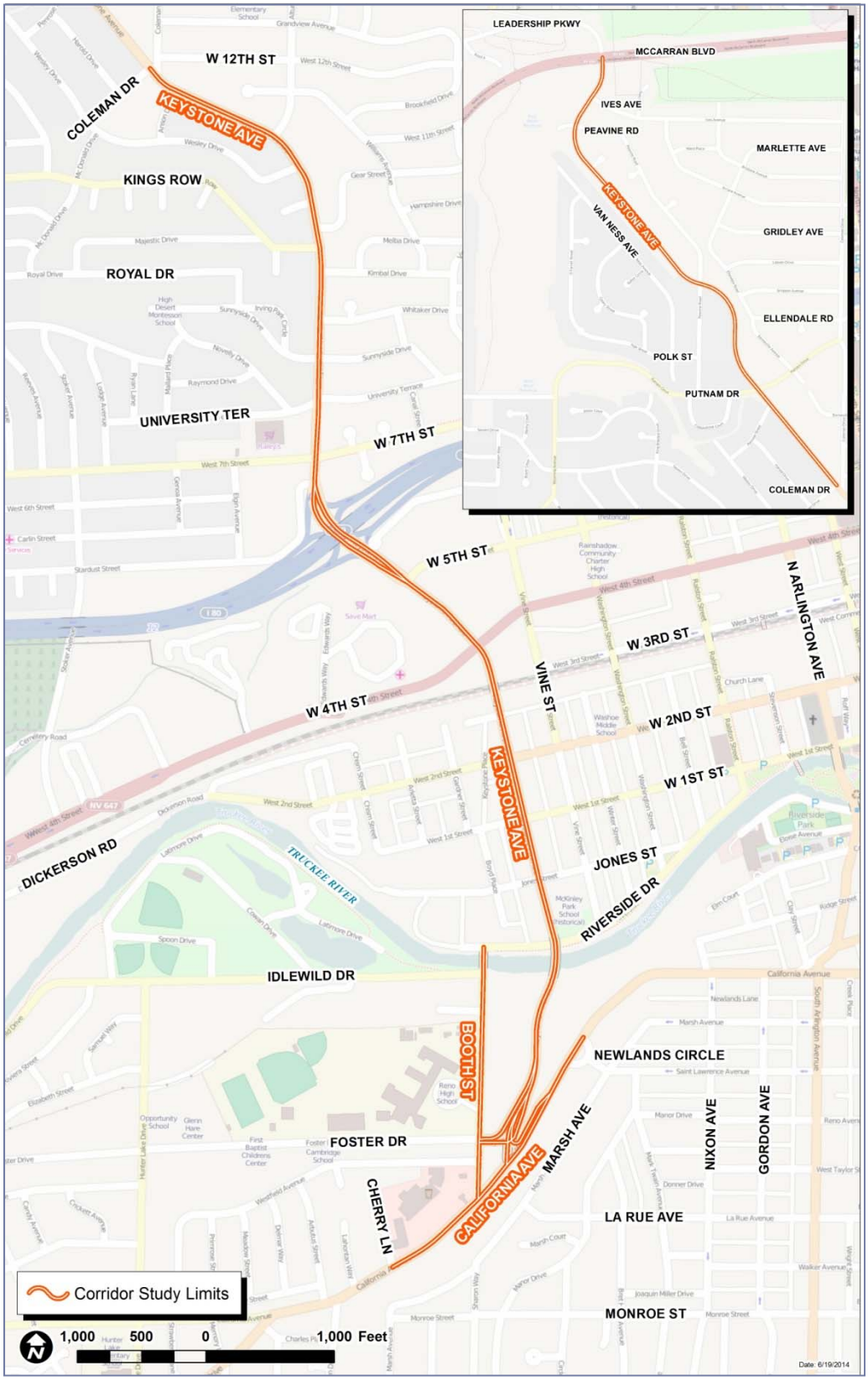
The focus of this corridor study is Keystone Avenue between California Avenue and Coleman Drive, approximately 1.8 miles in length, with some minor analysis extending to North McCarran Boulevard. Booth Street, Foster Drive, and California Avenue, located in the vicinity of Keystone Avenue, are also included. The study area corridor consists of:

- Keystone Avenue from California Avenue in the south to North McCarran Boulevard in the north
- California Avenue from Cherry Lane in the west to Newlands Circle in the east
- Booth Street from California Avenue in the south to Riverside Drive in the north (i.e., entire length of Booth Street)
- Foster Drive from Booth Street in the west to Keystone Avenue in the east

In order to develop and analyze alternatives, the corridor was divided into two distinct segments correlating with surrounding land uses. The southern segment is more commercial in nature. It begins at the intersection of Keystone Avenue / California Avenue and runs north to West 7th Street. The northern segment, consisting primarily of single-family residential, begins at West 7th Street, includes the intersections of University Terrace, Kings Row, and Coleman Drive, and ends at North McCarran Boulevard.

Figure 1-2 shows the corridor study limits.

Figure 1-2: Corridor Study Limits



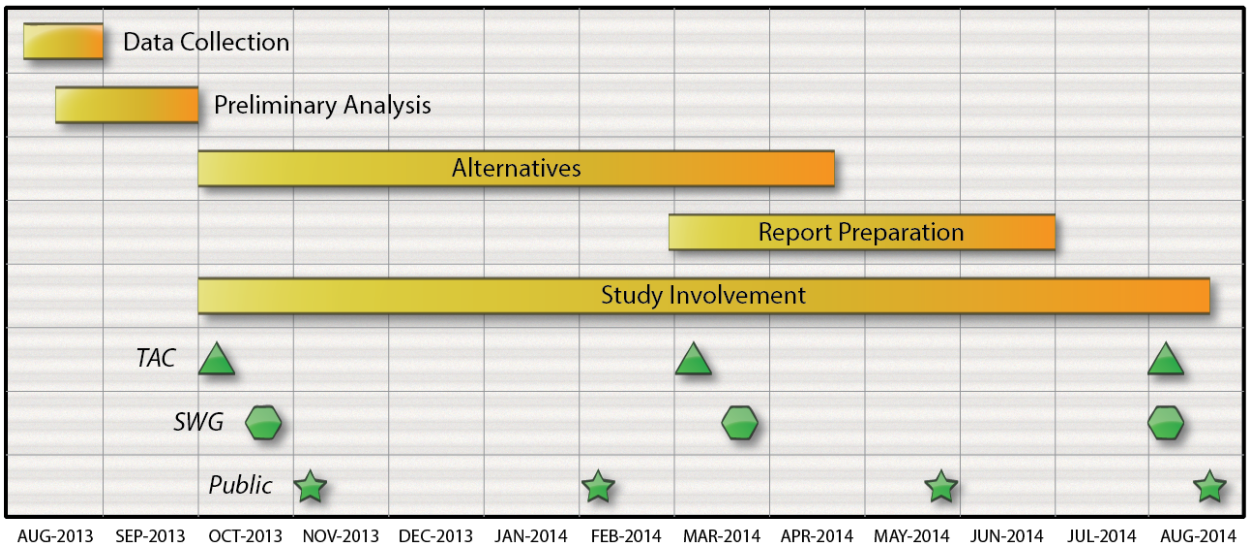
1.3. Study Process and Public Outreach

Initiated in August 2013, the study process included data collection, analysis of existing conditions, identification of deficiencies, and development of alternatives. The entire effort was based on community outreach and collaboration with local and state agencies. A technical advisory committee (TAC) with representatives from RTC, the City of Reno, and NDOT provided input and guidance throughout the study. A stakeholder working group (SWG) that included affected and concerned residents, business owners, and advisory groups was assembled for focused input. Figure 1-3 illustrates the study process.

RTC considered participation and input from the community and stakeholders vital in gaining supportive and successful results in the development of this study. As such, this study integrated several outreach methods and activities that promoted stakeholder and community participation. Throughout the process, RTC solicited feedback from the community and acknowledged the benefits of their participation. Public participation was solicited on the RTC website to collect initial thoughts from the public regarding needs and deficiencies of transportation and safety throughout the corridor. Stakeholder interviews helped support the team in collecting information and identifying major mobility needs along the corridor.

Four public meetings were held throughout the study process. The first public meeting focused on selecting and setting improvement goals and identifying issues along the corridor. The second meeting conducted included a wider range of attendees to ensure everyone was included in the issue identification and data collection process. The third meeting focused on the selection of alternatives. Comment forms allowed attendees of the meeting to select the alternative(s) they felt best addressed the needs of the corridor. This straw poll process assisted the study team in formulating the recommended improvements. The fourth meeting summarized the recommended improvements and outlined the path forward for future projects. Overall, the public meetings provided opportunities for extensive community input such as visioning, identification of assets, issues, opportunities and solutions. All outreach activities, including stakeholder involvement, are documented in Appendix A.

Figure 1-3: Study Process



1.4. Corridor Study Goals

Goals for the corridor guided the development of improvement alternatives. The development of these goals involved stakeholder and community input. Consistent with the study purpose, the focus was to incorporate safety, efficient traffic operations, safe accommodations of all modes, integration of smart transportation and land use, community needs, and the historical aspects of Keystone Avenue. The goals developed for the corridor include:

- Improving pedestrian, ADA, and bicycle safety and connectivity to businesses, residents, and existing facilities.
- Balance improvements for all modes of transpiration.
- Foster meaningful community participation for the entire corridor by reaching out to the public.
- Coordinate improvements with development and business needs.
- Identify logical and buildable phases of improvements to maintain progress over time.
- Improve aesthetics and user experience in the corridor.

2. Existing Conditions

2.1. Supporting Studies, Documents, and Plans

Various studies, documents, and plans that are relevant to this corridor study were reviewed. Some provided general insight while others have specific requirements and standards that apply to the corridor.

2035 Regional Transportation Plan (RTP): RTC's RTP is the region's 20-year long-range plan. It defines the long-range policies and priorities for the region's transportation system and it is a blueprint to stimulate public transit, provide clean air, and make roadways accessible to all regardless of age or ability. Keystone Avenue and California Avenue are identified as "regional roads" in the RTP. Booth Street is not listed as part of the Regional Road System (i.e., not identified as a "regional road"). The RTP includes level of service (LOS) and access management criteria for regional roads, which apply to Keystone Avenue and California Avenue. Two improvement projects are listed in the RTP for Keystone Avenue (Table 2-1).

Table 2-1: Corridor Projects in the RTP

Limits	Improvement	Potential Funding Source	Cost	Period
Keystone Avenue California Avenue to W. 7th Street	Multimodal improvements (Corridor Study Initiated)	Federal/Local	9,400,000	2013-2017
Keystone Avenue California Avenue to 4th Street	Multimodal improvements	Federal/State	113,300,000	2023-2035

City of Reno Master Plan: The City of Reno Master Plan consists of six citywide plans (including a land use plan that provides guidance for development and redevelopment for the next 20-year period), eight regional center plans, five transit-oriented development (TOD) corridor plans, and six neighborhood plans. The following four specific plans are relevant to this corridor study as portions of the corridor either lie within or adjacent to these areas. Section 2.9 (Land Use Analysis) discusses these four plans in more detail.

- Downtown Reno Regional Center Plan
- West 4th Street TOD Corridor Plan
- Newlands Neighborhood Plan
- West University Neighborhood Plan

Reno/Sparks Bicycle and Pedestrian Master Plan: The Reno/Sparks Bicycle and Pedestrian Master Plan is a guide for achieving a comprehensive system of bicycle routes, pedestrian routes, and other related facilities that will result in a safe and convenient circulation system for non-motorized travel within the region. The plan addresses goals, policies, standards, funding strategies, education, and intermodal linkages throughout the Reno-Sparks region. The plan identifies Keystone Avenue (between

Riverside Drive and 4th Street and between W. 7th Street and Coleman Drive) as "Planned Signed Shared Roadway," Booth Street as "Planned Bike Lane," California Avenue (between Booth Street and Newlands Circle) as "Planned Other Bike Facility," and California Avenue (west of Booth Street) as "Planned Bike Lane." The Master Plan also includes the following three partner documents:

- Design Best Practices (Formerly called Design Manual): This manual provides a toolbox of bicycle and pedestrian facility design options such as standard bike lane configurations, midblock crosswalk guidelines, and innovative bike treatments. Guidance from this document was used in developing the proposed bicycle and pedestrian improvements for the corridor (see Section 5).
- Reno Sparks ADA Transition Plan: This plan is a road map to make pedestrian facilities within the region accessible to the disabled. ADA requires that all new and retrofit facilities be accessible. In the plan, selected roadways were surveyed for ADA transitions. Data was collected for curb ramps, driveways, transit stops, sidewalk obstructions, and other deficiencies. Keystone Avenue (between Riverside Drive and Kings Row) is one of the surveyed routes in the plan.
- Northern Nevada Pedestrian Safety Action Plan: This plan identifies, assesses, and develops pedestrian safety policies and practices. Recommendations in the plan include items selected and prioritized based on high crash reduction factors, cost effectiveness, and public support. Notable goals and policies include providing sidewalks on both sides of regional roadways and maintaining crosswalk markings on regional roadways biannually. These goals and policies apply to Keystone Avenue and California Avenue, both of which are regional roads.

Road Safety Audit Report – Keystone Avenue from 4th Street to California Avenue (April 2012) and Road Safety Audit Report – Keystone Avenue from 4th Street to North McCarran Boulevard (February 2014): NDOT conducted two separate road safety audits (RSA) for Keystone Avenue. The first one covered 4th Street to California Avenue and the second one covered 4th Street to North McCarran Boulevard. The RSAs identified potential road safety issues and recommended countermeasures to mitigate those safety issues for inclusion into future projects. Both RSAs are included in Appendix B, and their recommendations are included throughout this report in the appropriate sections. Improvements proposed in this corridor study incorporate recommendations from the RSAs.

Truckee River Bridges / NDOT Bridge Inspection Reports (2012): There are two bridges that cross the Truckee River in the corridor study limits: the bridge at Keystone Avenue and the bridge at Booth Street. These bridges were inspected as part of NDOTs routine Bridge Inspection Program. The Keystone Avenue bridge has a sufficiency rating of 28 out of 100 and is considered structurally deficient under NDOT bridge inspection criteria. The inspection reports indicate that the bridges are eligible for repair or replacement. The full bridge inspection reports are included in Appendix C.

The existing Keystone Avenue bridge is only wide enough to carry the four travel lanes across the river. The existing structure does not have the necessary width to accommodate sidewalks or bike facilities. Currently, signing prohibits bicycle and pedestrian use of the bridge. These users are directed to cross the river using the Booth Street bridge.

As part of the Truckee River Flood Management Authority's plan, the Booth Street bridge is to be removed based on flood conveyance issues. A new structure, designed to be less constricting to flood

waters, would be constructed to accommodate only bicycle and pedestrian access. Vehicles would no longer be able to access Booth Street from Riverside Drive.

The Keystone Avenue Bridge is not directly part of the Truckee River Flood Management Authority's plan.

Nevada Strategic Highway Safety Plan (SHSP): Based on federal guidance, NDOT and the Nevada Department of Public Safety, along with numerous other safety partners (including RTC), finalized and adopted the Nevada SHSP in 2006. The plan identifies five critical emphasis areas: impaired driving, seat belts, intersections, lane departures, and pedestrians. Using the 4Es of safety (enforcement, engineering, education, and emergency medical services), the plan identifies 20 strategies that support these five critical emphasis areas. Strategies from this plan will be applied to mitigate high crash locations within the corridor.

2.2. Existing Traffic Volumes and Lane Configuration

Eighteen intersections were evaluated in this corridor study, including all of the signalized intersections (nine) and most of the unsignalized intersections.

Table 2-2 shows existing peak hour and daily traffic volumes as available from NDOT's traffic counts stations within the corridor. Figure 2-1 illustrates this data.[1] Keystone Avenue experiences its highest traffic volumes between 1st Street and W. 7th Street with the maximum volumes near 5th Street just south of I-80 (30,000 daily). North of W. 7th Street, the volumes drop considerably (to less than 15,000 daily); north of Coleman Drive the daily volumes drop to less than 5,000.

Turning movement counts (with heavy vehicle percentage and pedestrian crossings) were collected at the 18 study intersections in 15-minute increments from 7 AM to 9 AM and 4 PM to 6 PM in August and October 2013.

The count data (NDOT, tube, and turning movement) is provided in Appendix D.

Based on information available from the NDOT permanent count stations located in the region (ATR# 031222 and ATR# 031226), the intersection turning movement counts from the field were adjusted to represent the peak month of the year. This ensures that the traffic operations analysis is conducted for the peak month's traffic volumes. The seasonally adjusted intersection turning movement counts are shown in Figure 2-2, Figure 2-3, and Figure 2-4 at the 18 study intersections.

The lane configuration and traffic control along the corridor segments and intersections are shown in Figure 2-5 and Figure 2-6. This information was obtained from aerial imagery obtained from Washoe County and confirmed through a field visit conducted in October 2013.

[1] The data is from the most recent three years; year 2013 data is not available at most locations. To supplement the NDOT data, a seven-day tube count (with classification) was conducted on Keystone Avenue between 1st and 2nd Street and is also shown in Table 2-2.

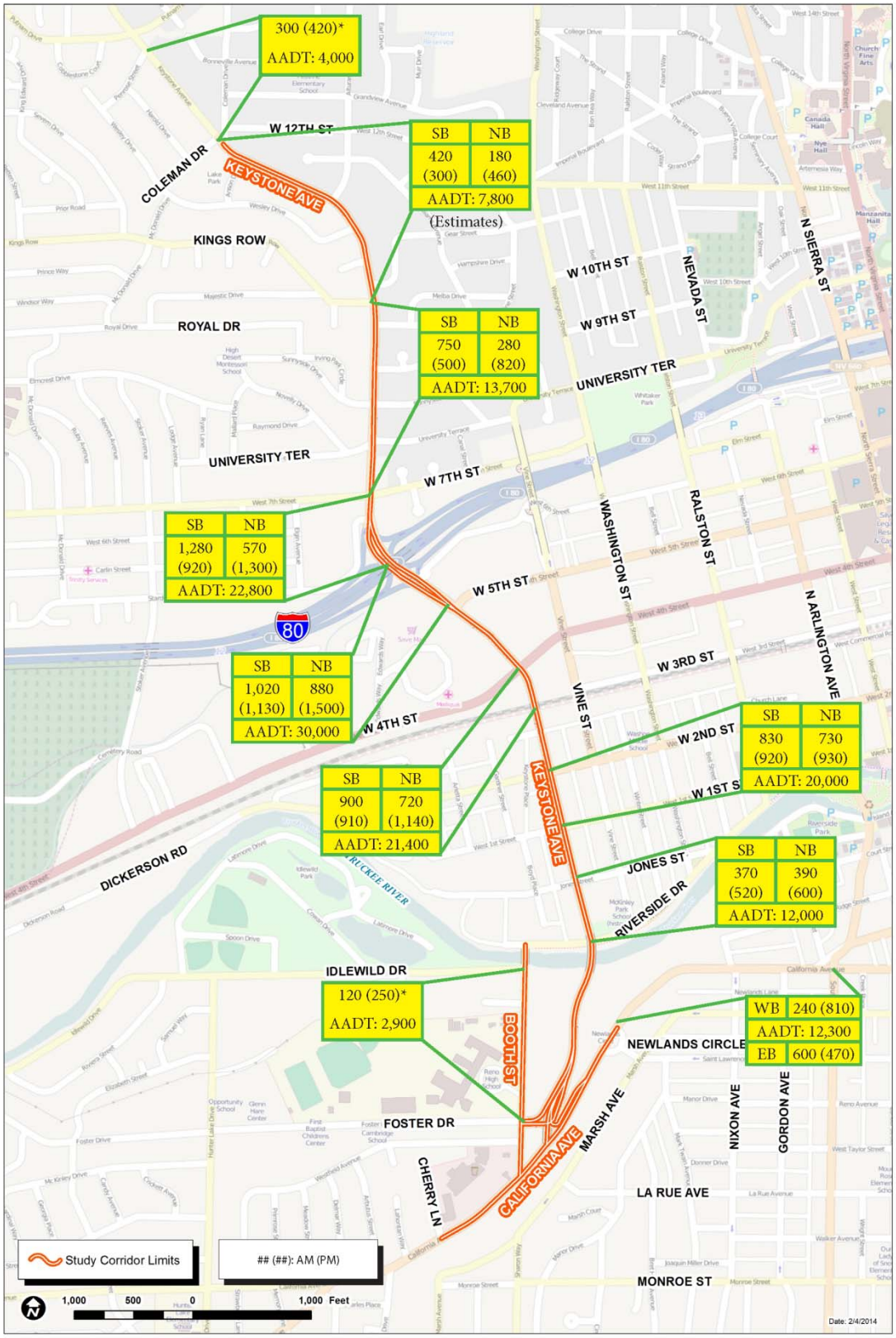
Table 2-2: Existing NDOT Count Summary

Count Location	NDOT Station #	Data Year	Time Period	Average Weekday Volume	
				NB/EB	SB/WB
Keystone 120' South of W. 7th	0310538	May-2013	7 to 8 AM	570	1,270
			5 to 6 PM	1,300	920
			AADT	22,800	
Keystone 0.1 mile' South of I-80	0310259	Jun-2010	7 to 8 AM	870	1,010
			5 to 6 PM	1,500	1,130
			AADT	30,000	
Keystone 100' South of 4th	0310537	May-2011	7 to 8 AM	720	900
			5 to 6 PM	1,130	910
			AADT	21,400	
Keystone 100' South of Jones	0310535	Jul-2012	8 to 9 AM	390	370
			5to 6 PM	600	520
			AADT	12,000	
Booth 50' South of Idlewild	0310912	Jul-2012	8 to 9 AM	120	
			5 to 6 PM	250	
			AADT	2,890	
Keystone 200' North of W. 7th Street	0310539	May-2011	7 to 8 AM	280	750
			5 to 6 PM	810	500
			AADT	13,700	
Keystone 300' North of Coleman	0310541	May-2012	7 to 8 AM	300	
			5 to 6 PM	420	
			AADT	4,000	
California 300' West of Arlington*	0310508	Jul-2012	8 to 9 AM	590	230
			5 to 6 PM	470	810
			AADT	12,300	
Keystone between 1st and 2nd	N/A**	Aug-2013	7 to 8 AM	720	820
			5 to 6 PM	930	910
			AADT	20,000	

**This location is not within the corridor study limits. This data is included as supplementary information, as there is no NDOT count station on California Street within the actual corridor limits between Cherry Lane and Newlands Circle.*

***There is no NDOT count station at this location; the volume shown is based on a seven-day tube count conducted in August 2013 specifically for this study.*

Figure 2-1: Existing NDOT Count Summary



* Bi-directional volumes not available.

Figure 2-2: Existing Intersection Turning Movement Volumes (California Avenue to Jones Street)

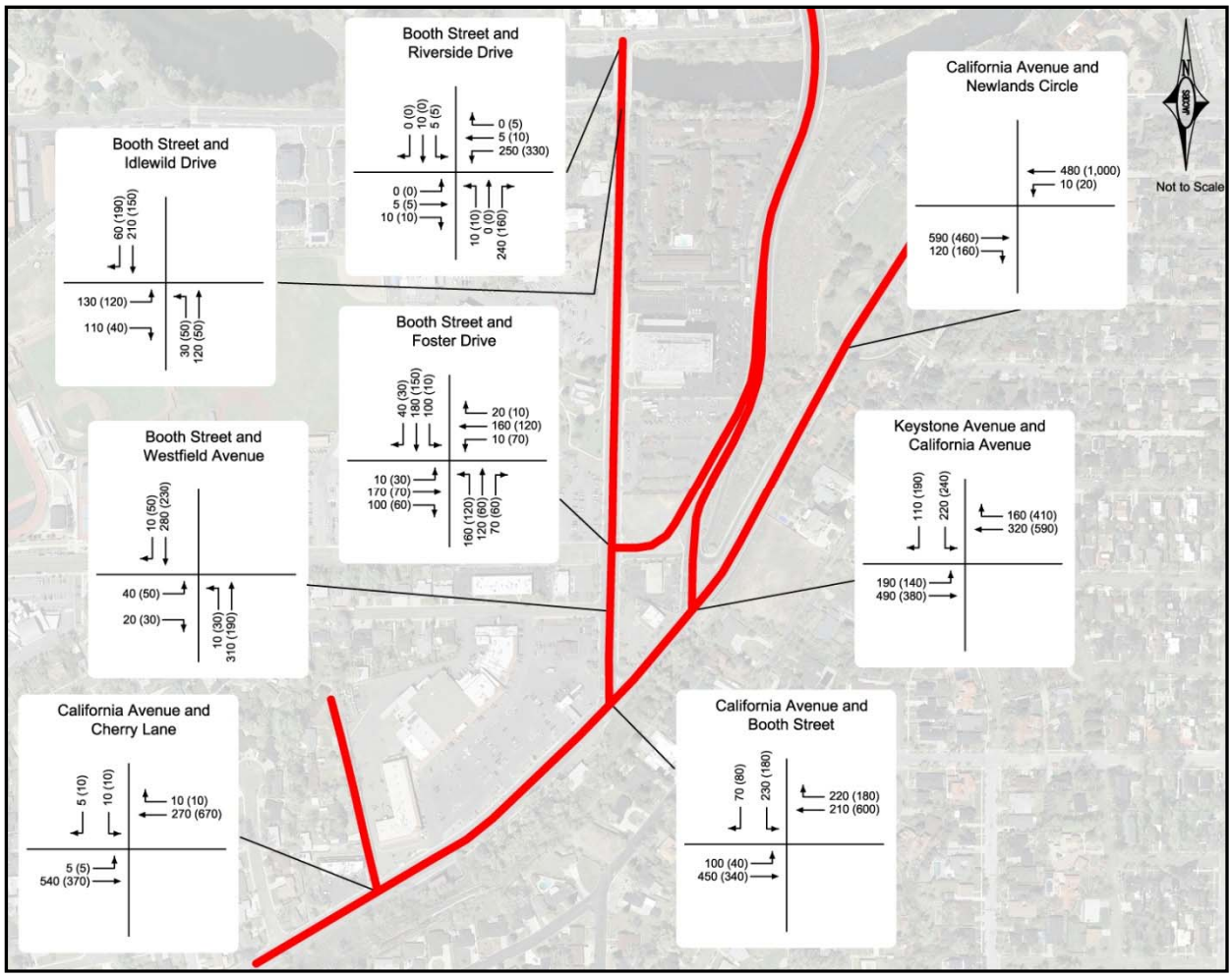


Figure 2-3: Existing Intersection Turning Movement Volumes (Jones Street to I-80)

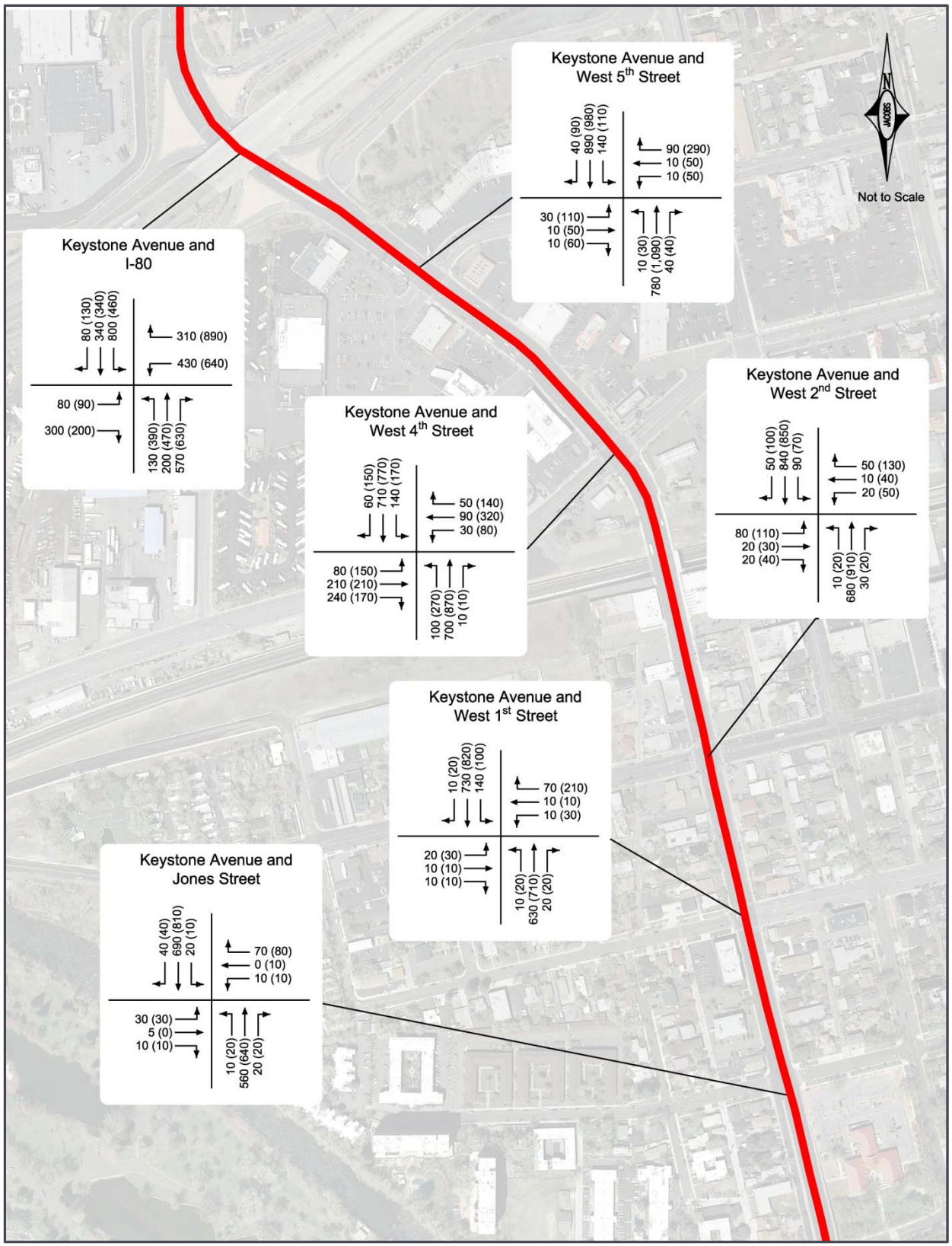


Figure 2-4: Existing Intersection Turning Movement Volumes (W. 7th Street to Coleman Drive)

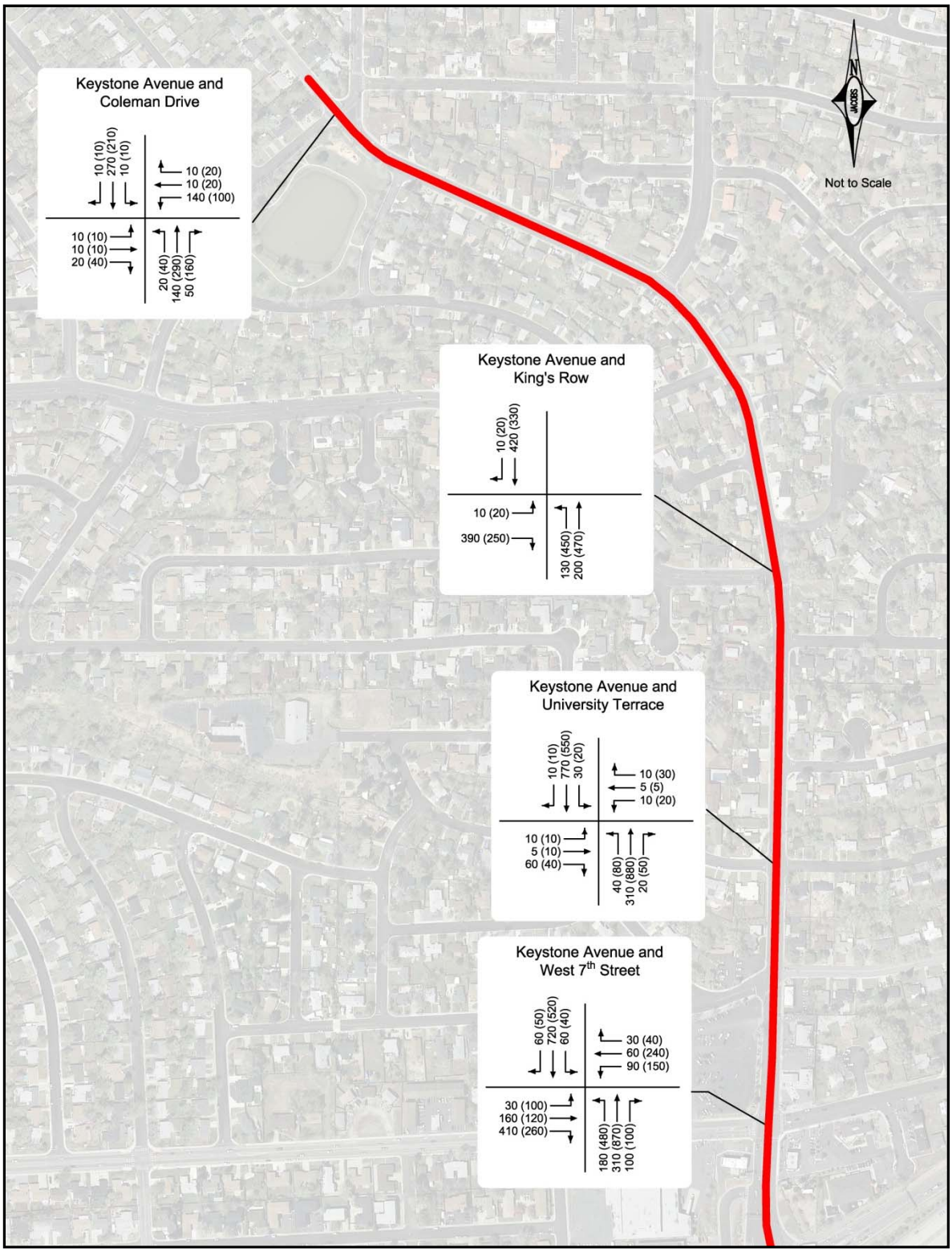


Figure 2-5: Lane Configuration and Traffic Control (California Avenue to I-80)

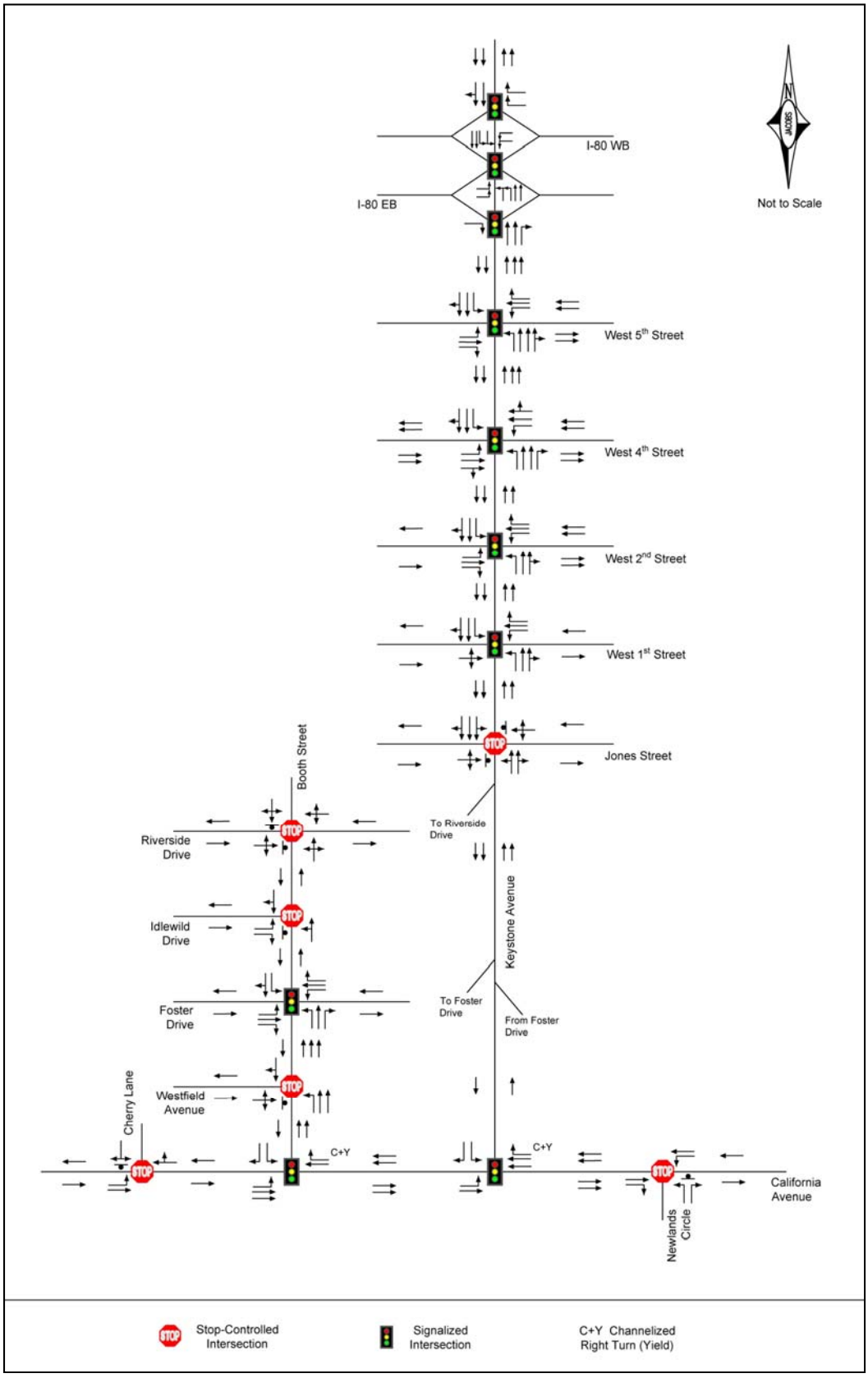
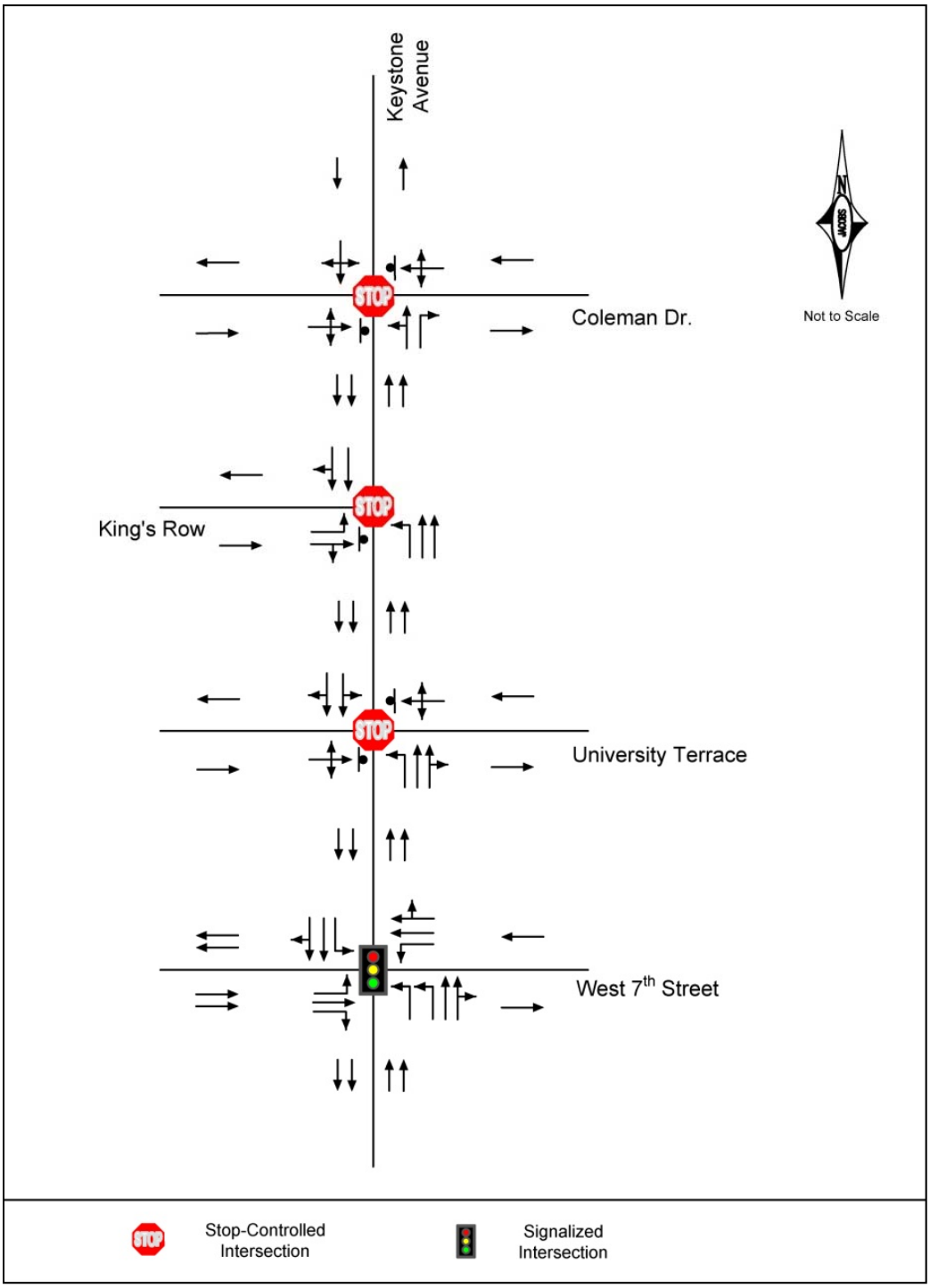


Figure 2-6: Lane Configuration and Traffic Control (W. 7th Street to Coleman Drive)



2.3. Pedestrian and Bicycle Facilities

There are few bicycle facilities along the corridor. Sidewalks are provided along most of the corridor; however, they are generally in poor condition. Figure 2-7 shows existing pedestrian and bicycle facilities along the corridor.

