TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

APPENDICES

1. INTRODUCTION

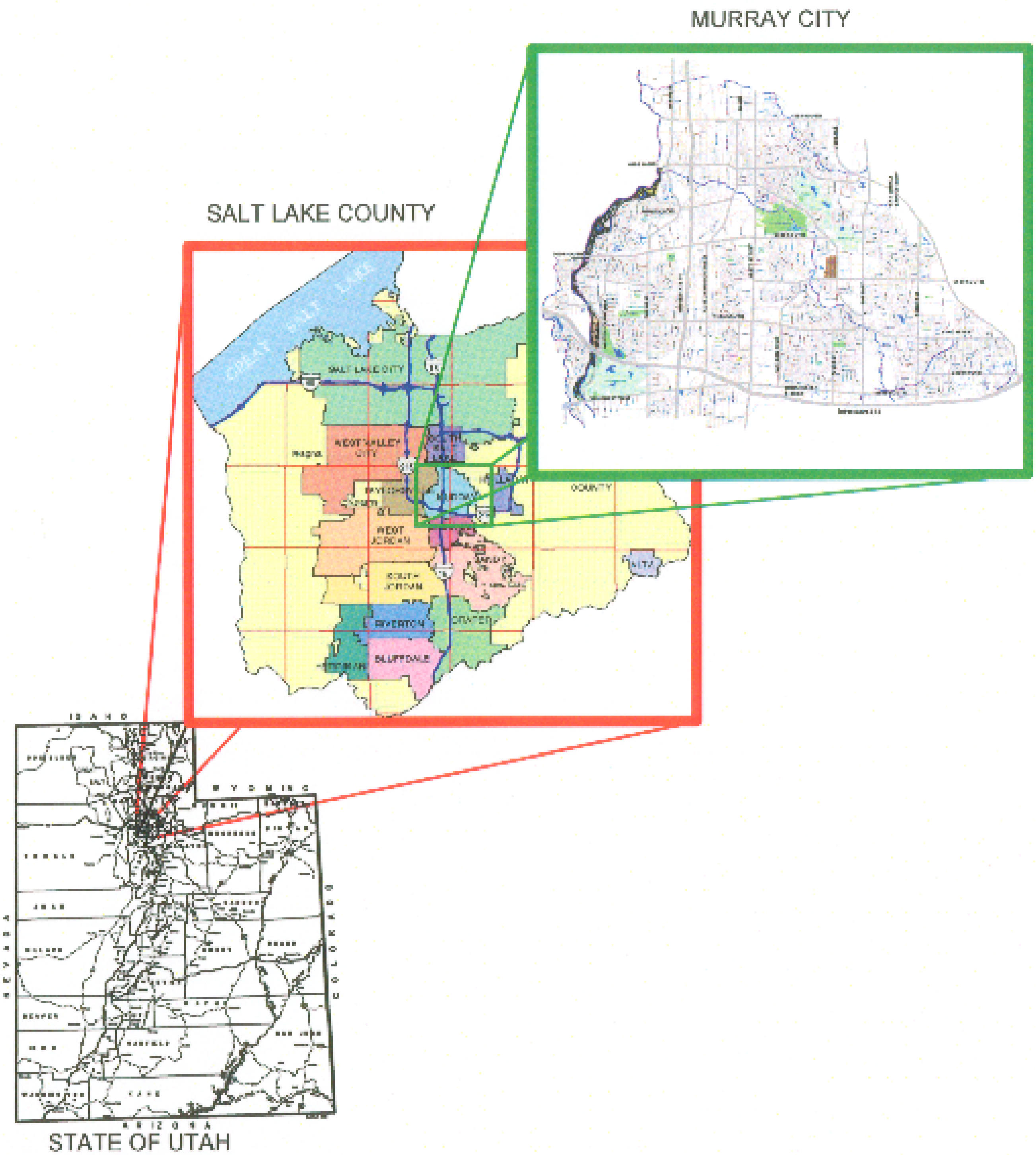
1.1. Overview

The City of Murray, Utah contracted with Stanley Consultants, Inc., who teamed with Korve Engineering, to update the City Transportation Plan dated February 1992. The original transportation plan was successful in assisting the City in implementation of improvement projects and in development of the City General Plan. Because of the current population growth and planned commercial development, it is necessary to update the original plan. This update will evaluate the existing transportation system, evaluate the original plan, and recommend short-range, mid-range, and long-range transportation improvements.

Murray City is a community located in the south central portion of the Salt Lake Valley. Murray is bordered on the north by South Salt Lake, and Salt Lake County; on the south by Midvale; on the east by Holladay; and on the west by Taylorsville City. Within the City there is a mix of residential, commercial, and industrial development as well as some undeveloped land, and other areas that are to be redeveloped. A map of Murray City and the surrounding area is shown in Figure 1.1.

Murray and the surrounding communities have experienced a significant amount of growth in traffic volumes and development over the last several years, and this growth is expected to continue in the future. According to the United States Census Bureau 2000 and Wasatch Front Regional Council projections, the population of Murray was just under 45,000 in 2002 and is expected to be over 50,000 by 2020. In order to keep pace with this growth, a comprehensive transportation plan must be developed and regularly maintained. This plan must incorporate the goals of Murray City regarding the transportation systems within their jurisdiction as well as those regional facilities maintained by UDOT, UTA, Salt Lake County, and neighboring communities.

FIG. 1.1 LOCATION MAP



1.2. Murray Transportation History

Before being established by in 1848, the area where Murray City is presently located was a crossroad and seasonal home of Piute, Shoshone, and Bannock Native American tribes. By 1860, twenty pioneer families lived in the area and the railroad soon placed a spur to the area, then known as Franklyn. Today the railroad still plays an important part in the transportation corridor through Murray City. Construction of Interstate 15 during the 1960's, the completion of Interstate 215 during the 1970's and 1980's, and the development of Fashion Place Mall in the 1970's represented major milestones in the shaping of contemporary Murray and its transportation system. Important recent changes include the expansion and improvement of Interstate 15, construction of the Cottonwood Street overpass and the north-south light-rail line known as TRAX through the community. The City's first Transportation Plan was adopted in 1992. This plan will be the first update to the original plan.

1.3. Transportation Plan Goals

This plan sets forth a number of transportation goals for the City. Each of these goals is listed below. Throughout the plan the goal(s) dealing with that chapter are discussed with the corresponding policies and implementation measures to be utilized in achieving that goal.

- Provide a safe and efficient movement of traffic on City streets while protecting the neighborhoods.
- Encourage the use of alternative transportation systems such as mass transit, pedestrian and bike travel.
- Support residential traffic calming where proven effective and cost efficient.
- Improve the aesthetic quality of the City's streets.
- Increase mass transit options in Murray.
- Maintain regional transportation corridors and promote capacity improvements.
- Provide additional north/south corridors between State Street and Interstate 15.
- Maintain and repair existing streets.

2. THE PLAN PROCESS

This chapter briefly details the process by which the Murray City Transportation Plan was prepared and by which comments were received from City staff and the public.

2.1. Project Phases

The process of preparing the Murray Transportation Master Plan was broken into four primary phases as described below.

1) **Initiate Project and Develop Database** - The initial stage of work dealt with organizing the project and the Technical Advisory Committee and assembling existing conditions data including mapping data, previous reports, traffic counts, and accident histories.

2) **Analysis** - The second phase of the project included the analysis of the existing data and the development of estimated future traffic volumes using a travel demand model. This also involved evaluation of the original Transportation Plan dated February 1992.

3) **Develop Master Plan** - This phase of the project represented the majority of work. The future roadway network for motorized vehicles was developed along with networks for transit, bicycles, and pedestrians. The roadway improvement plan was prepared including descriptions, cost estimates, and classifications of short, mid, or long range improvements.

4) **Approve Document** - The final phase of the plan preparation was to prepare a Capital Facilities Plan for potential projects, to write the plan, and to prepare additional tables and graphics. The completed draft document was then compiled and presented for comment to interested parties. The plan was then revised based on comments and the final plan was then presented to the Planning Commission and the City Council for adoption.

Throughout the entire plan preparation process, a public involvement plan was implemented with regular meetings of the Transportation Advisory Committee. A Public Open House was also held. Each of these are discussed in more detail in the following sections.

2.2. Public Involvement

A vital component in preparing this Transportation Plan has been seeking input from the citizens of Murray. A variety of different methods were utilized to inform the public of the Open House to acquire public opinion on the plan, each of which are presented below and then discussed in more detail. The Murray City Transportation Plan Open House was held October 13, 2005 at Murray High School. Approximately fifty citizens attended and provided input. Complete details and comments are provided in Appendix B.

2.3. Transportation Plan Technical Advisory Committee

A Technical Advisory Committee was created to provide technical guidance throughout the process. Monthly meetings were held to present the plan progress and receive staff feedback on interim activities.

The following lists provide the names and positions of key members contributing to the process.

Murray City Team Members
Craig Burnett - Assistant Chief of Police
Dennis Hamblin - Director of Community Development
Doug Hill - Public Services Director
Roy Kenney - Street Superintendent
Phil Markham - Public Services Deputy Director
Keith Snarr - Economic Development Director
Scott Stanger - City Engineer
Trae Stokes - City Civil Engineer

Support Agency Team Members
Tam Southwick - UDOT (alt.)
Mack Christensen - UDOT (alt.)
Kris Peterson - UDOT (alt.)
Pat O'Hara - Murray School District

Consultant Team Members
Larry Becknell - Stanley Consultants
Merlynn Anderson - Stanley Consultants
Kellie Goddard - Stanley Consultants
Jay Nelson - Korve Engineering

2.4. Transportation Plan Update Cycle

This report is the first update of the original Transportation Master Plan that was prepared in February of 1992. The plan should be updated approximately every five years to ensure that the plan will remain current and reflect the needs of the City. It will also enable the City to adjust the capital facilities plan so that the most important projects receive proper prioritization and funding.

3. EXISTING CONDITIONS

To understand how the transportation system functions in the Murray area today, an inventory of those elements comprising the existing system was conducted. Conducting this inventory was an integral step of the planning process in order to identify areas in need of improvement over the 25-year planning period. This inventory was based on available data compiled by the City's Public Services Department, data available on the City's Geographic Information System (GIS) database, information provided by the Utah Department of Transportation (UDOT), the Wasatch Front Regional Council (WFRC), and additional information compiled through supplemental field data collection efforts. This data included traffic counts, accident history, bicycle and transit routes, and street lane requirements and classification.

The transportation system in Murray is basically the same as that of other similar sized towns across the country. It is designed to serve the automobile, the predominant means of transportation. However, it is essential to examine and improve all modes of transportation since each comprises an important part of a transportation system. Therefore, information was gathered on the following modes of transportation:

- Roadway Network
- Transit System
- Pedestrian/Bicycle Facilities

3.1. Functional Classifications

A roadway network is comprised of a hierarchy of roadways whose functional classifications are defined by their usage. In general, streets serve two distinct and very different functions: mobility and land access. Both functions are vital and no trip is made without both.

The relative degree to which a road serves these functions defines its functional classification. There are four primary classifications:

- **Local Streets** - These facilities primarily serve land-access functions. Their design and control facilitates the movement of vehicles onto and off the street system from land parcels. Through movement is difficult and is discouraged by both the design and control of the facility. Slower speeds are desirable on local streets.
- **Collectors - Major and Minor** - These facilities, the "middle" classification, are intended to serve both through and land-access functions in relatively equal proportions. For long through trips, such facilities are usually inefficient, though they are frequently used for shorter through movements associated with the distribution and collection portion of trips.

- **Arterials - Major and Minor** - These facilities are provided to service primarily through-traffic movement. While some land-access service may be accommodated, it is clearly a minor function, and all traffic controls and the facility design are intended to provide efficient through movement.
- **Freeways and Expressways** - These facilities are provided to service long distance trips between cities and states. No direct land access service is provided by these facilities.

A more detailed description of the characteristics of the different functional classifications of highways is found in Table 3.1 below. The existing roadway classifications are shown in Figure 3.1 located on the next page. These previous functional classifications are somewhat changed in this update from the classifications in the 1992 Transportation Plan.

TABLE 3.1 CLASSIFICATION CHARACTERISTICS

	USE		DIMENSIONS		VOLUME
	Trip Length (miles)	Design Speed* (mph)	Lane Width (feet)	Number of Lanes	Average Daily Trips (ADT) (in thousands)
Freeway	>5 miles	>65	12	6-8	80
Expressway	>5 miles	55~65	12	6	75
Major Arterial	1-2 miles	45-55	12	6	15-50
Minor Arterial	>1 mile	40~45	12	4~5	10~25
Major Collector	1 mile	30-40	12	2-5	3.5-10
Minor Collector	1 mile	25~35	11~12	2~3	1.5~3.5
Local Street	<1 mile	20-30	10-12	2	<1.5

*Design Speed refers to the design specifications and can differ from posted speed limit.

3.2. Existing Street Conditions

Existing traffic volumes were collected and compiled for use in the analysis of existing traffic conditions. Average Annual Daily Traffic (AADT) volumes were obtained from UDOT's *Traffic on Utah's Highways* document for the state and local roads within Murray. The 2002 and 2004 AADT volumes as well as the associated percentage growth for the various roadway segments are shown in Table 3.2.

