

FINAL REPORT



# I-15 CORRIDOR ALTERNATE ROUTE STUDY

AUGUST 2017



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# I-15 Corridor Alternate Route Study

*Prepared for*



I-15 Mobility Alliance

August 2017



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# Acronyms and Abbreviations

AASHTO	American Association of State Highway and Transportation Officials
ADT	average daily traffic
AADT	average annual daily traffic
ATRI	American Transportation Research Institute
BTS	Bureau of Transportation Statistics
CA	California
Caltrans	California Department of Transportation
DOT	Department of Transportation
ESRI	Environmental Systems Research Institute
FEMA	Federal Emergency Management Agency
FHWA	Federal Highway Administration
FRA	Federal Railroad Administration
I	Interstate
ITS	Intelligent Transportation Systems
MPH	miles per hour
MPO	Metropolitan Planning Organization
NDOT	Nevada Department of Transportation
NHTSA	National Highway Traffic Safety Administration
NB	northbound
NV	Nevada
SB	southbound
US	United States
USDA	United States Department of Agriculture
USGS	United States Geological Survey
VPD	vehicles per day



# Introduction

## 1.1 I-15 Mobility Alliance

The I-15 Mobility Alliance includes involvement from the Departments of Transportation (DOTs) in California, Nevada, Arizona, and Utah, as well as key stakeholders along the corridor. The Alliance transcends traditional transportation thinking by advancing innovation, long-range planning, investment, and implementation of multimodal systems; including not only increased mobility of people and goods through highways, freight rail, transit, and high-speed passenger rail, but also forward-looking technologies for the transport of energy, data, and communications.

The I-15 Corridor is a vital linkage in the economy not only of the western U.S., but of the entire nation. Projected increases in commodity flows from the western U.S. and Mexican ports, and population growth will result in expanded segments of I-15 experiencing severe congestion thus impeding commerce, hindering mobility, and degrading the quality-of-life of the people served by the corridor.

Within the Alliance states, the I-15 Corridor runs from the southern terminus in San Diego, California to the Utah/Idaho border (Figure 1-1). This portion of the facility covers approximately 840 miles and runs through several major metropolitan areas including San Diego, the Inland Empire, Los Angeles, Las Vegas, and Salt Lake City, and connects with the major interstates of I-5, I-8, I-10, and I-40 in California, and I-70, I-80, and I-84 in Utah.

Figure 1-1. Study Area



The mission of the Alliance and its members is to develop, in partnership with public and private sectors, a comprehensive, multimodal Master Plan for the I-15 Corridor, to prioritize projects and policies of interregional significance, to seek financial and other resources necessary for the implementation of the Master Plan, and to devise appropriate governance mechanisms for the ongoing efficient and effective construction, operations, and maintenance of the corridor on a more sustainable basis.

## 1.2 Alternate Route Study

One of the elements of the mission of the I-15 Mobility Alliance is to maintain the efficient and effective operations of the I-15 Corridor. Through ongoing coordination efforts, it has become important to Alliance members to identify and understand operational constraints for alternative routes to I-15. In times of major incidents or natural disasters that may close or severely constrain use of I-15, drivers can make better and more informed choices on detour routing with advanced notice. In many cases, potential routing choices are limited due to the rural nature of the corridor, and these decisions may need to be made many miles in advance of the closure to avoid bottlenecks.

The purpose of this study is to identify regional alternate routes to I-15, inventory the existing conditions of those routes, and document potential needs to meet minimum operating conditions. This effort will result in a clear set of alternate routes, and a prioritized list of improvements needed on those routes.

A lack of alternative routes to I-15 exist. Major incidents that close I-15 cripple traffic, causing added congestion and lost economic dollars.



*I-15 flood damage, September 2014*

The **2014 Moapa flood** forced the closure of 50 miles of I-15, requiring a 223-mile detour for truck traffic bound from Las Vegas to Utah – more than doubling the travel time. This resulted in an extra daily cost of \$667,000 - \$790,000 in trucking operations, not including the economic impact of delayed freight deliveries (ATRI, 2015).



*Fire closes I-15 at Cajon Pass, July 2015*

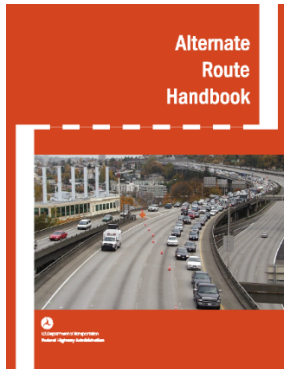
**Source:** San Bernardino Fire Department

The **July 2015 Cajon Pass** fire swept across I-15, resulting in more than 30 destroyed vehicles. Detour options exist, although none are direct and all pose additional hazards, ranging 20 to 50 miles out of direction on rural forest service roads. The Cajon Pass was closed again in August 2016 due to the Blue Cut Fire.



# Alternate Route Delineation

## 2.1 Framework



The primary objective of this study is to identify and prioritize a set of improvements needed for a regional alternate route to I-15 connecting Salt Lake City, Las Vegas, Inland Empire, and San Diego. While many short detours exist to re-route local traffic in emergency situations, the I-15 alternate route delineation is intended to provide a regional corridor for longer-distance trips. Defining this corridor will assist the four Alliance states in strategizing regional detour routes and coordinating communication protocols in the event of a closure.

A guiding resource in this delineation is the Federal Highway Administration's (FHWA) *Alternate Route Handbook*. The Handbook defines a regional alternate route as one that "typically represents a high-speed, high-capacity facility that services...through traffic, destined for some location (e.g., city) far downstream of the bottleneck location...[in order] to minimize travel time and delay anticipated on the local alternate route."

Local alternate routes, which divert "traffic a short distance, typically from one point (e.g., interchange or major intersection) to the next downstream point" (FHWA 2006), serve the local community and travelers and are needed in conjunction with regional alternate routes. By removing regional traffic farther upstream of the closure, detour traffic can be dispersed among both the local and regional alternate routes, and increase the possibility of both functioning at an acceptable level of service.

In addition to the *Alternate Route Handbook* several reports for local and regional alternate route studies were reviewed and their approaches incorporated into this study. The most helpful was the *Nebraska Statewide Interstate and Expressway Alternate Route Study* (URS 2007). This study presented an extensive review of alternate routing practices of other transportation departments, both state and metropolitan area, and includes a summary matrix of the methods and criteria upon which other agencies have based their selection of alternate routes, shown in Table 2-1.

Implementation of an alternate route plan is a key traffic management strategy, serving to reduce demand upstream of an event site or bottleneck through the diversion of traffic from the mainline. The location and time of such events may be known in advance, or the event may happen at random with very little or no warning. Congestion-causing events, whether planned or unplanned, typically results in a reduction in roadway capacity and/or an increase in traffic demand.

The following major cases of planned or unplanned event occurrences may necessitate the use of an alternate route plan:

- Traffic incidents, such as serious crashes or cargo spills that possibly include a hazardous material release, causing multi-lane or total road closure.
- Non-traffic incidents, such as major fires, industrial accidents, and bridge collapses, rendering sections of a roadway impassable.
- Emergencies, such as a severe weather event, acts of violence, or other major catastrophe, causing road closure and/or inducing a surge of traffic demand on evacuation routes that creates bottlenecks at capacity-restrained locations.
- Planned special events, such as a sporting/concert event or parade/festival, which creates an increase in travel demand and may require road closures to stage the event.
- Major roadway construction and maintenance, which may close or restrict a section of roadway.

The I-15 Corridor has experienced many of the above examples in the recent past, including the Moapa flood in southern Nevada, multiple closures of the Cajon Pass in California due to forest fires, traffic incidents, and inclement weather. Also, the segment between Las Vegas and southern California regularly experiences delay on weekends and holidays due to high volumes of recreational traffic.



## 2.2 Selection Criteria

The first step in delineating an alternate route or routes to I-15 is to identify the characteristics of an ideal alternate route for I-15. FHWA's *Alternate Route Handbook* recommends that criteria should be chosen to benefit both motorists and the community at large, and indicates that alternate routes must:

- Be able to accommodate all vehicle types
- Be reasonably close to the primary route
- Have sufficient capacity to accommodate the traffic that is diverted

Using this guidance, the primary characteristics used to define an alternate route to I-15 include the ability for the corridor(s) to:

- Maintain freight-supportive grades and bridges (able to accommodate all vehicle types)
- Have an acceptable free-flow travel time (reasonably close to the primary route)
- Currently have excess capacity (sufficient capacity to accommodate the traffic that is diverted)
- Limit community and environmental impacts (benefit the community at large)
- Support interstate travel

The last element – support interstate travel – is an overriding key factor in that the defined alternate route, when used, may be accommodating major volumes of long-distance traffic. Identifying an existing corridor(s) that already supports interstate travel is more likely to meet the other four characteristics. Additionally, with transportation spending low and state budgets so constrained, conducting improvements to a route that currently experiences regular interstate travel supports a stronger regional transportation network, as opposed to improving highway segments that would otherwise be minimally used.