Bicycle Facilities:

- There are no bicycle facilities along Keystone Avenue.
- There are bike lanes along Booth Street. These bike lanes are shared with on-street parking where on-street parking is allowed. North of Idlewild Drive, Booth Street crosses the Truckee River and connects with the Riverside Drive bike boulevard.
- There are bike lanes on California Avenue east of Newlands Circle and west of Booth Street. The segment in between, which includes the Keystone Avenue/California Avenue intersection, has no bicycle facilities.

Sidewalks:

- Along Keystone Avenue, there are no sidewalks south of Jones Street including the bridge over the Truckee River. To cross the river, pedestrians and bicyclists go down to Riverside Drive via a southbound split on Keystone Avenue and then cross the river along Booth Street. However, this is not clearly signed, which makes the pedestrian and bicycle routing confusing north of the bridge.
- There are sidewalks on both sides of Booth Street.
- There are no sidewalks on California Avenue between Newlands Circle and Booth Street. To access Keystone Avenue, pedestrians use the sidewalk along the westbound right turn split on California Avenue, and then use a set of stairs to access Booth Street/Foster Drive. This is the only pedestrian connection option between California Avenue (east of Newlands Circle) and Booth Street/Keystone Avenue. There are sidewalks on California Avenue west of Booth Street.

Keystone / California Intersection

- The sidewalks near the intersection of Keystone Avenue and Kings Row are discontinuous.

2.3.1. ADA Issues

Generally, there are ADA compliance issues at numerous intersections and segments along the corridor. Future projects along the corridor should ensure that ADA improvements are implemented.

The RSAs for Keystone Avenue (Appendix B) identified the following specific ADA issues:

- Keystone Avenue / W. 7th:
  - The southeast corner pedestrian pushbutton is only accessible by stepping up onto a curb area.

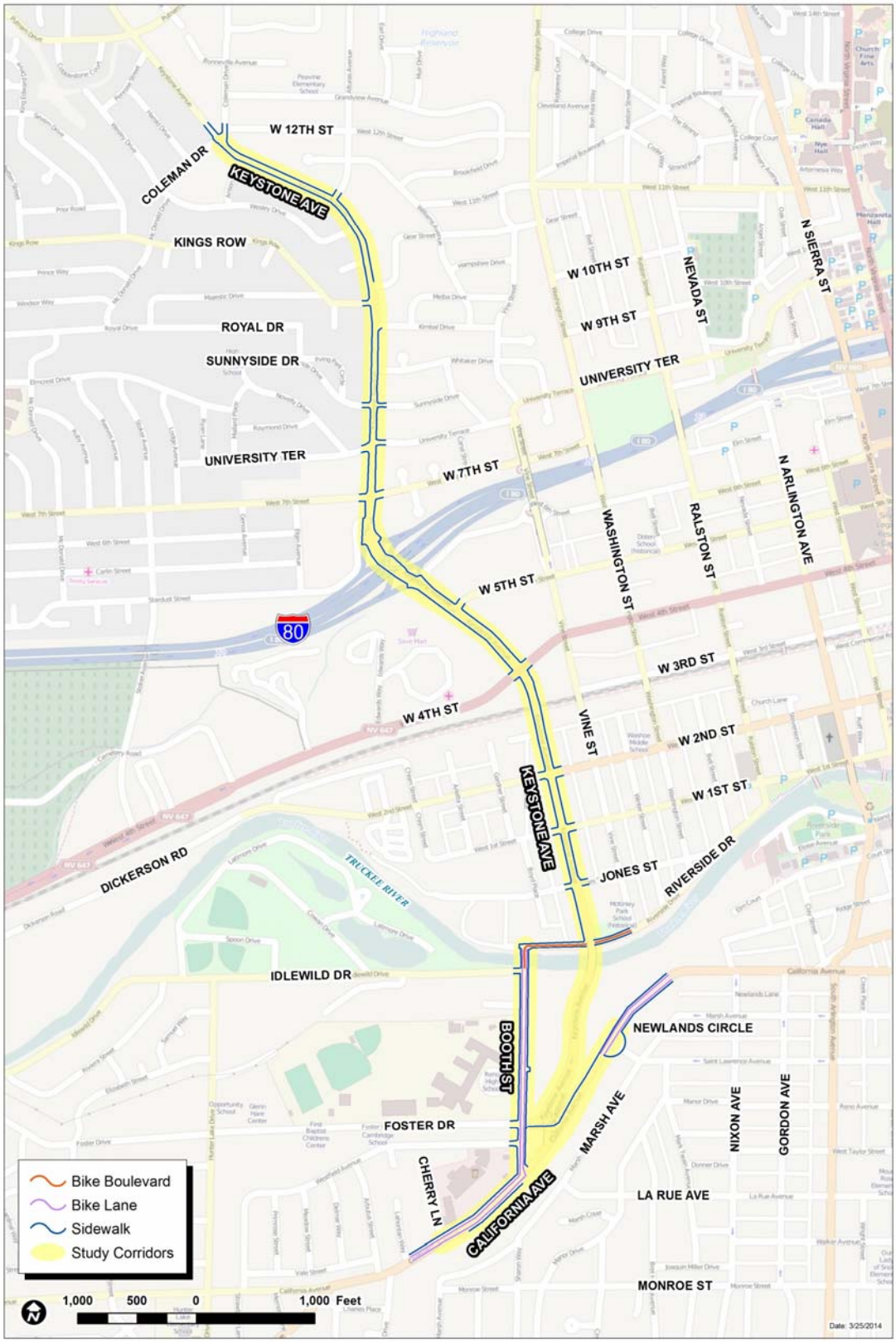
- Keystone Avenue / 4th Street:
  - Corners are missing the tactile strip.
  - Push buttons at the north corners are not placed at required distances from the crossing or sidewalk.
  - Traffic signal pole on the southwest corner is in the sidewalk; available sidewalk width is too narrow for wheelchairs.
- Keystone Avenue / 2nd Street:
  - Corners are missing the tactile strip.
  - Push buttons at the north corners are not placed at required distances from the crossing or sidewalk.
- Keystone Avenue / 1st Street:
  - Pedestrian pushbuttons on the southeast corner are higher than the standard ADA required height.

In addition to the ADA issues identified in the RSAs for Keystone Avenue, the following additional ADA issues were identified in the field. These are mostly for Booth Street and California Avenue, both of which are not part of the RSAs.

- Sidewalks along the south side of California Avenue west of Booth Street are extremely deteriorated with numerous obstructions, and are not ADA compliant.
- There is no accessible connection between California Avenue (east of Newlands Circle) and Keystone Avenue/Booth Street. There is no wheelchair access because of the presence of the stairs discussed previously.
- The Booth Street and Foster Drive intersection is not ADA compliant.
- The Booth Street bridge over Truckee River has decorative lighting poles /other obstructions in the sidewalk that do not allow for adequate width per ADA.
- Sidewalks along Keystone Avenue along the northern segments of the corridor (north of W. 7th Street) are narrow with numerous obstructions, and are not ADA compliant.

As discussed in Section 2.1, the RTC's Reno-Sparks ADA Transition Plan, which is an RTC document, includes Keystone Avenue (between Riverside Drive and Kings Row) in its database as one of the surveyed routes. The information from the database is too extensive and detailed to list herein. The future improvement projects along Keystone Avenue should consult the ADA Transition Plan and incorporate improvements for the individual issues listed.

Figure 2-7: Existing Pedestrian and Bicycle Facilities



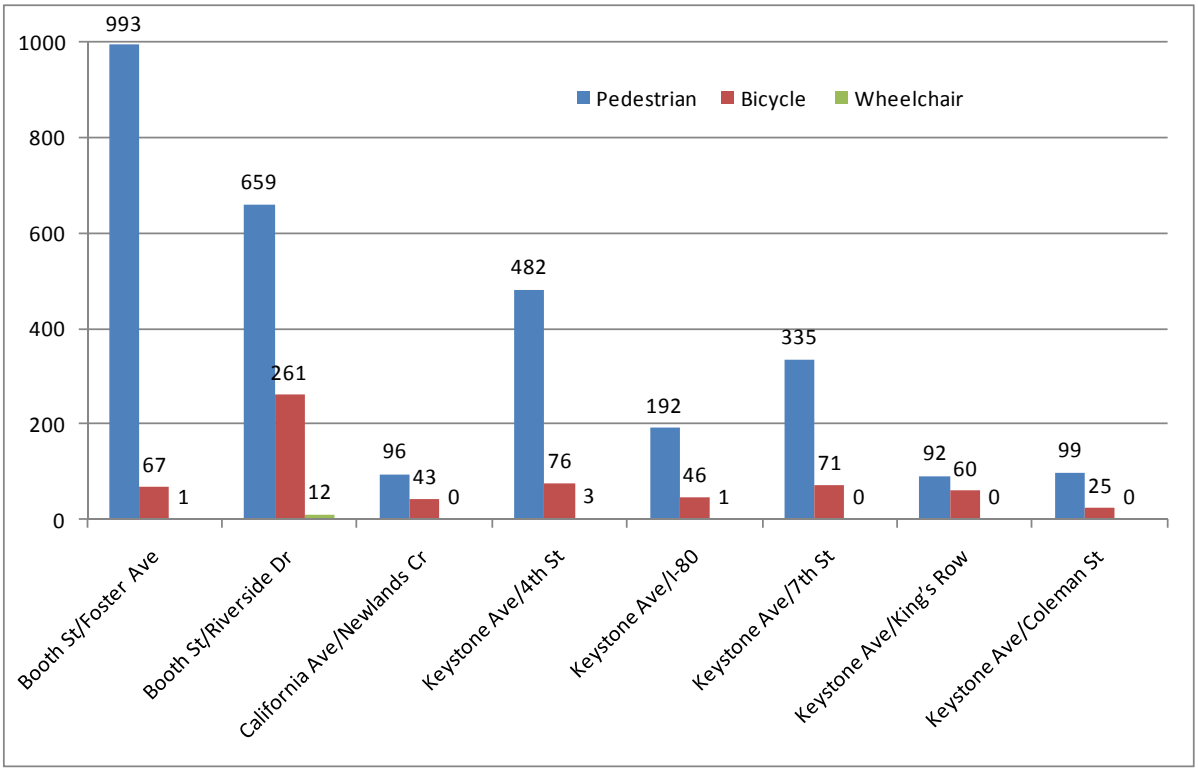
2.3.2. Bicycle/Pedestrian/Wheelchair Volumes

Pedestrian, bicycle, and wheelchair counts were collected at the following eight intersections within the corridor:

- Booth Street / Foster Avenue
- Booth Street / Riverside Drive
- California Street / Newlands Circle
- Keystone Avenue / 4th Street
- Keystone Avenue / I-80
- Keystone Avenue / W. 7th Street
- Keystone Avenue / Kings Row
- Keystone Avenue / Coleman Drive

The data was collected in 30-minute periods on a typical weekday in August and October of 2013. A comparative summary of the total volumes for all eight locations is shown in Figure 2-8. Volumes for each intersection (by time of day and by intersection leg) are included in Appendix E.

Figure 2-8: Comparative Summary of Bicycle, Pedestrian, and Wheelchair Volumes



Observations noted from these 12-hour pedestrian, bicycles, and wheelchair counts include the following:

Pedestrians: The Booth Street/Foster Avenue intersection had the highest pedestrian volume with 993 pedestrians. A majority of this activity occurred between 11 AM and 12 PM, during lunch break for

Reno High School. The second highest pedestrian activity occurred at the Booth Street / Riverside Drive intersection with 659 pedestrians. This intersection leads to the Riverside Drive path along the Truckee River. The third highest pedestrian activity was at the Keystone Avenue / 4th Street intersection with 482 pedestrians. This intersection is adjacent to the major retail center within the corridor. There is considerable pedestrian activity along the commercial segments of the corridor including W. 7th Street (335 counted); however, north of W. 7th Street, the pedestrian activity drops sharply. This is because the nature of the corridor changes at this point from mostly commercial with activity centers to residential.

Bicycles: The Booth Street / Riverside Drive intersection had the highest bicycle activity with 261 bicyclists traversing the intersection, which is part of the Riverside Drive bike boulevard. The other surveyed locations did not have significant bicycle activity. This could be attributable to the lack of bicycle facilities in the corridor rather than lack of demand. As summarized earlier, except for Booth Street, the corridor does not have bicycle facilities.

Wheelchairs: Except for the Booth Street / Riverside Drive intersection, wheelchair activity was negligible during the 12-hour count period. This could be attributable to poor sidewalk conditions and the ADA issues discussed earlier.

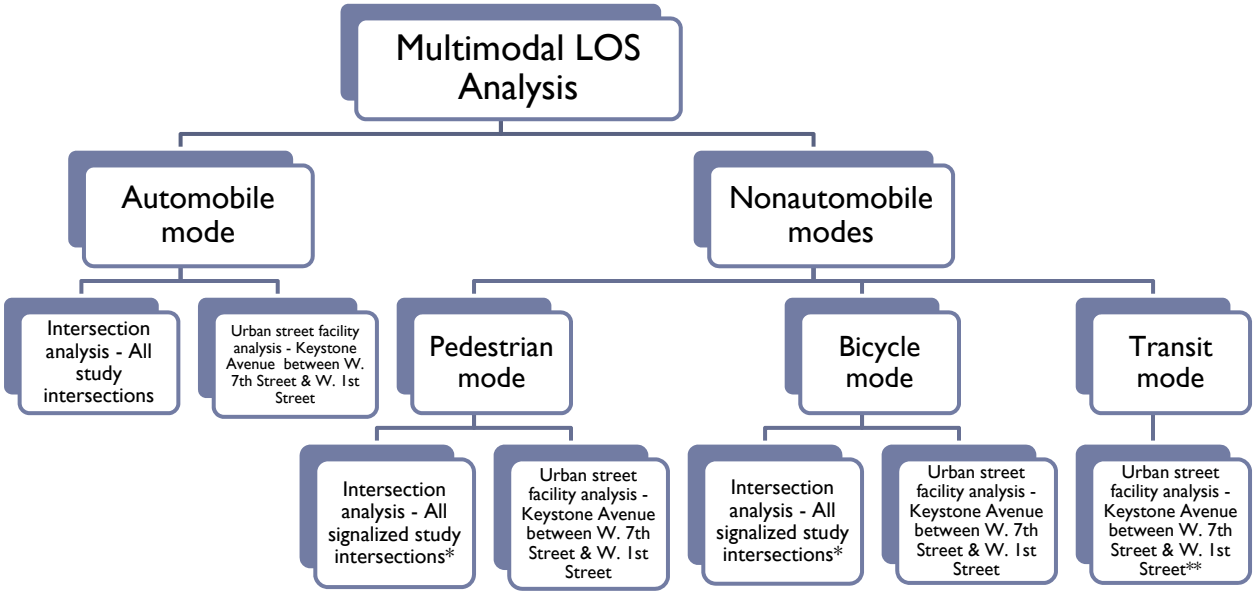
2.4. Multimodal Level of Service Analysis

A multimodal level of service (LOS) analysis following Highway Capacity Manual (HCM) methodologies was completed for the study intersections. A separate multimodal analysis for Keystone Avenue as an "urban street facility" was also completed.

HCM multimodal analysis included methodologies to analyze performance of the automobile mode (to calculate auto LOS) and methodologies to analyze the performance of nonautomobile modes (to calculate pedestrian, bicycle, and transit LOS). Figure 2-9 illustrates the HCM multimodal LOS analysis process as applied to this corridor study. The analysis was performed using the current version of the Highway Capacity Software (HCS) 2010.

In describing the LOS concepts for nonautomobile modes, the HCM states, "travelers consider a wide variety of factors in assessing the quality of service provided to them. Some of these factors can be described as performance measures (e.g., speed), and others can be described as basic descriptors of the intersection character (e.g., crosswalk width)." HCM methodologies provide procedures for mathematically combining these factors into a score for the segment or intersection. This score is then used to determine the LOS for a given direction of travel along a road segment or at an intersection.

Figure 2-9: HCM Multimodal LOS Analysis Process



* Pedestrian and bicycle LOS analysis is not applicable at unsignalized intersections.
** Transit LOS analysis is applicable at the urban street facility level only (i.e., transit analysis not applicable at the intersection level).

The LOS analyses were conducted according to the following methodology, assumptions, and criteria:

- Analysis periods are the AM and PM peak hours identified from the turning movement counts.
- The AM peak hour factor (PHF) for the intersections along Keystone Avenue is 0.86, and the AM PHF for the intersections along California Avenue and Booth Street is 0.74. The PM PHF for the intersections along Keystone Avenue is 0.93, the PM PHF for the intersections along California Avenue and Booth Street is 0.85. These values were calculated from the turning movement counts.
- The actual existing signal timing and phasing plans for the signalized study intersections were obtained from the City of Reno (See Appendix F) and used in the analysis.
- The right-turn-on-red volumes were assumed to be 25 percent of the total right turn volume at the signalized intersections that allow right turn on red.
- Per the RTP, the desired LOS threshold applicable to the study roadway facilities is LOS D. This policy LOS is applied to the overall intersection LOS. For the individual approaches/movements, LOS E is assumed to be the maximum acceptable LOS threshold.

Figure 2-2, Figure 2-3 and Figure 2-4 show the year 2013 peak hour intersection turning movement volumes, Figure 2-5 and Figure 2-6 show the intersection lane configuration and traffic control at the study intersections used in the LOS analysis.

2.4.1. Intersection Level of Service Analysis

An intersection LOS analysis was completed for the automobile mode for all of the 18 study intersections. For the non-automobile modes (pedestrian and bicycle), the intersection LOS analysis was completed for all nine signalized study intersections.

2.4.1.1. Automobile Mode - Intersections

Six levels of LOS are defined ranging from LOS A (the best, most desirable operating conditions) to LOS F (the worst, most congested operating conditions). HCM 2010 LOS criteria for the automobile mode for signalized and unsignalized intersections are shown in Table 2-3.

Table 2-3: HCM LOS Criteria for Intersections – Automobile mode

LOS	Control Delay per Vehicle (in seconds)	
	Signalized Intersections	Unsignalized Intersections
A	0-10	0-10
B	>10-20	>10-15
C	>20-35	>15-25
D	>35-55	>25-35
E	>55-80	>35-50
F	>80	>50

Source: Highway Capacity Manual 2010, Transportation Research Board

The results of the intersection LOS analysis for the automobile mode are shown in Table 2-4. HCS analysis worksheets are provided in Appendix G. HCS 2010 does not model the free eastbound through movement of the Keystone Avenue and California Avenue High-T intersection; this intersection was modeled as a regular T-intersection. The HCS results of the regular T-intersection configuration were used and the operations analysis results for the High-T configuration were calculated externally. These calculations are also provided in Appendix G.

From Table 2-4 and the HCS analysis worksheets provided in Appendix G, it can be seen that the study intersections, including the intersection movements and approaches operate at/or better than the desired automobile LOS thresholds, except for the following:

- The eastbound left movement of the Keystone Avenue and Kings Row unsignalized intersection operates at LOS F in the PM peak hour. Note that this movement has low volumes (20 vehicles/hour in the PM peak hour).
- The westbound approach of the Keystone Avenue and University Terrace unsignalized intersection operates at LOS F in the PM peak hour.
- The Keystone Avenue and I-80 (the SPUI) operates at LOS E condition in the AM peak hour. In addition, the eastbound right movement of this intersection operates at LOS F in the AM peak hour.

- The eastbound approach of the Keystone Avenue and Jones Street unsignalized intersection operates at LOS F in the PM peak hour.

As part of the intersection LOS analysis, a queuing analysis was also completed using HCS to determine if the 95th percentile queue lengths at the turn lanes are shorter than the available storage lengths at the intersections. Table 2-5 shows the available storage lengths and 95th percentile queue lengths (calculated by HCS) for those turn lanes with queue lengths longer than the available storage length.

It is worth noting that these analysis results (LOS and queue lengths) are based on the actual existing signal timing and phasing plans for the signalized study intersections obtained from the City of Reno. The use of a different timing and/or phasing plan (such as optimized plans) may give different results.

Table 2-4: Intersection LOS Analysis Results - Automobile mode

Intersection (Traffic Control)	AM Peak Hour		PM Peak Hour	
	Control Delay (s/veh)	LOS	Control Delay (s/veh)	LOS
Keystone Avenue and Coleman Drive (Unsignalized)	20.4	C	21.8	C
Keystone Avenue and Kings Row (Unsignalized)	21.3	C	96.5	F
Keystone Avenue and University Terrace (Unsignalized)	23.9	C	53.9	F
Keystone Avenue and West 7th Street (Signalized)	31.3	C	31.4	C
Keystone Avenue and I-80 SPUI Interchange (Signalized)	56.5	E*	48.1	D
Keystone Avenue and West 5th Street (Signalized)	15.2	B	21.9	C
Keystone Avenue and West 4th Street (Signalized)	23.8	C	26.0	C
Keystone Avenue and West 2nd Street (Signalized)	12.9	B	15.8	B
Keystone Avenue and West 1st Street (Signalized)	7.5	A	8.8	A
Keystone Avenue and Jones Street (Unsignalized)	45.2	E	54.6	F
Keystone Avenue and California Avenue (Signalized)	17.7	B	16.5	B
Booth Street and California Avenue (Signalized)	19.8	B	16.0	B

Intersection (Traffic Control)	AM Peak Hour		PM Peak Hour	
	Control Delay (s/veh)	LOS	Control Delay (s/veh)	LOS
Booth Street and Westfield Avenue (Unsignalized)	14.2	B	12.5	B
Booth Street and Foster Drive (Signalized)	6.9	A	5.4	A
Booth Street and Idlewild Drive (Unsignalized)	17.4	C	14.4	B
Booth Street and Riverside Drive (Unsignalized)	22.5	C	26.6	D
California Avenue and Cherry Lane (Unsignalized)	18.4	C	20.3	C
California and Newlands Circle (Unsignalized)	10.1	B	9.2	A

Note: Delay and LOS reported for the worst movement/approach at unsignalized intersections.

**The Eastbound Right movement at this intersection operates at LOS F.*

Table 2-5: Inadequate Turn Lane Storage Lengths at Intersections

Intersection	Movement	Required Storage Length* (ft/ln)		Existing Storage Length (ft/ln)
		AM Peak Hour	PM Peak Hour	
Keystone Avenue and West 7th Street	Westbound Left	150	225	120
	Westbound Through/Right	50	175	110
	Northbound Left	150	200	130
Keystone Avenue and I-80 SPUI Interchange	Eastbound Right	600	200	350
	Northbound Left	125	275	150
	Southbound Left	425	325	250
Keystone Avenue and West 5th Street	Eastbound Left	50	150	60
	Eastbound Right	25	75	60
Keystone Avenue and West 4th Street	Eastbound Left	125	200	130
	Northbound Left	100	175	110
	Southbound Left	125	200	130

Intersection	Movement	Required Storage Length* (ft/ln)		Existing Storage Length (ft/ln)
		AM Peak Hour	PM Peak Hour	
Keystone Avenue and West 2nd Street	Eastbound Left	125	175	50
Keystone Avenue and California Avenue	Southbound Right	125	200	180
Booth Street and California Avenue	Southbound Left	300	200	110

2.4.1.2. Non-automobile Modes - Intersections

The non-automobile mode LOS analysis at intersections was completed for the pedestrian and bicycle modes at all nine signalized study intersections. Just as the LOS is defined for the automobile mode, for non-automobile modes, the letter "A" represents the "best" quality of service, and the letter "F" represents the "worst" quality of service. HCM 2010 LOS criteria for the pedestrian and bicycle modes are shown in Table 2-6.

Table 2-6: HCM LOS Criteria for Intersections – Pedestrian and Bicycle Modes

LOS	LOS Score
A	≤2.00
B	>2.00-2.75
C	>2.75-3.50
D	>3.50-4.25
E	>4.25- 5.00
F	>5.00

Source: Highway Capacity Manual 2010, Transportation Research Board

The results of the intersection LOS analysis for the pedestrian and bicycle modes are shown in Table 2-7. From Table 2-7, it can be seen that all the study intersections operate acceptably at a pedestrian LOS of D or better. For the bicycle mode, the following intersections operate at LOS worse than the desired LOS D threshold:

- Keystone Avenue and I-80 SPUI Interchange
- Keystone Avenue and California Avenue intersection (AM peak hour)
- Booth Street and California Avenue intersection (PM peak hour)

Table 2-7: Intersection LOS Analysis Results – Pedestrian and Bicycle Modes

Intersection (Traffic Control)	Pedestrian LOS				Bicycle LOS			
	AM Peak Hour		PM Peak Hour		AM Peak Hour		PM Peak Hour	
	Approach	LOS	Approach	LOS	Approach	LOS	Approach	LOS
Keystone Avenue and West 7th Street	Eastbound	C	Eastbound	C	Eastbound	D	Northbound	D
Keystone Avenue and I-80 SPUI Interchange	Eastbound	D	Eastbound	D	Southbound	E	Southbound	E
							Northbound	F
Keystone Avenue and West 5th Street	Westbound	C	Westbound	D	Southbound	D	Southbound	D
Keystone Avenue and West 4th Street	Eastbound	C	Eastbound, Westbound, Southbound	C	Northbound, Southbound	D	Northbound	D
Keystone Avenue and West 2nd Street	Westbound	C	Westbound	C	Southbound	C	Northbound	C
Keystone Avenue and West 1st Street	Eastbound, Westbound	C	Eastbound, Westbound	C	Northbound	C	Northbound	C
Keystone Avenue and California Avenue	Southbound	C	Northbound, Southbound	C	Eastbound	E	Eastbound	D
Booth Street and California Avenue	Northbound	C	Northbound	C	Westbound	D	Westbound	E
Booth Street and Foster Drive	Southbound	C	Southbound	B	Northbound	C	Northbound	C

Analysis results are shown for the worst approach of the intersection or all the approaches that operate at LOS worse than the desired LOS D threshold.

2.4.2. Urban Street Facility Level of Service Analysis

An HCS urban street facility multimodal LOS analysis was completed for Keystone Avenue between W. 7th Street and 1st Street. These limits form a stand-alone "urban facility" because: 1) north of W. 7th Street, the character of the corridor changes and there are no signalized intersections to include,[2] and 2) these limits include all the signalized, coordinated intersections along Keystone Avenue. This analysis was completed for all four modes.

2.4.2.1. Automobile Mode – Urban Street

HCM 2010 LOS criteria for the automobile mode for the urban street facility analysis are shown in Table 2-8. HCS analysis worksheets showing the operations analysis results of the facility are provided in Appendix G.

Table 2-8: HCM LOS Criteria for Urban Streets – Automobile mode

Travel Speed as a Percentage of Base Free-Flow Speed (%)	LOS by Critical Volume-to-Capacity Ratio	
	≤1.0	>1.0
>85	A	F
>67-85	B	F
>50-67	C	F
>40-50	D	F
>30-40	E	F
≤30	F	F

Source: Highway Capacity Manual 2010, Transportation Research Board

Analysis results show that for the automobile mode, Keystone Avenue as an urban street facility operates at LOS E in both directions, both in the AM and PM peak hour of analysis. This is worse than the desired LOS D threshold.

2.4.2.2. Non-automobile Modes – Urban Street

The non-automobile mode LOS analysis was completed for the pedestrian, bicycle, and transit modes. The LOS for an urban street facility, for the pedestrian mode depends on both the LOS score and the average pedestrian space on the sidewalk. The HCM 2010 LOS criteria for an urban street facility, for the pedestrian mode are shown in Table 2.9.

[2] Urban street facility is applicable to a signalized corridor.

Table 2-9: HCM LOS Criteria for Urban Streets – Pedestrian mode

Pedestrian LOS Score	LOS by Average Pedestrian Space (ft^2/p)					
	>60	>40-60	>24-40	>15-24	>8.0-15[a]	≤8.0[a]
≤2.00	A	B	C	D	E	F
>2.00-2.75	B	B	C	D	E	F
>2.75-3.50	C	C	C	D	E	F
>3.50-4.25	D	D	D	D	E	F
>4.25- 5.00	E	E	E	E	E	F
>5.00	F	F	F	F	F	F

Note: In cross-flow situations, the LOS E/F threshold is 13 ft^2/p.

Source: Highway Capacity Manual 2010, Transportation Research Board

HCM 2010 LOS criteria for an urban street facility, for the bicycle and transit modes are shown in Table 2-10. The transit mode takes criteria such as bus frequency, dwell time, passenger load, and bus stop conditions into account.

Table 2-10: HCM LOS Criteria for Urban Streets – Bicycle and Transit modes

LOS	LOS Score
A	≤2.00
B	>2.00-2.75
C	>2.75-3.50
D	>3.50-4.25
E	>4.25- 5.00
F	>5.00

Source: Highway Capacity Manual 2010, Transportation Research Board

Analysis results for non-automobile mode with Keystone Avenue as an urban street facility are as follows:

- For the pedestrian mode, in both the AM and PM peak hour of analysis, in both the northbound and the southbound direction, the LOS is D. This meets the desired LOS D threshold.
- For the bicycle mode, in both the AM and PM peak hour of analysis, in both the northbound and the southbound direction, the LOS is E. This is worse than the desired LOS D threshold.
- For the transit mode, in both the AM and PM peak hour of analysis, in both the northbound and the southbound direction, the LOS is F. This is worse than the desired LOS D threshold.

2.4.3. Summary of the Multimodal Level of Service Analysis Results

The following is a summary of the findings from the multimodal LOS analysis:

- Automobile mode
  - Almost all of the signalized intersections, except for the Keystone Avenue and I-80 SPUI Interchange operate acceptably. Three unsignalized intersections operate at LOS worse than the desired thresholds.
  - Insufficient turn bay storage lengths were identified at several study intersections.
  - Keystone Avenue (in both direction) as an urban street facility operates at LOS E both in the AM and PM peak hour of analysis. This is worse than the desired LOS D threshold.
- Nonautomobile modes
  - All of the signalized intersections and Keystone Avenue as an urban street facility operate acceptably from a pedestrian perspective.
  - For the bicycle mode, some signalized intersections operate at LOS E. Similarly, Keystone Avenue (in both directions) as an urban street facility operates at LOS E, worse than the desired LOS D threshold.
  - Keystone Avenue (in both directions) as an urban street facility operates at LOS F from a transit perspective, worse than the desired LOS D threshold.

2.5. Travel Time

To further evaluate existing traffic operations conditions along the corridor, a travel time study was conducted along Keystone Avenue. Travel time runs were conducted along the one-mile segment between California Avenue and the I-80 SPUI interchange in both the northbound and southbound directions and in both the AM (7 to 9) and PM (4 to 6) peak periods. Additional details of the travel time runs are as follows:

- The AM period travel time runs along the northbound direction were conducted on August 26, 2013[3]; travel time statistics are based on 13 runs.
- The AM period travel time runs along the southbound direction were conducted on August 26, 2013; travel time statistics are based on 15 runs.
- The PM period travel time runs along the northbound direction were conducted on Thursday August 22, 2013; travel time statistics are based on 11 runs.
- The PM period travel time runs along the southbound direction were conducted on Thursday August 22, 2013; travel time statistics are based on 12 runs.

A summary of the travel time statistics is shown in Table 2-11. The detailed travel time study report is provided in Appendix H.

[3] Discrepancies were observed in the AM period travel time runs conducted on August 22, 2013 (Thursday). The AM period travel time runs were re-done on August 26, 2013 (Monday).

Table 2-11: Travel Time Statistics

Travel Time Statistics	Northbound		Southbound	
	AM	PM	AM	PM
Length of study segment (ft)	5,364		5,394	
Travel Time (seconds)	169.4	185.5	157.1	152.3
Number of Stops*	1.2	1.7	0.9	0.8
Average Speed (mph)	21.6	19.7	23.4	24.2
Total Delay# (seconds)	47.4	65.0	35.3	31.8

** Stops are defined when speeds are less than 5 mph.*

#Total delay is based on a threshold speed of 30mph.

Results show that the travel speeds during peak periods are below the speed limit resulting in delays. The northbound direction during the PM peak period has the worst travel time and delay with average speeds less than 20 mph.

2.6. Access Management

RTC established access management standards for its regional road system. The standards are included in the RTP and are shown in Table 2-12. In the RTP, arterials and collectors in the regional road system are classified as high-access control (HAC), moderate-access control (MAC), low-access control (LAC), and ultra-low access control (ULAC) for access policy. RTC intends to use these standards in the design of future improvements to regional roads. The study corridor is classified as follows:

- Keystone Avenue: MAC arterial
- California Avenue: LAC arterial
- Booth Street: Not part of the regional road system (e.g., no policy access classification)

The study corridor was inventoried for location and type of each access point (driveways and streets), access spacing, corner clearances, median types, and turn lanes. Additionally, on-street parking and the location and connectivity of adjacent parking lots were identified. Detailed inventory sheets that show all these access related information is in Appendix I. Current access control for the corridor is compared to the RTC's policy access control standards shown in Table 2-12. Documented in Table 2-13 and Table 2-14 is the comparison for Keystone Avenue and California Avenue respectively.[4]

As shown in the comparison tables, spacing requirements are not met for either Keystone Avenue or California Avenue. It should be noted that posted speeds are not consistent with the MAC designation. MAC is recommended for roadways with 40-45 mph speed limit. Keystone Avenue and California Avenue have 30 mph and 25 mph speed limits respectively. Furthermore, there are no medians except

[4] Booth Street is not part of the regional road system; thus, the RTP policy control does not apply. Regardless, Booth Street was also inventoried and included in the inventory sheets in Appendix I.

for a short segment of Keystone Avenue. MAC is typically used for roadways with raised or painted medians. The median and speed limit discrepancies, combined with the fact that the access spacing requirements are not met may indicate that the corridor is a candidate for re-designation to LAC or ULAC. It should be noted that the driveway frequency is extremely high such that most of the segments will not meet the ULAC criteria for driveway spacing. The inventory sheets (in Appendix I) identify every driveway and their respective spacing.

Table 2-12: RTC's Policy Access Control Standards

Access Management Standards-Arterials[1] and Collectors							
Access Management Class	**Posted Speeds**	**Signals Per Mile And Spacing[2]**	**Median Type**	**Left From Major Street? (Spacing From Signal?**	**Left From Minor Street Or Driveway?**	**Right Decel Lanes At Driveways?**	**Driveway Spacing[3]**
High Access Control	45-55 mph	2 or less Minimum spacing 2350 feet	Raised w/ channelized turn pockets	Yes 750 ft. minimum	Only at signalized locations	Yes[4]	250 ft./500 ft.
Moderate Access Control	40-45 mph	3 or less Minimum spacing 1590 feet	Raised or painted w/ turn pockets	Yes 500 ft. minimum	No, on 6- or 8-lane roadways w/o signal	Yes[5]	200 ft./300 ft.
Low Access Control	35-40 mph	5 or less Minimum spacing 900 feet	Raised or painted w/ turn pockets or undivided w/ painted turn pockets or two-way, left-turn lane	Yes 350 ft. minimum	Yes	No	150 ft./200 ft.
Ultra-Low Access Control	30-35 mph	8 or less Minimum spacing 560 feet	Raised or painted w/ turn pockets or undivided w/ painted turn pockets or two-way, left-turn lane	Yes 350 ft. minimum	Yes	No	150 ft./200 ft. 100 ft./100 ft.

1 On-street parking shall not be allowed on any new arterials. Elimination of existing on-street parking shall be considered a priority for major and minor arterials operating at or below the policy level of service.
2 Minimum signal spacing is for planning purposes only; additional analysis must be made of proposed new signals in the context of existing conditions, planned signalized intersections, and other relevant factors impacting corridor level of service.
3 Minimum spacing from signalized intersection/spacing from other driveways.
4 If there are more than 30 inbound, right-turn movements during the peak-hour.
5 If there are more than 60 inbound, right-turn movements during the peak-hour.
6 Minimum spacing on collectors.

Table 2-13: Current access control for Keystone Avenue

Segment	Median Type	Posted Speed	Signal Spacing	Left from Major Street? (Spacing from Signal)*	Left from Minor Street or Driveway?	Right Decel Lane at Driveways?	Driveway Spacing from Signal/Spacing from Other Driveways**	Meets MAC Criteria?
California Ave to Jones St	Raised	30 mph	N/A	Yes (2,185')	Yes	N/A	N/A	Yes
Jones St to 2nd St	Undivided w/painted turn pockets	30 mph	480'	Yes (500')	Yes	No	15'/20'	No
2nd St to 4th St	TWLTL	30 mph	915'	N/A (no minor street in this segment)	Yes	No	20'/20'	No
4th St to W. 7th St	Raised	30 mph	620'	No	Yes	No	50'/25'	No
7th St to Coleman Dr	Undivided w/painted turn pockets	30 mph	N/A	Yes (450')	Yes	No	35'/5'	No

N/A = Not Applicable

TWLTL = Two-Way Left-Turn Lane

Red indicates categories that do not meet the MAC criteria.

**The distance shown is the distance to the minor street. Distances to driveways are shown in the driveway spacing column.*

***The value shown is for the driveway with the shortest distance. See Appendix I for information on all driveways.*

Table 2-14: Current access control for California Avenue

Segment	Median Type	Posted Speed	Signal Spacing	Left in to Minor Street? (Spacing from Signal)	Left from Minor Street or Driveway?	Right Decel Lane at Driveways?	Driveway Spacing from Signal/Spacing from Other Driveways*	Meets MAC Criteria?
Cherry Ln to Booth St	TWLTL	25 mph	N/A	Yes (855')	Yes	No	25'/45'	No
Booth St to Newlands Cr	Undivided w/painted turn pockets	25 mph	380'	Yes (1,250')	Yes	No	85'/40'	No

N/A = Not Applicable

TWLTL = Two-Way Left-Turn Lane

Red indicates categories that do not meet the MAC criteria.

**The value shown is for the driveway with the shortest distance. See Appendix I for information on all driveways.*

2.6.1. Parking Analysis

As shown in the access inventory sheets (Appendix I), on-street parking is allowed along the following segments of the corridor:

- Keystone Avenue from Jones Street to 2nd Street
- Keystone Avenue from 2nd Street to 4th Street (short stretch on the east side)
- California Avenue from Cherry Lane to Booth Street (on the south side)
- Booth Street (unless marked otherwise with red curbs)

Per the access management policy, on-street parking is not allowed on any new arterial, and elimination of existing parking is considered a priority for arterials operating at or below the policy LOS. As previously discussed in Section 2.4.2.1, Keystone Avenue as an urban street facility operates at LOS E. Elimination of on-street parking may accommodate future pedestrian and bicycle improvements (see Section 5).