FIG. 3.1 EXISTING ROADWAY CLASSIFICATION

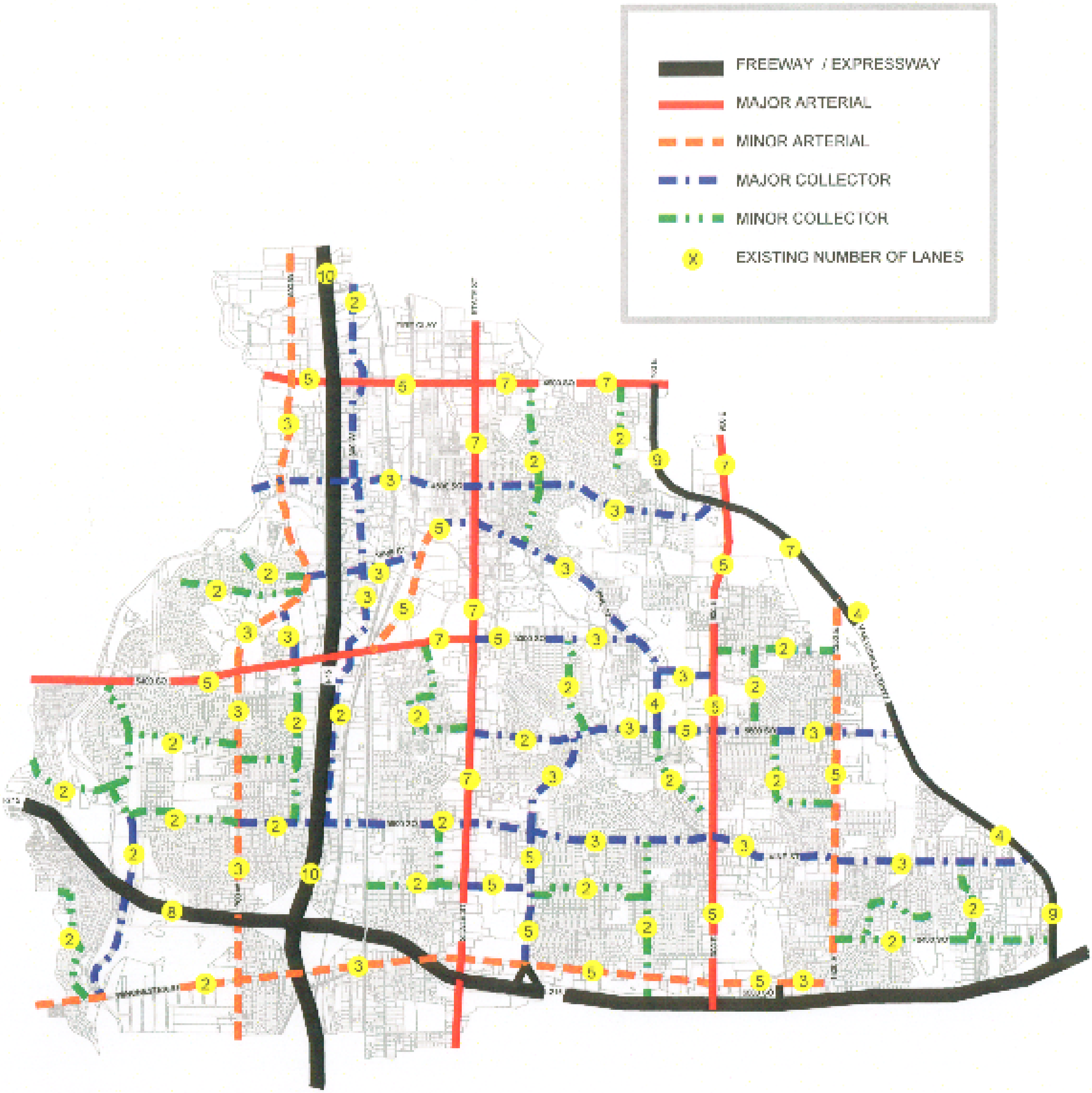


TABLE 3.2 MURRAY ROADWAY SEGMENT VOLUMES AND GROWTH

ROADWAY	LIMITS	2002	2004	% Change
I-15	4500 to 5300 South	167474	188730	6.35
I-15	5300 South to I-215	158230	163433	1.64
I-215	State St. to Union Park (900 E)	116261	120715	1.92
State Street	4500 to 4800 South	29900	30080	0.30
5300 South	700 West to I-15 Interchange	28210	29360	2.04
4500 South	300 E to Main St	34570	33505	-1.54
Van Winkle Expressway	6100 to 6200 South	38380	37195	-1.54
900 East	Van Winkle Expressway to 5600 South	27983	27815	-0.30
1300 East	5600 to 6100 South	21405	21535	0.30
700 East	4500 to 4800 South	28465	27610	-1.50
Winchester Street	State St to Fashion Blvd	21683	23165	3.42
Winchester Street	700 West to State St	12210	12285	0.31
700 West	5300 to 5900 South	17920	18030	0.31
Fashion Blvd	5900 South to Winchester Street	19845	19965	0.30
Murray Blvd	4800 to 5300 South	30250	30435	0.31
Murray Parkway Avenue	Winchester Street to 5400 S	6755	6795	0.30
Vine Street	5300 S to 5600 South	14605	8360	-21.38
300 West	4500 S to 4800 South	6185	5190	-8.04
300 West	4800 S to Vine St	8895	5105	-21.30
4800 South	Commerce Drive to State Street	8715	8770	0.32
5300 South	State Street to Vine Street	10435	10500	0.31
5600 South	Fashion Blvd to Vine Street	7025	7050	0.18
5900 South	300 W to State St	9275	11285	10.84

Source: UDOT Traffic Data

A capacity analysis for the major streets in Murray was performed using the traffic modeling software HCS2000®. The operational quality of an urban or suburban corridor is typically determined by the major signalized intersections that lie along that corridor. These intersections represent the "bottlenecks" because of the delays associated with traffic conflicts and signal timing and phasing. If the efficiency of the intersections is improved, the efficiency of the corridor is improved.

A volume to capacity ratio of 1.00 means the volume is equal to the capacity. This ratio is the level where significant congestion and delays begin to occur. The existing Level of Service based on volume-to-capacity ratios for the major streets are shown in Figure 3.2.

FIG. 3.2 EXISTING LEVEL OF SERVICE AND TRAFFIC VOLUMES

Existing Intersection and Signal Conditions

Peak hour intersection turning movement counts that have been performed recently for various commercial and residential developments were provided by Murray City. These various counts, performed between 2004 and 2005, were then factored up with a growth rate to estimate the existing (2005) peak hour traffic volumes at the various intersections. All City signalized intersections were observed, and the traffic volumes of several intersections were counted.

These peak hour traffic volumes were used in the analysis of existing conditions as well as in the modeling of the future traffic volumes and conditions. AM and PM peak hour turning movement counts were collected from UDOT or performed by Korve Engineering personnel in July, August, and September of 2005 at the following key intersections:

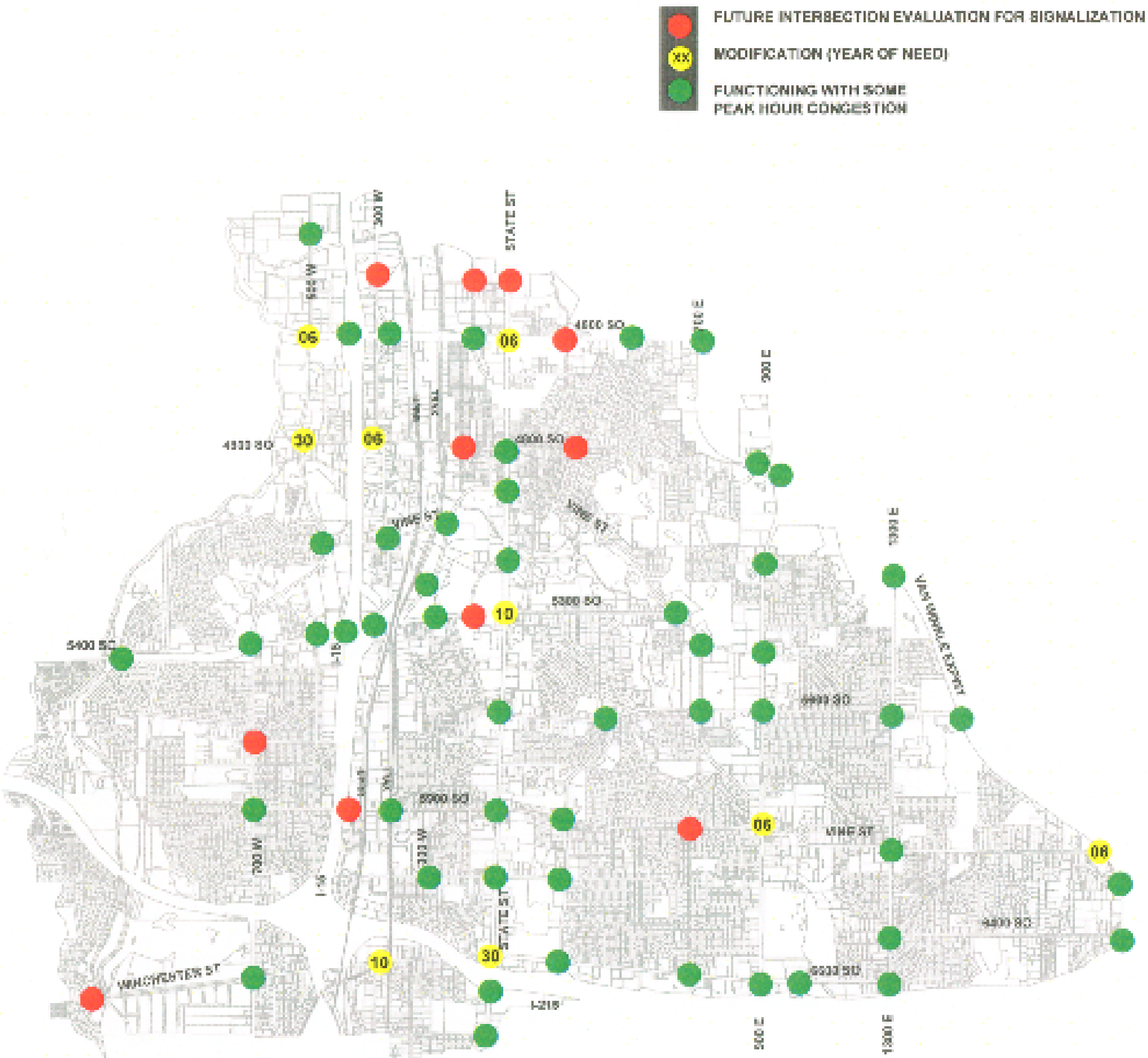
1. 500 W / 4500 S
2. 500 W / 4800 S
3. 700 W / 5300 S
4. 700 W / 5900 S
5. 700 W / WINCHESTER
6. 300 W / 4800 S
7. 300 W / 5900 S
8. MAIN ST / 4500 S
9. STATE ST / 4500 S
10. STATE ST / 5300 S
11. STATE ST / 5900 S
12. STATE ST / WINCHESTER
13. 900E / 5600 S
14. 900 E / VINE ST
15. VAN WINKLE EXPRESSWAY / VINE ST

The peak hour intersection turning movement counts can be found in Appendix C.

A capacity analysis for the major intersections in Murray was performed using the traffic analysis software Synchro™. The operational quality of an urban or suburban corridor is typically determined by the major signalized intersections that lie along that corridor. These intersections represent the "bottlenecks" because of the delays associated with traffic conflicts, signal timing and phasing etc. If the efficiency of the intersections is improved, the efficiency of the corridor is improved. This volume threshold is referred to as the capacity. If the actual number of vehicles passing through the intersection over that same time period is known, a ratio can be calculated by dividing the actual volume by the capacity. This is known as the volume to capacity (V/C) ratio or the intersection capacity utilization (ICU).

Figure 3.3 presents all the intersections in the City that were looked at as part of this study. Each of the intersections shown in green in Figure 3.3 are not expected to require any improvements although they may have some congestion during peak periods. Intersections that are expected to require some improvement to operate at an acceptable level of service are shown in yellow along with the approximate year the improvement would be required. The intersections presented in red in Figure 3.3 are stop-controlled intersections that may need to be evaluated for the installation of a traffic signal or other intersection improvement in the future. Appendix D includes the detailed peak hour intersection level of service analysis worksheets at the fifteen key signalized intersections.

FIG. 3.3 SIGNALIZED AND KEY INTERSECTIONS



STREET JURISDICTIONS

Some of the existing streets in Murray fall under the jurisdiction of the Utah Department of Transportation (UDOT), meaning UDOT controls and maintains these facilities. State roads are generally some of the busiest roads in a community and are typically continuous across several cities. Some of the authority and responsibility that they have over their facilities are:

- UDOT must approve any additional access points onto state roads that may be requested.
- UDOT develops and controls the traffic signal timing along state roads.
- UDOT is responsible for the capacity of state roads, which may include widening of roads or intersection improvements, although they will generally coordinate these activities with the City.
- UDOT is also responsible for the maintenance of these roadways. They provide snow removal, repair cracks, and perform all other roadway maintenance tasks.

Most other roadways within Murray come under the jurisdiction of the City, or they may share jurisdiction with a neighboring community for streets traveling along City borders.