Investment in the interregional alternate route serves:

- » Everyday interstate travel and commerce
- » Occasional alternate route
  - Divert traffic well in advance of bottleneck
  - Disperse traffic among regional and local alternate routes

Table 2-1. Alternate Route Case Study Summary Matrix (URS 2007)

Case Study	Geometric Conditions	Roadway Characteristics	Vehicle Restrictions	Safety & Other Capacity Constraints	Criterion Impacts	Route Operation	Amenities	Effectiveness	Miscellaneous
I-15 Synthesis	Number of lanes; shoulder and lane width; divided roadway; pavement condition index; presence of problem drainage areas; grades	Types and number of traffic control; speed limit; ADT; roadway classification; available turn lanes	Height, weight, and width restrictions; bridge efficiency rating; truck turning radius	At-grade rail crossings (train frequency); visibility and sight distance; Level of truck-related crashes; drivability of alternate route	School zones; major traffic generators; noise ordinances; residential areas	Available ITS components; level of congestion introduced onto the alternate route; methods of conveying detour information; signing to guide motorists; availability of and space for temporary traffic control devices	Highway lighting; access to freight terminals; availability of services (fuel, rest stops, food, lodging)	Detour distance; travel time; level of service; prep work needed to get alternate route ready	
I-95 Corridor Coalition			Height, width and weight restrictions	Stay away from routes with current or potential construction activities					Keep alternative routes away from toll facilities
Indiana DOT	Shoulder and lane width; pavement, striping and signage condition; presence of problem drainage areas		Height, weight and hazmat restrictions; turning radii at traffic signal; is the roadway a truck route?	Number of left turns on alternate route; at-grade rail crossings (number and quality of warning devices); lift bridges; tunnels	School zones; major traffic generators; noise ordinances	Potential for coordination of traffic signals; availability of guidance along route; available ITS components	Highway lighting availability	Detour distance; travel time; level of service; prep work needed to get alternate route ready	Objections from local political administrators; major events near route (concert, sporting event)
New Jersey DOT Traffic Operations North		Capacity of route; types of traffic control; county roads vs. trunk highways	Truck turning radius; height clearance; weight restrictions		Schools or hospitals near route	Who operates the traffic signals? Is police control of intersections required?			If necessary, will use two different routes for passenger and commercial traffic
Wisconsin DOT District 1	Number of lanes; geometrics; pavement condition	State highways when possible; long truck route rules; speed limit; traffic control; capacity constraints	Height and weight restrictions	At-grade rail crossings (train frequency); visibility and sight distance; water crossings	Don't pass through residential areas	Avoid routes with many signals, and many 90 degree turns		Avoid routes that go in the opposite direction for more than one mile	Consider options at all interchanges, and minimize the length of the route
Wisconsin DOT District 3	Pavement condition; number of lanes; is the roadway divided? Are there separate turn lanes?	Are roadways one way? speed limit; ADT; traffic control; roadway capacity		Is there an identified bottleneck location? Bridge/ tunnel					Route is analyzed based on the impact of peak-hour performance with diverted traffic
Des Moines Area I-235 Project	Pavement condition index; avoid roads with many curves and grade changes		Height restrictions; bridge efficiency rating; truck turning radius	At-grade rail crossings	Schools near route				Stay off other construction routes
Arizona DOT CANAMEX Corridor (creation of a bypass route)				Level of truck-related crashes	Potential positive economic impacts for nearby areas; negative impacts to residential areas		Access to freight terminals	Length of alternate route; travel time; LOS	Involves new or reconstruction of existing roadways to create a truck bypass
Cambridge, Ontario Area (new or reconstruction of alternate alignments)				Emergency response time to locations on route; at-grade rail crossings	Potential for disrupting neighborhoods; impacts on fish, wildlife, wetlands and vegetation		Accommodate alternate modes of transportation	Distance of travel; delays due to congestion	Must be convincing to the public; simple methods are conveyed easier than complex methods
Georgia DOT	Annual pavement condition inventory		Height, weight, and width restrictions			Use trailblazer signage, temporary changeable message signs and adjusted traffic signal timing to move traffic more efficiently	Various ITS components		Area engineers identify routes using local knowledge, and often ride routes to confirm; all routes are available via website
NCHRP Synthesis 279	Number of lanes; pavement conditions; grades	Number and type of controlled intersections	Height, weight, and width restrictions	Drivability of alternate route	Proximity to residential developments; types of nearby land uses; any schools and hospitals	Level of congestion introduced onto the alternate route; methods of conveying detour information	Availability of services (fuel, rest stops, food, lodging)	Proximity of the alternate route to the primary; ease of access; travel time	Percentage of heavy vehicles to reroute; means of communicating with the public

Case Study	Geometric Conditions	Roadway Characteristics	Vehicle Restrictions	Safety & Other Capacity Constraints	Criterion Impacts	Route Operation	Amenities	Effectiveness	Miscellaneous
<b>Omaha - Council Bluffs</b>	Grades and notable hills; number of turns and curves; shoulder width; pavement condition	Roadway classification; available turn lanes; speed limit	Weight and height restrictions; turning radii issues	At-grade rail crossings	Nearby land uses; high traffic generators; any schools and hospitals	Signing to guide motorists; availability of and space for temporary traffic control devices	Service stations and other amenities; bus routes	Travel distance prior to reentry; complexity of route	Volume of heavy vehicles to reroute; planned construction on route; special events nearby
<b>Cleveland/ Lorain, Ohio (identification of 'deal breakers')</b>	Substandard roadway alignment or geometry; lack of shoulders	Stay on limited access highways if possible; substantial change in speed limits		At-grade rail crossings	Nearby residential areas, schools or hospitals; areas of heavy pedestrian traffic	Circuitous routes; no traffic signals to control or increase capacity for diverted traffic			Roadways requiring resurfacing or reconstruction
<b>Dubuque and Clinton, Iowa Alternative Route Planning</b>		Is the route able to handle the increased volume?							Stakeholders identify candidate routes through local knowledge and expertise

## 2.3 Alternative Segment Evaluation

Areas along I-15 with no or limited reasonable local alternate routes have the highest need and were given extra consideration. These areas are shown on Figure 2-1.

Figure 2-1. Segments with no Reasonable Local Alternate Routes





A set of reasonable alternate routes options were identified for each of these segments based on a regional perspective—considering travel between the four major metropolitan areas of Salt Lake City, Las Vegas, Inland Empire, and San Diego. These options were evaluated based on the selection criteria noted in Section 2.2 of this report. The data and measures used for each criterion are listed in Table 2-2. Figures 2-2 through 2-4 show each of the three areas of highest need on I-15, with their associated alternate route options; and Tables 2-3 through 2-5 show the evaluation scores associated with each.

Table 2-2. Evaluation Criteria and Measures

Criteria	Data Source and Measure
Supports interstate travel	A subjective measure based on the number of miles of US highways vs. less traveled regional or local roads. A scale of 1 to 3 was used, where 3 is most supportive.
Additional mileage	The additional out of direction miles between two points on I-15, as calculated using Google Maps. The data was normalized on a 3-point scale where 3 is the least number of miles compared to the other alternate routes.
Additional free-flow travel time	The additional free-flow travel time needed to travel between two points on I-15, as calculated using Google Maps. The travel times were taken at approximately 4:00 am on a weekday to capture travel times during minimal congestion. The data was normalized on a 3-point scale where 3 is the least free-flow travel time compared to the other alternate routes.
Likelihood of excess capacity	A subjective measure on a scale of 1 to 3 was used, where 3 represents a 4-lane divided highway; and a 1 represents a rural highway that is narrow with stop conditions and very limited options for passing, or an urban roadway with peak period congestion.
Community and environmental impacts	A subjective measure based on the type of roadway. It is assumed that a higher capacity roadway that currently passes through a community or environmentally sensitive areas would have a negative impact (low score of 1, on a scale of 1 to 3).
Likelihood of freight-supportive grades and bridges	A subjective measure based on the number of miles of US highways vs. less traveled regional or local roads, assuming that US highways already have freight-supportive grades and bridges. A scale of 1 to 3 was used, where 3 is most supportive.

A common thread emerged—the highest performing options in each of these areas included the US 93 corridor (with includes portions of US 93a, US 6, and NV 318) north of Las Vegas, and the US 95 corridor south of Las Vegas. By stitching together these highest performing options the backbone of the I-15 alternate route corridor emerged, with multiple options for connecting back to I-15 via other highways and interstates.

With this framework in place, the interregional alternate route is defined as the US 95 corridor from I-10 (Blythe, CA) to I-515 (Las Vegas, NV), and the US 93 corridor from I-15 (Las Vegas, NV) to I-80 (Wells, NV) (Figure 2-5). Throughout this memo, these corridors may be referred to separately, as the broad characteristics along each segment of the route may differ.

The several connectors are also defined, to make the linkages back to I-15 both along existing interstate corridors and major state highway connections. Some of these connectors may serve as a more localized alternate route in the case of an incident; however, the primary corridor is intended to serve travelers that are bound for longer distances (generally traversing multiple states). This study effort will not focus on corridor conditions or needs for connector corridors.