2.7. Right-of-Way and Utilities

Aerial imagery and parcel lines/right-of-way for the corridor were obtained from the Washoe County GIS Department. Roadway, pedestrian, and bicycle improvements (Section 5) were developed by attempting to accommodate the improvements within the available right-of-way using the County information. Figure 2-10 shows the right-of-way widths along the corridor at representative locations. As shown, the widths differ from segment to segment. Along Keystone Avenue, the right-of-way width is generally 60 feet north of W. 7th Street. Right-of-way is wider (up to 94 feet wide) within the

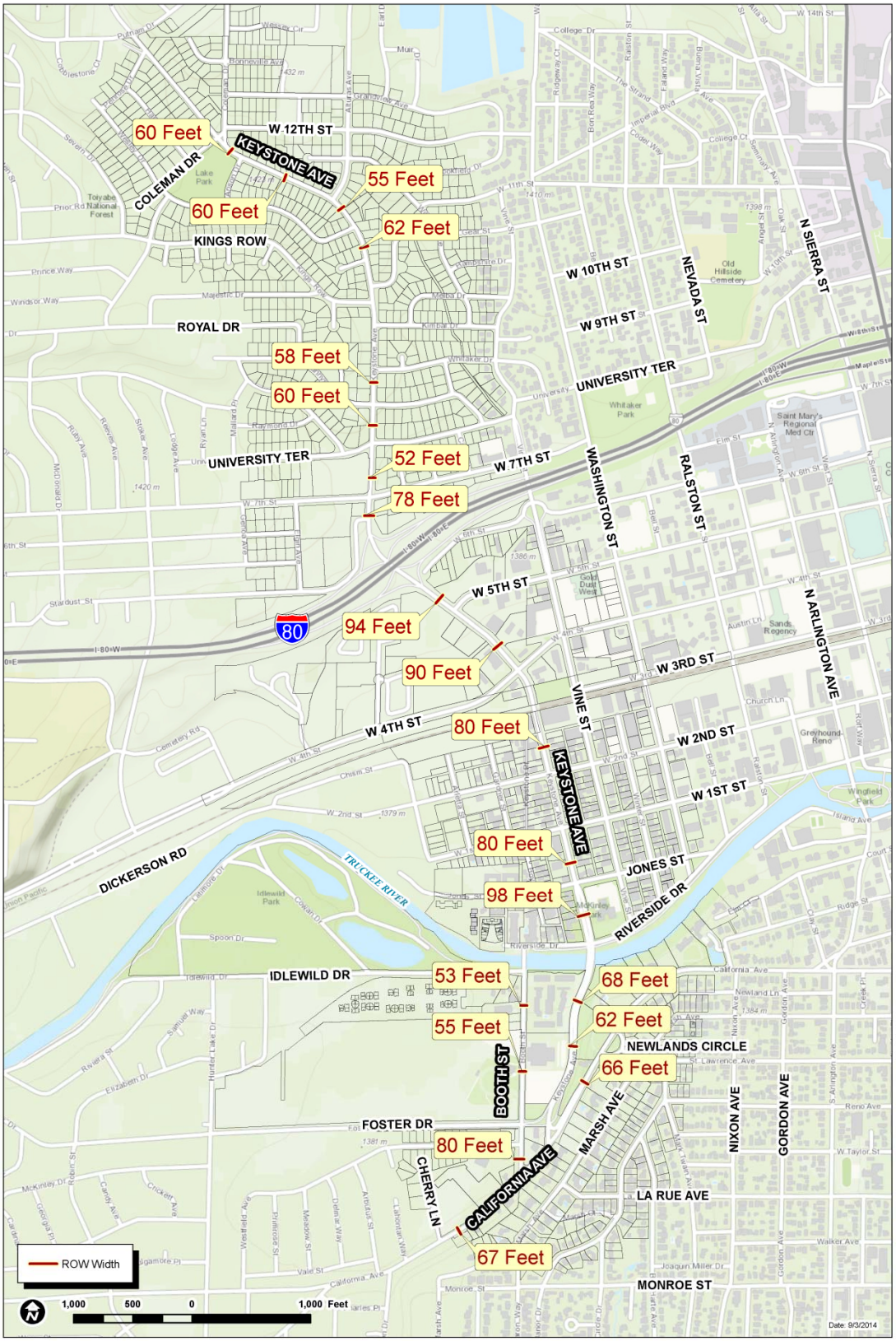
commercial section between W. 7th Street and Jones Street. The right-of-way is the widest (98 feet) just north of the Truckee River. South of the Truckee River, it drops to less than 70 feet.

Keystone Avenue between W. 7th Street and University Terrace partially lies within the limits of the Raley's parcel as shown by Parcel Map 2442 in Appendix J. An easement, recorded as Document 1328292 at the Washoe County Recorder's office, grants the roadway improvements along this section. It is likely that any proposed improvements to Keystone Avenue would be subject to any limitations of that easement.

Utilities Along Keystone Avenue

A field inventory of visible utilities within the right-of-way was conducted for the corridor. This preliminary survey identified locations of utility poles, signal poles, pedestrian push buttons, power lines, communication and pull boxes, and other visible utilities. Detailed survey sheets are provided in Appendix J.

Figure 2-10: Existing Right-of-Way



2.8. Transit Analysis

RTC operates its transit system via five types of fixed-route bus service: RTC RIDE, RTC RAPID, RTC SIERRA SPIRIT, RTC INTERCITY, and TART. Among the five, the following three RTC RIDE routes serve this corridor:

- Route 3 (3CC/3CL)[5] – Kings Row / Sky Mountain
- Route 16 - Idlewild
- Route 4 – West Seventh

Figure 2-11 illustrates segments of these three routes within the corridor and locations of each bus stop serving the corridor. All three routes originate and terminate at the RTC 4th Street Station. More detailed information for each route is provided in Appendix K.

Table 2-15 shows operating hours and frequency (headway) of each route. All three routes operate one-hour headways.

Table 2-15: Transit Operating Hours and Frequency

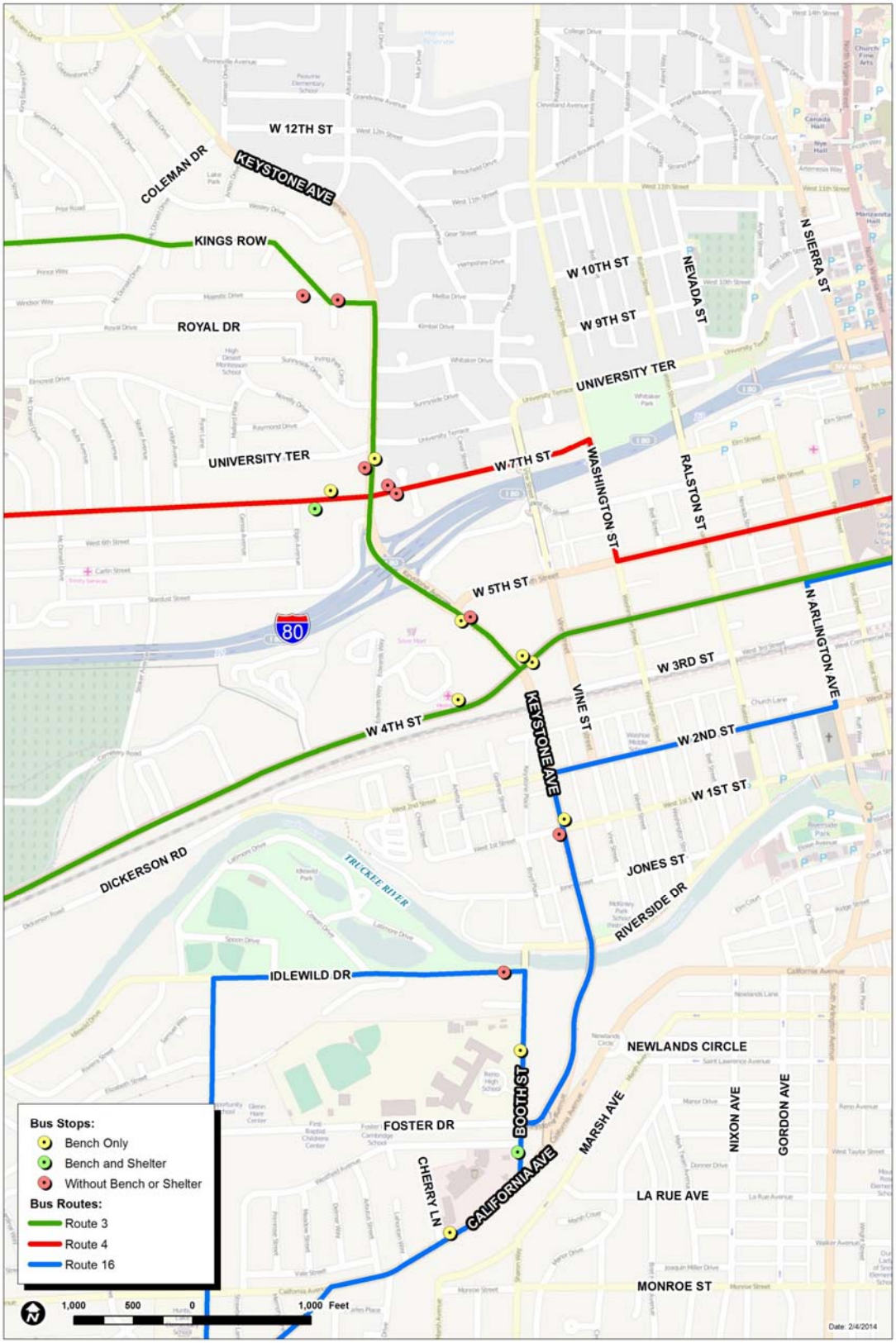
Route #	Route Name	Operating Hours/Headway		
		Weekdays	Saturday	Sunday/Holiday
3CL	Kings Row/Sky Mountain	5:15 AM to 10:05 PM / 1 hour	5:15 AM to 10:05 PM / 1 hour	6:15 AM to 7:05 PM / 1 hour
3CC	Kings Row/Sky Mountain	6:45 AM to 6 PM / 1 hour *	No service	No service
16	Idlewild	5:15 AM to 10:40 PM / 1 hour	6:15 AM to 7:40 PM / 1 hour	6:15 AM to 7:40 PM / 1 hour
4	West Seventh	5:45 AM to 11:35 PM / 1 hour	6:45 AM to 9:35 PM / 1 hour	6:45 AM to 9:35 PM / 1 hour**

** No service between 9:35 AM and 2:45 PM*

***No service between 10:35 AM and 2:45 PM*

[5] Route 3 is divided into two separate routes: 1) 3CC (counterclockwise), and 2) 3CL (clockwise).

Figure 2-11: RTC Transit Routes within the Corridor



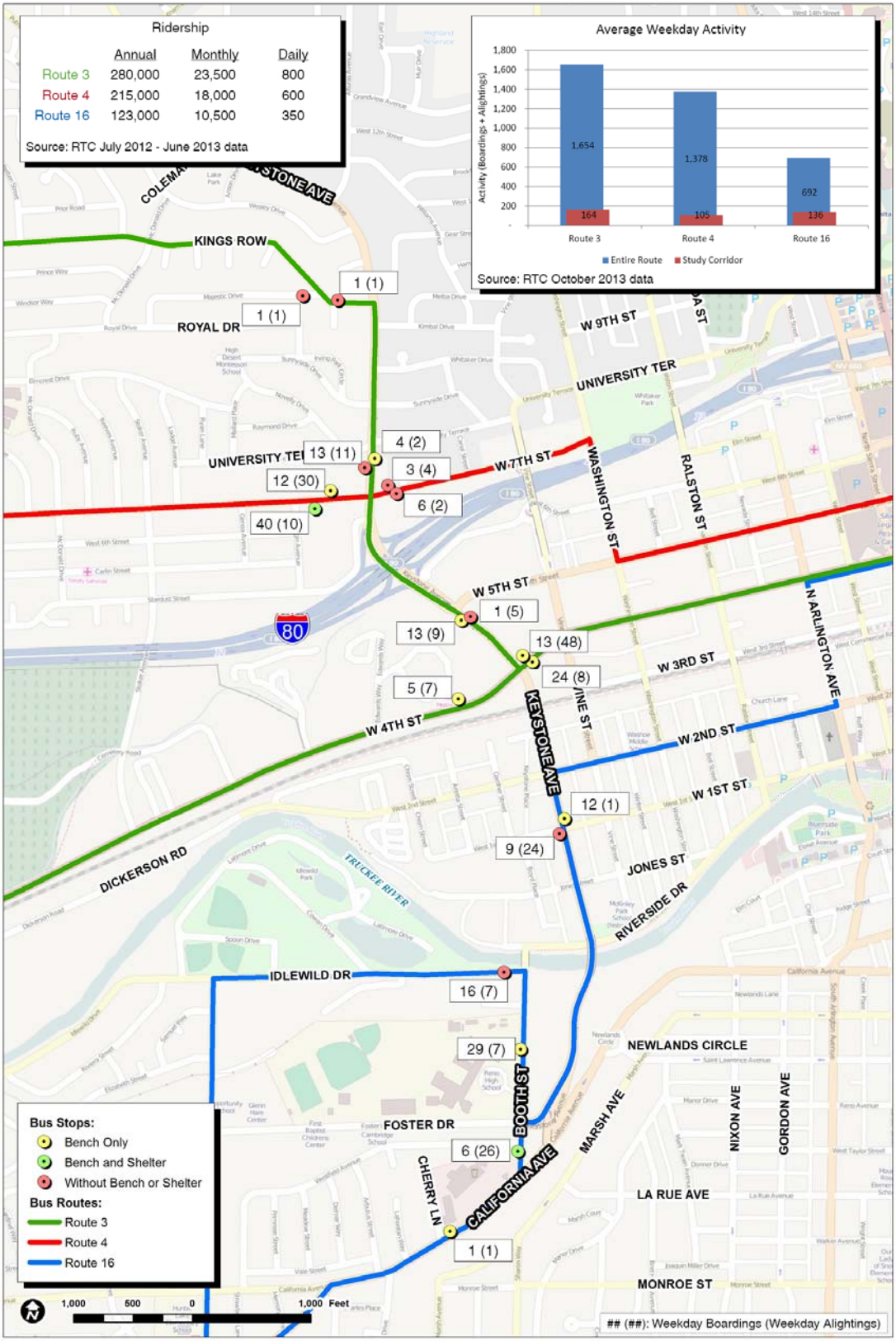
2.8.1. Ridership

Table 2-16 shows the most recent available 12-month ridership data (July 2012-June 2013) for the three routes. This ridership is approximately eight percent of the ridership for the entire RTC transit system. Figure 2-12 illustrates the summary of this ridership data along with average weekday boardings (i.e., number of passengers getting on the bus) and alightings (i.e., number of passengers getting off the bus) at each bus stop within the corridor. For Route 3, there are a total of 164 boardings and alightings within the corridor, which is approximately 10 percent of the total activity for the entire route. For Route 16, total boardings and alightings within the corridor (136) is approximately 20 percent of the entire route. For Route 4, this number is 105, which is approximately eight percent of the entire route.

Table 2-16: Transit Ridership Summary

Month	Route 3	Route 4	Route 16	All RTC Routes
July 2012	23,180	18,132	9,109	653,433
August 2012	24,564	19,499	10,000	702,761
September 2012	24,291	17,682	11,270	685,085
October 2012	25,096	18,913	11,233	721,353
November 2012	22,764	17,251	9,981	657,520
December 2012	22,241	17,056	9,535	639,383
January 2013	23,694	17,535	10,609	662,746
February 2013	21,978	16,183	9,806	621,824
March 2013	23,841	18,177	11,262	682,560
April 2013	23,498	17,955	10,760	676,942
May 2013	22,890	18,487	10,748	681,027
June 2013	22,022	17,730	8,501	646,235
Monthly Average	**23,338**	**17,883**	**10,235**	**669,239**
Daily Average	**778**	**596**	**341**	**22,308**
Annual	**280,059**	**214,600**	**122,814**	**8,030,869**

Figure 2-12: Existing Transit Facilities and Ridership



2.8.2. Passenger Load Factors

Load factor is a measure of the utilization of the available capacity of transit vehicles. The load factor specifies the number of passengers occupying the transit vehicle divided by the number of seats on the vehicle. If the number of passengers equals the number of seats, then the load factor equals 1.0.

Transit data showing the boardings and alightings at each stop was obtained from the RTC for the three routes serving the corridor. This data was obtained for the five-day period between October 7, 2013 and October 11, 2013 and included the data for each loop of service in that period. The passenger load factors were calculated (assuming bus capacity is 30 seats) for the routes, both for the entire routes and for the portion of the route within the corridor.

Table 2-17 shows the daily load factors for the routes within the corridor. The load factors for the entire routes were observed to be generally lower than the load factors within the corridor.

Table 2-17: Passenger Load Factors

Route #	Route Name	Daily Load Factor within the Corridor
3CL	Kings Row/Sky Mountain	0.43
3CC	Kings Row/Sky Mountain	0.27
16	Idlewild	0.35
4	West Seventh	0.51

2.8.3. ADA Conditions at the Bus Stops

A total of 19 bus stops serve the corridor as illustrated in Figure 2-11. The figure differentiates bus stops by "with bench only", "with both bench and shelter", and "without bench or shelter". There are only two bus stops with both a bench and a shelter. ADA issues at each bus stop were investigated through a field visit. A bus stop is considered compliant if the following criteria are satisfied[6]:

- Wheelchair seating: Wheelchair seating area shall have a minimum of 30" x 48" clear floor space.
- Wheelchair landing: The wheelchair landing area (where a bus can stop and deploy a lift or ramp) shall be a minimum of 96 inches deep by 60 inches wide. The depth shall be measured from the curb or vehicle roadway edge and the width shall be measured parallel to the vehicle roadway edge.
- Landing Slope: The wheelchair landing shall have a maximum cross slope of two percent.

[6] The criteria are per the ADA criteria included in the Reno-Sparks ADA Transition Plan.

Bus Stop at University Terrace

The field visit revealed ADA issues at each bus stop. The primary non-compliant item was the lack of the wheelchair landing area at a majority of the 19 of the identified stops. While each bus stop did provide the 60 inches of minimum width, only six of the stops had the required 96 inches of depth with some having as little as 48 inches when measured from the curb to the back of the sidewalk. Improvements should be provided at each bus stop to achieve the required wheelchair access dimensions. In areas where obstructions such as buildings or walls exist behind the bus stop that prevent the expansion of the landing area, considerations to move the stop to an alternate location should be made.

The two bus stops with existing shelters have adequate floor space to accommodate the necessary wheelchair access.

Based on the field review, the landing slopes are all within the two percent maximum cross slope specified criteria.

2.9. Land Use Analysis

The corridor has a mix of uses, ranging from single family residential to commercial. Keystone Avenue has two distinct characters divided by University Terrace. South of University Terrace the corridor is mostly commercial while north of University Terrace it is mostly residential. Figure 2-13 illustrates existing land use adjacent to the corridor and Figure 2-14 shows zoning. Generally:

- Keystone Avenue from California Avenue to 4th Street is a mix of residential and commercial.
- Keystone Avenue from 4th Street to University Terrace is mostly commercial.
- Keystone Avenue north of University Terrace is mostly single family residential.
- Land uses along California Avenue are mostly single family residential with some commercial west of Booth Street.
- Land uses along Booth Street are mixed (residential, commercial, and public).

As discussed in Section 2.1, the corridor lies within four specific planning areas from the City's Master Plan. Each is illustrated in Figure 2-15 and summarized below in relation to the corridor. The full plans are available on the RTC's website under the *City of Reno Master Plan*.

Downtown Reno Regional Center Plan: Downtown Reno Regional Center is generally located south of I-80, west of Wells Avenue, north of California Avenue, and east of Keystone Avenue. Keystone Avenue between I-80 and Riverside Drive lies adjacent to the Regional Center. The plan encourages concentrated development and pedestrian safety enhancements. Streetscape that supports TODs is recommended to accommodate and encourage the use of alternative modes of transportation as the preferred method of travel within the Regional Center. Strong pedestrian access and circulation is encouraged. The Keystone Avenue District of the plan encourages mixed land uses at lower intensities

and densities to transition into the surrounding neighborhoods. For multifamily development in the Keystone District, minimum policy density is 30 units per acre. A portion of the Keystone District permits gaming, which is generally located north of 5th Street, south of I-80, east of Keystone Avenue, and west of Vine Street.

West 4th Street TOD Corridor Plan: The "Eastern Plan Area" of West 4th Street TOD Corridor, which is the area near Keystone Avenue, generally extends along 4th Street from Keystone Avenue on the east and I-80 on the west. This plan encourages a mixture of land uses that will create a diverse neighborhood with increased transit use and pedestrian activity. The plan encourages pedestrian activity, supports retail businesses, promotes transit, and facilitates cohesive urban design. The plan proposes an integrated circulation system that accounts for pedestrians, bicycles, transit, and automobiles. Development within the "Eastern Plan Area" requires a minimum residential density of 14 dwelling units per acre.

West University Neighborhood Plan: The West University Neighborhood is bound by I-80 to the south, North McCarran Boulevard to the north, Keystone Avenue to the west, and Virginia Street to the east. The entire northern segment of Keystone Avenue lies adjacent to the West University Neighborhood. The neighborhood is mostly single family residential. Commercial properties are located within the "West 7th Street Business Corridor" (along W. 7th Street at and east of Keystone Avenue). The plan's vision includes a balanced neighborhood with safe and pleasant walking opportunities to most services and activities. Consistent with this vision, the plan encourages sidewalk improvements. The plan also has a section on traffic calming that discusses the need for a comprehensive approach to neighborhood traffic calming for residential areas west of Sierra Street.

Newlands Neighborhood Plan: The Newlands Neighborhood Plan was adopted by the city council in 1988. The Newlands neighborhood is generally bound by Truckee River on the north, Monroe Street on the south, Arlington Avenue on the east, and Bret Harte Avenue on the west. The Newlands Neighborhood is one of the first areas in Reno where a neighborhood planning program was initiated. The area comprises the second oldest neighborhood in the City and has a distinct architectural style. The neighborhood is also important because of its status as one of the few remaining residential neighborhoods located close to downtown. The majority of Newlands properties are single family residences and the consensus among the residents is to preserve the neighborhoods residential character. As shown in Figure 2-15, Newlands Neighborhood is located just southeast of the corridor.

It is also noteworthy to mention two planned developments/redevelopments with potential to impact travel demands along the corridor.

- A gaming property (hotel/casino) on the vacant land adjacent to Keystone Avenue between 5th Street and I-80 is planned. The development plans are currently on hold.
- A residential development (an apartment complex) at the Keystone Avenue / McCarran Boulevard intersection is proposed.

Figure 2-13: Existing Land Use

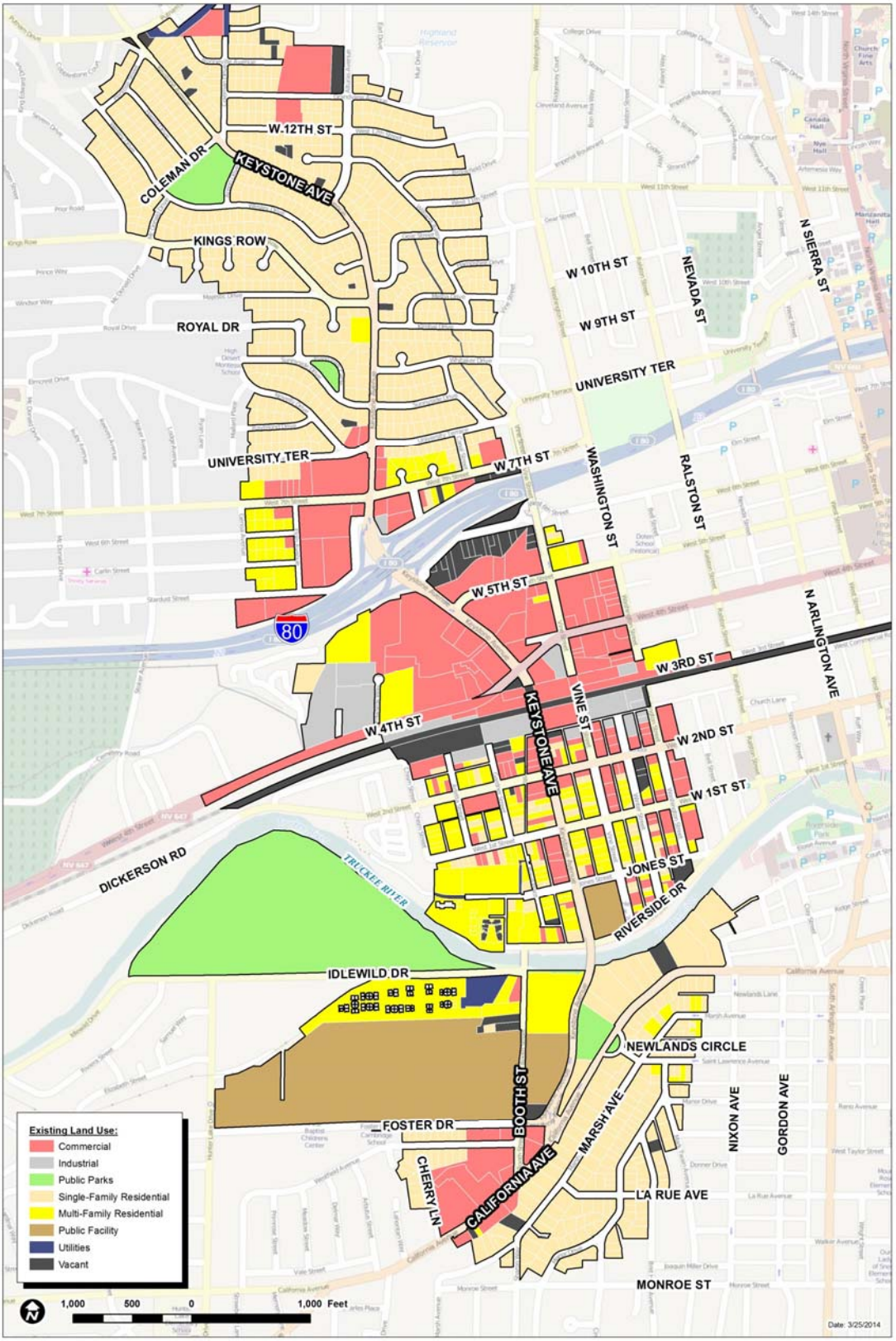


Figure 2-14: Zoning

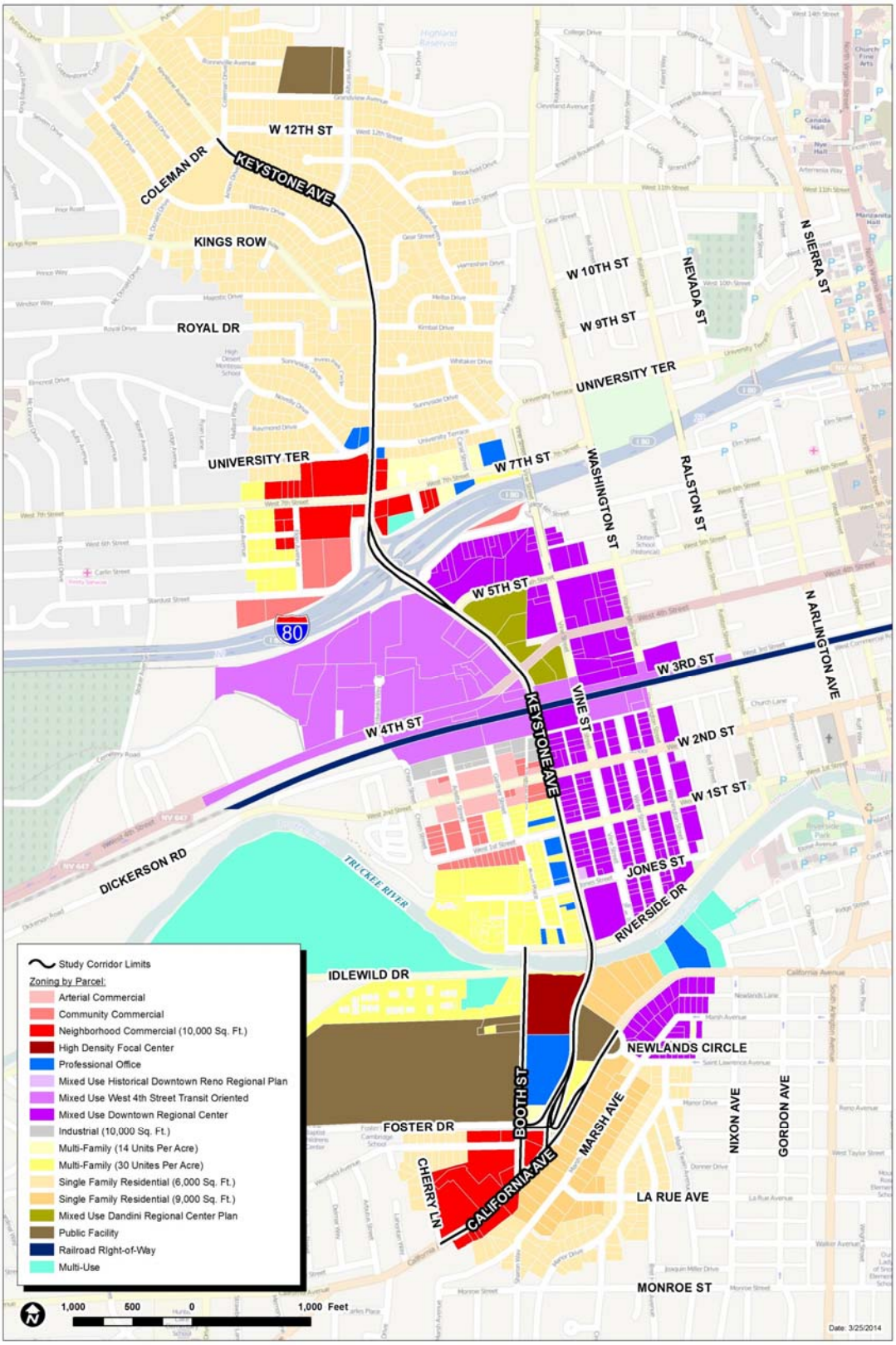
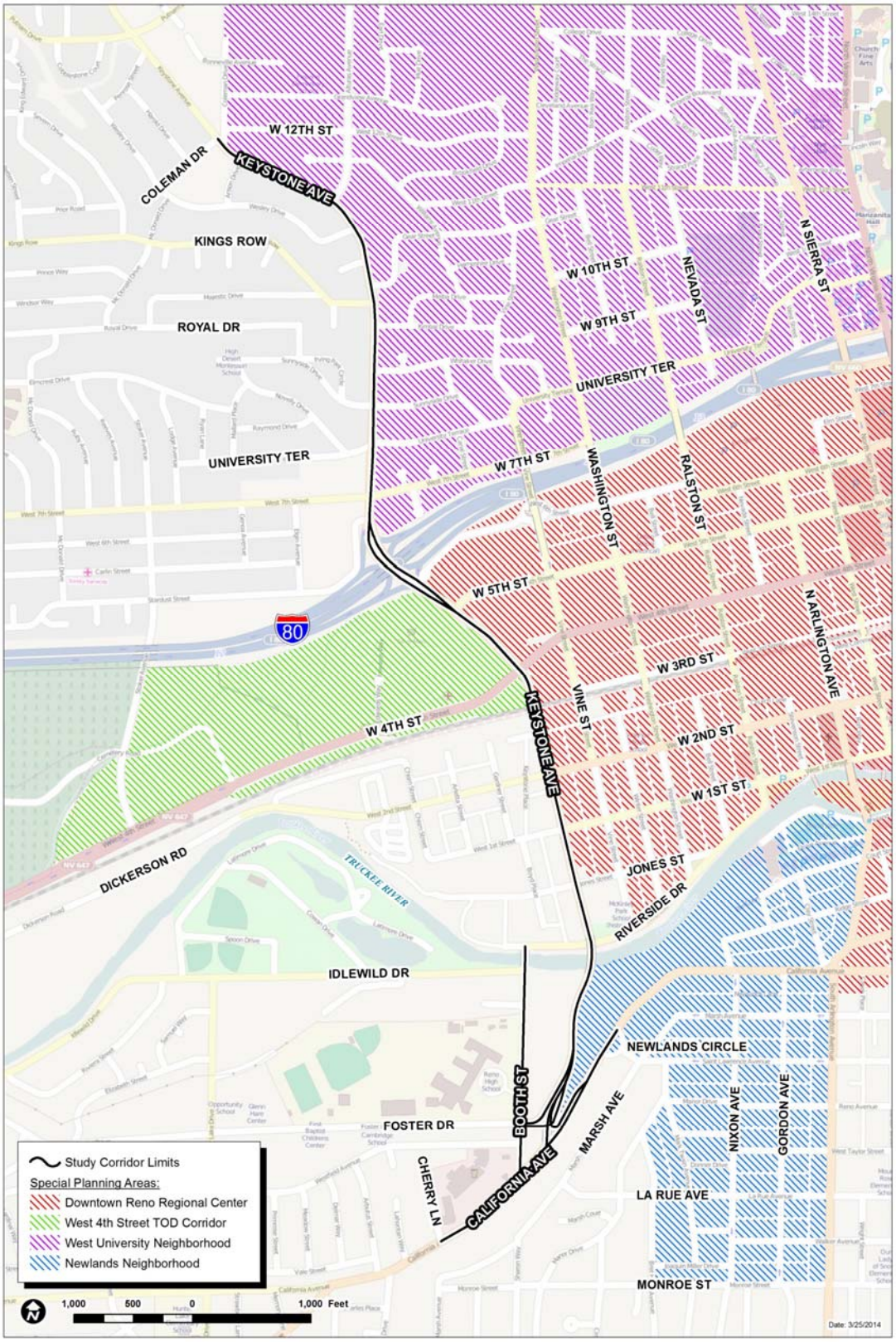


Figure 2-15: Special Planning Areas



2.10. Safety Analysis

This section summarizes the crash history along the corridor. Crash rates for the study segments and intersections were calculated and compared to typical crash rates for similar facilities around the State (when available). This section also explains the trends that emerged from the safety analysis and suggests potential improvements to increase safety for corridor users.

Crash data for the three-year period from June 2010 to June 2013 was obtained from NDOT. The safety analysis evaluated the crash data for the segments and the intersections separately; findings from each analysis are reported below for Keystone Avenue, California Avenue, and Booth Street respectively.

2.10.1. Keystone Avenue

2.10.1.1. Segment Analysis: Keystone Avenue

Table 2-18 summarizes the crashes along Keystone Avenue for the three-year study period by the crash type, crash severity, crash year, and crash cause. Within the three-year study period, there were 112 total crashes: 70 were property damage only (PDO) crashes and 42 were injury crashes; there were no fatal crashes during this period. Of the 112 crashes, the predominant type of crash was "angle" (43) and the second most common type of crash was "rear-end" (27).

Crash rates in Table 2-18 were calculated as the number of crashes experienced per million vehicle miles traveled (VMT). The total crash rate for the year 2010 – 2011 was 3.31 crashes per million VMT. The crash rate for the year 2011 – 2012 decreased to 2.81, but increased slightly to 3.03 for the year 2012 – 2013. Keystone Avenue, an urban minor arterial, had an average crash rate of 3.05 for the three-year study period; this is higher than the average crash rate for all urban minor arterials (2.41 crashes per million VMT) in the State.

Table 2-18: Summary of Crashes on Keystone Avenue by Crash Type, Severity, Year, and Crash Rate

Crash Type	Year	PDO Crashes	PDO Crash Rate	Injury Crashes	Injury Crash Rate	Fatal Crashes	Fatal Crash Rate	Total Crashes	Total Crash Rate
Angle	2010 - 2011	12	0.95	6	0.47	0	0.00	18	1.42
	2011 - 2012	4	0.33	7	0.58	0	0.00	11	0.91
	2012 - 2013	10	0.84	4	0.34	0	0.00	14	1.18
Head-on	2010 - 2011	0	0.00	1	0.08	0	0.00	1	0.08
	2011 - 2012	0	0.00	1	0.08	0	0.00	1	0.08
	2012 - 2013	0	0.00	0	0.00	0	0.00	0	0.00
Non-collision	2010 - 2011	1	0.08	3	0.24	0	0.00	4	0.32
	2011 - 2012	4	0.33	1	0.08	0	0.00	5	0.41
	2012 - 2013	5	0.42	3	0.25	0	0.00	8	0.67
Rear-end	2010 - 2011	5	0.39	8	0.63	0	0.00	13	1.03
	2011 - 2012	4	0.33	4	0.33	0	0.00	8	0.66
	2012 - 2013	4	0.34	2	0.17	0	0.00	6	0.50
Rear-to-rear	2010 - 2011	0	0.00	0	0.00	0	0.00	0	0.00
	2011 - 2012	1	0.08	0	0.00	0	0.00	1	0.08
	2012 - 2013	1	0.08	0	0.00	0	0.00	1	0.08
Sideswipe, Meeting	2010 - 2011	2	0.16	0	0.00	0	0.00	2	0.16
	2011 - 2012	4	0.33	0	0.00	0	0.00	4	0.33
	2012 - 2013	3	0.25	0	0.00	0	0.00	3	0.25
Sideswipe, Overtaking	2010 - 2011	4	0.32	0	0.00	0	0.00	4	0.32
	2011 - 2012	3	0.25	0	0.00	0	0.00	3	0.25
	2012 - 2013	3	0.25	0	0.00	0	0.00	3	0.25
Unknown	2010 - 2011	0	0.00	0	0.00	0	0.00	0	0.00
	2011 - 2012	0	0.00	1	0.08	0	0.00	1	0.08
	2012 - 2013	0	0.00	1	0.08	0	0.00	1	0.08
Total Crashes	**2010 - 2011**	**24**	**1.89**	**18**	**1.42**	**0**	**0.00**	**42**	**3.31**
	2011 - 2012	**20**	**1.65**	**14**	**1.16**	**0**	**0.00**	**34**	**2.81**
	2012 - 2013	**26**	**2.19**	**10**	**0.84**	**0**	**0.00**	**36**	**3.03**
Total Crashes (Total for three years)		**70**		**42**		**0**		**112**	

Table 2-19 summarizes the crashes along Keystone Avenue for the three-year study period by crash severity and the mode of travel. Automobiles were exclusively involved in a total of 101 crashes (68 PDO and 33 injury). The vulnerable modes (pedestrian, bicycle, moped, and motorcycle) were involved in a total of 11 crashes (two PDO and nine injury). Of the 11 crashes involving vulnerable modes, nine crashes involved an automobile and two crashes exclusively involved the vulnerable modes. As expected, when vulnerable road users are involved in a crash, it is more likely to result in injuries.

Table 2-19: Summary of Crashes on Keystone Avenue by Crash Severity and Mode of Travel

Mode of Travel	PDO Crashes	Injury Crashes	Fatal Crashes
Bicycle	1	5	0
Moped	0	1	0
Motorcycle	0	3	0
Pedestrian	1	0	0
Automobile	68	33	0

2.10.1.2. Intersection Analysis: Keystone Avenue

Figure 2-16, Figure 2-17 and Figure 2-18 show the total number of crashes that occurred at each of the study intersections over the three-year period. The figures also show the crash type and the crash severity at the intersections that had a relatively high number of crashes compared to the other intersections.

Crash rates were calculated for the study intersections as the number of crashes experienced per million vehicles entering the intersection. The field counts recorded at the intersections were used in calculating the number of vehicles entering the intersections.

Figure 2-19 compares the crash rates of the intersections along Keystone Avenue. The top three intersections with the highest crash rates are:

- Keystone Avenue and 4th Street: 36 crashes at a rate of 0.9 crashes per million entering vehicles (MEV).
- Keystone Avenue and W. 7th Street: 28 crashes at a rate of 0.74 crashes per MEV.
- Keystone Avenue and 2nd Street: 18 crashes at a rate of 0.6 crashes per MEV.

As seen in the figures, the crash types that were most common at the study intersections are rear-end and angle-type crashes. These crashes are typical crashes experienced at intersections. The data indicates that rear-end crashes are usually attributable to driver error and angle crashes are often attributable to drivers failing to yield or ignoring traffic signs and signals. Potential improvements to reduce these types of crashes are as follows:

- Conduct a speed zone study to ensure that the posted speed limit on Keystone Avenue is reasonable.

