NEVADA DOT

WASHOE COUNTY FREEWAY CORRIDOR STUDY

FOR NEVADA DEPARTMENT OF TRANSPORTATION

PARSONS

DECEMBER 2002

Washoe County Freeway Corridor Study

for the

Nevada Department of Transportation

P A R S O N S

December 2002

Table of Contents

Table of Contents (Continued)

Tables

Figures

Figures (Continued)

EXECUTIVE SUMMARY

Purpose

The *Washoe County Freeway Corridor Study* is a planning-level analysis that identifies freeway improvements needed within the Reno/Sparks metropolitan area between now and 2030. The corridor study includes both Interstate 80 and US Highway 395/Interstate 580. This analysis was undertaken by examining existing conditions, projecting future conditions and their impacts on the transportation system, identifying improvements, and evaluating the effect of alternative investment strategies. While the study was undertaken to fully define investment needs and options for major freeways and interchanges in the study area, it also investigated potential improvements to other elements of the transportation system in order to determine their potential as congestion-relievers on the freeway study corridors.

Study Area

The study area (Figure ES-1) covers the metropolitan limits of Reno and Sparks, Nevada. The I-80 corridor has been defined as extending from the East Verdi Interchange to Vista Boulevard in Sparks. The US-395/I-580 corridor under study extends from Cold Springs in the north to Mount Rose Highway in the south.

Existing Conditions

Both population and employment in Washoe County have grown consistently over the last decade, and by 2000 the county was home to 339,000 people and 193,000 jobs. This represented a 3.4 percent population increase per year and a total increase of 33.5 percent since 1990, when the county housed 254,000 people. Over the same period, employment grew 46.2 percent from 132,000 jobs in 1990 to the current total at a rate of 4.6 percent per year.

Ninety-seven percent of Washoe County workers are employed within the county and the majority travel to work via automobiles. Eighty-nine percent of Washoe County workers rely on automobiles for their trip to work. The spatial distribution of jobs and housing results in the need for many workers to drive across the metro area to reach their places of employment.

The rate of population and employment growth, along with imbalanced development patterns, has resulted in a significant increase in vehicle miles traveled in the Washoe County region. Between 1980 and 1999, annual vehicle miles traveled grew by 126 percent, according to Nevada Department of Transportation (NDOT) estimates. This growth amounts to a compound rate of nearly 4.5 percent increase per year.

Figure ES-1: Washoe County Freeway Corridor Study Area

Source: Parsons

Traffic operations on the county's freeways have suffered as a result. Several freeway segments currently often fail to meet adopted public policy for operational performance (LOS D). These LOS E or F segments are:

I-80 Eastbound

- West McCarran Boulevard to Keystone Avenue (a.m.)
- Keystone Avenue to Sierra Street (a.m.)
- Rock Boulevard to Pyramid Way (p.m.)
- Pyramid Way to East McCarran (a.m.)

I-80 Westbound

- East McCarran Boulevard to Pyramid Way (a.m. and p.m.)
- Pyramid Way to Rock Boulevard (a.m. and p.m.)

US-395 Northbound

- South Virginia to Moana Lane (p.m.)
- Moana Lane to Plumb Lane (a.m. and p.m.)
- Villanova to Mill Street (p.m.)
- Mill Street to Glendale Avenue (p.m.)
- Glendale to I-80 (p.m.)
- I-80 to Oddie Boulevard (p.m.)
- Oddie Boulevard to North McCarran Boulevard (p.m.)

US-395 Southbound

- Golden Valley to Virginia-Panther (a.m.)
- Parr Boulevard to North McCarran Boulevard (a.m.)
- North McCarran Boulevard to Oddie Boulevard (a.m.)
- I-80 to Glendale Avenue (a.m.)
- Glendale Avenue to Mill Street (a.m.)
- Plumb Lane to Moana Lane (p.m.)

Future Conditions

Population and employment in Washoe County have grown significantly over the past decade and are projected to continue to do so through 2030. The *Washoe County 2030 Regional Transportation Plan (RTP)* forecasts a 2020 population of 450,000, a 43 percent increase over the 2000 population. By 2030 population is projected to have grown to 530,000, representing a 69 percent growth from the year 2000. Employment is projected to grow 65 percent (to 288,000) by 2020 and 80 percent (to 315,000) by 2030.

Currently approved plans for land development indicate that much of the projected growth in population and employment is anticipated to occur beyond existing concentrations, effectively increasing the region's diameter and potentially increasing average trip lengths in the

region. Significant additional residential and commercial developments are also planned for locations on the outskirts of and bordering the county.

In order to forecast future freeway operations, the *Washoe County Freeway Corridor Study* rigorously examined the RTC's Year 2000 model validation forecasts and compared these volumes with traffic counts collected at each freeway ramp and at multiple mainline locations along both I-80 and US-395. Balanced sets of freeway link volumes were computed from each mainline traffic count location. A consensus estimate of existing traffic was derived, based on a convergence of data points, and was used to adjust future year traffic volume forecasts on a ramp-by-ramp basis. These adjusted traffic projections indicate that level-of-service deficiencies on the existing freeway system will worsen by the year 2030. Many miles of regional roads will also fall below adopted level-of-service standards by the year 2030.

Alternatives Evaluated and Rejected

Project need is based on the inadequacies of the existing and programmed (funded) freeway and regional road system to accommodate forecast traffic growth through year 2030. In order to define short-, mid-, and long-term transportation investments that will support existing population and projected growth, the *Washoe County Freeway Corridor Study* considered five sets of transportation improvements prior to formulation of a set of recommended strategies:

1. Base Case Alternative—Projects programmed as a result of the *I-80/I-580/US-395 Spaghetti Bowl Interchange Feasibility Study,* which identified projects that have already been designed and will be completed by Fiscal Year 2005. This alternative was considered to be the no-build condition and the reference point for evaluation of all other alternatives. CORSIM analysis found that on a segment-by-segment basis, only 50 to 90 percent of projected 2030 volumes can be accommodated by this network, forcing the remainder to surface streets.
2. 2015 Washoe County Freeway System Plan—Includes all projects programmed for construction in the *2015 Regional Transportation Plan*. When evaluated by the RTC under 2030 traffic conditions, this alternative was found to experience significant congestion within the McCarran Loop. Therefore, the 2015 Freeway System Plan was not considered further by this study.
3. *2030 Regional Transportation Plan*—The Regional Road System elements of the *2030 Regional Transportation Plan* were considered to be the given background for freeway system planning. This alternative relies mainly on alternative transportation modes, TSM/TDM strategies, widening of arterials, and facility access controls. The plan made some preliminary recommendations for freeways but left final recommendations for the results of this study. *The Washoe County Freeway Corridor Study* considers the non-freeway elements of the *2030 RTP*, including the Sun Valley Connector and the Outer Ring Road, to be the given background for its freeway analysis.
4. Freeway Reliever Route Alternatives—Five arterial street segments were identified with the potential to provide freeway congestion relief. These roadways could form a valuable component of an ITS/freeway management system that targets freeway congestion caused by incidents. However, the analysis does not assume these roads to be a significant freeway system component during a typical peak hour over and above *2030 RTP* forecasted utilization.
5. Freeway System Management Alternatives—Several techniques for increasing freeway throughput and decreasing delay are addressed by the *Washoe County Freeway Corridor Study.* Two of these were determined to have potential for improving freeway operations: ramp metering and intelligent transportation systems (ITS). Ramp metering is considered supplemental to other freeway improvements. ITS, which would include dynamic message signs and closed-circuit television cameras, is considered to be most beneficial to freeway operations during isolated incidents rather than during a typical peak hour. High-Occupancy Vehicle lanes, reversible lanes, and transit operations on the freeway system were considered but dismissed from further study due to the likelihood that these measures would not significantly alleviate freeway congestion in Washoe County.

Although these alternatives include several short-term or localized solutions to projected operational deficiencies on the freeway system, none would be able to effect a long-term, system-wide improvement. Instead, they served as a foundation for the development of a comprehensive set of freeway improvements that will result in satisfactory operations (at level of service D or better) through the year 2030.

Washoe County Freeway Study Recommended Alternative

The projected lane requirements for the year 2030 were calculated for each freeway segment in the study area. This analysis estimated the number of lanes required on each section of roadway in order to achieve a volume-to-capacity ratio equivalent to a level of service D or better.

Lane requirements were projected to one-tenth lane and then rounded up or down to full lanes based on consideration of AM and PM peak-hour mainline and ramp traffic operations. Providing bi-directional balance, i.e., the same number of mainline lanes in each direction, was also taken into consideration. The resulting freeway configuration was used as the basis for an initial CORSIM analysis. The results of the first microscopic traffic analysis were used to adjust the freeway configuration for subsequent iterations of CORSIM runs, and the process was repeated until the geometric layout and the model simulation reflected 2030 operations at Level of Service D or better.

In addition to the improvements identified by the CORSIM analysis, a number of other planned improvements were included in the analysis of future conditions. These include:

- US-395/I-580 freeway extension south of Mt. Rose Highway;
- Sutro Street/Clear Acre Lane Interchange;
- Outer Ring Freeway System Interchange;
- Meadowood Interchange (split diamond from the Del Monte Interchange);
- 2002 Spaghetti Bowl Interchange project; and
- Truck-climbing lanes on northbound US-395 north of the North McCarran Interchange and on westbound I-80 west of the West McCarran Interchange.

Recommended improvements to the I-80/US-395/I-580 Spaghetti Bowl Interchange are shown on Figure ES-2. Recommended improvements to I-80 and US-395/I-580 are shown on Figures ES-3 and ES-4, respectively. The set of freeway improvements initially identified by this analysis process does not reflect constructability issues or cost/benefit ratings.

Costs and Benefits of Recommended Alternative

Cost estimates were developed for each element of the recommended alternative, including the capital cost of construction, right-of-way acquisition, and project development/engineering expenses.

Estimates of benefits were also developed for each individual element, including travel time savings, vehicle operating costs, accident reductions, and improvements to air quality. Benefit estimates indicate that the recommended alternative would produce $74 million of travel time savings annually, $12 million of crash benefits annually, and $8.1 million of motor vehicle emission benefits annually (Year 2002 dollars). Vehicle operating cost savings are projected to be $519,480 annually as of Year 2020 and $890,537 annually as of Year 2030 (Year 2002 dollars).

The recommended alternative will produce net savings in travel time, motor vehicle emissions, crashes, and vehicle operating expense. Collectively, these will amount to $95.2 million annually based on Year 2030 traffic volumes (Year 2002 dollars). The recommended improvements are assumed to be implemented over time so that NDOT's standard for freeway operational performance may be maintained at level of service D or better. Benefits will likewise accrue over time as traffic demand volumes increase from present day levels to those forecast for Year 2030.

The highest dollar volume of benefits is produced from improvements to northbound US-395 between Damonte Ranch Road and Glendale Avenue. Improvements to the I-80/US-395 Spaghetti Bowl interchange complex also produce a high dollar volume of benefits. One section of potential road improvements, eastbound I-80 from Robb Drive to Wells Avenue, failed to generate significant benefits. Improvements identified for this segment are intended to balance eastbound with westbound traffic lane counts, rather than provide LOS D required traffic capacity.

A comparison of life-cycle benefits and costs yields several findings:

- Total benefits ($1,189,698,129) exceed total costs ($916,115,445) by $273,582,684 (Year 2002 dollars). This B/C ratio is 1.30.
- The net present value of these benefits, assuming a discount rate of 6 percent, is $433,880,925. The net present value of implementation costs, excluding maintenance and repair, is $476,059,781. This B/C ratio is 0.91.
- The rate of return on investment is 4.5 percent. This is the discount rate at which benefits and costs are equal.
- The payback period, at a discount rate of six percent, is 26 years.

The Washoe County Freeway Study recommended alternative also provides residual benefits over and above those identified through traditional life-cycle benefit analyses.

The recommended alternative operates at a high level of service D (near LOS C) or better throughout the freeway system when measured against Year 2030 forecast traffic volumes. To provide an indication of its ultimate LOS D "capacity," mainline traffic volumes were incrementally increased and tested with CORSIM. These tests showed that by and large, 1,500 additional vehicles per hour could be accommodated by most freeway mainline segments while maintaining a low level of service D (near LOS E) or better.

Given the pace of traffic growth forecast from 2000 to 2030, it appears that the recommended alternative could accommodate 15 to 20 years of additional metropolitan area growth beyond 2030. Fifteen to twenty years of additional freeway capacity would extend or increase life-cycle benefits over and above those estimated by this study.

Implementation

The recommended freeway improvements were grouped together to create project packages in order to maximize operational benefits. Packages targeted early action items (next five years), Year 2010 (four project packages), Year 2020 (six project packages), and Year 2030 (six project packages).

Because the Nevada Department of Transportation's (NDOT) operational standard for freeways is Level of Service D or better, the proposed improvements should be implemented by the target year to ensure that this operational level is attained. Currently, the most congested segments of the freeway system are within the Spaghetti Bowl Interchange and include the west, east and south freeway approaches to the Spaghetti Bowl. Addressing these congested segments will require major freeway project planning and implementation. NDOT should consider using the design/build method of project implementation for some portions of the freeway, such as the Spaghetti Bowl area, to meet the freeway operational standard (LOS D) in a timely manner.

The *RTP* includes a funding plan and phasing priorities for street and highway improvements within Washoe County. The Phasing Plan identifies $596 million for implementing improvements to I-80 and US-395 during the FY 2007–2012 timeframe. This funding would be sufficient to implement all of the 2010 projects identified, all of the 2020 projects, and approximately one-half of 2030 Project Package A.

The *RTP* additionally identifies $127.7 million for funding improvements to I-80 and US-395 during the FY 2013 to 2030 timeframe. This commitment will finance the remainder of 2030 Project Package A, all of 2030 Project Package B and C, and most of Package D.

As the *2030 RTP* funding plan was preliminary insofar as I-80 and US-395 funding requirements, the shortfall of $195 million (the remainder of Package D and all of Packages E and F) will need to be addressed by the first amendment to the 2030 RTP.

Overall, RTC anticipates a funding shortfall for the *2030 RTP* over and above that identified for the freeway system. To address these funding shortfalls, the RTC developed a financing plan for voter and state legislative approval. On November 5, 2002, voters in Washoe County approved WC-2, a transportation advisory ballot question, by a margin of 57% to 43%. WC-2 asked voters if state legislation should be sought which would provide additional transportation funding to the Regional Transportation Commission. Specifically identified in the ballot question were three funding sources: adjusting (indexing) the road impact fees paid by developers with inflation, adjusting (indexing) local motor vehicle fuel taxes with inflation, and a 1/8 % sales tax dedicated to transportation. Collectively, these sources are expected to generate approximately $750 million in additional revenue through the year 2030. This additional revenue, when combined with existing transportation funding and planned efficiencies, is projected to be sufficient to finance all the transportation improvements identified in the RTC's 2030 Regional Transportation Plan. The Regional Transportation Commission has proposed legislation to the State legislature for action in the 2004 session. The RTC will move promptly to seek all needed approvals and expects that all the new revenue sources will be implemented in the second calendar half of 2003.

Public Involvement

A public involvement plan for the project was established at the outset of the study to facilitate two-way communication between the project team and stakeholders in the community. The public involvement process included communication flow from the project team to the public regarding project status, with regular reporting by the team to project stakeholders and elected officials. The process also included communication flow in the reverse direction, allowing the project team to take advantage of stakeholder expertise in the study area and allowing the public to voice its issues and opinions throughout the life of the project. The formal public involvement process for the project included several components:

- A project steering committee comprising representatives from government and quasi-government entities within the Truckee Meadows
- Presentations regarding the project to elected officials, planning commissions, and other groups with an interest in the study results
- A telephone hotline in the project office
- Press releases
- Public open houses

The public involvement process for the *Washoe County Freeway Corridor Study* also included coordination with other ongoing transportation studies, including the *2030 Regional Transportation Plan*, the *Pyramid Corridor Study*, the *I-80/US-395 Intelligent Transportation System Study*, and NDOT's plans for improvements to the I-80/US-395/I-580 Spaghetti Bowl Interchange.

Figure ES-2: I-80/US-395/I-580 SPAGHETTI BOWL IMPROVEMENTS

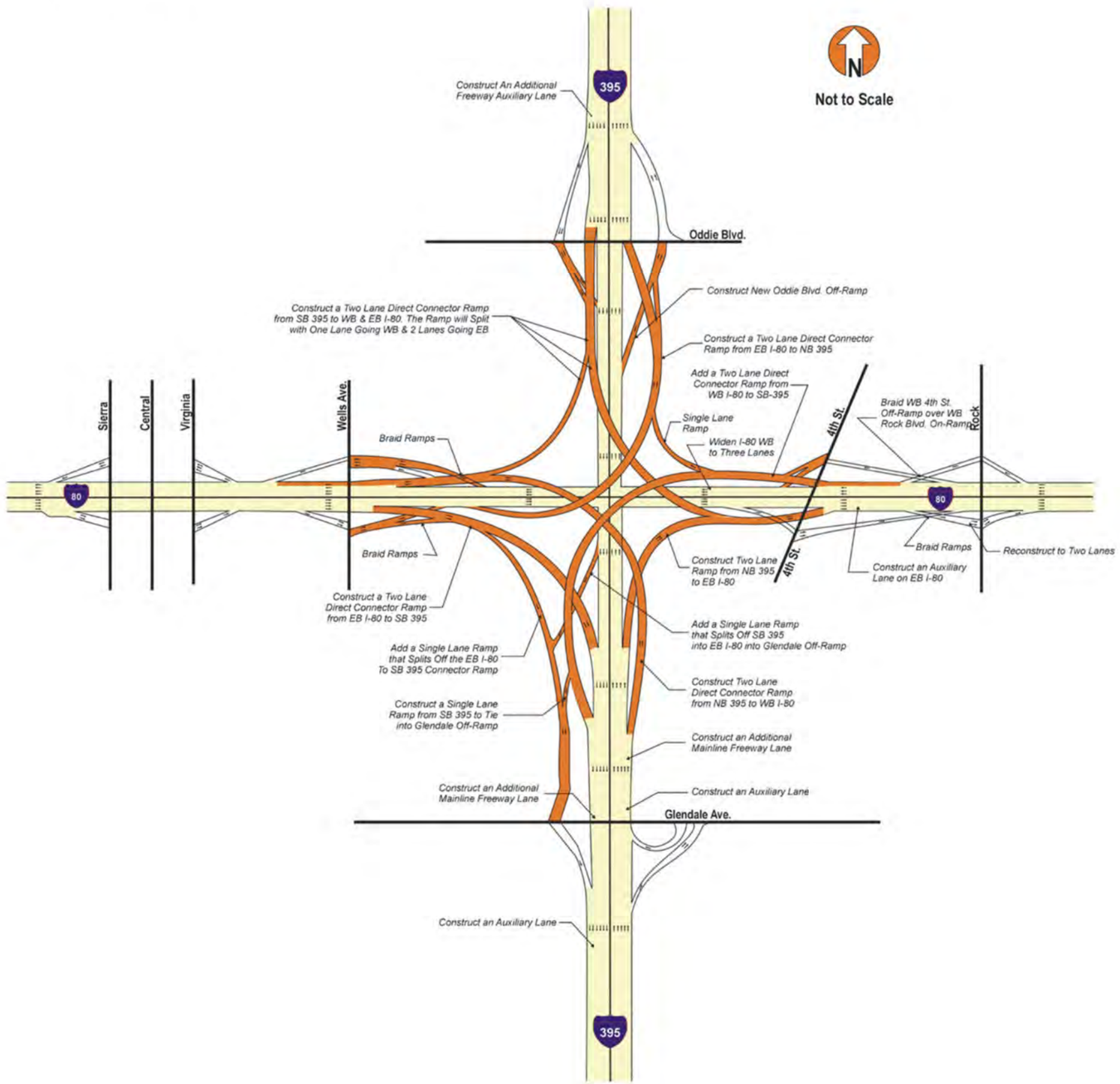


Figure ES-3: I-80 FREEWAY IMPROVEMENTS

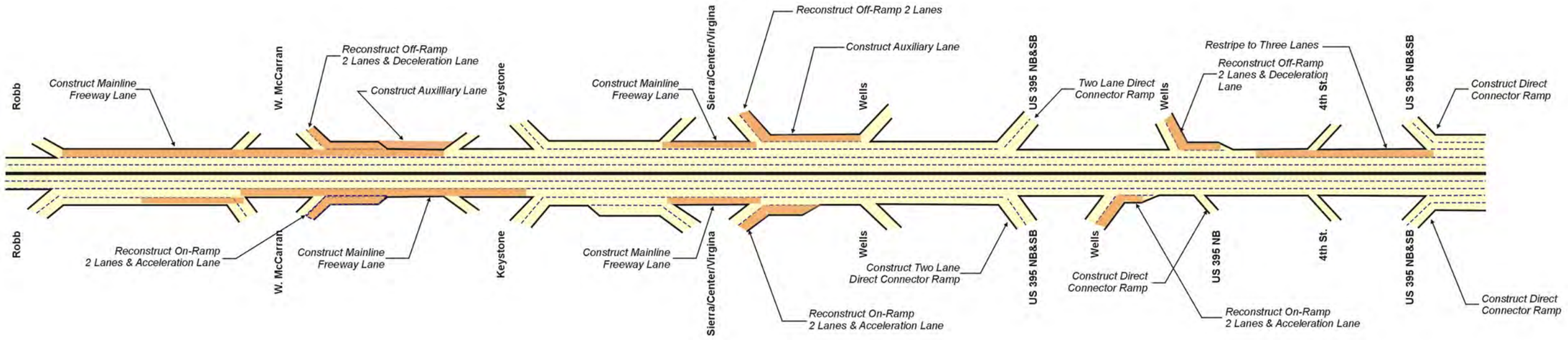
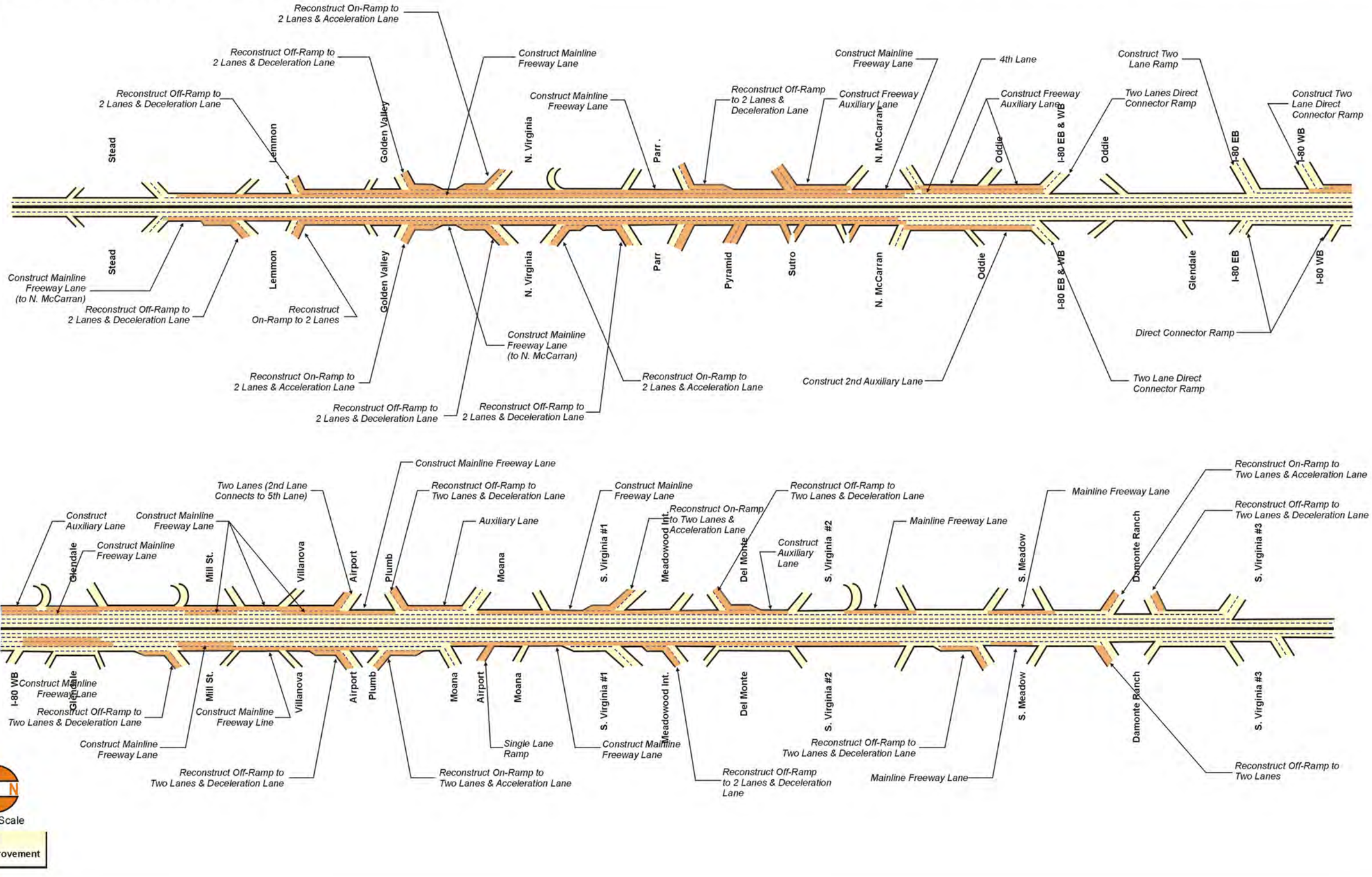


Figure ES-4: US 395/I-580 FREEWAY IMPROVEMENTS



INTRODUCTION

The *Washoe County Freeway Corridor Study* is a planning-level analysis that identifies freeway improvements needed within the Reno/Sparks metropolitan area between now and 2030. The study addressed existing and future transportation deficiencies by examining existing conditions, projecting future conditions and their impacts on the transportation system, identifying improvements, and evaluating the effect of alternative investment strategies. The study involved collaborative decision-making and public involvement to consider the socioeconomic, community, environmental, and cost impacts of alternative investments. The study focused on major freeways in the county and was not intended to be an area-wide or sub-regional transportation study. This study also addressed non-freeway investment options as alternatives or complements to the overall recommended investment strategy, including potential improvements to the regional road network, transit services and facilities, intelligent transportation system alternatives, and congestion management actions.

1.1 Study Area Description

The *Washoe County Freeway Corridor Study* addresses both Interstate 80 and U.S. Highway 395/Interstate 580 as they extend through the Reno-Sparks metropolitan area. A base map of the study area is shown in Figure 1-1.

The specific study area for the I-80 corridor has been defined from the East Verdi Interchange to Vista Boulevard in Sparks. It includes the following interchanges, from west to east:

- East Verdi Road
- Mogul Road
- West Fourth Street
- Robb Drive
- West McCarran Boulevard
- Keystone Avenue
- Virginia Street
- Wells Avenue
- US-395
- East Fourth Street
- Rock Boulevard
- Pyramid Way
- East McCarran Boulevard
- Sparks Boulevard
- Vista Boulevard

The portion of the US-395/I-580 corridor under study extends from Cold Springs in the north to Mount Rose Highway in the south. It includes the following interchanges, from north to south:

- Cold Springs Drive
- Red Rock Road
- Stead Boulevard
- Lemmon Drive
- Golden Valley Road
- North Virginia Street
- Parr Boulevard
- Sutro Street (Proposed)
- Clear Acre Lane (Slip ramp)
- McCarran Boulevard
- Oddie Boulevard
- Interstate 80
- Glendale Avenue
- Mill Street
- Plumb Lane/Villanova Drive
- Moana Lane
- South Virginia Street/Kietzke Lane (Exit 63)
- Meadowood (Proposed)
- Del Monte Lane
- South Virginia Street (Exit 61)
- South Meadows Parkway
- Damonte Ranch Parkway
- South Virginia Street (Exit 58)
- Mount Rose Highway

In addition to I-80 and US-395/I-580, major arterial roadways in the study area include McCarran Boulevard, Pyramid Way (State Route 445), Virginia Street (Business Route 395), and East Fourth Street (Business Route 80). The Reno-Tahoe International Airport is located less than one mile east of US-395 in the southern portion of the study area, and the Union Pacific Railroad line closely parallels the south side of I-80 along the length of the corridor.

The I-80 corridor contains a range of land uses and densities. The area between the western end of the corridor and Robb Drive is largely rural and currently undeveloped, although it is possible that it will be annexed by the City of Reno in the future. East of Robb Drive, residential density increases and some commercial uses appear. From McCarran Boulevard in the west to the eastern end of the corridor, land uses include a mix of residential, commercial, office, and industrial, with some gaming facilities. The densest development occurs

just east of the I-80/US-395/I-580 system interchange, known locally as the Spaghetti Bowl. South of the I-80 corridor, many industrial, distribution, and warehousing uses are located in proximity to the Union Pacific Railroad line.

The portion of US-395/I-580 between the north end of the corridor and Lemmon Drive is mostly rural and undeveloped. South of Lemmon Drive, residential densities increase and some industrial uses, research institutions, and government facilities begin to appear. At McCarran Boulevard, densities increase further and commercial and office uses begin to appear. South of I-80, residential uses give way to gaming, government facilities, commercial uses, manufacturing, and Reno-Sparks Indian Colony land. Near Villanova Drive/Plumb Lane, which provides access to the Reno/Tahoe International Airport, single-family and multi-family residential uses reappear and continue to be seen all the way to the southern end of the study corridor, mixed first with commercial uses and then with agriculture and undeveloped land.

1.2 Purpose and Need

The historical rate of population and employment growth in Washoe County has resulted in a significant increase in vehicle miles traveled within the region. Historical growth rates are projected to continue in the future, often taking place beyond existing development concentrations. These patterns will effectively increase the region's diameter and potentially increase average trip lengths in the region.

New development expected in the region includes more than 18,000 new homes and 15,000 jobs in the Spanish Springs Valley area to the north-east of downtown Reno. These additions are projected to generate more than 200,000 average daily trips. In addition, a 14,000-acre industrial park is planned in Storey County, which neighbors Washoe County to the east. Billed as "the world's biggest industrial park," the development is projected to create between 5,000 and 10,000 new jobs.

The Nevada Department of Transportation level-of-service standard for freeways is LOS D. The standard adopted by the *2030 RTP* for all freeways, freeway ramps, and freeway ramp intersections is also LOS D. However, in the year 2000, the entire length of US-395/I-580 from north of North McCarran Boulevard to Peckham Lane and the entire length of I-80 between Sierra Street and Pyramid Way failed to meet those standard thresholds for level of service. Because traffic volumes on both freeways and all interchanges are projected to increase significantly in the future, the freeway segments currently falling below level-of-service standards can be expected to decline even more. Other roadways in the study area can also be expected to fall below adopted standards for level of service.

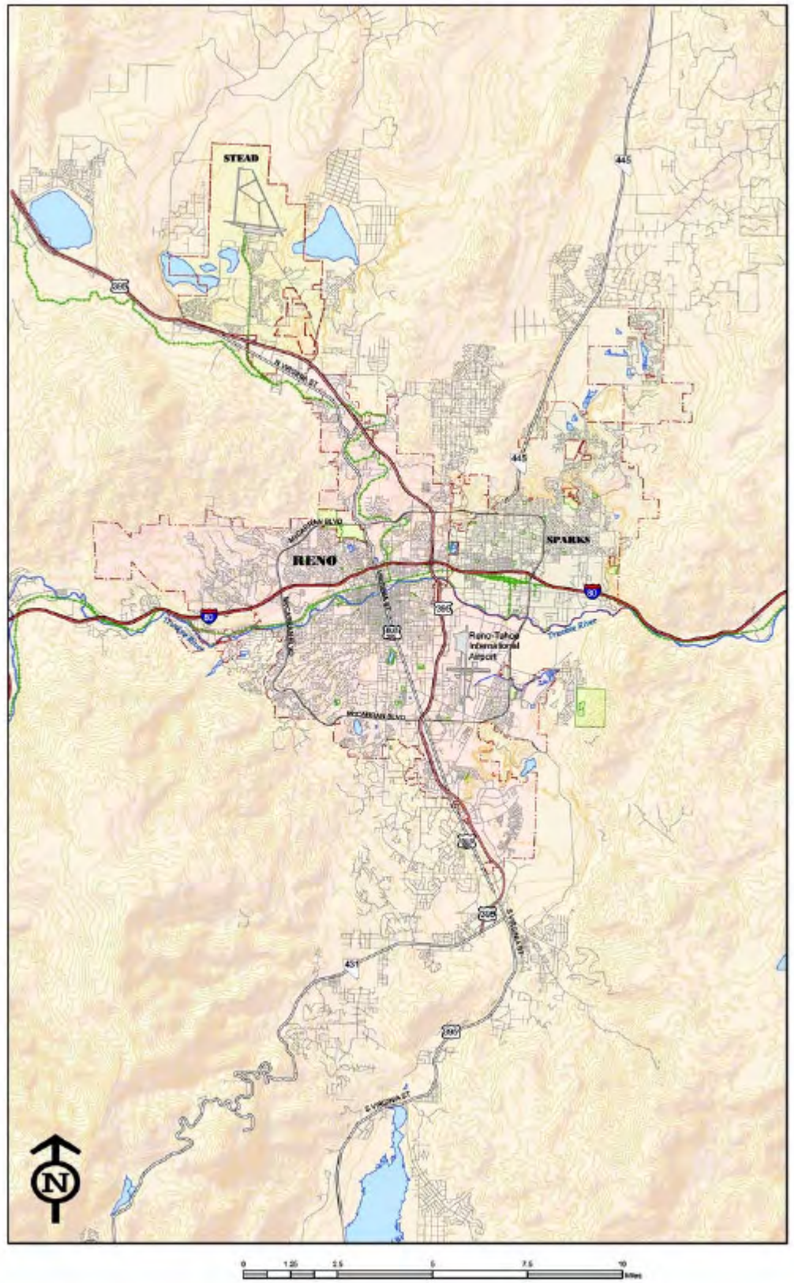
The *Washoe County Freeway Corridor Study* will address the impacts of these patterns on the county's freeway system and develop recommendations for improvements designed to mitigate the effects of increased freeway travel.

1.3 Study Process

The *Washoe County Freeway Corridor Study* was undertaken to fully define investment needs and options for major freeways and interchanges in the study area. However, it also investigated potential improvements to the regional road network, transit services and facilities, Intelligent Transportation System opportunities, and congestion management actions. Investments in these elements of the overall transportation system were studied to determine their potential as congestion-relievers on the freeway study corridors.

The study was performed in several basic stages, beginning with creation of a steering committee and identification of stakeholder agencies, including the Nevada Department of Transportation, the City of Reno, the City of Sparks, Washoe County, the Regional Transportation Commission (RTC), Reno-Tahoe International Airport, the Union Pacific Railroad, the Federal Transit Administration and the Federal Highway Administration. During meetings with the steering committee and stakeholder agencies, Parsons addressed the goals of the study, the plan of work, lines of responsibility, collection of resource materials, study alternatives, funding opportunities, and the public participation plan.

Figure 1-1: Washoe County Freeway Corridor Study Area



Source: Parsons

The project team next performed an analysis of existing conditions in the study area. Data collection during this stage of the project targeted:

- Products assembled for the *2030 Regional Transportation Plan*, including existing reports, traffic counts, and level-of-service analyses
- Field reviews
- Aerial photographic mapping and topographic surveys
- Reviews of design concept reports and *District 2 System Management* information
- Traffic counts, vehicle classification data, and travel speed profiles
- As-built files, highway inventory files, right-of-way records, railroad property valuation records, and utility plats
- Local construction cost histories
- Traffic accident surveillance and analysis system reports
- Nevada Department of Transportation traffic operational data, engineering data, and environmental data
- Data regarding the natural, manmade, and social environments
- Preliminary right-of-way evaluations, right-of-way unit costs, and relocation costs

The data collected during this stage served as a foundation for operational analysis and refinement of alternatives. Much of the data was summarized in an interim report entitled *Traffic Data Report*, and data analysis results were distributed and discussed at meetings of the steering committee.

During the third stage of the study, investment alternatives were defined through a process of traffic demand operational simulation and conceptual engineering design. The initial list of corridor study alternatives was screened based on stakeholder input and the interim findings of the *2030 Regional Transportation Plan*. The resulting set of alternatives was carried forward for additional definition and analysis.

In order to model the system and perform operational analysis, the RTC provided regional travel forecasts for the years 2000, 2010, 2020, and 2030. The RTC base year traffic assignment (2000) was compared with a representation of existing study-area traffic flows to determine the extent of refinement necessary before the RTC's regional traffic forecast volumes could be used for corridor analysis. Subsequent adjustments were made to the future year traffic forecasts, and the resulting set of forecasts was used to analyze the adequacy of the interchanges and mainline weaving sections.

As the operational analysis was performed, the team developed a set of possible design solutions using conceptual plan layouts on aerial photographs. The set of preliminary concepts was reviewed with the steering committee in order to eliminate those concepts with fatal flaws. Viable concepts were further refined through geometric design, traffic operational simulation, and plans for phasing corridor investments. In addition, cost estimates were prepared for right-of-way acquisition and construction.

During the fourth and final stage of the study, the project team undertook a technical evaluation of the identified investment options. Evaluation criteria were determined in conjunction with Nevada Department of Transportation and the steering committee. The evaluation addressed freeway system improvements within the context of the improvements cited in the adopted *2030 Regional Transportation Plan*. A cost-benefit analysis was performed to quantify the evaluation criteria and determine the relative performance of each element of investment.

All four stages of the project were conducted concurrently with a comprehensive program of public involvement activities to facilitate two-way communication between the project team and project stakeholders.

EXISTING CONDITIONS AND FACILITIES

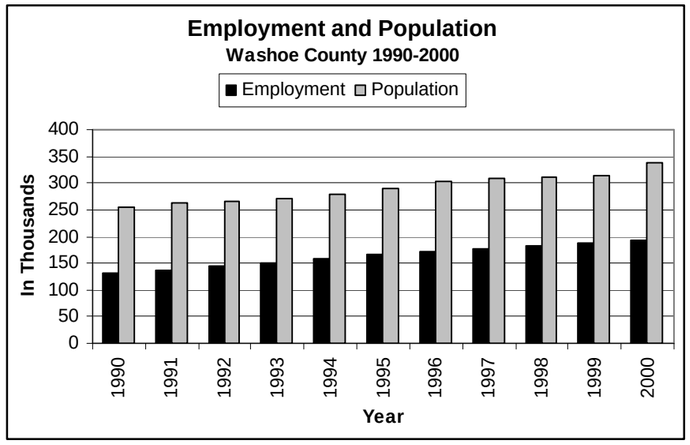
This chapter details the existing conditions in the study area. For an accurate picture of the existing travel environment in the Washoe County study area, physical and operational data regarding the freeway and regional road systems must be analyzed, along with demographic information regarding users of the system and data on the region's transit system. All of these directly affect freeway travel patterns.

2.1 Demographic Conditions and Travel Demand

Both population and employment in Washoe County have grown consistently over the last decade, and by 2000 the county was home to 339,000 people and 193,000 jobs. This represented a 3.4 percent population increase per year and a total increase of 33.5 percent since 1990, when the county housed 254,000 people. Over the same period, employment grew 46.2 percent from 132,000 jobs in 1990 to the current total at a rate of 4.6 percent per year. Figure 2-1 illustrates the significant population and employment growth in Washoe County during the past decade.

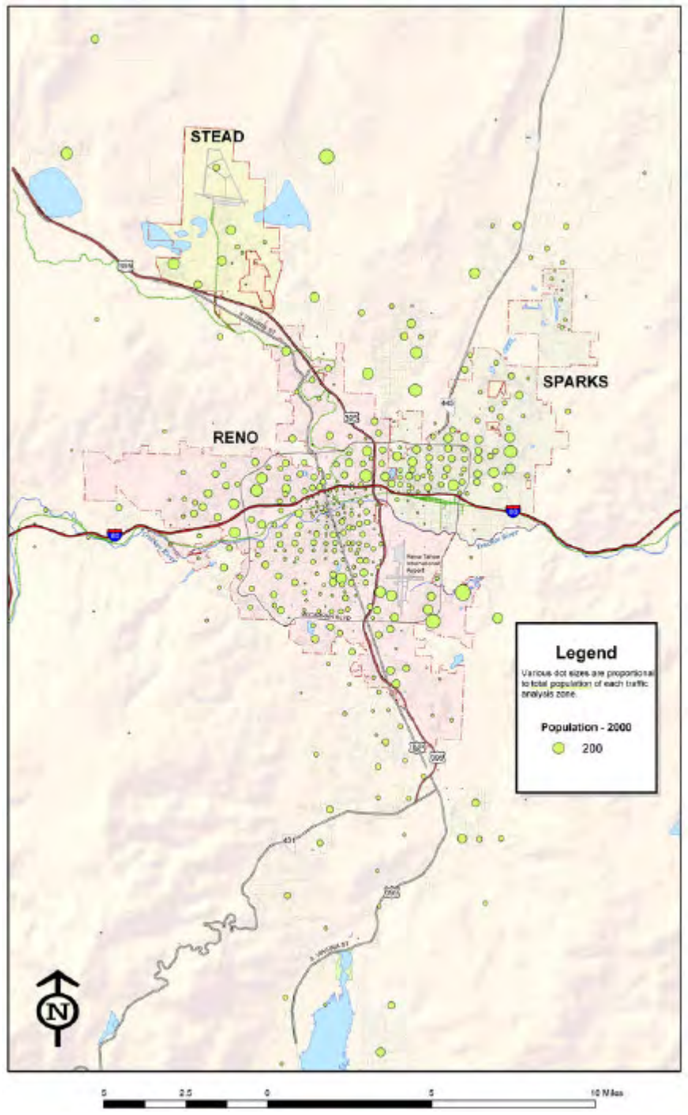
Figures 2-2 and 2-3 illustrate the geographic location of the region's current population and employment concentrations. As shown on these maps, residential densities are concentrated north of I-80 and

Figure 2-1: Historical Study Area Employment and Population



Source: Washoe County Department of Comprehensive Planning; State of Nevada Department of Employment, Training and Rehabilitation

Figure 2-2: 2000 Population by Traffic Analysis Zone



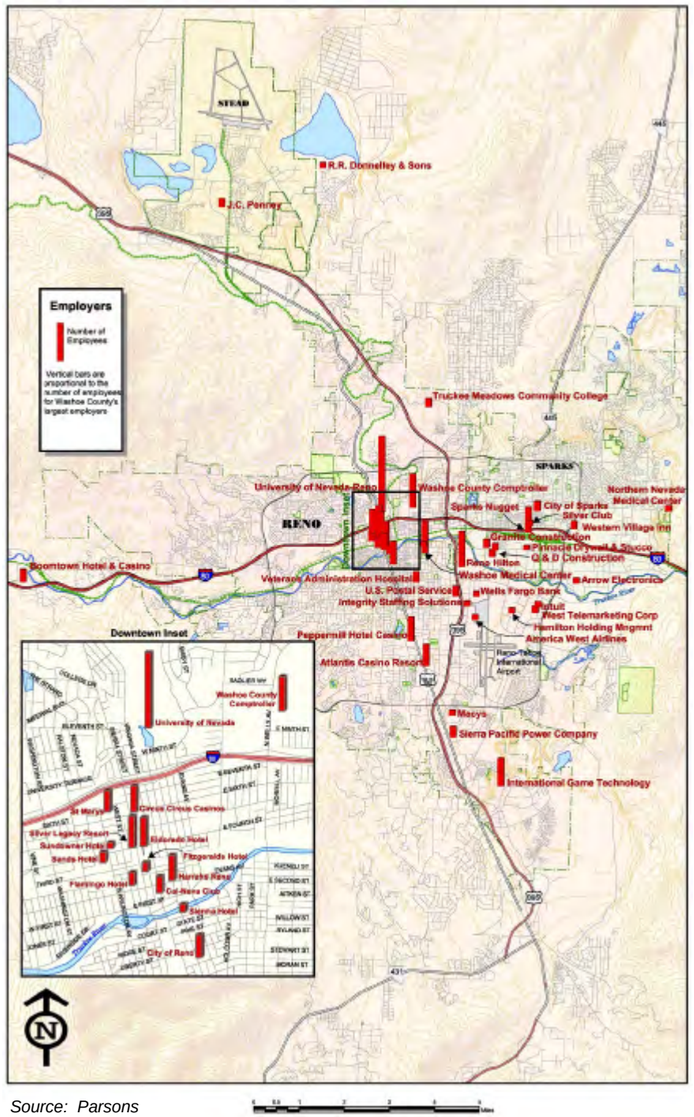
Source: Regional Transportation Commission of Washoe County, Parsons

Figure 2-3: 2000 Employment by Traffic Analysis Zone

Source: Regional Transportation Commission of Washoe County, Parsons

west of US-395/I-580. Offices and commercial development are concentrated inside the McCarran Boulevard loop, generally south of I-80. Figure 2-4 identifies the locations of the 50 largest employers in Washoe County. The racial distribution of the county's existing population is shown in the appendix to this document and can serve as the basis for more extensive environmental justice analysis.

Figure 2-4: Washoe County Employment Centers



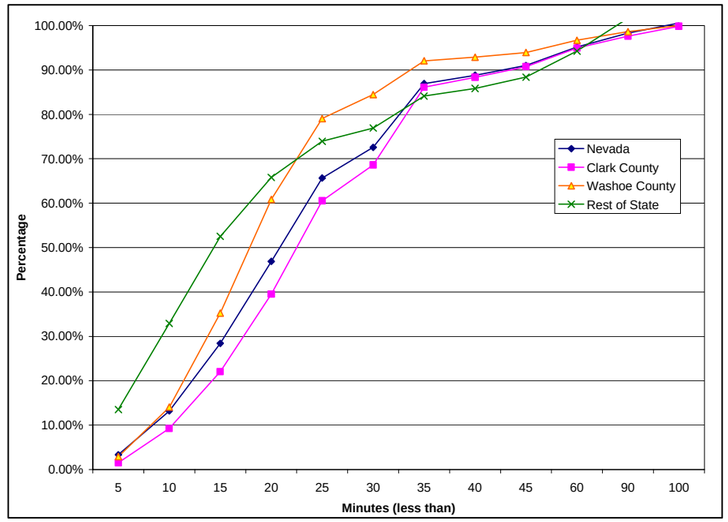
Source: Parsons

These figures show that the region's residential centers and employment centers are generally located on opposite sides of the region. Because 97.2 percent of Washoe County workers are employed within the county and the majority travel to work via automobiles (as shown in Table 2-1), the jobs-housing imbalance in the region results in the need for many workers to drive across the metro area to reach their places of employment.

Figure 2-5 illustrates travel time to work in Washoe County relative to Clark County, the rest of the state, and the state of Nevada as a whole. Average travel time to work is lower for Washoe County residents than for residents elsewhere in Nevada—whether commuting by public transportation (38 minutes) or by other means (19 minutes). Approximately 80 percent of Washoe County residents reach their workplaces within 25 minutes, whereas only approximately 61 percent of Clark County residents, 66 percent of all Nevada state residents, and 74 percent of residents in areas outside Clark or Washoe County reach their workplaces within that amount of time. Approximately 35 percent of Washoe County residents arrive at work within 15 minutes of leaving home.

The rate of population and employment growth, along with imbalanced development patterns, has resulted in a significant increase in

Figure 2-5: Cumulative Frequency Distribution of Travel Time to Work



Source: U.S. Census, Parsons

Table 2-1: Means of Transportation to Work for Workers 16 Years and Over

	Nevada		Clark County		Washoe County		Rest of State	
	Estimate	**Percent**	**Estimate**	**Percent**	**Estimate**	**Percent**	**Estimate**	**Percent**
Total:	**923,155**		**631,236**		**168,922**		**122,997**	
Car, truck, or van	**823,242**	**89.18%**	**563,766**	**89.31%**	**150,533**	**89.11%**	**108,943**	**88.57%**
Drove alone	687,368	74.46%	471,036	74.62%	127,276	75.35%	89,056	72.41%
Carpooled	135,874	14.72%	92,730	14.69%	23,257	13.77%	19,887	16.17%
Public Transp.	**36,446**	**3.95%**	**27,959**	**4.43%**	**5,394**	**3.19%**	**3,093**	**2.51%**
Bus or trolley bus	35,031	3.79%	27,091	4.29%	5,008	2.96%	2,932	2.38%
Taxicab and other	1415	0.15%	868	0.14%	386	0.23%	161	0.13%
Motorcycle	2,693	0.29%	2,156	0.34%	317	0.19%	220	0.18%
Bicycle	4,545	0.49%	2,915	0.46%	1,140	0.67%	490	0.40%
Walked	24,875	2.69%	14,695	2.33%	5,352	3.17%	4,828	3.93%
Other means	7,477	0.81%	5,368	0.85%	1,251	0.74%	858	0.70%
Worked at home	23,877	2.59%	14,377	2.28%	4,935	2.92%	4,565	3.71%

Source: U.S. Census

Data/Travel Patterns/47

vehicle miles traveled in the Washoe County region. Traffic information presented in Figure 2-6 demonstrates the growth of vehicle miles traveled over the 19 years between 1980 and 1999. During this timeframe, annual vehicle miles traveled grew by 126 percent according to Nevada Department of Transportation (NDOT) estimates. This growth amounts to a compound rate of nearly 4.5 percent increase per year.

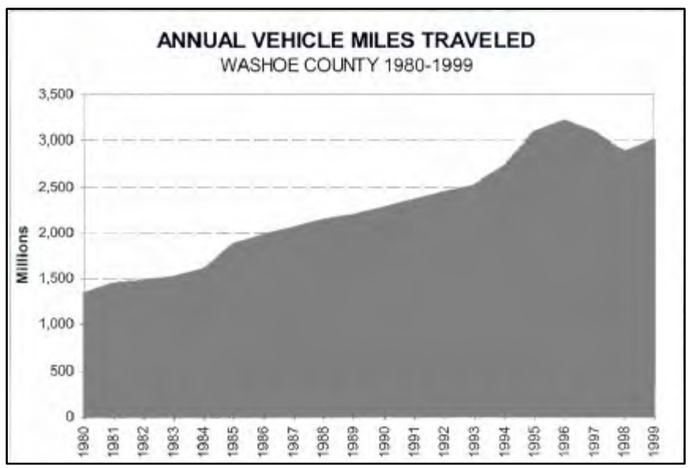
This growth in annual vehicle miles traveled exceeds Washoe County's population and employment increases from 1980 to 2000. During this time frame, the population increased by 72 percent while non-farm employment increased by 69 percent. These 20-year increases represent a compound annual growth rate of approximately 2.75 percent.

NDOT historical records of annual average daily traffic (ADT) illustrate similar trends. On I-80, just west of US-395/I-580, traffic volumes have grown by 3.5 percent annually over the past eleven years (1990–2001). The same rate of growth (3.5 percent) has also been recorded on US-395/I-580 north of the Panther Valley/North Virginia Street interchange. Traffic growth on US-395/I-580 south of the "Spaghetti Bowl" has been even more dramatic. Between 1993 and 2001, traffic volumes increased by 9 percent annually, as counted by NDOT just north of South Virginia Street near Meadowood Mall. The growth trends at these freeway locations are depicted in Figure 2-7.

While traffic volumes have dramatically increased on Washoe County freeways, volumes on other regional roads have remained flat over the past eight years. As shown in Figure 2-8, NDOT historical records of annual average daily traffic on Kietzke Lane, Oddie Boulevard, Glendale Avenue, and South Virginia Street (at Gentry Way) show virtually no increase in daily traffic volumes. North McCarran Boulevard is the exception to this generalization, as traffic volumes have increased by 4 percent annually over the past eight years.

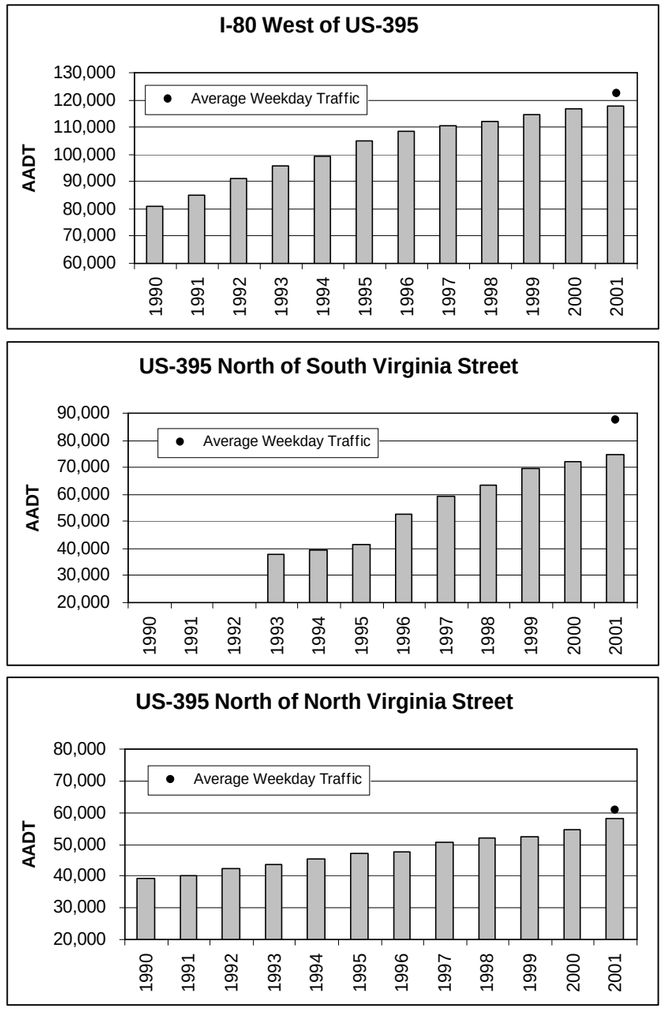
These historical traffic volumes indicate that regional traffic growth appears to be concentrated on the freeway system and McCarran Boulevard rather than parallel arterial streets.

Figure 2-6: Historical Vehicle Miles Traveled



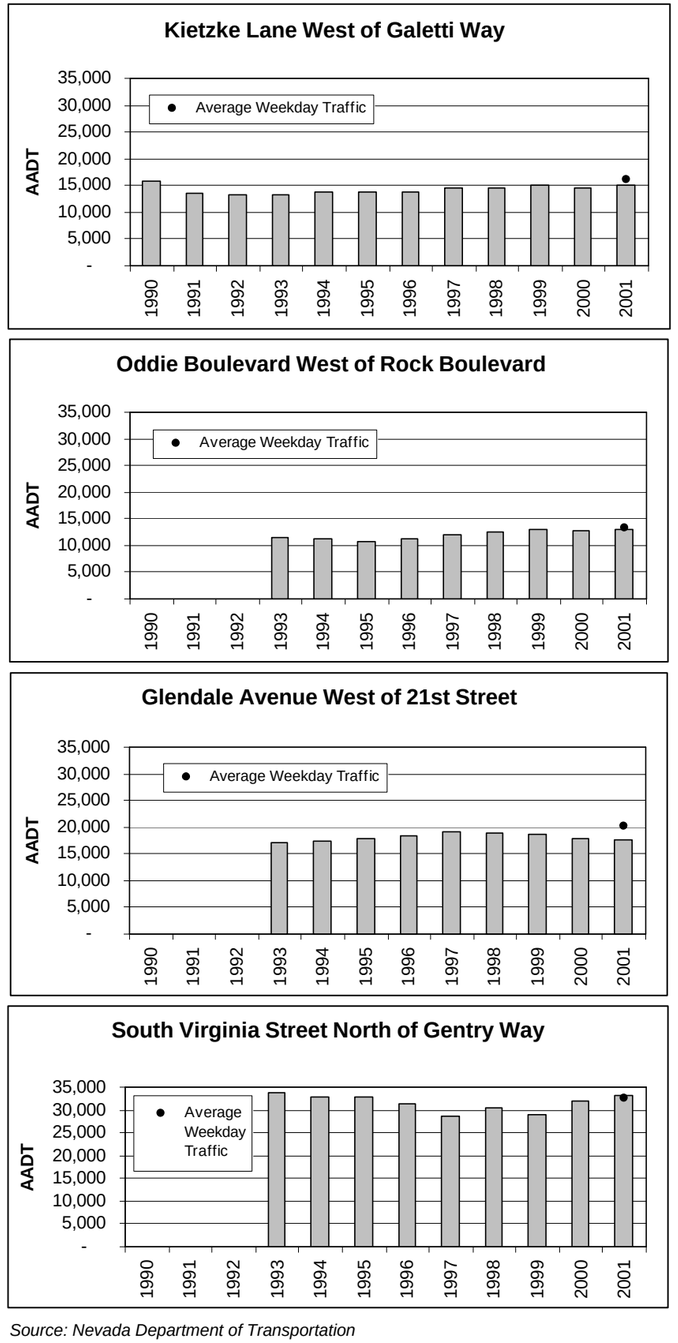
Source: Nevada Department of Transportation, Regional Transportation Commission of Washoe County

Figure 2-7: Historical Traffic Volumes on Study-Area Freeways



Source: Nevada Department of Transportation

Figure 2-8: Historical Traffic Volumes on Study-Area State Routes



Source: Nevada Department of Transportation

2.2 Freeway Network

The primary roadways addressed by the *Washoe County Freeway Corridor Study* are Interstate 80 and US-395/I-580. I-80 traverses the United States from California to New Jersey, while US-395/I-580 stretches across the United States from Washington to southern California. The two highways intersect northeast of downtown Reno. Of the 550 miles of regional roads within Washoe County, the I-80 and US-395/I-580 freeways represent only 16 percent of the total route miles, but carry approximately half of the daily vehicle miles traveled.

The Washoe County Regional Transportation Commission's *2030 Regional Transportation Plan* states that the primary existing problems on the freeway system are along the approaches to the I-80/US-395/I-580 system interchange. Declining levels of service at this location are caused by high traffic volumes, proximity to other interchanges, and limited capacity.

In addition to the county's major freeways, the study also addresses the Regional Road System, which the *2030 Regional Transportation Plan* defines as "all arterials and collector facilities that exceed 5,000 average daily trips or provide connectivity between jurisdictions and across major geographic barriers."

