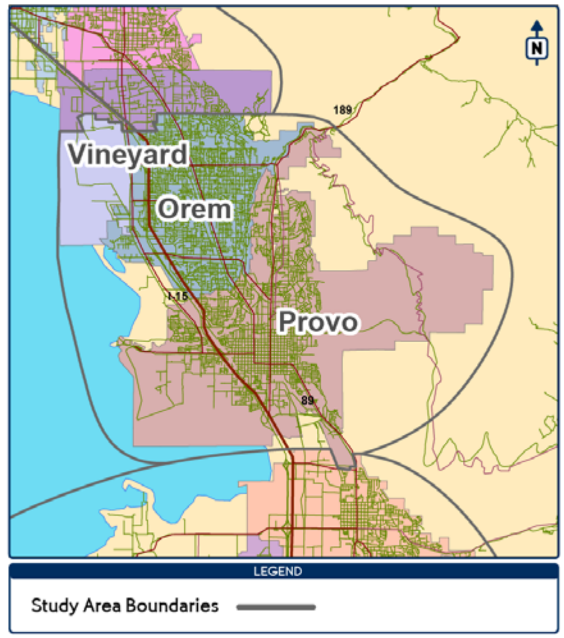
Utah Valley Transportation Studies

provo / orem transportation study

Provo / Orem Project Description

The Provo/Orem Transportation Study is part of the Quadrant Studies initiated by the Mountainland Association of Governments (MAG). This study will look at local level transportation planning projects in the east-central portion of Utah County based on population and employment projections for 2030. The study results will be a combination of recommendations specific to the area east of Utah Lake between the cities of Vineyard and Orem to the north and Provo to the south with the exclusion of the eastern Wasatch Mountains. The study will analyze transportation priorities through 2030—improved conditions and connections to transportation facilities—while also presenting a corridor preservation plan that anticipates needs in the years beyond 2030. The two major goals of the project are:

Provo/Orem Study Area



1. Develop and recommend transportation projects to be implemented in the Provo/Orem region that will handle projected capacity into, out of, and within the area.
2. Coordinate stakeholders from Utah County and each city in the Provo / Orem area to assist in the approach to developing the recommended projects.

The Provo/Orem study area extends from the cities of Orem and Vineyard in the north south through Provo. This study area is the most densely populated and developed quadrant. It includes a significant amount of urbanized area with two large universities and many major commercial and business centers, specifically in Orem and Provo. Vineyard is expected to experience a great amount of residential and retail growth, with plans to build on the Geneva Steel site currently under consideration. The existing network of state and local roadways, a heavily used transit service, and designated bike lanes and sidewalks provide a sophisticated transportation system with many mobility options for its users. The challenge is meeting future travel demand by maximizing the existing infrastructure and limiting impacts to established neighborhoods.

As Utah County continues to welcome growth, there is a great benefit to planning early for the infrastructure and regional travel needs. The collaborative approach of this study is necessary to create the most desired transportation plans. Coordination ensures that representatives from each city in the Provo/Orem area will have the opportunity to express needs and concerns specific to their communities and the Provo/Orem area as a whole.

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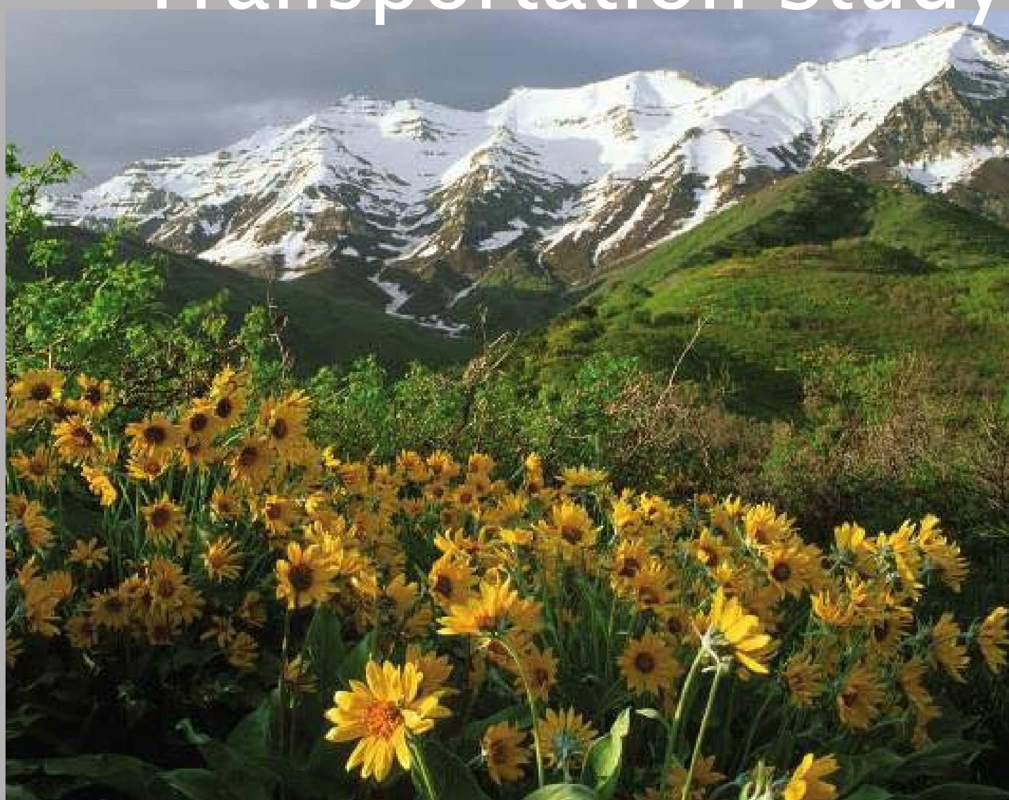
Provo-Orem Transportation Study



September 2006

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Chapter One

1. Study Methodology

The Provo/Orem area of Utah County is the population and employment hub of Utah County. Unlike most other cities in Utah County, the Provo/Orem area is largely built-out and does not anticipate the population explosion that faces other area municipalities. However, being one of the major employment centers on the Wasatch Front, the overall growth of the region has important impacts on this area, especially on the transportation system. Evaluating the local and regional impacts of this anticipated travel demand before it occurs allows decision-makers the opportunity to develop a system that meets the mobility needs of and provides choices to the transportation system users of the Provo/Orem area.

> *…being one of the major employment centers on the Wasatch Front, the overall growth of the region has important impacts on this area, especially on the transportation system.*

The Mountainland Association of Governments initiated this study with two primary objectives: first, to work with local governments to identify future transportation problems in the Provo/Orem area; and second, to define transportation projects and strategies that will satisfy projected travel demand in the study area in both the short and long terms. Projects identified as regionally significant will be included in the Mountainland Association of Governments' (MAG) 2030 regional Long Range Transportation Plan (LRTP). The Provo/Orem Study was done concurrently with studies for two other regions in Utah County, the Nebo area and the Lake Mountain area. In the fall of 2005, InterPlan completed a plan for the first of the four areas with the Northeast Utah Valley Transportation Study (NEUVTS). Collectively, these studies have been referred to as "the quadrant studies."

MAG contracted with a consultant team consisting of Carter-Burgess and InterPlan Co. to supply technical support to MAG staff. A Technical Advisory Committee (TAC) was assembled to provide direction and oversight to the process. The TAC included representation from cities within the study area, Utah County, the Utah Department of Transportation (UDOT), the Utah Transit Authority (UTA), and MAG, met on a monthly basis from October 2005 through May 2006, and was instrumental in weighing the impacts of various alternatives and developing the locally preferred alternative, presented later in this document. The TAC also offered guidance on topics such as:

- Population and employment projections
- Analysis of LRTP projects
- 2030 alternative transportation network development
- Alternative cross-section development
- Access control policies

Agendas from each TAC meeting are included in Appendix A.

In order to accomplish the first objective, identifying future transportation problems in the study area, the project team examined population and employment projections previously done by MAG staff. Revisions to socioeconomic data were made to reflect more recent growth and development trends. This updated data was used for travel demand modeling throughout the rest of the study.

Travel demand modeling is done by transportation planning agencies to determine the number of vehicles on roads and transit usage in the region for a specified future year. The model determines trips based on land uses and where people live, work, shop, recreate, and other destinations. Initial modeling efforts focused on establishing existing and future travel patterns of vehicle trips that originate in the study area. This gave the project team important information related to where people were traveling to, whether north into Salt Lake County, other parts of Utah County, or staying within the Provo/Orem area. In addition, in order to identify future transportation problems, a set of analysis scenarios was developed, including a no-build scenario, a LRTP scenario, and a "non-controversial projects" scenario. All are detailed later in this chapter.

Modeling of these future scenarios indicated that traffic congestion issues were present in each of them. In order to address the second goal of the project, to identify projects and strategies to solve those issues, the Technical Advisory Committee began examining specific transportation improvements. These improvements included widening existing roads, providing better connections between existing facilities, and identifying access management policies. At the same time, planning-level potential alignments were drawn in order to have a better understanding of possible property impacts of some of these improvements. Using measures of effectiveness such as vehicle hours of travel and travel time index, projects were compared and chosen to be included in the preferred alternative. Finally, phasing of improvements was considered related to the timing of population growth and the relative need for individual projects over time.

The above is intended only to give a brief summary of the study methodology and the process undertaken over the course of the project. Each of these steps is discussed in more detail later in this document. Specifically, elements addressed in further chapters include:

- Existing and future conditions related to socioeconomic data, land use, travel characteristics, local and regional planning efforts
- Problem identification
- Alternatives analysis including the Locally Preferred Alternative

1.1 Study Area

The Provo/Orem Study Area is shown in Figure 1.1. It encompasses the cities of Provo, Orem, and Vineyard.

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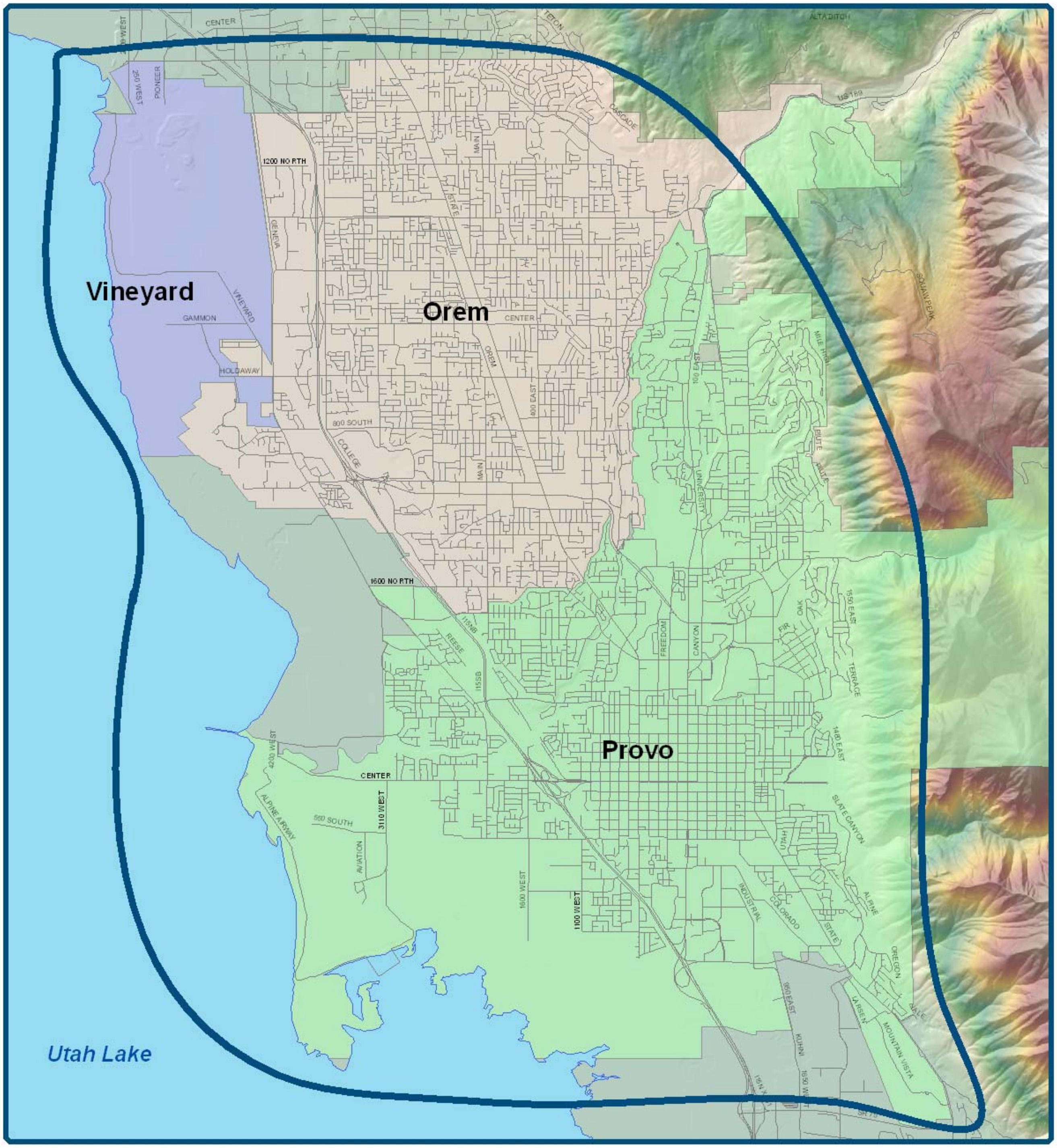
Figure 1.1
Study Area



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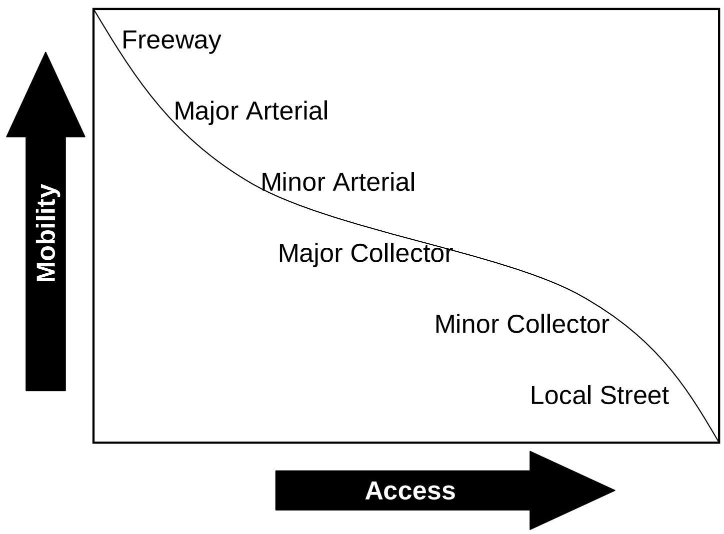
Study Area

1.2 Transportation Systems Analyzed

The transportation system that was examined during this process was the existing functional classification network. The functional class network is the foundation of the transportation system, moving people and goods into, out of, and throughout the region. It includes freeways, expressways, arterials, and collector roads under the jurisdiction of the state, county, and local entities. Generally, a road's functional classification is determined by whether its purpose is to provide access or mobility. Those roads at the smaller end of the functional class system move traffic more slowly but provide greater access, such as to local roads or to residential or small commercial properties. On the other end of the scale, expressways provide greater mobility as they move more traffic at greater speeds, but with more limited accesses such as driveways and intersections. This concept is illustrated in Figure 1.2. Figure 1.3, Roadway Functional Class, depicts the existing road network for the Provo/Orem area.

Figure 1.2: Access and Mobility by Functional Classification



Transportation projects that would help meet projected travel demand in the year 2030 were considered during this process. These projects included those already part of the region's Long Range Transportation Plan, as well as other new improvements that were suggested by city representatives. These projects were discussed and debated by the study's TAC and were considered with respect to how "controversial" they were between cities. This process is discussed in more detail later in this chapter and each of these projects is detailed in Chapter 5 of this document.

Transit is an important part of the MAG's future transportation choices. As a result, the existing and planned transit system was also considered when identifying projects to satisfy future transit demand. Existing transit facilities include bus service as well as park and ride facilities. Planned transportation improvements center on commuter rail connecting Utah and Salt Lake Counties, and a doubling of the bus services in the study area.

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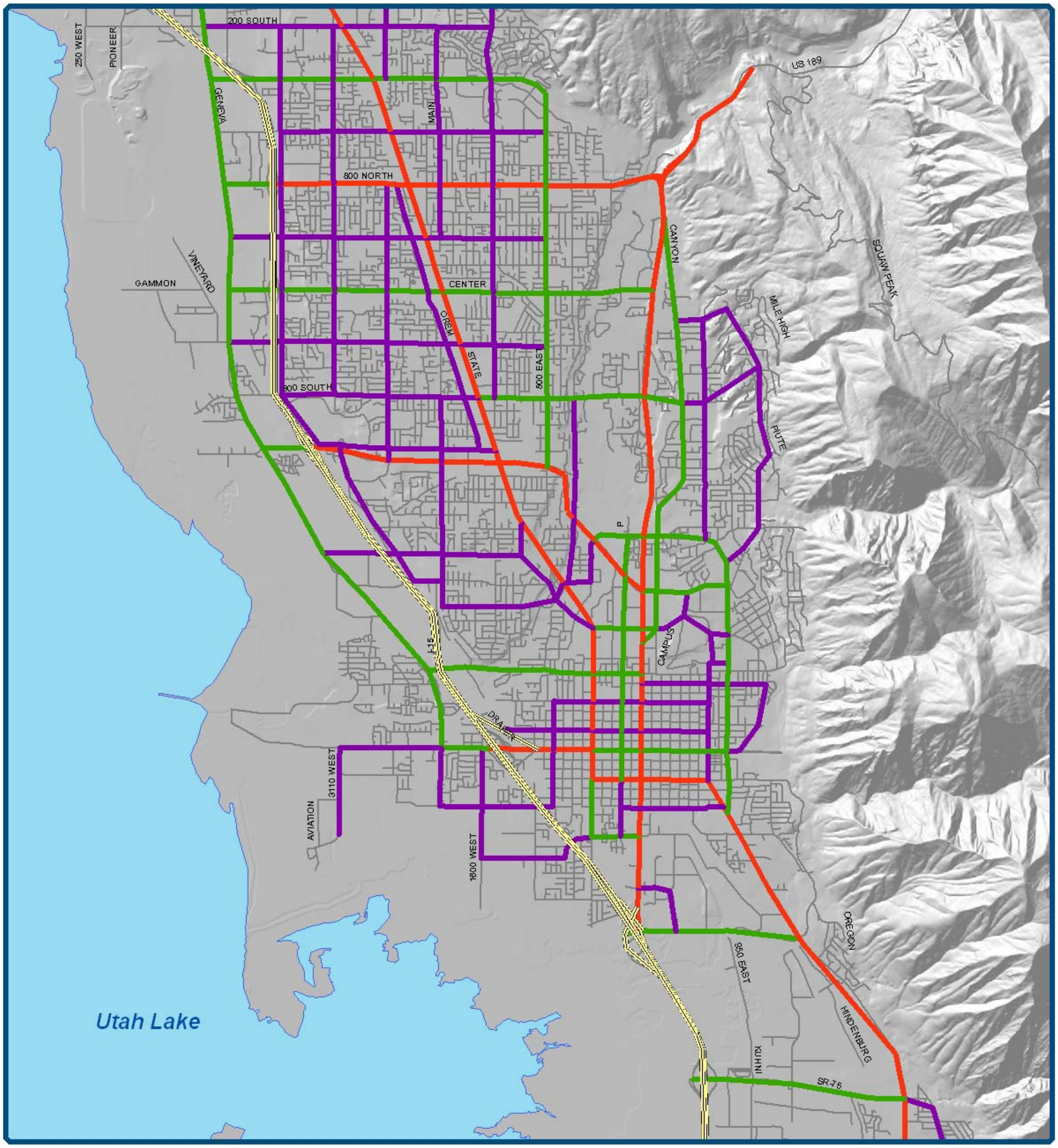
Figure 1.3
Existing Functional Class



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Interstate — Principal Arterial — Minor Arterial — Collector — Local Street

1.3 Analysis Years

The study team made comparative evaluations of roadway and transit conditions under different scenarios, and at different points in time, based on projected population and land use as defined by the cities. The purpose of reviewing conditions at various times was twofold. First, final recommendations, dependent on the projected need and cost, are based on implementation years 2015, 2030 and 2030+. Second, it was beneficial for committee members and other stakeholders to see the growth patterns and explore the potential of multi-modal options to address some of the issues. Consultants provided the TAC summaries of data and measures of effectiveness using detailed mapping, tables, and other graphics.

Committee members were asked to consider street networks including area interstate or freeway segments, state roads, and local roads for the current year 2005 and for future years 2015 and 2030. Transportation system scenarios were modeled in an iterative process and presented to the TAC to develop a transportation system that best met study goals. Each meeting involved review of increasingly refined scenarios until agreement was reached on the best scenario to meet this goal. Scenarios included combinations of interstate, roadway, and transit improvement projects and various phasing options.

It was beneficial for committee members and other stakeholders to see the growth patterns and explore the potential of multi-modal options to address issues.

1.4 Mapping

All map data was provided by the Mountainland Association of Governments and map development was conducted by Carter-Burgess and InterPlan. Additional layers needed throughout the course of the project for location maps, study areas, existing land use data, aerial photography, and environmental constraints data were developed by Carter-Burgess or were made available by MAG.

1.5 Existing Plans and Studies

The following transportation plans and studies were examined as part of the planning process and helped provide background for determining the scope and approach for the project.

- **General Plans.** City General Plans were consulted for land use and transportation conditions and to help determine future trends. In most cases, the evaluation of land use plans consisted of reviewing zoning maps, consulting with cities concerning existing and planned development, and incorporating negotiated changes into the model. The General Plans of the Provo/Orem Study Area include:
  - The Utah County General Plan was approved April 6, 1999, (with updates through 2003). In it, Objectives 15, 16, and 17 fully cover transportation services and systems including integration with other governmental entities. Recent land use updates also address cluster zoning and density. The Utah County Land Use

Ordinance was updated July 2005 and is the implementing ordinance of the General Plan. [1]

  - The Provo City General Plan, originally adopted in August 1997 and updated November 2004.
  - The City of Orem General Plan.

- **I-15 Corridor Environmental Impact Statement, Utah County (I-15 Corridor EIS), UDOT.** This EIS evaluates 65 miles of Interstate-15 to address population growth, travel demand, and system interconnectivity. Transit needs and new proposed interchanges are being evaluated to serve the Lake Mountain area.

- **City of Orem Southwest Area Transportation Study (2003).** Orem City conducted a major transportation study for the southwest portion of the city, which identified an alternative for further study. That recommendation includes: a new interchange at 800 North and I-15; ramp improvements at University Parkway and I-15; constructing and widening 800 South, 400 West, and UVSC's Campus Drive; a collector/distributor system on I-15 from University Parkway to Provo; constructing and improving collector roads including 1200 West.

- **Mountain View Corridor (MVC), UDOT.** The Mountain View Corridor EIS specifically addresses transportation needs in the western portions of Salt Lake County and northern Utah County.

- **North Valley Connector Study, MAG.** The North Valley Connector Study was completed in January 2002. It focused on east-west transportation needs in the northwest region of Utah County, specifically for the cities of American Fork, Lindon, Pleasant Grove, Cedar Fort, Eagle Mountain, Lehi, and Saratoga Springs. This study examined growth within this broad study area and attempted to identify projects that best met future east/west travel needs. The recommendations of this study include alternatives that have been adopted into the Lake Mountain area city general plans and some that are included in the LRTP.

- **I-15 Corridor Management Plan, MAG/UDOT.** The I-15 Corridor Management Plan evaluated options for additional interchanges and access to I-15 through Utah County. Recommendations included widening of I-15 and frontage roads.

- **Inter-Regional Corridor Alternatives Analysis (IRCAA), MAG.** The IRCAA study looked at a comprehensive transportation network for the 120 miles from Brigham City in the north to Payson in the south. Additionally, issues and observations raised during the IRCAA study have been important to consider for the quadrant studies.

- **Northeast Utah Valley Transportation Study (NEUVTS), MAG.** The NEUVTS study is the first of the quadrant studies to be completed. A report documenting the findings of

[1] Title 17, Chapter 27a, of the Utah Code Annotated 1953, and as these apply to LUDMA, Land Use Development and Management Act.

the study was published in September 2005 and some or all of the elements are expected to be incorporated in MAG's updated LRTP in 2006.

- **The Mountainland Association of Governments 2030 Long Range Transportation Plan (LRTP).** The LRTP consists of local and regional projects and is updated every four years to include multi-modal projects identified to meet a 30-year forecasted travel demand. It includes the local and regional roadway and transit projects identified by MAG in cooperation with the Utah Department of Transportation and the Utah Transit Authority. The most recent update was approved in February 2005.

  Selection of LRTP projects is largely justified by travel demand modeling and forecasting, which is based on population and employment data. Additional analysis and planning for the LRTP is required because amended population data shows significantly higher growth in all four study areas of Utah County than what was planned for in the February LRTP report.[2]

- **The Mountainland Association of Governments Transportation Improvement Program (TIP).** The Transportation Improvement Plan (TIP) is a five year program of projects taken from the LRTP. Projects in the first three years of the TIP have identified funding sources that can be obligated for activities from preliminary engineering to implementation; projects in the last two years are referred to as "Concept Development" (CD) and are moved into the three-year section when project details are more finalized and funding is available.

1.6 Proposed Analysis Scenarios

The Provo/Orem Study used the projects of the 2030 MAG Long Range Transportation Plan as a beginning point to develop scenarios for further evaluation and modification. The project development process included collaboration between cities, the county, UDOT, and UTA. The technical committee evaluated and selected transportation projects within their communities. This included consensus-based meetings of the technical committee to verify future travel needs within each municipality, identify controversial and non-controversial projects, and determine how to structure model run packages.

Further analysis considered project costs, regional development scenarios, and phasing. Analysis scenarios included:

- A "No Build" scenario where all projects included in the LRTP were built *outside* of the study area but none are built within the study area.
  - SR-92, widened to four lanes from I-15 to Highland;
  - 1100 East, extend existing road from State Street to I-15;
  - Springville 1400 North Interchange upgrade;
  - 800 North (Orem), widened to four/six lanes from 400 West to 400 East;
  - Center Street (Orem) to Canyon Road new construction; and
  - I-15 widening to three general purpose lanes and one HOV lane from Alpine to University Parkway.

[2]Provided by the State of Utah Governor's Office of Planning and Budget, 2005.

- An LRTP scenario which assumed all LRTP projects were built both within and outside of the study area. This also included “controversial” projects.
- A “non-controversial projects” scenario that was chosen by the TAC from the LRTP projects. These were projects that were considered by the sponsors to be relatively easy to implement and without much controversy at the city or regional level. Obviously, most projects will engender some amount of debate at the local and neighborhood level.
- Additional individual projects on a phased development basis.

Transportation network alternatives were evaluated with respect to several different performance measures, discussed below. Care was given in choosing the measures used so that they would be effective means of relaying relatively technical information to a wide range of audiences. For example, the performance measures needed to be able to be graphically represented in charts or graphs so that they would be quickly and easily understood and compared. They also needed to be understood in a non-technical way, so that they would be meaningful to all interested groups, including elected officials, city staff, and area residents.

Alternatives were compared based on several transportation performance measures or analysis tools.

- Level of service (LOS) – standard measurement used by engineers that identifies the amount of congestion on a given roadway. Level of service is given grades of A through F, with A being free-flow conditions and F being highly congested, “parking lot” conditions.
- Vehicle Hours of Travel (VHT) – a calculation of the total time all vehicles spend on the transportation network. This measure is easily obtained from the regional travel demand model and helps to identify area-wide congestion changes.
- Vehicle Miles of Travel (VMT) – similar to VHT, this refers to a calculation of the total miles traveled by all vehicles on the transportation network. It is also an output of the travel demand model.
- Travel Time Index (TTI) – refers to a measure of congestion determined by dividing the time it takes to travel a given road segment at the peak hour by the free-flow travel time for that segment.

Chapter Two

2. Existing Conditions Analysis

By having a clear picture of existing conditions, it is easier to more accurately predict future trends. Socioeconomic data including population and employment as well as generalized land use in the study area are discussed here. Also included is information regarding existing travel characteristics of the region, including study area mode choice and travel patterns, and community and environmental fatal flaw impact analysis.

2.1 Socioeconomic Data

Population and employment and their projected trends are key elements of the transportation planning process. Determining the location and extent of residential development is one of the many challenges of transportation planning. This section offers an examination of the existing population and employment for the Provo-Orem area. Future conditions are discussed in Chapter 3.

2.1.1 Population

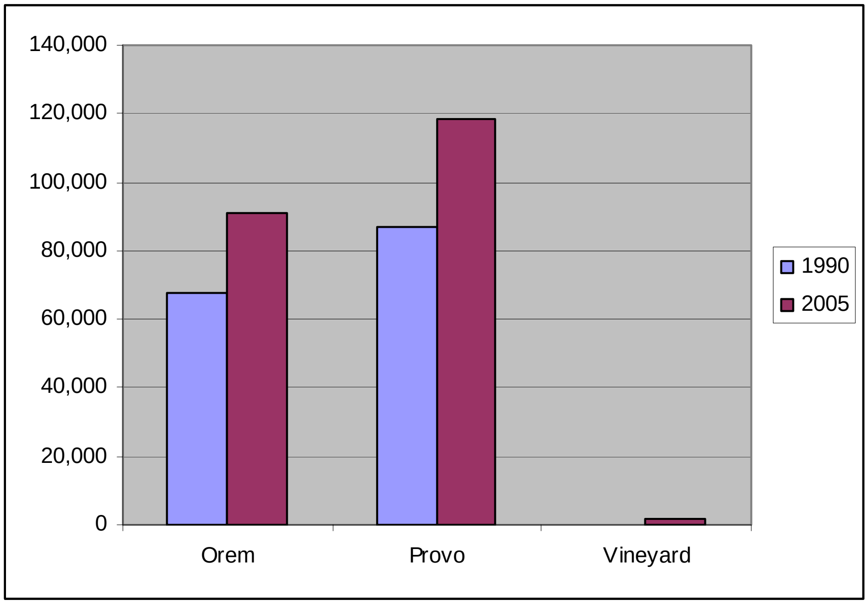
The Provo-Orem study area has grown since 1990, although not to the same extent as other areas in Utah County. Vineyard is the exception to this, with a growth rate of nearly 900 percent between 1990 and 2005, although as the following figure shows its population is still a small portion of Provo's and Orem's. Population growth by city is shown in Table 2.1 and Figure 2.1.

Table 2.1: Population Growth by City, 1990-2005

City	1990	2005	% Increase: 1990-2005	AARC* 1990-2005
Orem	67,561	90,973	34.7%	2.0%
Provo	86,835	118,454	36.4%	2.1%
Vineyard Area	151	1,500	893.4%	16.5%
Total	**154,547**	**210,927**	**36.5%**	**2.1%**

*****Average Annual Rate of Change
Source: 1990 US Census data and city estimates.

Figure 2.1: Population Growth by City, 1990-2005



Source: 1990 US Census data and city estimates.

The overall growth rate for the study area is 36.5 percent over the past 15 years. As discussed earlier, the Provo-Orem area is the commercial heart of Utah County and as such, has experienced slower growth than other municipalities in the area.

2.1.2 Employment

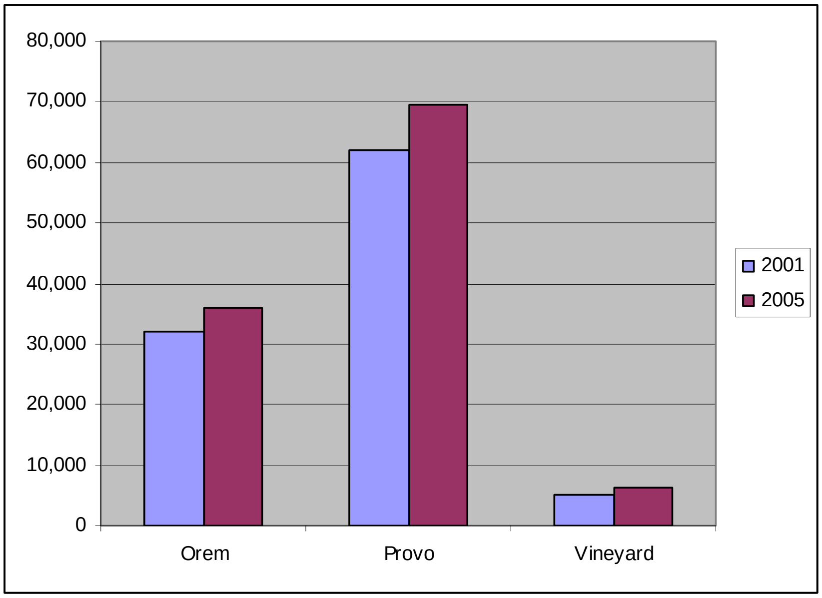
Unlike other areas of Utah County, the Provo-Orem area boasts strong employment numbers and a more balanced ratio of residents to employees. Table 2.2 and Figure 2.2 show employment growth by city between 2001 and 2005.