Figure 2-2. Alternate Route Options Around the Virgin River Gorge and Moapa Valley

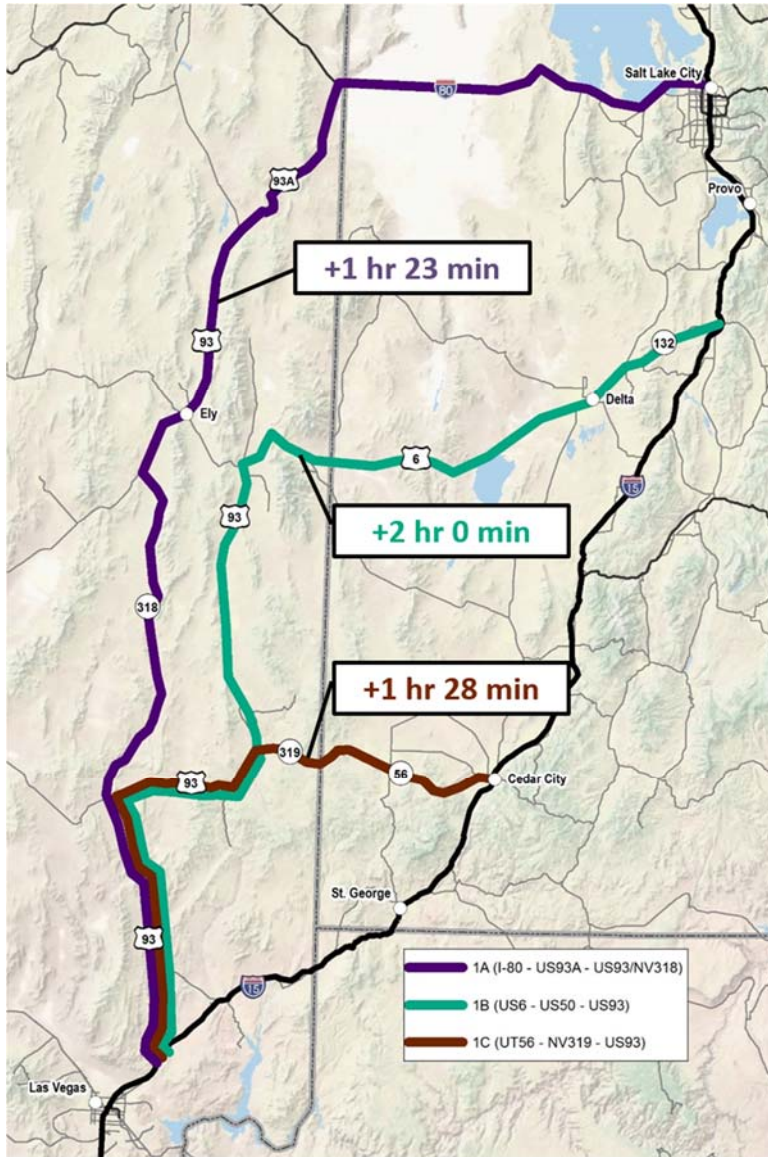


Table 2-3. Evaluation of Alternate Route Options Around the Virgin River Gorge and Moapa Valley

Criteria	1a I-80 – US93a – US93/NV318	1b US6 – US50 – US93	1c UT56 – NV319 – US93
Supports interstate travel	3	3	2
Additional mileage	3	1	2
Additional free-flow travel time	3	1	3
Likelihood of excess capacity	2	2	1
Community and environmental impacts	3	3	2
Freight-supportive grades and bridges	3	3	3
<b>Average</b>	<b>2.8333</b>	<b>2.1667</b>	<b>2.1667</b>

Figure 2-3. Alternate Route Options Around Mountain Pass

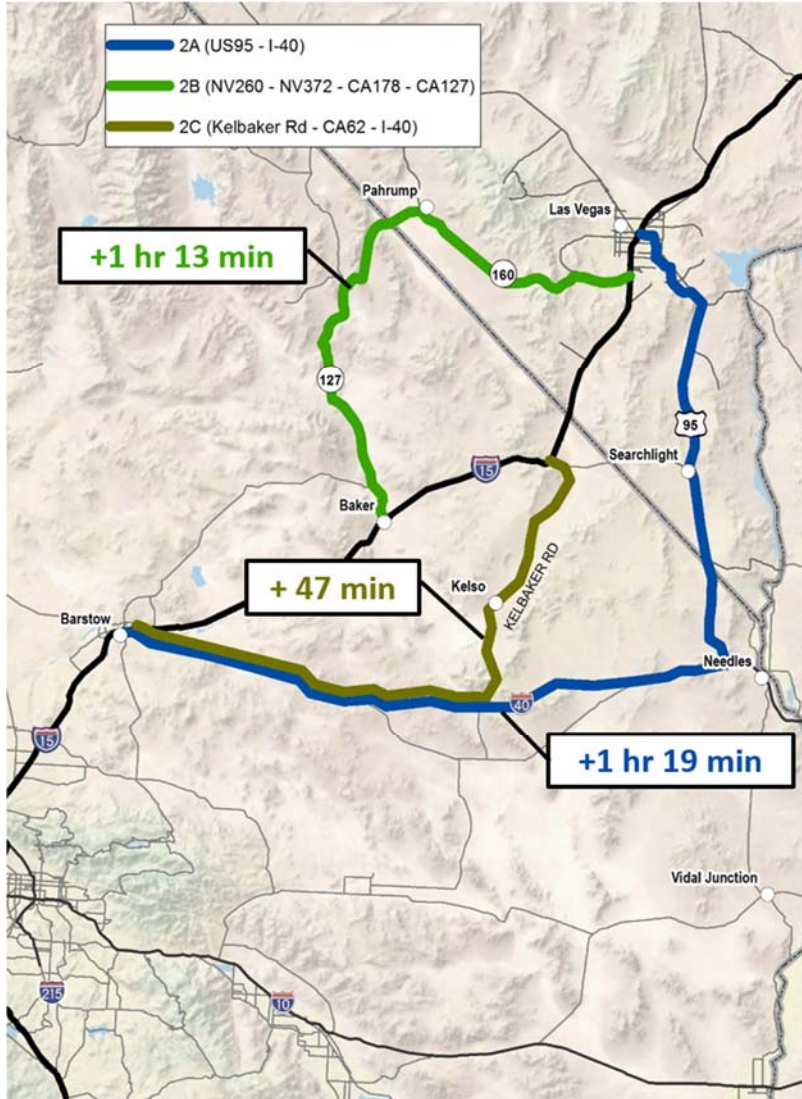


Table 2-4. Evaluation of Alternate Route Options Around Mountain Pass

Criteria	2a US95 – I-40	2b NV160 – NV372 – CA178 – CA127	2c Kelso Rd - CA62
Supports interstate travel	3	1	1
Additional mileage	1	2	3
Additional free-flow travel time	1	1	3
Likelihood of excess capacity	3	1	1
Community and environmental impacts	3	1	1
Freight-supportive grades and bridges	3	2	2
<b>Average</b>	<b>2.3333</b>	<b>1.3333</b>	<b>1.8333</b>