Several important projects have been constructed on the Washoe County freeway system since 1990. On I-80, two new interchanges were constructed: one at Sparks Boulevard (April 1990) and one at Robb Drive (December 1993). The reconstruction of the Keystone Interchange on I-80 was completed in July 1991; and the reconstruction of the interchange at Pyramid Way was completed in June 1999. The largest highway construction project in northern Nevada was completed in February 1996. This four-mile extension of the US-395/I-580 freeway from South Virginia Street/Patriot Boulevard to the Mt. Rose Highway (SR-431) included full interchanges at South Virginia Street/ Patriot Boulevard, South Meadows Parkway, South Virginia Street/ Carson City, and a half-interchange at SR-431. A slip-ramp from US-395/I-580 to Kietzke Lane was completed in 1997, and a slip-ramp from US-395/I-580 to Clear Acre Lane was completed in October 1999.

The freeway system, as it exists in 2002, is described on the pages that follow.

Interstate 80

The study limits on I-80 are from the East Verdi Road Interchange on the west end to the Vista Boulevard Interchange on the east end. West of the East Verdi Road Interchange to the California state line, the freeway has two lanes in each direction. A wide median separates the eastbound and westbound lanes near the East Verdi Road Interchange.

The East Verdi Road Interchange is a half interchange with a single-lane westbound off-ramp and a single-lane eastbound on-ramp. The freeway mainline lanes cross over the local street on two bridges. This interchange serves the Verdi area north of I-80, which is rural in character and comprises undeveloped land and low-density residential uses. The on- and off-ramps are free flowing with no traffic control at the tie-in to the local street.

Between the East Verdi Road and Mogul Road interchanges, the I-80 mainline has two lanes in each direction separated by a wide median. Midway between these interchanges is a scenic overlook site that is accessed with on- and off-ramps in each direction.

The Mogul Road Interchange is a half-diamond, half-trumpet interchange. The freeway mainline lanes cross over the local street on two bridges. The eastbound direction has single-lane on- and off-ramps in the half-diamond configuration. At the local cross street, these ramps are stop sign controlled. The westbound direction has a free-flow, single-lane off-ramp and a free-flow, single-lane loop on-ramp in a trumpet configuration east of the cross street at the interchange. This interchange primarily serves the residential development north of I-80 known as Mogul, which occupies about one-half square mile. Beyond this residential area is undeveloped land. Most of the area south of the interchange is undeveloped land except for a few homes and storage units.

Approximately 3,000 feet east of the Mogul Road Interchange is the Fourth Street half-diamond interchange. This interchange has a single-lane, eastbound off-ramp and a single-lane, westbound on-ramp. The eastbound off-ramp intersection at Fourth Street is stop sign controlled for movements to the west and yield sign controlled for eastbound movements. These ramps connect to Fourth Street, which parallels the south side of I-80 through downtown Reno and Sparks. Union Pacific Railroad tracks parallel the freeway along the south side between the Truckee River Bridge and a point just east of the Fourth Street Interchange. From there the tracks turn to the south and then east through downtown Reno. The area around the Fourth Street Interchange is rural in nature with a few residences located near the interchange on either side of the freeway.

Figure 2-9: I-80 from East Verdi Road to Robb Drive

Between the Mogul Road and Robb Drive interchanges, the freeway is two lanes in each direction separated by a wide median. A freeway bridge over Mae Anne Avenue is approximately 3,500 feet from each interchange. There are two westbound lanes and four eastbound lanes under the interchange bridge at Robb Drive.

The Robb Drive Interchange is a three-quarter diamond with a single-lane, on-ramp loop for eastbound traffic. The other three ramps are single lanes and are free flowing for the major traffic movements. The freeway mainline lanes pass under the Robb Drive Bridge. The westbound off-ramp is stop sign controlled for left and through movements. This interchange primarily serves the large and rapidly developing residential areas north of I-80. There is currently no development south of I-80 in the vicinity of this interchange.

Between the Robb Drive and West McCarran Boulevard interchanges, the freeway is two lanes wide in the westbound direction and three lanes wide in the eastbound direction. There are two eastbound lanes west of the Robb Drive Interchange and two lanes are added with the Robb Drive eastbound on-ramp loop, making a total of four lanes. One of the eastbound lanes is dropped approximately 2,400 feet east of the interchange, leaving three eastbound lanes to the West McCarran Boulevard Interchange. The third lane becomes an auxiliary lane, then becomes an exit-only lane at the West McCarran Boulevard Interchange. The freeway lanes between these two interchanges are separated by a wide median. There are two lanes per direction on the interchange bridges over West McCarran Boulevard.

The West McCarran Boulevard Interchange is a diamond interchange with single-lane on- and off-ramps. The freeway mainline lanes pass over the arterial street on two bridges. The ramp intersections with West McCarran Boulevard are controlled by traffic signals. West McCarran Boulevard is a four-lane arterial street. The westbound off-ramp expands from one lane to three lanes—two left-turn lanes and one right-turn lane. The on-ramps both have two lanes that merge to one lane at the gore point with the freeway mainline. The land use served by this interchange is primarily residential, with some pockets of commercial uses and business offices.

The freeway between the West McCarran Boulevard and Keystone Avenue interchanges has two lanes in each direction. There is a single, two-lane bridge over I-80 approximately 4,250 feet east of the West McCarran Boulevard Interchange. This bridge connects the Mountain View Cemetery with a vacant parcel on the north side of the freeway. Two mainline freeway bridges over Stoker Avenue are located 2,250 feet farther east of the cemetery. The land use north of I-80 between the two interchanges is primarily single-family residential. South of I-80, the land use is a mixture of single-family residential, multi-family residential, and commercial uses.

The Keystone Avenue Interchange is a single-point urban interchange (SPUI) with the mainline freeway lanes on a bridge over the arterial street. All interchange ramp and arterial street movements are controlled by a single traffic signal set up in the center of the interchange. The westbound off-ramp has two lanes, which diverge into two lanes for the right turn to northbound Keystone Avenue and two lanes for the left turn to southbound Keystone Avenue. The westbound on-ramp has two lanes that converge to one lane prior to joining the freeway. The eastbound off-ramp has one lane that diverges into two lanes for the left turn to northbound Keystone Avenue and one lane for the right turn to southbound Keystone Avenue. The eastbound on-ramp has three lanes that converge to two lanes, one of which becomes an auxiliary lane between the Keystone and Virginia Street interchanges. The second lane becomes the third eastbound freeway lane. The land north of the interchange primarily houses single-family residential uses. South of the interchange marks the beginning of the commercial land use that defines the west end of the Reno downtown area.

The portion of the freeway between the Keystone Avenue and Wells Avenue Interchanges was constructed in a cut section, so all cross streets are located on bridges. The freeway at the Keystone Avenue Interchange has three lanes westbound (one lane drops on the interchange bridge) and two lanes eastbound. The third eastbound lane begins at the eastbound on-ramp. There are auxiliary lanes in each direction between the Keystone Avenue and Sierra Street ramps. East of the Sierra Street ramp, the freeway has three lanes in each direction. Three local streets cross the freeway in this section—Vine Street, Washington Street, and Ralston Street. There is also a pedestrian bridge in the vicinity of Arlington Street.

The Virginia Street Interchange is a split-diamond interchange that incorporates Sierra Street, Virginia Street, and Center Street. The mainline freeway lanes pass under the three bridges that carry the Sierra Street, Virginia Street, and Center Street traffic. The westbound off-ramp has a single lane that exits the freeway as an auxiliary lane from the Wells Avenue Interchange and becomes three lanes as part of the Eighth Street frontage road (one-way westbound) at Center Street. There are traffic signals on the frontage road at Center Street, Virginia Street, and Sierra Street. The westbound on-ramp has two lanes at Sierra Street that narrow to one lane prior to entering the freeway.

Figure 2-10: I-80 from Robb Drive to Washington Street

The eastbound off-ramp has two lanes; one lane exits the freeway as an auxiliary lane from the Keystone Avenue Interchange and the other lane is the option lane on the freeway mainline. This ramp continues as part of the frontage road on Maple Street. This frontage is controlled by traffic signals at Sierra Street, Virginia Street and Center Street. The eastbound on-ramp from Center Street has two lanes that narrow to one as the ramp enters the freeway as an auxiliary lane between Center Street and Wells Avenue. An existing platform over the freeway between Virginia Street and Center Street is occupied by a Walgreen's drug store. The Virginia Street Interchange is the primary access point for the University of Nevada at Reno north of the interchange and for downtown businesses and casinos south of the Interchange. Within the limits of the Virginia Street interchange, the freeway has three lanes in each direction.

The freeway between the Virginia Street and Wells Avenue ramps has four lanes in each direction (three mainline lanes and one auxiliary lane). This section of freeway has two local streets (Evans Avenue and Valley Road) and a railroad spur line crossing over the freeway on bridge structures. The land use north of this section of freeway is a continuation of the downtown Reno businesses, single-family residences, and multi-family residences.

The Wells Avenue Interchange is a diamond interchange with the mainline freeway lanes passing over the arterial street on a bridge. The westbound off-ramp has a single lane that becomes three lanes (two left-turn lanes and one right-turn lane) at the intersection with Wells Avenue. This ramp is controlled by traffic signals. The westbound on-ramp has a single lane that becomes an auxiliary lane on the freeway mainline. The eastbound off-ramp is a single lane that is the eastbound auxiliary lane on the mainline and is controlled by traffic signals. This ramp splits into two lanes for left-turn and right-turn movements at Wells Avenue. The eastbound on-ramp is a two-lane ramp that narrows to one lane and serves as an auxiliary lane between Wells Avenue and the US-395/I-580 Interchange (known as the Spaghetti Bowl). The land use north of the interchange is a mixture of government offices, an events center, agricultural research, and residential uses. South of the interchange, the land use includes residential, commercial, and manufacturing.

The freeway between the Wells Avenue Interchange and the US-395/I-580 Interchange has four lanes in each direction—three mainline lanes and one auxiliary lane. The six mainline lanes continue through the US-395/I-580 Interchange. There is only one local street (Sutro Street) that crosses under this section of freeway. Land use north of the freeway is primarily single-family and multi-family residential; to the south, land use is a mix of industrial and commercial uses.

The Spaghetti Bowl Interchange is a system interchange of I-80, an east-west interstate freeway route, and US-395/I-580, a U.S. route built to freeway standards through the Truckee Meadows area. The I-80 mainline lanes pass under the US-395/I-580 freeway. All vehicles traveling from one freeway to the other use free-flow ramps. Traffic from I-80 eastbound to US-395/I-580 exits onto a two-lane ramp (one lane is the auxiliary lane between Wells Avenue and US-395/I-580, and the other lane is the option lane from the eastbound mainline freeway lanes). These two lanes split into a single lane for northbound US-395/I-580 (merges into the three northbound mainline lanes) and a single lane for southbound US-395/I-580 (becomes a short auxiliary lane to the southbound off-ramp at the Glendale Avenue Interchange). Traffic from I-80 westbound to US-395/I-580 exits onto a single-lane ramp (the auxiliary lane between Fourth Street and US-395/I-580) and then splits into separate single lanes for northbound US-395/I-580 and southbound US-395/I-580. The northbound US-395/I-580 ramp becomes a short auxiliary lane to the northbound off-ramp at the Oddie Boulevard Interchange, and the southbound US-395/I-580 ramp merges into the three southbound mainline freeway lanes.

A description of the US-395/I-580 ramps to I-80 is included in the freeway description for the US-395/I-580 freeway.

The portion of the freeway between the US-395/I-580 and Fourth Street interchanges is approximately 2,000 feet in length and consists of three mainline lanes in each direction, plus a single auxiliary lane in each direction. These auxiliary lanes are the result of ramp-to-ramp connections between the US-395/I-580 and Fourth Street ramps. The land use north of the freeway is primarily a mix of single-family and multi-family residences; to the south, land use is a mixture of government facilities and industrial/manufacturing uses.

The Fourth Street Interchange is a diamond interchange with the mainline freeway lanes passing over the arterial street on a bridge. The westbound off-ramp has a single lane that bridges over Kietzke Lane and becomes two lanes (one left-turn lane and one right-turn lane) at the intersection with Fourth Street. This ramp is controlled by traffic signals. The westbound on-ramp has a single lane that becomes an auxiliary lane on the mainline and feeds into the ramps to northbound and southbound US-395/I-580. The eastbound off-ramp has a single lane that is the eastbound auxiliary lane on the mainline formed by the northbound on-ramp from US-395/I-580. This ramp is controlled by

Figure 2-11: I-80 from Vine Street to 14th Street

traffic signals. The eastbound on-ramp has two lanes that narrow to one lane prior to entering the freeway mainline. The on-ramp lane becomes an auxiliary lane on the freeway. The interchange serves an area that includes a mixture of commercial and multi-family residential on the north side and industrial, manufacturing, and government facilities on the south side.

The freeway mainline between the Fourth Street and Rock Boulevard interchanges is one of lane transition. The westbound freeway has two mainline lanes and one auxiliary lane. The auxiliary lane drops at the Fourth Street westbound off-ramp and a third freeway lane begins just west of the off-ramp. The eastbound freeway has three mainline lanes and one auxiliary lane. The auxiliary lane drops at the Rock Boulevard eastbound off-ramp and the inside freeway lane ends just prior to the bridge over Rock Boulevard, resulting in two mainline freeway lanes eastbound through the Rock Boulevard Interchange. The land use north of this section of freeway is a combination of commercial, single-family residential, and multi-family residential uses. South of the freeway, the area houses a combination of government, industrial, manufacturing, and commercial uses.

The Rock Boulevard Interchange is considered a tight diamond interchange due to the close proximity of the railroad tracks on the south side and the residential area on the north side. The mainline freeway lanes are located on two bridges over the arterial street. The westbound off-ramp has a single lane that splits to two lanes for left and right turns. This ramp is an extension of the auxiliary lane between the Rock Boulevard and Pyramid Way interchanges. The ramp is controlled by traffic signals where it intersects with Rock Boulevard. The westbound on-ramp has two lanes that narrow to a single lane. This single lane becomes an auxiliary lane between Rock Boulevard and Fourth Street. The eastbound off-ramp has a single lane that is the eastbound auxiliary lane on the mainline formed by the northbound on-ramp from Fourth Street. This off-ramp also splits and provides a single-lane access over Rock Boulevard to Nugget Avenue (and to the Nugget Hotel Casino). The portion of the ramp that provides access to Rock Boulevard is controlled by traffic signals. The eastbound on-ramp has two lanes that narrow to a single lane. This single lane becomes an auxiliary lane between the Rock Boulevard and Pyramid Way interchanges. The Rock Boulevard Interchange serves a mixture of commercial and residential land uses to the north, and industrial, warehousing and commercial uses to the south.

The freeway portion between the Rock Boulevard and the Pyramid Way interchanges has about 1,000 feet of its 3,300-foot length on viaduct structure. Over the years, the Sparks Nugget Hotel Casino has expanded under part of the viaduct, and the viaduct columns can be seen in the casino and restaurant areas. Other hotel/casino buildings have also been built very close to the viaduct, making future freeway widening to the outside impractical. The freeway has three lanes in each direction, including an auxiliary lane between the Rock Boulevard and Pyramid Way interchanges. The only potential for freeway widening on the viaduct portion is to fill in between the bridges. The land use north of the freeway is a combination of gaming, commercial and residential uses. South of the freeway, the area houses both gaming and railroad facilities.

The Pyramid Way Interchange is a single-point urban interchange (SPUI). The mainline freeway lanes are located on a bridge over the arterial street. The westbound off-ramp has a single lane that splits into three lanes (two left-turn lanes and one right-turn lane) and is controlled by the single-point traffic signal under the interchange bridge. This ramp is an extension of the auxiliary lane between the Pyramid Way and East McCarran Boulevard interchanges. The westbound on-ramp has three lanes that narrow to one lane and become an auxiliary lane between Pyramid Way and Rock Boulevard. The eastbound off-ramp is a two-lane ramp with one lane from the auxiliary lane between the Rock Boulevard and Pyramid Way interchanges and the other lane from the optional movement on the mainline freeway lanes. These two ramp lanes transition into four lanes (three left-turn lanes and one right-turn lane) at the intersection with Pyramid Way. This ramp is controlled by the single-point traffic signal under the interchange bridge. The eastbound on-ramp has two lanes that narrow to one lane and become an auxiliary lane between the Pyramid Way and East McCarran Boulevard interchanges. This interchange serves a mixture of commercial and residential uses to the north, and gaming, industrial, and railroad facilities to the south.

The freeway mainline section between the Pyramid Way and East McCarran Boulevard interchanges is approximately 4,000 feet in length and has three lanes in each direction (two mainline lanes and one auxiliary lane). The auxiliary lanes are the result of ramp-to-ramp connections between the two interchanges. There is a paved median that is wide enough to accommodate a future lane in each direction. The land north of the freeway houses single-family and multi-family residences, city government facilities, and commercial uses. The land use south of the freeway includes industrial (petroleum storage), commercial, and railroad facilities.

The East McCarran Boulevard Interchange is a diamond interchange with a loop ramp in the northeast quadrant for northbound to

Figure 2-12: I-80 from 14th Street to Vista Boulevard

westbound movements. The mainline freeway lanes are located on two bridges over the arterial street. The westbound off-ramp has one lane that transitions into three lanes (two left-turn lanes and one right-turn lane) at the intersection with East McCarran Boulevard. This ramp is controlled by traffic signals. The westbound on-ramp movements are handled by two separate ramps. The southbound traffic on East McCarran Boulevard uses a single-lane ramp that becomes an auxiliary lane between Pyramid Way and East McCarran Boulevard. The northbound traffic on East McCarran Boulevard uses the free-flow single-lane loop on-ramp that merges into the westbound freeway mainline lanes. The eastbound off-ramp has two lanes (one from the auxiliary lane and one from the optional movement off the freeway mainline lanes) that transition into four lanes (three left-turn lanes and one right-turn lane) at the intersection with East McCarran Boulevard. This ramp is controlled by traffic signals. The operation of this ramp is affected by the traffic signals for the frontage road just south of the off-ramp. The eastbound on-ramp has a single lane that merges into the freeway mainline lanes. The land use north of the interchange is a mixture of commercial and multi-family residential uses; to the south the land use includes industrial uses and warehousing.

The freeway mainline section between the East McCarran Boulevard and Sparks Boulevard interchanges is approximately 6,500 feet in length and has two lanes in each direction. There is a wide median separating the lanes. The land north of the freeway is a combination of commercial uses, recreational uses, residential uses, and undeveloped land. The land to the south houses industrial uses and warehousing.

The Sparks Boulevard Interchange is a diamond interchange that is compressed on the south side by the railroad tracks. The mainline freeway lanes pass under the Sparks Boulevard Bridge. The westbound off-ramp has a single lane that splits into two lanes (one left-turn lane and one right-turn lane) at the intersection with Sparks Boulevard. The ramp is controlled by traffic signals. The westbound on-ramp has two lanes converging into a single lane that merges into the freeway mainline lanes. The eastbound off-ramp has a single lane that splits into two lanes (one left-turn lane, one right-turn lane) at the intersection with Sparks Boulevard. This ramp is controlled by traffic signals. The eastbound on-ramp has two lanes that narrow to one lane and then merge into the freeway mainline lanes. The land use north of the interchange is a mixture of open space, recreational uses, multi-family residences and warehousing. To the south, the area is home primarily to industrial uses and warehousing.

The portion of freeway between the Sparks Boulevard and Vista Boulevard interchanges is approximately 3,800 feet in length and has two lanes in each direction. The freeway lanes are separated by a wide median. Approximately 1,500 feet east of the Sparks Boulevard Interchange is a railroad bridge over the freeway. The land use north of the freeway is primarily manufacturing and warehousing. To the south, the land houses industrial and distribution centers.

The Vista Boulevard Interchange is a diamond interchange with freeway mainline lanes that pass under the Vista Boulevard Bridge. The westbound off-ramp has a single lane and is controlled by traffic signals at the intersection with Vista Boulevard. The westbound on-ramp has a single lane and merges with the freeway mainline lanes. The eastbound off-ramp has a single lane that splits into two lanes (one left-turn lane and one right-turn lane) and is controlled by traffic signals at the intersection with Vista Boulevard. The eastbound on-ramp has a single lane that merges with the freeway mainline lanes. There are four freeway mainline lanes (two per direction) east of the Vista Interchange.

US Highway 395/I-580

The study limits on US-395/I-580 are from the Cold Springs Road Interchange in the north to the Mt. Rose Highway Interchange in the south. North of the Cold Springs Road Interchange to the California state line, the freeway has two lanes in each direction. A wide median separates the freeway lanes in the vicinity of the Cold Springs Road Interchange.

The Cold Springs Road Interchange is a diamond interchange. The freeway mainline lanes pass under the Cold Springs Road Bridge. The northbound off-ramp has a single lane and the ramp is stop sign controlled. The northbound on-ramp has a single lane that merges into the freeway mainline lanes. The southbound off-ramp has a single lane and the ramp is stop sign controlled. The southbound on-ramp has a single lane that merges into the freeway mainline lanes. All four ramps are fenced and have cattle guards to prevent livestock from entering the freeway. The land on both sides of the interchange is open and undeveloped. The Cold Springs Road Interchange has become the freeway access point for a growing residential development several miles north of the freeway.

The freeway between the Cold Springs Road and Red Rock Road interchanges is approximately 2.6 miles in length and has two lanes in each direction. The freeway lanes are separated by a wide median. The land on both sides of the freeway is open and undeveloped.

Figure 2-13: US-395/I-580 from Cold Springs Road to Stead Boulevard

The Red Rock Road Interchange is a diamond interchange. The northbound off-ramp has a single lane and is stop sign controlled. The northbound on-ramp has a single lane that merges into the freeway mainline lanes. The southbound off-ramp has a single lane that is stop sign controlled. The southbound on-ramp has a single lane that merges into the freeway mainline lanes. All four ramps are fenced and have cattle guards to prevent livestock from entering the freeway. Some land north of the interchange is open and undeveloped; the remainder houses single-family residences. On the south side, the land is primarily undeveloped with a few single-family dwellings and some agricultural uses.

The portion of freeway between the Red Rock Road and Stead Boulevard interchanges is approximately 1.8 miles in length and has two lanes in each direction. The freeway lanes are separated by a wide median. Approximately 1,000 feet north of the Stead Boulevard Interchange are two freeway bridges that cross over railroad tracks. There is a wide median separating the freeway lanes. The land use northeast of the freeway is a mixture of single-family residential, open space, and recreational uses. The land to the southwest is primarily undeveloped.

The Stead Boulevard Interchange is a diamond interchange. The mainline freeway lanes pass over Stead Boulevard on two bridges. The northbound off-ramp has two lanes that lead to a two-lane free-flow right turn and a single-lane left turn. This ramp is stop sign controlled for the left-turn movements onto Stead Boulevard. The northbound on-ramp has a single lane that merges into the freeway mainline lanes. The southbound off-ramp has a single lane that is stop sign controlled.

The southbound on-ramp has two lanes that create two lanes on the freeway mainline. The first lane ends approximately 1,100 feet from the ramp gore and the second lane ends approximately 2,500 feet from the ramp gore. The land use northeast of the interchange is a mixture of commercial, warehousing, and residential uses. Southwest of the interchange, the land is primarily open space with some scattered residential uses.

The freeway mainline section between the Stead Boulevard and Lemmon Drive interchanges is approximately 1.8 miles in length and has two lanes in each direction. The southbound direction has a short section of four lanes to accommodate the two-lane on-ramp. There is a wide median separating the freeway lanes. The land on the northeast side of the freeway is primarily open and undeveloped. On the southwest side, the land is also largely undeveloped but does have scattered residential uses.

The Lemmon Drive Interchange is a diamond interchange. The mainline freeway lanes are located on two bridges over Lemmon Drive. The northbound off-ramp has a single lane that diverges into two lanes--one left turn controlled by stop signs and one free-flow right turn. The northbound on-ramp has a single lane that merges into the freeway mainline lanes. The southbound off-ramp has a single lane that is stop-sign controlled at Lemmon Drive. The southbound on-ramp has a single lane that merges into the freeway mainline lanes.

The freeway section between the Lemmon Drive and Golden Valley Road interchanges is approximately 1.4 miles in length and has two lanes in each direction. There is a wide median separating the freeway lanes. The land northeast of the freeway includes a mixture of single-family residences, industrial uses, and open space. Southwest of the freeway, the land contains single-family residences and open space.

The Golden Valley Road Interchange is a diamond interchange. The mainline freeway lanes are located on two bridges over Golden Valley Road. The northbound off-ramp has a single lane that splits into two lanes—one left turn controlled by a stop sign and one free-flow right turn. This ramp is an extension of the auxiliary lane between the Golden Valley Road and Panther Valley interchanges. The northbound on-ramp has a single lane that merges with the freeway mainline lanes. The southbound off-ramp has a single lane that splits into two lanes—one left turn controlled by a stop sign and one free-flow right turn. The southbound on-ramp has two lanes that narrow to one lane and create an auxiliary lane between the Golden Valley Road and Panther Valley interchanges. The land use northeast of the interchange is a mixture of single-family residences, industrial uses, and open space. Southwest of the interchange, the land use is primarily single-family residential and open space.

The freeway section between the Golden Valley Road and Panther Valley interchanges is approximately 1.0 mile in length and has three lanes in each direction—two mainline lanes and one auxiliary lane. There is a wide median separating the freeway lanes. Approximately 1,700 feet south of the Golden Valley Road Interchange are two freeway bridges that cross over railroad tracks. The land east of the freeway is primarily undeveloped but contains some industrial uses. On the west side, the area contains a mixture of single-family residences, industrial uses, and undeveloped land.

Figure 2-14: US-395/I-580 from Stead Boulevard to Golden Valley Road

The Panther Valley Interchange is a three-quarter diamond interchange with a loop ramp in the northeast quadrant for the northbound off-ramp. This interchange is the north terminus of North Virginia Street, a state highway. The mainline freeway lanes pass over North Virginia Street on two bridges. The northbound off-ramp is a loop ramp and has a single lane that flows freely onto southbound North Virginia Street. The northbound on-ramp is a free-flow movement from northbound North Virginia Street with a single lane that merges into the freeway mainline lanes. The southbound off-ramp has a single lane that is the auxiliary lane between the Golden Valley Road and Panther Valley interchanges. The ramp flows freely onto southbound North Virginia Street. The southbound on-ramp has a single lane that merges into the freeway mainline lanes. The land both east and west of the interchange contains a mixture of industrial uses, single-family residences and undeveloped land.

The freeway section between the Panther Valley and Parr Boulevard interchanges is approximately 1.5 miles in length and has two lanes in each direction. There is a wide median separating the freeway lanes. Approximately 1,300 feet south of the Panther Valley Interchange are two freeway bridges that cross over railroad tracks. The land east of the freeway is primarily undeveloped, but does house the government Regional Training Facility. To the west, the land use is a mixture of single-family residences, industrial uses, and undeveloped land.

The Parr Boulevard Interchange is a diamond interchange. The mainline freeway lanes pass under the Parr Boulevard Bridge. The northbound off-ramp has a single lane that is stop sign controlled at Parr Boulevard. The northbound on-ramp has a single lane that merges into the freeway mainline lanes. The southbound off-ramp has a single lane that is controlled by stop signs at Parr Boulevard. The southbound on-ramp has a single lane that merges into the freeway mainline lanes. The area east of the interchange primarily contains government facilities, research institutions, and undeveloped land. To the west, the land use is a mixture of government facilities, industrial uses and undeveloped land.

The portion of freeway between the Parr Boulevard and North McCarran Boulevard interchanges is approximately 1.7 miles in length and has two lanes in each direction. The median width in this section begins to narrow south of the Parr Boulevard Interchange. At the North McCarran Boulevard Interchange, the median is reduced to the width of a concrete barrier rail with shoulders on either side. Approximately 1,000 feet north of the North McCarran Boulevard Interchange are two freeway bridges that cross over Clear Acre Lane. The land use on the east side of the freeway is a mixture of undeveloped land, single-family and multi-family residences, and research facilities. To the west lie residences, commercial uses, and undeveloped land.

The North McCarran Boulevard Interchange is a diamond interchange with an additional slip ramp connection to Clear Acre Lane for northbound traffic. The mainline freeway lanes pass under the North McCarran Boulevard bridge. The northbound off-ramp has a single lane that diverges left to the Clear Acre Lane slip ramp and right to McCarran Boulevard. On the portion of the ramp to North McCarran Boulevard there are three lanes (two left-turn lanes and one free-flow right-turn lane). This ramp is controlled by traffic signals. The slip ramp to Clear Acre Lane is a free-flow right-turn movement. The northbound on-ramp has a single lane that merges with the freeway mainline lanes. The southbound off-ramp has a single lane that splits into two lanes and is controlled by traffic signals. The southbound on-ramp is configured to accept traffic from the westbound left-turning North McCarran Boulevard movement and from the southbound left-turn movement from Clear Acre Lane. The on-ramp has three lanes that narrow to two lanes, one of which is dropped just south of the gore area and one of which becomes an auxiliary lane between the North McCarran Boulevard and Oddie Boulevard interchanges. The interchange serves a mix of commercial land uses, single-family residences and multi-family residences to both the east and the west.

The freeway section between the North McCarran Boulevard and Oddie Boulevard interchanges is approximately 4,000 feet in length and has two lanes northbound and three lanes southbound (two mainline lanes and one auxiliary lane). The freeway lanes are separated by a concrete median barrier with shoulders. Approximately 1,700 feet south of the North McCarran Boulevard Interchange, there is a freeway bridge over Wedekind Road. The land on both sides of the freeway contains a mixture of commercial, single-family residential, and multi-family residential uses.

The Oddie Boulevard Interchange is a modified diamond. The westbound Oddie Boulevard-to-southbound US-395/I-580 traffic uses a loop ramp in the northwest quadrant of the interchange, and the eastbound Oddie Boulevard-to-southbound US-395/I-580 traffic uses the diamond on-ramp in the southwest quadrant. The mainline freeway lanes (two lanes northbound and three lanes southbound) are located on a bridge over Oddie Boulevard. The northbound off-ramp has a

Figure 2-15: US-395/I-580 from Panther Drive to Clear Acre Lane

single lane that splits to one lane for left turns and one lane that is a free-flow right-turn lane. The ramp is controlled by traffic signals on Oddie Boulevard. The northbound on-ramp has a single lane that merges with the freeway mainline lanes. The southbound off-ramp has a single lane that splits into two lanes (one left-turn lane and one right-turn lane) at Oddie Boulevard and is controlled by traffic signals. This ramp is an extension of the auxiliary lane between the Oddie Boulevard and North McCarran Boulevard interchanges. As mentioned above, the southbound movements from Oddie Boulevard onto the freeway are handled on two separate ramps. Both ramps have single lanes. The loop ramp (westbound to southbound from Oddie Boulevard) creates the third lane on southbound US-395/I-580. The diamond ramp (eastbound to southbound from Oddie Boulevard) merges into the freeway mainline lanes. The land use east of the interchange is a mixture of single-family residential, multi-family residential, and commercial uses. To the west, the land use is primarily single-family residential.

The freeway segment between the Oddie Boulevard Interchange and the I-80 Interchange is approximately 2,800 feet in length and has three lanes in each direction. In the northbound direction, the outside or third lane becomes a mandatory exit lane to Oddie Boulevard, and two mainline lanes continue to the north across Oddie Boulevard. The land on both sides of the freeway contains primarily single-family and multi-family residences.

As mentioned in the I-80 freeway description, the US-395/I-580 Interchange, or Spaghetti Bowl, is a system interchange between I-80 and US-395/I-580. The US-395/I-580 mainline lanes pass over the I-80 freeway on three mainline lanes in each direction. All traffic traveling from one freeway to another uses free-flow ramps. Northbound traffic on US-395/I-580 exits onto a two-lane ramp (one lane is the auxiliary lane between Glendale Avenue and I-80, and the other lane is the option lane from the northbound mainline freeway lanes). These two lanes split and go to ramps for westbound and eastbound I-80. The ramp to westbound I-80 has two lanes that narrow to one lane on a loop ramp (northeast quadrant of the interchange) and merge with the freeway mainline lanes. The ramp to eastbound I-80 has one lane and creates an auxiliary lane between the I-80 and Fourth Street interchanges. Southbound traffic on US-395/I-580 exits onto a single-lane ramp that splits into separate single lanes for westbound and eastbound I-80. The westbound ramp becomes an auxiliary lane to the westbound off-ramp at the Wells Avenue Interchange, and the eastbound ramp goes to a loop ramp (southwest quadrant of the interchange) and merges with the freeway mainline lanes.

The portion of the freeway between the Spaghetti Bowl and Glendale Avenue interchanges is approximately 3,500 feet in length and consists of three mainline lanes in each direction plus a single auxiliary lane in each direction. These auxiliary lanes are the result of ramp-to-ramp connections between the Spaghetti Bowl and Glendale Avenue ramps. Approximately 1,200 feet south of the Spaghetti Bowl Interchange, the freeway lanes pass over Fourth Street and the railroad tracks on a set of four bridges. Another 1,000 feet to the south, the freeway lanes pass over Kietzke Lane and the Truckee River on a bridge. The land west of the freeway contains primarily commercial and industrial uses. The area on the east side houses industrial and government facilities.

The Glendale Avenue Interchange is a three-quarter diamond interchange with a loop ramp in the southeast quadrant. The mainline freeway lanes are located on a bridge over Glendale Avenue. The northbound off-ramp has a single lane that splits into two lanes (one left-turn lane and one right-turn lane). This ramp is controlled by traffic signals on Glendale Avenue. The northbound on-ramp is a loop ramp. This ramp serves both eastbound and westbound Glendale Avenue and has two lanes that narrow to one lane. The on-ramp creates an auxiliary lane between the Glendale Avenue and Spaghetti Bowl interchanges. The southbound off-ramp has a single lane and is the extension of the auxiliary lane between the Glendale Avenue and Spaghetti Bowl interchanges. This ramp splits into three lanes (two left-turn lanes and one right-turn lane) and is controlled by traffic signals on Glendale Avenue. The southbound on-ramp has a single lane that creates an auxiliary lane between the Glendale Avenue and Mill Street interchanges. The land west of the interchange houses a mixture of commercial uses and Reno-Sparks Indian Colony land (residential and undeveloped land). The land on the east side contains a mixture of gaming, commercial uses, and Reno-Sparks Indian Colony land.

The segment of freeway between the Glendale Avenue and Mill Street interchanges is approximately 2,600 feet in length. This segment has four lanes northbound (the fourth lane drops just past the Glendale Avenue off-ramp) and four lanes southbound (three mainline lanes and one auxiliary lane). The land west of the freeway contains a mixture of commercial development and Reno-Sparks Indian Colony land (both residences and undeveloped land). The land on the east side is primarily used for gaming.

Figure 2-16: US-395/I-580 from North McCarran Boulevard to Plumb Lane

The Mill Street Interchange is a three-quarter diamond interchange with a loop ramp in the southeast quadrant. The mainline freeway lanes pass over Mill Street on a bridge. Through the interchange, there are four mainline lanes northbound and three lanes southbound, with an auxiliary lane dropping at Mill Street. The northbound off-ramp has a single lane that splits into three lanes (one left-turn lane, one shared left/through lane, and one right-turn lane) and is controlled by traffic signals on Mill Street. The northbound on-ramp is the loop ramp and serves both eastbound and westbound Mill Street. It has two lanes that narrow to one lane. The on-ramp creates an auxiliary lane between the Mill Street and Glendale Avenue interchanges. The southbound off-ramp has a single lane that comes off the auxiliary lane created by the southbound on-ramp from Glendale Avenue. This ramp splits into three lanes (two left-turn lanes and one right-turn lane) and is controlled by traffic signals on Mill Street. The southbound on-ramp has a single lane that creates an auxiliary lane between the Mill Street and Villanova Drive/Plumb Lane interchanges. The land use west of the interchange is a mixture of commercial and Reno-Sparks Indian Colony facilities. To the east, the land contains a mixture of commercial uses, manufacturing and gaming facilities.

The freeway segment between the Mill Street and Villanova Drive/Plumb Lane interchanges is approximately 3,500 feet in length. This segment has four lanes in each direction (northbound has three mainline lanes and one auxiliary lane). Approximately 2,300 feet south of the Mill Street Interchange, the freeway mainline lanes are located on a bridge over Vassar Street. The land use west of the freeway is a mixture of commercial uses, government facilities and undeveloped land, while the land use east of the freeway is primarily commercial and manufacturing.

The Villanova Drive/Plumb Lane Interchange is a split diamond interchange that incorporates Villanova Drive on the north end and Plumb Lane on the south end. The ramps at Villanova Drive and Plumb Lane are connected by frontage roads on either side of the freeway. The ramps and frontage roads are controlled by traffic signals on Villanova Drive and Plumb Lane. The mainline freeway lanes (three lanes northbound and four lanes southbound) are on a 1,400-foot-long viaduct structure over Villanova Drive and Plumb Lane. The Washoe County Regional Transportation Commission executive offices and bus transit facilities occupy the area under the viaduct structure. Between the split interchanges, direct southern freeway access to the Reno/Tahoe International Airport is provided via a flyover ramp. Direct access from the airport to the northern freeway is also provided.

The northbound off-ramp has a single lane that splits into three lanes (one left-turn lane, one shared left/through lane, and one right-turn lane) at the intersection with Plumb Lane. Traffic can also go straight across the intersection to the frontage road. The northbound on-ramp has two lanes that narrow to one lane. This ramp lane creates an auxiliary lane between the Villanova Drive/Plumb Lane and Mill Street interchanges. The southbound off-ramp has a single lane that splits into three lanes (one shared left/through lane, one through lane, and one right-turn lane) at the intersection with Villanova Drive. The southbound on-ramp has two lanes that narrow to one lane. This ramp lane merges into the fourth freeway lane that becomes a mandatory exit lane at Moana Lane. The Villanova Drive/Plumb Lane Interchange has “Texas turnarounds” at either end. These stop sign-controlled turnarounds allow traffic on one of the frontage roads to access the frontage on the other side of the freeway without going through the traffic signals on Villanova Drive or Plumb Lane. The land west of the interchange contains a combination of commercial uses, residences and public school facilities. To the east are airport facilities and commercial uses.

The Reno/Tahoe International Airport has direct freeway access to and from the north via a set of ramps that were incorporated into the south end of the Villanova Drive/Plumb Lane Interchange. The northbound on-ramp has a single lane that begins on airport property near the Plumb Lane/Terminal Way intersection. This ramp merges into the freeway mainline lanes on the viaduct structure over Plumb Lane and Villanova Drive. The southbound off-ramp has a single lane that starts on the viaduct structure, goes over the freeway and ties into the airport terminal access road.

The section of freeway between the Villanova Drive/Plumb Lane and Moana Lane interchanges is approximately 4,400 feet in length and has five lanes northbound (three mainline lanes, one auxiliary lane that merges into the mainline lanes, and one auxiliary lane that is a mandatory exit at the Villanova Drive/Plumb Lane Interchange) and four lanes southbound (three mainline lanes and one lane that becomes a mandatory exit at the Moana Lane Interchange). West of the freeway are commercial uses, single-family residences, and multi-family residences. Airport facilities are the primary land use to the east.

The Moana Lane Interchange is a diamond interchange with the mainline freeway lanes located on a bridge over Moana Lane. The northbound off-ramp has a single lane that splits into three lanes (one left-turn lane, one shared left/through lane and one right-turn lane) at the intersection with Moana Lane. The ramp is controlled by traffic

Figure 2-17: US-395/I-580 from Plumb Lane to Huffaker Lane

signals. The northbound on-ramp has three lanes that narrow to two lanes. One of these lanes merges with the freeway mainline lanes, and the other lane creates an auxiliary lane between the Moana Lane and Villanova Drive/Plumb Lane interchanges. The southbound off-ramp has two lanes (one from the mandatory exit lane and one from the option lane on the freeway mainline) that become three lanes at Moana Lane (one left-turn lane, one shared left/right-turn lane, and one right-turn lane). The southbound on-ramp has a single lane that merges into the freeway mainline lanes. The area west of the interchange is primarily commercial in nature, with some residential uses. To the east, the land use is primarily single-family and multi-family residential.

The freeway section between the Moana Lane and South Virginia Street/Kietzke Lane interchanges is approximately 5,000 feet in length and has three mainline lanes in each direction. Approximately 2,400 feet south of the Moana Lane Interchange, the freeway mainline lanes pass over Peckham Lane on a bridge. The land west of the freeway contains primarily commercial development and multi-family residences. East of the freeway, the land use is single-family and multi-family residential.

The South Virginia Street/Kietzke Lane Interchange is a half-diamond interchange. Several years ago a southbound off-ramp to Kietzke Lane was incorporated into the half-diamond configuration. The northbound on-ramp has a single lane that merges into the freeway mainline lanes. This ramp can only be accessed from northbound South Virginia Street. The southbound off-ramp has a single lane that diverges into two lanes—one lane to South Virginia Street and one lane to Kietzke Lane. The lane to South Virginia Street splits and has two left-turn lanes and one right-turn lane. The lane to Kietzke Lane splits into four lanes—two left-turn lanes, one through lane, and one right-turn lane. Both ramps are controlled by traffic signals. The area surrounding this interchange is primarily commercial.

The portion of freeway between the South Virginia Street/Kietzke Lane and Del Monte Lane interchanges is approximately 4,000 feet in length and has three mainline lanes in each direction. The land use on both sides of the freeway is primarily commercial.

The Del Monte Lane Interchange is a diamond interchange with the mainline freeway lanes located on a bridge over Del Monte Lane. The northbound off-ramp has a single lane that splits into three lanes (one left-turn lane, one shared left/through lane and one right-turn lane) and is controlled by traffic signals on Del Monte Lane. The northbound on-ramp has two lanes that narrow to one lane and merge with the freeway mainline lanes. The southbound off-ramp has a single lane that splits into three lanes (one left-turn lane, one shared left/through lane, and one right-turn lane) and is controlled by traffic signals on Del Monte Lane. The southbound on-ramp has two lanes that narrow to one lane and merge into the freeway mainline lanes. To the west of the interchange lie a combination of commercial uses and single-family residences. The area east of the interchange is primarily commercial.

The section of freeway between the Del Monte Lane and South Virginia Street interchanges is approximately 1.3 miles in length and has three mainline lanes in each direction. Approximately 4,300 feet south of the Del Monte Lane Interchange, the freeway mainline lanes pass over Longley Lane on a bridge. The land west of the freeway is primarily single-family residential; on the east is a mixture of single-family residential, multi-family residential, and commercial uses.

The South Virginia Street Interchange is a three-quarter diamond interchange with a loop ramp in the southeast quadrant. This is the second of three South Virginia Street interchanges on US-395/I-580 south of the Spaghetti Bowl. The mainline freeway lanes pass over South Virginia Street on a bridge. The northbound off-ramp has a single lane that is an extension of the auxiliary lane from the South Meadows Parkway Interchange and intersects as a “T” intersection with South Virginia Street and is controlled by stop signs. The northbound on-ramp movements are handled by two separate ramps. The southbound traffic on South Virginia Street uses the single-lane diamond ramp that merges with the freeway mainline lanes. The northbound traffic on South Virginia Street uses the free-flowing single-lane loop on-ramp that merges into the northbound freeway mainline lanes. The southbound off-ramp has two lanes that intersect with South Virginia Street as one left-turn lane and one right-turn lane. One of the off-ramp lanes begins approximately 1,400 feet north of the gore point as a deceleration lane. The southbound on-ramp has two lanes that narrow to one lane and create an auxiliary lane between the South Virginia Street and South Meadows Parkway interchanges. The land use west of the interchange is commercial and single-family residential. The land use to the east is commercial, single-family residential, and multi-family residential.

The section of freeway between the South Virginia Street and South Meadows Parkway interchanges is approximately 4,600 feet in length and has four lanes in each direction (three mainline lanes and one auxiliary lane). The land west of the freeway contains commercial uses

Figure 2-18: US-395/I-580 from Longley Lane to Zolezzi Lane

and single-family residences. Commercial uses and multi-family residences are located on the east side of the freeway.

The South Meadows Parkway Interchange is a diamond interchange. The mainline freeway lanes are located on a bridge over South Meadows Parkway. The northbound off-ramp has a single lane that is controlled by traffic signals. The northbound on-ramp has two lanes that narrow to a single lane that creates an auxiliary lane between the South Meadows Parkway and South Virginia Street interchanges. The southbound off-ramp has two lanes (one is from the extension of the auxiliary lane from the South Virginia Street Interchange and the other is the option lane on the freeway mainline) that split into three lanes (one left-turn lane, one shared left/through lane, and one right-turn lane). This ramp is controlled by traffic signals. The land west of the interchange houses commercial uses and single-family residences. On the east side of the freeway, the land use is commercial, single-family residential, and multi-family residential.

The section of freeway between the South Meadows Parkway and the Damonte Ranch Road interchanges is approximately 1.2 miles in length and has four lanes (three mainline lanes and one auxiliary lane) in each direction. The land west of the freeway contains agriculture and single-family residences, and east of the freeway is a mix of undeveloped land, single-family residences, and multi-family residences.

The Damonte Ranch Road Interchange is a diamond interchange. The mainline freeway lanes are located on a bridge over Damonte Ranch Road. The northbound off-ramp has a single lane that is an extension of the auxiliary (mandatory exit) lane from the South Virginia Street Interchange and is controlled by stop signs. The northbound on-ramp has two lanes that narrow to a single lane and create an auxiliary lane between the Damonte Ranch Road and South Meadows Parkway interchanges. The southbound off-ramp has two lanes (one is from the extension of the auxiliary lane from the South Meadows Parkway Interchange and the other is the option lane on the freeway mainline) and is controlled by stop signs. The southbound on-ramp has a single lane that creates an auxiliary lane between the Damonte Ranch Road and South Virginia Street interchanges. The land use west of the interchange is a combination of commercial and single-family residential. The area on the east side contains a combination of undeveloped land and single-family residences.

The freeway section between the Damonte Ranch Road and South Virginia Street interchanges is approximately 1.0 mile in length and has four lanes southbound (three mainline and one auxiliary) and four lanes northbound (two mainline and two added from the South Virginia Street on-ramp). Approximately 500 feet north of the South Virginia Street Interchange, the freeway mainline lanes and the interchange ramps are located on bridges over Old Virginia Road. The land west of the freeway houses a combination of commercial uses, single-family residences, and undeveloped land. Agricultural and single-family residential uses are located on the east side of the freeway.

The South Virginia Street Interchange is a half-diamond with a loop ramp in the southwest quadrant. This is the third of the three South Virginia Street interchanges. The mainline freeway lanes are located on a bridge over South Virginia Street. The northbound on-ramp has three lanes (one lane is dropped on the ramp, one lane becomes the third mainline lane, and one lane becomes an auxiliary lane between the South Virginia Street and Damonte Ranch Road interchanges). The southbound freeway movements are handled by two separate ramps. The traffic bound for northbound South Virginia Street uses the diamond ramp, which has a single-lane, free-flow right turn. The traffic bound for southbound South Virginia Street uses the loop ramp. This ramp has two lanes—one lane is a mandatory exit lane (auxiliary lane from the Damonte Ranch Road Interchange) and the other lane is the option lane on the freeway mainline. The land use on both sides of the interchange is agricultural and single-family residential.

The freeway section between the South Virginia Street and Mount Rose Highway interchanges is approximately 4,700 feet in length and has three lanes southbound and two lanes northbound. The area west of the freeway contains commercial uses, single-family residences, and agricultural uses. The land to the east is primarily undeveloped.

The Mount Rose Highway Interchange is a half-diamond interchange with a loop ramp in the southeast quadrant. The freeway mainline lanes are located on a bridge over the Mount Rose Highway. The freeway ends on the south side of the interchange. The northbound freeway movements are handled by two separate ramps. The freeway-bound traffic heading east on Mount Rose Highway uses the free-flow loop ramp, a two-lane ramp that creates the two northbound lanes on the freeway. The freeway-bound traffic heading west on Mount Rose Highway uses the diamond ramp, a single-lane ramp that merges into the freeway mainline lanes. The southbound off-ramp has two lanes that split between westbound and eastbound on the Mount Rose Highway. Traffic heading to westbound Mount Rose Highway has a free-flow right turn, and traffic going to eastbound Mount Rose Highway is controlled by a stop sign. Commercial uses, single-family residences and undeveloped land are located on the west side of the interchange. The land east of the interchange is primarily undeveloped.

Figure 2-19: US-395/I-580 from Damonte Ranch Road to Mt. Rose Highway

2.3 Freeway Traffic Operations

Traffic Volumes

The collection and analysis of existing traffic data was performed according to a formal data collection plan submitted to and approved by NDOT's Traffic Information Division. It focused on the peak morning and afternoon travel periods on the freeway, between 7 a.m. and 9 a.m. and between 4 p.m. and 6 p.m., respectively. Data was collected on Tuesdays, Wednesdays, and Thursdays to avoid weekend, holiday and special event traffic. Where possible, traffic was counted in 15-minute intervals. The following volume data was collected and analyzed:

- **Mainline freeway counts (a.m. and p.m. peak periods).** These counts were obtained by NDOT using counting machines at their established freeway count stations. The machines are connected to inductive loops installed in the freeway lanes and typically collect data for a seven-day period. Four of these count stations are set up as permanent count stations and provide data on a continuous basis. Two are located on I-80 (west of the Spaghetti Bowl and east of Pyramid Way) and two are located on US-395/I-580 (south of Golden Valley Road and south of Del Monte Lane). All counts were performed in 60-minute increments and are directional.

- **Freeway ramp counts (a.m. and p.m. peak periods).** Turning movement counts were performed and summarized in 15-minute increments for all movements at the ramp/arterial street intersections that are traffic signal controlled. At the ramp/arterial street intersections that are stop sign controlled, machine counts were tabulated in 15- or 60-minute increments that only counted the total traffic on the ramp (no turning movements). Most of the machine ramp counts obtained from NDOT were performed in 1999 or 2000. The remaining volumes were counted by Parsons during 2001.

- **Turning movement counts at signalized freeway ramp intersections.** These counts were performed by Parsons during the peak traffic periods and were collected at signalized ramp termini and the adjacent signalized intersections nearest the ramps. The turning movement counts were collected in 15-minute increments between 7:00 and 9:00 a.m. and between 4:00 and 6:00 p.m. These counts were used to determine the capacity of the signalized intersections at and near the freeway interchanges.

Figures 2-20 and 2-21 illustrate patterns of traffic volumes along both I-80 and US-395/I-580 as they traverse Washoe County.

Existing traffic volumes along I-80 and US-395/I-580 and on the freeway on/off ramps are shown in Figures 2-22 and 2-23.

Level of Service (LOS)

In order to determine the freeway levels of service, counts of vehicle densities and travel time/speed studies were performed. To obtain the density counts, NDOT provided aerial photography of both freeways from two-hour flights during the morning and evening peak periods. The aerial surveillance was able to observe traffic conditions on each freeway every eight to ten minutes, as each flight took approximately 2.5 minutes. The photographs were enlarged and manually counted for each direction between the freeway ramps. Each directional count was divided by the number of lanes and by the distance (in miles) between each ramp. This resulted in freeway vehicle density, or the number of vehicles per lane-mile (vplm). Using the 2000 Highway Capacity Manual methods, the density was converted to levels of service for the various time periods recorded during each flight. The density/level of service relationship is as follows:

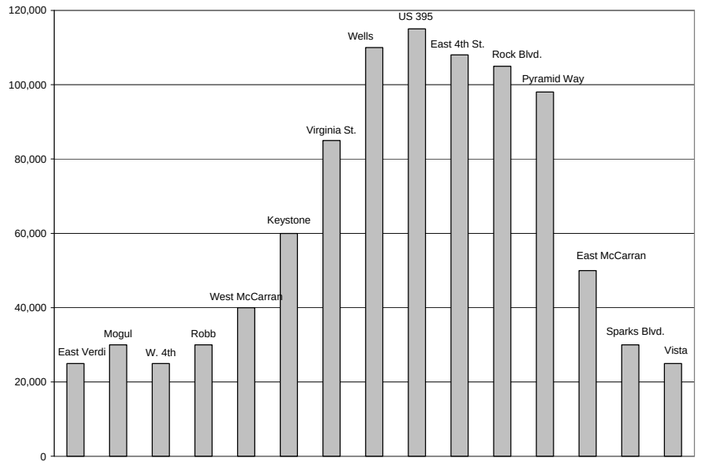
- LOS A – 0.0 to 10.0 vplm
- LOS B = 10.1 to 16.0 vplm
- LOS C = 16.1 to 24.0 vplm
- LOS D = 24.1 to 32.0 vplm
- LOS E = 32.1 to 45.0 vplm
- LOS F = 45.1 vplm and above

Existing densities and levels of service are shown in Table 2-2 for I-80 and in Table 2-3 for US-395/I-580. The range in densities reflects variations in traffic volumes observed during the peak hours.

Tables 2-2 and 2-3 also compare these levels of service on I-80 and US-395/I-580 with levels of service derived from HCM 2000 analysis and volume/capacity analysis.

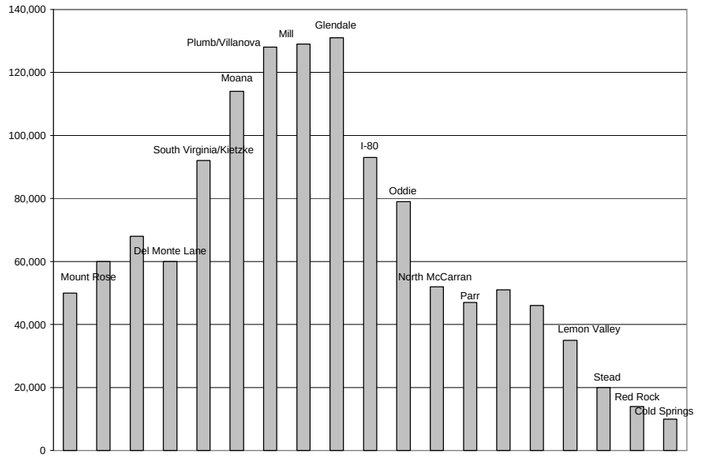
Both NDOT and the Regional Transportation Commission (RTC) establish policy levels of service on Washoe County freeways, freeway ramps, and freeway ramp intersections. The policy levels of service indicate the minimum acceptable operational level on a specific roadway and facilitate the planning of future improvements. Level of service standards for freeways are set by both agencies at LOS D, with one exception within the RTC standards.