Table 2.2: Employment Growth by City, 2001-2005

City	2001	2005	% Increase: 2001-2005	AARC*: 2001-2005
Orem	32,130	35,896	11.7%	2.8%
Provo	62,092	69,487	11.9%	2.9%
Vineyard Area	5,242	6,339	20.9%	4.9%
Total	**99,464**	**111,722**	**12.3%**	**2.9%**

*Average Annual Rate of Change
Source: MAG and city estimates

Figure 2.2: Employment Growth by City, 2001-2005



Source: MAG and city estimates

While there is much less disparity between jobs and population in the Provo-Orem study area than in the other quad study areas, assessing the impacts of growth on the transportation network is still an important part of the process. As Provo-Orem grows as an employment base for Utah County, more people enter and leave the area on a daily basis to get to and from their jobs. The impact of this commercial activity is especially important when the single-occupant vehicle is the predominant mode of transportation as it is in Utah County. More discussion of mode choice is provided later in this chapter.

2.2 Land Use

The majority of the land in the Provo/Orem study area lies within incorporated municipal boundaries. An analysis of land use highlights the fact that while most of the land in the study area is in residential land use, strong commercial areas exist primarily along major transportation corridors such as I-15 and State Street. Generalized land use is shown in Figure 2.3. Land use data is from Utah County's GIS database.

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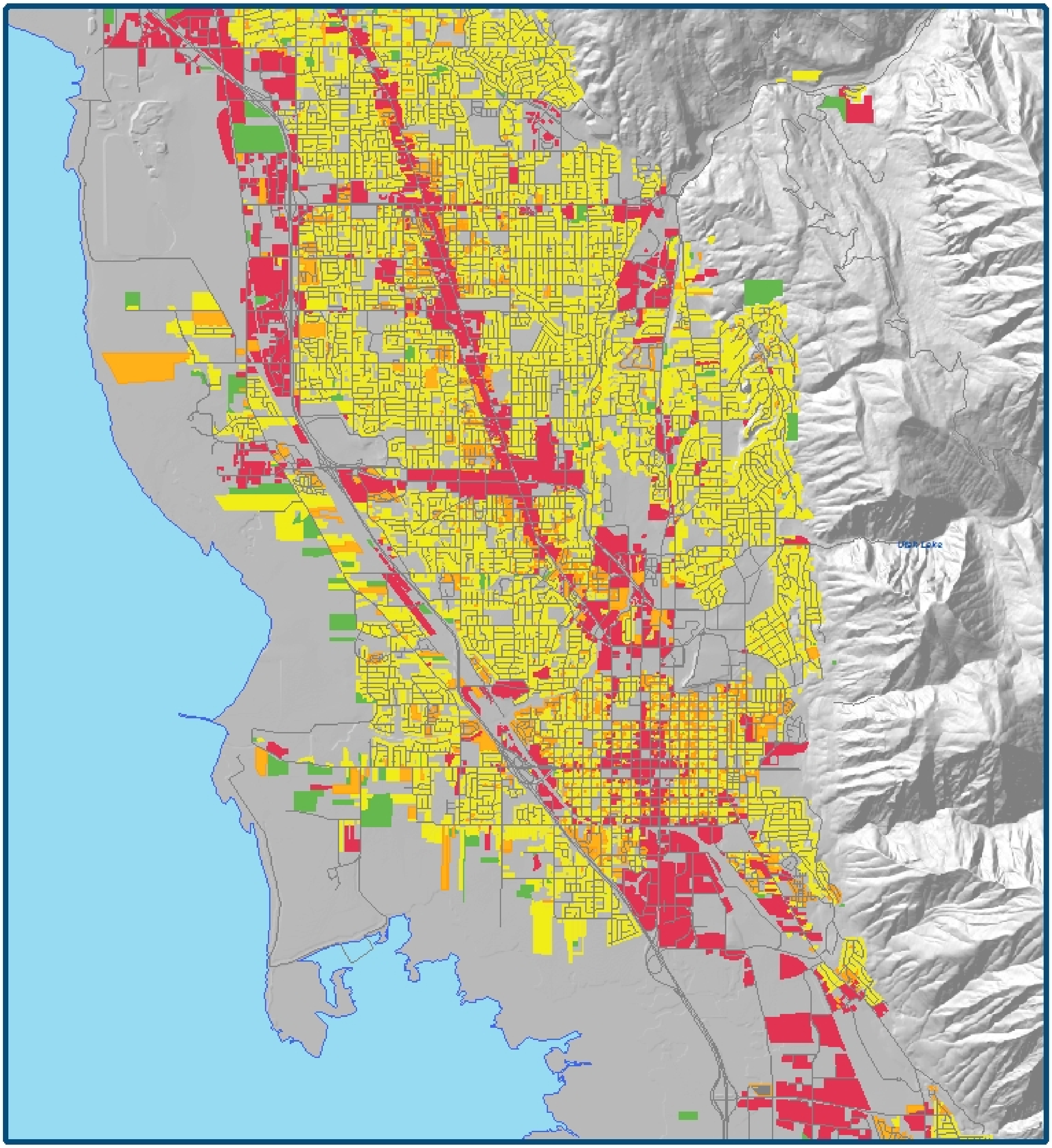
Figure 2.3
Generalized Land Use



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Agriculture | Single Family Residential | Multiple Family Residential | Commercial

2.3 Transportation System Data

2.3.1 Mode Choice

Mode choice refers to how people get to and from their destinations, whether by car, bus, train, walking, or bicycle. For existing conditions, census data provides the best information related to mode choice, but is available only for work trips. Almost all trips are made by personal vehicle. There is currently a lack of extensive transit facilities in the Utah County area which could account, at least in part, for the high use of personal vehicles. Additionally, geography and land use patterns in the county make transit use more difficult for trip purposes such as shopping and entertainment. Table 2.3 shows mode choice for work trips for the Provo/Orem Area for 1990 and 2000.

Table 2.3: Mode Choice to Work, 1990 and 2000

	1990		2000	
Mode	#	%	#	%
Drove Alone	42,553	67.2%	60,781	71.2%
Carpooled	9,316	14.7%	13,705	16.2%
Transit	1,515	2.4%	1,462	1.7%
Bicycle	1,065	1.7%	1,113	1.3%
Walked	5,415	8.6%	7,176	8.5%
Other	3,453	5.5%	931	1.1%

Source: 1990 and 2000 US Census.

As Table 2.3 shows, the percent of people who drove alone to work increased between 1990 and 2000. While transit use for work trips is typically in the range of three to four percent in Wasatch Front Counties, it is significantly less within the study area. In fact, transit shares for work trips decreased in both number and percent between 1990 and 2000. This study did look at transit improvements to address future travel demand needs. However, as transit use is obviously a small portion of total trips in the area, it was not seen to be a panacea solution to transportation issues, and so was not a priority of the technical committee.

2.3.2 Transit Data

The Utah Transit Authority (UTA) is the exclusive provider of public transit services in Utah Valley. UTA operates eight local and county routes within Utah County and nine interregional express routes between Utah County and Salt Lake Valley. Both local and interregional transit services fulfill distinct travel needs within Utah Valley. Interregional services provide higher speed service on the I-15 HOV lanes, encourage Utah County residents to use the bus and avoid the congested freeway. As such, transit helps the state maximize its investment in the freeway system. Figure 2.4 shows existing transit in the study area.

Several local bus routes provide connections to regional transit services and services to local destinations, especially for students, seniors, and other populations who may not have access to an automobile. The transit mode study will include recommendations for transit in this area.

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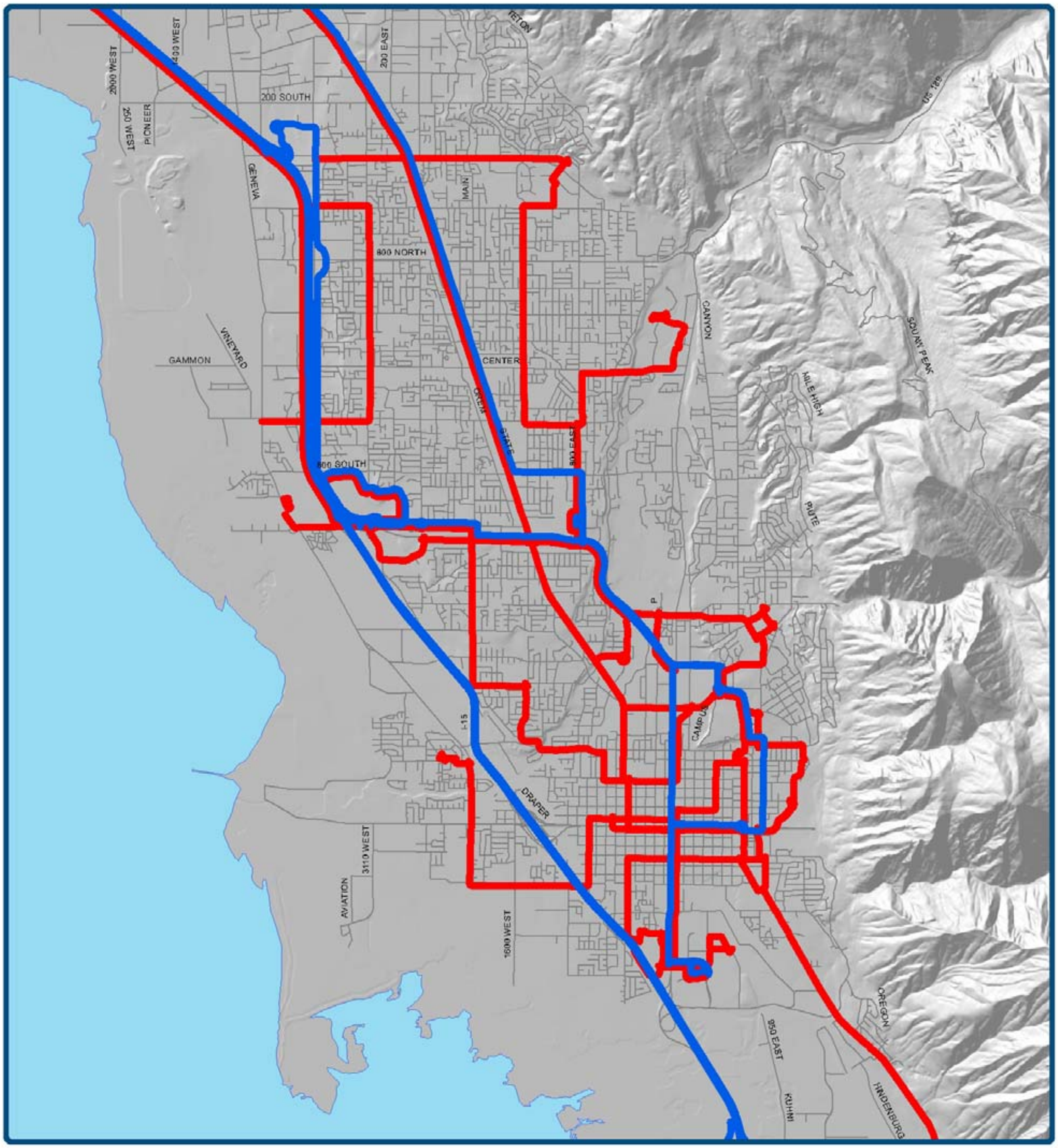
Figure 2.4
Existing Transit



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Express Service — Local Service

2.3.3 Travel Patterns

To gain a better understanding of the role of regional transportation facilities, the destinations of vehicle trips that originated in the study area were examined. This was done for total trips, regardless of their purpose, and for work trips. Figures 2.5 and 2.6 show these trip patterns.

Due to its strong mix of commercial and residential activity, most (88 percent) of all trips generated within the Provo/Orem study area stay within the area. An examination of work trips reveals a similar picture with 78 percent of work trips staying within the study area. Not surprisingly, the second most population for work trips is Salt Lake County and other areas north due to the strong employment base in that area. However, these account for only 11 percent of total work trips originating in the Provo/Orem area.

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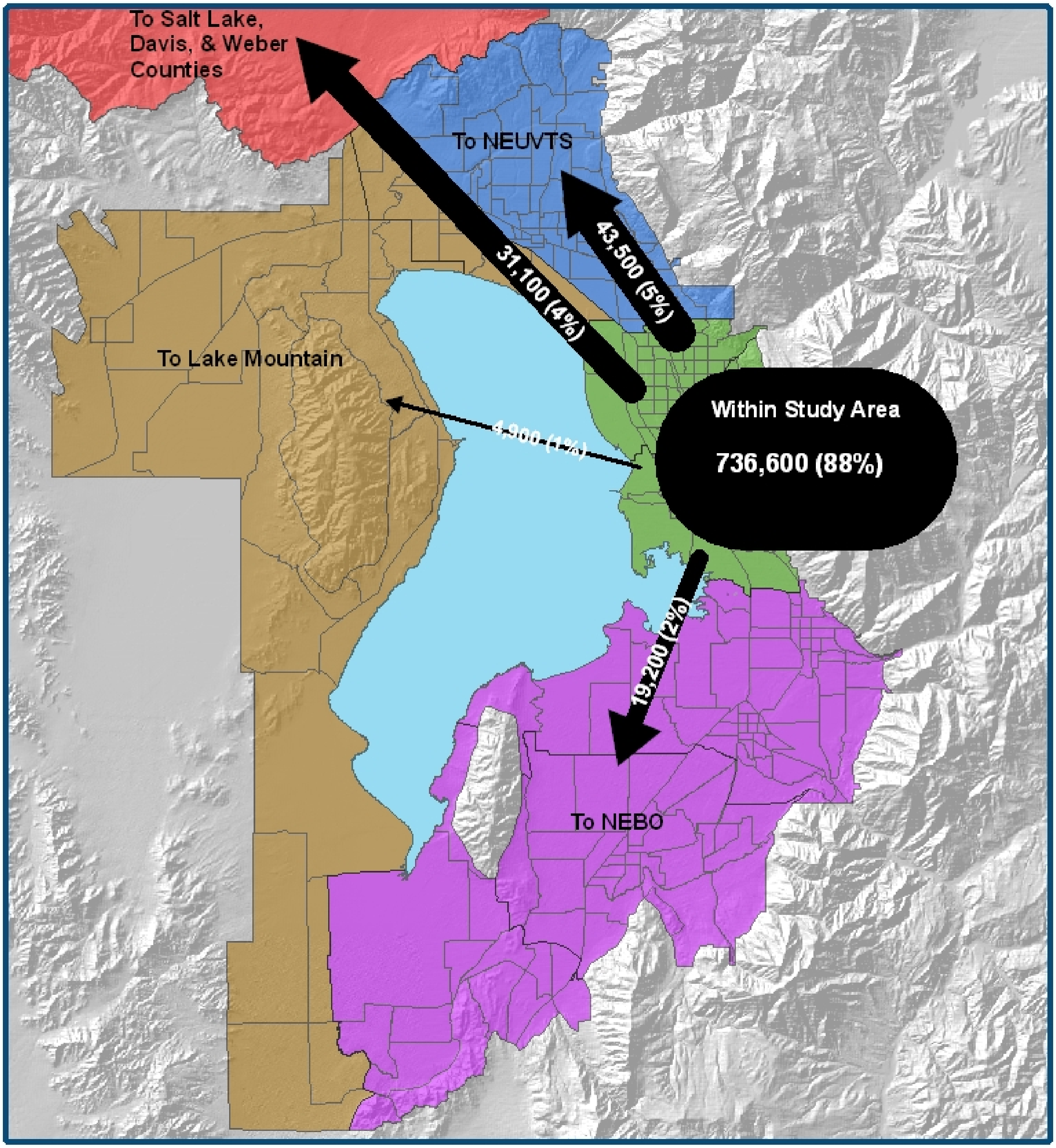
Figure 2.5
Total Trips from Study Area, 2001



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Salt Lake, Davis, Weber | NEUVTS Area | Lake Mountain | Orem/Provo | Nebo Area

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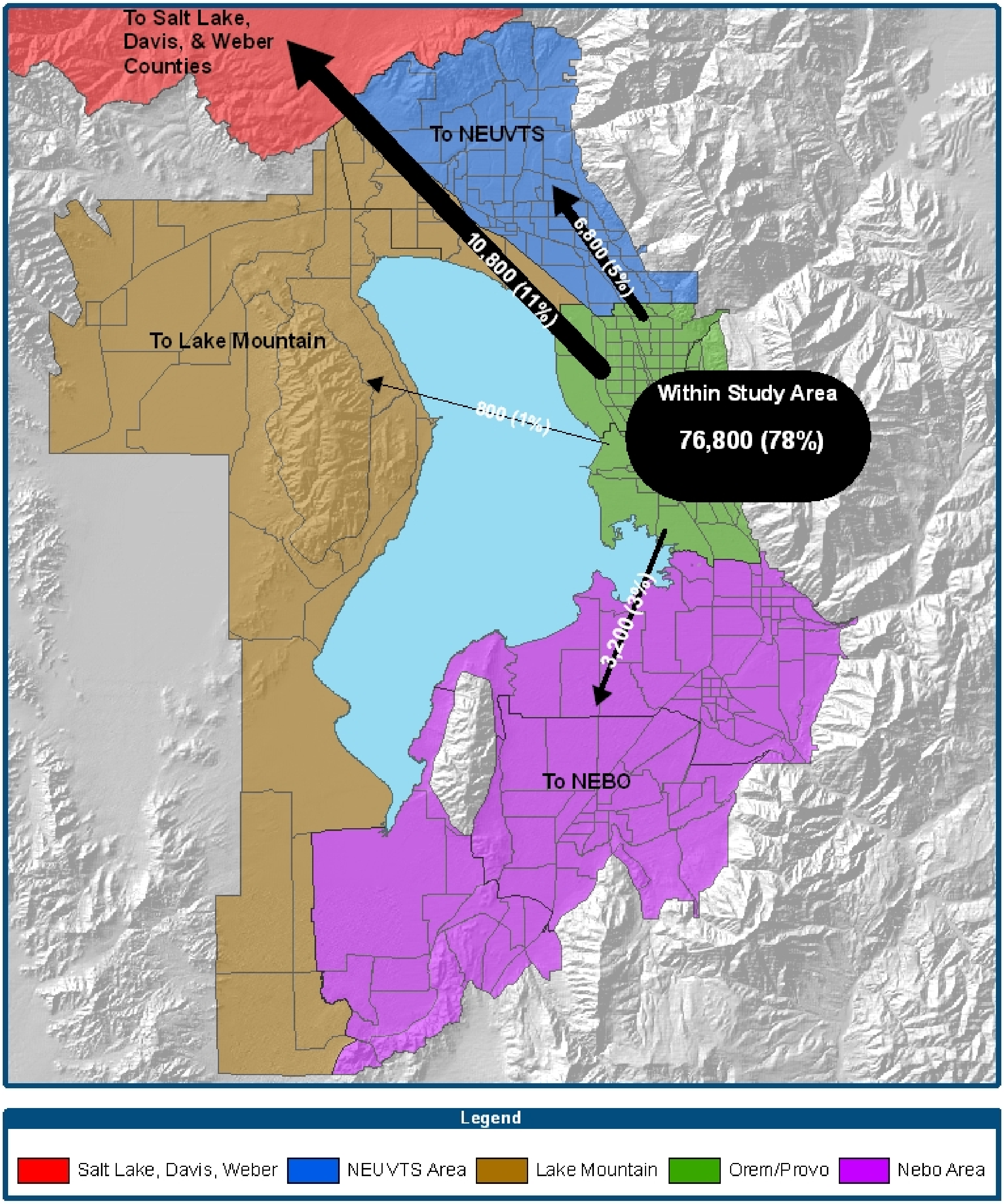
Figure 2.6
Work Trips from Study Area, 2001



2.4 Existing LOS Analysis

As discussed in Chapter 1, level of service refers to a standardized measure of traffic conditions on a given roadway. Figure 2.7 shows level of service on the functional class system in the study area for 2001. Red lines indicate heavy congestion in the peak hour and green lines indicate little congestion during that time.

2001 was used as the base year for two reasons. First, it was consistent with the analysis years used in the Northeast Utah Valley Transportation Study, the first of the four quadrant studies to be conducted. Second, considerable work had been done to calibrate the 2001 travel demand model to existing conditions, therefore increasing the accuracy of model output.

In 2001, there is evidence of some traffic congestion within the Provo/Orem study area in the afternoon peak hour. Pockets of congestion are apparent on Geneva Road, State Street, University Parkway, and other localized areas. However, overall traffic conditions in the study area are good, with few serious problems.

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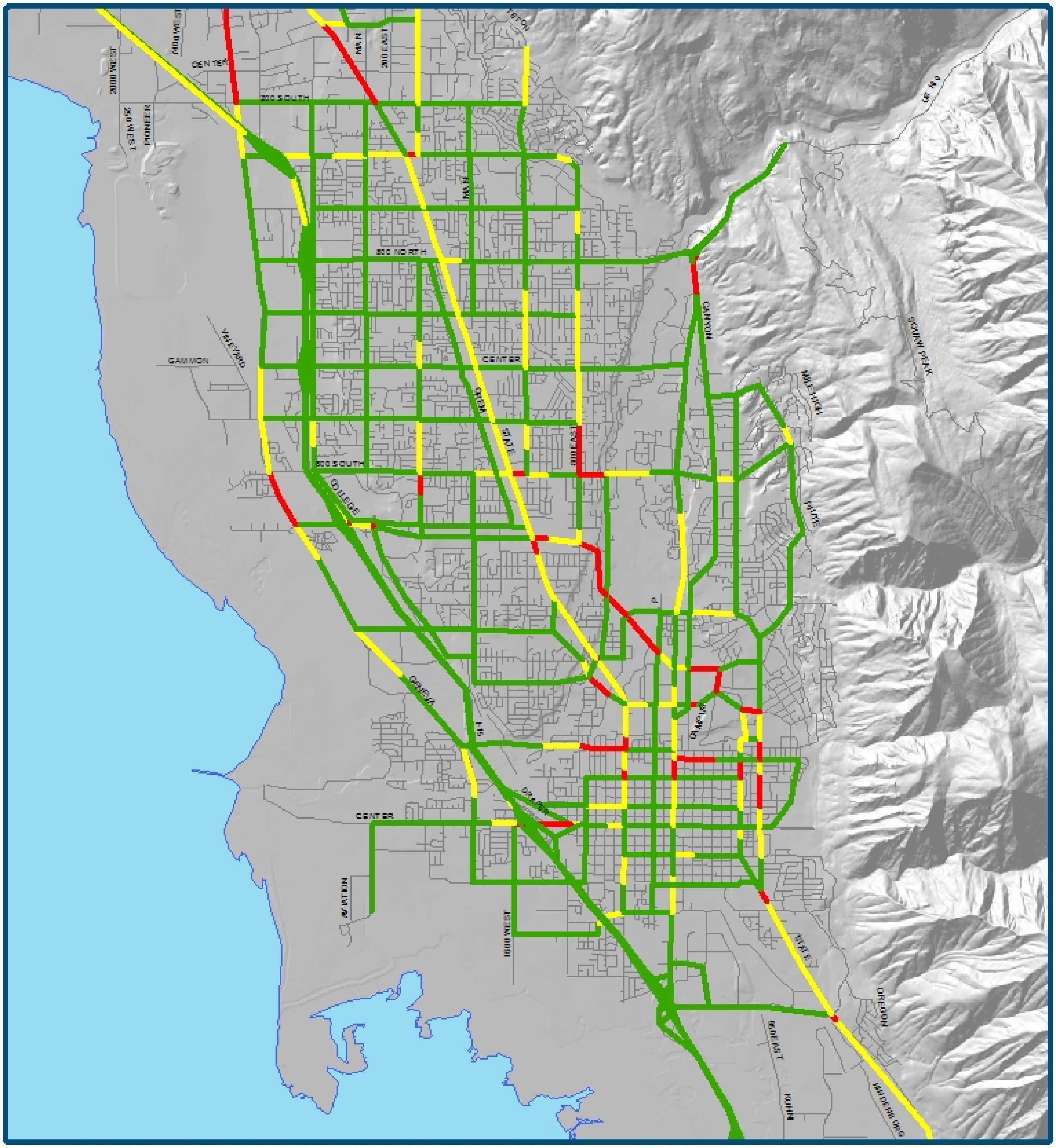
Figure 2.7
2001 Level of Service



Legend

PM Peak Period Volume to Capacity Ratio

0.00 - 0.80 | 0.81 - 1.00 | 1.01 - 2.80 | Existing Roads

2.5 Other Existing Deficiencies Analysis

With the exceptions noted above, traffic conditions tend to be relatively stable with little failure during the peak hour. However, it is important to remember that this information is from 2001 and changes both within the study area and throughout Utah County will likely have impacts on afternoon traffic conditions in that time.

2.6 Community and Environmental Fatal Flaw Impact Analysis

Existing physical and environmental impediments to project development were evaluated by obtaining land use, land cover, and mapping data from MAG. Natural restrictions were reviewed and evaluated including: ravines, fault zone, hazardous material sites, threatened and endangered species, habitat, and wetlands. The most significant constriction is the geographic location of Utah Lake between the Cedar Valley Mountains and the Wasatch Mountains. For reasons of cost effectiveness, major and secondary north/south highways must be routed through a relatively narrow band along the western side of Utah Lake.

The entire MPO area has been identified as important migratory waterfowl habitat described as the "Intermountain West Unit" by the U.S. Department of Interior in the *1994 Update to the North American Waterfowl Management Plan.* This plan's primary objective is to preserve habitat and increase duck, goose, and swan populations nationwide. Roadway improvements should avoid or minimize any wetland or waterfowl habitat taken. In addition, sections of important farmland should be preserved to act as migratory rest and feeding areas.

The Utah Division of Wildlife Resources has also mapped the entire MPO area for fish, mammal, reptile, and amphibian habitats. Primary areas of concern are the bench or foothill locations, riparian or wetlands and water bodies. Foothills occur where the urbanized area meets the Uinta National Forest in the eastern edge of the MPO area. These sagebrush and scrub oak covered hills provide critical habitat to mule deer, elk, mink, and snowshoe hare both in the winter and year long. Also several species of birds use the foothill are for yearlong habitat, such as California Quail, Ring Neck Pheasant, and Ruffed Grouse.

Important fisheries in the MPO area are the upper portion of the Spanish Fork River, the entire stretch of the Provo and Jordan Rivers, portions of Hobble Creek near Springville, portions of the American Fork River, and Utah Lake. Selected species include the June Sucker, Bonneville Cutthroat Trout, Utah Sucker, Utah Chud, and the Speckled Dace.

Several threatened and endangered species, both flora and fauna, exist within the MPO area. Coordination with the U.S. Fish and Wildlife Service and the Utah Division of Wildlife Resources determined the presence of the following threatened and/or endangered species.

- *Bald Eagle* (Haliaeetus leucocephalus) Status: Threatened – Wintering Populations (only three known nesting pairs in Southeastern Utah)
- *Clay Phacelia* (Phacelia argillacea) Status: Endangered – located near Tucker Rest Area in Spanish Fork Canyon
- *Peregrine Falcon* (Falco peregrinus) Status: De-listed – Nests in Utah County
- *Utah Valvata Snail* (Valvata Utahensis) Status: Endangered and thought to be extinct
- *Ute Ladies' tresses* (Spiranthes diluvialis) Status: Threatened
- *June Sucker* (Chasmistes liorus) Status: Endangered – Critical habitat in the MPO area. The Utah Division of Parks and Recreation created a June Sucker recovery plan for the

U.S. Fish and Wildlife Service. The plan involves the lower 7.8 km (4.90 miles) of the main channel of the Provo River, Provo Bay, and Utah Lake.

- *Desert Milkvetch* (Astragalus desereticus) Status: Threatened found near Birdseye on Highway 89.
- *Western Yellow-billed Cuckoo* (Coccyzus americanus occidentalis) Candidate Species

The following species may occur within a project area and are managed under Conservation Agreements and Strategies. Conservation Agreements are voluntary cooperation plans among resource agencies that identify threats to a species and implement conservation measure to proactively conserve and protect species in decline.

- *Spotted Frog* (Rana pretiosa)
- *Bonneville Cutthroat Trout* (Oncorhynchus clarki utah)[1]

[1] From Mountainland Association of Government's *Utah Valley 2030 Long Range Transportation Plan*, Section 4, Pages 32-33.

Chapter Three

3. Future Conditions Analysis

In order to plan for a transportation network that will accommodate future population growth, a careful examination of projected land use and socioeconomic conditions is important. This chapter provides a summary of population, employment, and land use in the year 2030 in the study area. The impacts of this growth on travel patterns as well as what future conditions will be with no transportation network improvements are also analyzed in detail.

3.1 Project Review Process

Review of projects and plans within the study area is especially important, given the area's high growth rates observed in the past and expected in the future. The consulting team worked closely with MAG staff as well as the technical advisory committees (TACs) in examining planned transportation projects and future socioeconomic conditions in the study area.

3.1.1 Review of Local Government Projects for Consistency with Model Data

The study team worked with local government representatives to determine whether or not planned transportation projects and expected city growth were adequately reflected in the MAG travel demand model so that modeled analysis of future conditions was as reflective of future conditions as possible. MAG staff attempts to keep the model as up-to-date as possible, although given the ever-changing nature of the cities within the region, it is difficult to always ensure the latest data is included in the model. The Provo-Orem Area Transportation Study allowed for a fine tuning of the travel demand model for joint use by the consulting team in this study and for on-going planning efforts of MAG staff.

3.1.2 Traffic Analysis Zone Consistency with Project Phasing and Socioeconomic Data

In Utah, there is no agency or organization that is given the responsibility of monitoring population growth and development. While some cities have processes of keeping track of population growth through monitoring building permits, there are not any municipalities in Utah that determine whether growth has occurred within the traffic analysis zone where it was projected. TAZs are the geographic building block of the travel demand model and are roughly equivalent to census block groups. Without this detailed information on the extent to which development "matches" projections, cities can only guess as to specific areas of population increase and so with future transportation needs as well. Due to this uncertainty, one of the primary transportation planning tools through land use is setback requirements during development.

> *In any study that relies on the travel demand model, it is important to be proactive in looking at population and employment projections in great detail.*

3.1.3 Revised Socioeconomic Data Process

In any study that relies on the travel demand model, it is important to be proactive in looking at population and employment projections in great detail. In Utah, population and employment projections are determined in a "top down" approach, from state to region, region to county, and county to city. However, more recent local development trends indicate greater population growth in the study area than originally projected by state and regional agencies.[1]

The consultant team worked closely with TAC members to revise city-level population and employment projections to reflect these increases. In updating land use information, city representatives considered specific development plans along with conceptual city development principles. All revisions to socioeconomic information were made prior to travel demand modeling. These revisions are used in the model in the form of updated population, household, and employment numbers and are organized by TAZ.

This process of involving municipal representatives in validating model data helped build an iterative, consensus-based decision process and became an important foundation on which to evaluate and select transportation projects. The results of these adjustments to socioeconomic projections are discussed in more detail in the next section.

3.2 Socioeconomic Data

3.2.1 Population

Unlike the rest of Utah County, the Provo-Orem study area population is expected to remain relatively stable to the year 2030. Being older cities and with little land area remaining for significant residential development, population projections show modest increases compared to the Lake Mountain and Nebo study areas. Vineyard is the exception to this, with considerable population increases expected over time, due primarily to the redevelopment of the Geneva Steel site. Existing, future, and city-revised future population numbers are shown for the study area in Table 3.1 and in Figures 3.1 and 3.2. It should be emphasized that city-level projections included in this analysis are based on an aggregate of traffic analysis zones as used in the travel demand model and do not necessarily match exact city boundaries.

