Herriman City

2019 Herriman Transportation Master Plan

April 2020

Prepared by:

Bowen Collins & Associates

BC&A Project No. 217-13-03

In Association with:

Parametrix

Prepared for:

Herriman City

2019 HERRIMAN TRANSPORTATION MASTER PLAN

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TABLE OF CONTENTS

LIST OF APPENDICES

LIST OF FIGURES

TABLE OF CONTENTS (CONT.)

LIST OF TABLES

1 INTRODUCTION

Herriman City, Utah, is located in the southwest portion of Salt Lake County. Incorporated in 1999, the City has contracted with Bowen Collins and Associates who has teamed with Parametrix to prepare this Transportation Master Plan.

The primary purpose of this Herriman City (hereinafter referred to as "Herriman" or "City") Transportation Master Plan is to create a planning document that can be used to help meet the transportation goals of the City and allow future development to enhance the positive aspects of the City while minimizing negative impacts associated with new development. Since incorporating in 1999, Herriman has experienced significant population growth and it is expected to continue for the next 30 years. Growth impacts will quickly exceed the capacity of some elements of the City's existing transportation system. This plan addresses future demands on the City's transportation system while retaining safe and active streets for non-motorized travel.

This plan has been organized into five sections, which cover the components of the Transportation Master Plan. Section 1 includes an introduction. Section 2 reviews the City's existing conditions and provides Herriman with comparisons to peer cities. Section 3 evaluates future transportation conditions that Herriman will likely encounter. Section 4 presents the Transportation Master Plan and recommended improvements. Section 5 outlines a recommended Street Facilities Plan. Appendices are also included and contain several transportation planning topics to be considered for future implementation.

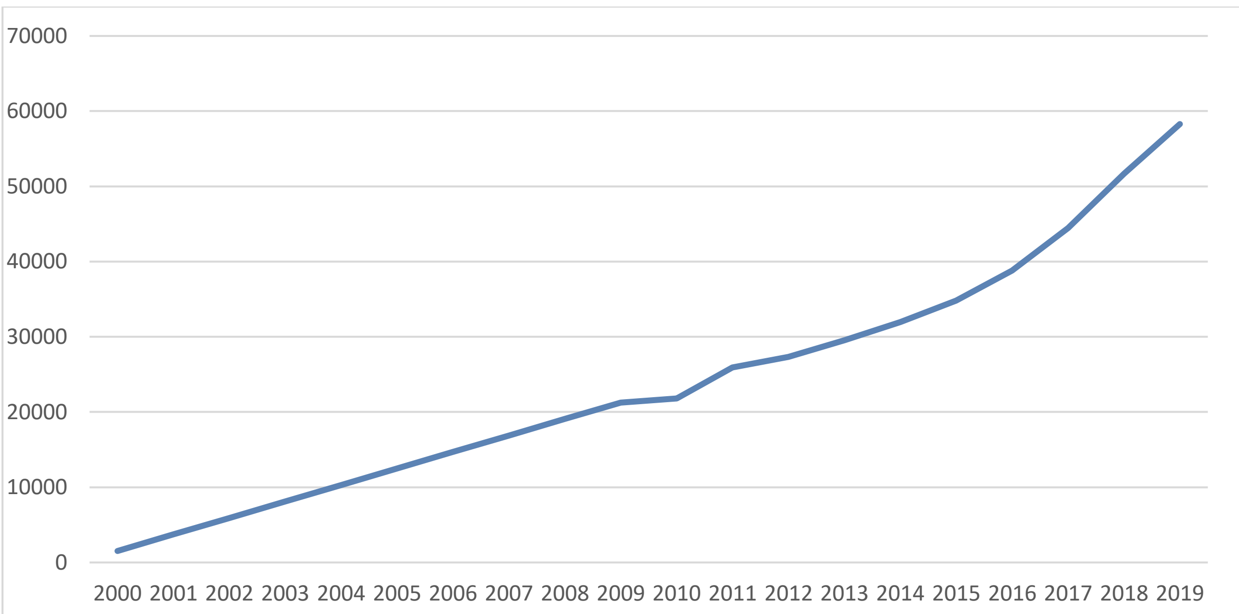
This plan primarily covers arterial roads in addition to major and minor collector roads.

2 EXISTING CONDITIONS

The existing population data and population projections discussed in this report are also summarized in a Technical Memorandum included in Appendix A of this report.

2.1 Demographics

Herriman has experienced significant population growth over the past 19 years. Figure 1 shows Herriman's growth since 2000, one year after incorporation in 1999. The 2000 census indicated that the population of the City was then 3,514. Between 2000 and 2019, the population increased more than 10-fold. Growth has remained constant, with an average of approximately 2,838 new people added each year.



Source: US Census Estimates (2000-2018), 2019 City estimates

Figure 1: Historic Herriman Population

Herriman is one of the fastest growing cities in the state. When looking at percent change, Herriman ranks first in the state, with a 105 percent increase from 2010 to 2018. This is well above other top-ranking cities, such Saratoga Springs and Eagle Mountain, with 75 percent and 65 percent increases respectively.

Table 1 shows the top 10 fastest growing cities in the state by percent change.

Table 1. Fastest Growing Cities in Utah, 2010-2018, Ranked by Percent Change

City	2010 Population	2018 Population	Percent Change 2010-2018
Herriman	21,785	44,877	106.00%
Saratoga Springs	17,919	31,393	75.19%
Eagle Mountain	21,555	35,616	65.23%
West Haven	10,317	15,239	47.71%
Washington	18,816	27,686	47.14%
South Jordan	50,595	74,149	46.55%
Heber	11,448	16,400	43.26%
Lehi	47,715	66,037	38.40%
Santaquin	9,187	12,274	33.60%
Farmington	18,352	24,514	33.58%

Source: US Census Estimates

When the total numeric increase in population between 2010 and 2018 is considered, Herriman ranks second for all cities in Utah, with a net increase of 23,014 people over eight years (see Table 2). This increase rivals the larger more established city of South Jordan, and even surpasses Lehi in terms of numeric change.

Table 2. Fastest Growing Cities in Utah, 2010-2018, Ranked by Numeric Change

City	2010 Population	2018 Population	Net Change
South Jordan	50,595	74,149	23,554
Herriman	21,785	44,877	23,092
Lehi	47,715	66,037	18,322
St. George	73,107	87,178	14,071
Eagle Mountain	21,555	35,616	14,061
Salt Lake City	187,082	200,591	13,509
Saratoga Springs	17,919	31,393	13,474
West Jordan	104,075	116,046	11,971
Layton	67,604	77,303	9,699
Sandy	87,846	96,901	9,055

Source: US Census Estimates

Based on data from the US Census, American Community Survey (ACS) Five-Year Estimates, the household characteristics of Herriman are unique to the area. On average, Herriman has larger households (3.91 people per) and a younger population (26.2 years old) than Salt Lake County and the State of Utah. Dependency ratios are an age-population ratio for those typically too young (0-14, child dependency) or too old (65 and over, aged dependency) to be in the labor force, and are used as an indication of what portion of the population is dependent. Table 3 summarizes household characteristics for Herriman compared to the county and the state. As seen in Table 3, the aged dependency ratio for Herriman is more than the county and the state, and the child dependency ratio is significantly higher. These household characteristics all point to a young population of large families. Educational attainment of a bachelor's degree or higher in Herriman is slightly higher than the county and statewide average (for individuals 25 years and older).

Table 3. Household Characteristics

Household Characteristic	Herriman	Salt Lake County	Utah
Average Household Size	3.91	3.01	3.14
Median Age (years)	26.2	32.4	30.5
Child Dependency Ratio	72.9	45.3	51.3
Aged Dependency Ratio	79.0	61.4	68.6
Bachelor's degree or higher (percent)	23.4	21.4	21.5

Source: US Census, ACS 5-year estimates

Herriman's economic indicators are comparable to Salt Lake County and the state. Table 4 shows several economic characteristics for Herriman as well as county and state comparisons. Herriman has a higher percentage of its residents in the labor force, higher unemployment, higher median income, and a lower poverty rate than the averages for the county and State of Utah.

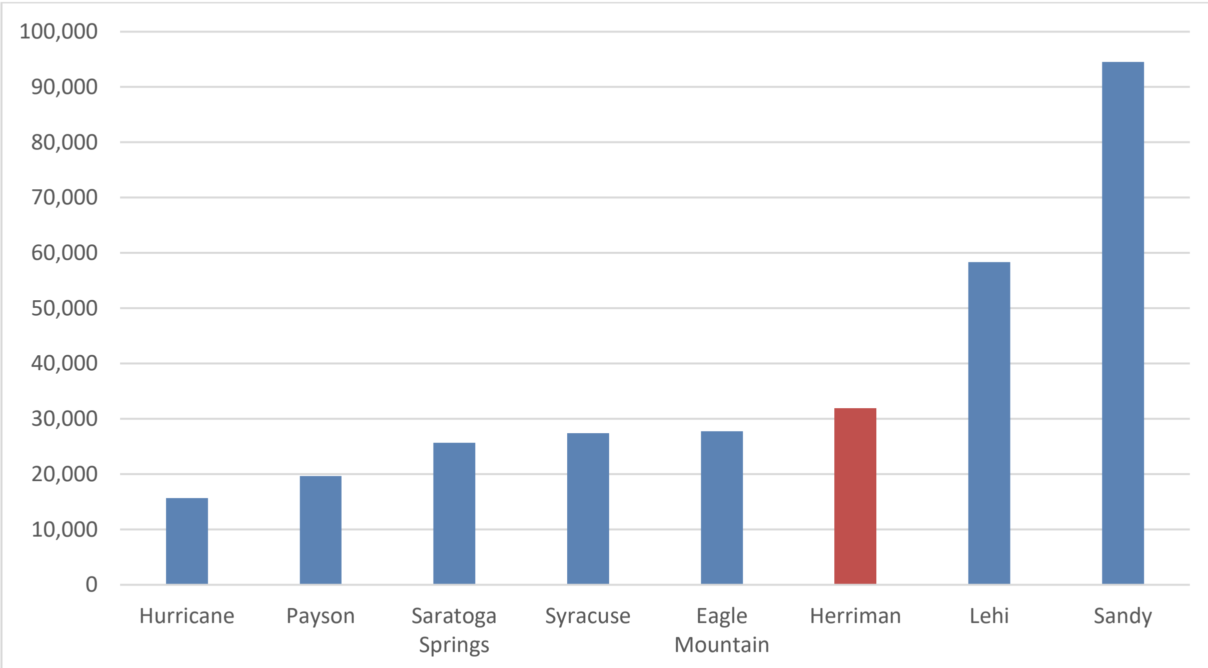
Table 4. Economic Characteristics

Economic Indicator	Herriman	Salt Lake County	Utah
In Labor Force	75.3%	71.3%	67.9%
Unemployed	5.6%	4.3%	4.4%
Median Household Income	$94,837	$67,922	$65,325
People whose income in the past 12 months is below the poverty level	2.8%	10.4%	11.0%