Figure 2-20: 1999 Daily Traffic along I-80



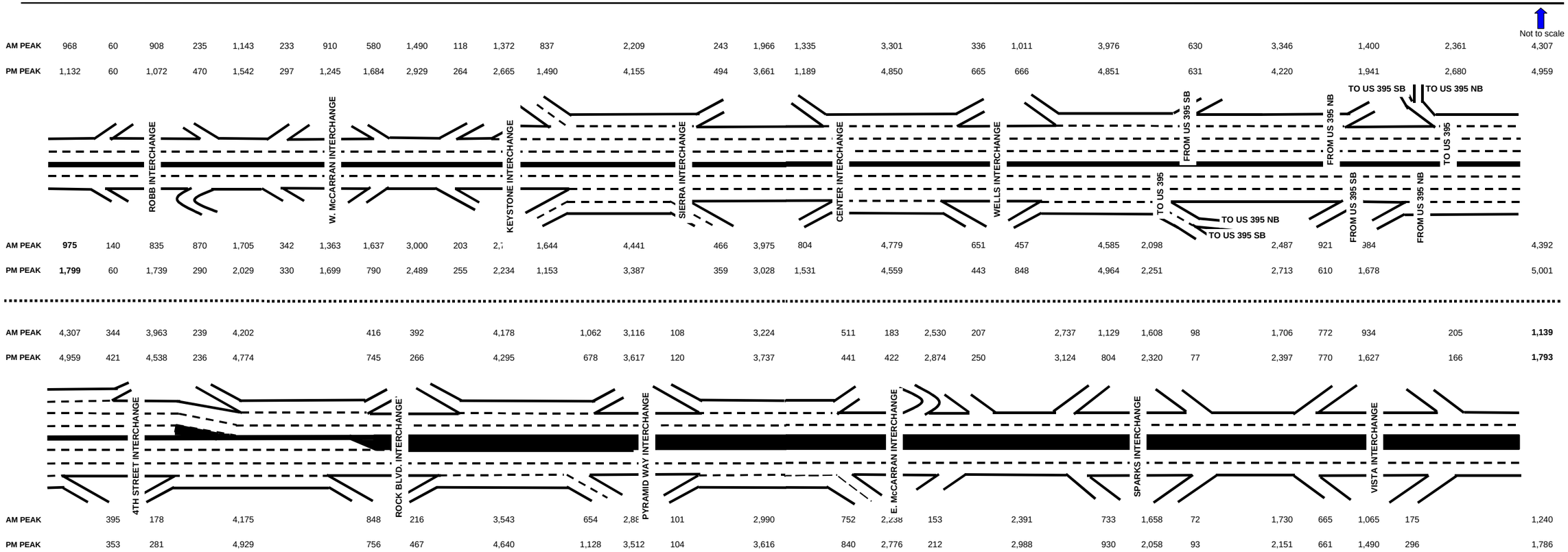
Source: Nevada Department of Transportation

Figure 2-21: 1999 Daily Traffic along US-395/I-580



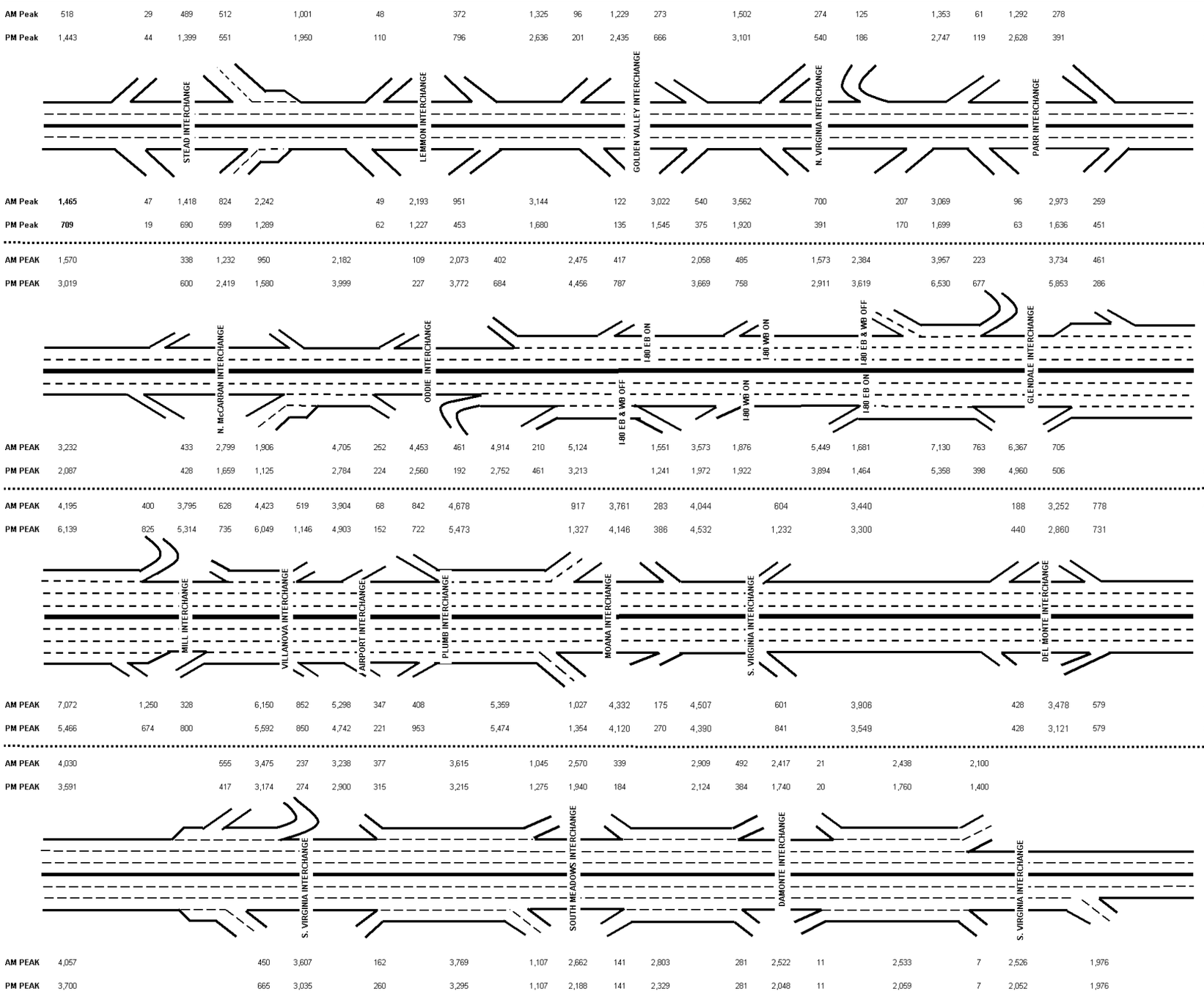
Source: Nevada Department of Transportation

Figure 2-22: Existing I-80 Ramp and Mainline Traffic Volumes



AM PEAK	968	60	908	235	1,143	233	910	580	1,490	118	1,372	837	2,209	243	1,966	1,335	3,301	336	1,011	3,976	630	3,346	1,400	2,361	4,307						
PM PEAK	1,132	60	1,072	470	1,542	297	1,245	1,684	2,929	264	2,665	1,490	4,155	494	3,661	1,189	4,850	665	666	4,851	631	4,220	1,941	2,680	4,959						
AM PEAK	**975**	140	835	870	1,705	342	1,363	1,637	3,000	203	2,1	1,644	4,441	466	3,975	804	4,779	651	457	4,585	2,098	2,487	921	384	4,392						
PM PEAK	**1,799**	60	1,739	290	2,029	330	1,699	790	2,489	255	2,234	1,153	3,387	359	3,028	1,531	4,559	443	848	4,964	2,251	2,713	610	1,678	5,001						
AM PEAK	4,307	344	3,963	239	4,202		416	392		4,178	1,062	3,116	108	3,224	511	183	2,530	207	2,737	1,129	1,608	98	1,706	772	934	205	**1,139**				
PM PEAK	4,959	421	4,538	236	4,774		745	266		4,295	678	3,617	120	3,737	441	422	2,874	250	3,124	804	2,320	77	2,397	770	1,627	166	**1,793**				
AM PEAK	395	178	4,175		848	216	3,543		654	2,88	101	2,990		752	2,238	153	2,391		733	1,658	72	1,730	665	1,065	175	1,240					
PM PEAK	353	281	4,929		756	467	4,640		1,128	3,512	104	3,616		840	2,776	212	2,988		930	2,058	93	2,151	661	1,490	296	1,786					

Figure 2-23: Existing US-395/I-580 Ramp and Mainline Traffic Volumes



Based on this LOS D standard, Tables 2-2 and 2-3 identify the following freeway segments as potentially operating below standard based on point-in-time observations of traffic conditions and analysis of available traffic count data.

I-80 Eastbound

- West McCarran Boulevard to Keystone Avenue (a.m.)
- Keystone Avenue to Sierra Street (a.m.)
- Rock Boulevard to Pyramid Way (p.m.)
- Pyramid Way to East McCarran (a.m.)

I-80 Westbound

- East McCarran Boulevard to Pyramid Way (a.m. and p.m.)
- Pyramid Way to Rock Boulevard (a.m. and p.m.)

US-395/I-580 Northbound

- South Virginia to Moana Lane (p.m.)
- Moana Lane to Plumb Lane (a.m. and p.m.)
- Villanova to Mill Street (p.m.)
- Mill Street to Glendale Avenue (p.m.)
- Glendale to I-80 (p.m.)
- I-80 to Oddie Boulevard (p.m.)
- Oddie Boulevard to North McCarran Boulevard (p.m.)

US-395/I-580 Southbound

- Golden Valley to Virginia-Panther (a.m.)
- Parr Boulevard to North McCarran Boulevard (a.m.)
- North McCarran Boulevard to Oddie Boulevard (a.m.)
- I-80 to Glendale Avenue (a.m.)
- Glendale Avenue to Mill Street (a.m.)
- Plumb Lane to Moana Lane (p.m.)

Accidents

Accident data was analyzed for 1997, 1998, and 1999 on I-80 and US-395/I-580. Figures 2-24 and 2-25 provide a graphical three-year summary of the freeway accidents and the accident rate for each section of freeway between interchanges. These figures show that the highest accident rates occur on those portions of the freeways that experience the highest overall traffic volume and the greatest degree of congestion. In most instances, these high rates occur within a one-mile radius of the I-80/US-395/I-580 Spaghetti Bowl Interchange.

Table 2-2: I-80 Level of Service Comparison

Section		Field Observation				HCM 2000 Analysis				Volume/Capacity Analysis			
		Westbound		Eastbound		Westbound		Eastbound		Westbound		Eastbound	
		LOS	Density	LOS	Density	LOS	Density	LOS	Density	LOS	v/c	LOS	v/c
Vista Boulevard to Sparks Boulevard	AM	-	-	-	-	B	15.1	B	15.3	B	0.476	B	0.483
	PM	-	-	-	-	C	21.2	C	19.0	C	0.669	C	0.600
Sparks Boulevard to McCarran Boulevard	AM	-	-	-	-	C	24.2	C	21.2	D	0.764	C	0.667
	PM	-	-	-	-	D	28.1	D	26.7	D	0.872	D	0.834
McCarran Boulevard to Pyramid Way	AM	F–F	56.2–91.9	B–E	12.2–34.7	C	19.0	B	17.6	C	0.574	C	0.532
	PM	C–F	17.0–47.7	A–D	8.4–25.3	C	22.0	C	21.3	C	0.665	C	0.643
Pyramid Way to Rock Boulevard	AM	E–F	39.5–58.0	B–D	14.9–28.3	D	27.8	C	20.9	D	0.743	C	0.630
	PM	B–E	14.5–38.2	C–E	19.4–40.3	C	25.4	C	24.7	D	0.764	D	0.826
Rock Boulevard to 4th Street	AM	A–C	8.5–23.0	B–C	11.7–17.6	C	18.6	C	18.5	C	0.561	C	0.557
	PM	A–C	10.9–23.0	A–C	5.9–17.0	C	21.1	C	21.8	C	0.637	C	0.658
4th Street to US 395	AM	B–D	15.7–28.3	A–B	7.8–15.5	C	25.5	C	19.4	D	0.766	C	0.586
	PM	A–D	9.5–29.9	A–B	5.2–12.9	D	30.2	C	22.1	D	0.882	C	0.667
US 395 to Wells Street	AM	B–C	16.2–20.1	B–D	10.6–31.7	B	17.6	C	20.3	C	0.531	C	0.612
	PM	A–B	5.6–17.8	A–C	6.2–22.0	C	21.5	C	22.0	C	0.647	C	0.662
Wells Street to Center Street	AM	A–C	9.1–18.2	C–C	17.8–20.3	B	14.6	C	21.1	B	0.441	C	0.638
	PM	A–B	6.6–14.9	A–C	6.5–16.2	C	21.4	C	20.2	C	0.647	C	0.608
Sierra Street to Keystone Ave	AM	A–B	7.1–10.6	B–E	12.6–36.6	A	9.8	C	19.6	A	0.295	C	0.593
	PM	A–B	8.3–15.9	A–B	6.0–14.6	C	18.4	B	15.0	C	0.555	B	0.452
Keystone Avenue to McCarran Boulevard	AM	A–B	8.4–11.1	C–F	23.8–54.8	B	13.2	D	26.8	B	0.416	D	0.837
	PM	C–D	17.9–24.3	B–C	12.7–21.9	C	26.1	C	22.0	D	0.817	C	0.695
McCarran Boulevard to Robb Drive	AM	—	—	—	—	A	10.1	A	10.1	B	0.319	B	0.303
	PM	—	—	—	—	B	13.6	B	12.0	B	0.430	B	0.361
Robb Drive to 4th Street	AM	—	—	—	—	A	8.6	A	8.6	A	0.270	A	0.272
	PM	—	—	—	—	A	10.0	B	15.9	B	0.316	C	0.502
4th Street to Mogul	AM	—	—	—	—	A	9.1	A	9.5	A	0.298	A	0.286
	PM	—	—	—	—	B	11.0	B	16.9	B	0.347	C	0.533

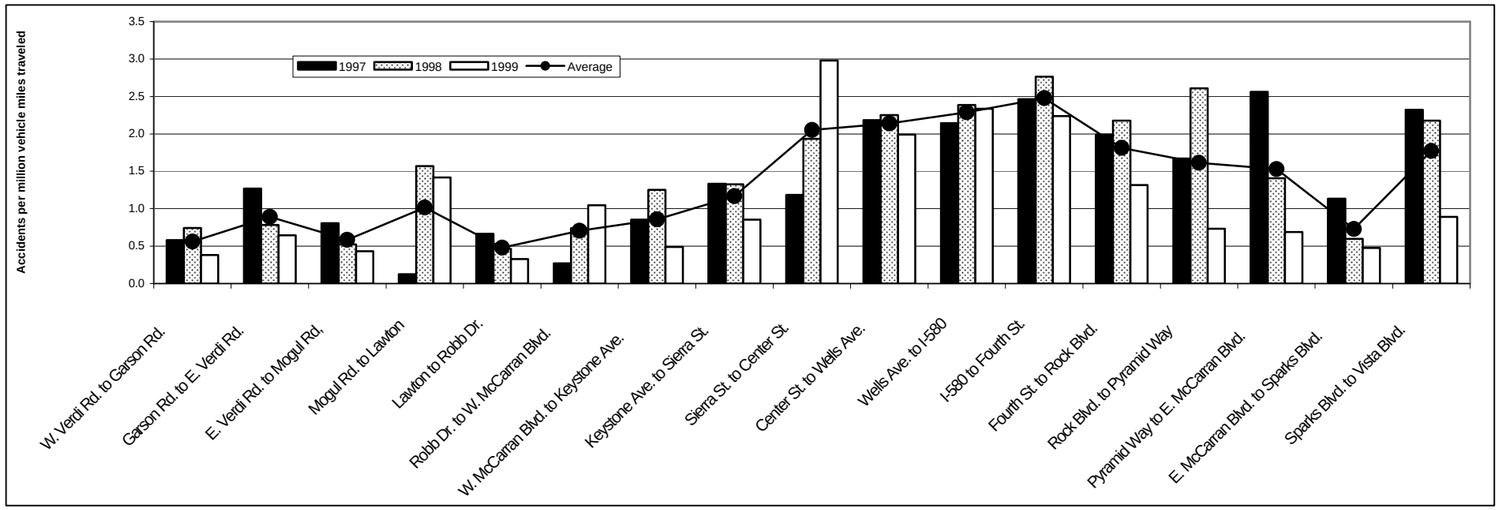
Source: Parsons

Table 2-3: US-395/I-580 Level of Service Comparison

Section		Field Observation				HCM 2000 Analysis				Volume/Capacity Analysis			
		Northbound		Southbound		Northbound		Southbound		Northbound		Southbound	
		LOS	Density	LOS	Density	LOS	Density	LOS	Density	LOS	v/c	LOS	v/c
Mt. Rose Highway to Virginia Street	AM	—	—	—	—	A	3.0	A	4.9	A	0.094	A	0.153
	PM	—	—	—	—	A	3.2	A	6.6	A	0.100	A	0.208
Virginia Street to Zolezzi Lane	AM	—	—	—	—	B	14.4	B	14.9	B	0.434	B	0.451
	PM	—	—	—	—	A	10.4	B	16.3	B	0.313	B	0.492
Zolezzi Lane to South Meadows Parkway	AM	—	—	—	—	B	17.2	B	16.5	B	0.446	B	0.430
	PM	—	—	—	—	B	12.5	C	18.1	B	0.326	B	0.471
South Meadows Parkway to South Virginia Street	AM	—	—	—	—	C	21.3	C	22.2	C	0.555	C	0.578
	PM	—	—	—	—	C	19.0	C	21.1	B	0.493	C	0.549
South Virginia Street to Del Monte Lane	AM	—	—	—	—	C	23.8	C	23.9	D	0.717	D	0.722
	PM	—	—	—	—	C	21.2	C	23.5	C	0.639	C	0.709
Del Monte Lane to South Virginia Street	AM	A–C	7.5–20.1	A–C	6.3–20.4	C	20.3	C	23.0	C	0.612	C	0.695
	PM	A–B	8.2–17.9	B–C	16.5–18.9	C	19.5	C	20.9	C	0.587	C	0.632
South Virginia Street to Moana Lane	AM	C–D	23.5–31.6	B–C	13.6–18.4	C	23.9	D	26.8	D	0.720	D	0.802
	PM	C–D	22.2–32.9	C–C	20.2–23.7	D	27.0	D	26.0	D	0.806	D	0.781
Moana Lane to Plumb Lane	AM	C–E	19.6–43.9	B–D	15.9–26.3	C	20.7	C	23.7	C	0.624	D	0.715
	PM	C–E	19.6–39.2	B–D	14.5–33.9	C	24.2	C	24.2	D	0.730	D	0.731
Villanova Street to Mill Street	AM	B–C	17.2–20.6	B–B	13.5–16.4	D	26.3	D	27.6	D	0.787	D	0.821
	PM	C–E	20.6–38.9	B–C	11.7–19.3	E	43.5	C	24.8	F	1.076	D	0.746
Mill Street to Glendale Avenue	AM	A–C	8.1–21.9	A–B	7.8–11.7	C	24.8	D	33.4	D	0.746	E	0.944
	PM	B–D	17.0–30.0	A–A	2.6–10.4	*	*	C	24.2	F	1.092	D	0.729
Glendale Avenue to I-80	AM	B–C	16.5–23.6	C–D	20.0–28.2	C	23.3	D	33.9	C	0.704	E	0.952
	PM	C–D	20.4–33.0	A–B	4.6–17.3	*	*	C	23.7	F	1.162	D	0.715
I-80 to Oddie Boulevard	AM	A–A	7.3–9.8	C–C	18.4–19.9	C	21.9	D	31.7	C	0.691	C	0.684
	PM	A–D	9.8–31.7	A–B	1.5–13.8	*	*	C	19.0	F	1.243	C	0.572
Oddie Boulevard to McCarran Boulevard	AM	A–C	10.3–22.7	F–F	54.8–86.9	C	19.3	D	28.2	C	0.609	D	0.837
	PM	B–D	16.5–28.9	A–C	9.4–21.4	E	42.6	B	16.4	F	1.116	B	0.495
McCarran Boulevard to Parr Boulevard	AM	—	—	—	—	B	13.9	D	29.3	B	0.438	E	0.902
	PM	—	—	—	—	D	27.0	C	18.5	D	0.842	C	0.582
Parr Boulevard to Virginia Street–Panther Valley Road	AM	—	—	—	—	B	12.0	D	27.5	B	0.378	D	0.856
	PM	—	—	—	—	C	24.3	B	15.0	D	0.767	B	0.474
Virginia Street–Panther Valley Road to Golden Valley Road	AM	—	—	—	—	B	13.3	D	33.8	B	0.419	E	0.994
	PM	—	—	—	—	D	27.8	B	17.0	D	0.865	C	0.536
Golden Valley Road to Lemmon Drive	AM	—	—	—	—	B	11.7	D	28.3	B	0.370	D	0.877
	PM	—	—	—	—	C	23.3	B	14.9	D	0.736	B	0.469
Lemmon Drive to Stead Boulevard	AM	—	—	—	—	A	8.9	C	19.8	A	0.279	C	0.626
	PM	—	—	—	—	B	17.2	B	11.4	C	0.544	B	0.360
Stead Boulevard to Red Rock Road	AM	—	—	—	—	A	4.6	B	13.0	A	0.145	B	0.409
	PM	—	—	—	—	B	12.8	A	6.3	B	0.403	A	0.198
Red Rock Road to Cold Springs Road	AM	—	—	—	—	A	3.1	A	7.4	A	0.097	A	0.232
	PM	—	—	—	—	A	7.3	A	4.6	A	0.229	A	0.147

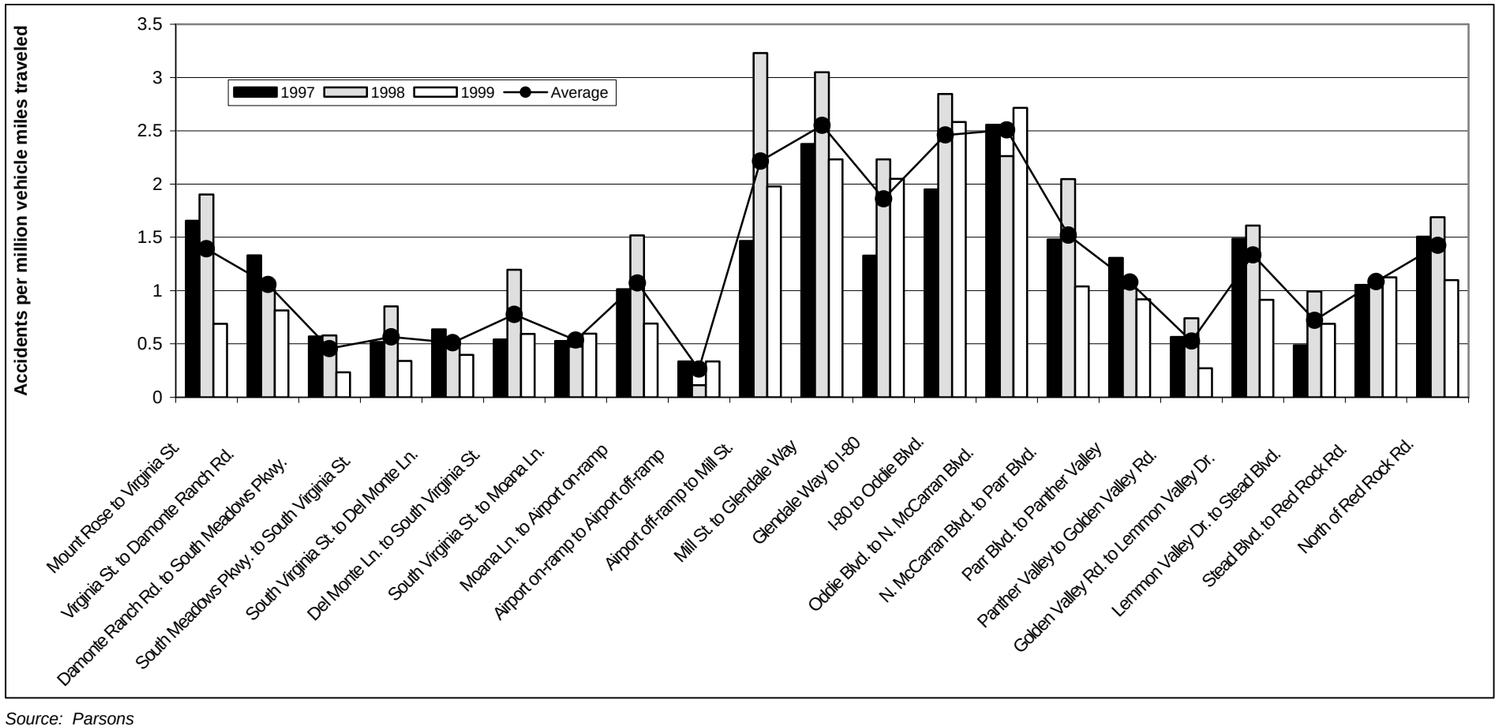
Source: Parsons

Figure 2-24: I-80 Two-Way Accident Data



Source: Parsons

Figure 2-25: US-395/I-580 Two-Way Accident Data



Source: Parsons

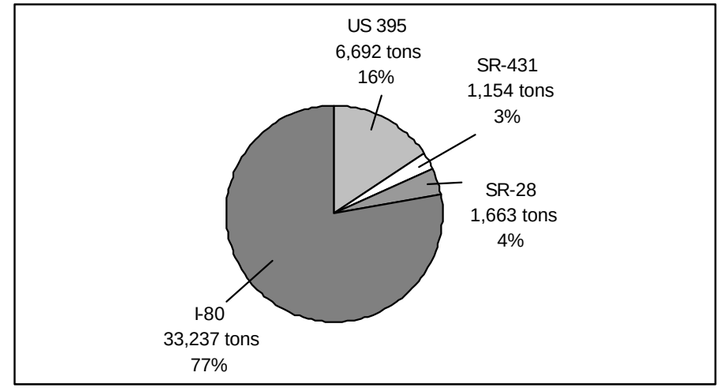
Truck Use

The study area serves both east–west and north–south trucking movements on its two major freeways. Commercial trucks are bound primarily for the Sparks industrial areas, the Stead industrial areas, the Parr Boulevard and Panther Valley industrial areas, and the Spice Island Drive trucking terminal. NDOT's 1993 Commodity Report indicated that 86 percent of commodity movement on I-80 and 17 percent of commodity movement on US-395/I-580 was interstate traffic. Figure 2-26 details the amount of daily commodity movement transported by truck over the regions' freeways and highways.

Truck volumes are highest on I-80 between US-395/I-580 and Vista Boulevard. Table 2-4 indicates the distribution of vehicle types using I-80 and US-395/I-580. The percentage of heavy truck use is highest on I-80 west of Keystone Avenue and east of Pyramid Way. These truck use percentages need to be viewed against the total volume of traffic using these freeway segments to be meaningful. In terms of actual truck volumes, trucks increase in number traveling from west to east across the metro area. Approximately 3,000 heavy trucks use I-80 each day between East Verdi Road and Robb Drive. This volume grows to nearly 4,000 heavy trucks per day between North Virginia Street and US-395/I-580, and approximately 5,000 heavy trucks per day between US-395/I-580 and Pyramid Way. East of Pyramid Way to Vista Drive, the volume falls slightly to approximately 4,500 heavy trucks per day.

On US-395/I-580, the volume of trucks is approximately 2,500 per day at the south end of the study area, increasing to 3,000 per day near Plumb Lane. Heavy truck volumes decline north of Plumb to approximately 2,500 vehicles per day at I-80, 1,400 vehicles per day at Stead Boulevard, and less than 500 heavy trucks per day north of Stead Boulevard to Cold Springs Road.

Figure 2-26: Average Daily Commercial Tonnage Transported on Regional Freeways and Highways



Source: 1993 Commodity Report, Nevada Department of Transportation

Table 2-4: Distribution of Vehicle Types Using I-80 and US-395/I-580

Segment	Autos	Buses	Recreational Vehicles	Trucks		Total %	AADT (in 1000s)
				Single Unit	Heavy		
I-80 East Verdi to Vista Boulevard							
East Verdi Road to Robb Drive	86.8	0.6	0.3	2.0	10.3	13.2	34–42
Robb Drive to Keystone Avenue	89.2	0.5	0.3	2.1	8.0	10.9	42–59
Keystone Avenue to Virginia Street	92.4	0.2	0.2	1.7	5.4	7.5	59–88
Virginia Street to US-395/I-580	93.8	0.8	0.2	1.3	3.9	6.2	88–115
US-395/I-580 to Pyramid Highway	93.0	0.3	0.2	1.5	4.9	6.9	115–91
Pyramid Highway to Vista Boulevard	86.2	0.4	0.5	3.4	9.4	13.7	91–35
US-395/I-580 Mount Rose Highway to Cold Springs							
Mt. Rose Highway to S. Virginia Street (Exit 57)	92.9	0.5	0.5	2.0	4.1	7.1	17–290
S. Virginia Street (Exit 57) to S. Virginia Street (Exit 61)	92.9	0.5	0.5	2.0	4.1	7.1	290–62
S. Virginia Street (Exit 61) to Plumb Lane/ Villanova Lane	93.6	0.8	0.3	2.6	2.6	6.3	62–115
Plumb Lane/Villanova Lane to I-80	94.8	1.0	0.3	1.8	2.1	5.2	115–134
I-80 to N. McCarran Boulevard	94.1	0.3	0.2	1.9	3.5	5.9	134–85
N. McCarran Boulevard to Stead Boulevard	94.1	0.3	0.2	1.9	3.5	5.9	85–36
Stead Boulevard to Cold Springs Road	93.8	0.2	0.4	2.3	3.3	6.2	36–15

Truck volumes are percentage of 1999 Annual Average Daily Traffic
Source: Nevada Department of Transportation

2.4 Regional Road System

In addition to the I-80 and US-395/I-580 freeways, the study also addresses the Regional Road System to the extent that its operations and performance directly affect freeway characteristics. The Regional Road System comprises streets and highways that connect regional communities. The *2030 Regional Transportation Plan* specifically identifies the Regional Road System as:

- All arterials, as designated by each jurisdiction. These roads are direct connections between freeways and other arterials, ensure continuity throughout the region, and generally accommodate longer trips within the region, particularly during the peak periods on high-volume corridors.

- Collector facilities that meet one of several criteria:
  - An ADT of 5,000 (either today or in the 2030 timeframe).
  - The crossing of a significant travel barrier such as the Truckee River or I-80.
  - A facility that provides access to regional facilities.

The *2030 Regional Transportation Plan* establishes policy levels of service for the Regional Road System as follows:

- LOS C on all non-freeway regional roadways outside the area bounded by McCarran Boulevard, unless otherwise noted.
- LOS D for all non-freeway regional roadways inside the area bounded by McCarran Boulevard, unless otherwise noted.
- LOS E for all of McCarran Boulevard, Virginia Street from Plumb Lane to Moana Lane, Mill Street from Ryland Street to Terminal Way, Terminal Way from Villanova Drive to Mill Street, the Mill Street/Kietzke Lane intersection, and the Plumb Lane/Virginia Street intersection.
- LOS F for Plumas Street from Plumb Lane to California Avenue, Rock Boulevard from Victorian Avenue to Glendale Avenue, and Virginia Street from Kietzke Lane to South McCarran Boulevard.

Table 2-5 identifies the approximate levels of congestion that equate to these level-of-service categories. Figure 2-27 depicts existing level of service deficiencies on the Regional Roadway System based on the adopted level of service standards.

Table 2-5: Average Daily Traffic Level of Service Thresholds by Facility Type for Roadway Planning

Facility Type Number of Lanes	Maximum Service Flow Rate (daily) for Given Service Level				
	LOS A	LOS B	LOS C	LOS D	LOS E
Freeway					
4	≤ 28,600	42,700	63,500	80,000	90,200
6	≤ 38,300	61,200	91,900	114,000	135,300
8	≤ 51,100	81,500	121,400	153,200	180,400
10	≤ 63,800	101,900	151,800	191,500	225,500
High Access Control-Arterial					
4	≤ 28,600	29,000	36,500	39,000	41,400
6	≤ 38,300	44,800	56,000	58,900	62,200
8	≤ 51,100	59,800	74,600	78,600	82,900
Moderate Access Control-Arterial					
4	n/a	n/a	28,700	33,500	36,100
6	n/a	n/a	44,400	51,400	54,600
8	n/a	n/a	59,200	68,600	72,700
Low Access Control-Arterial					
2	n/a	n/a	8,800	13,200	14,800
4	n/a	n/a	18,600	27,300	31,100
Collector					
2	n/a	n/a	7,300	8,500	9,100
Rural Highway					
2	2,100	4,200	6,800	10,800	17,300

Source: Regional Transportation Commission

2.5 Transit Service

The study area includes four transit systems: Citifare, CitiLift, Public Rural Ride, Tahoe Area Regional Transit.

Citifare, a fixed-route bus service owned by RTC, operates 24 bus routes with transit centers in downtown Reno, downtown Sparks, and south Reno. An adult fare costs $1.25. Service is provided between the hours of 5:30 a.m. and 7:30 p.m., seven days a week, with headways from ten minutes to one hour. On two routes, 24-hour service is provided. The system covers a 69-square-mile service area and includes four types of routes—radial, collector, cross-town, and special temporary service.

In fiscal year 2001, Citifare carried more than eight million passengers. The U.S. Census Bureau reports that approximately 3.2 percent of the total work trips in the region are made on Citifare, and that half of Citifare's trips comprise work trips. The majority of transfers in the system (88 percent) occur at the CitiCenter transit center in downtown Reno.

Figure 2-27: Regional Road System Deficiencies

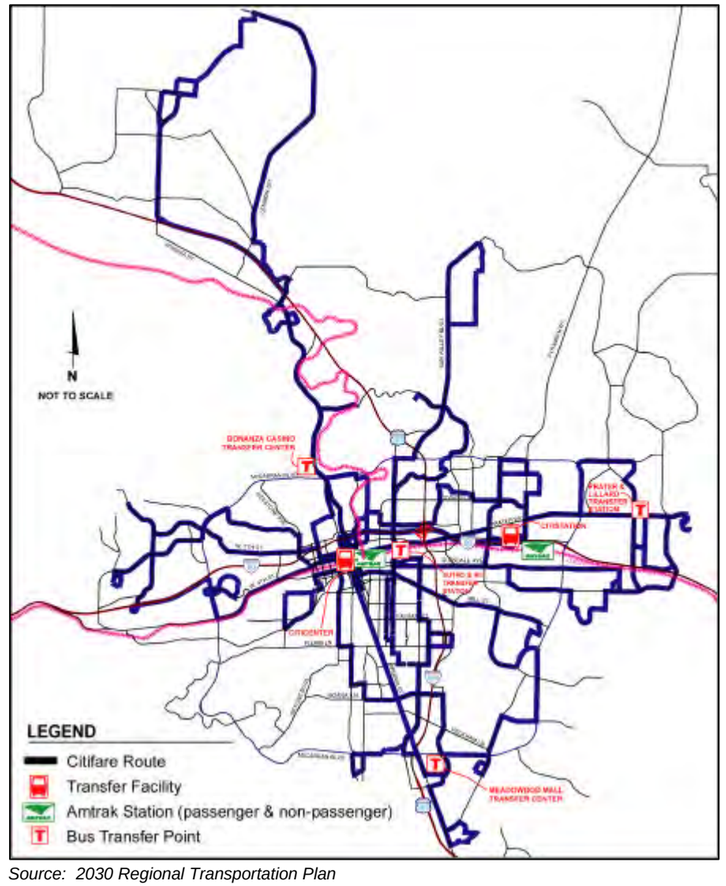
Source: 1998 Regional Transportation Plan

Figure 2-28 shows the service area and scheduled routes for the Citifare system.

CitiLift was established by the RTC in 1988 to provide service for senior citizens and disabled persons. CitiLift operates a fleet of 60 paratransit vans and provides prescheduled, door-to-door, demand-responsive transportation for eligible riders. A one-way fare on CitiLift is $1.25.

Tahoe Area Regional Transit, operating along the North Lake Tahoe shoreline, runs a shuttle between Tahoe City and Truckee several times each day. An adult fare is $1.25. Placer County, California operates Tahoe Area Regional Transit with partial funding from the RTC. According to the Year 2000 Census of population and housing, approximately 3.3 percent of Washoe County workers 16 years of age or older use public transportation as their primary means of transportation to work.

Figure 2-28: Citifare Route Map



Source: 2030 Regional Transportation Plan

FUTURE CONDITIONS AND FACILITIES

3.1 Demographic Forecasts

Population and employment in Washoe County have grown significantly over the past decade and are projected to continue to do so through 2030. The *Washoe County 2030 Regional Transportation Plan (RTP)* forecasts a 2020 population of 450,000, a 43 percent increase over the 2000 population. By 2030 it is projected to have grown to 530,000, representing a 69 percent growth from the year 2000. Employment is projected to grow 65 percent (to 288,000) by 2020 and 80 percent (to 315,000) by 2030. The *RTP's* projected employment and population growth for Washoe County are illustrated in Figure 3-1.

The population projections of the Regional Transportation Commission of Washoe County (RTC) closely match those contained in the *Washoe County Consensus Forecast, 2000-2020,* which was first adopted in 1993 and is revised annually. The *Consensus Forecast* provides an average of several leading forecasts to minimize the risk of forecast errors. Long-term forecasts synthesized in the *Consensus Forecast* were performed by:

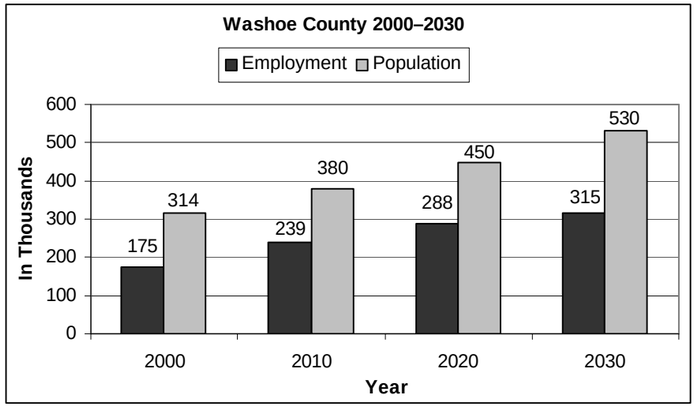
- The National Policy Association—a national forecasting firm in Washington, DC. NPA performs county, state and national forecasts.
- Sierra Pacific Power Company—uses an updated version of the Washoe County Econometric Model, which was originally developed in 1982 by Washoe County and the Bureau of Business and Economic Research at the University of Nevada, Reno.
- The WEFA Group—a national forecasting firm in Pennsylvania that performs county, state and national forecasts.
- Woods and Poole—a national forecasting firm in Washington, DC that also performs county, state and national forecasts.

The *Consensus Forecast* projects a 37.4 percent growth in population from 326,300 in 2000 to 448,400 in 2020. The annualized growth rate is projected to be 1.6 percent per year during that span, approximately 0.85 percent of which is estimated to result from net in-migration.

The *Consensus Forecast* is slightly less robust than population projections prepared by the Nevada State Demographer's Office. The State Demographer estimates Washoe County's population at 390,462 as of 2010, compared with the 380,000-population forecast adopted for use by the RTC.

Insofar as employment, the *Consensus Forecast* projects a 28.5 percent increase in employment over the 20-year period, from 185,460 in 2000 to 238,760 in 2020. This employment estimate is by place of work, whereas the RTC estimate is by place of worker residence. The annualized growth rate over 20 years is projected to be 1.26 percent, one-half of the 2.5 percent rate of growth assumed by RTC for the *2030 RTP*. Over the past ten years, from June 1992 to June 2002, industry employment has grown by 36.9 percent, or approximately three percent compounded annually. The *Consensus Forecast* therefore appears to be overly conservative as it pertains to employment. The Sierra Pacific Power Company forecasts that during the same time, the percentage of workers employed by business services will increase from 54 percent to 64 percent, while employment at hotel and gaming facilities will drop from 46 percent to 36 percent of total county employment.

Figure 3-1: Projected Study Area Employment and Population

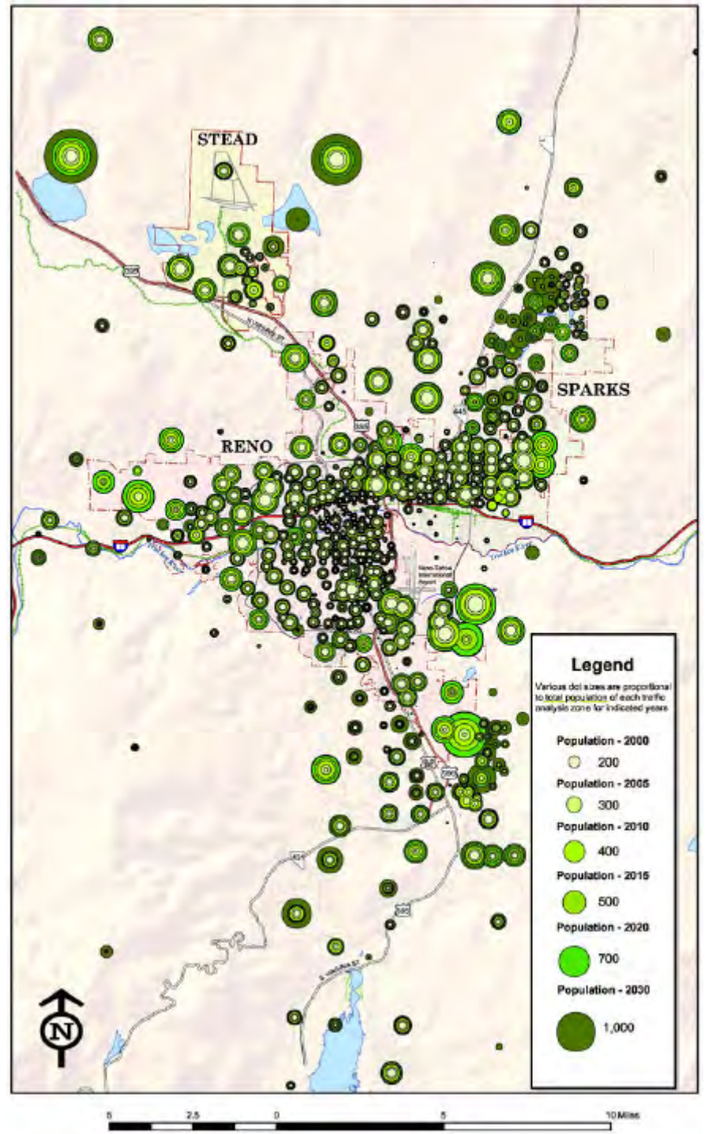


Source: Washoe County Department of Comprehensive Planning, State of Nevada Department of Employment, Training and Rehabilitation. Employment by Place of Residence

Total projected growth for each future year is allocated to Planning Areas and Transportation Analysis Zones based on approved zoning and development master plan applications. Localized population and employment projections determine assumptions regarding the future location and volume of traffic on each street.

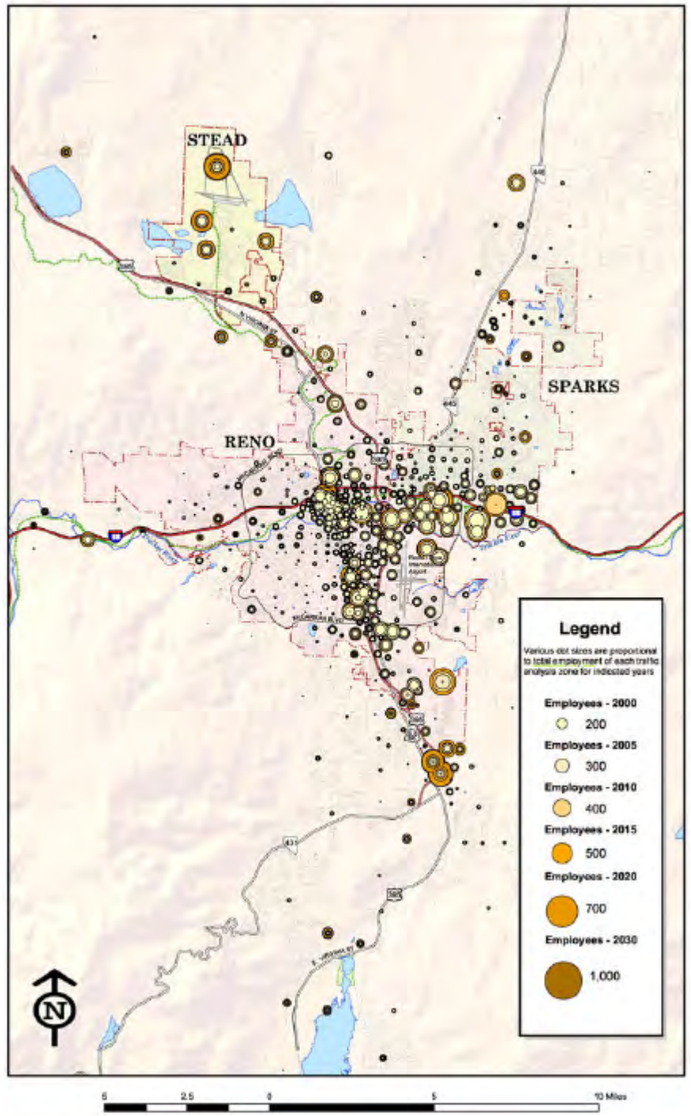
Figures 3-2 and 3-3 illustrate the distribution of population and employment growth over time in Washoe County. These maps, based on the *Consensus Forecast,* indicate that much of the projected growth in population and employment is anticipated to occur beyond existing development concentrations, effectively increasing the region's diameter and potentially increasing average trip lengths in the region.

Figure 3-2: Accumulated Population by Traffic Analysis Zone



Source: Regional Transportation Commission of Washoe County, Parsons

Figure 3-3: Accumulated Employment by Traffic Analysis Zone



Source: Regional Transportation Commission of Washoe County, Parsons

New development expected in the region includes more than 18,000 new homes and 15,000 jobs in the Spanish Springs Valley area to the northeast of downtown Reno. These additions are projected to generate more than 200,000 average daily trips. In addition, a 14,000-acre industrial park is planned in Storey County, which neighbors Washoe County to the east. Billed as "the world's biggest industrial park," the development is projected to create between 5,000 and 10,000 new jobs.

3.2 2030 Regional Transportation Plan

The Transportation Equity Act for the 21st Century requires metropolitan planning organizations to develop regional transportation plans for the identification of transportation policies, strategies, and facility plans for the region. As the Metropolitan Planning Organization for Washoe County, the RTC completed its *2030 RTP* in August 2001.

Three separate improvement packages were developed, which all contained, to some degree, the following elements to alleviate existing transportation problems or accommodate future travel demand:

- Appropriate access management strategies
- Bus Rapid Transit with shared travel lanes
- Expansion of transit service at the rate of population growth
- Bicycle and pedestrian improvements
- Roadway improvements to meet adopted level-of-service standards
- An aggressive Transportation System Management/Transportation Demand Management program

The resulting plan includes substantial widening of existing freeways, including consideration of high-occupancy vehicle lanes, subject to the findings of this *Washoe County Freeway Corridor Study.* The strategy for the Regional Road System is to widen existing arterials rather than add large numbers of new roads. The plan also emphasizes alternative modes and stringent facility access controls, such as signal spacing, driveway locations, medians and restricted turn movements.

Street and Highway Improvements

Street and highway improvements specified in the *2030 RTP*, along with Transit and Transportation Systems Management Improvements, form the basis for future travel demand forecasts. The street and highway elements are illustrated in Figure 3-4 and discussed in Chapter 4, Alternative Development and Evaluation.

Transit System Improvements

The current transit mode share in Washoe County is two percent. The Washoe County *2030 RTP* calls for increasing the mode share to six percent. Four specific improvements to public transportation are recommended in the *RTP*:

1. Convert major portions of Virginia Street and East Fourth Street/Prater Way to transit corridors with exclusive travel lanes for transit
2. Increase major transit service with demand-responsive transit in outlying areas
3. Provide aggressive bike and pedestrian improvements to support the enhanced transit system
4. Retrofit signals at intersections in the transit corridor along Virginia Street to improve transit operating speeds and provide transit queue jump capability

The *RTP* establishes a Primary Transit Network to be built around a "hierarchy of service strategies including Rapid Transit, Primary Locals, Primary Express, Commuter Express, Local Services and Paratransit."

The Primary Transit Network is made up of three high-density forms of transit service. Primary Express has station spacing wider than one mile, Rapid Transit is focused on nodes every ¼ to one mile apart, and Primary Locals are focused on nodes closer than ¼ mile apart. These three services are intended to appeal to many rider groups, in addition to reducing vehicle trips by competing with the automobile. The services also are intended to achieve maximum productivity while requiring the lowest operating subsidies per passenger. The Primary Transit Network will carry the majority of regional transit trips and serve the system's most utilized stops.

Deployment of Rapid Transit lines will require a high level of investment along selected corridors, and is therefore justified only in areas where there is high ridership traveling along linear paths. In Reno, the most intensely served bus corridor is South Virginia Street from Meadowood Mall to downtown Reno and the University of Nevada at Reno. As a result, this corridor is the most likely rapid transit corridor in the city. In addition, a corridor connecting Reno and Sparks may be a likely candidate for a Rapid Transit line. The *RTP* recommends Bus Rapid Transit as the most desirable transit mode for rapid transit deployment.

There are two types of Primary Local services—Primary Local I and Primary Local II. Type I consists of services that would support average all-day frequencies of eight minutes. Type II supports all-day

Figure 3-4: 2030 Regional Transportation Plan Street and Highway Plan

Source: 2030 Regional Transportation Plan

headways of 15 minutes or less, which is the minimum standard for Primary Transit Network service. By 2030, many corridors in Washoe County are expected to have densities to support transit service with a 15-minute or better service frequency.

Primary Express is a special type of service that operates nonstop express links on headways of 15 minutes or less. This service runs most effectively on uncongested highways or where there are dedicated lanes available for the buses.

Commuter Express, Local Coverage, and ADA Paratransit are additional services intended to provide transit access to areas that would not otherwise have service. Commuter Express service is focused on markets that do not support frequencies of 15-minute, all-day service, but that do have some transit demand at certain times of the day. These are peak-hour routes that are established to serve intense peaks. All other general public transit services that do not run all day with a frequency of 15 minutes or better are considered Local, whether fixed-route or demand-responsive services.

Transportation Management Improvements

Transportation System Management and Transportation Demand Management measures make up a large part of the Washoe County *2030 RTP*. Intelligent Transportation System measures are included as well.

Transportation Demand Management measures identified as potentially beneficial to the Washoe County area include area-wide rideshare programs, a transportation management association, third-party vanpool programs, employer-based ridesharing programs, reduced parking supply, alternate work schedules, telecommuting, and transit-oriented and planned-unit developments.

Potentially beneficial Transportation System Management measures include signal coordination, high-occupancy vehicle lanes, ramp metering, signal preemption, dedicated busways, public transit investments, bus shelters and support services, incident management, and real-time traveler information systems.

In addition to Transportation System Management and Transportation Demand Management measures, the RTP also addresses Intelligent Transportation Systems alternatives. Potential Intelligent Transportation System measures include ramp metering, signal coordination, transit signal priority, emergency vehicle management, automatic vehicle location, real-time bus information, flexible bus stop signage, automated onboard announcements, automatic passenger counters, automated train detection, and collision avoidance technology.

3.3 Traffic Volume Forecasts

Daily a.m. and p.m. peak-hour traffic forecasts were prepared by RTC for the years 2000, 2010, 2020, and 2030. The traffic forecasts were based on the demographic conditions discussed in section 3.1, Demographic Forecasts, and the transportation network summarized in section 3.2, 2030 Regional Transportation Plan. RTC utilized its regional travel demand model to prepare the traffic forecasts. This model was first developed and calibrated in 1992, and has been continually monitored for accuracy and updated since that time. In 1999, RTC undertook a comprehensive review of the then-current model for the *Pyramid Highway Corridor Study*[1].

Model validation, in essence, "forecasts" existing conditions based on current estimates of population and employment. Traffic generated from land uses is assigned to the road network and compared with ground traffic counts. If the forecast of existing traffic is within five to ten percent of the ground counts, a confidence can be assumed that the future forecasts will be reasonably accurate for planning purposes.

To compare the model forecast volume of traffic with actual ground counts of traffic, RTC prepared a table (reproduced here as Table 3-1) of traffic volumes forecast and counted along several screenlines, or collections of streets, throughout the metropolitan area. (The locations of the screenlines are illustrated on Figure 3-5). The overall results of the calibration process showed the existing forecasts at 99.7 percent of actual

Table 3-1: RTC Travel Model Validation Screenline Summary

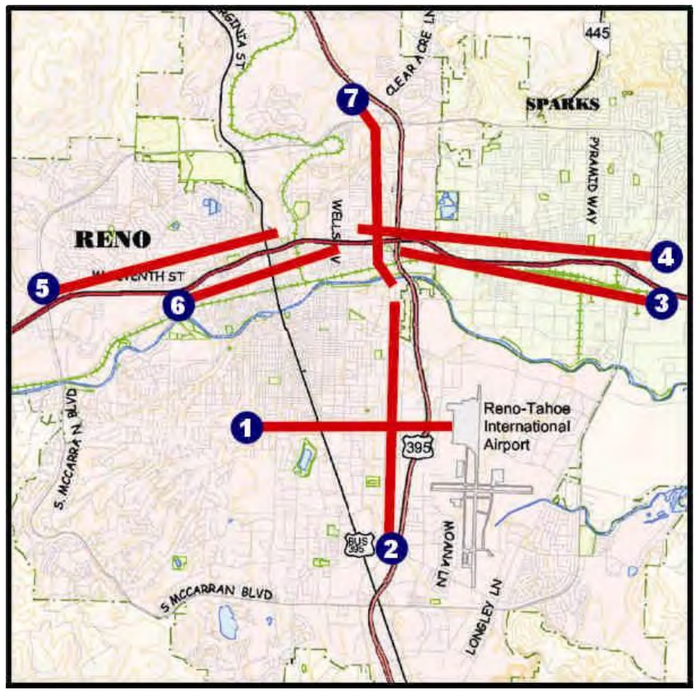
Screenline	Estimated Volume	Observed Volume	Ratio
1	215,000 ADT	229,000 ADT	0.939
2	112,00 ADT	107,000 ADT	1.047
3	241,000 ADT	248,000 ADT	0.972
4	219,000 ADT	209,000 ADT	1.048
5	81,000 ADT	81,000 ADT	1.000
6	114,000 ADT	111,000 ADT	1.027
7	182,000 ADT	182,000 ADT	1.000
Screenline Total	1,164,000 ADT	1,167,000 ADT	0.997

ADT = average daily traffic

Source: Regional Transportation Commission, 1999

[1]Memorandum to Pyramid Highway Corridor Study Steering Committee, subject Calibration of the RTC Traffic Model, from RTC Planning Department, dated May 20, 1999.

Figure 3-5: Screenline Locations



Source: Parsons, Regional Transportation Commission

ground counts and vehicle miles of travel. RTC considered this evidence to establish a strong confidence that future travel forecasts prepared by the RTC would accurately assess the long-range population and employment forecasts.

For the purpose of the *Washoe County Freeway Corridor Study*, Parsons examined RTC's Year 2000 model validation forecasts and compared these with traffic counts collected at each freeway ramp and at multiple mainline locations along both I-80 and US-395/I-580. Balanced sets of freeway link volumes were next computed from each mainline traffic count location. A consensus estimate of existing traffic was then derived based on a convergence of data points.

The consensus estimates of existing traffic volumes were subsequently used as pivot points for adjusting future year traffic volume forecasts on a ramp-by-ramp basis. For a large number of ramps, the required adjustments were relatively small, demonstrating the relatively good accuracy of RTC's traffic forecasting model. Absolute differences between Year 2000 counts and forecasts were applied to the model's 2030 forecasts to derive adjusted 2030 ramp volumes.

On the mainline freeway sections, traffic volumes entering the study area system at the four gateway locations were also examined. These forecasts were adjusted at the I-80 west (California) and US-395 south (Carson City) locations for the reasons discussed below.

In general, the RTC model accounts for growth in through traffic and tourism in a manner consistent with metropolitan area growth, absent any information to the contrary. The model also assumes diurnal, time of day distributions of traffic consistent with data collected for the model's calibration in 1992. This procedure produced Year 2000 model validation forecasts that matched traffic volumes entering the study area from the north on US-395/I-580 and from the east on I-80. Traffic volumes entering the study area from the west on I-80 and from the south on US-395/I-580 were, however, over-estimated by the RTC model.

To account for these differences, future year traffic entering the study area on I-80 from the west was adjusted downward to reflect differences from observed traffic counts and to reflect the operational capacity constraints of I-80 passing through the Sierra mountain range. Traffic entering the study area from US-395/I-580 on the south was adjusted to match detailed traffic forecasting efforts undertaken by NDOT for the extension of the roadway south as an upgraded freeway facility.

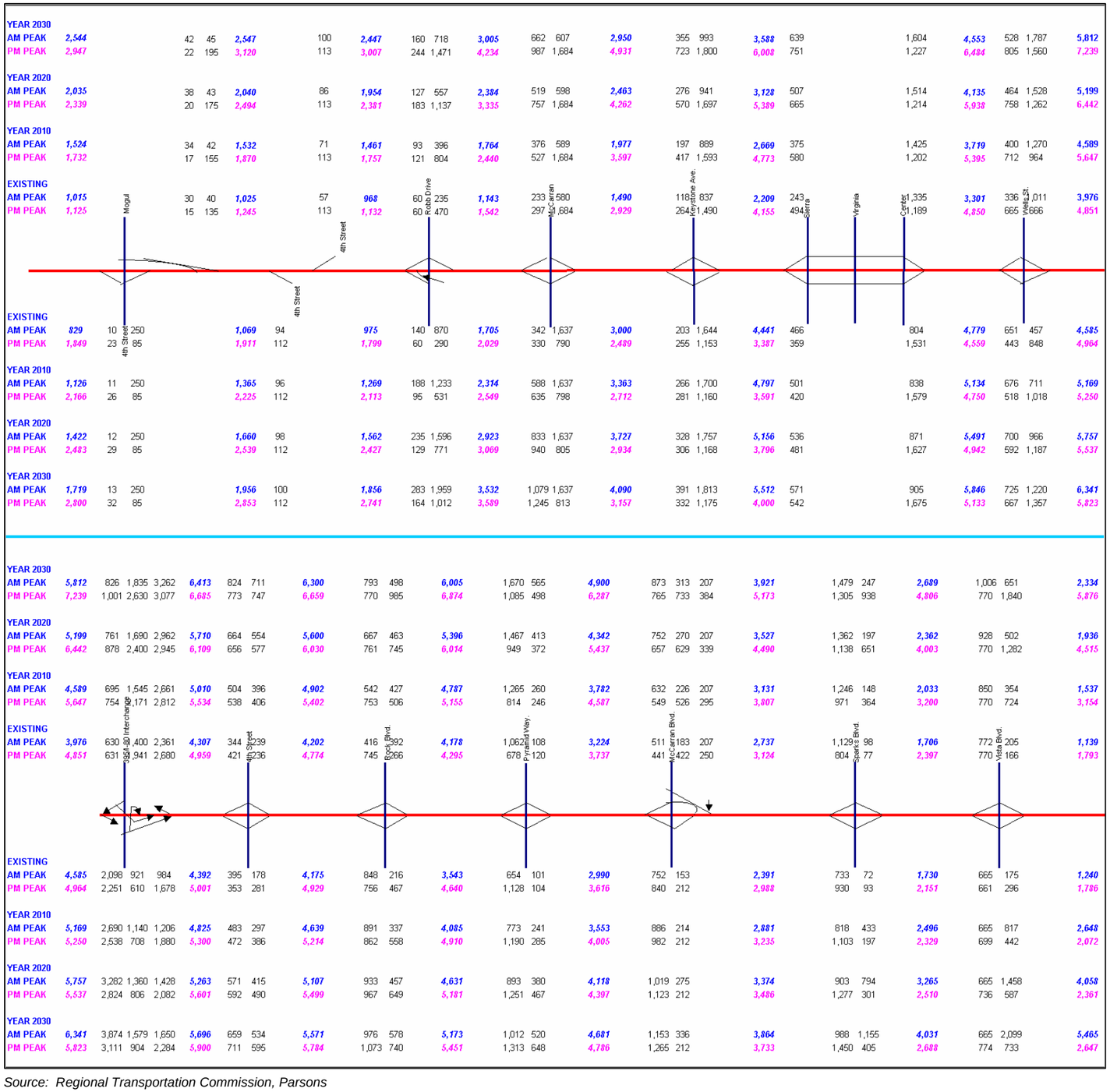
These specific gateway traffic forecast adjustments and the ramp volume adjustment process were reviewed with Nevada Department of Transportation (NDOT) and RTC staff at length. Once the traffic forecast adjustments were approved, system-wide mainline link volumes were calculated by adding and subtracting ramp volumes, beginning from the gateway entrances.

The resulting traffic forecasts are depicted on Figures 3-6 and 3-7. Year 2000 traffic counts are also reported for reference.

In addition to these projections, an alternative scenario was examined in which land use assumptions for the Pyramid Highway Corridor and Sparks areas were changed to reflect a more balanced distribution of jobs and housing. This scenario resulted in slightly higher peak-hour traffic volumes and freeway lane requirements than the adopted forecast of land use intensity and distribution. However, these numbers were not for operational analysis.