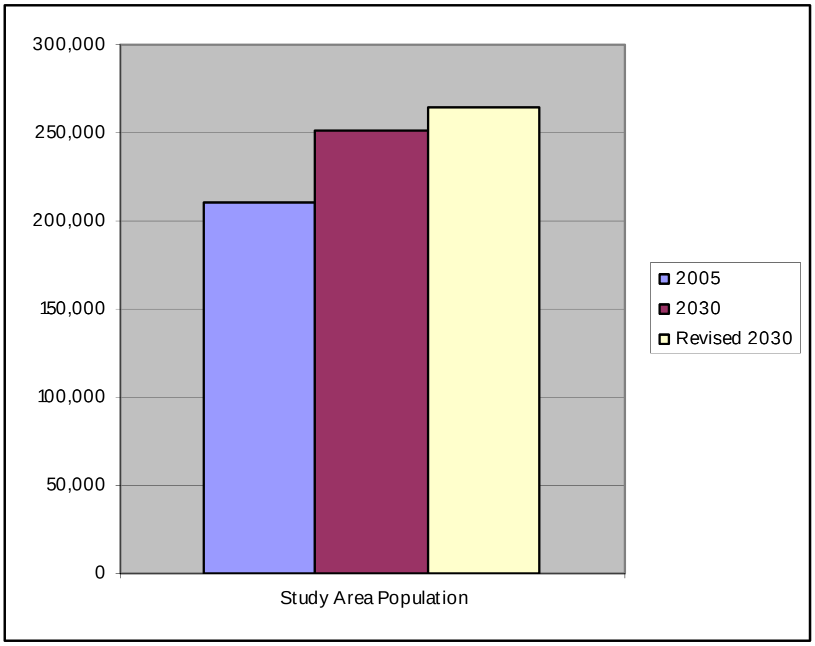
Table 3.1: Population Growth by City, 2005-2030

City	2005	2030	Revised 2030	% Increase: 2005-r2030	AARC* 1990-2005
Orem	90,973	102,127	102,127	12.3%	0.5%
Provo	118,454	137,616	137,616	16.2%	0.6%
Vineyard Area	1,500	11,955	24,457	1530.5%	11.8%
Total	**210,927**	**251,698**	**264,200**	**25.3%**	**0.9%**

*****Average Annual Rate of Change
Source: MAG and city estimates.

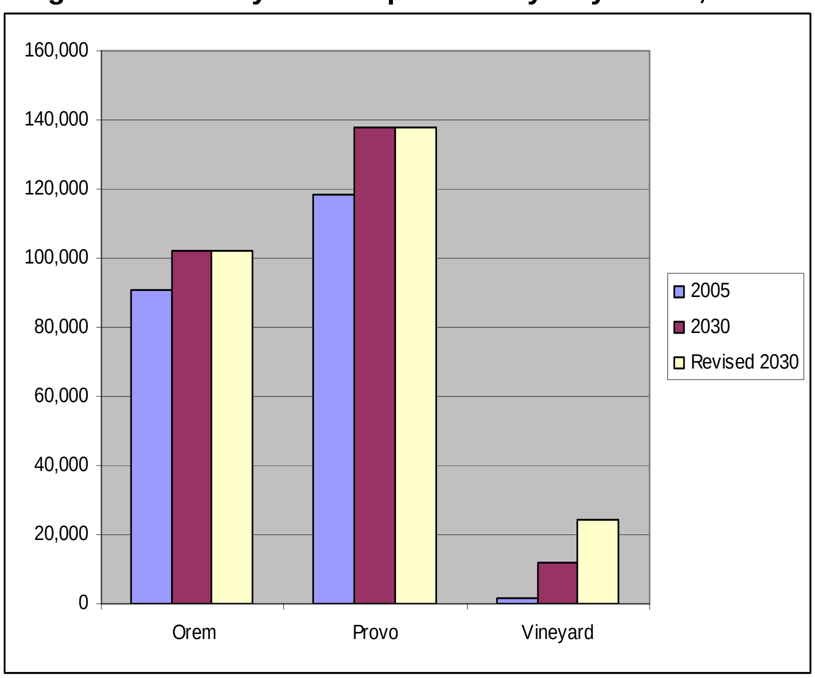
[1] Provided by the State of Utah Governor's Office of Planning and Budget.

Figure 3.1: Total Study Area Population: 2005, 2030



Source: MAG and city estimates and projections.

Figure 3.2: Study Area Population by City: 2005, 2030



Source: MAG and city estimates and projections.

Over the entire study area, population was increased by about five percent from original projections developed by MAG. All of this increase is attributable to Vineyard where major redevelopment efforts are expected in coming years.

3.2.2 Employment

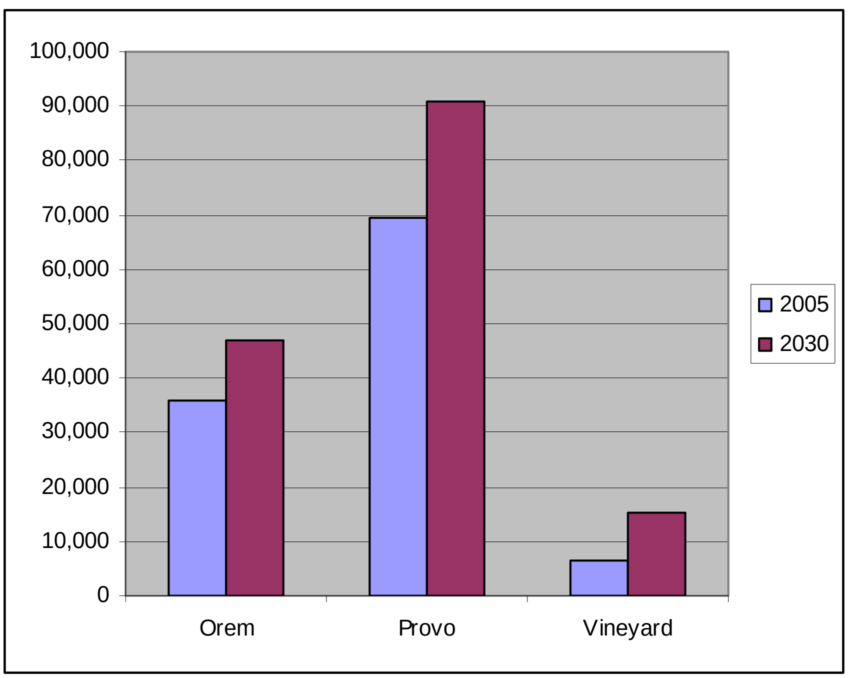
Employment within the study area is expected to increase by the year 2030. Existing and future employment for the study area is shown in Table 3.2 and Figure 3.3. Again, Vineyard's numbers differ markedly from those of Provo and Orem due to major redevelopment plans for the area. It should be noted that no changes were made to future employment numbers during the socioeconomic data review process.

Table 3.2: Employment Growth by City, 2005-2030

City	2005	2030	% Increase: 2005-r2030	AARC* 1990-2005
Orem	35,896	47,085	31.2%	1.1%
Provo	69,487	90,807	30.7%	1.1%
Vineyard Area	6,339	15,376	142.6%	3.6%
Total	**111,722**	**153,268**	**37.2%**	**1.3%**

*****Average Annual Rate of Change
Source: MAG and city estimates.

Figure 3.3: Study Area Employment by City: 2005, 2030



Source: MAG and city estimates.

Unlike other areas in Utah County, the Provo-Orem area expects a more balanced relationship between residents and jobs in future years. As the major employment center in Utah County and with Brigham Young University and Utah Valley State College, this area will continue to be a major destination for vehicle trips and careful planning of the transportation network remains extremely important.

3.3 Future Land Use

Future development patterns within the study area are not expected to change dramatically in coming years. Employment numbers indicate that while most cities do anticipate adding commercial land uses in coming decades, the ratio of residents to jobs will continue to favor residents.

Figure 3.4 shows the spread of development and generalized land uses over time. It is apparent that while there are additional areas of employment and commercial activity, the majority of recent and future development is low density residential land use.

3.4 Future Travel Patterns

Overall, the proportion of all vehicle trips that start and end within the study area will decrease slightly by 2030, from 88 percent in 2001 to 82 percent in 2030. Figure 3.5 shows the destinations of all trips that originate in the study area.

Work trips, however, tell a somewhat different story. In 2030, fewer work trips are staying within the study area than did in 2001 and more trips are headed to the NEUVTS area and to Salt Lake County. Figure 3.6 shows the destinations of work trips that originate within the study area.

Figure 3.4
Projected Growth

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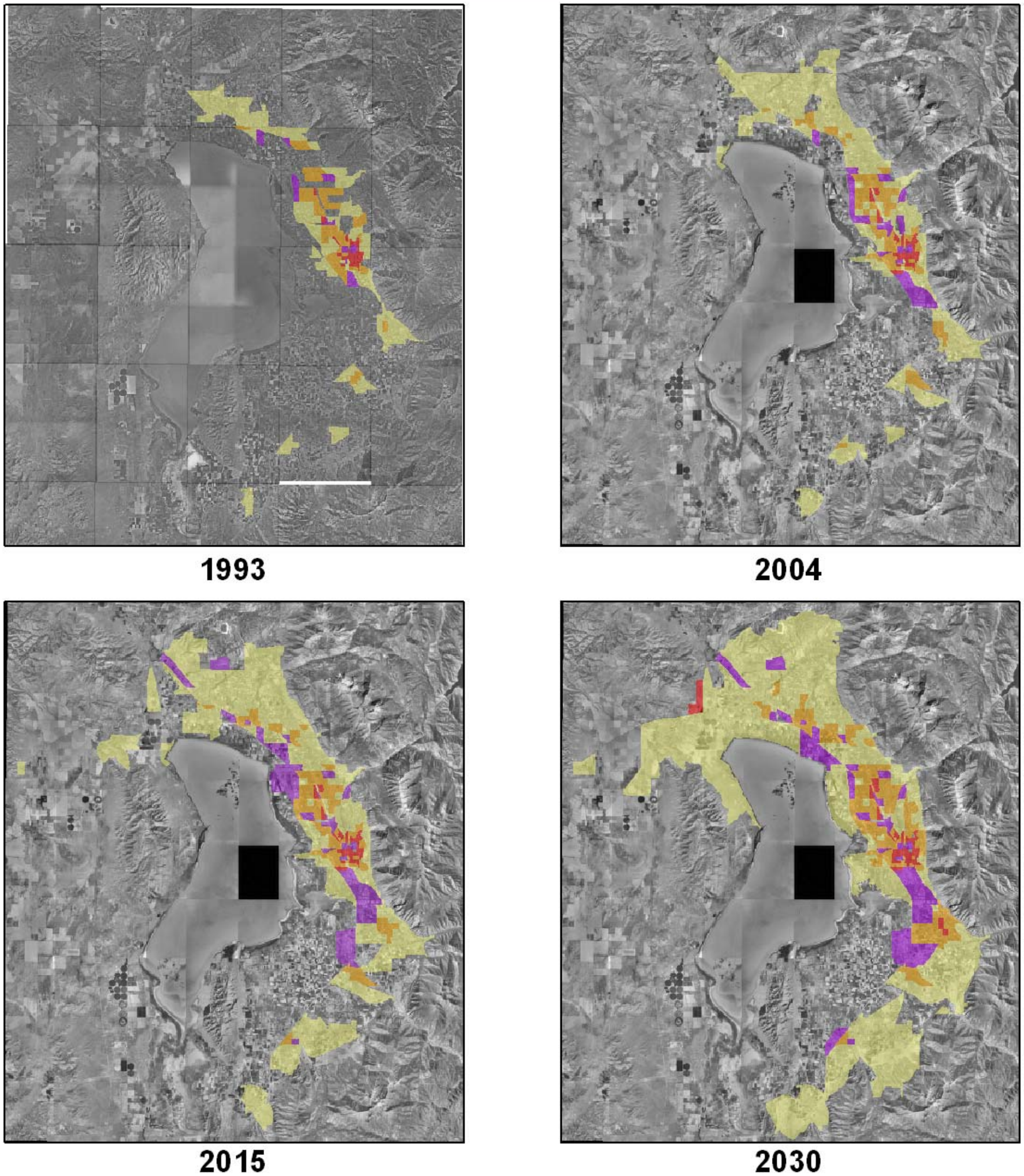

Legend

Low Density | Medium Density | High Density | Employment Centers

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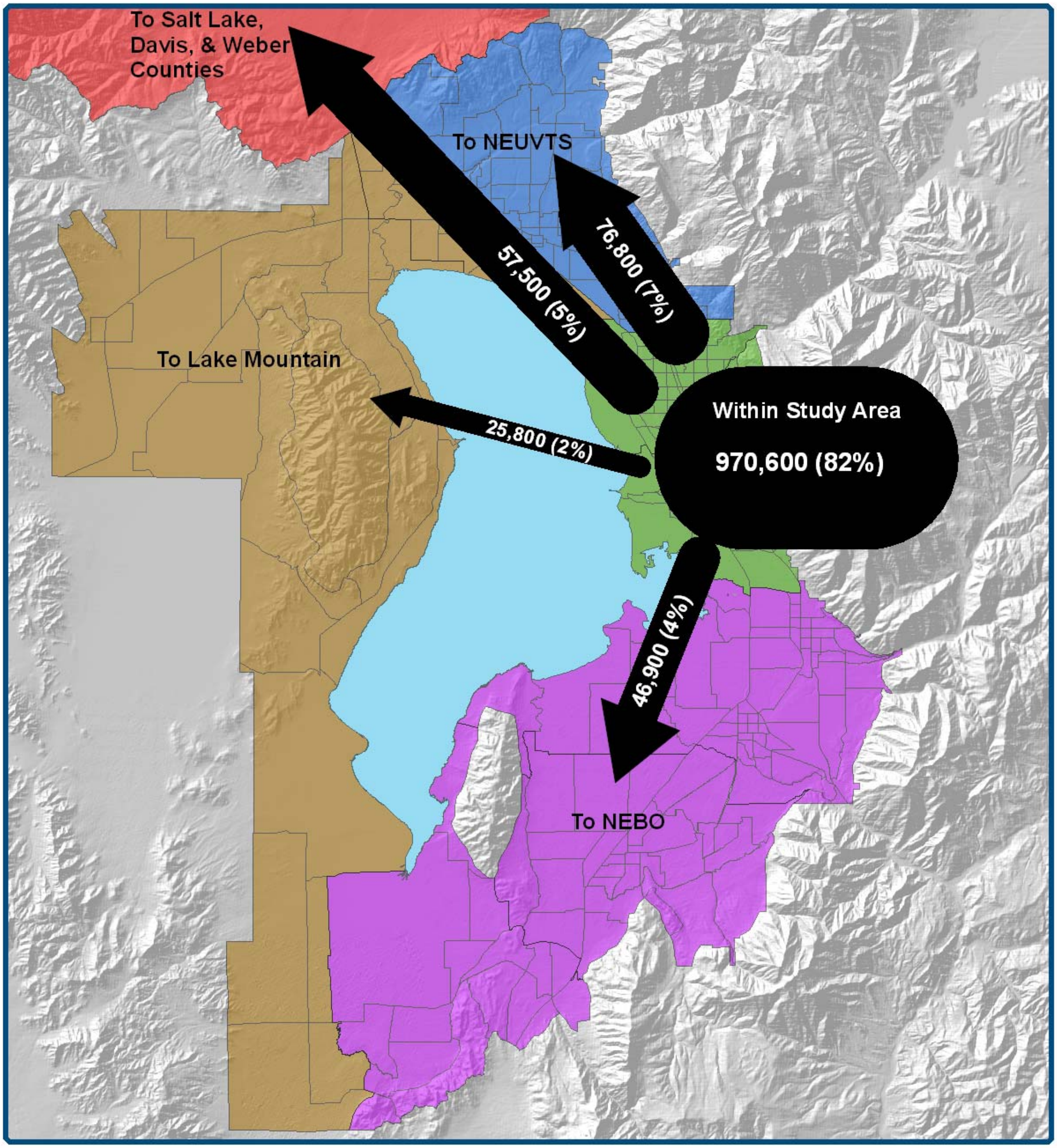
Figure 3.5
Total Trips from Study Area, 2030



Legend

Salt Lake, Davis, Weber | NEUVTS Area | Lake Mountain | Orem/Provo | Nebo Area

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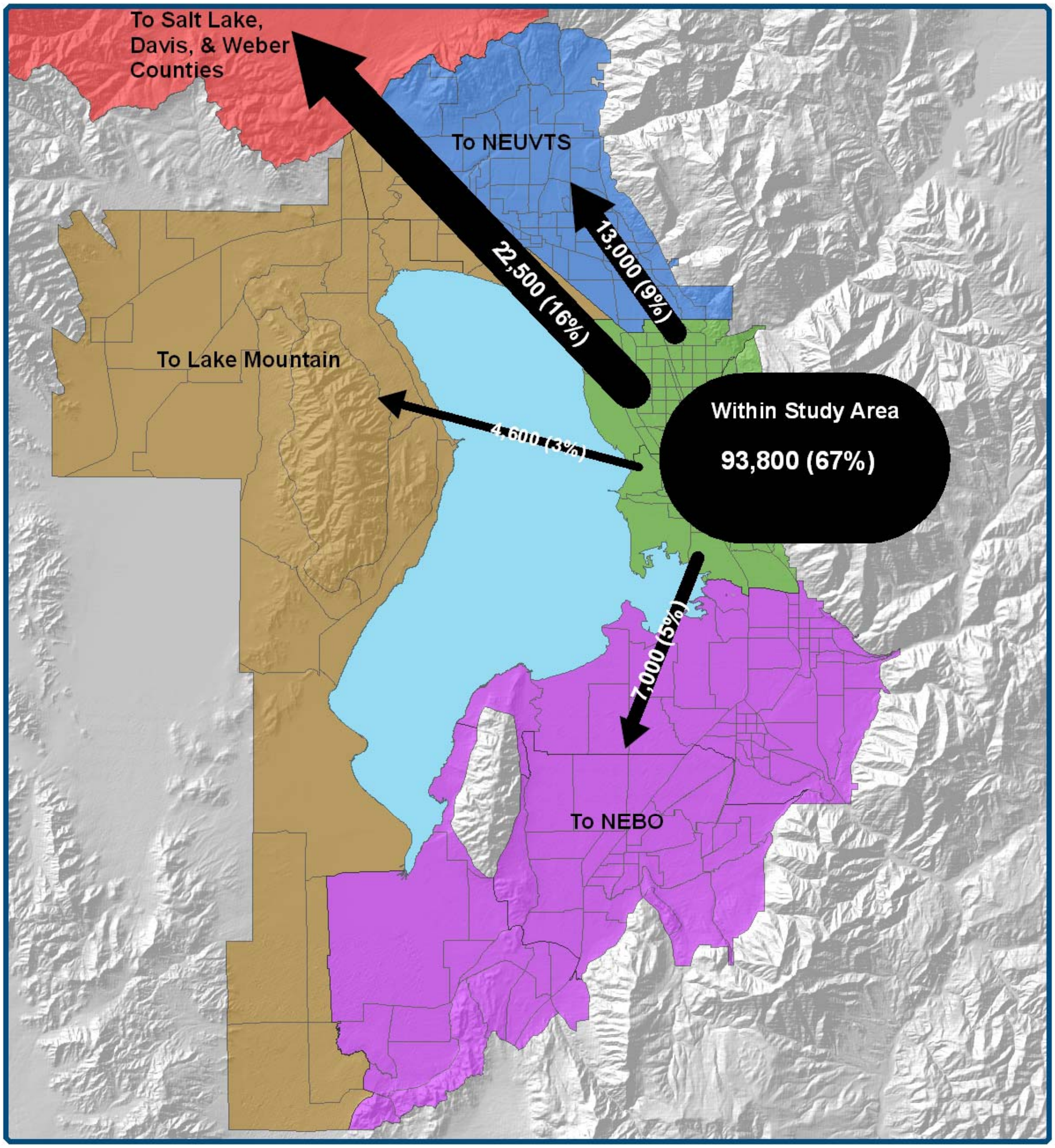
Figure 3.6
Work Trips from Study Area, 2030



Legend

Salt Lake, Davis, Weber | NEUVTS Area | Lake Mountain | Orem/Provo | Nebo Area

3.5 Problem Identification

One of the first steps in this process was to determine whether or not future transportation problems should be expected based on available information. The steering committee was careful to not rely solely on socioeconomic projections or non-quantitative data, but wanted instead to measure future conditions in terms of traffic volume and network capacity and from that information, determine if problems were to be anticipated in the study area. The process that was used to determine whether or not there were problems in the future was to test a "No Build" alternative assuming projected socioeconomic conditions.

3.5.1 No Build Alternative

Using the future socioeconomic data defined earlier in this chapter, the regional travel demand model was run with a transportation network that assumed no additional projects would be built inside the study area. Outside of the study area, all projects included in MAG's 2030 Long Range Transportation Plan were assumed to be built. The No Build alternative assumed that improvements would continue in Salt Lake County and points north consistent with the Wasatch Front Regional Council Long Range Transportation Plan. In Utah County, improvements included in the adopted 2006-2010 Transportation Improvement Program (TIP) were assumed to continue as committed projects. These projects included:

> *The steering committee was careful to not rely solely on socioeconomic projections or non-quantitative data, but wanted instead to measure future conditions in terms of traffic volume and network capacity…*

- SR-92, widened to four lanes from I-15 to Highland;
- 1100 East, extend existing road from State Street to I-15;
- Springville 1400 North Interchange upgrade;
- 800 North (Orem), widened to four/six lanes from 400 West to 400 East;
- Center Street (Orem) to Canyon Road new construction; and
- I-15 widening to three general purpose lanes and one HOV lane from Alpine to University Parkway.

Figure 3.7 shows these projects.

3.5.1.1 No Build Alternative Level of Service

Figure 3.8 shows level of service for the No Build alternative. Volume to capacity ratios which define the level of service "grades" are consistent with those shown in Chapter 2, Existing Conditions. Again, red lines indicate heavy congestion in the peak hour and green lines indicate little congestion. As shown in Figure 3.8, significantly more congestion is expected in the study area over 2001 conditions. Particular areas of concern include Geneva Road and SR-89 as well as I-15 and downtown Provo.

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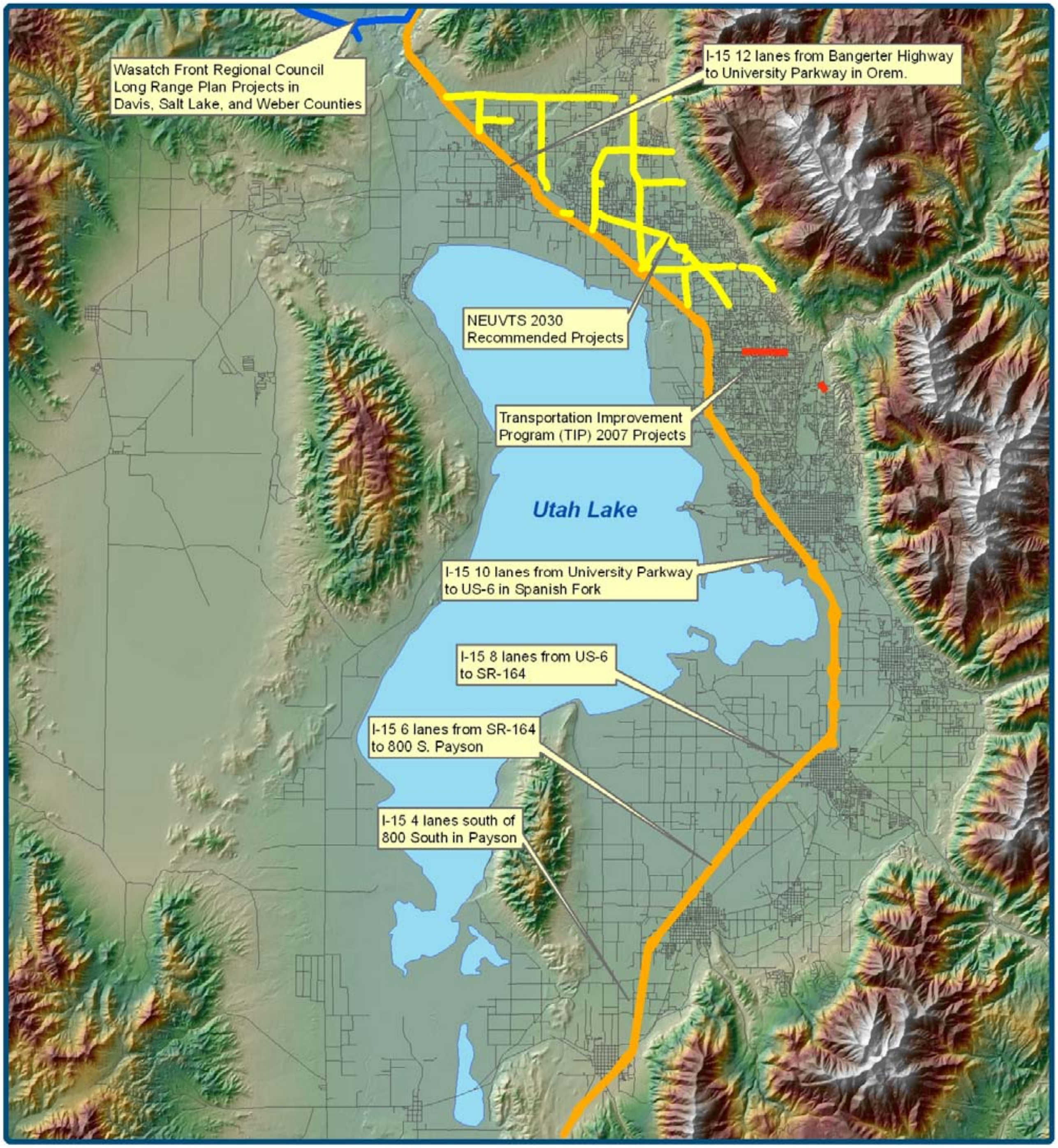
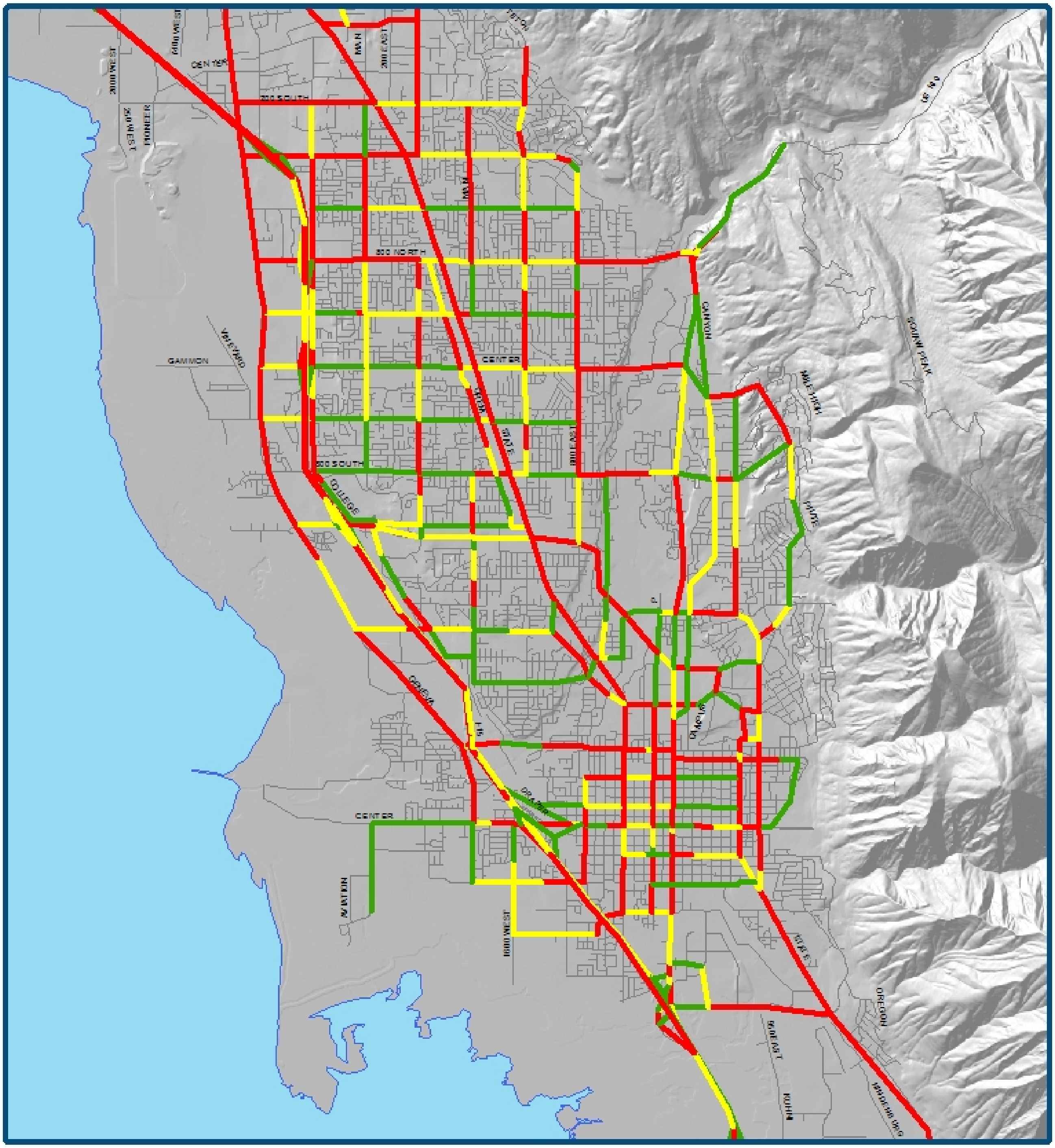
Figure 3.7
No Build Modeling Assumptions



Legend

- NEUVTS Recommended 2030 Projects
- I-15 LOS "D" Option
- Mountain View with Porter Rockwell
- Transportation Improvement Program 2007 Projects

Figure 3.8
2030 No Build Level of Service



Legend

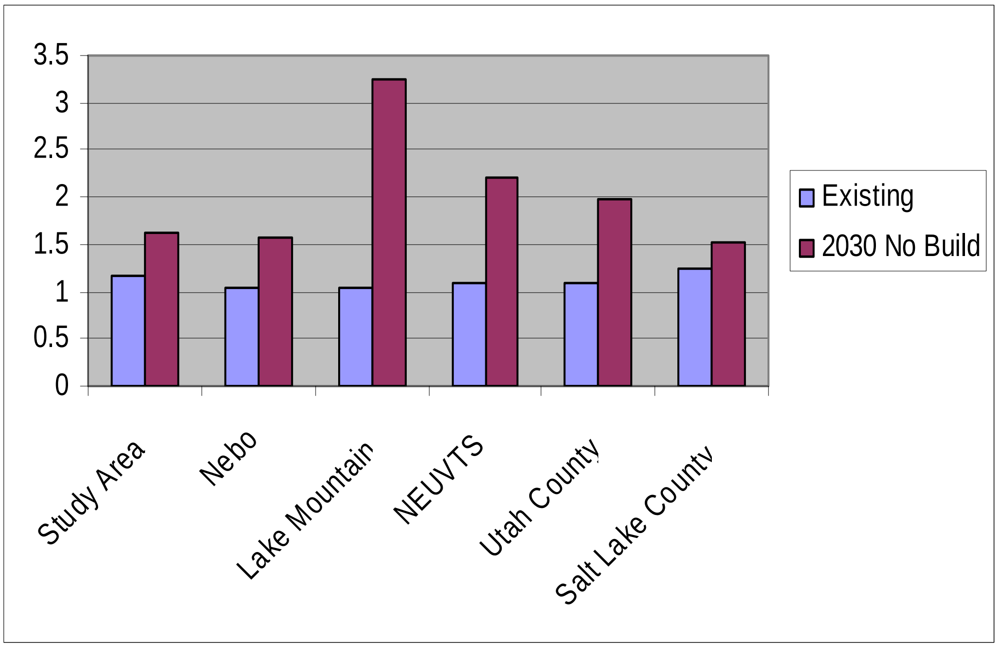
PM Peak Period Volume to Capacity Ratio

0.00 - 0.80 | 0.81 - 1.00 | 1.01 - 2.80 | Existing Roads

3.5.2 Comparison of Study Area to Regional Conditions

The Travel Time Index (TTI) is a generally-accepted measure of an area's congestion. It is the time it takes to travel a given road segment at the peak hour divided by the free-flow travel time for that segment. A TTI of 1.0 indicates that there is little or no difference between peak period and free-flow traffic and larger numbers point to increased congestion during the peak period. Figure 3.9 shows the TTI for the study area transportation system under existing and future no build conditions and for other Utah regions. As shown in the figure, the TTI for the future no-build scenario is 1.63 in the Provo-Orem study area. According to the definition, a TTI of 1.63 means that a trip that would take 30 minutes under free-flow conditions will take 49 minutes during the peak hour. While figures given here are comparing system-wide delay, TTI can be compared at the corridor level as well.

Figure 3.9: Travel Time Comparison



Chapter Four

4. Travel Demand Modeling

The travel demand model was an important tool for the evaluation of various packages of proposed transportation improvements. The consultant team coordinated all model development and analysis to be consistent with the plans of each community as well as with Utah County, UDOT, UTA, and the Mountainland Association of Governments.

4.1 Model Version

The WFRC-MAG regional travel demand model version 4.2 was used for all analysis of the Provo-Orem Transportation Study. The model uses the TP+ software from Citilabs Corporation as well as specific model scripts developed by the Wasatch Front Regional Council and Mountain Association of Governments staff. The Wasatch Front Regional Council and Mountainland Association of Governments work collaboratively on the model which covers the geographic extent of both agencies. They have worked together to develop updated and enhanced versions of the model, beta versions 4.3 and 5.0. While these later versions of the model offer improvements in such areas as managed lanes and transit/mode choice assumptions, they have not been as widely tested as the existing model. MAG recommended that for this project, version 4.2 of the model should be used, a recommendation with which other transportation agencies including UTA and UDOT concurred. These organizations are confident in the process and results shown in this model version.

