Murray City 2021
Transportation Master Plan

avenue CONSULTANTS

Parametrix

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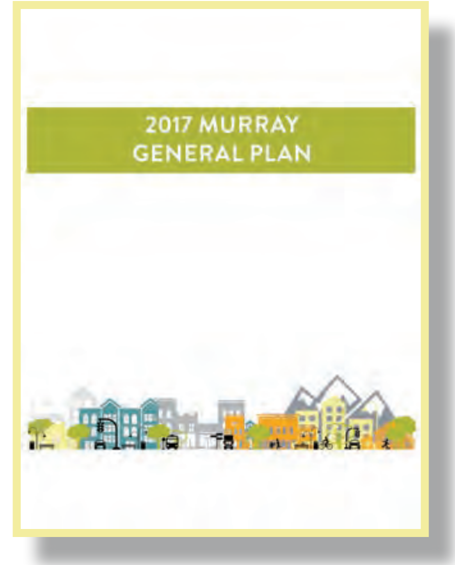
1 EXECUTIVE SUMMARY

This chapter identifies the transportation goal and objectives while summarizing the Capital Facilities Plan. It includes the final list of phased projects.

Murray City is growing, and this Transportation Master Plan (TMP) provides a fundamental resource to help the city prepare for the anticipated changes. Future needs are determined by assessing the current road, transit, and active transportation performance, and then necessary improvements are identified to support the city's growth. This TMP will help Murray prepare for a future community that is connected, inviting, beautiful, and provides mobility options to everyone.

The Murray City General Plan is a guide for growth in the community, and includes elements of land use, housing, economics, parks, and transportation. The General Plan includes a Transportation goal and objectives designed to promote transportation choice, and safety for all modes in Murray. The goal and objectives are:



Goal

Provide an efficient and comprehensive multi-modal transportation system that effectively serves residents and integrates with the regional transportation plan for the Wasatch Front.

Objectives

- *Provide safe and efficient movement of traffic*
- *Promote the use of alternative transportation*
- *Utilize corridors to showcase the City*
- *Optimize existing transportation network*
- *Enhance connectivity between key destinations*
- *Promote transit oriented development*
- *Connect adjacent land uses with transportation/mobility*
- *Support regional cooperation and coordination*

***"Guide growth to promote prosperity and sustain a high quality of life for those who live, work, shop, and recreate in Murray."* ~ Goal and Mission of the Murray City General Plan**

This TMP shares the goals of the General Plan while focusing on improving safety and accommodating all modes of transportation.

Organized into six chapters, This TMP includes: analysis of Existing Conditions (chapter 2), model outputs included to help tell the story of Future Conditions (chapter 3), documentation of community feedback through Public Outreach (chapter 4), a section on Travel Demand Management Strategies (chapter 5), and finally a complete and phased Capital Facilities Plan (chapter 6), which includes guidance for implementation and funding for projects.

This Plan focuses on improving safety across Murray's transportation network. Discussion about pedestrians and bicyclists is found throughout this TMP. This document conveys the understanding that Right of Way (ROW) is public space and it should therefore be made available to, and shared by all transportation users.

Perhaps the most important part of the Transportation Master Plan is Capital Improvement Projects. These projects represent the needs of the growing community. On the following pages are Tables 1-1 through 1-3, which show the planned projects in Murray by phase, and Figure 1-1, which is the map showing each project's location within the City.

Figure 1-1: Projects by Phasing

Table 1-1: Phase I Projects

Phase	#	Project	Location	Type	Funding	Total Cost	Murray City Total
2021-2030	1	Hanauer / Box Elder Street	Vine Street to 4500 South	New Construction / Widening with Bike Lanes	Murray City/WFRC	$10,100,000	$684,000
	2	Cottonwood Street	South City Limit to 5600 South	Widen: 2 to 3 Lanes with Bike Lanes	Murray City	$6,500,000	$6,500,000
	3	Murray Boulevard / 500 West	5400 South to 4500 South	Widen: 3 to 5 Lanes with Bike Lanes	Murray City	$7,280,000	$7,280,000
	4	500 West	4500 South to North City Limit	Restripe/Widen: 2 to 3 Lanes with Bike Lanes	Murray City	$1,587,000	$1,587,000
	5	Commerce Drive	Central Ave to 5900 South	Restripe/Widen: 2 to 3 Lanes with Bike Lanes / Sidewalks	Murray City	$1,059,000	$1,059,000
	6	Vine Street	1300 East to Vanwinkle	Widen: 2 to 3 Lanes with Bike Lanes / Sidewalks	Murray City/WFRC	$5,676,000	$386,000
	7	5300 South / College Drive	5300 South / College Drive	Intersection Improvements	Murray City/CMAQ	$2,400,000	$550,000
	8	Cottonwood Street	5600 South to Vine Street	Restripe with Bike Lanes	Murray City	$310,000	$310,000
	9	Murray Blvd / College Drive	Murray Blvd / College Drive	New Traffic Signal	Murray City	$430,000	$430,000
	10	4800 South	West City Limit to 200 West	Restripe: 2 to 3 Lanes with Bike Lanes	Murray City	$88,000	$88,000
	11	Cedar Street	Clay Park Dr to 6100 South	Add Sidewalk	Murray City	$413,000	$413,000
	12	5600 South	Fashion Blvd to 900 East	Restripe with Bike Lanes	Murray City	$96,000	$96,000
	13	4800 South	200 West to State Street	Mill/Overlay with Restripe: 2 to 3 Lanes with Bike Lanes	Murray City	$443,000	$443,000
	14	700 West / Winchester Street	700 West / Winchester Street	Intersection Improvements	Murray City/CMAQ	$2,258,000	$153,000
	15	4800 South/State Street	4800 South/State Street	Intersection Improvements	Murray City	$750,000	$750,000
	16	5400 South/700 W	5400 South/700 W	East/West Dual Left Turns	Murray City	$750,000	$750,000
	17	6600 South / Union Park Ave	6600 South / Union Park Ave	Intersection Improvements	Murray City	$674,000	$674,000
				PHASE I Total		**41,064,000**	**22,403,000**

Table 1-2: Phase II Projects

Phase	#	Project	Location	Type	Funding	Total Cost	Murray City Total
2031-2040	18	5600 South	900 East to 1300 East	Widening with Bike Lanes / Sidewalks	Murray City	$6,957,000	$555,000
	19	900 East	South City Limit to North City Limit	Restripe/Minor Widening with Bike Lanes / Sidewalks	UDOT	$10,721,000	$-
	20	Main Street	4500 South to North City Limit	Restripe with Bike Lanes / Minor Widening	Murray City	$505,000	$505,000
	21	4500 South / State Street	4500 South / State Street	Intersection Improvements	UDOT	$1,303,000	$-
	22	Fireclay Ave	Main Street to State Street	Add Sidewalk	Murray City	$292,000	$292,000
	23	Edison Street	Main Street to State Street	Add Sidewalk	Murray City	$123,000	$123,000
	24	4500 South / Atwood Blvd	4500 South / Atwood Blvd	New Traffic Signal	UDOT	$1,300,000	$-
	25	600 East	4700 South to 4500 South	Add Sidewalk	Murray City	$699,000	$699,000
	26	Atwood Boulevard	4800 South to 4500 South	Add Sidewalk	Murray City	$223,000	$223,000
	27	4800 South / Atwood Blvd	4800 South / Atwood Blvd	New Traffic Signal	Murray City	$430,000	$430,000
	28	4800 South / Cherry Street	4800 South / Cherry Street	New Traffic Signal	Murray City	$430,000	$430,000
	29	5300 South / State Street	5300 South / State Street	Intersection Improvements	UDOT	$8,600,000	$-
	30	Vine Street / State Street	Vine Street / State Street	Intersection Improvements	UDOT	$1,047,000	$-
	31	5460 South	State Street to 235 East	Widen: 2 Lanes with Parking	Murray City	$796,000	$796,000
	32	Vine Street	Murray Boulevard to Commerce Drive	Restripe: 2 to 3 Lanes with Bike Lanes and Sidewalks / Minor Widening	Murray City	$512,000	$512,000
	33	Bullion Street	1300 West to 1250 West	Widen: 2 Lanes with Sidewalk	Murray City	$975,000	$975,000
	34	5600 South	State Street to Fashion Blvd	Restripe with Bike Lanes	Murray City	$141,000	$141,000
	35	5900 South	700 West to 900 East	Restripe with Bike Lanes	Murray City	$429,000	$429,000
	36	6100 South	300 West to Fashion Boulevard	Restripe with Bike Lanes	Murray City	$60,000	$60,000
	37	Jefferson Street	Lenora Joe Cove to Winchester St	Widen with Sidewalks	Murray City	$608,000	$608,000
	38	Lester Avenue	Jefferson St to State St	Add Sidewalk	Murray City	$1,366,000	$1,366,000
	39	6200 South / State Street	6200 South / State Street	New Traffic Signal	Murray City	$750,000	$750,000
	40	5900 South / State Street	5900 South / State Street	Intersection Improvements	UDOT	$2,416,000	$-
	41	4800 South	State Street to 700 East	Restripe: 2 to 3 Lanes with Bike Lanes	Murray City	$297,000	$297,000
	42	6400 South	1300 to Van Winkle Expressway	Widen with Sidewalks	Murray City	$3,824,000	$3,824,000
	43	700 West	South City Limit to 5400 South	Restripe: 2 to 3 Lanes with Bike Lanes	Murray City	$985,000	$985,000
				PHASE II Total		**45,789,000**	**14,000,000**

Table 1-3: Phase III Projects

Phase	#	Project	Location	Type	Funding	Total Cost	Murray City Total
2041-2050	44	5300 South / Woodrow Street	5300 South / Woodrow Street	Intersection Improvements	UDOT	$1,349,000	$-
	45	5300 South / Commerce Drive	5300 South / Commerce Drive	Intersection Improvements	UDOT	$8,600,000	$-
	46	Winchester Street	1200 West to 700 West	Widen: 2 to 3 Lanes with Sidewalks	Murray City	$3,831,000	$3,831,000
	47	Fashion Boulevard	6300 South to 6200 South	Add Sidewalk	Murray City	$162,000	$162,000
	48	5290 South	900 East to 1300 East	Add Sidewalk	Murray City	$324,000	$324,000
	49	Fashion Blvd	6100 South to 5600 South	Restripe with Bike Lanes	Murray City	$262,000	$262,000
	50	1300 East	I-215 to 5290 South	Widen/Restripe with Bike Lanes	Murray City	$2,356,000	$2,356,000
	51	115 West	6100 South to 6000 South	Add Sidewalk	Murray City	$274,000	$274,000
	52	Main Street	6100 South to 5900 South	Add Sidewalk	Murray City	$223,000	$223,000
	53	5770 South	State Street to Fashion Blvd	Restripe: 2 to 3 Lanes	Murray City	$94,000	$94,000
	54	Alpine Drive	Avalon Dr to 5300 South	Add Sidewalk	Murray City	$344,000	$344,000
	55	5400 South / 630 East	560 East to Woodoak Ln	Add Sidewalk	Murray City	$313,000	$313,000
	56	5400 South / 550 East	5400 South / 550 East	Intersection Improvements	Murray City	$498,000	$498,000
	57	5600 South / 800 East	5600 South / 800 East	New HAWK Traffic Signal	Murray City	$1,587,000	$1,587,000
	58	1045 East	5290 South to 5150 South	Add Sidewalk	Murray City	$143,000	$143,000
	59	4500 South	Jordan River to I-15	Add Trail	UDOT	$115,000	$-
	60	4500 South	Main Street to 700 East	Widen with Bike Lanes	UDOT	$6,544,000	$-
	61	725 East	South City Limit to 5900 South	Restripe with Bike Lanes	Murray City	$88,000	$88,000
				PHASE III Total		**27,107,000**	**10,499,000**

Chapter 6 includes the full detailed description of the Capital Facilities Plan.

2 EXISTING CONDITIONS

This chapter summarizes the current transportation system and how it is performing across Murray

Current Land Use

In order to analyze the transportation system and plan for future growth it is essential to understand zoning and land use patterns within the area. Transportation is a daily requirement for most of the public as people travel from their homes to work, shopping, schools, health care facilities, and recreational opportunities. Zoning and land use patterns must function cohesively with the transportation system to support a high quality of life and promote economic development within Murray.

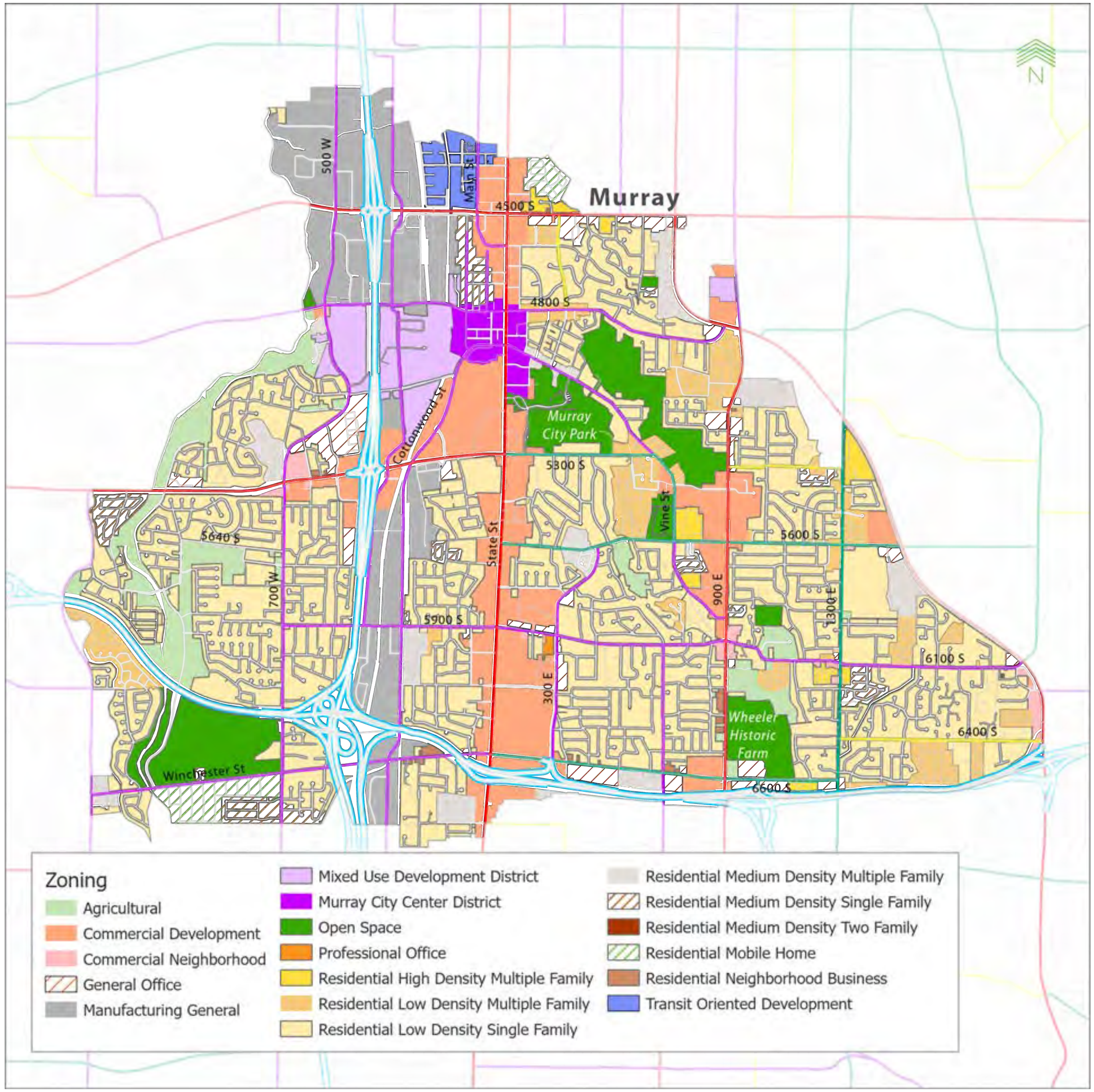
Almost 60% of Murray is zoned for residential family use, with 49% of this specifically designated for single family use. Throughout the rest of the city there is a variety of other zoning types.

Manufacturing primarily exists along the I-15 corridor and makes up 10% of zoned land. The total area in the city designated for Commercial Use is just over 13%. Mixed Use is 5%, which includes Transit Oriented Development and the Murray City Center District, all of which are types of mixed-use zones with very similar code requirements.

All of these land uses generate different travel patterns and this document will plan to accommodate for those generated trips, both coming and going to Murray.

Figure 2-1 is a map of Murray's current zoning.

Figure 2-1: Current Land Use



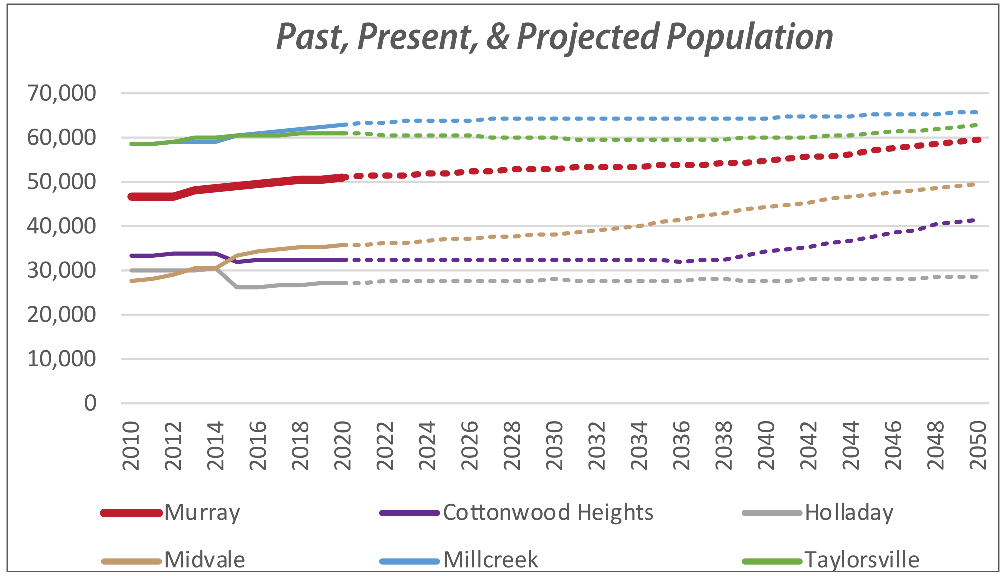
Demographics

Murray's population is increasing at a moderate and manageable rate. As infill development increases density and new housing options, Murray will have to adapt its transportation network to meet the needs of its residents. Knowing who lives in the city helps to make informed decisions about how to best provide appropriate transportation and mode choices within its borders. Since Murray is centrally located in the valley it is also affected by the growth surrounding it. Figure 2-2 shows current and predicted populations for Murray and neighboring cities.

Between 2010 and 2020 Murray's population grew almost 10%, which adds up to about 4,500 new residents to its current total of 51,184. This percentage increase is similar to Salt Lake County as a whole, which has experienced an increase just above 10% since 2010. Cities bordering Murray have seen both increases and decreases in population over the past decade. Midvale has added almost 8,000 residents, which is a 28% population increase. Both Holladay and Cottonwood Heights experienced a decrease in population over the same time period. Table 2-1 shows the population change between the years 2010 to 2020

Overall, Murray's population is predicted to slowly, but steadily climb towards the middle of the century, with population expected to reach approximately **60,000** by 2050.

Figure 2-2: Population Trend Comparison Graph



Source: US Census & WFRC TAZ Model

Table 2-1: Population Change Over Time

Population Change from 2010 to 2020				
	2010	2020	# Residents Added or Lost	% Change
Murray	46,742	51,184	4,442	9.5
Cottonwood Heights	33,638	32,707	-931	-2.7
Holladay	30,127	27,407	-2,720	-9.0
Midvale	27,994	35,823	7,829	28.0
Millcreek	58,729	62,960	4,231	7.2
Taylorsville	58,696	60,933	2,237	3.8

Source: US Census & WFRC TAZ Model

Who Lives in Murray?

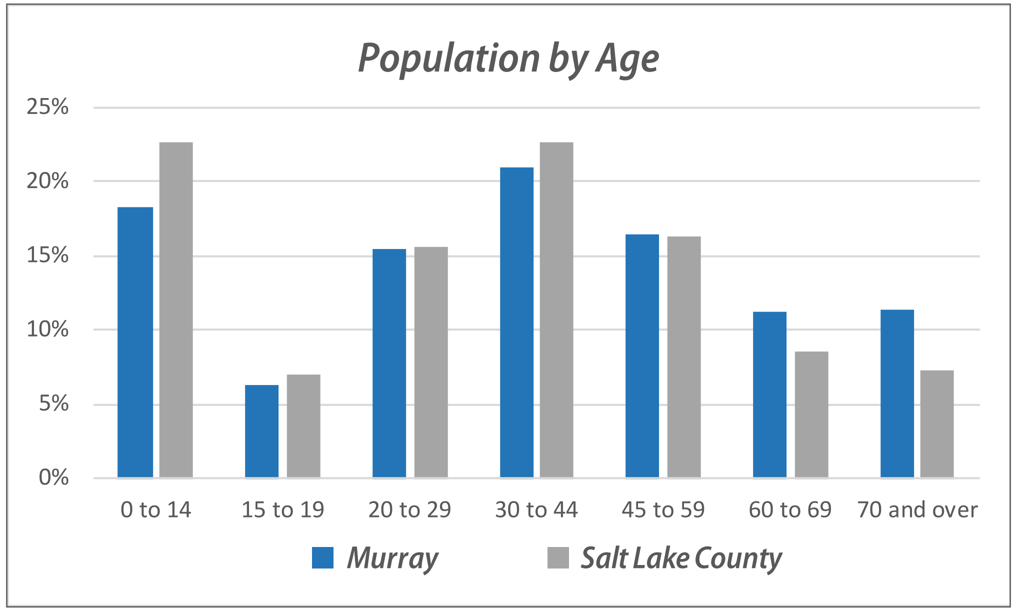
A well-functioning and resilient transportation network is one that provides access to mobility options for people of all ages and abilities.

The age of residents impacts how they interact with the transportation system. Of Murray's population an estimated 20% is under 16 years of age, and 11% is 70 or older. This combined total means that almost one-third of the City's population is either too young to drive or is approaching an age where the freedom of driving a personal vehicle may potentially become a more difficult transportation option to utilize.

Overall, Murray is slightly older than Salt Lake County, with 22% of the population over 60 years older compared to 16%. The aging population could impact Murray's transportation system as old drivers may struggle and others may be more reliant on transit or need mobility devices when walking.

Figure 2-3 shows population by age for Murray and Salt Lake County side by side.

Figure 2-3: Murray and Salt Lake County population by age



Source: US Census American Community Survey 1yr estimates (2018)

How Large are Murray's Households?

Although population is an important indicator in developing a transportation plan, households and housing provide a broader picture of how residential growth will affect transportation demand. The number of trips on the transportation network is estimated largely on the number and size of households. Table 2-2 summarizes the household size in Murray.

The average size is 2.4 persons per household, which is a smaller number than both the average for Salt Lake County and the State of Utah. All three of these regions have seen consistent population growth while the average household size has remained constant over the past decade.

Table 2-2: City, county, & state households

Household Comparisons Table			
Year	2010	2015	2018
Murray			
Population	46,271	48,460	49,118
HH units	19,469	19,522	20,025
Person Per HH	2.3	2.4	2.4
SLCo			
Population	1,000,155	1,078,958	1,120,805
HH units	357,013	372,990	390,308
Person Per HH	2.8	2.8	2.8
UT			
Population	2,776,469	2,995,919	3,161,105
HH units	880,025	930,980	998,891
Person Per HH	3.2	3.2	3.2

Source: US Census American Community Survey five year estimates (2018)

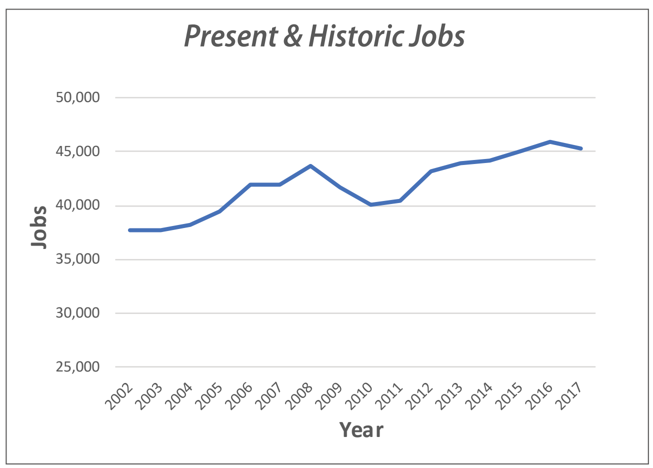
What are the Employment Options in Murray?

Murray has experienced steady job growth, with the exception of the 2008 recession, consistent with an expanding economy since the early 2000s. Figure 2-5 shows this growth.

There were approximately 45,000 jobs within Murray City in 2017. The number of jobs within the City from 2002 to 2017 is summarized in Figure 2-4. Since 2002, almost 15,000 jobs have been added to the City.

Murray is in a unique position as there are as many employees as residents. This means that weekday traffic will be higher than other bedroom communities.

Figure 2-4: Murray employment trend (2002 - 2017)



Source: https://onthemap.ces.census.gov/

Murray's top employers are mostly derived from the healthcare industry, as Table 2-3 shows. Intermountain Medical Center, Select Health, and T.O.S.H. Orthopedic Group, are the three largest employers in the City. Intermountain Medical Center and Select Health both are the only employers in Murray that have employees numbering in the thousands.

Table 2-3: Murray top employers

Top Employers	
Company	Workers
Intermountain Medical Center	5,000 - 6,999
Select Health	1,000 - 1,999
T.O.S.H.	500 - 999
Costco Wholesale	250-499
Geneva Rock Products	250 - 499
USA 3M Health Information Systems	250 - 499
Intermountain Employee Clinic	250 - 499

Source: Department of Workforce Services

*The Covid-19 pandemic has led to uncertainty in future economic predictions

Figure 2-5 is a map displaying where jobs are located in Murray. The locations where employment numbers are the highest are 5300 South, where Intermountain Medical Center is located, and along 6100 South and State Street, where Fashion Place Mall and a concentration of other commercial and retail businesses are found.

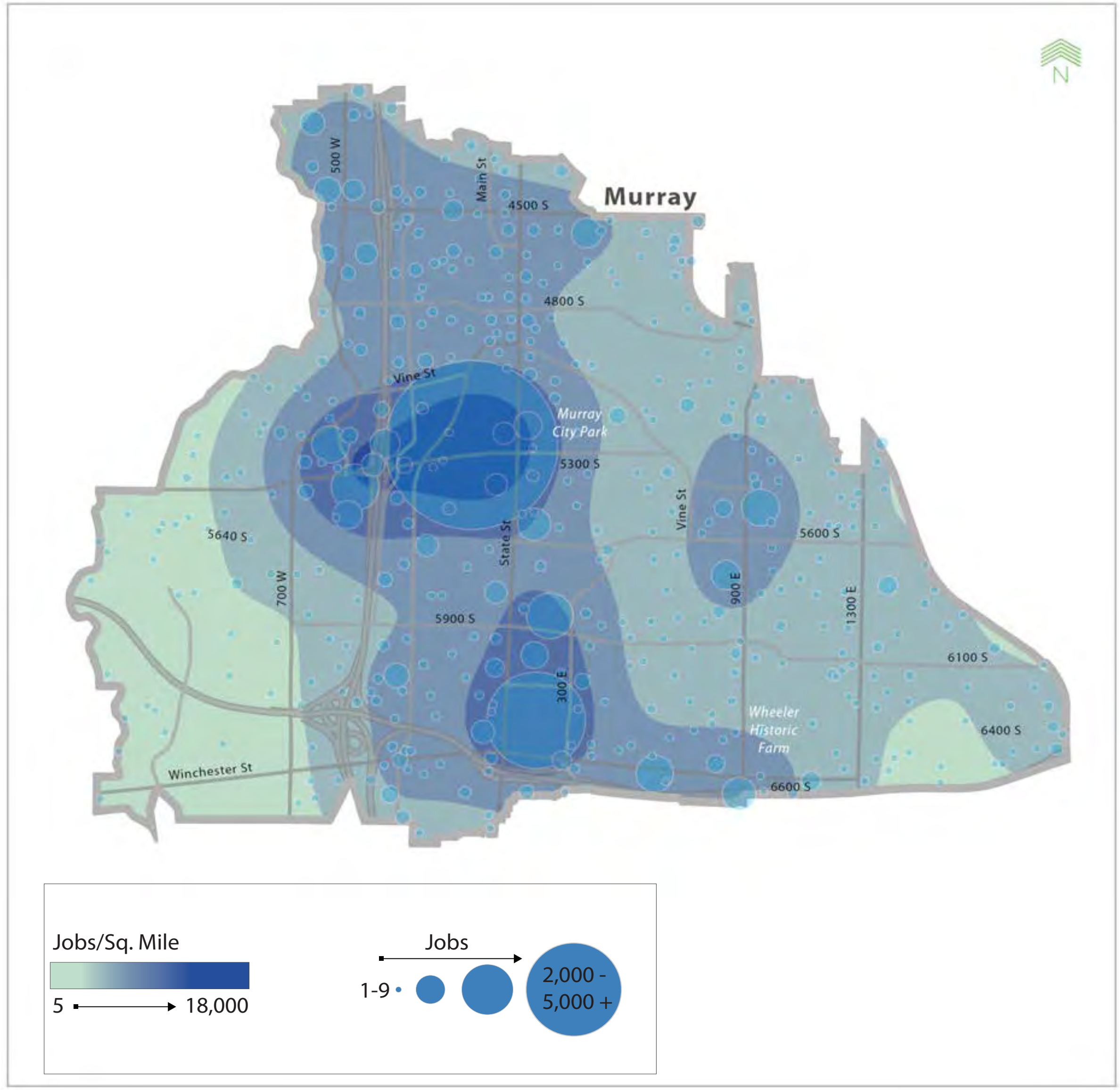
Table 2-4 shows the top employment industries in Murray. The Health care industry provides almost a quarter of all jobs. However, retail trade is 15.8% of total jobs and accommodation and food services create 6.3% of total jobs. Combined, the customer service jobs provided by retail and food service industries provide over 22% of total jobs in Murray.

Table 2-4: Top employment sectors

Top Industry Sectors		
Industry	**Number of Workers**	**Percent of Total Jobs**
Health Care and Social Assistance	10,754	23.60%
Retail Trade	7,197	15.80%
Professional, Scientific, and Technical Services	4,159	9.10%
Finance and Insurance	3,735	8.20%
Construction	3,724	8.20%
Accommodation and Food Services	2,892	6.30%
Administration & Support, Waste Management and Remediation	2,409	5.30%
Educational Services	2,213	4.90%
Manufacturing	1,811	4.00%

Source: https://onthemap.ces.census.gov/

Figure 2-5: Job density in Murray



Where Do Murray's Worker's Live?

Like many cities, there are many residents that live within Murray but are employed elsewhere. However, Figure 2-6 shows that Murray is a place of economic opportunity where almost twice as many people come into Murray for work every day than leave to go to work elsewhere. There are 3,225 residents, or about 12% of Murray's population who both live and work in the city.

The Neighboring city of Millcreek has a population of 62,960, which is about 20% larger than Murray. Table 2-5 shows their city worker in-flow and out-flow closely mirrors the daily pattern seen in Murray.

Salt Lake City, for comparison, has a population around 200,000, which is approximately four times that of Murray. The city sees a smaller percentage of people leaving for work compared to those who enter the city for work. Table 2-4 shows that almost 200,000 people come to Salt Lake City to work every day, while about one fourth of that number leaves the city to work. Over 14% of the City's working population both live and work in the city.

These existing commuting patterns help inform transportation investment decisions since people commuting into and out of the city for work can have a significant impact on the overall transportation system.

Figure 2-6: Murray employment inflow-outflow

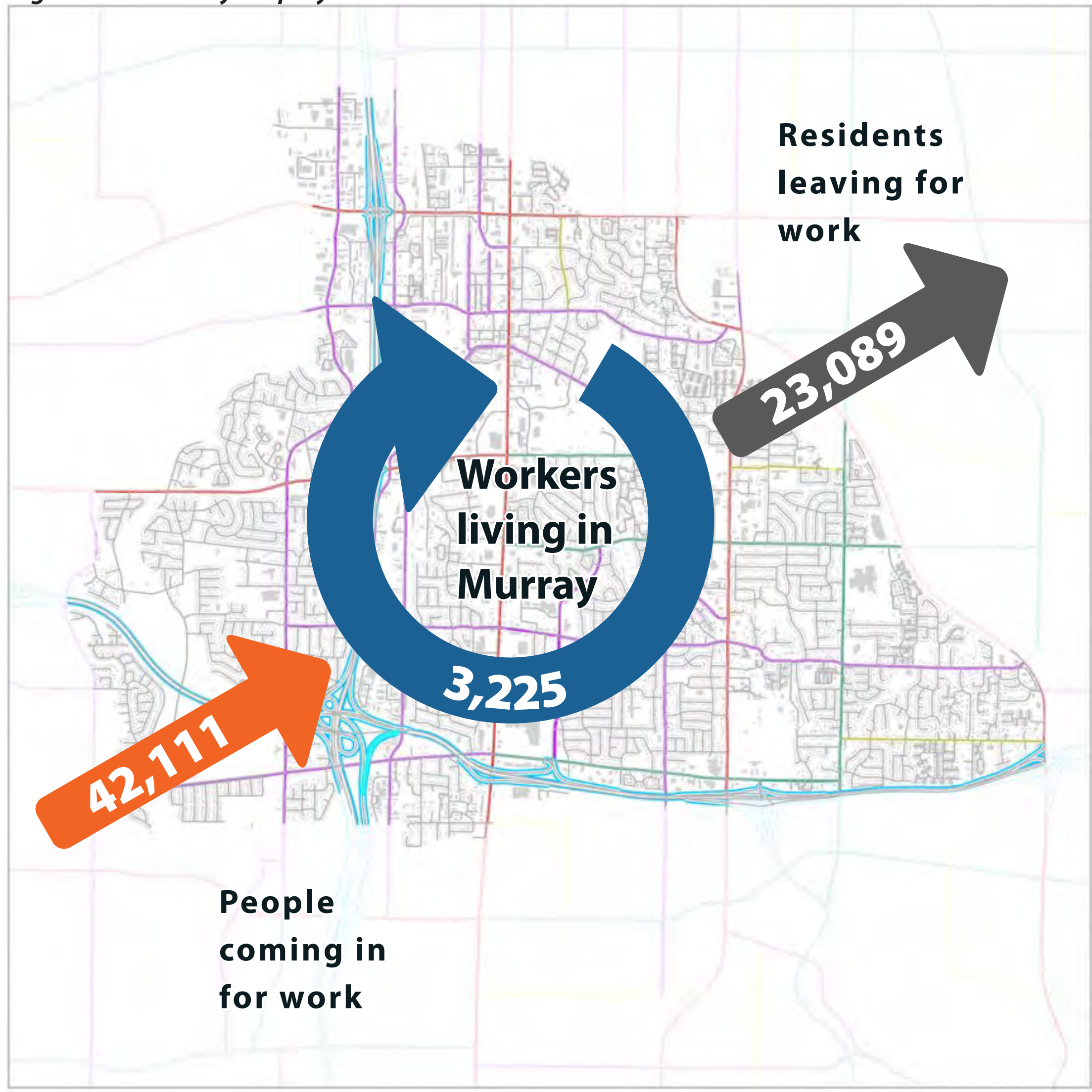


Table 2-5: Murray employment inflow-outflow table

City	Enter for Work	Live & Work in City (& Percent of Total Working Population)	Leave for Work
Murray	**42,111**	**3,225, 12%**	**23,089**
Millcreek	44,800	4,201, 14%	26,510
Salt Lake City	194,143	40, 378, 14%	53,801

Source: https://onthemap.ces.census.gov/

Transportation System

The transportation network in Murray is designed to support the community transportation vision. Opportunities exist to modify the current system to make a transportation network that provides viable choices to Murray residents. Improvements in the transportation network will involve making the system more accessible, safer, efficient, and overall more welcoming to alternative modes of travel.

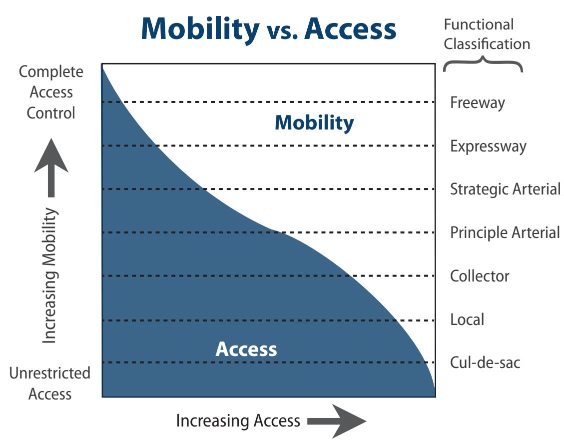
Roadway Functional Classification

Roadway functional classification is a means to categorize how a roadway functions and operates based upon a combination of roadway characteristics. Streets provide for two distinct and competing functions: mobility and land access. As mobility increases, land access decreases and vice versa as shown in Figure 2-7. Both functions are vital, and no trip is made without both. The classifications of roadways, with descriptions is in Table 2-6 on the following page and in the text below:

Roadway functional classification does not define the number of lanes required for each roadway's automobile capacity. For instance, a collector street may have two, three, or four lanes, whereas an arterial street may have up to nine lanes for motorized traffic. The number of lanes is a function of the expected automobile traffic volume on the roadway and serves as the greatest measure of roadway capacity for vehicles.

Freeways & Expressways – Freeway and expressway facilities are provided to service long distance trips between cities and states. No land access is provided by these facilities. I-15 and I-215 are freeways that run through Murray.

Figure 2-7: Mobility vs access



Arterials – Arterial facilities are designed to serve a high level of mobility providing fast flowing through-traffic movement but with low level land-access service. The traffic controls and facility designs are primarily intended to provide efficient through movement. 1300 East, 900 East, State Street, and 4500 South are examples of arterials in Murray. Arterials frequently provide the most direct route from A to B not only for automobiles but also for pedestrians, bicyclists and transit. These roads may offer wide shoulders that can accommodate buffered or separated bike lanes and can be choice locations for bus stops.

Collectors – Collector facilities are intended to serve both through and land-access functions in relatively equal proportions. For longer, through trips requiring high mobility such facilities are inefficient. Instead they are used for shorter trips requiring increased access to destinations. Commerce Drive, Winchester Street, and 4800 South are examples of collectors in Murray. For the bicyclist or pedestrian, collectors can offer a comfortable level of safety and a number of route choices because of lower vehicle speeds and a variety of access options to potential destinations.

Local Streets – Local streets primarily serve land-access functions. Local street 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 this facility. This level of street network is likely to provide the highest level of comfort to bicyclists and pedestrians. Local roads will have the lowest speeds and be mostly absent of large vehicles.

Murray's Functional Class:

Table 2-6 shows Murray's roadway classification from the city's engineering specifications and requirements document which was amended May 2019. Trip length, design speed, lane width and average daily trips are all part of the equation necessary to properly determine a roadway's best classification.

Table 2-7 below shows general characteristics for each classification such as whether parking is allowed and what percentage of a city's surface street system is made up of a specific roadway classification. The table indicates that the majority of roadways in a typical city are residential.