Source: US Census, ACS 5-year estimates

2.2 Peer City Analysis

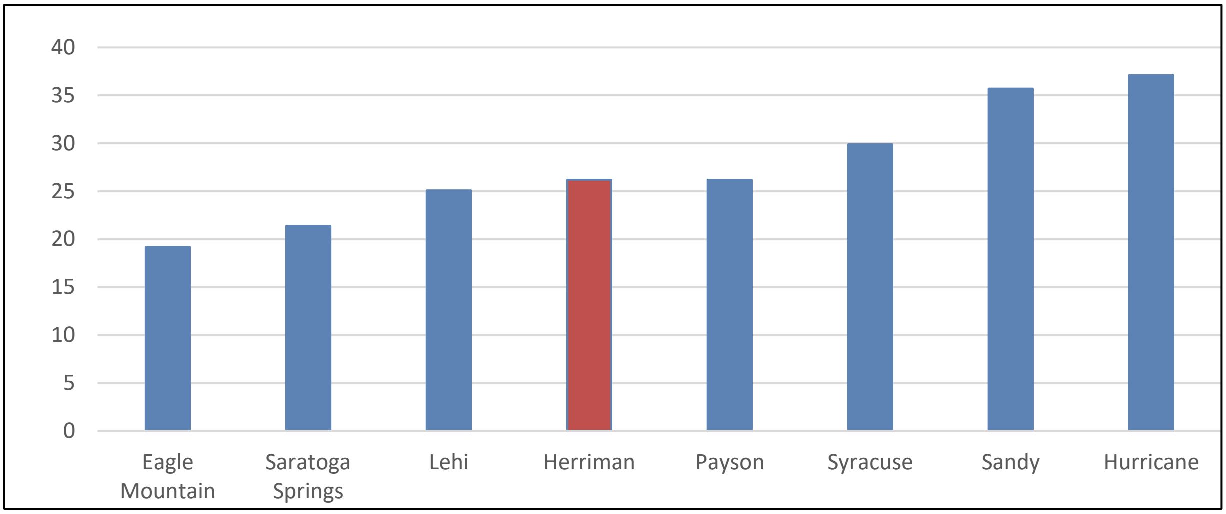
A peer city analysis was conducted to compare Herriman's demographics to other cities. Peer cities were chosen based on similarities to Herriman in population size and geographic isolation from a major interstate highway. Based on these criteria, Hurricane, Saratoga Springs, Payson, Eagle Mountain, and Syracuse were chosen. Lehi and Sandy were also included in the analysis to serve as 'aspirational' cities, or cities that may have characteristics of a future Herriman. These cities were then compared to Herriman utilizing available ACS data on median age, place of work (relative to place of residence), mode of travel to work, and travel time to work. The population of each of the peer cities is shown in Figure 2.



Source: US Census, ACS 5-year estimates

Figure 2: Peer City Population Data

Herriman has a median age of 26.2 years old, which is relatively young compared to its peer cities. Only Eagle Mountain, Saratoga Springs, and Lehi are lower, with median ages of 19.2, 21.4, and 25.1 respectively (see Figure 3).

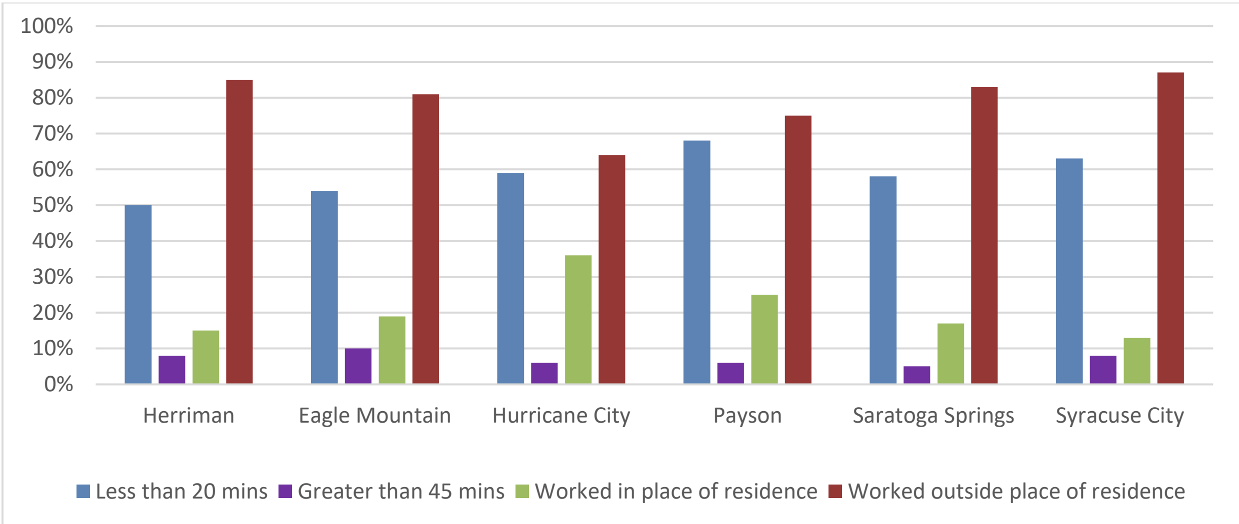


Source: US Census, ACS 5-year estimate

Figure 3: Peer City Resident Median Age (Years)

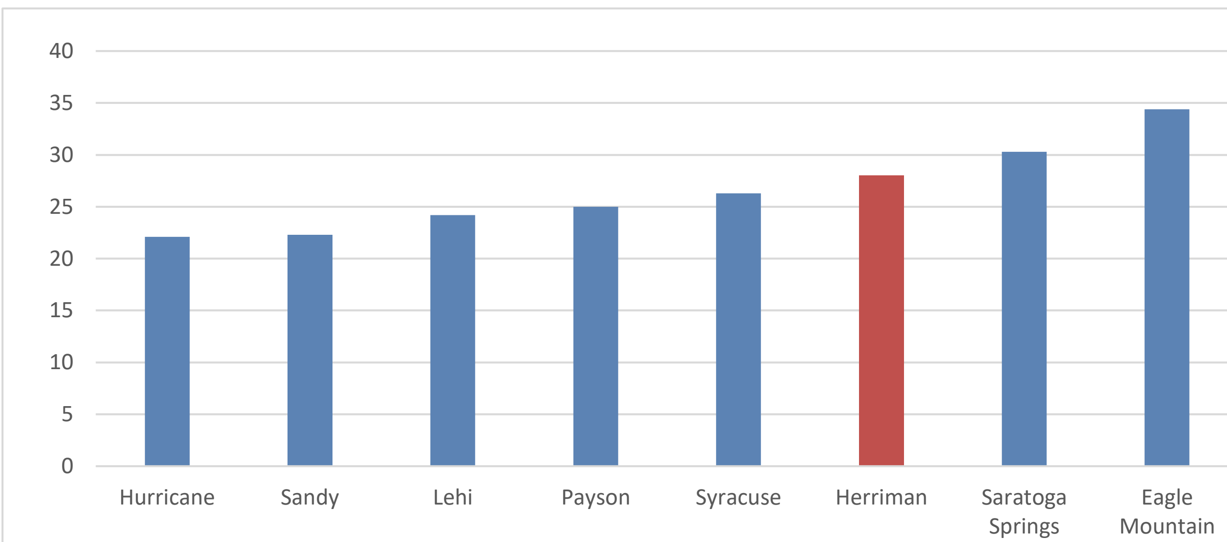
About 15 percent of Herriman residents work in Herriman, while the remainder leave the City to work. This is higher than in Syracuse, but much lower than Hurricane and Lehi (see Figure 4). The higher rates in Hurricane and Lehi can largely be explained by their relative isolation from major metropolitan areas. Payson and Sandy also have higher work-in-the-city rates, but as larger cities, they have more employment opportunities within their city boundaries. Herriman may expect a higher rate of local employment when it grows to a similar size.

Only 50 percent of Herriman commuters have a travel time to work of less than 20 minutes, which is above average for the group and higher than Sandy and Lehi (see Figure 5). About 8 percent of residents have a commute of over 45 minutes. The mean travel time to work is 28 minutes for residents of Herriman.