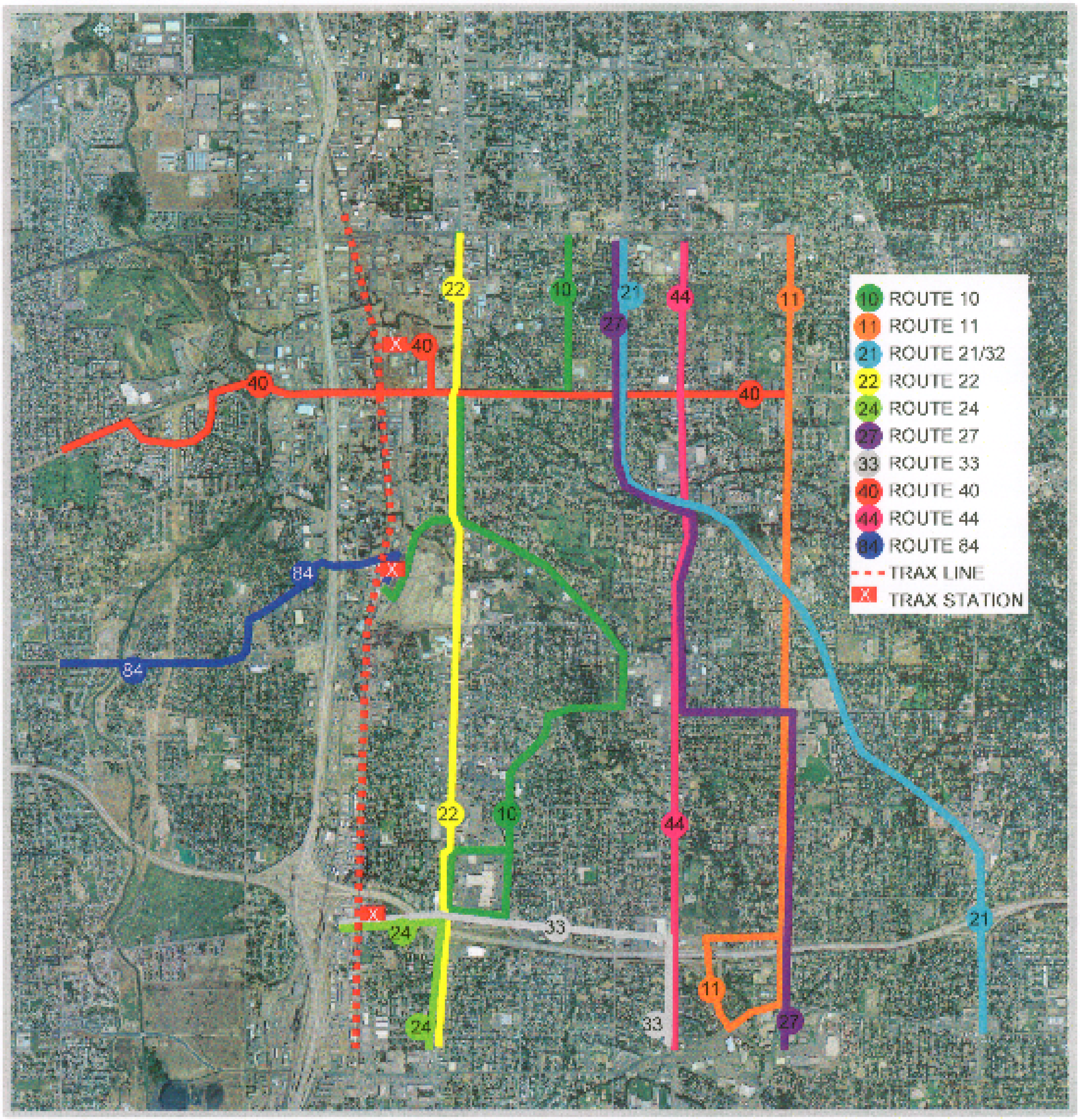
3.3. Existing Transit Conditions

Murray City has two major forms of mass transit available to the traveling public; buses and TRAX light rail. The routes are illustrated in Figure 3.4. Currently the bus service is provided from about 6:00 am to about 11:00 pm. There are three TRAX stations located within the City and each station has a park-and-ride lot for commuters to park. Bus routes 84 and 10 serve the Murray central station, routes 24 and 33 service the Fashion Place Murray station and route 40 serves the northern station. TRAX trains run at approximately 15-minute intervals on weekdays and about 30 minutes on weekends.

3.4. Existing Rail System Conditions

Major railroad lines owned by Union Pacific Railroad and Utah Railway carry freight and AmTrak passenger trains through Murray City. There are currently no passenger terminals located within the City, but future commuter rail stations are currently in the planning stages.

FIG. 3.4 EXISTING TRANSIT SERVICES



3.5. Accident Data and Analysis

Accident and safety analysis can be quite thorough and intensive, which is outside the scope of this report. The accident analysis given here is quite preliminary and macroscopic in scale. The purpose of this section is to give the City a guide as to which intersections may warrant further analysis and study in the future. Such studies could evaluate specific intersections in much more detail as well as using other criteria such as types of accidents or time periods. For each type of accident there are several probable causes that may have contributed to the accident. For each probable cause there are several countermeasures that are intended to reduce the probability of those types of accidents occurring in the future. Each countermeasure can be evaluated in terms of the expected overall or percent reduction in accidents at that location.

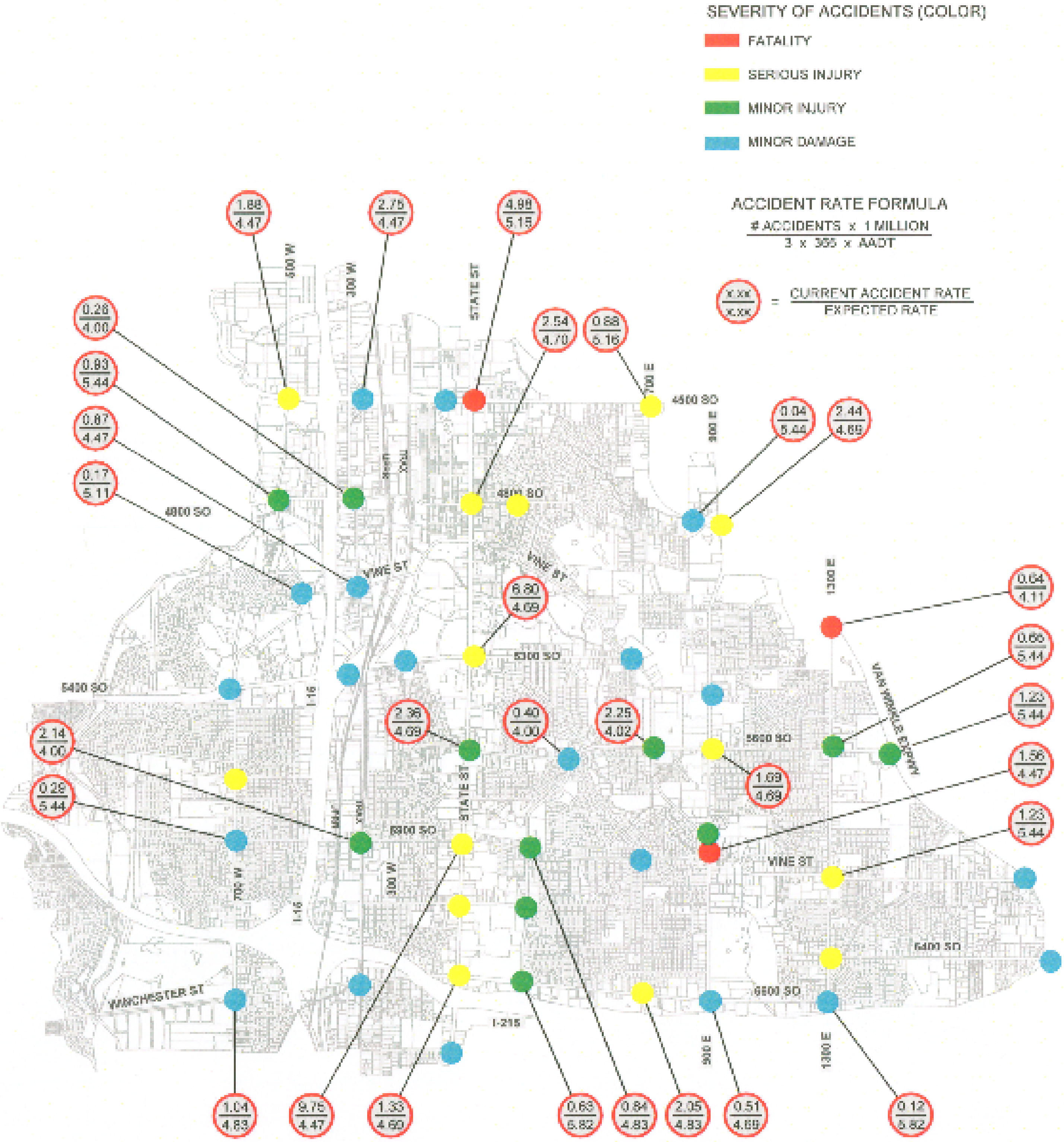
Accident data was obtained from the Murray City Police Department from the beginning of 2001 through the current year of 2005. This data provided a summary of the accidents at each of the major intersections in the City over the full five years. There are typically five different ways that accidents at intersections can be summarized:

- Type of accident
- Severity
- Frequency of accidents
- Environmental conditions
- Time periods

Due to the nature of the information supplied by the Police Department and the purposes of this report it was determined that the intersections would be evaluated by summarizing the accidents in terms of accident frequency and then calculated vehicle to frequency ratios. This is a common way of summarizing accident rates at intersections as well as along highways and streets. See Figure 3.5.

By knowing the number of accidents per year, as well as the yearly traffic volume traveling through an intersection, an accident rate can be calculated for each intersection. Accident rates represent the total number of accidents occurring for every million vehicles passing through the intersection or through one mile of roadway. Accident rates allow the comparison of many intersections in order to identify those intersections that are more dangerous, or that tend to have more accidents than others relative to the total volume. Figure 3.5 categorizes the accident severity by color and also depicts UDOT's accident rate with expected accident rates of similar roadway type and vehicular volume

FIG. 3.5 CURRENT ACCIDENT DATA



4. FUTURE CONDITIONS

4.1. Land Use and Population Projections

In order to properly identify potential improvement projects for the transportation system in Murray, it is important to first understand the nature and volume of traffic in the study area in the future. It is also useful to understand existing traffic flow patterns, as presented in the previous chapter. The analysis of future traffic volumes for the Murray study area is based on the 2030 regional transportation model developed by WFRC. This computerized model includes the entire Salt Lake County region. It was used as a basis for Murray forecasts because it provides the context of Murray in relation to the rest of the Salt Lake region.

Demographic data sets, including population and employment estimates and forecasts associated with a system of Traffic Analysis Zones (TAZ), form the basis for travel demand forecasting. WFRC regional population and employment estimates for 2001 and forecasts for 2030 were used as an initial basis. The regional data were then refined in the Murray planning area based on the City's General Master Plans. Finally, using the 2001 and 2030 population and employment data, interim year forecasts for 2010 and 2025 were developed.

A. Current Year Data Refinement

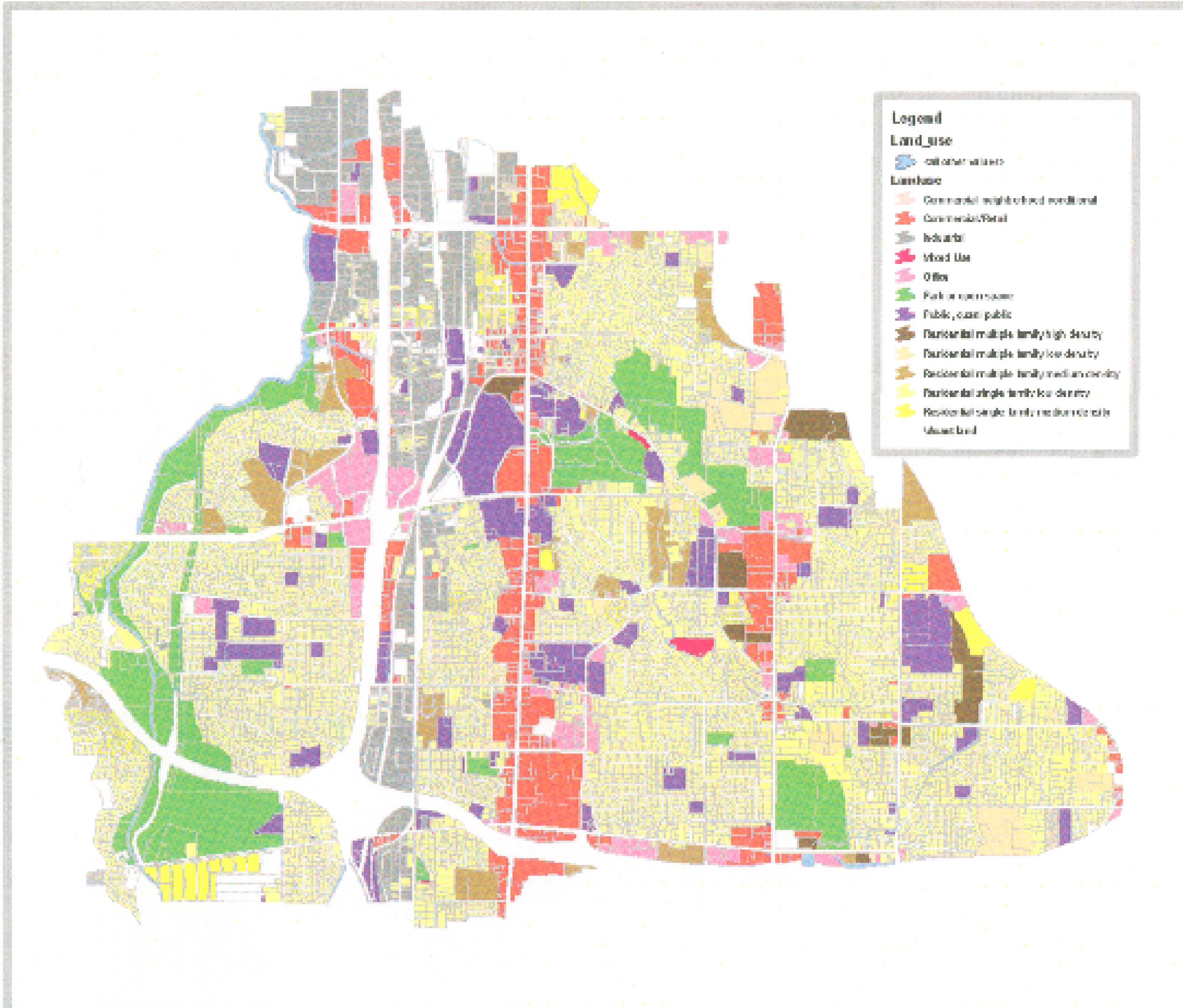
WFRC's regional model currently divides the Salt Lake metro area into 1,530 traffic analysis zones (TAZ's). WFRC has recently developed a regional TAZ system that will be used in future modeling. The refined TAZ system provides additional detail, increasing the number of TAZ's in the Salt Lake region from 1,530 to more than 2,500, and approximately refined TAZ system, and Murray's forecasts also used this refined TAZ system.

> **Traffic Analysis Zones (TAZs)** are the neighborhood level pieces that comprise a travel demand model, each of which contains its corresponding land use, socioeconomic, and demographic information along with access to the surrounding street network.