Table 2-6: Murray roadway classification table

Murray Roadway Classification	Use		Dimensions		Volume
	Trip Length (Miles)	Design Speed (MPH)	Lane Width(Feet)	Number of Lanes	Average Daily Trips (ADT in Thousands)
Freeway	>5	>65	12	6 - 8	80
Major Arterial	1 - 2	45 - 55	12	6	15 - 50
Minor Arterial	>1	40 - 45	12	3 - 5	10 - 25
Major Collector	1	30 - 40	12	2 - 5	3.5 - 10
Minor Collector	1	25 - 35	11 - 12	2 - 3	1.5 - 3.5
Local Street	<1	20 - 30	10 - 12	2	<1.5

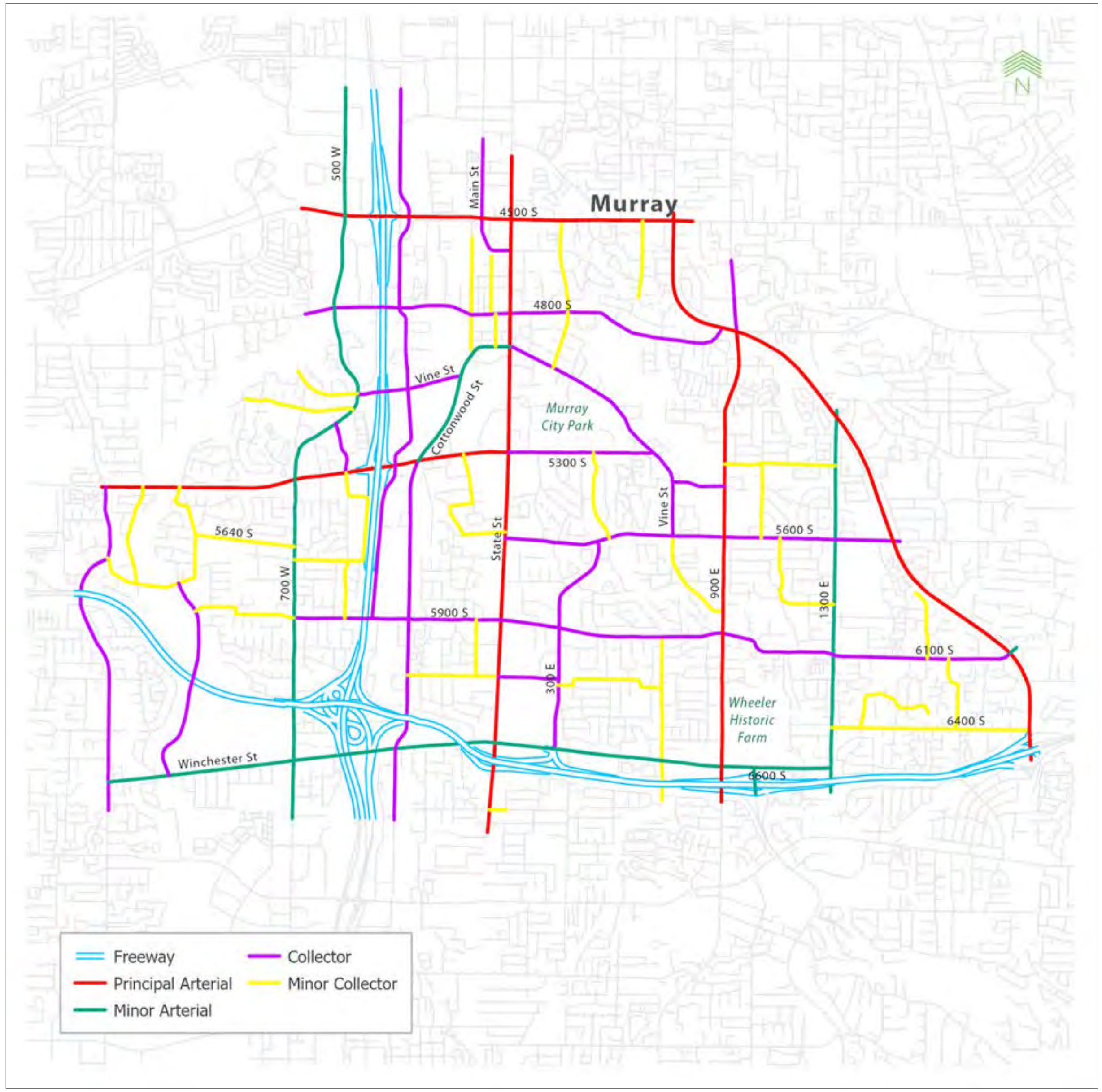
Table 2-7: Elements of functional classification table

	General Characteristics of Functional Classification			
	Freeway & Expressway	Arterial	Collector	Residential Street
Function	Traffic movement	Traffic movement, land access	Collect & distribute traffic between streets & arterials, land access	Land Access
Typical % of Surface Street System	Not applicable	5 - 10%	10-20%	60-80%
Continuity	Continuous	Continuous	Continuous	None
Spacing	See City's Engineering Standards and Specifications			
Typical % of Surface Street System Vehicle Miles Carried	Not applicable	40 - 65%	10-20%	10-25%
Direct Land Access	None	Limited: Major generators only	Restricted: Some movements prohibited; number & spacing of driveways controlled	Safety controls access
Minimum Roadway Intersection Spacing	See City's Engineering Standards and Specifications			
Speed Limit	See City's Engineering Standards and Specifications			
Parking	Prohibited	Discouraged	Limited	Allowed
Comments	Supplements capacity of arterial street system & provides high-speed mobility	Backbone of Street System		Through traffic should be discouraged

The existing functional class network for Murray is shown in Figure 2-8. The roadways are separated into functional classes by access as well as the general right-of-way width.

In Murray the majority of roadway surface is dedicated to local streets that provide access to homes. Many of these roads bend and curve and dead end in neighborhoods. The fewer, higher volume roads run straight for long distances creating larger, grid-like network. These roads make efficient and continuous north to south connections at areas like State Street, 900 East, and 1300 East, and the East to West connections are found along 6100/5900 South, Winchester Street/6600 South, and 4800 South.

Figure 2-8: Murray functional classification



Murray's Annual Average Daily Traffic Volume

Annual average daily traffic (AADT) is an estimation of how many cars travel along a specific street segment in a day.

This number is typically derived by recording traffic counts for an extended period of time on a specific street. After the traffic counts have concluded and the numbers are examined and determined to be representative of normal traffic behavior these data are then used to create an annual daily average.

Excluding I-15 and I-215, the streets in Murray with the highest AADT are 4500 S, State St, and Van Winkle to Highland Dr. These streets have speed limits between 40 mph to 50 mph, and multiple travel lanes in each direction. This combination of higher speeds and multiple lanes allows for a larger capacity of traffic volume. Figure 2-9 shows Murray's AADT (2017 is the most current and accurate available data).

Figure 2-9: Annual average daily traffic volume (2017)

Source: UDOT ; UPLAN data

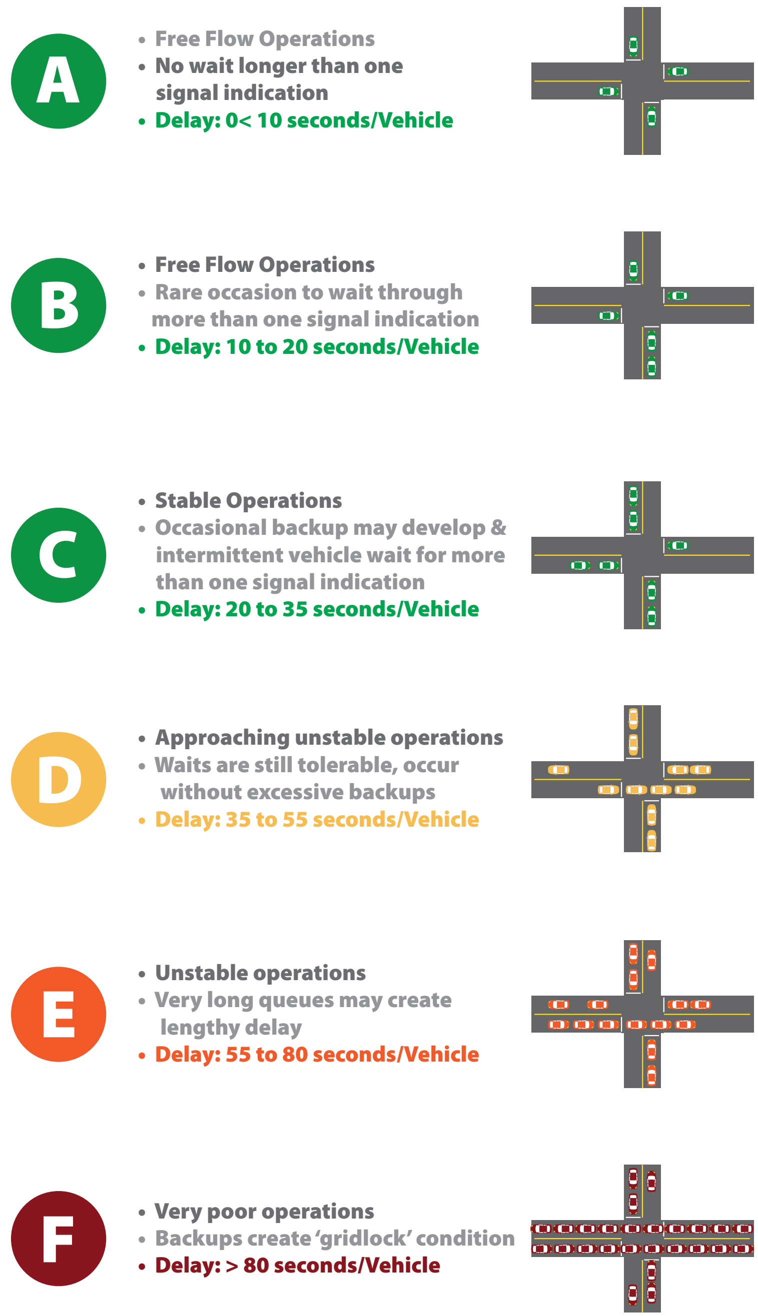
Level of Service

Roadway level of service is typically displayed in the relationship between the traffic volume and the roadway capacity (generally the number of lanes), or a V/C ratio. This ratio is represented as a letter grade ranging from A-F, much like letter grades assigned in school.

A-C are generally considered free-flowing traffic operations, and while some congestion occurs at LOS D, the transportation system is assumed to be adequate (not failing) at this level. Figure 2-10 explains what conditions need to exist for a road segment to receive a particular letter grade.

LOS D was identified as the planning goal for Murray in the peak traffic hours, meaning that LOS E and F are unacceptable. Although LOS D is a planning goal, roadway LOS may vary on a street-by-street basis. Roadway capacity cannot be scaled to exactly fit demand since demand varies by time of day, day of week, and time of year.

Figure 2-10: Level of service A-F



While the travel demand model is used to predict future traffic and level of service, it can also be used to estimate current conditions. Existing conditions were modeled with a 2019 base year for Murray. Figure 2-11 shows the existing LOS within Murray. Green roads have little or no traffic congestion corresponding to LOS A, B, while orange and red roads have "peak hour" traffic congestion. Currently, 5900 South experiences congestion during the peak hours. This is also true for 4500 South, 5900 South, Winchester, portions of Vine Street, and Fashion Boulevard. There are minimal delays on the other roadways in Murray.

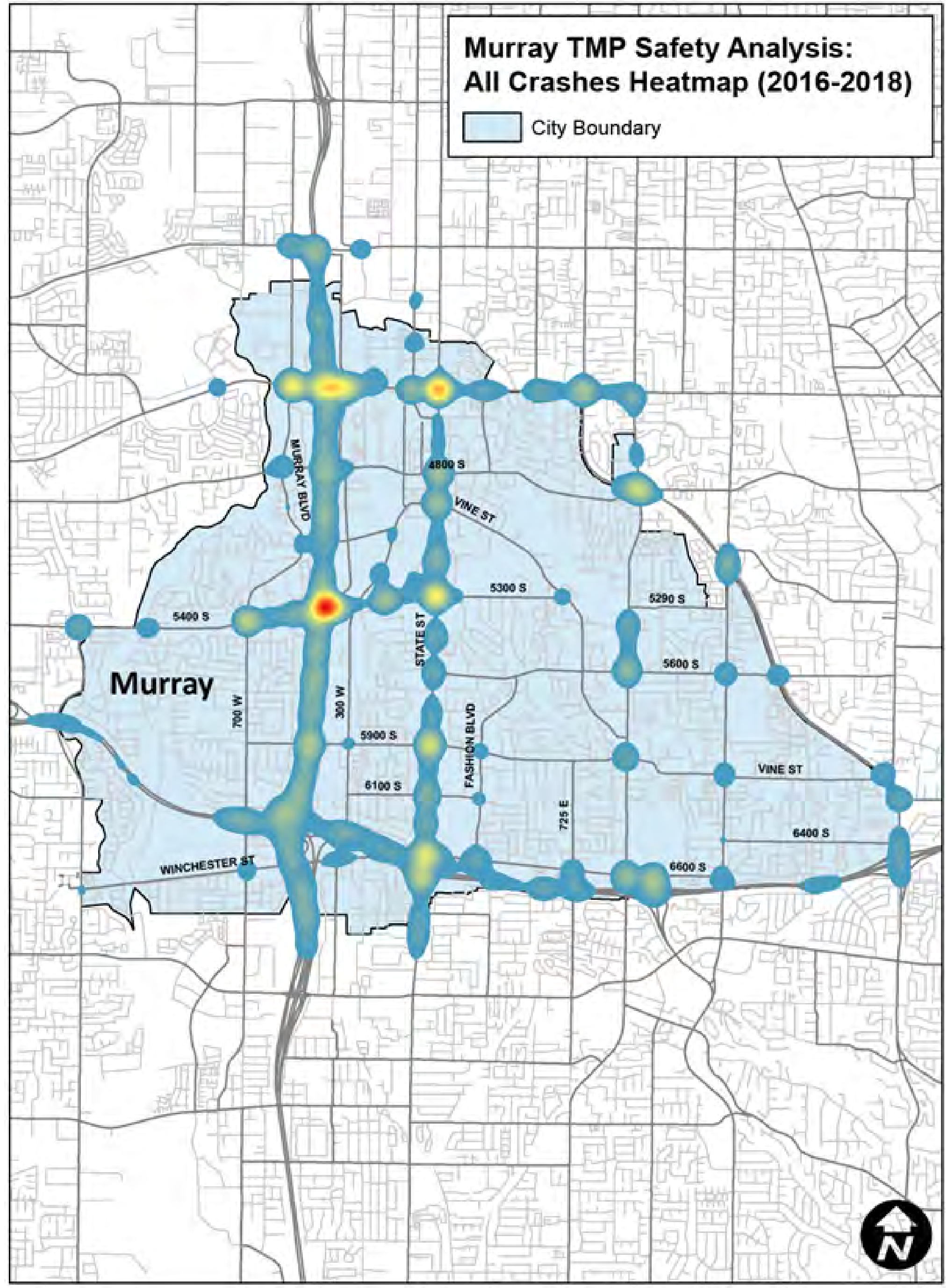
Figure 2-11: Existing level of service

Safety

City-wide Crashes

Between 2016-2018 there were 7,071 reported crashes within the city boundary. Figure 2-12 is a heat map of crash locations illustrating the highest concentrations of crashes within the city. The most predominant crash concentrations occurred at I-15 interchanges at 5300 South and 4500 South. Outside of I-15 and its access points, other notable hotspots occurred along State Street at intersections with I-215, 5900 South, 5300 South, and 4500 South.

Figure 2-12: All crashes heat map (2016-2018)



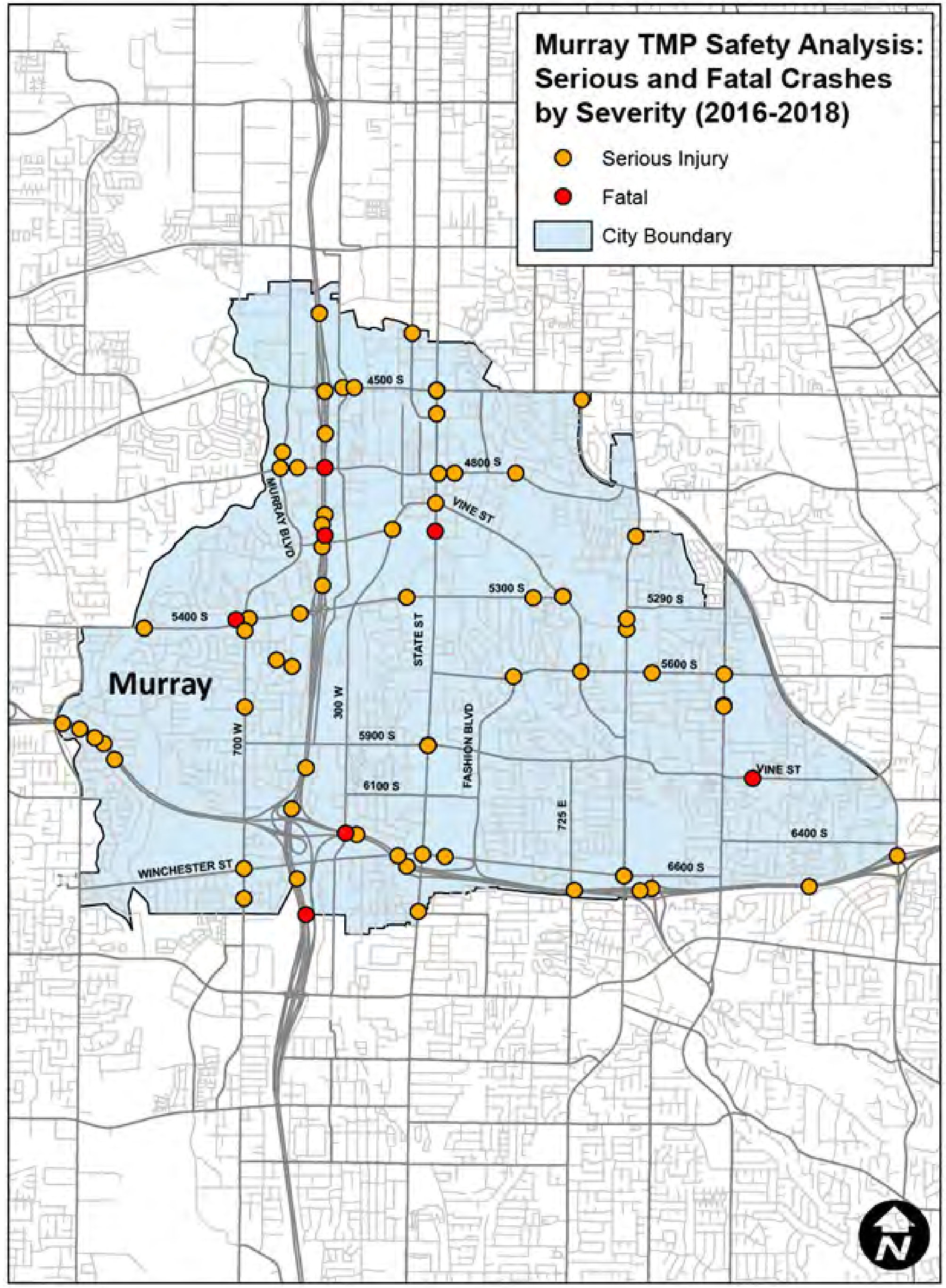
Note: Confidential: This data may be protected under 23 USC 409.

Fatal and Serious Injury Crashes:

Crash severity is reported according to a five-category scale ranging from no injury to fatality. There is considerable emphasis in Utah among safety agencies, transportation planners and engineers to eliminate fatal crashes. However, the low frequency of fatal crashes can result in an insufficient sample size to identify meaningful patterns. As a result, the next level of crash severity, serious injury crashes, is often included in a crash severity analysis.

Figure 2-13 illustrates the fatal and serious injury crashes in Murray City. For the analysis period, there were seven crashes with a fatality and 71 serious injury crashes. The number of fatal and serious injury crashes in Murray City as a percentage of total crashes is 1.1 percent, below Salt Lake County at 1.8 percent, and lower than all peer cities studied (Taylorsville, Midvale, Millcreek, and West Jordan). West Jordan had the highest percentage of fatal and serious injury crashes at four percent.

Figure 2-13: Crashes by severity (2016-2018)



Note: Confidential: This data may be protected under 23 USC 409.

Table 2- 8: Fatal and Serious Injury Crashes Peer Comparison (2016-2018)

Fatal and Serious Injury Crashes	
Murray City	78 (1.1%)
Midvale	45 (1.3%)
Salt Lake County	1,474 (1.8%)
Millcreek	59 (1.8%)
Taylorsville	104 (1.9%)
West Jordan	247 (4.0%)

Note: Confidential: This data may be protected under 23 USC 409.

Bicycle-Involved Crashes:

For 2016-2018, 47 vehicle crashes involving a cyclist occurred in Murray City. Figure 2-14 symbolizes the locations of these crashes by crash severity. There were no recorded cyclist fatalities during the study period, however there were several crashes that involved injuries – almost all of which occurred along major roads (collectors and arterials). Only two of the 47 incidents occurred on a minor (local) road, one of which had no injury and one possible injury. The majority of crashes occurred along State Street, where there are shoulders, but has no designated cyclist route. The shoulders do allow parking in most cases, but on-street parking is fairly infrequent, leading to unpredictable and inconsistent riding conditions. Murray has plans to expand the city's bike network which includes bike lane projects along state roads 900 East and 4500 South. The City should continue to coordinate with UDOT to improve safety along State Street.

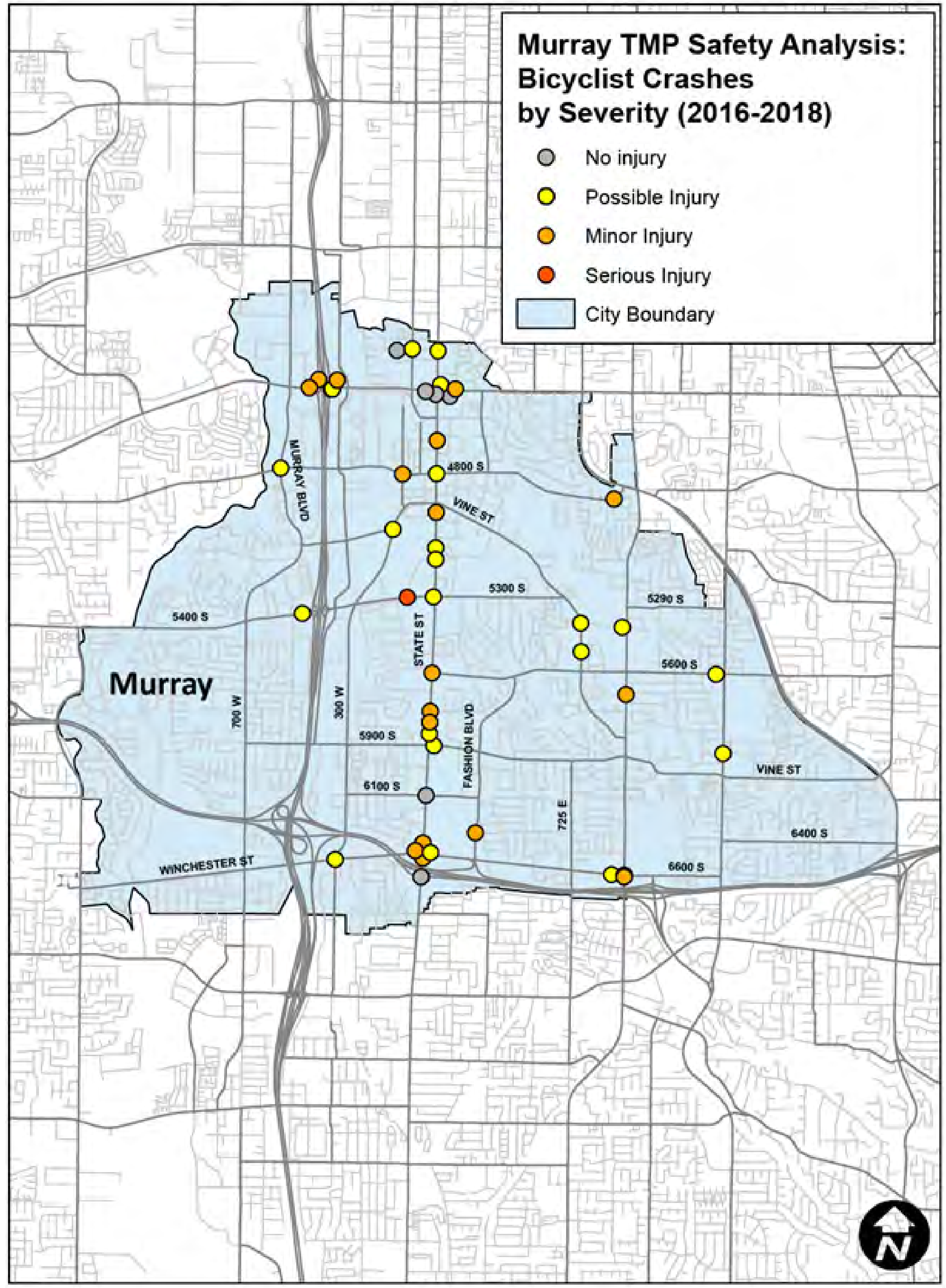
As shown in Table 2-9, the percent of all crashes involving a cyclist is higher in Murray City than in Midvale, equal to that of Taylorsville, but lower than West Jordan, Millcreek, and Salt Lake County. Millcreek had the highest percentage of bicycle-involved crashes at 1.2 percent.

Table 2-9: Bicycle-Involved Crashes Peer Comparison (2016-2018)

Bicycle-Involved Crashes	
Midvale	18 (0.5%)
Murray City	47 (0.7%)
Taylorsville	36 (0.7%)
West Jordan	51 (0.8%)
Salt Lake County	838 (1.0%)
Millcreek	40 (1.2%)

Note: Confidential: This data may be protected under 23 USC 409.

Figure 2-14: Bicycle crashes by severity (2016-2018)



Note: Confidential: This data may be protected under 23 USC 409.

Pedestrian-Involved Crashes

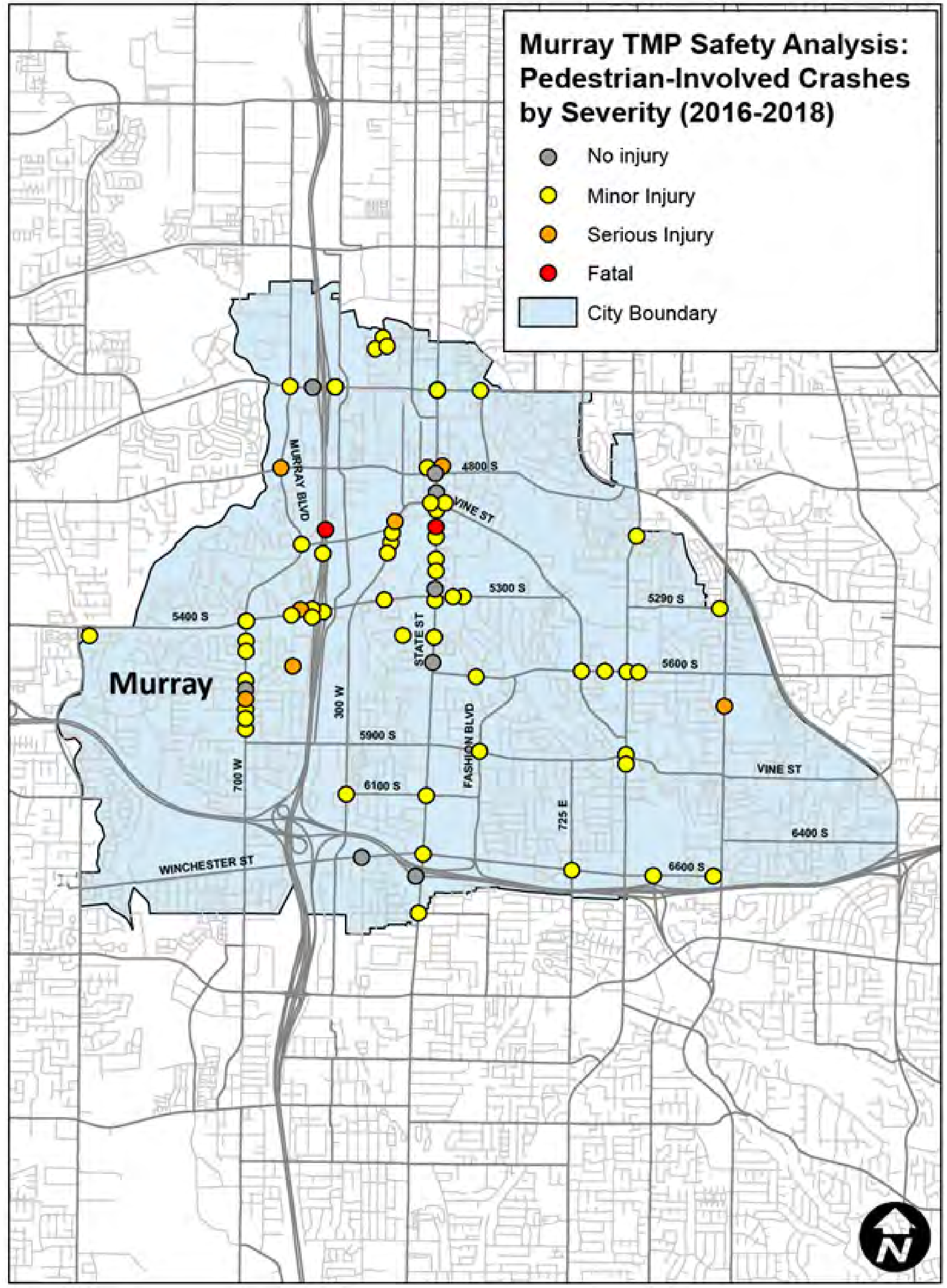
For 2016-2018, 79 vehicle crashes involving a pedestrian occurred in Murray. Figure 2-15 symbolizes the locations of these crashes by location. Clusters are found along State Street, 5300 South, and 700 West. The 700 West cluster coincides with land uses that drive high pedestrian activity, with an elementary, junior high, and two churches from 5900 South to 5400 South. There are several clusters of crashes located at intersections, with 56 of the 79 (70 percent) of the incidents located at an intersection.

Furthermore, 73 out of 79 (92 percent) crashes occurred along large roads, such as major collectors and arterials. State Street in particular had the highest number of pedestrian-related incidents. Traffic speed and volume along these larger streets are likely contributing factors. Pedestrian-related crashes also had a higher mortality rate than bicycle-related incidents, with two pedestrian fatalities during the study period (compared to zero cyclist). Most pedestrian incidents occurred during the day (67 percent) which is similar to day-light cyclist incidents (80 percent).

While within Murray, UDOT owned roads such as State Street and 5400 South are areas of concern for pedestrians. Mitigation measures should be coordinated between Murray and UDOT. It is recommended the City works with UDOT to address pedestrian crashes at signals.

The percent of crashes involving a pedestrian is lower in Murray than all peer cities studied, (see Table 2-10). Millcreek had the highest percentage of pedestrian-involved crashes at 2.1 percent.

Figure 2-15: Pedestrian-involved crashes



Note: Confidential: This data may be protected under 23 USC 409.

Table 2-10: Pedestrian-Involved Crashes Peer Comparison (2016-2018)

Pedestrian-Involved Crashes		
Murray City	**79**	**(1.1%)**
Taylorsville	82	(1.5%)
Midvale	59	(1.6%)
Millcreek	69	(2.1%)
West Jordan	92	(1.5%)
Salt Lake County	1,310	(1.5%)

Note: Confidential: This data may be protected under 23 USC 409.

Hotspots

City and State Route Crashes:

A large concentration of the vehicle activity in Murray City occurs on state routes. As such, most crash hotspots occur on state routes or at junctions with state routes where Murray City has limited influence to correct potential design deficiencies. Because of this, it is helpful to look at crashes off state routes to isolate potential hotspots where the city can influence change. Figure 2-16 shows a heat map of City and state crashes within Murray City.

Non-state corridors that stand out are 6600 South, 500 West/Murray Boulevard, 1300 East, and 5600 South. Table 2-11 shows intersection hotspots that involve City and State routes. Most of these hotspot intersections occur along notable and high traffic corridors, with the biggest hotspot occurring at the intersection of State Street and 6400 South.

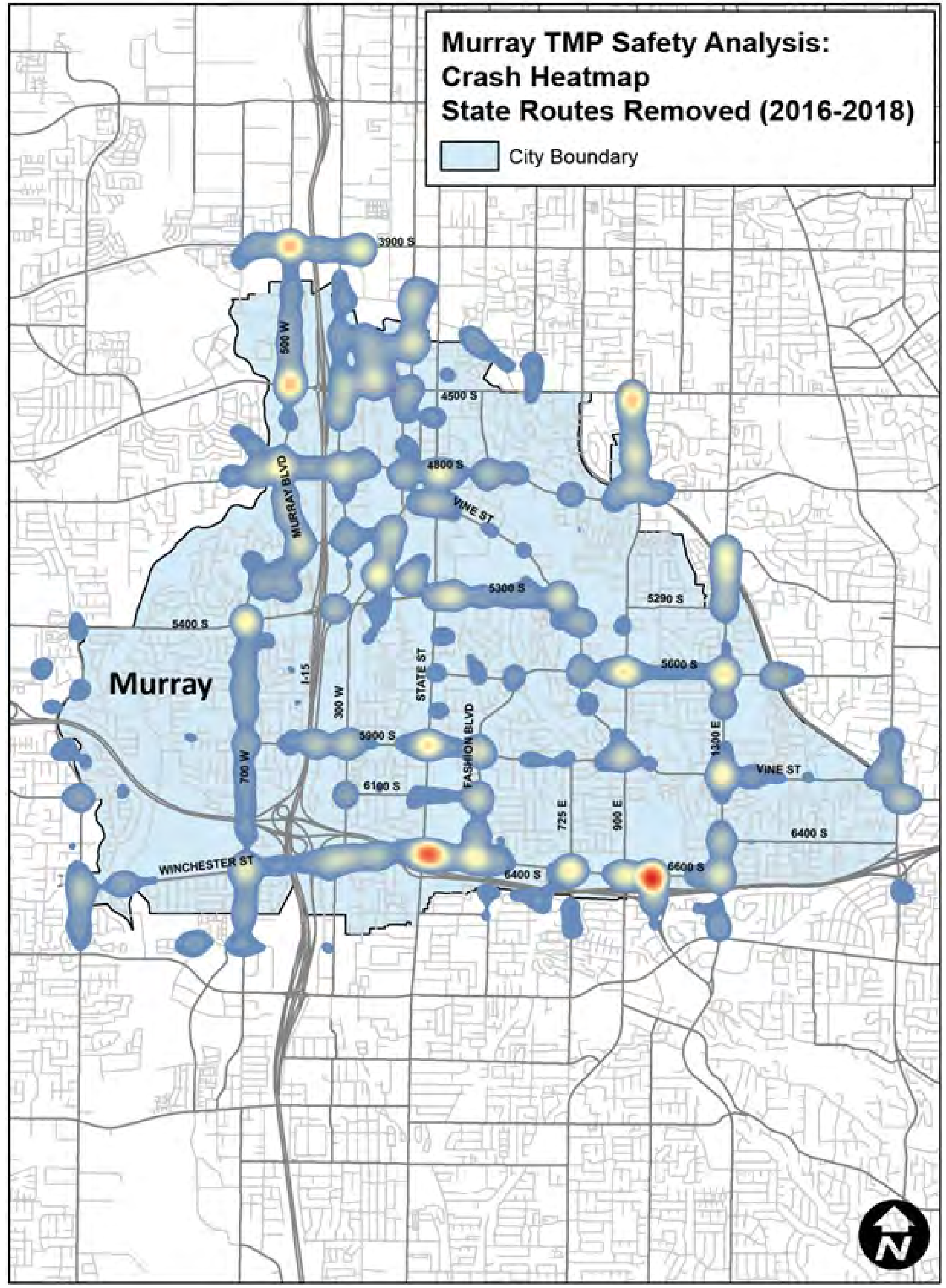
Table 2-11: City and State Route Hotspots (2016-2018)

Location	Total Crashes
State and City Intersections	
State Street and 6400 South	80
500 West and 4500 South	40
State Street and 5900 South	33
900 East and 5600 South	28
City Only Intersections	
Winchester and 700 West	76
Union Park Avenue and 6600 South	75
1300 East and 5600 South	30
1300 East and Vine	22
Murray Boulevard and Vine Street	13

Note: Confidential: This data may be protected under 23 USC 409.

Figure 2-16 highlights crashes on Murray controlled street. Several corridors have a concerning level of crashes, specifically Murray Boulevard, 900 East, 5900 South, and Winchester. Many of these safety issues are being addressed by the Capital Facilities Plan projects in chapter 6.

Figure 2-16: Crashes on City and state routes



Note: Confidential: This data may be protected under 23 USC 409.

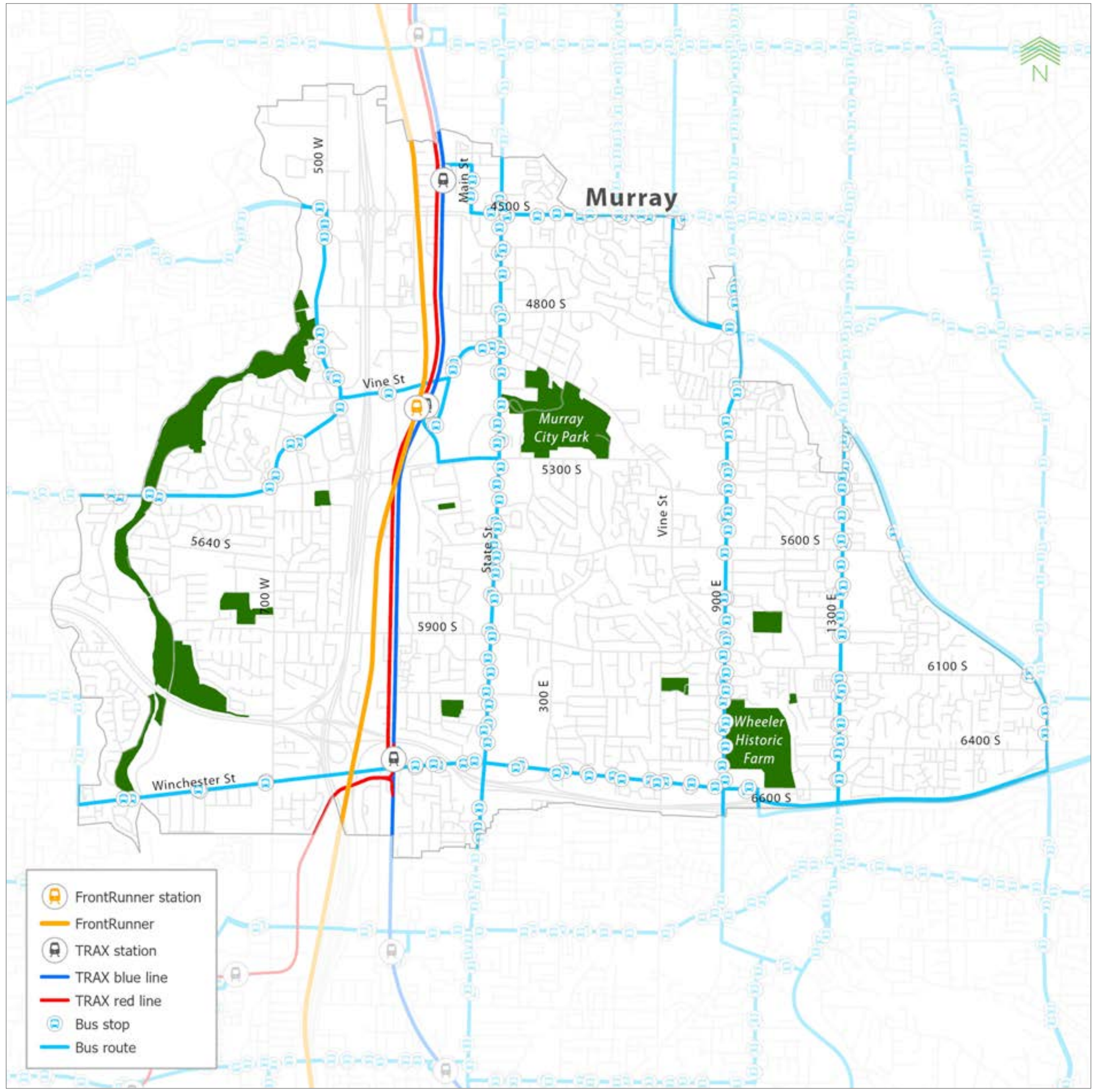
Transit

UTA (Utah Transit Authority) is the primary transit service for Murray. The city has three rail transit stations, Murray North Station, Murray Central Station, and Fashion Place. Two of the three UTA TRAX lines (Blue and Red), as well as the UTA FrontRunner commuter train stop in Murray. All three have service at Murray Central Station, which is where the Intermountain Medical Center is located, Murray's largest employer. The FrontRunner does not stop at Murray North Station or Fashion Place, however, the Red and Blue lines stop at both. Figure 2-17 shows the existing transit in Murray.