Source: US Census, ACS 5-year estimates

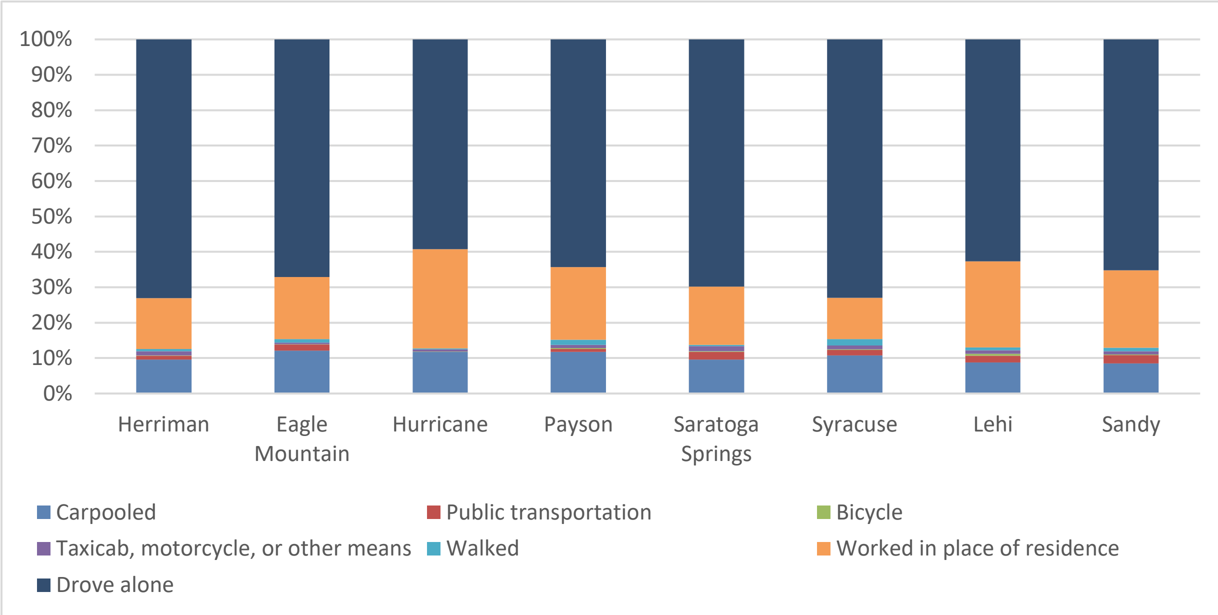
Figure 4: Peer City Place of Work and Travel Time to Work



Source: US Census, ACS 5-year estimates

Figure 5: Peer City Mean Travel Time to Work (Minutes)

Mode of travel to work is shown in Figure 6. Seventy-seven percent of people in Herriman drive alone to work, which is slightly above average for the group. Residents of Herriman typically do not bicycle or walk to work, and one percent use public transportation (based on the data provided). Fifteen percent of Herriman residents work from home, which is below the average of the group. This auto-dominated mode-split can largely be explained by the long distances to major employment centers and a lack of regular and prevalent public transit service.



Source: US Census, ACS 5-year estimates

Figure 6: Peer City Means to Work by Percent of Mode Share

Existing Land Use

Historically, land uses in Herriman can best be described as predominantly residential, low density, and suburban. With intense development pressures, land use is changing rapidly with more medium density housing and commercial development.

On July 1, 2014, Herriman annexed approximately 300 acres in the northwest section of the city. The Dansie Annexation occurred on January 1, 2016 and included approximately 500 acres. In the future, Herriman anticipates annexation applications for additional areas that are currently part of unincorporated Salt Lake County to the west of the current city boundary, as shown in Figure 7. The future potential annexation areas cover approximately 5,100 acres, which could increase Herriman's existing land area by about 30 percent.

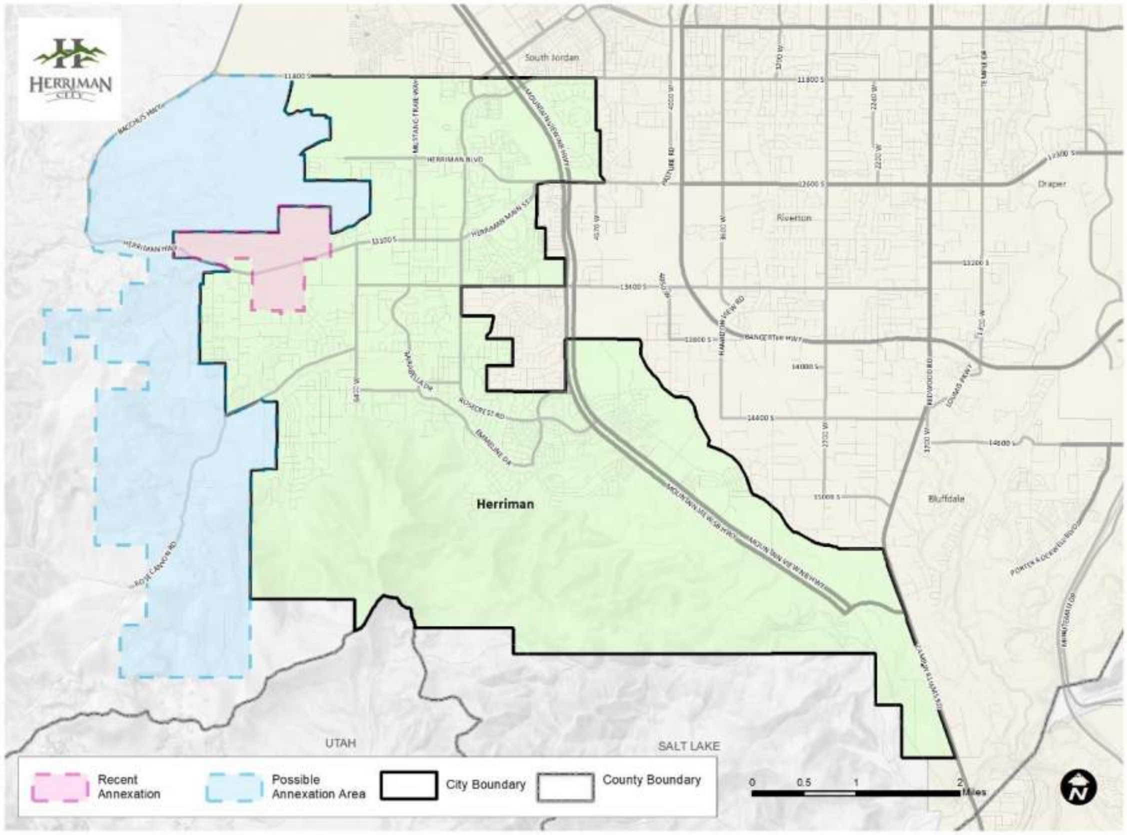


Figure 7: Herriman Current Boundaries and Possible Annexation Area

Transportation planning depends on estimating future land uses in addition to demographic changes. This information is used in a computer-modeling tool, known as the Travel Demand Model, which forecasts trips to and from destinations based on smaller regions known as traffic analysis zones (TAZs). The traffic analysis zones are geographically smaller than a municipality and are similar in size to census block groups. TAZs are defined by the Wasatch Front Regional Council (WFRC). Data associated with the TAZs from WFRC were updated by Herriman personnel to represent 2019 population and employment data and used to develop the travel demand computer model. Figure 8: Herriman Area Traffic Analysis Zones

Figure 8 shows the TAZs within Herriman with the TAZ identification numbers.

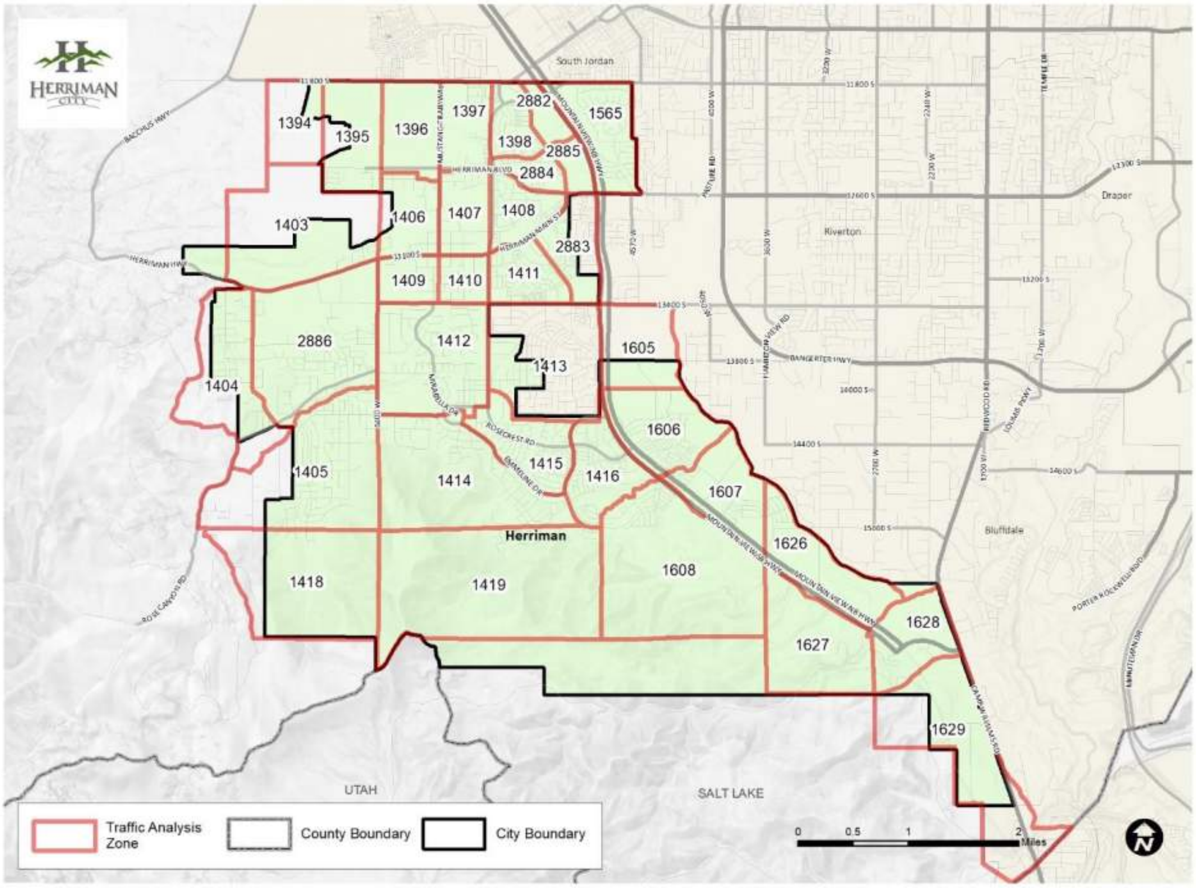


Figure 8: Herriman Area Traffic Analysis Zones

Figure 9 shows the number of existing households by TAZ. The highest densities of households are found in the central portion of the City. Currently, there is only a small number of homes located in the southern portion of the City. Unincorporated areas to the northwest also have relatively few households.