To develop 2001 population and employment data, WFRC 2001 totals for the Murray area were used as a basis. The data were distributed among the refined TAZ's using WFRC's allocation to its existing TAZ system and examination of existing land use patterns in coordination with Murray's planning staff and the Murray Economic Development Department (MEDD). The resulting 2001 population and employment data by TAZ are provided in Table G.1 in Appendix F along with a map illustrating the location of the TAZ's. In 2001 there was approximately 44,145 people and 35,219 jobs in the Murray area.

The traffic modeling process assigns different trip generation characteristics to populations with low, medium, and high-income levels, as well as to employment in the industrial, retail, and service sectors. Figure 4.1 shows the current land use as defined in the City General Plan.

FIG. 4.1 EXISTING LAND USE



SOURCE: MURRAY CITY GENERAL PLAN 2005, MAP 2-1

Similar to the refinement of population and employment totals, distribution among these population and employment categories was performed using WFRC distribution as a basis, then the employment allocations were refined based on more detailed examination of existing land use patterns.

B. Murray Planning Area 2030 Forecasts

Several different sources of 2030 population and employment forecasts for the Murray area are available. These available forecasts were compared and, based on discussions with Murray planning staff and MEDD, the most appropriate of these Murray area forecasts were selected.

WFRC regional forecasts show 53,154 people in the Murray area in 2030, representing about 4% annual growth rate between 2001 and 2030. The final draft of Murray City's General Plan provides a projected population growth rate somewhat slower than Salt Lake County through 2010 with a 2003-2010 average annual growth rate (AAGR) of 1.43% compared to the county's 2.26%. This rate does not include any growth by annexation. Murray's growth will slow considerably from 2010 to 2020 with an AAGR of 0.44% while the County will slow only mildly with an AAGR of 1.75%. The diminishing population growth is due to the limited availability of land for new development.

C. Transit Forecasts

Two key pieces of information emerge from the demographic forecasts and travel model. The first is the overall growth in the community and the impact it will have on local roadways. As congestion increases, transit may be seen as a more important part of the transportation network. The second important factor is how the balance between population and employment is anticipated to change by 2030.

Traffic congestion and transit access between the light rail line and employers will significantly impact the use of regional service. A second factor is the availability of park-n-ride spaces. Many regional riders will need to access the service at a park-n-ride lot; therefore, adequate spaces need to be available. Bus routes in Murray can reduce the need for local residents to drive to a park-n-ride lot. The third factor is quality of service. To obtain high ridership levels, service will need to be reliable, frequent, and operate over a long enough span of hours (early in the morning to evening service) so the service is viable for many residents. The ability to provide high service quality is dependent on the financial resources the region and the community decide to use for transit.

D. Transit Oriented Development

The anticipated land use surrounding Murray's existing light rail station near Fireclay Avenue will be an important factor in development trends. New commercial development in the I-15/5300 South vicinity and surrounding land uses should be complementary to rail transit stations. Transit-oriented development (TOD) refers to pedestrian-friendly land development activities that are built within easy walking distance of a major transit station. TOD's generally include a compact mix of different land uses that are oriented to public walkways and automobile parking is minimized to promote pedestrian activity. Livable communities are neighborhoods that include a range of housing options, jobs, commercial services, and recreational opportunities all within easy access of transit services. These are communities in which residents, workers, and shoppers can get around without the need of an automobile.

Walkable distances to TRAX Stations in Murray and areas within one quarter and one-half mile radius from the stations are proposed. These areas are prime locations for transit oriented development or high density and mixed-use development. Because these areas are so close to the existing TRAX stations, no transfers between bus and train are needed.

4.2. Traffic Volumes

Travel demand modeling is a process that involves forecasting future year traffic volumes based on estimates of future year population, employment, and other land use and demographic variables. Since travel in Murray City is dependant upon the location of populations, jobs, and shopping locations within the entire metropolitan area, the regional travel model used by the Wasatch Front Regional Council (WFRC) was used and adjusted for the specific growth projections in Murray City. This model divides the large Wasatch Front area into smaller Traffic Analysis Zones (TAZs).

A. Forecasted 2030 Traffic Volumes

The future travel demand patterns in the Murray area and the Salt Lake Metropolitan region as a whole are primarily a function of the population and employment opportunities in the area. The household and employment data outlined in the preceding section were used as input in the WFRC travel demand model. The model provided traffic forecasts on the various street networks that were used to assess improvement needs. These forecasted volumes could then be used to identify deficiencies in the roadway network and to evaluate the effectiveness of alternative improvements.

B. Volume-Capacity Relationships

With the general trends observed in the Level of Service (LOS) analyses in mind, the initial model run involved assigning 2030 volumes to the existing base network. This assignment was used to identify specific roadways on which significant congestion could be expected in the future if no improvements were made to the existing system. The volume to capacity (v/c) ratio is a planning level measure of the LOS experienced by the roadway users. The v/c ratio on each link of the travel demand model in Murray was calculated using the forecasted year 2030 traffic volumes and the existing maximum capacities, as defined previously. The v/c ratios were calculated in six categories that generally correspond to levels of service. These can be further combined into three groups: 1) greater than or equal to 1.0, (LOS E –F), indicating that the projected volume on the roadway segment is at or above capacity, 2) between 0.8 and 1.0, (LOS D – E), indicating that the projected volume is nearing the capacity of the roadway, and 3) below 0.8, (LOS A – C), indicating that the projected volumes are sufficiently below the capacity of the roadway.

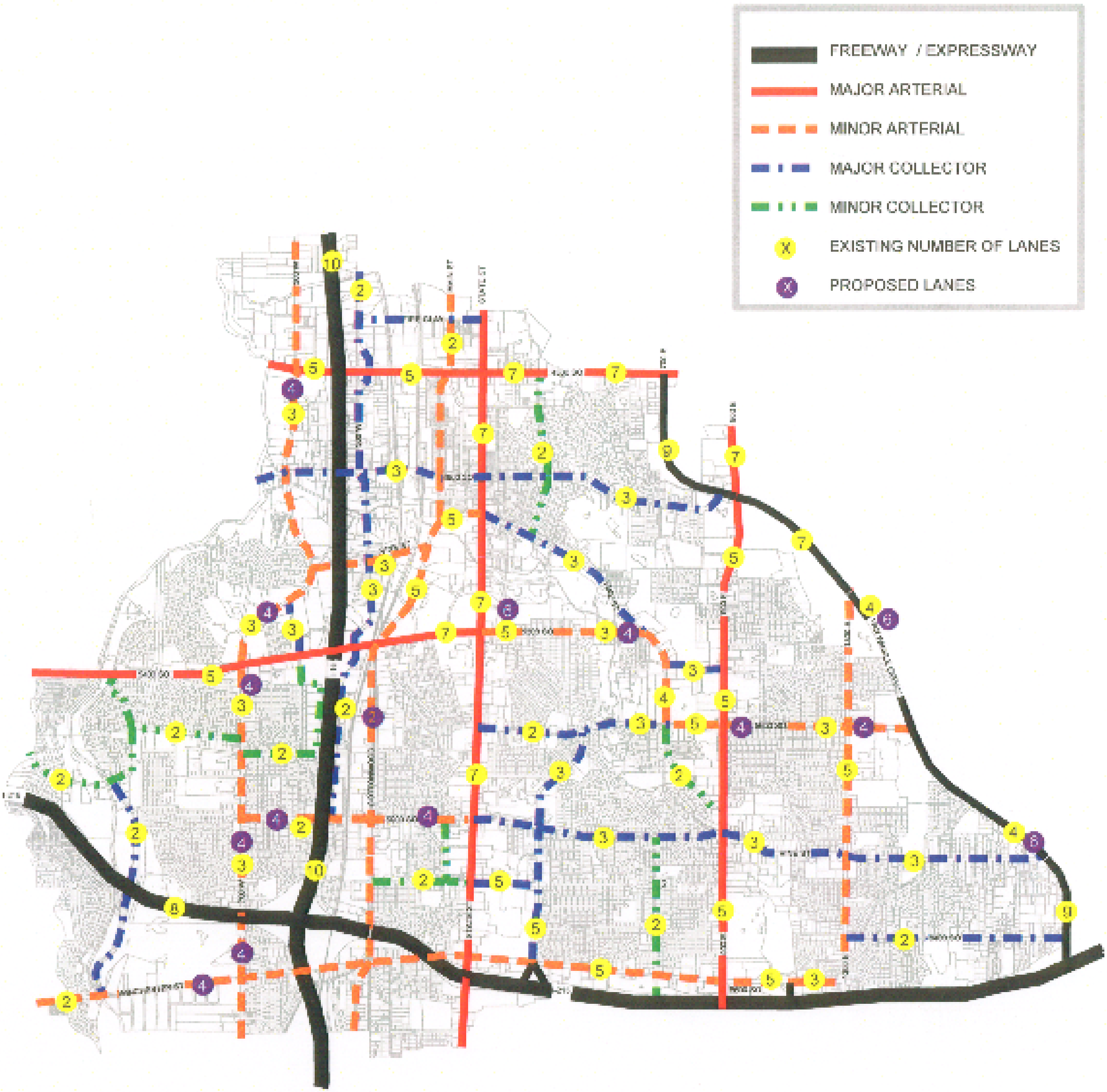
4.3. Recommended Street Network

With much of the City already developed, the major growth factors will be in redeveloping existing areas within the City and influences from surrounding cities and their development. The current roadway classifications will only have a few modifications that will consider the planned development and also facilitate the growing need for adding capacity to the street system. Improvements to the existing street system may require additional width required on arterial streets and major collectors constructed in previously undeveloped areas can be obtained by one of two methods: the City may acquire the property or the City may obtain a sidewalk easement for the use of property.

The travel demand model was run using this preliminary roadway network and the 2030 traffic conditions, and volume-to-capacity ratios were recorded for each arterial and collector. The future recommended roadway network and proposed road classifications for Murray is shown in Figure 4.2. The two additions to the existing roadway classification are two major collectors, which are Fireclay Avenue and Cottonwood Street.

One significant difference between figure 3.1 (existing roadway classification) and figure 4.2 (proposed roadway classification) is the proposed deletion of several roads that were previously designed as minor collectors. Approximately 14 roadway segments are recommended to remain as local roads rather than keep the minor collector designation. These facilities sustain much less than 2,000-3,000 vehicles per day, which is recognized as the functional volume for this category.

FIG. 4.2 PROPOSED ROADWAY CLASSIFICATION



4.4. Intersection Improvements

Generally, the City's standard cross-sections are adequate for signalized intersections. However, there are two situations in which the road needs to be wider at a signalized intersection to accommodate all of the lanes necessary for the efficient movement of traffic. These two situations are at the intersection of two arterial streets and at a signalized intersection involving a minor collector. Each of these is described in more detail below.

A. Arterial-Arterial Intersection

The typical cross-section at the intersection of two arterial streets needs to be widened or flared out to accommodate the dual left-turn lanes typical of such intersections. The pavement width, as measured from lip of gutter to lip of gutter, needs to be expanded from 81 feet to 96 feet for a net increase of 15 feet. This additional width is taken equally from both sides of the street, 7.5 feet from each. The length of the left and right turn pockets should be at least 200 feet long.

When combined with the taper length, the distance from the stop bar to the beginning of the widening should be about 350 feet. The intersection widening will also affect the park strip and sidewalk treatments depending on whether the arterials are being constructed as an in-fill project or in a previously undeveloped area. The in-fill construction with its typical 106-foot right-of-way and its 5-foot park strips and sidewalks will be widened to a 113-foot right-of-way with 6-foot sidewalks and no park strips. Using the park strip as part of the area to be widened reduces the amount of extra right-of-way needed.

The new construction in previously undeveloped areas with its 126-foot total width and its 10- foot park strips and sidewalks will not have any increase in total width. The 7.5 feet of widening can occur within the 10-foot park strip, leaving 2.5 feet to be added to the sidewalk, since 2.5 feet is too small for a park strip.

B. Minor Collector Signalized Intersection

The signalized intersection of a minor collector and an arterial or major collector also needs to be widened or flared out to accommodate the right turn lane of the minor collector. No changes are necessary to either the arterial or the major collector. The pavement width, as measured from lip of gutter to lip of gutter, needs to be expanded from 41 feet to 48 feet for a net increase of 7 feet. This additional width is taken entirely from the side of the street with the right turn pocket. No changes are required on the other side of the street. The length of the left and right turn pockets should be at least 100 feet long. When combined with the taper length, the distance from the stop bar to the beginning of the widening should be about 250 feet.

The intersection widening will affect the park strip and sidewalk treatments. The 66-foot right-of-way and its 5-foot park strips and sidewalks will be widened to a 69-foot right-of-way with a 6-foot sidewalk and no park strip on the side being widened. Using the park strip as part of the area to be widened reduces the amount of extra right-of-way needed. Typically, an intersection between two minor collectors will not need to be signalized. However, it is recommended that widening take place in those locations as well. This will provide adequate capacity, regardless of the method of traffic control.

4.5. Cottonwood Street Options

The Cottonwood Street corridor is a north/south community arterial currently under construction between I- 15 and State Street. Starting at 7200 South and running north to connect with Main Street just west of State Street at 4500 South Street.

Several roadway and safety deficiencies exist in the area of the corridor on Winchester Street including five rail crossings within a 350-foot radius. The best alternative for improving these roadway and safety deficiencies would be to realign the 300 West and Cottonwood Street approaches to one intersection at the UTA Western Spur Track. Meyers Lane would then be relocated south to tie into the new Cottonwood Street alignment. These two improvements will reduce the number of rail crossings. This potential improvement is illustrated in Figure 4.3.

The new alignment for Cottonwood Street over 5300 South includes a longer bridge that would run between the Union Pacific Railroad and UTA Light Rail tracks. This bridge will cross the UTA Light Rail just south of 5300 South and connect to the new Vine Street alignment.