4.2 Quality Assurance/Quality Control

Establishing and maintaining a modeling process that provided meaningful results was important in this planning process. Reliable output from the model depended on a quality control process that was thoughtful, ongoing, and comprehensive. In addition to internal quality control of the consultant staff, quality control between the consultant analysis and the raw travel model was important in order to allow members of the consultant team to achieve consistent results. Consistency between MAG and consultant work as well as overall quality control was accomplished in three key ways.

Establishing and maintaining a modeling process that provided meaningful results was of utmost importance in this planning process.

First, socioeconomic data and land use information was examined in detail at the traffic analysis zone level. The project team worked with city staff in each city to determine future growth scenarios for population, employment, and land use. Once the cities and the team had developed a future scenario that was realistic both for the city and within the context of growth of the county, this data was entered into the model. At this point, various future transportation networks could be tested against each other and against a No Build alternative to determine the highest priority transportation projects while still ensuring that underlying socioeconomic and land use assumptions remained constant. Updates to socioeconomic and land use information was coordinated with MAG staff so that long range planning efforts could reflect updated data. Model data sets involving the revised socio-economic inputs were established early so that each subsequent model run could reference the same input data.

Second, the travel demand modeling process was a collaborative one where MAG and consultant staff worked closely together in determining and testing future transportation networks. Road improvement "packages" were discussed with MAG staff prior to modeling so that all parties were clear on what problem each package was meant to address, what issues might be present within each of the packages, etc. This collaborative process ensured that errors were minimized and that network packages made sense, addressed future problems in a realistic way, and the impacts of them were fully recognized.

Finally, the technical aspects of the travel demand model are highly detail oriented. With many scenarios to test among all the study areas, coding transportation networks necessitated keeping close track of the assumptions for each. Consultant staff coordinated with MAG staff to provide network definitions at a high, more easily understood level. In addition, specific coding assumptions were detailed in modeling logs for those working with the model at a more technical level. These modeling logs included such detail as transit line file inputs, speed and capacity class assumptions, and related details which would ensure that future model runs by MAG staff as part of the Long Range Transportation Plan could duplicate the basic results of the quad studies.

4.3 Travel Demand Model Basics

The WFRC/MAG regional travel demand model is a four-step gravity model where trips are "attracted" to destinations such as large employment, commercial, and housing centers. Data inputs and the four steps are described here in order to provide an overview of the modeling process. This summary is provided at a general level and further detail can be made available through the Mountainland Association of Governments.

…households with more people and/or more vehicles available tend to make more trips.

Socioeconomic Inputs

Socioeconomic data is input separate from the actual modeling framework. In other words, land use is not forecast as part of the travel model and must be forecast separately and used as model inputs. These inputs are the variables that most affect travel forecasts. Since socioeconomic data is input at the traffic analysis zone (TAZ) level, it is typically not necessary to be as precise as the actual land use variables that are approved by the City. It is more important to adequately reflect the magnitude and type of development patterns. Specific variables such as automobile ownership are derived from a logit model (probability model) within the travel model that is sensitive to detailed inputs on household size, income, street density, and other variables that are not presented in this summary. Figure 4.1 shows traffic analysis zones for the study area.

Trip Generation

Trip generation is performed in the first step of the traditional four-step travel demand modeling process. Trip generation is largely based on a regional 1993 small sample home interview survey. Trip rates generally follow cross classification rates based on household size and automobile availability so that households with more people and/or more vehicles available tend to make more trips. Trips rates are derived for trip production and attraction pairs for specific trip purposes such as Home Based Work trips, Home Based Other trips, Non-Home Based trips, and External trips.

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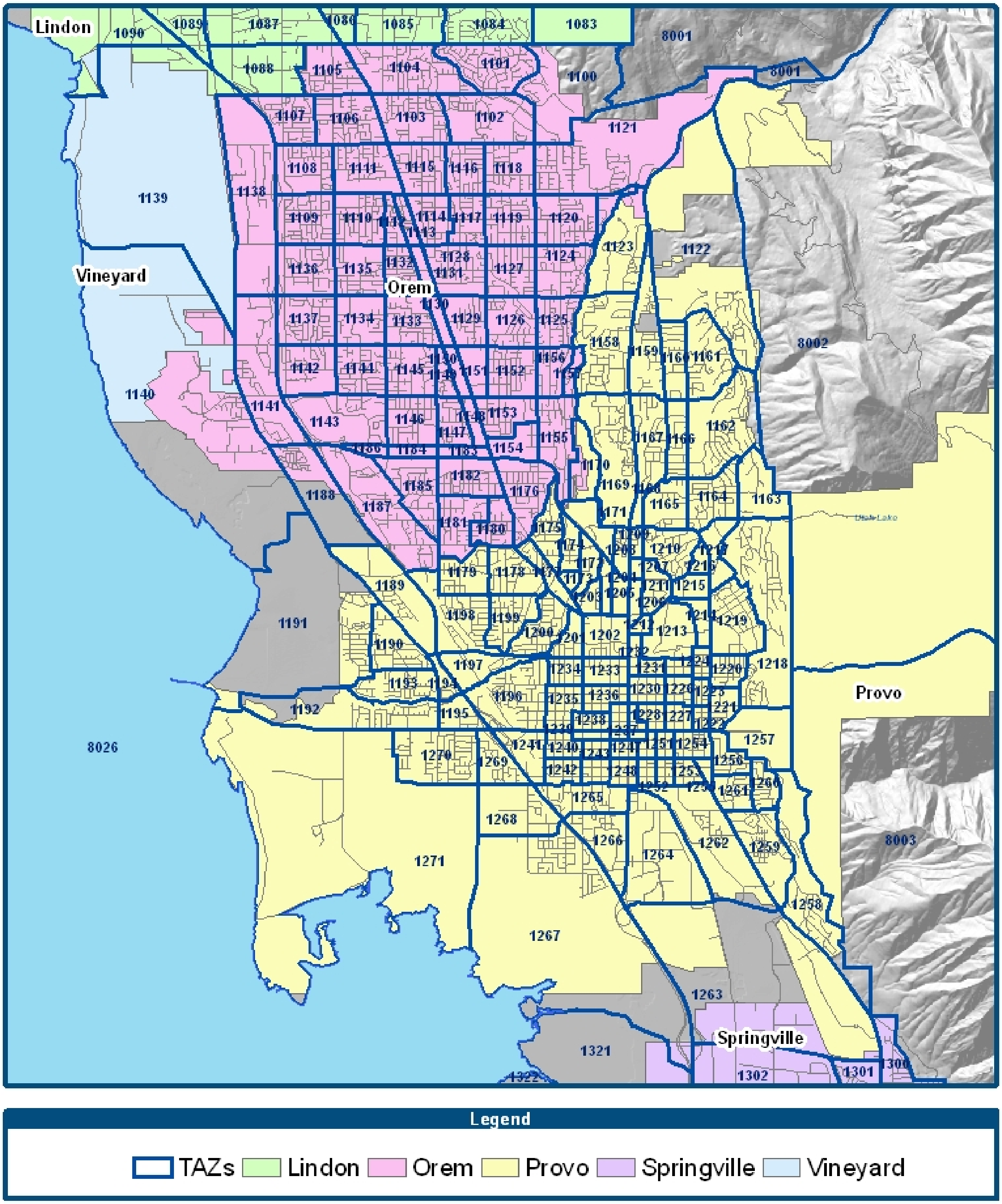
Figure 4.1
Traffic Analysis Zones



Trip Distribution

Trip distribution is the process of matching trip productions to trip attractions. For example, "bedroom" areas, those areas with high population and dwelling units but little employment such as many areas in Utah County, will produce work trips that will be attracted to downtown areas. The regional travel model uses the TP+ software for the entire four-step travel demand process. Within TP+, trip distribution is performed using a "gravity model" that attracts a given production proportional to the relative size of the attraction in each area and inversely proportional to the distance (travel time) between the production and each attraction. Trip distribution is performed based on feedback derived from traffic assignment (to be discussed) using pre-defined time periods and other distribution variables for each trip purpose. The beta model version 5.0 varies from the traditional gravity model for work trips and uses what is called a destination choice model. Since the destination choice and the gravity model are both calibrated to the same base year trip distribution data, they will produce very similar results. However, future model versions such as 5.0 will be more sensitive to a wider range of variables such as toll roads.

Mode Choice

Trips are distributed based on highway terminal times but are later sorted to reflect actual travel modes. Travel modes are estimated using a nested logit function. The "nesting" of this probability allows for competitive trip purposes to be separated. For example, express transit riders may take express buses or rail, rail trips can be light rail or commuter rail, etc. Mode split variables have been estimated based on recent on-board transit surveys, but rely on either borrowed or estimated variables for new modes such as commuter rail, and for trip purposes other than home based work and home based college trips.

Traffic Assignment

Resulting automobile trips are assigned to each road based on the shortest travel time path to complete the trip. Assignment is developed for four specific time periods (am peak, pm peak, evening, and mid-day) which can be summed to cover the 24 hours in a day. Congested conditions are estimated based on modifications to the Bureau of Public Roads speed degradation estimates derived from the Highway Capacity Manual.

4.4 Transit Mode Split

The primary use of the travel model is the ability to forecast future traffic volumes on various roads in the region in order to assist in capital facilities planning. However, aggregate analysis can also be achieved through the travel models so that other information can be pulled from the model such as transit ridership. Transit mode split is an output of the regional travel model and it varies by the transit options that are included in the model's transportation network. Mode split for each alternative is discussed in more detail in Chapter 5 of this report, but is typically about three percent for work trips and one percent for all trips. Table 4.1 shows the transit mode split for Wasatch Front Counties for various transportation networks.

Table 4.1: Transit Mode Split

	Percent of All Trips	Percent of Work Trips
Existing (2001)	1.14%	3.75%
2030 Long Range Plan	1.57%	4.90%
2030 No Build	0.93%	2.75%

Chapter Five

5. Alternatives Analysis and Transportation Solutions

The process of choosing and analyzing alternatives for the Provo-Orem Transportation Study involved developing a set of projects that the technical advisory committee believed would address travel demand to the year 2030. This chapter describes the tools that were used to differentiate between the projects and as a basis for comparison. A description of the process and various projects is offered, followed by an evaluation of these alternatives. Finally, the locally preferred alternative recommended project list is described including highway and transit projects for 2015, 2030, and beyond.

5.1 Analysis Tools

As discussed in Chapter 3, transportation network alternatives were evaluated using a consistent set of performance measures. The performance measures were chosen because they were effective ways of converting technical information to something more easily understood by a broad range of stakeholders.

Network alternatives were evaluated based on the following performance measures:

- Level of service (LOS) – standard measurement used by engineers that identifies the amount of congestion on a given roadway. Level of service is given grades of A through F, with A being free-flow conditions and F being highly congested, "parking lot" conditions.
- Vehicle Hours of Travel (VHT) – a calculation of the total time all vehicles spend on the transportation network. This measure is easily obtained from the regional travel demand model and helps to identify area-wide congestion changes.
- Vehicle Miles of Travel (VMT) – similar to VHT, this refers to a calculation of the total miles traveled by all vehicles on the transportation network. It is also an output of the travel demand model.
- Travel Time Index (TTI) – refers to a measure of congestion determined by dividing the time it takes to travel a given road segment at the peak hour by the free-flow travel time for that segment.

Level of service analysis for the LRTP alternative showed several areas of concern related to future travel demand.

In addition to these performance measures, the impacts of a transportation project were also considered in the evaluation process. "Impacts" included right-of-way, cost, environmental, social, and land use. While these impacts are less quantifiable than the above performance measures, they were nevertheless important factors in the viability of alternatives. More discussion of project impacts is included in Appendix B.

5.2 Alternatives

The alternatives evaluated by the technical advisory committee ranged from a No Build transportation network to interchange and frontage road alternatives related to I-15 reconstruction. Each alternative looked at travel demand beyond the year 2030.

5.2.1 No Build

The No Build alternative is discussed in detail in Chapter 3. It assumes that no current Long Range Transportation Plan projects are built within the study area although all LRTP projects are built outside the study area. In addition, it assumes the existing transit network within the study area. As shown in Figure 3.7 in Chapter 3, the level of service of the No Build alternative was determined to be unacceptable by the steering committee and was not further considered.

5.2.2 2030 Long Range Transportation Plan

The first build alternative considered was the existing 2030 LRTP developed by the Mountainland Association of Governments. Projects included in the current LRTP within the Provo-Orem study area that are assumed in this alternative are shown in Figure 5.1. It assumes that LRP projects are built throughout Utah County including transit projects consisting of commuter rail, bus rapid transit between Provo and Orem, and expanded bus service county-wide.

Level of service analysis for the LRTP alternative showed several areas of concern related to future travel demand. These included I-15 and State Street as well as specific areas of Provo and many east/west facilities in Orem. Figure 5.2 shows level of service in the Provo-Orem area based on the 2030 Long Range Transportation Plan.

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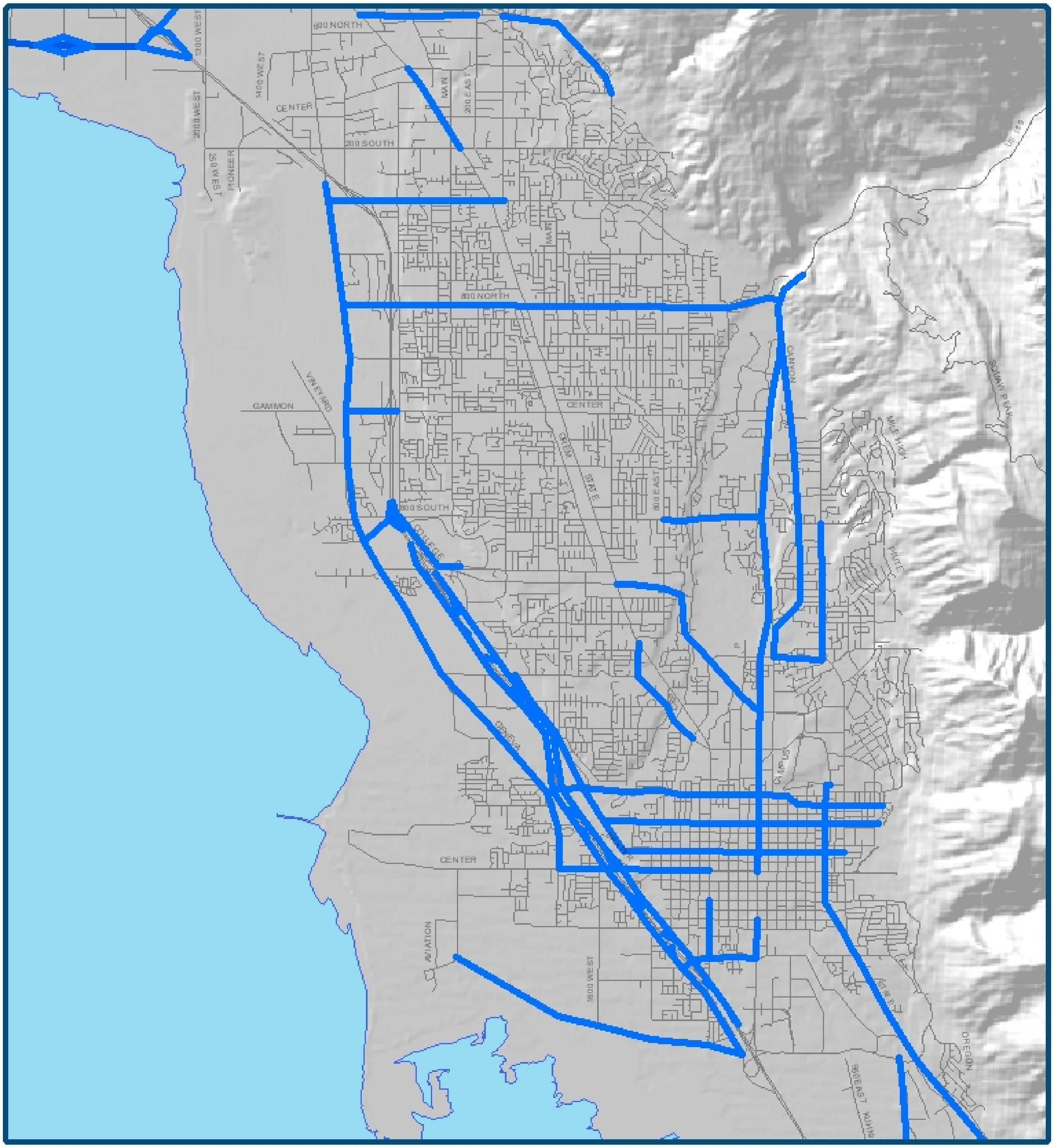
Figure 5.1
2030 Long Range Plan Projects



Legend

Long Range Plan Projects — Existing Roads

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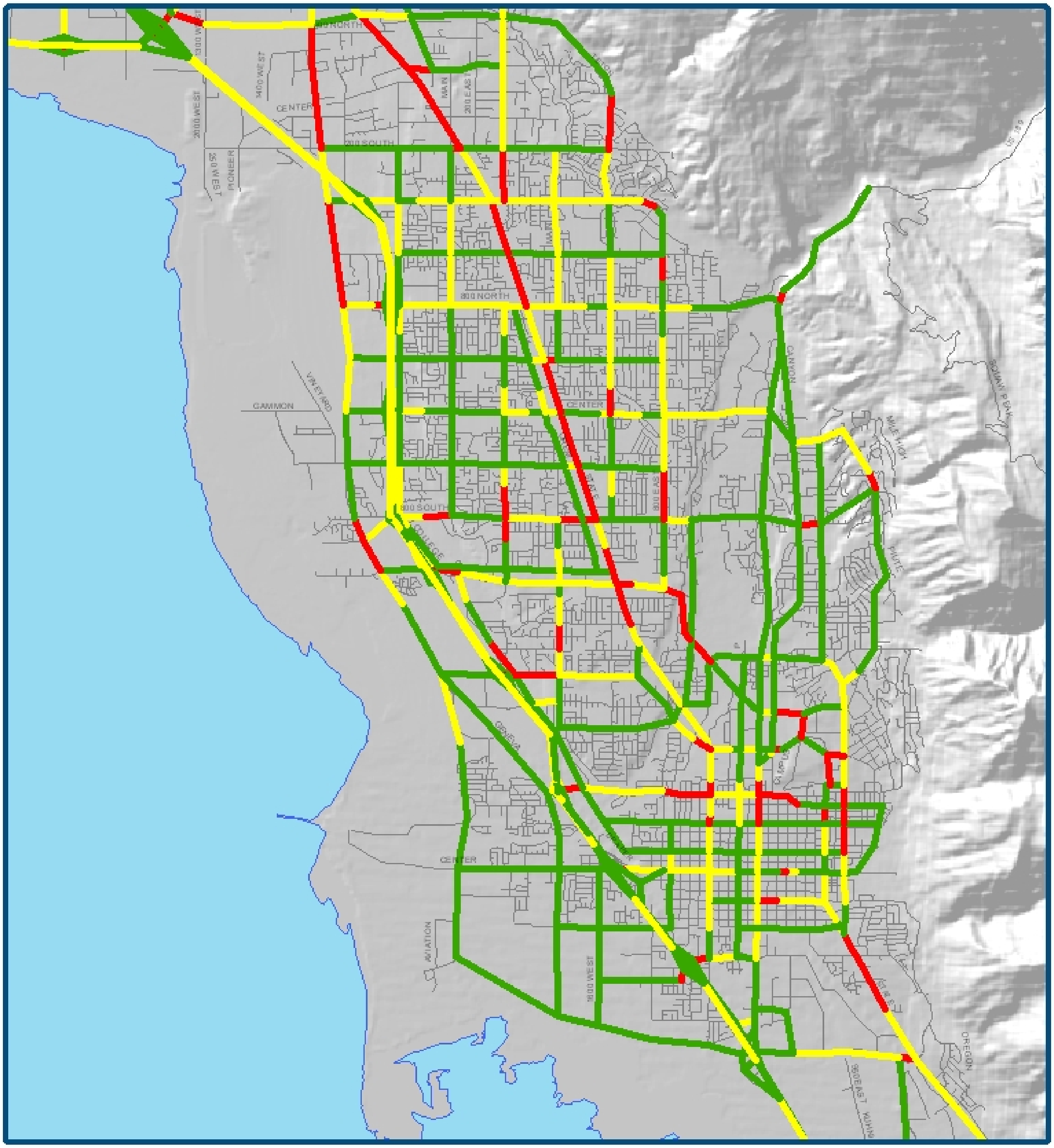
Figure 5.2
2030 Long Range Plan Level of Service



Legend

PM Peak Period Volume to Capacity Ratio

0.00 - 0.80 | 0.81 - 1.00 | 1.01 - 5.00 | Existing Roads

5.2.3 Non-controversial Projects

In addition to the concerns described above related to the 2030 LRTP alternative, the technical advisory committee wanted to give a more detailed look at the individual projects included in the plan and remove projects that were deemed to be more controversial. A list of "non-controversial" projects was chosen by the TAC from the LRTP projects. In theory, all transportation projects that are included in the Long Range Transportation Plan have been promoted by the cities that are planning for their construction or improvement and are part of city master transportation plans. However, often there are individual projects that are more important at the regional level and that may be lacking local support. Those projects that are fully supported by both local governments and MAG are called "non-controversial" projects and are a subset of the LRTP project list.

> *Level of service for the non-controversial projects alternative was of concern to the TAC as travel conditions in 2030 are significantly worse than in the Long Range Plan alternative.*

Although they are being called non-controversial projects for purposes of this planning process, it is not expected that these projects will cause no discussion or disagreement when they are more imminent. Most transportation projects provoke debate at the local level. Non-controversial projects in the Provo-Orem study area are shown in Figure 5.3.

Level of service for the non-controversial projects alternative was of concern to the TAC as travel conditions in 2030 are significantly worse than in the Long Range Plan alternative. Because the Non-controversial projects alternative does not adequately address future travel demand, it was eliminated from further consideration. Figure 5.4 shows the level of service for the non-controversial projects alternative in the Provo-Orem study area.

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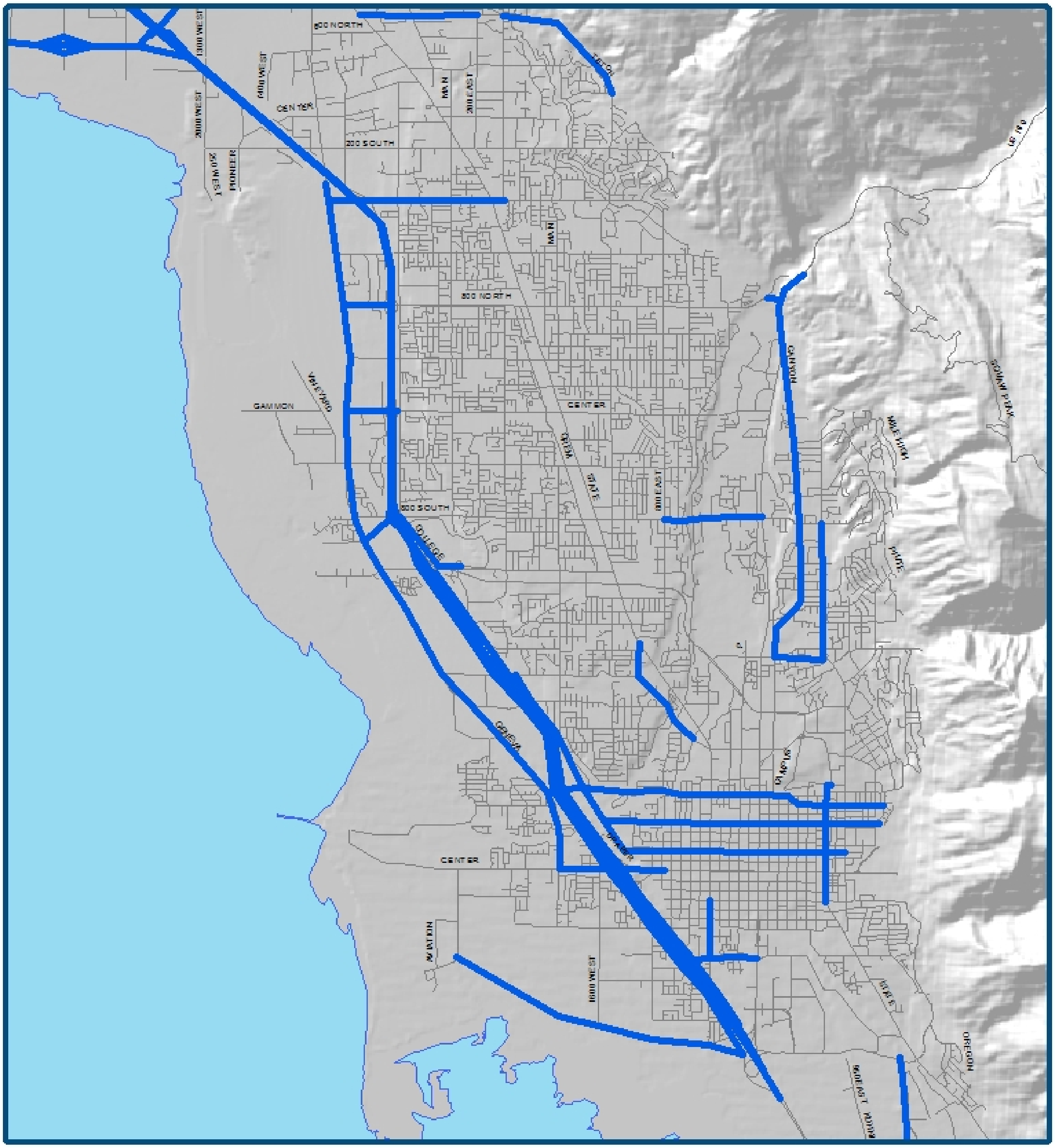
Figure 5.3
2030 Non-controversial Projects



Legend

Non-controversial Projects — Existing Roads

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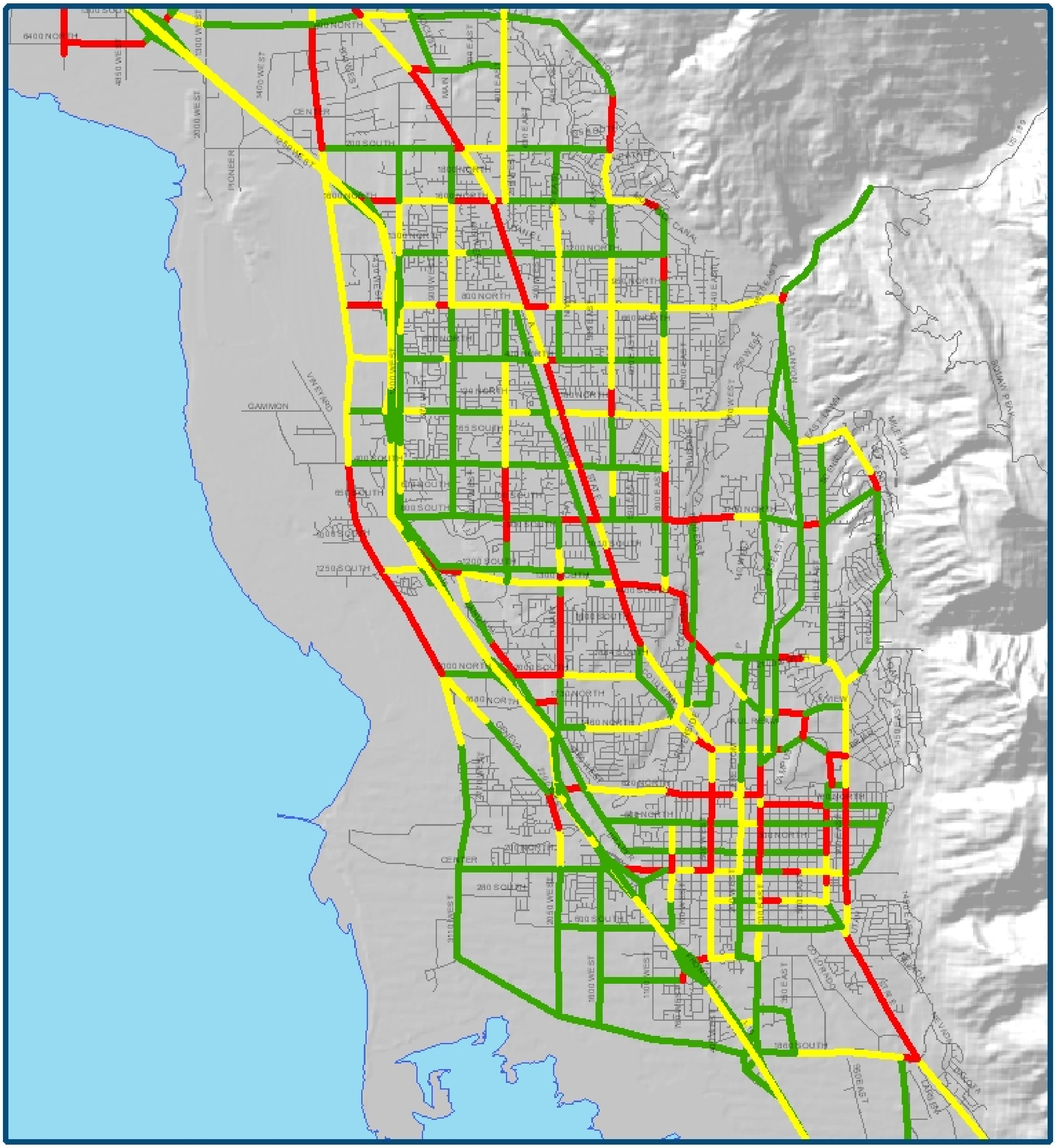
Figure 5.4
2030 Non-controversial Projects Level of Service



Legend

PM Peak Period Volume to Capacity Ratio

0.00 - 0.80 | 0.81 - 1.00 | 1.01 - 5.00 | Existing Roads

5.2.4 Transportation Alternatives

With no viable transportation alternative, the TAC began looking at transportation projects individually with no regard as to whether they were included in the current Long Range Transportation Plan. The committee was visionary in this exercise in that they considered a range of transportation projects for implementation beyond 2030. In the early stage of the project, the TAC discussed a Utah Lake crossing, but was not seriously considered in further deliberation. More information regarding a lake crossing is provided in Appendix C. Based on some preliminary testing of individual projects, a list of possible transportation projects was developed for further analysis and consideration.

5.2.4.1 Transportation Projects

The technical advisory committee decided that in order to reach consensus on a locally preferred alternative, there needed to be a more detailed comparison of individual transportation projects including those that were not fully supported by the entire TAC, the "controversial" projects. The projects that the committee considered are shown in Figure 5.5 and include non-controversial projects, LRP projects, and "vision" projects.