Murray's number of transit stations as well as its existing UTA bus system places it in a strong position to meet the "5 Key Initiatives" identified in the city's 2017 General Plan, which are:

1. ***Build a "City Center District" that "can be the social and economic heart of the city"***
2. ***"Create Office/Employment Centers"***
3. ***Create nodes that are "livable + vibrant neighborhoods"***
4. ***"Linking centers/districts to surrounding context"***
5. ***"A city geared toward multi-modality"***

Figure 2-17: Existing transit



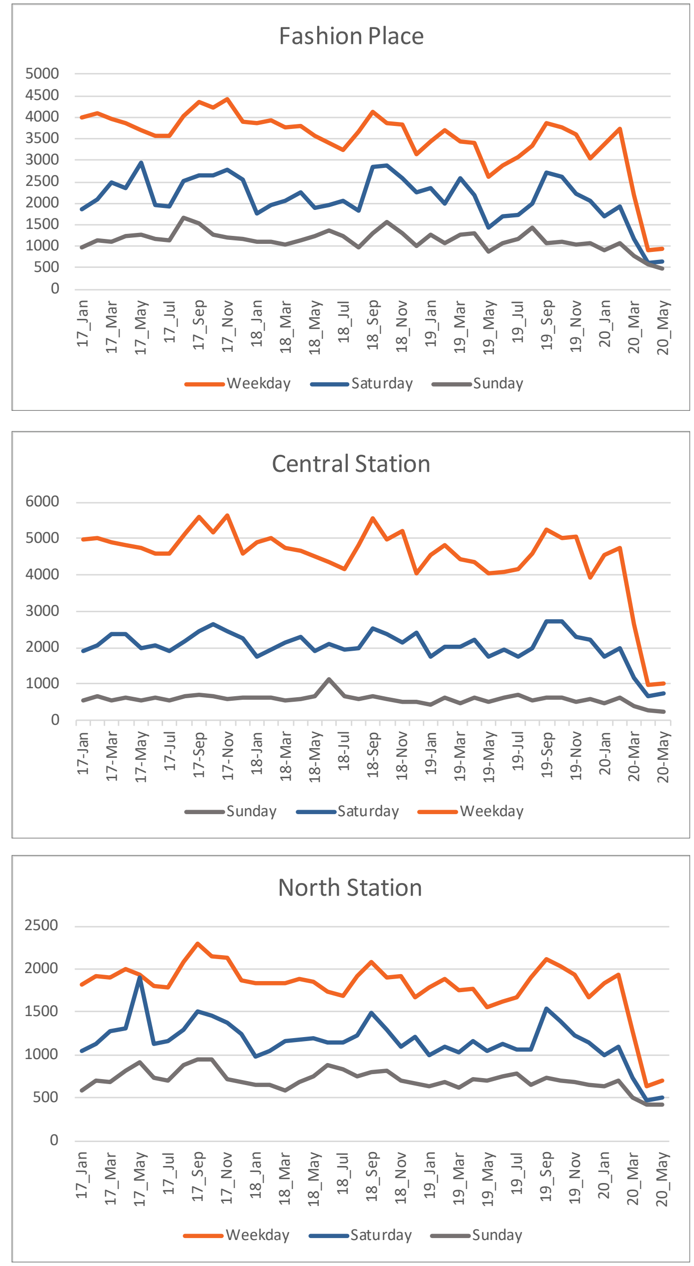
Murray has over 170 bus stops within its city's limits. The two busiest stops are Murray Central Station and Fashion Place West Station, followed by Cottonwood Street at 5149 South, which is in front of the Intermountain Medical Center. This stop is serviced by routes 54, 47, 45, and 201 and is adjacent to Murray Central Station. That the most utilized bus stops in the city are connected to light rail and commuter train is demonstrative of the city's existing demand for multi-modal transportation as well as the importance of options to meet people's daily transportation needs within Murray.

Figures 2-18, 2-19, and 2-20 are graphs showing monthly total estimates for light rail and commuter train ridership by station from January 2017 to May 2020. Currently, UTA's data portal provides this information for boardings but not for those who exit the train. The calculated estimates shown here were generated under the assumption that the number of people boarding and exiting are roughly equal, and therefore the number of boardings (UTA's available data) were doubled.

The next most utilized bus stops in Murray are at 4500 S and 155 E, State Street and 4489 S, and 900 E and 5545 S. The bulk of bus stops within Murray are along these larger, busier corridors like 1300 E, 900 E, State St, and Winchester St.

* The transit system was drastically affected by COVID-19 in the year 2020. The rapid drop off in ridership is seen in Figures 2-18: 2-20 during March of 2020. It is unknown when ridership will return to pre-COVID-19 levels.

Figures 2-18 : 2-20: Light rail & commuter train ridership by station (2017 - 2020)



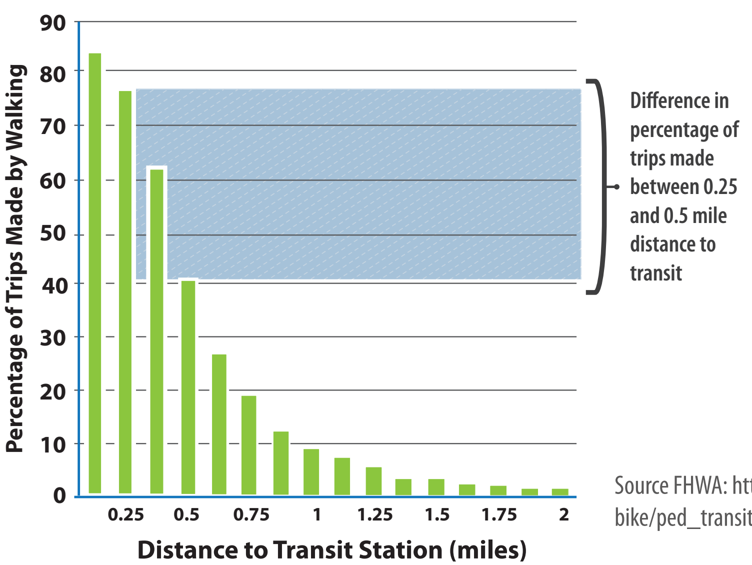
Source: https://data-rideuta.opendata.arcgis.com/

According to the FHWA (Federal Highway Administration): "most people are willing to walk 1/4 [mile] to 1/2 [mile] to a transit stop.... in order to encourage transit usage, safe and convenient pedestrian facilities should be provided within 1/4 to 1/2 mile of transi stops, and greater distances near (heavy) rail stations."

The majority of Murray has access to bus stops within a half-mile distance, determined by an "as the crow flies" straight line estimate, rather than the full distance a person would travel walking along a sidewalk. However, there are areas in Murray where the housing located on local streets is beyond a half-mile distance from the closest bus stop "as the crow flies", including a section north of I-215 and west of I-15 and an area in between State Street and 900 E. Figure 2-21shows Murray's and the areas beyond a half-mile distance, which are shown in blue. This map does not show actual walking distance from transit due to barriers such as I-15, rail corridors, creeks, etc. Within Murray's Mixed Use zones lack of sidewalks and other barriers that discourage transit use exist.

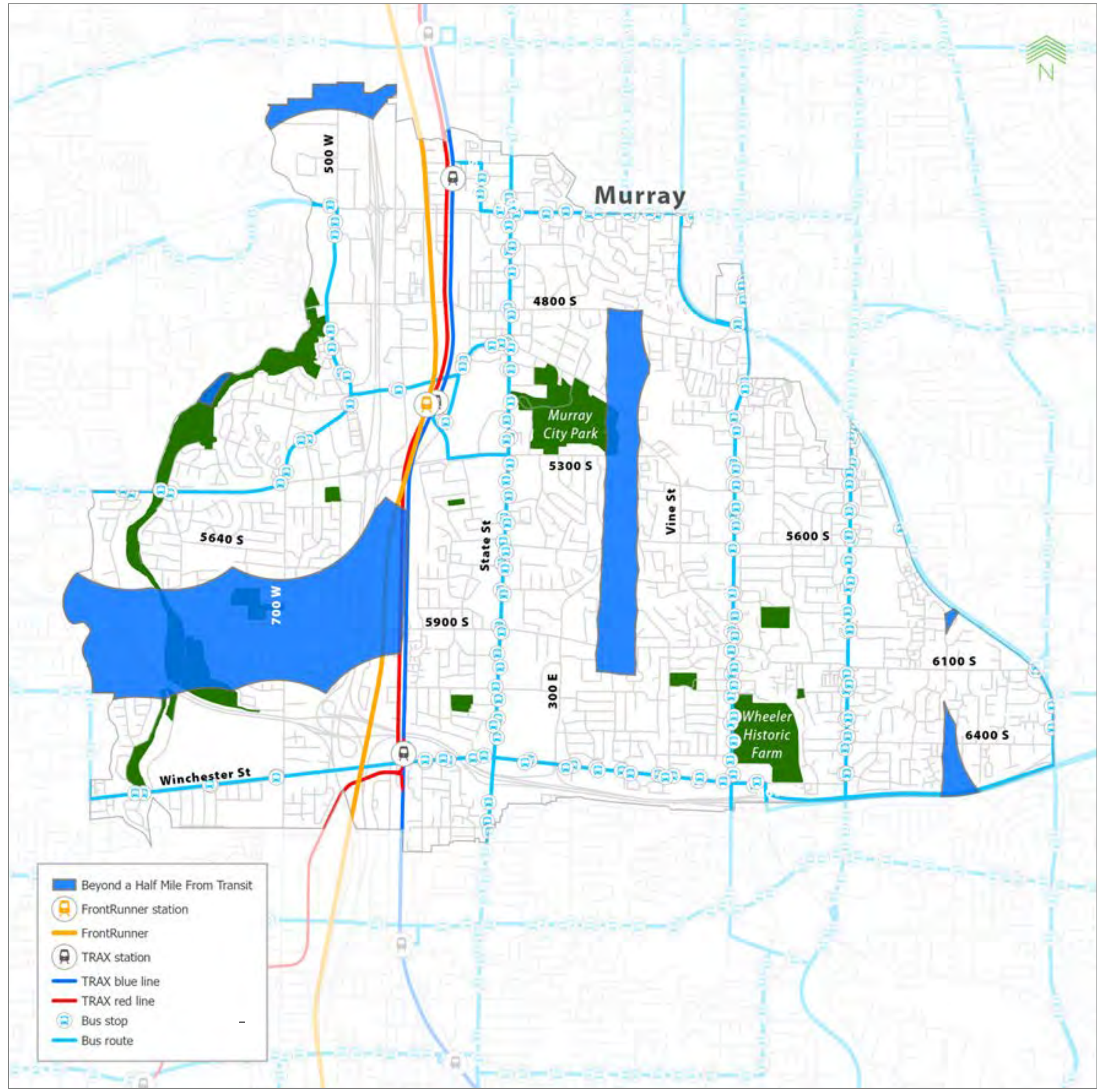
Figure 2-22 is a graph showing the relationship between distance and transit usage.

Figure 2-22: Relationship between distance and number of trips



Source FHWA: https://safety.fhwa.dot.gov/ped_bike/ped_transit/ped_transguide/ch4.cfm

Figure 2-21: Bus stops with half-mile buffer



Active Transportation

An active transportation (AT) network is a key component of a transportation system because it provides mobility options for all residents. Making walking and biking safe and convenient is a key goal of any complete transportation plan. The benefits of a practical and accessible active transportation network are broad and include improving physical and mental health, decreasing noise and air pollution, providing a low-cost mode-choice, and increasing the property values along the AT network. When there are more transportation choices, connectivity is improved throughout the community because more access is provided to both specific and regional origins and destinations. While freeways and expressways favor high speed long distance mobility for motor vehicles, a robust active transportation network provides its own accessibility options that can connect people to neighborhoods, downtowns, parks, schools, places of work and worship, shopping centers, etc., without the requirement of a car.

Figure 2-22 shows how comfort relates to different types of active transportation infrastructure and design. The comfort an AT user feels is affected by things like whether a protective physical barrier exists, the distance from vehicles, an AT user's sight-line visibility, and motor vehicle speed.

While those are some of the main factors taken into consideration when creating an active transportation network, designs should reflect the needs of the local context.

Figure 2-22: Active transportation facility type

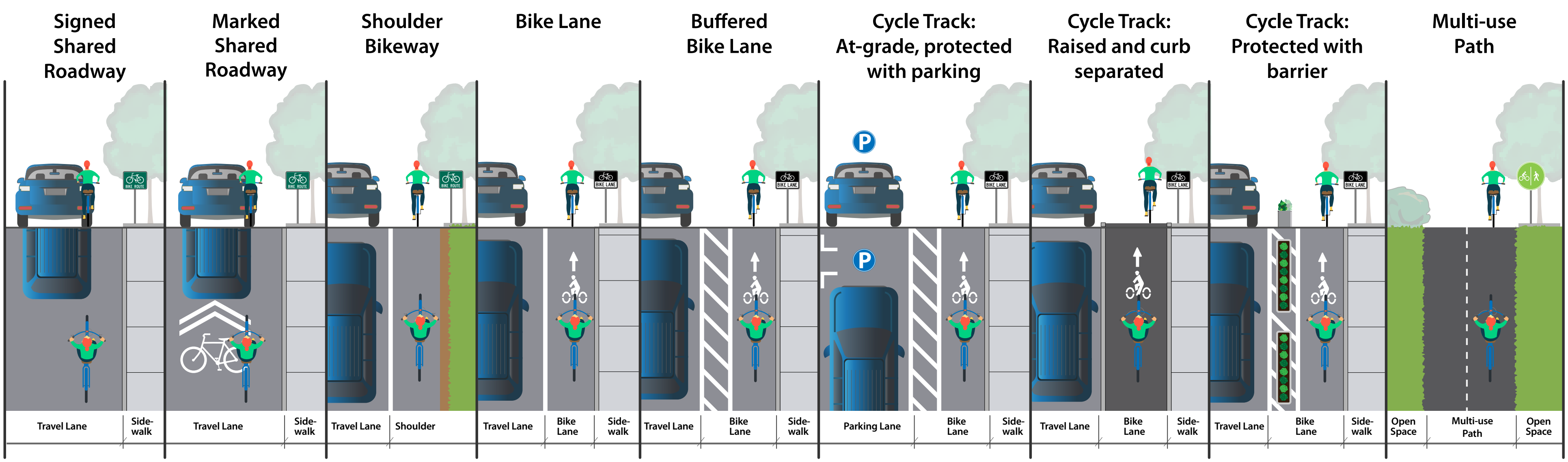


Figure 2-23 shows the existing active transportation in Murray. On the west side, Murray has the well-known Jordan River Trail running north to south across the entirety of its city. This is a paved separated trail that is part of a connected trail system from Provo Canyon to Ogden Canyon.

Vine street has a combination of bike lanes and shared roadways as it bends west to east through Murray where it joins a bicycle shared roadway along 5900 S while heading towards Highland Dr. The western half of Winchester Street is a bike lane, that temporarily turns into a shared roadway where the shoulder width narrows, and then returns to a bike lane again when ROW is available. Extending east from Wheeler Historic Farm is an unpaved trail that runs along the Jordan and Salt Lake City Canal, and between Intermountain Medical Center and Little Cottonwood Creek is a paved multi-use path.

While Murray does not have an extensive existing AT network it is in a good position to expand upon existing facilities to provide local and regional options that offer high-comfort for users and desirable accessibility to the origins and destinations within the city.

Figure 2-23: Existing active transportation facilities

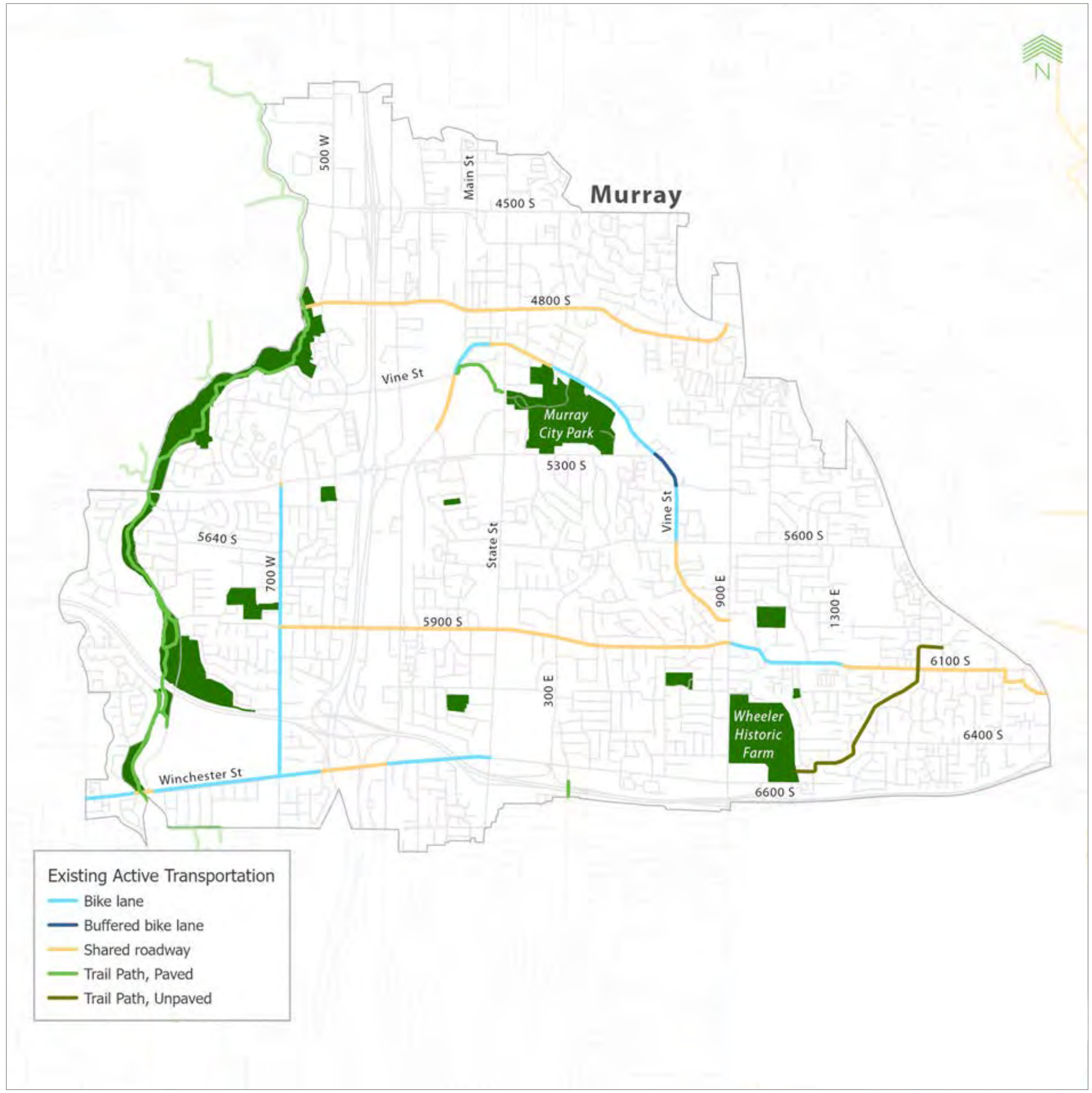


Figure 2-24, again shows existing active transportation, but in this map it is displayed as a single color. Visually, it is placed below a color graduated representation of Strava data for Murray. Strava is an app that uses GPS tracking to record a cyclist, runner, jogger, walker's, etc. specific route. The data provide a general idea of where people are participating in active transportation. It is understood that the data is representative of only certain segments and demographics of the population and does not by any means represent all active transportation users. However, it is beneficial to see where these AT trips are occurring along the road network in Murray. While certain routes, mainly those that run along roads that are classified as arterials and collectors, such as Vine Street, receive the highest amount of use, it should be noted that a significant number of local streets have recorded trips on them. When this data is combined on a map with Murray's existing AT facilities, it can help identify where projects may be of highest use, or where there is a latent demand for AT infrastructure.

Figure 2-24: Active transportation facilities and Strava usage

Figure 2-25 shows the existing crosswalks in Murray separation by location according to mid-block or intersection and school zone or non-school zone. The location of schools is also shown on the map.

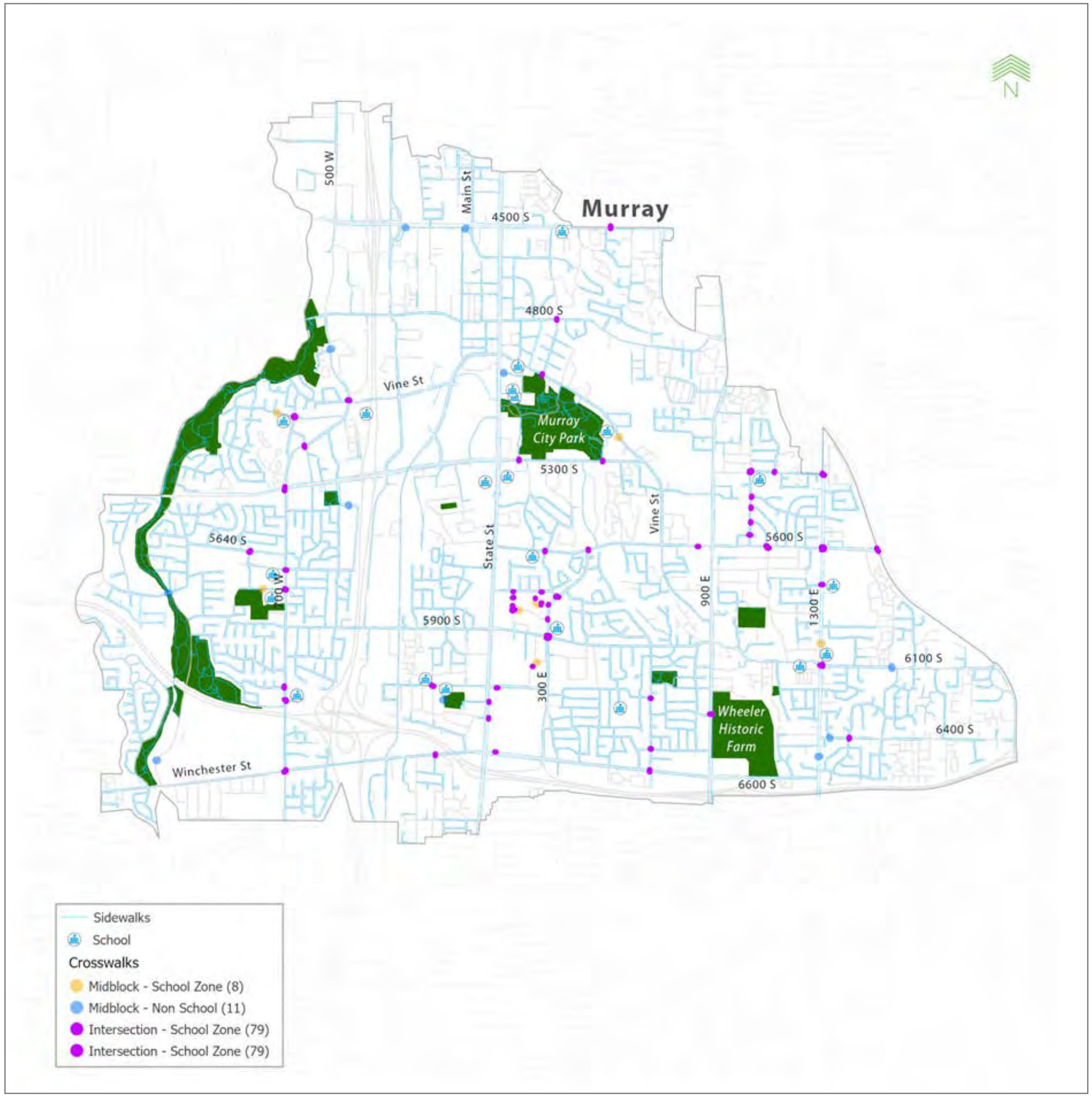
Pedestrians experience the built environment on a fine-grained level and require frequent safe crossings to destinations for crosswalks to be effective. An area that has adequate crossing facilities can encourage walkability. Crossings that align with pedestrian desire lines (paths taken because they are the shortest, obvious, easiest, etc. to access a destination) may prove to have the highest use and/or greatest efficacy.

Design and location are both important when considering the installation of a crosswalk. According to NACTO (National Association of City Transportation Officials), if a pedestrian has to spend over 3 minutes to get to a crossing, cross a road and get back on track to their destination it becomes very likely the pedestrian will forgo the crosswalk entirely and chose a riskier option for crossing a street.

To provide a safe crossing facility painted lines may be insufficient. Flashing beacons, HAWK (High-intensity activated crosswalk beacon) signals, pedestrian refuge islands, alternative textured or colored paving, or other traffic calming or safety measures should be considered.

Murray's Crosswalk Guidelines and Standards should be consulted. These can be found in the appendix.

Figure 2-25: Crosswalks and sidewalks



3 FUTURE CONDITIONS

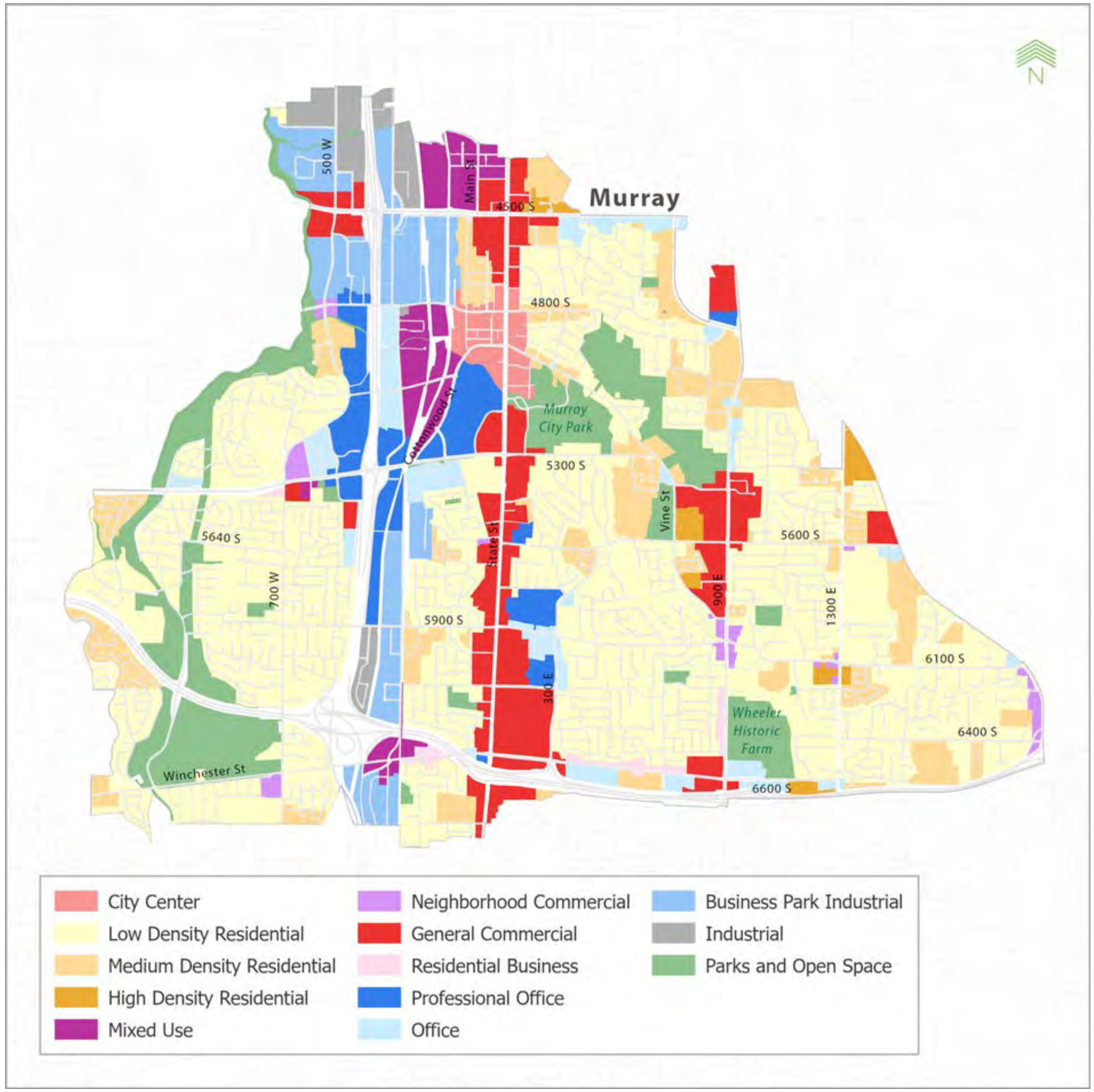
This chapter discusses the background and assumptions used to forecast transportation related growth in Murray. It also shows future level of services maps for the city.

Travel Model

Using travel demand modeling techniques in conjunction with projected socioeconomic, population, and employment trends, future transportation demands were forecast. Transportation system improvements that are committed or planned by agencies such as Utah Department of Transportation (UDOT) and Wasatch Front Regional Council (WFRC) were included in the transportation forecasting prior to identifying additional transportation projects within the city.

Most of the projected socioeconomic data used in this study comes from the Land-Use Element of the Murray General Plan. The General Plan was lasted updated in 2017 and is shown in Figure 3-1. To accommodate the anticipated growth, specific areas are planned to allow a more flexible mix of uses within community and neighborhood nodes. These nodes are areas within the City where job and housing growth can occur to provide amenities to surrounding residential neighborhoods as well as to stabilize these neighborhoods by preventing unplanned growth. The land use plan aims to emphasize growth within identified transit corridors, transit station areas, community centers, and neighborhood centers. Development is occurring slightly different than anticipated in the General Plan. Updates, such as the known mixed-use island and the mixed-use west of I-15 have been accounted for in the Travel Model.

Figure 3-1: General Plan land use map



Outside of known developments, the future growth within the City comes from land use modeling completed by Wasatch Front Regional Council (WFRC). WFRC is the Association of Governments (AOG) for Box Elder, Davis, Morgan, Salt Lake, Tooele, and Weber counties that is responsible for coordinating transportation planning in the region. WFRC recently updated their 2019-2050 Regional Transportation Plan (RTP), which is the blueprint to guide investments in the future transportation system. As part of this process WFRC modeled future land use changes based upon allowed development densities and the planned transportation system.

Figure 3-2 shows where household growth is anticipated within the city. This heatmap illustrates that most of the household growth is anticipated near I-15 between 4500 South and 5300 South. Outside this area, infill development is expected to moderately increase the number of households throughout the city. There are also six identified mixed-use, high residential density nodes within Murray.

Figure 3-2: Household growth (2020-2050)

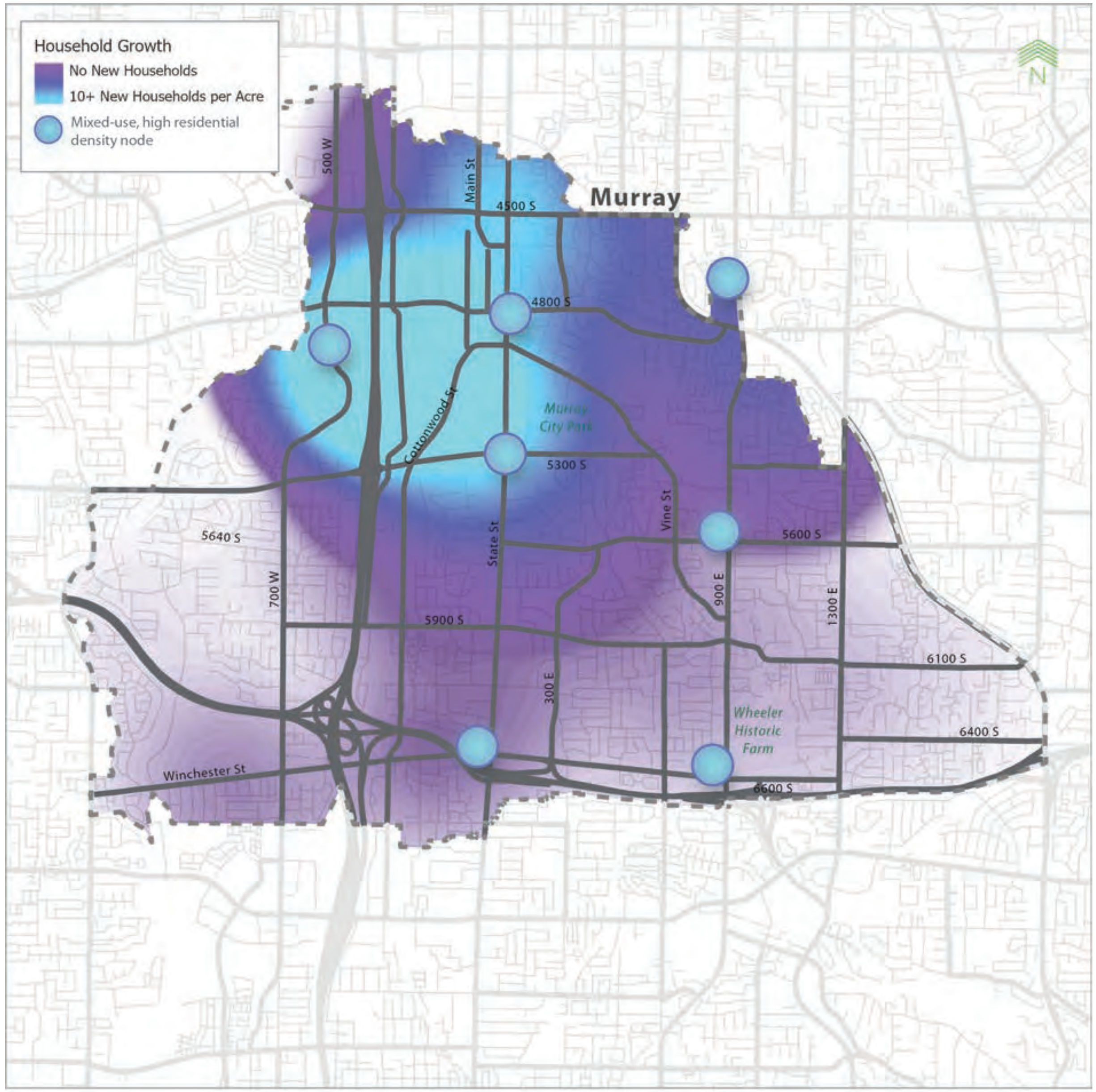
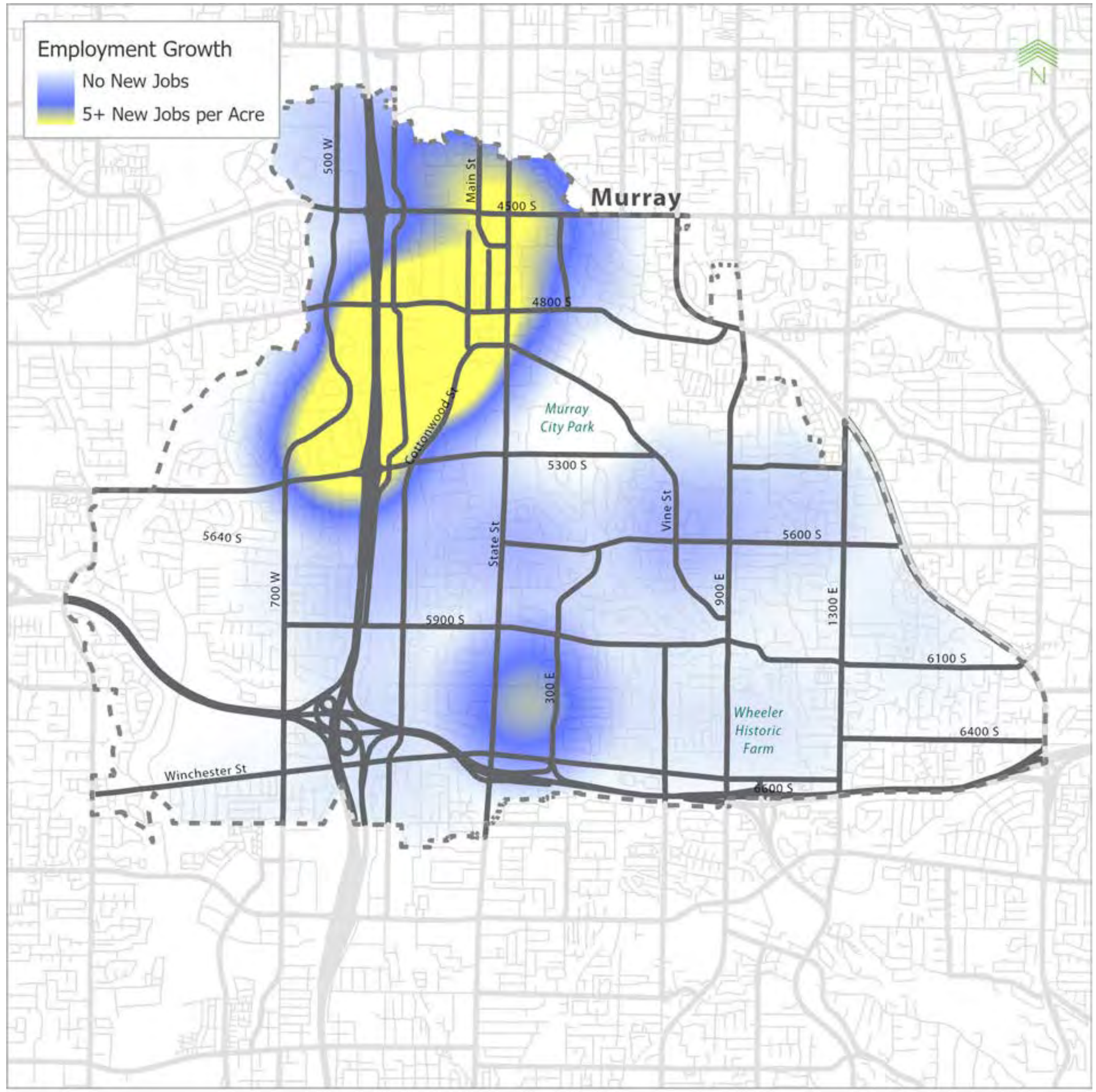


Figure 3-3 illustrates the location of the future employment growth in Murray. As with housing growth, employment growth is concentrated near I-15 between 4500 South and 5300 South. Other locations that are expected to see increased job opportunities are near Fashion Place as well as 5600 South at State Street and 900 East. Although there is anticipated to be some employment growth in these areas, most new jobs are expected to be located within the TRAX and neighborhood nodes near the I-15 corridor.

Figure 3-3: Employment growth (2020-2050)

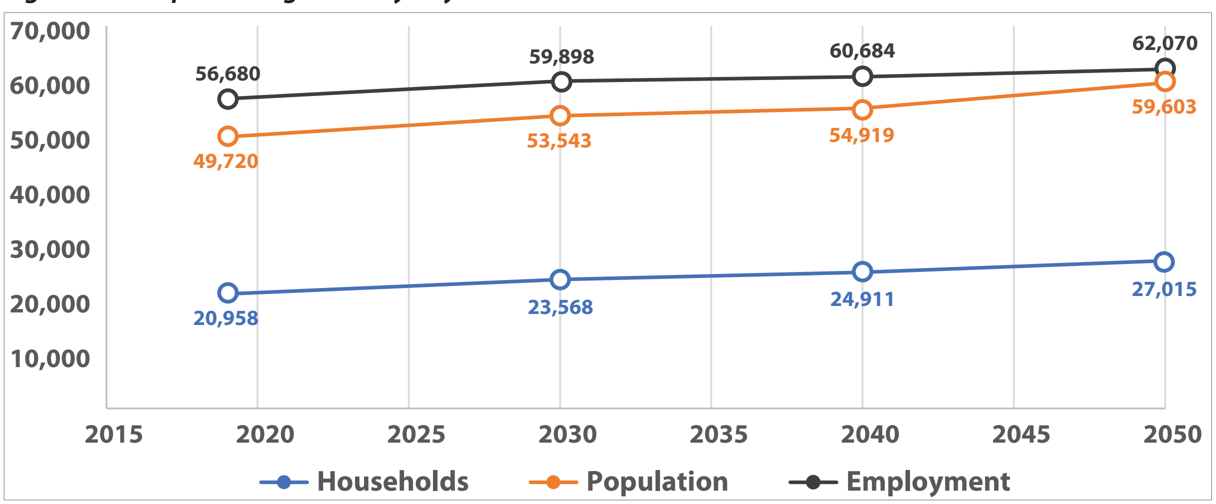


Travel Model Development

Projecting future travel demand is a function of projected land use and socioeconomic conditions. The WFRC Travel Demand Model (TDM) was used to predict future traffic patterns and travel demand. The travel demand model was modified to reflect better accuracy through the study area by creating smaller Traffic Analysis Zones (TAZ) and a more accurate and extensive roadway network. Existing conditions were simulated in the TDM and compared to the observed traffic count data to get a reasonable base line for future travel demand. Once this effort was completed, future land uses, and socioeconomic data were input into the model to predict the roadway conditions for the horizon year 2050. Year 2050 was selected as the planning year horizon to be consistent with the regional planning process.

The future for which we are planning includes a moderate increase in population and employment. Figure 3-4 summarizes this employment, household, and population growth over the next 30 years. This chart shows Murray's population, households, and jobs used in the TDM for the years 2019, 2030, 2040, and 2050. The projected 2050 population in Murray is 60,000 people with nearly 10,000 new residents. Employment growth is also adding 5,000 new jobs over the next 30 years. While employment is anticipated to increase by 10%, population is forecast to increase by more than 20% bringing the number of residents close to the number of jobs.

Figure 3-4: Population growth by city



Source: US Census & WFRC TAZ Model

Land Use's Effect on Transportation

The steady growth that Murray has experienced is expected to continue in the coming years. Population is expected to increase by 20% and employment is projected to increase by 10% over the next thirty years, resulting in increased transportation system demands. This increasing demand will require new and improved transportation facilities. Additionally, development within community and neighborhood nodes will include a mix of residential, commercial, and industrial land uses. These changes will require transportation options for people to walk, bike, or take transit for these shorter distance trips changing how people commute in the future.

As mixed use development occurs, location specific studies should be conducted such as a traffic impact study (TIS) or a small area plan. These studies examine the potential negative impacts of traffic at a close-up, granular level. The analysis provided from these studies can be especially beneficial for areas of higher densities.