Another section of Cottonwood Street is being proposed to extend from north of Vine Street, to Main Street at the City's north boundary. There are currently three alignments that have been developed that would all connect with Main Street and 4500 South Street intersection. Each of these options are presented in Figure 4.4. One option would be a new roadway that will follow along the backs of existing residences west of Box Elder Street, another alignment would propose widening the existing Box Elder Street, and the third would connect Hanauer Street with Vine Street and Auto Blvd. An exact alignment would be determined through detailed environmental studies, which have not yet been conducted. Cottonwood Street will likely cross over 4500 South and connect to the existing sections of Main Street near the Murray Central TRAX station. Murray can work with UDOT and take a more active role in promoting alternative land uses in the area, such as more pedestrian-friendly development.

FIG. 4.3 COTTONWOOD STREET / TRAX AT WINCHESTER OPTIONS

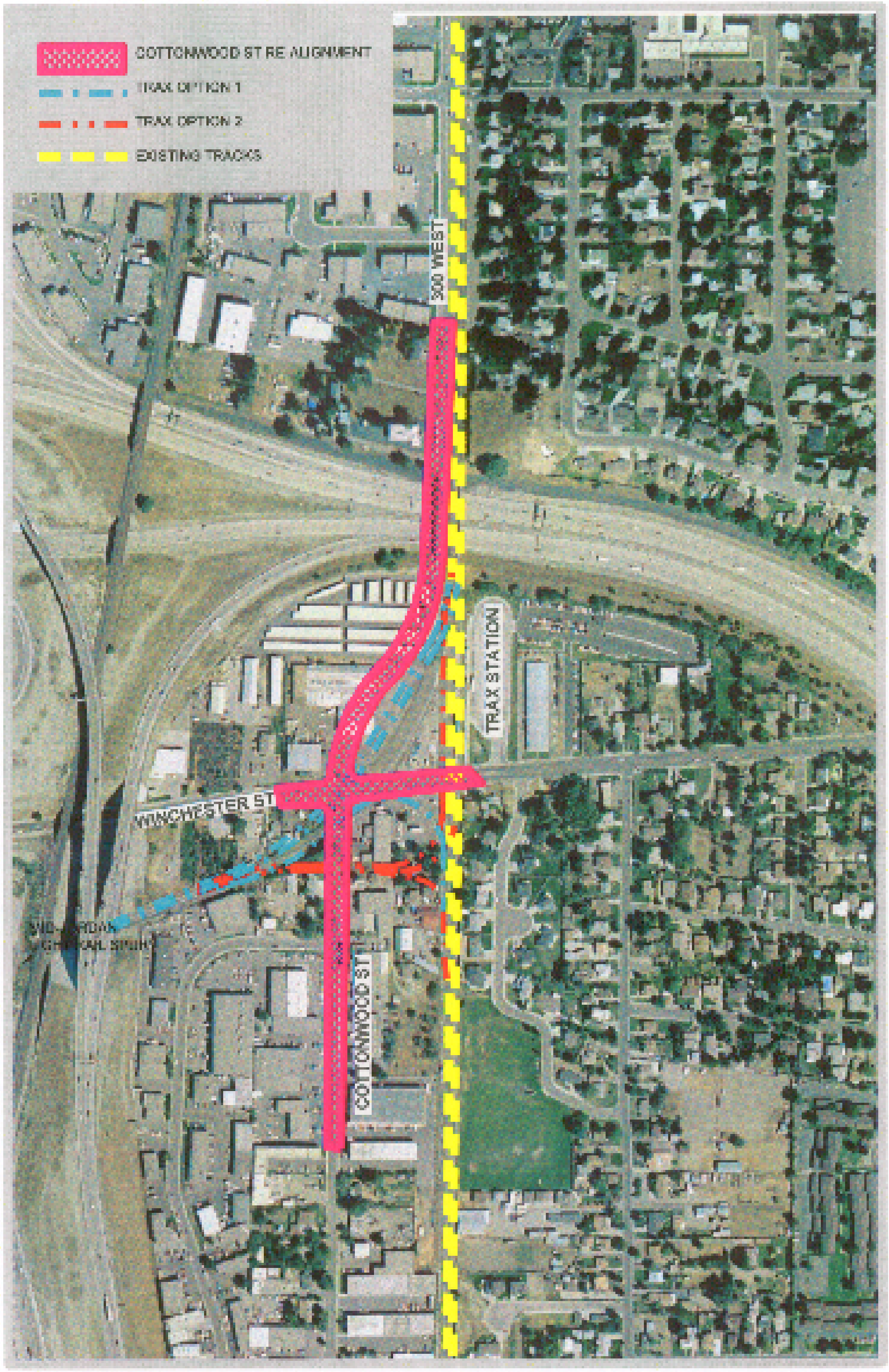
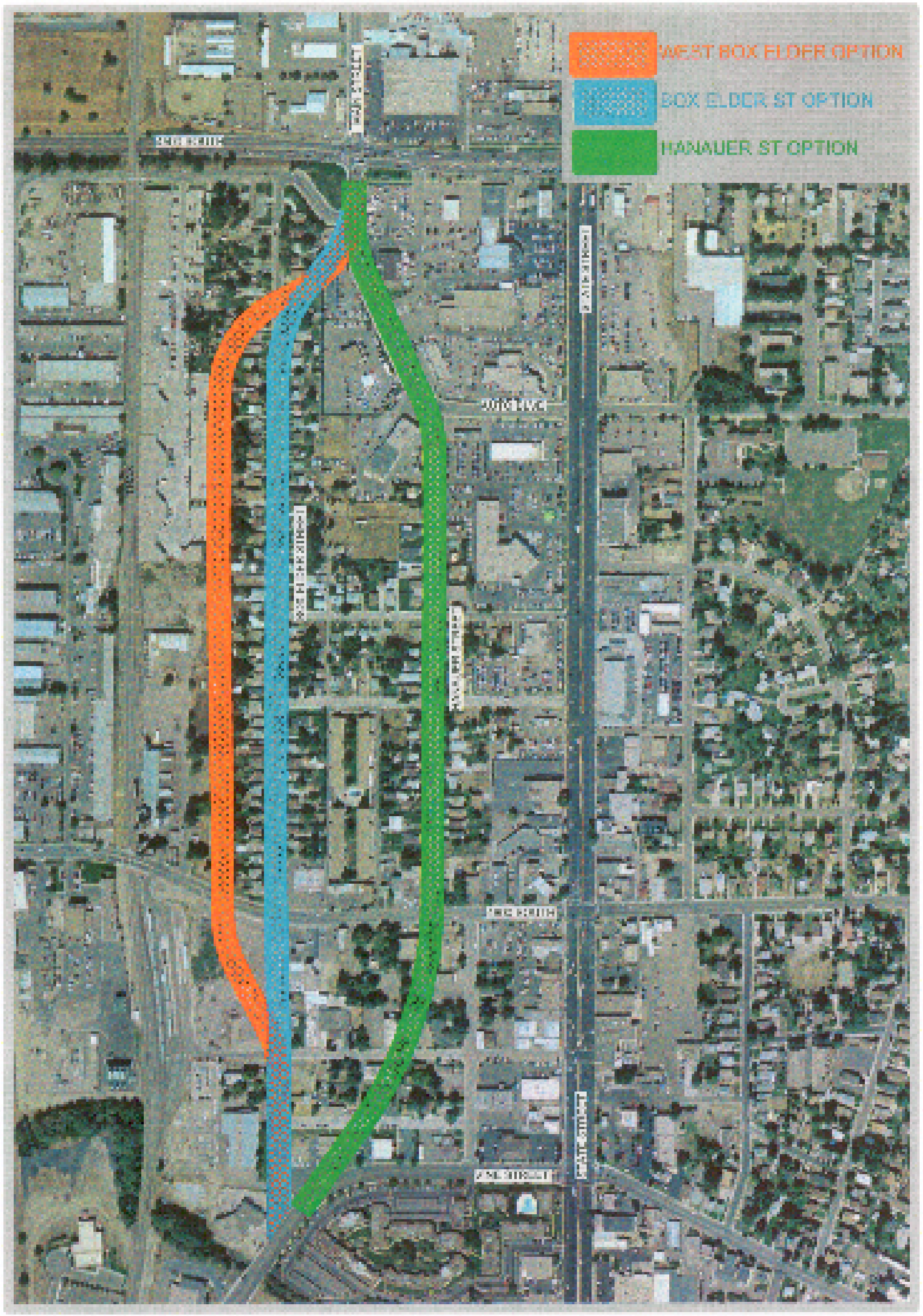


FIG. 4.4 COTTONWOOD STREET ALTERNATIVE ALIGNMENTS



5. ACCESS MANAGEMENT

A. Access Management Guidelines for Developed Areas

Introducing a "retrofit" program of access control to an existing roadway or built-out area is very difficult. Pressure from adjacent property and business owners is perhaps the most challenging obstacle of all. It can be difficult to compare the cost of economic hardship on an individual to the overall benefits to the general public.

Most retrofit actions involve the application of accepted traffic engineering techniques that limit the number of conflict points, separate basic conflict areas, limit speed adjustment problems, and remove turning vehicles from the through travel lanes.

Most of the information in this section was taken from the *NCHRP Report 348: Access Management Guidelines for Activity Centers* produced by the Transportation Research Board and FHWA's "Access Management for Streets and Highways." Table 5.1 on the following page summarizes available access management retrofit techniques.

Table 5.1 Access Management Retrofit Techniques

CATEGORY A LIMIT NUMBER OF CONFLICT POINTS

- A-1. Install median barrier with no direct left-turn access
- A-2. Install raised median divider with left-turn deceleration lanes
- A-3. Install one-way operations on the highway
- A-4. Install traffic signal at high-volume driveways
- A-5. Channelize median openings to prevent left turn ingress and/or egress maneuvers
- A-6. Widen right through lane to limit right-turn encroachment onto the adjacent lane to the left
- A-7. Install channelizing islands to prevent left-turn deceleration lane vehicles from returning to the through lanes
- A-8. Install physical barrier to prevent uncontrolled access along property frontages
- A-9. Install median channelization to control the merge of left-turn egress vehicles
- A-10. Offset opposing driveways
- A-11. Locate driveway opposite a three-leg intersection or driveway and install traffic signals where warranted
- A-12. Install two one-way driveways in lieu of one two-way driveway
- A-13. Install two two-way driveways with limited turns in lieu of one standard two-way driveway
- A-14. Install two one-way driveways in lieu of two two-way driveways
- A-15. Install two two-way driveways with limited turns in lieu of two standard two-way driveways
- A-16. Install driveway channelizing island to prevent left-turn maneuvers
- A-17. Install driveway channelizing island to prevent driveway encroachment conflicts
- A-18. Install channelizing island to prevent right-turn deceleration lane vehicles from returning to the through lanes
- A-19. Install channelizing island to control the merge area of right-turn egress vehicles
- A-20. Regulate the maximum width of driveways

CATEGORY B SEPARATE BASIC CONFLICT AREAS

- B-1. *Regulate minimum spacing of driveways
- B-2. Regulate minimum corner clearance
- B-3. Regulate minimum property clearance
- B-4. *Optimize driveway spacing in the permit authorization stage
- B-5. *Regulate maximum number of driveways per property frontage
- B-6. Consolidate access for adjacent properties
- B-7. Require highway damages for extra driveways
- B-8. Buy abutting properties
- B-9. Deny access to small frontage
- B-10. Consolidate existing access whenever separate parcels are assembled under one purpose, plan entity, or usage
- B-11. *Designate the number of driveways regardless of future subdivision of that property
- B-12. Require access on collector street (when available) in lieu of additional driveway on highway

CATEGORY C LIMIT DECELERATION REQUIREMENTS

- C-1. Install traffic signals to slow highway speeds and meter traffic for larger gaps
- C-2. Restrict parking on the roadway next to driveways to increase driveway turning speeds
- C-3. Install visual cues of the driveway
- C-4. Improve driveway sight distance
- C-5. Regulate minimum sight distance
- C-6. *Optimize sight distance in the permit authorization stage
- C-7. Increase the effective approach width of the driveway (horizontal geometrics)
- C-8. Improve the vertical geometrics of the driveway
- C-9. Require driveway paving
- C-10. Regulate driveway construction (performance bond) and maintenance
- C-11. Install right-turn acceleration lane
- C-12. Install channelizing islands to prevent driveway vehicles from backing onto the driveway
- C-13. Install channelizing islands to move ingress merge point laterally away from the highway
- C-14. Move sidewalk-driveway crossing laterally away from highway

CATEGORY D REMOVE TURNING VEHICLES FROM THE THROUGH LANES

- D-1. Install two-way left-turn lane
- D-2. Install continuous left-turn lane
- D-3. Install alternating left-turn lane
- D-4. Install isolated median and deceleration lane to shadow and store left turning vehicles
- D-5. Install left-turn deceleration lane in lieu of right-angle cross-over
- D-6. Install median storage for left-turn egress vehicles
- D-7. Increase storage capacity of existing left-turn declaration lane
- D-8. Increase the turning speed of right-angle median crossovers by increasing the effective approach width
- D-9. Install continuous right turn lane
- D-10. Construct a local service road
- D-11. *Construct a bypass road
- D-12. *Reroute through traffic
- D-13. Install supplementary one-way right-turn driveways to divided highway (non-capacity warrant)
- D-14. Install supplementary access on collector street when available (non-capacity warrant)
- D-15. Install additional driveway when total driveway demand exceeds capacity
- D-16. Install right-turn deceleration lane
- D-17. Install additional exit lane on driveway
- D-18. Encourage connections between adjacent properties (even when each has highway access)
- D-19. Require two-way driveway operation where internal circulation is not available
- D-20. Require adequate internal design and circulation plan

Source: "Access Management for Streets and Highways," Federal Highway Administration, June 1982

*Not directly applicable for retrofit

B. Median Types for Access Management

Physical medians fully separate opposing traffic flows, clearly define where cross movements are permitted, provide space for single- and multiple-turning lanes at signalized intersections, and may limit certain access points to right-turn movements only. They also provide better pedestrian protection than painted islands. They may be continuous, allow only left-turn entry (or exit), or provide full openings at specified locations. Thus, medians are generally desirable at major activity centers where a few high volume channelized driveways provide property access. They are also desirable where volume or safety considerations require restricting property access to right turns. The lists in Table 5.2 compare raised medians to two-way left turn lanes.