Figure 2-4. Alternate Route Options Around Cajon Pass

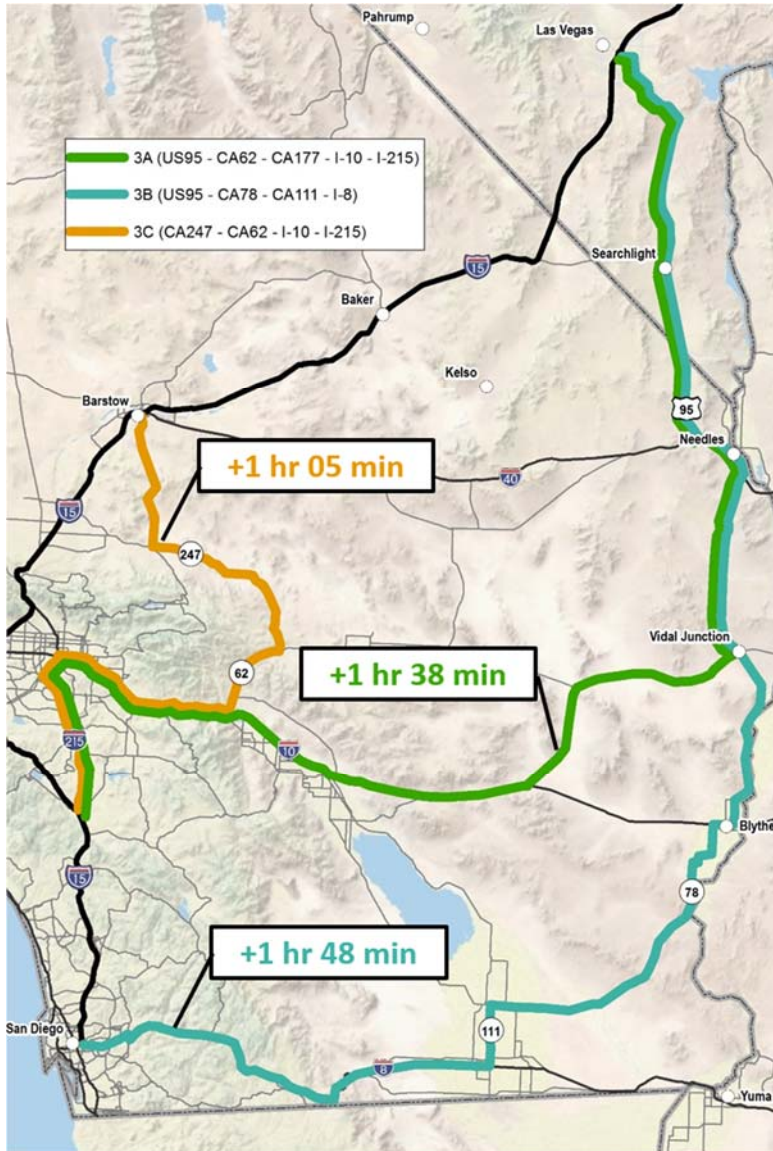
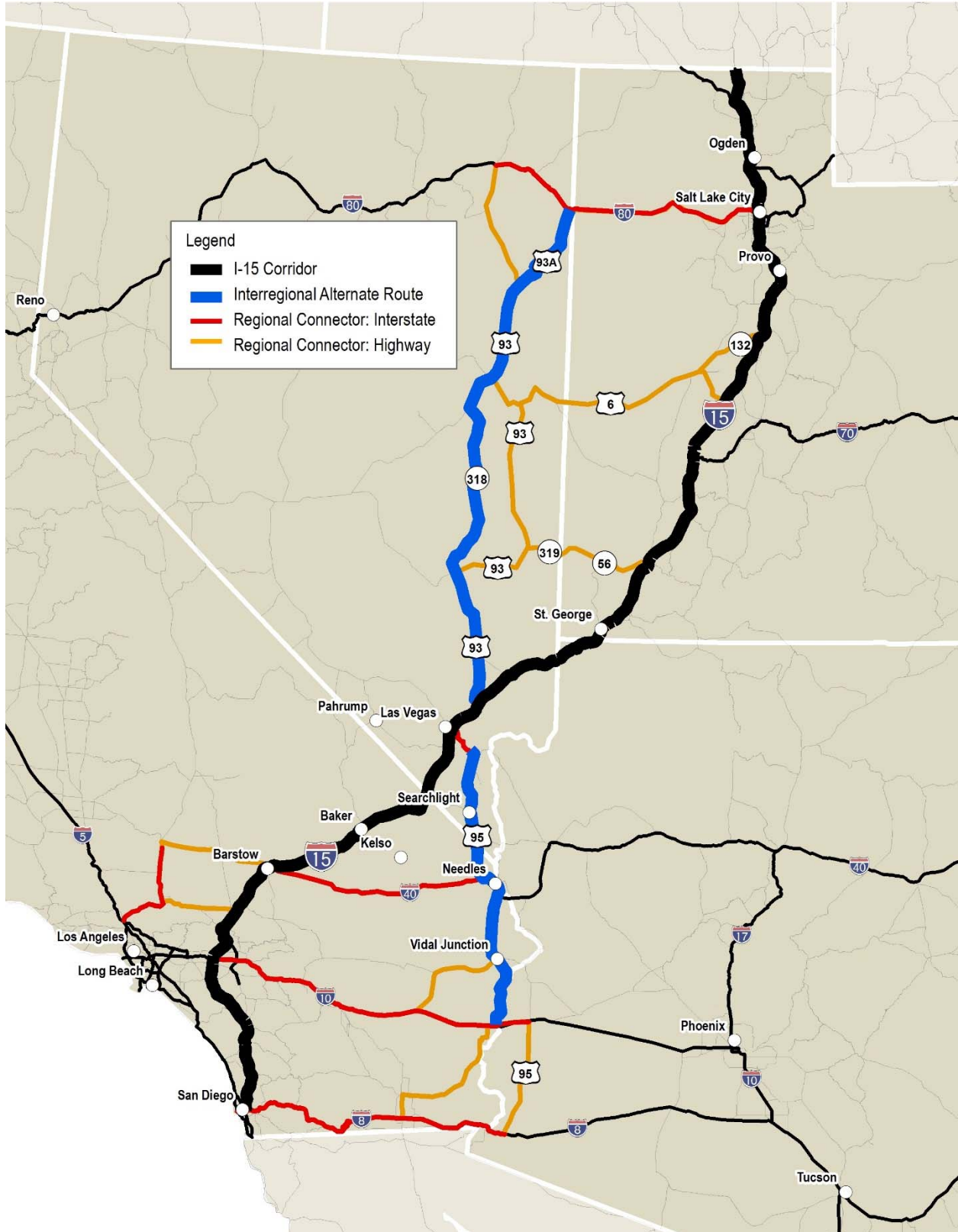


Table 2-5. Evaluation of Alternate Route Options Around Cajon Pass

Criteria	3a US95 – CA62 – CA177 – I-10 – I-215	3b US95 – CA78 – CA111 – I-8	3c CA247 – CA62 – I-10 – I-215
Supports interstate travel	3	3	1
Additional mileage	1	1	3
Additional free-flow travel time	1	1	3
Likelihood of excess capacity	2	2	1
Community and environmental impacts	3	2	1
Freight-supportive grades and bridges	3	3	3
<b>Average</b>	<b>2.1667</b>	<b>2</b>	<b>2</b>

Figure 2-5. I-15 Alternate Route





## 2.4 Stakeholder Input

At the inception of this study effort, a series of in-person meetings and a webinar were held with I-15 Mobility Alliance Steering Committee members in major I-15 Corridor cities (San Diego, San Bernardino, Las Vegas, and Salt Lake City) to provide an update on general Alliance activities, including this Alternate Route Study. DOT partners, along with representatives from the regional Metropolitan Planning Organizations (MPOs) and other Alliance partners attended.

The primary interregional alternate route was presented, along with an overview of major corridor conditions. Most partners agreed that the route will not always be used in full, but that the delineation provides (1) a parallel route to I-15 that can handle interstate travel, and (2) a reliable detour, which is an important factor for the freight industry.

Depending on the bottleneck location, using the defined alternate route may add 1-3 hours on to the trip, as opposed to potentially longer delays experienced during major closures. Ongoing coordination will be required among state DOTs to facilitate clear and effective communication in the case of an I-15 road closure.



# Alternate Route Condition

## 3.1 Criteria

A set of physical roadway and operating condition factors that establishes the desired condition for an alternate route, accounting for use by both passenger vehicles and trucks, was developed to inform the data collection and inventory effort with the intent to highlight major corridor needs and deficiencies. Factors applicable to the I-15 alternate route were selected and modified from long lists of possible criteria presented in both the *Alternate Route Handbook* and the *Nebraska Statewide Interstate and Expressway Alternate Route Study*. Table 3-1 presents the major criteria categories selected for use in this study.

Table 3-1. Alternate Route Condition Criteria

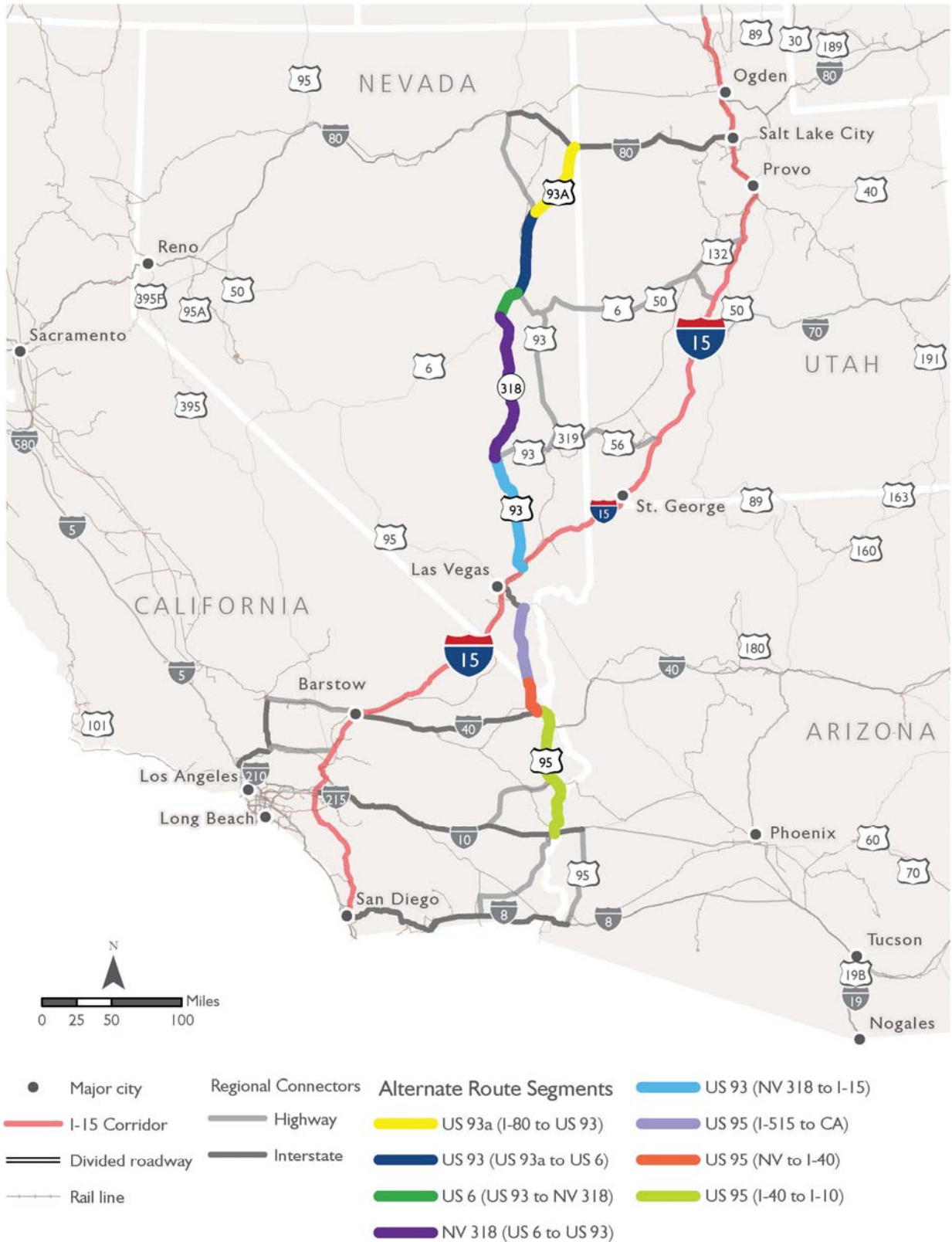
Criteria	Measures	Desired Condition
Geometrics	Number of lanes	2 lanes with adequate locations for safe passing
	FEMA hazard areas and major waterbodies/waterways	No problem drainage areas or roadway flooding
Capacity Constraints	Types and number of traffic control	No stop conditions
	Speed limit	65 mph
	Available turn lanes	At all major traffic generators
	At-grade railroad crossings	None at locations with greater than 100 trains per day, or where significant crashes occur
	2015 traffic volumes (AADT)	Less than 20,000 AADT on 2-lane sections
Safety	Clusters of fatal crashes – locations with 2 or more crashes	Zero fatalities
	Drivability	No intersections requiring a turn or highway change
Vehicle Restrictions	Height, weight, and width restrictions	None
	Bridge efficiency rating	Acceptable
Amenities	Locations of food, fuel, restrooms, and hotel facilities	No gaps of 120 miles or more