Model Years and Results

Projected Traffic Volumes & Conditions

The resulting outputs of the travel demand model consist of traffic volumes on all the classified streets in the city and surrounding area. These forecast traffic volumes were used to identify the need for future roadway improvements to accommodate growth. The following two scenarios were analyzed in detail to assess the travel demand and resulting network performance in the City:

- ***No Build***
- ***Recommended Roadway Network***

No-Build Conditions

A no-build scenario is intended to show what the roadway network would be like in the future if no action were taken to improve the roadway network. The travel demand model was again used to predict this condition by applying the future growth and travel demand to the existing roadway network. Interim year growth assumptions were also modeled to understand how congestion grows over time. Figure 6 to Figure 7 show the 2030, and 2050 No Build LOS respectively. These maps show growing congestion on State Street, 4500 South, 5300 South and other corridors as the population and employment increases without improvements to the transportation system. This growing congestion is visible in the expansion of orange and red roadway segments.

As shown in Figure 3-5, if no improvements are made to the transportation system, projected traffic volumes for the planning year 2050 will worsen the LOS of many streets and intersections throughout the city. The following list includes the streets expected to perform at LOS D or worse:

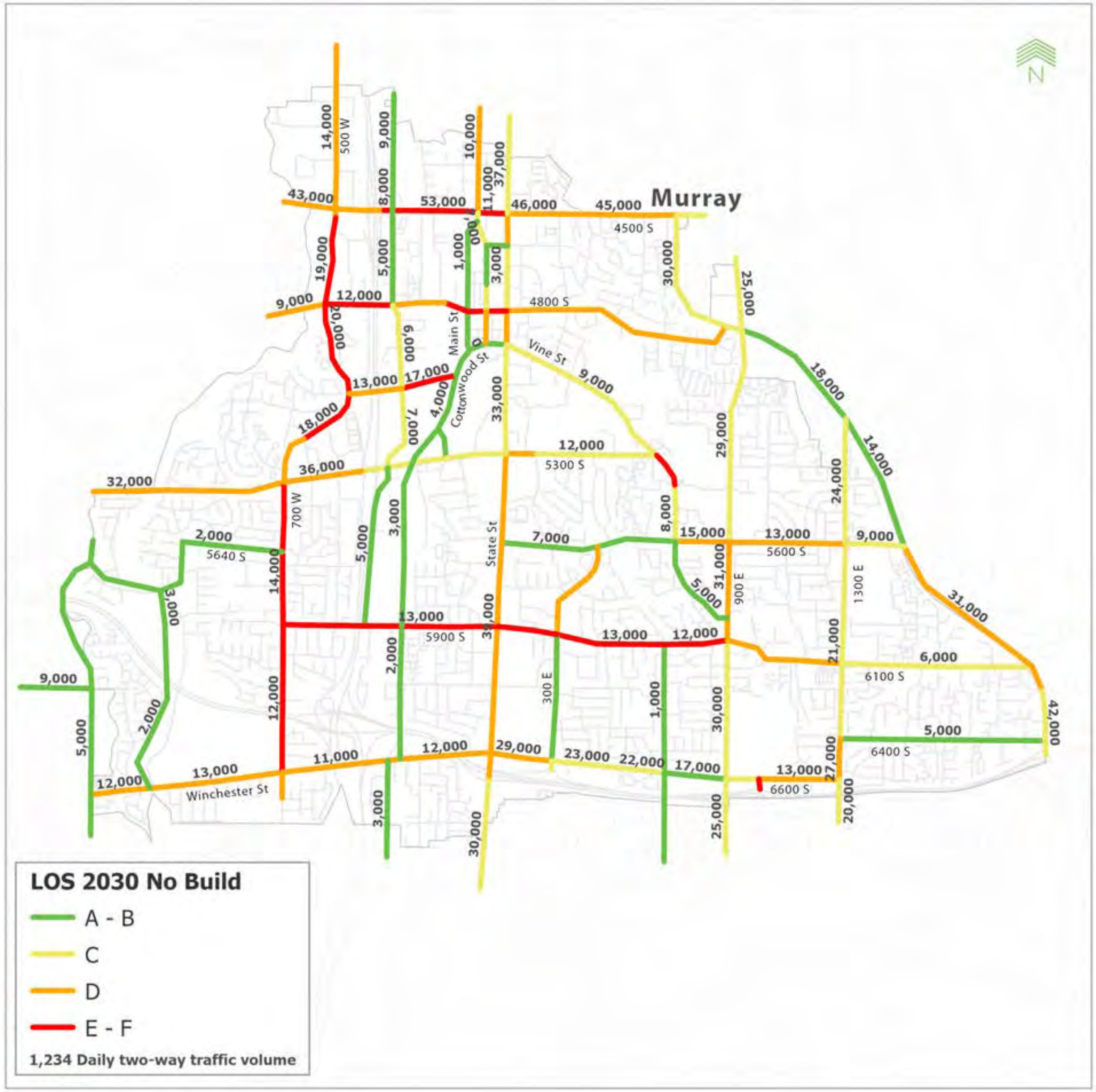
LOS D (Peak Congestion but Acceptable)

West 4500 South (West City Boundary to I-15)
4500 South (Atwood Blvd to 700 E)
4800 South (Atwood Blvd to Vanwinkle Expwy)
Vine Street (Murray Blvd to Commerce Dr)
5300 South (West City Boundary to 700 W)
5300 South (Commerce Dr to Vine Street)
5600 South (900 E to 1300 E)
Vine Street (900 E to 1300 E)
Winchester St (West City Boundary to Fashion Blvd)
500 West (4500 South to North City Boundary)
300 West (4500 South to North City Boundary)
Main Street (4500 South to North City Boundary)
State Street (Vine St to North City Boundary)
700 East (4500 South to North City Boundary)
State Street (I-215 to 5300 South)
Fashion Boulevard (5900 S to 5600 S)
900 East (Winchester St to 5290 S)
Vanvinkle Expressway (6400 S to 5600 S)

LOS E or Worse (Unacceptable)

4500 South (I-15 to Atwood Blvd)
4800 South (500 W to State St)
Vine Street (Commerce Dr to Cottonwood St)
5300 South (700 W to I-15)
5600 South (Vine St to 900 East)
5900 South (700 West to 900 East)
Murray Boulevard (South City Boundary to 4500 S)
Vine Street (5400 S to 5300 S)

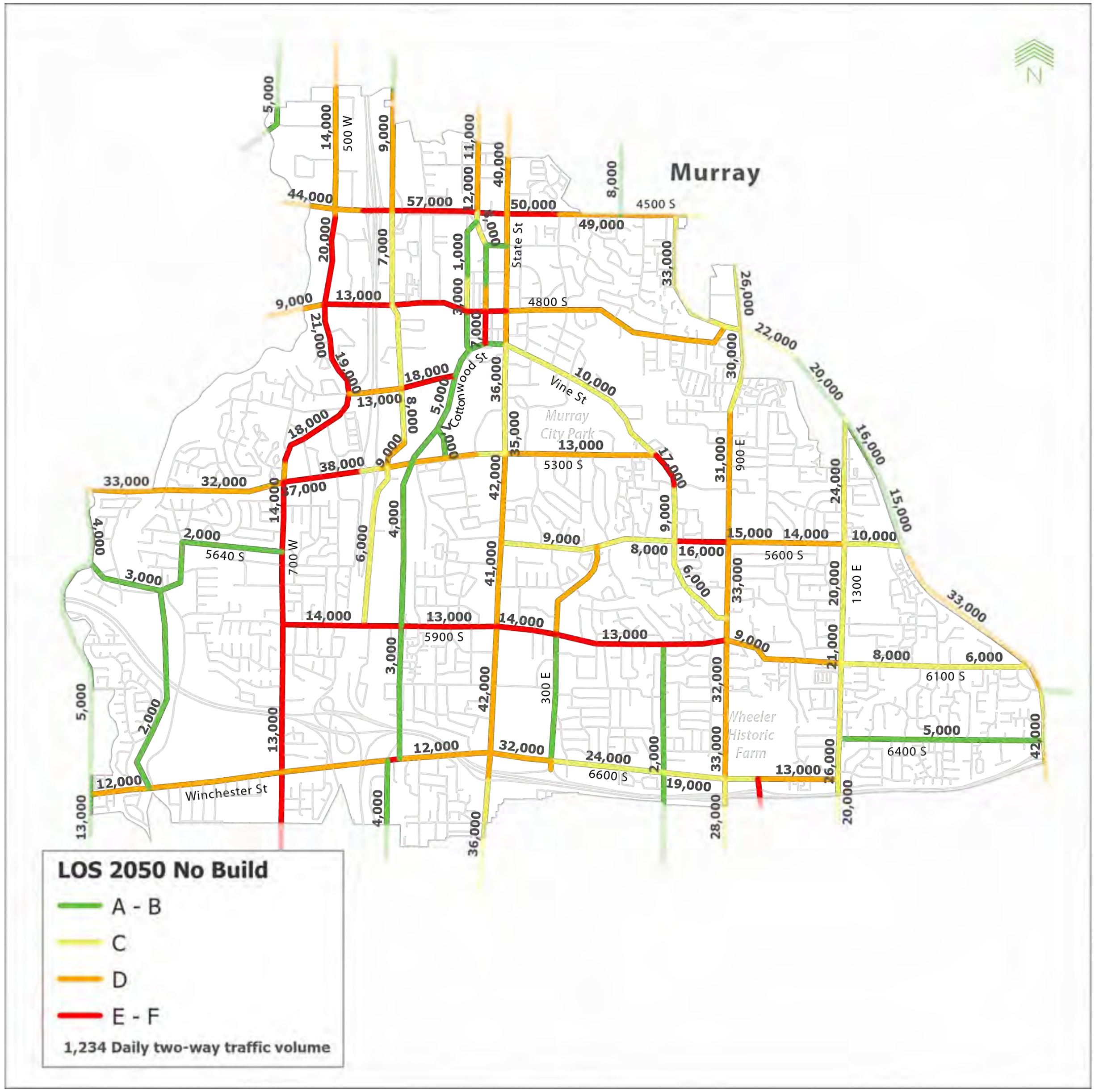
Figure 3-5: 2030 No build level of service



With no improvements by 2050 Murray will experience a lot of congestion with many corridors in gridlock. Figure 3-6 shows future LOS with volumes in a No Build scenario.

This highlights the need for transportation planning to avoid this congested future.

Figure 3-6: 2050 No build level of service



Regional Transportation Plan

Murray is not alone in improving the roadway network. WFRC, in cooperation with UDOT, provides financial assistance for projects included in their RTP. If the roadway is included on the RTP and is owned and operated by UDOT, full financial responsibility falls to UDOT. It is important to include these projects in this Plan as well as coordinate with UDOT to ensure these projects are implemented. If the roadway is on the RTP and not owned by UDOT, Murray may be able to apply for funding through WFRC, in which case, the city will only be responsible to match 6.77% of the total cost of the project. RTP projects within Murray included on the RTP are shown in Figure 3-7, and are listed here by project phase. An interactive map can be viewed on WFRC's website https://wfrc.org/rtp-2019-adopted/.

PHASE I (2021-2030)

1. **Cottonwood Street** (4500 S to Vine St)
   - New 3 Lane Road
2. **Vine Street** (900 E to Van Winkle)
   - Operational Improvements

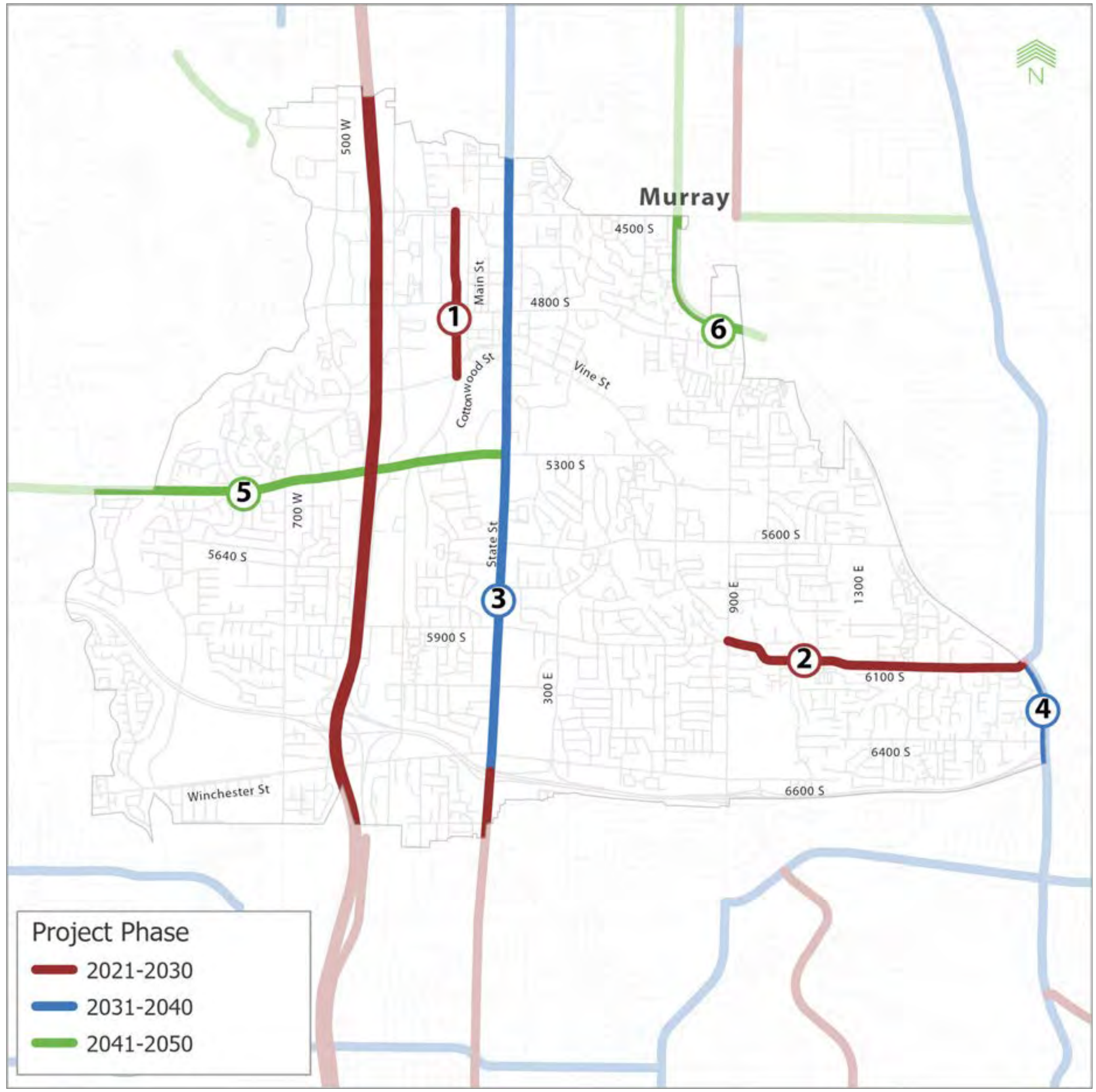
PHASE II (2031-2040)

3. **State Street** (600 S to I-215)
   - Operational Improvements
4. **Highland Drive** (1300 E to Fort Union Blvd)
   - Operational Improvements

PHASE III (2041-2050)

5. **5400 South** (Redwood Rd to State St)
   - Operational Improvements
6. **700 East** (I-80 to Murray Holladay Rd)
   - Operational Improvements

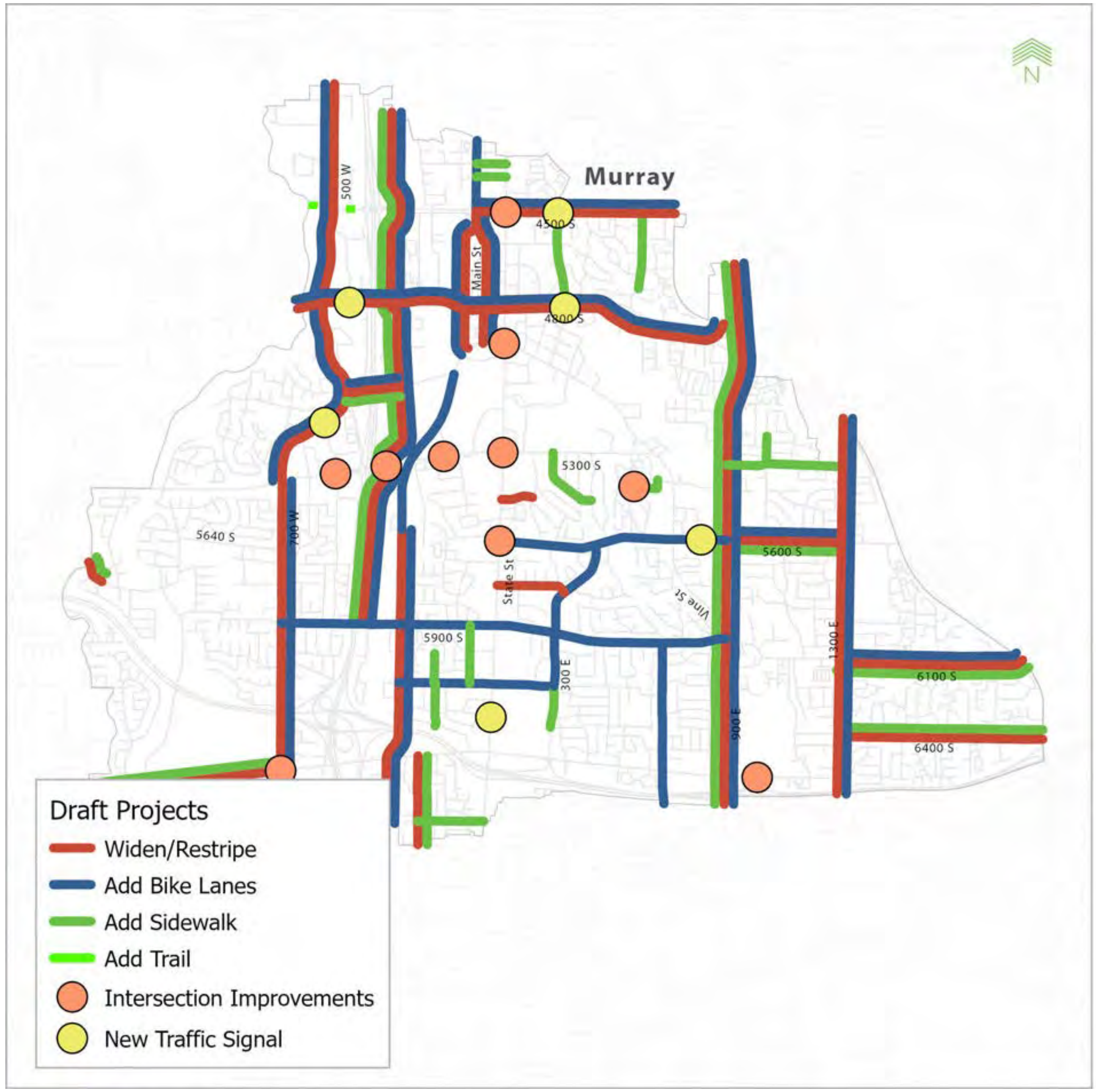
Figure 3-7: Regional Transportation Plan projects



Local Projects

In addition to the RTP projects, City staff input along with travel demand model results were utilized to determine local capacity projects. While many of these are smaller, local projects, they still improve connectivity and transportation options throughout the city and are shown by type in Figure 3-8.

Figure 3-8: Planned project by type



With these local capacity projects included, Figure 3-9 shows the proposed 2050 roadway LOS with all future projects (including WFRC RTP projects). These proposed projects address the larger capacity needs within the city. However, even with these projects some roadway segments are anticipated to be at LOS E. Most of these roadways provide access to I-15 such as 4500 South and 5300 South. However, capacity improvements to these would require right-of-way acquisition as well as potentially costly railroad bridge improvements on 4500 South. As a result, widening is not currently identified to address traffic congestions on these roads, but congestion should be monitored in case additional capacity is required.

Figure 3-9: Future build LOS

Future Functional Classification

The recommended functionally classified roadway network is illustrated in Figure 3-10. This future functional classification was developed based upon the existing roadway functional classification shown in Figure 3-10 while incorporating other planning efforts. The existing roadway network was refined to serve the updated future land use and traffic forecasts from the travel demand modeling. The recommended network also includes planned projects from WFRC's Regional Transportation Plan. These arterial and collector roadways will provide the backbone of the functionally classified transportation network within Murray. Finally, the recommended functional classification was improved to reflect stakeholder and public comments to create a network that will serve existing and future travel demand.

This future functional classification map is a comprehensive image of the Transportation Master Plan. It shows the existing as well as future roads along with their typical size, so that the community knows what is planned for each road within Murray.

Figure 3-10: Future functional classification

Conclusion

The process of refining the travel model to analyze future transportation demand for Murray led to the identification of local projects, which are shown by type in this chapter in Figure 3-9. These projects, combined with the projects from the regional transportation plan (Figure 3-8), provide the improvements needed to address future capacity. These upgrades address all modes and facility types, including road widening, sidewalk installations, bike lane striping, and intersection improvements. As the City increases its mixed use, high residential areas, the ability for people to use multiple modes of transportation will become more essential. As the demand on the transportation system increases, these recommended projects as designed to keep level of service acceptable through the planning year 2050.

4 PUBLIC OUTREACH

Public Outreach is a significant part of the planning process. This chapter discusses results from the TMP Public Survey, which guided planning decisions and the Capital Facilities Plan.

A focus of this plan was to seek public input. The City reached out to the public through the City website, Murray City social media, and notices mailed in residential utility bills.

The project website: murraytransportationplan.com hosted a 12-question survey, that was available for the public starting in June 2020 and was open through mid-September. The City received 370 responses from Murray residents. These respondents provided hundreds of comments and good ideas.

This survey was curated to get feedback about resident's relationship to the overall transportation system. The results from this on-line public survey are summarized on the subsequent pages and more details can be found in the appendix.

Like many suburban communities, many of Murray survey respondents indicated that they drive alone as their primary mode of transportation as shown in Figure 4-1. While 73% of those surveyed drive alone daily, an additional 24% of respondents drive alone weekly, and only 2% said they never drive alone.

The next most popular mode was walking with 40% of respondents indicating that they walk "daily" and 70% "weekly". While not as popular as waking, 10% of those surveyed said they bike "daily" and an additional 26% bike "weekly". After driving alone, or walking/biking, carpooling was the fourth most common mode choice with 9% respondents reporting they carpool "daily" while 26% carpool "weekly".

The number of survey respondents that in-dicated that they regularly used transit was substantially lower than for other modes. TRAX and FrontRunner were identified as

Figure 4-1: Number of respondents by date

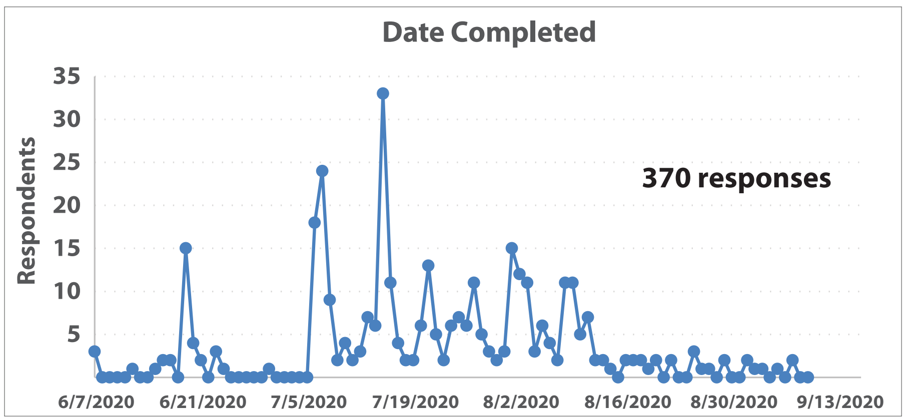
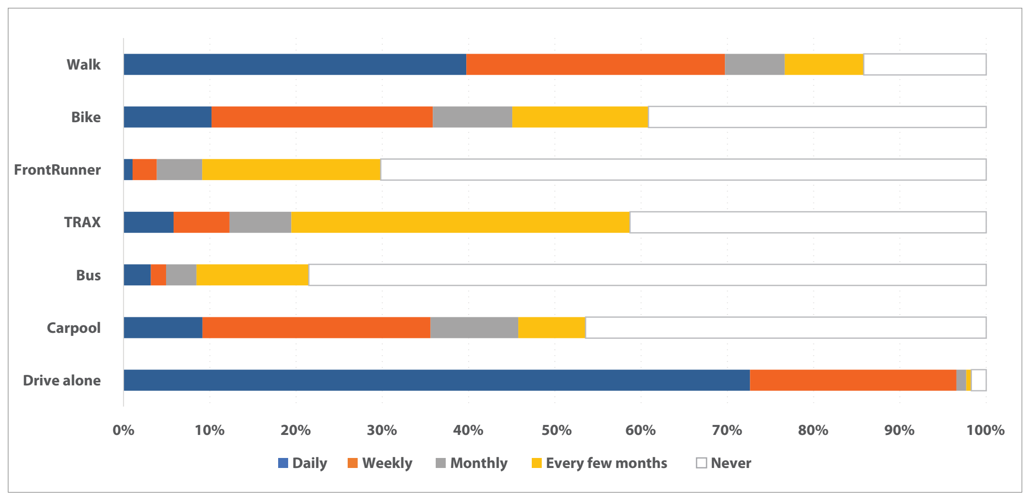


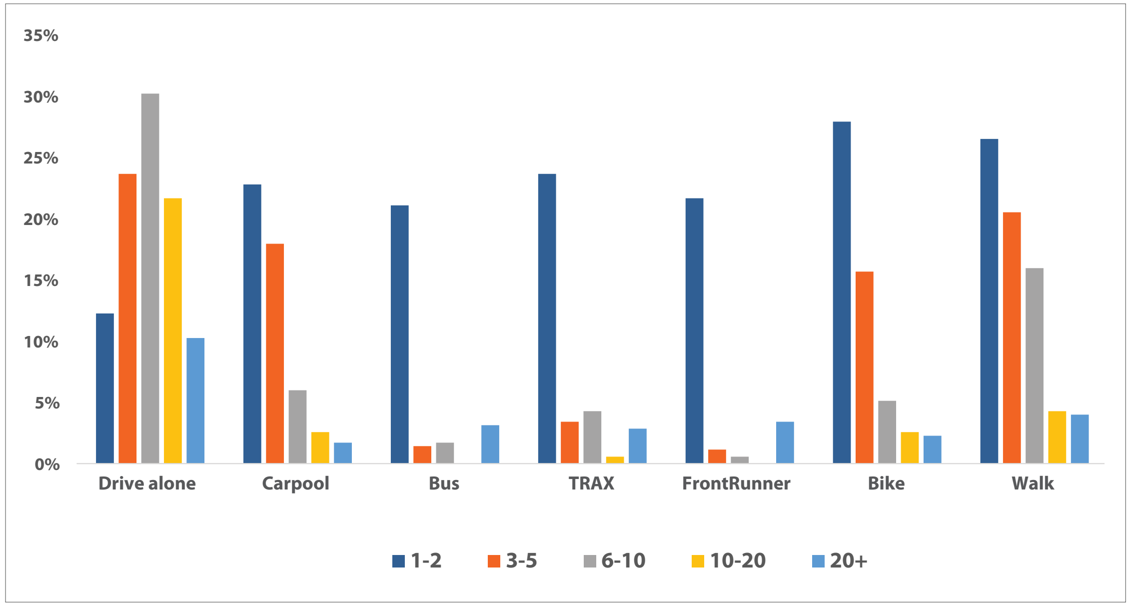
Figure 4-2: How often do you use the following modes of transportation?



the most frequently used transit service. These rail services were most commonly used "every few months," indicating that rail may be used for events that occur on a semi-frequent basis. While rail transit is semi-frequently used, 79% of survey respondents indicated that they "never" use the bus.

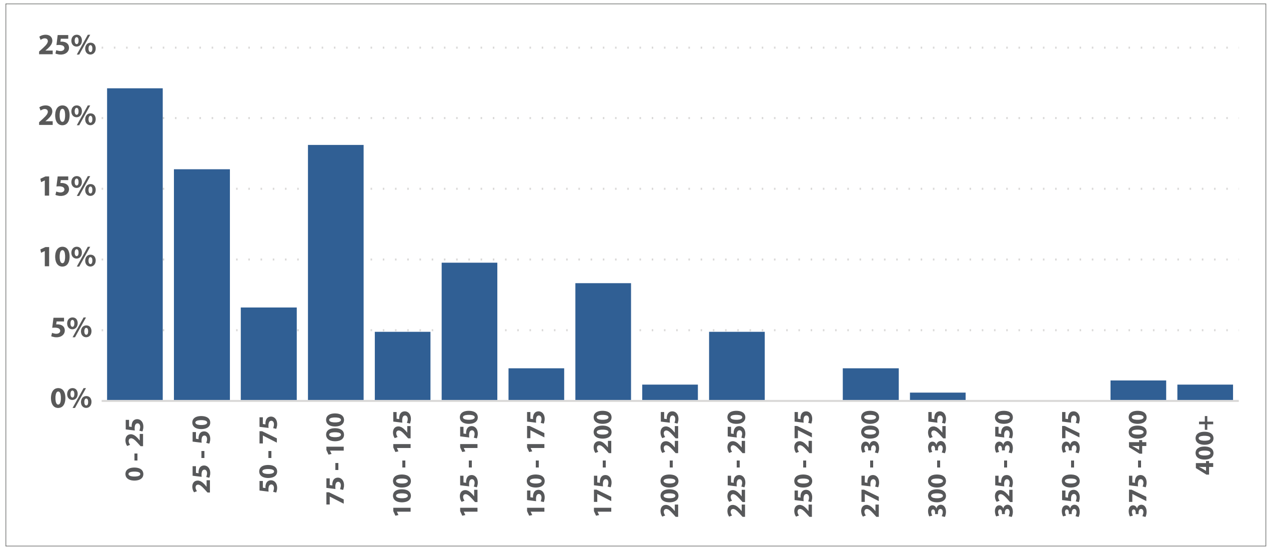
Figure 4-3 offers another perspective about mode choice and frequency of use by asking "how many trips do you make using each mode" (A trip was defined as "beginning in one place and arriving to another"). While the lack of transit trips taken during the week is evident, the number of trips made either by biking or walking stand out, as well. Over 26% of respondents are biking once or twice per week and almost the same amount are walking at least 6 plus times per week. Like other modes of travel, active transportation is reliant upon the transportation system's available connections to other land uses within the built environment. Just as single occupancy vehicle trips are conducive to areas where there is plenty of parking, a lack of congestion, and high mobility, active transportation trip levels are reflective of existing available facilities that provide high levels of comfort to the user while creating access between multiple origins and destinations.

Figure 4-3: How many trips do you make using each mode per week?



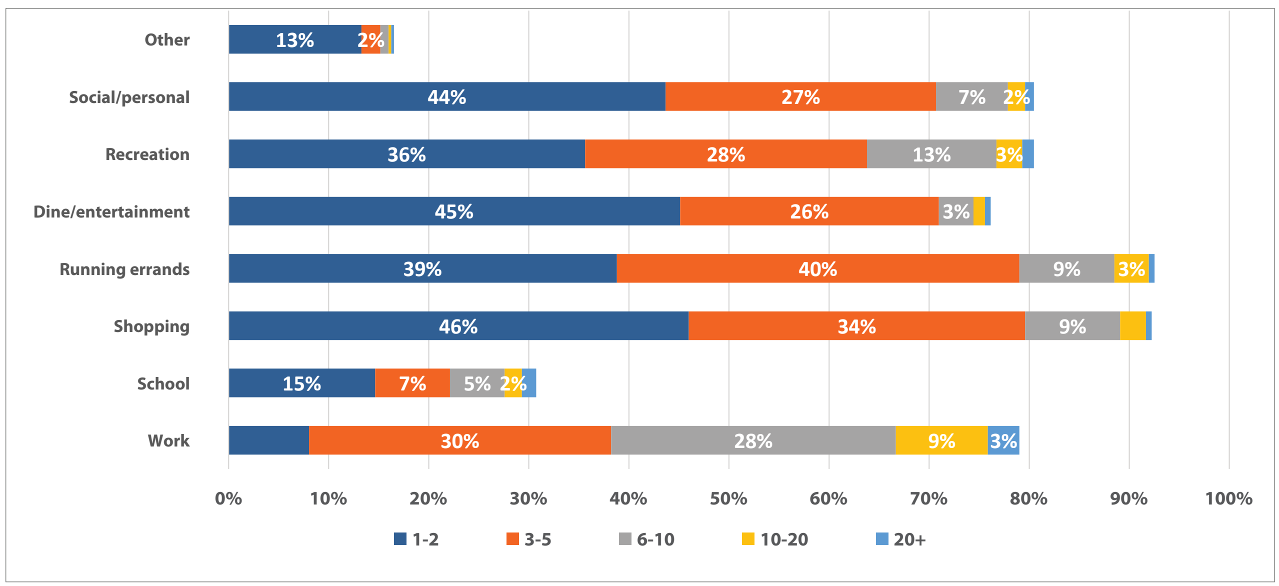
While Murray residents' survey responses indicate they are walking and biking to many destinations, they are still traveling on average 120 miles per week. The survey responses for how far people travel in a week ranged from 5 miles to 800 miles as shown in Figure 4-4. Additionally, these responses reflected travel changes due to corona virus with respondents saying "Now: ~30 Pre-covid: ~100". Respondents that travel the most weekly distance also indicated that they mostly "drive alone".

Figure 4-4: How many miles do you travel in an average week?



Murray residents were also asked the purpose for their travel in an average week. As illustrated in Figure 4-5, "shopping" or "running errands" was the most common reason to make at least one trip with 91% of respondents saying they made one trip for these purposes. "Recreation" and "social/personal", were the next most common reason for making a trip with 79% of respondents making at least one trip for these reasons. "School" and "Other" were the least common reason for making trip with on 31% of survey respondents traveling for school and 18% for other reasons.

Figure 4-5: How many trips do you make for the following purpose per week?



As seen in the graph in Figure 4-6, "air quality" is the major transportation issue concerning Murray residents who responded to the survey. "Traffic congestion" came in second, closely followed by "biking and walking options. " As the city grows, pollution from traffic can be managed and mitigated by installing connected sidewalks and bike lanes, allowing for more multi-modal options which can lead to reduced vehicle congestion and improved air quality.

Figure 4-6: What transportation issues most concern you?

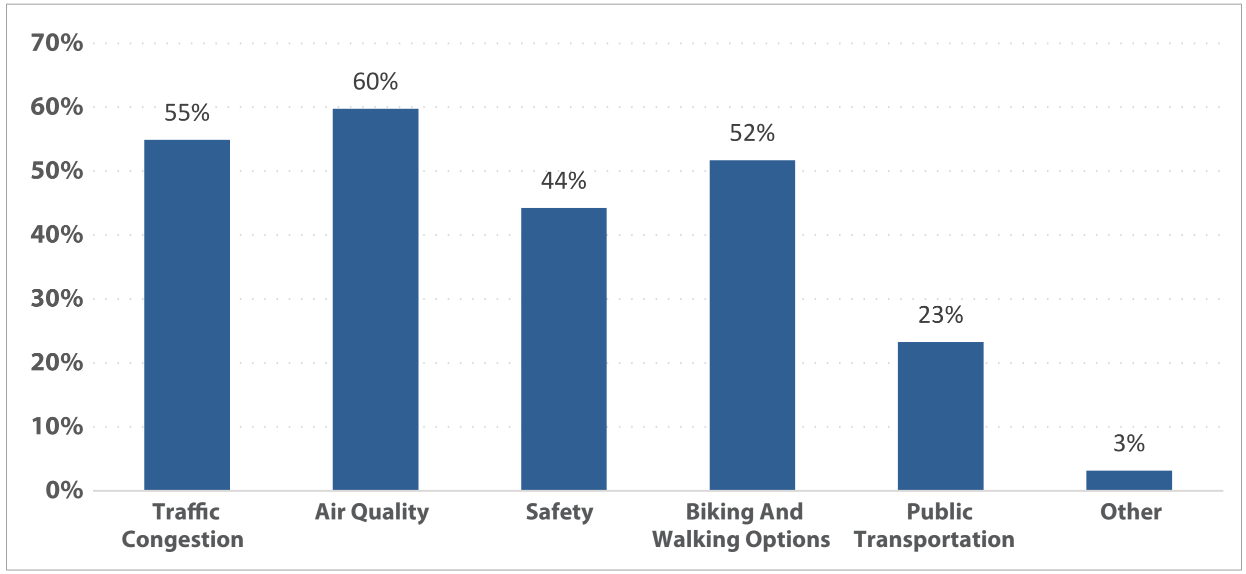
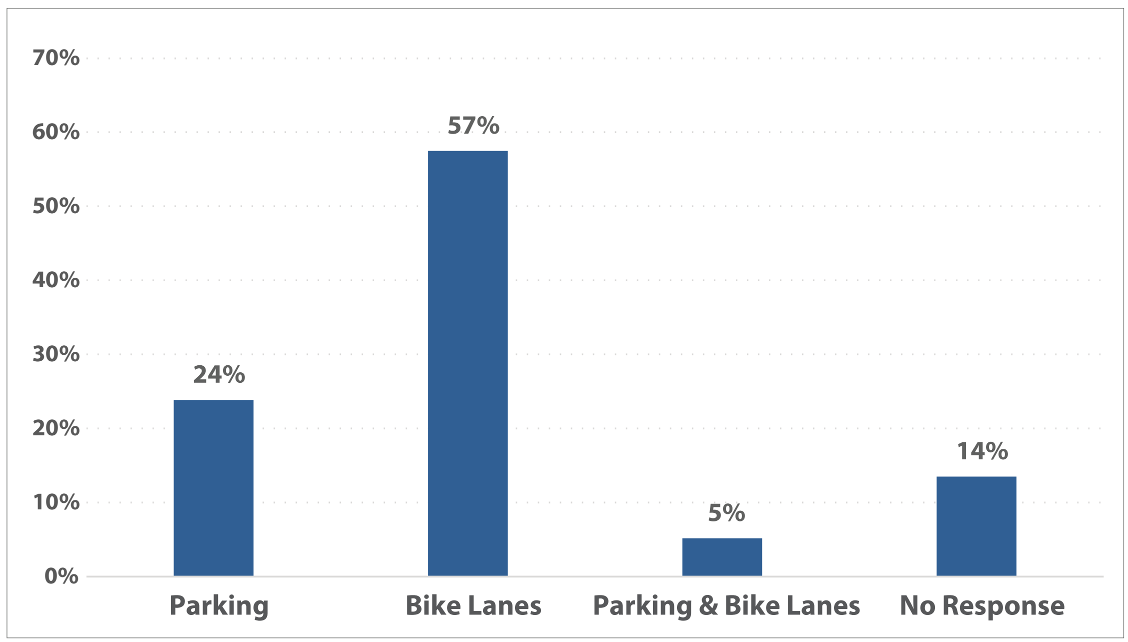


Figure 4-7 shows responses to the question "Should roadway shoulders be used for bike lanes or on-street parking?" According to the survey results most respondents think that road shoulders should be used for bike lanes. Only 24% of people indicated that they should be used for parking. This figure shows that bike lanes should be evaluated on future roadway restriping projects where parking was once the standard approach. As Murray develops, designs, and adopts its future transportation system, the City will have opportunities to create facilities that are inclusive, offer an equitable and holistic vision of right-of-way utilization, and provide access and mobility options that serve all its residents. As shown in this chapter, public outreach and engagement will help identify what is required for a transportation plan to meet the current and future needs of the community.

Figure 4-7: Should shoulders be used for bike lanes or parking?



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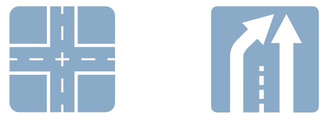
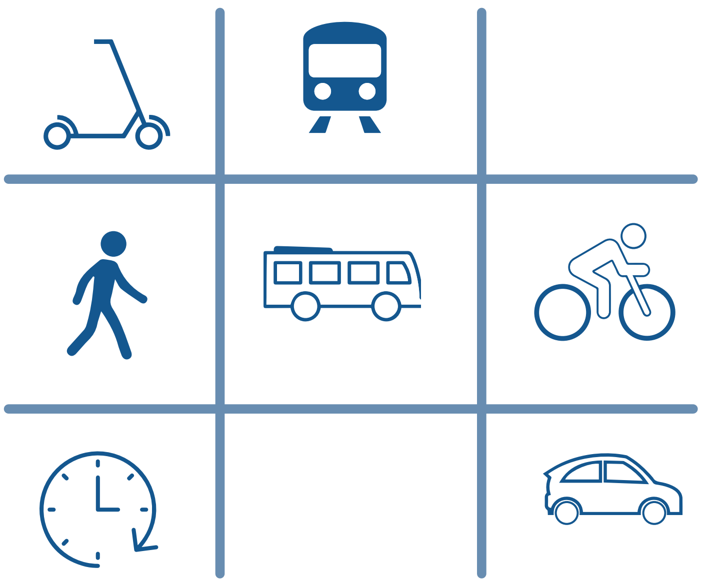
5
HOTSPOTS



and
TRAVEL DEMAND MANAGEMENT



Hotspots are areas of concern. This chapter highlights the 3 that were identified in Murray.

Travel Demand Management (TDM) allows transportation professionals to respond to the increase and decrease of demand placed on roadway networks over certain periods of time. Information relevant to TDM for Murray's roadway network is discussed in this chapter.