TABLE 5.2 MEDIAN APPLICATION COMPARISONS

	Raised Median	Two-Way Left Turn Lane
Advantages	• Discourages strip development • Allows better control of land uses by local government • Reduces number of conflicting maneuvers at driveways • Provides pedestrian refuge • If continuous, restricts access to right turns only • Reduces accidents in mid-block areas • Provides positive separation of opposing traffic	• Makes use of "odd-lanes" • Reduces left turns from through lanes • Provides operational flexibility for emergencies • Safer than roads with no left turn lanes or medians • Facilitates detours • Provides positive separation of opposing traffic
Disadvantages	• Reduces operational flexibility for emergency vehicles • Increases left turn volumes at median openings • Increases travel time and circuity for some motorists • May increase accidents at openings • Limits direct access to property • Operating speeds usually limited to 45 mph	• Encourages random access • Illegally used as a passing lane • No refuge for pedestrians • Poor visibility of markings • High maintenance cost • Operate poorly under high volume of through traffic • Allows head-on collisions

Source: "Access Management Guidelines for Activity Centers," NCHRP Report 348

Driveway access restrictions may be required for certain access levels or road types. A review of the number and location of access drives is needed. Safety considerations associated with intersecting traffic volumes or poor visibility are the primary reasons for access restrictions. Whether or not driveway restrictions such as these should be used should be evaluated on an individual basis during the planning stages of any particular development.

6. PAVEMENT MANAGEMENT SYSTEM

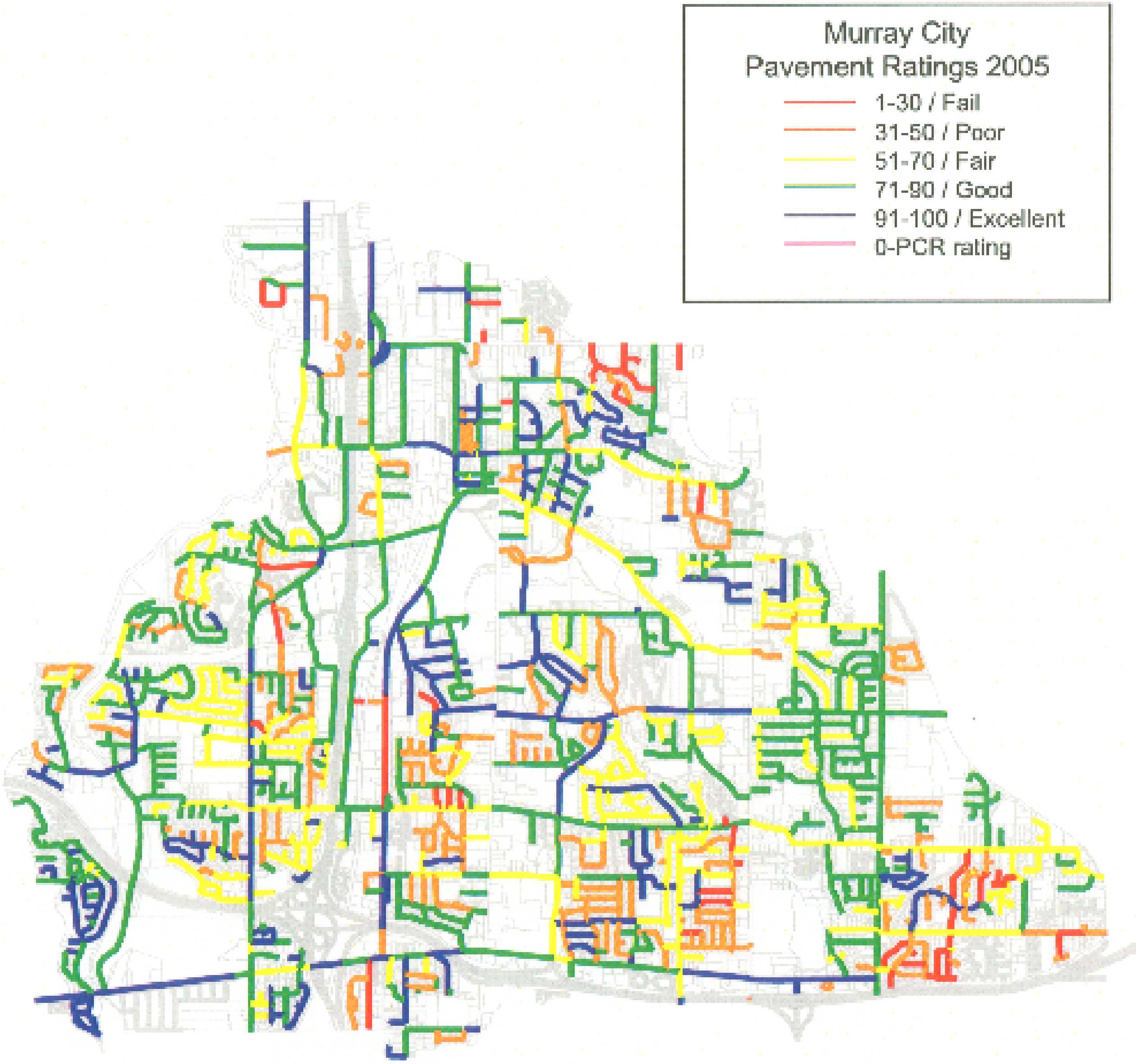
A pavement management system (PMS) is a decision-making process or system that helps Murray personnel make cost-effective decisions concerning the maintenance and rehabilitation of the pavements for which they are responsible in a systematic way.

Murray City Public Services has recently updated the roadway pavement inventory and is currently utilizing a pavement management system. The function of a pavement management system is to collect and analyze pavement condition data to improve the efficiency of decision-making and provide feedback on the consequences of decisions. There are three main types of data to be collected:

- **Construction history data** - Provides the age, surfacing thicknesses, and surfacing types for all sections. This data is generally best available at the Region level. Good age data is essential to the performance of computerized pavement management models, which generally rely on age as the basis for performance prediction curves.
- **Inventory data** - Information about the roads generally remains static over time. Data items include pavement type, number of lanes, width, functional classification, and administrative items.
- **Condition data** - Systematically collected pavement condition data, as well as traffic data. This is data that is typically collected on predetermined cycles, such as every 3 years, and includes such items as traffic, pavement roughness, rut depth, skid number, cracking, weathering, bleeding, structural strength, and faulting. This data is collected for the network to be analyzed and is broken into analysis sections, which can all be input into a pavement management software program. The software can then be utilized to develop strategies and recommendations for the pavement network. A pavement management system can be difficult and expensive to create and maintain, but it can be an effective tool in maximizing a City budget. Murray has recently created a pavement management system, and it is important that the City maintain the system so that it may be a worthwhile investment in the City's ever expanding roadway network.

Figure 6.1 depicts the pavement condition ratings (PCR) for the year 2005. The PCR is a numerical rating of the pavement's condition and is very useful and indicative of what maintenance strategies should be applied in the future. The ratings appear numerically from 0-100. A rating of less than 30 is considered failing while a rating of 91-100 is excellent with perhaps little or no maintenance activity required that year.

FIGURE 6.1 – Pavement Ratings 2005



7. NEIGHBORHOOD TRAFFIC CALMING PROGRAM

TRAFFIC CALMING is the combination of physical measures that reduce the undesirable effects of motor vehicle use, alter driver behavior, and improve conditions for non-motorized street users. The purpose of traffic calming is to reduce the speed and/or volume of traffic along a roadway to acceptable levels.

7.1. Introduction

The Murray City Neighborhood Traffic Calming Program (NTCP) incorporates education, enforcement and engineered street design into protecting the quality of life in City neighborhoods. The City has developed the NTCP to provide residents with the opportunity to raise neighborhood traffic concerns and to participate in the selection of strategies that promote safe and pleasant conditions for residents, pedestrians, bicyclists, and motorists in City neighborhoods.

7.2. Goals

The goals of the NTCP are as follows:

A. Provide protection to residential neighborhoods from traffic operating at excessive speeds and excessive volumes of traffic.
B. Keep neighborhood street use within the classification defined in the transportation chapter of the Master Plan (i.e. Minor Collectors, Major Collectors, etc).
C. Base the expenditure of public resources on need, effectiveness, and cost.
D. Foster a collaborative working relationship between City staff and neighborhood residents in the development of traffic calming measures.

7.3. Criteria

For a neighborhood to qualify for NTCP assistance, the adopted Traffic Calming Policy and Procedure must be followed. Traffic surveys conducted by the City will determine whether these thresholds are met. These criteria are based on those used in successful traffic calming programs in North America and Europe.

7.4. Traffic Calming Toolbox of Applications

Any project can be made easier with the right tools and selecting the right tool for traffic calming boils down to two things:

- Identifying the nature and extent of traffic-related problems on a given street or in a given area.
- Selecting and implementing cost-effective measures for solving identified problems.

If cut-through traffic is the problem (as determined by traffic counts), it suggests one set of applications. If speeding is the problem (as determined by speed measurements), it suggests another set. School zones and crosswalk safety issues may suggest a third set.

Some traffic calming methods, such as landscaped medians or roundabouts, may work to solve some traffic issues but also add to the attractiveness of the area. There are dozens of variations of traffic calming techniques, limited only by the imagination of landscape architects, motivated residents, and roadway designers.

PROCEDURAL / ADMINISTRATIVE TRAFFIC MANAGEMENT TOOLS

These programs are those that deal with changing driver behavior through resident education and participation. They are typically low cost solutions and may be utilized before the more expensive physical modifications will occur.

Pace Car is a citizen based, self-help initiative to reduce speeding and improve neighborhood quality of life. It is a simple idea that uses vehicles to calm vehicles. To participate, residents sign a pledge agreeing to drive within the speed limit. This simple commitment influences all drivers following a Pace Car to also drive within the speed limit. In effect, the Pace Car logo on their on their vehicle will identify them as a program participant, and signify their willingness to reclaim their street by observing posted speed limits. The effectiveness of the Pace Car program is directly proportional to the number of participants in the neighborhood.

Estimated Cost:	None to Residents.
Positive Aspects:	Neighbors feel useful in solving speeding process.
Negative Aspects:	Dependant upon high resident participation.

Neighborhood Speed Watch program is a neighborhood self help tool used to educate drivers and residents about speeding problems in neighborhoods. With the assistance of the City, residents first distribute educational flyers in their neighborhood informing residents of the problems of speeding and how to reduce it. If the problem persists, the City will work with the residents to provide other solutions. For example, the city may loan residents hand held radar equipment connected to a small digital readout used for displaying the speed of the approaching vehicles to the drivers. Another solution may be to place a speed trailer on the street. A speed trailer displays real time speeds of approaching vehicles and raises the driver's awareness of the speed he/she is traveling.

Estimated Cost:	None to Residents.
Positive Aspects:	Neighbors feel useful in solving speeding process.
Negative Aspects:	Not an enforcement tool.

A. **What are the Solutions?** The easiest response is to encourage citizens to use City streets for the purpose they were intended. Murray has three classifications of streets with sub-classifications for major and minor. They are: local, collector, and arterial.

- **Local Streets** - Local or residential streets provide direct access for residences and businesses which they serve. Traffic flow is not as important as property access. Most local streets have a speed limit of 25 mph.
- **Collector Streets** - Collector streets provide traffic a link between arterials and residential streets. Access is restricted at locations. Traffic flow is as important as property access. Most collector streets have a speed limit of 35 mph.
- **Arterial Streets** - Arterial streets provide through traffic movement across long distances. These streets are typically the widest in the City. Traffic flow is more important than property access. Most arterial streets have a speed limit of 40 + mph. If possible, Murray wishes to use traffic calming measures to encourage motorists to use residential streets to access their residence, collector streets to access arterial streets, and arterial streets to travel long distances. It is not the intent of Murray to move a traffic problem from one residential street to another.

B. **How do I Participate?**

- **Application** -Any citizen or neighborhood group can make an application for traffic calming devices to be applied according to the Neighborhood Traffic Calming Policies and Procedures (see Appendix H). Copies of the policy and procedure can also be obtained from the Public Services Department office at 4646 South 500 West, or from the City web site at www.murray.utah.gov. To demonstrate neighborhood support and agreement for a traffic calming request, a complete application must contain signatures from 50% or more of the households along the facing street in the area where the perceived traffic problem exists.
- **Eligibility and Priority** -Traffic management requests will be reviewed upon receipt to determine eligibility and priority. Traffic management plans will be developed on a priority basis. Upon receipt of the application, a City staff member will contact the applicant to discuss the problem, determine project boundaries, and to review the NTCP process. A City staff member will then collect the neighborhood traffic data for input into an eligibility and priority formula. The formula is based on traffic volumes, vehicular speeds, presence or lack of sidewalks, pedestrian generators, bike routes and transit service. The formula produces a numerical score to determine the requests' eligibility and priority. Applications must achieve a score of at least 80 points to be considered eligible for implementation. Plans will be developed for eligible applications in a priority manner based on the numerical score. The request with the highest score will be given top priority.

C. **Traffic Calming Plan (TCP)** - For those applications that have proven "eligible", an initial meeting will be held with residents, business owners and property owners identified in the study boundaries. City staff will also invite the City Council Member for the area. The purpose of the meeting is to seek input on the neighborhood's traffic issue(s), to allow staff to explain the program in more detail, and to explore potential solutions. Using input received from the public meeting, City staff will create a draft plan to address the neighborhood's traffic issue(s). The plan may include alternatives for addressing the issue.

D. **Testing the Plan** - Once a draft plan is determined, temporary testing measures may be employed. Testing allows the neighborhood to experience first hand the effectiveness of the plan. If the measures are not functioning satisfactory, the test may be revised or discontinued. At the conclusion of the testing period all test measures will be removed and the staff will prepare a letter summarizing the results. City staff will mail the letter and ballot to all property/business owners within the project boundaries. If at least 70% of the residents are in favor of the plan, it will proceed to the funding process. If not, staff will meet with the neighborhood to decide whether to revise the plan or discontinue the traffic management request.