- Refine the signal timing coordination of the intersections to reduce the number of stops experienced along the corridor.
- Reevaluate the signal timing parameters – increase the yellow and all red intervals at the intersections where the incidence of angle crashes is very high.
- Eliminate the permitted left turn movements at the signalized intersections where appropriate.
- Increase enforcement to ensure traffic signs and signals are not disregarded.
- Eliminate and/or consolidate driveways near intersections where possible.
- Install raised medians at major cross street intersections to eliminate left-turn conflicts at driveways.

Figure 2-16: Intersection Crashes - Trend Map 1 (I-80 to Coleman Drive)

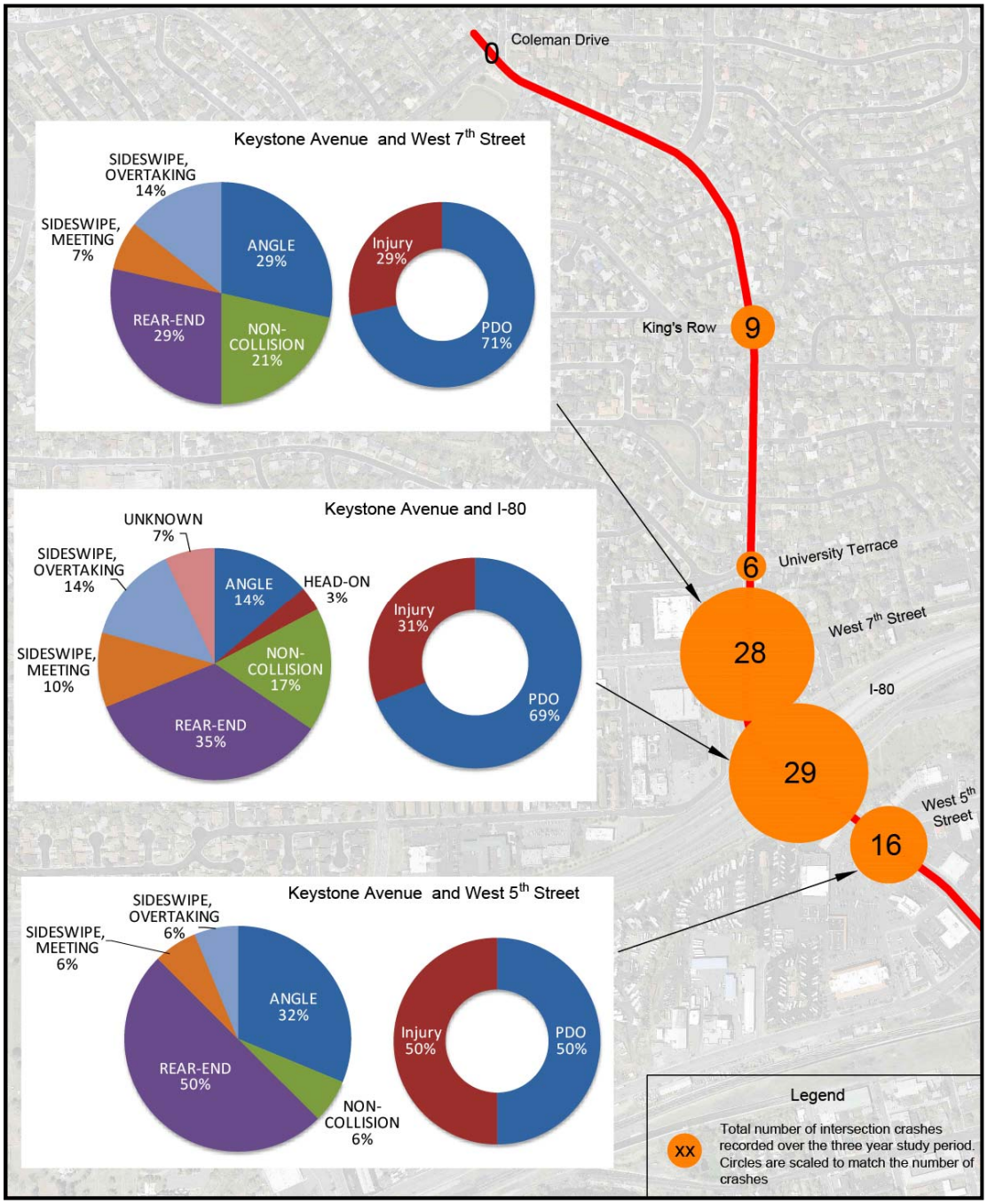


Figure 2-17: Intersection Crashes - Trend Map 2 (Jones Street to 5th Street)

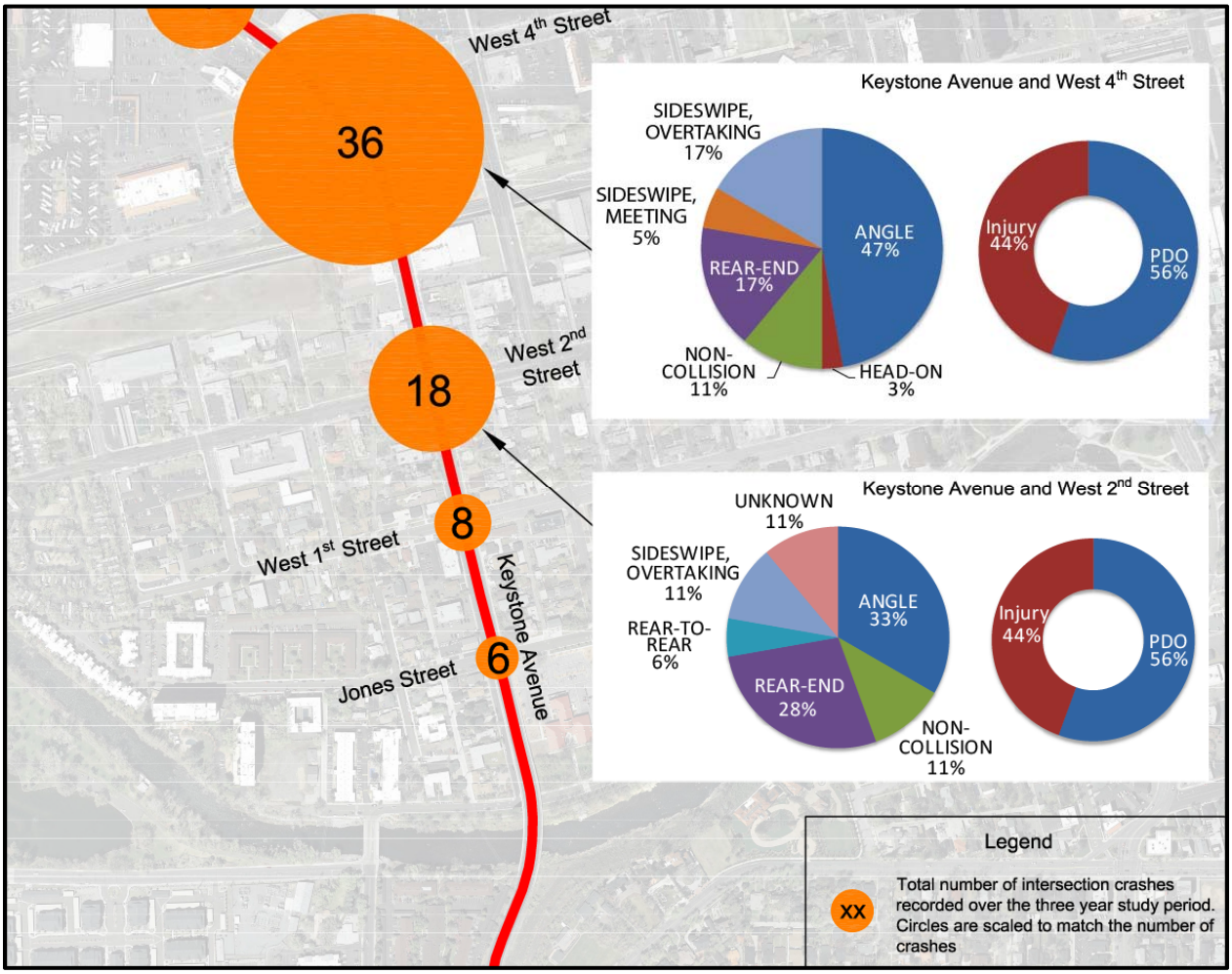


Figure 2-18: Intersection Crashes – Trend Map 3 (California Ave. to Jones Street)

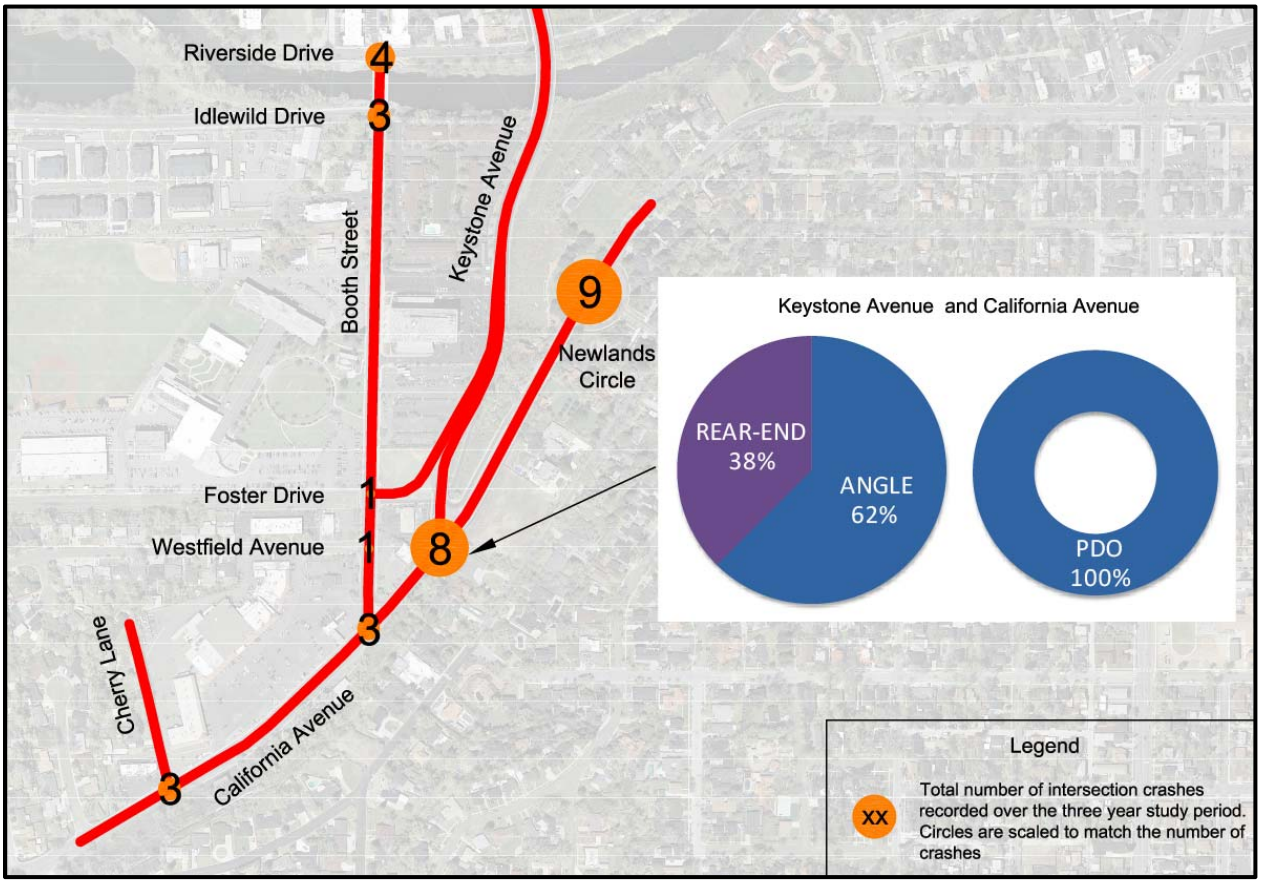
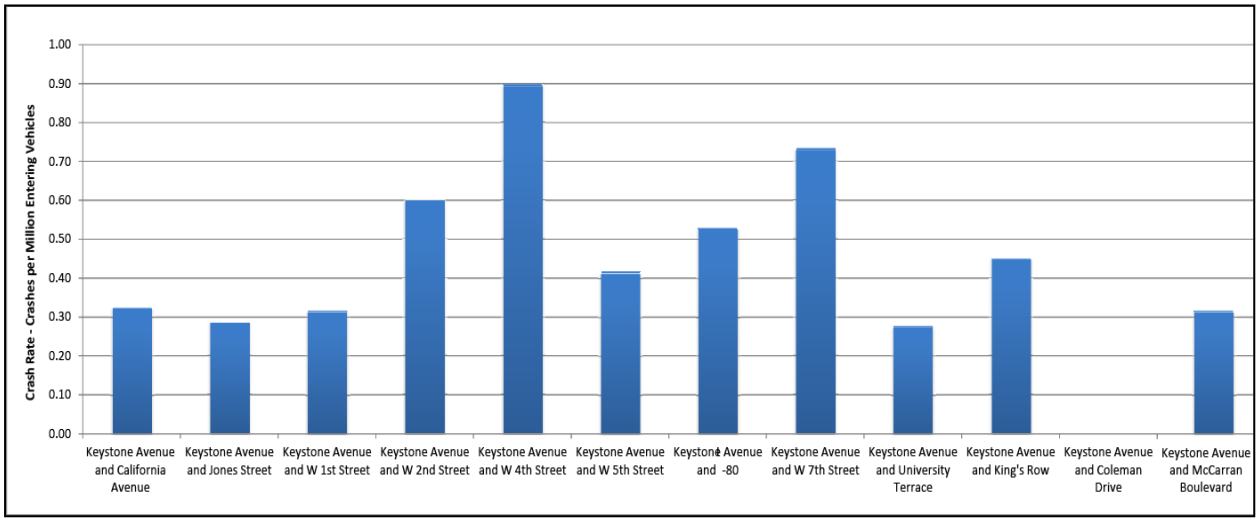


Figure 2-19: Crash Rates for the Intersections along Keystone Avenue



2.10.2. California Avenue

2.10.2.1. Segment Analysis: California Avenue

Table 2-20 summarizes the crashes along California Avenue for the three-year period by the crash type, crash severity, crash year, and crash cause. Within the three-year period, there were 15 total crashes: nine were PDO crashes and six were injury crashes; there were no fatal crashes during this period. Of the 15 crashes, the predominant type of crash was "rear-end" (11).

Table 2-20 shows the crash data by year and provides the crash rates. The total crash rate for the year 2010 – 2011 was 2.38 crashes per million VMT. The crash rate for the year 2011 – 2012 increased to 4.57, but dropped to 2.62 for the year 2012 – 2013. California Avenue, an urban minor arterial, had an average crash rate of 3.19 for the three-year period. This is higher than the average crash rate for all urban minor arterials (2.41 crashes per million VMT) in the State.

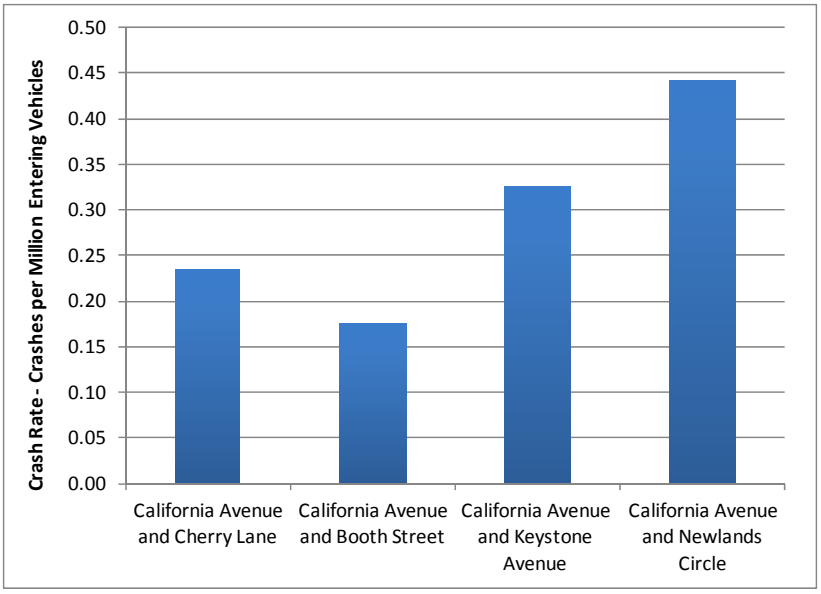
Table 2-20: Summary of Crashes on California Avenue by Crash Type, Severity, Year and Crash Rate

Crash Type	Year	PDO Crashes	PDO Crash Rate	Injury Crashes	Injury Crash Rate	Fatal Crashes	Fatal Crash Rate	Total Crashes	Total Crash Rate
Angle	2010 - 2011	0	0.00	0	0.00	0	0.00	0	0.00
	2011 - 2012	1	0.65	0	0.00	0	0.00	1	0.65
	2012 - 2013	1	0.66	0	0.00	0	0.00	1	0.66
Head-on	2010 - 2011	0	0.00	0	0.00	0	0.00	0	0.00
	2011 - 2012	0	0.00	1	0.65	0	0.00	1	0.65
	2012 - 2013	0	0.00	0	0.00	0	0.00	0	0.00
Non-collision	2010 - 2011	0	0.00	0	0.00	0	0.00	0	0.00
	2011 - 2012	0	0.00	0	0.00	0	0.00	0	0.00
	2012 - 2013	0	0.00	0	0.00	0	0.00	0	0.00
Rear-end	2010 - 2011	2	1.19	1	0.60	0	0.00	3	1.79
	2011 - 2012	4	2.61	1	0.65	0	0.00	5	3.26
	2012 - 2013	0	0.00	3	1.97	0	0.00	3	1.97
Rear-to-rear	2010 - 2011	0	0.00	0	0.00	0	0.00	0	0.00
	2011 - 2012	0	0.00	0	0.00	0	0.00	0	0.00
	2012 - 2013	0	0.00	0	0.00	0	0.00	0	0.00
Sideswipe, Meeting	2010 - 2011	1	0.60	0	0.00	0	0.00	1	0.60
	2011 - 2012	0	0.00	0	0.00	0	0.00	0	0.00
	2012 - 2013	0	0.00	0	0.00	0	0.00	0	0.00
Sideswipe, Overtaking	2010 - 2011	0	0.00	0	0.00	0	0.00	0	0.00
	2011 - 2012	0	0.00	0	0.00	0	0.00	0	0.00
	2012 - 2013	0	0.00	0	0.00	0	0.00	0	0.00
Unknown	2010 - 2011	0	0.00	0	0.00	0	0.00	0	0.00
	2011 - 2012	0	0.00	0	0.00	0	0.00	0	0.00
	2012 - 2013	0	0.00	0	0.00	0	0.00	0	0.00
Total Crashes	**2010 - 2011**	**3**	**1.79**	**1**	**0.60**	**0**	**0.00**	**4**	**2.38**
	2011 - 2012	**5**	**3.26**	**2**	**1.30**	**0**	**0.00**	**7**	**4.57**
	2012 - 2013	**1**	**0.66**	**3**	**1.97**	**0**	**0.00**	**4**	**2.62**
Total Crashes (Total for three years)		**9**		**6**		**0**		**15**	

2.10.2.2. Intersection Analysis: California Avenue

Figure 2-18 shows the total number of crashes that occurred at each of the study intersections over the three-year period. The crash types that were most common were rear-end and angle crashes. Figure 2-20 compares the crash rates of the intersections along California Avenue.

Figure 2-20: Crash Rates for the Intersections along California Avenue



The intersection of California Avenue and Newlands Circle has the highest crash rate among all the study intersections along California Avenue, with nine crashes in the three-year period. Of these nine crashes, eight crashes were rear-end crashes and of these eight crashes, six crashes involved a vehicle rear-ending a slowing/stopped vehicle.

2.10.3. Booth Street

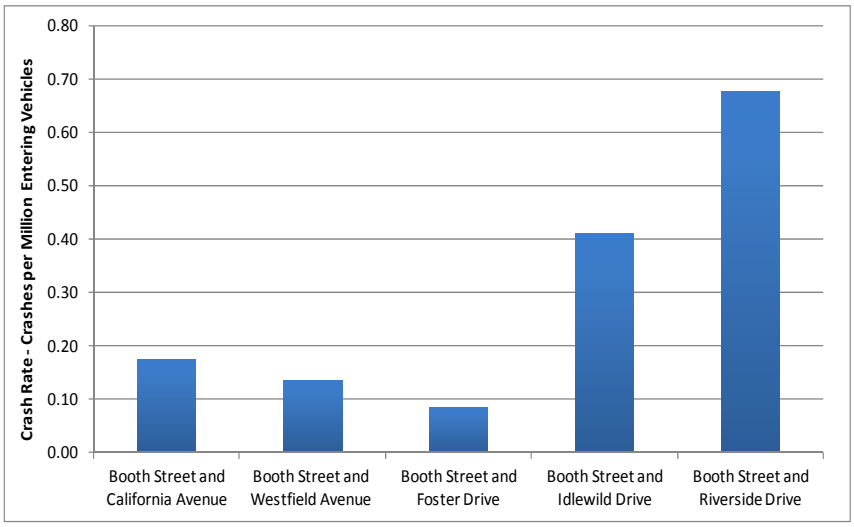
2.10.3.1. Segment Analysis: Booth Street

Within the three-year period, there were only two crashes along Booth Street; both were PDO crashes. The total crash rate for the year 2010 – 2011 was 5.08 crashes per million VMT. There were no crashes in the year 2011 – 2012 and the year 2012 – 2013.

2.10.3.2. Intersection Analysis: Booth Street

Figure 2-18 shows the total number of crashes that occurred at each of the study intersections over the three-year period. Figure 2-21 compares the crash rates of the intersections along Booth Street.

Figure 2-21: Crash Rates for the Intersections along Booth Street



2.10.4. Road Safety Audits

As described in Section 2.1, two separate RSAs were conducted for Keystone Avenue (Appendix B). The first one, conducted in 2012, covered California Avenue to 4th Street. The second one, conducted in 2014, covered 4th Street to North McCarran Boulevard.[7]

A summary of the crash data from the first RSA (California Avenue to 4th Street) is as follows:

- There were 54 total crashes during the three-year time-period of July 2008 to June 2011. There were 15 injury crashes and no fatalities. The overall crash rate was 3.70, which is higher than the year 2010 overall crash rate for the same functional class, and met the high crash location criteria.
- The predominant crash type was rear-end (26).
- Keystone Avenue / 4th Street intersection met the high crash location criteria with 45 intersection crashes within the same three-year time-period.

A summary of the crash data from the second RSA (4th Street to McCarran Boulevard) is as follows:

- There were 95 total crashes during the three-year time-period of June 2010 to June 2013. There were 38 injury crashes and no fatalities. The overall crash rate was 1.92, which is lower than the year 2011 overall crash rate for the same functional class.
- The predominant crash types were angle (37) and rear-end (24).
- Keystone Avenue/4th Street intersection once again met the high crash location criteria with 32 intersection crashes; however, this is significantly lower than the 45 crashes that occurred in the previous three-year period evaluated in the first RSA. The gas station on the southwest corner of the intersection has been closed since the first RSA; the decrease in the number of crashes are likely attributable to this closure.

[7] The northern limit of this corridor study is Coleman Drive; however, RSA recommendations for north of Coleman Drive (to McCarran Boulevard) are also included herein.

Following is a summary of the specific safety issues identified in the RSAs along with proposed recommendations.[8] These proposed recommendations from the RSAs are considered and included (as appropriate) as part of the proposed improvements of this corridor study.

- **Keystone Avenue / California Avenue:**
  - Issue: The intersection is confusing and not bike or pedestrian friendly.
  - Recommendation: Perform a study to determine if another intersection type can improve the operations at the Keystone Avenue, Booth Street, and California Avenue intersections.[9]
- **Keystone Avenue / Jones Street:**
  - Issue: Keystone Avenue Bridge over the Truckee River has no bike lanes or sidewalks. Most users will stay on the west side of Keystone Avenue and go down to Riverside Drive via a southbound split on Keystone Avenue and then cross the river at Booth Street. There is signing on the east side of the Keystone Avenue (facing north) just north of the bridge that prohibits pedestrians and bicycles on the bridge. There is no signing to direct pedestrians and bicycles to use the west side split. Additionally, there is no signing on the west side of the bridge.
  - Recommendation: Upgrade the signing to direct pedestrians and bicycles to use Riverside Drive and Booth Street to cross the Truckee River.
- **Keystone Avenue / 1st Street:**
  - Issue: There is a utility pole anchor wire in the sidewalk on the southeast side that can be an issue to pedestrians during nighttime hours.
  - Recommendation: Coordinate with NV Energy to remove or add protection to the anchor wire.
- **Keystone Avenue / 2nd Street:**
  - Issue: The eastbound traffic signal pole on the southeast corner is no longer a standard pole and appears to have substandard vertical clearance to the traffic below, nor do the signal heads line up over the lanes.
  - Recommendation: Replace the eastbound traffic signal and the mast arm to a standard pole to the approved standards.
  - Issue: The pedestrian signal on the northwest corner for the southwest to northwest crossing is hidden behind a utility pole.
  - Recommendation: Adjust the signal head or recommend coordination with NV Energy to have the utility pole relocated to the west.
  - Issue: The driveway to the convenience store on the northeast corner has severe cracks and potholes which is a pedestrian tripping hazard.
  - Recommendation: Replace the driveway/sidewalk.

[8] Issues listed in the RSAs that are specific to ADA were summarized earlier in Section 2.3.1.
[9] Improvements to this intersection are a major component of this corridor study. See Section 5.

- **Keystone Avenue / 4th Street:**
  - Issue: The intersection meets the high crash criteria. There are driveways on the east and west legs that allow full movements that often cut around or through the queues stopped at the signal. This increases the chance of angle crashes.
  - Recommendation: Place median islands for the left-turn pockets on the east and west legs.
  - Issue: The driveway to McDonalds has access to 4th Street and Keystone Avenue. Vehicles cut through the parking lot on the northeast corner to avoid the queue at the 4th Street and Keystone Intersection.
  - Recommendation: Review the approach on 4th Street just east of Vine Street and determine if curb and gutter to remove the direct access can be added to discourage drivers from cutting the north east corner of 4th Street and Keystone Avenue.
- **Keystone Avenue California Avenue to 4th Street:**
  - Issue: The Keystone Avenue Bridge over the Truckee River is structurally deficient and does not accommodate pedestrians and bicyclists.
  - Recommendation: Coordinate with NDOT Bridge Design division in the event of bridge replacement to meet the need for all modes of traffic.
  - Issue: The segment meets the high crash criteria.
  - Recommendation: Review signal timing and progression along the segment.
  - Issue: The segment currently has on-street parking from 1st Street to 4th Street and no bicycle lanes. The route serves as a connection point for residential neighborhoods to commercials area of downtown Reno.
  - Recommendation: Consider a feasibility study to determine the need for bike lanes along the route.
- **Keystone Avenue 4th Street to 5th Street:**
  - Issue: High number of pedestrians cross at the midblock location in the area of McDonalds and Wells Fargo (approximately 300 feet north of 4th Street). This seemed to be a usual pedestrian pattern due to the area locations of businesses.
  - Recommendation: Perform a pedestrian study to determine the feasibility for a midblock pedestrian crossing. The crossing location could use the median island to direct pedestrians so they are facing traffic before entering the lanes on the opposite side. If warranted add a midblock Danish Offset pedestrian crossing between 4th Street and 5th Street.
  - Issue: The shoulder width for northbound Keystone Avenue drops considerably before the McDonalds driveway. The reduction has no warning and forces bicycles into the travel lane.
  - Recommendation: Add advance signing before the shoulder drop to warn bicyclists.
  - Issue: There are two back-to-back median openings between 4th Street and 5th Street to access businesses. The southbound opening crosses three lanes of traffic with the outside lane containing a higher volume due to direct access to I-80. All the properties that the medians serve also have access from either 4th Street and 5th Street both of which have signalized intersections with Keystone Avenue. The median openings have the potential to add to angle collisions on Keystone Avenue.
  - Recommendation: Consider access management standards for the median openings. Determine if the median openings can be combined or closed.

- **Keystone Avenue / I-80:**
  - Issue: The configuration of the SPUI at I-80 allow for high speed on-ramps due to the large radius of the curves. The pedestrian crossings on the on-ramps have to give extra caution in crossing the on-ramps.
  - Recommendation Reconfigure the on-ramps to allow for tighter radius and a slower entry speed and a separate right-turn lane approaching the ramps.
- **Keystone Avenue / W. 7th Street:**
  - Issue: The Starbucks at the southeast corner is creating a daily issue in the peak hours. The entrance to the Starbucks drive through is immediately on the driver's right when entering the driveway from W. 7th Street. The location of the menu and speaker only allows approximately three vehicles to queue before the driveway is blocked and cars begin to stack out onto W. 7th Street. The stacked cars on W. 7th Street then block traffic through the Keystone Avenue and W. 7th Street intersection.
  - Recommendation: Coordinate with Starbucks to consider closing off the W. 7th Street driveway and signing traffic to enter from Alvero Street to the east of Starbucks. This would allow for a longer queue for Starbucks without impeding traffic on W. 7th Street or Keystone Avenue.
  - Issue: The Starbucks entrance from Keystone Avenue has a "Do Not Enter" sign for the drive through. The direction of the sign may be misleading as to whether it is intended for the drive through or for the Keystone Avenue approach.
  - Recommendation: Contact Starbucks to move the sign to the opposite side of the drive through approach.

Starbucks Drive-Through

- **Keystone Avenue / University Terrace:**
  - Issue: The northbound outside lane width narrows down to approximately 9.5 feet approaching University Terrace to allow for a left turn pocket. The southbound lane narrows to 10 feet. The narrow lane width puts bicyclists out into the travel lane.
  - Recommendation: Add Share the Road signs approaching the University Terrace intersection from both directions.
- **Keystone Avenue / Wesley Street:**
  - Issue: There is a private driveway into a cluster of homes on the east side of the roadway across from Wesley Drive which also has a utility pole located on the south side of the driveway. Due to the location of the pole vehicles cannot make a right turn from the far right lane and therefore have to swing out into the inside lane to turn right into the driveway.
  - Recommendation: Coordinate with NV Energy to relocate the utility pole to allow for a better access radius into the driveway.

- **Keystone Avenue / Coleman Drive:**
  - Issue: Coleman Drive has an "All Way Stop" control with Keystone Avenue. There have not been any issues with this intersection.
  - Recommendation: Perform a feasibility study for a roundabout in the future should issues arise.
- **Keystone Avenue University Terrace to Coleman Drive:**
  - Issue: The segment is four lanes with no bike lanes or turn lanes. This is a residential area with driveways at each property. Vehicles either pull out or back out of driveways into the flow of traffic.
  - Recommendation: Consider reducing the number of general-purpose lanes from two in each direction to one in each direction and include bicycle lanes on each shoulder and a two-way-left-turn lane down the middle.
  - Issue: There is only a single marked pedestrian crossing between University Terrace and Coleman Drive located at the intersection of Kings Row. The crossing is not illuminated at night and on the east side of the crossing, the sidewalk ends approximately 25 feet short of the marked crossing. Pedestrians on the east side have to walk on the shoulder approaching the crossing location from either side due to landscaping or other yard features.
  - Recommendation: Remove the pedestrian crossing at Kings Row and Keystone Avenue and replace it with two separate crossings. The first crossing would be located on the south corner of Keystone Avenue and Kimbal Drive and the second crossing would be located at the north corner of Keystone Avenue and Gear Street. Review both locations to determine if e pedestrian activated flashers are warranted. Add all PROWAG features and lighting necessary for the new crossings.
- **Keystone Avenue Coleman Drive to McCarran Boulevard:**
  - Issue: There is a designated bike lane that begins just north of Peavine Road. The first 250 feet is located from the curb and gutter to the shoulder stripe, roughly five feet in width. This section was observed with parked vehicles in the bike lane.
  - Recommendation: Add No Parking signs to the first 250 feet of the bike lane north of Peavine Road.
  - Issue: The first traffic calming chicane north of Peavine Road blocks the northbound bike lane.
  - Recommendation: Reconfigure the chicane to allow for unimpeded bicycle flow through the traffic calming device.
  - Issue: There is no continuation of the bike lane south of Peavine Road, but there appears to be enough roadway width to have a bike lane striped for the northbound uphill section starting at Coleman Drive.
  - Recommendation: Add a bike lane on the northbound side and Share the Road signs for the southbound direction.
  - Issue: The pedestrian crossing at Putman Drive has school crossing signs that are not florescent yellow-green per the MUTCD. Also, the crossings are not lit at night.
  - Recommendation: Change the signs to yellow-green per the MUTCD. Add streetlights to the crossings.

- **Keystone Avenue / North McCarran Boulevard:**
  - Issue: A worm island to restrict left turn movements from Keystone Avenue onto North McCarran Boulevard was previously installed. The worm island does not extend beyond the left turn pocket median on North McCarran allowing for traffic from Keystone to proceed around the island and make the left turn onto North McCarran.
  - Recommendation: Coordinate with NDOT District II to extend the worm island in the east and west direction beyond the nose of the left turn islands.

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3. Future Traffic Volumes and Level of Service

3.1. Future (Year 2035) Traffic Volumes

Section 2.2 presented the existing traffic volumes along the corridor. This section presents the estimated future (year 2035) traffic volumes for the roadways identified in the corridor.

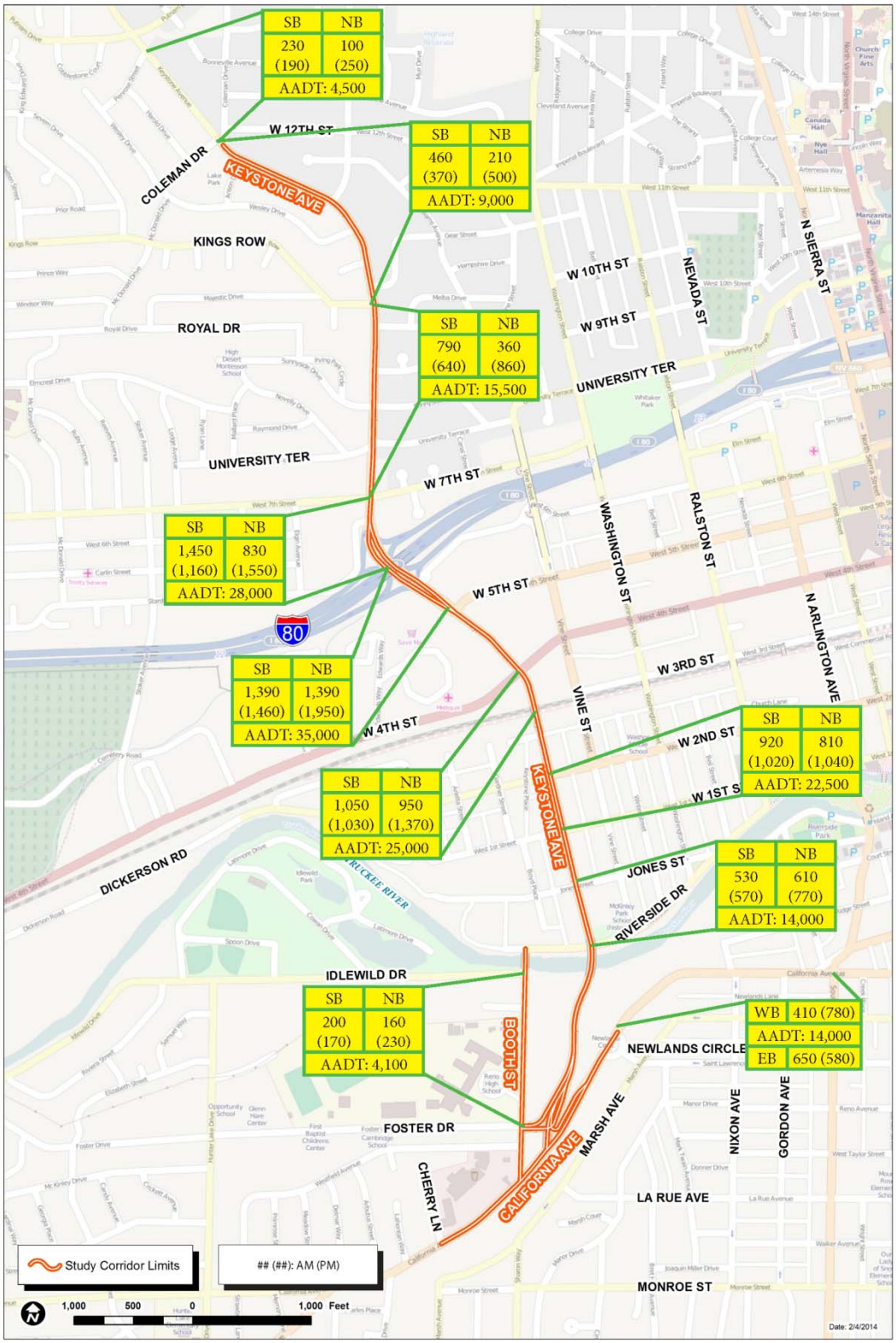
Year 2035 traffic volume forecasts along the corridor were developed from the RTC's regional travel demand models; the year 2010 and year 2035 models were used to obtain the forecasts. Traffic volume forecasts were developed per guidance in the NDOT Traffic Forecasting Guidelines. The year 2035 daily model volumes were obtained and post processed (adjusted) to improve their accuracy. The peak hour volumes were obtained from the adjusted daily volumes through the application of suitable peak hour and directional (K_{30} and D_{30}) factors.

In addition to the forecasts from the travel demand model, a second set of forecasts were developed by applying historical growth rates. For each of the NDOT count stations within the corridor, listed in Table 2-2, 20-year historical count data (AADT) was obtained. The historical average growth rate observed at each count station was calculated from the historical count data; subsequently, the representative average growth rate for each roadway (Keystone Avenue, California Avenue, and Booth Street) was also calculated. The calculated historical growth rates were applied to the existing peak hour and daily traffic volumes to obtain the future (year 2035) peak hour and daily traffic volumes. A nominal growth rate of 0.5% was used if the calculated growth rate was less than 0.5%.

The historical average growth rate observed at each count station was calculated from the historical count data; subsequently, the representative average growth rate for each roadway (Keystone Avenue, California Avenue, and Booth Street) was also calculated. In general, the calculated historical growth rates for the study area were found to be low (mostly less than 0.5%). To be conservative, a nominal growth rate of 0.5% was used if the calculated growth rate was less than 0.5%. These growth rates were applied to the existing peak hour and daily traffic volumes to obtain the future (year 2035) peak hour and daily traffic volumes.

The final future forecast were developed based on a subjective comparison of the forecasts developed using the model and the forecasts developed using the historical growth rates. For example, when the forecasts developed using the model were higher than the forecasts developed using the historical growth rates, the model forecasts were chosen. Alternatively, when the forecasts developed using the model were lower than the forecasts developed using the historical growth rates, the forecasts developed using the historical growth rates were chosen. The year 2035 forecast developed using this process is shown in Figure 3-1.

Figure 3-1: Future (Year 2035) Traffic Volumes



* Bi-directional volumes not available.

3.2. No-Action Year 2035 Level of Service Analysis

A year 2035 LOS analyses was completed for a No-Action scenario (i.e., without any improvements). The no-action analysis was completed following the methodology, assumptions, and criteria listed in Section 2.4.

3.2.1. Intersection Level of Service Analysis

An intersection LOS analysis was completed for all of the 18 study intersections. The results of the intersection LOS analysis are shown in Table 3-1; HCS analysis worksheets are provided in Appendix G. The following movements, approaches, and intersections operate unacceptably, worse than the desired LOS thresholds:

- The eastbound left movement of the Keystone Avenue and Kings Row unsignalized intersection is anticipated to operate at LOS F in the PM peak hour in the existing condition. Note that this movement has low volumes (23 vehicles/hour in the PM peak hour).
- The westbound approach of the Keystone Avenue and University Terrace unsignalized intersection is anticipated to operate at LOS F in the PM peak hour.
- The Keystone Avenue and I-80 (the SPUI) intersection is anticipated to operate at LOS F condition in the AM peak hour and at LOS E in the PM peak hour, worse than the desired LOS D threshold.
  - In the AM peak hour, the eastbound right, northbound through and the northbound right movements of this intersection operate at LOS F.
  - In the PM peak hour, the westbound left and the northbound right movements at this intersection operate at LOS F.
- The eastbound approach of the Keystone Avenue and Jones Street unsignalized intersection is anticipated to operate at LOS F in the AM and the PM peak hour.
- The southbound approach of the Booth Street and Riverside Drive unsignalized intersection is anticipated to operate at LOS F in the PM peak hour. Note that this movement has low volumes (eight vehicles/hour in the PM peak hour) and is proposed to be eliminated with the replacement of the Booth Street Bridge.