## 3.2 Assessment

The geometrics, capacity constraints, safety, vehicle restrictions, and amenities along the corridor were assessed to understand the functionality and constraints of the I-15 alternative route. This inventory was performed through a mapping analysis and field review to identify areas that do not meet the desired criteria described in Section 3.1. and to detect cumulative area concerns to improve the route(s) to the appropriate standard.

A summary of the assessment of each criterion is presented in Table 3-2, organized by the following corridor segments shown on Figure 3-1: US 93a (I-80 – US 93), US 93 (US 93a – US 6), US 6 (US 93 – NV 318), NV 318 (US 6 – US 93), US 93 (NV 318 - I-15), US 95 (I-515 - CA), US 95 (NV - I-40), US 95 (I-40 – I-10).

Figure 3-1. I-15 Alternate Route Segments



Data Sources: NDOT, Bureau of Transportation Statistics

Document Path: F:\I15\_AltRoute\_Study\GIS\MapFiles\I15\_AltRouteStudy\_AltRouteSegments.mxd

Table 3-2. Assessment of Alternate Route Criteria by Corridor Segment

Criteria	Measures	US 93a (I-80 – US 93)	US 93 (US 93a – US 6)	US 6 (US 93 – NV 318)	NV 318 (US 6 – US 93)	US 93 (NV 318 - I-15)	US 95 (I-515 - CA)	US 95 (NV - I-40)	US 95 (I-40 - I-10)
Geometrics	Number of lanes	2 lanes; mostly long, straight, flat with ample safe passing	2 lanes; mostly long, straight, flat with ample safe passing	2 lanes; Long grade with limited safe passing	2 lanes; mostly long, straight, flat with ample safe passing	2 lanes; mostly long, straight, flat with ample safe passing (except around Pahranaagat Lake); grades 5-30 miles north of I-15	Mostly 4-lane divided	2 lanes with lots of curves and undulating profile limiting safe passing	2 lanes with lots of curves and undulating profile limiting safe passing
	FEMA hazard areas and major waterways	No problem drainage areas or roadway flooding	No problem drainage areas or roadway flooding	No problem drainage areas or roadway flooding	Prone to flooding around Nesbitt Lake (south of Hiko)	No problem drainage areas or roadway flooding	No problem drainage areas or roadway flooding	Limited culverts; most drainage crosses highway	Limited culverts; most drainage crosses highway
Capacity Constraints	Types and number of traffic control	No stops	3 signals in Ely	No stops	Stop signs on NV 318: NB at US 6, and SB at US 93	No stops	No stops	No stops	Signals at I-40 and I-10 ramps. Stop signs at CA 62 (Vidal Junction) and Hobsonway (Blythe)
	Predominant speed limit	70 mph	70 mph (reduced speed through McGill, Ely)	55 mph	70 mph (reduced speed through Lund, Hiko)	70 mph (reduced speed through Ash Springs, Alamo)	75 mph (reduced speed through Searchlight)	65 mph (reduced speed at BNSF crossing)	65 mph (reduced speed at Needles, Vidal Junction, Blythe)
	Available turn lanes	Few to none	Few to none	Few to none	Few to none	Few to none	Yes	Few to none	Few to none
	Railroad crossings	None	3 at-grade crossings; very few trains	None	None	None	None	BNSF crossing just north of I-40; 84 trains per day	1 at-grade crossing just south of CA 62; very few trains
	2015 AADT	Less than 11,200 vpd	Less than 11,200 vpd	Less than 11,200 vpd	Less than 11,200 vpd	Less than 11,200 vpd	Less than 11,200 vpd	Less than 11,200 vpd	Less than 11,200 vpd
Safety	Fatal crash locations	None	1 location (in Ely) with 2 or more crashes	None	1 location (south of Lund) with 2 or more crashes	1 location (near Pahranaagat Lake) with 2 or more crashes	1 location (south of US 93) with 2 or more crashes	None	1 location (north of Blythe) with 2 or more crashes
	Drivability	Easy	Transition to US 93 does not require stop or direction change	Transition at US 93/US 6 requires stop and/or direction change	Transition at US 6/NV 318 requires stop and/or direction change	Transition at NV 318/US 93 requires stop and/or direction change	Easy	Easy	Easy
Vehicle Restrictions	Height, weight, and width restrictions	None	None	None	None	None	None	None	None
	Bridge efficiency rating	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable
Amenities	Location of facilities	West Wendover (food, gas, lodging)	McGill (food, gas); Ely (food, gas, lodging)	None	Preston (food, gas, lodging)	At NV 318 (food); Alamo (food, gas, lodging); at I-15 (food, gas)	Searchlight and Cal-Nev-Ari (food, gas, lodging); Palm Gardens (gas, food)	None	Needles and Blythe (food, gas, lodging); Vidal Junction (gas, food)