E. **Funding, Design, and Construction** - Once the plan has received final endorsement of the neighborhood and staff, the City will prepare a cost estimate and proposed schedule for the project design and construction. Design and construction will proceed as determined by availability of funds.

F. **Modifications to Constructed Applications** - City staff will consider a request for removal or modification of existing traffic management measures if a petition for removal is submitted with the signatures of 50% or more of the residents, business, or property owners within the original project area. Staff will organize a neighborhood meeting to discuss the request. A mailing providing the results of the meeting and ballot, if appropriate, will follow. To be approved for removal or modification, more than 50% of the residents must be in favor of the request. All costs incurred for removal or modification will be borne by the neighborhood. However, if the City finds a traffic management measure must be removed or modified for technical or safety reasons, the City will pay all costs incurred.

G. **Funding Options** - An approved TCP project will likely have funding implications. Funding for all TCP projects must be obtained before engineering design and construction begins. The following is a list of funding options available for TCP projects:

   a. Traffic Improvement Plan Funds: Each year the City Council will consider funding a "pool" of funds, as recommended by the City Administration, in the City's Capital Improvement Program for implementing approved TCP projects. When available, these funds will be utilized to fund TCP projects.

b. Neighborhood Funding: Any approved TCP project can be funded 100% through neighborhood funding sources. Neighborhoods may collect monies in any manner they deem equitable to pay for the cost of the project.
c. A Special Improvement District (SID) may also be utilized to fund TCP projects when deemed appropriate by the City.

7.5. Traffic Calming Tools Defined

There are numerous traffic calming tools available, which can be divided into two main types, those that deal with procedural/administrative techniques and those that deal with physical modification techniques. Although most traffic calming applications have some effect on both volume and speed, they are usually classified according to their dominant effect. Full and half street closures, diverters of various types, median barriers, and forced turn islands are classified as volume control applications. Their primary purpose is to discourage, divert or eliminate through traffic.

Speed humps, speed tables, raised intersections, roundabout, chicanes, chokers, lateral shifts, and realigned intersections are classified as speed control applications. Their primary purpose is to slow traffic.

Appendix H is a summarized listing of the traffic management and calming tools that may be available when proven beneficial and cost effective.

8. TRANSPORTATION IMPROVEMENT PLAN

8.1. Recommended Transportation Plan

The Murray City Transportation Plan is structured around a number of key elements that directly relate to the principles and policies listed in the Introduction of this plan. The plan recognizes the need to provide better vehicular mobility in high growth areas, as well as promoting increased opportunities for alternative modes of transportation. Input from the Technical Advisory Committee and residents (through the public involvement process) provided valuable guidance throughout the process of developing, refining, and evaluating alternative transportation improvements for the Murray City area.

This plan contains a summary of specific improvements for each transportation mode. A framework for priority and timing is provided for the roadway improvements so that there is continuity with surrounding future development, as well as other elements of the network.

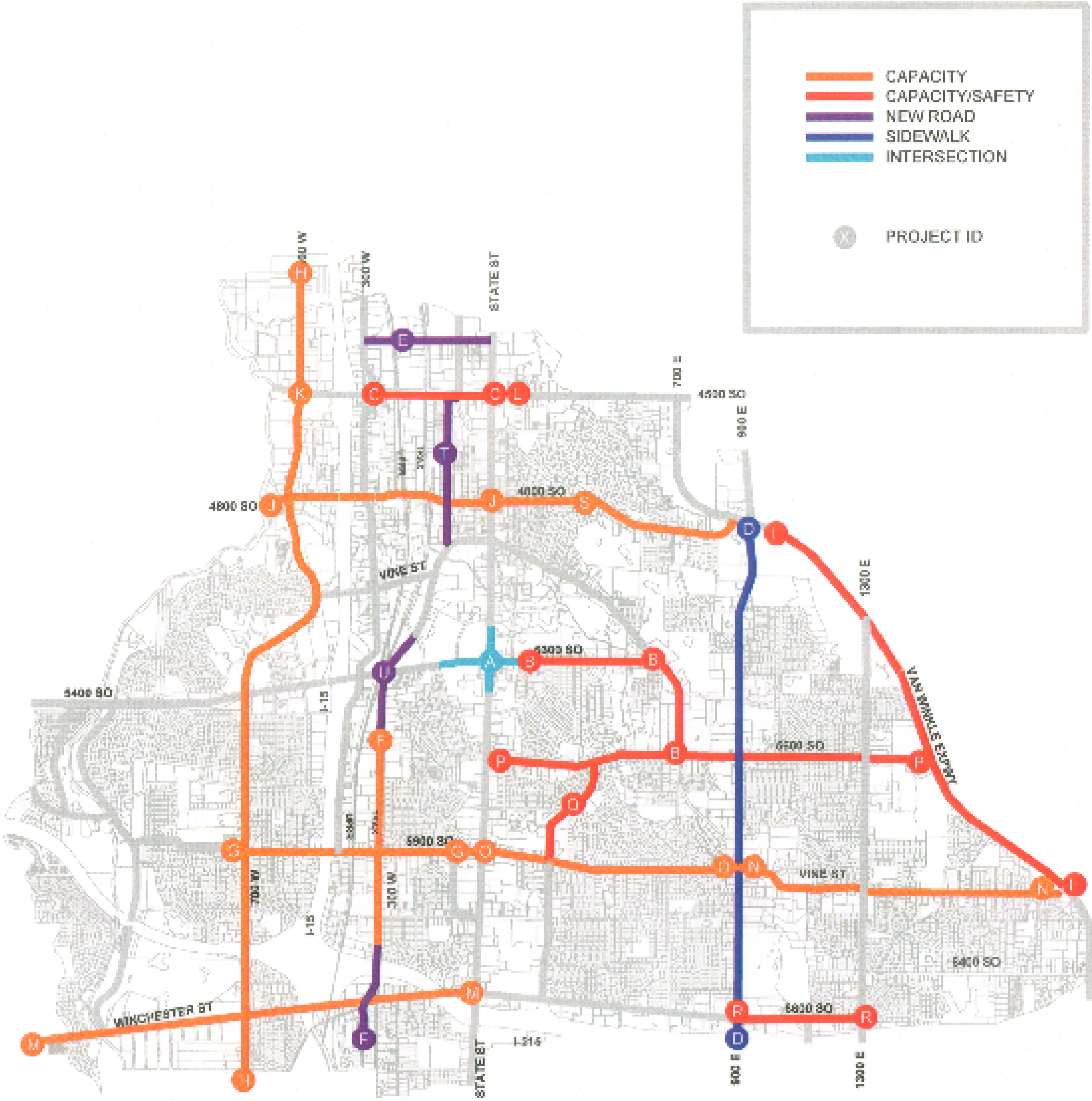
8.2. Roadway Plan

The Roadway Plan has been developed based upon technical analyses, several transportation planning studies previously conducted for Murray and the surrounding region, and on public input. The Roadway Plan is shown in Figure 8.1. The major improvement alternatives discussed in Chapter 4 form the basis for the Roadway Plan. After incorporating the recommended improvements for the major corridors into the travel demand model, the deficiencies in the roadway network where identified. The Roadway Plan was then developed to address these deficiencies.

A. Functional Classification and Lane Requirements

The functional classification determines the ultimate lane requirements, cross-section, right-of-way requirements, and other characteristics of the roadways. However, based on the projected travel demand, the ultimate lane requirements for a particular street may not be required by 2030. The lanes illustrated are those that will be needed by 2030 to address the projected travel demand. Steps should be taken to preserve the right-of-way necessary to construct the ultimate cross-section based on the roadway classification. In some cases, it may be economical and more convenient to construct the ultimate lane requirements earlier than needed.

FIG. 8-1 FUTURE ROADWAY PLAN



B. Projected Future Traffic Volumes

Subsequent to establishing an initial Roadway Plan, a computer run of the travel demand model was performed to project the 2030 daily traffic volumes. An iterative process was then conducted to determine the functional classification and lane requirements of each roadway segment based on the projected volumes. A final model run was done to estimate 2030 traffic volumes.

C. Projected Capacity Deficiencies

A volume to capacity (v/c) ratio analysis was completed using 2030 calculated traffic projections, similar to the analysis conducted on the existing roadway network. The projected Level of Service (LOS) is based on the v/c ratio on key roadways in the Murray study area, and was calculated using the forecasted 2030 traffic volumes and the planning level capacities associated with the Roadway Plan. The resulting v/c ratio and LOS groups are shown in Figure 8.2. The majority of the Murray roadway network will operate under capacity conditions in 2030 with the recommended roadway improvements.

D. Recommended Roadway Improvements

In order to complete the Roadway Improvement Plan by 2030, there are a large number of improvement projects that will need to be implemented over the next 10 to 20 years. Based on the traffic forecasts for 2015 and 2030, discussions with the Technical Advisory Committee, and input from the public, the improvement projects were grouped into three time periods: **short-range** (0 to 5 years), **mid-range** (5 to 10 years), and **long-range** (10 to 20 years) based on their relative need for completion. The locations for the individual projects are shown in Figure 8.1, and they are color coded by type of improvement.

General Implementation Guidelines	
Short Range	1-5 years
Mid Range	5-10 years
Long Range	10-25 years

Following Figure 8.2 is a listing of these same projects with a planning level opinion of the probable cost and an assignment of cost sharing between responsible entities. It should be noted that the projects within each time period have the same priority and can be rearranged without any change in priorities. The following information provides a brief description of the roadway improvement projects that are shown in Figure 8-1. The list includes a brief description of the proposed improvement and the recommended phasing for implementation.

FIG. 8.2 FUTURE LEVEL OF SERVICE

2030 With Improvements

E. ROADWAY PROJECTS

PROJECT A: State Street and 5300 South intersection improvements.	ISSUE: Capacity/Safety	RANGE: SHORT
Build double left turn lanes on 5300 South Northbound movements and double left turns on State Street Westbound movements.		
COST: $750,000	FUNDING: State	

PROJECT B: 5300 South from State to Vine Street and Vine to 5600 South Street.	ISSUE: Capacity/Safety	RANGE: SHORT
Restripe or widen roadway to 5 lanes with intersection improvements at all intersections. Possible BRT route. School zone safety improvements at Parkside Elementary and Hillcrest Jr. High School.		
COST: $800,000	FUNDING: 80% City 20% Exactions	

PROJECT C: 4500 South from 300 West to State Street.	ISSUE: Capacity	RANGE: SHORT
Widen roadway to 6 lanes with intersection improvements at all intersections. Includes replacing the railroad structure and TRAX structure.		
COST: $1,000,000	FUNDING: State	

PROJECT D: 900 East from Van Winkle to 6600 South.	ISSUE: Sidewalks	RANGE: SHORT
Ellerby Ave (5030 South) to Arrowhead Lane (5120 South) - widen east side for parking lane, curb & gutter and sidewalk. Pontiac Drive (5180 South) to Mick Riley (5300 South) - widen east for parking lane, curb & gutter and sidewalk, major Right-of-Way. 5325 South to 5185 South - widen east side for parking lane, curb & gutter and sidewalk. 5600 South to 5859 South - widen east for parking lane, curb & gutter and sidewalk, minor Right-of-Way. 6000 South to 6110 South - widen east side and match curb & gutter and sidewalk.		
COST: $1,500,000	FUNDING: 80% City 20% Exactions	

PROJECT E: Fireclay Avenue from 300 West to State Street.	ISSUE: New Road	RANGE: SHORT
Extend new roadway from TRAX station to 300 West, widen from State Street to Main Street. Railroad underpass structure required.		
COST: $6,500,000	FUNDING: RDA	

PROJECT F: Cottonwood Street (300 West) from Winchester Street to 5600 South.	ISSUE: Access / Capacity	RANGE: SHORT
Realign intersection at Winchester from Cottonwood to 300 West. New or widen bridge across I-215 to 4 lanes. Widen or restripe roadway to 3 lanes beginning at 5600 South to southern city limits.		
COST: $10,500,000	FUNDING: 10% City 90% State-Federal	

PROJECT G: 5900 South from State Street to 700 West.	ISSUE: Capacity/Safety	RANGE: MID
Restripe or widen roadway to 4 lanes with intersection improvements at all intersections. School zone safety improvements at McMillan Elementary.		
COST: $650,000	FUNDING: 100% City	

PROJECT H: 700 West/500 West from south City limits to north city limits.	ISSUE: Capacity/Safety	RANGE: MID
Widen roadway to 4 lanes with intersection improvements at all intersections. School zone safety improvements at Viewmont Elementary and Riverview Jr. High School.		
COST: $2,000,000	FUNDING: 100% City	

PROJECT I: Van Winkle Expressway widening from 900 East to Highland Drive.	**ISSUE:** Capacity	RANGE: MID
Widen roadway to 6 lanes with intersection improvements at all intersections.		
COST: $1,800,000	FUNDING: 100% State	

PROJECT J: 4800 South from Jordan River bridge to State Street.	**ISSUE:** Capacity	RANGE: MID
Widen Jordan River bridge to 4 lanes. Stripe and widen various sections from the bridge to State Street to 5 lanes. State Street to Jordan River.		
COST: $3,000,000	FUNDING: 100% City	

PROJECT K: 4500 South and 500 West intersection improvements.	**ISSUE:** Geometry	RANGE: MID
Add dual left turn lane westbound and northbound with additional thru lanes northbound and southbound.		
COST: $900,000	FUNDING: 100% State	

PROJECT L: 4500 South and State Street.	**ISSUE:** Dual Left Turn	RANGE: MID
Add dual left turn lanes northbound and westbound.		
COST: $600,000	FUNDING: 100% State	

PROJECT M: Winchester Street widening from State Street to 1300 West.	**ISSUE:** Capacity	RANGE: LONG
Widen roadway to 4 lanes with center turn lane. Intersection improvements at 700 West and Cottonwood Street (300 West). Widen bridges to 5 lanes.		
COST: $2,500,000	FUNDING: 100% City	