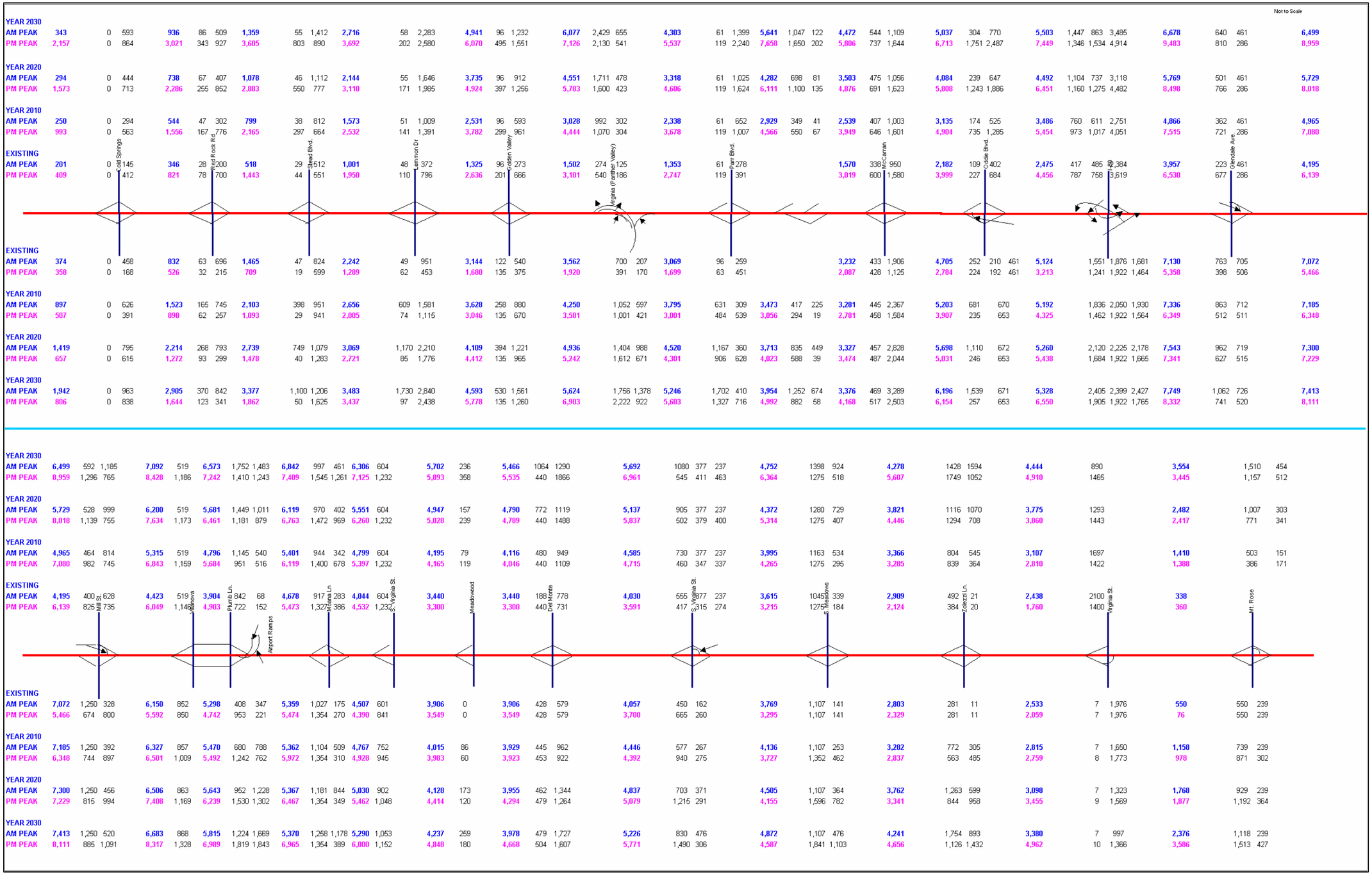
Figure 3-8 depicts the 2030 average daily traffic (ADT) volumes on the Washoe County freeway system as reported in the *2030 RTP*. The graphic also depicts projected level-of-service deficiencies on the 2030 freeway system based on these ADT volumes and the number of freeway lanes depicted on Figure 3-4.

Figure 3-6: I-80 Traffic Volume Forecasts



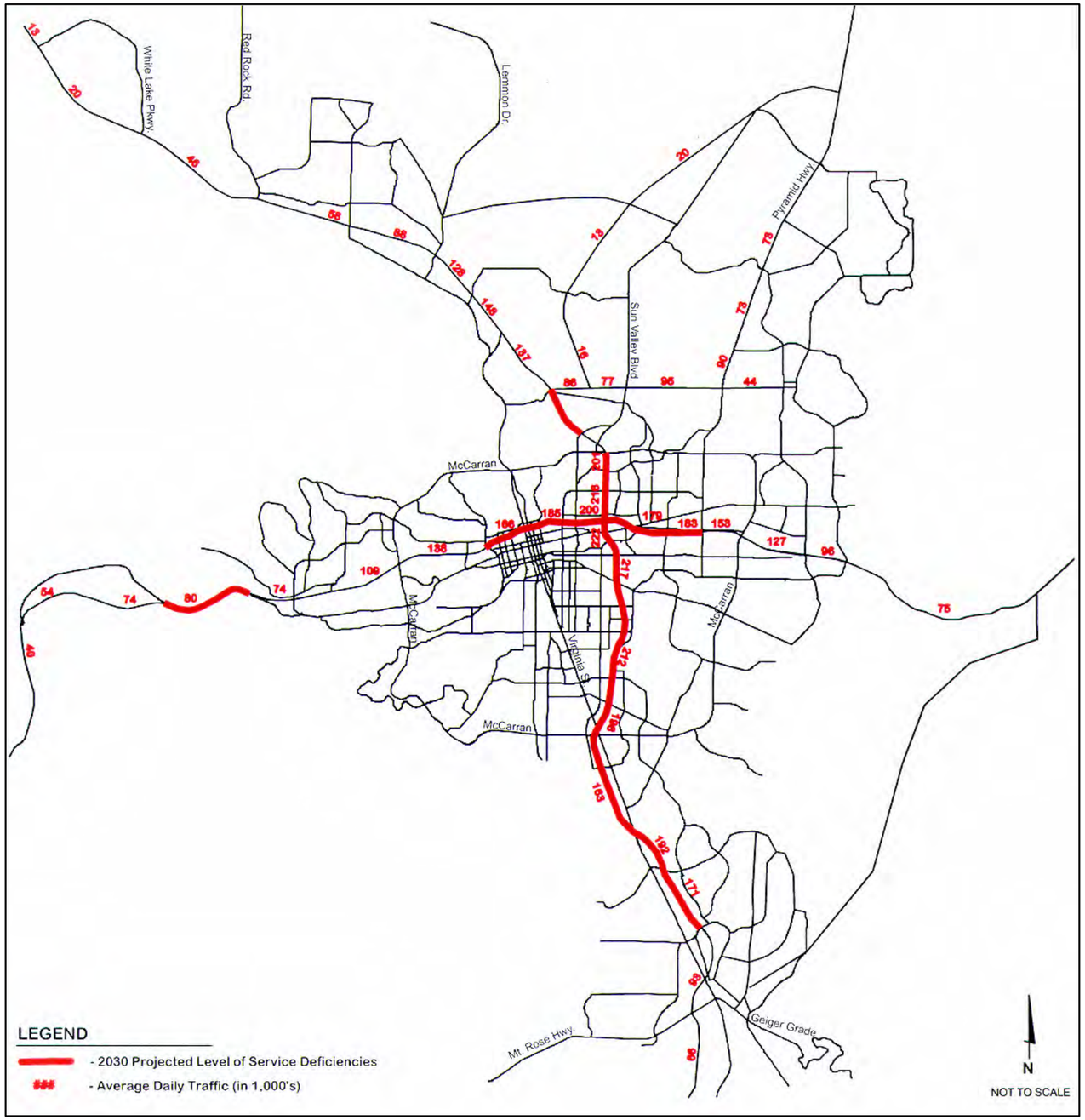
Source: Regional Transportation Commission, Parsons

Figure 3-7: US-395/I-580 Traffic Volume Forecasts



Source: Regional Transportation Commission, Parsons

Figure 3-8: 2030 ADTs and LOS Deficiencies on Washoe County Freeway System



Source: 2030 Regional Transportation Plan

Truck Use

The *Nevada Statewide Intermodal Goods Movement Study* estimates that goods movement to and from industries in the Reno/Sparks metropolitan area will increase by a compound rate of 1.0 percent annually between 1995 and 2020. Within this overall estimate of growth, transport by truck and intermodal rail is expected to increase at a slightly faster rate of growth than goods shipped by rail boxcar.

Table 3-2 reports the *Goods Movement Study* estimates of goods movement by mode, extrapolated to Year 2030 by RTC for the *2030 RTP*.

These estimates of goods movement in and out of the Reno/Sparks area do not include freight carried by "bridge" trucks and trains (that is, vehicles that have both an origin and destination outside of Nevada). NDOT's *1993 Commodity Report* estimated that approximately 60,000 tons of goods traversed I-80 west of Reno (in 1991), while 46,000 tons traversed I-80 east of Sparks. Nearly 86 percent of this tonnage was estimated to be interstate bridge traffic, with one-half of the total volume being farm, food, and kindred products flowing to and from California. The *Commodity Report* estimated much lower volumes of freight movement on US-395/I-580 north (8,100 tons) and south (10,700 tons) of Reno. Of these smaller commodity flows, the vast majority (83 percent) was destined to/from Washoe County or was intra-state (having an origin and destination within Nevada).

Comparison of the estimates of freight tonnage moved to/from shippers and receivers in Reno/Sparks versus tonnage moved on I-80 and US-395/I-580 approaching the metro area indicates that the majority of trucking occurs solely within Reno and Sparks rather than being pass-through activity. Based on this finding, it is reasonable to assume that trucking activity will mirror overall economic activity existing and forecasted for Washoe County.

Examination of ten years of employment statistics for the Reno Metropolitan Statistical Area indicates that the *Goods Movement Study* estimates of intra-regional commodity flows may be conservative. Table 3-3 displays place of work employment estimates reported by the State of Nevada for selected industries, which provide indicators of trucking activity. The lowest observed rate of growth was 2.75 percent over the past ten years. This historical growth is considerably greater than the one-percent growth assumed by the statewide *Intermodal Goods Movement Study*.

Table 3-2: Average Daily Tonnage of Freight

Mode	Receivers			Shippers		
	1995	2020	2030	1995	2020	2030
Rail car	377,844	446,932	477,795	256,216	314,209	340,946
Rail IMX	257,080	338,102	377,189	134,360	180,086	202,500
Truck	814,991	1,052,247	1,165,792	423,906	566,696	636,601
Less than truck	85,691	108,491	119,249	165,665	220,663	247,393
Private truck	656,367	824,709	903,802	773,233	1,006,283	1,118,183
Total	2,191,973	2,770,481	3,043,827	1,753,380	2,287,937	2,545,623

Source: Final Nevada Statewide Intermodal Goods Movement Study, NDOT, 2000 (excludes air). Year 2030 by Regional Transportation Commission of Washoe County.

Table 3-3: Reno Metropolitan Statistical Area Employment Estimates (in thousands)*

Industry	1992	1995	2000	2002	Annualized Growth 1992–2002
Total All Industries	146.5	166.6	194.4	200.5	3%
Construction	7.3	10.6	15.0	16.6	9%
Manufacturing	9.0	12.3	14.1	14.6	5%
Trade	33.6	37.0	43.5	44.2	2.75%
Transportation	5.3	7.3	8.2	8.1	4.25%

*Industry, Non-Farm Employment for June, by place of employment. Includes multiple jobholders.

Source: Research and Analysis Bureau, Nevada Department of Employment.

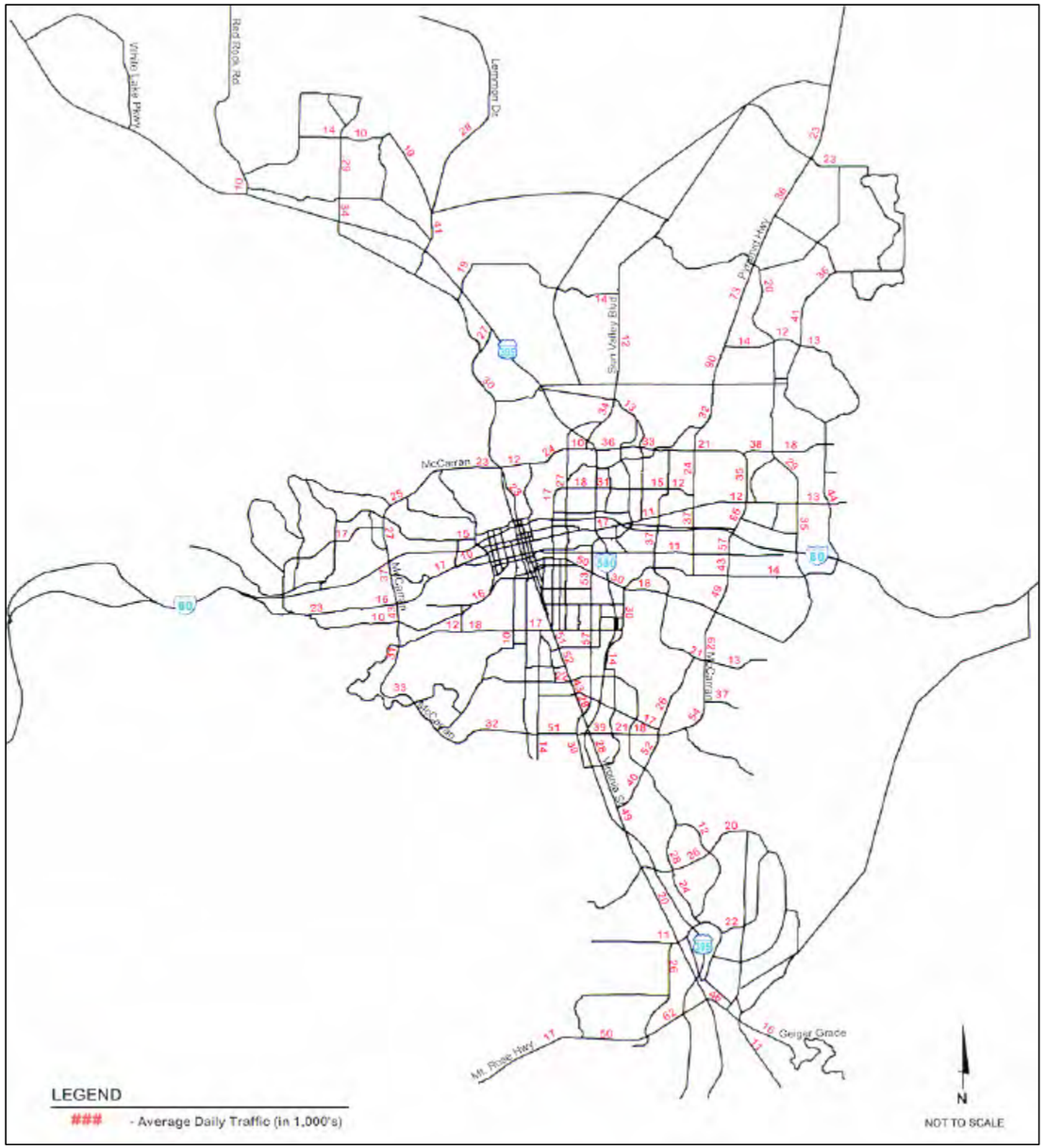
Given these historical patterns of employment activity, the forecasts of overall employment growth between 2000 and 2030 (two percent annually), and the RTC's forecast increases in vehicle miles of travel using the NDOT freeway system within Washoe County (2.25 percent annually), it is reasonable to conclude that trucking activity and truck percentages using I-80 and US-395/I-580 will keep pace with general traffic growth within Washoe County.

For purposes of the *Washoe County Freeway Corridor Study* traffic operational analysis, Parsons therefore assumed no change in the mix of vehicle percentages using I-80 and US-395/I-580

3.4 Regional Road System Operations

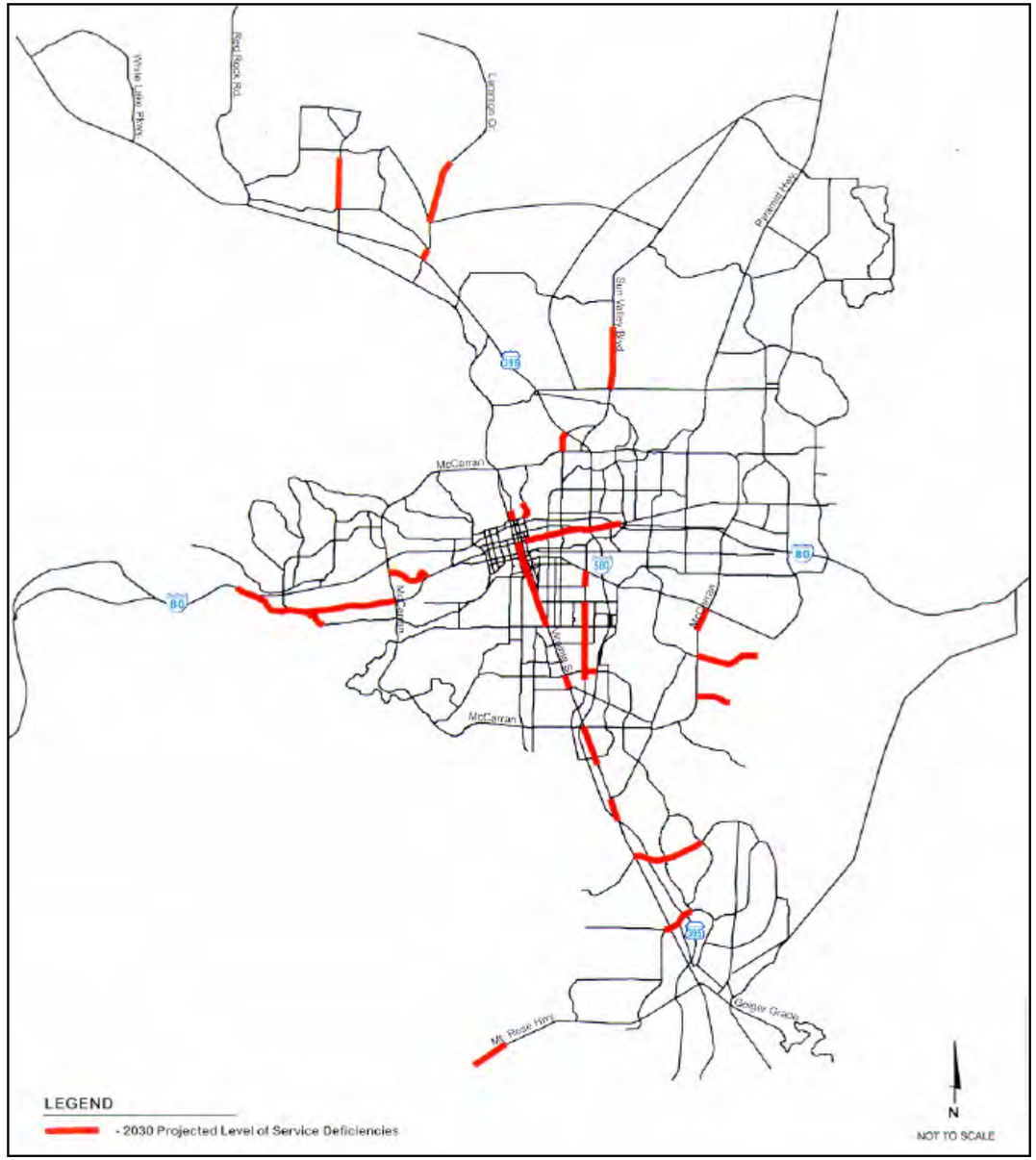
Figures 3-9 and 3-10 depict projected average daily traffic and level-of-service deficiencies on the 2030 Regional Roadway System based on the RTC's adopted level-of-service standards. These figures show that several miles of regional roads will fall below the adopted level-of-service standards by 2030, particularly along Virginia Street and Fourth Street.

Figure 3-9: 2030 ADTs on Washoe County Regional Road System



Source: 2030 Regional Transportation Plan

Figure 3-10: 2030 LOS Deficiencies on Washoe County Regional Road System



Source: 2030 Regional Transportation Plan

ALTERNATIVE DEVELOPMENT AND EVALUATION

I-80 and US-395/I-580 are the primary east-west and north-south travel corridors serving Washoe County and the Reno/Sparks metropolitan area. At present, operating conditions are generally poor on both freeways within the core of the metro area formed by McCarran Boulevard. The poor operating conditions are due to insufficient capacity to accommodate heavy traffic volumes, which occur during peak hour commute periods. The poor operating conditions will continue to deteriorate during the next decades as population, employment, and vehicle miles of travel increase. As the freeway system becomes more congested, travel times will increase, speeds will decrease, and air quality will worsen. The arterial roadway network will also experience increased congestion as travelers seek alternative routes.

The purpose of this study is therefore to define short-, mid-, and long-term transportation investments that will support existing population and projected growth. Project need is based on the inadequacies of the existing and programmed (funded) freeway and regional road system to accommodate forecast traffic growth through year 2030.

The Regional Transportation Commission (RTC) of Washoe County has extensively documented the need for a comprehensive freeway system improvement plan. The *2015 Regional Transportation Plan*, as amended, provides a comprehensive needs assessment for the freeway and non-freeway regional road network and other elements of the transportation system. These needs are further refined by the *2030 Regional Transportation Plan*. Both the current and prior *RTPs* task the *Washoe County Freeway Corridor Study* as the vehicle to fully define freeway system improvement projects.

This chapter describes the alternatives that were developed and evaluated, which in turn led to the recommended set of investment projects. Alternatives development was a sequential process, undertaken by multiple entities over several years. These alternatives and their disposition are reported here in chronological order.

4.1 Base Case Alternative

In 1997/1998, the Nevada Department of Transportation (NDOT) sponsored *the I-80/I-580/US-395 Spaghetti Bowl Interchange Feasibility Study*. As this interchange is both a system capacity restraint and the location of numerous accidents, the purpose of the study was to identify short-term improvements to relieve existing congestion and improve safety. Potential long-term improvements to the interchange were also considered to ensure compatibility of short-term improvements with long-term reconstruction options.

Projects ultimately selected and funded for implementation are illustrated in Figure 4-1 and listed in Table 4-1. These projects have since been designed and will be constructed during Fiscal Years 2002–2005.

Beyond these improvements to the Spaghetti Bowl Interchange, other projects along the freeways are being considered by NDOT and RTC for programming. These include constructing a northbound truck-climbing lane on US-395/I-580 north of the North McCarran Boulevard Interchange; providing direct access from Clear Acre Lane to southbound US-395/I-580; and constructing additional access to US-395/I-580 near Meadowood.

This group of improvements was considered by the *Washoe County Freeway Corridor Study* to be the base case alternative. The study did not formally evaluate the base case alternative, as it is intended to address short-term safety needs and capacity deficiencies. The corridor study does, however, assume the base case alternative as the reference point (no-build) condition for evaluating benefits resulting from the build alternative.

Within the context of providing a reference point for other alternatives, the base case alternative was tested with 2030 forecast traffic volumes, using the CORSIM microscopic traffic simulation model. CORSIM is a computer software program that was developed for FHWA and has been calibrated by Parsons to Washoe County motorist travel behavior. Tables 4-2 and 4-3 report the extent to which the base case alternative can accommodate year 2030 forecast traffic volumes. The tables indicate that approximately 80 to 90 percent of the anticipated traffic demand could be carried on I-80, while US-395/I-580 would be able to meet 50 to 70 percent of its demand volumes. Traffic volumes not accommodated by the freeway system would likely be carried on other regional roadway facilities, i.e., arterial and collector streets.

4.2 2015 Washoe County Freeway System Plan

The *2015 RTP Washoe County Freeway System Plan* is illustrated in Figure 4-2. As of September 1998, this plan included all projects programmed for construction in the then-current Regional Transportation Improvement Program and additional projects anticipated for construction through the year 2015. Elements of the 2015 Freeway System Plan are listed in Table 4-4.

The Regional Transportation Commission evaluated this 2015 Plan, assuming year 2030 traffic conditions. Using average daily traffic volumes as its measure of effectiveness, and the traffic capacities listed earlier in Table 2-6, the RTC concluded that the 2015 Freeway and Regional Roadway Plans would experience significant congestion within the McCarran Boulevard Loop, as illustrated in Figure 4-3.

As a result of this deficiency finding, the 2015 Washoe County Freeway System Plan was not subjected to further study by this effort.

4.3 2030 Regional Transportation Plan

During 2000 and 2001, the RTC worked extensively with a Citizens Steering Committee (CSC) to identify potential improvement options for the *2030 Regional Transportation Plan (RTP)*. Ideas for new roadways considered by RTC and the CSC are illustrated on Figure 4-4 and listed in Table 4-5. These elements were identified without consideration of political, financial, or environmental constraints. Three alternative improvement packages resulted and are detailed in the *2030 RTP*. They are characterized as follows:

Alternative Improvement Package 1—A transportation system that meets current congestion standards mainly by adding new roadway capacity and allows transit expansion to keep pace with population growth.

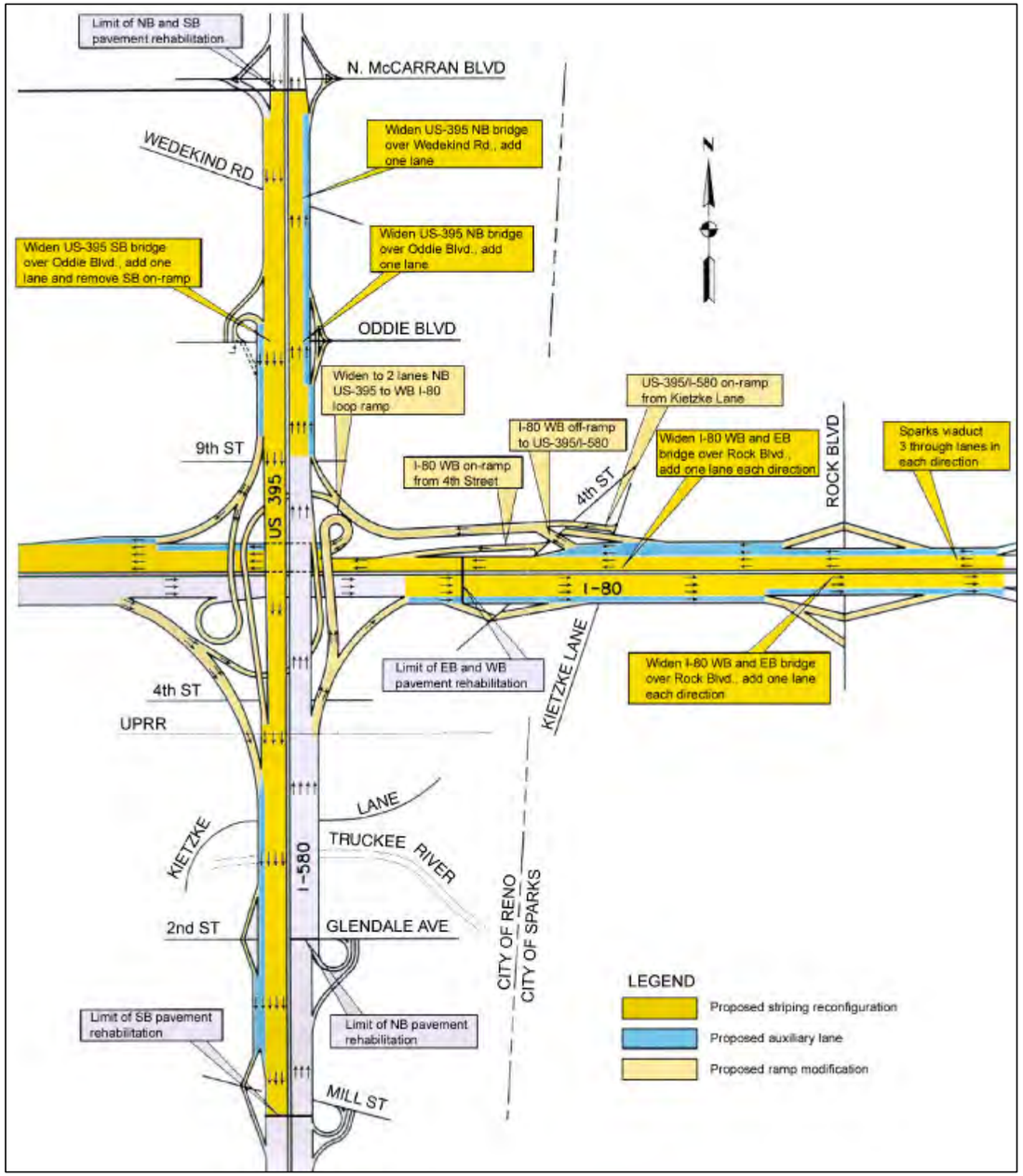
Alternative Improvement Package 2—An improvement package that allows for increasing levels of congestion by adopting lower level of service standards and allows transit expansion to keep pace with population growth.

Alternative Improvement Package 3—An improvement package that relies mainly on investments in alternative modes of transportation and TSM/TDM strategies, thus reducing the need for new road construction. This package provides for widening of existing roads and a major investment in transit and high-occupancy vehicle (HOV) facilities, but allows congestion to increase.

The performance of these alternatives was measured against criteria that reflected the goals and policies adopted in the *2030 RTP*. Based on this information, stakeholder input, and consideration of political, financial, and environmental constraints, the Citizens Steering Committee selected a preferred improvement plan that was very similar to Alternative Improvement Package 3. This package relies mainly on investments in alternative modes of transportation and TSM/TDM strategies.

The adopted Street and Highway Plan element of the *2030 RTP* is illustrated in Figure 4-5. It is notable that the North Connector, the Southeast Connector, and the Outer Ring Freeway are the only cross-town roads to be included in the plan. The Southeast Connector was eventually removed from the adopted plan and approved as a “future study corridor.”

Figure 4-1: Base Case Alternative-Funded Projects



Source: Nevada Department of Transportation

Table 4-1: I-80/US-395/I-580 Interim Improvements (Base Case Alternative)

Freeway Segment	Proposed Improvements
I-80 WB from US-395/I-580 to 0.3 mile east of Rock Boulevard	Widen from 2 to 3 lanes, including Fourth Street, Kietzke Lane, and Rock Boulevard bridges. Construct an auxiliary lane from US-395/I-580 to Rock Boulevard
I-80 WB from Fourth Street to US-395/I-580 exit	Construct dual lane bridge with retaining walls; reconstruct Fourth Street entrance from 1 to 2 ramps, providing access to US-395/I-580 exit bridge and I-80 exit under bridge
I-80 WB at US-395/I-580 exit	Restripe from 3 to 2 lanes
US-395/I-580 NB to I-80 WB ramp	Widen from 1 to 2 lanes around the loop, merging to 1 dedicated lane on I-80 westbound
I-80 EB to US-395/I-580 SB ramp	Widen from 1 to 2 lanes, merging to one dedicated lane on US-395/I-580
US-395/I-580 SB from I-80 EB exit to I-80 WB entrance	Restripe from 3 to 2 lanes
I-80 WB to US-395/I-580 SB ramp	Restripe to convert from a merging entrance to a dedicated lane on US-395/I-580 southbound
US-395/I-580 SB from Glendale Avenue to Mill Street	Restripe from 3 to 4 lanes and add an auxiliary lane
US-395/I-580 SB to I-80 EB exit	Widen from 1 to 2 lanes
I-80 EB from US-395/I-580 to Rock Boulevard	Restripe from 3 to 4 lanes and from Rock Boulevard to 0.3 mile east, widen from 2 to 3 lanes
Oddie Boulevard EB to US-395/I-580 SB	Close ramp
US-395/I-580 at Oddie Boulevard	Modify existing signal on Oddie Boulevard west of US-395 /I-580 to accommodate a left-turn lane
US-395/I-580 NB from Oddie Boulevard to McCarran Boulevard	Widen from 2 to 3 lanes, including bridges over Oddie Boulevard and Wedekind Road. Outside (third) lane becomes northbound exit ramp at North McCarran Boulevard
I-80 EB and WB from Wells Avenue to McCarran Boulevard	Remove and replace pavement, upgrade signing and lighting; miscellaneous bridge rehabilitation
US-395/I-580 SB from SB Mill Street exit ramp to SB Oddie Boulevard exit ramp	Upgrade signing and lighting, miscellaneous bridge rehabilitation
US-395/I-580 SB and NB from Oddie Boulevard to I-80 exit	Construct an auxiliary lane (widen in both directions)
US-395/I-580 SB from Oddie Boulevard exit to Oddie Boulevard entrance	Widen from 2 to 3 lanes, including the bridge over Oddie Boulevard

Source: Nevada Department of Transportation

Table 4-2: Year 2030 Forecast Traffic Volumes for I-80 with Base Case Alternative

	AM				PM			
	2030 Volume	Corsim Volume	Difference	% Modeled	2030 Volume	Corsim Volume	Difference	% Modeled
I-80 Eastbound Direction								
Before Keystone	4,090	4,087	-3	100%	3,157	3,157	0	100%
Between Keystone Off & Keystone On	3,699	3,691	-8	100%	2,825	2,796	-29	99%
Between Keystone On & Sierra/Center Off	5,512	5,493	-19	100%	4,000	3,967	-33	99%
Between Sierra/Center Off & Sierra/Center On	4,941	4,887	-54	99%	3,458	3,420	-38	99%
Between Sierra/Center On & Wells Off	5,846	5,743	-103	98%	5,133	5,087	-46	99%
Between Wells Off & Wells On	5,121	4,873	-248	95%	4,466	4,296	-170	96%
Between Wells On & US 395 NB/SB Off	6,341	5,973	-368	94%	5,823	5,557	-266	95%
Between US 395 NB/SB Off & US 395 SB On	2,467	2,391	-76	97%	2,712	2,710	-2	100%
Between US 395 SB On & US 395 NB On	4,046	3,800	-246	94%	3,616	3,503	-113	97%
Between US 395 NB On & 4th Street Off	5,696	5,317	-379	93%	5,900	4,966	-934	84%
Between 4th St Off & 4th St On	5,037	4,683	-354	93%	5,189	4,322	-867	83%
Between 4th Street On & Rock Off	5,571	5,207	-364	93%	5,784	4,911	-873	85%
Between Rock Off & Rock On	4,595	4,371	-224	95%	4,711	3,998	-713	85%
Between Rock On & Pyramid Off	5,173	4,950	-223	96%	5,451	4,697	-754	86%
Between Pyramid Off & Pyramid On	4,161	4,043	-118	97%	4,138	3,584	-554	87%
End of Freeway	4,681	4,565	-116	98%	4,786	4,238	-548	89%
I-80 Eastbound Direction Off-Ramps								
Keystone Off-Ramp	391	400	9	102%	332	354	22	107%
Sierra/Center Off-Ramp	571	608	37	106%	542	551	9	102%
Wells Off-Ramp	725	705	-20	97%	667	680	13	102%
US 395 NB/SB Off-Ramp	3,874	3,582	-292	92%	3,111	2,801	-310	90%
4th Street Off-Ramp	659	654	-5	99%	711	647	-64	91%
Rock Off-Ramp	976	843	-133	86%	1,073	896	-177	84%
Pyramid Off-Ramp	1,012	918	-94	91%	1,313	1,094	-219	83%
I-80 Eastbound Direction On-Ramps								
Keystone On-Ramp	1,813	1,813	0	100%	1,175	1,173	-2	100%
Sierra/Center On-Ramp	905	904	-1	100%	1,675	1,674	-1	100%
Wells On-Ramp	1,220	1,163	-57	95%	1,357	1,356	-1	100%
US 395 SB On-Ramp	1,579	1,411	-168	89%	904	795	-109	88%
US 395 NB On-Ramp	1,650	1,515	-135	92%	2,284	1,465	-819	64%
4th Street On-Ramp	534	534	0	100%	595	593	-2	100%
Rock On-Ramp	578	578	0	100%	740	738	-2	100%
Pyramid On-Ramp	520	519	-1	100%	648	646	-2	100%

	AM				PM			
	2030 Volume	Corsim Volume	Difference	% Modeled	2030 Volume	Corsim Volume	Difference	% Modeled
I-80 Westbound Direction								
Before Pyramid Interchange	4,900	4,900	0	100%	6,287	5,025	-1,262	80%
Between Pyramid Off & Pyramid On	4,335	4,297	-38	99%	5,789	4,655	-1,134	80%
Between Pyramid On & Rock Off	6,005	5,978	-27	100%	6,874	5,737	-1,137	83%
Between Rock Off & Rock On	5,507	5,523	16	100%	5,889	4,874	-1,015	83%
Between Rock On & 4th Street Off	6,300	6,311	11	100%	6,659	5,859	-800	88%
Between 4th St Off & US 395 Off	5,589	5,644	55	101%	5,912	5,184	-728	88%
Between US 395 Off & 4th St On	2,746	2,692	-54	98%	3,191	2,771	-420	87%
Between 4th Street On & US 395 NB On	3,151	3,088	-63	98%	3,608	3,194	-414	89%
Between US 395 NB On & US 395 SB On	4,986	4,829	-157	97%	6,238	4,820	-1,418	77%
Between US 395 SB On & Wells Off	5,812	5,641	-171	97%	7,239	5,761	-1,478	80%
Between Wells Off & Wells On	4,025	3,923	-102	97%	5,679	4,575	-1,104	81%
Between Wells On & Sierra/Center Off	4,553	4,457	-96	98%	6,484	5,374	-1,110	83%
Between Sierra/Center Off & Sierra/Center On	2,949	2,816	-133	95%	5,257	4,307	-950	82%
Between Sierra/Center On & Keystone Off	3,588	3,457	-131	96%	6,008	5,070	-938	84%
End of Freeway	2,950	2,894	-56	98%	4,931	4,321	-610	88%
I-80 Westbound Direction Off-Ramps								
Pyramid Off-Ramp	565	600	35	106%	498	386	-112	78%
Rock Off-Ramp	498	449	-49	90%	985	862	-123	88%
4th Street Off-Ramp	711	677	-34	95%	747	671	-76	90%
US 395 NB & SB Off Ramp	2,843	2,944	101	104%	2,721	2,405	-316	88%
Wells Off-Ramp	1,787	1,708	-79	96%	1,560	1,205	-355	77%
Sierra/Center Off-Ramp	1,604	1,647	43	103%	1,227	1,065	-162	87%
Keystone Off-Ramp	993	925	-68	93%	1,800	1,471	-329	82%
I-80 Westbound Direction On-Ramps								
Pyramid On-Ramp	1,670	1,670	0	100%	1,085	1,084	-1	100%
Rock On-Ramp	793	792	-1	100%	770	985	215	128%
4th Street On-Ramp	405	404	-1	100%	417	416	-1	100%
US 395 NB On-Ramp	1,835	1,731	-104	94%	2,630	1,632	-998	62%
US 395 SB On-Ramp	826	795	-31	96%	1,001	959	-42	96%
Wells On-Ramp	528	528	0	100%	805	804	-1	100%
Virginia On-Ramp	639	639	0	100%	751	749	-2	100%
Keystone On-Ramp	355	355	0	100%	723	721	-2	100%

2030 corsim results

Source: Parsons

Table 4-3: Year 2030 Forecast Traffic Volumes for US-395/I-580 with Base Case Alternative

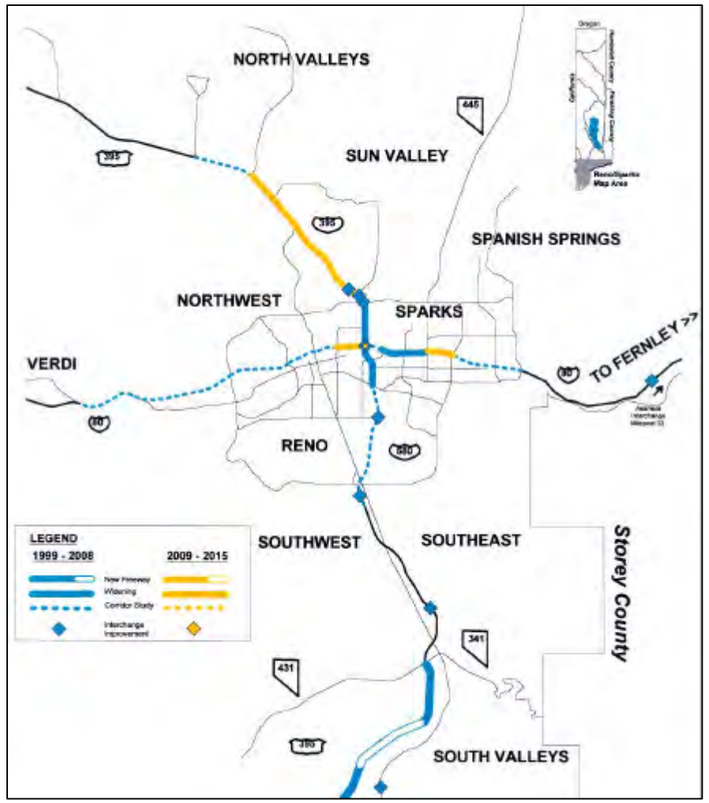
	AM				PM			
	2030 Volume	Corsim Volume	Difference	% Modeled	2030 Volume	Corsim Volume	Difference	% Modeled
US 395 Northbound Direction								
Before Del Monte Interchange	5,692	5,692	0	100%	6,961	6,275	-686	90%
Between Del Monte Off & Del Monte On	4,402	4,364	-38	99%	5,095	4,256	-839	84%
Between Del Monte On & Meadowood On	5,466	5,423	-43	99%	5,535	4,465	-1,070	81%
Between Meadowood On & S. Virginia On	5,702	5,656	-46	99%	5,893	4,592	-1,301	78%
Between S. Virginia On & Moana Off	6,306	6,262	-44	99%	7,125	5,281	-1,844	74%
Between Moana Off & Moana On	5,845	5,786	-59	99%				
Between Moana On & Plumb Off	6,842	6,782	-60	99%	7,409	4,935	-2,474	67%
Between Plumb Off & Airport On	5,090	5,092	2	100%	5,999	3,784	-2,215	63%
Between Airport On & Villanova On	6,573	6,579	6	100%	7,242	4,401	-2,841	61%
Between Villanova On & Mill Off	7,092	7,099	7	100%	8,428	5,232	-3,196	62%
Between Mill Off & Mill On	5,907	5,919	12	100%	7,663	4,718	-2,945	62%
Between Mill On & Glendale Off	6,499	6,425	-74	99%	8,959	5,565	-3,394	62%
Between Glendale Off & Glendale On	6,038	5,774	-264	96%	8,673	5,372	-3,301	62%
Between Glendale On & I-80 EB/SB Off	6,678	6,203	-475	93%	9,483	6,209	-3,274	65%
Between I-80 EB/SB Off & I-80 EB On	3,193	2,611	-582	82%	4,569	2,810	-1,759	62%
Between I-80 EB On & I-80 WB On	4,640	3,671	-969	79%	5,915	3,198	-2,717	54%
Between I-80 WB On & Oddie Off	5,503	4,174	-1,329	76%	7,449	3,562	-3,887	48%
Between Oddie Off & Oddie On	4,733	3,316	-1,417	70%	4,962	2,269	-2,693	46%
Between Oddie On & McCarran Off	5,037	3,532	-1,505	70%	6,713	3,627	-3,086	54%
Between McCarran Off & McCarran On	3,928	2,691	-1,237	69%	5,069	2,754	-2,315	54%
Between McCarran On & Parr Off	5,641	4,395	-1,246	78%	7,658	4,498	-3,160	59%
Between Parr Off & Parr On	4,242	3,226	-1,016	76%	5,418	3,176	-2,242	59%
Between Parr On & N. Virginia Off	4,303	3,299	-1,004	77%	5,537	3,295	-2,242	60%
Between N. Virginia Off & N. Virginia On	3,648	2,777	-871	76%	4,996	2,942	-2,054	59%
Between N. Virginia On & Golden Valley Off	6,077	4,273	-1,804	70%	7,126	4,505	-2,621	63%
Between Golden Valley Off & Golden Valley On	4,845	3,362	-1,483	69%	5,575	3,572	-2,003	64%
Between Golden Valley On & Lemmon Valley Off	4,941	3,458	-1,483	70%	6,070	4,065	-2,005	67%
Between Lemmon Valley Off & Lemmon Valley On	2,658	1,800	-858	68%	3,490	2,400	-1,090	69%
Between Lemmon Valley On & Stead Off	2,716	1,861	-855	69%	3,692	2,596	-1,096	70%
Between Stead Off & Stead On	1,304	868	-436	67%	2,802	1,983	-819	71%
End of Freeway	1,359	920	-439	68%	3,605	2,787	-818	77%
US 395 North Direction Off-Ramps								
Del Monte Off	1,290	1,327	37	103%	1,866	1,677	-189	90%
Moana Off	461	483	22	105%	1,261	902	-359	72%
Plumb Off	1,752	1,690	-62	96%	1,410	962	-448	68%
Mill Off	1,185	1,184	-1	100%	765	435	-330	57%
Glendale Off	461	435	-26	94%	286	161	-125	56%
I-80 EB & WB Off	3,485	3,239	-246	93%	4,914	3,109	-1,805	63%
Oddie Off	770	597	-173	78%	2,487	1,165	-1,322	47%
McCarran Off	1,109	710	-399	64%	1,644	866	-778	53%
Parr Off	1,399	1,157	-242	83%	2,240	1,302	-938	58%
N. Virginia Off	655	521	-134	80%	541	309	-232	57%
Golden Valley Off	1,232	913	-319	74%	1,551	929	-622	60%
Lemmon Valley Off	2,283	1,658	-625	73%	2,580	1,663	-917	64%
Stead Off	1,412	987	-425	70%	890	618	-272	69%
US 395 Northbound Direction On-Ramps								
Del Monte On	1,064	1,063	-1	100%	440	393	-47	89%
Meadowood On	236	236	0	100%	358	358	0	100%
S. Virginia On	604	603	-1	100%	1,232	925	-307	75%
Moana On	997	996	-1	100%	1,545	1,139	-406	74%
Airport On	1,483	1,484	1	100%	1,243	786	-457	63%
Villanova On	519	518	-1	100%	1,186	868	-318	73%
Mills On	592	591	-1	100%	1,296	944	-352	73%
Glendale On	640	639	-1	100%	810	810	0	100%
I-80 EB On	1,447	1,152	-295	80%	1,346	496	-850	37%
I-80 WB On	863	551	-312	64%	1,534	422	-1,112	28%
Oddie On	304	304	0	100%	1,751	1,386	-365	79%
N. McCarran On	1,713	1,696	-17	99%	2,589	1,733	-856	67%
Parr On	61	60	-1	98%	119	118	-1	99%
N. Virginia On	2,429	1,498	-931	62%	2,130	1,568	-562	74%
Golden Valley On	96	95	-1	99%	495	495	0	100%
Lemmon Valley On	58	58	0	100%	202	201	-1	100%
Stead On	55	55	0	100%	803	803	0	100%

Source: Parsons

	AM				PM			
	2030 Volume	Corsim Volume	Difference	% Modeled	2030 Volume	Corsim Volume	Difference	% Modeled
US 395 Southbound Direction								
Before Stead Off	3,377	3,378	1	100%	1,862	1,859	-3	100%
Between Stead Off & Stead On	2,277	2,242	-35	98%	1,812	1,793	-19	99%
Between Stead On & Lemmon Valley Off	3,483	3,466	-17	100%	3,437	2,617	-820	76%
Between Lemmon Valley Off & Lemmon Valley On	1,753	1,789	36	102%	1,753	2,534	781	145%
Between Lemmon Valley On & Golden Valley Off	4,593	4,178	-415	91%	5,778	4,004	-1,774	69%
Between Golden Valley Off & Golden Valley On	4,063	3,605	-458	89%	4,063	3,931	-132	97%
Between Golden Valley On & N. Virginia Off	5,624	5,154	-470	92%	6,903	5,182	-1,721	75%
Between N. Virginia Off & N. Virginia On	3,868	3,560	-308	92%	4,681	3,540	-1,141	76%
Between N. Virginia On & Parr Off	5,246	4,931	-315	94%	5,603	4,443	-1,160	79%
Between Parr Off & Parr On	3,544	3,388	-156	96%	4,276	3,336	-940	78%
Between Parr On & McCarran Off	3,954	3,790	-164	96%	4,992	4,047	-945	81%
Between McCarran Off & McCarran On	2,233	2,112	-121	95%	3,593	2,892	-701	80%
Between N. McCarran On & Oddie Off	6,196	6,070	-126	98%	6,154	5,449	-705	89%
Between Oddie Off & Oddie On	4,657	4,555	-102	98%	5,897	5,240	-657	89%
Between Oddie On & I-80 EB & WB Off	5,328	5,215	-113	98%	6,550	5,891	-659	90%
Between I-80 Off to I-80 WB On	2,923	2,899	-24	99%	4,645	4,099	-546	88%
Between I-80 WB On & I-80 EB On	5,322	5,547	225	104%	6,567	6,352	-215	97%
Between I-80 EB On & Glendale Off	7,749	7,789	40	101%	8,332	8,470	138	102%
Between Glendale Off & Glendale On	6,687	6,720	33	100%	7,591	7,687	96	101%
Between Glendale On & Mill Off	7,413	7,450	37	100%	8,111	8,169	58	101%
Between Mill Off & Mill On	6,163	6,144	-19	100%	7,226	7,231	5	100%
Between Mill On & Villanova Off	6,683	6,660	-23	100%	8,317	8,329	12	100%
Between Villanova Off & Airport Off	5,815	5,758	-57	99%	6,989	6,964	-25	100%
Between Airport Off & Plumb On	4,146	4,003	-143	97%	5,146	5,120	-26	99%
Between Plumb On & Moana Off	5,370	5,227	-143	97%	6,965	6,934	-31	100%
Between Moana Off & Moana On	4,112	3,983	-129	97%				
Between Moana On & S. Virginia Off	5,290	5,162	-128	98%	6,000	5,980	-20	100%
Between S. Virginia Off & Meadowood Off	4,237	4,096	-141	97%	4,848	4,772	-76	98%
Between Meadowood Off & Del Monte Off	3,978	3,798	-180	95%	4,668	4,632	-36	99%
Between Del Monte Off & Del Monte On	3,499	3,393	-106	97%	4,164	4,114	-50	99%
End of Freeway	5,226	5,117	-109	98%	5,771	5,726	-45	99%
US 395 Southbound Direction Off-Ramps								
Stead Off	1,100	1,132	32	103%	50	57	7	114%
Lemmon Valley Off	1,730	1,683	-47	97%	97	66	-31	68%
Golden Valley Off	530	503	-27	95%	135	86	-49	64%
N. Virginia Off	1,756	1,602	-154	91%	2,222	1,644	-578	74%
Parr Off	1,702	1,545	-157	91%	1,327	1,100	-227	83%
Pyramid Pkwy Off	0	0	0	0%	0	0	0	0%
N. McCarran Off	1,721	1,679	-42	98%	1,399	1,155	-244	83%
Oddie Off	1,539	1,520	-19	99%	257	226	-31	88%
I-80 EB & WB Off	2,405	2,316	-89	96%	1,905	1,795	-110	94%
Glendale Off	1,062	1,068	6	101%	741	745	4	101%
Mill Off	1,250	1,284	34	103%	885	900	15	102%
Vilanova Off	868	887	19	102%	1,328	1,348	20	102%
Airport Off	1,669	1,714	45	103%	1,843	1,835	-8	100%
Moana Off	1,258	1,245	-13	99%	1,354	1,363	9	101%
S. Virginia Off	1,053	1,042	-11	99%	1,152	1,205	53	105%
Meadowood Off	259	294	35	114%	180	143	-37	79%
Del Monte Off	479	418	-61	87%	504	517	13	103%
US 395 Southbound Direction On-Ramps								
Stead On	1,206	1,204	-2	100%	1,206	1,174	-32	97%
Lemmon Valley On	2,840	2,399	-441	84%	2,840	1,558	-1,282	55%
Golden Valley On	1,561	1,561	0	100%	1,561	1,259	-302	81%
N. Virginia On	1,378	1,377	-1	100%	1,378	921	-457	67%
Parr On	410	410	0	100%	410	716	306	175%
Pyramid Pkwy On	0	0	0	0%	0	0	0	0%
N. McCarran On	3,963	3,960	-3	100%	2,561	2,561	0	100%
Oddie On	671	669	-2	100%	653	653	0	100%
I-80 WB On	2,399	2,666	267	111%	1,922	2,265	343	118%
I-80 EB On	2,427	2,244	-183	92%	1,765	2,119	354	120%
Glendale On	726	724	-2	100%	520	518	-2	100%
Mills On	520	519	-1	100%	1,091	1,090	-1	100%
Plumb On	1,224	1,221	-3	100%	1,819	1,817	-2	100%
Moana On	1,178	1,176	-2	100%	389	388	-1	100%
Del Monte On	1,727	1,726	-1	100%	1,607	1,606	-1	100%

2030 corsim results (version 1)

Figure 4-2: 2015 RTP Washoe County Freeway System Plan



Source: Regional Transportation Commission of Washoe County, 2015 Regional Transportation Plan

Table 4-4: 2015 Washoe County Freeway System Plan

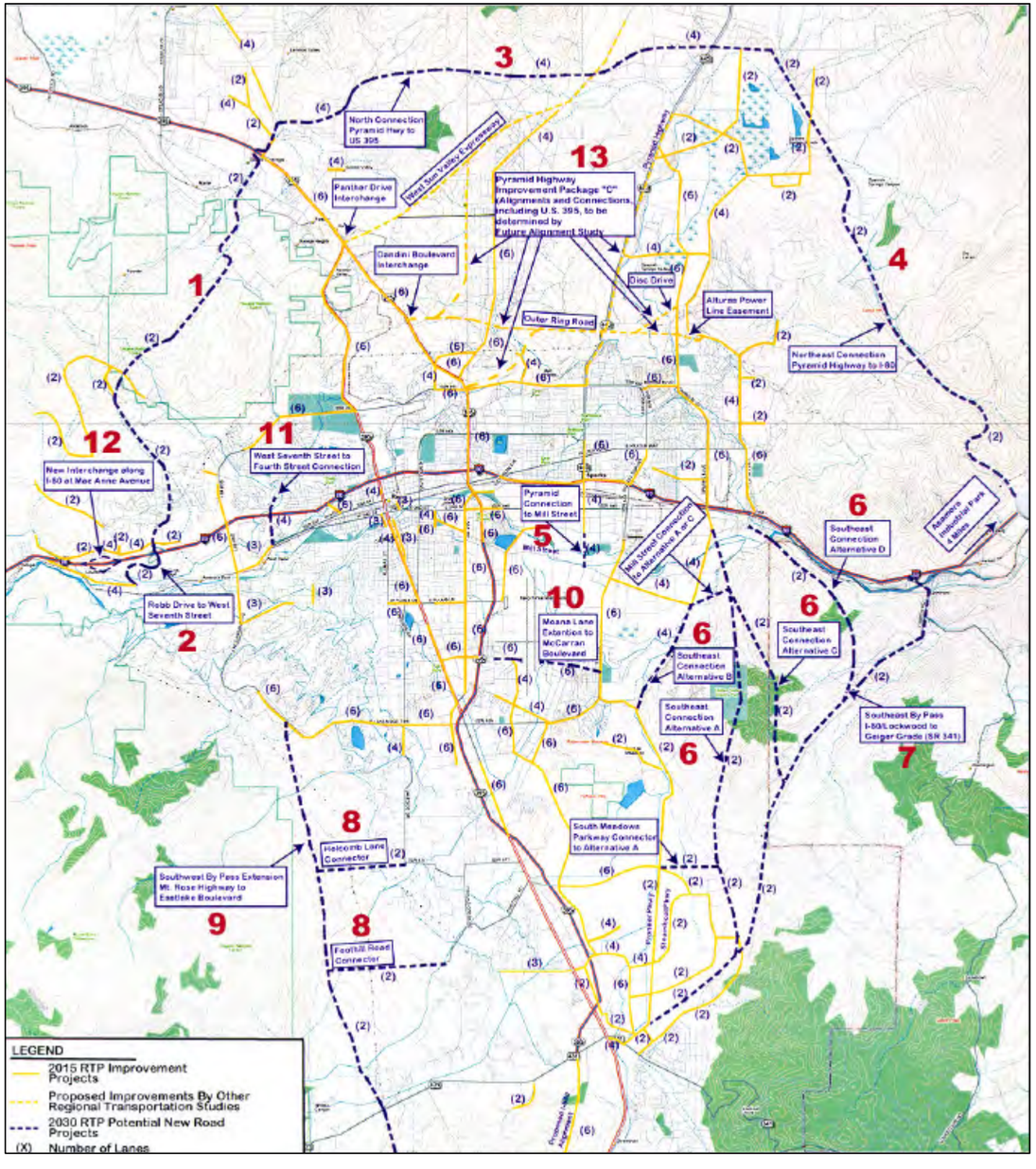
Roadway Segment	Project
FY 1999–2003 Projects	
I-80 from East Verdi Road to Vista Boulevard	Corridor study
I-80 at milepost 33 (16 miles east of Sparks)	Construct new interchange
I-80 at US-395/I-580	Interim interchange improvements
US-395/I-580 from Bowers Mansion to Mount Rose Highway	Construct new 6-lane freeway
US-395/I-580 from Del Monte Lane to Stead Boulevard	Corridor study
US-395/I-580 at Meadowood Mall Way	Construct new interchange
US-395/I-580 at Zolezzi Lane (Damonte Parkway)	Add northbound and southbound ramps
US-395/I-580 at Pagni Lane	Construct new interchange
US-395/I-580 at North McCarran Interchange	Add northbound off-ramp to Clear Acre Lane
US-395/I-580 at Clear Acre Lane	Northbound on-ramp, southbound on- and off-ramps
US-395/I-580 at Sutro Street	Add interchange and extend right-of-way purchase
US-395/I-580/I-80	Add Freeway Management ITS
FY 2004–2008 Projects	
I-80 from Fourth Street to Pyramid Way	Widen from 4 to 6 lanes
US-395/I-580 from Mill Street to I-80	Widen from 6 to 8 lanes
US-395/I-580 at Plumb Lane southbound on-ramp	Widen from 1 to 2 lanes
US-395/I-580 from I-80 to North McCarran Boulevard	Widen from 4 to 6 lanes
FY 2009–2015 Projects	
I-80 from Wells Avenue to US-395/I-580	Widen from 6 to 8 lanes
I-80 at US-395/I-580 Interchange	Reconstruct interchange
I-80 from Pyramid Way to McCarran Boulevard	Widen from 4 to 6 lanes
US-395/I-580 from North McCarran to Lemmon Drive	Widen from 4 to 6 lanes

Source: Regional Transportation Commission of Washoe County, 2015 Regional Transportation Plan

Figure 4-3: 2030 Projected Level of Service Deficiencies on 2015 Freeway System and Average Daily Traffic

Source: Regional Transportation Commission of Washoe County, 2030 Regional Transportation Plan

Figure 4-4: Potential Improvements for the 2030 RTP



Source: Regional Transportation Commission of Washoe County

Table 4-5: 2030 RTP New Roadway Concepts

Roadway Segment	Potential Project
1. Lemmon Drive/US-395/I-580 to Robb Drive/I-80	Northwest Connection: Extend Robb Drive to Fourth Street at Mayberry Drive
2. Robb Drive from I-80 interchange to Fourth Street	Extend Robb Drive from the I-80 interchange to Fourth Street and connect at Mayberry Drive
3. Pyramid Highway to US-395/I-580	North Connection: Extend existing Pyramid Highway at Spanish Springs Road to Lemmon Drive near Military Road, and on to the Lemmon Drive/US-395/I-580 interchange
4. Pyramid Highway to I-80	Northeast Connection: Construct a connecting roadway from east of the Mustang/I-80 interchange to Pyramid Highway at Spanish Springs Road
5. Pyramid Highway to Mill Street	Construct roadway from Pyramid Highway along Marietta Way, south from Greg Street to Mill Street. Requires structure over Truckee River.
6. Sparks Boulevard to Pioneer Parkway	Southeast Connection Alternative A: Construct a roadway beginning at Sparks Boulevard, along the edge of the mountains, remaining east of the developed area of Hidden Valley Park, terminating at Pioneer Parkway. Includes a connection to Mill Street and South Meadows Parkway.
Future intersection of Mill Street/ Sparks Boulevard to Pioneer Parkway	Southeast Connection Alternative B: Construct a roadway beginning at the future intersection of Mill Street/Sparks Boulevard, parallel to Steamboat Creek south of the Truckee River, to Pioneer Parkway.
Sparks Boulevard to Pioneer Parkway or the Southeast Bypass	Southeast Connection Alternative C: Construct a connector road from Sparks Boulevard to Pioneer Parkway, or from Sparks Boulevard to the Southeast Bypass described in number 7. A Mill Street connector is possible with this alternative.
Vista/I-80 interchange to Pioneer Parkway or the Southeast Bypass	Southeast Connection Alternative D: Construct a connector roadway from the Vista/I-80 interchange at Larson Circle to Pioneer Parkway, or the Vista/I-80 interchange at Larson Circle to the Southeast Bypass described in number 7.
7. Lockwood/I-80 interchange to Pioneer Parkway near SR-341	Southeast Bypass: Construct a connector roadway from the Lockwood I-80 interchange along existing unimproved roadways, intersecting Pioneer Parkway near SR-341.
8. South McCarran Boulevard to Mount Rose Highway	Southwest Bypass: Construct a connector roadway from McCarran Boulevard to SR-431, west of Arrow Creek. Holcomb Lane Connector would connect Holcomb Lane to the Southwest Bypass, and the Foothill Road Connector would connect Foothill Road with the Southwest Bypass.
9. Mount Rose Highway to Eastlake Boulevard	Southwest Bypass Extension: Construct a connector roadway from Mount Rose Highway to Eastlake Boulevard.
10. Moana Lane to McCarran Boulevard	Extend Moana Lane under Airport north/south runways to McCarran Boulevard. Possible water table problems.
11. West Seventh Street to Fourth Street	Construct a connector roadway from the east leg of Everett Drive, near West Seventh Street to West Fourth Street, east of Summit Ridge Drive.
12. I-80 at Mae Anne Avenue Interchange	Construct a full or partial interchange along I-80 at Mae Anne Avenue.
13. Pyramid Highway Corridor Improvements (Package C)	Incorporate the preferred alternative into the *2030 RTP*.