Table 3-1: Future Year (No-Action) Intersection LOS Analysis Results

Intersection (Traffic Control)	AM Peak Hour		PM Peak Hour	
	Control Delay (s/veh)	LOS	Control Delay (s/veh)	LOS
Keystone Avenue and Coleman Drive (Unsignalized)	26.2	D	28.3	D
Keystone Avenue and King's Row (Unsignalized)	25.0	C	186.7	F
Keystone Avenue and University Terrace (Unsignalized)	44.7	E	112.5	F
Keystone Avenue and West 7th Street (Signalized)	38.0	D	33.3	C
Keystone Avenue and I-80 SPUI Interchange (Signalized)	122.3	F*	62.5	E#
Keystone Avenue and West 5th Street (Signalized)	21.4	C	29.7	C
Keystone Avenue and West 4th Street (Signalized)	28.1	C	30.3	C
Keystone Avenue and West 2nd Street (Signalized)	14.0	B	18.5	B
Keystone Avenue and West 1st Street (Signalized)	7.7	A	9.5	A
Keystone Avenue and Jones Street (Unsignalized)	74.1	F	98.3	F
Keystone Avenue and California Avenue (Signalized)	18.9	B	17.9	B
Booth Street and California Avenue (Signalized)	21.4	C	18.1	B
Booth Street and Westfield Avenue (Unsignalized)	20.7	C	16.5	C
Booth Street and Foster Drive (Signalized)	9.2	A	6.4	A
Booth Street and Idlewild Drive (Unsignalized)	39.0	E	22.5	C
Booth Street and Riverside Drive (Unsignalized)	45.2	E	53.6	F
California Avenue and Cherry Lane (Unsignalized)	20.5	C	24.0	C
California and Newlands Circle (Unsignalized)	10.7	B	9.5	A

Note: Delay and LOS reported for the worst movement/approach at unsignalized intersections.

**The Eastbound Right, the Northbound Through and the Northbound Right movements at this intersection operate at LOS F.*

 # The Westbound Left and the Northbound Right movement at this intersection operates at LOS F.

From Table 3-1, it can be seen that the increase in the peak hour volumes in the future year, compared to the existing conditions (presented in Section 2.4.1.1), results in a deterioration of traffic operational performance. The deterioration of performance in the future No-Action conditions is mostly within acceptable limits, except the following:

- Under existing conditions, at the Keystone Avenue and I-80 (the SPUI) intersection,
  - The northbound through and the northbound right movements operate acceptably at LOS D and LOS E respectively in the AM peak hour, whereas under future No-Action conditions, these movements operate unacceptably at LOS F in the AM peak hour.
  - The westbound left and the northbound right movements operate acceptably at LOS E and LOS C, respectively in the PM peak hour, whereas under future No-Action conditions, these movements operate unacceptably at LOS F in the PM peak hour.
- Under existing conditions, the eastbound approach of the Keystone Avenue and Jones Street unsignalized intersection operates acceptably at LOS E in the AM peak hour, whereas under future No-Action conditions, this movement operates unacceptably at LOS F in the AM peak hour.
- Under existing conditions, the southbound approach of the Booth Street and Riverside Drive unsignalized intersection operates acceptably at LOS D in the PM peak hour, whereas under future No-Action conditions, this movement operates unacceptably at LOS F in the PM peak hour.

3.2.2. Urban Street Facility Level of Service Analysis

An urban street facility LOS analysis was completed for Keystone Avenue between 1st Street and W. 7th Street. Analysis results show that for the automobile mode, southbound Keystone Avenue as an urban street facility is anticipated to operate at LOS E both in the AM and in PM peak hour of analysis, whereas northbound Keystone Avenue operates at LOS F both in the AM and in PM peak hour of analysis. This is worse than the desired LOS D threshold. The LOS results for the northbound direction of travel for the future No-Action condition is worse than that of the existing conditions.

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4. Summary of Deficiencies and Potential Opportunities

Two distinct segments consistent with the land use characteristics divide the corridor. South of W. 7th Street is referred to as the southern segment and includes Booth Street and California Avenue. Keystone Avenue north of W. 7th Street is referred to as the northern segment. Building upon the existing conditions analysis, stakeholder, and public comments, Table 4-1 and Table 4-2 provide a summary of issues for both the southern segment and the northern segment respectively. Identified are opportunities (potential improvements) for each issue. This information serves as the basis for developing improvement alternatives (Section 5).

Table 4-1: Summary of Issues – Southern Segment

Street	Location	Issues	Opportunities
California	Keystone	Incomplete bike lanes through intersection	Include full bike facilities with any new intersection design.
			Reduce the number of lanes and include a combination of bike lanes and sharrows.
			Install sharrows for immediate benefit.
			Install sharrows with green lane for immediate benefit.
California	Keystone	Poor pedestrian routing and circulation	Add signing to avoid south sidewalk dead end.
			Consider ramping at Foster overpass in lieu of existing stairs.
			Include full pedestrian facilities with any new intersection design.
California	Keystone	Dysfunctional signalized modified T-intersection	Analyze potential signal timing improvements.
			Identify ultimate intersection configurations.
California	Keystone	Insufficient turn bay storage for the SBR movement	Address with new intersection design.
California	Cherry to Booth	Numerous residential and commercial curb cuts on the south side with deteriorated concrete (not ADA compliant)	Consolidate driveways where possible and include sidewalk replacement with future improvements.
California	Cherry	No shelter at the bus stop	Evaluate adding a shelter if right-of-way permits.
California	Cherry to Newlands	Crash rate is higher (3.19) than statewide averages (2.41)	Propose safety improvements with a focus on the Keystone and Newlands intersection. Incorporate safety features into new Keystone intersection design. Improve pedestrian crossing at Newlands.
			Install pedestrian actuated flasher at Newlands Circle.

Street	Location	Issues	Opportunities
Booth	California to Idlewild	Numerous driveways, some with little corner clearance, and entries/exits not clearly defined	Consider consolidating driveways where possible. Improve signing / striping with future improvements.
Booth	Foster	Misaligned intersection	Include restriping in next pavement rehab or slurry seal to improve alignment.
Booth	Foster	No shelter at the bus stop	Evaluate adding a shelter if right-of-way permits.
Booth	California	Numerous commercial driveways	Consolidate driveways and reduce driveway entrances to standard widths.
Booth	California	Insufficient turn bay storage for the SBL movement	Evaluate refined signal timing.
			Extend turn bay striping in next pavement rehab or slurry seal improvement project.
Booth	Idlewild	No shelter or bench at the bus stop	Add bench. Evaluate adding a shelter if right-of-way permits.
Booth	Truckee River	TRFCP proposing to replace Booth St bridge with a pedestrian / bike only bridge	Analyze impacts to surrounding street network and identify improvements as needed.
Riverside	Booth	TRFCP proposing to reduce Riverside to one-way with bike / pedestrian park	Analyze impacts to surrounding street network and identify improvements as needed.
Keystone	Foster	Aging structure over Foster Drive	Consider replacement with any replacement of the Keystone bridge over the Truckee River.
Keystone	Truckee River	Aging structure with low sufficiency rating	Initiate conceptual plan for replacement with NDOT.
Keystone	Truckee River	No bicycle or pedestrian facilities on the bridge or approaches	Improve bike / pedestrian signage to direct users to Booth Street bridge
			Include bike / pedestrian facilities on any proposed bridge replacement.
Keystone	California to University	No bicycle facilities	Evaluate options for accommodating bicycles
Keystone	Jones to University	Numerous, closely spaced commercial driveways; a specific example is the back-to-back full median openings between 4th and 5th	Consider access management improvements such as driveway consolidation.
Keystone	Jones to University	Lack of bus turnouts and no shelters or benches at existing bus stops	Propose bus turnouts, shelters, and benches where right-of-way allows.
Keystone	4th to 5th	High number of pedestrians cross at the midblock locations near McDonalds and Wells Fargo	Evaluate feasibility of a midblock crossing at this location.

Street	Location	Issues	Opportunities
Keystone	2nd to 7th	Insufficient turn bay storage at intersections	Re-evaluate signal timing. Extend turn bays where feasible.
Keystone	1st to 7th	Operates at LOS E as an urban street facility for the automobile mode	Refine signal timing plans for better coordination.
Keystone	1st to 7th	Operates at LOS F for transit mode	Consider increasing the frequency with additional stops.
Keystone	2nd to 5th	Crash rate is higher (3.05) than statewide averages (2.41)	Propose safety improvements such as refining signal timing parameters, signal coordination, and eliminating permitted left turn movements.
Keystone	2nd and 4th	Intersection not ADA compliant	Coordinate ADA improvements with future projects at this location.
Keystone	2nd and 4th	Driveways spaced close to intersection on the cross street	Install raised left turn medians to block overlapping traffic movements.
Keystone	5th	Potential redevelopment project in NW corner	Evaluate potential traffic impacts and propose requirements.
Keystone	I-80	Ramp meter not effective	Coordinate with NDOT to reconsider use under current traffic conditions.
Keystone	I-80	Intersection operates a LOS E in the AM peak hour with EBR movement LOS F	Re-evaluate signal timing.
			Evaluate need for additional EBR turn lane.
Keystone	I-80	Higher speed ramp terminal unfriendly for pedestrian crossing and creates conflicts with close spacing to W. 7th St	Consider tighter radius ramp terminal movement for right turns (both on and off).
Keystone	I-80 to 7th	Exit ramp to WB 7th weave	Consider tighter radius ramp terminal to increase weave distance.
Keystone	7th	No WB right-turn lane and no protected left-turn phase for EB/WB traffic	Evaluate potential operational and safety issues and propose appropriate improvements.
Keystone	7th	Starbucks drive through in SE quadrant backs up onto W. 7th St and to the Keystone/W. 7th intersection	Coordinate with City of Reno to close the driveway closest to Keystone and allow traffic to enter from Alvero Street to the east of Starbucks

Table 4-2: Summary of Issues – Northern Segment

Street	Location	Issues	Opportunities
Keystone	University to Coleman	No bicycle facilities	Evaluate options for bike lane or shared bike facility
Keystone	University to Coleman	Numerous driveways create hazards when backing in/out residences	Incorporate buffer space in proposed Keystone roadway section if possible.
Keystone	University to Coleman	4-foot sidewalks with numerous obstructions and poor concrete condition	Consider sidewalk replacement and potentially wider sidewalks with Keystone improvements. Coordinate with NV Energy to see if pole relocations or undergrounding is feasible.
Keystone	University to Coleman	Speeding / safety concerns due to four lanes	Evaluate roadway cross-section options.
Keystone	University to Coleman	Bus service ends at Kings Row	Consider opportunities to extend service lines.
Keystone	University	Designated crosswalk often ignored by motorists; commercial driveways on the south side complicates the situation	Evaluate higher visibility pedestrian signal options. Evaluate additional pavement markings. Evaluate access management options.
Keystone	University to Coleman	Limited crosswalk options	Consider additional crosswalk locations.
Keystone	Kings Row	Crosswalk does not lead to a NB Keystone sidewalk	Extend Keystone sidewalk to Gear Street.
Keystone	Kings Row	Perceived safety issues	Complete stop warrant analysis. Evaluate safety and sight distance improvements.
Keystone	Coleman/12th	Perceived safety issues near 12th	Evaluate poor sight distance issue for 12th to Keystone movement, which may result in conflict with the northbound Coleman traffic that have turned right from Keystone
Keystone	Coleman to McCarran	No bike lanes between Coleman and Peavine and cars park in the NB bike lane within the first 250 feet north of Peavine Road	Add a NB bike lane between Coleman and Peavine, add no parking signs, add share the road signs for the southbound direction.
Keystone	McCarran	The median island to restrict left turn onto McCarran is being ignored	Extend the island in the east and west direction beyond the nose of the left turn island.

5. Alternatives Development and Evaluation

Several multimodal improvement alternatives along the corridor were considered, developed, and evaluated based on providing improvements to the summary of issues indentified through the public outreach process. Each alternative is described in this chapter by location.

5.1. Southern Segment

The southern segment of the corridor runs along Keystone Avenue between California Avenue and W. 7th Street. This segment is the urban portion of the corridor and includes the California / Keystone intersection, the intersection of 4th Street, and the interchange with Interstate 80. California Avenue, Foster Drive, and Booth Street are also included in the southern segment.

5.1.1. California Avenue / Keystone Avenue Intersection Alternatives

The Keystone Avenue and California Avenue intersection has repeatedly been identified as a priority location for potential improvements. Earlier sections of the report described the issues associated with this intersection; a brief listing of these follows:

- The intersection does not accommodate bicycles and pedestrians. Connectivity between California Avenue (east of Newlands Circle) and Booth Street / Keystone Avenue is poor/non-existent.
- The intersection does not have sidewalks and is not ADA compliant.
- The intersection skew creates sight distance issues and issues for large vehicles trying to maneuver through the turning movements.
- Storage for the southbound right-turn lane is inadequate.

Figure 5-1 shows the existing Keystone Avenue / California Avenue intersection. The evaluation included the entire area illustrated in the exhibit along with the four intersections listed below:

- California Avenue / Keystone Avenue
- California Avenue / Booth Street
- Booth Street / Foster Drive
- Booth Street /Westfield Avenue

Evaluating the four intersections as a system/network was necessary to improve the overall connectivity and efficiency for all modes and movements.

Figure 5-1: Existing California Avenue / Keystone Avenue Intersection

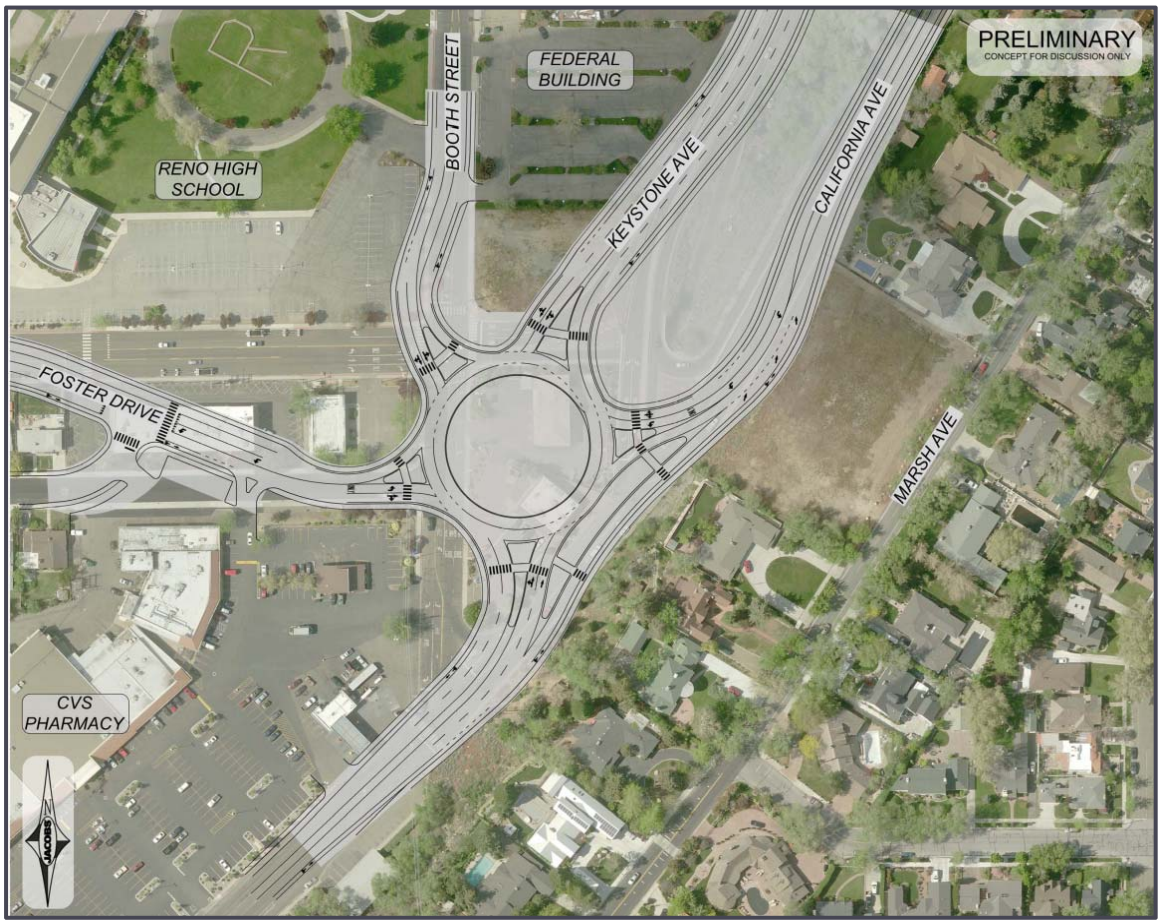
Six different alternatives (Alternatives A through G) were developed and evaluated. Figure 5-2 through Figure 5-8 illustrates each alternative. The alternatives were developed based on the following criteria:

- Improving safety
- Providing ADA compliant pedestrian access along all roadways
- Providing bicycle connectivity along California Avenue and Booth Streets
- Improving traffic circulation and connectivity
- Maintaining acceptable traffic operations

Alternative A, illustrated in Figure 5-2, eliminates all four existing intersections and replaces them with a large-footprint roundabout. An unsignalized T-intersection west of the roundabout provides the connection from Westfield Avenue. Features of Alternative A include:

- A single roundabout that serves all movements
- Sidewalks and bike lanes along all roadways
- Large amount of right-of-way acquisition
- Reconfiguration of commercial access
- Relocation of bus stop at Booth/Westfield
- Highest cost among the five alternatives

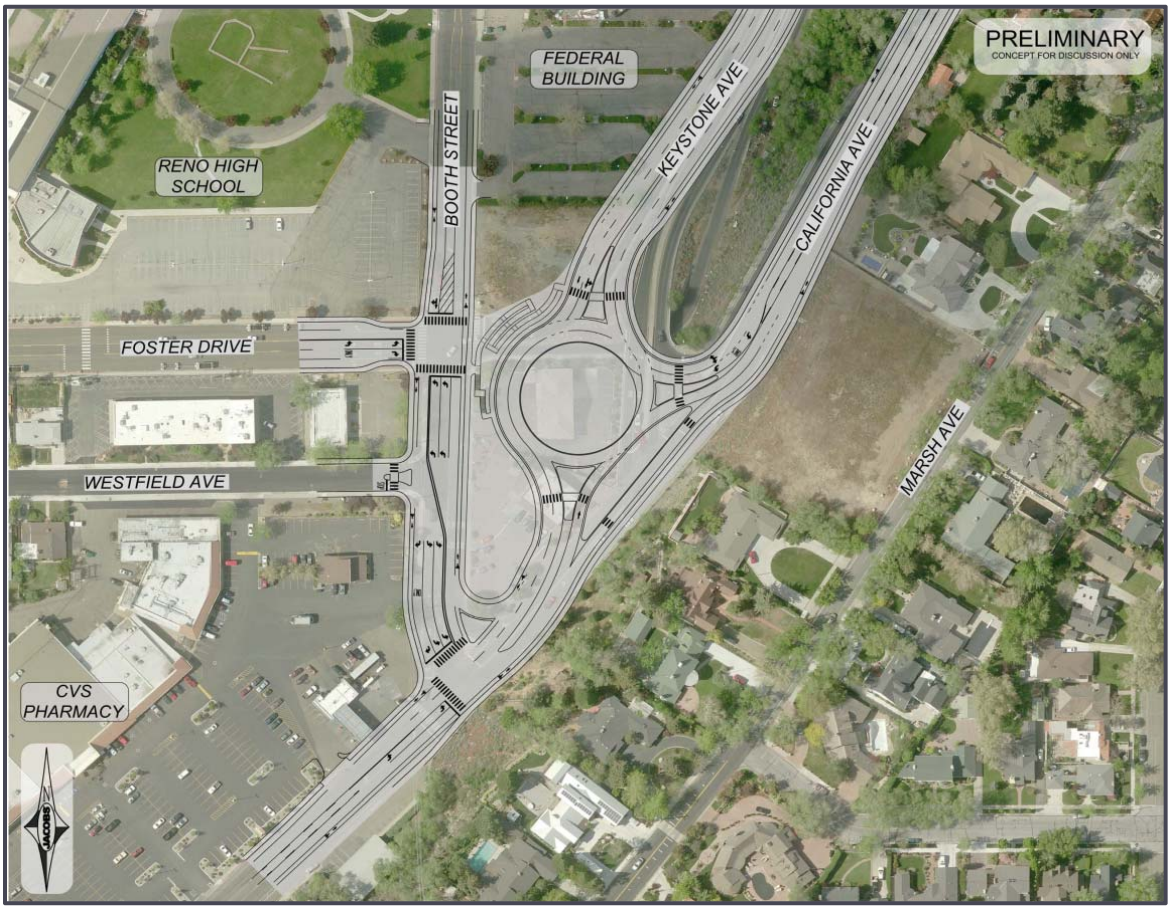
Figure 5-2: California/Keystone/Booth/Foster – Alternative A



Alternative B replaces the existing High-T style intersection at California Avenue / Keystone Avenue with a three-legged roundabout, and it eliminates the direct connection between Keystone Avenue and Foster Drive. One of the benefits of Alternative B is it maintains and prioritizes the major regional roadway network and better separates major traffic movements from Keystone and California Avenues from using the local street network. Features of Alternative B include:

- Sidewalks and bike lanes along all roadways
- Right-in/right-out at Westfield
- Right-of-way acquisition
- Separating pedestrians from Reno High School from the traffic using the major roads
- Mid to high cost compared to the other alternatives

Figure 5-3: California/Keystone/Booth/Foster – Alternative B



Alternatives C and D eliminate the Keystone / California intersection. Instead, Keystone Avenue connects directly to Booth Street at a four-legged signalized intersection (Alternative C), or a four-legged roundabout (Alternative D). Since the intersection layout is similar for each of these alternatives, their features have been combined. Alternative D operates better than Alternative C as the traffic is more free flowing through the roundabout resulting is less delay. Alternative C could better protect pedestrians because traffic is controlled by the signalized intersection more so than with a roundabout. This is particularly important due to the high number of pedestrians around Reno High School. Other features of both Alternatives C and D include:

- Sidewalks and bike lanes
- Right-in/right-out at Westfield
- May require right-of-way acquisition
- Could increase traffic volumes on Foster Drive
- Relocation of bus stop at Booth/Westfield

Figure 5-4: California/Keystone/Booth/Foster – Alternative C

Figure 5-5: California/Keystone/Booth/Foster – Alternative D

Alternative E retains a similar configuration to the existing intersection except that it modifies the California / Keystone intersection to a regular T intersection by improving the geometry and reducing the skew. Improvements have also been provided at the intersection of Booth Street and Foster Drive with increased turn pocket storage and better lane alignment as compared to the existing configuration. Features of Alternative E include:

- Sidewalks and bike lanes
- Allow larger vehicles to maneuver
- Reconstruction of the bridge over Foster Drive
- May require right-of-way acquisition
- Second highest cost of the alternatives

Figure 5-6: California/Keystone/Booth/Foster – Alternative E

Alternative F generally maintains the existing configuration of the California Avenue / Keystone Avenue and Booth Street / Foster Drive intersections in so far that it maintains the existing road alignments and connection points. Modifications include making the intersection at California Avenue / Keystone Avenue a regular T intersection with some improved geometry. This alternative does not meet all the needs of the evaluation criteria. It includes only limited improvements to bicycle and pedestrian facilities, and no improvements to turn pocket storage or large vehicle maneuverability. This alternative would provide some multimodal enhancements lacking along this short stretch of California Avenue. The features of Alternative F include:

- ADA improvements only to existing pedestrian facilities
- Some bike lane improvements in the uphill direction of California Avenue
- Limited new pedestrian facilities including ADA access and sidewalks in select locations
- Reducing the number of westbound lanes of California Avenue
- Slight increase in delay in the westbound direction
- Booth Street and Keystone Avenue signal optimization
- Lowest cost of the alternatives

Figure 5-7: California/Keystone/Booth/Foster – Alternative F

An alternative (Alternative G) representing the no-action alternative was also evaluated and presented. The only improvement provided was an ADA accessible ramp leading from California Avenue down to Foster Drive.

Traffic operations for each alternative were evaluated in Synchro software using year 2035 forecasted volumes. Analysis worksheets are included in Appendix G. Each alternative was evaluated as a system

(i.e., all four intersections in the evaluated area) to better differentiate the operational impacts. Table 5-1 shows LOS and delay for each intersection as well as network delay for overall comparison. As shown, each intersection operates at LOS D or better for each alternative. Based on the network delays, Alternative C clearly operates poorly compared to other alternatives. Network delay for the remaining alternatives is generally similar; although, Alternative A operates much better than the other alternatives especially during the AM peak hour. Alternative D has the least overall delay; however, when factors such as weave distance and pedestrian volumes are considered, Alternative A becomes the best alternative from a traffic operations standpoint.

Table 5-1: California/Keystone/Booth/Foster Traffic Operations Comparison

Alternatives	Intersection	AM Peak		PM Peak	
		HCM Delay	LOS	HCM Delay	LOS
Alternative A (Large single roundabout)	Keystone/California/Booth/Foster	14.5	B	26.0	D
	Foster/Westfield	15.6	C	13.5	B
	Network Total Delay	12		23	
Alternative B (California/Keystone roundabout)	Keystone/California	9.5	A	15.7	C
	Booth/California	13.9	B	13.7	B
	Booth/Foster	18.1	B	9.0	A
	Booth/Westfield	21.9	C	13.3	B
	Network Total Delay	23		23	
Alternative C (Keystone/Foster intersection)	Booth/California	14.4	B	18.2	B
	Keystone/Booth/Foster	29.6	C	31.1	C
	Booth/Westfield	11.9	B	12.5	B
	Network Total Delay	28		31	
Alternative D (Keystone/Foster roundabout)	Booth/California	14.4	B	18.2	B
	Keystone/Booth/Foster	18.0	C	9.8	A
	Booth/Westfield	11.9	B	12.5	B
	Network Total Delay	20		19	
Alternative E (Modified T intersection)	Keystone/California	18.3	B	19.2	B
	Booth/California	13.8	B	10.3	B
	Booth/Foster	10.6	B	8.8	A
	Booth/Westfield	13.9	B	13.3	B
	Network Total Delay	20		20	
Alternative F (Limited Improvements)	Keystone/California	18.1	B	19.2	B
	Booth/California	19.6	B	23.2	C
	Network Total Delay	22		26	

** Operations of Alternative G are the same as the existing conditions*

An evaluation matrix was created to rank the alternatives (Table 5-2). Evaluation criteria considered vehicular operations, pedestrian and bicycle facilities, right-of-way impacts, constructability, and cost. All of the proposed alternatives are ADA compliance; therefore, a separate criterion for ADA compliance was not established.

Table 5-2: California/Keystone/Booth/Foster Alternatives Evaluation Matrix

Alternative	Vehicular Operations	Bike Facilities	Pedestrian Facilities	Right-of-Way Impacts	Construct ability	Total Cost
A	◒	◒	◒	●	●	$$$$$
B	◒	◔	◔	◕	◒	$$$
C	◕	◔	◒	◒	◔	$$
D	◔	◒	◕	◒	◔	$$
E	◔	◔	◔	◒	◒	$$$
F	◒	◕	◕	None	◔	$

◔ - Excellent ◒ - Good ◕ - Fair ● - Poor $ - Least $$$$$ - Most

The evaluation matrix was shared with the TAC and SWG, and was presented at the public meetings as a guide to assist in determining preferred alternatives. The TAC, particularly due to cost and right-of-way impacts, eliminated Alternative A; however, the remaining alternatives for the intersection were carried forward for input from the SWG and the public.

5.1.2. Jones Street to University Terrace

The segment of Keystone Avenue from Jones Street to University Terrace was evaluated for safety, traffic operations, access management, pedestrian and bicycle facilities, and ADA compliance with the overall goal of providing better multimodal connectivity throughout the corridor. Earlier sections of the report described each issue along this segment. The major ones are as follows:

- There are no bicycle facilities.
- Numerous closely spaced commercial driveways do not meet access management standards.
- Traffic operations are poor with daily volumes reaching 30,000 ADT.
- The crash rates are high with the highest rate at 4th Street.
- There are ADA compliance issues at several locations.
- The segment includes a high-volume freeway interchange.

- The right-of-way is narrow for certain portions.
- There are parking requirements for residential properties.
- The width of the existing bridge over the Truckee River is too narrow for additional facilities.

The primary alternative for this segment focuses on improving north-south bicycle connectivity.

5.1.2.1. Keystone Avenue & Vine Street Bike Facilities

An analysis was completed to determine if bike lanes could be installed within the existing Keystone Avenue Corridor in order to improve bicycle connectivity. Given the overall safety and right-of-way challenges described along this segment of Keystone Avenue, alternatives bike routes were evaluated for other nearby roadway facilities.

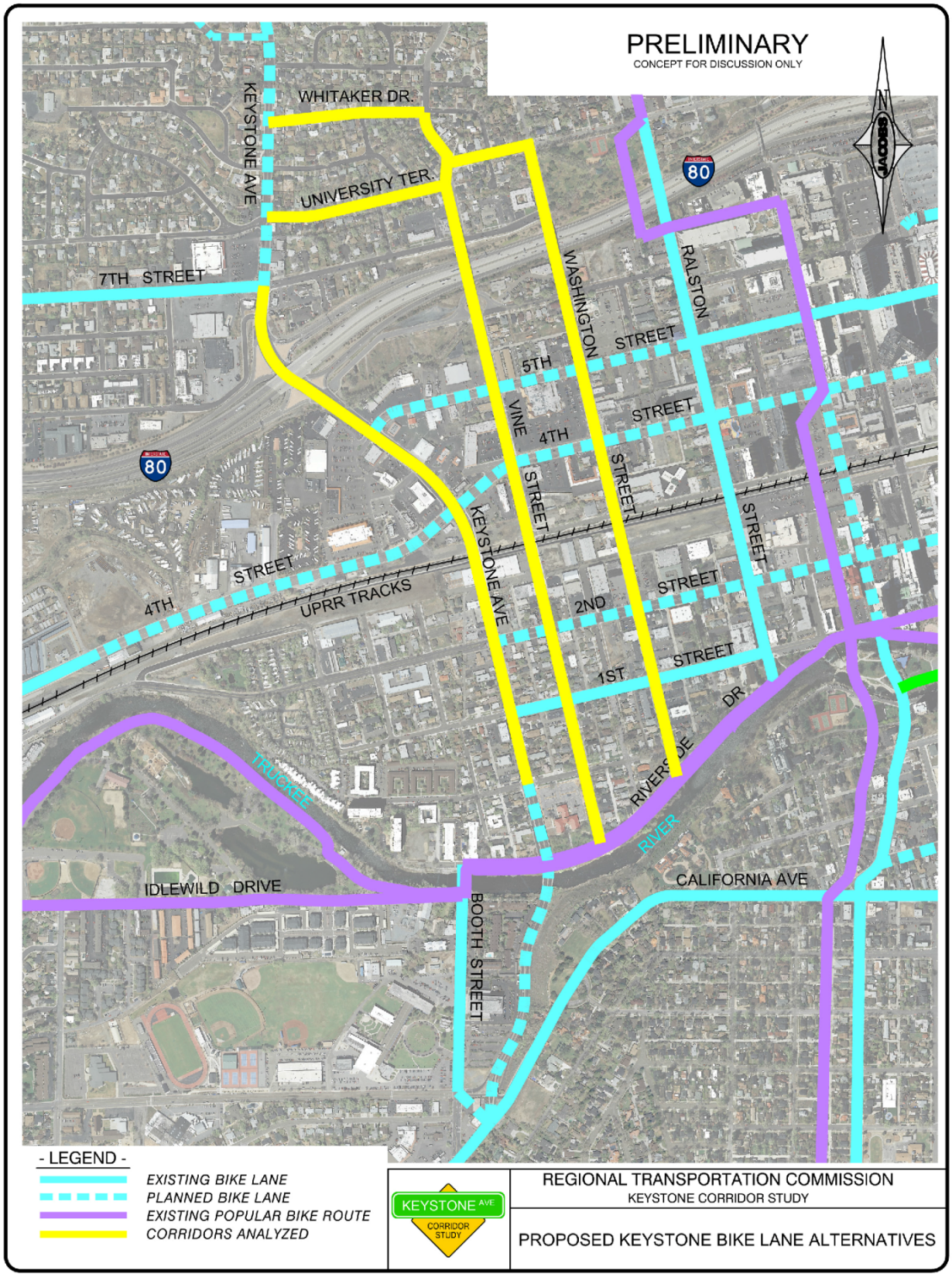

Vine Street at 2nd Street

These alternative facilities included Vine Street, Washington Street, and Ralston Street. These streets are similar in type in that they serve both residential and commercial areas, have less traffic than Keystone Avenue, and cross I-80 without a freeway interchange. Ralston Street was eliminated because it already serves as an existing bike route located too far from Keystone Avenue to provide improvement to the north-south connectivity. Vine Street, located one block east of Keystone Avenue, provides the same north-south connectivity as Keystone Avenue between Riverside Drive and Kings Row. Vine Street also provides access to many of the same shopping and commercial areas accessed from Keystone Avenue. Vine Street carries less traffic, has fewer driveways, and has more right-of-way for bike lanes or sharrows than does Keystone Avenue. Additionally, Vine Street does not go through a freeway interchange; a bridge that passes over the freeway separates Vine Street from Interstate 80. The bridge has sufficient width to accommodate a bike lane.

Washington Street provides only part of the connectivity provided by Vine Street. There are fewer direct connections between Keystone Avenue and Washington Street especially north of I-80 and fewer access points to the commercial areas. The intersection at 4th Street is a differentiating factor as well. Vine Street has a signalized intersection, while there is no signal at Washington Street; the intersection is uncontrolled. The signalized intersection provides a safer opportunity for less experienced cyclists to cross 4th Street.

The alignment alternatives are illustrated in Figure 5-8 along with adjacent existing and planned bike routes.

Figure 5-8: Proposed Vine Street Bicycle Facility



A bike facility along the entire length of Keystone is not feasible for the reasons mentioned previously necessitating the need for the Vine Street or other alternate facility; however, bicycle improvements can be made along select portions of Keystone Avenue. An alternative to alter the median islands and restripe Keystone Avenue between 4th Street and I-80 was developed, based on input from the SWG, and presented at the public meetings. This alternative is a way to provide better bicycle access to the commercial shopping areas. The alternative essentially reduces lane widths and reduces the existing median area to accommodate bike lanes and sidewalk improvements primarily within the existing right-of-way limits between 4th Street and 5th Street. This alternative is illustrated in Figure 5-9.

Figure 5-9: Keystone Roadway Section I-80 to 4th Street

The segment between 4th and 5th Streets was chosen due to the future incorporation of bike facilities along these corridors. In addition, Keystone Avenue south of 4th Street does not have adequate existing right-of-way to make striping or median island modifications for the additional width of a bike lane. The freeway interchange north of 5th Street has a similar lack of right-of-way and lack of width along the roadway to provide a facility without major reconstruction. The limited proposed bike lanes in this segment will require adequate signing directing cyclists to use Vine Street as the means to continue north or south along Keystone Avenue.

5.1.2.2. Access Management Improvements

Access management improvements are needed regardless of the proposed alternatives. Following the guidelines in the access management section of the RTP, changes to driveways and turn pocket spacing

were evaluated. The primary criteria used when determining which driveway access should be altered and which turn pockets should be eliminated included:

- Functional classification of the roadway
- Distances to adjacent intersections
- Distance between other driveways
- Alternative access locations
- Parking lot circulation
- Potential impacts to businesses or residences incurred by loss of parking or changes to access points

Keystone Avenue serves as the only access point for the majority of the properties along the corridor resulting in little to no opportunity to make access changes. There are numerous residential properties with separate driveways directly accessing Keystone Avenue where changes to eliminate or combine driveways cannot occur without affecting the property. This is particularly true for the properties between Jones and 4th Street and University Terrace to Coleman Drive. For these areas, access management alternatives were not considered and changes are not recommended. This restriction limits possible alternatives for access management to select areas of the corridor. Areas identified for access management improvements include:

Keystone Avenue near 4th Street

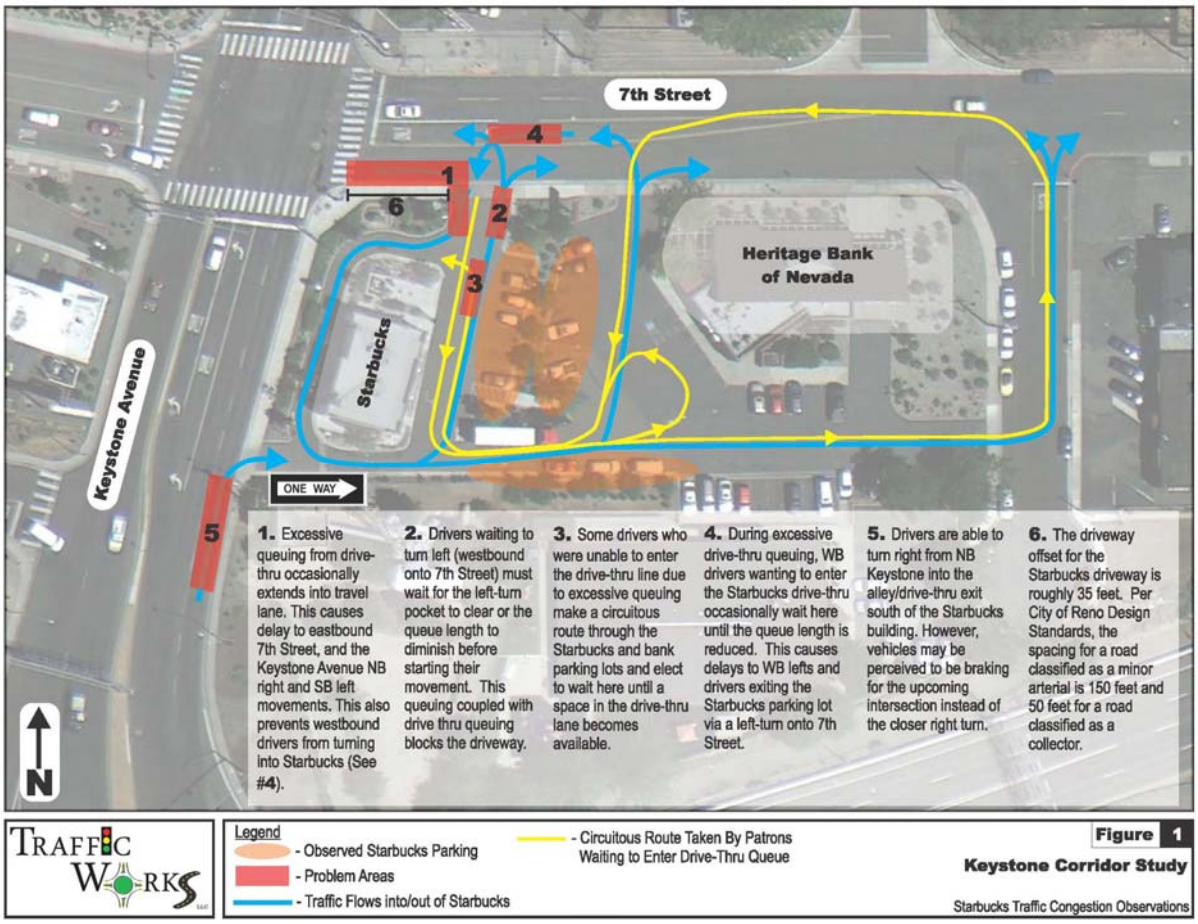
- Intersection of Keystone Avenue and W. 7th Street
- Keystone Avenue between 4th and 5th Streets
- Intersection of Keystone Avenue and California Avenue

A detailed summary of all driveways and driveway spacing throughout the corridor is included in Appendix I. Additional discussion regarding specific changes to access within the selected areas is located in Chapter 6.