Hotspots

Four locations in Murray were identified as areas of concern in regards to transportation issues. These locations have unique transportation needs, and the primary issues and context are summarized in fact sheets on the subsequent pages. The specific areas are shown in the map in Figure 5-1.

The hotspot fact sheets include recommendations from the transportation analysis completed. The hotspot fact sheets are designed to define the problem, provide some data, and offer insight into possible solutions.

Figure 5-1: Hotspot locations

TOSH State Street Access

The Orthopedic Specialty Hospital (TOSH) provides full orthopedic care within a 28.9-acre campus located off Fashion Boulevard at approximately 5800 South. The TOSH campus was the site of Intermountain Health Care's (IHC) Cottonwood Hospital until 2007 when IHC opened their flagship Intermountain Medical Center Hospital just four blocks north on State Street. Since then, specialty offices and support facilities have continued to expand on the TOSH campus as part of an on-going improvement plan.

Currently, IHC is planning a new orthopedic surgical and recovery center on the northeast corner of the campus. This new surgical center will replace existing surface parking lots and a landscaped field along 5770 South.

As the TOSH campus continues to grow, access to TOSH facilities and the associated traffic circulation in nearby neighborhoods will continue to be a more pressing concern. Currently, the primary access to the campus are from Hospital Drive and Medical Tower Drive. These roadways connect to Fashion Boulevard, 5770 South, and 5900 South which are functionally classified as collector roadways that provide access to local neighborhoods. However, State Street (US 89) is a major state highway located just west of the campus. Despite the proximity to State Street the TOSH campus currently does not have access to or from this regional roadway.

Rendering of Main entrance of the surgical center (Source: Environments for Health Architecture)

As properties along State Street redevelop, and the TOSH campus continues to grow, Murray City should coordinate with IHC and UDOT to plan for a potential new access point on State Street. This access could be completed by extending Hospital Drive to State Street. This would improve connectivity and access to the TOSH campus potentially reducing traffic on other neighborhood collector roadways. Since State Street at this location has minimum signal spacing requirements of ½ mile and currently both intersections of 5770 South as well as 5900 South are signalized, this access would likely be unsignalized. However, even unsignalized access to State Street would reduce traffic on more local roadway and should be considered as nearby properties redevelop.

TOSH campus and roadway access

Conclusion:

Murray City should coordinate with IHC and UDOT to plan for a potential extension of Hospital Drive to connect and consider access type to State Street.

Murray Square

Murray Square is a 10.5-acre mixed-use development planned on the old K-mart site located on the westside of 900 East at approximately 4600 South. The site plan for Murray Square includes 421 housing units and 21,000 square feet of commercial space. The residential units will be located in four residential buildings that vary in height with the largest buildings being four and five stories. Murray Square will be developed in two phases with the large residential building constructed in the first phase. The second phase will include the smaller residential building and the commercial space. The residential building is this phase will be located closer to established land uses while the commercial elements are planned to be situated along the 900 East frontage. The specific size and location of these commercial buildings has not been determined since retail space needs can change based upon the tenet's requirements.

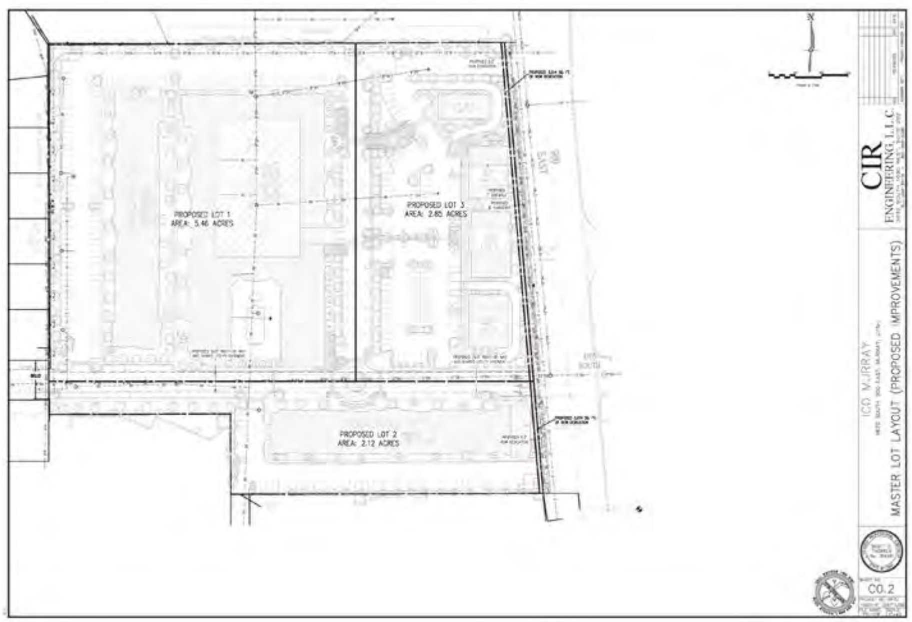
Concept sketch of residential mixed-use for Murray Square

The primary site access will be via 900 East at the existing traffic signal at 4705 South. This access will be supplemented with a second access onto 900 East at the north end of the property as well as connections to 4680 South to west and to the Ivy Place shopping center to the south. These connections are important to provide signalized access to the established Greenvalley neighborhood and Ivy Place shopping center.

Even with the planned residential units and commercial space the traffic analysis shows that Murray Square has minimal traffic impacts. This includes at the planned access on 900 East as well as nearby intersections of 4500 South / 900 East and Van Winkle Expressway / 900 East. However, the traffic analysis did recommended improvements at 4705 South that include eastbound and westbound left-turn lanes as shown in the concept layout. This turn lanes help minimize impacts at this traffic signal and improve egress for the development.

For pedestrians, the project frontage on 900 East includes 8' parkstrips to buffer the pedestrian area from the higher traffic volumes on 900 East. The sidewalks on are also planned to be 7' improving pedestrian mobility along the corridor. The access roads throughout the development are designed to feel like public streets with park strips, sidewalks, and on-street parking. These sidewalks provide pedestrian connections throughout the site and to existing neighborhoods providing transportation choices to residents. However, a bicycle crossing at this intersection is important to safely connect people north to south along 900 East.

Conceptual site plan for Murray Square (source CIR Engineering)



Conclusion:

A bicycle trail crossing at this intersection is important to connect people north to south along 900 East.

This will create a safe access and mobility option, and it will ensure that Murray Square is providing active transportation facilities that are convenient and easy to use.

Murray Square is not expected to have a significant impact on motorized vehicle traffic.

Galleria Apartments

The Galleria Apartments is a 26- acre parcel planned as part of a mixed-use, high residential density development along 500 West and Galleria Drive, south of Murray Taylorsville Road. Upon approval, it will provide between 1,200 to 2,600 residential units and 120,000 square feet of commercial space, which will create an estimated 250 jobs. This added density will bring increased traffic along with it.

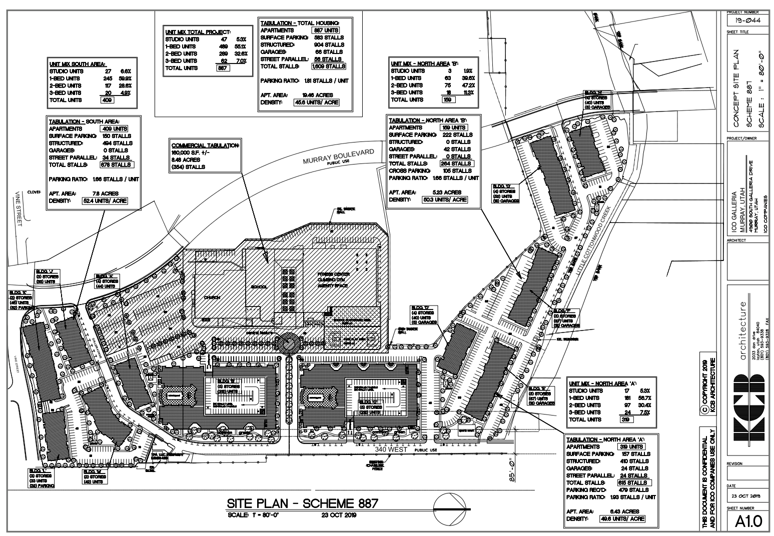
Currently, 4800 South needs capacity improvements west of Murray Boulevard. By year 2030, Murray Boulevard is expected to need improvements north of 4500 South and from Germania Avenue to Vine Street. With the 1,200 residential units scenario improvements from College Drive to 4800 South along Murray Boulevard will be required. The impact from these scenarios does not result in any other roadway segments exceeding the level of service D outside of the study area. This includes Vine Street, which will not need improvements due to this development.

However, the development scenario of 2,600 residential units results in LOS F from Vine Street to 4800 South on Murray Boulevard. Widening Murray Boulevard to 5 lanes north of Vine Street is needed under every scenario.

Figure 5-2 shows potential traffic growth increases for residential densities of 1,600 units and 2,600 units.

It is likely there will be demand for on street parking. In all scenarios at least 15 acres are needed on a 26-acre parcel for off street surface parking to be compliant with city code requirements or the Institute of Transportation Engineers (ITE) standards. Solutions that reduce on street parking demand should be coordinated with the developer.

Conceptual site plan for Galleria Apartments

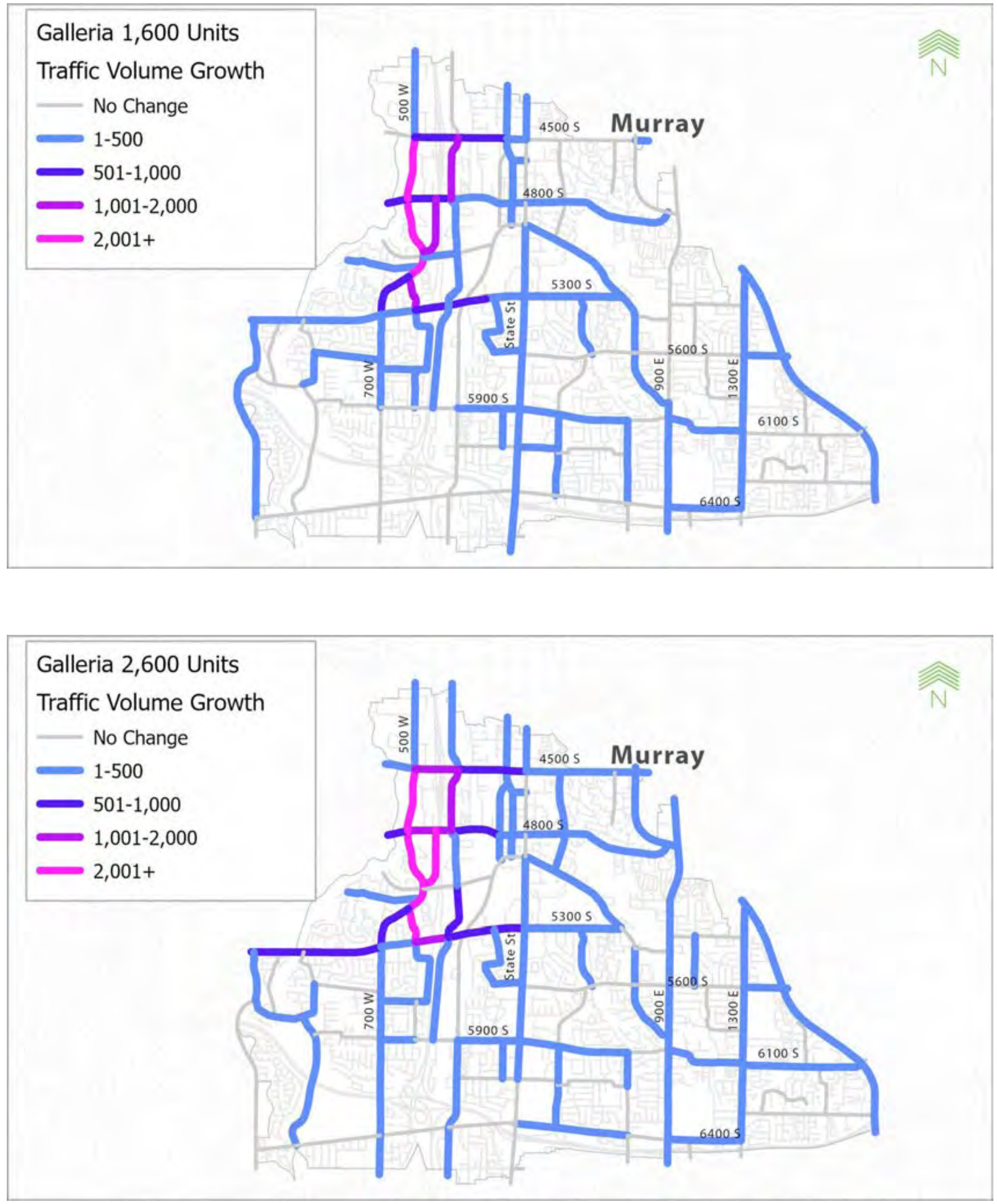


Since this development is mixed-use and near TRAX, it is recommended that active transportation infrastructure be incorporated into the design and the surrounding area, offering people an alternative to driving to get to destinations. Developer agreements that require active transportation facilities will help reduce the burden the development will place on the transportation system. In addition to sidewalks and bike lanes, short-term and long-term bicycle parking should be considered based upon the different uses of the development. Long-term parking is ideal for office and residential spaces, while short-term parking benefits shoppers and other business patrons.

Conclusion:

The Galleria Apartments developer is working with the city to finalize densities and their site plan. The final number of units, while still to be determined, will have an impact on adjacent road systems. This will require a detailed traffic study.

Figure 5-2: Potential traffic volume growth



5300 South Corporate Center

This intersection is located to the west of the 5400 South I-15 interchange and east of Murray Boulevard. To the north, College Drive terminates when it meets Murray Boulevard about one-third of a mile from 5400 South.

This intersection is located next to a large business park accessed by Ascension Way, as well as multiple healthcare facilities and offices, including the regional Intermountain Medical Center, which is one of the largest medical centers in the Salt Lake Valley, with over 450 beds, and covers an area of over 100 acres.

These existing land uses, the heavily used transportation access points that surrounding it, and the design of the intersection itself, make this a hotspot for Murray.

Southbound traffic queuing is problematic and may begin to potentially block upstream traffic at the intersection of Ascension Way, which is a primary access point for the business park. Extending southbound storage capacity on College Drive at the 5300 South intersection may be part of an effective remedy for this intersection. An additional left turn lane would allow more vehicles to head towards the I-15 intersection during each light cycle, maximizing the utility and increasing the efficiency of potential signal timing options.

Traffic on 5300 South in the westbound lanes that are turning south onto College Drive/Green Street are met with two lanes, however, the inside lane almost immediately becomes a left turn only lane to accommodate vehicles entering the Select Health business center, an area with over 300 surface level parking spaces. Vehicles have about 150 feet to get out of the inside lane if they wish to continue straight and vice versa, creating possible points of conflict.

Intersection improvements, in the general area, could contribute to the alleviation congestion. Locations such as the intersection of Murray Boulevard and College Drive and Green Pine/Germania Avenue and Murray Boulevard could help disperse traffic north of the intersection. Upgrading these intersections also provides an opportunity to design and integrate safe and friendly active transportation facilities in locations that may currently feel unwelcoming and hazardous to those who chose (or would if safe facilities existed) an alternative mode of transportation to a car.

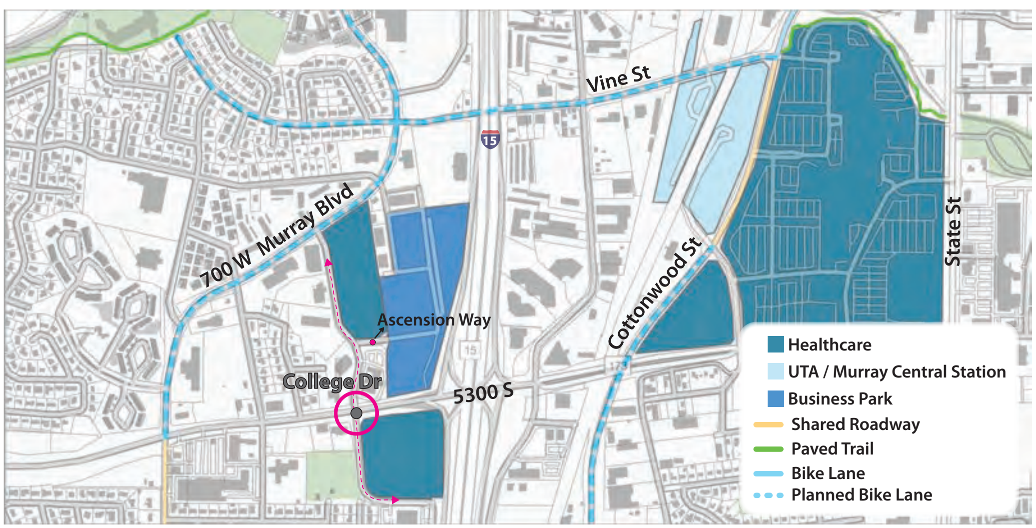
Both Vine Street and Murray Boulevard have planned active transportation infrastructure improvements on regional plans. A 10 minute bike ride or less can take an average rider from Murray Central Station to other key destinations in the area, such as the previously referenced healthcare facilities and office park. UTA survey data shows that Murray Central Station has a higher than average (7%) of users arriving by bike, and over 50% of users walk to the station. The installation of improved, new, and connected active transportation facilities could potentially get more vehicle drivers out of their cars and using alternative modes.

A bus rapid transit (BRT) line currently goes from Murray Boulevard to Vine Street to Murray Central Station. Expanding the route and adding stop locations would make riding transit a more viable option for a greater percentage of the population in the area.

The new Ascension office park and the several healthcare facilities collectively employee hundreds of people. Fostering public, private partnerships (P3) among these businesses and organizations to implement Travel Demand Management (TDM) strategies can help reduce the burden that is placed on the transportation system, including the intersection of College Drive and 5300 South. UDOT's program TravelWise, specifically works at establishing innovative P3 transportation solutions and can be used as a resource to tap.

Conceptual site plan for 5300 South Corporate Center Square (source Murray City)

College Drive and surrounding area



Conclusion:

A mix of transportation strategies, including geometry improvements, active transportation infrastructure, and accommodating transit options, will help create solutions that are resilient and enjoyable for the intersection of College Drive and 5300 South.

Travel Demand Management

Travel Demand Management (TDM) is a complement to traditional roadway infrastructure projects. TDM focuses on understanding how people make their transportation decisions and utilizes this knowledge to encourage travel choices that reduced demand on the transportation system. TDM is a cost-effective option to help plan and design the transportation network to naturally encourage alternatives to driving. TDM strategies can help create a more balanced transportation system that provides transportation options and choices for all users. These strategies can help Murray residents walk, bike, or use transit reducing the need for roadway capacity improvements.

To understand what factors are important for Murray residents when selecting a travel mode, the community survey also included questions on travel behavior. The first question asked residents which factors are most important when selecting a travel mode(see Figure 5-3). Overall, travel time was the most important consideration with 83% of respondents identifying it as an important factor when choosing to drive, walk, bike or take transit. Both convenience (70%) and ease of use (66%) were also identified important factors with more than half of the survey respondents identifying them as key factors when selecting a travel mode.

Figure 5-3: What impacts travel mode choice?

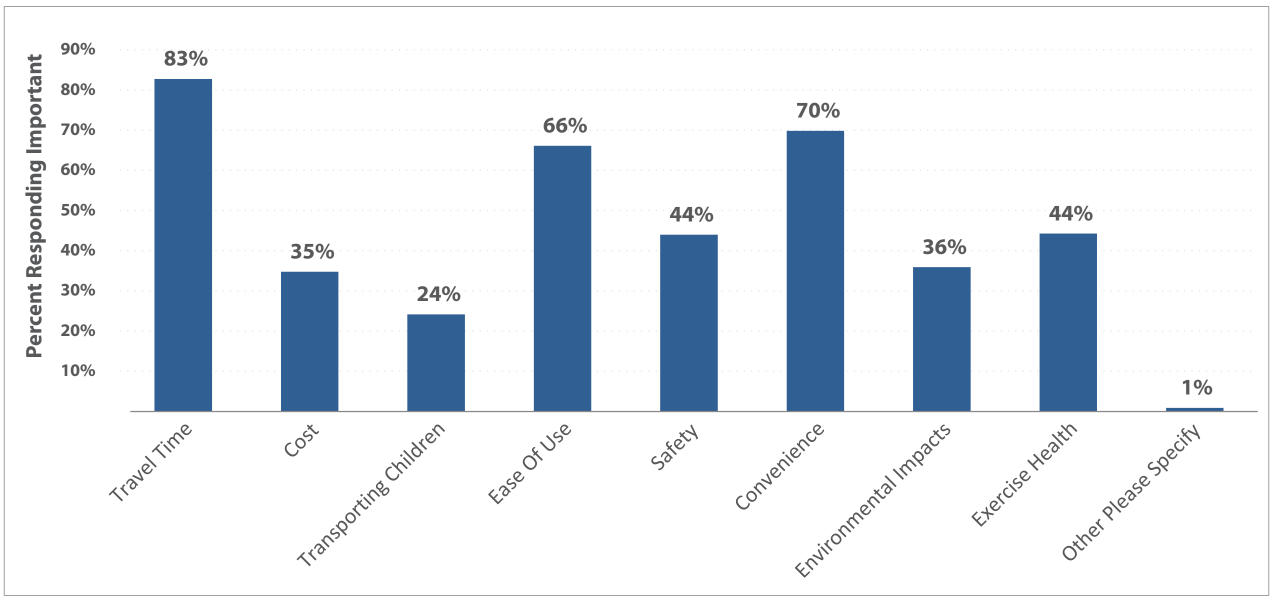
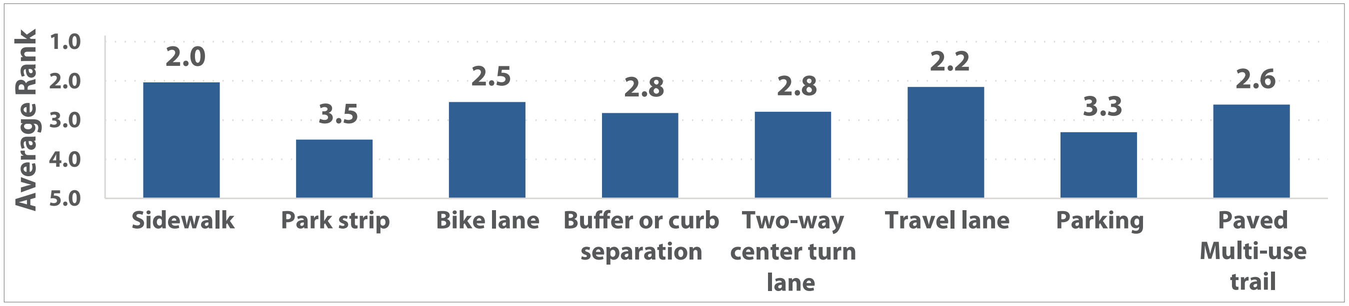
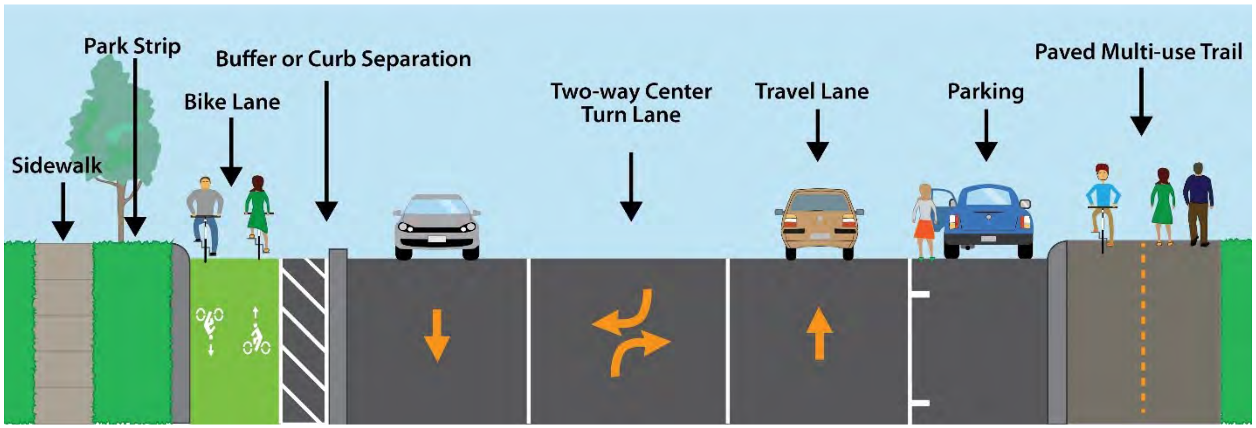


Figure 5-4: Most important cross-section feature





Residents also ranked which elements were most important to them within a typical street right-of-way from most important (1) to least important (5). As illustrated below, residents ranked sidewalks as the most important element with an average rank of 2. This was followed by travel lane (2.2), bike lane (2.5), multi-use trail (2.6), buffer or curb separation (2.8), and two-way center turn lane (2.8). The least important elements were parking (3.3) and park strip (3.5). The relative importance of these elements was used to identify which roadway elements are included in projects when there is insufficient space to provide all elements. Specifically, Murray City residents are indicating that sidewalks and bike lanes are more important than parking and park strips. This facilitates TDM strategies by providing a greater opportunity for residents to get out of their cars to walk and bike to their destinations.

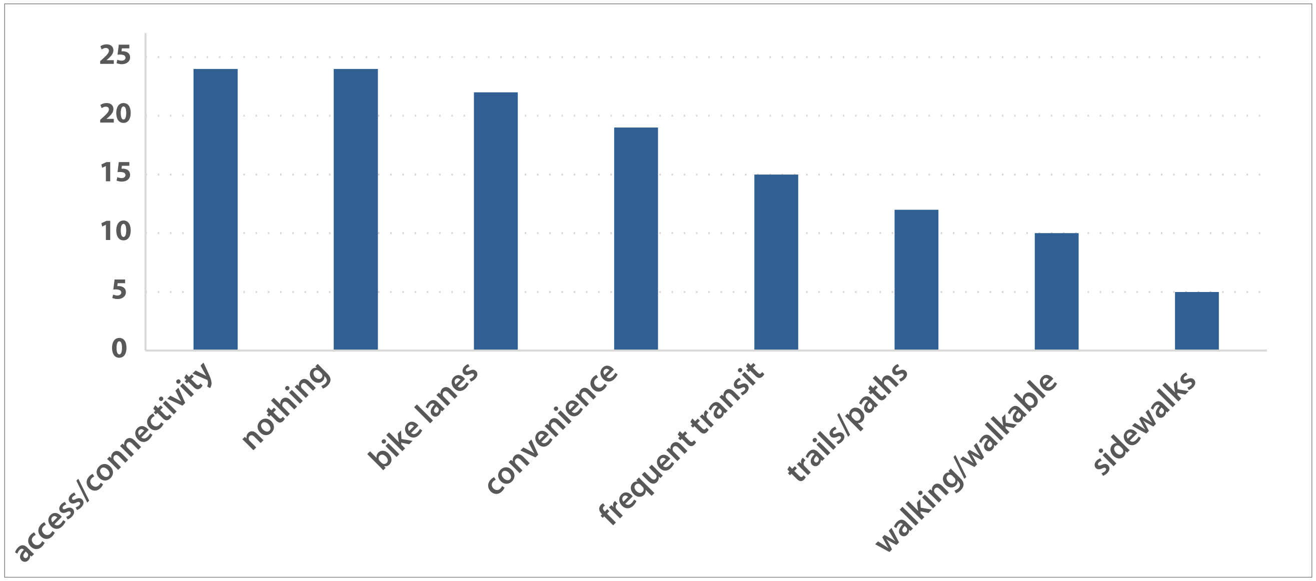
Figure 5-5: Bike lane projects

Each of these elements that were identified as a priority by Murray residents were evaluated and incorporated into projects identified in the Capital Facilities Plan in chapter 6.

Figure 5-5 shows the location of bike lane projects identified for the Capital Facilities Plan. Theses projects will increase mobility options and active transportation use. They will create safe, direct, and accessible connections across the city. These recommended bike lane projects will increase connectivity and will advance and improve the effectiveness of TDM strategies within the City.

This map of bike lane projects exemplifies the cohesive planning and continued commitment to keep city wide planning aligned with the transportation goal identified in Murray's 2017 General Plan : *"Provide an efficient and comprehensive multi-modal transportation system that effectively serves residents and integrates with the regional transportation plan for the Wasatch Front. "*

Figure 5-6: What is need to encourage alternative transportation?



Connectivity

Access/connectivity was the most common response, and it is a requirement to achieve both the transportation plan goals, as well as others found in Murray's General Plan. Street connectivity throughout neighborhoods is proven to reduce vehicle miles traved (VMT), increase response time from emergency services, provide a wider array of access choices within close proximity to more people, and increase sales to local businesses, in return increase local sales tax revenue. As for vehicular accidents, it is safer in general to walk and bike in neighborhoods with better connectivity because more severe crashes occur where there are fewer intersections. When there are fewer intersections, and access is restricted, vehicles travel at higher speeds, the outcome of which is more intense and serious crashes.

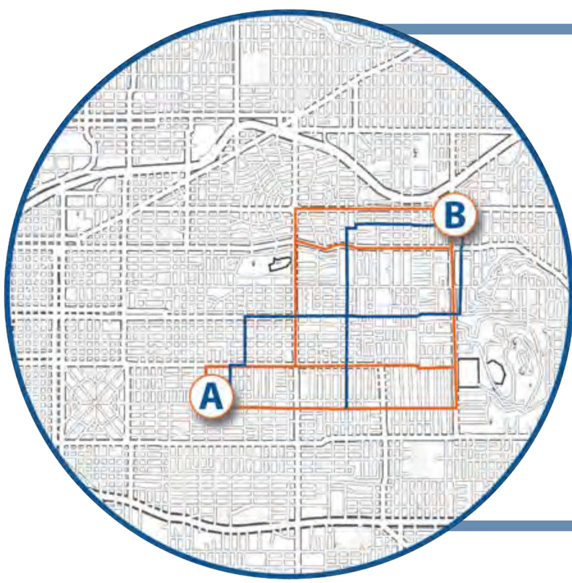
To allow for multiple connections from a neighborhood means more choices for residents when deciding how and where to go. Greater neighborhood connectivity allows for more mobility choices such as walking and biking, which can lead to an increase in the overall health of the community. The CDC (Centers for Disease Control and Prevention) offer community strategies to improve health, and a top recommended instrument of success is utilizing planning and design to connect routes to destinations in ways people can access places through active transportation.

Some of the CDC 's suggestions to incorporate connectivity into community plans are considering block length and size, developing a connectivity index and complementing/associated standards, subdivision regulations for connectivity, the encouragement of paths and greenways along creeks, streams, and utility easements, and pedestrian and street connectivity between neighborhoods.

Murray City Code has policy regulations regarding connectivity for existing streets and future developments which include the requirement that "the street and traffic access design of a proposed subdivision development shall promote the purposes and goals of the City's Master Transportation Plan," and "the street pattern in the subdivision shall be in general conformity with a plan for the most advantageous development of adjoining areas and the entire neighborhood or district," with "the intent of the city to have streets interconnect with other subdivisions and adjacent properties."

Murray should continue to stub its streets and utilities on existing roads as development occurs to ensure that these roads and utilities can continue to connect to and through neighborhoods when future development occurs. This process is one of the essential steps in supporting a well-connected neighborhood.

These travel behavior questions from the public survey, along with travel demand results in Future Conditions were used to identify transportation improvements within Murray. These transportation improvements focus on increasing connections that can encourage walking, biking, and transit as legitimate alternatives to driving. These connections create a more balanced transportation system by providing practical mobility choices for all users. Ultimately, these improvements will help reduce the need for roadway capacity projects within Murray. A map of all recommend projects is in the next chapter as Figure 6-1.



Connectivity: **A transportation system with high connectivity benefits all users and modes. By increasing the amount of continuous direct connections, connectivity increases access and mobility and allows more people to get to more places easier. It removes traffic from busy major roads, reducing air and noise pollution and time spent traveling. It increases safety not only for vehicles, but for pedestrians and bicyclists, too. It contributes to a healthier community because people can travel by foot or bike. In addition, it also provides better access to public transportation. Overall, a well connected road network increases options for residents, increasing livability and quality of life .**

6 CAPITAL FACILITIES PLAN

This chapter includes a capital facilities plan with the recommended transportation projects and cost estimates. It also includes a detailed section on funding.

Identified Projects

Based upon the evaluation of existing and future conditions, as well as public input received through the planning process, specific recommendations were developed for each plan element. These recommendations will be used to complete the transportation network, including functionally classified roads, transportation investments, and AT projects.

CAPITAL FACILITIES

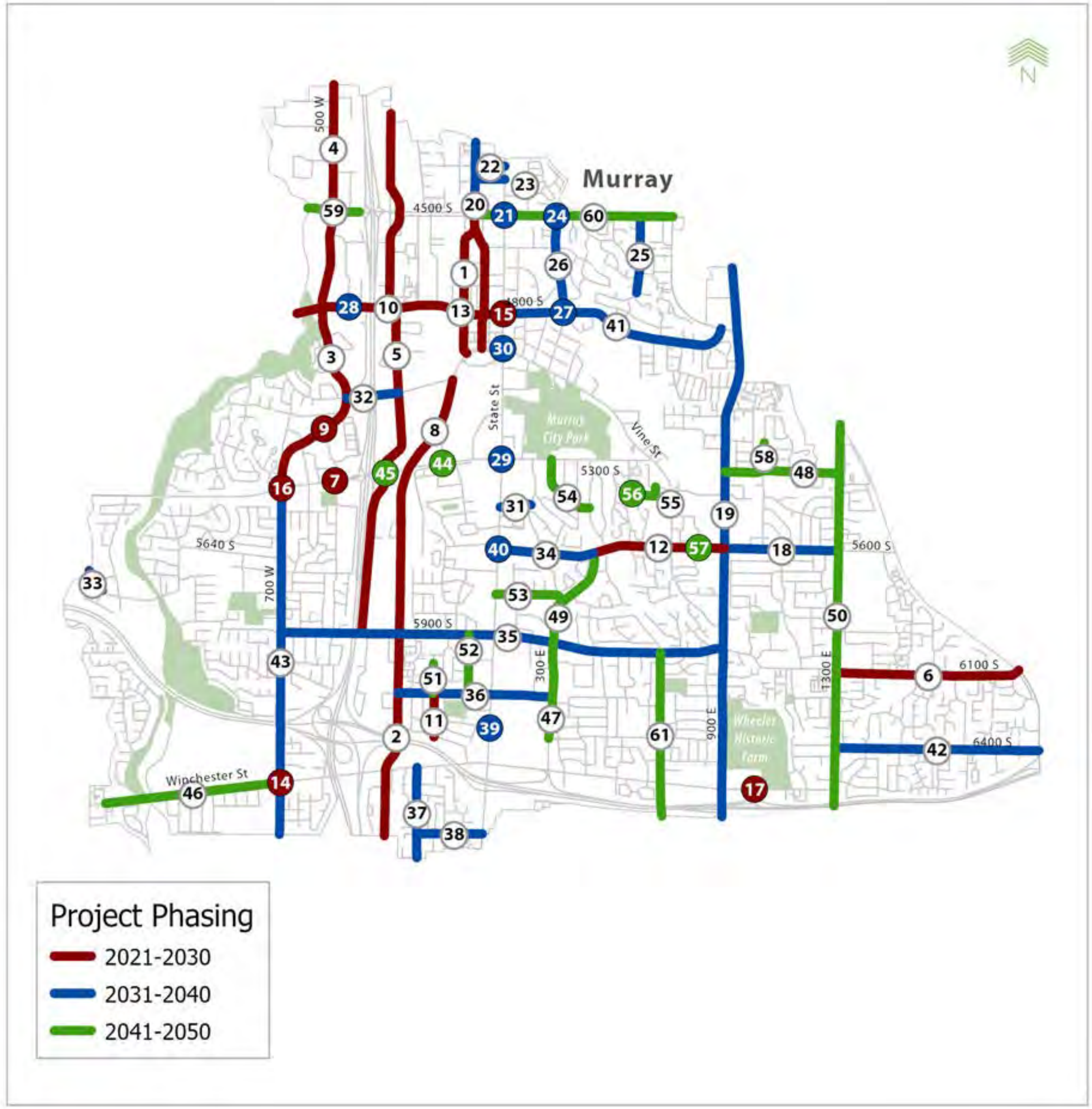
A capital facilities plan is designed to show the future transportation investment needed in a community. It enhances existing transportation corridors and plans for spot improvements to provide future residents of the community with a high-quality transportation system.

The capital facilities plan through the year 2050 is provided in this chapter, and is displayed in five parts, first by project type and then by project phase. These include projects for: Bikeways, Intersections, Roadway Widening, Sidewalks and Trails and then by phase for when these project projects are needed.

Table 6-1: Project costs

	Cost	Murray's Share
Total	**$105,974,000**	**$38,642,000**
PHASE I	**$33,524,000**	**$15,019,000**
PHASE II	**$39,860,000**	**$7,641,000**
PHASE III	**$32,590,000**	**$15,982,000**

Figure 6-1: Capital Facilities Plan projects



Phase I covers years 2021 to 2030 and includes 14 total projects.

Figure 6-2 is a map of the projects and Table 6-2 is the full project list, including all project types.

Figure 6-2: Phase I projects

Table 6-2: Phase I project list

Phase	#	Project	Location	Type	Funding	Total Cost	Murray City Total
2021-2030	1	Hanauer / Box Elder Street	Vine Street to 4500 South	New Construction / Widening with Bike Lanes	Murray City/WFRC	$10,100,000	$684,000
	2	Cottonwood Street	South City Limit to 5600 South	Widen: 2 to 3 Lanes with Bike Lanes	Murray City	$6,500,000	$6,500,000
	3	Murray Boulevard / 500 West	5400 South to 4500 South	Widen: 3 to 5 Lanes with Bike Lanes	Murray City	$7,280,000	$7,280,000
	4	500 West	4500 South to North City Limit	Restripe/Widen: 2 to 3 Lanes with Bike Lanes	Murray City	$1,587,000	$1,587,000
	5	Commerce Drive	Central Ave to 5900 South	Restripe/Widen: 2 to 3 Lanes with Bike Lanes / Sidewalks	Murray City	$1,059,000	$1,059,000
	6	Vine Street	1300 East to Vanwinkle	Widen: 2 to 3 Lanes with Bike Lanes / Sidewalks	Murray City/WFRC	$5,676,000	$386,000
	7	5300 South / College Drive	5300 South / College Drive	Intersection Improvements	Murray City/CMAQ	$2,400,000	$550,000
	8	Cottonwood Street	5600 South to Vine Street	Restripe with Bike Lanes	Murray City	$310,000	$310,000
	9	Murray Blvd / College Drive	Murray Blvd / College Drive	New Traffic Signal	Murray City	$430,000	$430,000
	10	4800 South	West City Limit to 200 West	Restripe: 2 to 3 Lanes with Bike Lanes	Murray City	$88,000	$88,000
	11	Cedar Street	Clay Park Dr to 6100 South	Add Sidewalk	Murray City	$413,000	$413,000
	12	5600 South	Fashion Blvd to 900 East	Restripe with Bike Lanes	Murray City	$96,000	$96,000
	13	4800 South	200 West to State Street	Mill/Overlay with Restripe: 2 to 3 Lanes with Bike Lanes	Murray City	$443,000	$443,000
	14	700 West / Winchester Street	700 West / Winchester Street	Intersection Improvements	Murray City/CMAQ	$2,258,000	$153,000
	15	4800 South/State Street	4800 South/State Street	Intersection Improvements	Murray City	$750,000	$750,000
	16	5400 South/700 W	5400 South/700 W	East/West Dual Left Turns	Murray City	$750,000	$750,000
	17	6600 South / Union Park Ave	6600 South / Union Park Ave	Intersection Improvements	Murray City	$674,000	$674,000
				PHASE I Total		**41,064,000**	**22,403,000**

Phase II covers years 2031 to 2040 and includes 24 total projects.

Figure 6-3 is a map of the projects and Table 6-3 is the full project list, including all project types.