Source: Regional Transportation Commission of Washoe County

Following RTC adoption of the *RTP*, the Storey County Commission and the Storey County RTC rejected any alignment of the Southeast Connector through their jurisdiction. The RTC Board recommended that a task force be established in the future to further study all of the new and rejected alignments considered during the formulation of the plan.

The adopted set of improvements includes substantial widening of existing freeways and relatively few new roads. As noted on the Street and Highway Plan map, "improvements identified for freeway facilities are preliminary. Ultimate improvements (lanes and limits) will be determined as part of NDOT's *Washoe County Freeway Corridor Study*."

Rather than building a large number of new roads, the *2030 RTP* also supports the substantial widening of arterials and emphasizes stringent facility access controls such as signal spacing, driveway locations, medians and restricted turn movements.

Given the locally adopted status of the street and highway element of the *2030 RTP*, the *Washoe County Freeway Corridor Study* considered the Regional Road System (non-freeway) elements of this plan to be the given background for all freeway system planning.

4.4 Freeway Reliever Route Alternatives

Prior to determining what freeway system improvements would be needed to address future year traffic demands, an analysis of key arterial roadways was undertaken to identify and evaluate the potential effectiveness of freeway congestion reliever routes.

Candidates for reliever routes would need to have direct access to the freeway system and either re-connect to the system downstream of typically congested freeway segments or create a "cutoff" to the traveler's destination, creating opportunity to avoid traditionally congested points such as the Spaghetti Bowl. Such alternate routes would primarily serve daily commuters as these drivers comprise the largest percentage of users during the congested peak periods and know the local roadway system well enough to discover and utilize alternate routes. Viable routes would be a valuable component of an ITS/freeway management system to alleviate congestion due to freeway incidents.

NDOT identified 18 collector and arterial roadway segments for evaluation as part of the *Washoe County Freeway Corridor Study*. One additional roadway (Sutro Street) was added to the evaluation list during the study. A field survey was performed to identify types of adjacent land uses, roadway configurations, right-of-way constraints, the general nature of each roadway, and most importantly, the attractiveness of the roadway as a congestion bypass route. The roadways evaluated by this study are shown in Figure 4-6, with symbology indicating their overall attractiveness as a freeway reliever route.

Figure 4-5: 2030 Regional Transportation Plan Street and Highway Plan

Source: Regional Transportation Commission of Washoe County

The RTC provided traffic volumes for the Year 2030 AM and PM peak hours. The projected volumes were developed using the RTC's travel demand traffic model and reflected implementation of the improvements (widening projects, roadway extensions, new roadway projects and alternative mode improvements) identified in the *2030 RTP*.

Each of the candidate freeway reliever routes is either an integral part of the *2030 RTP* or directly affected by improvements to nearby roadways, as identified in the plan. Therefore, consideration of each roadway as a congestion bypass route was highly dependent on the *2030 RTP* regional street and highway network and the traffic volumes assigned to the network.

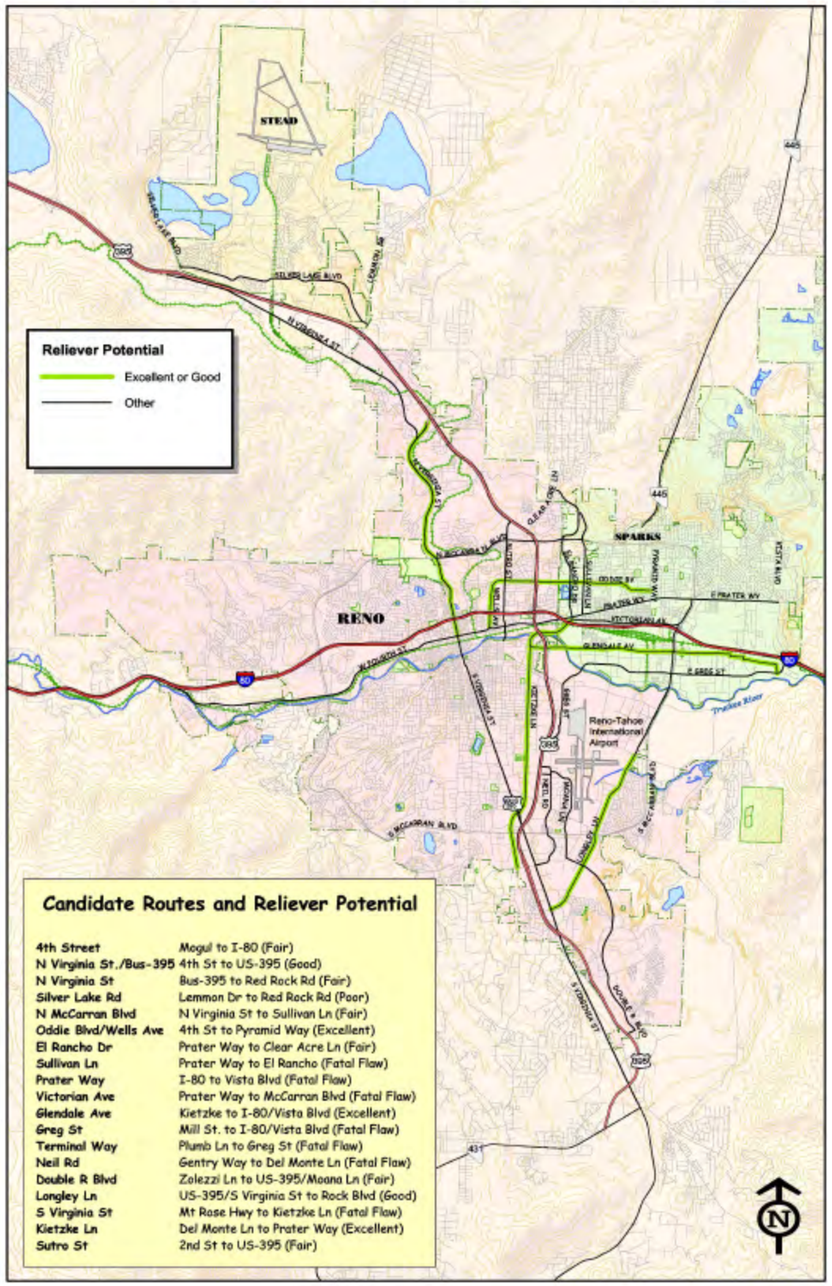
Each candidate roadway was screened against the following criteria to determine which segments could serve as effective bypass routes:

1. Would designation of the roadway as an arterial (higher traffic volumes and speeds, high access control, and increased roadway widths) be consistent with community planning goals and priorities for the subject roadway and the *2030 Regional Transportation Plan*?
2. Would the impacts on adjacent land uses and the local environment outweigh the benefits of creating a high-efficiency roadway at the subject location?
3. Does the candidate roadway location and length create a desirable link for peak hour commuters?
4. Is the roadway or could the roadway be directly connected to the freeway system to provide an immediate alternative route during congested periods on the freeway?
5. Could the roadway provide adequate vehicular capacity and high enough travel speeds to attract vehicles from the freeway system?
6. Is the roadway parallel to and well linked to the freeway system to provide detour routes during major freeway incidents?

Table 4-6 provides a summary of the initial screening process for each of the candidate roadways. Roadway segments found to have a *fatal flaw* or major constraints were not evaluated further. An overall rating of *Excellent, Good, Fair, or Poor* was given to each roadway segment advanced for further evaluation based on the specific criteria ratings.

An operational analysis was performed for the shortlisted congestion bypass routes, in accordance with the Highway Capacity Manual, using the HCS 2000 Arterial Planning Module. Calculations were performed for the base condition (no improvements beyond those identified in the *2030 RTP*) and for an upgraded condition, where widening could be undertaken to create a more attractive and efficient alternate route. A summary of the operational analysis is provided in Table 4-7.

Figure 4-6: Candidate Freeway Reliever Route Alternatives



Source: Parsons

The following paragraphs describe the potential of each of the candidate roadways as viable alternate routes to the freeway system.

Fourth Street—I-80/Mogul to I-80/US-395/I-580 (Fair)

Fourth Street's most attractive segment as an alternate route is from its west terminus at I-80 (Mogul) to Keystone Avenue. High travel speeds could be provided from I-80 to Keystone Avenue (40 mph), but would require widening of Fourth Street to a four-lane cross-section from McCarran Boulevard to west of Summit Ridge Drive, and near the Fourth Street/Mae Anne Avenue and Mayberry Drive intersections. Widening to a four-lane section east of McCarran could be a challenge, as this segment is immediately adjacent to the Truckee River and a mobile home park. Right-of-way is constrained and the roadway is designated for bicycle lanes in the *2030 RTP*. Widening at the Mae Anne Avenue and Mayberry Drive intersections could occur in conjunction with the *2030 RTP* widening project between these two intersections. The Reno Transportation Rail Access Corridor project would potentially remove the Second Street/Fourth Street intersection, providing an opportunity to permanently remove the traffic signal and further improve average travel speeds on the segment. Overall, Fourth Street from I-80 to Keystone Avenue has a *Fair* potential as an alternate route if widened to four lanes immediately east of McCarran Boulevard. There is some question, however, as to the actual need for a congestion bypass route at this location, as it is a considerable distance from downtown and I-80 can be easily widened west of the McCarran Boulevard or Keystone Avenue interchanges to accommodate forecast traffic volumes.

The downtown segment (Keystone Avenue to Sierra Street) would be even less desirable from an operational standpoint (<10 mph travel speeds). However, the City of Reno has expressed an interest in improving operations on Fourth Street to provide an alternate travel route to the downtown area. Improvement for automobile travel on the segment eastof Sierra Street would conflict with the planning of a transit corridor from Sparks to Reno on Prater Way and Fourth Street.

North Virginia Street/North Sierra Street—Fourth Street to US-395/I-580 (Good)

The segment of North Virginia Street from US-395/I-580 to North McCarran Boulevard, if widened to six lanes, would have the potential to be a high-speed alternate route (travel speeds approaching 50 mph). High speeds would be desirable on this roadway segment to counteract fairly low speeds through the University of Nevada, Reno area (travel speeds would be approximately 27 mph without widening). In order to be effective, an efficient roadway segment would also need to be created from North McCarran Boulevard to I-80 through the university area. North Virginia Street has a 25 mph posted speed through the university campus and travel is further slowed by high pedestrian volumes at many of the existing crosswalks, making this route unattractive.

Table 4-6: Initial Screening Summary

Roadway	Study Segment	Potential	Comments
Fourth Street	I-80/Mogul to I-80/US-395/I-580	Fair	Segment west of West McCarran Boulevard has low traffic demand. Segment east of Virginia Street planned for primary transit route.
North Virginia Street (Business 395)	Fourth Street to US-395/I-580	Good	Difficulty with congestion and one-way couplets south of I-80. Use North Sierra Street to avoid congested University of Nevada at Reno campus area and provide better connection to I-80.
North Virginia Street	Business 395 to Red Rock Road	Fair	Segment has low traffic demand.
Silver Lake Road	Lemmon Drive to Red Rock Road	Poor	Not attractive due to out of direction travel. North Virginia Street would be more attractive and serve the same motorists.
North McCarran Boulevard	North Virginia Street to Sullivan Lane	Fair	Segment east of El Rancho does not connect with a viable alternate route to the freeway system.
Oddie Boulevard/ Wells Avenue	Fourth Street to Pyramid Way	Excellent	Oddie has reserve capacity, but too many signalized intersections.
El Rancho Drive	Prater Way to Clear Acre Lane	Fair	Poor freeway connections, but extends reach of Kietzke Lane.
Sullivan Lane	Prater Way to El Rancho Drive	Fatal flaw	Significant impacts to neighborhoods and schools.
Prater Way	I-80/US-395/I-580 to Vista Boulevard	Fatal flaw	Very poor operations. Inconsistent with transit corridor planning for Prater Way.
Victorian Avenue	Prater Way to McCarran Boulevard	Fatal flaw	Inconsistent with Victorian Square pedestrian mall theme.
Glendale Avenue	US-395/I-580 to McCarran Boulevard/I-80	Excellent	Good freeway access and reserve capacity.
Greg Street	Mill Street to I-80/Vista Boulevard	Fatal flaw	Heavy truck traffic and numerous signals create very poor progression through the segment.
Terminal Way	Plumb Lane to Greg Street	Fatal flaw	Extreme levels of congestion south of Vassar Street.
Neil Road	Gentry Way to Del Monte Lane	Fatal flaw	Significant impact on neighborhoods and schools. Very slow travel speeds.
Double R	Zolezzi Lane to US-395/I-580/Moana Lane	Fair	Out of direction travel, not yet full constructed.
Longley Lane	US-395/I-580 to Rock Boulevard	Good	Linked with South McCarran Boulevard or Rock Boulevard to create southeast connector.
South Virginia Street (Business 395)	Mount Rose Highway to US-395/I-580/Kietzke Lane	Fatal flaw	Inconsistent with Bus Rapid Transit planned for this corridor.
Kietzke Lane	Del Monte Lane to Prater Way	Excellent	Parallels US-395/I-580 with good freeway access.
Sutro Street	Second Street to US-395/I-580	Fair	Too congested south of Oddie Boulevard.

Source: Fehr & Peers Associates, Inc.

A better long-term improvement option to complete the link to I-80 is North Sierra Street (designated as a low-access control arterial in the *2030 RTP*). North Sierra Street has sufficient right-of-way for two travel lanes in each direction, and the posted speeds are 10 mph greater than those on North Virginia Street. A short segment of Sierra Street (Ninth Street to Maple Street) would require conversion to two-way traffic, but this would provide direct freeway access to both eastbound and westbound I-80. Extension of the segment to Fourth Street would be difficult due to the presence of parking garages configured for one-way couplets and the conversion of these one-way couplets to two-way operations.

Given the aforementioned widenings and conversions to two-way operation, this link could provide an excellent bypass of the Spaghetti Bowl and numerous existing and planned interchanges on US-395/I-580. This segment received an overall rating of *Good*, even without the University of Nevada, Reno neighborhood impacts, and slow speeds in the Ninth Street/I-80 area.

North Virginia Street—Business 395 to Red Rock Road (Fair)

This roadway segment was viewed to offer *Fair* potential as an alternate route, but the usefulness of this route is questionable. Should significant levels of congestion occur north of the Stead Boulevard/US-395/I-580 interchange, consideration could be given to maintaining access control on North Virginia Street to create an efficient arterial roadway at this location when the need arises.

Silver Lake Road—Lemmon Drive to Red Rock Road (Poor)

This roadway was found to be less desirable than North Virginia Street in serving the same purpose. Travel speeds would likely be slower than North Virginia Street and greater out-of-direction travel would be incurred. Silver Lake Road was dismissed during the initial screening process.

North McCarran Boulevard—North Virginia Street to Sullivan Lane (Fair)

This portion of McCarran Boulevard received a *Fair* overall rating, since it provides a connection between two other potential alternate routes and creates a bypass of the Spaghetti Bowl. The segment from North Virginia Street to US-395/I-580 could receive a rating of *Good*, with average travel speeds around 35 mph, if three through lanes in each direction were provided from US-395/I-580 to El Rancho Drive. The 130-foot right-of-way width on McCarran Boulevard should be adequate for construction of a six-lane section with bicycle lanes. Analysis of the traffic operations on the US-395/I-580 to El Rancho Drive segment, with the existing four-lane cross-section indicates a poor level of service.

Table 4-7: Year 2030 Operational Analysis

Roadway	Segment	Length	Signals	Direction	Through Lanes	Through Volume	V/C Ratio	Travel Speed (mph)
Fourth Street	I-80/Mogul to West McCarran Boulevard	3.2	2	Eastbound	1/2	950	1.53/0.76	15/39
			2	Westbound	1/2	1250	2.0/1.0	10/37
	West McCarran Boulevard to Keystone Avenue	2.0	2	Eastbound	2	1600	0.82	40
			2	Westbound	2	1600	0.82	40
	Keystone Avenue to Sierra Avenue	0.65	5	Eastbound	2	1800	0.97	13
			5	Westbound	2	1800	0.97	13
North Virginia Street (Business 395)	US-395/I-580 to North McCarran Boulevard	2.5	2	Northbound	2/3	3000	1.28/0.86	21/49
			2	Southbound	2/3	2700	1.15/0.77	28/50
North Sierra Street	North McCarran Boulevard to I-80	1.15	3	Northbound	2	2200	1.13	13
			2	Southbound	2	2700	1.39	6
North Virginia Street	Red Rock Road to Business 395	5.8	1	Northbound	1	900	1.1	36
			1	Southbound	1	900	1.1	36
North McCarran Boulevard	North Virginia Street to US-395/I-580	1.9	4	Eastbound	2	1100	0.56	37
			5	Westbound	2	1300	0.67	32
	US-395/I-580 to El Rancho Drive	0.9	4	Eastbound	2/3	2100	1.08/0.72	11.7/25
			3	Westbound	2/3	2100	1.08/0.72	11.7/25
Oddie Boulevard/Wells Avenue	Interstate 80 to Pyramid Way	3.25	13	Eastbound	2	1200	0.62	25
			13	Westbound	2	1000	0.51	26
El Rancho Drive	Clear Acre Lane to Prater Way	2.8	6	Northbound	2	1200	0.62	30
			6	Southbound	2	1450	0.74	29
Glendale Avenue	US-395/I-580 to East McCarran Boulevard	2.35	7	Eastbound	2	1200	0.62	30
			7	Westbound	2	1400	0.72	29
	East McCarran Boulevard to Vista Boulevard	2.2	2	Eastbound	1	400	0.49	31
			2	Westbound	1	400	0.49	31
Double R Boulevard	Zolezzi Lane (Damonte Parkway) to US-395/I-580/Moana Lane	5.75	8	Northbound	3	2700	1.16	17
			8	Southbound	3`	2700	1.16	17
Longley Lane	South McCarran Boulevard to South Virginia Street	1.65	4	Northbound	2	1900	0.98	30
			4	Southbound	2	1750	0.90	32
Kietzke Lane	Prater Way to Second Street	1.1	3	Northbound	2	1700	0.87	29
			3	Southbound	2	170	0.87	29
	Second Street to Moana Lane	2.4	6	Northbound	3	3000	0.97	29
			6	Southbound	3	3000	0.97	29
	Moana Lane to Del Monte Lane	1.8	6	Northbound	2	1900	0.92	26
			6	Southbound	2	1700	0.83	27
Sutro Street	Oddie Boulevard to US-395/I-580	1.1	3	Northbound	2	1600	1.03	18
			3	Southbound	2	1600	1.03	18

Source: Fehr & Peers Associates, Inc.

Oddie Boulevard/Wells Avenue—Fourth Street (Reno) to Pyramid Way (Excellent)

The segment of Oddie Boulevard/Wells Avenue from I-80 to Pyramid Way has excellent potential to serve as an alternate route around the Spaghetti Bowl from I-80 to both US-395/I-580 and Pyramid Way. Average travel speeds through the segment are anticipated to be approximately 25 mph with considerable reserve capacity. The greatest restraint along this segment is the presence of 13 signals, so the removal of any existing signals should be considered, if possible.

El Rancho Drive—Prater Way to Clear Acre Lane (Fair)

The segment of El Rancho Drive from Clear Acre Lane to Prater Way was given a *Fair* overall rating. It has poor highway connections, but provides an extension of the Kietzke Lane arterial further north to Sun Valley. The roadway would have good operating speeds and reserve capacity, but serve a limited group of commuters. The route may be quite attractive to commuters who work near the north end of Kietzke Lane, as these drivers could use El Rancho Drive and Kietzke Lane to avoid the Spaghetti Bowl.

Sullivan Lane—I-80/US-395/I-580 to Vista Boulevard (Fatal Flaw)

Sullivan Lane is not appropriate for arterial classification, increased traffic volumes, or increased speeds due to the presence of schools, apartment complexes, and other conflicting land uses throughout the segment. These planning conflicts were determined to be a *fatal flaw* with respect to establishing an arterial roadway and no further consideration was given to the segment.

Prater Way—I-80/US-395/I-580 to Vista Boulevard (Fatal Flaw)

Although Prater Way initially appears to be a prime alternate route to I-80 through Sparks, the long-term plans for this roadway and its local street environment are a *fatal flaw* when attempting to create an efficient arterial. Prater Way is designated a primary transit corridor in the *2030 RTP* with the possibility of deploying bus rapid transit along this street. The anticipated high percentage of buses on the roadway and possible reduction in the number of travel lanes available for vehicles would directly conflict with any efforts to improve the roadway for automobile travel.

Victorian Avenue—Fourth Street/Prater Way to McCarran Boulevard (Fatal Flaw)

This roadway was dismissed during the initial screening process due to the conflicts an arterial type of roadway would have with the City of Sparks' revitalization of Victorian Avenue as a pedestrian mall environment.

Glendale Avenue—Kietzke Lane to Vista Boulevard/I-80 (Excellent)

Glendale Avenue presents an ideal opportunity to create an alternate route parallel to I-80. The west end of the street connects with Kietzke Lane and Second Street to downtown Reno, and the east end could be extended to connect with Vista Boulevard via Kleppe Lane. Interstate 80 would be accessible from five interchanges just north of Glendale Avenue. The greatest obstacles would be overcoming the lack of access management along the segment and creating a quality roadway link to Vista Boulevard. Center medians would be necessary to restrict movements from the many commercial driveways located on both sides of the roadway. To reach its full potential, Glendale Avenue would need to be protected from new signal installations (with the exception of Pyramid Way extension) and maintained at a high level of access management. Glendale Avenue was given an *excellent* overall rating with its existing four-lane cross-section.

Greg Street—Mill Street to I-80/Vista Boulevard (Fatal Flaw)

Although Greg Street parallels I-80 for over four miles, the presence of a very high percentage of heavy trucks and the low speed limit necessary to accommodate their poor acceleration rates creates adverse conditions for improving travel speeds. The roadway segment is also cluttered with traffic signals; ultimately lowering average travel speeds to the point where traffic operations on the segment would be a *fatal flaw* for a freeway congestion bypass route.

Terminal Way—Plumb Lane to Greg Street (Fatal Flaw)

A six-lane cross-section on Terminal Way from Mill Street to Vassar Street is one of the improvements identified in the *2030 RTP*. Even with a six-lane section carried south to Plumb Lane, the roadway segment would still be near capacity and travel speeds would likely be less than 10 mph. The anticipated poor progression of traffic on Terminal Way is considered a *fatal flaw* insofar as developing an efficient freeway congestion bypass route.

Neil Road—Gentry Way to Del Monte Lane (Fatal Flaw)

Neil Road has a number of characteristics that make it a poor choice for arterial classification. The roadway is not proximal to the freeway system, it has no connections to the highway, and the adjacent land uses are not compatible with an arterial roadway. The potential adverse impacts to schools, high-density housing, and adjacent neighborhoods rate this as a *fatal flaw* for congestion relief.

Double R Boulevard—Zolezzi Lane to US-395/I-580/Moana Lane (Fair)

Double R Boulevard received a *fair* overall rating. While it presents the opportunity to create a southeast connector when combined with Longley Lane, the northern segment (Longley Lane to Moana Lane) would present some out-of-direction travel. Although the southern portion would serve an already large and fast growing residential area and business parks, much of the roadway shown on the *2030 RTP* is not yet constructed.

Longley Lane—US-395/I-580/South Virginia Street to Rock Boulevard (Good)

Longley Lane, linked with South McCarran Boulevard, has the potential to provide a connector/bypass around the east side of Reno. Longley Lane is crucial in this effort, as it would provide a northbound exit from US-395/I-580 to South McCarran Boulevard without diverting traffic through the Meadowood Mall area. Longley Lane was given a *good* overall rating due to the opportunity to not only bypass the Spaghetti Bowl, but also 8.5 miles of freeway between southern Reno and Sparks. The pseudo southeast connector would be further improved by constructing grade-separated intersections at South McCarran Boulevard, Mill Street, Greg Street, and Glendale Avenue as proposed in the *2030 RTP*.

South Virginia Street—Mount Rose Highway to US-395/I-580/Kietzke Lane (Fatal Flaw)

The reconfiguration of South Virginia Street for bus rapid transit, as identified in the *2030 RTP*, eliminates the opportunity to create a high-efficiency arterial on South Virginia Street. While short portions of the roadway are designated for widening to a six-lane section additional widening for automobile use would be unlikely. The planned bus rapid transit project, therefore presents a *fatal flaw* in terms of improved automobile travel speeds on South Virginia Street and its use as a freeway reliever route.

Kietzke Lane—Del Monte Lane to Prater Way (Excellent)

Kietzke Lane stands out as an ideal alternate route to the freeway system. The roadway is adjacent to and parallels US-395/I-580 for nearly 5.5 miles of one of the currently most-congested freeway segments. Kietzke Lane also connects with Second Street/Glendale Avenue and El Rancho Drive, providing a number of choices for connecting to alternate routes. The roadway's well-spaced signals and numerous connections to US-395/I-580 earned Kietzke Lane an *excellent* overall rating. Average speeds in the Year 2030 are estimated at near 30 mph over the entire study segment, with center median islands and a well-coordinated signals system.

Sutro Street—Second Street to US-395/I-580 (Fair)

Sutro Street was added to the list of study roadways due to its ability to provide a bypass around several interchanges and the Spaghetti Bowl from the north valleys to downtown Reno. The roadway's potential is entirely dependent on the construction and alignment of the US-395/I-580/Sutro Street interchange identified in the *2030 RTP*. Sutro Street received a *fair* overall rating for the segment from US-395/I-580 to Oddie Boulevard (which connects to I-80 via Wells Avenue. This segment is somewhat hampered by the 15 mile-per-hour Hug High School speed zone just south of North McCarran Boulevard during the AM peak period. The segment south of Oddie Boulevard would not be attractive due to the presence of numerous traffic signals and the lack of connectivity to other primary arterials.

Based on the above analysis of freeway reliever route alternatives, five roadways have been identified as offering *good* to *excellent* opportunities for congestion relief. These roadways are listed below in Table 4-8. Greater use of these roadways will not obviate the need for freeway improvements on I-80 and US-395/I-580. The freeway reliever routes will instead form an integral element of the Intelligent Transportation System (ITS) incident management system response, discussed under the next alternative.

4.5 Freeway System Management Alternatives

As part of the *Washoe County Freeway Corridor Study*, a technical analysis was undertaken to evaluate freeway system management techniques for increasing vehicular throughput along the freeways, as well as reducing delays to the motoring public. Techniques addressed by this evaluation for potential inclusion as part of the freeway system improvement plan include: the installation of high-occupancy vehicle lanes; transit operations along the corridors; the provision of ramp meters; reversible lanes; and the implementation of intelligent transportation system components.

Table 4-8: Arterial Street Segments Offering Good or Excellent Freeway Congestion Relief

Arterial	Segment	Freeway Relief
North Virginia Street	US-395/I-580 to Fourth Street	US-395/I-580
Oddie Boulevard and Wells Avenue	Fourth Street to Pyramid Way	Spaghetti Bowl
Glendale Avenue	Kietzke Lane to Vista Boulevard	I-80
Longley Lane	South Virginia Street to Rock Boulevard	US-395/I-580
Kietzke Lane	Del Monte Lane to Prater Way	US-395/I-580

Source: Parsons

High Occupancy Vehicle (HOV) Lanes

HOV lanes are separate lanes that are restricted to use by vehicles occupied by two or more people, such as carpools, vanpools, and buses. Vehicles classified as being Inherently Low-Emission Vehicles (ILEV) by the Environmental Protection Agency may be permitted by the states to operate in HOV lanes with one occupant (23 U.S.C. 102(a)(2)). Motorcycles with one occupant may also be allowed in HOV lanes (23 U.S.C. 102(1)(1)). HOV lanes are generally located in or adjacent to the median along freeways.

The primary purpose of HOV lanes is to increase the total person throughput of the roadway by promoting ridesharing. Because vehicle densities in HOV lanes are generally less than on the general-purpose lanes, speeds are usually higher and more consistent. The combination of higher speeds with less delay makes HOV lanes attractive for commuters. Even though fewer vehicles use the HOV lanes per hour, the lanes carry more people per vehicle than vehicles in the general-purpose lanes. The total number of people moved along the HOV lanes may therefore be higher than along the general-purpose lanes.

In order for HOV lanes to be successful, they must meet most, if not all, of the following screening criteria:

- Congestion—the congestion levels along the freeway must be high enough that speeds during the peak travel periods are consistently 30 mph or less and high enough to create minimum trip delays of 10 to 20 minutes.
- Trip distance—trips along the HOV corridor must be long enough to attract HOV traffic. A recent study by the California Legislative Accounting Office (*HOV Lanes in California: Are They Achieving Their Goals*, January 7, 2000) concluded that the HOV lane usage declines for trips less than twenty miles in length.
- Travel destinations—HOV lanes must serve commuters who are traveling to densely developed work activity centers.
- Reliable trip time savings—a report by the National Cooperative Highway Research Program (*NCHRP Report 414—The HOV System Manual*) recommends that HOV lanes offer time savings of at least one minute per mile, with minimum time savings of five minutes and preferred time savings of at least eight minutes. This time savings must be realized on a consistent basis.
- Current HOV volumes—corridors that currently have a high percentage of carpools, vanpools, and transit will make the best candidates for HOV lanes.
- Support facilities—facilities such as park-and-ride lots, carpool (rideshare) telephone hot lines, transit hubs, ramps with HOV lane bypass, direct access ramps, and enforcement areas will also contribute to the success of HOV lanes.
- Pool of potential users—there must be a large enough pool of people who have the ability or desire to rideshare to make HOV lanes feasible. The portion of the commuter traffic that is attracted to ridesharing is generally relatively small.

A report prepared by Texas Transportation Institute (*ABCs of HOV—The Texas Experience*, September 1999) identified objectives and measures of effectiveness that are important to successfully implement and operate HOV lanes. Table 4-9 was extracted from that report.

Table 4-9: HOV Objectives and Measures of Effectiveness

HOV lanes should increase person movement.
- Does the HOV lane move a greater percentage of persons in the peak hour than the percentage of total lane capacity it represents?
- Has the peak-hour vehicle occupancy increased by 10% to 15%?
- Have new carpools increased by at least 25% due to the HOV lane?
- Has bus ridership increased at least 25% as a result of the HOV lane?

HOV lanes should enhance bus operations.
- Have peak-hour bus speeds increased by 50%?

HOV lanes should not result in an adverse impact on freeway general-purpose lane operations.
- Have general-purpose lane speeds been impacted by the HOV lane?
- Has the general-purpose lane accident rate increased significantly due to the HOV lane?

Implementation of an HOV lane should increase the overall efficiency of the roadway.
- Has the roadway per-lane efficiency increased by a value of at least 20 due to the HOV lane?

HOV lanes should be cost-effective.
- Does the value of the benefit outweigh the costs?
- Does the HOV lane have an equal or greater benefit-to-cost ratio than a general-purpose lane alternative?

HOV lanes should have public support.
- Do more than 50% of the persons responding to the surveys indicate support for HOV lane development?

HOV lanes should have favorable air quality and energy impacts.
- Has adding an HOV lane been more effective than a general-purpose lane would have been in terms of air quality and energy impacts?

Overall Assessment: Is the HOV facility effective?

Source: Texas Transportation Institute

Other factors that must be taken into consideration for implementing HOV lanes include nonrecurring delays and their effects on freeway operations. The previously referenced California Legislative Accounting Office report found that approximately 50 percent of the delays on freeways are caused by nonrecurring delays such as accidents, inoperative vehicles, and special events. Clearing accidents and inoperative vehicles as soon as possible and providing the motoring public with timely traffic information through Intelligent Transportation System (ITS) devices such as a closed circuit television (CCTV) freeway surveillance system, Dynamic Message Signs (DMS) and Highway Advisory Radio and through the use of Freeway Service Patrols may prove to be more cost-effective than implementing HOV lanes.

HOV lanes must be part of a comprehensive regional transportation plan. HOV lanes in and of themselves will not solve regional transportation problems nor relieve congestion on freeways.

The local arterial network must have the capacity to deliver and/or receive the additional volume of traffic that the freeway will be capable of accommodating if HOV lanes are added to the existing lanes on the freeway. The capacity of key local arterials may have to be increased. HOV lanes may also be added to arterials to accommodate HOVs from high-HOV areas, such as park-and-ride lots, parking facilities of large employment bases, and transit hubs.

To increase the number of carpoolers, employers may need to offer incentives to their employees, such as preferred parking spaces or reduced or eliminated parking fees for carpools. However, due to the prevalence of free employee parking in Nevada, these types of incentives may not be as effective.

Although the two-people-per-car minimum for HOV lane use is not a high occupancy, most areas that have attempted higher minimums (in general, three persons per vehicle) have had to reduce the minimum to two persons. Other areas have also implemented high-occupancy vehicle tolls, where low-occupancy vehicles can use HOV lanes by paying a toll, to increase the number of vehicles in HOV lanes.

Information presented in Chapter 2, Existing Conditions, indicates that the potential for successful HOV lane applications in Washoe County is relatively low. Data obtained from the 2000 Census indicates that the average travel time to work for Washoe County residents is 16.7 minutes for commuters traveling by means other than public transportation. Eighty percent of Washoe commuters reach their destination within 25 minutes and 91 percent travel less than 35 minutes. Due to the relatively short commute distances in the Truckee Meadows area, HOV lanes may not attract sufficient numbers of carpoolers to make HOV lanes effective.

The 2000 Census also found that 85 percent of Washoe County commuters who used a car, truck or van to travel to work drove alone, while fifteen percent carpooled. While this carpool rate matches those of several San Francisco Bay Area counties having fully developed HOV lane systems, the absolute number of carpoolers is far lower (see Table 4-10).

Table 4-10: Private Vehicle Carpoolers

County	Estimated Number of Carpoolers	Percent Carpool
Washoe	23,447	15.13
Alameda (California)	89,034	16.37
San Mateo (California)	41,666	13.76
Santa Clara (California)	111,470	14.97

Source: 2000 Census, Parsons

Transit Operations

Washoe County RTC, the operator of Citifare, currently operates the PRIDE route (Public Rural Ride) between Reno and Carson City on US-395/I-580 south of I-80 and on I-80 from Virginia/Center streets to the US-395/I-580 Interchange. The frequency of the PRIDE service is generally one trip per hour during peak commute times. In addition, a portion of Citifare Route 7 uses US-395/I-580 north of Reno from Panther Valley to the Stead interchange, Route 11X uses I-80 from Sierra/Center Streets to Pyramid Highway, and Route 18X uses I-80 from Sierra/Virginia Streets to Rock Boulevard. Citifare Routes 7 and 11X run every 30 minutes, while Route 18X runs every hour between 5:15 and 7:15 a.m. and once in the afternoon. While these transit vehicles currently operate over portions of the freeway system, the RTC perceives no current need to provide HOV lanes in the Truckee Meadows area for bus service or to use more of the freeway corridors for transit operations.

Ramp Meters

Ramp meters are traffic signals that are placed near the point where on-ramps connect to freeways. They prevent concentrated platoons of vehicles from attempting to enter the freeway traffic system at once by allowing vehicles to proceed onto the freeway only at timed intervals. Whenever a freeway is operating at high levels of congestion, a concentration of entering vehicles will cause the freeway operations to become stop-and-go. This negative effect is transmitted upstream in a wave, and the cumulative effect is that the backup never has enough time to clear between entering platoons of vehicles. Properly timed ramp meters can minimize the effect entering vehicles have on the freeway traffic flows by spacing them at timed intervals. With the use of readily available equipment, ramp meters can be traffic-responsive by automatically adjusting the meter time based on traffic volumes on the freeway and on the ramp.

To encourage ridesharing, HOV bypass lanes can be provided at the ramp meter signal. These HOV bypass lanes can be either free-flowing or metered. Metered HOV bypass lanes may be required at locations where a significant number of HOVs enter the freeway in platoons, potentially causing degraded freeway operations. Because there will typically be fewer vehicles in the HOV bypass lane, HOVs will experience less delay at the ramp meter. The HOV ramp meter can also be set at a faster meter rate to reduce the delays.

The State of Minnesota Department of Transportation completed a government-mandated study of ramp meters in the Twin Cities metropolitan area in the fall of 2000. This study was performed by deactivating all of the ramp meters on portions of I-494, I-35W, I-94, and I-35E in the metropolitan area. The baseline for this study was performed using existing fixed-time ramp meters that have the timing plans preset for different times of day. Detailed analyses were performed on the metered and unmetered scenarios on traffic volumes and throughput, travel times, travel time reliability, safety, emissions, fuel consumption, and benefits and costs. Table 4-11 summarizes those findings.

Ramp meters have been proven effective for smoothing out traffic flows on congested freeway segments. The throughput along the freeway will be improved and significant delay reductions may also be realized. Ramp metering may also reduce the number of crashes at the ramp merge point as well as upstream from the ramp.

These advantages need to be weighed against the availability of right-of-way for developing additional ramp storage capacity to accommodate traffic queues produced by the ramp meter. Traffic queue spillback onto the adjacent arterial streets must also be considered. Continued study of

Table 4-11: Minnesota Ramp Metering Study Results

Evaluation Criteria	Results of Ramp Meter Deactivation
Traffic volumes and throughput	–14%
Travel time	+25,121 hours/year
Travel time reliability (recurring delays)	+2,600,000 hours/year
Safety (crashes)	+26%
Emissions	+1,160 tons/year
Fuel consumption*	–5,500,000 gallons/year
Benefit/Cost analysis	+$40,000,000/year

Source: Minnesota DOT

* Based on slower average traffic speeds resulting from deactivation of ramp meters. Does not take into account the stop-and-go condition of traffic due to platoon arrivals from on-ramps or the smoother flow resulting from ramp metering.

the feasibility of ramp meter installation on the Washoe County Freeway System is therefore recommended during the next phase of project development.

Reversible Lanes

Reversible lanes are sometimes used in areas where there is a distinct difference in directional volumes for morning (inbound) and evening (outbound) commutes. These lanes are used to change directional capacity to accommodate peak directional (commuter) traffic demands. Reversible lanes are typically HOV lanes, but need not be.

On freeways, reverse direction traffic must be physically separated from the opposing traffic flow in the general-purpose lanes. This can be accomplished through two different systems. In the first method, permanent concrete barrier rails are placed on each side of the reversible lanes. Access to the reversible lanes is by slip ramps from the general-purpose lanes. The directional flows and slip ramp accesses are controlled by lane-control changeable message signs. In the second method, moveable (segmented and hinged) barrier rail is moved by specialized equipment twice a day from one side of the reversible lanes to the other to provide access to the lanes and separate the opposing traffic flows.

Reversible lanes are effective only where significant directional flows exist for a distance that make implementation of the lanes practical. Consideration must also be given to available space in the medians and around structure columns in the medians.

Parsons' review of the traffic volumes existing and forecast for the Truckee Meadows indicates that differences in directional traffic volumes are insufficient (less than 2000 vph) to warrant further consideration of this freeway system management alternative.

Intelligent Transportation Systems

Intelligent Transportation Systems (ITS) include a wide range of devices that are used to monitor and manage travel throughout a region. They may be implemented on both freeway and arterial networks and are typically operated from a Traffic Operations Center.

One of the key components of ITS is a comprehensive surveillance system that may include closed circuit television (CCTV) cameras and traffic detectors that monitor speeds and congestion in order to detect incidents along the routes. For minor incidents a Freeway Service Patrol may be dispatched by the Traffic Operations Center to quickly remove a disabled vehicle from the travel way. For major incidents, such as a crash, the Traffic Operations Center can dispatch emergency responders immediately.

In order to provide the traveling public with real-time information regarding incidents along their route, other ITS devices, such as dynamic message signs (DMS), highway advisory radio, and websites, can be used. Traffic that is diverted from the freeway can be guided along the arterial network and back to the freeway with trailblazer signs. The local traffic signal system can also be an integral part of the ITS by automatically adjusting signal timing to respond to increased arterial traffic due to incidents on the freeway.

NDOT recently completed the preparation of an ITS Plan for the Nevada I-80/US-395/I-580 Corridor, which includes recommendations for DMS, CCTV, and road weather information systems (RWIS) on I-80 in Reno over the next five years. In Reno, these projects are collectively referred to as the Reno Freeway Management System. The plan calls for twelve DMS signs to be mounted on overhead structures at key interchanges. Top priority would be given to the Spaghetti Bowl interchange. The estimated cost of each DMS sign is $275,000. Twenty-one CCTV cameras are also recommended for relating information on traffic conditions and incidents to the Reno Operations Center, and four additional RWIS sensors are recommended for the Reno RWIS system. Data from both the CCTV cameras and the RWIS sensors would be made available to the public on NDOT's website.

The Reno Freeway Management System has a budget of $1,000,000 per year for five years and is estimated to require an operational staff of 2.0 full-time-equivalent employees and a maintenance staff of 2.00 full-time-equivalent employees. Specific equipment locations for the recommended plan are shown on Figure 4-7.

By reducing the amount of time that freeways are blocked by non-recurring delays such as crashes and inoperative vehicles, a comprehensive ITS program is expected to provide nearly the same benefits as HOV lanes at a significantly reduced cost.

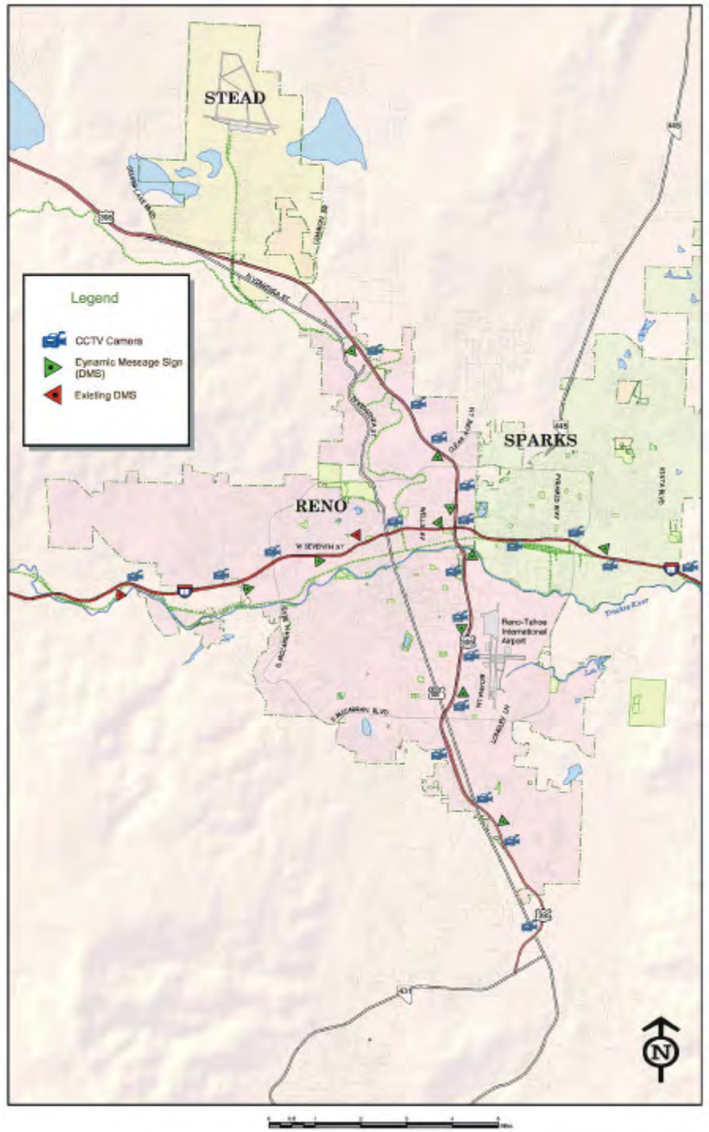
4.6 Summary of Alternatives Considered and Rejected

The purpose of the *Washoe County Freeway Corridor Study* is to identify short-, mid- and long-range transportation investments that will support existing population and projected growth. Project need is based on the inability of the existing and programmed freeway and regional road system to accommodate forecasted traffic growth through Year 2030.

This section summarizes the previously described alternatives, which were studied as part of the *Washoe County Freeway Corridor Study* and rejected because they did not meet the purpose and need for the proposed project.

- Base Case Alternative—This scenario is based on the *I-80/I-580/US-395 Spaghetti Bowl Interchange Feasibility Study*, which identified projects that have already been designed and will be completed by Fiscal Year 2005. The base case alternative was considered by the *Washoe County Freeway Corridor Study* to be the no-build condition for the Year 2030 analysis.

Figure 4-7: Reno Freeway Management System CCTV Camera Locations



Source: Intelligent Transportation System Strategic Deployment for the I-80/US-395 Corridor

CORSIM analysis found that only 50 to 90 percent of projected 2030 volumes can be accommodated by this network, forcing the remainder to surface streets.

- *2015 RTP Washoe County Freeway System Plan*—This scenario is based on the *2015 Regional Transportation Plan* and all projects programmed and anticipated for construction through the year 2015. When evaluated by the RTC under 2030 traffic conditions, this alternative was found to experience significant congestion within the loop formed by McCarran Boulevard.
- *2030 Regional Transportation Plan*—This alternative relies mainly on alternative transportation modes, TSM/TDM strategies, widening of arterials, and facility access controls. The plan made some preliminary recommendations for freeways but left final recommendations for the results of this study. *The Washoe County Freeway Corridor Study* considers the non-freeway elements of the *2030 RTP*, including the Sun Valley Connector and the Outer Ring Road, to be the given background for its freeway analysis.
- Freeway Reliever Route Alternatives—Five arterial roadways were identified by the *Washoe County Freeway Corridor Study* as offering potential for freeway congestion relief. These roadways could form a valuable component of an ITS/freeway management system that targets freeway congestion caused by incidents. However, the analysis does not assume these roads to be a significant freeway system component during a typical peak hour over and above *2030 RTP* forecasted utilization.
- Freeway System Management Alternatives—Several techniques for freeway system management were considered for implementation by the *Washoe County Freeway Corridor Study*. Two of these were determined to have potential for improving freeway operations: ramp metering and intelligent transportation systems (ITS), which would include dynamic message signs and closed-circuit television cameras. Ramp metering is considered supplemental to other freeway improvements. In order to be conservative, it was not included in the CORSIM analysis undertaken to refine the definition of the preferred alternative. The deployment of ITS components is considered to be most beneficial to freeway operations during isolated incidents rather than during a typical peak hour. High-occupancy vehicle lanes, reversible lanes, and transit operations on the freeway system were considered but dismissed from further study due to the likelihood that these measures would not significantly alleviate freeway congestion in Washoe County.

Although these alternatives include several short-term or localized solutions to projected operational deficiencies on the freeway system, none would be able to effect a long-term, system-wide improvement. Instead, they served as a foundation for the development of a comprehensive set of freeway improvements that will result in satisfactory operations (at level of service D or better) through the year 2030.

4.7 Washoe County Freeway Study Recommended Alternative

Based on the forecasted effects of the background scenarios with Year 2030 volumes in place, the study team analyzed each freeway segment and interchange ramp in the study area. A standard lane capacity for the study area was calculated by applying a peak hour factor and a heavy vehicle factor to a base capacity of 2,200 vehicles per lane per hour for four-lane segments and 2,300 vehicles per lane per hour for segments with more than four lanes. Using these capacities and peak-hour volume projections calculated as described in Chapter 3, Future Conditions, the projected lane requirement for the year 2030 was calculated for each freeway segment. This analysis estimated the number of lanes required on each section of roadway in order to achieve a volume-to-capacity ratio equivalent to a level of service D or better.

Lane requirements were projected to one-tenth lane and then rounded up or down to full lanes based on consideration of AM and PM peak-hour mainline and ramp traffic operations. Providing bi-directional balance, i.e., the same number of mainline lanes in each direction, was also taken into consideration. The resulting freeway configuration was used as the basis for an initial CORSIM analysis. The results of the first microscopic traffic analysis were then used to adjust the freeway configuration for subsequent iterations of CORSIM runs, and the process was repeated until the geometric layout and the model simulation reflected 2030 operations at level of service D or better.

In addition to the proposed improvements described in the subsequent section, a number of other planned improvements were included in the analysis of future conditions. These include:

- US-395/I-580 freeway extension south of Mt. Rose Highway;
- Sutro Street/Clear Acre Lane Interchange;
- Outer Ring Freeway System Interchange;
- Meadowood Interchange (split diamond from the Del Monte Interchange);
- 2002 Spaghetti Bowl Interchange project; and
- Truck-climbing lane on northbound US-395/I-580 north of the North McCarran Interchange.

The set of freeway improvements identified by this analysis process does not reflect constructability issues or cost/benefit ratings. Those issues are discussed in detail in Chapter 5, Cost-Benefit Analysis.

4.8 Proposed Freeway Improvements

The proposed freeway improvements can be considered in five groups, according to geographic location: the Spaghetti Bowl, West I-80, East I-80, North US-395/I-580, and South US-395/I-580. The set of freeway improvements for each location is described in the sections that follow. A phasing implementation plan for these improvements follows in Chapter 6, Implementation.

Spaghetti Bowl (See Figure 4-8)

1. Widen I-80 westbound to three lanes between the Fourth Street Interchange and the northbound US-395/I-580–to–westbound I-80 on-ramp. This widening will not require any additional right of way or modifications to existing bridge structures. The 2002 Spaghetti Bowl project will reduce the number of westbound mainline lanes from three to two, but future traffic demands will require that the third lane be restored.

2. Add a two-lane direct connector ramp from westbound I-80 to southbound US-395/I-580; this ramp will tie into the US-395/I-580 southbound mainline lanes near the beginning of the existing Glendale off-ramp and will provide a new access ramp to the Glendale Interchange. This ramp will be an extension of the ramp improvements made as part of the 2002 Spaghetti Bowl project. The existing ramp that provides access from westbound I-80 to northbound US-395/I-580 will be modified and remain in service until a future ramp is constructed.

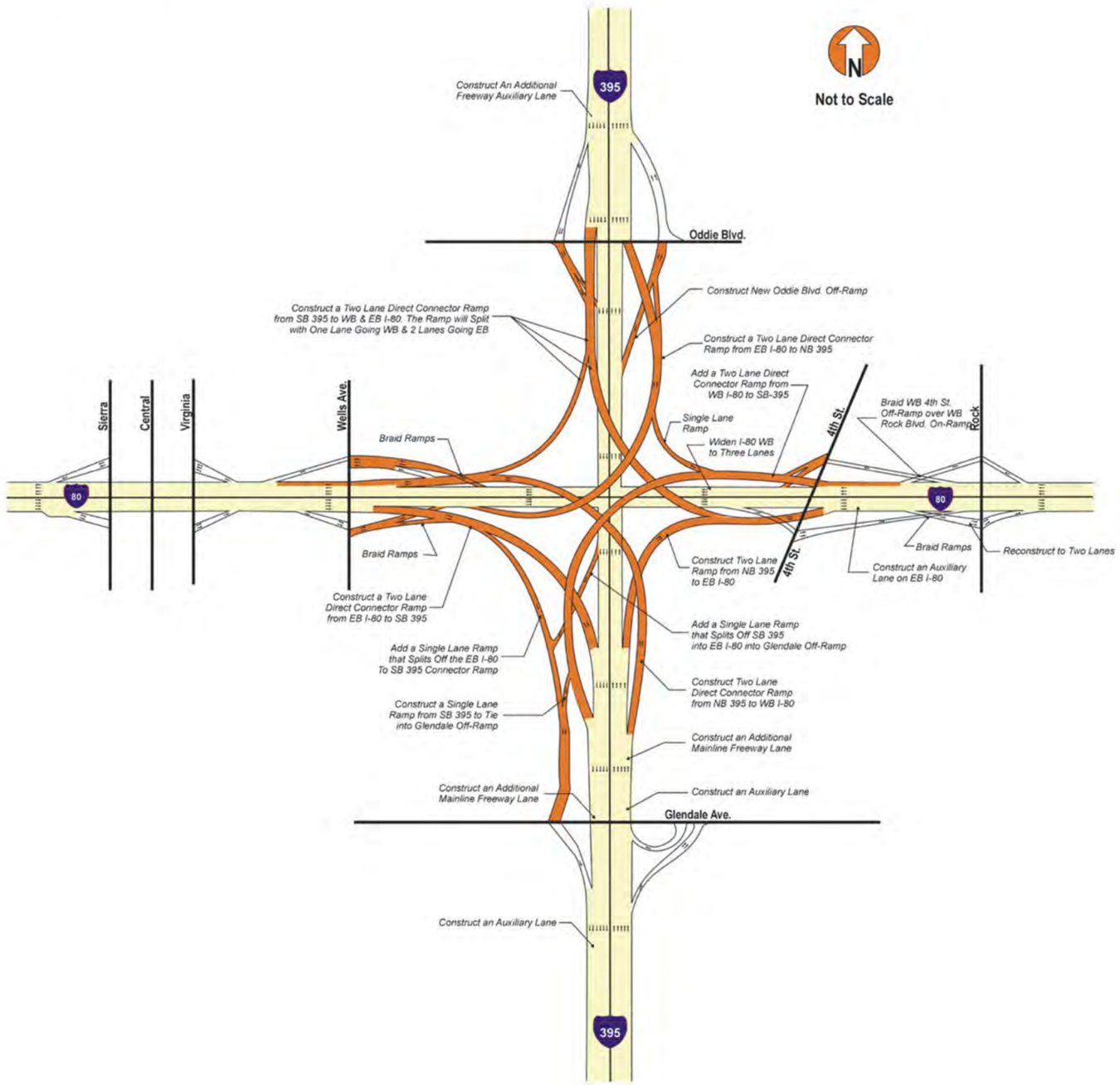
3. Construct a two-lane direct connector ramp from eastbound I-80 to southbound US-395/I-580. This ramp will tie into the new westbound I-80–to–southbound US-395/I-580 ramp and will not provide access to the Glendale Interchange.