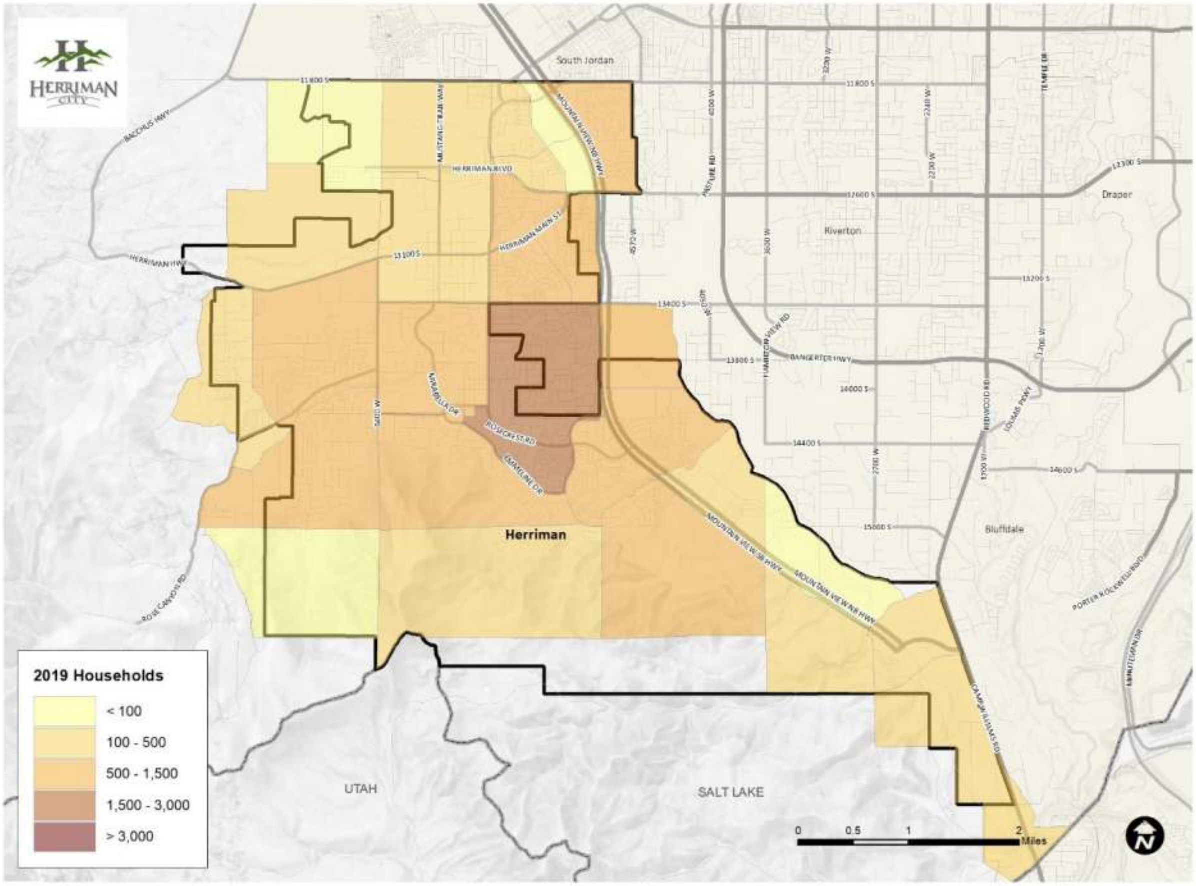


Figure 9: Household Numbers by Traffic Analysis Zone

Figure 10 shows the estimated number of employed Herriman residents by TAZ. There is a central band of employment across the City, along with additional nodes to the northwest and southeast. Again, there are very low concentrations of employment in the southern portions of the City.

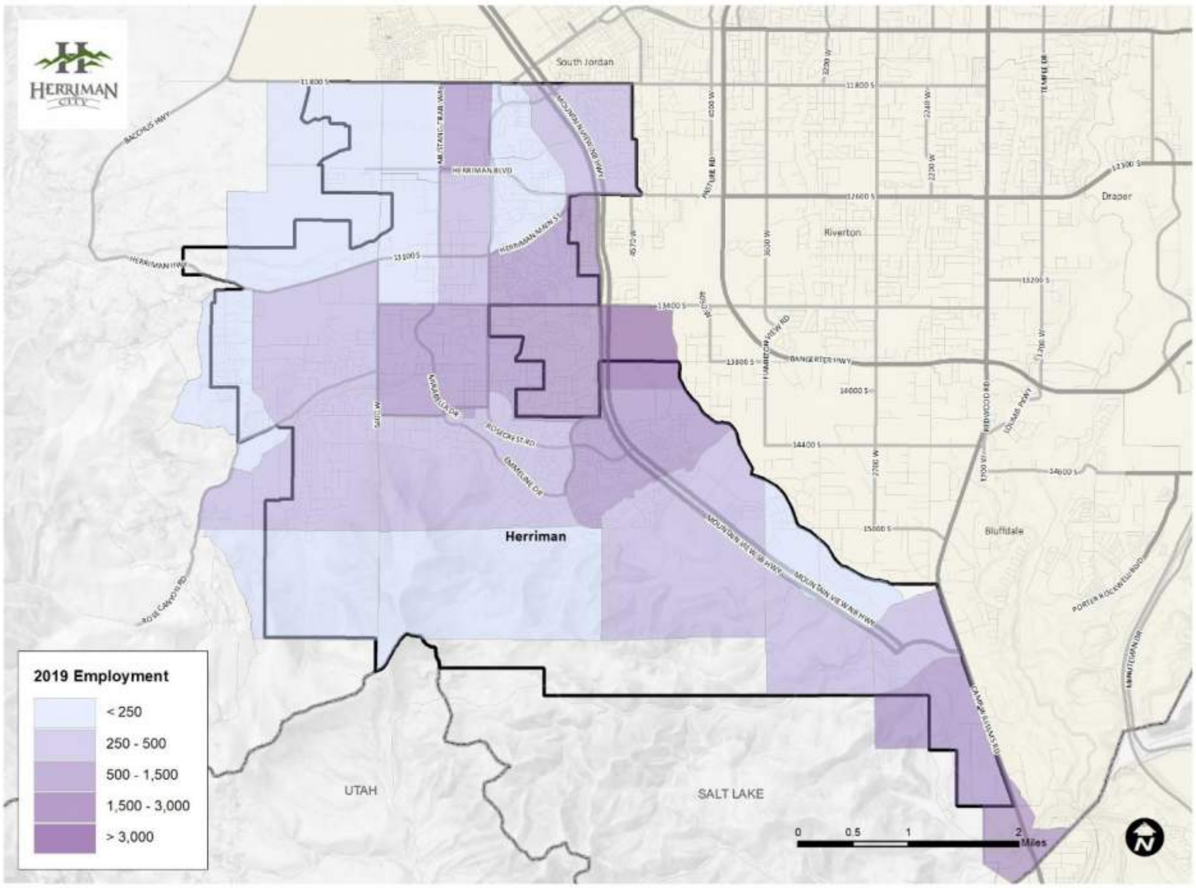


Figure 10 : Employed Residents by Traffic Analysis Zone

Much of the southern portion of Herriman is geographically constrained by the steep slopes of the foothills to the south and west, which inhibits development. Future development in south Herriman will likely be limited to hillside residences. The northwest unincorporated region, however, does not contain these same constraints and should see higher development densities in the future. The current zoning (see Figure 11) within Herriman closely represents what exists today, with several planned zones for mixed use development. The largest planned mixed-use development

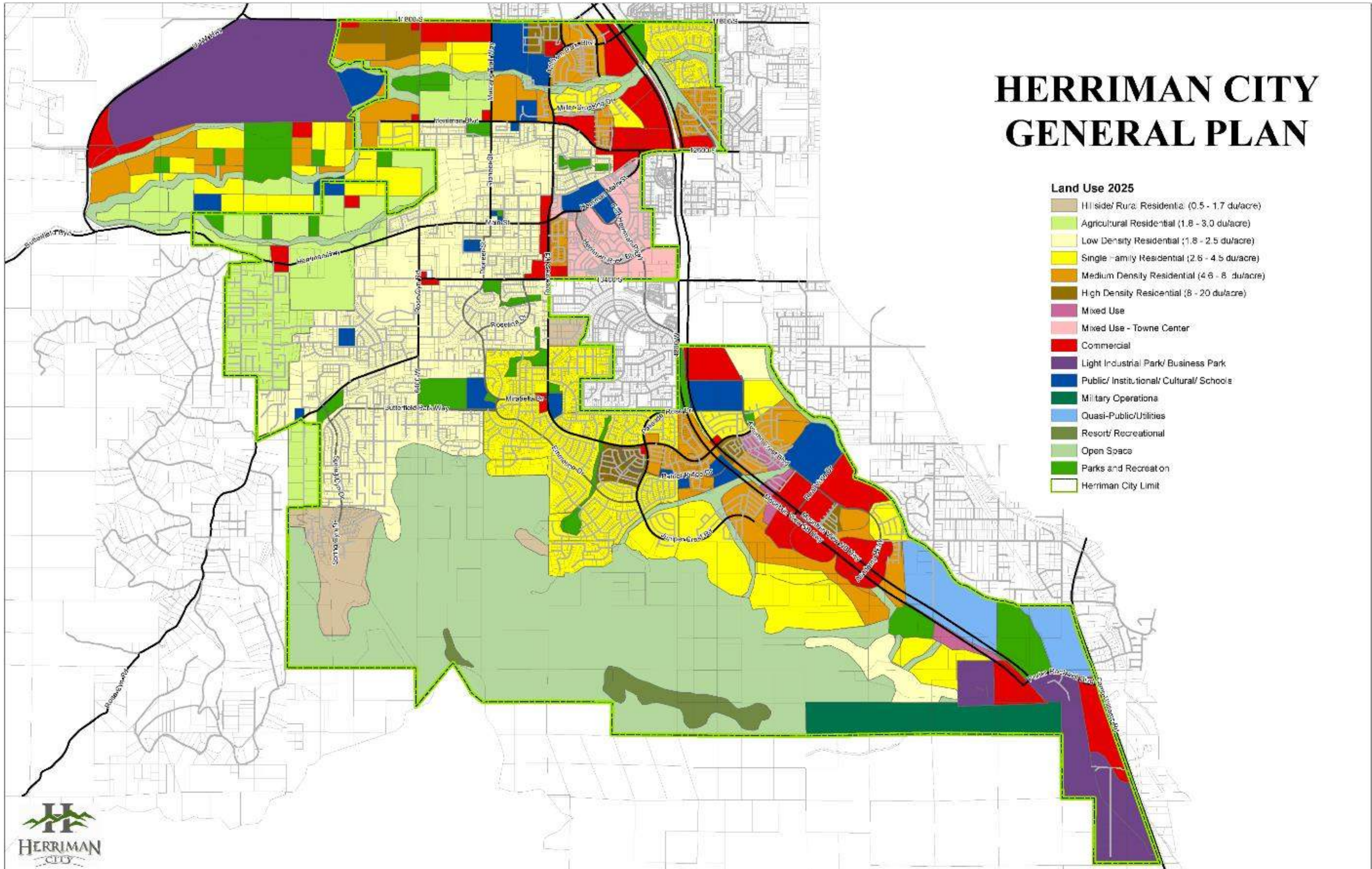


Figure 11: Herriman Current Zoning Map

EXISTING FUNCTIONAL CLASSIFICATION

Figure 12 shows the existing roadway network by functional classification. This classification includes major and minor collectors and major and minor arterial roadways. Roads that are under construction, such as the extension of Herriman Main Street, north to 11800 South, are not shown on this map.