5.1.3. Keystone Avenue / W. 7th Street

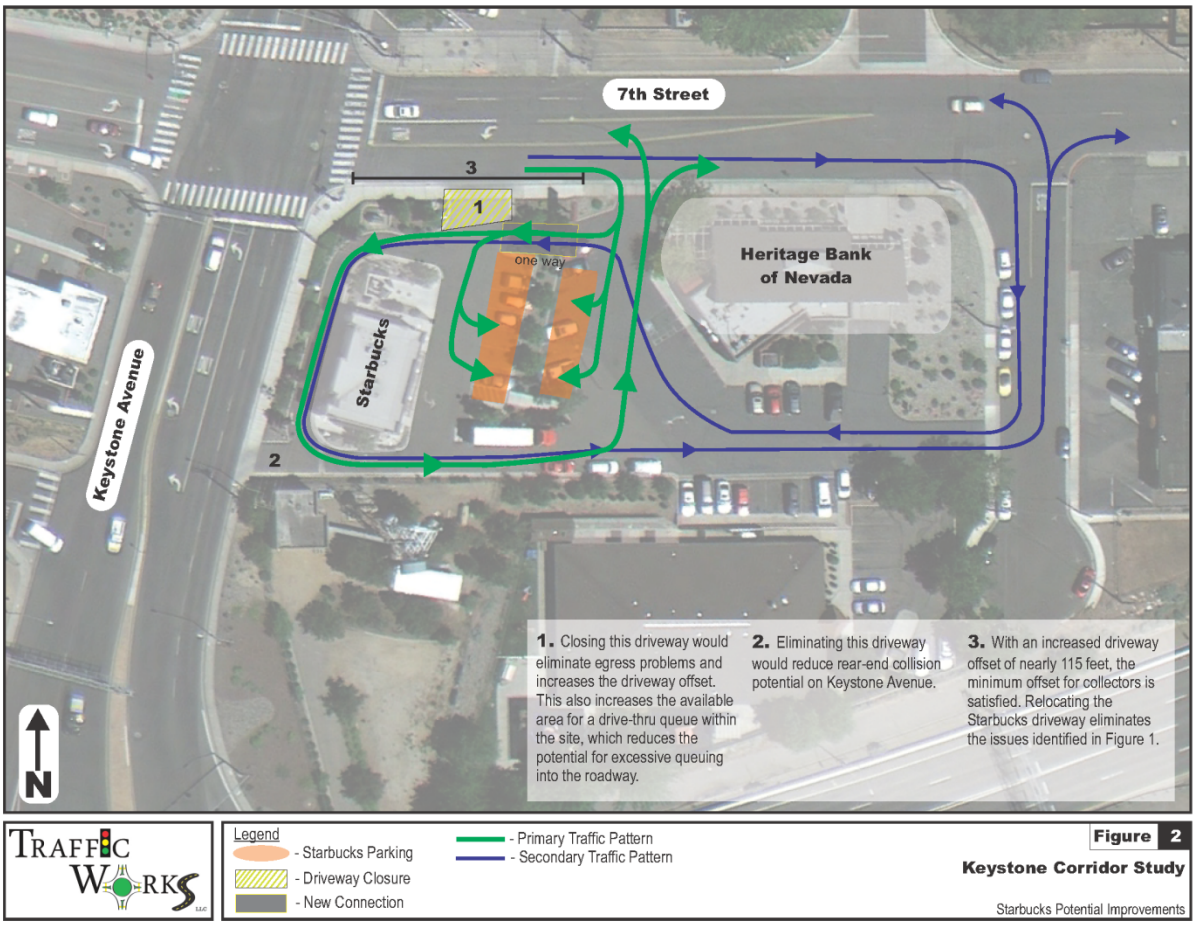
Poor drive-through operations at the Starbucks located on the southeast corner of Keystone Avenue / W. 7th Street affects traffic operation at the intersection. The main issue is the backing-up of drive-through vehicles on to W. 7th Street because of the closely spaced driveway access. Figure 5-10 illustrates the issue in detail and shows the existing traffic circulation through the site.

Figure 5-10: Issues at the Starbucks Drive-Through at Keystone/W. 7th



The City of Reno permitted the existing driveways in 2008. Further investigation led to the indication that Starbucks and Heritage Bank may have an agreement in place such that these businesses are allowed to share parking spaces; however, there remains an overall lack of parking at this location. The lack of parking for Starbucks and the adjacent businesses also contributes to the impacts of the intersection operation. Vehicles not able to find parking are circling the parking lot repeatedly until a space opens up. Figure 5-11 illustrates a potential alternative that could alleviate impacts to the intersection. his alternative would require closing the driveway nearest to the intersection forcing traffic to utilize the second driveway, farther to the east, as well as Alvero Street.

Figure 5-11: Potential Solution for the Starbucks Drive-Through Issue



Additional discussion regarding access to Starbucks and other adjacent businesses is located in Chapter 6.

5.2. Northern Segment

The northern segment of the Keystone Avenue corridor begins at W. 7th Street, runs through University Terrace and King Row, and ends at Coleman Drive. Also included in the northern segment is the section from Coleman Drive to McCarran Boulevard. Table 4-2 listed each issue identified along this segment. The major issue is pedestrian and bicyclist safety because of several factors, including:

- Lack of bicycle facilities
- Narrow sidewalks in poor condition with multiple obstructions directly adjacent to travel lanes
- Limited crosswalk options not connecting to sidewalks
- Poor sight distance
- Speeding due to the four-lane segment with low traffic volumes

These issues can be mitigated by developing several roadway section alternatives and other associated improvements.

5.2.1. Roadway Sections University Terrace to Coleman Drive

Five roadway section options developed for this segment include:

- "All users with Four-lanes"
- "Parking"
- "Partial Sharrow" (bike lane provided in uphill, northbound, direction only)
- "Super Sharrow" (Share the Road)
- "Complete Street" (three-lanes)

The five sections are illustrated in Figure 5-12 through Figure 5-16

Figure 5-12: University Terrace to Coleman: "All Users with Four-Lanes"

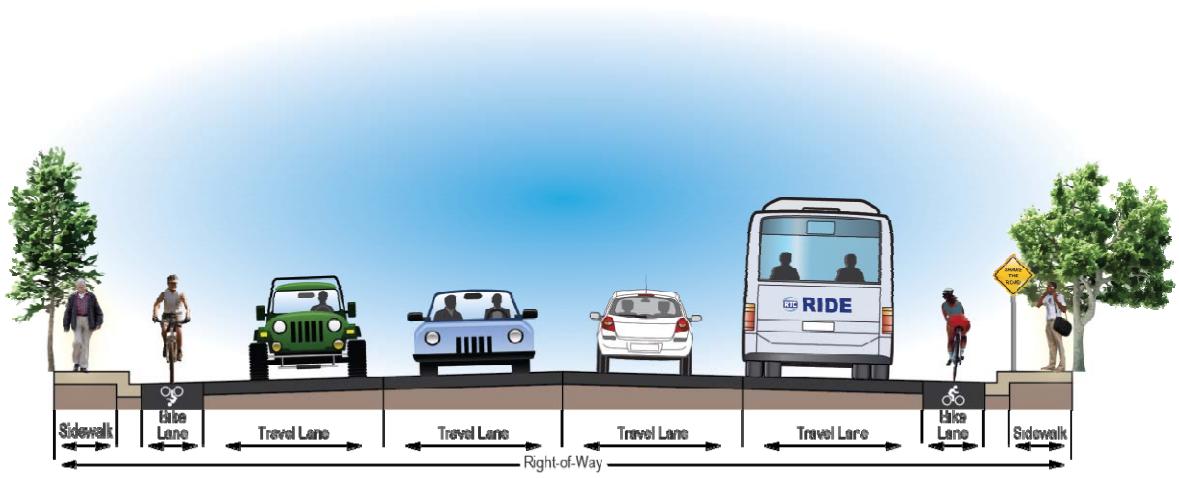


Figure 5-13: University Terrace to Coleman: "Parking"

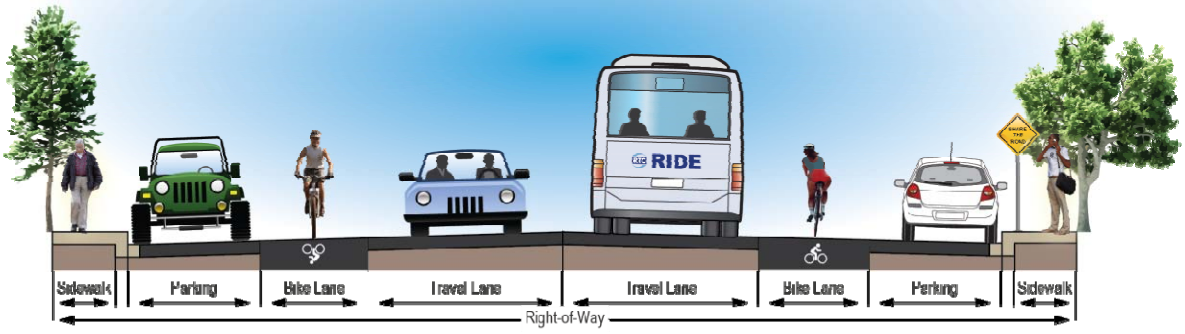


Figure 5-14: University Terrace to Coleman: "Partial Sharrow"

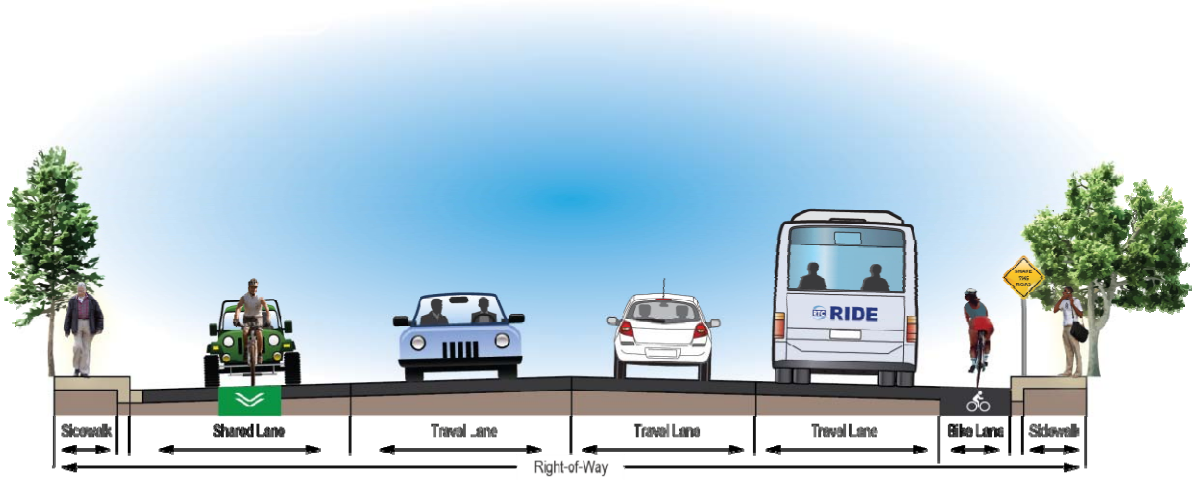


Figure 5-15: University Terrace to Coleman: "Super Sharrow"

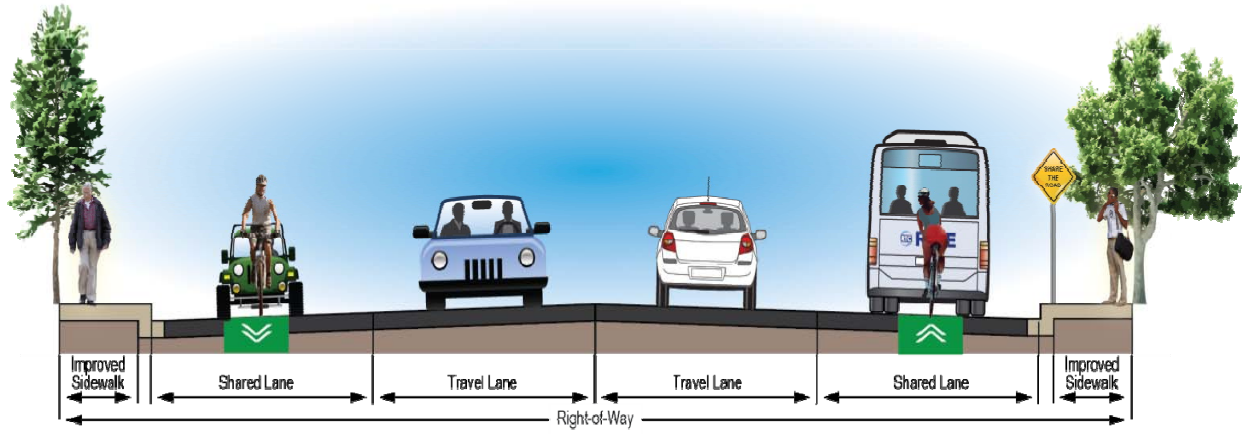
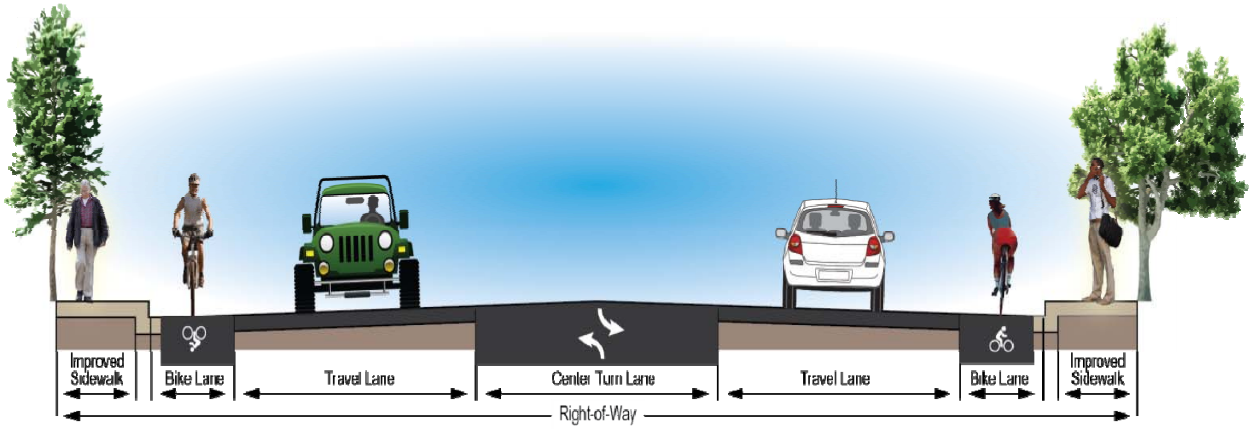


Figure 5-16: University Terrace to Coleman: "Complete Street"



The evaluation criteria for the five roadway sections consisted of improving safety, maintaining acceptable vehicular operations, providing bicycle facilities, improving pedestrian facilities, limiting right-of-way impacts, providing a buffer for separating the travel lanes from the sidewalk and driveways, and cost. Table 5-3 outlines the benefits and challenges of each section, and Table 5-4 shows the evaluation matrix used to compare the differences in each roadway section.

Table 5-3: Comparison of Benefits and Challenges

Section	Benefits	Challenges
All Users with Four-Lanes	- Increased safety for bikes and pedestrians - Provides bike lanes - Provides small 'buffer' for driveways and pedestrians	- Does not widen sidewalks - Does not provide a center turn lane - Narrow travel lanes - Requires right-of-way
Parking	- Provides bike lanes - Provides parking - Provides 'buffer' for driveways and pedestrians	- Does not widen sidewalks - Does not provide a center turn lane - Decreases sight distance - Reduces number of lanes - Slight decrease to the LOS, but still above LOS E
Partial Sharrow	- Bicycle lane in the uphill direction; sharrows downhill - Alerts drivers to cyclists - Provides similar LOS as existing	- Does not widen sidewalks - Does not provide a Center turn lane - Does not provide a 'buffer' - No increase to sight distance
Super Sharrow	- Cyclists share the road - Alerts drivers to cyclists - Widens sidewalks - Provides similar LOS as existing	- Cyclists and vehicles share the travel lanes - Does not provide a center turn lane - Does not provide a 'buffer' for residences - Reduces lane width - Only small increase to sight distance
Complete Street	- Greatest increase of safety for all users - Provides bike lane - Widens sidewalk - Provides center turn lane - Provides 'buffer' for driveways and pedestrians	- Reduces the number of travel lanes - Slight decrease to the LOS, but still above LOS E - Without modifications, right turn at Kings Row is LOS F during AM

Table 5-4: University Terrace to Coleman Section Evaluation Matrix

Section	Vehicular Operations	Bike Facilities	Pedestrian Facilities	Right-of-Way Impacts	Safety	Cost
4-Lane	◔	◔	●	◒	◒	$$
Parking	◕	◒	●	◔	◕	$
Partial Sharrow	◔	◒	●	◔	◒	$
Super Sharrow	◔	◕	◒	◔	◕	$
Complete Street	◕	◔	◔	◔	◔	$

◔ - Excellent ◒ - Good ◕ - Fair ● - Poor $ - Least $$$$$ - Most

This evaluation matrix was shared with the TAC and SWG. Based on the minimal improvements to safety, the lack of improvements to pedestrian facilities, and the potential impacts to right-of-way, the four-lane, parking, and partial sharrow options were eliminated by both the TAC and SWG. The remaining two roadway sections, the Super Sharrow and Complete Street, were carried forward into the alternative development process.

In order to create a clearer picture of how the remaining roadway sections would function along this northern segment of Keystone, three alternatives using versions of the two roadway sections were developed showing potential lane configurations and striping layouts. The alternatives developed include:

- Alternative 1: Share the Road
- Alternative 2: Complete Street
- Alternative 3: Combination

5.2.2. Share the Road Alternative 1

The Share the Road alternative uses the Super Sharrow roadway section beginning at W. 7th Street and ending at Coleman Drive. Figure 5-17 details a possible striping layout for this alternative and highlights some of the key features.

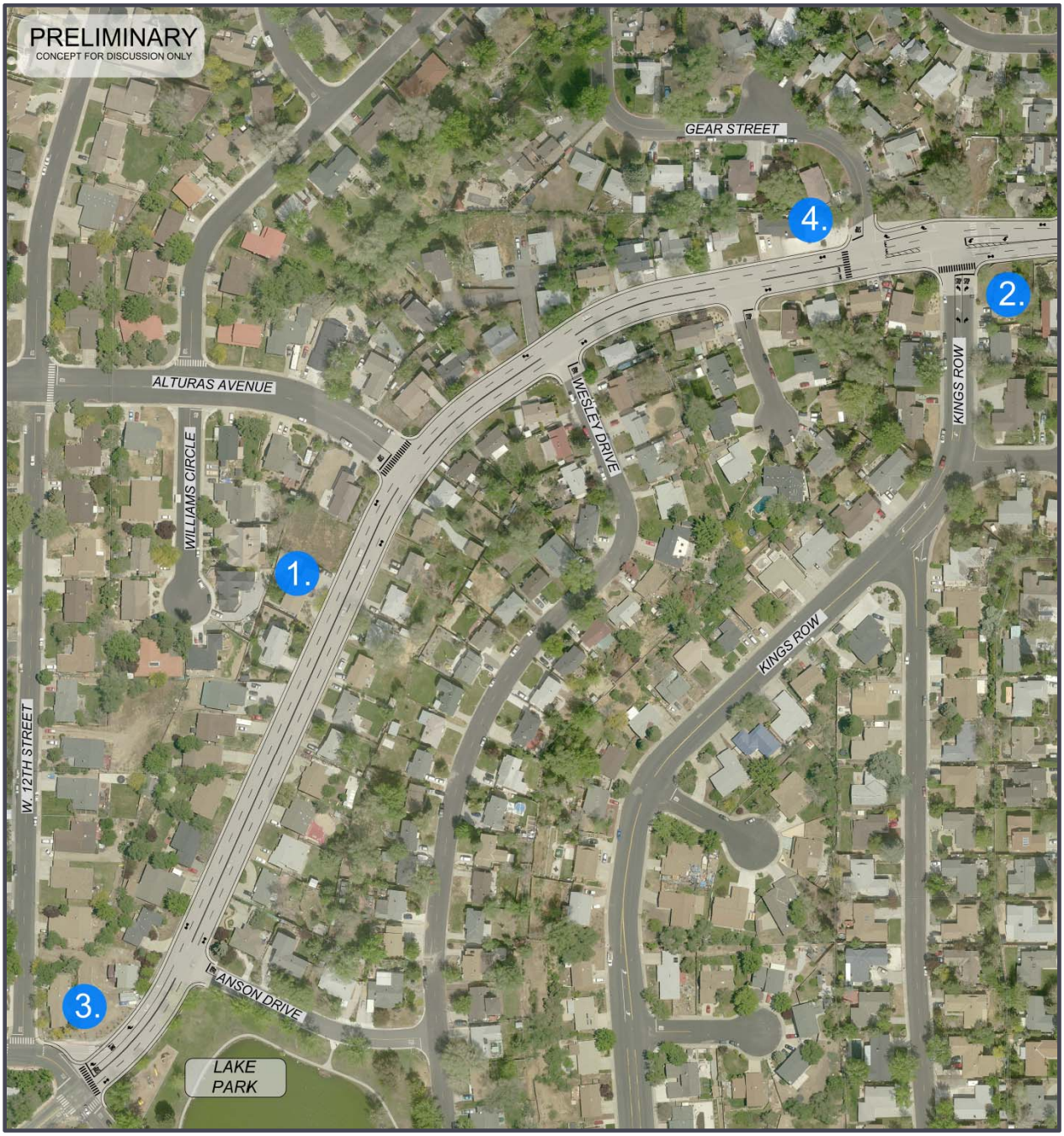
The vehicle operations for the Super Sharrow would be very similar to the existing condition and operate with an LOS C between University Terrace and Kings Row, and an LOS B north of Kings Row both today and in 2035.

This Share the Road alternative limits improvements that could be made to the Keystone / Kings Row intersection. The intersection would essentially operate similar to the existing condition. At University Terrace, a left turn pocket in the southbound direction would provide safer access for vehicles and bicycles and improved alignment of the lanes. The improvements at University Terrace would likely require right-of-way from adjacent properties. Additional discussion specific to the intersections of Kings Row and University Terrace is outlined in detail in subsequent sections.

5.2.2.1. Sharrows

The Share the Road alternative as well as two of the previous roadway section options uses a 'sharrow'. A sharrow is a lane marking that directs cyclists to share the travel lane with the vehicular traffic. It serves to remind motorists that bicycles have equal right to use the lane. An example of a sharrow and associated signing is shown below.

Figure 5-17: Alternative 1: Share the Road



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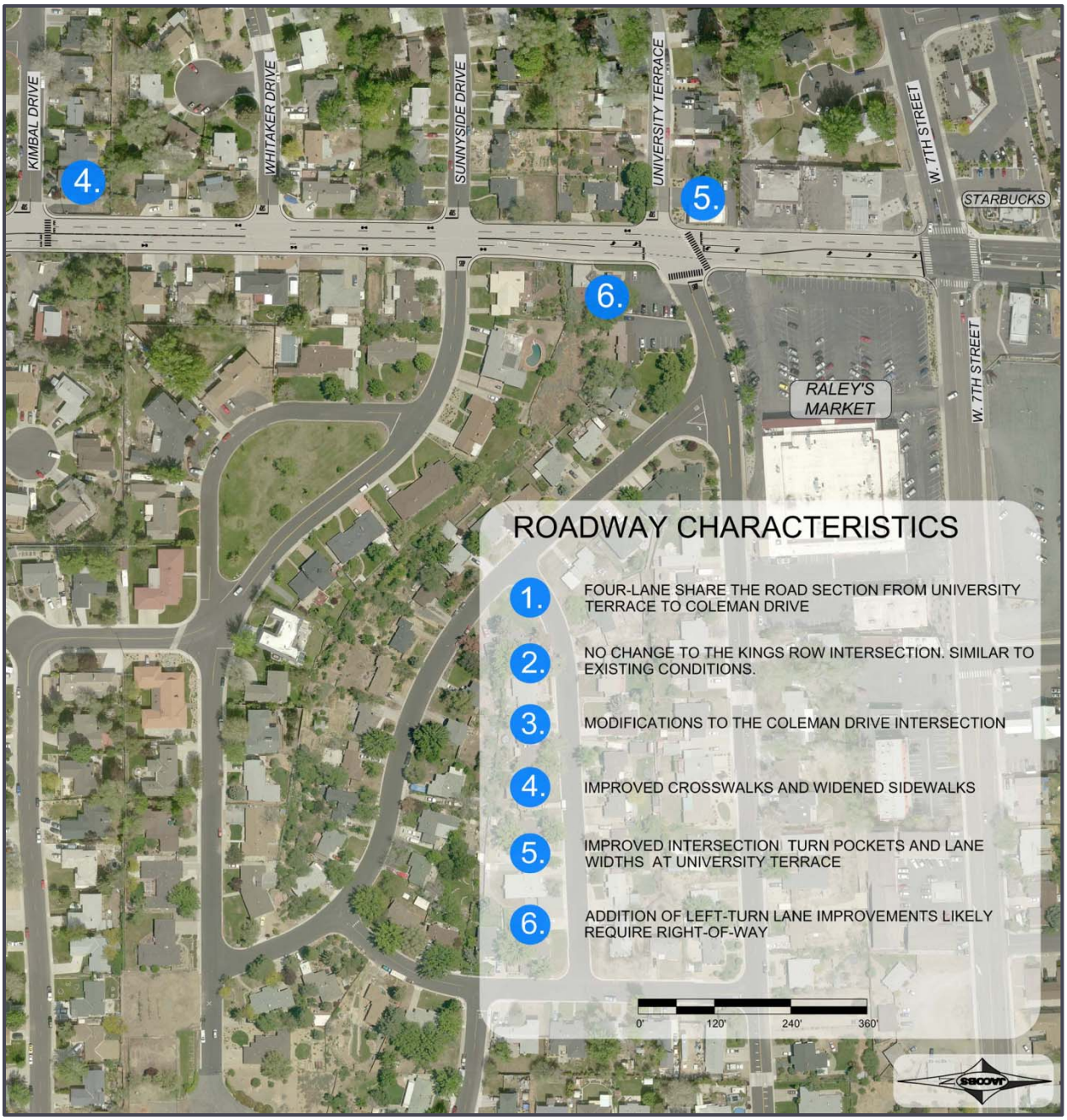

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5.2.3. Complete Street Alternative 2

The second alternative is a Complete Street, three-lane section, beginning at University Terrace and ending at Coleman Drive. Figure 5-19 illustrates a possible striping layout for this section.

The vehicular operations for the Complete Street alternative worsen slightly because of the reduced number of lanes; however, the LOS remains within acceptable threshold (LOS D or better) under future 2035 conditions, allowing the same number of vehicles to travel through the corridor. Figure 5-18 illustrates the anticipated year 2035 volumes and corresponding LOS for a three-lane scenario north of University Terrace.

Carrying a three-lane section through the intersection at Kings Row worsens the operations of the eastbound right-turn movement during the AM peak hour. With the reduced number of lanes, the LOS for this movement worsens to F; however, there are mitigation options to improve the LOS, which are described in subsequent sections (see Section 5.2.5).

At University Terrace in the southbound direction, the three-lane section is carried through the intersection with a fourth lane being added between the bus stop near Raley's and the W. 7th Street intersection. In the northbound direction, a second lane is required through the intersection to ensure adequate level of service and lane utilization at W. 7th Street. As shown in Figure 5-19, two lanes continue northbound until the left hand lane drops at the intersection of Keystone Avenue and Whitaker Drive. Dropping the left lane allows for correct lane alignment as the lane width previously used for the left hand travel lane now becomes a center turn lane allowing vehicles a safer turning area. An adverse affect of dropping the left hand travel lane is that it creates a 'trap lane,' which may confuse drivers and could introduce a less safe situation without proper advanced signing.

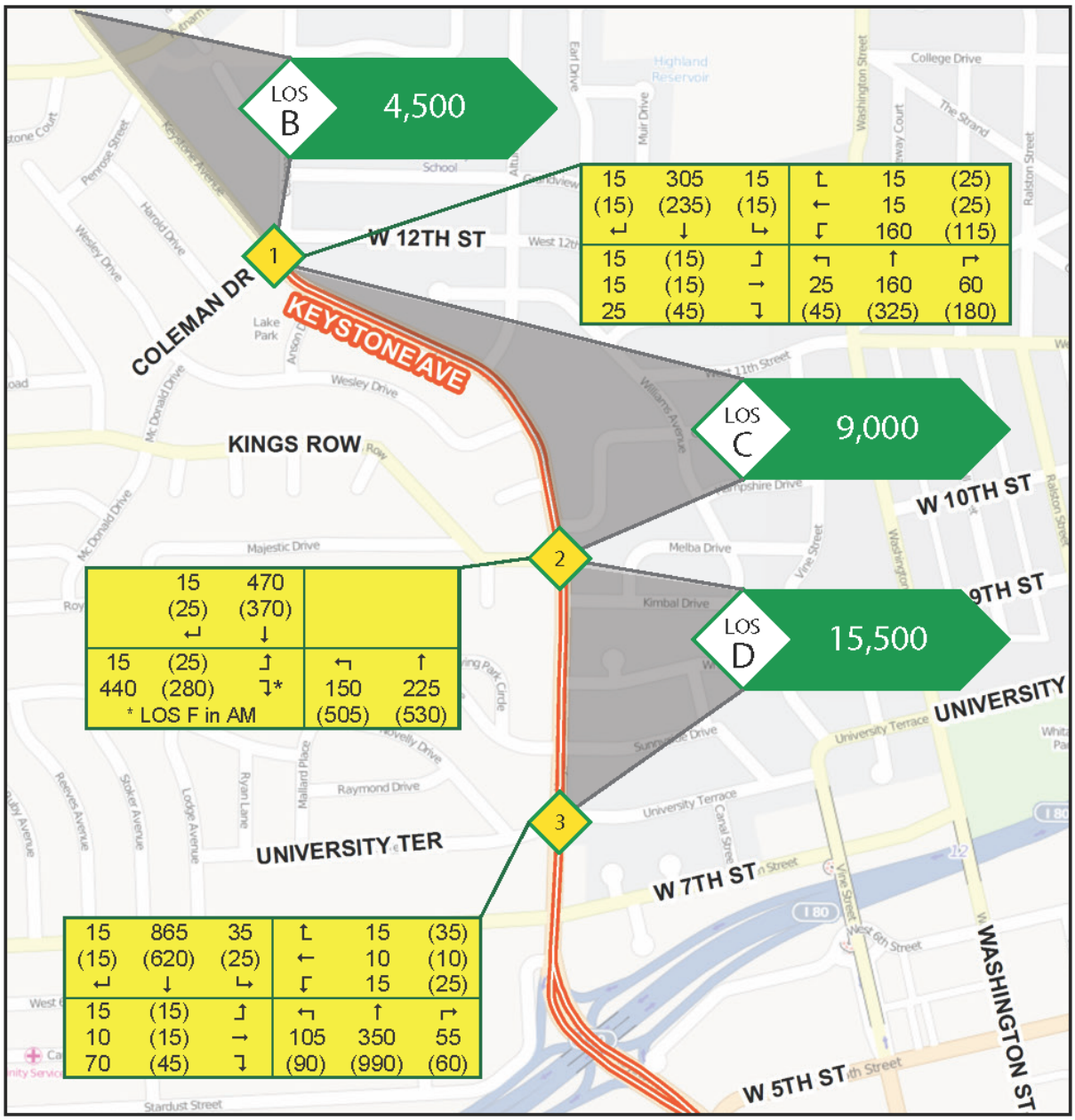
5.2.4. Combination Alternative 3

The third alternative is a combination of the Share the Road and the Complete Street roadway sections. This alternative uses a four-lane Super Sharrow section between W. 7th Street and Kings Row, and a Complete Street section from Kings Row to Coleman Drive. Figure 5-20 shows the lane configuration of this alternative.

Vehicular operations for this section would be similar to the existing conditions with an LOS C from W. 7th Street to Coleman Drive.

The intersection at University Terrace would match the configuration of the Share the Road alternative with the same benefits and challenges. The benefits of the Combination alternative become evident at the intersection of Kings Row. The addition of a lane allows for the eastbound right-turn movement from Kings Row to turn into a developed lane, thereby creating a partially free right turn. Vehicles would be required to yield to bicycles and pedestrians, but they would not be required to wait for traffic traveling southbound on Keystone Avenue. Specific details are further described in Section 5.2.5.

Figure 5-18: University Terrace to Coleman – 2035 Volumes and LOS for a Complete Street



NOTE: LOS shown are based on a three-lane cross-section north of University Terrace. Segment LOS are per AADT LOS thresholds in the RTP.

Volumes: AM (PM)

Figure 5-19: Alternative 2: Complete Street Alternative

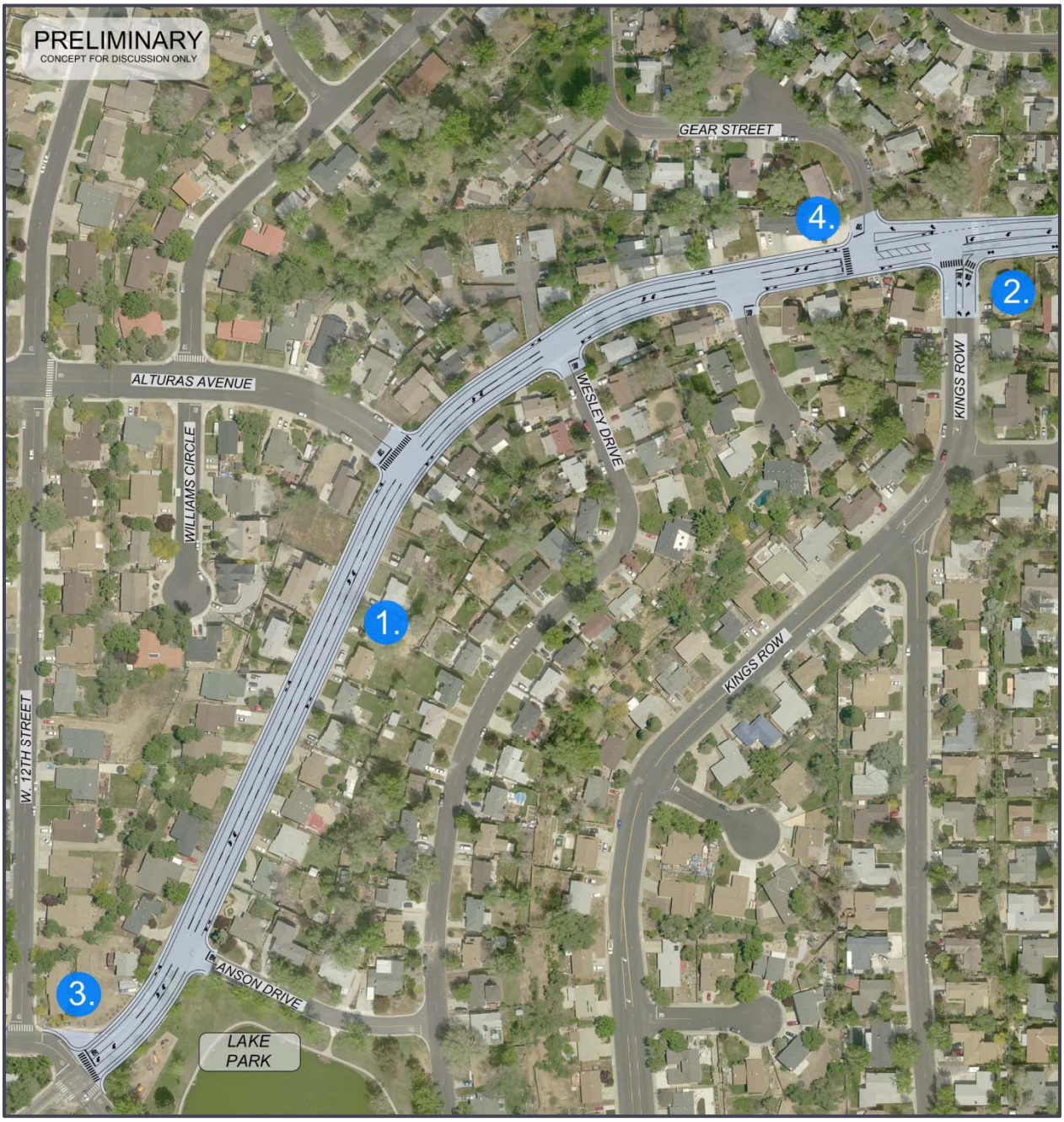


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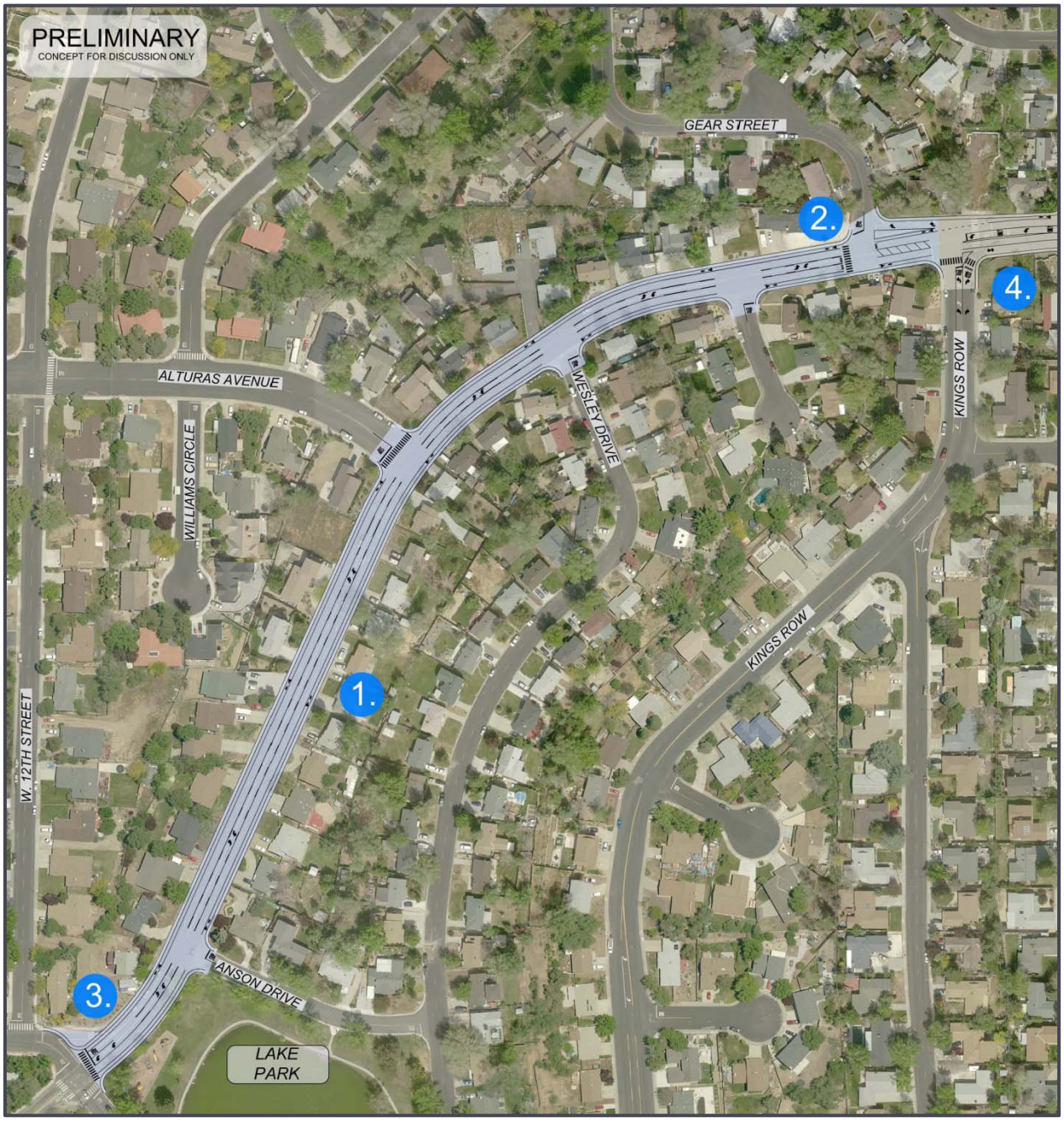
Figure 5-20: Alternative 3: Combo Alternative



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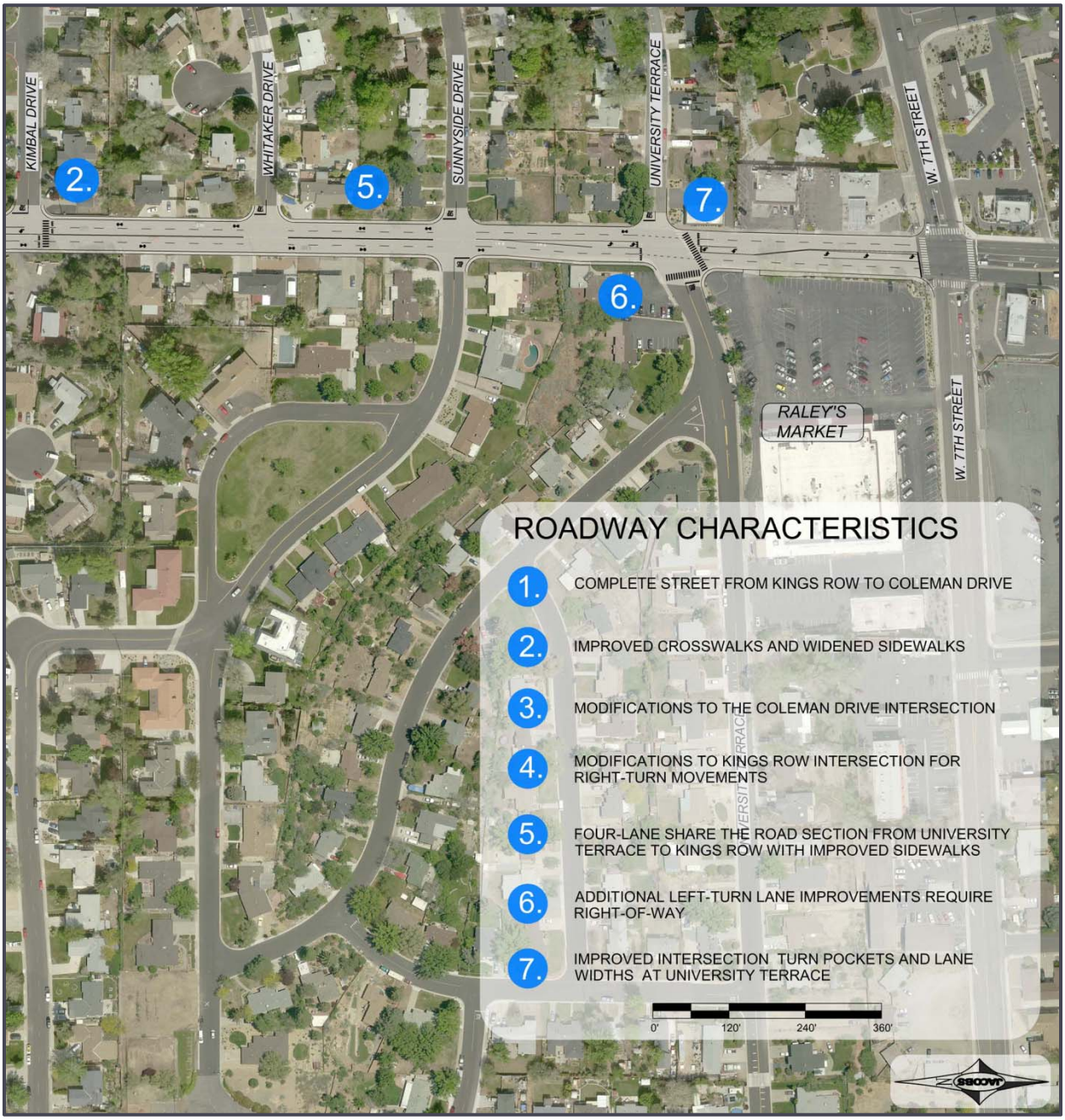

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5.2.5. Keystone Avenue / Kings Row

Approximately 45 percent of the traffic on Keystone Avenue turns at Kings Row, as Kings Row provides access to many residential areas and provides direct connection with full movements to North McCarran Boulevard. A summary of issues identified for the Keystone Avenue / Kings Row intersection include:

- The existing crosswalk on the south leg does not connect to a sidewalk. The sidewalk along the eastern side of Keystone Avenue is missing between Kimbal Drive and Gear Street.
- There is inadequate left turn storage.
- The proximity and existing striping of Gear Street causes driver confusion.
- The sight distance when looking north is blocked by a freestanding decorative brick wall and turret. Because of the curved geometry of Keystone, this wall blocks the view of the right lane when looking north.
- There are no bicycle facilities through the intersection.
- For a three-lane Complete Street alternative, the LOS for the right-turn movement from Kings Row to southbound Keystone Avenue degrades to F during the AM peak hour.