4. Add a single-lane ramp that splits off the eastbound I-80–to–southbound US-395/I-580 direct connector ramp and ties into the southbound Glendale off-ramp.

5. Add a single-lane ramp that splits off southbound US-395/I-580 and ties into the ramp described above (Item 4).

6. Construction of the ramps described above (Items 2–5) will require the braiding of those ramps with the westbound Wells Avenue off-ramp and the eastbound Wells Avenue on-ramp. This will include the provision of two lanes on these ramps.

Figure 4-8: I-80/US-395/I-580 SPAGHETTI BOWL IMPROVEMENTS



7. Construct a single-lane ramp from the westbound I-80-to-southbound US-395/I-580 direct connector ramp to northbound US-395/I-580. Part of this ramp may be constructed as a two-lane ramp to accommodate the eastbound I-80-to-northbound US-395/I-580 direct connector ramp recommended in Item 8, below. This ramp will be required to braid over the recommended northbound off-ramp for Oddie Boulevard.

8. Construct an auxiliary freeway lane on eastbound I-80 between the northbound US-395/I-580 direct connector ramp and the braided off-ramp between the Fourth Street and Rock Boulevard Interchanges. This will also include constructing the braided ramp discussed in Item 6 and reconstructing the eastbound Rock Boulevard/Nugget Avenue off-ramp to provide two lanes.

9. Construct a two-lane direct connector ramp from eastbound I-80 to northbound US-395/I-580. This ramp will tie into the westbound I-80–to–northbound US-395/I-580 ramp recommended above (Item 6).

10. Restripe the southbound US-395/I-580 mainline freeway between the off-ramp to I-80 and the eastbound I-80 on-ramp. This lane will be dropped as part of the 2002 Spaghetti Bowl project but future traffic demand will require that it be reactivated.

11. Construct a single-lane off-ramp from southbound US-395/I-580 to tie into the single-lane ramp from eastbound I-80 (see Item 4) and provide direct access to the southbound Glendale Avenue off-ramp.

12. Construct a two-lane direct connector ramp from northbound US-395/I-580 to westbound I-80. This ramp will tie into the southbound US-395/I-580–to–westbound I-80 ramp recommended below (see Item 14). The ramp will braid over the westbound off-ramp to Wells Avenue. The westbound Wells Avenue off-ramp will be reconstructed to provide two lanes as part of direct connector ramp construction. There will be a single-lane slip ramp that will split from the direct connector ramp to allow access to Wells Avenue for US-395/I-580 traffic. In order for the direct connector ramp to operate effectively, an auxiliary lane will be needed between the ramp tie-in to I-80 and the westbound Wells Avenue on-ramp.

13. Construct a two-lane ramp from northbound US-395/I-580 to eastbound I-80. This ramp will join with the direct connector from southbound US-395/I-580 to eastbound I-80, recommended below (see Item 14). The combined ramps will braid over the eastbound Fourth Street off-ramp and tie into I-80 just east of the Fourth Street Bridge. This connection will require the eastbound Fourth Street on-ramp to be extended to the east to avoid weave problems with the ramp. The Fourth Street on-ramp will braid with the eastbound Rock Boulevard off-ramp and tie into the mainline at the west side of the Rock Boulevard Bridge.

14. Construct a two-lane direct connector ramp from southbound US-395/I-580 to eastbound and westbound I-80. The ramp will split, with one lane going to westbound I-80 and two lanes going to eastbound I-80. The ramp to eastbound I-80 will connect with the northbound-to-eastbound ramp that was recommended above (see Item 13). The ramp to westbound I-80 will tie into the direct connector ramp from northbound US-395/I-580 and will be braided over the westbound I-80 off-ramp to Wells Avenue. A ramp will be constructed from westbound I-80 to northbound US-395/I-580 and will braid over the northbound Oddie Boulevard off-ramp. This ramp will require construction of a fourth northbound freeway lane that will tie into the fourth lane constructed between the Oddie and North McCarran Interchanges.

West I-80 (See Figure 4-9)

Where possible, all future widening will take place in the median rather than along the edges of the roadway.

1. Reconstruct the westbound West McCarran Boulevard off-ramp to provide two lanes and a deceleration lane to handle traffic from the mainline freeway lanes.

2. Reconstruct the eastbound West McCarran Boulevard on-ramp to provide two lanes and an acceleration lane to merge the second lane into mainline freeway lanes.

3. Reconstruct the westbound Virginia Street off-ramp to provide two lanes to handle traffic from the mainline freeway lanes. Add a deceleration lane.

4. Reconstruct the eastbound Virginia Street on-ramp to provide two lanes to merge the second lane into mainline freeway lanes. Add an acceleration lane.

5. Construct an auxiliary freeway lane on westbound I-80 between the Keystone Avenue Interchange on-ramp and the West McCarran Boulevard Interchange off-ramp.

6. Add an additional eastbound mainline freeway lane between the on-ramp at the Robb Drive Interchange and the interchange bridge over Keystone Avenue. This will provide three eastbound mainline lanes that will start at the Robb Drive Interchange and tie into the existing three lanes at the Keystone Avenue Interchange. This widening can be made in the existing median without affecting private property or modifying existing bridge structures. This will also include the truck-climbing lane previously identified by NDOT for implementation in 2004.

7. Construct an additional eastbound mainline freeway lane between the Virginia Street Interchange off-ramp and on-ramp. This will add the fourth eastbound mainline lane within the Virginia Street Interchange and provide four mainline lanes from the Keystone Interchange on-ramp to the I-80–to–US-395/I-580 direct connector ramp (see Spaghetti Bowl Item 3).

8. Construct an additional mainline freeway lane on westbound I-80 between the Virginia Street Interchange off-ramp and on-ramp. This will add the fourth westbound mainline lane within the Virginia Street Interchange and provide four mainline lanes from the US-395/I-580 direct connector ramp (see Spaghetti Bowl Item 2) to the Keystone Avenue Interchange off-ramp.

   This widening would require 72 feet of width per NDOT standards between the columns supporting the freeway deck cover that is occupied by a pharmacy building. This includes two feet of shy distance from the barrier rail and ten feet of shoulder on each side plus four twelve-foot lanes. The available width of 66.68 feet would require sub-standard shoulders and/or travel lanes to avoid construction impacts to the building deck.

9. Construct an additional mainline freeway lane on westbound I-80 between the West McCarran Boulevard Interchange off-ramp and the Robb Drive Interchange off-ramp. This will provide for three westbound freeway lanes between the Keystone Avenue and Robb Drive interchanges.

10. Construct an auxiliary freeway lane on westbound I-80 between the Wells Avenue Interchange on-ramp and the Virginia Street Interchange off-ramp.

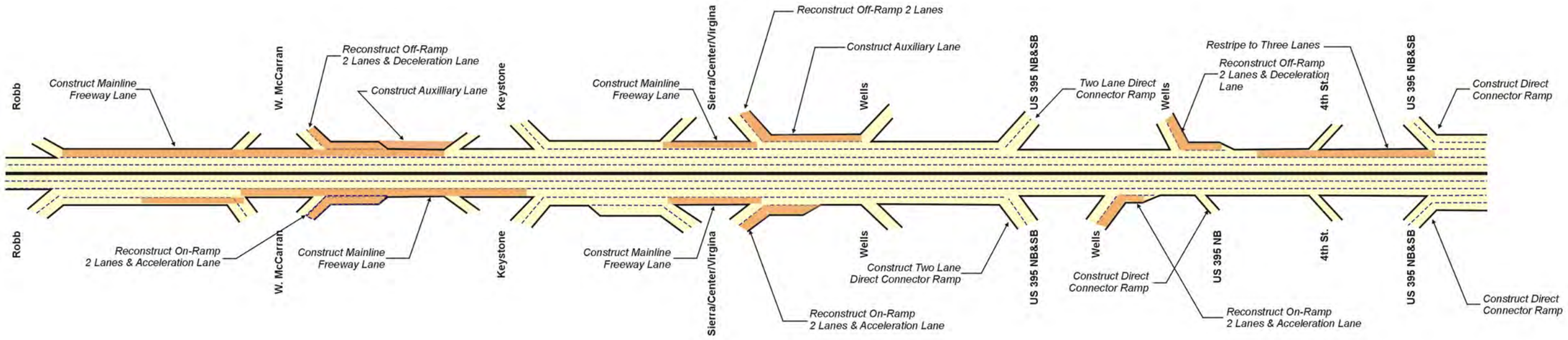
East I-80 (See Figure 4-9)

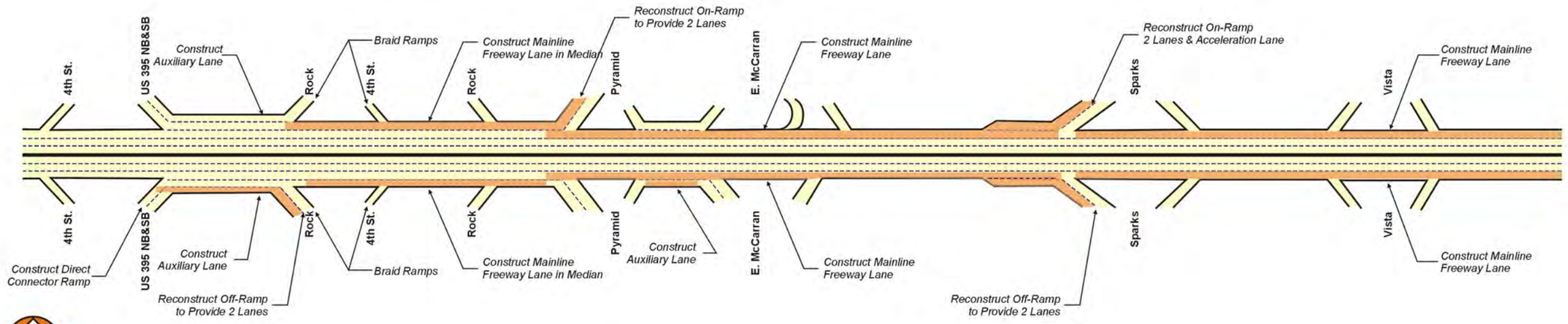
Where possible, all future widening will take place in the median rather than along the edges of the roadway.

1. Reconstruct the westbound Sparks Boulevard on-ramp to provide two lanes and an acceleration lane to merge the second lane into freeway mainline lanes.

2. Construct an additional mainline freeway lane on eastbound I-80 between the braided off-ramp (between the Fourth Street and Rock Boulevard interchanges) and the Pyramid Way Interchange off-ramp.

Figure 4-9: I-80 FREEWAY IMPROVEMENTS





3. Construct an additional mainline freeway lane on westbound I-80 between the Pyramid Way Interchange on-ramp and the Rock Boulevard Interchange on-ramp. Reconstruct the westbound Pyramid Way on-ramp to provide two lanes that will match the added freeway lane mentioned in Item 2. Due to the close proximity of the Sparks Nugget Hotel/Casino buildings on either side of I-80, the proposed eastbound and westbound freeway widening would be accomplished by constructing a new bridge segment between the existing bridge structures over the casino buildings.

4. Reconstruct the westbound Fourth Street off-ramp to braid over the westbound Rock Boulevard on-ramp in order to avoid westbound weaving problems on I-80 between the Fourth Street and Rock Boulevard Interchanges.

5. Construct an additional mainline freeway lane on eastbound I-80 between the Pyramid Way Interchange off-ramp and the Sparks Boulevard Interchange off-ramp.

6. Reconstruct the eastbound Sparks Boulevard off-ramp to provide two lanes when the additional freeway lane is added between the Pyramid Way and Sparks Boulevard Interchanges (see Item 5).

7. Construct an auxiliary freeway lane on eastbound I-80 between the Pyramid Way Interchange on-ramp and the East McCarran Boulevard Interchange off-ramp.

8. Construct an additional mainline freeway lane on westbound I-80 between the Sparks Boulevard Interchange on-ramp and the Pyramid Way Interchange on-ramp.

9. Construct an additional mainline freeway lane on eastbound I-80 from the Sparks Boulevard Interchange off-ramp to just past the Vista Boulevard Interchange. This will provide for three eastbound freeway lanes east of the Spaghetti Bowl.

10. Construct an additional mainline freeway lane on westbound I-80 from just east of the Vista Boulevard Interchange to the Sparks Boulevard Interchange on-ramp. This will provide for three westbound freeway lanes east of the Spaghetti Bowl.

    Travel forecasts for the Vista Boulevard Interchange ramps indicate the westbound off-ramp and eastbound on-ramp will need to be reconstructed to provide two lanes by 2020. The ramp volumes were based on a 50% build-out for the Reno-Tahoe Industrial Park in Storey County by 2030. Due to the uncertainty of development potential for this industrial park, it is recommended that no improvements be made to the interchange ramps pending further traffic analysis in the future.

North US-395/I-580 (See Figure 4-10)

1. Construct an additional mainline freeway lane on northbound US-395/I-580 between the North McCarran Boulevard off-ramp and the Golden Valley off-ramp. This improvement is being considered by NDOT for implementation in 2005 to address concerns about traffic delay caused by large trucks.

2. Construct a freeway auxiliary lane on northbound US-395/I-580 between the North McCarran Boulevard on-ramp and the Parr Boulevard off-ramp. This improvement may be done in 2005.

3. Construct an additional freeway auxiliary lane on northbound US-395/I-580 between the Oddie Boulevard on-ramp and the North McCarran Boulevard off-ramp.

4. Construct an additional mainline freeway lane on northbound US-395/I-580 between the Golden Valley off-ramp and the Stead Boulevard off-ramp.

5. Reconstruct the Lemmon Drive northbound off-ramp to provide two lanes and a deceleration lane from the freeway mainline lanes.

6. Reconstruct the Lemmon Drive southbound off-ramp to provide two lanes and a deceleration lane from the freeway mainline lanes.

7. Reconstruct the Lemmon Drive southbound on-ramp to provide two lanes and an acceleration lane to merge the second lane into the freeway mainline lanes.

8. Construct an additional mainline freeway lane on southbound US-395/I-580 between the Stead Boulevard on-ramp and the North McCarran Boulevard on-ramp.

9. Reconstruct the northbound Golden Valley off-ramp to provide two lanes and a deceleration lane from the mainline freeway lanes.

10. Reconstruct the southbound Golden Valley on-ramp to provide two lanes and an acceleration lane to merge the second lane into the mainline freeway lanes.

11. Reconstruct the northbound Panther Valley (North Virginia Street) on-ramp to provide two lanes and an acceleration lane to merge the second lane into the mainline freeway lanes.

12. Reconstruct the southbound Panther Valley off-ramp to provide two lanes and a deceleration lane from the mainline freeway lanes.

13. Reconstruct the southbound Panther Valley on-ramp to provide two lanes and an acceleration lane to merge the second lane into the freeway mainline lanes.

14. Construct a second freeway auxiliary lane on southbound US-395/I-580 between the North McCarran Boulevard on-ramp and the new I-80 eastbound and westbound direct connector ramp.

15. Construct an additional mainline freeway lane on northbound US-395/I-580 between the Parr Boulevard off-ramp and the Lemmon Drive off-ramp.

16. Reconstruct the northbound Parr Boulevard off-ramp to provide two lanes and a deceleration lane from the mainline freeway lanes.

17. Reconstruct the southbound Parr Boulevard off-ramp to provide two lanes and a deceleration lane from the freeway mainline lanes.

18. Construct an additional mainline freeway lane on southbound US-395/I-580 between the Lemmon Drive on-ramp and the North McCarran Boulevard on-ramp. This will create a fourth freeway mainline lane.

19. Construct an additional auxiliary freeway lane on northbound US-395/I-580 between the North McCarran Boulevard on-ramp and the proposed off-ramp for the Outer Ring Freeway. The location of the Outer Ring is assumed to be between the North McCarran Boulevard and Parr Boulevard interchanges.

20. Construct an additional mainline freeway lane on northbound US-395/I-580 between the I-80 direct connector ramp and the North McCarran Boulevard on-ramp.

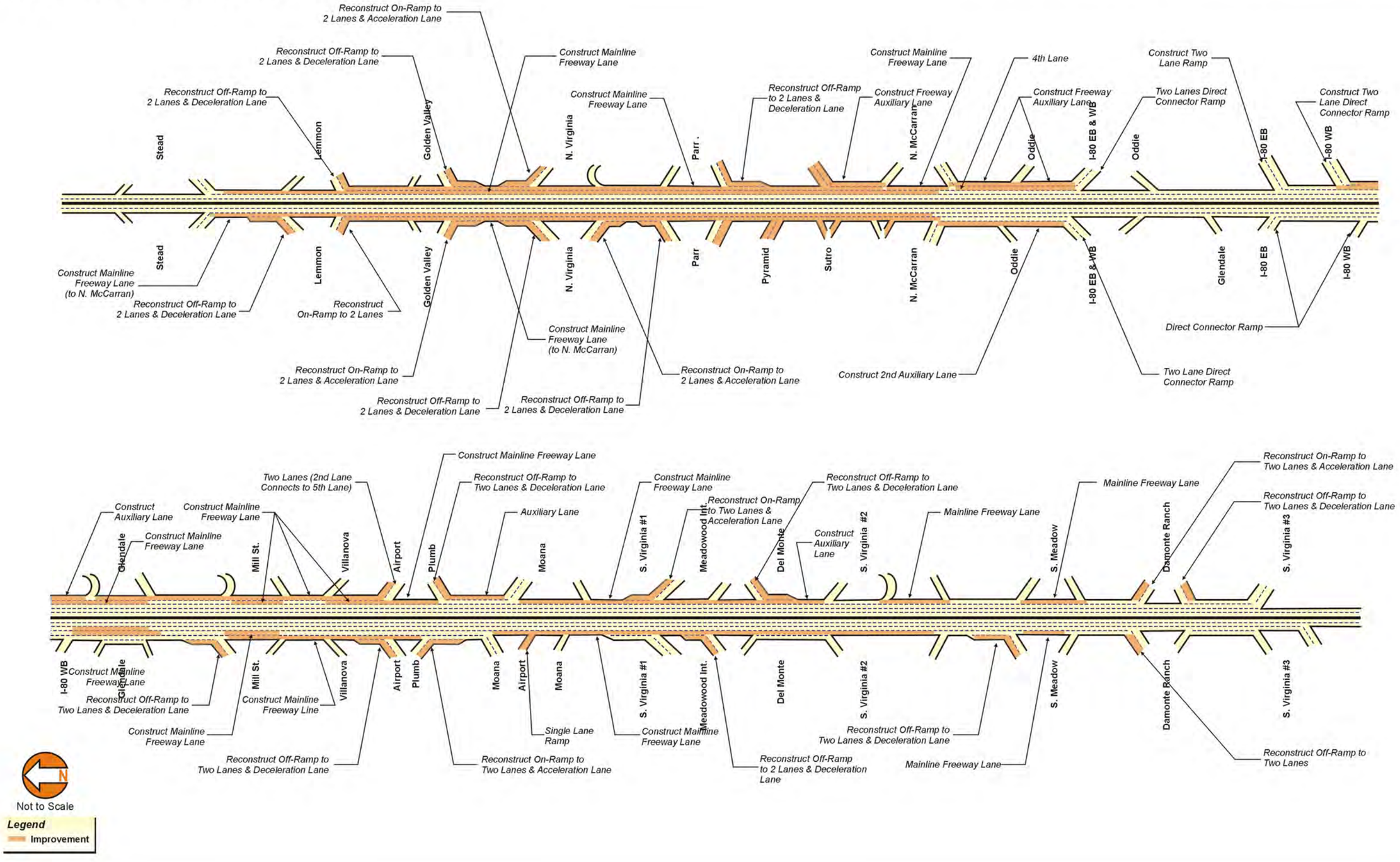
South US-395/I-580 (See Figure 4-10)

1. Construct an additional mainline freeway lane on southbound US-395/I-580 between the westbound I-80 on-ramp and the Glendale Avenue Interchange on-ramp. This will provide a continuous fourth lane on southbound US-395/I-580 from the Spaghetti Bowl to the Moana Avenue Interchange.

2. Construct an auxiliary freeway lane on southbound US-395/I-580 between the westbound I-80 on-ramp and the Glendale Avenue Interchange on-ramp.

3. Construct an additional mainline freeway lane on northbound US-395/I-580 between the Glendale Avenue off-ramp and the

Figure 4-10: US 395/I-580 FREEWAY IMPROVEMENTS



new westbound I-80 off-ramp. This will provide a continuous mainline lane to the eastbound I-80 off-ramp.

4. Construct an auxiliary freeway lane on northbound US-395/I-580 between the Glendale Avenue on-ramp and the new northbound US-395/I-580–to–westbound I-80 off-ramp.

5. Construct an additional mainline freeway lane on southbound US-395/I-580 between the Mill Street off-ramp and the Mill Street on-ramp. This will eliminate the mainline lane drop that occurs just south of the off-ramp gore.

6. Reconstruct the southbound Mill Street off-ramp to provide two lanes and a deceleration lane from the mainline freeway lanes.

7. Construct a mainline freeway lane on northbound US-395/I-580 between the Mill Street off-ramp and the Mill Street on-ramp. This will provide continuance of the previous fourth mainline lane to the Glendale off-ramp.

8. Construct a mainline freeway lane on northbound US-395/I-580 between the Plumb Lane off-ramp and the Villanova Street on-ramp. This will provide a connection of the auxiliary lanes from Moana Lane to the Mill Street off-ramp. Due to the lack of available width, this freeway widening will require the reconstruction of the southbound off-ramp into the Airport.

9. Reconstruct the northbound South Virginia Street on-ramp to provide two lanes and an acceleration lane to merge the second lane into the mainline freeway lanes.

10. Construct an auxiliary lane on northbound US-395/I-580 between the South Virginia Street on-ramp and the Del Monte Lane off-ramp.

11. Reconstruct the northbound Del Monte Lane off-ramp to provide two lanes and a deceleration lane from the mainline freeway lanes.

12. Reconstruct the southbound Del Monte Lane off-ramp to provide two lanes and a deceleration lane from the mainline freeway lanes.

13. Construct an additional mainline freeway lane on northbound US-395/I-580 between the Airport on-ramp and the Glendale Avenue on-ramp. This improvement will provide five continuous lanes from the Airport to the Spaghetti Bowl.

14. Construct an additional mainline freeway lane on southbound US-395/I-580 between the Mill Street off-ramp and the Plumb Lane on-ramp. This improvement will create five continuous lanes from the Spaghetti Bowl to Moana Lane.

15. Reconstruct the northbound Plumb Lane off-ramp to provide two lanes and a deceleration lane from the mainline freeway lanes. This ramp widening will also accommodate the northbound traffic on US-395/I-580 that is bound for the Reno/Tahoe International Airport. The airport traffic will split off the Plumb Lane off-ramp on a two-lane ramp that will bridge over Terminal Way and tie into the existing roadway that accesses the terminal building area.

16. Reconstruct the southbound Plumb Lane on-ramp to provide two lanes and an acceleration lane to merge the second lane into the mainline freeway lanes.

17. Reconstruct the northbound Airport on-ramp to provide two lanes. The second ramp lane will connect to the fifth northbound freeway lane on US-395/I-580 between this ramp and the Glendale Avenue on-ramp.

18. Reconstruct the southbound Airport off-ramp to provide two lanes and a deceleration lane from the mainline freeway lanes.

19. Construct a new single-lane ramp from the Reno/Tahoe International Airport to southbound US-395/I-580. This ramp is proposed to split from the existing Airport ramp for northbound US-395/I-580, fly over the airport southbound ramp and US-395/I-580 freeway lanes, parallel the freeway to the southbound Moana Lane off-ramp, braid over the Moana Lane ramp and tie into the freeway mainline.

20. Construct an auxiliary lane on northbound US-395/I-580 between the Moana Lane on-ramp and the Plumb Lane off-ramp.

21. Construct a mainline freeway lane on northbound US-395/I-580 between the Del Monte Lane off-ramp and the Moana Lane on-ramp.

22. Construct a mainline freeway lane on northbound US-395/I-580 between the South Virginia Street off-ramp and the South Virginia Street on-ramp.

23. Construct a mainline freeway lane on southbound US-395/I-580 between the Moana Lane off-ramp and the South Virginia Street on-ramp.

24. Construct a mainline freeway lane on northbound US-395/I-580 between the South Meadows Parkway off-ramp and the South Meadows Parkway on-ramp.

25. Construct a mainline freeway lane on southbound US-395/I-580 between the South Meadows Parkway off-ramp and the South Meadows Parkway on-ramp.

26. Reconstruct the northbound Damonte Ranch Road on-ramp to provide two lanes and an acceleration lane to merge the second lane into the freeway mainline lanes.

27. Reconstruct the northbound Damonte Ranch Road off-ramp to provide two lanes and a deceleration lane from the mainline freeway lanes.

28. Reconstruct the southbound Damonte Ranch Road off-ramp to provide two lanes and a deceleration lane from the freeway mainline lanes.

COSTS AND BENEFITS OF THE WASHOE COUNTY FREEWAY STUDY RECOMMENDED ALTERNATIVE

The recommended alternative includes widening both I-80 and US-395/I-580 to accommodate Year 2030 forecast traffic volumes at level of service D or better. A detailed description of this alternative is provided in section 4.7, Washoe County Study recommended alternative, and conceptual design drawings are provided in the appendix of this report. This chapter identifies the costs and estimated benefits associated with implementing the recommended alternative. A potential construction phasing scenario is provided in Chapter 6, Implementation.

5.1 Cost Estimates

Cost estimates were developed for each individual element of the recommended alternative. These costs include the capital cost of construction, right-of-way acquisition, and project development/ engineering expenses. The process and/or basis used to derive these costs are described below. Total freeway improvement costs, expressed in 2002 dollars, are reported in Table 5-1 as $916 million.

Construction Costs

Estimates of construction costs have been developed for improving the individual segments of the Washoe County freeway system. Costs reported in Table 5-1 are in present-year 2002 dollars. Unit costs are based on the accepted bid prices for the interim Spaghetti Bowl improvements, which are described as the base case alternative. From these bids, per lane mile or square foot costs for various roadway and structure improvements were calculated. The basis for estimating quantities is the preliminary geometric plan drawings, which are reproduced in the appendix. Cost estimate worksheets are provided in the appendix for each project listed in Table 5-1. The estimated construction costs include an allowance of 20 percent for contingencies.

Right-of-Way Costs

Preliminary right-of-way requirements were determined by comparing Nevada Department of Transportation (NDOT) as-built plans with the footprint of the recommended alternative and tax parcel boundary information collected from the Washoe County Tax Assessor's office. As a vertical profile was not prepared for the conceptual design plans, the toe of slope and right-of-way offset could only be approximated. Therefore, all right-of-way requirements are preliminary and are subject to change.

Right-of-way costs were computed from the preliminary right-of-way requirements based on the appraised value of the land parcel (minus improvements). In the case of partial land takes, a cost to acquire the entire parcel was assumed in lieu of establishing a contingency reserve. Right-of-way cost estimates are preliminary and are subject to change.

An allowance equal to seven percent (7%) of the preliminary right-of-way cost estimate was added for right-of-way appraisals, engineering, and public agency expense.

Engineering Costs

Engineering costs include the cost of professional services for preliminary engineering and environmental documents; final design plans, specifications and estimates; and construction surveys, administration and inspection. An allowance equal to 36 percent of the estimated construction cost was assumed, based on NDOT and industry experience for the recommended type of highway improvements.

5.2 Benefits Estimates

Estimates of benefits were developed for each individual element of the recommended alternative. The benefits measured include time savings, vehicle operating costs, accident reductions and improvements to air quality. These benefits were estimated for travelers using the Washoe County freeway system in lieu of traveling on other elements of the regional road system (i.e., arterial streets). To compute most of these benefits, the CORSIM traffic simulation model was used to test the performance of the recommended alternative assuming 2030 traffic demand volumes. The performance of the recommended alternative was then compared to that of the base case alternative assuming 2030 traffic demand volumes. Traffic volumes not accommodated by the base case alternative were assumed to use the arterial street system.

Shifts in time of day travel (peak spreading) were not assumed as current traffic volumes observed during the afternoon peak period are relatively consistent across a three to four hour time span, from 3:00 p.m. to 7:00 p.m. The morning peak period is shorter in duration, lasting 60 to 90 minutes between 7 a.m. and 9 a.m. at present. Based on a.m. and p.m. peak hour performance, benefits were computed for a total of six hours per day (two hours a.m. and four hours p.m.), five days per week, 52 weeks per year.

Travel time, accident, and air quality benefits were computed for the Washoe County freeway corridors rather than the overall region. Region-wide network calculations of vehicle hours of travel and vehicles miles of travel (VMT) are typically generated using a regional travel forecast model, such as that developed and maintained by the Washoe County Regional Transportation Commission (RTC). The regional model was not used for the travel time, accident, and air quality benefit/cost comparisons, because the travel demand forecasts produced by the model were adjusted using a post-processing step to improve the accuracy of the forecasts (see section 3.3, Traffic Volume Forecasts). These travel forecast adjustments were not incorporated within the regional model—hence, calculations could not be accurately performed using RTC's modeling software.

Travel time, accident, and air quality benefits were instead computed based on the traffic operational performance of the freeway alternatives, using the CORSIM software described previously. The traffic operational simulation addresses on-ramp/off-ramp weaving and merging conditions and the effects of traffic bottlenecks on speeds and throughput. Traffic volumes and speeds, and thus vehicle hours of travel, are approximated by CORSIM with a much higher degree of accuracy than is possible with traditional regional travel demand models.

While the CORSIM software is capable of modeling both freeway and adjacent arterial street networks simultaneously, the intersecting and parallel arterial street network was not coded for the Washoe County Freeway Corridor Study due to the large area served by the freeway system being studied and CORSIM's network size capacity constraints. For this reason, the change in total system VMT could not be computed using this software platform. Benefits/disbenefits associated with vehicle operating costs were therefore computed based on region-wide network calculations of VMT, undertaken by RTC for its air quality conformity determination.

Assumptions and rates specific to the individual benefit calculations are described below.

Table 5-1: Capital Cost for Recommended Alternative (2002 Dollars)

	Construction Cost	Section Total	Estimate No.
Interstate-80 Eastbound			
W. McCarran 2-Lane On Ramp	$ 1,617,093		52
Center Street 2-Lane On Ramp	$ 962,998		53
Wells Ave 2-Lane On Ramp	$ 1,322,427		54
Robb to W. Keystone	$ 39,819,654		60
Sierra Ave to Center	$ 4,055,953		61
Center Street On Ramp Accel Lane	$ 1,412,492		65
Rock On to Rock Off	$ 4,387,571		63
Pyramid to Sparks Blvd	$ 34,597,847		64
Rock Blvd 2-Lane Off Ramp	$ 960,494		66
New 4th Street On Ramp	$ 7,550,768		67
Sparks Blvd 2-Lane Off Ramp	$ 1,551,599		68
Sparks Blvd to Vista Blvd	$ 6,755,461		79
Section Total		*$ 104,994,360*	
Interstate-80 Westbound			
Wells Ave 2-Lane Off Ramp	$ 12,728,754		57
Sierra Ave 2-Lane Off Ramp	$ 2,170,137		58
W. McCarran 2-Lane Off Ramp	$ 2,332,897		59
Sparks Blvd 2-Lane On Ramp	$ 3,008,608		55
Center Street to Sierra St	$ 3,917,474		71
Keystone to W. McCarran	$ 12,065,821		72
Center Street Off Ramp Decel Lane	$ 1,016,994		75
Sparks Blvd to Pyramid	$ 46,270,918		69
Pyramid to Rock On	$ 8,111,907		70
Pyramid Ave 2-Lane On Ramp	$ 847,495		73
New 4th Street Off Ramp	$ 5,757,195		74
Wells Ave to Center Street	$ 1,723,332		77
W. McCarran to Robb Drive	$ 21,211,788		78
Vista Blvd to Sparks Blvd	$ 6,755,461		76
Section Total		*$ 127,918,783*	
US 395 Northbound			
Oddie to McCarran	$ 8,934,596		4
McCarran to Golden Valley	$ 40,272,175		5
Plumb to Villanova	$ 17,949,532		1
Mill On to Mill Off	$ 2,889,464		2
S. Virginia 2-Lane On Ramp	$ 1,597,235		6
Golden Valley to Stead	$ 31,343,393		15
New Oddie Blvd Off Ramp	$ 3,794,781		17
Panther Valley 2-Lane On Ramp	$ 2,412,620		18
Golden Valley 2-Lane Off Ramp	$ 4,505,495		19
Lemmon Valley Off-Ramp	$ 3,633,464		20
South of Del Monte to Del Monte	$ 5,016,319		12
Del Monte 2-Lane Off Ramp	$ 1,482,453		16
I-80 On Ramp to N. McCarran	$ 3,803,014		34
Parr to Lemmon	$ 38,209,481		36
Parr Blvd 2-lane Off Ramp	$ 3,813,728		41
S. Meadows Off to S. Meadows On	$ 3,255,257		29
S. Virginia Off to S. Virginia On	$ 5,183,558		30
Del Monte to Moana	$ 18,246,386		31
Moana to Plumb	$ 4,947,405		32
Airport to Glendale	$ 15,017,044		33
N McCarran to Pyramid Link	$ 6,038,151		35
Damonte Ranch 2-Lane Off ramp	$ 2,824,984		37
Damonte Ranch 2-Lane On ramp	$ 2,203,487		38
Plumb Lane 2-Lane Off Ramp	$ 3,178,070		39
Airport Connector 2-Lane On Ramp	$ 15,532,070		40
Section Total		*$ 246,084,163*	
US 395 Southbound			
Mill On To Mill Off	$ 4,788,749		7
Glendale Access	$ 23,769,346		8
I-80WB to Glendale On Ramp	$ 8,276,862		9
Mill Street 2-Lane Off Ramp	$ 590,627		11
Stead to N. McCarran	$ 58,653,476		21
N. Mc Carran to I-80 E&W	$ 6,956,942		22
Lemmon Valley 2-Lane Off Ramp	$ 2,809,321		23
Lemmon Valley 2-Lane On Ramp	$ 3,919,671		24
Golden Valley 2-Lane On Ramp	$ 2,474,878		25
Panther Valley 2-Lane Off Ramp	$ 3,491,007		26
Panther Valley 2-Lane On Ramp	$ 3,478,207		27
Del Monte 2-Lane Off Ramp	$ 2,073,546		28
Lemmon to N. McCarran	$ 41,876,076		42
Parr 2-Lane Off Ramp	$ 1,720,636		46
Mill to Plumb	$ 13,147,624		43
Moana to S. Virginia Street	$ 31,065,426		44
S. Meadows Off to S. Meadows On	$ 5,532,336		45
Airport Connector 2-Lane Off Ramp	$ 21,488,544		47
Plumb Lane 2-Lane On Ramp	$ 1,139,340		48
New Airport Connection On	$ 33,116,570		49
S. Meadows 2-Lane Off Ramp	$ 581,296		50
Damonte Ranch 2-Lane Off Ramp	$ 581,296		51
Section Total		*$ 271,531,775*	
Spaghetti Bowl - System Interchange			
US 395 On to Rock Aux Lane	$ 11,909,122		62
N-W Direct Connector	$ 30,792,615		80
N-E Ramp	$ 6,078,551		81
W-S Direct Connector	$ 17,459,732		84
E-S Ramp	$ 12,288,859		87
S-E Ramp	$ 30,425,340		82
S-W Ramp	$ 7,744,995		83
W-N Ramp	$ 3,241,481		85
E-N Ramp	$ 32,490,494		86
Glendale to I-80 West	$ 8,371,268		3
New I-80 On Ramp to Oddie	$ 2,485,925		14
Add Lane to Spaghetti Bowl	$ 489,983		10
New US 395 On to 4th Street On	$ 1,807,990		56
Section Total		*$ 165,586,354*	
	$ 916,115,435	*$ 916,115,435*	

Source: Parsons

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Travel Time Savings

Vehicle hours of travel were computed for each link in the freeway system. Traffic demand volumes not accommodated by the freeways were assumed to use parallel roadways. Freeway link travel speeds were output directly from CORSIM along with the traffic throughput processed by the facility configuration. Parallel roadway speeds were computed to average 30 mph, based on RTC's 2030 Air Quality Analysis and Conformity Determination for Washoe County. The *2030 Regional Transportation Plan (RTP)* reports that congested link speeds for the "Action Scenario" will average 34.7 mph for minor arterials and 38.1 mph for major arterials as of 2030. These link speeds do not take signalized intersection delay into account, as this refinement to state-of-the-art traffic assignment procedures was developed subsequent to RTC's model calibration.

Consistent with U.S. Department of Transportation guidance for the valuation of travel time in economic analysis, Parsons assumed local personal travel to be valued at 50 percent of the local median wage rate. Business travel by truck and bus drivers was valued at 100 percent of the mean wage for these occupations plus fringe benefits. Washoe County's mean wage for all occupations was reported by the Nevada Department of Employment, Training and Rehabilitation to be $15.50/hour for 2001, hence a value of time equal to $7.75/hour was used for local personal travel. The state reported that transportation and public utility workers residing in Washoe County earned $17.86 per hour on average in 2001. A fringe benefit rate of 50 percent of the mean wage was assumed by Parsons for bus and truck drivers, based on an equal mix of employees covered by Teamsters (55.5 percent) and other (44.5 percent) labor agreements. The corresponding value of time for these business travelers was thus estimated to be $26.79/hour.

Computation of benefits also took vehicle occupancy into account for local personnel travel. The following average daily vehicle occupancies were derived from RTC's 1990 Household Survey: 1.10 for home-based work trips, 1.43 for home-based other trips, 1.48 for home-based social/recreation trips, 1.21 for home-based school trips, 1.29 for non-home-based trips and 1.43 for home-based shop trips. Year 2000 census data indicates that vehicle occupancies for work trips have declined to 1.09 persons per vehicle. Taking this lower work trip vehicle occupancy rate into account, the average daily vehicle occupancy for all trip purposes in Washoe County is estimated to be 1.28 persons per vehicle. While this average occupancy may be lower or higher during peak periods, the average rate was assumed for the benefits calculation for lack of better data.

Table 5-2 reports the estimated benefits associated with travel time savings. The assumptions and values of time discussed above are reflected in the calculation spreadsheet. Vehicle classification data (autos and

Table 5-2: Vehicle Hours Traveled and Costs

Description	Total Vehicle Demand	Freeway Operations: Vehicles Served	Freeway Operations: Vehicles % Served	Freeway Operations: Total VHT	Freeway Operations: Avg Speed MPH	Freeway Operations: Length Miles	Arterial Diversion: Vehicles Diverted	Arterial Diversion: Avg Speed MPH	Arterial Diversion: Estimated VHT	Total VHT	Workdays	Hours In Peak	Automobiles: Percent	Automobiles: VHT	Automobiles: Avg Occup	Automobiles: Value of Time/Hr	Automobiles: Total Value of Time	Transportation (Trucks & Buses): Percent	Transportation (Trucks & Buses): VHT	Transportation (Trucks & Buses): Value of Time/Hr	Transportation (Trucks & Buses): Total Value of Time	Value of Time $	Net Benefit $
No Project - AM Peak																							
I-80																							
Vista to 4th Street Off Ramp	70851	70708	100%	327.9	60.3	4.83	171	30	0.75	328.6	260	2	0.933	306.6	1.28	$ 7.75	$ 1,475,371	0.067	22.0	$ 26.79	$ 306,672	$ 1,782,043	
4th Street On Ramp to Vista	80440	75817	94%	598.6	58.3	5.06	4623	30	48.70	645.6	260	2	0.933	602.4	1.28	$ 7.75	$ 2,899,056	0.067	43.3	$ 26.79	$ 602,600	$ 3,501,657	
Wells to Robb	55299	53985	98%	269.7	61.4	5.71	1314	30	7.77	276.3	260	2	0.926	255.9	1.28	$ 7.75	$ 1,222,215	0.074	20.4	$ 26.79	$ 284,851	$ 1,507,066	
Robb to Wells/Virginia	70798	70456	100%	376.2	60.3	5.90	342	30	1.93	377.8	260	2	0.926	349.9	1.28	$ 7.75	$ 1,671,300	0.074	28.0	$ 26.79	$ 389,516	$ 2,060,816	
US-395																							
Stead to Oddie	147206	140178	95%	479.5	54.5	6.63	7093	30	39.22	513.1	260	2	0.943	483.9	1.28	$ 7.75	$ 2,353,657	0.057	29.2	$ 26.79	$ 407,432	$ 2,761,089	
Oddie to Stead	136724	99872	73%	585.8	44.9	6.63	36852	30	222.41	776.4	260	2	0.943	732.2	1.28	$ 7.75	$ 3,561,653	0.057	44.3	$ 26.79	$ 616,544	$ 4,178,197	
Glendale to Damonte	147862	145688	99%	619.8	59.6	8.40	2243	30	15.40	633.0	260	2	0.934	591.2	1.28	$ 7.75	$ 2,848,525	0.066	41.8	$ 26.79	$ 582,011	$ 3,430,535	
Damonte to Glendale	174061	173130	99%	751.9	57.4	8.57	964	30	7.25	758.1	260	2	0.934	708.1	1.28	$ 7.75	$ 3,411,413	0.066	50.0	$ 26.79	$ 697,020	$ 4,108,433	
System Interchange Complex	334471	317143	95%	1430.3	42.2	11.50	21309	30	85.31	1503.4	260	2	0.945	1420.7	1.28	$ 7.75	$ 6,925,476	0.055	82.7	$ 26.79	$ 1,151,887	$ 8,077,362	
Total				5,440					428.74	5,812.4							$ 26,368,666				$ 5,038,534	**$ 31,407,199**	
Project - AM Peak																							
I-80																							
Vista to 4th Street Off Ramp	74936	74836	100%	335.9	62.1	5.01	103	30	0.48	336.3	260	2	0.933	313.7	1.28	$ 7.75	$ 1,509,988	0.067	22.5	$ 26.79	$ 313,867	$ 1,823,855	$ (41,812)
4th Street On Ramp to Vista	67254	67465	100%	329.1	60.3	4.89	3	30	0.01	329.2	260	2	0.933	307.1	1.28	$ 7.75	$ 1,477,998	0.067	22.1	$ 26.79	$ 307,218	$ 1,785,215	$ 1,716,441
Wells to Robb	55299	53814	97%	267.8	62.1	5.71	1485	30	8.88	275.4	260	2	0.926	255.1	1.28	$ 7.75	$ 1,218,314	0.074	20.4	$ 26.79	$ 283,942	$ 1,502,257	$ 4,810
Robb to Wells/Virginia	70798	70854	100%	372.7	61.7	5.90	26	30	0.17	372.8	260	2	0.926	345.2	1.28	$ 7.75	$ 1,649,044	0.074	27.6	$ 26.79	$ 384,329	$ 2,033,373	$ 27,443
US-395																							
Stead to Oddie	140990	140252	99%	400.0	61.0	6.63	815	30	4.48	403.8	260	2	0.943	380.8	1.28	$ 7.75	$ 1,852,331	0.057	23.0	$ 26.79	$ 320,650	$ 2,172,981	$ 588,108
Oddie to Stead	138845	138039	99%	425.0	59.9	6.63	862	30	5.78	430.0	260	2	0.943	405.5	1.28	$ 7.75	$ 1,972,378	0.057	24.5	$ 26.79	$ 341,431	$ 2,313,809	$ 1,864,388
Glendale to Damonte	147839	149660	101%	626.4	60.8	8.40	0	30	0.00	626.4	260	2	0.934	585.1	1.28	$ 7.75	$ 2,818,832	0.066	41.3	$ 26.79	$ 575,944	$ 3,394,777	$ 35,759
Damonte to Glendale	180739	180230	100%	734.9	60.9	8.73	516	30	3.29	737.7	260	2	0.934	689.0	1.28	$ 7.75	$ 3,319,600	0.066	48.7	$ 26.79	$ 678,261	$ 3,997,861	$ 110,573
System Interchange Complex	293311	290868	99%	632.6	59.3	13.28	5097	30	19.74	649.5	260	2	0.945	613.8	1.28	$ 7.75	$ 2,991,982	0.055	35.7	$ 26.79	$ 497,644	$ 3,489,627	$ 4,587,736
Total				4,124					42.83	4,161.1							$ 18,810,467				$ 3,703,287	**$ 22,513,754**	
																						AM Peak Period Benefit	***$ 8,893,445***
No Project - PM Peak																							
I-80																							
Vista to 4th Street Off Ramp	90985	70603	78%	647.4	41.3	4.83	20382	30	233.58	873.2	260	4	0.933	814.7	1.28	$ 7.75	$ 7,841,572	0.067	58.5	$ 26.79	$ 1,629,955	$ 9,471,528	
4th Street On Ramp to Vista	78587	68904	88%	542.1	58.1	5.06	9683	30	68.45	604.9	260	4	0.933	564.4	1.28	$ 7.75	$ 5,432,412	0.067	40.5	$ 26.79	$ 1,129,185	$ 6,561,597	
Wells to Robb	88278	73173	83%	574.7	59.3	5.71	15105	30	179.39	744.8	260	4	0.926	689.7	1.28	$ 7.75	$ 6,589,090	0.074	55.1	$ 26.79	$ 1,535,664	$ 8,124,755	
Robb to Wells/Virginia	56277	55951	99%	311.3	61.8	5.90	326	30	1.97	313.0	260	4	0.926	289.9	1.28	$ 7.75	$ 2,769,113	0.074	23.2	$ 26.79	$ 645,374	$ 3,414,487	
US-395																							
Stead to Oddie	170803	134817	79%	1017.5	42.7	6.63	35986	30	200.05	1189.0	260	4	0.943	1121.2	1.28	$ 7.75	$ 10,907,870	0.057	67.8	$ 26.79	$ 1,888,220	$ 12,796,090	
Oddie to Stead	183224	113787	62%	682.8	46.9	6.63	69437	30	413.57	1037.3	260	4	0.943	978.1	1.28	$ 7.75	$ 9,516,099	0.057	59.1	$ 26.79	$ 1,647,295	$ 11,163,395	
Glendale to Damonte	170666	168395	99%	993.1	55.5	8.40	2448	30	36.91	1029.3	260	4	0.934	961.4	1.28	$ 7.75	$ 9,264,010	0.066	67.9	$ 26.79	$ 1,892,824	$ 11,156,834	
Damonte to Glendale	204059	146230	72%	2569.5	13.3	8.57	8159	30	459.15	2984.5	260	4	0.934	2787.6	1.28	$ 7.75	$ 26,860,672	0.066	197.0	$ 26.79	$ 5,488,177	$ 32,348,849	
System Interchange Complex	375819	303213	81%	1900.8	41.0	11.50	78347	30	301.75	2159.4	260	4	0.945	2040.7	1.28	$ 7.75	$ 19,895,082	0.055	118.8	$ 26.79	$ 3,309,069	$ 23,204,152	
Total				9,239					1894.81	10935.5							$ 99,075,922				$ 19,165,764	**$ 118,241,686**	
Project - PM Peak																							
I-80																							
Vista to 4th Street Off Ramp	95878	96118	100%	444.4	61.7	5.01	2	30	0.00	444.4	260	4	0.933	414.6	1.28	$ 7.75	$ 3,991,024	0.067	29.8	$ 26.79	$ 829,577	$ 4,820,602	$ 4,650,926
4th Street On Ramp to Vista	64756	64518	100%	308.6	59.6	4.89	238	30	1.24	309.7	260	4	0.933	288.9	1.28	$ 7.75	$ 2,781,064	0.067	20.7	$ 26.79	$ 578,074	$ 3,359,138	$ 3,202,459
Wells to Robb	88278	87191	99%	431.3	60.5	5.71	1087	30	7.13	437.4	260	4	0.926	405.0	1.28	$ 7.75	$ 3,869,152	0.074	32.4	$ 26.79	$ 901,751	$ 4,770,903	$ 3,353,851
Robb to Wells/Virginia	56277	56400	100%	310.7	62.5	5.90	5	30	0.05	310.8	260	4	0.926	287.8	1.28	$ 7.75	$ 2,749,358	0.074	23.0	$ 26.79	$ 640,770	$ 3,390,127	$ 24,359
US-395																							
Stead to Oddie	164918	164638	100%	451.0	61.4	6.63	405	30	2.16	452.8	260	4	0.943	427.0	1.28	$ 7.75	$ 4,154,509	0.057	25.8	$ 26.79	$ 719,171	$ 4,873,680	$ 7,922,410
Oddie to Stead	178881	171682	96%	554.8	57.6	6.63	7199	30	43.15	591.7	260	4	0.943	558.0	1.28	$ 7.75	$ 5,428,812	0.057	33.7	$ 26.79	$ 939,761	$ 6,368,573	$ 4,794,822
Glendale to Damonte	170666	171240	100%	696.4	60.5	8.40	137	30	0.46	696.8	260	4	0.934	650.8	1.28	$ 7.75	$ 6,270,981	0.066	46.0	$ 26.79	$ 1,281,288	$ 7,552,269	$ 3,604,565
Damonte to Glendale	213542	211748	99%	905.1	59.3	8.73	0	30	11.34	914.8	260	4	0.934	854.4	1.28	$ 7.75	$ 8,233,129	0.066	60.4	$ 26.79	$ 1,682,194	$ 9,915,323	$ 22,433,526
System Interchange Complex	332608	329260	99%	730.3	58.5	13.28	4135	30	15.05	743.2	260	4	0.945	702.3	1.28	$ 7.75	$ 6,847,381	0.055	40.9	$ 26.79	$ 1,138,897	$ 7,986,278	$ 15,217,874
Total				4,833					80.58	4901.6							$ 44,325,409				$ 8,711,484	***$ 53,036,893***	
																						PM Peak Period Benefit	***$ 65,204,793***
																						Total Travel Time Benefit	***$ 74,098,238***

Source: Parsons

transport percents) were obtained from Table 2-4 and the discussion of future truck volumes reported in section 3-3, Traffic Volume Forecasts.

Overall, the recommended alternative provides $74 million of travel time savings annually, assuming current year dollars and Year 2030 traffic volumes. Assuming a linear, year-to-year increase in traffic volumes and the delivery of capacity enhancements as needed the recommended alternative would produce $926 million of travel time savings over a 24-year freeway improvement time period.

Crash Benefits

The frequency of accident occurrence is typically lower on freeways compared with other types of regional roads and city streets. To compute benefits associated with the recommended alternative versus the baseline alternative, the number of vehicle miles traveled over the freeway system was computed for each alternative, using the CORSIM traffic simulation model. Demand volumes not served by the freeway system were "assigned" to the arterial street system.

Rates of crash occurrences resulting in fatalities, personal injuries, and property damage only were obtained from NDOT for Year 2000. Statewide rates listed for interstate urban roadways (freeways) and urban principal arterial streets were used in the calculation of benefits. These rates are listed in Table 5-3.

Table 5-3: Nevada Crash Rates by Functional Roadway Classification (2000)

Functional Classification	P.D.O. Crash Rate	Injury Crash Rate	Fatal Crash Rate
Interstate urban	196.38	78.74	0.91
Urban other principal arterial	422.78	214.04	1.87

Source: Nevada Department of Transportation

The values of loss associated with accidents were obtained from the National Safety Council and a *1991 Urban Institute/Federal Highway Administration (FHWA) Study*, updated for use by the California Life-Cycle Benefit/Cost Analysis Model. Periodically, the National Safety Council makes estimates of the average cost of fatal and non-fatal injuries due to motor vehicle crashes. These estimates are made using a comprehensive, or willingness to pay method. These costs include economic costs such as wage and productivity losses, medical expenses, motor vehicle damage, etc.; and a value reflecting lost quality of life.

In 2000, the National Safety Council estimated the following average comprehensive costs on a per injured person basis:

Death	$3,214,290
Incapacitating Injury	$ 159,449
Non-incapacitating Evident Injury	$ 41,027
Possible Injury	$ 19,528

These per injured person costs were converted to per vehicle crash costs using formulas published in FHWA Technical Advisory T-7570 (June 30, 1988). The resulting costs per vehicle crash were computed to be the following, expressed in Year 2000 dollars:

Fatal Accident	$3,674,951
Injury Accident	$ 82,822

Property Damage Only (PDO) accident costs were computed using a cost value obtained from the California Life-Cycle Benefit/Cost Analysis Model. This model uses a value for PDO accidents estimated by the *1991 Urban Institute/FHWA Study*. The Urban Institute/FHWA calculated its estimate taking two primary factors into account:

- Unreported accidents—Automobile accident surveys indicate that roughly 40 percent to 50 percent of all PDO accidents go unreported.
- Combined property value—PDO accidents frequently involve more than one vehicle.

The value of an average non-fatal, non-injury accident was calculated primarily using records of vehicle and property damage payments made by insurance companies. Some additional cost categories, such as travel delay and lost wages, were included to make minor contributions to the final estimate.

After adjusting the Urban Institute/FHWA estimate to Year 2000 using the gross domestic product deflator, Cal-B/C derived a value of $6,850 per reported PDO accident.

These estimates of accident costs compare favorably with values used in four computerized benefit-cost models, as reported in Table 5-4.

Table 5-5 reports the estimated benefits associated with reduced accident costs. The assumptions and values of accident occurrences and costs are reflected in the calculation spreadsheet. Overall, the recommended alternative provides $12 million of accident cost savings annually, assuming current year dollars and Year 2030 traffic volumes. Assuming a linear, year-to-year increase in traffic volumes, and the delivery of capacity enhancements when needed to address traffic demands, the recommended alternative would produce $151 million of crash benefits over a 24-year freeway improvement timeframe.

Motor Vehicle Emissions and Costs

Motor vehicle emissions were calculated for the base case and recommended alternatives using estimates of vehicle miles traveled on the freeway system from the CORSIM traffic simulation model. Traffic demand volumes not accommodated by the freeway system were assumed to utilize the arterial street system.

Rates of motor vehicle emissions were obtained from RTC's most recent Air Quality and Conformity Determination, as reported in the *2030 RTP*. These rates are listed in Table 5-6 for the affected facility types, along with a description of vehicle pollution emissions monitored by RTC.

Emission rates listed in Table 5-6 were multiplied by estimates of VMT computed for two a.m. plus four p.m. peak hours, occurring 260 days per year. The resulting quantities were multiplied by the dollar values listed in Table 5-7 to calculate the health cost of motor vehicle emissions.

Values for CO, PM_{10} and NO_X emissions were obtained from research undertaken by Donald McCubbin and Mark Delucchi reported in "The Social Cost of Health Effects of Motor-Vehicle Use in the United States," as updated for use in the California Life-Cycle Benefit/Cost Analysis Model. Values reported for urban areas as a whole were used for the Washoe County Freeway Corridor Study.

Table 5-4: Accident Cost Estimates

Accident Type	CSI[1] $1993	StratBENCOST[2] $1996	STEAM[3] $1997	RailDEC[4] $1997	Washoe Co. $2000
Fatality	$3,325,095	$3,521,359	$2,726,350	$3,613,137	$3,674,451
Injury	$ 78,903	$ 83,848	$ 59,718	$ 86,033	$ 82,822
PDO	$ 5,651	$ 5,806	$ 3,322	$ 5,957	$ 6,850

[1]Cambridge Systematics, Inc. (CSI), Approaches for Developing Nationwide Estimates of congestion Delay, Accidents, Emissions, and Noise Impacts: Interim Report, 1995.
[2]NCHRP Project 2-18(3), Development of an Innovative Highway User cost Estimation Procedure. Midrange of costs reported.
[3]FHWA, Surface Transportation Efficiency Analysis Model, 1997. Total of internal and external costs.
[4]Companion to StratBENCOST which estimates the reduction in accident costs as the change in highway accidents between the base and alternative (rail) case. StratBENCOST values inflated by 2.6 percent for all accident types.

Source: California Life-Cycle Benefit/Cost Analysis Model, Technical Supplement to User's Guide and Parsons.