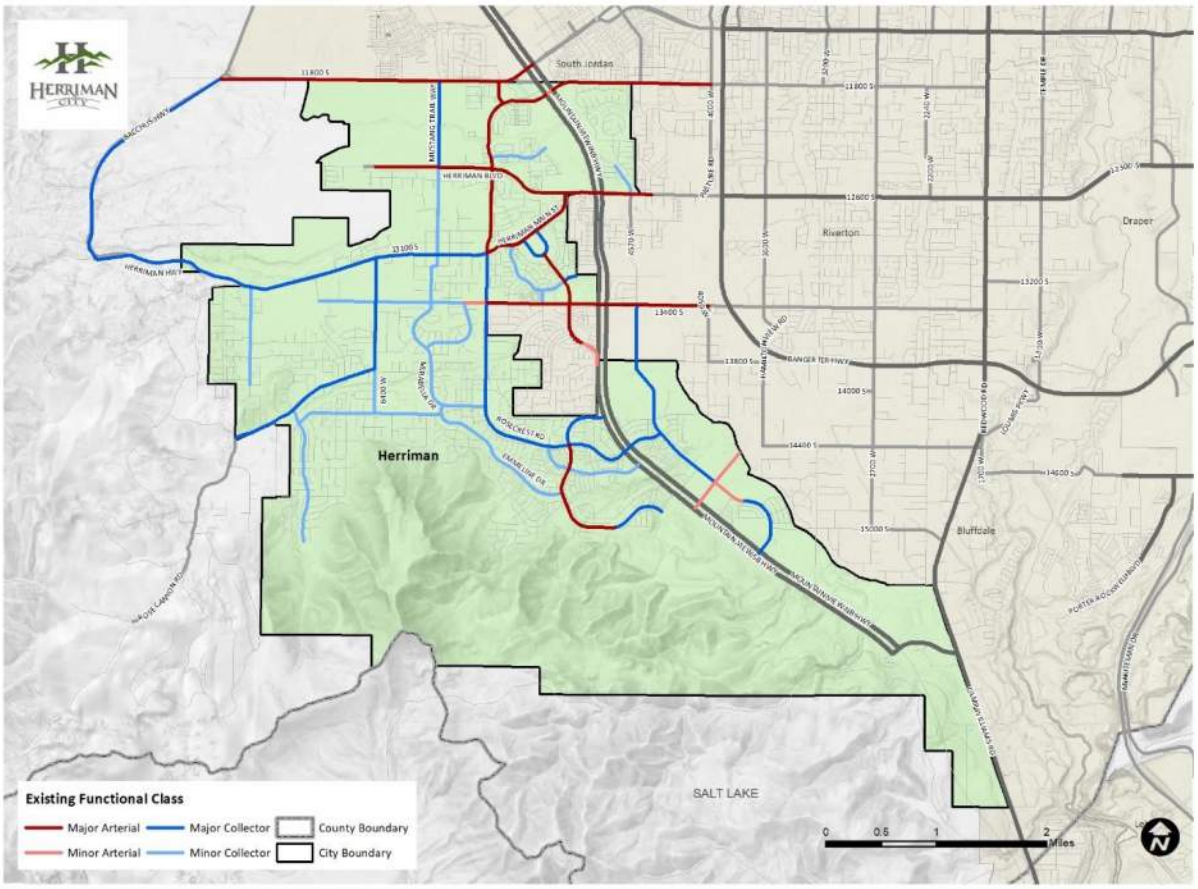


Figure 12: Existing Functional Classification of Roads

PEDESTRIAN AND BICYCLE FACILITIES

The sidewalk network is 'varied' with areas of good coverage, sections with sidewalks on only one side of the road, and other areas without any pedestrian facilities (see Figure 13). The pedestrian facilities identified on Figure 13 do not include local streets or minor collector streets. Only the pedestrian facilities along the modeled roads are included on Figure 13. However, in some areas construction of sidewalks is currently underway. When those projects are completed, the sidewalk network will be greatly improved. The City has made it a priority to address sidewalk needs along school walking routes.

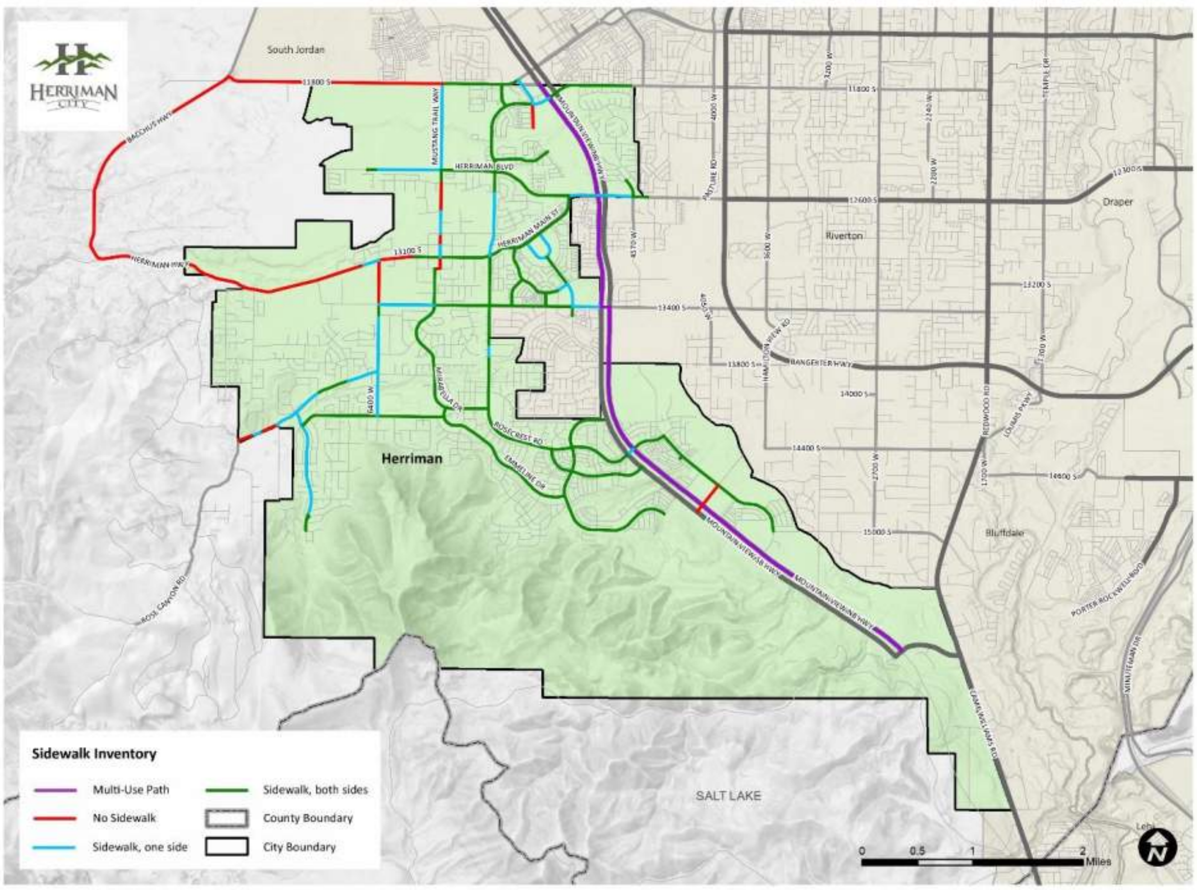


Figure 13: Current Pedestrian Facilities on Modelled Roads

Figure 14 shows the existing bicycle facilities within Herriman. The most significant bicycle infrastructure which services the City are the bicycle lanes and multi-use pathways along Mountain View Corridor. There are a handful of bicycle lanes on collector and arterial streets throughout the City and a multi-use pathway which connects the Mountain View Corridor system to trails in the foothills.