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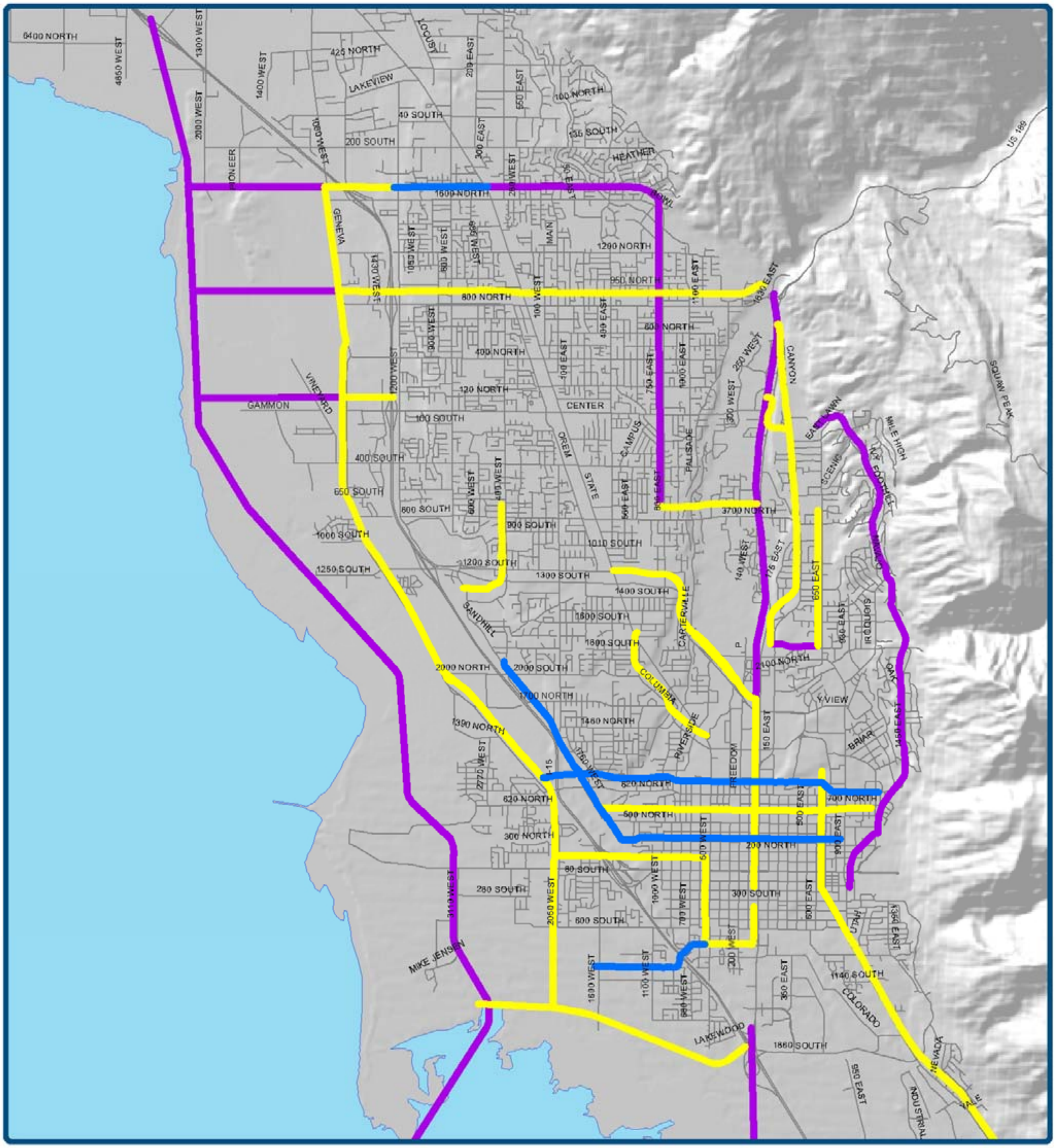
Figure 5.5
All Modeled Projects



Legend

Low Build Projects — Medium Build Projects — High Build Projects

5.2.4.2 Transportation "Packages"

Coordination with the other two quad studies was important and was considered throughout the process. Packages of transportation projects were developed countywide in order to test various transportation alternatives in the Lake Mountain and Nebo study areas. These packages were consistent across Utah County, using the recommendations from the Northeast Utah Valley Transportation Study (NEUVTS) along with various alternatives in the other quadrants. So, Package 1 is consistent among all three quadrants, as is Package 2, etc. The transportation network in the Provo-Orem area assumed:

- All non-controversial and LRP projects
- No C/D Roads (C/D roads were modeled within the Provo/Orem alternatives analysis, but were not part of the "package" of alternatives used to for the other two study quadrants).
- No new I-15 interchanges
- LRP Transit: commuter rail, Provo/Orem BRT, plus expanded bus service

5.3 Alternatives Comparison

The Provo-Orem Transportation Study process was somewhat different than the other quadrants, and did not examine projects based on these packages.

After considering the list of projects shown in Figure 5.5, the project team began discussions with cities in the study area to determine the viability of individual projects.

The team found that it was difficult to make decisions regarding the importance of specific projects because the priority of those projects was very closely tied to the final interchange or C/D scenario on I-15 which is not yet known. In order to prioritize the transportation project list for the Provo-Orem area, the TAC developed three different future phases based on the availability of resources and the number of projects that can reasonably be built. These scenarios were called Low Build, Medium Build, and High Build, assuming low availability of funds and a small number of projects to high availability of funds and a large number of projects. Low, Medium, and High Build are assumed over time, so that all projects in the Low Build are assumed in the Medium Build, and these are all assumed in the High Build. I-15 is assumed in the Medium and High Build phases, but not in the Low Build.

The team found that it was difficult to make decisions regarding the importance of specific projects because the priority of those projects was very closely tied to the final interchange or C/D scenario on I-15 which is not yet known.

Discussions with local officials also made it clear that the feasibility of a majority of these projects relied on what happens during I-15 reconstruction, whether interchanges are reconfigured or added, frontage roads are built, etc.

Due to these factors, the project team modeled the Low, Medium, and High Build networks while also considering the variations related to I-15 reconstruction. In the Medium Build modeling, each of the three (existing interchanges, future interchanges, frontage roads) was modeled separately, yielding three different Medium Build results. Projects and impacts in the Low, Medium, and High scenarios are shown in Tables 5.1, 5.2, and 5.3. Level of service and travel time index for the Low, Medium and High Build futures are shown in Figures 5.6 through 5.10.

Table 5.1: Future Transportation Projects, Low Scenario

Project	NAME / Location	IMPROVEMENT	Length (Miles)	ROW (feet)	Properties Impacted	Structures Impacted	Wetlands (Acres)	Construc-tion Cost (Millions)	Right-of-way Cost (Millions)	Structure Costs (Millions)	Total Cost (Millions)	Volume Served	Cost per annual VMT
HWY-14	**Geneva Rd** From University Pkwy to Orem 1600 North	Widen - 4 lanes 10' Trail	3.8	110	136	28	4.51	$22.15	$7.02	$12.00	$41.17	30,000	$1.06
HWY-15	**Orem 800 North** From Geneva Rd to I-15	Widen - 6 lanes 10' Trail	0.5	125	20	1	0	$3.40	$1.27	$0.00	$4.67	30,000	$1.06
HWY-16	**Orem 800 North** From I-15 to University Ave	Widen - 6 lanes 10' Trail	3.8	125	275	48	0.03	$25.81	$9.65	$0.00	$35.46	45,000	$0.70
HWY-17	**Provo Center St** From I-15 to Geneva Rd	Widen - 4 lanes Bike lane	0.5	110	52	15	0.03	$2.92	$0.92	$0.00	$3.84	29,000	$0.80
HWY-18	**Provo Center St** From I-15 to Provo 500 West	Widen - 6 lanes Bike lane	0.7	110	0	0	0	$4.22	$1.29	$10.00	$15.51	55,000	$1.75
HWY-19	**University Ave - Provo** From Provo 500 North to University Pkwy	Re-stripe - 6 lanes	1.0	125	0	0	0	$6.79	$0.00	$0.00	$6.79	67,000	$0.31
HWY-20	**University Ave - Provo** From Provo 900 South to Provo 500 South	Widen - 6 lanes Replace RR Viaduct	0.3	125	11	11	0	$2.04	$0.76	$10.00	$12.80	50,000	$1.91
HWY-32	**State St** Springville 400 North to Provo 300 South	Widen - 6 lanes	4.5	125	139	59	0.01	$30.56	$11.43	$0.00	$41.99	43,000	$2.76
RD-21	**Columbia Lane - Provo** From Provo River to State St, Orem	Widen - 4 lanes	0.5	84	60	23	0	$2.29	$0.32	$10.00	$12.61	11,000	$2.12
RD-25	**Orem Center Street** From Geneva Rd to I-15	Widen - 4 lanes	0.4	84	19	12	0	$1.83	$0.26	$2.00	$4.09	22,000	$1.34
RD-26	**Provo 1860 South** From I-15 to Lakeshore Dr	New road - 4 lanes	3.1	84	14	0	61.81	$14.20	$12.02	$0.00	$26.22	2,000	$5.13
RD-28	**Provo 4800 North / Foothill Dr** From Provo Canyon Rd to University Ave	New road - 4 lanes	0.5	84	6	12	0	$2.29	$1.94	$0.00	$4.23	14,000	$2.31
RD-32	**Provo 500 West** From Provo 300 South to Provo 920 South	Widen - 4 lanes	0.6	84	31	19	0	$2.75	$0.39	$10.00	$13.14	20,000	$2.76
RD-33	**Provo 700 East** From Provo 300 South to Provo 900 North	Widen - 4 lanes	1.1	84	157	35	0	$5.04	$0.71	$0.00	$5.75	37,000	$1.03

RD-34	**Provo 920 South** From University Ave to Provo 500 West	Widen - 4 lanes	0.4	84	49	12	0	$1.83	$0.26	$0.00	$2.09	24,000	$0.58
RD-35	**Provo Canyon Rd** From Provo 2230 North to University Ave	Widen - 4 lanes Bike lane	3.1	84	250	26	0	$14.20	$2.00	$0.00	$16.20	11,000	$1.36
RD-36	**Timpview Dr - Provo** From Provo 2230 North to Quail Valley Dr	Restripe - 4 lanes	1.3	84	106	0	0	$5.95	$0.00	$0.00	$5.95	14,000	$1.06
RD-37	**400 West /Campus Drive, UVSC** From Sand hill Rd to Orem 800 South	Widen - 4 lanes	0.6	84	35	0	0	$2.75	$0.39	$0.00	$3.14	10,000	$0.78
RD-38	**Provo 500 North** From Independence Ave to Seven Peaks Blvd	Widen - 4 lanes Bike lane	2.3	84	217	55	0	$10.53	$1.49	$0.00	$12.02	8,000	$2.56
	800 South Interchange Orem on I-15	New I-15 Interchange	-	-	0	0	0.05	$28.00	$0.00	$0.00	$28.00	44,000	$11.82
HWY-21	**University Pkwy - Orem to Provo** From State St Orem to University Ave Provo	Widen - 6 lanes 10' Trail	2.1	125	7	0	0.57	$14.26	$5.33	$10.00	$29.59	51,000	$1.13
HWY-22	**University Ave - Provo** From Provo 300 South to Provo 500 North	Widen 6 lanes	0.5	125	0	0	0	$3.40	$1.27	$0.00	$4.67	61,000	$0.30
HWY-14	**Geneva Rd** From University Pkwy to Provo Center St	New Arterial	3.6	110	215	36	13.64	$19.95	$6.65	$10.00	$36.60	21,000	$1.57
	Geneva Rd Provo Center St to Airport Road	Widen - 4 lanes 10' Trail	1.4	110	54	18	3.41	$7.76	$2.59	$0.00	$10.35	8,000	$5.98
RD-22	**Orem 1600 North** From Geneva Rd to Orem 1200 West	Widen - 4 lanes	0.7	84	16	0	0.05	$3.12	$0.45	$0.00	$3.57	32,000	$0.58
RD-23	**Orem 800 South / Provo 3700 North** From Orem 800 East to University Ave	Widen - 4 lanes	0.9	84	97	9	0	$4.12	$0.58	$10.00	$14.70	23,000	$1.91
										Total	**$395.16**		

Table 5.2: Future Transportation Projects, Medium Scenario

Project	NAME / Location	IMPROVEMENT	Length (Miles)	ROW (feet)	Properties Impacted	Structures Impacted	Wetlands (Acres)	Construc-tion Cost (Millions)	Right-of-way Cost (Millions)	Structure Costs (Millions)	Total Cost (Millions)	Volume Served	Cost per annual VMT
RD-30	**Independence Ave - Provo** From Provo 200 N to Provo 2000 N	New road - 4 lanes	2.0	84	65	7	3.5	$9.16	$7.76	$10.00	$26.92	4,000	$9.96
	Orem 1600 North From 1200 West to State Street	Widen - 4 lanes	0.9	84	96	16	0	$4.12	$0.58	$0.00	$4.70	28,000	$0.51
RD-29	**Provo 800 / 820 North** From University Ave to Geneva Rd	Widen - 4 lanes	1.9	84	150	31	7.9	$8.70	$1.23	$20.00	$29.93	22,000	$1.76
RD-31	**Provo 200 North** From Independence Ave to Provo 900 East	Widen - 4 lanes Bike lane	2.0	84	154	41	0.33	$9.16	$1.29	$0.00	$10.45	5,000	$2.65
RD-39	**Provo 700 North / 800 North** From University Ave to Seven Peaks Blvd	Widen - 4 lanes Bike lane	0.9	84	69	39	0	$4.12	$0.58	$0.00	$4.70	15,000	$0.56
RD-40	**Provo 920 South / 1150 South** From Provo 500 West to Provo 1600 West	Widen - 4 lanes	1.6	84	97	18	0.2	$7.33	$1.03	$0.00	$8.36	30,000	$1.62
										Total	**$85.07**		

Table 5.3: Future Transportation Projects, High Scenario

Project	NAME / Location	IMPROVEMENT	Length (Miles)	ROW (feet)	Properties Impacted	Structures Impacted	Wetlands (Acres)	Construc-tion Cost (Millions)	Right-of-way Cost (Millions)	Structure Costs (Millions)	Total Cost (Millions)	Volume Served	Cost per annual VMT
	Orem 1600 North From State Street to 800 East	Widen - 4 lanes	1.7	84	166	36	0	$7.78	$1.10	$0.00	$8.88	17,000	$0.82
RD-27	**Provo 2230 North** From Provo Canyon Rd to Timpview	Widen - 4 lanes	0.7	84	28	17	0	$3.21	$0.45	$0.00	$3.66	22,000	$1.04
VSN-2	**Eastlake Highway** From Mountain View Corridor in Pleasant Grove to I-15 in Payson	New Highway	8.9	150	75	0	59.33	$66.44	$61.64	$30.00	$158.08	22,000	$4.49
VSN-5	**Complete Foothill Dr Provo** From 4525 North to 300 South	Collector	1.5	84	324	66	0	$6.87	$0.97	$0.00	$7.84	7,000	$0.90
VSN-8	**University Ave extended south** From I-15 in Provo to 400 South in Springville	New Arterial	5.9	150	92	17	57.04	$43.75	$11.98	$20.00	$75.73	24,000	$1.41
VSN-12	**Widen 800 East Orem** From 800 S. to 1600 North	Widen – 4 Lanes	3.0	84	246	65	0	$13.74	$1.94	$10.00	$25.68	23,000	$1.29
VSN-13	**University Ave** From 800 N. Orem to University Parkway	Widen – 6 Lanes	4.1	125	68	9	0.36	$27.85	$10.41	$0.00	$38.26	32,000	$1.00
VSN-14	**1600 North Orem** Geneva Rd to East Lake Highway	New Arterial	1.3	106	5	1	0.44	$7.33	$6.36	$10.00	$23.69	1,000	$25.52
VSN-15	**800 North Orem** Geneva Rd to East Lake Highway	New Arterial	1.8	106	2	0	7.02	$10.15	$8.81	$10.00	$28.96	17,000	$5.78
VSN-16	**Center Street Orem** Geneva Rd to East Lake Highway	New Arterial	1.7	106	19	0	1.58	$9.58	$8.32	$10.00	$27.90	13,000	$10.68
										Total	**$389.81**		

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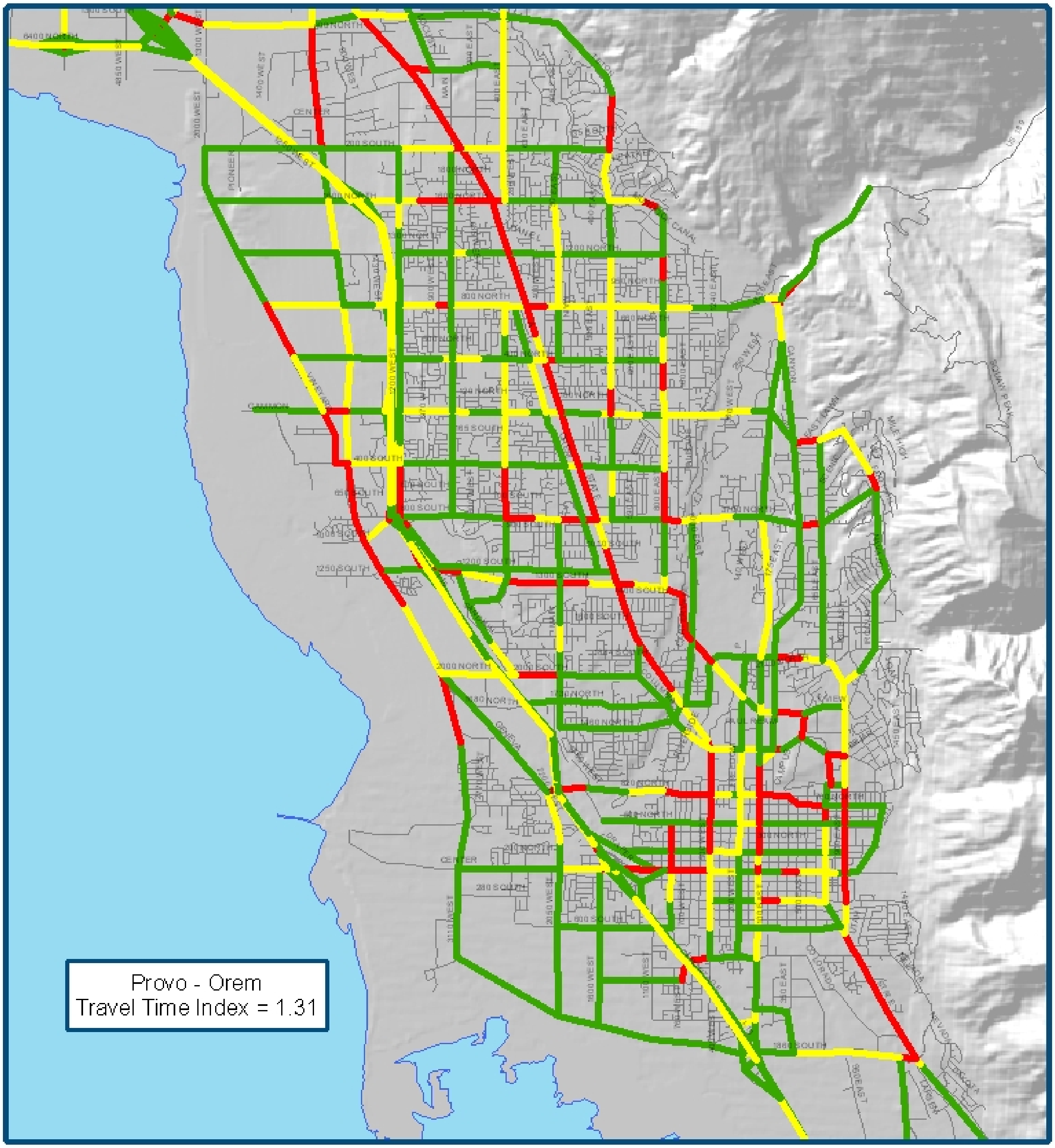
Figure 5.6
2030 Low Build Level of Service



Legend

PM Peak Period Volume to Capacity Ratio

0.00 - 0.80 | 0.81 - 1.00 | 1.01 - 5.00 | Existing Roads

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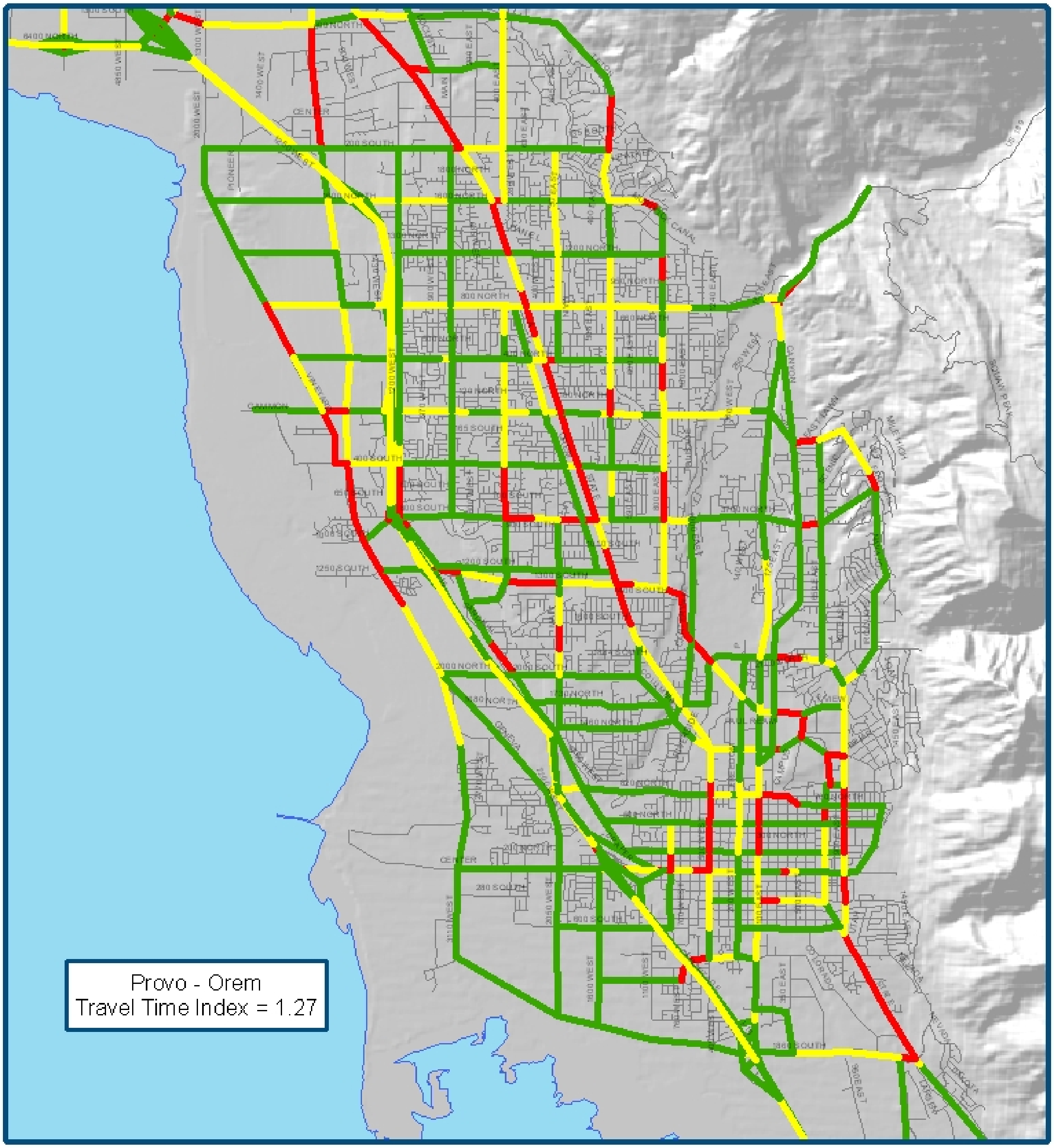
Figure 5.7
2030 Medium Build with Existing Interchanges
Level of Service



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PM Peak Period Volume to Capacity Ratio

0.00 - 0.80 | 0.81 - 1.00 | 1.01 - 5.00 | Existing Roads

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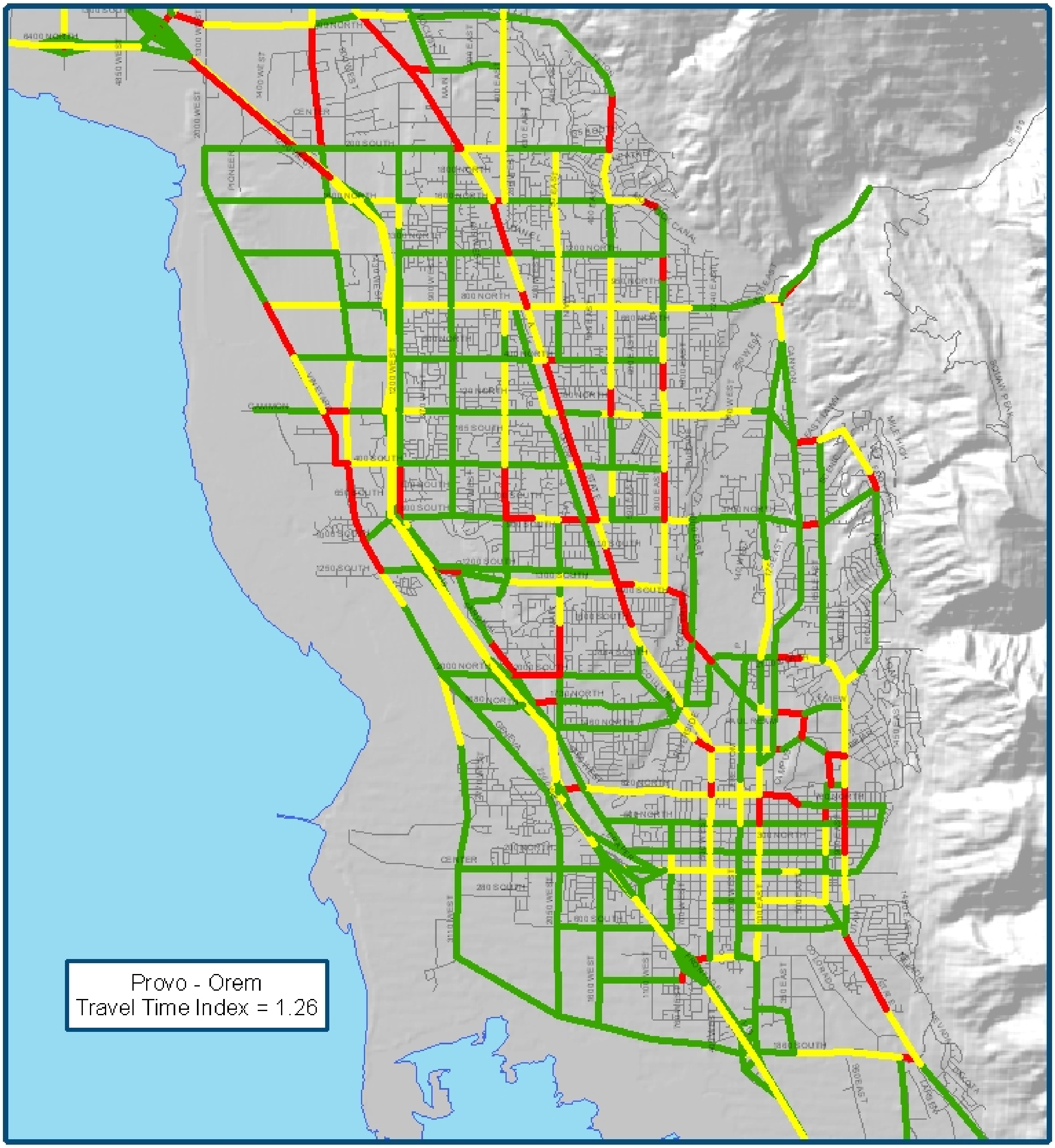
Figure 5.8
2030 Medium Build with Future Interchanges
Level of Service



Legend

PM Peak Period Volume to Capacity Ratio

0.00 - 0.80 | 0.81 - 1.00 | 1.01 - 5.00 | Existing Roads

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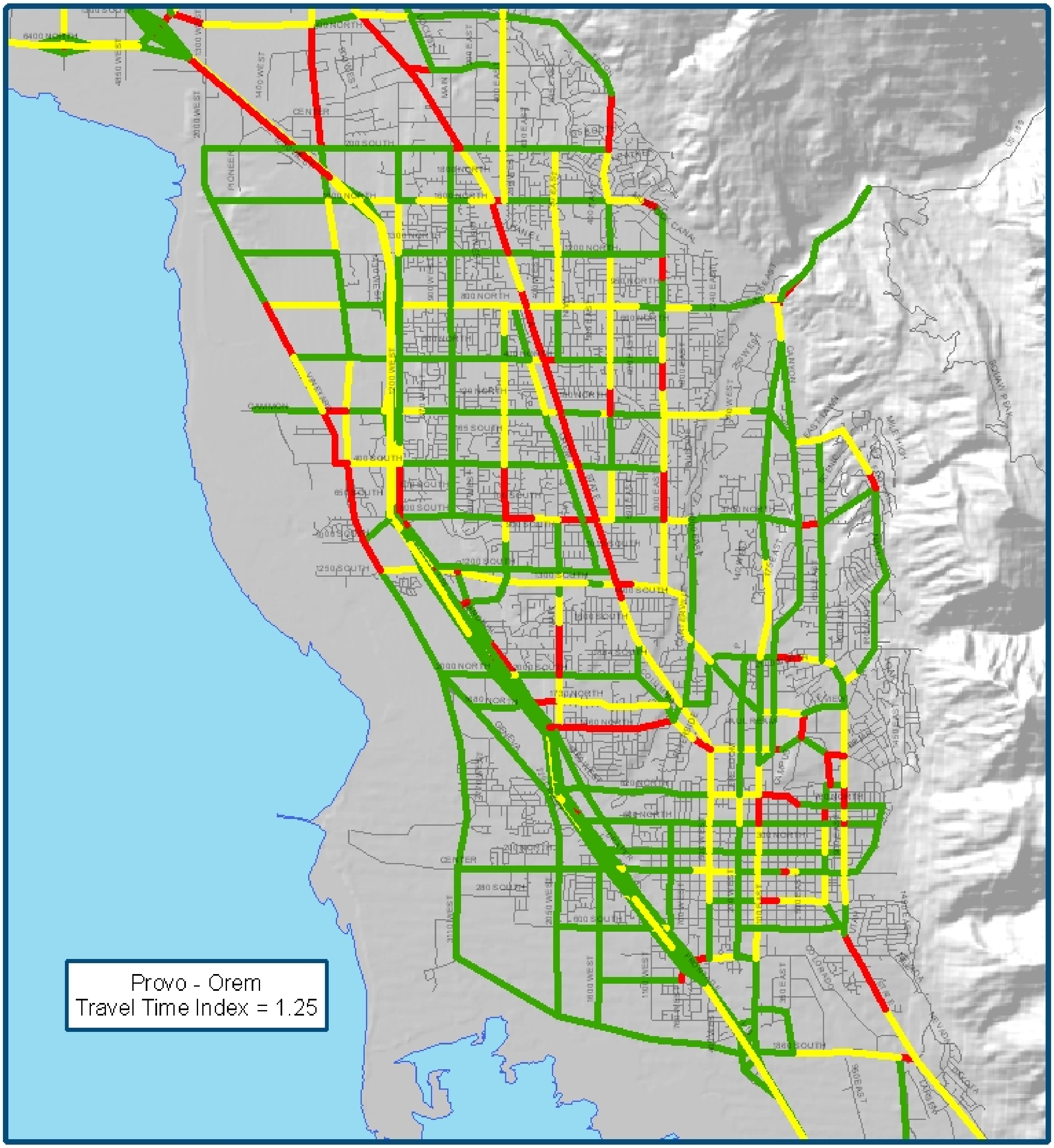
Figure 5.9
2030 Medium Build Level of Service with Frontage Roads



Legend

PM Peak Period Volume to Capacity Ratio

0.00 - 0.80 | 0.81 - 1.00 | 1.01 - 5.00 | Existing Roads

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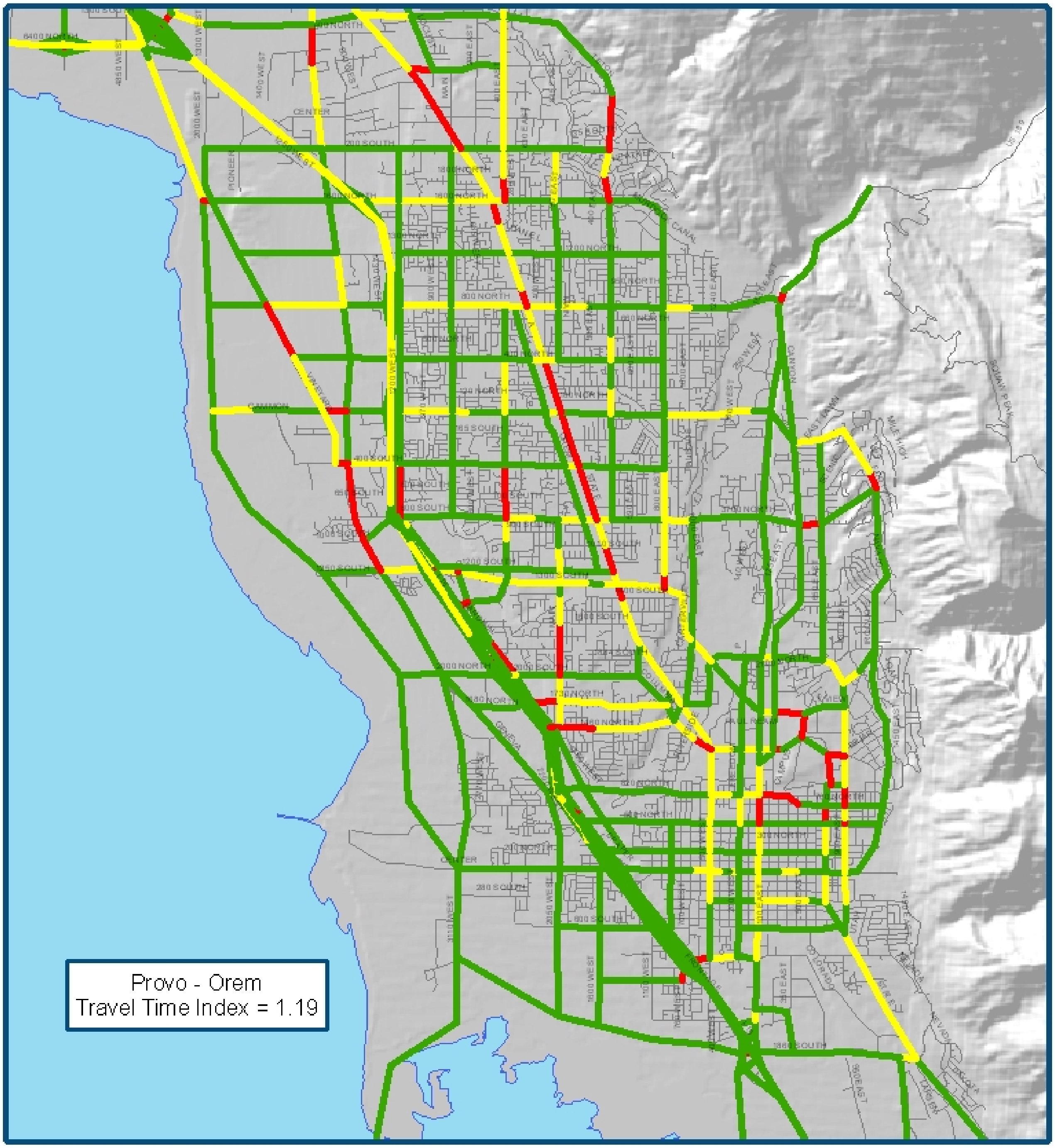
Figure 5.10
2030 High Build Level of Service with Frontage Roads



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PM Peak Period Volume to Capacity Ratio

0.00 - 0.80 | 0.81 - 1.00 | 1.01 - 5.00 | Existing Roads

The level of service and travel time index results of these model runs indicated that the frontage roads alternative yielded the best future conditions, and so frontage roads were assumed in all further analysis. I-15 improvements are not assumed in the Low Build scenario but are in the Medium Build and High Build scenarios. Additionally, frontage roads were included in the Medium and High Build scenarios.