Table 5-5: Crash Benefits

Description	Peak Hour VMT			Workdays	Hours In Peak	Freeway				Arterial				Total				Total Cost	Net Benefit
	Freeway	Arterial	Total			Annual CMVMT	Fatal	Injury	PDO	Annual CMVMT	Fatal	Injury	PDO	Annual CMVMT	Fatal	Injury	PDO		
No Project - AM Peak						**Rates >**	**0.91**	**78.74**	**196.38**	**Rates >**	**1.87**	**214.04**	**422.78**						
I-80																			
Vista to 4th Street Off Ramp	19,717.9	22.5	19,740.4	260	2	0.103	0.09	8.07	20.14	0.0001	0.00	0.03	0.05	0.103	0.09	8.10	20.18	$ 1,152,694	
4th Street On Ramp to Vista	19,553.8	1,460.9	21,014.7	260	2	0.102	0.09	8.01	19.97	0.0076	0.01	1.63	3.21	0.109	0.11	9.63	23.18	$ 1,348,789	
Wells to Robb	16,397.7	233.0	16,630.7	260	2	0.085	0.08	6.71	16.74	0.0012	0.00	0.26	0.51	0.086	0.08	6.97	17.26	$ 989,238	
Robb to Wells/Virginia	22,645.7	58.0	22,703.7	260	2	0.118	0.11	9.27	23.13	0.0003	0.00	0.06	0.13	0.118	0.11	9.34	23.25	$ 1,328,452	
US-395																			
Stead to Oddie	24,631.6	1,176.6	25,808.2	260	2	0.128	0.12	10.09	25.15	0.0061	0.01	1.31	2.59	0.134	0.13	11.39	27.74	$ 1,604,161	
Oddie to Stead	17,900.1	6,672.3	24,572.4	260	2	0.093	0.08	7.33	18.28	0.0347	0.06	7.43	14.67	0.128	0.15	14.76	32.95	$ 1,997,483	
Glendale to Damonte	37,092.5	461.9	37,554.4	260	2	0.193	0.18	15.19	37.88	0.0024	0.00	0.51	1.02	0.195	0.18	15.70	38.89	$ 2,228,397	
Damonte to Glendale	43,508.2	217.6	43,725.8	260	2	0.226	0.21	17.81	44.43	0.0011	0.00	0.24	0.48	0.227	0.21	18.06	44.91	$ 2,567,473	
System Interchange Complex	39,528.1	2,559.4	42,087.5	260	2	0.206	0.19	16.18	40.37	0.0133	0.02	2.85	5.63	0.219	0.21	19.03	45.99	$ 2,670,274	
Total	240,975.6	12,862.3	253,837.8			1.253	1.14	98.67	246.08	0.0669	0.13	14.32	28.28	1.320	1.27	112.98	274.36	**$ 15,886,961**	
Project - AM Peak																			
I-80																			
Vista to 4th Street Off Ramp	20,454.5	14.4	20,468.9	260	2	0.106	0.10	8.38	20.89	0.0001	0.00	0.02	0.03	0.106	0.10	8.39	20.92	$ 1,194,480	$ (41,786)
4th Street On Ramp to Vista	19,806.3	14.6	19,806.5	260	2	0.103	0.09	8.11	20.23	0.0001	0.00	0.02	0.03	0.103	0.09	8.13	20.26	$ 1,156,725	$ 192,064
Wells to Robb	16,359.3	266.4	16,625.7	260	2	0.085	0.08	6.70	16.71	0.0014	0.00	0.30	0.59	0.086	0.08	6.99	17.29	$ 991,769	$ (2,531)
Robb to Wells/Virginia	22,710.1	5.0	22,715.1	260	2	0.118	0.11	9.30	23.19	0.0000	0.00	0.01	0.01	0.118	0.11	9.30	23.20	$ 1,324,625	$ 3,827
US-395																			
Stead to Oddie	24,519.6	134.5	24,654.1	260	2	0.128	0.12	10.04	25.04	0.0007	0.00	0.15	0.30	0.128	0.12	10.19	25.33	$ 1,448,631	$ 155,530
Oddie to Stead	25,427.4	173.4	25,600.8	260	2	0.132	0.12	10.41	25.97	0.0009	0.00	0.19	0.38	0.133	0.12	10.60	26.35	$ 1,507,118	$ 490,365
Glendale to Damonte	37,927.5	-	37,927.5	260	2	0.197	0.18	15.53	38.73	-	-	-	-	0.197	0.18	15.53	38.73	$ 2,211,028	$ 17,369
Damonte to Glendale	44,635.4	98.8	44,734.2	260	2	0.232	0.21	18.28	45.58	0.0005	0.00	0.11	0.22	0.233	0.21	18.39	45.80	$ 2,616,196	$ (48,723)
System Interchange Complex	37,868.4	592.3	38,460.7	260	2	0.197	0.18	15.51	38.67	0.0031	0.01	0.66	1.30	0.200	0.18	16.16	39.97	$ 2,292,273	$ 378,001
Total	249,708.5	1,299.4	250,993.5			1.298	1.18	102.24	255.00	0.0068	0.01	1.45	2.86	1.305	1.19	103.69	257.85	**$ 14,742,845**	
																		AM Peak Period Benefit	**$ 1,144,116**
No Project - PM Peak																			
I-80																			
Vista to 4th Street Off Ramp	19051.9	7007.4	26059.3	260	4	0.198	0.18	15.60	38.91	0.0729	0.14	15.60	30.81	0.271	0.32	31.20	69.72	$ 4,225,090	
4th Street On Ramp to Vista	17781.7	2053.3	19835.0	260	4	0.185	0.17	14.56	36.32	0.0214	0.04	4.57	9.03	0.206	0.21	19.13	45.34	$ 2,660,365	
Wells to Robb	20841.3	5381.7	26223.0	260	4	0.217	0.20	17.07	42.57	0.0560	0.10	11.98	23.66	0.273	0.30	29.05	66.23	$ 3,968,848	
Robb to Wells/Virginia	18938.9	59.0	18997.9	260	4	0.197	0.18	15.51	38.68	0.0006	0.00	0.13	0.26	0.198	0.18	15.64	38.94	$ 2,225,005	
US-395																			
Stead to Oddie	22866.4	6001.5	28867.9	260	4	0.238	0.22	18.73	46.70	0.0624	0.12	13.36	26.39	0.300	0.33	32.08	73.09	$ 4,382,197	
Oddie to Stead	21135.6	12407.0	33542.6	260	4	0.220	0.20	17.31	43.17	0.1290	0.24	27.62	54.55	0.349	0.44	44.93	97.72	$ 6,012,059	
Glendale to Damonte	40776.9	1107.4	41884.3	260	4	0.424	0.39	33.39	83.28	0.0115	0.02	2.47	4.87	0.436	0.41	35.86	88.15	$ 5,070,939	
Damonte to Glendale	39362.5	13774.4	53136.9	260	4	0.409	0.37	32.23	80.39	0.1433	0.27	30.66	60.56	0.553	0.64	62.90	140.96	$ 8,528,200	
System Interchange Complex	38875.9	9052.5	47928.4	260	4	0.404	0.37	31.84	79.40	0.0941	0.18	20.15	39.80	0.498	0.54	51.99	119.20	$ 7,121,208	
Total	239,631.1	56,844.2	296,475.3			2.492	2.27	196.23	489.41	0.5912	1.11	126.54	249.94	3.083	3.37	322.77	739.35	**$ 44,193,913**	
Project - PM Peak																			
I-80																			
Vista to 4th Street Off Ramp	26950.8	0.1	26950.9	260	4	0.280	0.26	22.07	55.04	0.0000	0.00	0.00	0.00	0.280	0.26	22.07	55.04	$ 3,142,294	$ 1,082,796
4th Street On Ramp to Vista	18483.7	37.2	18520.8	260	4	0.192	0.17	15.14	37.75	0.0004	0.00	0.08	0.16	0.193	0.18	15.22	37.91	$ 2,165,699	$ 494,667
Wells to Robb	26010.6	213.8	26224.4	260	4	0.271	0.25	21.30	53.12	0.0022	0.00	0.48	0.94	0.273	0.25	21.78	54.06	$ 3,093,782	$ 875,066
Robb to Wells/Virginia	19016.5	1.6	19018.1	260	4	0.198	0.18	15.57	38.84	0.0000	0.00	0.00	0.01	0.198	0.18	15.58	38.85	$ 2,217,625	$ 7,381
US-395																			
Stead to Oddie	27738.4	64.9	27803.3	260	4	0.288	0.26	22.71	56.65	0.0007	0.00	0.14	0.29	0.289	0.26	22.86	56.94	$ 3,252,655	$ 1,129,543
Oddie to Stead	32034.9	1294.6	33329.5	260	4	0.333	0.30	26.23	65.43	0.0135	0.03	2.88	5.69	0.347	0.33	29.11	71.12	$ 4,105,211	$ 1,906,849
Glendale to Damonte	32022.1	13.7	32035.8	260	4	0.333	0.30	26.22	65.40	0.0001	0.00	0.03	0.06	0.333	0.30	26.25	65.46	$ 3,737,466	$ 1,333,473
Damonte to Glendale	53993.1	340.1	54333.2	260	4	0.562	0.51	44.21	110.27	0.0035	0.01	0.76	1.50	0.565	0.52	44.97	111.77	$ 6,392,427	$ 2,135,774
System Interchange Complex	43064.3	451.5	43515.8	260	4	0.448	0.41	35.27	87.95	0.0047	0.01	1.00	1.99	0.453	0.42	36.27	89.94	$ 5,150,070	$ 1,971,138
Total	279,314.4	2,417.5	281,731.7			2.905	2.64	228.73	570.46	0.0251	0.05	5.38	10.63	2.930	2.69	234.11	581.09	**$ 33,257,227**	
																		PM Peak Period Benefit	**$ 10,936,686**
																		Total Crash Benefit	**$ 12,080,802**

Source: Parsons

Table 5-6: Vehicle Pollution Emissions*

Emission	Description	Source	Harmful Effects	Scale	Quantity Grams/VMT*	
					Arterial	Freeway
Carbon monoxide (CO)	A toxic gas that undermines blood's ability to carry oxygen	Engine	Human health, climate change	Very local	10.03	7.30
Fine particulates (PM_{10})	Inhaleable particles consisting of bits of fuel and carbon	Diesel engines and other sources	Human health, aesthetics	Local and Regional	1.12	0.12
Nitrogen oxides (NO_X)	Various compounds; some are toxic, all contribute to ozone.	Engine	Human health, ozone precursor	Regional	1.96	2.69
Hydrocarbons (HC)	Unburned fuel; forms ozone	Fuel production and engines	Human health, ozone precursor	Regional	1.33	1.11

*2030 Emissions Within Washoe County or Reno/Sparks Hydrographic Basin—No Action Scenario

Source: Regional Transportation Commission of Washoe County and Parsons

Table 5-7: Health Cost of Motor Vehicle Emissions ($/ton)

Emission		Value
Carbon monoxide	CO	$60
Fine particulates	PM_{10}	$110,258
Nitrogen oxides	NO_X	$13,646
Hydrocarbons	HC	$6,687

Values in Year 2000 dollars

Source: California Life-Cycle Benefit/Cost Analysis Model, Parsons

The health cost of hydrocarbon emissions was taken from a second source that also valued NO_X[1]. These values were indexed to the Cal-B/C values to estimate the per ton cost of hydrocarbons.

The resulting motor vehicle emissions and costs, computed for Year 2030 traffic volumes are reported in Table 5-8. As of 2030, motor vehicle emission benefits are estimated to be $8.1 million annually.

Vehicle Operating Costs

Vehicle operating costs were calculated for the base case and recommended alternatives using estimates of VMT produced by RTC's regional travel forecasting model.

For the purpose of this calculation, RTC's Year 2020 travel forecasts were utilized as the Year 2020 highway network most closely approximates the "recommended freeway alternative" described in Chapter 4, Alternative Development and Evaluation. RTC's 2030 highway network includes two non-interstate, large-scale freeway projects, the "Outer Ring Freeway" and the "West Sun Valley Freeway," which distort meaningful comparison with the base case condition.

RTC's estimates of VMT by facility type are reported in Table 5-9. This table indicates that traffic shifts from lower speed facilities to the freeway system as the later is improved. The net change in total VMT is relatively small, as would be expected given the close proximity of the metro area's trip attractions to Washoe County's freeway system.

[1]Gunnar Linberg, Benefit-Cost Analysis in a Multi-Modal Planning Process, "Exploring the Application of Benefit-Cost Methodologies to Transportation Decision Making," May 1995, Tampa.

The change in VMT by facility type reported in Table 5-9 was used to calculate the cost of fuel consumption as a function of slower average speeds. These fuel cost calculations are reported in Table 5-10 and indicate that construction of the recommended freeway improvements will save consumers approximately $2100 daily in fuel expense, assuming an average cost of gasoline at $1.45 per gallon. Annually, these savings will amount to $538,000 as of 2020, assuming that benefits accrue over 260 weekdays per year, entirely within a six-hour peak period.

Fuel cost savings will be partially offset by non-fuel expense associated with a small increase in daily VMT. This non-fuel expense is estimated to be $111 daily, equal to 650 miles at $0.1708 per mile, or $29,000 annually.

The mileage rate used in this calculation is based on those found in the STEAM model for automobiles, updated to 2000 by the Cal-B/C model, and inflated to 2002 for this investigation.

Total vehicle operating costs savings for the recommended alternative, combining fuel and non-fuel expense, is thus estimated to be $519,480 annually as of year 2020, and $890,537 annually as of year 2030, expressed in current year dollars.

5.3 Summary of Benefits

The recommended alternative will produce net savings in travel time, motor vehicle emissions, crashes, and vehicle operating expense. Collectively, these will amount to $95.2 million annually based on Year 2030 traffic volumes. These findings are summarized in Table 5-11, sorted by peak period and freeway segment.

The recommended improvements are assumed to be implemented over time so that NDOT's standard for freeway operational performance may be maintained at level of service D or better. Benefits will likewise accrue over time as traffic demand volumes increase from present day levels to those forecast for Year 2030. A measurement of life-cycle benefits, assuming a straight-line projection of traffic growth, is reported in Table 5-12. This table indicates that the highest dollar volume of benefits is produced from improvements to northbound US-395/I-580 between Damonte Ranch Road and Glendale Avenue. Improvements to the I-80/US-395/I-580 Spaghetti Bowl interchange complex also produce a high dollar volume of benefits.

One section of potential road improvements, eastbound I-80 from Robb Drive to Wells Avenue, failed to generate significant benefits. Improvements identified for this segment are intended to balance eastbound with westbound traffic lane counts rather than provide LOS D-required traffic capacity.

Benefit/Cost Comparisons

A comparison of life-cycle benefits with costs is reported in Table 5-13. This table lists benefits and costs for each section of freeway and the I-80/US-395/I-580 Spaghetti Bowl System interchange. Total benefits and costs, and the net present values of the overall system improvements, assuming a discount rate of 6 percent, are listed on the far right columns of Table 5-13.

These findings indicate the following:

1. Total benefits ($1,189,698,129) exceed total costs ($916,115,445) by $273,582,684 (Year 2002 dollars). This B/C ratio is 1.30.

Table 5-8: Motor Vehicle Emissions and Costs

Description	Hours in Peak	Workdays	Hydrocarbons Freeway	Hydrocarbons Arterial	Hydrocarbons Total	Hydrocarbons Value	Nitrogen Oxides Freeway	Nitrogen Oxides Arterial	Nitrogen Oxides Total	Nitrogen Oxides Value	Carbon Monoxide Freeway	Carbon Monoxide Arterial	Carbon Monoxide Total	Carbon Monoxide Value	Particulate Matter (PM10) Freeway	Particulate Matter (PM10) Arterial	Particulate Matter (PM10) Total	Particulate Matter (PM10) Value	Total Value	
No Project - AM Peak																				
I-80																				
Vista to 4th Street Off Ramp	2	260	21.9	0.0	21.9	$ 84,007	53.0	0.0	53.1	$ 415,228	143.9	0.2	144.2	$ 4,958	2.4	0.0	2.4	$ 151,132	$ 655,326	
4th Street On Ramp to Vista	2	260	21.7	1.9	23.6	$ 90,642	52.6	2.9	55.5	$ 433,828	142.7	14.7	157.4	$ 5,413	2.3	1.6	4.0	$ 251,706	$ 781,589	
Wells to Robb	2	260	18.2	0.3	18.5	$ 70,954	44.1	0.5	44.6	$ 348,595	119.7	2.3	122.0	$ 4,197	2.0	0.3	2.2	$ 140,853	$ 564,600	
Robb to Wells/Virginia	2	260	25.1	0.1	25.2	$ 96,645	60.9	0.1	61.0	$ 477,376	165.3	0.6	165.9	$ 5,705	2.7	0.1	2.8	$ 175,851	$ 755,578	
US-395																				
Stead to Oddie	2	260	27.3	1.6	28.9	$ 110,797	66.3	2.3	68.6	$ 536,311	179.8	11.8	191.6	$ 6,590	3.0	1.3	4.3	$ 270,094	$ 923,791	
Oddie to Stead	2	260	19.9	8.9	28.7	$ 110,173	48.2	13.1	61.2	$ 478,927	130.7	66.9	197.6	$ 6,796	2.1	7.5	9.6	$ 608,045	$ 1,203,940	
Glendale to Damonte	2	260	41.2	0.6	41.8	$ 160,170	99.8	0.9	100.7	$ 787,542	270.8	4.6	275.4	$ 9,472	4.5	0.5	5.0	$ 314,008	$ 1,271,192	
Damonte to Glendale	2	260	48.3	0.3	48.6	$ 186,221	117.0	0.4	117.5	$ 918,789	317.6	2.2	319.8	$ 10,998	5.2	0.2	5.5	$ 345,368	$ 1,461,377	
System Interchange Complex	2	260	43.9	3.4	47.3	$ 181,225	106.3	5.0	111.3	$ 870,947	288.6	25.7	314.2	$ 10,807	4.7	2.9	7.6	$ 480,947	$ 1,543,926	
Total			267.5	17.1	284.6	$ 1,090,832	648.2	25.2	673.4	$ 5,267,544	1,759.1	129.0	1,888.1	$ 64,937	28.9	14.4	43.3	$ 2,738,004	**$ 9,161,318**	
Project - AM Peak																				
I-80																				
Vista to 4th Street Off Ramp	2	260	22.7	0.0	22.7	$ 87,100	55.0	0.0	55.1	$ 430,603	149.3	0.1	149.5	$ 5,140	2.5	0.0	2.5	$ 156,147	$ 678,990	$ (23,664)
4th Street On Ramp to Vista	2	260	22.0	0.0	22.0	$ 84,343	53.3	0.0	53.3	$ 416,968	144.6	0.1	144.7	$ 4,978	2.4	0.0	2.4	$ 151,247	$ 657,536	$ 124,053
Wells to Robb	2	260	18.2	0.4	18.5	$ 70,961	44.0	0.5	44.5	$ 348,299	119.4	2.7	122.1	$ 4,199	2.0	0.3	2.3	$ 142,924	$ 566,382	$ (1,782)
Robb to Wells/Virginia	2	260	25.2	0.0	25.2	$ 96,648	61.1	0.0	61.1	$ 477,918	165.8	0.0	165.8	$ 5,703	2.7	0.0	2.7	$ 172,586	$ 752,857	$ 2,721
US-395																				
Stead to Oddie	2	260	27.2	0.2	27.4	$ 105,008	66.0	0.3	66.2	$ 517,978	179.0	1.3	180.3	$ 6,202	2.9	0.2	3.1	$ 195,478	$ 824,665	$ 99,126
Oddie to Stead	2	260	28.2	0.2	28.5	$ 109,068	68.4	0.3	68.7	$ 537,675	185.6	1.7	187.4	$ 6,444	3.1	0.2	3.2	$ 205,118	$ 858,305	$ 345,635
Glendale to Damonte	2	260	42.1	0.0	42.1	$ 161,367	102.0	-	102.0	$ 798,030	276.9	-	276.9	$ 9,522	4.6	-	4.6	$ 287,642	$ 1,256,561	$ 14,630
Damonte to Glendale	2	260	49.5	0.1	49.7	$ 190,411	120.1	0.2	120.3	$ 940,685	325.8	1.0	326.8	$ 11,240	5.4	0.1	5.5	$ 345,506	$ 1,487,843	$ (26,466)
System Interchange Complex	2	260	42.0	0.8	42.8	$ 164,136	101.9	1.2	103.0	$ 805,868	276.4	5.9	282.4	$ 9,712	4.5	0.7	5.2	$ 329,121	$ 1,308,837	$ 235,089
Total			277.2	1.7	278.9	$ 1,069,042	671.7	2.5	674.3	$ 5,274,023	1,822.9	13.0	1,835.9	$ 63,141	30.0	1.5	31.4	$ 1,985,769	**$ 8,391,975**	
																			AM Peak Period Benefit	**$ 769,343**
No Project - PM Peak																				
I-80																				
Vista to 4th Street Off Ramp	4	260	21.15	9.32	30.47	$ 233,564	51.25	13.73	64.98	$ 1,016,600	139.08	70.28	209.36	$ 14,401	2.3	7.85	10.13	$ 1,281,004	$ 2,545,569	
4th Street On Ramp to Vista	4	260	19.74	2.73	22.47	$ 172,244	47.83	4.02	51.86	$ 811,246	129.81	20.59	150.40	$ 10,345	2.1	2.30	4.43	$ 560,399	$ 1,554,235	
Wells to Robb	4	260	23.13	7.16	30.29	$ 232,215	56.06	10.55	66.61	$ 1,042,055	152.14	53.98	206.12	$ 14,178	2.5	6.03	8.53	$ 1,077,999	$ 2,366,446	
Robb to Wells/Virginia	4	260	21.02	0.08	21.10	$ 161,758	50.95	0.12	51.06	$ 798,794	138.25	0.59	138.85	$ 9,550	2.3	0.07	2.34	$ 295,619	$ 1,265,721	
US-395																				
Stead to Oddie	4	260	25.38	7.98	33.36	$ 255,766	61.51	11.76	73.27	$ 1,146,279	166.92	60.20	227.12	$ 15,622	2.7	6.72	9.47	$ 1,196,462	$ 2,614,130	
Oddie to Stead	4	260	23.46	16.50	39.96	$ 306,347	56.85	24.32	81.17	$ 1,269,848	154.29	124.44	278.73	$ 19,172	2.5	13.90	16.43	$ 2,077,020	$ 3,672,388	
Glendale to Damonte	4	260	45.26	1.47	46.74	$ 358,272	109.69	2.17	111.86	$ 1,749,924	297.67	11.11	308.78	$ 21,239	4.9	1.24	6.13	$ 775,276	$ 2,904,711	
Damonte to Glendale	4	260	43.69	18.32	62.01	$ 475,387	105.89	27.00	132.88	$ 2,078,799	287.35	138.16	425.50	$ 29,268	4.7	15.43	20.15	$ 2,547,072	$ 5,130,526	
System Interchange Complex	4	260	43.15	12.04	55.19	$ 423,102	104.58	17.74	122.32	$ 1,913,537	283.79	90.80	374.59	$ 25,766	4.7	10.14	14.80	$ 1,871,211	$ 4,233,616	
Total			266.0	75.6	341.6	$ 2,618,655	644.6	111.4	756.0	$ 11,827,082	1,749.3	570.1	2,319.5	$ 159,542	28.8	63.7	92.4	$ 11,682,062	**$ 26,287,341**	
Project - PM Peak																				
I-80																				
Vista to 4th Street Off Ramp	4	260	29.92	0.00	29.92	$ 229,333	72.50	0.00	72.50	$ 1,134,144	196.74	0.00	196.74	$ 13,533	3.2	0.00	3.23	$ 408,807	$ 1,785,817	$ 759,752
4th Street On Ramp to Vista	4	260	20.52	0.05	20.57	$ 157,662	49.72	0.07	49.79	$ 778,970	134.93	0.37	135.30	$ 9,307	2.2	0.04	2.26	$ 285,628	$ 1,231,567	$ 322,668
Wells to Robb	4	260	28.87	0.28	29.16	$ 223,511	69.97	0.42	70.39	$ 1,101,131	189.88	2.14	192.02	$ 13,208	3.1	0.24	3.36	$ 424,800	$ 1,762,650	$ 603,796
Robb to Wells/Virginia	4	260	21.11	0.00	21.11	$ 161,832	51.15	0.00	51.16	$ 800,298	138.82	0.02	138.84	$ 9,550	2.3	0.00	2.28	$ 288,663	$ 1,260,343	$ 5,378
US-395																				
Stead to Oddie	4	260	30.79	0.09	30.88	$ 236,695	74.62	0.13	74.74	$ 1,169,275	202.49	0.65	203.14	$ 13,973	3.3	0.07	3.40	$ 429,929	$ 1,849,872	$ 764,258
Oddie to Stead	4	260	35.56	1.72	37.28	$ 285,792	86.17	2.54	88.71	$ 1,387,783	233.85	12.98	246.84	$ 16,979	3.8	1.45	5.29	$ 669,175	$ 2,359,729	$ 1,312,659
Glendale to Damonte	4	260	35.54	0.02	35.56	$ 272,625	86.14	0.03	86.17	$ 1,347,972	233.76	0.14	233.90	$ 16,089	3.8	0.02	3.86	$ 487,658	$ 2,124,343	$ 780,367
Damonte to Glendale	4	260	59.93	0.45	60.38	$ 462,909	145.24	0.67	145.91	$ 2,282,559	394.15	3.41	397.56	$ 27,346	6.5	0.38	6.86	$ 867,109	$ 3,639,922	$ 1,490,604
System Interchange Complex	4	260	47.80	0.60	48.40	$ 371,048	115.84	0.88	116.73	$ 1,826,070	314.37	4.53	318.90	$ 21,935	5.2	0.51	5.67	$ 717,113	$ 2,936,167	$ 1,297,449
Total			310.0	3.2	313.3	$ 2,401,407	751.4	4.7	756.1	$ 11,828,202	2,039.0	24.2	2,063.2	$ 141,919	33.5	2.7	36.2	$ 4,578,882	**$ 18,950,410**	
																			PM Peak Period Benefit	**$ 7,336,931**
																			Total Emissions Benefit	**$ 8,106,273**

	$ / ton	$ / kg
Hydrocarbons	6,687	7.371
Nitrogen Oxides	13,646	15.042
Carbon Monoxide	60	0.066
Particulate Matter (PM10)	110,258	121.539

Source: Parsons

Table 5-9: Year 2020 Daily Vehicle Miles Traveled by Facility Type

Facility	No Action	Action	Change
Local	916,044	887,604	(28,440)
Collector	336,055	317,961	(18,094)
Minor arterial	1,510,658	1,477,664	(32,994)
Major arterial	2,733,505	2,642,396	(91,109)
Freeway	4,101,619	4,252,477	150,858
Ramps	321,077	341,506	20,429
Total	9,918,958	9,919,608	650

Source: Regional Transportation Commission of Washoe County, 2030 Region Transportation Plan, Air Quality and Conformity Determination Tables 8-11 and 8-12.

Table 5-10: Fuel Cost Savings (Recommended vs Base Alternative)

Facility	Change in VMT	Congested Speed	Fuel[1] Consumption	Fuel $/gal	Fuel Cost
Local	(28,440)	25	0.054	1.45	(2227)
Collector	(18,094)	30	0.044	1.45	(1154)
Minor arterial	(32,994)	30	0.044	1.45	(2105)
Major arterial	(91,109)	30	0.044	1.45	(5813)
Freeway	150,858	60	0.037	1.45	8094
Ramps	20,429	35	0.037	1.45	1096
					($2109)

[1]Rates from ITE Transportation Planning Handbook, 1992.

Source: Parsons

Table 5-11: Summary of Benefits* (Year 2030)

Description	Total VMT Hour	VMT Peak Period	Net Benefit Cost of Time	Net Benefit Emissions	Net Benefits Crashes	Net Benefits Veh Op Cost	Total Net Benefit
Project - AM Peak							
I-80							
Vista to 4th Street Off Ramp	20,469	40,938	$ (41,812)	$ (23,664)	$ (41,786)	$ 22,381	***$ (84,882)***
4th Street On Ramp to Vista	19,807	39,613	$ 1,716,441	$ 124,053	$ 192,064	$ 21,657	***$ 2,054,215***
Wells to Robb	16,626	33,251	$ 4,810	$ (1,782)	$ (2,531)	$ 18,179	***$ 18,675***
Robb to Wells/Virginia	22,715	45,430	$ 27,443	$ 2,721	$ 3,827	$ 24,837	***$ 58,829***
US-395							
Stead to Oddie	24,654	49,308	$ 588,108	$ 99,126	$ 155,530	$ 26,957	***$ 869,721***
Oddie to Stead	25,601	51,202	$ 1,864,388	$ 345,635	$ 490,365	$ 27,992	***$ 2,728,380***
Glendale to Damonte	37,927	75,855	$ 35,759	$ 14,630	$ 17,369	$ 41,470	***$ 109,229***
Damonte to Glendale	44,734	89,468	$ 110,573	$ (26,466)	$ (48,723)	$ 48,913	***$ 84,296***
System Interchange Complex	38,461	76,921	$ 4,587,736	$ 235,089	$ 378,001	$ 42,053	***$ 5,242,880***
AM Peak	***250,993***	***501,987***	***$ 8,893,445***	***$ 769,343***	***$ 1,144,116***	***$ 274,439***	***$ 11,081,343***
Project - PM Peak							
I-80							
Vista to 4th Street Off Ramp	26,951	107,804	$ 4,650,926	$ 759,752	$ 1,082,796	$ 58,937	***$ 6,552,411***
4th Street On Ramp to Vista	18,521	74,083	$ 3,202,459	$ 322,668	$ 494,667	$ 40,502	***$ 4,060,296***
Wells to Robb	26,224	104,898	$ 3,353,851	$ 603,796	$ 875,066	$ 57,348	***$ 4,890,062***
Robb to Wells/Virginia	19,018	76,072	$ 24,359	$ 5,378	$ 7,381	$ 41,589	***$ 78,708***
US-395							
Stead to Oddie	27,803	111,213	$ 7,922,410	$ 764,258	$ 1,129,543	$ 60,801	***$ 9,877,011***
Oddie to Stead	33,329	133,318	$ 4,794,822	$ 1,312,659	$ 1,906,849	$ 72,886	***$ 8,087,215***
Glendale to Damonte	32,036	128,143	$ 3,604,565	$ 780,367	$ 1,333,473	$ 70,057	***$ 5,788,462***
Damonte to Glendale	54,333	217,333	$ 22,433,526	$ 1,490,604	$ 2,135,774	$ 118,817	***$ 26,178,720***
System Interchange Complex	43,516	174,063	$ 15,217,874	$ 1,297,449	$ 1,971,138	$ 95,161	***$ 18,581,622***
PM Peak	***281,732***	***1,126,927***	***$ 65,204,793***	***$ 7,336,931***	***$ 10,936,686***	***$ 616,098***	***$ 84,094,507***
Total			***$ 74,098,238***	***$ 8,106,273***	***$ 12,080,802***	***$ 890,537***	***$ 95,175,850***

Source: Parsons *Values in Year 2002 dollars

Table 5-12: Life-Cycle Benefits*

	I-80				US-395					
	Vista to 4th Street Off Ramp		Wells to Robb		Stead to Oddie		Glendale to Damonte		Spaghetti Bowl	Total
Year	Westbound	Eastbound	Westbound	Eastbound	Southbound	Northbound	Southbound	Northbound	All Directions	Benefits
2007	$ 269,480	$ 254,771	$ 204,531	$ 5,731	$ 447,781	$ 450,650	$ 245,737	$ 1,094,292	$ 992,688	$ 3,965,660
2008	$ 538,961	$ 509,543	$ 409,061	$ 11,461	$ 895,561	$ 901,300	$ 491,474	$ 2,188,585	$ 1,985,375	$ 7,931,321
2009	$ 808,441	$ 764,314	$ 613,592	$ 17,192	$ 1,343,342	$ 1,351,949	$ 737,211	$ 3,282,877	$ 2,978,063	$ 11,896,981
2010	$ 1,077,922	$ 1,019,085	$ 818,123	$ 22,923	$ 1,791,122	$ 1,802,599	$ 982,949	$ 4,377,169	$ 3,970,750	$ 15,862,642
2011	$ 1,347,402	$ 1,273,856	$ 1,022,654	$ 28,653	$ 2,238,903	$ 2,253,249	$ 1,228,686	$ 5,471,462	$ 4,963,438	$ 19,828,302
2012	$ 1,616,882	$ 1,528,628	$ 1,227,184	$ 34,384	$ 2,686,683	$ 2,703,899	$ 1,474,423	$ 6,565,754	$ 5,956,125	$ 23,793,963
2013	$ 1,886,363	$ 1,783,399	$ 1,431,715	$ 40,115	$ 3,134,464	$ 3,154,549	$ 1,720,160	$ 7,660,047	$ 6,948,813	$ 27,759,623
2014	$ 2,155,843	$ 2,038,170	$ 1,636,246	$ 45,845	$ 3,582,244	$ 3,605,198	$ 1,965,897	$ 8,754,339	$ 7,941,501	$ 31,725,283
2015	$ 2,425,324	$ 2,292,941	$ 1,840,776	$ 51,576	$ 4,030,025	$ 4,055,848	$ 2,211,634	$ 9,848,631	$ 8,934,188	$ 35,690,944
2016	$ 2,694,804	$ 2,547,713	$ 2,045,307	$ 57,307	$ 4,477,805	$ 4,506,498	$ 2,457,371	$ 10,942,924	$ 9,926,876	$ 39,656,604
2017	$ 2,964,284	$ 2,802,484	$ 2,249,838	$ 63,037	$ 4,925,586	$ 4,957,148	$ 2,703,108	$ 12,037,216	$ 10,919,563	$ 43,622,265
2018	$ 3,233,765	$ 3,057,255	$ 2,454,368	$ 68,768	$ 5,373,366	$ 5,407,798	$ 2,948,846	$ 13,131,508	$ 11,912,251	$ 47,587,925
2019	$ 3,503,245	$ 3,312,027	$ 2,658,899	$ 74,499	$ 5,821,147	$ 5,858,447	$ 3,194,583	$ 14,225,801	$ 12,904,938	$ 51,553,586
2020	$ 3,772,726	$ 3,566,798	$ 2,863,430	$ 80,230	$ 6,268,927	$ 6,309,097	$ 3,440,320	$ 15,320,093	$ 13,897,626	$ 55,519,246
2021	$ 4,042,206	$ 3,821,569	$ 3,067,961	$ 85,960	$ 6,716,708	$ 6,759,747	$ 3,686,057	$ 16,414,385	$ 14,890,313	$ 59,484,906
2022	$ 4,311,686	$ 4,076,340	$ 3,272,491	$ 91,691	$ 7,164,488	$ 7,210,397	$ 3,931,794	$ 17,508,678	$ 15,883,001	$ 63,450,567
2023	$ 4,581,167	$ 4,331,112	$ 3,477,022	$ 97,422	$ 7,612,269	$ 7,661,047	$ 4,177,531	$ 18,602,970	$ 16,875,689	$ 67,416,227
2024	$ 4,850,647	$ 4,585,883	$ 3,681,553	$ 103,152	$ 8,060,049	$ 8,111,697	$ 4,423,268	$ 19,697,263	$ 17,868,376	$ 71,381,888
2025	$ 5,120,128	$ 4,840,654	$ 3,886,083	$ 108,883	$ 8,507,830	$ 8,562,346	$ 4,669,005	$ 20,791,555	$ 18,861,064	$ 75,347,548
2026	$ 5,389,608	$ 5,095,425	$ 4,090,614	$ 114,614	$ 8,955,610	$ 9,012,996	$ 4,914,743	$ 21,885,847	$ 19,853,751	$ 79,313,209
2027	$ 5,659,088	$ 5,350,197	$ 4,295,145	$ 120,344	$ 9,403,391	$ 9,463,646	$ 5,160,480	$ 22,980,140	$ 20,846,439	$ 83,278,869
2028	$ 5,928,569	$ 5,604,968	$ 4,499,675	$ 126,075	$ 9,851,171	$ 9,914,296	$ 5,406,217	$ 24,074,432	$ 21,839,126	$ 87,244,529
2029	$ 6,198,049	$ 5,859,739	$ 4,704,206	$ 131,806	$ 10,298,952	$ 10,364,946	$ 5,651,954	$ 25,168,724	$ 22,831,814	$ 91,210,190
2030	$ 6,467,530	$ 6,114,511	$ 4,908,737	$ 137,536	$ 10,746,732	$ 10,815,595	$ 5,897,691	$ 26,263,017	$ 23,824,502	$ 95,175,850
	$ 80,844,119	**$ 76,431,382**	**$ 61,359,210**	**$ 1,719,204**	**$ 134,334,156**	**$ 135,194,942**	**$ 73,721,139**	**$ 328,287,709**	**$ 297,806,269**	**$ 1,189,698,129**

Source: Parsons **Values in Year 2002 dollars*

Table 5-13: Life Cycle Benefit-Cost

Life Cycle Benefit–Cost

	I-80								US-395													
	Vista to 4th Street Off Ramp				Wells to Robb				Stead to Oddie				Glendale to Damonte				Spaghetti Bowl All Directions		Total	Total	Net Pesent	Net Present Value	Net Present Value
	Westbound		Eastbound		Westbound		Eastbound		Southbound		Northbound		Southbound		Northbound								
Year	Benefits	Costs	Benefits	Costs	Benefits	Costs	Benefits	Costs	Benefits	Costs	Benefits	Costs	Benefits	Costs	Benefits	Costs	Benefits	Costs	Benefits	Costs	Value	Benefits	Costs
2004		$ 429,801		$ -		$ 2,461,684		$ 557,503		$ -		$ 11,507,166		$ 5,346,512	0	$ 3,205,176		$ 11,041,285	$ -	$ 34,549,127	1.000	$ -	$ 34,549,127
2005		429,801		-		2,461,684		557,503		-		11,507,166		5,346,512	0	3,205,176		11,041,285	-	34,549,127	0.943	-	32,593,647
2006		429,801		-		2,461,684		557,503		-		11,507,166		5,346,512	0	3,205,176		11,041,285	-	34,549,127	0.890	-	30,748,723
2007	$ 269,480	429,801	$ 254,771	-	$ 204,531	2,461,684	$ 5,731	557,503	$ 447,781	-	$ 450,650	11,507,166	$ 245,737	5,346,512	$ 1,094,292	3,205,176	$ 992,688	11,041,285	3,965,660	34,549,127	0.840	3,329,568	29,007,447
2008	538,961	429,801	509,543	-	409,061	2,461,684	11,461	557,503	895,561	-	901,300	11,507,166	491,474	5,346,512	2,188,585	3,205,176	1,985,375	11,041,285	7,931,321	34,549,127	0.792	6,282,399	27,366,364
2009	808,441	429,801	764,314	-	613,592	2,461,684	17,192	557,503	1,343,342	-	1,351,949	11,507,166	737,211	5,346,512	3,282,877	3,205,176	2,978,063	11,041,285	11,896,981	34,549,127	0.747	8,890,614	25,818,563
2010	1,077,922	429,801	1,019,085	-	818,123	2,461,684	22,923	557,503	1,791,122	-	1,802,599	11,507,166	982,949	5,346,512	4,377,169	3,205,176	3,970,750	11,041,285	15,862,642	34,549,127	0.705	11,183,162	24,357,135
2011	1,347,402	6,098,752	1,273,856	4,904,828	1,022,654	1,700,029	28,653	4,528,810	2,238,903	8,178,350	2,253,249	1,434,636	1,228,686	207,355	5,471,462	649,877	4,963,438	5,580,686	19,828,302	33,283,323	0.665	13,187,804	22,136,738
2012	1,616,882	6,098,752	1,528,628	4,904,828	1,227,184	1,700,029	34,384	4,528,810	2,686,683	8,178,350	2,703,899	1,434,636	1,474,423	207,355	6,565,754	649,877	5,956,125	5,580,686	23,793,963	33,283,323	0.627	14,928,332	20,881,957
2013	1,886,363	6,098,752	1,783,399	4,904,828	1,431,715	1,700,029	40,115	4,528,810	3,134,464	8,178,350	3,154,549	1,434,636	1,720,160	207,355	7,660,047	649,877	6,948,813	5,580,686	27,759,623	33,283,323	0.592	16,430,921	19,700,399
2014	2,155,843	6,098,752	2,038,170	4,904,828	1,636,246	1,700,029	45,845	4,528,810	3,582,244	8,178,350	3,605,198	1,434,636	1,965,897	207,355	8,754,339	649,877	7,941,501	5,580,686	31,725,283	33,283,323	0.558	17,715,398	18,585,408
2015	2,425,324	6,098,752	2,292,941	4,904,828	1,840,776	1,700,029	51,576	4,528,810	4,030,025	8,178,350	4,055,848	1,434,636	2,211,634	207,355	9,848,631	649,877	8,934,188	5,580,686	35,690,944	33,283,323	0.527	18,801,989	17,533,655
2016	2,694,804	6,098,752	2,547,713	4,904,828	2,045,307	1,700,029	57,307	4,528,810	4,477,805	8,178,350	4,506,498	1,434,636	2,457,371	207,355	10,942,924	649,877	9,926,876	5,580,686	39,656,604	33,283,323	0.497	19,709,332	16,541,811
2017	2,964,284	6,098,752	2,802,484	4,904,828	2,249,838	1,700,029	63,037	4,528,810	4,925,586	8,178,350	4,957,148	1,434,636	2,703,108	207,355	12,037,216	649,877	10,919,563	5,580,686	43,622,265	33,283,323	0.469	20,450,118	15,603,222
2018	3,233,765	6,098,752	3,057,255	4,904,828	2,454,368	1,700,029	68,768	4,528,810	5,373,366	8,178,350	5,407,798	1,434,636	2,948,846	207,355	13,131,508	649,877	11,912,251	5,580,686	47,587,925	33,283,323	0.442	21,048,139	14,721,214
2019	3,503,245	6,098,752	3,312,027	4,904,828	2,658,899	1,700,029	74,499	4,528,810	5,821,147	8,178,350	5,858,447	1,434,636	3,194,583	207,355	14,225,801	649,877	12,904,938	5,580,686	51,553,586	33,283,323	0.417	21,513,311	13,889,131
2020	3,772,726	6,098,752	3,566,798	4,904,828	2,863,430	1,700,029	80,230	4,528,810	6,268,927	8,178,350	6,309,097	1,434,636	3,440,320	207,355	15,320,093	649,877	13,897,626	5,580,686	55,519,246	33,283,323	0.394	21,852,375	13,100,316
2021	4,042,206	675,546	3,821,569	675,546	3,067,961	2,293,512	85,960	-	6,716,708	4,359,671	6,759,747	4,582,623	3,686,057	10,665,243	16,414,385	7,642,641	14,890,313	3,249,049	59,484,906	34,143,833	0.371	22,092,694	12,681,019
2022	4,311,686	675,546	4,076,340	675,546	3,272,491	2,293,512	91,691	-	7,164,488	4,359,671	7,210,397	4,582,623	3,931,794	10,665,243	17,508,678	7,642,641	15,883,001	3,249,049	63,450,567	34,143,833	0.350	22,226,734	11,960,585
2023	4,581,167	675,546	4,331,112	675,546	3,477,022	2,293,512	97,422	-	7,612,269	4,359,671	7,661,047	4,582,623	4,177,531	10,665,243	18,602,970	7,642,641	16,875,689	3,249,049	67,416,227	34,143,833	0.331	22,281,063	11,284,537
2024	4,850,647	675,546	4,585,883	675,546	3,681,553	2,293,512	103,152	-	8,060,049	4,359,671	8,111,697	4,582,623	4,423,268	10,665,243	19,697,263	7,642,641	17,868,376	3,249,049	71,381,888	34,143,833	0.312	22,256,873	10,646,047
2025	5,120,128	675,546	4,840,654	675,546	3,886,083	2,293,512	108,883	-	8,507,830	4,359,671	8,562,346	4,582,623	4,669,005	10,665,243	20,791,555	7,642,641	18,861,064	3,249,049	75,347,548	34,143,833	0.294	22,167,249	10,045,116
2026	5,389,608	675,546	5,095,425	675,546	4,090,614	2,293,512	114,614	-	8,955,610	4,359,671	9,012,996	4,582,623	4,914,743	10,665,243	21,885,847	7,642,641	19,853,751	3,249,049	79,313,209	34,143,833	0.278	22,009,415	9,474,914
2027	5,659,088	675,546	5,350,197	675,546	4,295,145	2,293,512	120,344	-	9,403,391	4,359,671	9,463,646	4,582,623	5,160,480	10,665,243	22,980,140	7,642,641	20,846,439	3,249,049	83,278,869	34,143,833	0.262	21,802,408	8,938,855
2028	5,928,569	675,546	5,604,968	675,546	4,499,675	2,293,512	126,075	-	9,851,171	4,359,671	9,914,296	4,582,623	5,406,217	10,665,243	24,074,432	7,642,641	21,839,126	3,249,049	87,244,529	34,143,833	0.247	21,549,399	8,433,527
2029	6,198,049	675,546	5,859,739	675,546	4,704,206	2,293,512	131,806	-	10,298,952	4,359,671	10,364,946	4,582,623	5,651,954	10,665,243	25,168,724	7,642,641	22,831,814	3,249,049	91,210,190	34,143,833	0.233	21,251,974	7,955,513
2030	$ 6,467,530	$ 675,546	$ 6,114,511	$ 675,546	$ 4,908,737	$ 2,293,512	$ 137,536	$ -	$ 10,746,732	$ 4,359,671	$ 10,815,595	$ 4,582,623	$ 5,897,691	$ 10,665,243	$ 26,263,017	$ 7,642,641	$ 23,824,502	$ 3,249,049	$ 95,175,850	$ 34,143,833	0.220	$ 20,919,652	$ 7,504,814
	$ 80,844,119	$ 70,751,585	$ 76,431,382	$ 55,803,741	$ 61,359,210	$ 57,167,199	$ 1,719,204	$ 49,190,619	$ 134,334,156	$ 125,380,214	$ 135,194,942	$ 140,722,757	$ 73,721,139	$ 146,151,561	$ 328,287,709	$ 105,361,415	$ 297,806,269	$ 165,586,354	$ 1,189,698,129	$ 916,115,445		$ 433,880,925	$ 476,059,781
	BC=	1.14	BC=	1.37	BC=	1.07	BC=	0.03	BC=	1.07	BC=	0.96	BC=	0.50	BC=	3.12	BC=	1.80	BC=	1.30		BC=	0.91

Construction Costs

Year	Total	Annualized	Total	Annualized	Total	Annualized	Total	Annualized	Total	Annualized	Total	Annualized	Total	Annualized	Total	Annualized	Total	Annualized
2010	$ 3,008,608	$ 429,801	$ -	$ -	$ 17,231,789	$ 2,461,684	$ 3,902,519	$ 557,503	$ -	$ -	$ 80,550,164	$ 11,507,166	$ 37,425,584	$ 5,346,512	$ 22,436,230	$ 3,205,176	$ 77,288,997	$ 11,041,285
2020	$ 60,987,516	$ 6,098,752	$ 49,048,280	$ 4,904,828	$ 17,000,290	$ 1,700,029	$ 45,288,100	$ 4,528,810	$ 81,783,502	$ 8,178,350	$ 14,346,360	$ 1,434,636	$ 2,073,546	$ 207,355	$ 6,498,772	$ 649,877	$ 55,806,863	$ 5,580,686
2030	$ 6,755,461	$ 675,546	$ 6,755,461	$ 675,546	$ 22,935,120	$ 2,293,512	$ -	$ -	$ 43,596,712	$ 4,359,671	$ 45,826,233	$ 4,582,623	$ 106,652,431	$ 10,665,243	$ 76,426,413	$ 7,642,641	$ 32,490,494	$ 3,249,049

Source: Parsons

2. The net present value of these benefits, assuming a discount rate of 6 percent, is $433,880,925. The net present value of implementation costs, excluding maintenance and repair, is $476,059,781. This B/C ratio is 0.91.
3. The rate of return on investment is 4.5 percent. This is the discount rate at which benefits and costs are equal.
4. The payback period, at a discount rate of six percent, is 26 years.

5.4 Residual Benefits

The Washoe County Freeway Study recommended alternative provides residual benefits over and above those identified through traditional life-cycle benefit analyses.

The recommended alternative was devised to provide operational performance at level of service D or better when measured against Year 2030 forecast traffic volumes. To identify physical improvements, the functional requirements of the freeway system were initially defined through Highway Capacity Manual volume-to-capacity analysis, conceptually designed, and tested with the CORSIM traffic simulation model. The conceptual design was then refined to operationally balance capacity with demand and the system was retested with CORSIM. For several freeway segments leading to and from the I-80/US-395/I-580 Spaghetti Bowl Interchange, multiple design options were tested, refined and retested to arrive at the recommended alternative.

The recommended alternative operates at a high level of service D (near level of service C), or better, throughout the freeway system when measured against Year 2030 forecast traffic volumes. To provide an indication of its ultimate level of service D "capacity," mainline traffic volumes were incrementally increased and tested with CORSIM. These tests showed that by and large, 1,500 additional vehicles per hour could be accommodated by most freeway mainline segments while maintaining a low level of service D (near level of service E) or better. The results of these tests are reported in Tables 5-14 and 5-15. A few segments would operate at LOS E with the addition of 1,500 extra vehicles per hour.

Given the pace of traffic growth forecast from 2000 to 2030, shown on Figure 3-6 and 3-7, it appears that the recommended alternative could accommodate 15 to 20 years of additional metropolitan area growth beyond 2030. Alternatively, the hypothetical land use assumptions that were briefly discussed in section 3.3, Traffic Volume Forecasts, and which result in higher traffic volumes and freeway lane requirements could be accommodated by the recommended alternative.

Fifteen to twenty years of additional freeway capacity or higher than forecast 2030 traffic volumes would extend or increase life-cycle benefits over and above those reported in Table 5-12. Five additional years of service life, for example, would increase the net present value of benefits reported in Table 5-13 by nearly $100 million, with no increase in net present costs.

Table 5-14: Year 2030 Forecast Traffic Volumes and Capacities for I-80 with Recommended Alternative

	AM				PM			
	2030 Volume	Corsim Volume	2045* Volume	Corsim Volume	2030 Volume	Corsim Volume	2045* Volume	Corsim Volume
I-80 Eastbound Direction								
Before Keystone	4,090	4,087	5,590	5,586	3,157	3,157	4,657	4,601
Between Keystone Off & Keystone On	3,699	3,691	5,199	5,031	2,825	2,796	4,325	4,297
Between Keystone On & Sierra/Center Off	5,512	5,526	7,012	6,952	4,000	4,003	5,500	5,486
Between Sierra/Center Off & Sierra/Center On	4,941	4,936	6,441	6,398	3,458	3,484	4,958	4,841
Between Sierra/Center On & Wells Off	5,846	5,845	7,346	7,315	5,133	5,158	6,633	6,524
Between Wells Off & US 395 SB Off	5,121	5,152	6,621	6,523	4,466	4,471	5,966	5,808
Between US 395 SB Off & Wells On	3,161	3,238	4,661	4,638	3,112	3,120	4,612	4,629
Between Wells On & US 395 NB Off	3,914	3,992	5,414	5,313	4,058	4,070	5,558	5,515
Between US 395 NB Off & 4th Street Off	2,467	2,517	3,967	3,901	2,712	2,711	4,212	4,263
Between 4th Street Off & US 395 NB_SB On	1,808	1,886	3,308	3,383	2,001	1,997	3,501	3,468
Between US 395 NB_SB On & Rock Off	5,037	5,000	6,537	6,526	5,189	5,148	6,689	6,536
Between Rock Off & 4th Street On	4,061	4,070	5,561	5,492	4,116	4,102	5,616	5,654
Between 4th Street On & Rock On	4,595	4,604	6,095	6,003	4,711	4,696	6,211	6,171
Between Rock On & Pyramid Off	5,173	5,185	6,673	6,609	5,451	5,444	6,951	6,803
Between Pyramid Off & Pyramid On	4,161	4,170	5,661	5,672	4,138	4,100	5,638	5,507
End of Freeway	4,161	4,198	5,661	5,629	4,786	4,752	6,286	6,189

	AM				PM			
	2030 Volume	Corsim Volume	2045* Volume	Corsim Volume	2030 Volume	Corsim Volume	2045* Volume	Corsim Volume
I-80 Westbound Direction								
Before Pyramid Interchange	4,900	4,900	6,400	6,326	6,287	6,288	7,787	7,759
Between Pyramid Off & Pyramid On	4,335	4,297	5,835	5,799	5,789	5,815	7,289	7,207
Between Pyramid On & Rock Off	6,005	5,984	7,505	7,476	6,874	6,892	8,374	8,265
Between Rock Off & 4th Street Off	5,507	5,510	7,007	7,019	5,889	5,931	7,389	7,293
Between 4th Street Off & Rock On	4,796	4,791	6,296	6,261	5,142	5,183	6,642	6,661
Between Rock On & US 395 NB_SB Off	5,589	5,594	7,089	7,061	5,912	5,962	7,412	7,388
Between US 395 NB_SB Off & 4th Street On	2,746	2,712	4,246	4,215	3,191	3,216	4,691	4,580
Between 4th Street On & Wells Off	3,151	3,115	4,651	4,543	3,608	3,637	5,108	5,093
Between Wells Off & US 395 NB_SB On	2,182	2,132	3,682	3,694	2,830	2,874	4,330	4,384
Between US 395 NB_SB On & Wells On	4,025	3,883	5,525	5,537	5,679	5,618	7,179	7,181
Between Wells On & Sierra/Center Off	4,553	4,416	6,053	6,032	6,484	6,418	7,984	7,948
Between Sierra/Center Off & Sierra/Center On	2,949	2,851	4,449	4,475	5,257	5,233	6,757	6,762
Between Sierra/Center On & Keystone Off	3,558	3,508	5,058	5,000	6,008	5,985	7,508	7,536
End of Freeway	2,950	2,840	4,450	4,446	4,931	4,812	6,431	6,426

* 2045 Volume = 2030 Volume + 1500 vph

Source: Parsons

Table 5-15: Year 2030 Forecast Traffic Volumes and Capacities for US-395/I-580 with Recommended Alternative

	AM				PM			
	2030 Volume	Corsim Volume	2045* Volume	Corsim Volume	2030 Volume	Corsim Volume	2045* Volume	Corsim Volume
US 395 Northbound Direction								
Before Del Monte Interchange	5,692	5,692	7,192	7,184	6,961	6,958	8,461	6,426
Between Del Monte Off & Del Monte On	4,402	4,363	5,902	5,897	5,095	5,032	6,595	6,538
Between Del Monte On & Meadowood On	5,466	5,466	6,966	6,838	5,535	5,469	7,035	6,961
Between Meadowood On & S. Virginia On	5,702	5,656	7,202	7,136	5,893	5,833	7,393	7,389
Between S. Virginia On & Moana Off	6,305	6,265	7,805	7,813	7,125	7,061	8,625	8,564
Between Moana On & Plumb Off	6,842	6,830	8,342	8,247	7,409	7,331	8,909	8,932
Between Plumb Off & Airport On	5,090	5,089	6,590	6,439	5,999	5,915	7,499	7,383
Between Airport On & Villanova On	6,573	6,575	8,073	8,187	7,242	7,154	8,742	8,768
Between Villanova On & Mill Off	7,092	7,097	8,592	8,449	8,428	8,342	9,928	9,435
Between Mill On & Glendale Off	6,499	6,493	7,999	7,927	8,959	5,564	10,459	10,201
Between Glendale On & I-80 WB Off	6,678	6,651	8,178	8,009	9,483	9,415	10,983	10,971
Between I-80 WB Off & I-80 EB Off	4,843	4,866	6,343	6,397	6,853	6,830	8,353	8,237
Between I-80 EB Off & Oddie Off	3,193	3,206	4,693	4,685	4,569	4,480	6,069	6,191
Between Oddie Off & I-80 EB_WB On	2,746	2,708	4,246	4,189	3,044	3,035	4,544	4,484
Between I-80 EB_WB On & Oddied On	4,733	4,723	6,233	6,131	4,962	4,611	6,462	6,368
Between Oddie On & McCarran Off	5,037	5,026	6,537	6,403	6,713	6,364	8,213	8,197
Between Clear Acre Off & N. McCarran On	3,928	3,946	5,428	5,405	5,069	4,802	6,569	6,425
Between Clear Acre On & Parr Off	5,314	5,299	6,814	6,731	7,388	7,046	8,888	8,779
Between Pyramid Pkwy On & Parr On	5,342	5,339	6,842	6,879	5,857	5,600	7,357	7,342
Between Parr On & N. Virginia Off	5,403	5,390	6,903	6,938	5,976	5,726	7,476	7,358
Between Golden Valley Off & N. Virginia On	3,843	3,786	5,343	5,324	4,154	4,023	5,654	5,669
Between N. Virginia On & Golden Valley On	4,845	4,792	6,345	6,267	5,575	5,443	7,075	7,167
Between Golden Valley On & Lemmon Valley Off	4,941	4,863	6,441	6,498	6,070	5,932	7,570	7,448
Between Lemmon Valley On & Stead Off	2,716	2,671	4,216	4,064	3,692	3,577	5,192	5,019
End of Freeway	1,359	1,341	2,859	2,771	3,605	3,484	5,105	5,078

	AM				PM			
	2030 Volume	Corsim Volume	2045* Volume	Corsim Volume	2030 Volume	Corsim Volume	2045* Volume	Corsim Volume
US 395 Southbound Direction								
Before Stead Off	3,377	3,374	4,877	4,864	1,862	1,862	3,362	3,355
Between Stead On & Lemmon Valley Off	3,483	3,470	4,983	4,967	3,437	3,423	4,937	4,906
Between Lemmon Valley On & Golden Valley Off	4,593	4,576	6,093	5,865	5,778	5,783	7,278	7,114
Between Golden Valley On & N. Virginia Off	5,624	5,591	7,124	7,031	6,903	6,929	8,403	8,459
Between N. Virginia On & Parr Off	4,659	4,623	6,159	6,257	5,137	5,110	6,637	6,631
Between Parr Off & Pyramid Pkwy Off	2,957	2,918	4,457	4,329	3,810	3,796	5,310	5,297
Between Parr On & Pyramid Pkwy On	3,037	2,994	4,537	4,565	4,166	4,144	5,666	5,782
Between Pyramid Pkwy On & Cear Acre Off	3,954	3,911	5,454	5,784	4,992	4,966	6,492	6,389
Between Clear Acre On & N. McCarran On	2,907	2,913	4,407	3,986	3,651	3,649	5,151	5,019
Between N. McCarran On & Oddie Off	6,196	6,206	7,696	7,592	6,154	6,136	7,654	7,552
Between Oddie Off & I-80 EB_WB Off	4,657	4,620	6,157	6,254	5,897	5,910	7,397	7,439
Between I-80 EB_WB Off & Oddie On	2,555	2,603	4,055	4,136	4,182	4,155	5,682	5,767
Between Oddie On & Glendale Off	2,923	2,965	4,423	4,375	4,645	4,616	6,145	6,292
Between Glendale Off & I-80 EB On	2,522	2,587	4,022	4,138	4,232	4,191	5,732	5,616
Between I-80 EB On & I-80 WB On	4,616	4,644	6,116	6,088	5,840	5,795	7,340	7,357
Between I-80 WB On & Glendale On	6,686	6,717	8,186	8,106	7,591	7,553	9,091	9,129
Between Glendale On & Mill Off	7,412	7,440	8,912	8,867	8,111	8,077	9,611	9,541
Between Mill On & Villanova Off	6,682	6,714	8,182	8,150	8,317	8,291	9,817	9,871
Between Villanova Off & Airport Off	5,814	5,870	7,314	7,109	6,989	7,008	8,489	8,476
Between Airport Off & Plumb On	4,145	4,206	5,645	5,567	5,146	5,147	6,646	6,620
Between Plumb On & Moana Off	5,369	5,423	6,869	6,429	6,965	6,952	8,465	8,466
Between Moana On & S. Virginia Off	5,289	5,394	6,789	6,694	6,000	6,028	7,500	7,476
Between S. Virginia Off & Meadowood Off	4,236	4,336	5,736	5,593	4,848	4,917	6,348	6,284
Between Meadowood Off & Del Monte Off	3,977	4,125	5,477	5,338	4,668	4,760	6,168	6,148
End of Freeway	5,225	5,356	6,725	6,692	5,771	5,842	7,271	7,259

* 2045 Volume = 2030 Volume + 1500 vph

Source: Parsons

IMPLEMENTATION

The freeway improvements proposed in Chapter 4, Alternative Development and Evaluation, were grouped together to create project packages for both freeways in order to maximize operational benefits. For example, the construction of a direct connector ramp through the Spaghetti Bowl Interchange would not produce satisfactory operational benefits without freeway improvements on the ends of the ramp. The project package descriptions are for the early action items (next five years) and for each of the target year traffic forecasts—2010, 2020, and 2030.