Figure 6-3: Phase II projects

Table 6-3: Phase II project list

Phase	#	Project	Location	Type	Funding	Total Cost	Murray City Total
2031-2040	18	5600 South	900 East to 1300 East	Widening with Bike Lanes / Sidewalks	Murray City	$6,957,000	$555,000
	19	900 East	South City Limit to North City Limit	Restripe/Minor Widening with Bike Lanes / Sidewalks	UDOT	$10,721,000	$-
	20	Main Street	4500 South to North City Limit	Restripe with Bike Lanes / Minor Widening	Murray City	$505,000	$505,000
	21	4500 South / State Street	4500 South / State Street	Intersection Improvements	UDOT	$1,303,000	$-
	22	Fireclay Ave	Main Street to State Street	Add Sidewalk	Murray City	$292,000	$292,000
	23	Edison Street	Main Street to State Street	Add Sidewalk	Murray City	$123,000	$123,000
	24	4500 South / Atwood Blvd	4500 South / Atwood Blvd	New Traffic Signal	UDOT	$1,300,000	$-
	25	600 East	4700 South to 4500 South	Add Sidewalk	Murray City	$699,000	$699,000
	26	Atwood Boulevard	4800 South to 4500 South	Add Sidewalk	Murray City	$223,000	$223,000
	27	4800 South / Atwood Blvd	4800 South / Atwood Blvd	New Traffic Signal	Murray City	$430,000	$430,000
	28	4800 South / Cherry Street	4800 South / Cherry Street	New Traffic Signal	Murray City	$430,000	$430,000
	29	5300 South / State Street	5300 South / State Street	Intersection Improvements	UDOT	$8,600,000	$-
	30	Vine Street / State Street	Vine Street / State Street	Intersection Improvements	UDOT	$1,047,000	$-
	31	5460 South	State Street to 235 East	Widen: 2 Lanes with Parking	Murray City	$796,000	$796,000
	32	Vine Street	Murray Boulevard to Commerce Drive	Restripe: 2 to 3 Lanes with Bike Lanes and Sidewalks / Minor Widening	Murray City	$512,000	$512,000
	33	Bullion Street	1300 West to 1250 West	Widen: 2 Lanes with Sidewalk	Murray City	$975,000	$975,000
	34	5600 South	State Street to Fashion Blvd	Restripe with Bike Lanes	Murray City	$141,000	$141,000
	35	5900 South	700 West to 900 East	Restripe with Bike Lanes	Murray City	$429,000	$429,000
	36	6100 South	300 West to Fashion Boulevard	Restripe with Bike Lanes	Murray City	$60,000	$60,000
	37	Jefferson Street	Lenora Joe Cove to Winchester St	Widen with Sidewalks	Murray City	$608,000	$608,000
	38	Lester Avenue	Jefferson St to State St	Add Sidewalk	Murray City	$1,366,000	$1,366,000
	39	6200 South / State Street	6200 South / State Street	New Traffic Signal	Murray City	$750,000	$750,000
	40	5900 South / State Street	5900 South / State Street	Intersection Improvements	UDOT	$2,416,000	$-
	41	4800 South	State Street to 700 East	Restripe: 2 to 3 Lanes with Bike Lanes	Murray City	$297,000	$297,000
	42	6400 South	1300 to Van Winkle Expressway	Widen with Sidewalks	Murray City	$3,824,000	$3,824,000
	43	700 West	South City Limit to 5400 South	Restripe: 2 to 3 Lanes with Bike Lanes	Murray City	$985,000	$985,000
				PHASE II Total		**45,789,000**	**14,000,000**

Phase III covers years 2041 to 2050 and includes 21 total projects.

Figure 6-4 is a map of the projects and Table 6-4 is the full project list, including all project types.

Figure 6-4: Phase III projects

Table 6-4: Phase III project list

Phase	#	Project	Location	Type	Funding	Total Cost	Murray City Total
2041-2050	44	5300 South / Woodrow Street	5300 South / Woodrow Street	Intersection Improvements	UDOT	$1,349,000	$-
	45	5300 South / Commerce Drive	5300 South / Commerce Drive	Intersection Improvements	UDOT	$8,600,000	$-
	46	Winchester Street	1200 West to 700 West	Widen: 2 to 3 Lanes with Sidewalks	Murray City	$3,831,000	$3,831,000
	47	Fashion Boulevard	6300 South to 6200 South	Add Sidewalk	Murray City	$162,000	$162,000
	48	5290 South	900 East to 1300 East	Add Sidewalk	Murray City	$324,000	$324,000
	49	Fashion Blvd	6100 South to 5600 South	Restripe with Bike Lanes	Murray City	$262,000	$262,000
	50	1300 East	I-215 to 5290 South	Widen/Restripe with Bike Lanes	Murray City	$2,356,000	$2,356,000
	51	115 West	6100 South to 6000 South	Add Sidewalk	Murray City	$274,000	$274,000
	52	Main Street	6100 South to 5900 South	Add Sidewalk	Murray City	$223,000	$223,000
	53	5770 South	State Street to Fashion Blvd	Restripe: 2 to 3 Lanes	Murray City	$94,000	$94,000
	54	Alpine Drive	Avalon Dr to 5300 South	Add Sidewalk	Murray City	$344,000	$344,000
	55	5400 South / 630 East	560 East to Woodoak Ln	Add Sidewalk	Murray City	$313,000	$313,000
	56	5400 South / 550 East	5400 South / 550 East	Intersection Improvements	Murray City	$498,000	$498,000
	57	5600 South / 800 East	5600 South / 800 East	New HAWK Traffic Signal	Murray City	$1,587,000	$1,587,000
	58	1045 East	5290 South to 5150 South	Add Sidewalk	Murray City	$143,000	$143,000
	59	4500 South	Jordan River to I-15	Add Trail	UDOT	$115,000	$-
	60	4500 South	Main Street to 700 East	Widen with Bike Lanes	UDOT	$6,544,000	$-
	61	725 East	South City Limit to 5900 South	Restripe with Bike Lanes	Murray City	$88,000	$88,000
				PHASE III Total		**27,107,000**	**10,499,000**

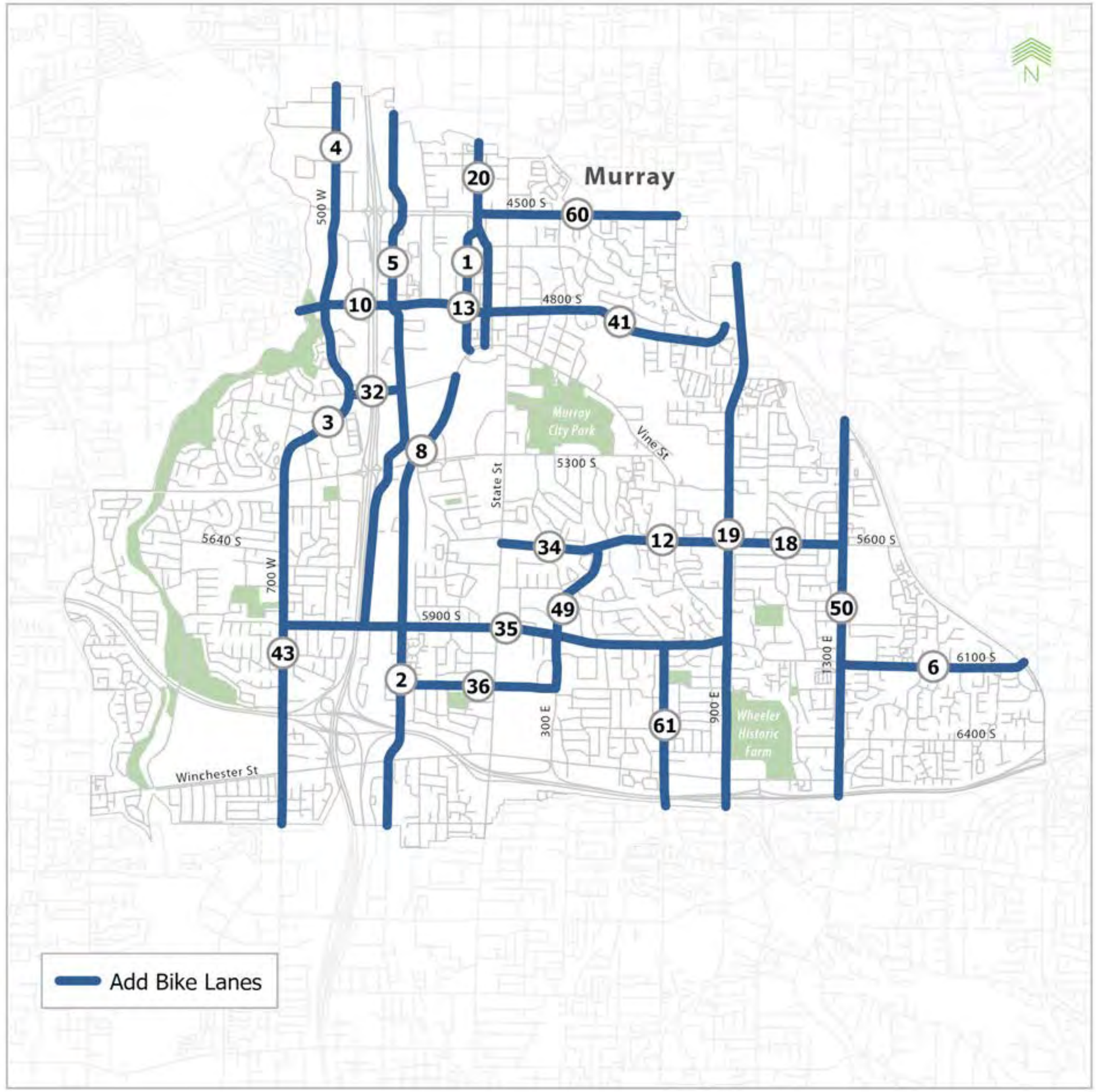
The complete project list for the Murray Transportation Master Plan includes widening projects, new roads, intersection improvements, transit, and active transportation facilities. This list is extensive with 61 projects and ensures that Murray residents will have a future transportation network that is well functioning and stable.

While project phasing is central to a capital improvements plan, Murray's mix of widening projects, new roads, intersection improvements, sidewalks, and bike lane facilities contains many project types. To understand how these projects fit together, Figure 6-5 through 6-10 summarizes all projects by type, providing a large-scale view of the planned transportation improvements within the City. This provides for an easy understanding of what transportation improvements are expected.

Bike lane projects represent important connections within the community and are highly important to Murray residents.

There are 23 bike lane projects planned for Murray, 10 of which are in phase I.

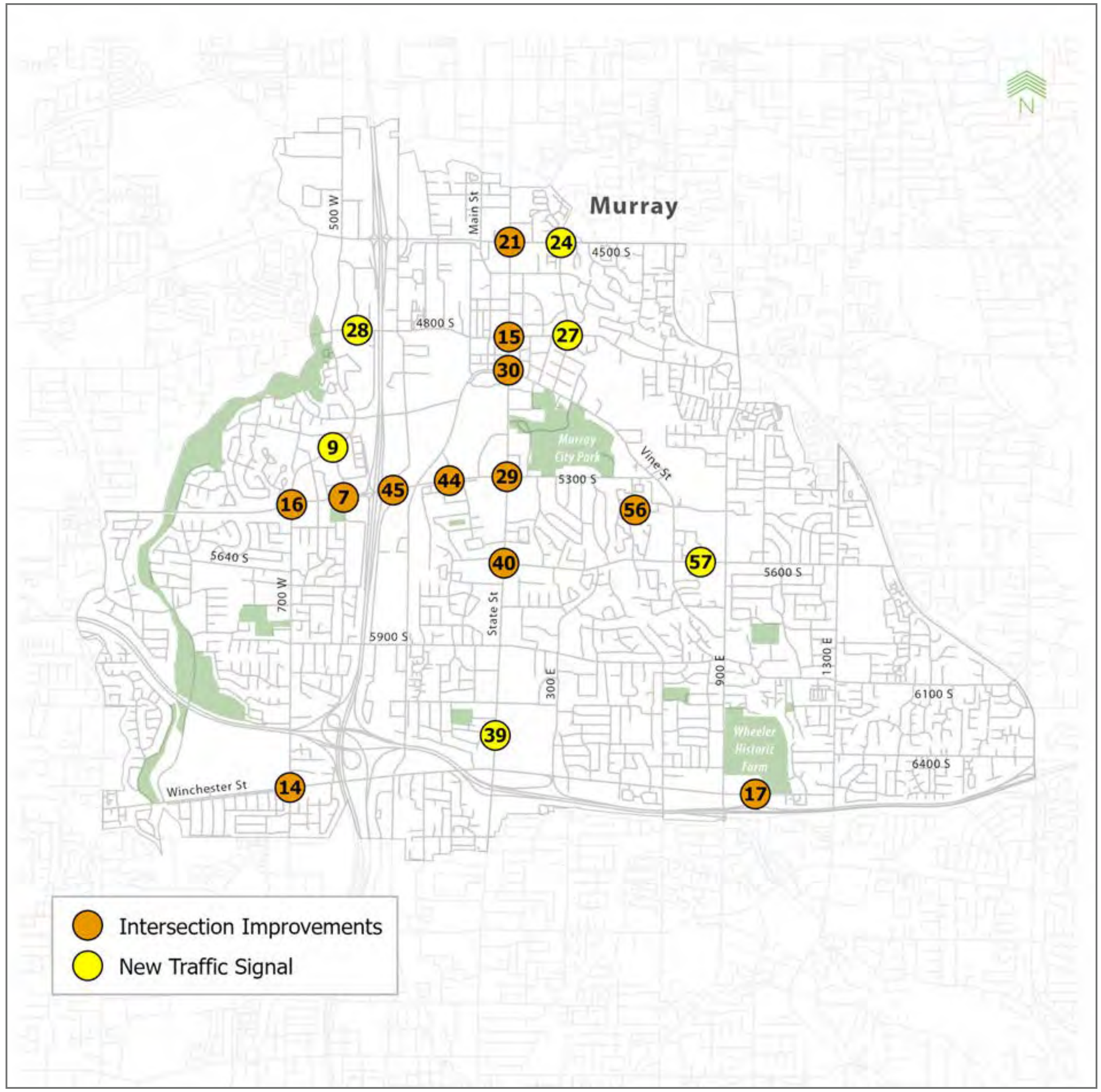
Figure 6-5: Bike lane projects



This Plan includes several types of intersection projects, including adding turn lanes, installing signals, constructing HAWK signals, etc.

There are 16 intersection projects planned, including 3 in phase I.

Figure 6-6: Intersection improvement projects



Roadway widening and restriping projects provide a big benefit to the overall transportation system.

This plan identifies 21 projects needed over the next 30 years.

Figure 6-7: Widening and restriping projects

Sidewalks provide human-level connections that are important to Murray residents, and not to be overlooked. A total of 21 sidewalk projects are included in all phases of this plan.

Figure 6-8: Sidewalk projects

Figure 6-9: All projects by phase

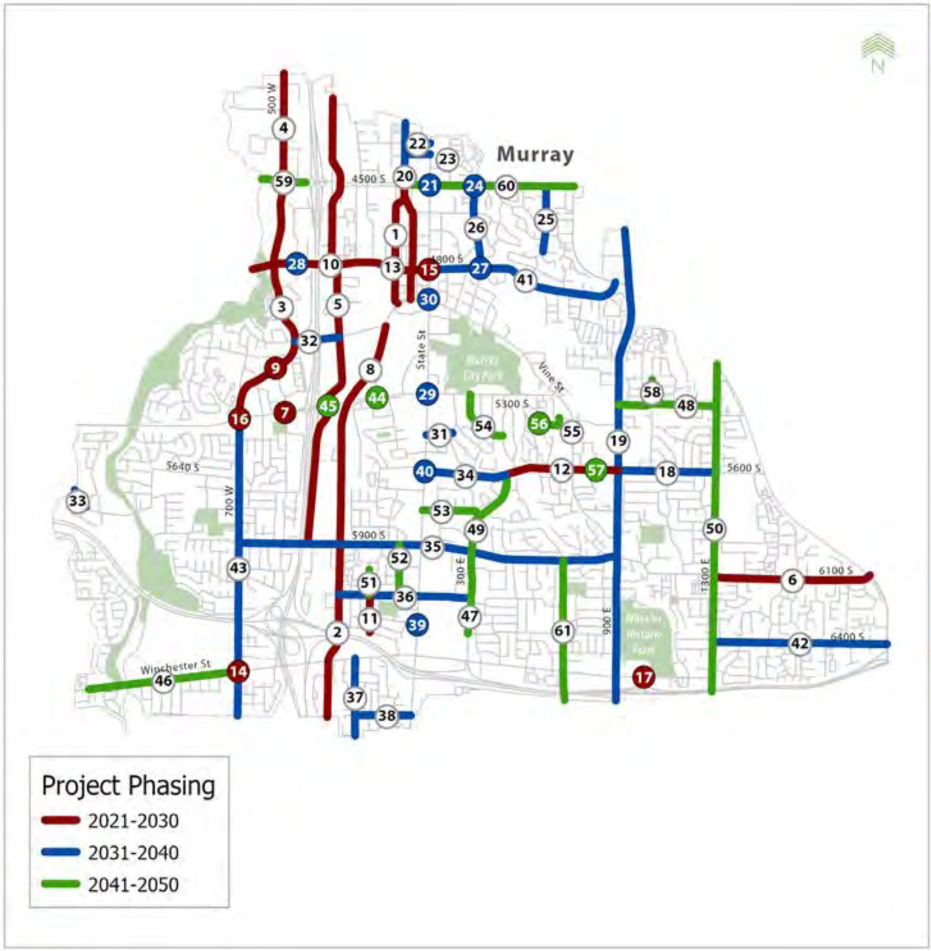
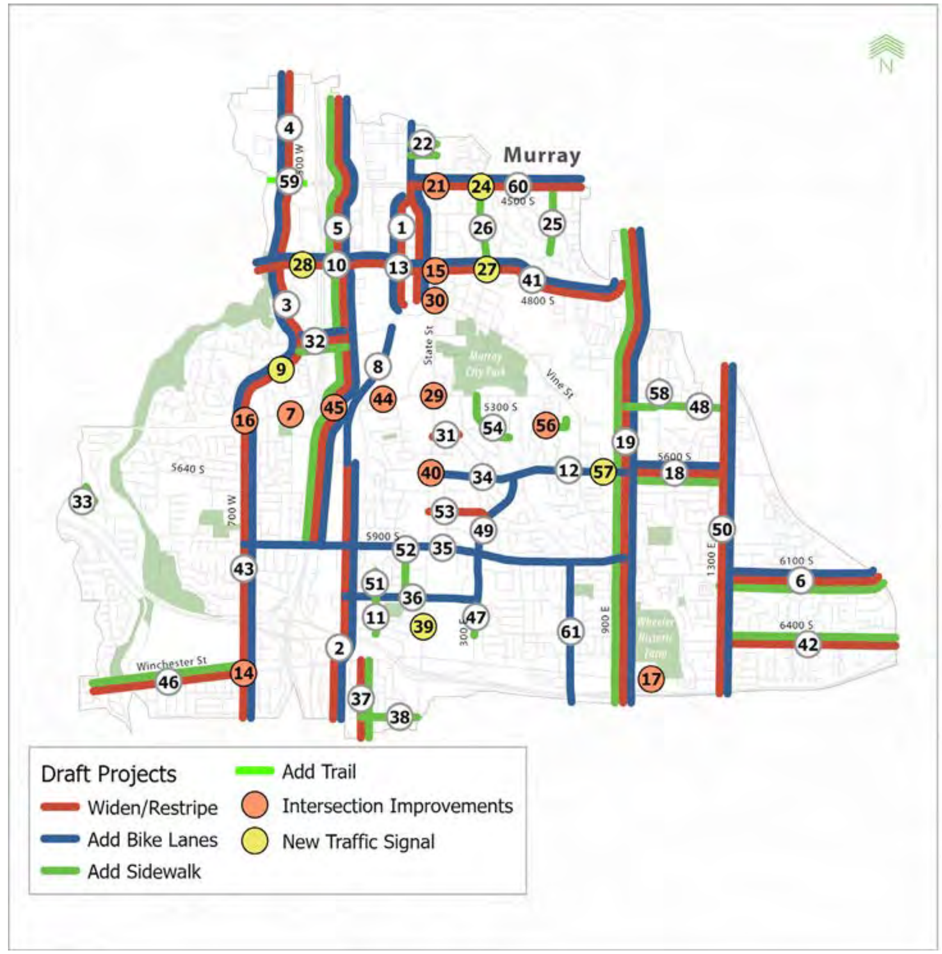


Figure 6-10: All projects by type



Funding

All possible revenue sources have been considered as a means of financing transportation capital improvements needed as a result of new growth. This section discusses the potential revenue sources that could be used to fund transportation needs as a result of new development.

Transportation routes often span multiple jurisdictions and provide regional significance to the transportation network. As a result, other government jurisdictions or agencies often help pay for such regional benefits. Those jurisdictions and agencies could include the Federal Government, the State (UDOT), the County, and WFRC. The City will need to continue to partner and work with these other jurisdictions to ensure adequate funds are available for the specific improvements necessary to maintain an acceptable LOS. Murray will also need to partner with adjacent communities to ensure corridor continuity across jurisdictional boundaries (i.e., arterials connect with arterials; collectors connect with collectors, etc.).

Funding sources for transportation are essential if Murray recommends improvements to be built. The following paragraphs further describe the various transportation funding sources available to the City.

Federal Funding

Federal monies are available to cities and counties through the federal-aid program. UDOT administers the funds. In order to be eligible, a project must be listed on the five-year Statewide Transportation Improvement Program (STIP).

The Surface Transportation Program (STP) funds projects for any roadway with a functional classification of a collector street or higher, as established on the Statewide Functional Classification Map. STP funds can be used for both rehabilitation and new construction. The Joint Highway Committee programs a portion of the STP funds for projects around the state in urban areas. Another portion of the STP funds can be used for projects in any area of the state at the discretion of the State Transportation Commission. Transportation Enhancement funds are allocated based on a competitive application process. The Transportation Enhancement Committee reviews the applications and then a portion of the application is passed to the State Transportation Commission. Transportation enhancements include twelve categories ranging from historic preservation, bicycle and pedestrian facilities, and water runoff mitigation.

WFRC accepts applications for federal funds from local and regional government jurisdictions. The WFRC Technical Advisory and Regional Planning Committees select projects for funding every two years. The selected projects form the Transportation Improvement Program (TIP). In order to receive funding, projects should include one or more of the following aspects:

» Congestion Relief – spot improvement projects intended to improve Levels of Service and/ or reduce average delay along those corridors identified in the Regional Transportation Plan as high congestion areas

» Mode Choice – projects improving the diversity and/or usefulness of travel modes other than single occupant vehicles

» Air Quality Improvements – projects showing demonstrable air quality benefits

» Safety – improvements to vehicular, pedestrian, and bicyclist safety

The Rebuilding American Infrastructure with Sustainability and Equity (RAISE) grant provides opportunities for investment in road, rail, transit, and port projects. The RAISE grant program replaced the Better Utilizing Investments to Leverage Development (BUILD) grant program and Transportation Investment Generating Economic Recovery (TIGER) program. RAISE can provide capital funding directly to any public entity, including municipalities, counties, MPOs, and others in contrast to traditional Federal funding that goes to mostly State DOTs and transit agencies. BUILD grants are intended to fund multi-modal, multi-jurisdictional projects that are more difficult to support through traditional DOT programs. Potential projects within Murray include 900 East that provides regional mobility, and multi-modal improvements for the greater Wasatch Front. BUILD grants are competitively awarded, with only 91 awarded projects out of 851 applications in 2018. The U.S. DOT has allocated $1 billion in fiscal year 2020 for these grants. Source: https://www.transportation.gov/BUILDgrants

State/County Funding

The distribution of State Class B and C Program funds is established by State Legislation and is administered by the State Department of Transportation. Revenues for the program are derived from State fuel taxes, registration fees, driver license fees, inspection fees, and transportation permits. 75 percent of these funds are kept by UDOT for their construction and maintenance programs. The rest is made available to counties and cities. As many of the roads in the city fall under UDOT jurisdiction, it is in the interests of the City that staff are aware of the procedures used by UDOT to allocate those funds and to be active in requesting that the funds be made available for UDOT-owned roadways in the City.

Class B and C funds are allocated to each city and county by a formula based on population, centerline miles, and land area. Class B funds are given to counties, and Class C funds are given to cities and towns. Class B and C funds can be used for maintenance and construction projects; however, 30 percent of those funds must be used for construction or maintenance projects that exceed $40,000. The remainder of these funds can be used for matching federal funds or to pay the principal, interest, premiums, and reserves for issued bonds.

Salt Lake County collects a 0.25% percent sales tax to fund transit and local and regional transportation projects. After the tax is collected, 20% is in control of county to distribute, 40% goes to UTA, and the remaining 40% is distributed to each city equally.

In 2005, the State Senate passed a bill providing for the advance acquisition of right-of-way for highways of regional significance. This bill enabled cities and counties to better plan for future transportation needs by acquiring property to be used as future right-of-way before it is fully developed and becomes extremely difficult to acquire. UDOT holds on account the revenue generated by the local corridor preservation fund, but the county is responsible to program and control monies. In order to qualify for preservation funds, the City must comply with the Corridor Preservation Process, found at the following link www.udot.utah.gov/public/ucon and also provided in the appendix of this report.

City Funding

Some cities utilize general fund revenues for their transportation programs. Another option for transportation funding is the creation of special improvement districts. These districts are organized for the purpose of funding a single specific project that benefits an identifiable group of properties. Another source of funding used by cities is revenue bonding for projects intended to benefit the entire community.

Private interests often provide resources for transportation improvements. Developers construct the local streets within subdivisions and often dedicate rights-of-way and participate in the construction of collector/arterial streets adjacent to their developments. Developers can also be considered a possible source of funds for projects through the use of impact fees. These fees are assessed as a result of the impacts a particular development will have on the surrounding roadway system, such as the need for traffic signals or street widening.

General fund revenues are typically reserved for operation and maintenance purposes as they relate to transportation. However, general funds could be used, if available, to fund the expansion or introduction of specific services. Providing a line item in the City-budgeted general funds to address roadway improvements, which are not impact fee eligible, is a recommended practice to fund transportation projects, should other funding options fall short of the needed amount.

General obligation bonds are debt paid for or backed by the City's taxing power. In general, facilities paid for through this revenue stream are in high demand amongst the community. Typically, general obligation bonds are not used to fund facilities that are needed as a result of new growth because existing residents would be paying for the impacts of new growth. As a result, general obligation bonds are not considered a fair means of financing future facilities needed as a result of new growth.

Certain areas might have different needs or require different methods of funding than traditional revenue sources. A Special Assessment Area (SAA) can be created for infrastructure needs that benefit or encompass specific areas of the City. Creation of the SAA may be initiated by the municipality by a resolution declaring public health, convenience, and necessity to require the creation of a SAA. The boundaries and services provided by the district must be specified and a public hearing must be held prior to creation of the SAA. Once the SAA is created, funding can be obtained from tax levies, bonds, and fees when approved by the majority of the qualified electors of the SAA. These funding mechanisms allow the costs to be spread out over time. Through the SAA, tax levies and bonding can apply to specific areas in the City needing to benefit from the improvements.

Interfund Loans

Since infrastructure must generally be built ahead of growth, it must sometimes be funded before expected impact fees are collected. Bonds are the solution to this problem in some cases. In other cases, funds from existing user rate revenue will be loaned to the impact fee fund to complete initial construction of the project. As impact fees are received, they will be reimbursed. Consideration of these loans will be included in the impact fee analysis and should be considered in subsequent accounting of impact fee expenditures.

Developer Dedications & Exactions

Developer dedications and exactions can both be credited against the developer's impact fee analysis. If the value of the developer dedications and/or extractions are less than the developer's impact fee liability, the developer will owe the balance of the liability to the City. If the dedications and/or extractions of the developer are greater than the impact fee liability, the City must reimburse the developer the difference.

Developer Impact Fees

Impact fees are a way for a community to obtain funds to assist in the construction of infrastructure improvements resulting from and needed to serve new growth. The premise behind impact fees is that if no new development occurred, the existing infrastructure would be adequate. Therefore, new developments should pay for the portion of required improvements that result from new growth. Impact fees are assessed for many types of infrastructures and facilities that are provided by a community, such as roadway facilities. According to state law, impact fees can only be used to fund growth related system improvements.

It is recommended that Murray perform an impact fee study to evaluate the effectiveness.

APPENDIX

Travel Demand Management Memo

The Wasatch Front Travel Demand Model, version 8.3.1 was used for the purposes of generating 2030 and 2050 forecasts for the Murray Transportation Master Plan. The following sections document the modeling process, including model revisions, methods and forecasts.

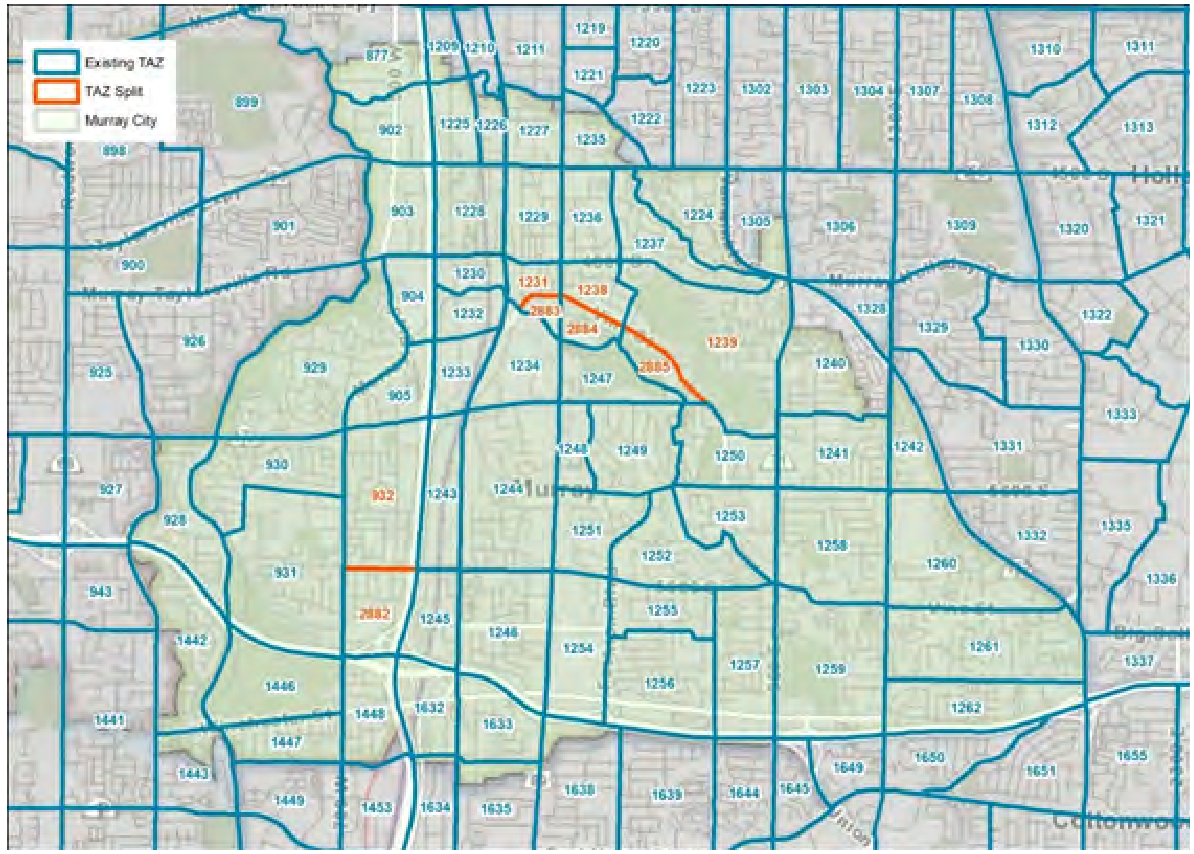
Model Revisions

Model revisions were made in an effort to refine the model to better capture existing travel patterns and thus generate better forecasts. Revisions were made to traffic analysis zones (TAZ), socioeconomic (SE) inputs, and model networks. The following sub-sections outline these revisions.

TAZ Splits

TAZ splits were performed within the city to better capture geographic breaks in land uses and to enable appropriate loading of traffic from land uses onto the highway network. Figure 1 shows the TAZ splits that were performed. A total of four zones were split into a resulting eight TAZs. The first TAZ split was made to zone 932 along 5900 South and resulted in new zone 2882. The remaining three zones (1231, 1238, and 1239) were split along Vine street and resulted in zone 2883, 2884, and 2885.

Figure 1: TAZ splits



SE Revisions

For the purposes of the 2019 base year and the 2030 and 2050 forecast year model runs, SE inputs were revised to better match existing conditions and planned development. Additionally, to accommodate the TAZ splits detailed above the SE data for the impacted zones had to get redistributed in the new TAZ structure. Existing land use, SE growth, new TAZ geometries and developable lands were all used to inform the reallocation of the data. Table 1, Table 2 and Table 3 show the original and reallocated SE data by TAZ for 2019, 2030 and 2050.

Table 1: 2019 Socioeconomic revisions

	2019 Existing			2019 Revised		
TAZ #	Households	Population	Employment	Households	Population	Employment
1209	2	6	925	-	-	925
1225	1	6	393	-	-	393
1233	4	10	1,203	-	-	1,203
1234	1	2	9,984	-	-	9,984
1243	6	16	1,152	-	-	1,152
1446	7	11	1	-	-	21
932	752	2,115	3,887	502	1,410	3,692
2882	-	-	-	**167**	**463**	**194**
1231	645	1,301	933	13	26	373
2883	-	-	-	**632**	**1,275**	**560**
1238	401	931	1,215	300	698	486
2884	-	-	-	**100**	**233**	**729**
1239	1,189	2,399	1,147	1,165	2,351	1,032
2885	-	-	-	**24**	**48**	**115**

***New TAZ**

Table 2: 2030 Socioeconomic revisions

	2030 Existing			2030 Revised		
TAZ #	Households	Population	Employment	Households	Population	Employment
904	379	899	395	1,279	2,699	395
905	30	74	3,478	30	74	3,978
1305	491	1,139	681	841	1,839	681
932	759	2,023	4,038	506	1,348	3,836
2882	-	-	-	**253**	**674**	**202**
1231	681	1,325	1,024	14	26	410
2883	-	-	-	**667**	**1,298**	**614**
1238	459	1,058	1,315	344	793	526
2884	-	-	-	**115**	**264**	**789**
1239	1,290	2,658	1,187	1,264	2,605	1,068
2885	-	-	-	**26**	**53**	**119**

***New TAZ**

Table 3: 2050 Socioeconomic revisions

	2050 Existing			2050 Revised		
TAZ #	Households	Population	Employment	Households	Population	Employment
904	440	988	504	1,340	2,788	504
905	34	78	3,598	34	78	4,100
1305	576	1,276	562	924	1,975	562
932	769	1,928	4,077	513	1,286	3,873
2882	-	-	-	**256**	**643**	**204**
1231	762	1,494	1,275	15	30	510
2883	-	-	-	**746**	**1,464**	**765**
1238	687	1,606	1,238	515	1,204	495
2884	-	-	-	**172**	**401**	**743**
1239	1,449	3,012	1,155	1,420	2,952	1,040
2885	-	-	-	**29**	**60**	**116**

***New TAZ**

Modeled Network

Network revisions were completed to better represent existing and future no-build conditions. Figure 2 below shows the revised 2019 network used for this analysis. Revisions included additional centroid connectors necessary to accommodate the new split TAZs, and the incorporation of Murray Parkway Avenue, Bullion Street, and 5640 South.

The pink lines shown are centroid connectors. When building a model, each (TAZ) has a central point, or centroid. The centroid connectors are links that connect the centroids to the transportation network.

Figure 2: 2019 Revised network by lanes

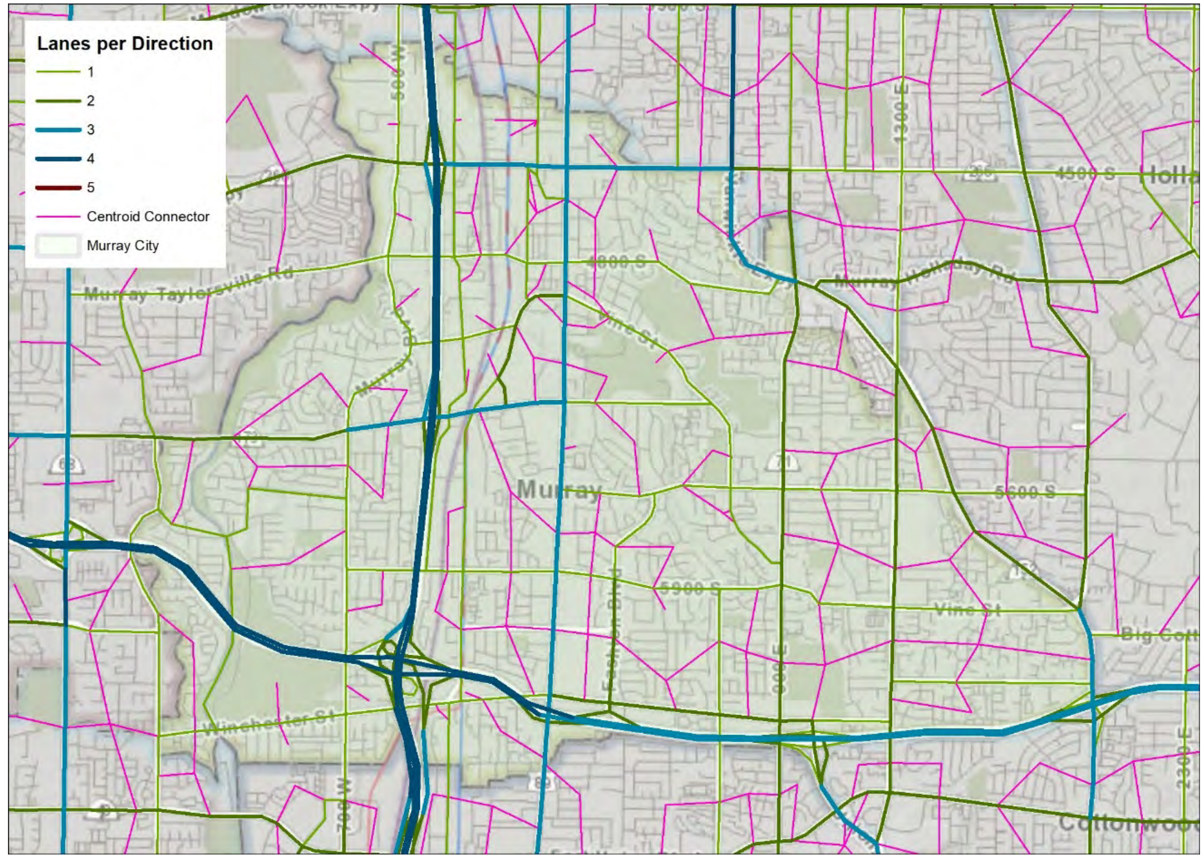


Table 4: Roadway Classification

Murray Roadway Classification	Use		Dimensions		Volume
	Trip Length (Miles)	Design Speed (MPH)	Lane Width(Feet)	Number of Lanes	AADT in Thousands
Freeway	>5	>65	12	6 - 8	80
Expressway	>5	55 - 65	12	5 - 6	75
Major Arterial	1 - 2	45 - 55	12	6	15 - 50
Minor Arterial	>1	40 - 45	12	3 - 5	10 - 25
Major Collector	1	30 - 40	12	2 - 5	3.5 - 10
Minor Collector	1	25 - 35	11 - 12	2 - 3	1.5 - 3.5
Local Street	<1	20 - 30	10 - 12	2	<1.5

Figure 3 shows the revised network for both the no build 2030 and 2050 forecast years. In addition to the changes carried over from the 2019 network revisions, the two-way couplet planned for Box Elder Street and Hanauer Street was incorporated.