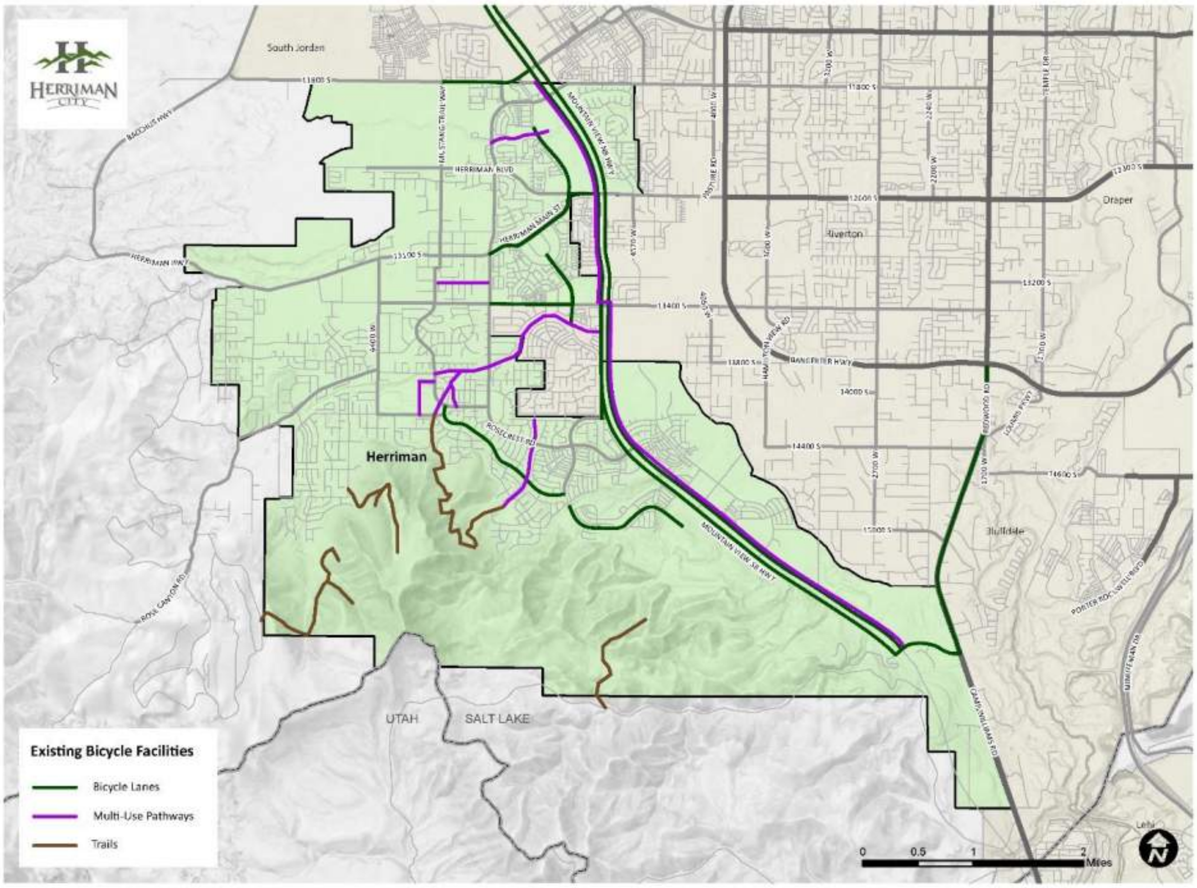


Figure 14: Existing Bicycle Facilities

PUBLIC TRANSPORTATION

Utah Transit Authority (UTA) currently operates two bus lines in Herriman City, including the Herriman Flex Shuttle (F534), and the Herriman Lift (F547). The Herriman Flex Shuttle is limited to service on weekdays during the morning and evening commutes. It takes people from Herriman to the South Jordan FrontRunner Station in the morning and from the same station to Herriman in the evening. Figure 15 and Figure 16 show the routes of the Herriman Flex Shuttle and Table 5 shows the current morning and evening schedules.

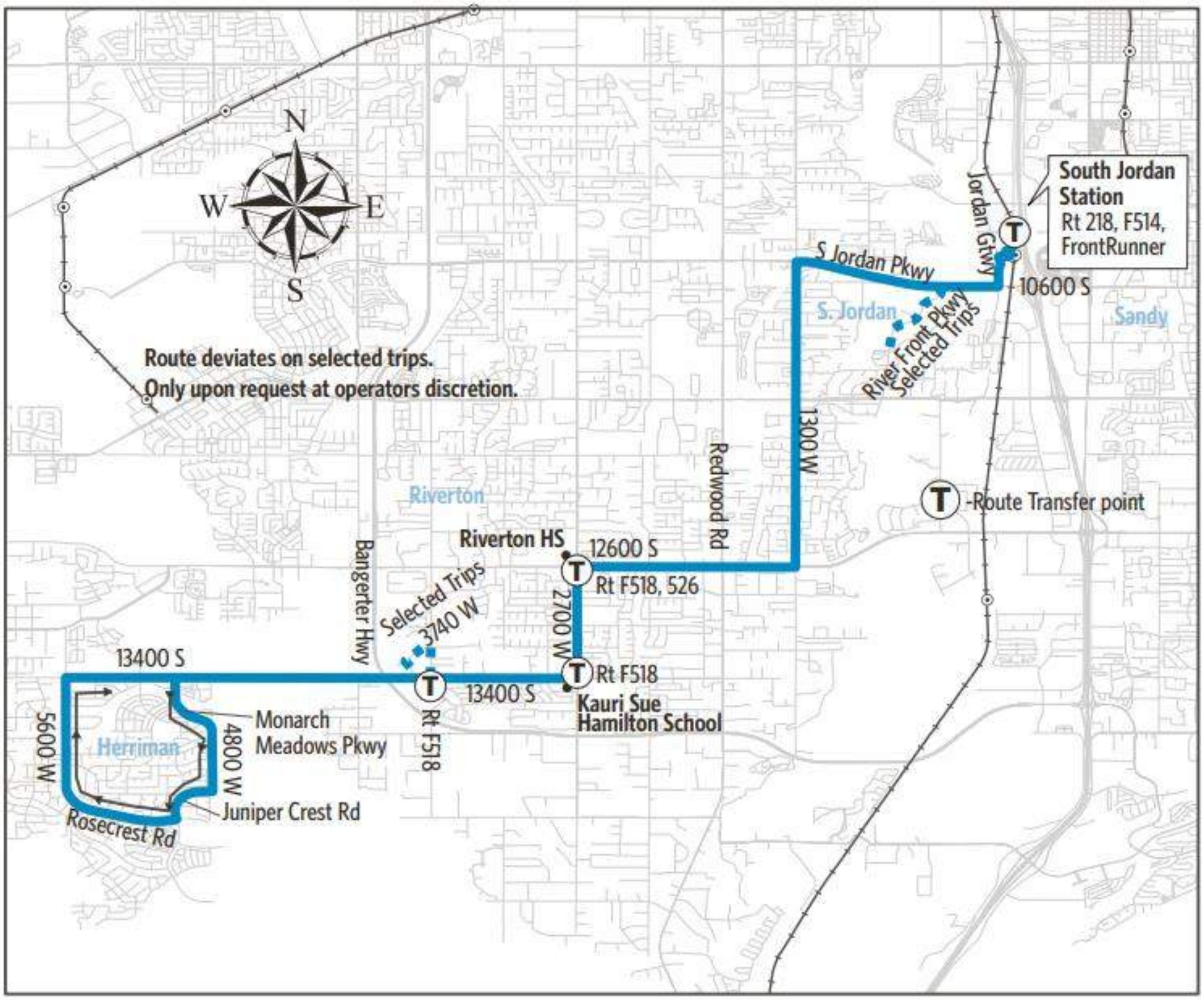


Figure 15: UTA Flex Shuttle F 534 Route

Table 5. UTA Flex Shuttle F 534 Schedule

To South Jordan FrontRunner Station					To 5600 West			
13700 S and Monarch Meadows Dr	12800 S and 2700 W	12600 S and Redwood Rd	10400 S and 1300 W	South Jordan FrontRunner	South Jordan FrontRunner	10400 S and 1300 W	12800 S and 2700 W	13700 S and 5600 W
5:57 AM	6:13 AM	6:16 AM	6:23 AM	6:29 AM	5:00 PM	5:07 PM	5:18 PM	5:35 PM
6:57	7:13	7:16	7:23	7:29	6:00	6:07	6:18	6:35

Route F547 provides more regular service. Clockwise one-hour service is provided all day from 5:30 AM to 8:30 PM, while counter-clockwise one-hour service is provided during the AM and PM peaks of 6:00-10:00 AM and 2:00-6:00 PM. The flex route connects Herriman to Riverton and Daybreak, and provides transfer opportunities to the TRAX Red Line and bus routes F504 and F518.

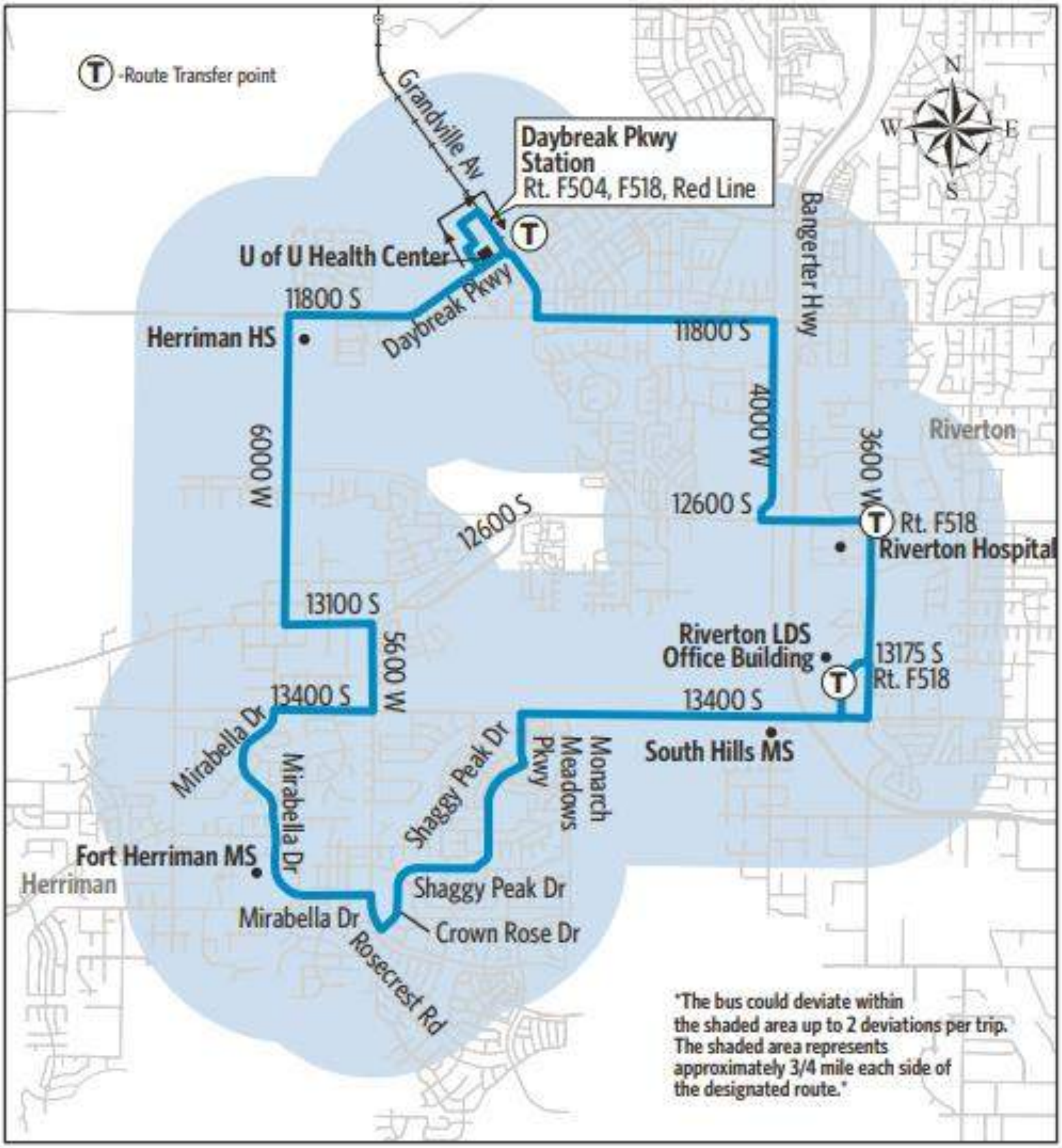


Figure 16: UTA Route F547 – Herriman Flex Route

SAFETY ANALYSIS

The most recent (2016-2018) crash data available for Herriman from the Utah Department of Transportation (UDOT) Traffic and Safety Division was used to perform a traffic safety analysis. Based on the frequency of crashes, several intersections were identified as "intersection hot spots". Table 6 includes a summary of the intersections in Herriman with at least ten crashes occurring from 2016 to 2018 and Figure 17 shows crash frequency throughout the City. The three intersections—12600 South and Mountain View Corridor, Anthem Park Boulevard and Mountain View Corridor, and 13400 South and Rosecrest Road (5600 West)—in which over fifty crashes have occurred will receive additional focus in this section. Although not an intersection, it is worth noting that the segment of Mustang Trail Way (6000 West) in front of Herriman High School is the seventh most significant concentration of vehicle crashes in the City.