5.4 Highway and Transit Recommendations

5.4.1 Study Area Recommendations

Transportation recommendations for the Provo-Orem study area are shown by phase in Figure 5.11. Projects included in the 2015 project list focus on I-15 and Geneva Road improvements as well as Orem's 800 North and other east-west corridors.

The 2030 project list includes improvements to accommodate Utah Valley State College users such as a new I-15 interchange at 800 South. In addition, it recommends expanded facilities on 800 North and 500 North in Provo and improvements on Canyon Road and a University Parkway extension on the east side of the study area.

Ultimate plan recommendations include an east lake highway, Utah Lake crossings, and the extension of some roads in the northern part of the study area out to the east lake highway.

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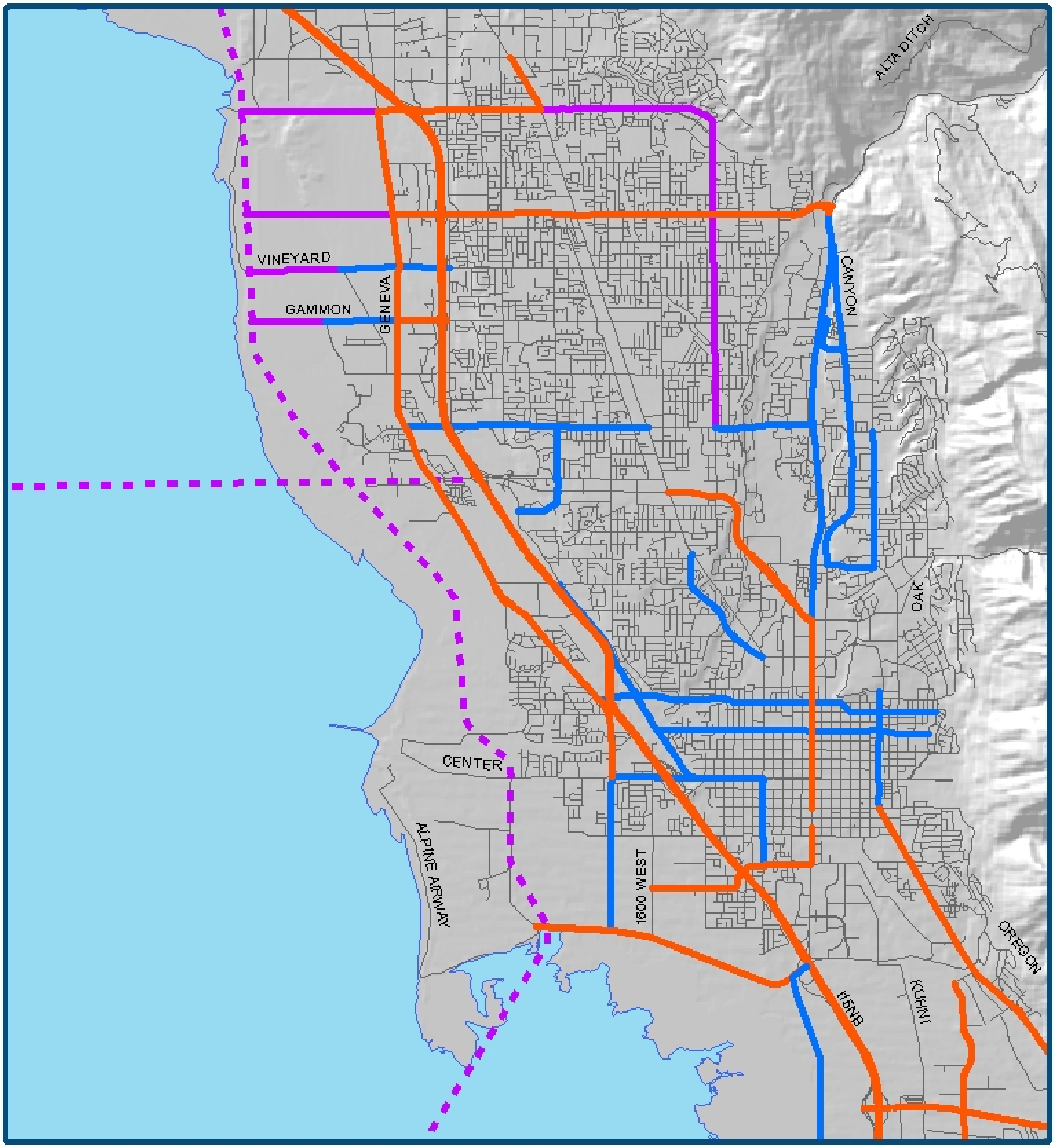
Figure 5.11
Recommended Road Projects



Legend

2015 Recommended Projects	Recommended Long Range Plan Projects	Ultimate Plan Projects	Ultimate Plan Flexible Alignments

Transit recommendations for the Provo-Orem study area reflect the transit component of the current Long Range Transportation Plan for Utah County. Regional commuter rail service from Payson to Salt Lake City is a transit priority as is expanded local bus service. In addition, the Provo-Orem Transportation Study recommends express transit service on I-15 and on 800 South in Orem as well as community connector service for easier transit access to other Utah County destinations. Figure 5.12 shows transit recommendations for Provo-Orem study area. Figure 5.13 shows the recommendations from Transit Vision 2030, a long-term transit plan for Utah County.

5.4.2 Regional Recommendations

As has been discussed throughout this document, the Provo-Orem Transportation Study was done simultaneously with two other areas in Utah County, the Lake Mountain area and the Nebo area. It is important to consider the recommendations of each of these processes together, along with the recommendations of the Northeast Utah Valley Transportation Study, so that projects, phasing, and priorities are consistent countywide. Figure 5.14 shows the recommended transportation projects for Utah County by phase.

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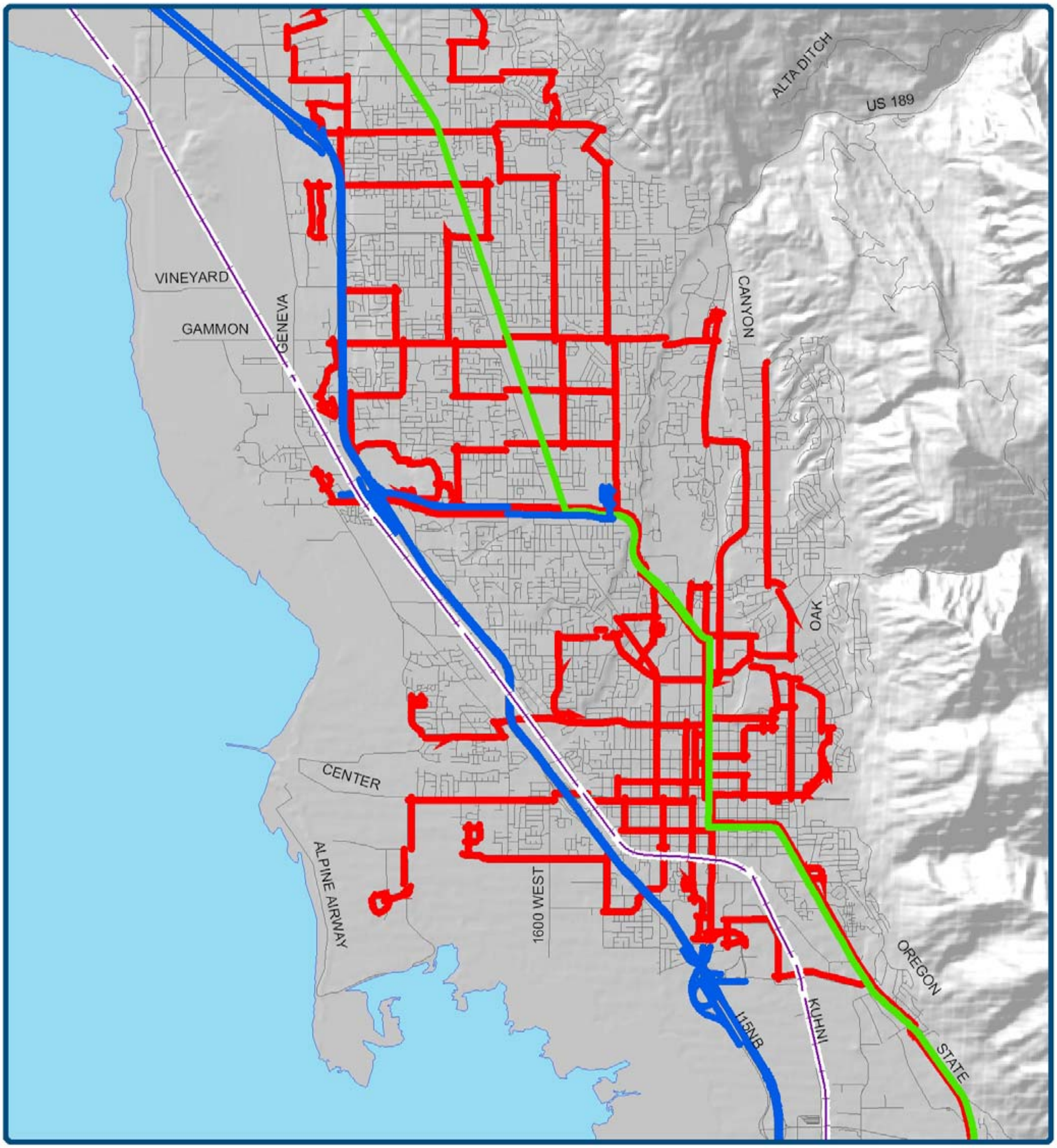
Figure 5.12
Recommended Transit Projects



Legend

Proposed Local Service
Proposed Express Service
Proposed Community Connector Service
Proposed Rail Service

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Figure 5.13
Recommended Transit Projects

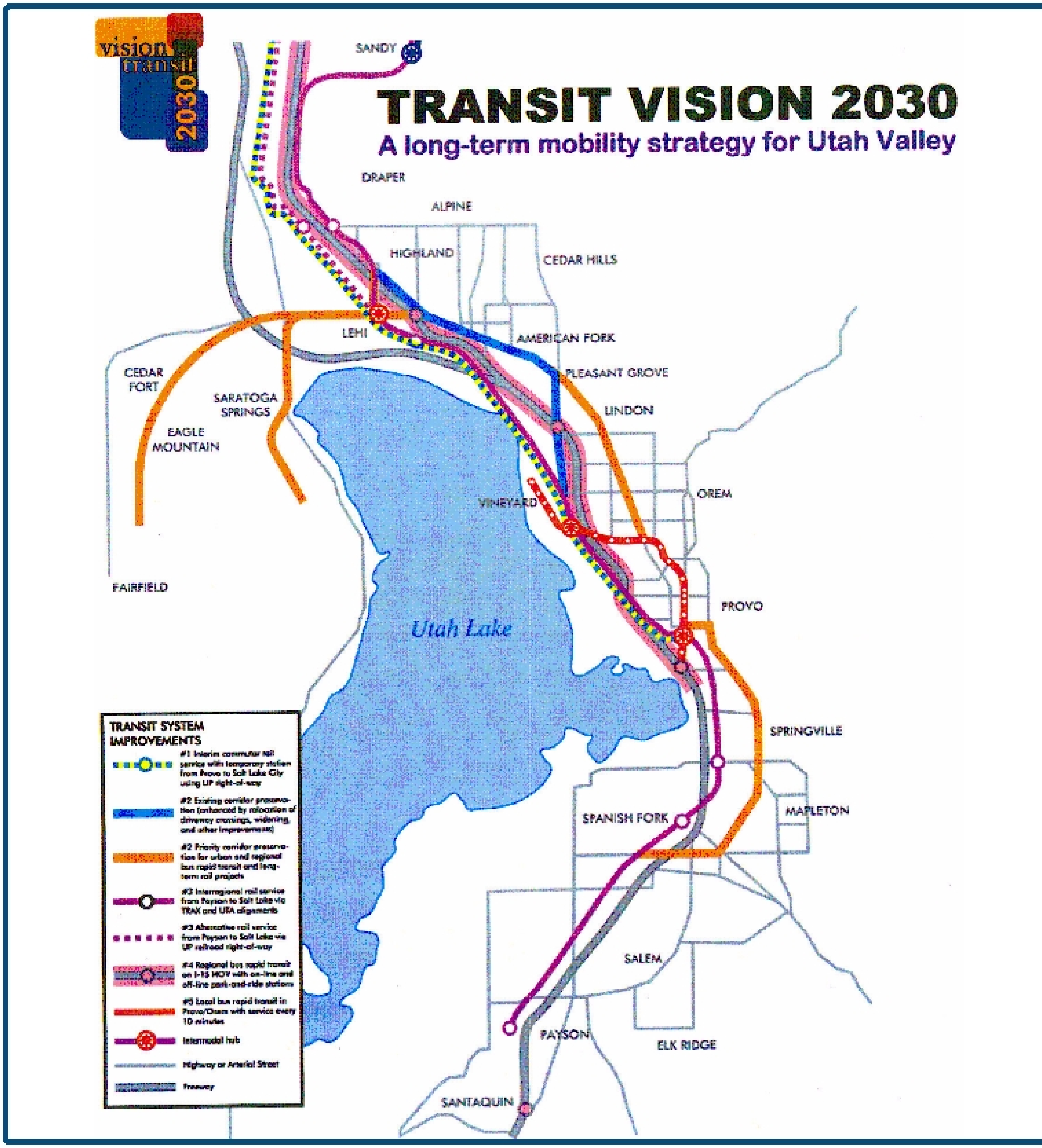

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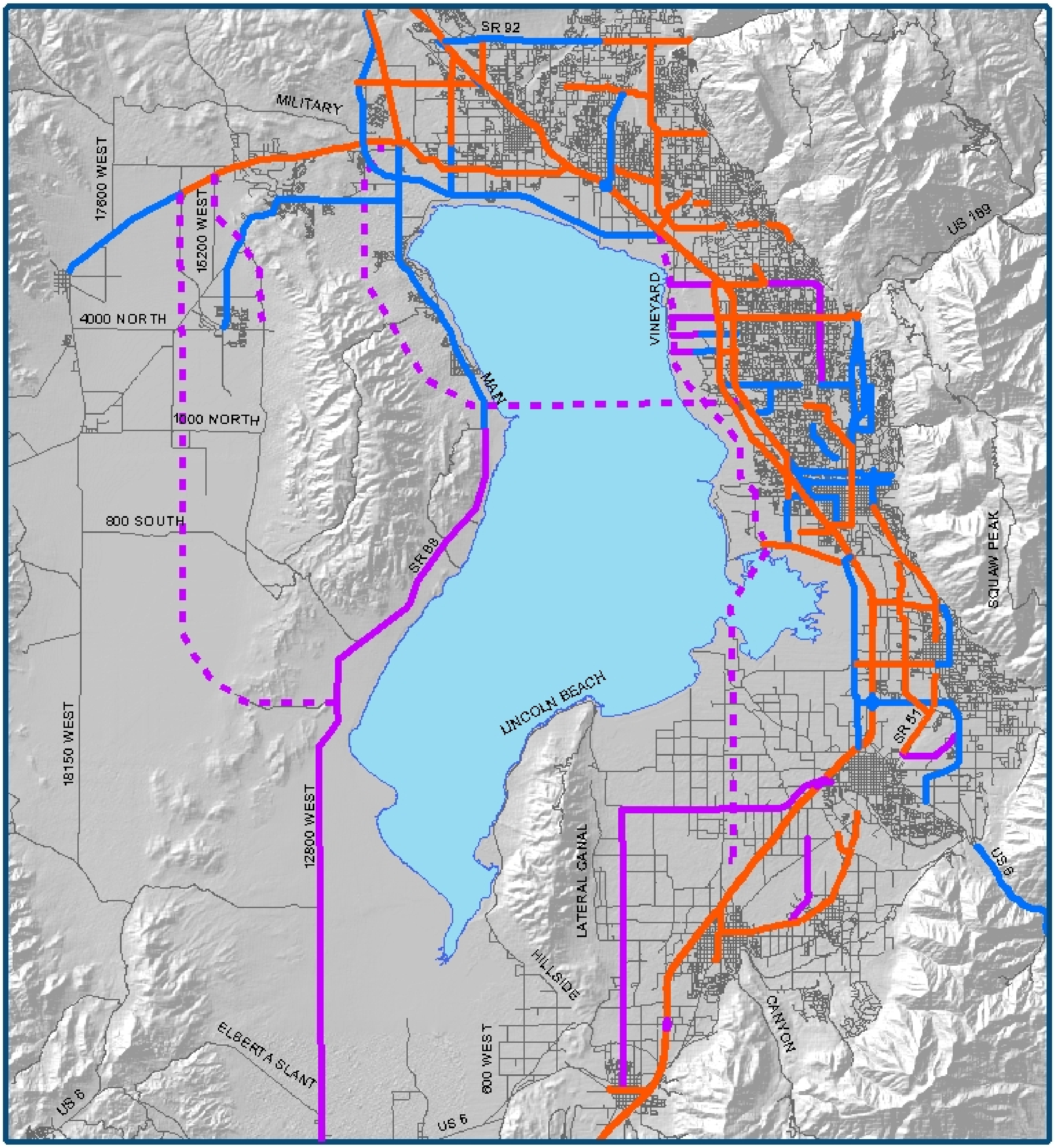
Figure 5.14
Countywide Recommended Road Projects



Legend

- 2015 Recommended Projects
- Recommended Long Range Plan Projects
- Ultimate Plan Projects
- Ultimate Plan Flexible Alignments

Chapter Six

6. Recommended Next Steps

The MAG Provo-Orem Transportation Study provides for a review of transportation needs and includes several recommendations for future transportation improvements to solve long-term mobility problems in the Provo-Orem study area. Despite the wealth of information included in this plan, implementation of the study recommendations will require further action on the part of the affected municipalities. The Mountainland Association of Governments is prepared to update their Long Range Transportation Plan using the results of the Provo-Orem Transportation Study as a starting point in order to evaluate funding and phasing options which prepare the project recommendations for programmed funding. In addition to the follow-up actions by MAG, each local government should use the Provo-Orem Transportation Study as a starting point for planning for further transportation improvements within their community. This chapter outlines specific steps for each local government.

> *Despite the wealth of information included in this plan, implementation of the study recommendations will require further action on the part of the affected municipalities.*

6.1 Orem

Orem City is one of the largest cities in Utah County and does not have a recent Master Transportation Plan. Development of a transportation plan should be a high priority for Orem City. The recommendations of the MAG Provo-Orem Transportation Study should be used as a catalyst to initiate the transportation planning process in the city. Table 6.1 summarizes the highway recommendations for Orem City.

Table 6.1: Recommended Projects in Orem

Project	Lanes	Right-of-way (feet)	Total Length (miles)	Cost (millions)	Phase		
					2015	2030	Ultimate
Geneva Road (1600 North Orem to University Parkway)	4	110	3.8	$41.41	✓		
Geneva Road (University Parkway to Center Street Provo)	4	110	3.6	$36.60	✓		
Orem 1600 North (1200 West to State Street)	4	84	0.9	$4.70	✓		
Orem 1600 North (Geneva Road to 1200 West)	4	84	0.7	$3.57	✓		
Orem 800 North (Geneva Road to I-15)	6	125	0.5	$4.67	✓		
Orem 800 North (I-15 to University Avenue)	6	125	3.8	$35.46	✓		
Orem Center Street (Geneva Road to I-15)	4	84	0.4	$4.09	✓		
State Street (1600 N to 2000 N)	6	-	-	-	✓		
University Parkway (State Street to University Ave)	6	125	2.1	$29.59	✓		
400 West /Campus Drive, UVSC (Sandhill Road to 800 S Orem)	4	84	0.6	$3.14		✓	
800 South Interchange	-	-	-	$28.00		✓	
Columbia Lane (State Street Orem to Provo River)	4	84	0.5	$12.61		✓	
Orem 800 South / Provo 3700 North (800 E Orem to University Ave)	4	84	0.9	$14.70		✓	
800 East Orem (1600 N to 800 S)	4	84	3	$25.68			✓
East Lake Highway (Mountain View to I-15 in Payson)	4	150	8.9	$158.08			✓
Lake Crossing (Saratoga Springs to Orem)	4	180	7.72	$475.44			✓
Orem 1600 North (State Street to 800 E)	4	84	1.7	$8.88			✓

Specific recommended actions for Orem City include:

- Update the city's Master Transportation Plan to reflect priority projects identified during this process.
- Review and establish a plan for action for 1600 North. Growth in this corridor has lead to increasing traffic congestion. However, widening this facility has significant impacts.
- Plan for the entire area around UVSC, which has also grown and is experiencing traffic congestion problems.
- Coordinate with UDOT for a new 800 South interchange
- Refine circulation plans in and around the UVSC campus.
- Coordinate long-term projects with MAG and Vineyard.
- Coordinate with MAG in defining a Lake Crossing terminus. It is not clear whether East Lake Highway will be promoted from the south through Provo or from the north, but it is clear that longer term solutions to north-south traffic growth will need to be explored beyond the year 2030 and likely beyond the feasible cross section of I-15.

6.2 Provo

Being the largest city and major employment center in Utah County, Provo plays an important role in the transportation future of the region. I-15 access is a major part of the city's transportation planning and is reflected in the priorities and recommended actions offered here. Table 6.2 summaries the highway projects affecting Provo City.

Table 6.2: Recommended Projects in Provo City

Project	Lanes	Right-of-way (feet)	Total Length (miles)	Cost (millions)	Phase		
					2015	2030	Ultimate
Geneva Road (University Parkway to Center Street Provo)	4	110	3.6	$36.60	✓		
Provo 1860 South (I-15 to Lake Shore Drive)	4	84	3.1	$26.22	✓		
Provo 920 South (500 West to University Ave)	4	84	0.4	$2.09	✓		
Provo 920 South / 1150 South (500 W to 1150 W)	4	84	1.6	$8.36	✓		
State St (400 N Springville to 300 S Provo)	6	125	4.5	$41.99	✓		
University Ave - Provo (300 S to 500 N)	6	125	0.5	$4.67	✓		
University Ave - Provo (500 N to University Parkway)	6	125	1	$6.79	✓		
University Ave - Provo (900 S to 500 S)	6	125	0.3	$12.80	✓		
University Parkway (State Street to University Ave)	6	125	2.1	$29.59	✓		
Provo 2230 North (Provo Canyon Road to Timpview Drive)	4	84	0.7	$3.66		✓	
Timpview Dr - Provo (2300 N to Quail Valley Drive)	4	84	1.3	$5.95		✓	
Provo 700 North / 800 North (University Ave to Seven Peak Blvd)	4	84	0.9	$4.70		✓	
University Ave (800 N Orem to University Parkway)	6	125	4.1	$38.26		✓	
Provo 700 East (300 S to 900 N)	4	84	1.1	$5.75		✓	
Provo Center St (Geneva Road to I-15)	4	110	0.5	$3.84		✓	
Provo Canyon Rd (2230 N to University Ave)	4	84	3.1	$16.20		✓	
Provo 4800 North / Foothill Dr	4	84	0.5	$4.23		✓	
Provo Center St (I-15 to 500 W)	4	110	0.7	$15.51		✓	
Provo 800 / 820 North (University Ave to Geneva Road)	4	84	1.9	$29.93		✓	
Provo 500 North (Independence Ave to Seven Peaks Blvd)	4	84	2.3	$12.02		✓	
Provo 500 West (Center Street to 920 South)	4	84	0.6	$13.41		✓	
Independence Ave - Provo (2000 N to 200 N)	4	84	2	$9.16		✓	
Geneva Rd (Center Street to 1860 South	4	110	1.4	$10.35		✓	
East Lake Highway (Mountain View to I-15 in Payson)	4	150	8.9	$158.08			✓

Specific actions which Provo City should pursue include:

- Continue to coordinate I-15 improvements with UDOT. A major issue in Provo City has been the frontage road concept with respect to I-15. Major improvements such as

Independence Avenue rely on near-term solutions to I-15 access issues associated with the frontage roads.

- Focus on improvements to many collector streets which are experiencing increasing traffic volumes through communities.
- Evaluate the need to re-stripe a range of primarily east-west facilities to serve as minor arterial streets.

6.3 Vineyard

The recent purchase of Geneva Steel will dramatically change the landscape of the Town of Vineyard and force the need for increased coordination with UDOT and Orem. Table 6.3 summarizes the recommended highway projects affecting the Town of Vineyard.

Table 6.3 Recommended Projects in Vineyard

Project	Lanes	Right-of-way (feet)	Total Length (miles)	Cost (millions)	Phase		
					2015	2030	Ultimate
Geneva Road (1600 North Orem to University Parkway)	4	110	3.8	$41.41	✓		
400 North Orem (Vineyard Road to East Lake)	4	106	1	$15.64		✓	
Center Street Orem (Holdaway to East Lake	4	106	0.7	$13.95		✓	
1600 North Orem (Geneva Road to East Lake)	4	106	1.3	$23.69			✓
800 North Orem (Geneva Road to East Lake)	4	106	1.8	$28.96			✓
Eastlake Highway (Mountain View to I-15 in Payson)	4	150	8.9	$158.08			✓

Specific recommendations for Vineyard include:

- Use the momentum of the Provo-Orem Transportation Study to initiate a Master Transportation Plan.
- Anticipate that major issues in Vineyard will focus on the selection of major east-west roads and the crossing of the Union Pacific railroad to Geneva Road.

Appendix A:
Technical Advisory Committee
Meeting Agendas

Utah Valley Transportation Studies
provo / orem transportation study

Provo / Orem Technical Committee Agenda

PROVO/OREM TECHNICAL COMMITTEE

Nick Jones
Provo

Ed Gifford
Paul Goodrich
Orem

Grant Holdaway
City Council - Vineyard

Paul Hawker
Utah County

Brent Schvaneveldt
Region 3, UDOT

Ken Anson
UTA Timpanogos Division

PROJECT STAFF

Chad Eccles, MAG

PROVO / OREM TRANSPORTATION STUDY

TECHNICAL COMMITTEE MEETING

1:30 P.M.

Wednesday, November 9, 2005

Mountainland Association of Governments
Main Conference Room
586 East 800 North, Orem

Agenda

1. Introductions and Study Purpose - Chad, MAG
2. Population and Employment Update and Forecast for Travel Demand Model - Keith, C-B
3. Travel Origins / Destinations and Transit – Keith, C-B
4. Long Range Plan Projects
   Review by Each city/UDOT/UTA/MAG -Tech Comm.
5. Questions and other business - Chad, MAG
6. Next meeting & Project schedule – Keith, C-B

If you have any questions please contact:
Chad Eccles. Mountainland Association of Governments,
Direct line: 801-229-3824
e-mail: ceccles@mountainland.org

PROVO/OREM TECHNICAL COMMITTEE

Nick Jones
Provo

Ed Gifford
Paul Goodrich
Orem

Grant Holdaway
City Council - Vineyard

Paul Hawker
Utah County

Brent Schvaneveldt
Region 3, UDOT

Ken Anson
UTA Timpanogos Division

PROJECT STAFF

Chad Eccles, MAG

PROVO / OREM TRANSPORTATION STUDY

TECHNICAL COMMITTEE MEETING

2:30 P.M.

Wednesday, December 14, 2005

Mountainland Association of Governments
Main Conference Room
586 East 800 North, Orem

Agenda

7. Welcome and Introductions - Chad, MAG
8. I-15 EIS update and discussion
9. Geneva Land update – Chad, MAG or Grant Holdaway, Vineyard City Council
10. Controversial and non-controversial Projects Chad, MAG Review by Each city/UDOT/UTA/MAG .
5. City ideas / other projects / brainstorming – Keith, C-B
6. Questions and other business - Chad, MAG
7. Next meeting & Project schedule – Keith, C-B

Utah Valley Transportation Studies
provo / orem transportation study

Provo / Orem Technical Committee Agenda

PROVO/OREM TECHNICAL COMMITTEE

Orem City
Paul Goodrich

Provo City
Nick Jones

Vineyard
Grant Holaway

Vineyard City
Jennifer Robinson

Utah County
Paul Hawker

UDOT - Region 3
Brent Schvaneveldt

UTA - Timpanogos Division
Ken Anson

Mountainland-Chad Eccles
Provo/Orem Study Lead

Carter and Burgess - Keith Hall
Provo/Orem Study Lead

PROVO/OREM TRANSPORTATION STUDY

TECHNICAL COMMITTEE

1:30 P.M.

Wednesday, February 8, 2006

Mountainland Association of Governments
586 East 800 North
Orem, Utah

****This is a critical meeting. Problems will be identified and solutions discussed. It is important that your municipality be represented****

Agenda

11. Presentation of Transportation Problems – Keith Hall, Carter & Burgess
12. Discussion of Transportation Projects – Keith Hall, Carter & Burgess
13. Summary of Transit Needs Assessment – Chad Eccles, Mountainland MPO
14. Discussion of Next Steps – Keith Hall, Carter & Burgess
15. Questions and other business – Chad Eccles, Mountainland MPO
16. Next meeting schedule – Keith Hall, Carter & Burgess

Utah Valley Transportation Studies
provo / orem transportation study

Provo / Orem Technical Committee Agenda

PROVO/OREM TECHNICAL COMMITTEE

Orem City
Paul Goodrich

Provo City
Nick Jones

Vineyard
Grant Holaway

Vineyard City
Jennifer Robinson

Utah County
Paul Hawker

UDOT – Region 3
Brent Schvaneveldt

UTA – Timpanogos Division
Ken Anson

Mountainland–Chad Eccles
Provo/Orem Study Lead

Carter and Burgess – Keith Hall
Provo/Orem Study Lead

PROVO/OREM

TRANSPORTATION STUDY

TECHNICAL COMMITTEE

3:00 P.M.

Tuesday, March 21, 2006

Provo City Traffic Operations Center
1377 South 350 East
Provo, Utah

****This is a critical meeting. Problems will be identified and solutions discussed. It is important that your municipality be represented****

Agenda

1. Revised presentation of I-15 impacts
   - "Baseline" alternative with no new interchanges or collector-distributor roads
   - Alternative with new interchanges
   - Alternative with collector-distributor roads
2. Discussion on project needs
   - Project needs assuming "baseline" alternative
   - Variations on project needs with new interchanges or collector-distributor roads
3. Transit program
   - Segment-by-segment discussion on shared lane or dedicated lane configuration of University Corridor BRT
   - Other transit capital needs (transit centers, park-and-ride lots, intermodal center needs)
4. Next steps and meeting

PROVO/OREM TECHNICAL COMMITTEE

Orem City
Paul Goodrich

Provo City
Nick Jones

Vineyard
Grant Holaway

Vineyard City
Jennifer Robinson

Utah County
Paul Hawker

UDOT – Region 3
Brent Schvaneveldt

UTA – Timpanogos Division
Ken Anson

Mountainland-Chad Eccles
Provo/Orem Study Lead

Carter and Burgess – Keith Hall
Provo/Orem Study Lead

PROVO/OREM TRANSPORTATION STUDY

TECHNICAL COMMITTEE

3:00 P.M.

Tuesday, May 2, 2006

Mountainland Conference Roomr
586 East 800 North
Orem, Utah

Agenda

5. Discussion of Critical Collector Streets under I-15 Alternatives

6. Discussion of Project Impacts and Benefits

7. Discussion of Next Steps

4. Next Meeting

Utah Valley Transportation Studies
provo / orem transportation study

Provo/Orem
Technical Committee Agenda

PROVO/OREM TRANSPORTATION STUDY

TECHNICAL COMMITTEE

3:00 P.M.