Figure 3: 2030 and 2050 No build revised modeled network by lanes

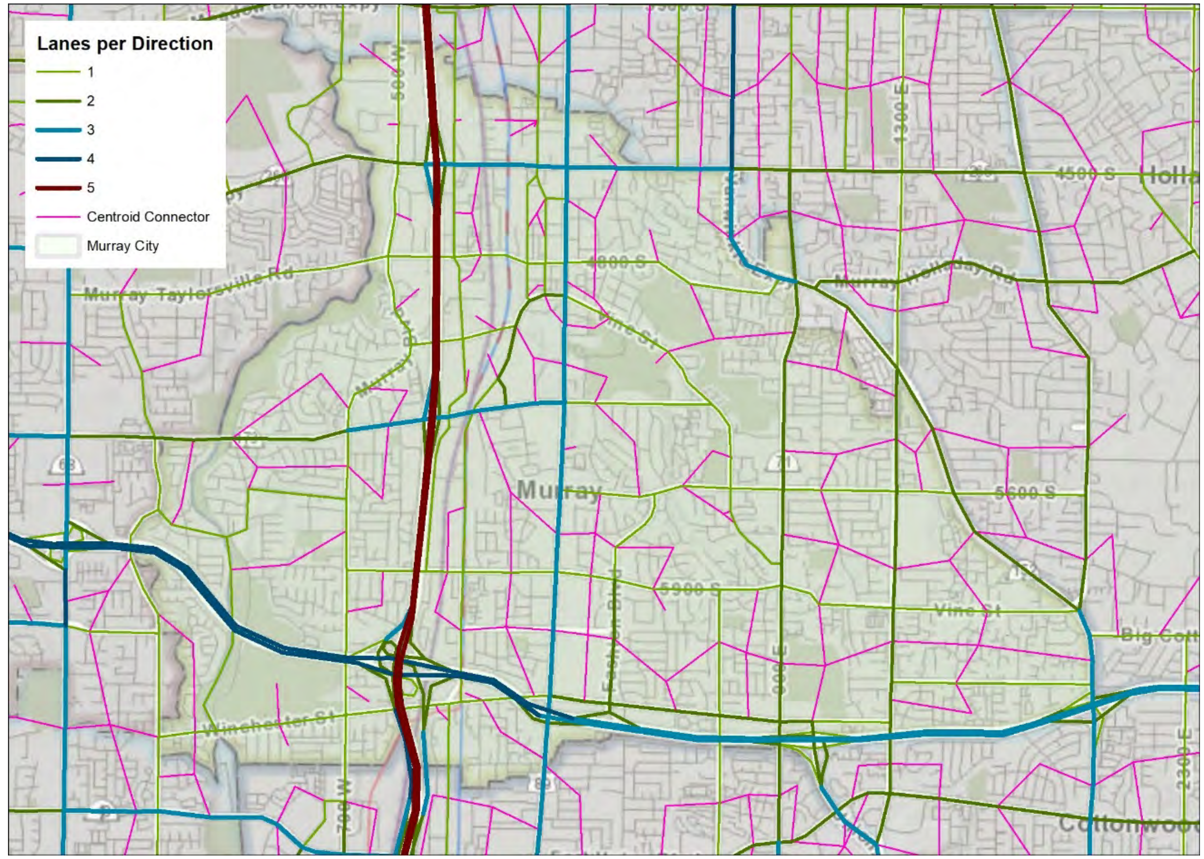
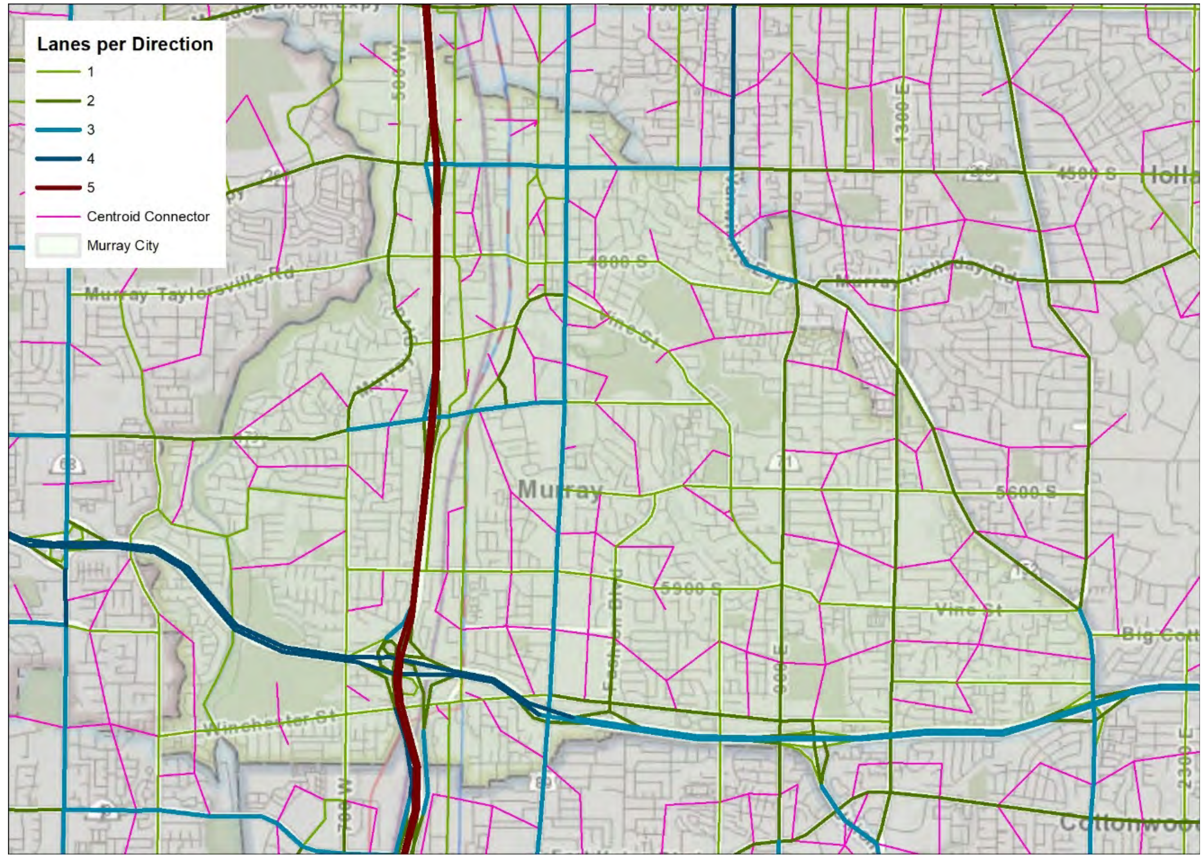


Figure 4 shows the 2030 and 2050 build network for the Murray Transportation plan. Since the model only represents through lanes, widening projects from 2 to 3-lanes will not show as a difference between the build and no build networks. The major difference represented in the build model network is the widening of 500 West/Murray Boulevard from 3 to 5-lanes, which is represented as having 2 through lanes per direction in the build network.

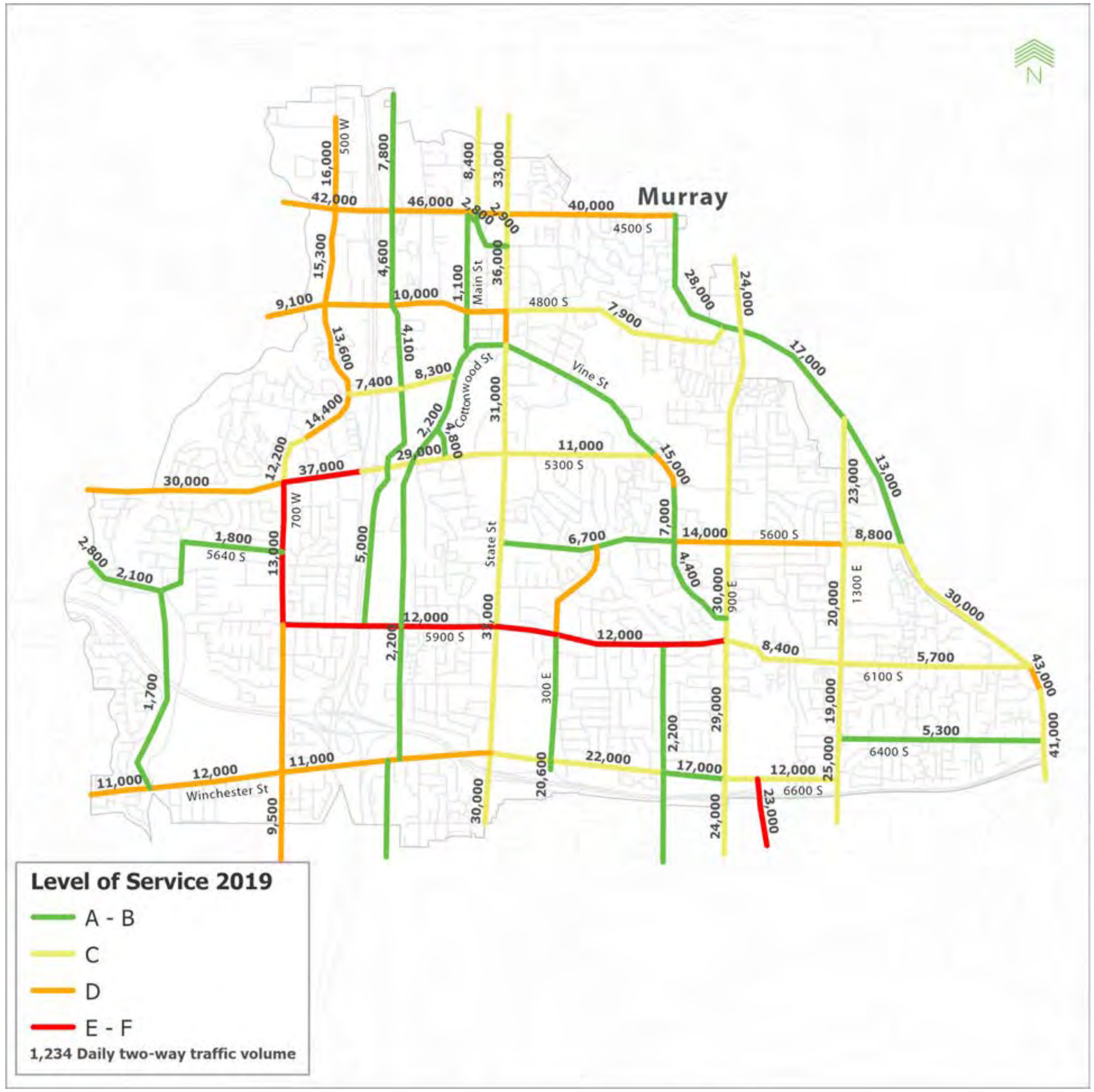
Figure 4: 2030 and 2050 Build revised modeled network by lanes



Model Results

The years of 2019, 2030 and 2050 were modeled using the above described inputs. Travel demand forecasts were produced for the forecast years using a correction factor developed from the 2019 model outputs and actual UDOT traffic data. Additionally, a level of service analysis was performed for each model year to assess existing and forecasted conditions.

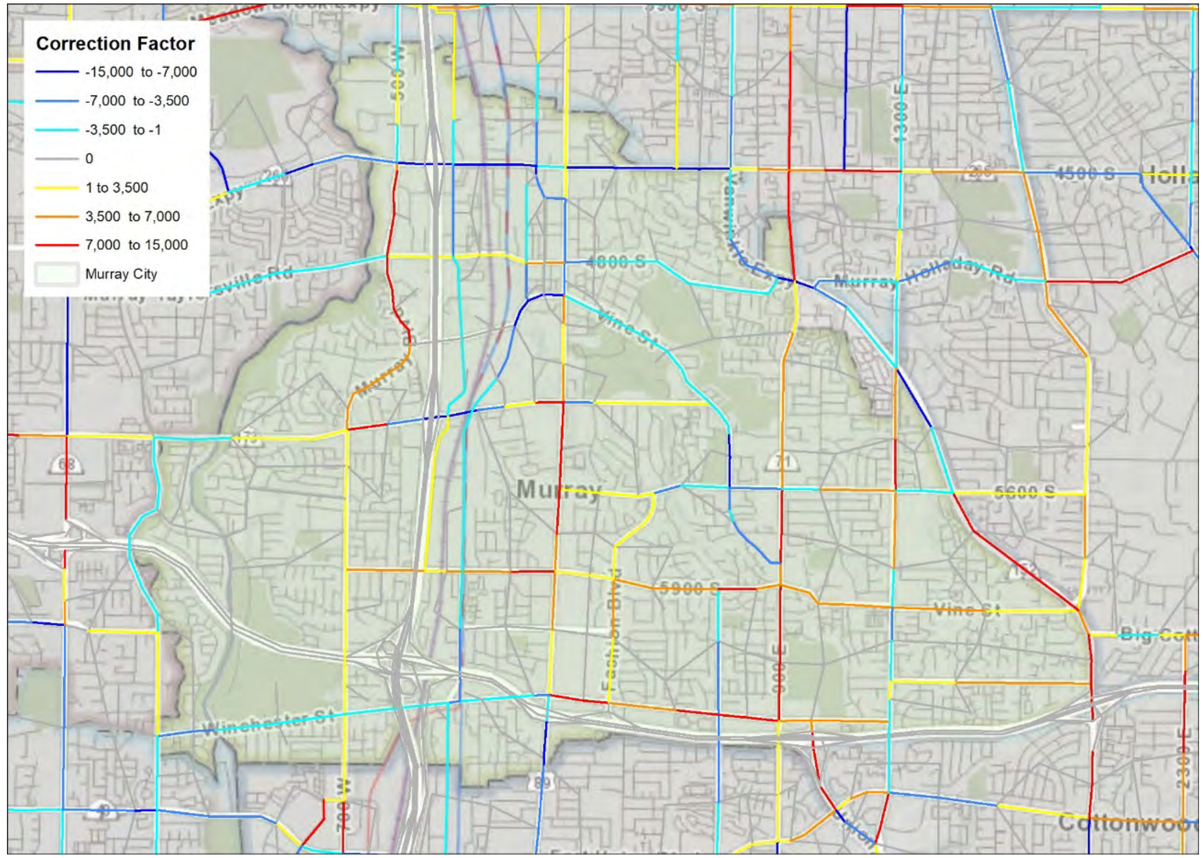
Figure 5: Existing 2019 level of service



Base-Year Correction

A base-year correction was developed to produce more accurate travel forecasts. The correction was created by subtracting traffic counts by the 2019 modeled volumes shown in Figure 5. For this purpose, UDOT 2017 Traffic on Utah Highways data, UDOT ATSPM data, and traffic counts from the city were used. The correction was then applied to the modeled volumes, with the assumption being that similar discrepancies will persist through the difference forecast years of the model. Figure 6 shows the base-year corrections applied to generate the 2030 and 2050 forecasts.

Figure 6: Base-year correction



Model Forecasts

Model forecasts were produced for 2030 and 2050 for both no build and build conditions. The same underlying adjusted volumes were used for both build and no build conditions, with the difference being the capacities assigned to different road segments. All planned capacity improvements for the two forecast years involved center turn lanes, and since the model only captures through-lanes, a single volume set was able to be used for both the build and no build conditions. Figure 7 and Figure 8 show the 2030 and 2050 no build volumes and level of service respectively.

Figure 7: 2030 No build level of service

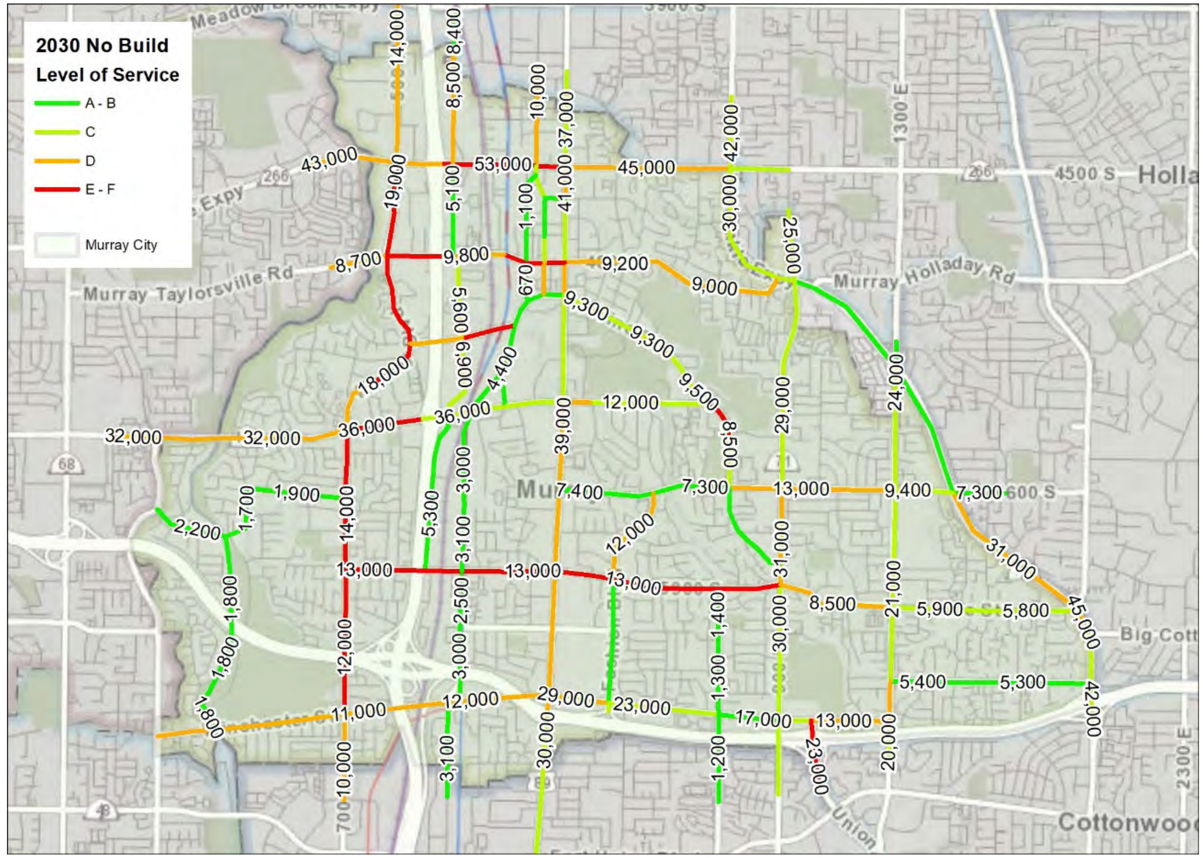


Figure 8: 2050 No build level of service

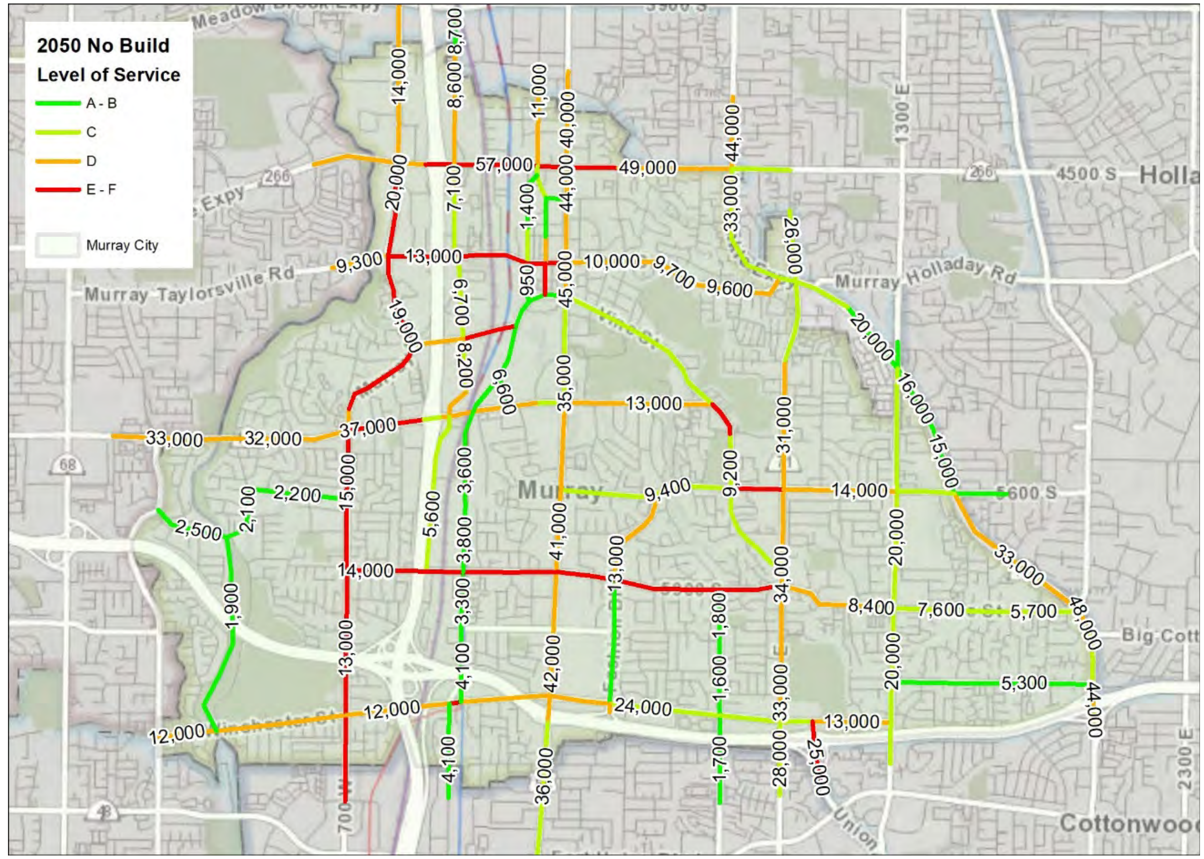


Table 5 shows the capacity adding projects from the transportation master plan which were incorporated into the build level of service analysis. This is a subset of the complete project list, which includes a number of projects that do not provide capacity improvements.

Table 5: TMP capacity adding projects

#	Project	Location	Type
2	Cottonwood Street	South City Limit to 5600 South	Widen: 2 to 3 Lanes with Bike Lanes
3	Murray Boulevard / 500 West	5400 South to 4500 South	Widen: 3 to 5 Lanes
5	500 West	4500 South to North City Limit	Restripe / Widen: 2 to 3 Lanes with Bike Lanes
7	Commerce Drive	Central Avenue to 5900 South	Restripe / Widen: 2 to 3 Lanes with Bike Lanes + Sidewalks
8	Vine Street	1600 East to 1800 East	Widen: 2 to 3 Lanes with Bike Lanes + Sidewalks
20	4800 South	West City Limit to 700 East	Restripe: 2 to 3 Lanes
22	Vine Street	Murray Boulevard to Commerce Drive	Restripe / Widen: 2 to 3 Lanes with Bike Lanes
30	Winchester Street	1200 West to 700 West	Widen: 2 to 3 Lanes with Sidewalks
45	5770 South	State Street to Fashion Boulevard	Restripe: 2 to 3 Lanes

Figure-9 shows the 2030 build LOS. This LOS is expected if capacity adding projects from Table-5 are completed.

Figure 9: 2030 Build level of service

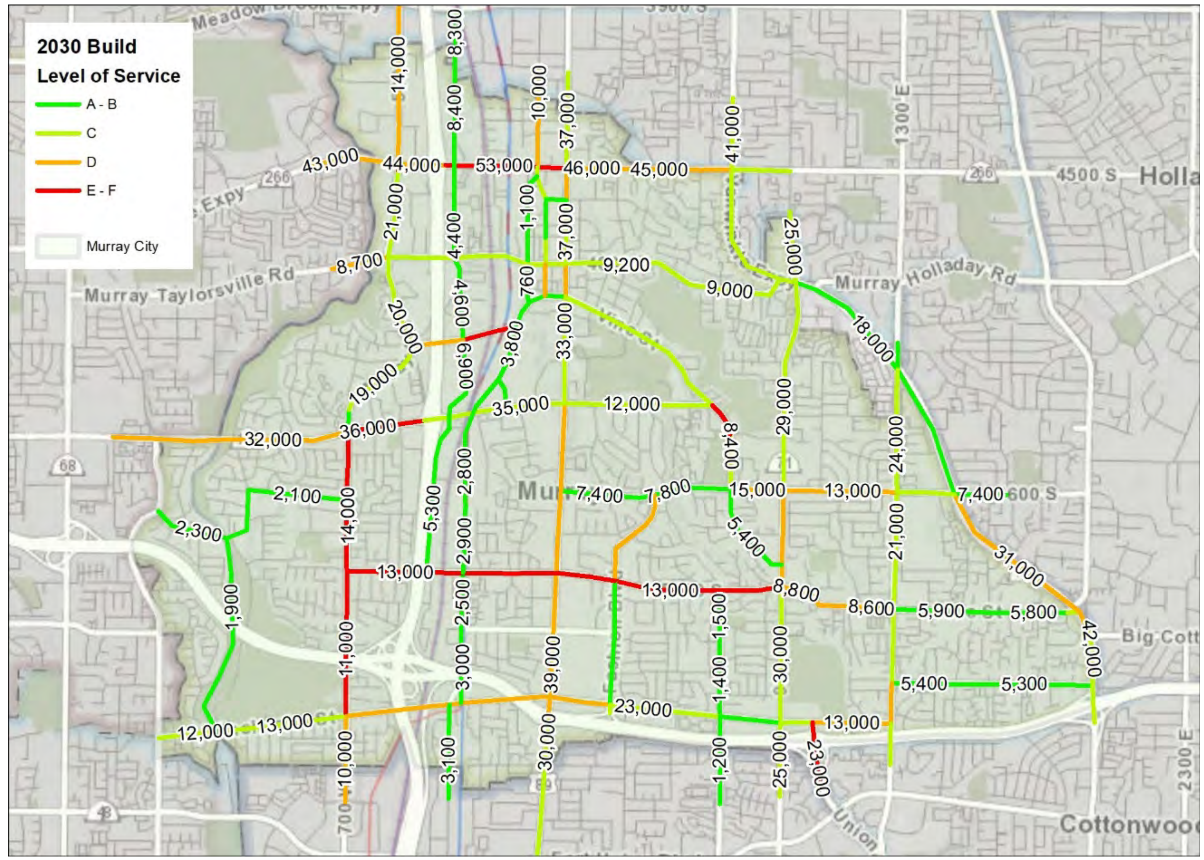
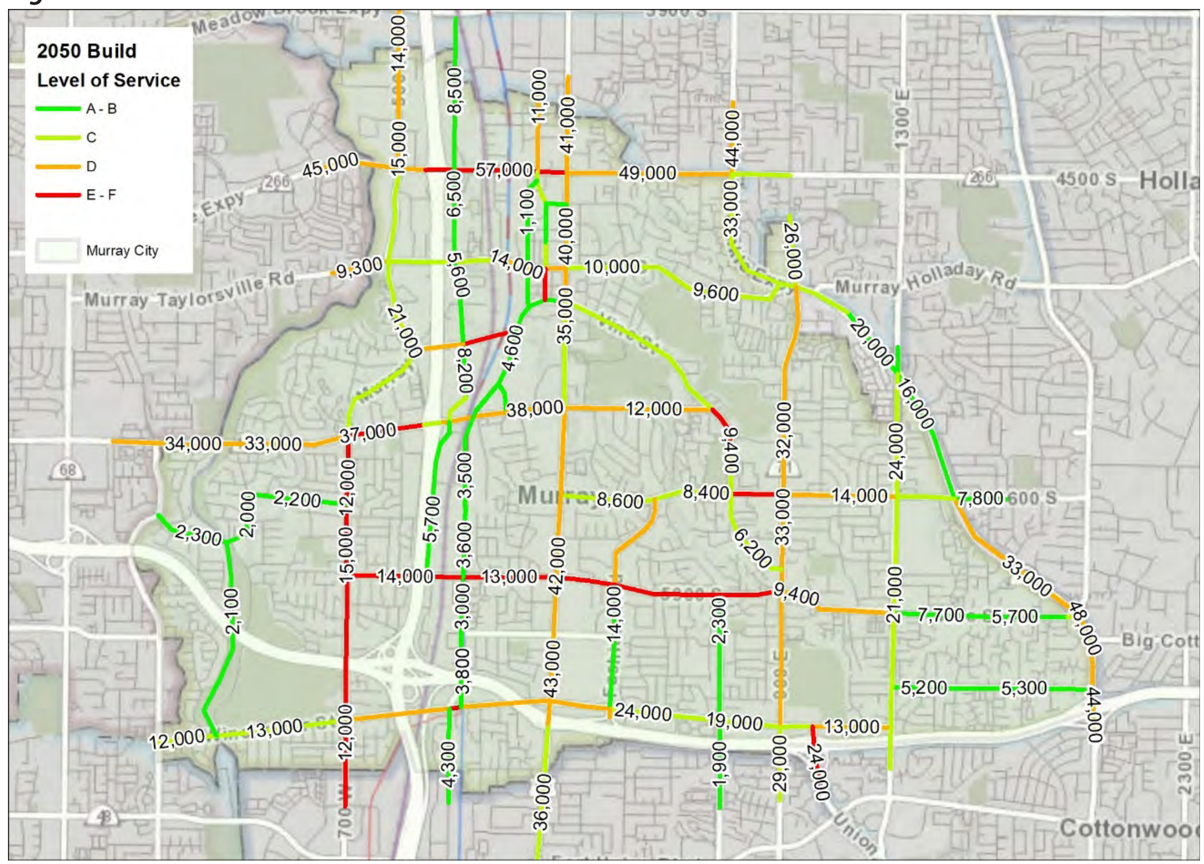


Figure-10 shows the 2030 build LOS. This LOS is expected if capacity adding projects from Table-5 are completed.

Figure 10: 2050 Build level of service



Murray City Access Management Standards

Purpose

Access Management is to serve as a standard to ensure efficient and safe travel on Murray City streets while at the same time providing access for developmental use such as businesses and residences. In general access management provides for the least amount of access and greatest mobility on a freeway or arterial and the most amount of access and least mobility on local streets. This document will describe the standards across all functional roadway classifications located within Murray City.

Roadway Classifications

Transportation facilities are separated into classifications based upon use, roadway geometry and traffic volume. Table 6 below is adapted from the 2020 Murray Transportation Plan and defines the functional classification of the roadways contained within Murray City.

Table 6: Classification characteristics

Roadway Classification	Use		Dimensions		Volume
	Trip Length (Miles)	Design Speed (MPH)	Lane Width (Feet)	Number of Lanes	Average Daily Trips (ADT in Thousands)
Freeway	>5	>65	12	6-8	80
Expressway	>5	55-65	12	5-6	75
Major Arterial	1-2	45-55	12	6	15-50
Minor Arterial	>1	40-45	12	3-5	10-25
Major Collector	1	30-40	12	2-5	3.5-10
Minor Collector	1	25-35	11-12	2-3	1.5-3.5
Local Street	<1	20-30	10-12	2	<1.5

Access Management for Freeways, Expressways and Major Arterials:

The Utah Department of Transportation (UDOT) is responsible for the maintenance and design of interstates and state highways within these classifications. Any access proposed will be subject to review and approval by UDOT. Refer to UDOT's Access Management Plan (R930-6) for access management within these roadways.

Access Management for Minor Arterials, Collectors and Local Streets:

Murray City roadways are composed of minor arterials, major/minor collectors and local (neighborhood) streets. As mentioned previously in this document, the higher the order of classification of roadway, the more limited the access. Guidelines for these streets are developed in concert with Murray City Code, the UDOT Access Management Plan (R930-6), and general traffic engineering principles. In general, the following requirements should be incorporated into development plans and coordinated with Murray City Planners and Engineers. At the determination of the City Engineer, a traffic study may be required to determine impacts and mitigation of new or modified access points on the roadway system.

Typically, a Traffic Impact Study (TIS) is required for any proposed development that generates 100 or more peak hour trips.

Access Requirements

Access Spacing:

Table 7 summarizes the minimum spacing for signals, streets and driveways for each roadway classification and is adapted from UDOT's access management guidelines. These distances were derived for the maximum amount of traffic flow while maintaining access. Uniform signal spacing allows for maximum progression of traffic along a corridor, signal spacing less than the minimums shown may result in poor progression and increased delays due to drivers encountering red signals. Minimum street spacing is measured from edge to edge and not on the centerlines.

Table 7: Access spacing requirements

Roadway Classification	Minimum Signal Spacing (Feet)	Minimum Street Spacing (Feet)	Minimum Driveway Spacing (Feet)	Minimum Spacing Crossroad to Drive Access
Minor Arterial	2640	660	300	100
Major Collector	1320	330	150	85
Minor Collector	1320	250	85	50
Local Street	N/A	250	N/A	20

Arterial Connections:

For a drive access on a collector or local street that connects to arterial roadway, the minimum spacing from the arterial roadway to the drive access is 100 feet measured from the point of intersection of the right-of-way lines.

Sight Distance:

Access designs must meet AASHTO sight distance guidelines. Objects that obstruct or limit sight distance such as advertising signs, business signs, street signs, structures, fences, walls, trees, and plantings must be designed, placed, and maintained to meet minimum sight distance requirements for vehicles.

Sight distance is a function of roadway speed and control type. In general, the less restrictive the control and the higher the cross-street speeds, the larger the sight distance triangle must be. Ensuring that sight distance triangles are enforced and maintained obstruction free for street intersections and drive approaches is essential for safe roadway operations.

The figures and tables included in this document are derived from the AASHTO publication "A Policy on Geometric Design of Highways and Streets". Each entry in the table and figures refers to the posted speed limit of the roadway and it is assumed that the design speed, which corresponds to AASHTO's recommendations, is 5 mph higher than the posted speed limit. Access to Collector or Arterial streets whether with a driveway or connecting street should include sight distance triangle analyses as part of the application process. See below for sight distance examples.

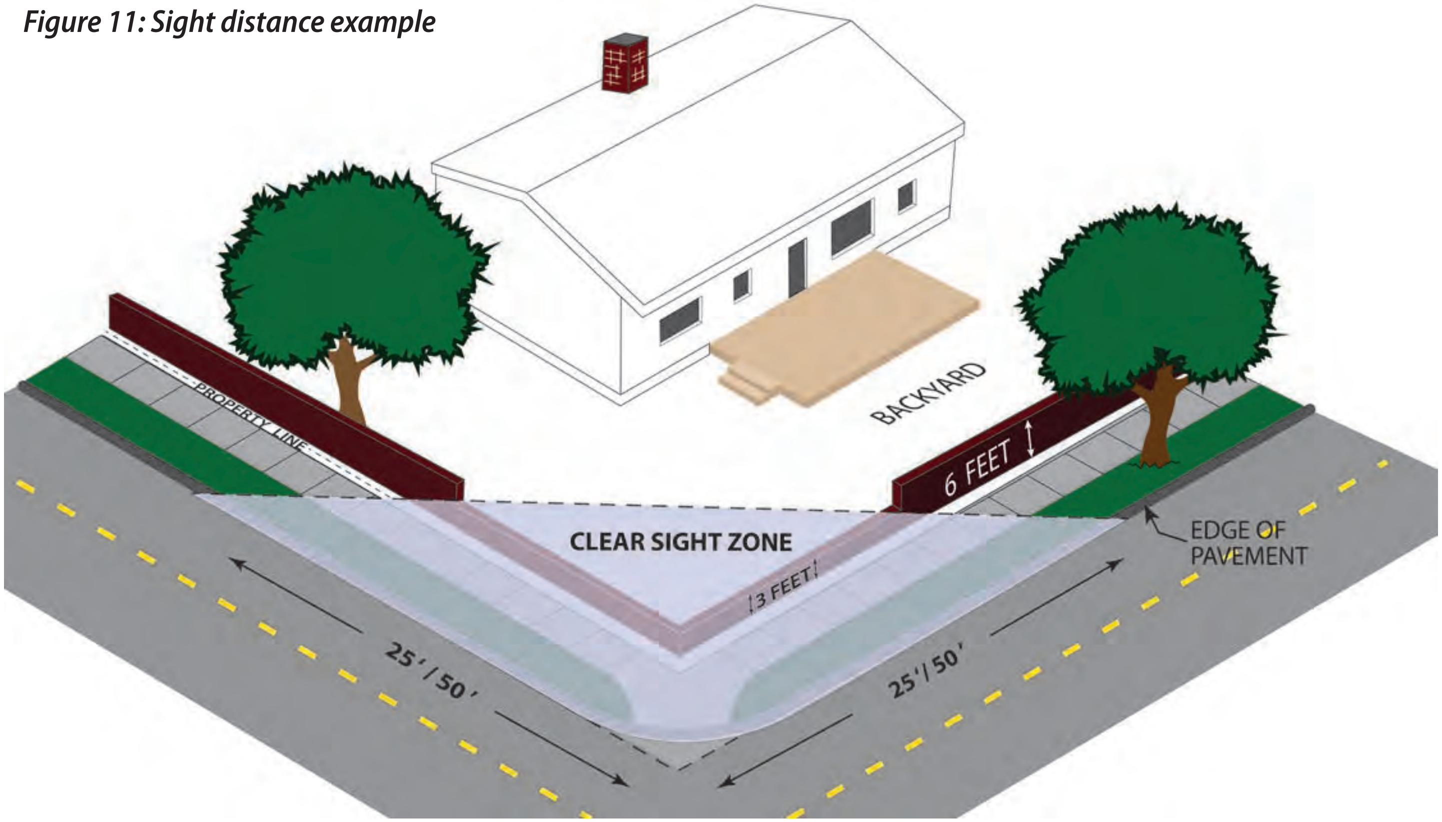
Table 8: Sight triangle distance

Control Type	Cross Street Posted Speed (mph)	Sight Distance Length (Feet)
Uncontrolled	25	140
Yield/Stop	25	335
Yield/Stop	30	390
Yield/Stop	35	445
Yield/Stop	50	610

* Sight triangle distance recommendations are for optimal conditions and are subject to change with road geometry

Street corners that include backyards must also include fence corner cuts to ensure unobstructed views of cross traffic. Local cross streets should include 25′ corner cuts and all other cross streets should include 50′ corner cuts. The corner cuts should be established to follow the standards in the following figure. The state minimum is 50' corner cuts, or an AASHTO recommended sight triangle, which is determined by an engineer. A clear sight zone should be a 25′ triangle measured from the back of walk or 50′ triangle measured from lip of gutter/ edge of pavement.

Figure 11: Sight distance example



Signing:

All signs that serve the public (coordinate markers, stop signs, yield signs, etc.) must conform to the current MUTCD standards.

Railroads:

No access may be located within 250 feet of an at-grade railroad crossing. Access distances may be greater depending on roadway geometry and access category spacing. Refer to UDOT rule R930-5 and R930-6 for additional information.

Driveways:

Driveway access in Murray City is controlled by permit through the Public Works Division. Businesses, multi-family residential developments and new construction must complete the Excavation/Encroachment Permit Application available through the Murray City Engineering Division.

Additional Planning and Engineering level approvals may also be required for new developments and Non-Residential driveway access changes.

Residents in existing single-family residential lots may apply for the Street Improvement Permit through Murray City Engineering to modify an existing or construct a new driveway. Table 9 summarizes Murray City Code regarding the location and widths of driveways for each property utilization.

Table 9: Access requirements

Lot Use	Driveway Width		Driveway Spacing (feet)
	Min (Feet)	Max (Feet)	
Single Family Residential	12	30	Two driveways (max.) per property – 35 foot spacing for circular drives
Multi-Family Residential	20	30	85 - 300
Non-Residential (Any access not included above)	25	50	85 - 300

A minimum distance of 5 feet from the property line is required for all driveways unless a reciprocal easement is provided. When appropriate, it is desired for shared or combined driveways within a lot or multiple lots to promote circulation and minimize conflict points and impacts to arterial or collector streets.

Local and Collector Street Corners:

For Single Family corner lots on a local road, the distance from the crossroad to the driveway must be a minimum of 20 feet measured from the point of intersection of the right-of-way lines. However, it is encouraged to locate driveways to the opposite side of the property away from the corner.

For Single Family corner lots on a collector road, the distance from the crossroad to the driveway must be a minimum of 50 feet measured from the point of intersection of the right-of-way lines.

For Multi-Family and Non-Residential uses with an ADT<100, the distance from the crossroad to the driveway access must be a minimum of 50 feet measured from the point of intersection of the right-of- way lines.

For Multi-Family and Non-Residential uses with an ADT>100, the distance from the crossroad to the driveway access must a minimum of 85 feet measured from point of intersection of the right-of-way lines.

Sight Distance Example 1

Control Type	-	STOP
Cross Street Functional Class	-	Minor Collector
Cross Street Pavement Width	-	36'
Cross Street Posted Speed Limit	-	30 mph
Cross Street Lanes	-	2
Cross Street Lane Width	-	12'
Vehicle Offset from Road CL	-	6'
Sight Distance Value (from Table 3)	-	390'
Clear Zone Length (measured to middle of planter strip)		
Left	-	122'
Right	-	92'

Figure 12: Sight distance example of minor collector

* Sight triangle distance recommendations are for optimal conditions and are subject to change with road geometry

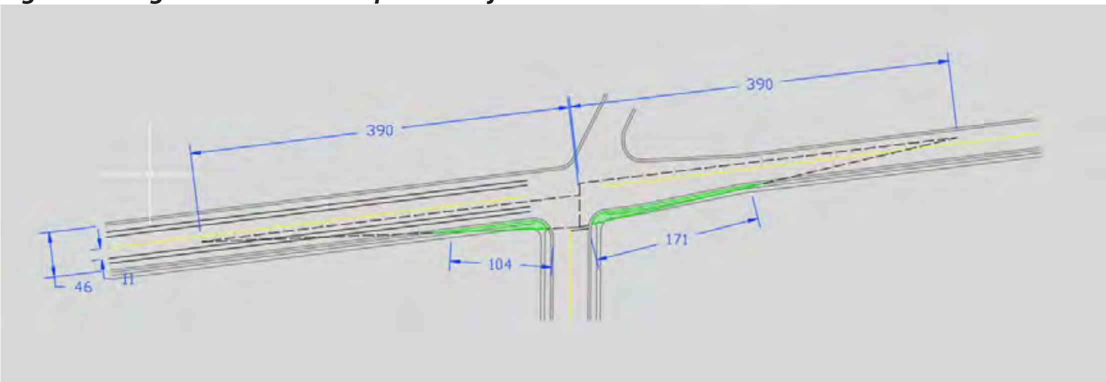
Sight Distance Example 2

Control Type	-	STOP
Cross Street Functional Class	-	Major Collector
Cross Street Pavement Width	-	46′
Cross Street Posted Speed Limit	-	30 mph
Cross Street Lanes	-	2
Cross Street Lane Width	-	11′
Vehicle Offset from Road CL	-	5.5′
Sight Distance Value (from Table 3)	-	390′

Clear Zone Length (measured to middle of planter strip)

Left	-	104′
Right	-	171′

Figure 13: Sight distance example of major collector



* Sight triangle distance recommendations are for optimal conditions and are subject to change with road geometry

Survey Results

MURRAY CITY UTAH

TRANSPORTATION PLAN

Number of Surveys

- 348 completed surveys
  - 35 June
  - 196 July
  - 110 August
  - 7 September (On-going)
  - 33 completed on July 15 alone
- The most surveys completed between 2:00 and 3:00 PM

MURRAY CITY UTAH TRANSPORTATION PLAN

Survey

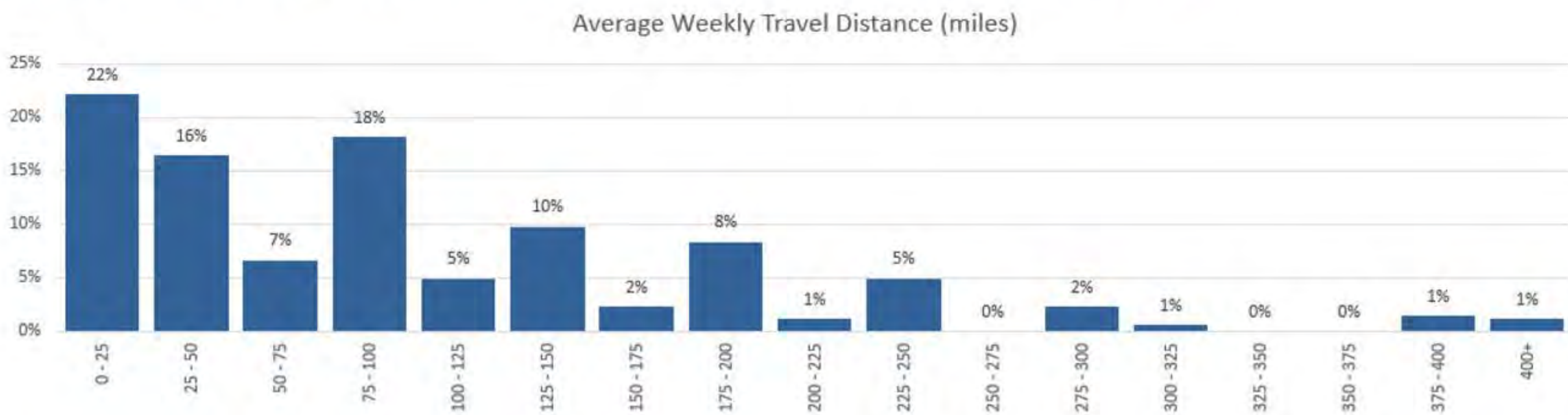
How many miles do you travel in an average week?