Table 6. Intersection Hot Spots Ranked by Total Number of Crashes, 2016-2018

Rank	Location	Total Crashes	Serious Injury Crashes	Fatal Crashes
1	12600 South and Mountain View Corridor	83	0	0
2	Anthem Park Boulevard and Mountain View Corridor	57	0	0
3	13400 South and Rosecrest Road (5600 West)	52	1	0
4	Rosecrest Road and Mountain View Corridor	48	1	1
5	Porter Rockwell Boulevard and Redwood Road	26	0	0
6	Porter Rockwell Boulevard and Mountain View Corridor	24	2	0
7	Herriman High School	22	0	0
8	12600 South and Legacy Ranch Boulevard (4570 West)	19	0	0
9	11800 South and Freedom Park Boulevard	18	1	0
10	Main Street and Rosecrest Road	17	0	0
11	Herriman Parkway and Pioneer Street	16	0	0
12	Herriman Parkway and Main Street	13	0	0
13	Bonica Lane / Callander Drive (13940 South) and Rosecrest Road (5600 West)	11	0	0
13	Main Street and Pioneer Street	11	0	0
14	Herriman Parkway and Anthem Park Boulevard	10	0	0

This data in this table is protected in accordance with 23 USC 409.

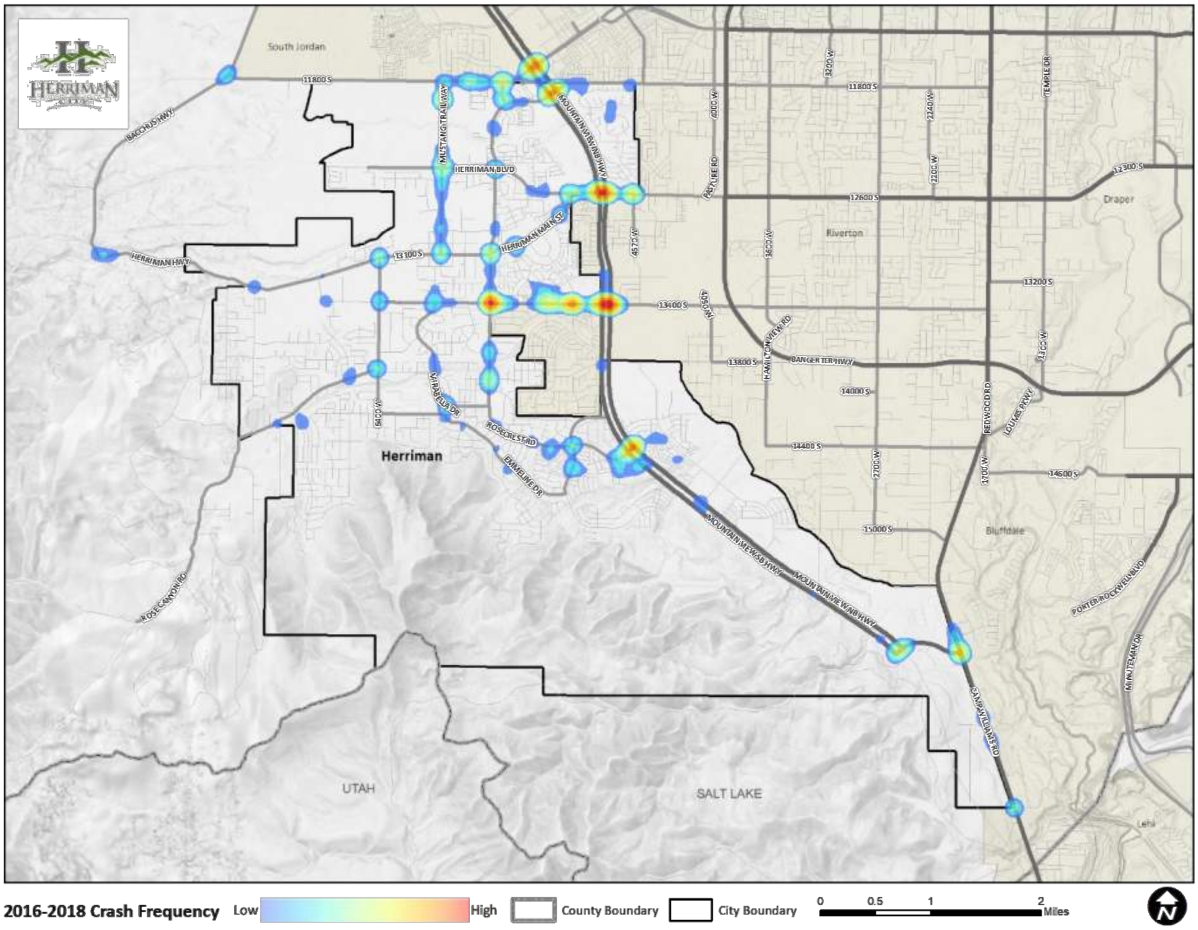


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Figure 17: 2016-2018 Crash Frequency Summary

From 2016-2018, 28 severe crashes occurred within or near Herriman. A severe crash is defined as a vehicle collision resulting in an incapacitating injury or fatality. Figure 18 summarizes the locations of these severe crashes. Six crashes resulted in fatilities, while 22 resulted with an incapacitating injury.

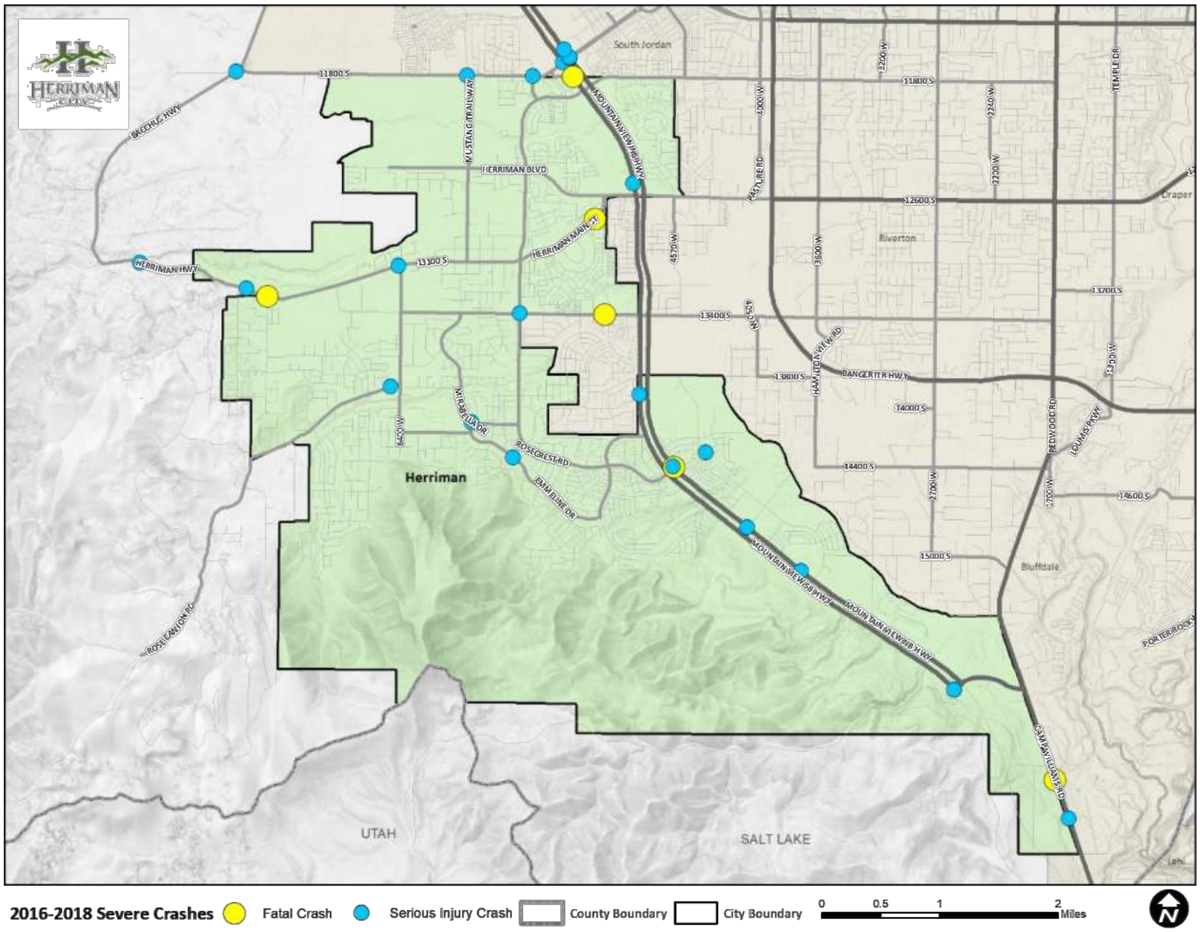

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Figure 18: 2016-2018 Severe Crashes

2.2.1 12600 South and Mountain View Corridor

The intersections of 12600 South and the northbound/southbound directions of the Mountain View Corridor experienced 83 crashes during the analysis timeframe; the largest concentration of crashes in Herriman. Due to their proximity, these dual signals operate as a single intersection.