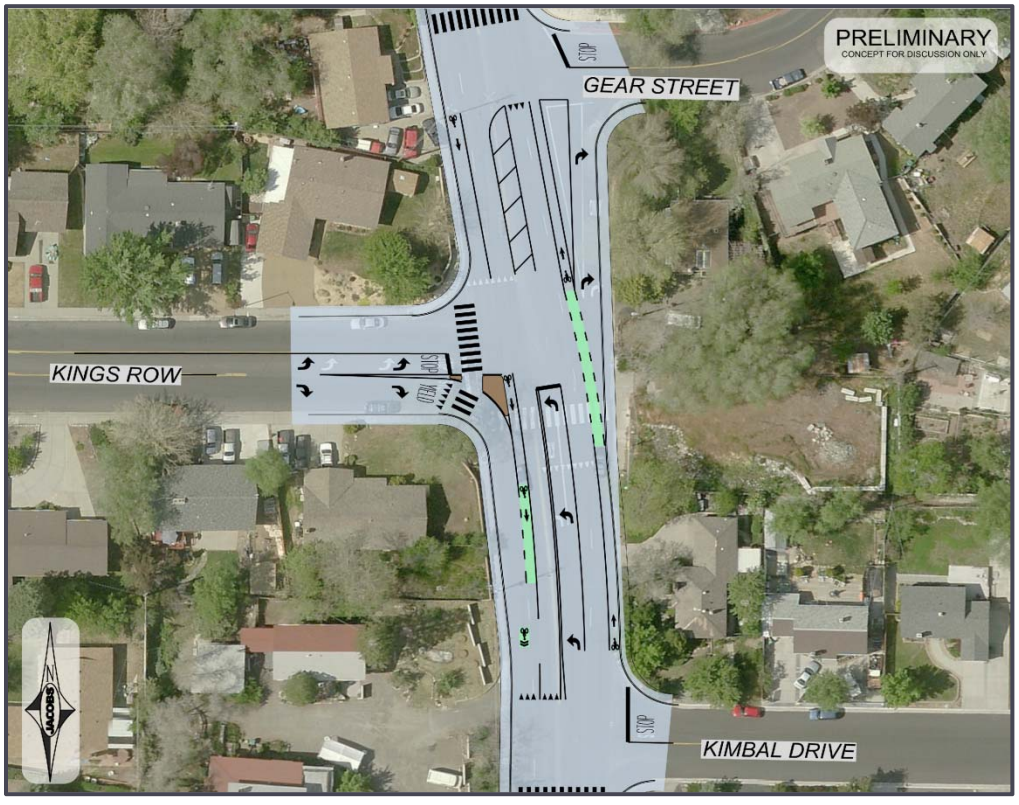
Two alternatives were developed to mitigate these issues. Both alternatives assume that Keystone Avenue is reduced to a three-lane section north of Kings Row. This assumption was made because a four-lane section north of Kings Row provides little to no improvements to the intersection operations over the existing condition, and the added lane, specifically for a roundabout alternative, results in several property acquisitions and relocations. The first alternative converts the existing T intersection to a three-legged roundabout as shown in Figure 5-21. The second alternative, shown in Figure 5-22, retains the existing T configuration with geometric improvements to mitigate the issues identified. Additionally, a second southbound through lane is provided for the T configuration beginning south of the intersection to improve the eastbound right-turn LOS (i.e., create a free right-turn). As mentioned previously, vehicles would be required to yield only to bicycles and pedestrians, but not be required to stop for traffic traveling southbound on Keystone Avenue. Both alternatives accommodate pedestrians and bicycles through the intersection, and both operate within acceptable LOS for vehicular operations.


Keystone / Kings Row Intersection

For the Complete Street alternative, the additional southbound lane added at Kings Row is dropped at a distance sufficient to provide the proper notification to merge left. For the Combination and Share the Road alternatives, this added lane would remain, and it would be carried through the remainder of the segment south to W. 7th Street. In the northbound direction, the left lane of the four-lane sections for both the Share the Road and Combination alternatives transition into a left turn only lane at Kings Row. For the three-lane Complete Street section, the center turn lane striping is changed to a turn pocket to provide a separate left-turn lane to Kings Row. (Figure 5-19.)

Figure 5-21: Keystone/Kings Row Roundabout Alternative

Figure 5-22: Keystone/Kings Row T-Intersection Alternative



The TAC and SWG evaluated these alternatives. Due to the right-of-way requirements and limited operational benefits over the T intersection, the roundabout alternative was eliminated. The T intersection was included in previous figures for the Share the Road, Complete Street, and Combination alternatives. (Figures 5-17, 5-19, 5-20)

5.2.5.1. Multi-way Stop Analysis

In addition to the above analyses, a multi-way stop control warrant analyses was performed for the Keystone Avenue / Kings Row intersection to determine if the addition of stop signs on all approaches would improve safety at the intersection. The engineering analysis concluded that a multi-way stop was not warranted at this intersection primarily for two reasons: 1) the vehicle delay is not great enough to meet criteria, and 2) the few number of collisions at the intersection does not meet minimum thresholds. The detailed warrant analysis report is included in Appendix L.

5.2.5.2. Left Turns at Kimbal Drive

The close proximity of Kimbal Drive and Kings Row necessitated an analysis and development of an alternative to eliminate left turns to and from Kimbal Drive. Figure 5-23 depicts the alternative preventing left turns from Kimbal Drive.

Figure 5-23: Keystone / Kimbal No Left-Turn Intersection Alternative

Benefits of this alternative include reducing the number of conflicts, improving the flow of traffic along Keystone Avenue and though the Kings Row intersection, and providing increased left pocket storage at

Kings Row. The challenge includes limiting access to right-in / right-out only. Traffic would need to use either Whitaker Drive or Gear Street to access southbound Keystone Avenue. This alternative was presented to the public for their input.

5.2.6. Keystone Avenue / University Terrace

Because of the different alternatives in the roadway sections, and the proposed bike facilities on Vine Street, improvements to the Keystone Avenue / University Terrace intersection will be necessary. Additionally, improvements are necessary to mitigate other issues identified such as crosswalk safety, bus stop safety, and access problems associated with the commercial driveway south of the intersection. To best accomplish these improvements, several intersection alternatives were considered.

Keystone / University Terrace Intersection

Each of the intersection improvement alternatives are directly associated with the adjacent roadway section alternatives discussed previously. For the three-lane Complete Street alternative, the reduction of lanes allows a new left-turn pocket to be added in the southbound direction to better access University Terrace. Wider lane widths are also provided. For the four-lane alternatives (Share the Road and Combination), a southbound left-turn pocket could be added to provide this same improved access to University Terrace. Adding the left-turn lane would also better align the lanes through the intersection. Improved lane widths are proposed with these alternatives as well. The added left-turn lane along with additional lane width would require right-of-way, primarily along the west side of Keystone Avenue for the four-lane alternatives; however, property relocations are not anticipated.

An alternative to eliminate left turns from University Terrace was developed due to the poor operations of both the existing and future intersection. This alternatives allows full turning movements from Keystone Avenue on to University Terrace, but only right turns from University Terrace to Keystone Avenue; left-turn and through movements would be eliminated. The primary benefit includes improving safety. The left-turn movement from University Terrace has high delays. Instead of waiting for an opening, drivers may attempt to force their way into traffic potentially causing an unsafe situation. Eliminating the movements reduces the delay at this intersection.

Other alternatives included changing, and possibly closing, the driveway access to the Raley's parking lot, relocating the bus stop locations, and altering the location and angle of the crosswalk and flashing beacons. The selected alternatives are discussed in Chapter 6.

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6. Selected Alternatives and Proposed Improvements

This chapter presents the recommended alternatives and proposed improvements for the Keystone Avenue corridor. The corridor is divided into a Southern and a Northern Segment similar to those defined previously.

6.1. Southern Segment Recommendations

6.1.1. California Avenue / Keystone Avenue Intersection

Alternative F (California / Keystone Limited Improvements), shown in Figure 6-1, is the recommended alternative for the configuration of the intersection. This alternative provides some improvements to the identified deficiencies; however, it does not meet all the established criteria due to the costs associated with meeting all the criteria.

Figure 6-1: Alternative F – Limited Intersection Improvements

This Alternatives includes the following features:

- Could be implemented as a short-term improvement within the next two-five years

- Reduces the number lanes through the intersection in order to accommodate a new bike lane and sidewalk in the uphill, or eastbound, direction of California Avenue
- It changes the intersection type to a typical three-leg intersection instead of the more freely flowing High-T style that exists currently. Through signal optimization between the Keystone Avenue and Booth Street intersections, the operations will be similar to the existing condition with only a few added seconds of delay during the peak hours. Refer to Table 5-1.
- Provides continuity for the complete street section of California Avenue
- In order to mitigate an increase in delay at Booth Street, the right hand lane of Booth Street would be changed to serve as a free right-turn lane allowing turning vehicles from California Avenue to flow freely onto Booth Street without having to yield to traffic.
- It provides a new ADA ramp between California Avenue and Foster Drive replacing the existing staircase. Additional analysis is needed to determine the final configuration of this ramp as the adjacent property owner has expressed a willingness to allow for additional pedestrian enhancements.
- Does not require right-of-way
- Was the public's preferred alternative for providing short-term improvements

6.1.1.1. Long-Term Improvement Analysis

Of all the alternatives presented for this intersection, Alternative B (California / Keystone Roundabout) received the most positive input from the public. Alternative B is designed to address all the identified needs including improved safety, enhanced multimodal connectivity, and meeting the vehicular operational needs of 2035. Due to the size, cost, and complexity, additional analysis and design is needed before moving forward with this alternative. A concept similar to Alternative B should be considered as a long-term option that could be combined with replacement of the Keystone Avenue Bridge over the Truckee River.

6.1.2. Jones Street to W. 7th Street

Recommended improvements along Keystone Avenue between Jones Street and W. 7th Street include improvements to the intersections of Jones Street, 4th Street, W. 7th Street, and the I-80 interchange as well as multimodal improvements on Vine Street.

6.1.2.1. Jones / Keystone Avenue Intersection

The intersection at Jones Street and Keystone Avenue presents a unique challenge due to the existing access to Riverside Drive and the proximity of the Keystone Avenue bridge crossing the river. The long-term solution is directly related to replacement of the bridge, which is further discussed in Section 6.1.4.

Replacement of the bridge provides an opportunity to lower the roadway grade of Keystone Avenue to match the existing ground closer to the river. This provides the following three major benefits:

1. An increase in sight distances for vehicles on Jones. The existing barrier rails make it difficult to see vehicles traveling northbound on the bridge. This is compounded on the west side of Keystone Avenue with the large separation between the travel lanes and the intersection with the one-way portion of Keystone leading to Riverside Drive.

2. Opportunities increase for improving the configuration of the intersection. The one-way portion of Keystone Avenue leading south to Riverside Drive begins immediately at the Jones intersection. There is inadequate signing and striping to properly define the lanes where vehicles and cyclists are to travel through the intersection. Additionally, the intersection does not provide left-turn pockets to Jones, requiring northbound and southbound vehicles to stop in the left hand lane to wait for oncoming traffic if they wish to turn left. The lack of definition and lack of turn pockets create confusion for drivers which ultimately leads to collision potential. By lowering the roadway grade near the bridge, some separation from the Jones Street intersection may be possible. This separation, along with signing and striping revisions, would allow for a clearer delineation of travel lanes and turn pockets.
3. A reduction of vehicle speeds through the intersection. The current grade is conducive to high vehicle speeds as it slopes gently downhill matching the existing grade at the Jones Street intersection. Drivers may not be fully aware of cross traffic at the Jones Street intersection as it is difficult to see due to the barrier rails.

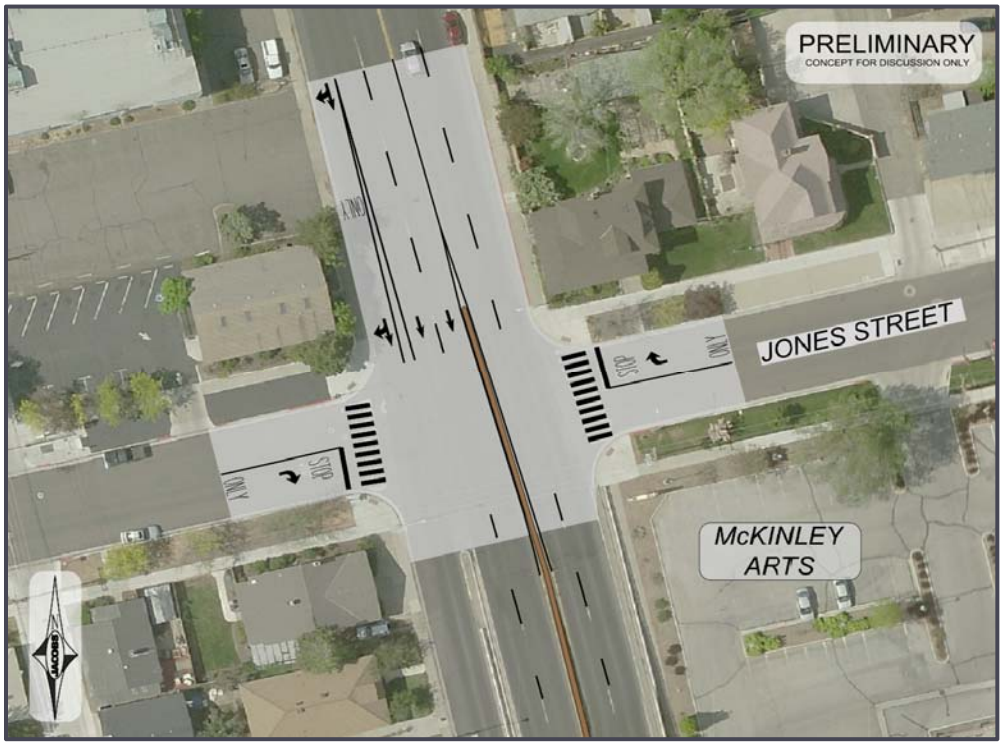

Keystone / Jones St Intersection

The long-term recommendation includes reconfiguration of the intersection based on improvements proposed for the new bridge. Additional evaluation and design is needed to determine what modifications can be made to the intersection in order to safely allow left-turn and through movements. The reconstruction of the bridge requires elaborate coordination between NDOT, City of Reno, Truckee River Flood Management Authority, U.S. Army Corps of Engineers and FHWA if federal funds are used. Due to the length of this process, an interim solution that addresses the safety concerns at this intersection is needed.

The recommended short-term alternative includes the elimination of left-turn and through movements at Jones Street. The elimination of these movements would reduce the number of conflict points and prevent vehicles from crossing the travel lanes on Keystone Avenue. The construction of a median island across Keystone Avenue would inhibit drivers from attempting to make the left or through movements. Figure 6-2 shows how these median island improvements can be constructed.

Left-turn movements to/from Jones Street would be accommodated using the signalized intersection at 1st Street or Riverside Drive. To accommodate the movement of bicycles, additional signage would direct cyclists to use Riverside Drive and 1st Street as well as some of the adjacent paved alleys that connect to Jones Street. This alternative would provide an immediate safety benefit at the intersection.

Figure 6-2: Jones Street Median Islands



6.1.2.2. Keystone Avenue Roadway Improvements – Jones to 4th Street

Recommended improvements for the segment of Keystone Avenue between Jones Street and 4th Street focus on providing sidewalk and ADA enhancements. All of the ADA ramps at the intersection crosswalks should be made compliant. The pedestrian push buttons should be accessible and audible. The concrete along the existing curbs, gutters, and sidewalks is deteriorating, and the sidewalk is narrow and it constrained in numerous locations by utility poles. It is recommended that any future roadway project replace the curb, gutter, and sidewalk and coordination with utility companies be initiated early to evaluate to the possibility of relocating the poles.

6.1.2.3. Keystone Avenue / 4th Street Intersection Improvements

Recommended improvements to the Keystone Avenue / 4th Street intersection focus on reducing the number of accidents. Modifications include reducing turning movement conflicts and improving median islands. As shown in Figure 6-8 in Section 6.3.2, median islands are recommended along the left-turn pockets of 4th Street to limit left-turn movements from adjacent commercial properties.

Additional left-turn pocket storage is required in the eastbound direction of 4th Street. There is adequate space to provide this additional storage along the existing median of 4th Street.

6.1.2.4. I-80 Interchange Improvements

The reconstruction of the interchange at Keystone Avenue and I-80 is included as part of NDOT's long-range transportation improvements; however, there is no set timeframe for this reconstruction. NDOT has indicated that any improvements made to this interchange will include new or improved facilities for pedestrian access and accommodation of bicycles.

Other recommended improvements include reducing the radii of the single point urban interchange (SPUI) ramps by tightening the overall configuration to reduce speed and increase spacing between adjacent intersections. Additional left-turn pocket storage is also required in the northbound direction, which could be accommodated with reconstruction of the median islands as part of access management changes described in Section 6.3. Additional right-turn storage is also needed for the eastbound off ramp to ensure vehicles are not backing up on to the travel lanes of I-80.

Intelligent Transportation Systems (ITS) could be implemented as part of the interchange improvements. Evaluating the need for ramp meters and ensuring those ramp meters are coordinated with the existing ITS infrastructure along I-80 could enhance the operations of both the freeway on-ramps and the signalized intersection along Keystone Avenue.

6.1.2.5. Keystone Avenue / W. 7th Street Intersection Improvements

Improvements to the W. 7th Street intersection are limited because of right-of-way constraints. Additional right-of-way is required along Keystone Avenue to widen lanes, increase turn pocket storage, and provide bicycle facilities. These improvements would likely result in property acquisitions. Along W. 7th Street, access management changes and increased turn pocket storage is possible and recommended. The access changes and increased storage along W. 7th Street are shown in Figure 6.6 of Section 6.2.3.

ADA improvements are needed at each of the four intersection corners to ensure the ramp grades are compliant and the pedestrian push buttons are accessible and audible.

6.1.2.6. Keystone Avenue & Vine Street Bike Facilities

The public overwhelmingly supported the Vine Street Bike Facility Alternative. In order to provide the best possible north/south connectivity as an alternate to Keystone Avenue, it is recommended that both Vine Street and Washington Street be modified to accommodate bike lanes. While additional analysis is needed, one potential option for modifying Vine Street is shown in Figure 6-3. This option includes the placement of bike lanes between 1st Street and University Terrace. Lanes would be shifted slightly and parking would be eliminated along one side of Vine Street. In the more residential areas south of 1st Street and north of University Terrace, sharrows would be painted within the existing travel lanes to indicate to road users that bikes will be sharing the travel lane.

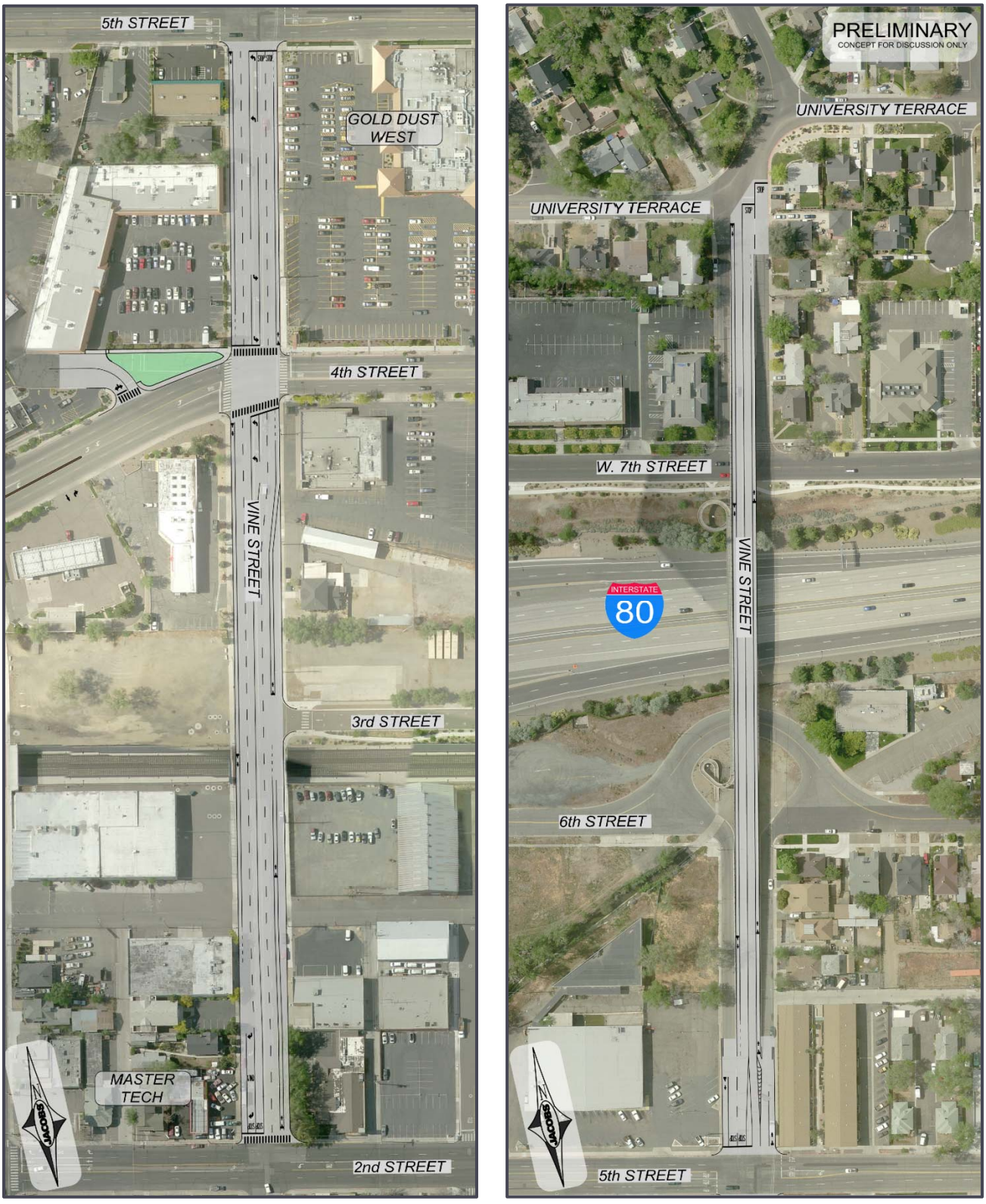
On the northern end of Vine Street, the connection to Keystone Avenue would occur at University Terrace and Whitaker Drive. Signs would be placed directing bicycles to follow the selected route based on the desired destination. Similar signs would be provided for Washington Street.

Prior to making the changes, a more in-depth traffic analysis is needed to ensure the reduction of lanes does not reduce the operations to below policy LOS. Coordination with the property owners is needed to ensure the loss of parking does not impact businesses. se

A concern raised by the public regarding this alternative is the crossing of 1st and 2nd Streets. The intersections only require traffic on Vine Street to stop, while traffic on 1st and 2nd are free flowing. The RTC's Bike Master Plan includes modifications to 2nd Street that would improve bicycle facilities and reduce the conflict points at this crossing. Additional improvements to protect pedestrians and other

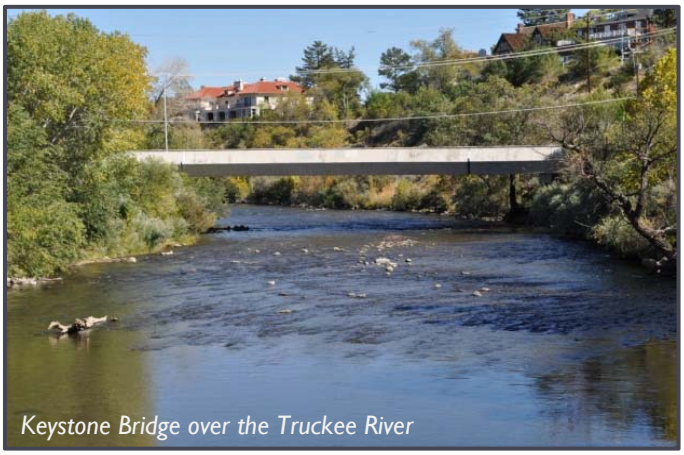
users include the possible installation of rectangular rapid flashing beacons (RRFB) and/or sidewalk bulb-outs at these intersections.

Figure 6-3: Vine Street Striping Configuration



6.1.3. Keystone Avenue Bridge

The Keystone Avenue Bridge over the Truckee River was constructed in 1966. The existing bridge is beginning to show signs of deterioration. Spawling and cracking is occurring at the piers and abutments, and rebar is exposed in a few locations. Based on NDOT"s bridge inspection reports (included in Appendix C), the bridge has a sufficiency rating of 28 out of 100 and is considered structurally deficient under NDOT bridge inspection criteria. Lastly, the existing bridge has no shoulders and does not provide accommodations for bicycles or pedestrians. The bridge has an estimated remaining life of nine years.

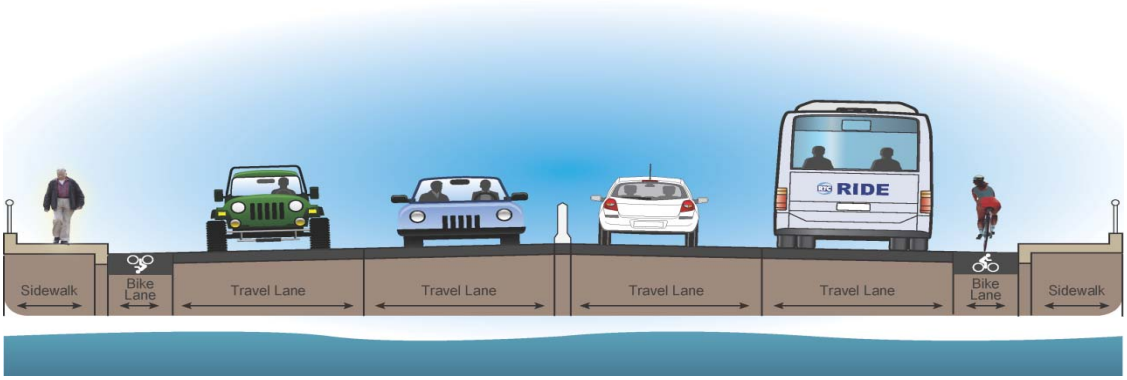


Keystone Bridge over the Truckee River

In 2011, the City of Reno submitted a project submittal application for replacement of the bridge to NDOT. No follow up action occurred. It is recommended that following this study, a more formal request be compiled that outlines what is envisioned, approximate costs, future needs, and the relationship of the Keystone Avenue Bridge to Booth Street and to the Truckee River Flood Project.

Any replacement structure proposed for the bridge should provide four travel lanes with additional width for bike lanes. The new bridge should also include sidewalks for pedestrian access. Figure 6-4 depicts a possible roadway section for the bridge. Providing accommodations for bicycles and pedestrians becomes critical when the adjacent Booth Street Bridge is replaced as part of the Flood Project. Since the existing Keystone Avenue Bridge cannot accommodate bikes and pedestrians, it is recommended that it be replaced prior to replacement of the Booth Street Bridge to avoid eliminating all cross-river access (Keystone Avenue / Booth Street are the only river crossings between McCarran Boulevard and Arlington Avenue).

Figure 6-4: Recommended Keystone Avenue Bridge Section



Other design considerations for a new bridge should evaluate the possibility of lowering and shortening the structure, particularly on the northern end to provide more distance between the end of the structure and the intersection of Jones Street. The existing parking lot located under the structure could be eliminated to provide some of the needed reduction of length.

6.2. Northern Segment Recommendations

6.2.1. Proposed Roadway Sections

Based on input from the public, Alternative 2 (Complete Street) was the most preferred alternative. This alternative meets the engineering and traffic flow requirements of the corridor and provides a safer alternative over the existing condition. It is recommended that all of the roadway and intersection improvements presented with this alternative continue forward for further design evaluation and implementation. The Complete Street Alternative is depicted in Chapter 5.

It is anticipated that there will be some increased delay during the peak hour for vehicles along this northern segment of Keystone Avenue specifically between University Terrace and Kings Row; however, this delay will be minor and will not result in significant operational reductions.

The recommended roadway section includes bringing all sidewalks into conformance with the ADA. Sidewalks will also be widened to meet current standards and reduce the number of conflicts with utilities. Coordination with NV Energy and other utility companies is required to determine if pole locations can be adjusted to accommodate sidewalk improvements.

It is anticipated that the majority of the recommended improvements can be accommodated within the existing right-of-way. There are likely instances in limited locations where improvements for the construction of new sidewalks may require small acquisitions or easements from properties along Keystone, however these will be limited in nature. Additional recordation research and field survey is needed to determine the exact area of the property impacts.

6.2.1.1. Keystone Avenue / Kings Row Intersection Improvements

The free-right turn concept depicted by the Complete Street roadway section alternative is recommended as part of any design improvements for this northern section of the corridor. The added lane will improve LOS of the intersection and allow vehicles turning off Kings Row space to merge into the traffic traveling southbound on Keystone.

Other recommendations include crosswalk improvements at this location and at Gear Street where sight distance is greater. These crosswalks shall be illuminated with streetlights as well as RRFBs. Improvements to sidewalks are also recommended, including construction of new sidewalks along portions of the intersection where they are currently lacking.

Green highlights in the bike lanes are recommended to delineate them from the travel lanes and better define the proper position of vehicles and bikes through the intersection. The green highlights will serve as a way to alert drives that bicycles may be present through the intersection.

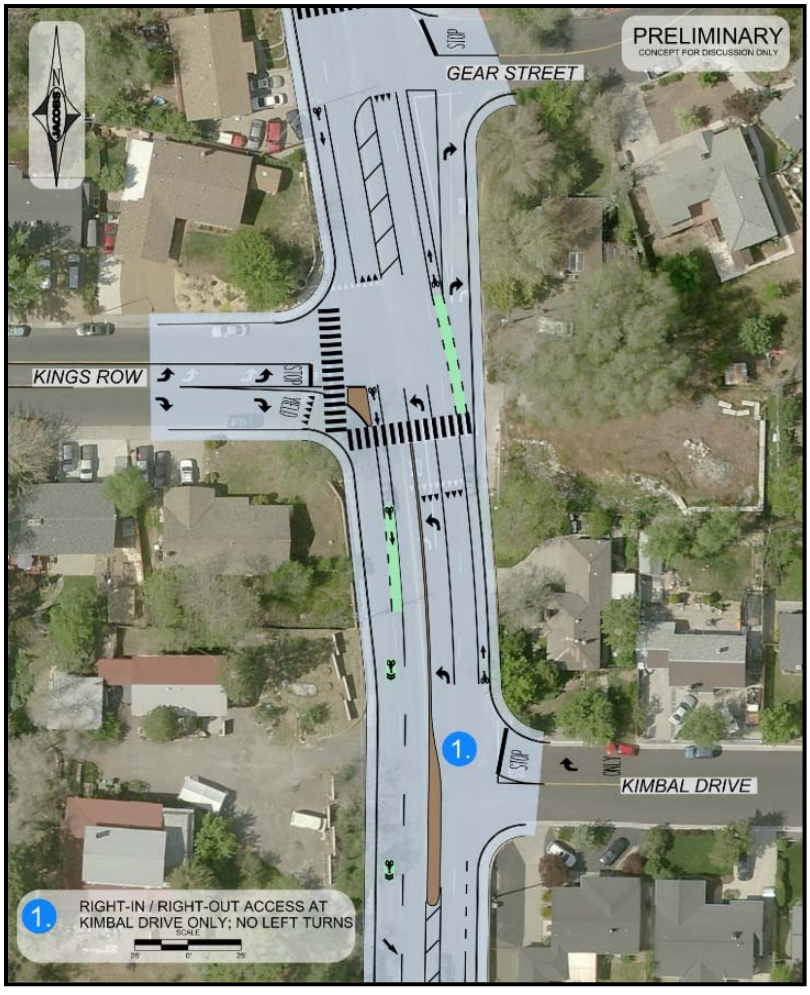
Another recommended improvement is removal of the decorative "Royal Heights" brick wall and turret on the northwest corner of the intersection. The removal would increase sight distance for turning vehicles. Additional research is needed to determine if this wall is historically significant as it serves as the 'gateway' to the residential community.

6.2.1.2. Kimbal Drive Intersection

It is recommended that left-turn movements be eliminated to and from Kimbal Drive as shown in Figure 6-5, for the following reasons:

1. There is insufficient roadway width to provide a left-turn pocket at Kimbal Drive similar to what is proposed at Whitaker Drive, Sunnyside Drive, and University Terrace. The elimination of left-turns reduces conflicts and improves safety.
2. Traffic turning right (free right-turn at Kings Row) is not expecting to stop for vehicles wishing to turn left onto Kimbal Drive. In this case, free flowing vehicles from Kings Row are focused on merging left with southbound traffic (watching for through traffic behind them) and are potentially not looking for stopped or turning vehicles ahead.
3. Currently there are two lanes southbound, and when a motorist signals intent to turn left at Kimbal, the vehicles following can easily move into the adjacent lane. With the revised configuration at Kings Row, the adjacent lane is no longer a general purpose lane as it now serves traffic trying to merge to the left. This creates a potential conflict point and a safety hazard.
4. It allows more flexibility for providing increased left-turn storage at Kings Row.

Figure 6-5: No Left-turns at Kimbal Drive

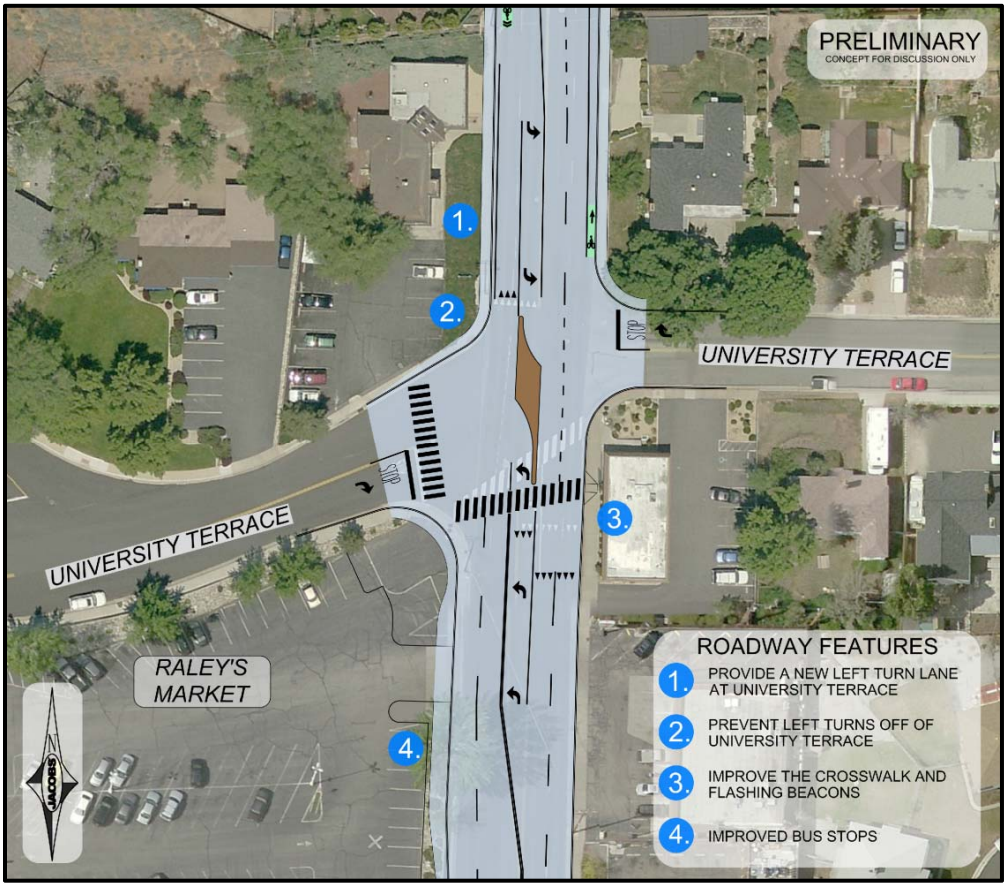


6.2.1.3. Keystone Avenue / University Terrace Intersection Improvements

As part of the recommended layout included in the Complete Street alternative, it is recommended that all lane widths be increased to at least 11 feet through this intersection. In addition, the recommended roadway section alternative provides for a new left-turn lane in the southbound direction of Keystone Avenue. This turn lane provides a location for vehicles and cyclists to wait for oncoming traffic without blocking the travel lanes of Keystone Avenue and provides the proper lane alignment through the intersection.