Wednesday, May 31, 2006

Mountainland Conference Room
586 East 800 North
Orem, Utah

1. Discussion of Highway Project Recommendations
   a. 2015 Project List
   b. 2030 Project List
   c. Ultimate Project List
2. Transit Concepts
3. Schedule
4. Council/Planning Commission Presentation(s)

Appendix B:
Project Impacts and Costs
Technical Memorandum

InterPlan Co.
Transportation Planning
7719 South Main Street
Midvale, Utah 84047
(801) 307-3400 (801) 307-3451 Fax
www.interplanco.com

Technical Memorandum

To: Mountainland Association of Governments (MAG)

From: InterPlan Co.

Date: April 25, 2006

Subject: Explanation of Impacts and Costs

As part of the three quadrants studies conduct by InterPlan Co. and Carter Burgess roadway project impacts and costs were used in evaluated projects. The impacts, including: properties impacted, structures relocated, and acres of wetlands impacted and costs were displayed in the projects lists and the project fact-sheets. This memorandum is designed to serve as an explanation of how impacts were estimated and how project costs were calculated.

Impacts

Before impacts were measured a road alignment needed to be identified. In most cases the project was a widening of an existing road therefore the alignment was already defined for us. In other cases an entirely new road was planned for and the alignment needed to be determined. InterPlan worked with MAG staff and the Technical Advisory Committees (TAC) to develop alignments for new build projects such as the East Lake Highway and others.

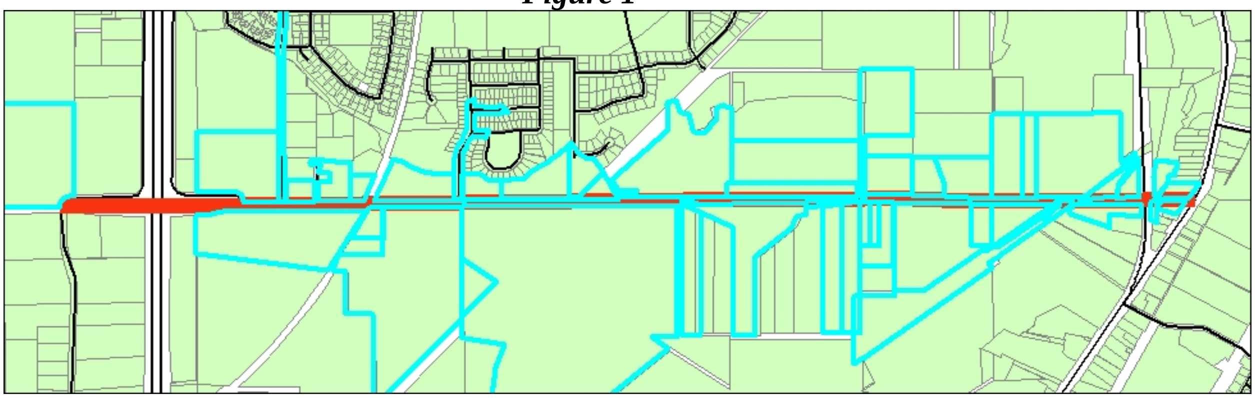
The other piece of information necessary to measure impacts was the right-of-way (ROW) for each proposed project. Without knowing how wide a road would be we have no idea how many houses it would potentially impact. Again, InterPlan along with MAG and the TAC developed right-of-ways based on the volume and speed of the roads. Right-of-ways were measured in feet and cross-sections for each possible right of way were developed an included on the project's fact-sheet.

Once an alignment and a cross-section were determined the project impacts could be measured. Geographic Information Systems (GIS) was used as a tool to measure the impacts. InterPlan collected geographic data for Utah County including: streets centerlines, land parcels, aerial photography, and National Wetlands Inventory (NWI) wetlands. This data gave us the information we needed to calculate the impacts of a project.

Properties Impacted

To calculate the properties impacted InterPlan used GIS to overlay the county parcels with the street centerline files. The project was selected and then buffered by half of the right-of-way. Half of the right-of-way was used because the street centerline is buffered on both sides. In many cases the impacts may be lessened by widening to one side of the road or the other, but for this planning study we always buffered the street centerline. All the properties with land in this buffered right-of-way were determined to be impacted and were selected. Finally the selected parcels were counted. Figure 1 is an example of properties that would be impacted by widening 1600 South in Springville.

Figure 1



Structures Relocated

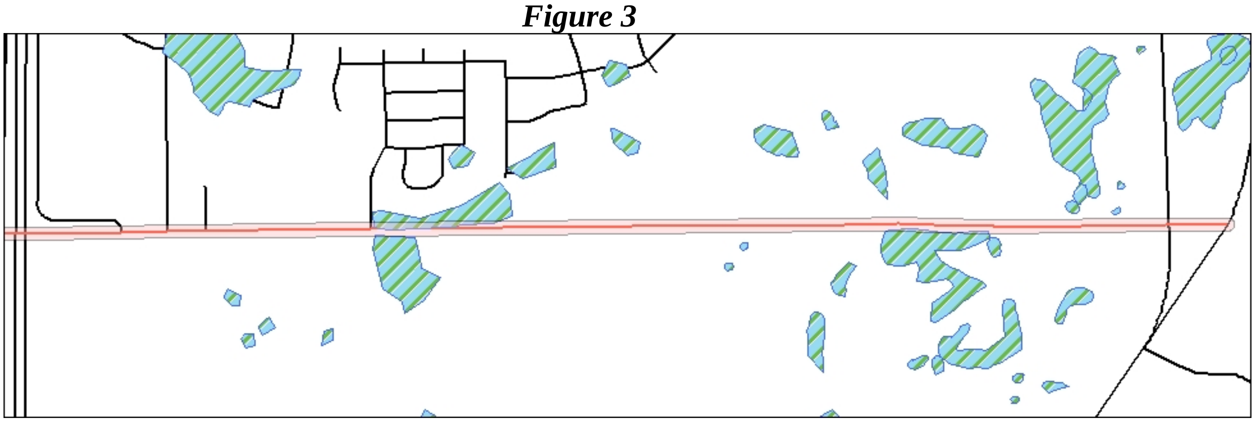
Structures relocated refer to the buildings whether they are houses or other buildings that would have to be removed to accommodate the right-of-way for a proposed road project. Again, InterPlan used GIS to layer the streets centerline over the newest aerial photographs available. We then buffered the roadway project by have of the right-of-way plus 15 feet. So a 106 foot cross-section would have been buffered on both sides by 68 feet. We added 15 feet because that is what Utah Department of Transportation (UDOT) uses to determine if a structure needs to be removed from a widening project. If the building is set back more than 15 feet from the new right-of-way then the structure is not removed, but if it is with 15 feet than it would be removed. With the road buffered correctly it is simply a matter of counting all the structures that are within that buffer. This is done be zooming in a sufficient amount to be able to see the buildings and counting how many would need to be removed. Figure 2 is an example of structures that would need to be removed along 1600 South in Springville.

Figure 2

Acres of Wetlands

Calculating acres of wetlands was done in similar fashion using GIS layers. Again InterPlan buffered the street centerline based on the proposed right-of-way. This new buffered centerline was converted to a polygon with a measured area. Then this polygon of the right-of-way was overlaid with the NWI wetlands data. Using a GIS tool to clip the NWI wetlands that are within the right-of-way polygon InterPlan created a new lay of the wetlands impacted by the proposed project. Then the acreage of the wetlands impacts was measured in GIS and entered into the table of impacts. Figure 3 is an example of NWI wetlands that would be impacted if 1600 South in Springville were widened.

Figure 3



Project Costs

Individual project costs were calculated for each project analyzed. These planning level cost estimates were calculated by decomposing total cost into construction cost, infrastructure cost (bridge, tunnel, etc.), and right-of-way cost. These three cost categories were then estimated for each project by using GIS data to determine project area, length, and river/railroad crossing that require additional infrastructure.

Construction Cost

Construction costs were developed from a spreadsheet created by Carter Burgess. This spreadsheet utilizes bid prices from 2003-2005 to estimate the cost for new road construction but does not include cost for curb/gutter or sidewalk. The new construction cost estimates are based upon an 48 inch burrow, a 12 inch granular burrow, a 10 inch untreated base course, and 10 inch plant mix for low volume roads or 11 inch Portland cement concrete for high capacity/speed facilities. Due to the imprecision of the average bid prices, construction cost estimates also include a 50% contingency. Table 1 summarizes the average material bid price used to estimate construction costs.

Table 1- Average Unit Bid Price for Construction Material

Burrow (cubic yard)	Granular Burrow (cubic yard)	Untreated Base Course (cubic yard)	Plant Mix (Ton)	Portland Cement Concrete (square yard)
$11.28	$13.64	$46.37	$36.08	$46.63

Infrastructure Cost

Infrastructure costs for each project were estimated by using Utah County GIS data. InterPlan employed railroad centerline, river, and stream GIS data along with aerials to total the number of structures need for each proposed project to cross rivers, railroads or other high capacity facilities. Table 2 summarizes the individual infrastructure costs assumed.

Table 2 – Structure Costs

At-grade railroad crossing (million)	**Grade-separated railroad crossing** (million)	**River/stream crossing** (million)	**Freeway Interchange** (million)
$2.00	$10.00	$10.00	$28.00

Right-of-Way Cost

Cost estimates for right-of-way were developed for each quad study area by using Utah County GIS parcel data. For all parcels in Utah County the GIS parcel data includes appraised improvement and land value. The average appraised land value for each study area was used as the cost for acquiring new right-of-way. For new roads that are not on existing right-of-way, the right-of-way cost was estimated from the total area of the proposed road and the respective land cost in the study area from the Utah County Assessors Office. Where proposed road are to be widened on existing right-of-way, it was assumed that the existing road has a 70 foot right-of-way. The right-of-way cost for widening roads is the cost for acquiring the land necessary for the proposed road cross-section. Table 3 summarizes the assumed right-of-way cost per acre for all study areas.

Table 3 – Average Land Cost by Study Area

Lake Mountain Study Area	**Nebo Study Area**	**Provo-Orem Study Area**
$142,214 per acre	$137,707 per acre	$380,925 per acre

Appendix C:
Utah Lake Crossing
Technical Memorandum

InterPlan Co.
7719 South Main Street
Midvale, Utah 84047
(801) 307-3400 (801) 307-3451 Fax
www.interplanco.com

Technical Memorandum

To: Mountainland Association of Governments (MAG)

From: InterPlan Co.

Date: June 6, 2006

Subject: Utah Lake Crossing

Access across Utah Lake has been a subject of discussion for many years. Recently, it has received even more attention because of the development of land on the west side of Utah Lake and in Cedar Valley. Currently, the main route to access the Provo/Orem area for residents living in Saratoga Springs and Cedar Valley is SR-73, which is Lehi City's Main Street. Access to Provo is important because Provo is the county seat and many governmental functions, employment, social services, education, health care, and regional shopping are located there. In Orem, employment, education, and regional shopping are all factors for the need to access Orem City.

The Utah Division of Water Resources of the Utah Department of Natural Resources has a Utah State Water Plan for the Utah Lake Basin. This plan was completed in December 1997 and states the following about Utah Lake:

> Utah Lake is perceived by many to have great potential for economic development of municipal water supply, recreation, transportation, fish and wildlife management, real estate, and other uses.

Despite this great development potential, no formal plan for the improvement and management of Utah Lake is currently in place. The Utah State Water Plan for the Utah Lake Basin recommends that "Utah County should take the lead in establishing an interagency entity to oversee the preparation for a management plan for Utah Lake." The key objectives of the Utah State Water Plan for the Utah Lake Basin are:

> To increase the efficiency of the lake for water storage, enhance the quality of the lake water, and gain control of its fluctuating surface while protecting wildlife values and established water rights.

As of yet, no official organization has been formed for the management of Utah Lake. However, there are some elected officials (mayors and county commissioners) from Utah County trying to form an official interagency entity.

The June Sucker (Chasmistes Iiorus) is unique to Utah Lake and was federally listed as an endangered species with critical habitat on April 30, 1986. To prevent the extinction of the June Sucker, the U.S. Fish and Wildlife Service has prepared a June Sucker Recovery Plan. This plan designated Utah Lake and nearly 5 miles of the Provo River as critical habitat.

Besides the environmental issue of the June Sucker, carp in Utah Lake have been found to contain high levels of PCBs – polychlorinated biphenyls – are man-made chemicals that were used as coolants and lubricants. There are an estimated 7.5 million carp in Utah Lake, accounting for as much as 90 percent of its volume of fish. Carp are bottom-feeders that get down in the sediments, churn around in the mud and make the lake turbid. Carp basically make it so it's a better environment for them to the exclusion of all other fishes.

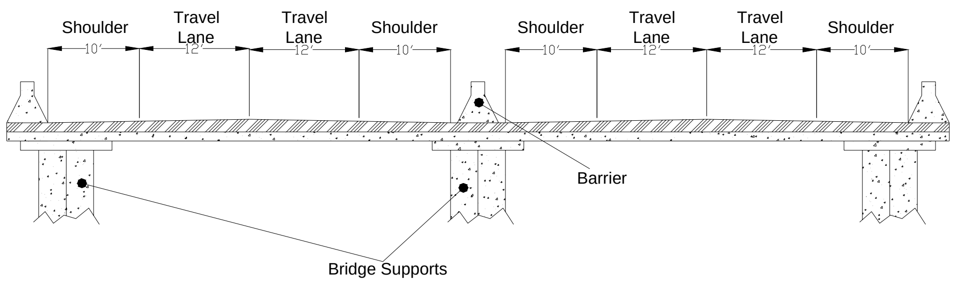
Because the average depth of Utah Lake is only 9.2 feet, a causeway for access across Utah Lake seems like a natural option. However, concern about the aesthetic, recreational, and environmental impacts a causeway could have on Utah Lake is one of the major issues. While a causeway is not eliminated from options in future studies, InterPlan wanted to look at other options too. The following options were discussed as possible means to across Utah Lake.

- Ferry boats
- Causeway
- Piling bridge
- Tunnel

InterPlan was able to dismiss the ferry boat option because of the depth, which would require some type of dredging for a ferry boat corridor. A causeway was dismissed simply based upon concerns about aesthetic, recreational, and environmental impacts. An underground tunnel was also dismissed because of the earthquake faults running through the bottom of Utah Lake, the enormous cost associated with tunneling, and the affect it may have on the water table below the lake bed. Finally, the piling bridge was chosen because it was perceived to have fewer impacts to recreational and environmental issues even though the cost is substantial.

InterPlan modeled a lake crossing from Redwood Road just north of Pelican Point to Geneva Road at University Parkway. The four-lane arterial/freeway was assumed to have a design speed of 60 mph or greater. The results showed a volume of 39,000 vehicles a day. The crossing from shore to shore is approximately 5.6 miles and the entire length of the road from Redwood Road to Geneva Road would be approximately 7.4 miles. A preliminary planning analysis of wetlands affected totaled nearly 18 acres for the 100-foot wide cross-section. Approximately 13 structures and 27 properties could potentially be affected. The cost of right-of-way acquisition could total $6.68 million and construction could cost $468.76 million totaling $475.44 million dollars. This facility could be a logical candidate for a toll road and could reasonably generate approximately $35 million annually (assuming a $3 per vehicle toll). A preliminary cross-section of the road is included below. Certainly further study would be needed to confirm road alignment, purpose and need, tolling, costs, and environmental impacts.

100' Four Lane Bridge/Freeway (60 mph +)



Appendix D:
Corridor Preservation Technical Memorandum

InterPlan Co.
7719 South Main Street
Midvale, Utah 84047
(801) 307-3400 (801) 307-3451 Fax
www.interplanco.com

Technical Memorandum

To: Mountainland Association of Governments Quadrant Studies

From: InterPlan Co.

Date: August 17, 2006

Subject: Corridor Preservation

Corridor preservation is a strategy to ensure that the network of highways, roads, and other travel ways will be available in the future to serve future development needs. For many transportation projects in urban areas, more than half the cost of the total transportation improvement is spent on right-of-way purchases which could have been avoided with early corridor preservation activities. Corridor preservation involves the application of various measures that:

- Maximize public investment by protecting corridors from unnecessary environmental, social, and economic impacts.
- Reduce the amount of developed property that needs to be purchased as part of a transportation corridor expansion.

The Utah State legislature has provided enabling legislation to counties to levy a tax for the sole purpose of corridor preservation. In their 2005 General Session, the Legislature passed Senate Bill 8 and it was signed into law. The legislation creates an opportunity for county governments to impose a fee of up to $10 per vehicle registration for the purposes of corridor preservation. These funds are to be used in the county in which they are generated and are to be held by UDOT on behalf of the local governments. The Metropolitan Planning Organizations have the opportunity, under the legislation, to prioritize the use of these funds for the purposes of corridor preservation starting January 1, 2006. The Utah County Commission has approved the use of these funds in Utah County where it is expected that total corridor preservation revenues may exceed $2.5 million per year.

As presently proposed, the county option corridor preservation fund is not a revolving loan fund (where right-of-way costs are returned to the fund when projects are implemented). As such, the corridor preservation fund would by itself be insufficient to purchase the right-of-way needs for even a handful of priority transportation corridors. While complete right-of-way purchase needs to be a “tool in our toolbox” for corridor preservation, it is only one of many tools. Like a hammer, our corridor purchase tool is appropriate for some but not all applications of corridor preservation. This Technical Memorandum provides a brief description of corridor preservation tools and their proper application.

This Technical Memorandum is offered through the Mountainland Association of Governments to describe corridor preservation tools and options. It should be noted that this memo does not supersede the legal opinions of each local government or UDOT and is provided to offer positive examples of corridor preservation activities observed in the MAG planning area and throughout Utah. Future policies of the corridor preservation fund may seek to encourage positive corridor preservation examples without judgment as to the equity of these examples from a property rights standpoint, but aimed as using right-of-way purchase as one of many corridor preservation tools.

Local governments possess the widest range of tools in their planning and zoning powers. New developments in a city or county must ask permission in the form of zoning, site plan, or other local land use approvals and requirements. This permission allows for the diligent evaluation of the health, safety, and welfare of existing and future residents of the local government. In broad terms, local governments can grant permission, deny permission, or grant permission subject to various conditions. Continuing to speak in broad terms, the court system has often limited the powers of local governments to grant approval subject to conditions where the conditions exceed the impact of the development. Therefore, many of the planning and zoning powers offered in the following section are subject to a case-by-case evaluation and should not be broadly interpreted for all applications.

Master Transportation Plans

Utah statute requires that the actions of a city, such as the approval of a new development, must be consistent with City Master Plan. A transportation element is one of several elements required to be addressed by Utah Code in a City Master Plan. Many cities have developed Master Transportation Plans as either sections of larger plans or stand-alone documents. Master Transportation Plans allow communities to define a planned transportation network including the right-of-way of future corridors. Once adopted as a plan of the community, new developments must be consistent with the Master Transportation Plan. Therefore, the Master Transportation Plan becomes a tool where new developments may be denied if they block or preclude a planned transportation facility. The Master Transportation Plan is one of the most valuable tools for corridor preservation. The MAG Quad studies provide a strong modeling basis and regional coordination for local governments to build from to adopt or amend their Master Transportation Plan. All Cities in Utah County should adopt a Master Transportation Plan and review and amend the plan on an ongoing basis. The Corridor Preservation Fund can be used for planning activities and may be eligible to assist with Master Transportation Plan development.

Official Maps

The Official Map was eliminated and recently returned to Utah Land Use Legislation as a tool to define transportation corridors at a greater level of detail. Where Master

Transportation Plans may identify the general location of transportation corridors, they typically do not identify the corridors to a level of detail where individual parcel building permits would preclude a corridor. Official Maps provide local governments an added tool of identifying corridors at a parcel level of detail, but also provide for an obligation of local governments to progress on corridor purchase and not restrict development indefinitely. Local governments may have longer time frames and greater flexibility to restrict new uses of land, such as new subdivisions of new commercial site plans, than to restrict permitted but regulated uses such as building permits. Official Maps can be adopted City-wide but are more commonly the outcome of an individual corridor study. Corridor studies offer an added benefit of coordination with resource agencies and adjacent cities to better define the needs, costs, impacts, and mitigation of new transportation corridors. As such, corridor studies may offer money savings in a future National Environmental Policy Act (NEPA) environmental study, which is a prerequisite for federal actions, including federal transportation funding. Corridor studies and Official Map development are also eligible planning activities for county Corridor Preservation Funds subject to County and MPO restrictions.

Development Exactions

New developments which create the need for a community to build several miles of new street just to access the development, for example, may often be granted approval of the development subject to the requirement that the development put into service the new street. These approvals subject to a set of traded conditions are often referred to development exactions. Cities may gain an “upper hand” on this trade and still be fair and reasonable to all developments when they have strong planning and can clearly define their needs through tools such as a Master Transportation Plan. Development exactions in this sense do not mean unfair dealings with new development, but rather a community’s ability to define long term planning goals and rely on each new development to contribute toward the achievement of these goals. As a traded or negotiated process, exactions are subject to the concern that all developments are not treated equally. In addition, there are examples of court rulings where the city has required unfair trades or have acted in an arbitrary manner.

Development Impact Fees

Development impact fees have been used by many local governments in Utah and legislated as a local government planning tool for approximately ten years. Utah impact fee legislation allows for the development of transportation impact fees provided that the impact is reasonably related to the development demand and the need flows from an adopted Capital Facilities Plan which identifies the costs of planned infrastructure expansion necessitated by new growth. Transportation impact fees are presently not allowed for State Highways. The assessment of impact fees allows for a means of calculating the value of exactions such that new development is not required to put in new facilities but may be required to pay a portion of the cost for new facilities to be implemented. Although impact fees are generally resisted by development interests, they are a means of taking the negotiation process away from development exactions. Impact fees play two roles in corridor preservation. First, developments may dedicate right-of-way in lieu of impact fee payments. Second, communities may collect impact fees and use the revenue to purchase and implement new transportation corridors. The studies which support the adoption of impact fees may be eligible for Corridor Preservation Funds, but are also eligible costs to be recouped by the actual impact fee.

Set-Back Requirements

Most communities require specific building setbacks from front, side, and rear property lines. These setbacks often result in a more desirable single family residential environment by reducing noise and providing safety and other benefits. Communities with large lot sizes may increase set-back requirements on major transportation corridors for the short-term purpose of maintaining property values through reducing the impacts of the transportation facility on the residential environment. In the longer term, these setbacks offer communities the ability to purchase private land which is not encumbered by buildings. Although set-back requirements reduce the need to purchase buildings, they are difficult to implement in the future since large lot developments tend to have high property values.

Density Bonuses

The ability of communities to "trade" density between developments varies based on the size of the development and communities must be conscious of the policy implications of various actions. However, like set-back requirements, density bonuses may be applied in specific applications where a development may be asked to "donate" a transportation corridor in exchange for permission to build the same number of units which would be built if the corridor remained in private ownership. This tool allows for a win-win of community and development interests, but may not create a "level playing field" of competing developments of different sizes. Density bonuses are a form of exactions where the city is more proactive in offering incentives for corridor preservation.

Access Management

In addition to planning and zoning powers, local governments and UDOT share the police powers necessary to regulate the safe use of public facilities. While there is some overlap of local government planning and police powers, there is a clear divide in the ability of UDOT to regulate the use of (State) highways and the inability of UDOT to regulate the use of land adjacent to highways. In fact, Administration Rule R930-6 describes the ability of UDOT to manage and control the access to and from the State Highway system separate from the ability of local governments to approve land use. Since the recent adoption of this rule, there have been examples of local government site plan approvals which have not been permitted for access onto the State Highway system. Therefore, State Highways allow for double protection of corridors since local governments must approve land use and UDOT must approve highway access. While access management does not gather corridor rights-of-way from private ownership and put them into public ownership, it does provide a mechanism of protecting the past investment of the transportation corridor by preserving its safety and traffic-carrying capacity function.

There are three broad aspects of access management which are employed by UDOT through Administrative Rule R930-6 and slowly gaining acceptance by a handful of local governments. While access management is often proposed as solution for previously widened corridors where retro-fit actions are more cost-effective than continual corridor widening, access management should be more widely practiced in the growth of undeveloped corridors to ensure that planned development does not result in choked or clogged facilities in the future.

Driveway Design

The design of driveways and access points can have a noticeable affect on traffic capacity and safety. High-speed corridors, for example, should be designed with appropriate corner radii to allow turns at higher speeds. Similarly, corridors with trails and bicycle lanes, effective tools in their own right for reducing the demand for highways but beyond the scope of corridor preservation, should tighten turn radii to reduce high speed conflicts between motorized and non-motorized uses. Other design criteria related to vehicle design, sight distance considerations, and various other engineering considerations should be carefully considered by UDOT and local governments but often are not given the attention of other corridor preservation techniques.

Driveway Separation

In addition to the design of driveways, the spacing of driveways is an important planning consideration. According to the AASHTO Green Book, on a per mile basis, each new driveway reduces the progressive speed on a corridor by 0.25 mile per hour. The net result of failing to restrict driveway spacing can be found on commercial corridors such as State Street where over 40 driveways per mile restrict the travel speeds by over 20 percent of the free flow speed. With the capacity of major facilities reduced by 20 percent, other facilities must carry the traffic load. It is incumbent on all communities to develop access spacing standards which balance the role of the facility to serve individual land development and land uses against the degradation of the facility's carrying capacity through the entire community. UDOT standards suggest a minimum driveway spacing of approximately 150 feet for lower functioning streets with progressively larger separation as the speed and geographic importance of the facility increases.

Signal Spacing

The single largest determinant of a facility's traffic-carrying capacity is the spacing of traffic signals. A single travel lane on a freeway, for example, can service approximately 2,000 vehicles per hour. Traffic signals essentially split green time with cross traffic and, through various inefficiencies, reduce the traffic capacity of a single travel lane to less than 900 vehicles per hour. In fact, as signals are spaced closer than approximately one-half mile, crash rates can be expected to increase and the ability to coordinate signals so that drivers may progress in a platoon dramatically decreases. Like access spacing, signal spacing must be planned based on the role of the facility in the regional network and the desired speed of that facility. As a general guideline, signals should be spaced uniformly with larger signal spacing offered for higher functioning facilities and smaller signal spacing, typically no less than one-quarter mile, can be allowed on facilities serving limited geographic areas.

All communities in Utah County should be encouraged to preserve corridors included in the MAG Long Range Transportation Plan. This plan currently anticipates transportation needs to the year 2030 and includes both near-term and longer-term transportation improvement projects. All corridor preservation actions of local governments and UDOT should be promoted for projects included in the MAG Long Range Transportation Plan. Unfortunately, the MAG Long Range Transportation Plan is required by federal guidance to be "financially constrained." As a constrained plan, it is difficult to identify corridors which might be implemented beyond the planning horizon of the plan but which still require right-of-way protection in the form of corridor preservation. The MAG Quadrant Study Ultimate Plan projects offer some guidance for longer term transportation corridors which should be preserved. Specifically, the Nebo Belt Loop and the East Lake Highway are identified as potential long range corridors which offer a dramatic improvement to the transportation network in Utah County but will require active coordination of multiple local governments. Both of these corridors were identified as having minimal residential impacts in 2006, but development may preclude these facilities by the time they offer benefit.

Appendix E:
Congestion Management System
Technical Memorandum

InterPlan Co.
7719 South Main Street
Midvale, Utah 84047
(801) 307-3400 (801) 307-3451 Fax
www.interplanco.com

Technical Memorandum

To: Mountainland Association of Governments (MAG)

From: InterPlan Co.

Date: August 17, 2006

Subject: Congestion Management System

With Utah County being one of the fastest growing areas of the country, travel demand is quickly meeting, indeed exceeding, the existing transportation network capacity in the area. In order to most effectively use the limited resources available, the Mountainland Association of Governments wants to maximize the capacity of the existing transportation network before building new capacity, and as a first step asked InterPlan to develop a list of most congested corridors. Roads on this list will become candidates for implementation of congestion management strategies as determined by the Technical Advisory Committee/Planners Advisory Committee.

In creating this list, InterPlan developed a spreadsheet with the intent of inventorying all of the major roads in Utah County as well as the roads with the highest volumes. The County was divided into the same four quadrants of the transportation studies that are currently being finalized or have been recently completed. These four areas are referred to as:

- The Lake Mountain Study Area
- The Nebo Study Area
- The Provo/Orem Study Area
- The Northeast Utah Valley Transportation Study Area

In each of these quadrants, roads with traffic volumes of at least 10,000 vehicles/day were included in the inventory. The exception is in the Lake Mountain study area where there is less infrastructure and lower traffic volumes. In this area, roads have been included that have traffic volumes less than 10,000 vehicles/day.

In order to determine capacity, a detailed inventory of each facility needed to be done, including such elements as cross-sections and lane configurations. InterPlan staff drove many of these roads to gather detailed information. Aerial photography was used to gather information for roads that weren't manually verified.

After specific configurations for each corridor were obtained, traffic capacities were determined. Where appropriate, varying sections of the same road were calculated separately to account for changing road widths. For example, the cross-section of State Street changes from section to section; these sections were included in the inventory by segment.

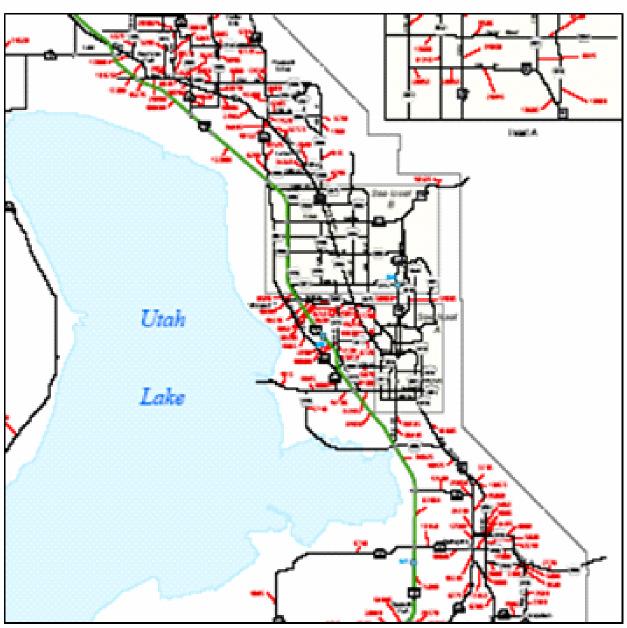
In order to determine traffic capacity, a standardized method of assigning volumes to different lane configurations was developed. These standardized capacities are shown in Table 1 below.

Table 1: Traffic Capacity by Lane Configuration

Through Lanes	Turn Lanes	Capacity
2	None	13,500
2	Right	15,500
2	Left	16,000
2	Right and Left	18,500
4	None	29,500
4	Right	33,500
4	Left	35,000
4	Right and Left	40,500
6	None	44,000
6	Right	48,500
6	Left	50,500
6	Right and Left	55,500

In determining traffic volumes, UDOT's *Traffic on Utah Highways* for 2004 used as it is the most recent widely available and consistent data across the transportation network. Figure 1 below is an example of a Traffic on Utah Highways map from the UDOT web page.