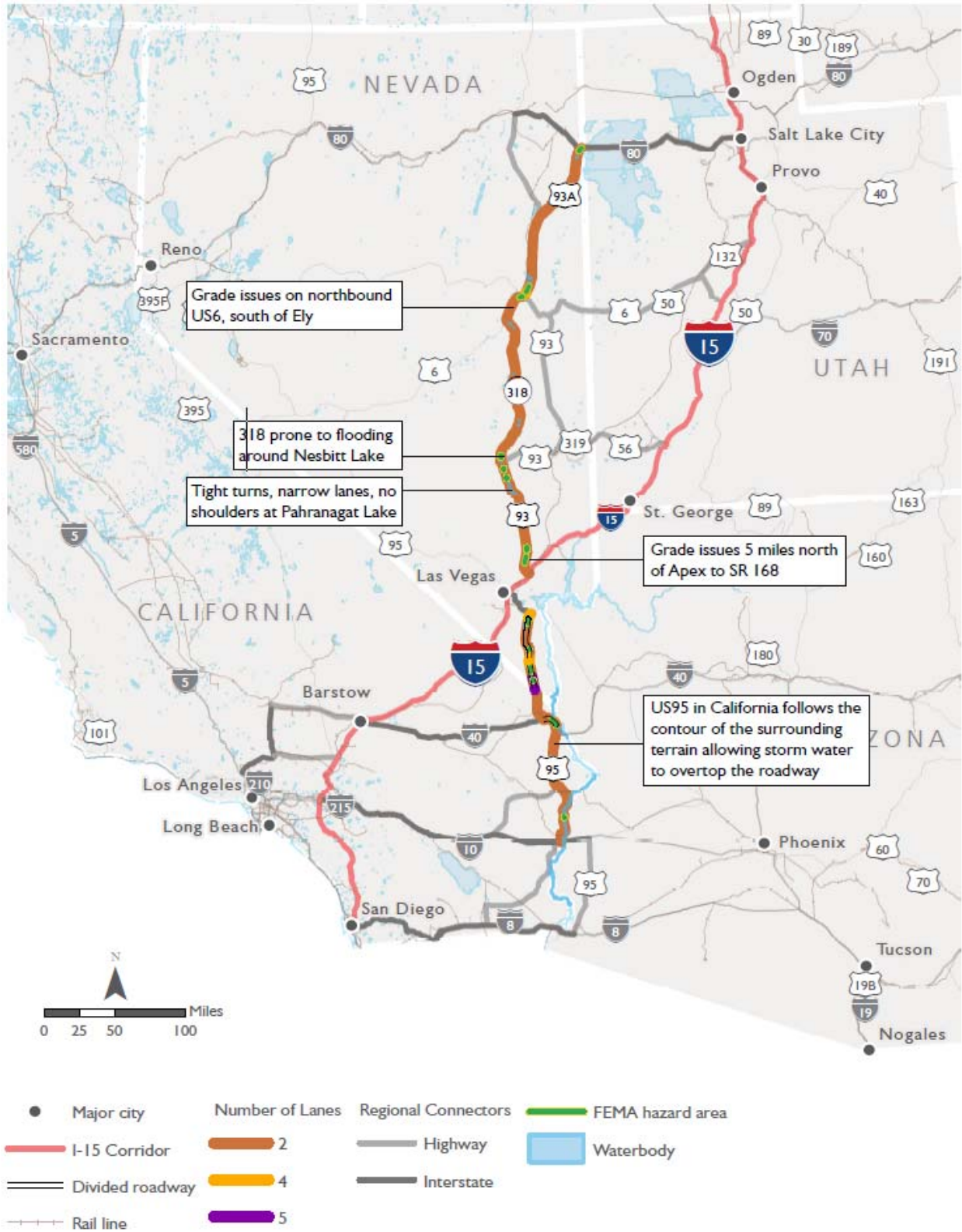
### 3.2.1 Geometrics

While a 4-lane, divided highway is ideal, the desired conditions for this alternate route are 2 lanes with adequate locations for safe passing, and no problem drainage areas or roadway flooding. Figure 3-2 indicates the key geometric conditions along the corridor.

Most of US 93a, US 93, and NV 318 are 2-lanes with long stretches that are straight and flat, shown in Figure 3-3, providing ample opportunities for safe passing. US 6 is a 2-lane highway with approximately 10 miles of steep grades over Murry Summit, just south of Ely, Nevada which has limited opportunities for safe passing of slow moving vehicles (Figure 3-4). US 93 around Pahrnagat Lake is windy and narrow (Figure 3-5), inhibiting passing. Most of US 95 in Nevada is a 4-lane divided highway (Figure 3-6) with a 75 mph speed limit. US 95 in California is a 2-lane highway that follows the profile of the terrain (Figure 3-7) and is somewhat windy, providing fewer opportunities to pass safely (Figure 3-8).

For the most part there are no drainage or flooding issues on the alternate route segments in Nevada, with the exception of NV 318 around Nesbitt Lake. US 95 in California, as noted above, follows the contour of the surrounding terrain allowing storm water to overtop the roadway (Figure 3-9).

Figure 3-2. Map of Geometric Conditions



Data Sources: USGS, FEMA, Google Earth, NDOT, Bureau of Transportation Statistics

Figure 3-3. Long, Straight, Flat Portion of US 93a



Figure 3-4. US 6 at Murry Summit





Figure 3-5. US 93 around Pahrnagat Lake is Windy and Narrow



Figure 3-6. US 95 in Nevada is Mostly 4-Lane Divided Highway



Figure 3-7. US 95 in California Follows the Profile of the Terrain



Figure 3-8. US 95 in California has a High Volume of Trucks and RVs, and Few Opportunities for Safe Passing





Figure 3-9. No Storm Drains or Culverts on US 95 in California Allow Storm Water to Overtop the Roadway



### 3.3 Capacity

The desired conditions to maximize the capacity of the I-15 alternate route include:

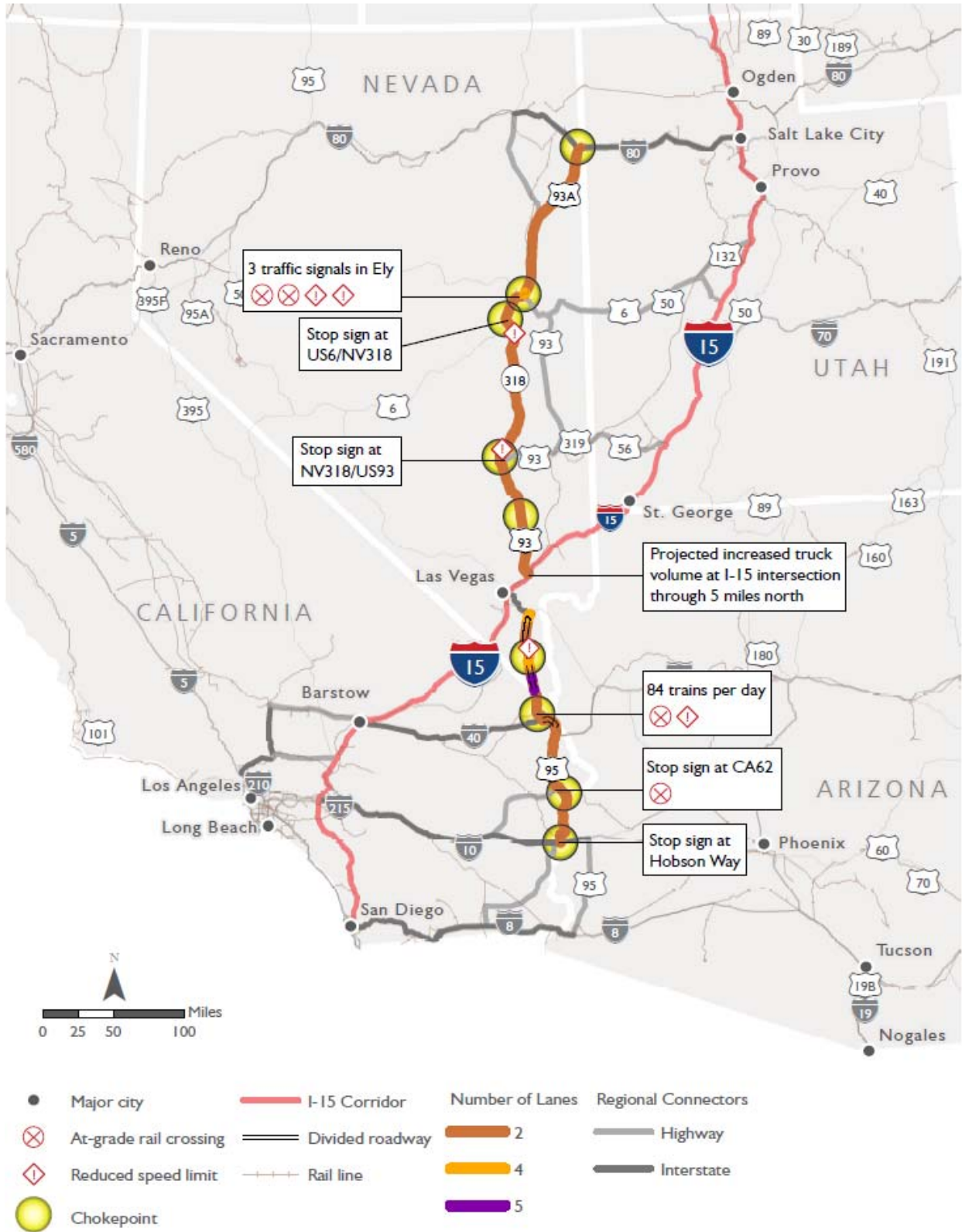
- No stop conditions
- 65 mph speed limit
- Three or more lanes in areas where the average annual daily traffic (AADT) exceeds 20,000
- Available turn lanes at all major traffic generators with cross streets or driveways (especially in high-speed locations)
- No at-grade railroad crossings at locations with greater than 100 trains per day, or where significant crashes occur

Most of the corridor has speed limits of 65 mph except where the speed limit slows through towns, and on the 4-lane divided highway stretch of US 95 in Nevada where the speed limit is mostly 75 mph. There are only a handful of stop signs and signals, noted on Figure 3-10, and many of those are also in towns. There are no segments of the corridor where the average annual daily traffic exceeds 20,000 vehicles per day (vpd).

With the exception of US 95 in Nevada, there are almost no right or left turn lanes, which can cause delays at locations with high turn volumes, and contribute to rear-end crashes in high-speed locations. Figure 3-11 is an example of a turn-off to a recreation area on NV 318 that does not have right or left turn lanes.

There is only one at-grade railroad crossing, located on US 95 north of I-40 (Figure 3-12), where a significant number of trains cross the corridor (84 per day from BNSF). In addition to the delay caused by the trains, the speed limit is also reduced to 20 mph due to the rough conditions crossing two sets of tracks. The other three railroads that cross the corridor at grade level have limited to no service, shown on Figures 3-13 through 3-15.

Figure 3-10. Current Capacity Conditions



Data Sources: FRA, Google Earth, NDOT, Bureau of Transportation Statistics, CALTRANS

Figure 3-11. No Turn Lanes on NV 318 for the Kirch Wildlife Area



Figure 3-12. BNSF Railroad Crossing on US 95 north of I-40





Figure 3-13. Railroad Crossing on US 93 near McGill, Nevada



Figure 3-14. Railroad Crossing on US 93 at Ely, Nevada



Figure 3-15. Railroad Crossing on US 95 near Vidal, California



## 3.4 Safety

### 3.4.1 Clusters of Fatal Crashes

Crash information from the National Highway Traffic Safety Administration (NHTSA) (2015) was collected for the corridor to target safety concerns, as shown in Figure 3-16. Nineteen fatal crashes are scattered throughout the corridor, with the largest cluster just south of the US 95/NV 165 intersection, south of metropolitan Las Vegas.