It is further recommended that left-turn and through movements from University Terrace be eliminated to reduce conflicts and reduce delay at the intersection. Left-turns from Keystone Avenue would still be allowed. Figure 6-6 shows the recommended configuration at University Terrace.

Figure 6-6: Recommended University Terrace Intersection



Improvements to this intersection should not be completed without modifications to the crosswalk Keystone Avenue. The primary issue with this crossing location includes inadequate and improper sign spacing and visibility used to notify drivers to the presence of pedestrians in the crosswalk. Specifically, the bus stop sign in the northbound direction blocks the RRFB for the crosswalk. To improve the advanced notification of the crosswalk, the bus stop sign needs to be moved and modified. Options for this include:

- Raise the bus stop sign approximately three feet. This change would require replacement of the sign pole with one of a taller height. This is the recommended option.
- Move the bus stop sign approximately 20 feet south to a new location such that vehicles traveling in the northbound direction see the RRFB.
- Replace the existing yellow/orange signs with higher intensity yellow signs.

Two bus stops are located just south of the intersection. Improvements such as widening the sidewalk and increasing the lane widths to better accommodate buses are proposed. In order to provide ADA improvements to the bus stop in the southbound direction, reconstruction of the retaining wall along the Raley's parking lot would be required. The wall should be moved toward the parking lot to take advantage of the landscaped area. No loss of parking is anticipated. Coordination with Raley's is required as Keystone Avenue has an easement through the Raley's parcel.

6.2.2. Coleman Drive to North McCarran Boulevard Improvements

Recommendations for the segment along Keystone Avenue from Coleman Drive to North McCarran Boulevard stem directly from the recommendations outlined in the RSA performed by NDOT. The recommended improvements include:

- Place No Parking signs on the first 250 feet of the bike lane north of Peavine Road.
- Reconfigure the existing chicanes to allow for unimpeded bicycle flow through the traffic calming device.
- Add a bike lane on the northbound side with Share the Road signs and sharrows for the southbound direction.
- Replace the existing signs to yellow-green per the MUTCD and add streetlights to the crosswalks.
- Coordinate with NDOT District II at McCarran Boulevard to extend the worm island in the east and west direction beyond the nose of the left turn islands to prevent left turn and through traffic.

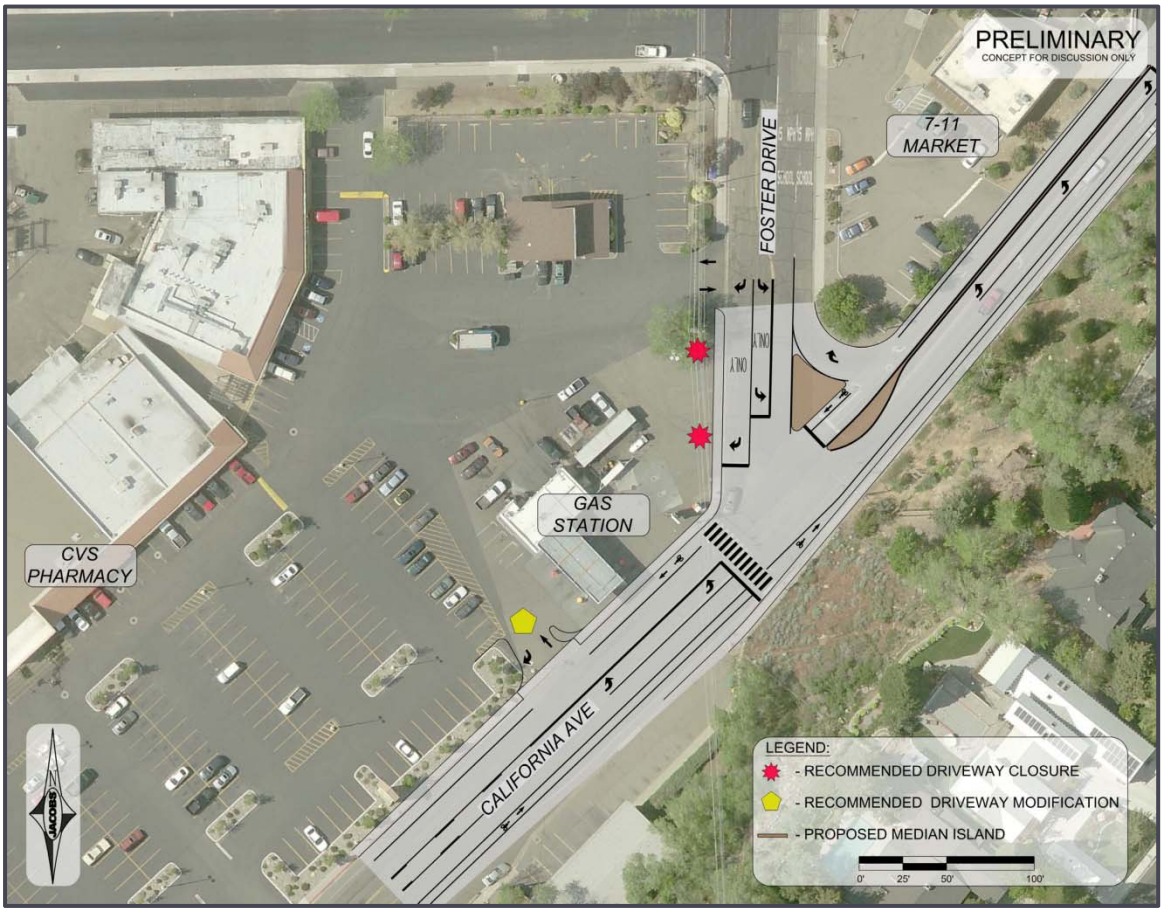
6.3. Access Management Improvements

Due to the limitations described in Chapter 5, recommendations for access management improvements focus on three key areas within the corridor. These key areas include the commercial access area surrounding the Keystone Avenue / California Avenue intersection, the segment along Keystone Avenue between 4th Street and 5th Street, and access near the Keystone Avenue / W. 7th Street intersection.

6.3.1. Keystone/California Access Management

Access management changes shown in Figure 6-7 are based on the selected intersection alternative. Changes include closing the shopping center driveways nearest to the California Avenue / Booth Street intersection and eliminating left-turn movements into and out of driveways that are in conflict with intersection storage pockets. All other driveways to the shopping center would remain open with full movements similar to existing conditions.

Figure 6-7: Recommended Access Management Changes – Keystone/California



6.3.2. 4th Street and 5th Street Access Management

The segment between 4th Street and 5th Street is the second of the access management areas of focus. This is the most urban and commercial stretch of Keystone Avenue and includes numerous driveways leading to a variety of businesses. Using the access management guidelines and analyzing those guidelines against potential business impacts, potential access changes were evaluated at each driveway along this portion of the corridor. Recommended changes are depicted in Figure 6-8.

Figure 6-8: Recommended Access Management Changes – 4th to 5th Streets

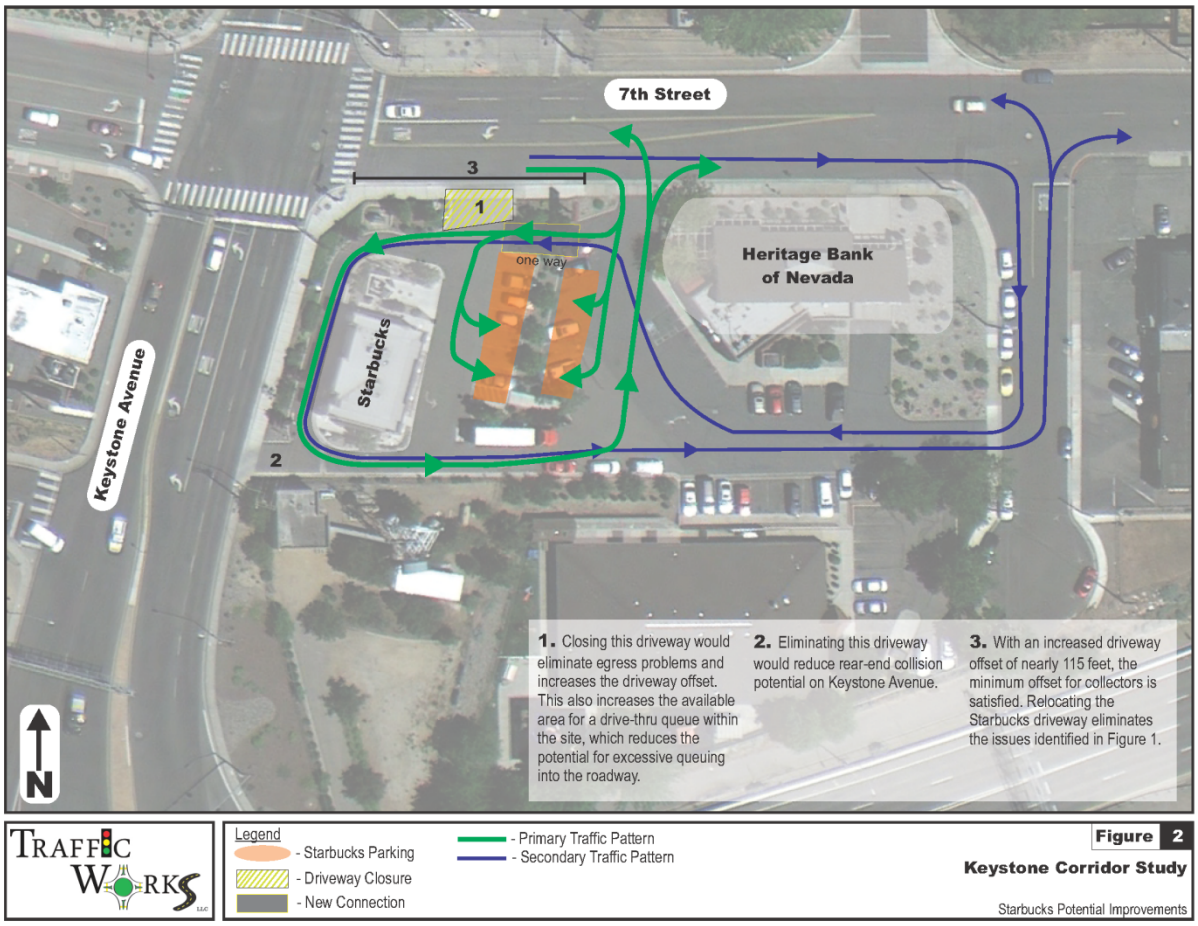
The primary changes include reducing the number of left-turn movements from driveways by reconfiguring or installing median islands. Other changes include eliminating or reconfiguring driveways that do not meet the guidelines to those properties with other points of access. Reducing the number of conflict points along this segment will improve safety and traffic circulation through the corridor.

6.3.3. Keystone Avenue / W. 7th Street Intersection Access Management

As discussed in Chapter 5, traffic operations at Keystone Avenue / W. 7th Street are impacted because of poor drive-through operations, inadequate driveway spacing and an overall lack of parking at the Starbucks and other adjacent businesses located on the southeast corner of the intersection.

The recommended solution as depicted in Figure 6-9 requires closing the driveway nearest to the intersection of Keystone Avenue and W. 7th Street. Drivers would instead utilize the driveway farther to the east as well as the access driveway located on Alvero Street. Additional modifications to the parking facilities are required to allow for additional queuing at the drive-through window. While these proposed modifications may impact a small number of parking spaces, the overall storage increase and improved circulation of the site will benefit operations at the Keystone Avenue / W. 7th Street intersection. Additional parking may be accommodated through modifications to the existing parking lot or by accommodating additional on-street parking on Alvero Street. Further investigation and coordination with property owners is required such that all potential options to improve the parking configuration and intersection operations occur.

Figure 6-9: Recommended Potential Access Management Improvements



6.4. Transit Improvements

The public raised two separate issues regarding transit service in the corridor: 1) lack of turnouts, shelters, and benches at the bus stops, and 2) lack of service north of King's Row. In addition to these issues raised by the public, the study team identified several ADA issues at the bus stops as listed in Section 2.8.3, as well as a LOS F for the existing transit service from 1st Street to W. 7th Street. The following transit improvements are recommended to address these issues.

6.4.1. Bus Stop Enhancements

The recommended improvements for each bus stop vary depending on the location in the corridor. Many of the bus stops are located along sidewalks where right-of-way is required in order to provide the necessary ADA improvements. Because the amount of right-of-way in most locations is limited to needing only a small strip about five feet long and three feet deep, easements could be obtained from property owners to allow sidewalks to be placed outside of the established right-of-way. Benches and trashcans would be added to locations with sufficient room to handle the additional area needed for those appurtenances.

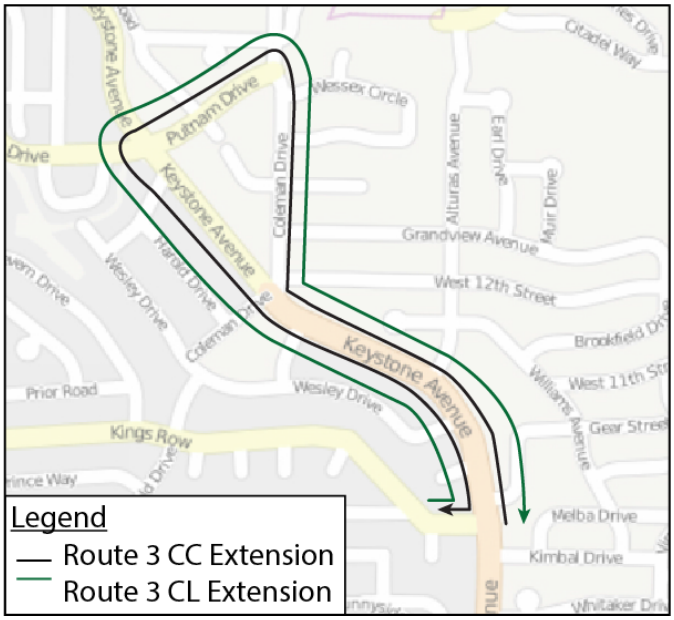
6.4.2. Transit Route Enhancements

As discussed in Section 2.8, the corridor is served by three RTC RIDE routes. As indicated by a few residents of the northern area, none of the routes serve the corridor past King's Row. It is recommended the RTC consider extending Route 3 service to Putnam Drive to serve the residents along the northernmost parts of the corridor. A possible way to accomplish this is to extend Route 3CC and Route 3CL to Coleman Drive and Putnam Drive as illustrated in Figure 6-10.

In order to alleviate the LOS F condition indicated by the multimodal LOS analysis, it is recommended the RTC consider increasing the frequency to half-hour headways during peak hours.

Both the route extension to Coleman/Putman and increased frequency of the existing service during peak hours require a more detailed evaluation by RTC's transit division. The recommendations herein are based on the general public comments and the LOS analysis; they do not take into account additional factors such as operational impacts, financial considerations, and potential utilization.

Figure 6-10: Potential Transit Route Extensions



6.5. Other Recommended Improvements

All of the recommended improvements to the northern and southern segments include the installation of amenities such as landscaping, street trees, and public art where possible. Particular attention should be paid to landscaping and aesthetic improvements at key intersections that serve as gateways to the commercial section of the corridor. These intersections include Keystone Avenue / California Avenue, Keystone Avenue / 4th Street, and Keystone Avenue / W. 7th Street. Intersections such as these can serve as visual dividers separating the commercial areas from the residential areas and improve how the public and private realms inter-relate.

Other improvements including the installation of street lights at crosswalks, upgrading street signs to current MUTCD standards, and replacement of damaged or deteriorated sidewalks should be implemented with recommended projects occurring in the area.

6.6. Proposed Alternative Summary and Phasing

Table 6-1 and Table 6-2 outline the recommended improvements to improve safety and enhance multimodal connectivity for the northern and southern segments of the corridor. Each recommendation has been categorized as short-term, mid-term, or long-term. Beginning from the date this report is adopted, the periods for each category are generally considered as the following:

- Short-term: Within the next 5 years
- Mid-term: Within the next 5 to 15 years
- Long-term: More than 15 years

Due to the limitations associated with cost and the constraints of right-of-way along Keystone Avenue, significant improvements such as improving intersections, widening sidewalks, replacing bridges, and installing new bike facilities along the entire corridor length cannot be fully implemented while still maintaining property access and policy LOS for the existing traffic volumes. As redevelopment occurs, the long-term approach should include the reconstruction of Keystone Avenue to accommodate any lacking or sub-standard facilities and other enhancements to promote a corridor that is safe for all modes of transportation.

Table 6-1: Summary of Recommended Improvements – Southern Segment

Location	Recommended Improvements	Phasing Category
Keystone / California Intersection	Intersection Alternative F (California / Keystone Limited Improvements)	Short-term
	Consider further study of intersection configurations similar to Alternative B. (California / Keystone Roundabout)	Long-term
	Relocate the bus stop near Westfield based on recommended intersection improvements. New stop shall be ADA compliant and include a shelter.	Long-term
California / Booth / Foster	Close some driveways and modify others to reflect access management standards and the recommended intersection configuration at Keystone/California.	Short-term
	Install RRFB at the crosswalk at Newlands Circle	Short-term
	Relocate the bus stop near the intersection of Idlewild and Booth approximately 100 feet east to take advantage of additional right-of-way for ADA compliance. Install a bench and trashcan.	Short-term
	Construct additional sidewalk width to bring bus stop adjacent to Reno High into compliance with ADA. Coordinate with Reno High School for easement.	Short-term

Location	Recommended Improvements	Phasing Category
Keystone Avenue Bridge	Provide additional signing and striping directing cyclists and pedestrians to use Riverside and Booth Street to cross the river.	Short-term
	Coordinate with NDOT and the Flood Project on possible funding sources and timing of the bridge replacement.	Short-term
	Replace the bridge with accommodations for bicycles and pedestrians as well as revisions to the grade and northern abutment location. Possibly include the California / Keystone Intersection as part of project.	Long-term
Keystone / Jones Intersection	Provide a median island to eliminate left-turns and through movements.	Short-term
	Reconfigure the intersection based on the design for the replacement of the Keystone Bridge.	Long-term
Jones to 4th Street	Reconstruct sidewalks ramps and driveway aprons into compliance with the ADA.	Short-term
	Coordinate signal timing through corridor.	Short-term
	Provide additional sidewalk width at bus stops north and south of 1st Street. Easements are required from adjacent property owners.	Mid-term
	Coordinate with NV Energy to remove or add protection to the anchor wires along sidewalks.	Mid-term
	Reconstruct sidewalks with full ADA improvements. Relocate utilities out of sidewalk to ensure minimum clearance requirements are met.	Long-term
Keystone / 2nd Street Intersection	Provide additional storage for the eastbound left-turn pocket.	Short-term
	Adjust the pedestrian signal head or recommend coordination with NV Energy to have the utility pole relocated west.	Mid-term
	Relocate push buttons on the northern side of the intersection to the proper distance from the crosswalk.	Mid-term
	Replace the eastbound traffic signal and the mast arm to a standard pole with the approved standards.	Mid-term
Keystone / 4th Street Intersection	Install median islands along 4th Street for access management.	Short-term
	Increase left-turn storage length for both northbound and southbound left turn movements along Keystone.	Short-term
	Construct additional sidewalk width to bring bus stops adjacent to the Jack in the Box and Chevron Gas Station along 4th Street east of Keystone into compliance with ADA. Coordinate with property owners for easements.	Mid-term

Location	Recommended Improvements	Phasing Category
	Relocate push buttons on the northern side of the intersection to the proper distance from the crosswalk.	Mid-term
Vine Street	Provide new bike facilities (sharrows and bike lanes) along Vine Street and Washington Street from Riverside drive to University Terrace.	Short-term
4th Street to I-80 Interchange	Limit new driveway access to properties under redevelopment.	Short-term
	Modify the driveway access on 4th Street near Vine Street to prevent traffic from passing through the McDonalds parking lot.	Short-term
	Coordinate with NDOT to reconsider use of ramp meters under current traffic conditions.	Short-term
	Close some driveways and modify others to reduce conflict points and improve traffic flow along Keystone.	Mid-term
	Reconfigure northbound left-turn pocket to increase storage at the freeway interchange.	Mid-term
	Adjust lane widths and median island widths to accommodate bike lanes along the commercial core.	Mid-term
	Relocate the bus stop along northbound Keystone 160 feet south to take advantage of increased right-of-way width and limit potential for mid-block pedestrian crossings. Provide a shelter.	Mid-term
	Ensure future design of freeway interchange includes bike lanes and improved pedestrian facilities.	Long-term
	Lengthen the eastbound off-ramp right-turn storage	Long-term
	Tighten radii of interchange ramps to increase distance between 5th Street and W. 7th Street intersections and reduce intersection speeds	Long-term
Keystone / 7th Street Intersection	Coordinate with Starbucks and other business owners regarding possible access and parking modifications.	Short-term
	Modify the raised curb area at the southeast corner of the intersection to allow ADA access to the crosswalk push button.	Short-term
	Install a flashing yellow arrow signal to provide protected-permitted signal phase.	Short-term
	Acquire additional right-of-way width to increase lane widths and provide bike lanes through the intersection.	Long-term
W. 7th Street	Re-construct the sidewalk for the bus stop on the westbound side of W. 7th Street.	Short-term

Location	Recommended Improvements	Phasing Category
	Construct additional sidewalk width to bring bus stop adjacent to Heritage Bank along eastbound W. 7th Street into compliance with ADA. Coordinate with bank for easement.	Short-term

Table 6-2: Summary of Recommended Improvements – Northern Segment

Location	Recommended Improvements	Phasing Category
University to Coleman Drive	Evaluate extension of Route 3CC or 3CL service to Coleman Drive	Short-term
	Coordinate with NV Energy to remove or adjust the location of the utility poles located in the sidewalk.	Mid-term
	Provide full roadway section improvements as proposed for Alternative 2 (Complete Street)	Mid-term
Keystone / University Terrace Intersection	Eliminate left-turn and through movements at University Terrace.	Mid-term
	Modify the sidewalk adjacent to Raley's for bus stop improvements and ADA compliance. Modifications to the existing easement are required.	Mid-term
	Provide a southbound left-turn lane on to University Terrace.	Short-term
	Adjust the bus stop sign position to make crosswalk notification more visible.	Short-term
	Reconstruct sidewalks ramps into compliance with the ADA.	Short-term
	Remove brick walls and other landscaping to increase sight distance. Begin coordination with State Historic Preservation office.	Short-term
	Provide free turn lane for right turns off Kings Row to southbound Keystone.	Short-term
	Construct sidewalks along intersection where they are currently lacking.	Mid-term
	Trim trees and modify the sidewalk at the bus stop along westbound Kings Row for ADA compliance. The right-of-way appears to be of sufficient width to accommodate the improvements.	Mid-term
	Construct a sidewalk bulb-out for the bus stop located along eastbound Kings Row taking the area from the parking to provide the necessary ADA compliance.	Mid-term
	Provide crosswalk at Gear Street and improve crosswalk at Kings Row. Include advanced signing, RRFB, and street lighting.	Mid-term
Keystone / Coleman Drive Intersection	Eliminate free right-turn lane north to Coleman Drive to provide a more typical four-way stop intersection.	Short-term
Coleman Drive to McCarran Blvd	Implement recommendations from the NDOT RSA.	Mid-term

Location	Recommended Improvements	Phasing Category
Keystone / McCarran Intersection	Coordinate with NDOT District II on median improvements.	Short-term

6.7. Project Development and Cost

Table 6-1 and 6-2 summarized the complete list of recommended improvements. From that complete list, specific projects for different segments of the corridor encompassing multiple recommendations can be developed. These recommended projects have been categorized by phase with cost assigned to each potential project. The listing of recommended projects is shown in Table 6-3.

The planning level costs for each project were developed using historical cost information. All recommended improvements associated with a project segment are included in the total cost. Escalation has been applied to the costs for both the mid-term and long-term categories based on historical data collected by NDOT. This table allows the RTC to efficiently identify future projects and incorporate those projects into future RTP updates.

Table 6-3: Recommended Projects

	Project Description	Cost*	Phasing Category
California Avenue to I-80	California / Keystone Intersection Alternative F (Includes changes to the signalized intersection along with ADA ramp and bike improvements along California Ave.)	$ 1,000,000	Short-term
	Jones Street to 4th Street access management and ADA improvements	$ 500,000	Short-term
	Vine Street and Washington Street Bike Lanes	$ 500,000	Short-term
	4th Street to I-80 Access Management, roadway and sidewalk reconstruction	$ 3,000,000	Mid-term
	Replace the Keystone Avenue Bridge	$ 30,000,000	Long-term
	Jones Street to 4th Street roadway and sidewalk improvements	$ 4,500,000	Long-term
	I-80 SPUI re-construction	$ 6,500,000	Long-term
I-80 to McCarran Blvd	W. 7th Street to Coleman Drive ADA and crosswalk improvements	$ 500,000	Short-term
	Coleman Drive to McCarran Boulevard Safety Improvements	$ 500,000	Mid-term
	W. 7th Street to Coleman Drive Complete Street roadway section, access management, and transit improvements	$ 5,000,000	Mid-term

**Costs rounded to the nearest $ 500,000*

6.8. Summary of Deficiencies and Resolution

The table below outlines resolutions to the specific identified deficiencies in Chapter 4.

Table 6-4: Resolution of Issues – Southern Segment

Street	Location	Issues	Resolution
California	Keystone	Incomplete bike lanes through intersection	The recommended design accommodates new bike lanes in the uphill direction.
			Long-term improvements will include full bicycle facilities.
California	Keystone	Poor pedestrian routing and circulation	The recommended design provides more ADA compliant pedestrian access along roadways.
California	Keystone	Dysfunctional signalized modified T-intersection	Revise the geometry of the intersection and optimize the signal timing with adjacent signals.
California	Keystone	Insufficient turn bay storage for the SBR movement	The recommended design includes sufficient storage.
California	Cherry to Booth	Numerous residential and commercial curb cuts on the south side with deteriorated concrete (not ADA compliant)	Long-term improvements insure improved and compliant sidewalks. Residential driveways are to remain.
California	Cherry	No shelter at the bus stop	Ensure shelter has bench and trashcan. Evaluate placing shelter as funding becomes available.
California	Cherry to Newlands	Crash rate is higher (3.19) than statewide averages (2.41)	Crash rates are based on the roadway section prior to the lane reduction. Data should be re-evaluated in the coming years.
			A pedestrian actuated flasher such as a RRFB should be installed at Newlands Circle.
Booth	California to Idlewild	Numerous driveways, some with little corner clearance, and entries/exits not clearly defined	Consolidate multiple driveways near California; access management standards are not applicable to Booth Street.
Booth	Foster	Misaligned intersection	Incorporate striping improvements as appropriate with next pavement preservation project.
Booth	Foster	No shelter at the bus stop	Coordinate with Reno High School to evaluate stop improvements.
Booth	California	Numerous commercial driveways	Driveway locations to be altered based on intersection improvements.
Booth	California	Insufficient turn bay storage for the SBL movement	Ensure the long-term design includes sufficient storage.
			Re-time the signal at Booth Street to reduce the number of stopped vehicles.

Street	Location	Issues	Resolution
Booth	Idlewild	No shelter or bench at the bus stop	Relocate stop location and provide a bench and trashcan. Evaluate placing shelter as funding becomes available.
Booth	Truckee River	TRFCP proposing to replace Booth St bridge with a pedestrian / bike only bridge	The design of the recommended intersection alternative accounts for the removal of this bridge.
Riverside	Booth	TRFCP proposing to reduce Riverside to one-way with bike / pedestrian park	Recommend installation of additional signing indicating bike route.
Keystone	Foster	Aging structure over Foster Drive	Ensure continued analysis for the long-term California / Keystone Intersection includes the elimination or reconstruction of this bridge.
Keystone	Truckee River	Aging structure with low sufficiency rating	Coordination with NDOT is to occur after completion of the study.
Keystone	Truckee River	No bicycle or pedestrian facilities on the bridge or approaches	Place more visible bike / pedestrian signage to direct users to Booth Street bridge
			Any new bridge over the Truckee River is to be designed to accommodate bicycles and pedestrians.
Keystone	California to University	No bicycle facilities	Restripe both Vine Street and Washington Street to accommodate bike lanes to serve as the primary north-south bicycle route for the corridor.
			Other bike facilities be added between 4th and 5th Streets to gain better access to the commercial areas.
Keystone	Jones to University	Numerous, closely spaced commercial driveways; a specific example is the back-to-back full median openings between 4th and 5th	Access modifications are proposed to driveways and median islands primarily between 4th Street and 5th Street. Residential driveways are to remain.
Keystone	Jones to University	Lack of bus turnouts and no shelters or benches at existing bus stops	Coordinate with property owners to make the necessary ADA improvements to bus stops. Install benches and trashcans.
Keystone	4th to 5th	High number of pedestrians cross at the mid-block locations near McDonalds and Wells Fargo	Relocate northbound bus stop south closer to 4th street intersection to discourage mid-block crossings.
Keystone	2nd to 7th	Insufficient turn bay storage at intersections	Re-evaluate signal timing. Extend turn bays where feasible.
Keystone	1st to 7th	Operates at LOS E as an urban street facility for the automobile mode	Recommend signal timing be adjusted for better coordination.

Street	Location	Issues	Resolution
Keystone	1st to 7th	Operates at LOS F for transit mode	Consider increasing the frequency to half-hour service during peak periods.
Keystone	2nd to 5th	Crash rate is higher (3.05) than statewide averages (2.41)	Improvements such as eliminating some driveway movements and installing median islands to reduce conflict points are proposed. Also, refining signal timing is recommended.
Keystone	2nd and 4th	Intersection not ADA compliant	ADA improvements will be made with future projects.
Keystone	2nd and 4th	Driveways spaced close to intersection on the cross street	Modifications to access are proposed including the closure of some driveways near these intersections.
Keystone	5th	Potential redevelopment project in NW corner	Coordination with the property owner is required. It is recommended that driveway access not be granted to Keystone from this site because of the proximity to 5th Street and the freeway interchange.
Keystone	I-80	Ramp meter not effective	Coordinate with NDOT to reconsider use under current traffic conditions.
Keystone	I-80	Intersection operates a LOS E in the AM peak hour with EBR movement LOS F	Re-evaluate signal timing.
			Coordinate with NDOT to design an additional eastbound right-turn lane.
Keystone	I-80	Higher speed ramp terminal unfriendly for pedestrian crossing and creates conflicts with close spacing to W 7th St	NDOT has proposed improvements to this interchange as part of their long-range improvement plans.
Keystone	I-80 to 7th	Exit ramp to WB W. 7th Street weave	Coordinate with NDOT to design a tighter radius ramp terminal to increase weave distance between intersection and interchange.
Keystone	7th	No WB right-turn lane and no protected left-turn phase for EB/WB traffic	Recommend increased turn lane storage capacity.
			Install a flashing yellow arrow signal to provide protected-permitted signal phase.
Keystone	7th	Starbucks drive through in SE quadrant backs up onto 7th St and to the Keystone/W. 7th intersection	Recommended solution includes closing one driveway and modifying the parking area for better circulation. Coordination between RTC, the City of Reno and the business owners is required.

Table 6-5: Resolution of Issues – Northern Segment

Street	Location	Issues	Resolution
Keystone	University to Coleman	No bicycle facilities	The recommended Complete Street alternative provides bike facilities.
Keystone	University to Coleman	Numerous driveways create hazards when backing in/out residences	The recommended alternative provides buffer distance between the driveways and the travel lanes due to improvements to the sidewalks and addition of bike lanes. The elimination of driveways is not recommended.
Keystone	University to Coleman	4-foot sidewalks with numerous obstructions and poor concrete condition	Sidewalk replacement and widening improvements are included in the recommended alternative.
Keystone	University to Coleman	Speeding / safety concerns due to four lanes	The reduction in the number of travel lanes of the recommended alternative will likely slow vehicle traffic.
Keystone	University to Coleman	Bus service ends at King's Row	Evaluate opportunities to extend service lines (Route 3CC) to Coleman Drive.
Keystone	University	Designated crosswalk often ignored by motorists	Changes to the signing are proposed that improve the visibility of the crosswalk.
			The reduction in the number of travel lanes reduces the number of lanes a pedestrian needs to cross improving safety.
Keystone	University to Coleman	Limited crosswalk options	Additional crosswalks are proposed at Gear Streets.
Keystone	Kings Row	Crosswalk does not lead to a NB Keystone sidewalk	Modifications to the crosswalk locations and the installation of new sidewalks at all locations where it is currently lacking is proposed.
Keystone	Kings Row	Perceived safety issues	Improvements will be completed as part of the recommended alternative.
Keystone	Coleman/12th	Perceived safety issues near 12th	Provide intersection improvements by eliminating the channelized right-turn.
Keystone	Coleman to McCarran	No bike lanes between Coleman and Peavine and cars park in the NB bike lane within the first 250 feet north of Peavine Road	Add a northbound bike lane between Coleman and Peavine and install 'Share the Road' signs for the southbound direction. Install additional no parking signs.
Keystone	McCarran	The median island to restrict left turn onto McCarran is being ignored	NDOT is leading the effort to install an improved median island at this intersection.

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7. Environmental Linkages

The corridor study recommendations were developed with the input of stakeholders and the public. As such, the goals, objectives, and needs identified serve to support future advancement of projects in the corridor. This support includes advancement through the National Environmental Policy Act (NEPA) process. This corridor study begins to define a framework from which future decisions can build upon in order to provide a link between the planning and environmental processes. The result is the progressive refinement of the transportation decision-making process and continued advancement from the perspective of stakeholders and the public. Other benefits of the planning and environmental framework include:

- Early development of the "purpose and need" and alternative analysis processes
- Transparency in the needs identification and alternative screening for partner agencies and the public
- Reduced duplication of efforts during project advancement
- Encourages environmental stewardship and streamlining
- Improves project delivery

Three critical aspects of linking the planning and environmental phases is documenting the alternatives considered and dismissed, providing clear evidence of how the public and stakeholders shaped decisions, and environmental resource considerations. The first two items are described throughout this report. Environmental resources were considered on a qualitative basis. Due to the developed nature of the corridor, few resources are anticipated to be of primary concern. Table 7-1 provides a summary of resources and associated potential for impact on future projects. A description of each potentially resource follows.

Table 7-1: Summary of Environmental Resources

Environmental Resource	Low Potential Impact	Potentially Impacted	Significant Potential Impact
Air Quality	X		
Noise	X		
Biological (including vegetation, invasive/noxious species, wildlife, migratory birds)	X		
Threatened and Endangered Species			X
Energy Resources and Minerals	X		
Floodplains and Water Resources / Quality		X	
Hazardous Materials		X	
Land Use	X		
Geology, Soils, and Paleontology	X		
Cultural Resources/Section 106			X
Native American Religious Concerns	X		
Section 4(f)			X

Environmental Resource	Low Potential Impact	Potentially Impacted	Significant Potential Impact
Social and Economic Conditions, including Environmental Justice		X	
Visual Resources		X	
Wetlands / Riparian Zones		X	
Prime Farmlands	X		

Threatened and Endangered Species: The Keystone Avenue Bridge is recommended for replacement. The current bridge spans the ordinary high water of the Truckee River. It is likely that a replacement bridge will clear span the river; however, the construction of a new bridge will likely require falsework and/or river diversions requiring Section 7 consultation. The Truckee River is home to the Lahontan Cutthroat Trout which is listed as a threatened species. Biological consultation is anticipated.

Floodplains and Water Resources / Quality: Areas of the project near the Truckee River lie within a floodplain. Analysis will be required for improvements within the floodplain to ensure no rise in the flood elevation occurs.

Hazardous Materials: The segment of Keystone Avenue from West 1st Street to University Terrace consists of numerous commercial developments. Many of these parcels are currently or have been gas stations. Underground storage tank leaks may be encountered during any excavation in this area.

Cultural Resources/Section 106: The greatest potential for Section 106 impacts is with historic architecture. Many segments of the Keystone Corridor were developed as far back as the 1920s-1940s; therefore there is a high likelihood of eligible properties throughout the corridor. Known resources that may be impacted by recommended improvements include the Keystone Avenue Bridge over the Truckee River, the McKinley Arts and Culture Center, the Orr Ditch, and the Royal Heights community brick signs and turret.

Native American Religious Concerns: No known Native American sites exist in the project area; however, it is anticipated the Reno-Sparks Indian Colony will want to be consulted during the development of a replacement Keystone Avenue Bridge to ensure a tribal monitor can be present during excavation activities.

Section 4(f): Section 4(f) properties potentially impacted by proposed improvements include Newlands Park, the Keystone Avenue Bridge, McKinley Arts and Culture Center, Riverside Linear Park (not currently designated by the City of Reno), Orr Ditch, Lake Park and any other historic architecture potentially impacted.

Social and Economic Conditions, including Environmental Justice: No known underserved communities were identified during the study process; however, demographic analysis was not conducted. Additional analysis may be required.

Wetlands / Riparian Zones: The Truckee River is designated as Waters of the United States and is under jurisdiction of the U.S. Army Corp of Engineers. Any work in or along the Truckee River will require consultation with the U.S. Army Corp of Engineers and will likely require a Section 404 permit.

As mentioned, only qualitative analysis was conducted. The resources and potential impacts listed above are to support future projects and to serve as a guide as advancement decisions are made and are not intended to supersede appropriate environmental analysis.

Acronyms

AADT .....annual average daily traffic
ADA.....Americans with Disabilities Act
EBR.....eastbound right-turn
FHWA .....Federal Highway Administration
ITS.....intelligent transportation systems
HCM .....Highway Capacity Manual
HCS.....Highway Capacity Software
LAC.....low-access controlled
LOS .....level of service
MAC.....moderate-access controlled
NDOT.....Nevada Department of Transportation
NEPA .....National Environmental Policy Act
NBL.....northbound left-turn
NB/SB/EB/WB...northbound/southbound/eastbound/westbound
PDO.....property damage only
PHF.....peak hour factor
RRFB .....rectangular rapid flashing beacon
RSA.....Roadside Safety Audit
RTC.....Regional Transportation Commission of Washoe County
RTP.....Regional Transportation Plan
SBL.....southbound left turn
SHSP.....Strategic Highway Safety Plan
SPUI.....Single Point Urban Interchange
SWG .....Stakeholder Working Group
TAC .....Technical Advisory Committee
TRFCP .....Truckee Meadows Regional Flood Control Project
TMRPA.....Truckee Meadows Regional Planning Agency
TOD.....transit oriented corridor
VMT .....vehicle miles traveled
WBR .....westbound right-turn

Appendices

Appendix A: Public/Stakeholder Outreach Process

Appendix B: Keystone Avenue Road Safety Audit Reports

Appendix C: NDOT Bridge Inspection Report for Keystone Avenue / Truckee River and Keystone Avenue / Foster Drive

Appendix D: Traffic Count Data

Appendix E: 12-Hour Bicycle, Pedestrian, and Wheelchair Volumes

Appendix F: Signal Timing and Phasing Information from the City of Reno

Appendix G: HCS and Synchro Analysis Worksheets

Appendix H: Detailed Travel Time Study Report

Appendix I: Access Management – Inventory Sheets

Appendix J: Right-of-Way and Utility Survey Sheets

Appendix K: Transit Route Information

Appendix L: Keystone Avenue / Kings Row Multi-way Stop Control Warrant Analysis

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