It is important to reiterate that the Nevada Department of Transportation's (NDOT) operational standard for freeways is level of service D or better and that the proposed improvements should be implemented by the target year to ensure that this operational level is attained. Currently, the most congested segments of the freeway system are within the Spaghetti Bowl Interchange and include the west, east and south freeway approaches to the Spaghetti Bowl. Addressing these congested segments will require major freeway project planning and implementation as shown in the Early Action Item Package and the Phase I Project Package A. NDOT should consider using the design/build method of project implementation for some portions of the freeway, such as the Spaghetti Bowl area, to meet the freeway operational standard (level of service D) in a timely manner.

6.1 Early Action Plan

The analysis of existing conditions revealed a need for improvements that could be implemented in the next five years for a reasonable cost, that require no additional right-of-way, and that have little or no environmental impact. These improvements and the related implementation costs are described in the following list:

- Implement a Freeway Service Patrol—Minor incidents such as vehicle malfunctions (flat tires, out of gas, overheating, etc.) and debris on the roadway lead to major congestion on the freeways. This was apparent in many instances during the course of this study. Several years ago NDOT implemented a freeway service patrol on the Las Vegas freeway system using contracted services. NDOT will also implement a limited freeway service patrol in Reno as part of the 2002 Spaghetti Bowl Improvement Project. This will include two units; one on I-80 between the West and East McCarran Boulevard interchanges and one on US-395/I-580 between the Parr Boulevard and Del Monte Lane interchanges. It is recommended that NDOT make this a permanent service after the Spaghetti Bowl Project and consider expanding the service as the need arises. The current contract cost for the freeway service patrol in Las Vegas is $134,000 per unit, per year.
- Traffic Signal Coordination Improvements—Improve traffic signal coordination on all streets that intersect with the I-80 and US-395/I-580 freeway system. This will require a cooperative effort between NDOT, Washoe County, the Regional Transportation Commission and the cities of Reno and Sparks.
- Truck Climbing Lane on Northbound US-395/I-580 between the North McCarran Boulevard and Golden Valley Road Interchanges—This is currently being considered by NDOT for implementation and can also be found in this chapter under 2010 Project Package C.
- Widen the Northbound On-ramp at South Virginia Street Interchange (#1, between Moana and Del Monte)—Reconstructing this ramp to provide two lanes is needed to accommodate the current p.m. peak demand, which exceeds 1200 vehicles per hour. This improvement would also allow for better utilization of the dual-left turn lanes on the west leg at South Virginia Street and South McCarran Boulevard.
- Striping Changes to Improve Ramp Capacity at South Virginia Street Interchange (#3, between Damonte Ranch Road and Mt. Rose Highway Interchanges)—Restripe South Virginia Street to allow the two southbound, loop off-ramp lanes to flow onto South Virginia without forcing a merge into one lane. The a.m. and p.m. peak hour volumes on this ramp exceed 1900 vehicles per hour.
- Striping Changes to Improve Ramp Capacity at South Meadows Parkway Interchange—Restripe the northbound on-ramp to provide two lanes to accommodate the p.m. peak hour volumes, which exceed 1200 vehicles per hour.
- Begin the Environmental Process for the 2010 Recommended Projects—The projects recommended for Package A in 2010 will address current and future traffic congestion in the Spaghetti Bowl Interchange area. To ensure these projects are implemented by the 2010 target year it will be necessary to begin the environmental review process within the next two years.

The following are the freeway reliever routes that were evaluated:

- North Virginia Street/Sierra Street—Further study of the proposal to widen North Virginia Street from four to six lanes between US-395/I-580 to the intersection with Sierra Street, and to widen Sierra Street to four lanes between the intersection with North Virginia Street to Eighth Street is recommended. This will also require that Sierra Street be converted to two-way traffic between Ninth Street and Maple Street.
- Oddie Boulevard/Wells Avenue—Evaluate all traffic signals between Fourth Street and Pyramid Way to determine potential candidates for removal or replacement with four-way stops or roundabouts and for improved coordination.
- Glendale Avenue–Kietzke Lane to Vista Boulevard—Develop and implement an access management plan (i.e., restriction on new traffic signal installations, raised medians to control turning movements, etc.) and the extension of Glendale Avenue to Vista Boulevard via Kleppe Lane.
- Longley Lane–US-395/I-580/South Virginia to Rock Boulevard—Designate this corridor as a connector/bypass route around the east side of Reno. Efforts to preserve this corridor would include restrictions on traffic signal installations, intersection improvements to increase capacity, access management, etc.
- Kietzke Lane–Del Monte Lane to Prater Way—Preserve this corridor as an alternate route to US-395/I-580. This would include restrictions on traffic signal installations, intersection improvements to increase capacity, access management, etc.

6.2 Proposed Phase I Projects

The following projects address freeway improvement needs associated with Year 2010 forecast traffic volumes.

Project Package I-A
Cost Estimate—$123,386,387

These recommended improvements are in the vicinity of the Spaghetti Bowl interchange and includes the following improvement segments:

Construct a two-lane direct connector ramp from westbound I-80, Station "I-80" 815+00, to southbound US-395/I-580, Station "US-395" 772+50, that will tie into the US-395/I-580 southbound mainline lanes near the beginning of the existing Glendale off-ramp and will provide a new access ramp to the Glendale Interchange.

Construct a two-lane direct connector ramp from eastbound I-80, Station "I-80" 743+00, to southbound US-395/I-580, Station "US-395" 788+00. This ramp will tie into the new westbound I-80 to southbound

US-395/I-580 ramp and will not provide access to the Glendale Interchange.

Two additional ramps will provide the access to the Glendale Avenue Interchange; these ramps are not needed to meet traffic demand until 2020. The first ramp is a single-lane ramp that will split off the I-80 eastbound to US-395/I-580 southbound direct connector ramp and tie into the Glendale southbound off-ramp. The second ramp, a single-lane ramp, will split off southbound US-395/I-580 at Station "US-395" 794+00 and tie into the first ramp about 580 feet to the south.

Construct a two-lane direct connector ramp from northbound US-395/I-580, "US-395" 773+00 to westbound I-80, Station "I-80" 749+80. This ramp will tie into the US-395/I-580 southbound to I-80 westbound ramp recommended for 2020. The direct connector ramp will braid over the westbound off-ramp to Wells Avenue. There will be a single-lane slip ramp that will split from the direct connector ramp to allow access for US-395/I-580 traffic to Wells Avenue. In order for the direct connector ramp to operate effectively, an auxiliary lane will be needed between the ramp tie-in to I-80, Station "I-80" 748+00, and the Wells Avenue westbound on-ramp, Station "I-80" 735+00.

The construction of the direct connector ramps at the Spaghetti Bowl to serve the I-80 traffic west of the Spaghetti Bowl Interchange (to and from US-395/I-580) will require the braiding of these ramps with the Wells Avenue westbound off-ramp and the eastbound on-ramp. This will include providing two lanes on these on and off-ramps.

Construct a two-lane ramp from northbound US-395/I-580, Station "XN" 34+50 to eastbound I-80, Station "I-80" 816+00. This ramp will be joined with the direct connector ramp to be constructed in 2020 from southbound US-395/I-580 to eastbound I-80. The combined ramps will braid over the eastbound Fourth Street off-ramp and tie into I-80 just east of the Fourth Street Bridge at Station "I-80" 816+00.

Widen westbound I-80 to three lanes between the Fourth Street Interchange, Station "I-80" 806+50, and the US-395/I-580 northbound to I-80 westbound loop on-ramp, Station "I-80" 788+00.

Restripe the southbound US-395/I-580 mainline freeway between the off-ramp to I-80, Station "US-395" 809+25, and the eastbound I-80 on-ramp, Station "US-395" 794+00.

Widen southbound US-395/I-580 to 4 lanes between the westbound I-80 on-ramp, Station "US-395" 785+00 and the Glendale Interchange on-ramp, Station "02" 750+00.

Construct an auxiliary freeway lane on southbound US-395/I-580 between the westbound I-80 on-ramp, Station "US-395" 785+00, and the Glendale Interchange on-ramp, Station "02" 750+00.

Construct an additional mainline freeway lane on northbound US-395/I-580 between Glendale off-ramp, Station "O2" 746+50 and the new I-80 to westbound off-ramp near Station "US-395" 779+70. This will provide a continuous mainline lane to the I-80 eastbound off-ramp.

Construct a freeway auxiliary lane on northbound US-395/I-580 between the Glendale on-ramp, Station "02" 759+00, and the new US-395/I-580 northbound to I-80 westbound off-ramp, Station "US-395" 773+00.

Project Package I-B
Project Cost Estimate—$10,091,733

The recommended improvements in this group involve interchange ramp widening at I-80 interchanges and are described as follows:

Reconstruct the West McCarran Boulevard westbound off-ramp to provide two lanes and a deceleration lane to handle traffic from the freeway mainline lanes.

Reconstruct the West McCarran Boulevard eastbound on-ramp to provide two lanes and an acceleration lane to merge the second lane into freeway mainline lanes.

Reconstruct the Virginia Street westbound off-ramp to provide two lanes to handle traffic from the freeway mainline lanes.

Reconstruct the Virginia Street eastbound on-ramp to provide two lanes to merge the second lane into freeway mainline lanes.

Reconstruct the Sparks Boulevard westbound on-ramp to provide two lanes and an acceleration lane to merge the second lane into freeway mainline lanes.

Project Package I-C
Project Cost Estimate—$49,206,771

The recommended improvements in this project package are on US-395/I-580 between the Oddie Boulevard Interchange and the Golden Valley Interchange and are described as follows:

Add a mainline freeway lane on northbound US-395/I-580 between North McCarran off-ramp, Station "XN" 44+34 and the Golden Valley off-ramp, Station "XN" 265+40. This improvement is being considered by NDOT for implementation in 2003 to address concerns about traffic delay caused by large trucks.

Construct a freeway auxiliary lane on northbound US-395/I-580 between the North McCarran on-ramp, Station "XN" 79+20 and the Parr Boulevard off-ramp, Station "XN" 146+90.

Construct an additional freeway auxiliary lane on northbound US-395/I-580 between the Oddie on-ramp, Station "XN" 44+34 and the North McCarran off-ramp, Station "XN" 67+40.

Project Package I-D
Project Cost Estimate—$27,815,607

The recommended improvements in this project package are on US-395/I-580 between the Glendale Avenue Interchange and the Plumb Lane Interchange and are described as follows:

Widen the freeway to four lanes on northbound US-395/I-580 between the Mill Street off-ramp, Station "O2" 716+00 and the Mill Street on-ramp, Station "O2" 725+00.

Reconstruct the Mill Street southbound off-ramp to provide two lanes and a deceleration lane from the freeway mainline lanes.

Construct a mainline freeway lane on northbound US-395/I-580 between the Plumb Lane off-ramp, Station "O2" 663+34, and the Villanova Street on-ramp, Station "O2" 700+54. This widening will also require reconstruction of the northbound Airport on-ramp to provide sufficient right-of-way.

Construct an additional mainline freeway lane on southbound US-395/I-580 between the Mill Street off-ramp, Station "O2" 740+00, and the Mill Street on-ramp, "O2" 722+00.

Reconstruct the South Virginia Street (# 1) northbound on-ramp to provide two lanes and an acceleration lane to merge the second lane into the freeway mainline lanes.

6.3 Proposed Phase II Projects

The following projects address freeway improvement needs associated with Year 2020 forecast traffic volumes.

Project Package II-A
Project Cost Estimate—$55,243,290

The recommended improvements are the direct connector ramps at the Spaghetti Bowl Interchange from I-80 westbound and US-395/I-580 southbound:

Construct a single-lane ramp from the I-80/US-395/I-580 direct connector ramp (westbound to southbound) to northbound US-395/I-580, Station "XN" 34+50. It is proposed this ramp be constructed as a two-lane ramp 960 feet from the exiting gore to accommodate the I-80 eastbound-to-US-395/I-580 northbound direct connector ramp recommended by 2030 (the existing ramp for I-80 eastbound to US-395/I-580 northbound can continue to be used until 2030). This ramp will also be required to braid over a recommended new northbound off-ramp for Oddie Boulevard.

Construct a two-lane direct connector ramp from southbound US-395/I-580, Station "XN" 34+50, to east- and westbound I-80. The ramp will split with one lane going to westbound I-80 and two lanes going to eastbound I-80. The ramp to eastbound I-80 will connect with the northbound-to-eastbound ramp that was constructed in 2010. The ramp to westbound I-80 will tie into the direct connector ramp from northbound US-395/I-580 and will be braided over the westbound I-80 off-ramp to Wells Avenue.

Project Package II-B
Project Cost Estimate—$62,288,388

The recommended improvements in this project package are on I-80 between the West McCarran Boulevard Interchange and the Virginia Street Interchange and are described as follows:

Construct an auxiliary freeway lane on westbound I-80 between the Keystone Avenue Interchange on-ramp, Station "OW" 650+00, and the West McCarran Boulevard Interchange off-ramp, Station "OE" 581+00.

Add an eastbound mainline freeway lane between the on-ramp at the Robb Drive Interchange, Station "OE" 546+30, and the interchange bridge over Keystone Avenue, Station "OE" 657+66.

Add an eastbound mainline freeway lane between the Virginia Street Interchange off-ramp, Station "I-80" 720+00, and the on-ramp, Station "I-80" 696+00.

Construct a mainline freeway lane on westbound I-80 between the Virginia Street Interchange off-ramp, Station "I-80" 691+00, and the on-ramp, Station "I-80" 717+00.

Construct an acceleration lane for the eastbound Virginia Street on-ramp (reconstructed to provide two lanes in 2010).

Construct a deceleration lane for the westbound Virginia Street off-ramp (reconstructed to provide two lanes in 2010).

Project Package II-C
Project Cost Estimate—$31,126,289

The recommended improvements in this project package are on I-80 between the Fourth Street Interchange and the Pyramid Way Interchange and are described as follows:

Construct an additional mainline freeway lane on eastbound I-80 between the braided off-ramp (between the Fourth Street and Rock Boulevard Interchanges), Station "M" 835+00, and the Pyramid Way Interchange off-ramp, Station "M" 875+00.

Construct an auxiliary freeway lane on eastbound I-80 between the US-395/I-580 northbound direct connector ramp, Station "I-80" 816+50, and the braided off-ramp between the Fourth Street and Rock Boulevard Interchanges, Station "M" 835+00. This will also include constructing the above mentioned braided ramp and reconstructing the Rock Boulevard/Nugget Avenue eastbound off-ramp to provide two lanes.

Construct an additional mainline freeway lane on westbound I-80 between the Pyramid Way Interchange on-ramp, Station "M" 876+00, and the Rock Boulevard Interchange on-ramp, Station "M" 863+00. Reconstruct the Pyramid Way westbound on-ramp to provide two lanes that will match the added freeway lane mentioned above. This freeway widening would be accomplished by constructing a new bridge segment between the existing bridge structures over the Sparks Nugget casino buildings.

Braid the westbound Fourth Street off-ramp over the westbound Rock Boulevard on-ramp to avoid westbound weaving problems on I-80 between the Fourth Street and Rock Boulevard Interchanges.

Reconstruct the eastbound Rock Boulevard off-ramp to provide two lanes to handle traffic from the freeway mainline lanes. The access to Rock Boulevard will be from a two-lane off-ramp that splits between Rock Boulevard and Nugget Avenue.

Project Package II-D
Project Cost Estimate—$83,267,859

The recommended improvements in this project package are on I-80 between the Pyramid Way Interchange and the Sparks Boulevard Interchange and are described as follows:

Construct an additional mainline freeway lane on eastbound I-80 between the Pyramid Way Interchange off-ramp, Station "M" 875+00, and the Sparks Boulevard Interchange off-ramp, Station "FWY" 466+00.

Reconstruct the Sparks Boulevard eastbound off-ramp to provide two lanes when the additional freeway lane is added between the Pyramid Way and Sparks Boulevard Interchanges.

Construct an auxiliary freeway lane on eastbound I-80 between the Pyramid Way Interchange on-ramp, Station "O1" 900+00, and the East McCarran Boulevard Interchange off-ramp, Station "M" 917+00.

Construct an additional mainline freeway lane on westbound I-80 between the Sparks Boulevard Interchange on-ramp, Station "FWY" 467+00, and the Pyramid Way Interchange on-ramp, Station "M" 876+00.

Reconstruct the Pyramid Way westbound on-ramp to provide two lanes when the fourth freeway lane is added between the Pyramid Way on-ramp and the Rock Boulevard on-ramp.

Project Package II-E
Project Cost Estimate—$123,679,018

The recommended improvements in this project package are on US-395/I-580 between the Golden Valley Interchange and the North McCarran Boulevard Interchange and are described as follows:

Add a mainline freeway lane on northbound US-395/I-580 between the Golden Valley off-ramp, Station "XN" 265+40, and the Stead Boulevard off-ramp, Station "XN" 417+00.

Reconstruct the Lemon Valley northbound off-ramp to provide two lanes and a deceleration lane from the freeway mainline lanes.

Reconstruct the Lemon Valley southbound off-ramp to provide two lanes and a deceleration lane from the freeway mainline lanes.

Reconstruct the Lemon Valley southbound on-ramp to provide two lanes and an acceleration lane to merge the second lane into the freeway mainline lanes.

Construct an additional mainline freeway lane on southbound US-395/I-580 between the Stead on-ramp, Station "XS" 418+00 and the McCarran on-ramp, Station "XS" 69+50.

Reconstruct the Golden Valley northbound off-ramp to provide two lanes and a deceleration lane from the freeway mainline lanes.

Reconstruct the Golden Valley southbound on-ramp to provide two lanes and an acceleration lane to merge the second lane into the freeway mainline lanes.

Reconstruct the Panther Valley (North Virginia Street) northbound on-ramp to provide two lanes and an acceleration lane to merge the second lane into the freeway mainline lanes.

Reconstruct the Panther Valley southbound off-ramp to provide two lanes and a deceleration lane from the freeway mainline lanes.

Reconstruct the Panther Valley southbound on-ramp to provide two lanes and an acceleration lane to merge the second lane into the freeway mainline lanes.

Construct a second freeway auxiliary lane on southbound US-395/ I-580 between the North McCarran on-ramp and the new I-80 eastbound and westbound direct connector ramp.

Project Package II-F
Project Cost Estimate—$11,825,558

The recommended improvements in this project package are on US-395/I-580 between the Del Monte Lane and South Virginia Street (#2) Interchanges and are described as follows:

Reconstruct the Del Monte Lane northbound off-ramp to provide two lanes and a deceleration lane from the freeway mainline lanes.

Reconstruct the Del Monte Lane southbound off-ramp to provide two lanes and a deceleration lane from the freeway mainline lanes.

Construct an auxiliary lane on northbound US-395/I-580 between the South Virginia Street (#2) on-ramp, Station “P4” 690+00, and the Del Monte Lane off-ramp, Station “O5” 519+00.

6.4 Proposed Phase III Projects

The following projects address freeway improvement needs associated with Year 2030 forecast traffic volumes.

Project Package III-A
Project Cost Estimate – $32,490,494

The recommended improvement in this project package is the last remaining direct connector ramp at the Spaghetti Bowl Interchange:

Construct a two-lane direct connector ramp from eastbound I-80, Station “I-80” 765+00, to northbound US-395/I-580. This ramp will tie into the I-80 westbound-to-US-395/I-580 northbound ramp recommended for 2020 and would complete the improvements needed at the Spaghetti Bowl.

Project Package III-B
Project Cost Estimate—$22,935,120

The recommended improvements in this project package are on I-80 between the Robb Drive and West McCarran Boulevard Interchanges and between the Wells Avenue and Virginia Street Interchanges:

Construct an additional mainline freeway lane on westbound I-80 between the West McCarran Boulevard Interchange off-ramp, Station “OW” 578+82, and the Robb Drive Interchange off-ramp, Station “OW” 506+30.

Construct an auxiliary freeway lane on westbound I-80 between the Wells Avenue Interchange on-ramp, Station “I-80” 735+00, and the Virginia Street Interchange off-ramp, Station “I-80” 719+00.

Project Package III-C
Project Cost Estimate—$13,510,922

The recommended improvements in this project package are on I-80 between the Sparks Boulevard Interchange and the Vista Boulevard Interchange and are described as follows:

Add a mainline freeway lane on eastbound I-80 between the Sparks Boulevard Interchange off-ramp, Station “FWY” 467+00, and Station “OE” 146+00, just past the Vista Boulevard Interchange.

Construct an additional mainline freeway lane on westbound I-80 between Station “OW” 146+00 (just east of the Vista Boulevard Interchange) and the Sparks Boulevard Interchange on-ramp, Station “FWY” 468+00.

Project Package III-D
Project Cost Estimate—$95,461,086

The recommended improvements in this project package are on US-395/I-580 between the Lemmon Drive Interchange and the North McCarran Boulevard Interchange and are described as follows:

Construct an additional mainline freeway lane on northbound US-395/I-580 between the Parr Boulevard off-ramp, Station “XN” 146+90, and the Lemmon Drive off-ramp, Station “XN” 324+00.

Reconstruct the Parr Boulevard northbound off-ramp to provide two lanes and a deceleration lane from the freeway mainline lanes.

Reconstruct the Parr Boulevard southbound off-ramp to provide two lanes and a deceleration lane from the freeway mainline lanes.

Construct an additional mainline freeway lane on southbound US-395/ I-580 between the Lemmon Drive on-ramp, Station “XS” 322+00, and the North McCarran on-ramp, Station “XS” 69+50. This will create a fourth freeway mainline lane.

Construct a freeway auxiliary lane on northbound US-395/I-580 between the North McCarran on-ramp, Station “XN” 79+20, and the proposed off-ramp for the Outer Ring Freeway Interchange. For this freeway widening scenario the location of the Outer Ring Freeway is assumed to be located between the North McCarran Boulevard and Parr Boulevard Interchanges.

Construct an additional freeway mainline lane on northbound US-395/ I-580 between the I-80 direct connector ramp, Station “XN” 34+50, and the North McCarran on-ramp, Station “XN” 68+00.

Project Package III-E
Project Cost Estimate—$125,813,053

The recommended improvements in this project package are on US-395/I-580 between the Glendale Avenue Interchange and the Del Monte Lane Interchange and are described as follows:

Construct an additional freeway mainline freeway lane on northbound US-395/I-580 between the Airport on-ramp, Station “O2” 676+20, and the Glendale Avenue on-ramp, Station “O2” 759+00.

Construct an additional mainline freeway lane on southbound US-395/I-580 between the Mill Street off-ramp, Station “O2” 740+00, and the Plumb Lane on-ramp, Station “O2” 665+00.

Reconstruct the Plumb Lane northbound off-ramp to provide two lanes and a deceleration lane from the freeway mainline lanes. This ramp widening will also accommodate the northbound traffic on US-395/ I-580 that is bound for the Reno/Tahoe International Airport. The airport traffic will split off the Plumb Lane off-ramp on a two-lane ramp that will bridge over Terminal Way and tie-into the existing roadway that accesses the terminal building area.

Reconstruct the Plumb Lane southbound on-ramp to provide two lanes and an acceleration lane to merge the second lane into the freeway mainline lanes.

Reconstruct the Airport northbound on-ramp to provide two lanes. The second ramp lane will connect to the fifth northbound freeway lane on US-395/I-580 between this ramp and the Glendale Avenue on-ramp.

Reconstruct the Airport southbound off-ramp to provide two lanes and a deceleration lane from the freeway mainline lanes.

Construct a new single-lane ramp from the Reno/Tahoe International Airport to southbound US-395/I-580. This ramp would split from the existing Airport ramp for northbound US-395/I-580, fly over the airport southbound ramp and US-395/I-580 freeway lanes, parallel the freeway to the Moana southbound off-ramp, braid over the Moana ramp and tie into the freeway mainline at Station "O3" 625+00.

Construct an auxiliary lane on northbound US-395/I-580 between the Moana on-ramp, Station "O3" 637+00 and the Plumb Lane off-ramp, Station "O2" 667+00.

Construct a mainline freeway lane on northbound US-395/I-580 between the Del Monte Lane off-ramp, Station "O5" 541+60 and the Moana Lane on-ramp, Station "O3" 616+00.

Project Package III-F
Project Cost Estimate—$51,227,640

The recommended improvements in this project package are on US-395/I-580 between the Moana Lane Interchange and the Damonte Ranch Road Interchange and are described as follows:

Construct a mainline freeway lane on northbound US-395/I-580 between the South Virginia (#2) off-ramp, Station "P4" 663+00, and the South Virginia (#2) on-ramp, Station "P4" 692+45.

Construct a mainline freeway lane on southbound US-395/I-580 between the Moana Lane off-ramp, Station "O3" 619+00, and the South Virginia (#2) on-ramp, Station "P4" 662+00.

Construct a mainline freeway lane on northbound US-395/I-580 between the South Meadows off-ramp, Station "H" 613+00, and the South Meadows on-ramp, Station "H" 640+00.

Construct a mainline freeway lane on southbound US-395/I-580 between the South Meadows off-ramp, Station "H" 638+00, and the South Meadows on-ramp, Station "H" 615+50.

Reconstruct the South Meadows southbound off-ramp to provide two lanes and a deceleration lane from the freeway mainline lanes.

Reconstruct the Damonte Ranch Road northbound on-ramp to provide two lanes and an acceleration lane to merge the second lane into the freeway mainline lanes.

Reconstruct the Damonte Ranch Road northbound off-ramp to provide two lanes and a deceleration lane from the freeway mainline lanes.

Reconstruct the Damonte Ranch Road southbound off-ramp to provide two lanes and a deceleration lane from the freeway mainline lanes.

Graphics illustrating the general location and phasing of these improvements follow as Figures 6-1, 6-2, and 6-3.

6.5 Funding Plan

The recommended freeway improvement plan is included within the *2030 Regional Transportation Plan (RTP)*, adopted by the Regional Transportation Commission (RTC) on August 17, 2001. The *RTP* acknowledges that improvements to I-80 and US-395/I-580 will be identified by the *Washoe County Freeway Corridor Study*.

The *RTP* includes a funding plan and phasing priorities for street and highway improvements within Washoe County. The Phasing Plan (*2030 RTP* Table 5-1A) identifies $596 million for implementing improvements to I-80 and US-395/I-580 during the FY 2007–2012 timeframe. This funding would be sufficient to implement all of the Phase I projects identified above (Packages A–D); all of the Phase II projects (Packages A–F); and approximately one-half of Phase III Project Package A.

The *RTP* additionally identifies $127.7 million for funding improvements to I-80 and US-395/I-580 during the FY 2013 to 2030 timeframe. This commitment will finance the remainder of Phase III Project Package A, all of Phase III Project Package B and C, and most of Package D.

As the *2030 RTP* funding plan was preliminary insofar as I-80 and US-395/I-580 funding requirements, the shortfall of $195 million (the remainder of Package D and all of Packages E and F) will need to be addressed by the first amendment to the 2030 RTP.

Overall, RTC anticipates a funding shortfall for the *2030 RTP* over and above that identified for the freeway system. To address these funding shortfalls, the RTC developed a financing plan for voter and state legislative approval. On November 5, 2002, voters in Washoe County approved WC-2, a transportation advisory ballot question, by a margin of 57% to 43%. WC-2 asked voters if state legislation should be sought which would provide additional transportation funding to the Regional Transportation Commission. Specifically identified in the ballot question were three funding sources: adjusting (indexing) the road impact fees paid by developers with inflation, adjusting (indexing) local motor vehicle fuel taxes with inflation, and a 1/8 % sales tax dedicated to transportation. Collectively, these sources are expected to generate approximately $750 million in additional revenue through the year 2030. This additional revenue, when combined with existing transportation funding and planned efficiencies, is projected to be sufficient to finance all the transportation improvements identified in the RTC's 2030 Regional Transportation Plan. The Regional Transportation Commission has proposed legislation to the State legislature for action in the 2004 session. The RTC will move promptly to seek all needed approvals and expects that all the new revenue sources will be implemented in the second calendar half of 2003.

6.6 Project Delivery

The *Washoe County Freeway Corridor Study* is a planning-level analysis that identifies freeway improvements needed within the Reno/Sparks metropolitan area between now and 2030. Projects identified by the study must now be prioritized by NDOT and RTC for project development and construction. Projects identified as being high-priority for near-term implementation will require additional definition, programming of funds within the Transportation Improvement Program, design, study of environmental impacts, right-of-way acquisition if required, and construction. This project delivery process typically takes four to ten years to accomplish, depending on the complexity of the project, right-of-way requirement, and environmental review. Given the relatively long lead time required for project delivery, the project development effort initiated by this study needs to be continuously carried forward to meet the mobility needs of Washoe County residents.

Figure 6-1: I-80/US-395/I-580 SPAGHETTI BOWL IMPROVEMENTS

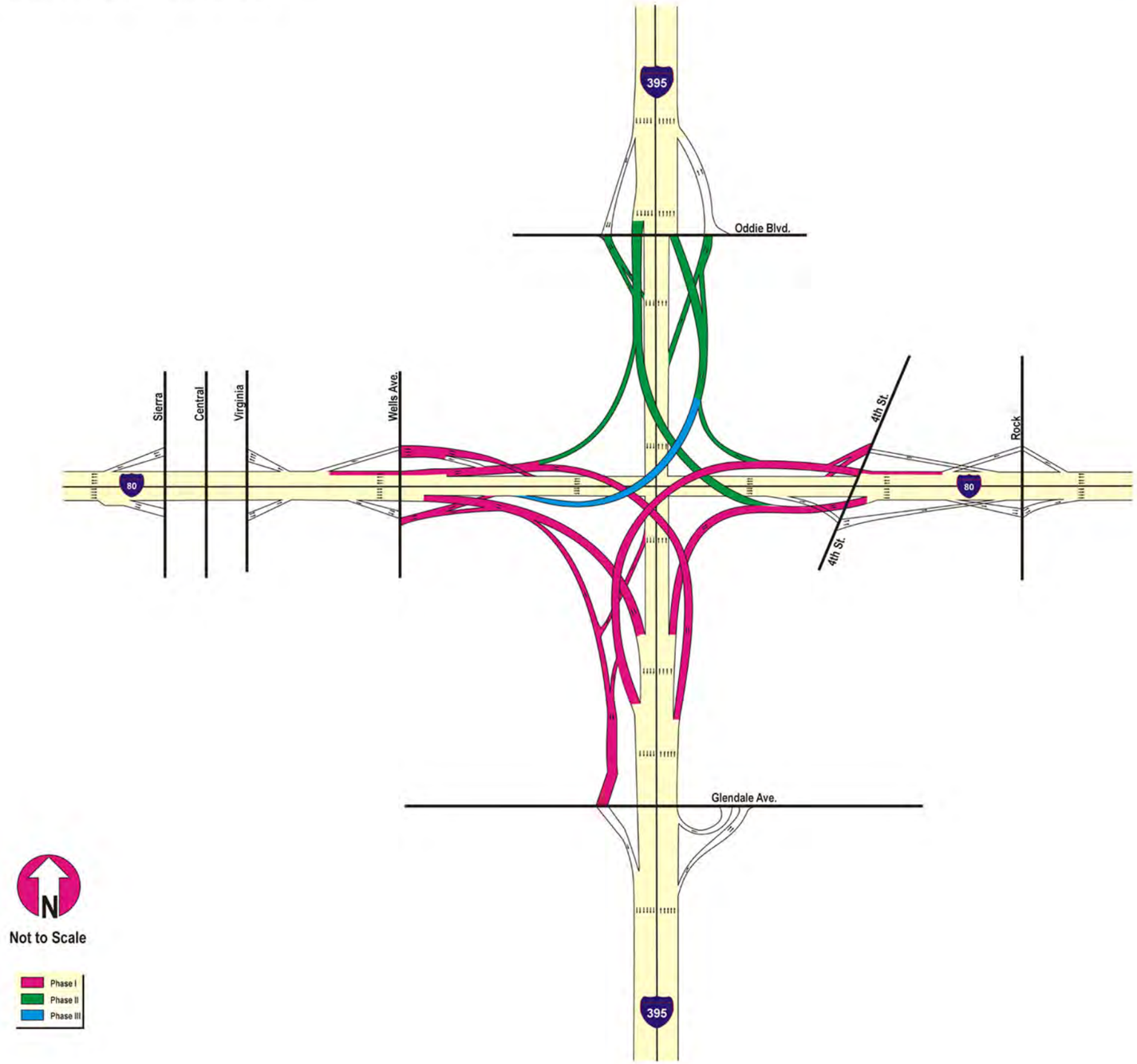


Figure 6-2: I-80 FREEWAY IMPROVEMENTS

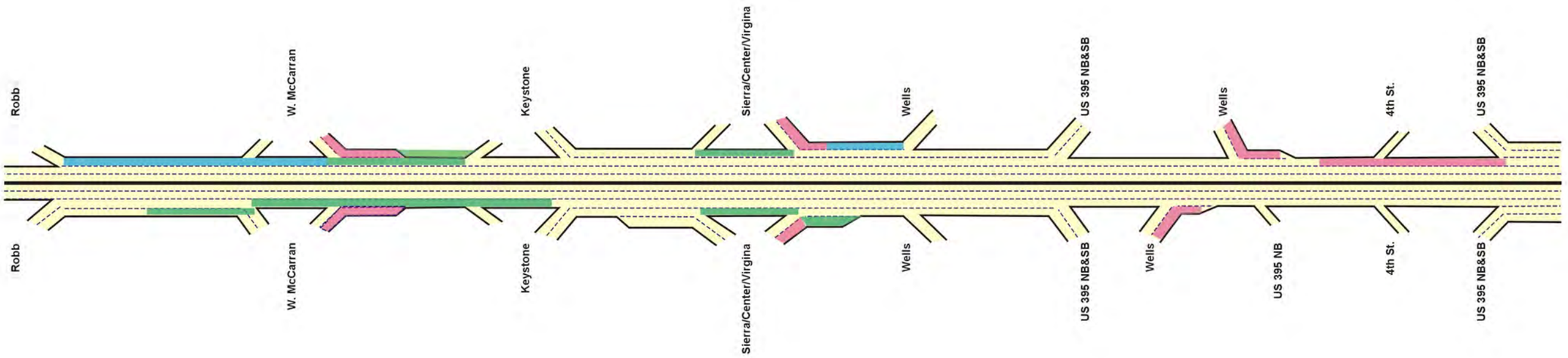
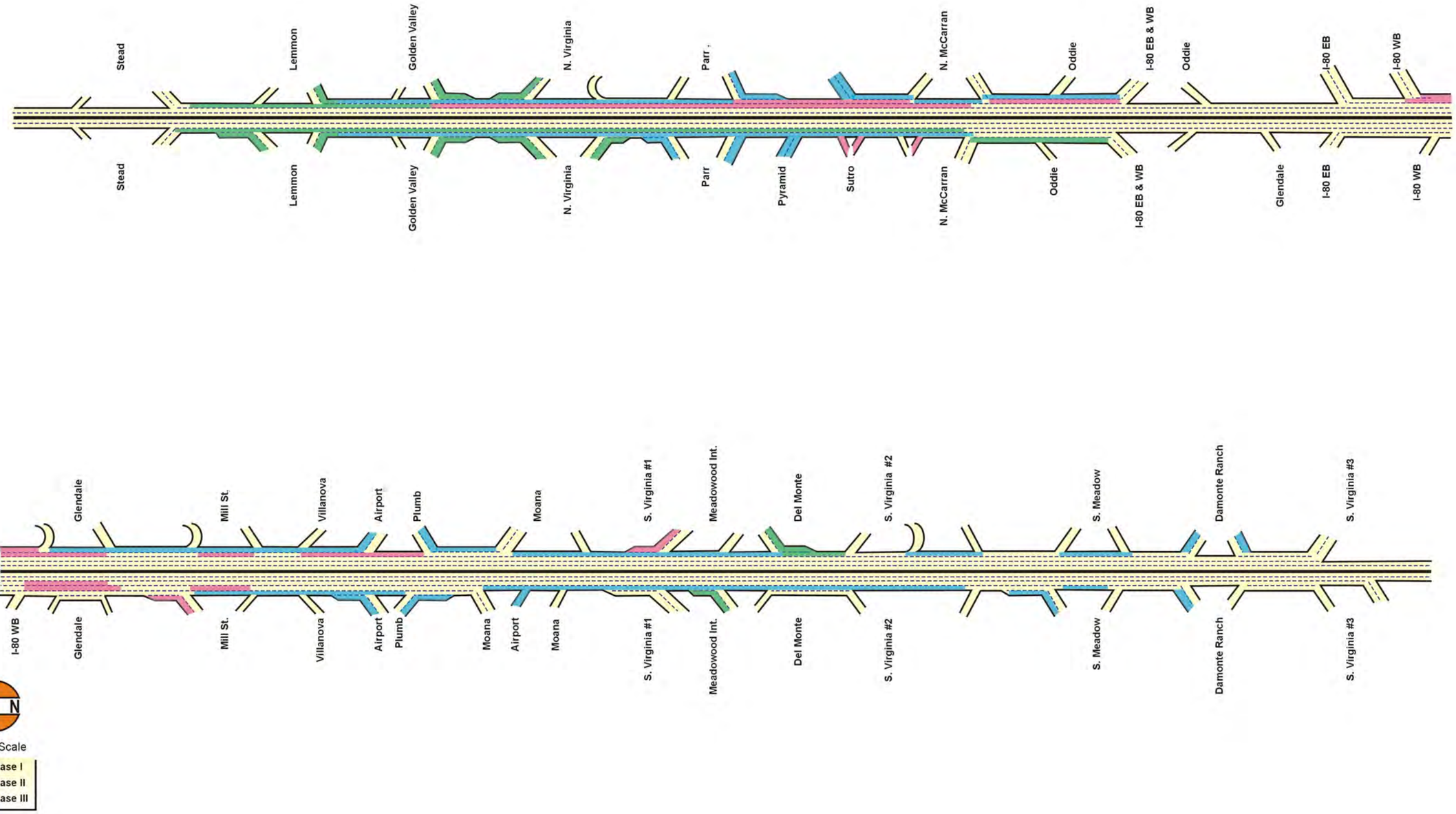


Figure 6-3: US 395/I-580 FREEWAY IMPROVEMENTS



PUBLIC INVOLVEMENT

A public involvement plan for the project was established at the outset of the study to facilitate two-way communication between the project team and stakeholders in the community. The public involvement process included communication flow from the project team to the public regarding project status, with regular reporting by the team to project stakeholders and elected officials. The process also included communication flow in the reverse direction, allowing the project team to take advantage of stakeholder expertise in the study area and allowing the public to voice its issues and opinions throughout the life of the project. The formal public involvement process for the project included several components. This chapter describes the activities and issues associated with the public involvement program, which is depicted in Figure 7-1.

7.1 Steering Committee

The project steering committee consisted of representatives from government and quasi-government entities within the Truckee Meadows. Steering committee meetings commonly took place on a monthly basis. Based on the status of study research and evaluations, as well as frequency of study findings, meetings were held more or less frequently than the regular monthly interval.

Steering Committee Membership

Membership on the steering committee comprised representatives of local agencies with significant roles in regional freeway transportation issues—generally, agencies that address transportation, land use, or development issues. The steering committee formed the initial contact between the project team and the public, elected officials, and other stakeholders. Principal agencies that formed the steering committee were as follows:

- Airport Authority of Washoe County
- Washoe County Community Development
- City of Reno
- City of Sparks
- Washoe County Public Works
- Federal Highway Administration
- Truckee Meadows Regional Planning Agency
- Federal Transit Authority
- Washoe County Regional Transportation Commission (RTC)
- Nevada Department of Transportation

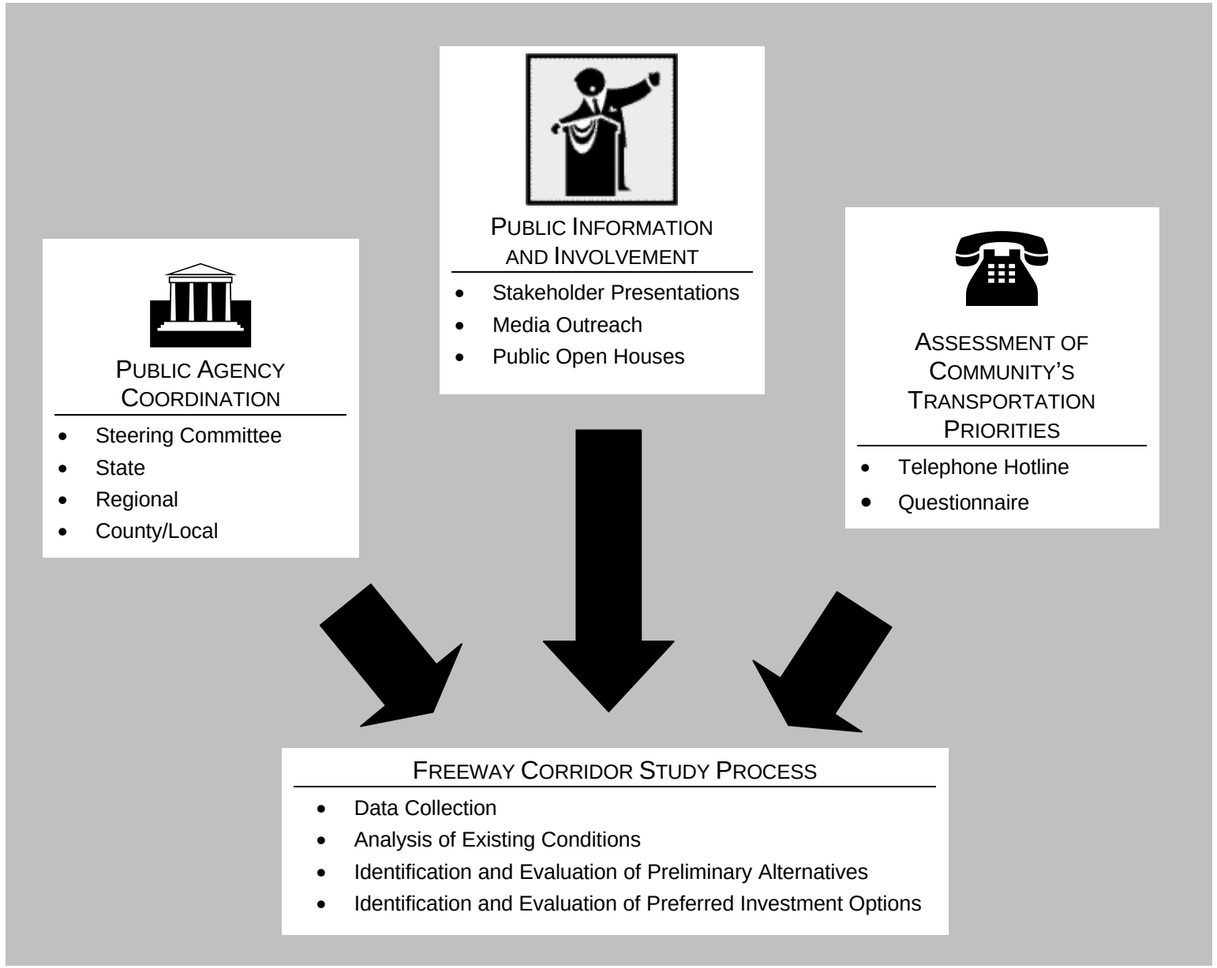
In addition to agency employees, agency consultants who were retained for projects or studies that related to the corridor study also attended committee meetings.

Steering Committee Input

As the study progressed, the project team updated steering committee members on the study process, key elements of the study that required input or decisions, and the schedule of study milestones. During the first series of steering committee meetings, project team members provided descriptions of study elements and the approaches used for the evaluations and assessments. As the study progressed, aspects of the study were described to agency representatives in order to identify their concerns and opinions and to receive their suggestions.

One of the most important areas in which planning agency representatives assisted the study effort was the identification of pending development projects and coordination with other projects sponsored by the agencies. They also provided the project team with a rigorous,

Figure 7-1: Public Involvement Approach



ongoing review of project progress and products. Additionally, steering committee members brought a unique perspective that underscored the importance of community acceptance of potential solutions.

Topics addressed at meetings of the steering committee included data collection, public involvement, project schedule and scope, *2030 Regional Transportation Plan* status, Spaghetti Bowl project status, analysis of existing conditions, traffic projections and modeling, lane requirements, and conceptual freeway plans. The minutes of steering committee meetings are included in the appendix of this report.

7.2 Stakeholder Presentations

Stakeholders are people or groups that have an interest in the findings and recommendations of the project study. While maintaining a flow of information from the project team to the stakeholders is necessary, the reverse direction of information flow is not required of the stakeholders. It is therefore incumbent upon the project team to elicit and promote the sharing of such information. Dialogue with stakeholders took place in several ways in order to gather questions, concerns, and comments relating to the project.

Washoe County stakeholders fall into three general groups: elected officials comprising the Sparks City Council, Reno City Council, and Washoe County Board of Commissioners; Planning Commissions of Sparks, Reno, and Washoe County; and other groups with an interest in the study results. Presentations regarding the project were made to members of all three groups.

City Councils and County Commission

The project team made introductory presentations to the Sparks City Council, the Reno City Council, and the Washoe County Commission. The purpose of the presentations was to describe the objective of the study and the process to be used in assessing travel demand, evaluating freeway capacity, and determining future transportation solutions. At each meeting, a project information sheet was distributed (shown in the appendix).

City of Sparks

The project team made its introductory presentation to the Sparks City Council on April 2, 2001. The mayor expressed concern regarding the ability of future freeway improvements to handle the growth anticipated in Sparks. The mayor described ongoing coordination meetings between the city and the Washoe County School District and asked that the Nevada Department of Transportation join in those meetings, which the department's representative committed to do. Council members also asked if the Reno-Tahoe International Airport ramps were included in the corridor study and if ramp metering would be evaluated. The project team responded affirmatively to both inquiries.

City of Reno

The project team introduced the corridor study to the Reno City Council at its April 12, 2001 meeting. Project team members described the study process and objectives and noted that recommendations for future improvements would target four time frames: immediate implementation, three years to five years, ten years, and long term (30 years).

Council members asked questions about truck-climbing lanes, the RTC's *Pyramid Corridor Study*, the Nevada Department of Transportation's I-80/US-395/I-580 Interchange project, and presentations to the city's Neighborhood Boards. In response, respectively, currently planned truck-climbing lanes on I-80 west and I-580 north were described to the Council. The Department of Transportation representative pointed out that while the RTC-sponsored *Pyramid Corridor Study* would make recommendations influencing the freeway system, those recommendations were separate from those of the Nevada Department of Transportation and the *Washoe County Freeway Corridor Study*. He stated that the recommendations of the corridor study would be reviewed in concert with both the *Pyramid Corridor Stud*y and the ongoing *Freeway Corridor Study*. Finally, the Council was advised that presentations to Neighborhood Boards were not included as part of the public involvement program; although, if requested, a presentation would be made.

Washoe County Commission

On February 20, 2001, a presentation was made to a joint meeting of the Washoe County Board of Commissioners and the Washoe County Planning Commission. Questions raised by commissioners related to inclusion of the *Pyramid Corridor Study* findings, identification of funding for future improvements, inclusion of various elements of the RTC's pending *Regional Transportation Plan*, and candidate solutions such as high-occupancy vehicle lanes, reversible lanes, and ramp metering.

Planning Commissions and Airport Authority of Washoe County

The project team also made introductory presentations to the Sparks Planning Commission, the Reno Planning Commission, and to the Airport Authority Board of Trustees. A presentation to the Washoe County Planning Commission was also made at a joint meeting with the County's Board of Commissioners. As with the City Council presentations, the purpose of the appearances was to describe the objective of the study and the process to be used for assessing travel demands, evaluating capacity of the existing and planned freeways, and determining future transportation solutions.

Sparks Planning Commission

On March 15, 2001, the project team made its introductory presentation to the Sparks Planning Commission at its regularly scheduled meeting. The two principal concerns voiced by the Commissioners were inclusion of the *Pyramid Corridor Study* findings and recognition of recent and proposed changes in the land use assumptions in the east Sparks area.

Reno Planning Commission

The project team made the introductory study presentation to the Reno Planning Commission on March 7, 2001. Questions and comments from the Commissioners related primarily to the need for advanced planning by the Department of Transportation for freeway improvements required by growth in the Truckee Meadows. The department representative acknowledged the need for such planning and also underscored the shared responsibility of local governments when making land use decisions that affect the transportation system.

Airport Authority of Washoe County

On June 12, 2001, the project team presented introductory comments about the corridor study to the Airport Authority of Washoe County Board of Trustees. Issues raised by the trustees and Executive Director Krys Bart included operational characteristics of the Plumb Lane intersection with the I-580 ramps, airport accessibility, and incorporating planned or approved development in the region.

Other Stakeholder Groups

In addition to the elected officials and appointed planning commissions, the project team also met with other groups that expressed interest in commenting on the study. Three such groups were John Ascuaga's Nugget Hotel Casino, the Reno Hilton Hotel Casino, and the Sparks Citizens Advisory Committee.

John Ascuaga's Nugget Hotel Casino

Project team members met with senior administrative staff of the Nugget. The February 7, 2001 meeting presented an opportunity for the Nugget's staff to offer its concerns to the study team. The senior executive vice president for the Nugget complimented the department for the improved operation of the recently completed Pyramid Way Interchange, noting the reduced queuing for eastbound traffic. He expressed concern about possible interruption of hotel and casino operations if additional lanes were constructed on the freeway above the casino. The Nugget staff also asked several questions about the planned improvements to the I-80/I-580 interchange (Spaghetti Bowl). They stated that the impact of the Spaghetti Bowl on the Nugget operations becomes apparent during the hours when guests check out

of the hotel and leave by automobile via westbound I-80. The staff also described the extreme congestion in the westbound lanes of I-80.

Reno Hilton Hotel Casino

The Reno Hilton management staff met with the project team on August 7, 2001. The Reno Hilton president offered a suggestion that the Hilton's Glendale Avenue access road become a dual left-turn operation, which the department representative supported. Hilton management also suggested the development of an arterial link on Second Street to connect Kietzke Lane with Keystone Avenue. He speculated that several downtown casinos would support the concept as an economic development opportunity. Management staff also emphasized how frequently the Glendale Avenue and Mill Street ramps (northbound and southbound, entrance and exit ramps) are used by the Reno Hilton employees.

Sparks Citizens Advisory Committee

The project team presented the study information to the Sparks Citizens Advisory Committee on April 5, 2001 during its regularly scheduled meeting at the Sparks Police Department. The committee members made suggestions and observations regarding poor signage at the Spaghetti Bowl. The department representative stated that much of the signing at the Spaghetti Bowl would be improved during the upcoming construction project.

7.3 Telephone Hotline

The project team established a telephone hotline in the project office to enhance the opportunity for stakeholders to offer comments and ask questions. Experience indicates that telephone recordings that provide project updates or histories have limited success due to the impatience of the caller. Therefore, the principal purpose of the hotline was to provide an avenue for interested parties to leave a question or comment relating to the corridor study. Announcement of the hotline telephone number was an ongoing element of press releases and project information sheets.

Callers to the hotline left comments and questions relating to the corridor study, general transportation issues in the Truckee Meadows, and specific issues concerning I-80 or US-395/I-580. When callers left messages requiring a response from the project team, they were contacted within 24 hours. All comments and questions were noted in a hotline log.

Prior to the second public meeting, the hotline had received 59 calls. Most of the calls fell into one of the following categories:

- *40.7 percent of the callers made comments regarding freeway ramps*. Of these, 16.9 percent called to urge that some ramps be closed, either permanently or during certain times of the day, 10.2 percent cited locations where additional lanes should be added to make existing ramps two-lane, and 13.6 percent called with other comments regarding ramp length, sight distance, and banking.
- *11.9 percent of calls made to the hotline regarded freeway signing.* Of these, 6.8 percent suggested signs instructing through traffic at interchanges to stay left and 5.1 percent identified the need for more advance signing prior to interchanges for easier way-finding.
- *11.9 percent of calls were complaints about other drivers and requests for better regulation.* Of those, 6.8 percent cited excessive driving speeds and 5.1 percent cited improper and dangerous merging.
- *11.9 percent of calls urged the addition of freeway capacity through widening or addition of lanes.*
- *5.1 percent of calls cited the need for truck-climbing lanes in certain locations.*
- *18.6 percent of calls were made regarding other issues, some of which were not related to freeway operations.*

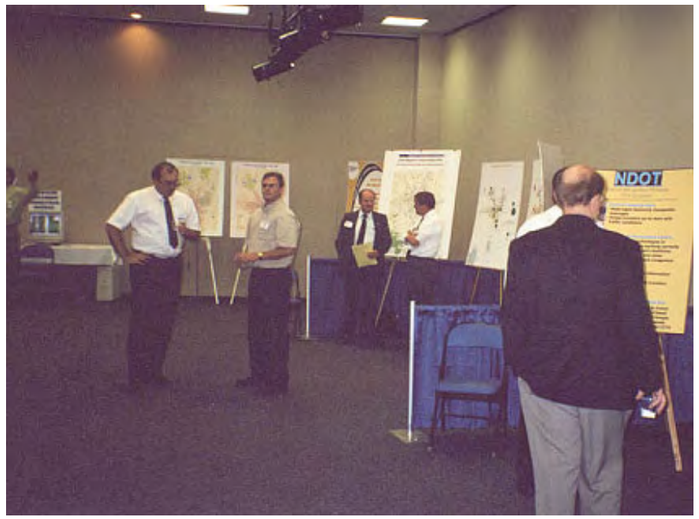
A summary of the telephone calls is included in the appendix of this report.

7.4 Press Releases

The Department of Transportation public information office released several press releases during the course of the study. In addition, the *Reno Gazette Journal* reporter who covers transportation issues conducted several in-depth interviews with senior project staff.

7.5 Public Meetings

Two public open houses were held to present project information to the public. The first public open house presented introductory information regarding the purpose of the study, the study approach, analysis tools used to project traffic demand, and expected study results. The second open house presented findings of the study, including the recommended transportation improvements and implementation schedule.



Open House 1—July 26, 2001

The introductory open house took place on Thursday, July 26, 2001 at Lawlor Events Center at the University of Nevada between 4:00 p.m. and 7:00 p.m. The event was publicized in newspaper articles and flyers that were distributed by public agencies (see the appendix). Twenty-six people attended.

The open house was organized to present information to the public regarding the study objectives, process, and expected results. Poster displays were situated throughout the meeting room to allow the public to circulate at a pace comfortable for each person. Staffing consisted of project team members and volunteers from the project steering committee.

A "Frequently Asked Questions" (FAQ) sheet was developed and handed out at the open house. Comments from the attendees indicated that the FAQ sheet was beneficial in helping the public better understand the study. A reproduction of the FAQ sheet is contained in the appendix.

The Program Management Division of the Nevada Department of Transportation also developed a questionnaire to identify areas of concern to the public and its desire for various transportation management measures. Eleven attendees completed and returned questionnaires during the open house, and one attendee returned a questionnaire by U.S. mail afterwards.

In general, the questionnaire revealed that:

- 55 percent of respondents would support the short-term closing of freeway on-ramps during rush hours;
- 64 percent of respondents would support ramp metering at some interchanges during rush hours;
- 73 percent of respondents believe that additional traffic-carrying capability is needed on surface streets in addition to freeways;
- 64 percent of respondents had never used Citifare, the local bus transit system; and
- 45 percent of respondents would be willing to pay additional taxes to reduce traffic congestion.

Respondents were also asked to note problematic freeway sections other than the Spaghetti Bowl. Their responses included:

- The two-lane section of I-80 near the Nugget;
- I-80 both east and west of the Spaghetti Bowl (between Keystone Avenue and East McCarran Boulevard, between Pyramid Way and East McCarran Boulevard, westbound between Keystone Avenue and Robb Drive, and at the eastbound Rock Boulevard Interchange); and
- US-395/I-580 both north and south of the Spaghetti Bowl (between Mill Street and Parr Boulevard, between North McCarran Boulevard and Plumb Lane).

Detailed summaries of the responses received are included in the appendix, along with a list of additional comments submitted by respondents.

A second open house was held on Wednesday, December 4, 2002 at the Nevada Department of Transportation District 2 Main Conference Room between 4:00 p.m. and 7:00 p.m. The event was publicized in newspapers. Nineteen people attended the open house.

The open house was held to present information to the public regarding the findings and recommendations of the study. Information boards were located throughout the meeting room to allow easy access to information. Staffing consisted of the consultant staff and volunteers from the project steering committee. Project information packets were provided to all attendees showing the recommended improvements on the freeway to the year 2030. The improvements were also shown on the information boards. No written comments were received from the public.

7.6 Coordination with Other Studies

The public involvement process for the *Washoe County Freeway Corridor Study* also included coordination with other ongoing transportation studies, including the *2030 Regional Transportation Plan*, the *Pyramid Corridor Study*, the *I-80/US-395 Intelligent Transportation System Study*, and the Nevada Department of Transportation's plans for improvements to the Spaghetti Bowl. Because public confusion between the *Washoe County Freeway Corridor Study* and the *2030 Regional Transportation Plan* was a particular concern, project team members attended public meetings and steering committee meetings for that study as well.