### 3.4.2 Drivability

The *Alternate Route Handbook* states: “Select routes that are easy for motorists to navigate and provide a sense of comfort” (FHWA 2006). There are sections of the corridor where US 93 and US 95 are collocated with interstate freeways, but they are well-marked and easy to navigate. However, one location on the corridor has caused confusion for years.

The most direct route between I-80 and I-15 follows the route recommended in this study, which deviates from US 93 at Ely, following instead US 6 to NV 318 and rejoining US 93 at Crystal Springs. The 2015 *Annual Traffic Report* indicates that this route carries over three times the volume of traffic than does the parallel US 93, as shown on Figure 3-17. However, the through-movement follows the lower volume and less direct US 93. This is particularly problematic at the intersections of NV 318/US 6 (Figure 3-18) and NV 318/US 93 (Figure 3-19) where travelers following the proposed alternate route are required to either turn left, or stop and turn right (depending on direction of travel). Those not familiar with this route could get confused by the options and signage (see Figure 3-20) and may end up missing the turn.

During a heavily congested detour condition traffic can dramatically back-up at these locations. This was evident during the I-15 closure in 2014 due to the Moapa flood. Southbound I-15 traffic was detoured at Cedar City, UT onto UT 56, to NV 319, and then to southbound US 93 back to I-15. Figure 3-21 shows the tremendous back-up that occurred at the intersection of NV 319 with US 93.

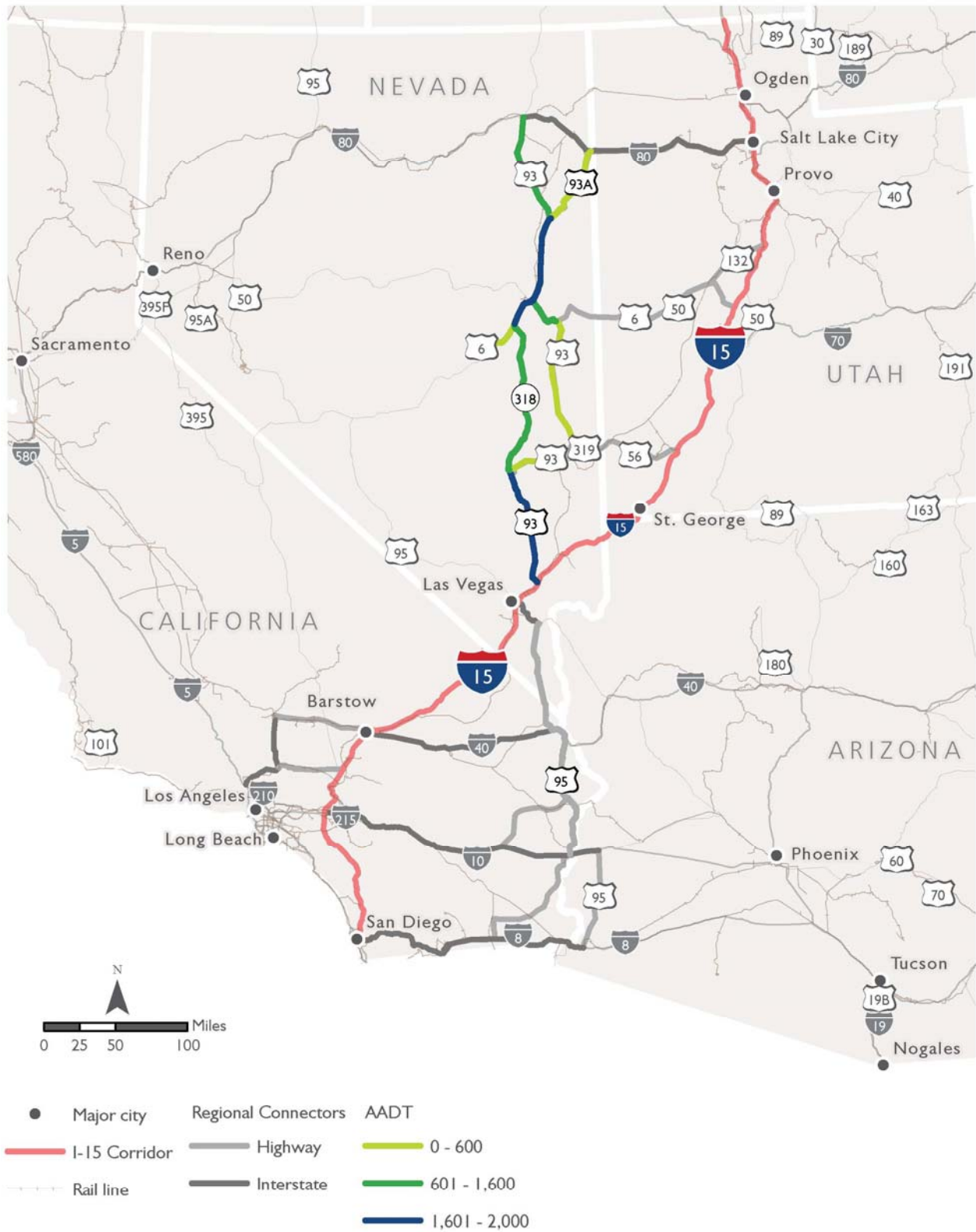


Figure 3-16. Fatal Crash Locations



Data Sources: FRA, Google Earth, NDOT, Bureau of Transportation Statistics, CALTRANS  
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Figure 3-17. Traffic Volumes on US 93 Compared to Volumes on NV 318 and US 6 Alternate Route



Data Sources: NDOT, Bureau of Transportation Statistics

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Figure 3-18. Intersection of NV 318 and US 6



Figure 3-19. Intersection of NV 318 and US 93





Figure 3-20. Signs at Ely, Nevada Providing Options for Travel South to Las Vegas, Nevada



Figure 3-21. Back-up at the intersection of NV 319 with US 93 During the 2014 Moapa Flood I-15 Closure



### 3.5 Vehicle Restrictions

An assessment of bridge conditions was conducted to identify any issues along the desired alternate route with height, weight, or width restrictions, or with bridge efficiency ratings. Bridge data was collected from the National Bridge Inventory on 34 bridges identified along the corridor, and no structural deficiencies nor other restrictions were reported (Figure 3-22).

Figure 3-22. Maximum Permissible Load on Bridges



Data Sources: National Bridge Inventory

Document Path: F:\I15\_AltRoute\_Study\GIS\MapFiles\I15\_AltRouteStudy\_ALLBridges.mxd



## 3.6 Amenities

Access to fuel, food, and hotel accommodations increases the feasibility of the corridor for use as an alternate route. Presence of these amenities is also a requirement for truck drivers, to meet hours-of-service regulations.

An aerial review of the corridor revealed food, gas, and hotel options along the corridor, shown in Figure 3-23. Services are clustered predominately in West Wendover, Ely, Las Vegas (metropolitan area), and Searchlight in Nevada; and in Needles and Blythe, California. Sixteen food locations, 16 gas stations, and 12 lodging areas were identified. Food and lodging are typically paired together, while the gas stations are spread throughout the route. Only one span of the corridor, along NV 318, was identified as having a distance greater than 120 miles between gas stations.