Figure 1: 2004 Traffic on Utah Highways, Central Utah County



Using the traffic volume and road capacity, a volume to capacity (V/C) ratio was calculated. Level of service is typically based on V/C as it is the best measure of congestion on a roadway or a particular time. Table 2 shows the volume, capacities, V/C ratio, and LOS for each road in the inventory. Roads indicated in red have a LOS of F and those in yellow have a LOS of D or E. Figure 2 shows the roads in Utah County by LOS. Level of service definitions assumed in Table 2 are:

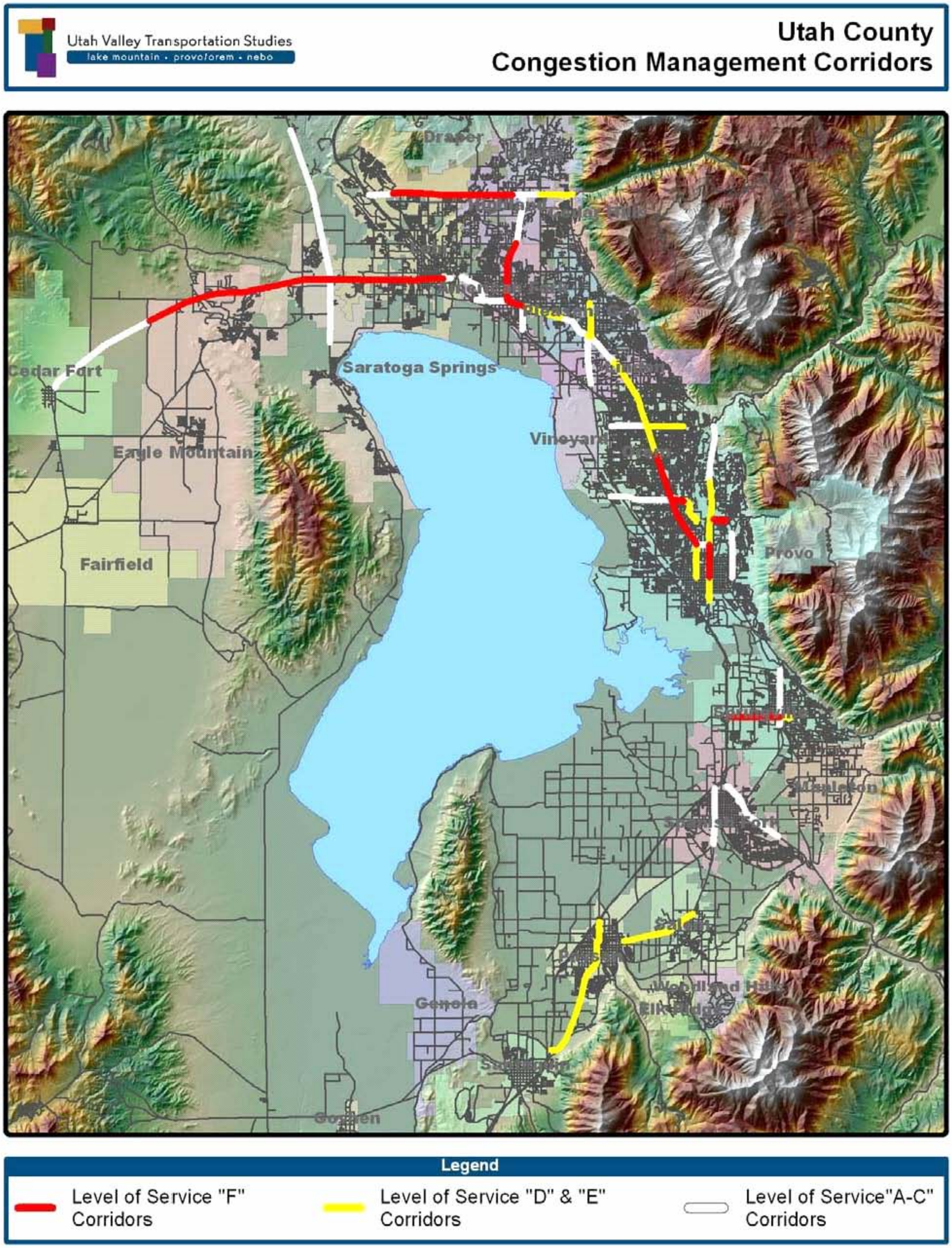
- White = Less than .75
- Yellow = .75 to .99
- Red = Equal to or greater than 1.0

Table 2: Congested Corridors in Utah County

Region	Corridor	Start	End	Volume	Capacity	V/C Ratio	LOS
Lake Mountain							
LM 1	SR-73 (east of Redwood Rd)	Redwood Rd	1700 West	21,520	13,500	1.59	F
LM 2	Main Street (in Lehi, SR-73)	780 West	Center Street	21,520	13,500	1.59	F
LM 3	SR-73 (east of Redwood Rd)	1700 West	780 West	21,520	16,000	1.35	F
LM 4	SR-73 (west of Redwood Rd)	800 West	Redwood Rd	16,400	16,000	1.03	F
LM 5	Main Street (Lehi, SR-73)	Center Street	600 East	16,400	16,000	1.03	F
LM 6	Redwood Rd (north of SR-73)	SL County	SR-73	10,010	13,500	0.74	C
LM 7	SR-73 (west of Redwood Rd)	Cedar Fort	800 West	7,955	13,500	0.59	C
LM 8	Main Street (Lehi, SR-73)	600 East	I-15	21,520	40,500	0.53	C
LM 9	Redwood Rd (south of SR-73)	SR-73	Saratoga Springs	9,660	18,500	0.52	C
NEUV							
NV1	State Street	500 East	Main Street	39,265	35,000	1.12	F
NV2	100 East/Alpine Hwy (in AmericanFork)	Main Street	1120 North	20,620	18,500	1.11	F
NV3	SR-92	6000 West	5600 West	17,225	15,500	1.11	F
NV4	SR-92	1200 East	6000 West	17,225	15,500	1.11	F
NV5	SR-92	1500 West	1200 East	17,205	15,500	1.11	F
NV6	100 East/Alpine Hwy	1120 North	97th North	20,365	18,500	1.10	F
NV7	State Street	100 East	Main Street	34,605	35,000	0.99	E
NV8	State Street (in Lindon)	400 North	1600 North	34,545	35,000	0.99	E
NV9	100 East (Pleasant Grove)	500 North	1100 North	13,230	13,500	0.98	E
NV10	100 East (in Pleasant Grove, SR-146)	State Street	Center Street	17,570	18,500	0.95	E
NV11	SR-92	4800 West	Canyon Rd	12,325	13,500	0.91	E
NV12	State Street	Proctor Ln	500 East	30,965	35,000	0.88	E
NV13	100 East (Pleasant Grove)	Center Street	500 North	15,400	18,500	0.83	D
NV14	Main Street (Am. Fork)	State Street	State Street	26,990	35,000	0.77	C
NV15	100 East/Alpine Hwy	97th North	SR-92	13,525	18,500	0.73	C
NV16	State Street	Main Street	Proctor Ln	23,355	35,000	0.67	C
NV17	State Street	400 North	100 East	32,775	50,500	0.65	C
NV18	500 East (in Am. Fork)	I-15	State Street	19,020	35,000	0.54	C
NV19	SR-92	5600 West	4800 West	17,225	35,000	0.49	B

NV20	SR-92	I-15	1500 West	17,205	35,000	0.49	B
NV21	State Street	Main Street	SR-73	17,200	35,000	0.49	B
NV22	Geneva Rd	State Street	2000 North	16,125	35,000	0.46	B
NV23	Main Street (American Fork)	I-15	State Street	15,575	35,000	0.45	B
Provo-Orem							
PO 1	University Pkwy (in Orem)	State Street	800 East	45,930	35,000	1.31	F
PO 2	State Street (in Provo)	1230 North	800 South	58,230	50,500	1.15	F
PO 3	State Street (in Orem)	Center Street	800 South	58,115	50,500	1.15	F
PO 4	University Ave (in Provo)	Center Street	400 North	44,650	40,500	1.10	F
PO 5	University Ave (in Provo)	400 North	800 North	43,825	40,500	1.08	F
PO 6	University Ave (in Provo)	800 North	1230 North	42,760	40,500	1.06	F
PO 7	2230 North (in Provo)	University Ave	650 East	15,990	16,000	1.00	F
PO 8	State Street (in Orem)	Center Street	800 North	49,210	50,500	0.97	E
PO 9	800 North (in Orem)	State Street	400 East	34,060	35,000	0.97	E
PO 10	University Ave (in Provo)	900 South	Center Street	38,515	40,500	0.95	E
PO 11	State Street (in Orem)	800 North	1600 North	47,730	50,500	0.95	E
PO 12	University Pkwy (in Orem)	800 East	2230 North	37,700	40,500	0.93	E
PO 13	State Street (in Provo)	Center Street	1230 North	36,850	40,500	0.91	E
PO 14	University Ave (in Provo)	2230 North	800 South	36,160	40,500	0.89	E
PO 15	University Ave (in Provo)	1230 North	University Pkwy	35,830	40,500	0.88	E
PO 16	University Ave (in Provo)	University Pkwy	2230 North	35,750	40,500	0.88	E
PO 17	800 North (in Orem)	400 East	800 East	27,515	35,000	0.79	D
PO 18	900 East (in Provo)	700 North	University Pkwy	25,290	35,000	0.72	C
PO 19	University Pkwy (in Orem)	I-15	State Street	39,235	55,500	0.71	C
PO 20	800 North (in Orem)	I-15	State Street	27,355	40,500	0.68	C
PO 21	University Ave (in Provo)	Canyon Road	800 North Orem	19,150	30,000	0.64	C
PO 22	900 East (in Provo)	Center Street	700 North	18,765	35,000	0.54	C
PO 23	University Ave (in Provo)	South Towne	900 South	28,445	55,500	0.51	C
PO 24	1230 North (in Provo)	State Street	University Ave	27,350	55,500	0.49	B
Nebo							
NE 1	400 South (in Springville, SR-77)	I-15	400 West	19,140	15,500	1.23	F
NE 2	400 South (in Springville, SR-77)	400 West	Main Street	18,665	18,500	1.01	F
NE 3	Main Street (in Payson)	I-15	100 North	13,305	13,500	0.99	E
NE 4	100 West (in Payson)	800 South	100 North	13,170	13,500	0.98	E
NE 5	400 South (in Springville, SR-77)	Main Street	400 East	14,455	15,500	0.93	E
NE 6	SR-198 (Payson)	South end of the road, by I-15		12,095	13,500	0.90	E
NE 7	Main Street (in Spanish Fork)	SR-164	Payson	10,560	13,500	0.78	D
NE 8	Main Street (in Spanish Fork)	I-15	400 North	28,060	40,500	0.69	C
NE 9	State Street (in Springville)	SR-75	400 North	25,650	40,500	0.63	C
NE 10	State Street (in Springville)	400 North	Center Street	24,330	40,500	0.60	C
NE 11	Main Street (in Spanish Fork)	400 North	300 South	23,875	40,500	0.59	C
NE 12	US-6 (in Spanish Fork)	I-15	400 North	20,605	35,000	0.59	C
NE 13	US-6 (in Spanish Fork)	400 North	1800 East	20,085	35,000	0.57	C
NE 14	Main Street (in Spanish Fork)	300 South	SR-164	20,720	40,500	0.51	C
NE 15	State Street (in Springville)	400 South	700 South	19,240	40,500	0.48	B
NE 16	State Street (in Springville)	Center Street	400 South	17,580	40,500	0.43	B

Figure 2


Utah Valley Transportation Studies
lake mountain • provo/orem • nebo
Utah County
Congestion Management Corridors
Draper
Saratoga Springs
Cedar Fort
Eagle Mountain
Vineyard
Fairfield
Provo
Genola
Goshen
Legend
Level of Service "F" Corridors
Level of Service "D" & "E" Corridors
Level of Service"A-C" Corridors

Next Steps

The results of this congested corridor inventory are only useful to the Mountainland Association of Governments to the extent that the list helps MAG address additional capacity improvements throughout Utah County. In order to use the inventory most effectively, MAG should consider two tasks:

- Compare this list to the recommended projects lists developed during each of the four quadrant studies. Projects recommended in the quadrant studies that address projects on the congested corridor inventory should be of high priority.
- For congested corridors that do not appear on the recommended project lists from the quadrant studies, MAG, UDOT, and local governments should be looking at lower-cost, short-term solutions such as intersection improvements, access control measures and other actions.

Appendix F:
PowerPoint Presentation

MAG MPO
Quadrant Transportation Studies

Mountainland Association of Governments

Carter::Burgess InterPlan Co. Transportation Planning

Utah Valley Transportation Studies

Introduction

- Four MAG initiated “Quadrant” Studies:
  1. Nebo,
  2. Lake Mountain,
  3. Provo/Orem and
  4. Northeast Utah Valley Transportation Study (NEUVTS)
- NEUVTS completed in September, 2005
- Studies address Regional Transportation Plan options and recommendations

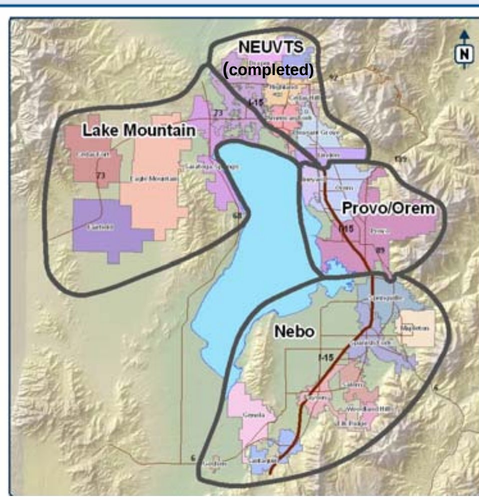
Carter::Burgess InterPlan Co. Transportation Planning

Utah Valley Transportation Studies

Purpose of Studies

- Identify transportation needs through the year 2030 Plus
- Evaluate multi-modal options
- Develop additional Transportation Plan options
- Minimize costs and impacts of improvements with early coordination

Map of 4 Quadrants



Area Studies Schedule

2005

November
- Project Initiation
- First TAC Meetings

December
- TAC Meetings #2

2006

January
- Analyze Alternatives and prepare preliminary Recommendations

February
- TAC Meetings #3
- Presentation of Initial Findings

March
- TAC Meetings #4
- Refinement of Initial Findings

April
- Presentation of Recommendations

May
- TAC Meetings #5

Final Recommendations

Carter Burgess InterPlan Co. Utah Valley Transportation Studies

Technical Committee Meeting

Carter Burgess InterPlan Co. Utah Valley Transportation Studies nebo transportation study

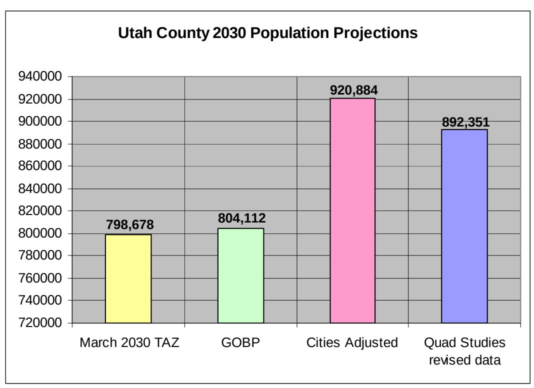
Study Deliverables / Goals

- Priority Transportation Improvements to Be Implemented within Next 10 Years
- Recommended Transportation Projects to Be Implemented in Next 25 Years
- An Ultimate Plan of Transportation Improvements to Be Built as Funding Allows
- Future Congestion Management Corridor Identification
- Next Steps to be Performed by Each Member

2030 Population Projections

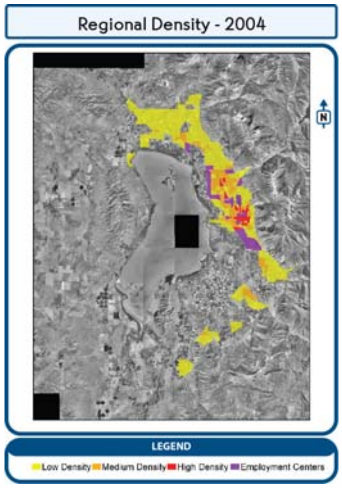
Utah County 2030 Population Projections

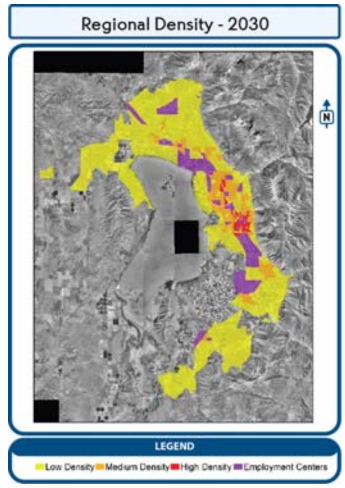
March 2030 TAZ population	**798,678**
GOBP Projections	**804,112**
Cities Adjusted Numbers	**920,884**
Quad Studies revised data	**892,351**



Land Use Growth - 2004 & 2030

County Population
436,022





County Population
892,351

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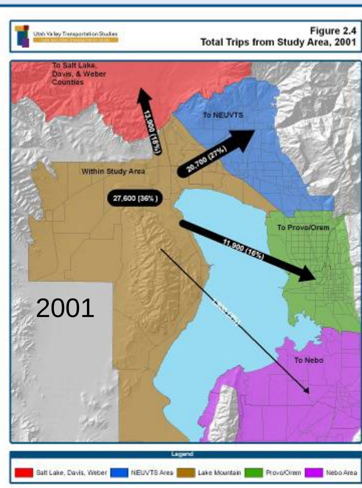
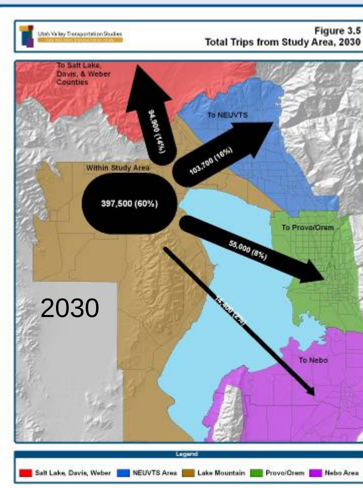
Utah Valley Transportation Studies

Lake Mountain Travel Patterns – 2001 and 2030





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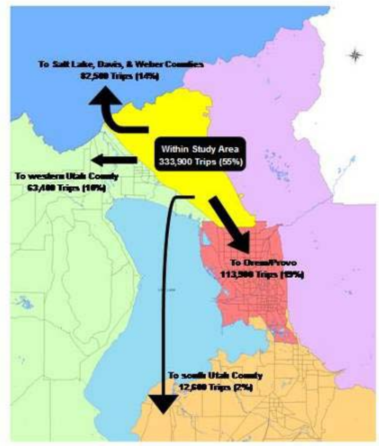
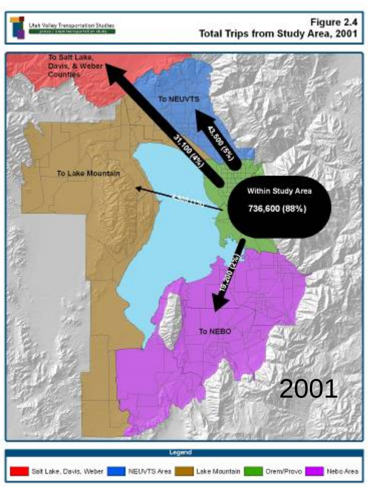
NEUVTS Travel Patterns – 2001 and 2030

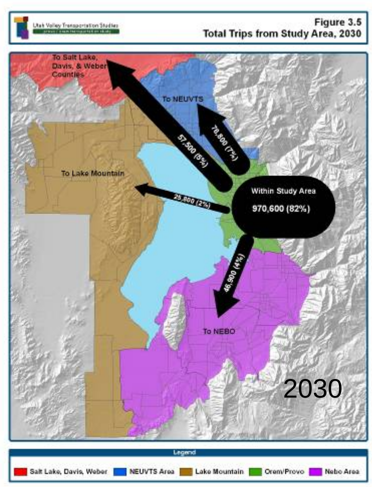
2001

2030



Provo/Orem Travel Patterns – 2001 and 2030





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Utah Valley Transportation Studies

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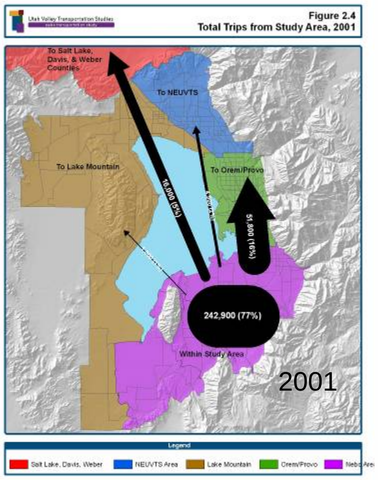
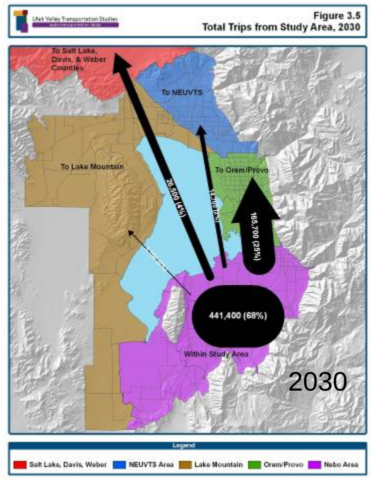
Nebo Travel Patterns – 2001 and 2030





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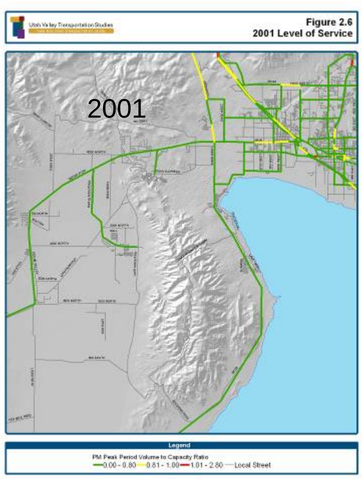
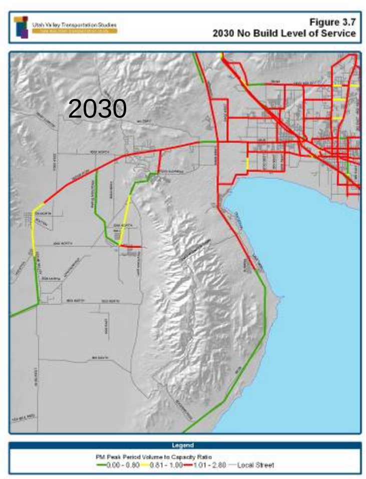
Lake Mountain Level of Service – 2001 vs. 2030 No-Build





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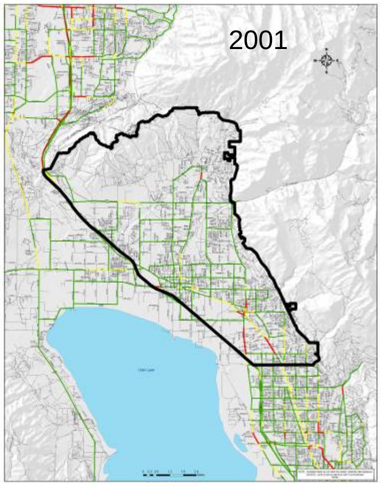
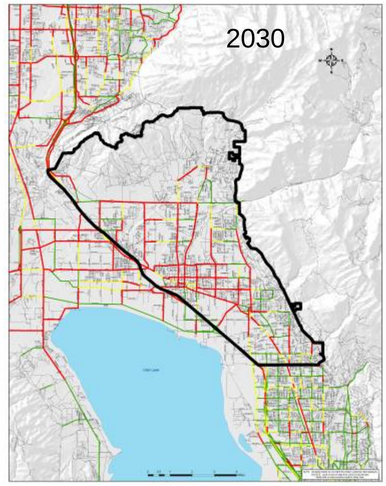
NEUVTS Level of Service – 2001 vs. 2030 No-Build





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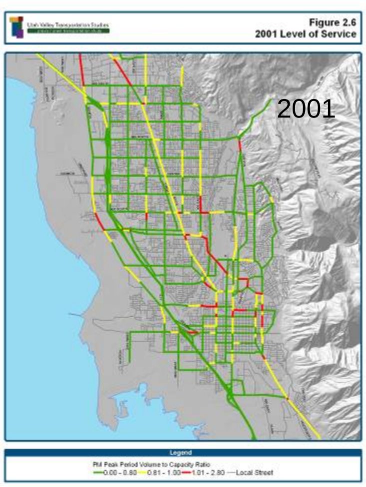
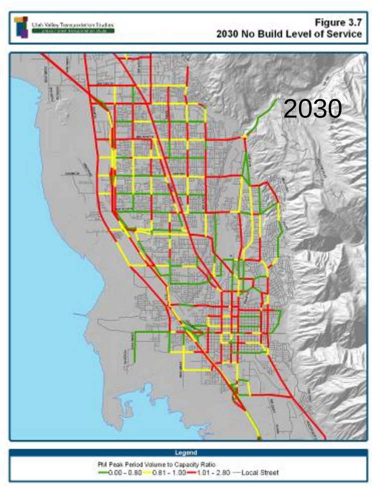
Provo/Orem Level of Service – 2001 vs. 2030 No-Build





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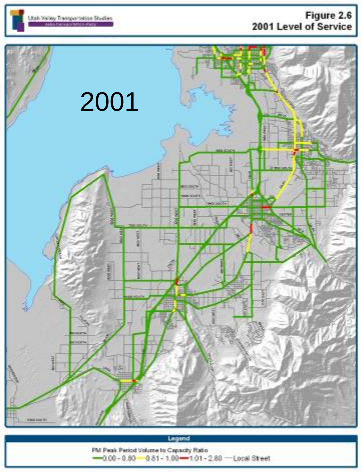
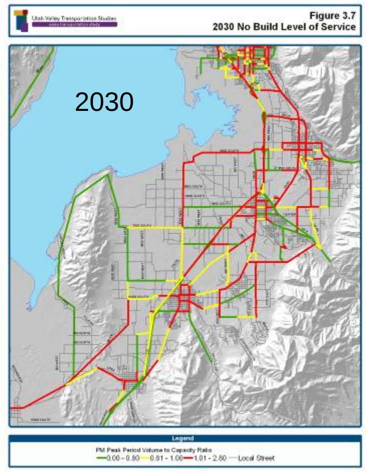
Nebo Level of Service – 2001 vs. 2030 No-Build





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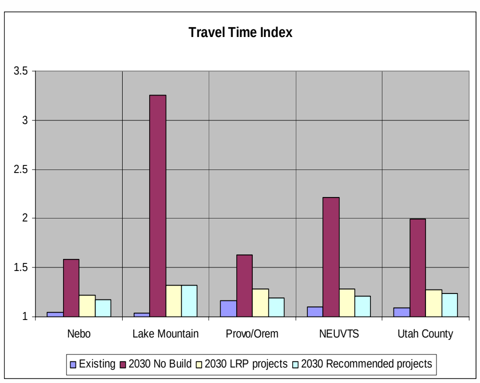
Travel Time Index



	Existing	2030 No Build	2030 LRP Projects	2030 Recommended Projects
Nebo	1.05	1.58	1.22	1.17
Lake Mountain	1.04	3.25	1.32	1.32
Provo/Orem	1.16	1.63	1.28	1.19
NEUVTS	1.1	2.21	1.28	1.21
Utah County	1.09	1.99	1.27	1.24

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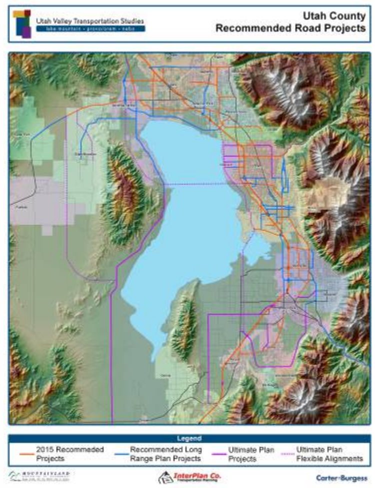
Road Recommendations



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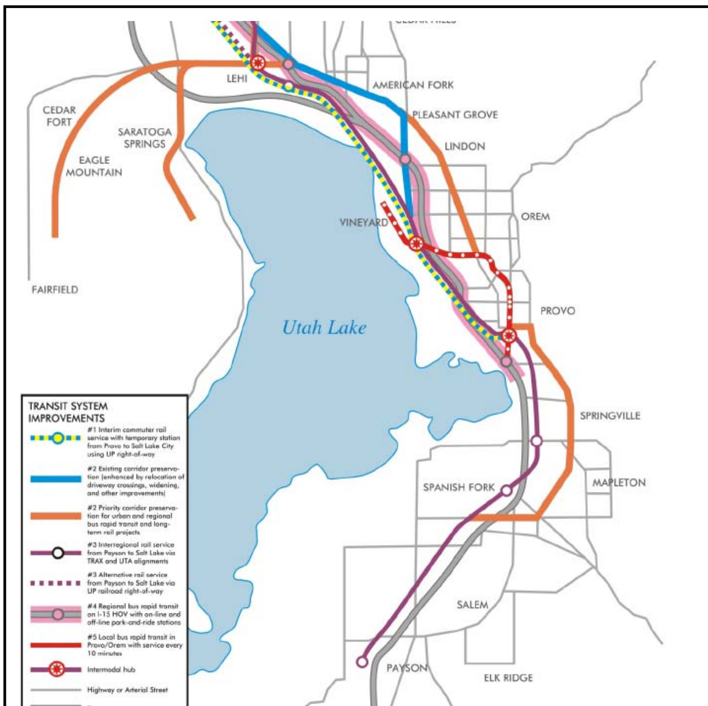
Transit Vision 2030



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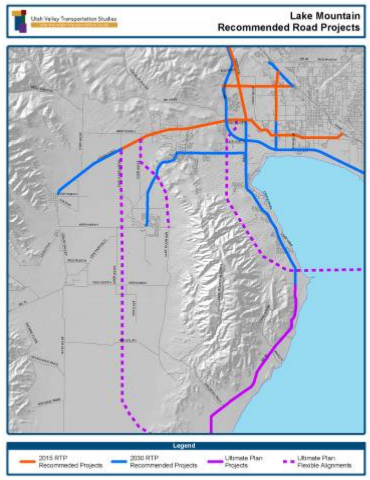
Lake Mountain Road Recommendations



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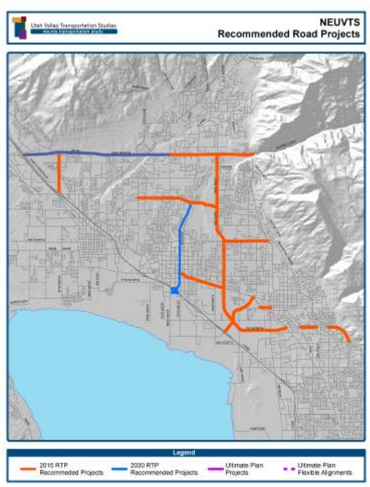
NEUVTS Road Recommendations



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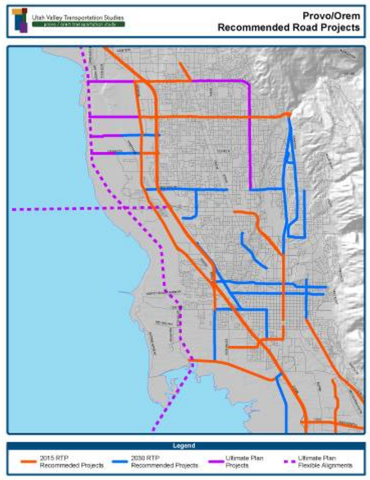
Provo/Orem Road Recommendations



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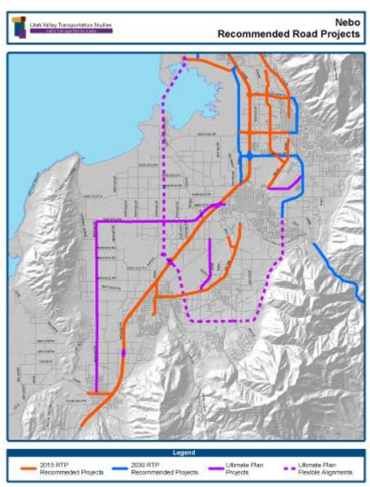
Nebo Road Recommendations



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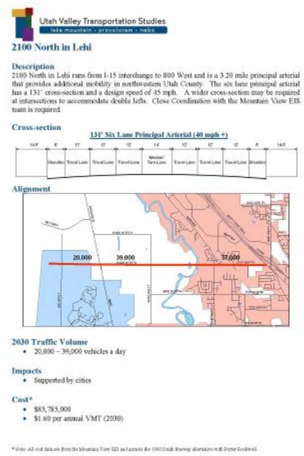
Next Steps – Cities/County

- Coordinate with neighboring Municipalities
- Coordinate with UDOT on State Roads
- Update City Master Transportation Plan
- Preserve appropriate Right-of-ways through Development
- Apply for corridor preservation funding at county and state
- Use local funds to leverage priority projects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lake mountain • provolorem • nebo

2100 North in Lehi

Description

2100 North in Lehi runs from I-15 interchange to 800 West and is a 3.20 mile principal arterial that provides additional mobility in northwestern Utah County. The six lane principal arterial has a 131' cross-section and a design speed of 45 mph. A wider cross-section may be required at intersections to accommodate double lefts. Close Coordination with the Mountain View EIS team is required.

Cross-section

131' Six Lane Principal Arterial (40 mph +)

Alignment

2030 Traffic Volume

- 20,000 – 39,000 vehicles a day

Impacts

- Supported by cities

Cost*

- $85,785,000
- $1.60 per annual VMT (2030)

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Next Steps – UDOT/UTA

- Promote additional transportation funding based on demonstrated need
- Work with Cities and MAG to coordinate project phasing
- Manage access on regional significant facilities
- Develop corridor level access management plans for signal <u>and driveway</u> spacing on these facilities
- Advance NEPA documents and construct 2015 recommended facilities as quickly as possible

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Next Steps – MAG, MPO

- Update Regional Transportation Plan based on study recommendations and projected funding
- Continue to meet federal SAFETEA-LU regulations for multi-modal planning, air quality, etc.
- Assist prioritizing corridor preservation in advance of development throughout the MPO
- Promote and perform corridor alignment studies for East Lake Highway, Nebo Belt loop, etc.

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Questions

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