PROJECT N: 5900 South from 900 East to Van Winkle Expressway.	**ISSUE:** Capacity/Safety	RANGE: LONG
Restripe or widen roadway to 4 lanes with intersection improvements at all intersections. School zone safety improvements at McMillan Elementary.		
COST: $300,000	FUNDING: 100% City	

PROJECT O: 5900 South from State Street to 900 East.	**ISSUE:** Capacity/Safety	RANGE: LONG
Restripe or widen roadway to 4 lanes with intersection improvements at all intersections. School zone safety improvements at McMillan Elementary.		
COST: $550,000	FUNDING: 100% City	

PROJECT P: 5600 South from State Street to Van Winkle Expressway.	**ISSUE:** Capacity	RANGE: LONG
State Street to Fashion Boulevard - Restripe or widen roadway to 3 lanes with improvements at all intersections. Fashion Boulevard to Vine Street. - Restripe roadway to 3-5 lanes with improvements at all intersections. Vine to 900 East - Restripe roadway to 5 lanes with improvements at all intersections. Possible BRT route. 900 East to Van Winkle Expressway - Restripe or widen roadway to 5 lanes with improvements at all intersections. Possible BRT route. School zone safety improvements at Cottonwood High School.		
COST: $1,700,000	FUNDING: 100% City	

PROJECT Q: Fashion Boulevard from 5900 South to 5600 South with intersection improvement.	**ISSUE:** Capacity	RANGE: LONG
Restripe from 3 lanes to 5 lanes.		
COST: $250,000	FUNDING: 100% City	

PROJECT R: 6600 South from 900 East to 1300 East.	**ISSUE:** Capacity	RANGE: LONG
Widen roadway to 5 lanes.		
COST: $600,000	FUNDING: 100% City	

PROJECT S: 4800 South from State Street to Van Winkle Expressway.	**ISSUE:** Capacity	RANGE: LONG
Widen and replace broken concrete pavement from State Street to Van Winkle Expressway with 3 lanes and 5 lanes at intersections.		
COST: $1,500,000	FUNDING: 100% City	

PROJECT T: Cottonwood Street from Vine Street to 4500 South.	**ISSUE:** New Road	RANGE: LONG
COST: $4,000,000	FUNDING: 20% City 80% State-Federal	

8.3. Traffic Signal Improvement Plan

The Traffic Signal Improvement Plan (TSIP) has been developed based upon technical analyses, several transportation planning studies previously conducted for Murray in the surrounding region, and on public input. The TSIP is shown in Figure 8.3. After incorporating the recommended improvements for the key intersections, the deficiencies in the intersection Level of Service where identified. The TSIP was then developed to address these deficiencies. Below is a listing of these same projects with a planning level opinion of the probable cost and an assignment of cost sharing between responsible entities.

A. SIGNAL PROJECTS

PROJECT S1: 4800 South and 300 West intersection signal upgrade.		**ISSUE:** Signal	RANGE: SHORT
Upgrade signal with mast arm type of poles and improve sight distance issues. 2-phase to a possible 4-phase upgrade.			
COST: $250,000	FUNDING: 100% City		

PROJECT S2: 4500 South and Main Street intersection signal upgrade.		**ISSUE:** Signal	RANGE: SHORT
Add northbound and southbound left turn phases.			
COST: $20,000	FUNDING: 100% State		

PROJECT S3: 300 West and Winchester intersection		**ISSUE:** Signal	RANGE: SHORT
New signal.			
COST: $250,000	FUNDING: 100% City		

PROJECT S4: 900 East and 5900 South intersection.		**ISSUE:** Signal	RANGE: SHORT
Upgrade for a protected left turn.			
COST: $50,000	FUNDING: 100% State		

PROJECT S5: Fireclay and Main Street.		**ISSUE:** Signal	RANGE: SHORT
New traffic signal.			
COST: $200,000	FUNDING: 100% RDA		

PROJECT S6: 300 West and Fireclay.		**ISSUE:** Signal	RANGE: SHORT
New traffic signal.			
COST: $250,000	FUNDING: 100% RDA		

PROJECT S7: Fashion Boulevard and 5600 South intersection signal upgrade.		**ISSUE:** Signal	RANGE: MID
Add westbound to southbound left turn phase.			
COST: $50,000	FUNDING: 100% City		

PROJECT S8: Fireclay Avenue and State Street intersection.		**ISSUE:** Signal	RANGE: MID
New signal locations.			
COST: $250,000	FUNDING: 100% RDA		

PROJECT S9: 300 West and 5900 South intersection.	**ISSUE:** Signal	RANGE: MID
Upgrade signal with protected left turns.		
COST: $350,000	FUNDING: 100% City	

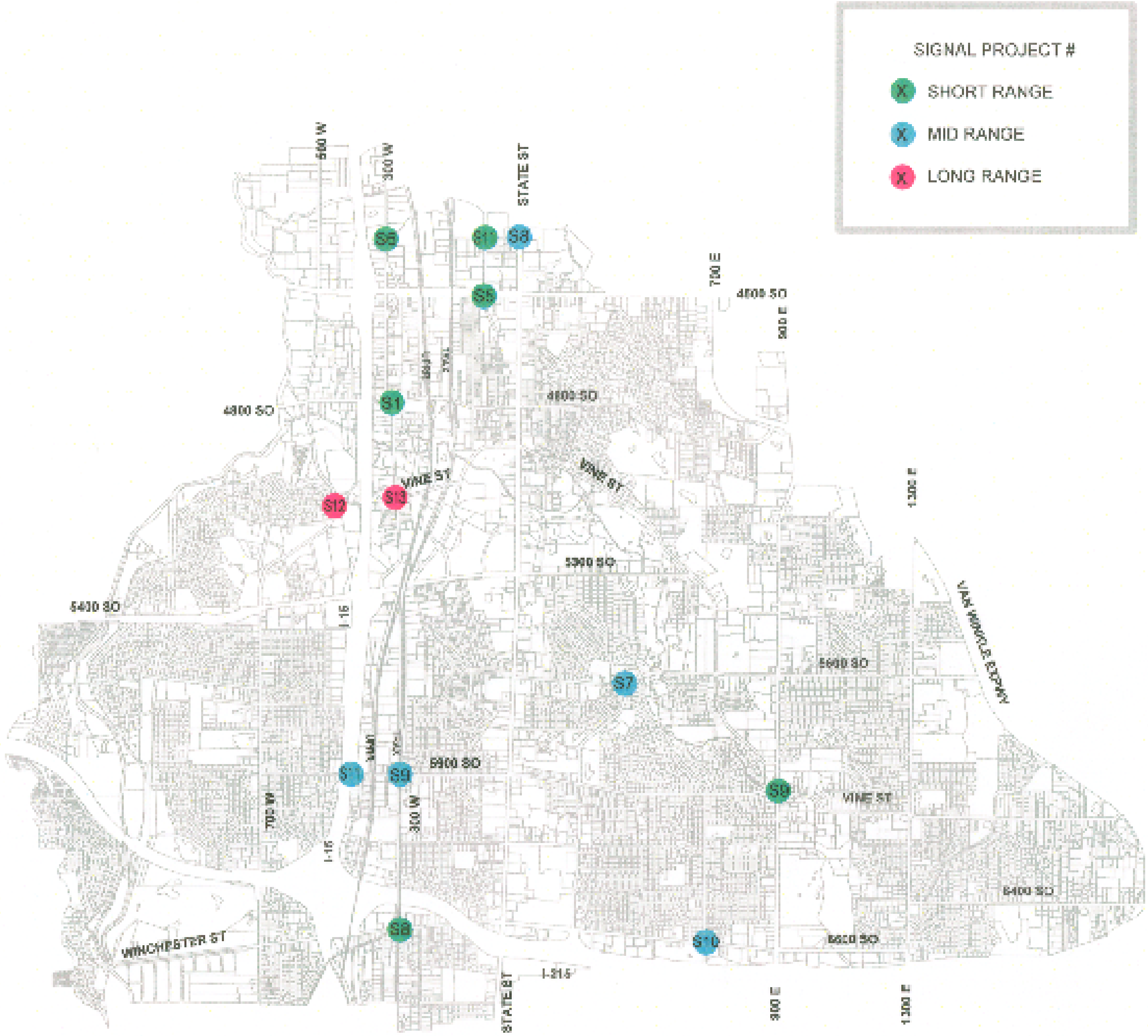
PROJECT S10: Winchester (6600 South) and 725 East intersection.	**ISSUE:** Signal	RANGE: MID
Upgrade signal to 4- or 8-phase signal, with isolated left turn lane onto 725 East.		
COST: $150,000	FUNDING: 100% City	

PROJECT S11: Commerce Drive (380 West) and 5900 South.	**ISSUE:** Signal	RANGE: MID
New traffic signal.		
COST: $200,000	FUNDING: 100% City	

PROJECT S12: Vine Street and Murray Boulevard intersection signal upgrade.	**ISSUE:** Signal	RANGE: LONG
Upgrade signal from 4- to 8-phase signal.		
COST: $75,000	FUNDING: 100% City	

PROJECT S13: Commerce Street (300 West) and Vine Street intersection signal upgrade.	**ISSUE:** Signal	RANGE: LONG
Upgrade signal from 4- to 8-phase signal.		
COST: $75,000	FUNDING: 50% City 50% Exactions	

FIG. 8-3 SIGNAL PLAN



9. FUNDING SOURCES

Several funding sources are available to the City to provide the necessary financing to implement the projects listed in the Transportation Plan. Below is a brief description of the most common sources and a more detailed listing can be found in Appendix I.

Federal Funding Sources Most federal transportation funds are allocated through provisions in the Safe, Accountable, Flexible, Efficient, Transportation Equity Act.

Surface Transportation Program STP funds are flexible in that states and local governments can use the funding for projects on federal-aid highways, bridge projects on public roads, and transit capital projects. In Utah, STP funds are distributed on an annual basis through the Metropolitan Planning Organizations, which in Salt Lake County is the Wasatch Front Regional Council. A committee, on which every city has a vote, allocates funding to projects. Fifty percent of STP funds are distributed based on population, 30% are distributed statewide, 10% are distributed based on priority of safety projects, and 10% are allocated to transportation enhancements funds.

The highway safety designated components of the Surface Transportation Program sets aside funding for safety improvements. These funds may be used on any public road for activities related to rail-highway crossings and hazard elimination projects.

Congestion Mitigation/Air Quality Program (CMAQ) The CMAQ program funds projects in air quality non-attainment and maintenance areas for ozone, carbon monoxide, and small particulate matter (PM-10) that aim to reduce vehicle emissions. Examples of these projects include bicycle trails that demonstrate a reduction in vehicle miles of travel (VMT) and projects to improve intersection delay. Like STP funds, CMAQ funds are also administered by the Wasatch Front Regional Council.

Transportation Enhancements Transportation Enhancement funding is available for activities that are designed to "strengthen the cultural, aesthetic, and environmental aspects of the Nation's intermodal transportation system." Funds from this program go to local governments to implement projects such as restoring historic transportation facilities, bicycle and pedestrian facilities, landscaping and scenic beautification, and mitigating water pollution from highway runoff. Transportation Enhancements are funded through the Enhancements Committee of the Utah Department of Transportation (UDOT).

State Funding Sources Several sources of transportation funding are programmed at the state level. Some of these sources are eligible for use on roads other than State Highways, while others must be used only on State Highways. The City may also utilize funds from the state's sidewalk and bridge replacement programs.

B&C Road Funds Class B&C road funds are distributed by the State to cities and counties for the construction and maintenance of public highways, roads or streets that are maintained to certain minimum standard and over which a normal two-wheel drive vehicle would be able to travel. Included in the list of permissible uses of these funds are equipment purchase, sidewalks, curb, gutter, and federal matching grants, among many others.

High Hazard Elimination Projects This funding source applies to State Highways only and includes a variable amount of money that is competitive on a statewide basis. Requests should be submitted to the UDOT Headquarters Traffic and Safety Division. Accident rates, cost estimates, traffic volumes, and other information are evaluated on a formula basis and improvements are ranked statewide.

Spot Improvement Funds Similar to High Hazard Elimination projects, spot improvements are funded statewide and are only eligible for State Highways. These projects are generally smaller in scale than High Hazard Elimination Projects and are also requested, evaluated, and coordinated at the UDOT Headquarters Traffic and Safety Division.

Signing and Striping Improvements Direct requests for speed limit signs, animal crossing signs, and related small scale striping and signing changes on State Highways can be made directly to UDOT Region 2. These projects can generally be absorbed within short-term programming at the region and can be requested via phone call, email, or regular mail. Specific requests that include schematic design drawings, quantity estimates, and other justification data might be more readily funded.

Drainage and Maintenance Requests Similar to signing and striping, requests to address drainage and other maintenance issues on State Highways should be made directly to the Maintenance Area at the Region.

Local Funding Sources The budget for the City of Murray includes two primary categories for transportation costs including both capital and maintenance costs. The first is using money from the General Fund, which for transportation is primarily money from Class C road funds. The second is from the Capital Projects Fund. Currently the City has allocated 25% of sales tax revenue to the Capital Projects Fund; however, this money is not always used for transportation projects and may be adjusted by the City Council. Special Improvement Districts are also utilized to fund transportation and other improvements that are clearly defined to assess those property owners benefiting from the project.

While general fund appropriations are important in funding transportation priorities, the bulk of local capital projects funding will be through sales tax revenue. Local funding also includes the portion of the Statewide Gas Tax distributed to cities in the form of Class C road funds. Class C road funds are distributed at an existing rate of 25% of (net) gas tax revenue (since transfers to other purposes are diverted from the gross total) based on a ratio of population, road mileage, and land area. Class C road funds are typically used for maintenance projects and spot improvements rather than large-scale capital projects.

Local general fund and other local contributions to transportation have been utilized somewhat inconsistently based on need and political will. According to more regional trends by the WFRC, local contributions to transportation can be expected to exceed the present level of Class B - C revenue.

See Appendix I for a more complete listing of funding sources.