Figure 3-23. Availability of Services

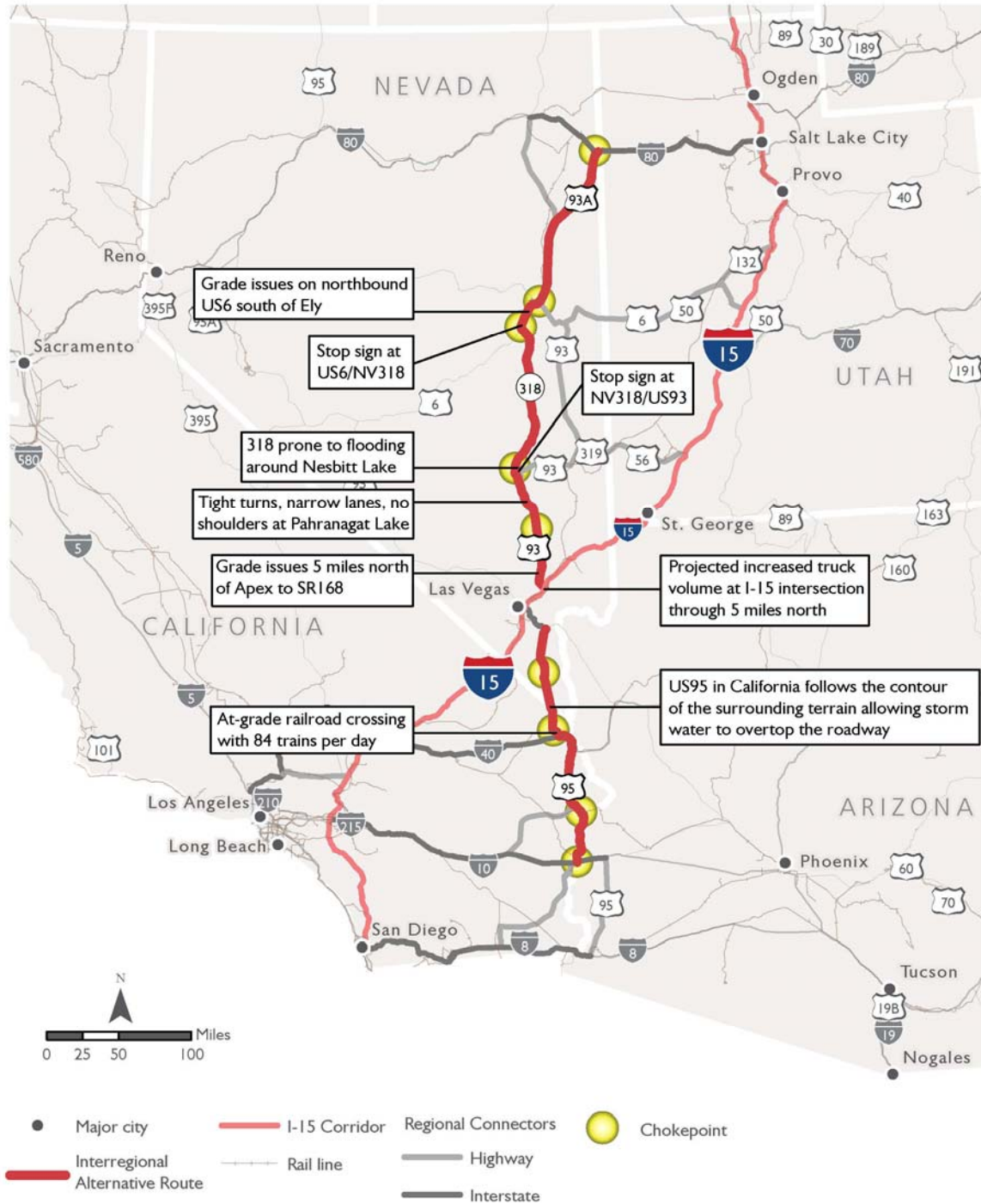


Data Sources: Google Earth Assessment, NDOT  
 Document Path: F:\I15\_AltRoute\_Study\GIS\MapFiles\I15\_AltRouteStudy\_Amenities.mxd

### 3.7 Cumulative Areas of Concern

Figure 3-24 illustrates the cumulative areas of concern along the proposed alternate route.

Figure 3-24. Cumulative Areas of Concern



Data Sources: FRA, Google Earth, NDOT, Bureau of Transportation Statistics, CALTRANS  
 Document Path: F:\I15\_AltRoute\_Study\GIS\MapFiles\I15\_AltRouteStudy\_CumulativeAreasofConcern.mxd



# Recommendations

A set of potential improvements needed to address the areas of concern noted in this report, is presented in this chapter. **Appendix A** includes conceptual designs and a planning-level cost estimate range for each recommendation. These improvements will not only help this corridor function better as an alternative route corridor, but will also improve the flow and safety of traffic that daily rely on this corridor.

## 4.1 US 93 Corridor Improvement Options

### 4.1.1 Truck Climbing Lanes on US 6

Truck passing lanes over the steep grades leading to Murry Summit on US 6 (see Figure A-1), just south of Ely, will help separate vehicles traveling at dramatically different speeds, thereby improving safety, operations, and travel time.

### 4.1.2 Facilitate Through-traffic on SR 318

As noted in Section 3.4.2 of this report, the majority of vehicles traveling between Las Vegas and Ely use SR 318. For this reason it is recommended that the intersections at US 6/SR 318 and US 93/SR 318 (see Figure 4-1) be reconfigured to facilitate through-traffic on SR 318, and the stop condition on US 6 and US 93 respectively. The goal with each of these intersections is to maintain a speed limit of 65 mph and avoid or minimize impacts to any private property. In both cases, trade-offs are necessary and several options are presented. Additional analysis will be required to make a determination if any of these options are feasible and desirable, or if other options should be considered.

Figure 4-1. Intersection Improvements Needed to Facilitate Through-traffic on SR 318



#### 4.1.2.1 US 6/SR 318 Intersection Reconfiguration

Two possible options for reconfiguring the US 6/SR 318 intersection are shown in Figures A-2 and A-3. Both options have a design speed of 70 mph, but Option 1 incorporates the existing asphalt to provide additional access to the adjacent private parcels, while Option 2 does not.

#### 4.1.2.2 US 93/SR 318 Intersection Reconfiguration

Two possible options for reconfiguring the US 6/SR 318 intersection are shown in Figures A-4 and A-5. Option 1 has a design speed of 70 mph; however, it has a greater right-of-way impact on private parcels. Option 2 reduces the right-of-way impact by tightening the turn, thereby reducing the design speed to 45 mph.

### 4.1.3 Widen US 93 Around Pahranaagat Lake

Much of US 93 around Pahranaagat Lake is very narrow with no shoulders, from approximately mile markers 24.5 to 34.8. The American Association of State Highway and Transportation Officials (AASHTO) recommends 6-foot shoulders for highways that have similar vehicular volume as US 93. Widening US 93 throughout this section of highway will be costly and have environmental impacts, therefore, three options, shown in Figures A-6 and A-7, are proposed for consideration.

- Option 1 widens US 93 by 12 feet to allow for 6-foot shoulders on either side, following AASHTO standards (see Figure A-6)
- Option 2 widens US 93 by 4 feet to allow for a minimum of 2-foot shoulders on either side (see Figure A-6)
- Option 3 provides 2-foot shoulders throughout, and 6-foot shoulders in select locations where widening might have the fewest environmental and constructability challenges (see Figure A-7)

### 4.1.4 US 93 Corridor Acceleration and Deceleration Lanes

Throughout the US 93 Corridor there are very few turn lanes for acceleration and deceleration at cross streets in the high-speed areas. Figure A-8 shows a number of locations where turn lanes might provide a safety and operational benefit, and includes four general configurations (Detail A – D) that could be applied to these various locations. Figures A-9 through A-31 show each location in greater detail, and indicate which Detail would be most appropriate at that location, including a planning-level cost estimate. Additional engineering analyses are needed to validate whether and what type of turn lanes are needed.

## 4.2 US 95 Corridor Improvement Options

### 4.2.1 Wash Crossing on US 95

Halfway between the Nevada-California border and I-40 (between mile markers 70 and 71) a major wash crosses US 95, frequently closing the highway during major storm events. The basin feeding this wash appears to be very large, shown in Figure A-32; however, detailed hydrology and hydrologic analyses will be needed to determine the exact requirements for a wash crossing. For planning purposes, a cost estimate range is shown in Figure A-32 for a bridge or culvert 1,000 feet long and 6 feet high, with 2,000 feet of roadway approach improvements.

### 4.2.2 BNSF Crossing at US 95

There are two issues at the BNSF crossing of US 95—reduced speeds to cross the tracks, and frequent stops when trains pass. A grade separation, shown in Figure A-33, would address both of these.



Without a grade separation, regular maintenance of the crossing, shown in Figure A-34, can help to level the crossing and increase the speed at which vehicles can safely cross the tracks. The intersection of a roadway surface and a railroad crossing has always been problematic. The rails and ties must be able to move, but the roadway can't. Periodically the railroad is re-profiled to add a few inches of ballast and elevation to the crossing. At that time the roadway would also need to be elevated to match, but then over time the railroad bed drops slightly with usage, creating an uneven crossing again.

### 4.2.3 US 95 Turn Lanes at Havasu Lake Road

South of Needles, Havasu Lake Road intersects with US 95. While there is not a large volume of traffic entering or exiting US 95 from Havasu Lake Road, it is fairly consistent and includes recreational vehicles that require greater acceleration and deceleration distances. Right and left-turn pockets on US 95, shown in Figure A-35, would improve safety and operations.

## 4.3 Truck Climbing Lanes on SR 164

A consistent chokepoint on I-15 that often results in many hours of delay, occurs on southbound I-15 at Primm, Nevada—the border with California where one lane is dropped. The delay regularly occurs on Sundays from approximately 11:00 am to 2:00 pm after Southern California visitors to the Las Vegas area check out of their hotels for the return trip home. On 3-day weekends the delay can extend 10-20 miles and last well into the evening hours.

An alternate route around this chokepoint is southbound US 95 from Las Vegas to Searchlight, and westbound on SR 164 which ties back in to I-15 south of Primm. The primary challenge with SR 164 is steep grades over a small mountain pass with unpassable curves near the summit. Passing lanes on either side of the summit, shown in Figure A-36, would improve safety, operations, and travel time. Ideally, SR 164 would also need to be widened to accommodate shoulders, according to AASHTO standards.

In addition to the potential travel time savings, SR 164 is a beautiful and scenic drive on the northern border of the Mojave National Preserve, that also passes through the historic towns of Searchlight and Nipton, for those interested in a more relaxing drive (see Figures 4-2 and 4-3).

Figure 4-2. SR 164 West of Searchlight



Figure 4-3. SR 164 through Historic Nipton



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