120 miles on average

5 miles lowest response

800 miles highest

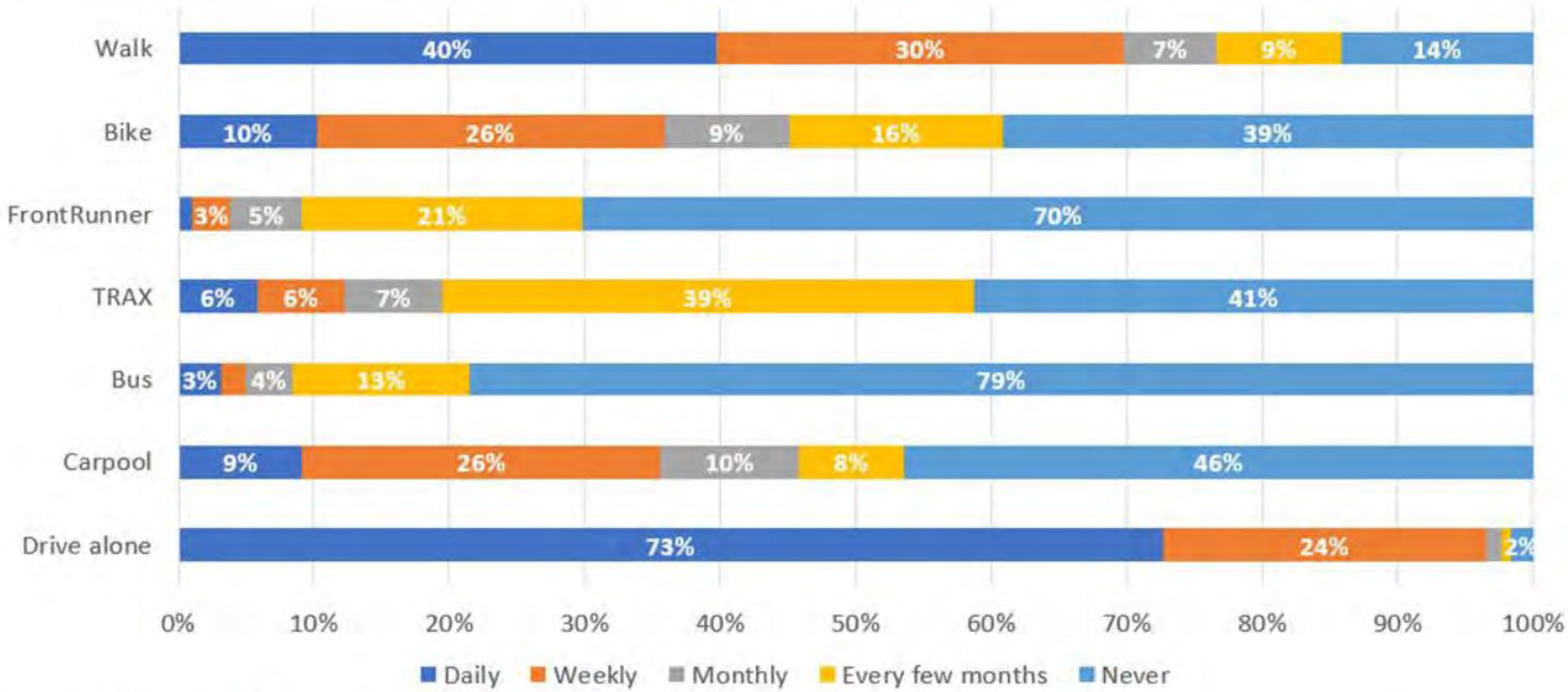
Some responses changed by time period "Now: ~30 Pre-COVID-19: ~100"



MURRAY CITY UTAH TRANSPORTATION PLAN

Survey

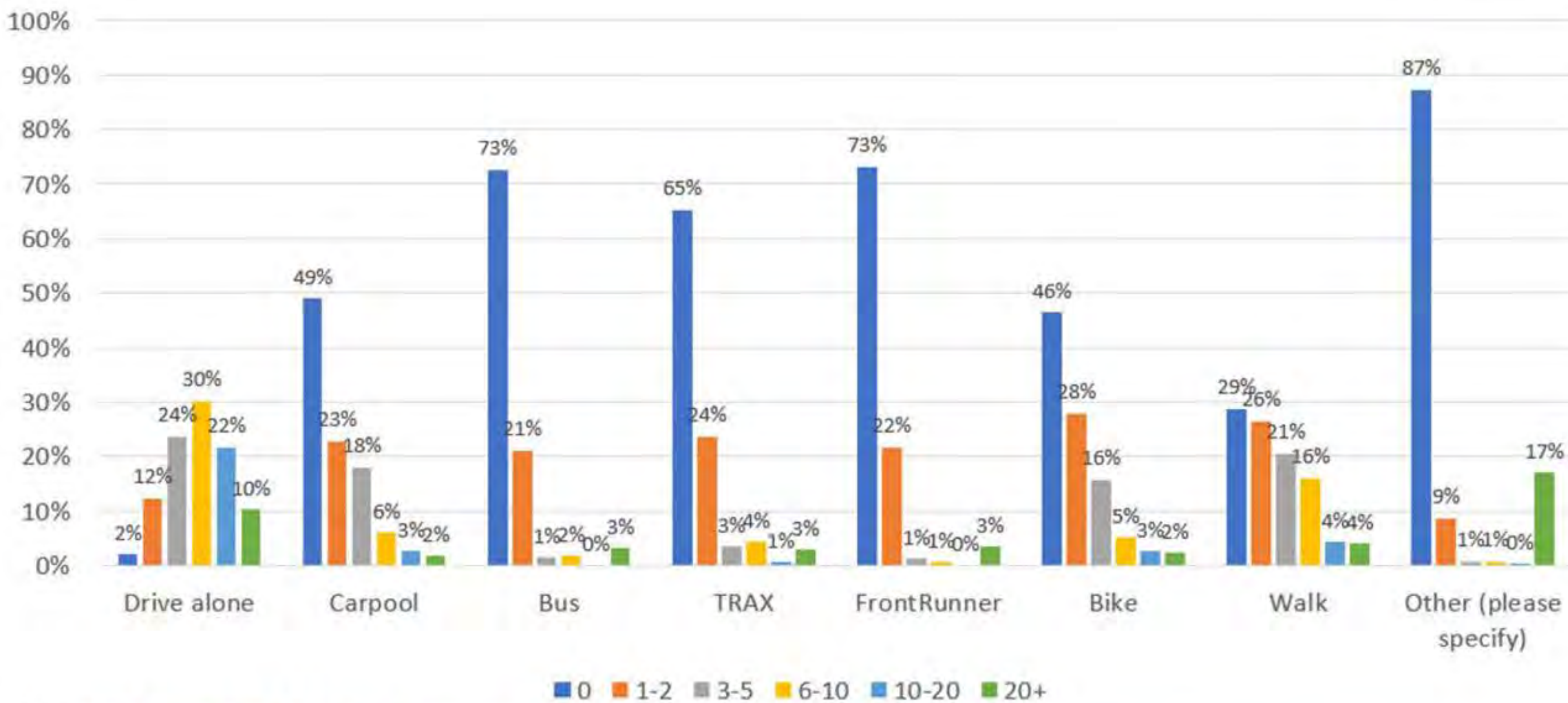
How often do you use the following modes of transportation?



MURRAY CITY UTAH TRANSPORTATION PLAN

Survey

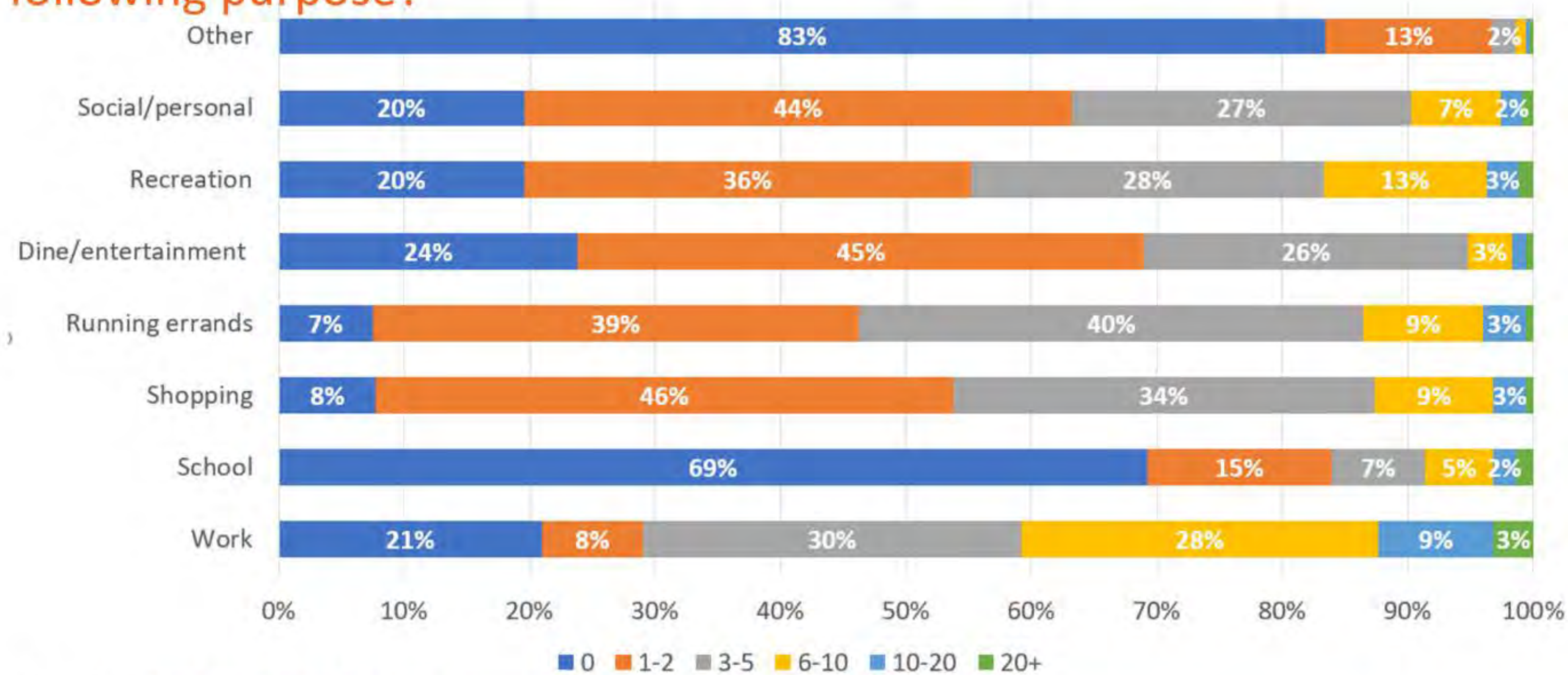
In an average week, how many trips do you make using each mode?



MURRAY CITY UTAH TRANSPORTATION PLAN

Survey

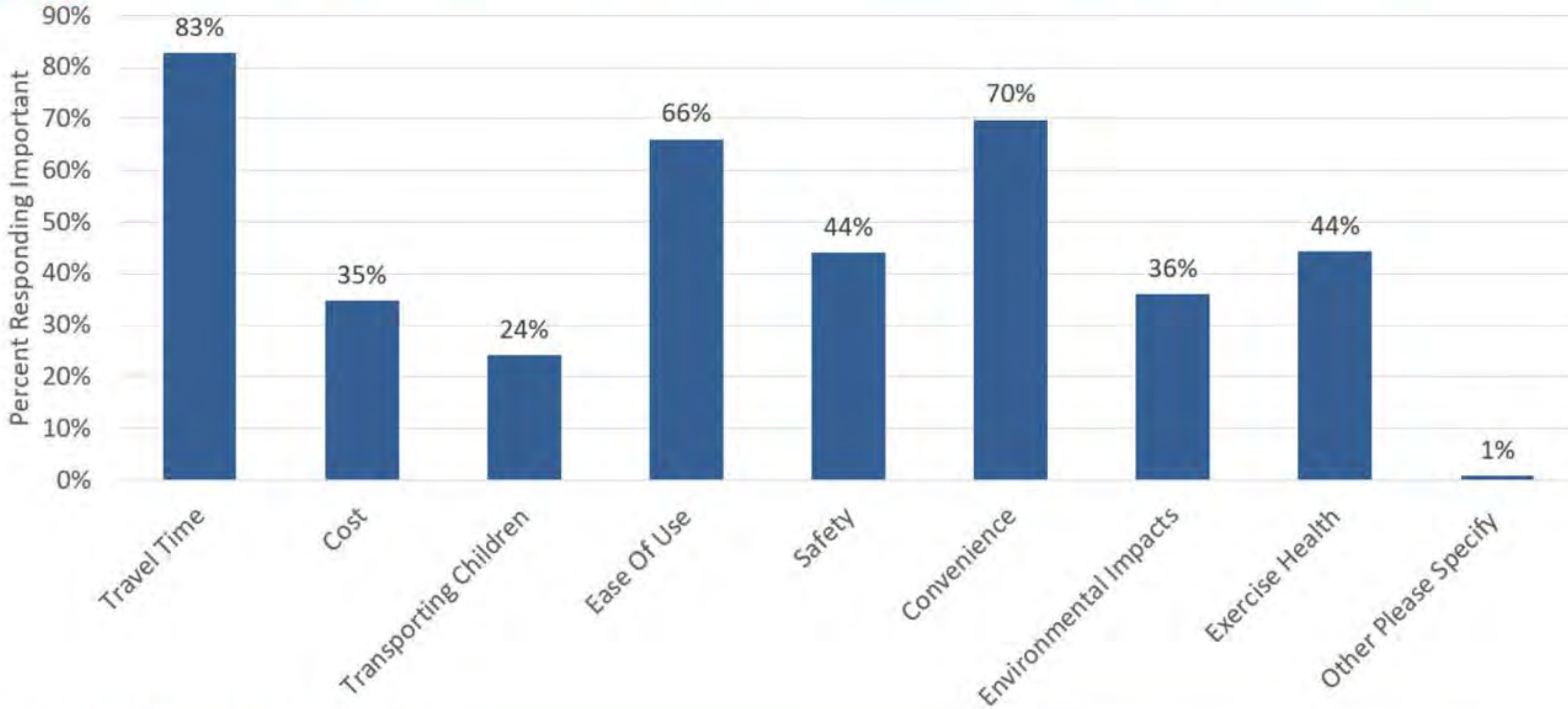
In an average week, how many trips do you make for the following purpose?



MURRAY CITY UTAH TRANSPORTATION PLAN

Survey

What factors are most important to you when selecting a travel mode?



MURRAY CITY UTAH TRANSPORTATION PLAN

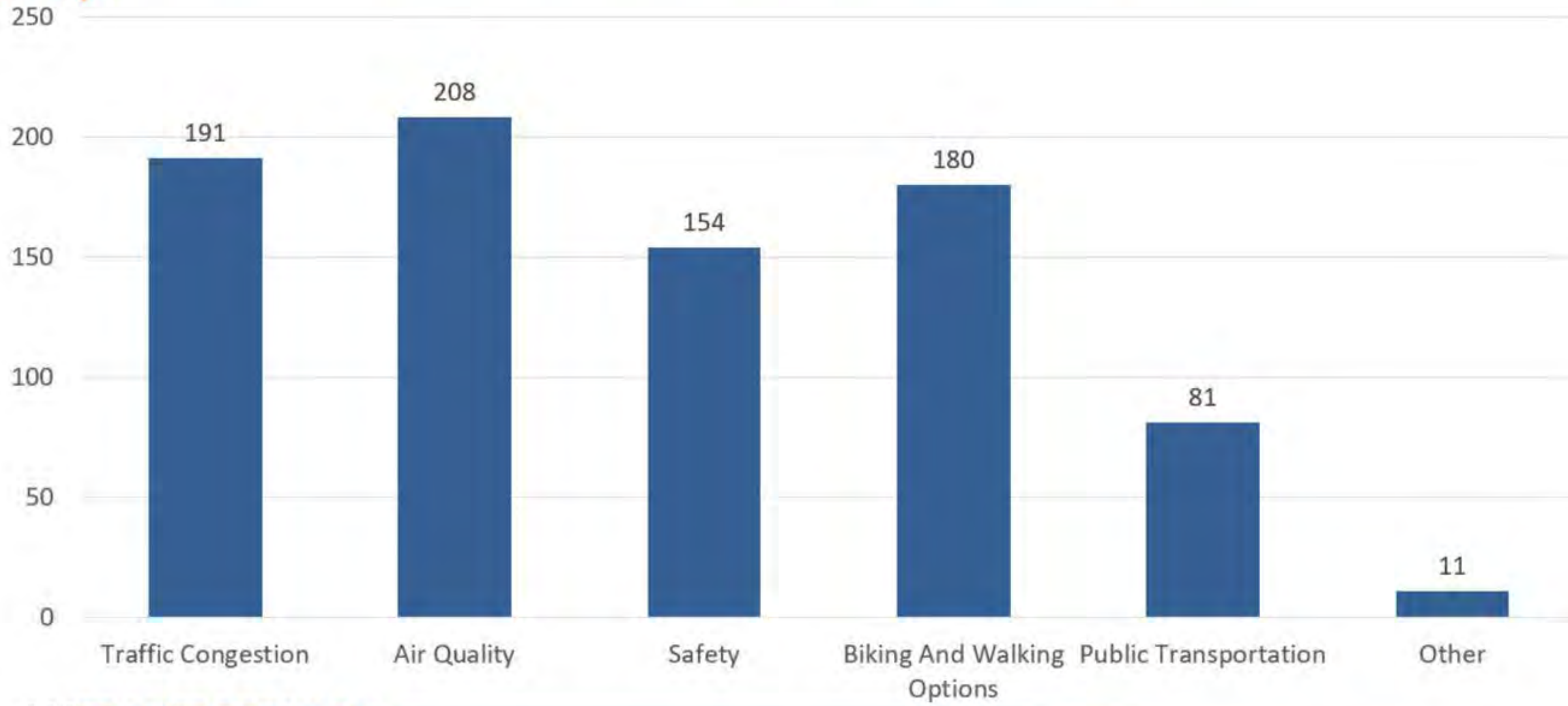
Survey

What would encourage you to use an alternative to driving alone?

- *"Better proximity to public transportation and better frequency"*
- *"Better 'last mile' at my work destination"*
- *"Improved bike lane connectivity"*
- *"Better access to bus routes, walkable destinations, bike paths and places to leave my bike"*
- *"Cheaper Trax fares"*
- *"Earlier and later services"*

Survey

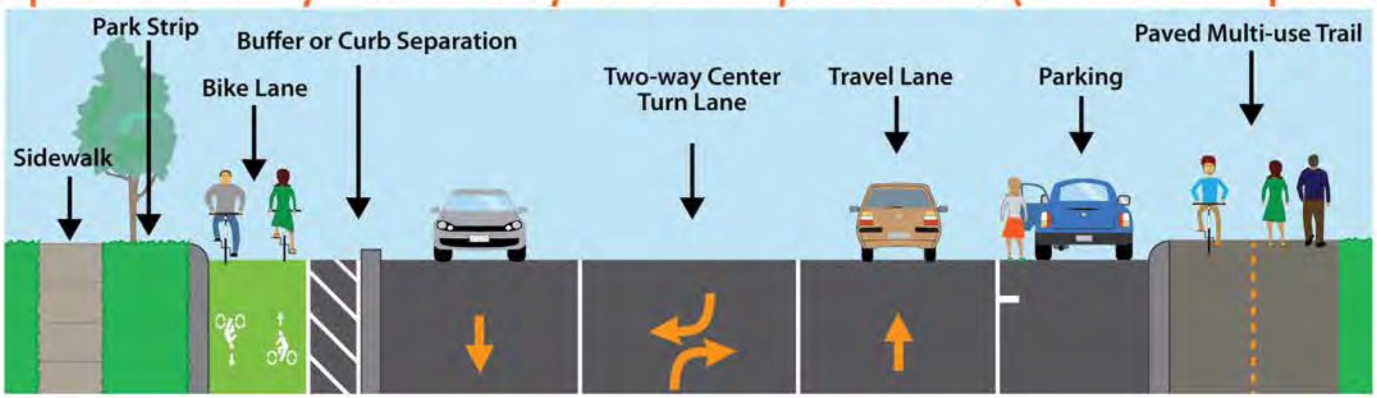
What transportation issues are you most concerned within Murray?

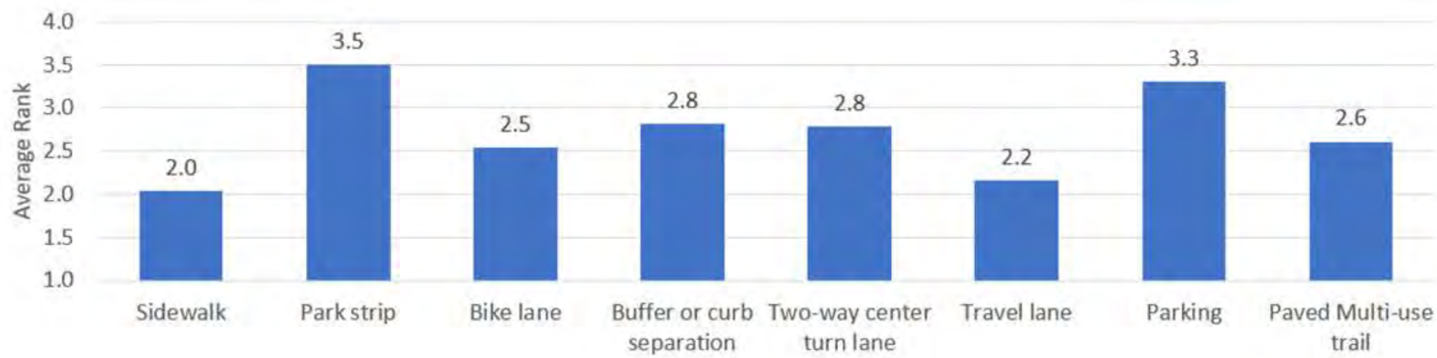


MURRAY CITY UTAH TRANSPORTATION PLAN

Survey

Rank the top 5 roadway realms by their importance (1 most important)

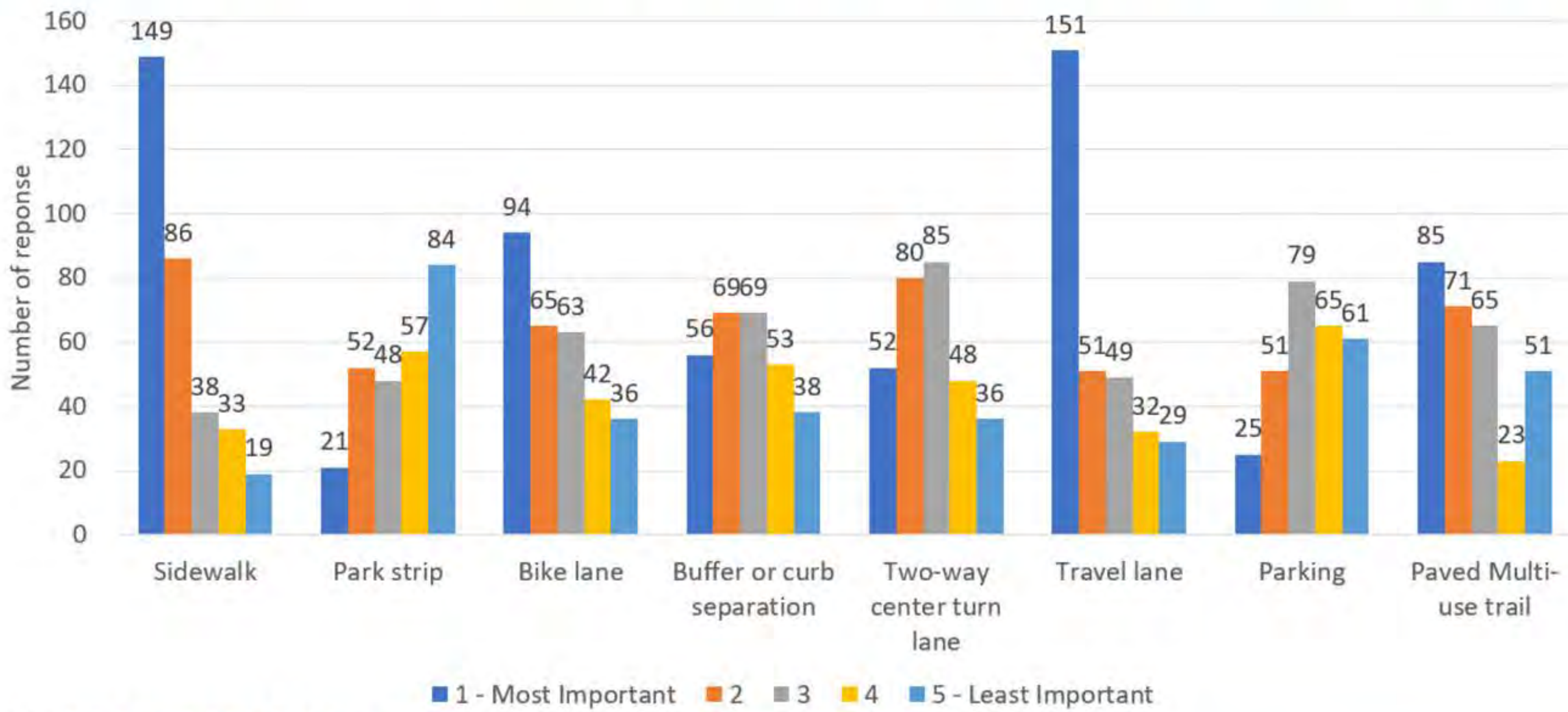




MURRAY CITY UTAH TRANSPORTATION PLAN

Survey

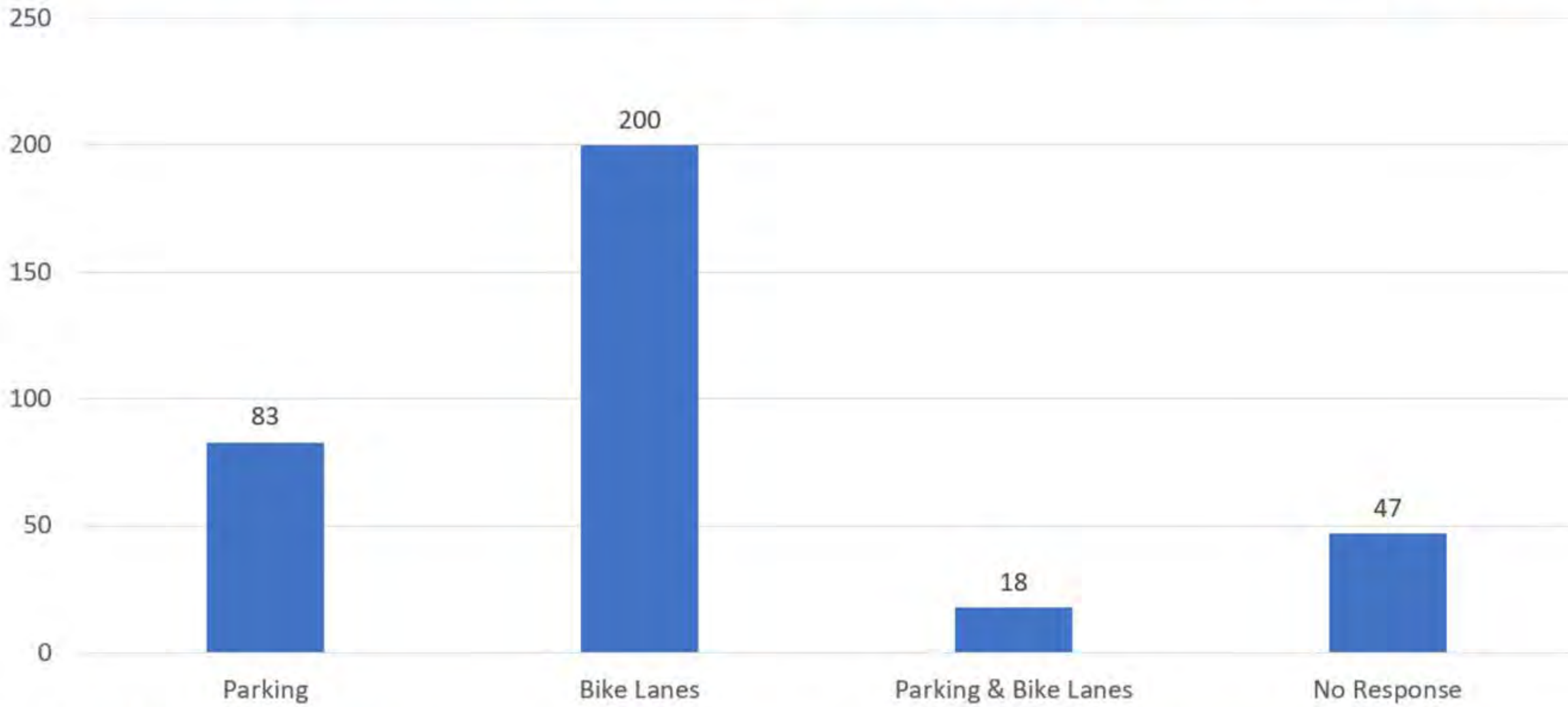
Rank the top 5 roadway realms by their importance (1 most important)



MURRAY CITY UTAH TRANSPORTATION PLAN

Survey

Should roadway shoulders be used for bike lanes or on-street parking?

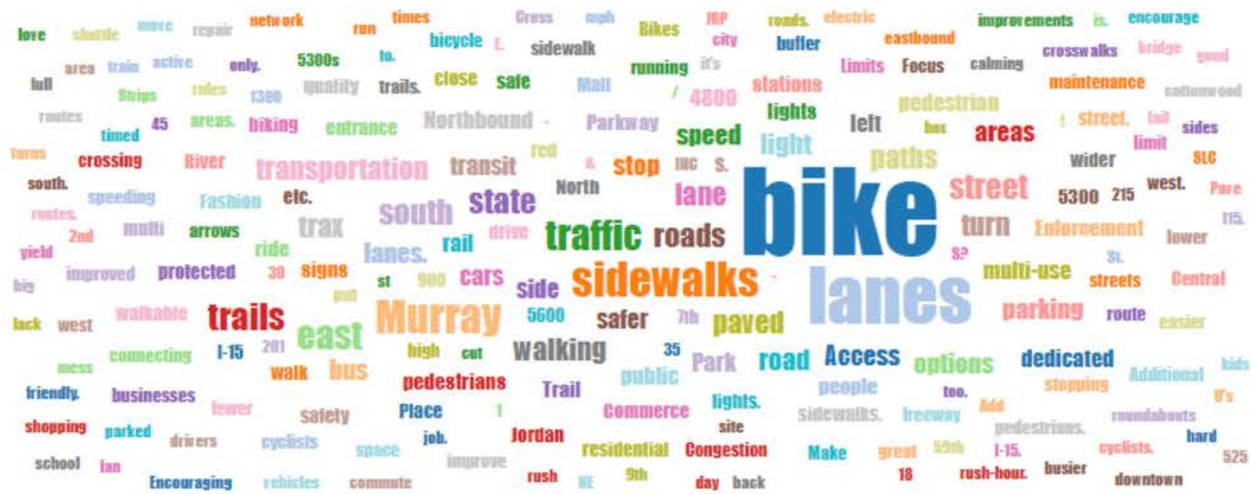


MURRAY CITY UTAH TRANSPORTATION PLAN

Survey

What transportation improvements would you like to see in Murray?

- *"More walkable community, better enforcement of speeding and school zones"*
- *"Better lit and painted bicycle lanes (with ample buffer space) and pedestrian pathways"*
- *"Wider sidewalks. More bike lanes. Multi-use paved trails for skating"*
- *"Bike connections to transit, East-side BRT/TRAX, more bike infrastructure, street trees, traffic calming"*



MURRAY CITY UTAH TRANSPORTATION PLAN

Survey

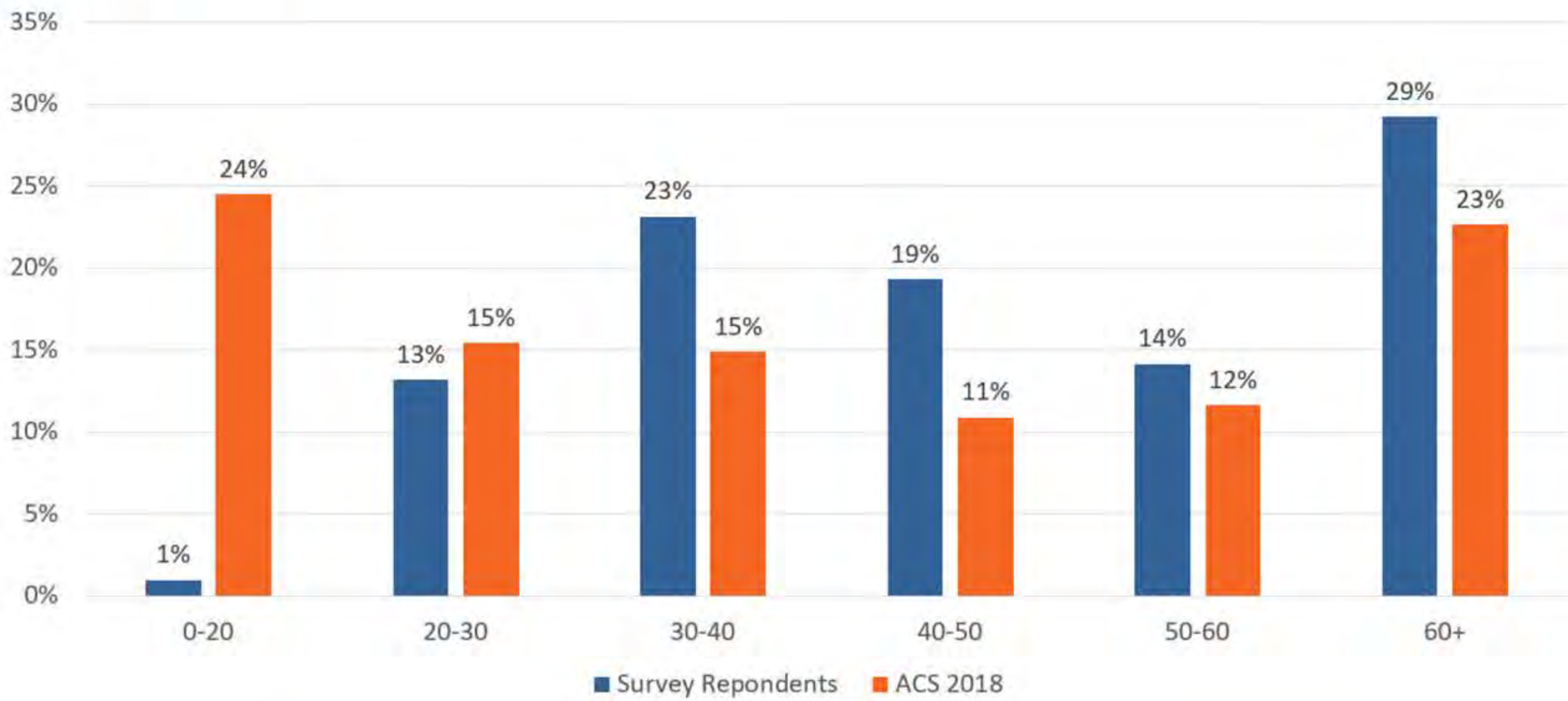
Are there areas in Murray that you feel are unsafe for vehicles, pedestrians or cyclists? Please describe this transportation issue.

- *"Dangerous merge lane on to I-15 freeway northbound at 5300 South"*
- *"Low visibility hill, faster speed limit, no sidewalk seems to be where I see the most accidents"*
- *"Lack of sidewalks makes it unsafe to reach bus stops"*
- *"No bike lane or safe way to get from 48th to 9th east "*
- *"6900-6100 South State Street at Fashion Place Mall is a traffic nightmare"*
- *"It would also be helpful to have a bike/pedestrian lane on Murray Parkway Ave. where the road crosses I-215."*

MURRAY CITY UTAH TRANSPORTATION PLAN

Survey

What is your age?



MURRAY CITY UTAH TRANSPORTATION PLAN

Standards and Specifications (continued)

Crosswalk Guidelines and Standards

Engineering Study

An Engineering Study is required for new crosswalks. The objective is to determine where marked pedestrian crosswalks are appropriate, where marking or signing is ineffective and when additional treatments should be applied. An engineering study should be completed to determine the need of any marked crosswalk and should, at a minimum include the following information:

- Roadway geometry
- Motorist sight distance
- Traffic and pedestrian volume data
- Site characteristics and observations
- Posted speed limits, design speed, average speed and 85^{th} percentile speed
- Crash history

Crosswalks should be avoided in locations with the following characteristics:

- Inadequate stopping sight distance for motorists
- Inadequate visibility for pedestrians
- Heavy truck traffic
- High vehicle turning movements
- High vehicular speeds
- Inadequate lighting

Crosswalk Installation Criteria

Mid-Block Locations

- Adequate stopping sight distance for design speed of the roadway must be achieved
- 20 or more pedestrian crossings in a one hour time frame or
- 15 or more elderly and/or child pedestrian crossings per hour or
- 60 or more pedestrian crossings in a 4 hour time period or
- A pedestrian destination such as a school, park, retail shops, office building or trail
- Mid-block crosswalks should not be installed within a reasonable distance of an established crossing or signalized intersection (600 feet).
- Mid-block crosswalk spacing should be at least 600 feet. In very urban, heavy pedestrian areas of the City, mid-block crosswalk spacing may be reduced to 300 feet
- Mid-block crosswalks must be signed and striped as per MUTCD requirements
- For higher speed and higher volume roads, a center island refuge and/or pedestrian activated flasher system (RRFB) or (HAWK) should be considered

Signalized Intersections

- Crosswalks should be installed on every approach that has pedestrian indications
- Crosswalks should not be signed at signals
- Crosswalk striping should be parallel with stop bars
- Crosswalk striping should be straight and run from pedestrian ramp to pedestrian ramp

MURRAY

Standards and Specifications (continued)

Crosswalk Guidelines and Standards

Unsignalized Intersections

- 10 or more pedestrian crossings in a one hour time frame
- Crosswalks should only be used at the stop controlled approaches to the intersections
- Crosswalks should not be signed at unsignalized intersections

Crosswalks should be evaluated and installed as per the Manual on Uniform Traffic Control Devices (MUTCD)

School Crosswalks

- School crosswalk locations should be evaluated and installed as per Part 7 of the Utah Manual on Uniform Traffic Control Devices

Standards

- Manual on Uniform Traffic Control Devices (MUTCD)
- Utah Manual on Uniform Traffic Control Devices
- AASHTO A Policy on Geometric Design of Highways and Streets
- AASHTO Guide for the Development of Bicycle Facilities

References

- NCITE. *Guidance for the Installation of Pedestrian Crossing Facilities*, January 2009
- Federal Highway Administration. *Manual on Uniform Traffic Control Devices for Streets and Highways*. Washington D.C., 2009
- Virginia Department of Transportation. *Guidelines for the Installation of Marked Crosswalks*, May 2007
- City of Boulder Colorado. *Pedestrian Crossing Treatment Installation Guidelines*, November 2011