Figure 19 summarizes the configuration of crashes at this intersection for each year between 2016 and 2018. This perspective can highlight emerging issues or the effects of safety improvements. Fortunately, none of the crashes were severe, with 66 percent of crashes resulting in no injury. Crash frequency spiked in 2017 before returning to slightly below 2016 levels. The most common crash type was “front-to-rear” crashes, comprising half of the crashes at this intersection. This type of crash is trending upward during the analysis period, typical of a signal-controlled intersection on an increasingly busy roadway. The second most common crash type involves two vehicles colliding at an angle, occurring when a vehicle turns. Angle crashes were at their highest in 2016 but have trended downward for the remaining years during the analysis. This pattern could reflect a safety improvement or increased driver familiarity with the intersections.

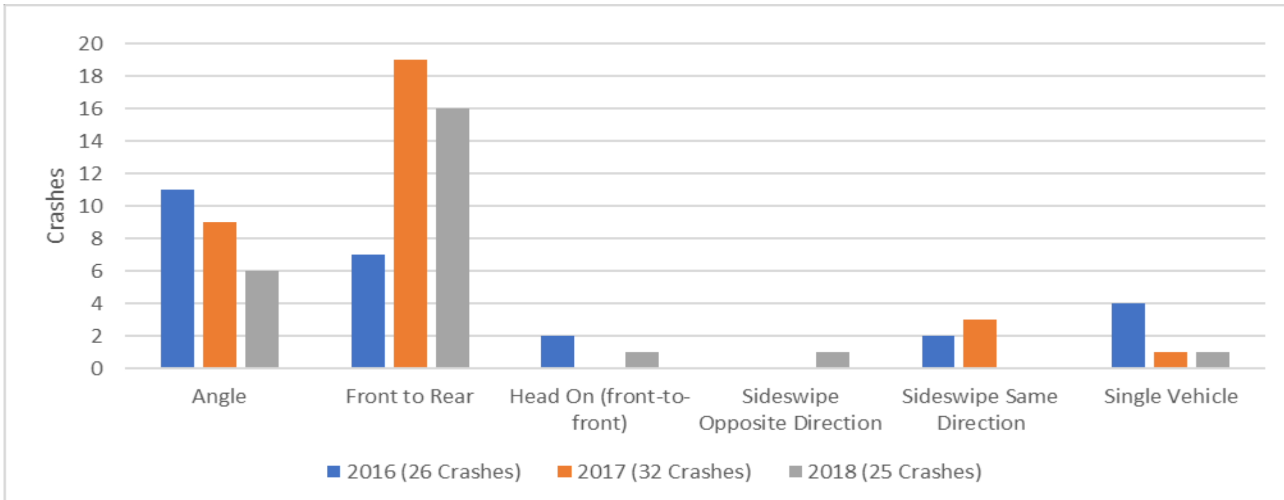


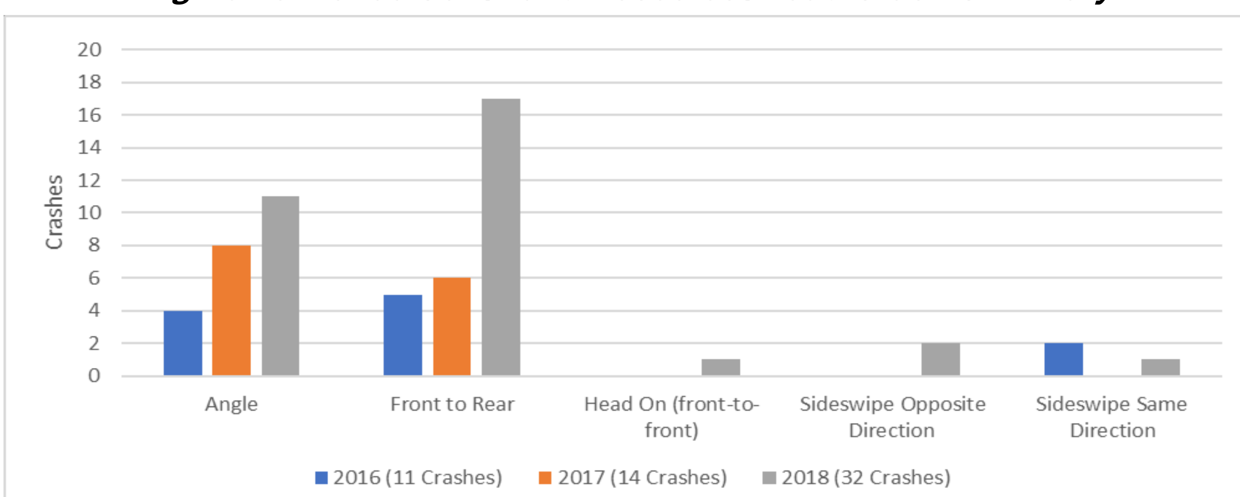
Figure 19: 12600 South and Mountain View Corridor Crash Summary

2.2.2 Anthem Park Boulevard and Mountain View Corridor

The intersections of Anthem Park Boulevard and the northbound/southbound directions of the Mountain View Corridor experienced 57 crashes during the analysis timeframe; the second largest concentration of crashes in Herriman. Due to their proximity, these dual signals operate as a single intersection. No severe crashes occurred at these intersections during the analysis timeframe.

Figure 20 summarizes the crash types that occurred between 2016 and 2018. Overall, crashes at these intersections approximately doubled between 2017 and 2018. Again, front-to-rear style crashes were the most common and accounted for almost half of all crashes. This crash type has increased every year with a dramatic spike occurring in 2018, perhaps indicating the longer queues that form at busy signal-controlled intersections. About 40 percent of crashes involved an angle configuration. These crashes steadily increased each year between 2016 and 2018.

Figure 20: 13400 South and Rosecrest Road Crash Summary



2.2.3 13400 South and Rosecrest Road

Of the top three most significant crash hot spots in Herriman, the intersection of 13400 South and Rosecrest Road is the only intersection that doesn't involve a state highway. During the three-year analysis timeframe, 52 crashes occurred at this location. One of these crashes involved an angle crash resulting in an incapacitating injury in 2016. Overall, crash numbers have consistently declined at this intersection. As traffic volumes increase in Herriman, it remains to be seen if this trend will continue.

Figure 21 summarizes crash configurations at this intersection between 2016 and 2018. Slightly less than half of the crashes at this intersection are angle crashes, the most common crash configuration at this location. After dramatically dropping in frequency in 2017, the frequency of angle crashes remained stable in 2018. Front-to-rear crashes are the next most common crash type, and increased in 2017 before returning to 2016 levels.

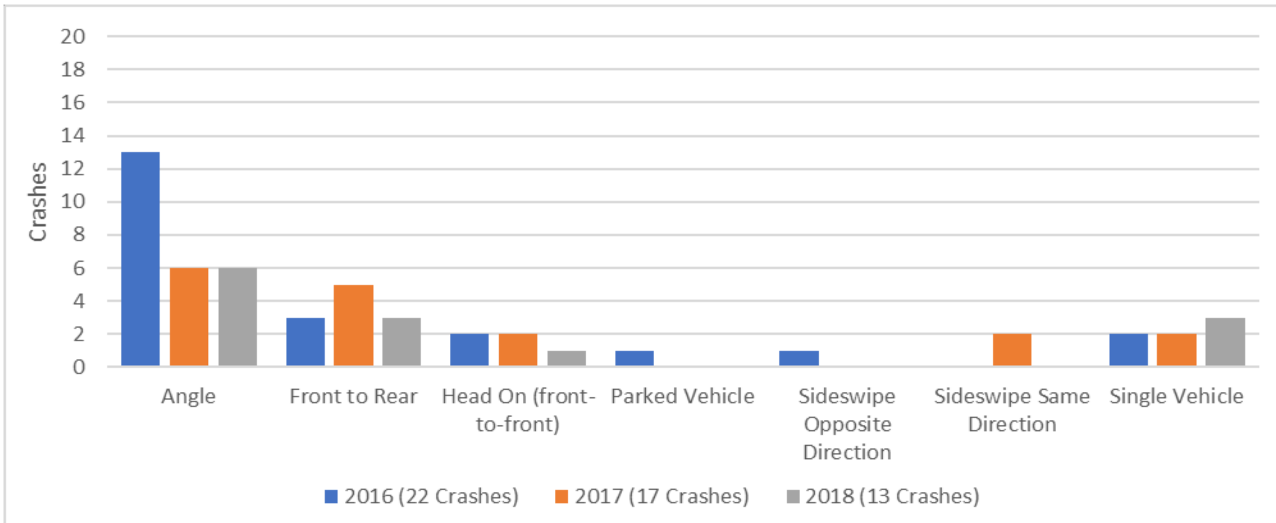


Figure 21: 13400 South and Rosecrest Road Crash Summary

3 FUTURE CONDITIONS

Having completed the analysis of existing conditions, this section discusses the projected population growth and future transportation needs of Herriman.

3.1 LAND USE

Herriman City officials expect the population of the City to grow to 93,465 by 2030 and to 113,772 by 2050, with an ultimate build-out population of approximately 116,000. The build-out population includes the potential annexation areas. This number is higher than region-wide population estimates made by WFRC. WFRC constrains growth to regional totals, which is good at a large scale, but when looking at small geographies these projections are less reliable. To account for this issue, numbers provided by Herriman were utilized for this plan to adjust TAZ level demographic information. Table 7 shows projections for population, households, and employment from WFRC and Herriman. For detailed tables with information at the TAZ level, see the Appendix B.

Table 7. Demographic Projections

	WFRC Current Model	Herriman Revisions	WFRC Projections		Herriman Projections	
	2019	2019	2030	2050	2030	2050
Population	40,725	58,287	59,534	86,350	93,465	113,772
Households	12,124	17,353	19,652	31,357	41,315	80,852
Employment	11,917	11,754	24,532	33,608	24,345	33,413

The number of total projected households by TAZ for 2030 and 2050 is shown in Figure 22 and Figure 23 respectively. The projected growth of the number of Households is particularly high in undeveloped areas where terrain is suitable for development.

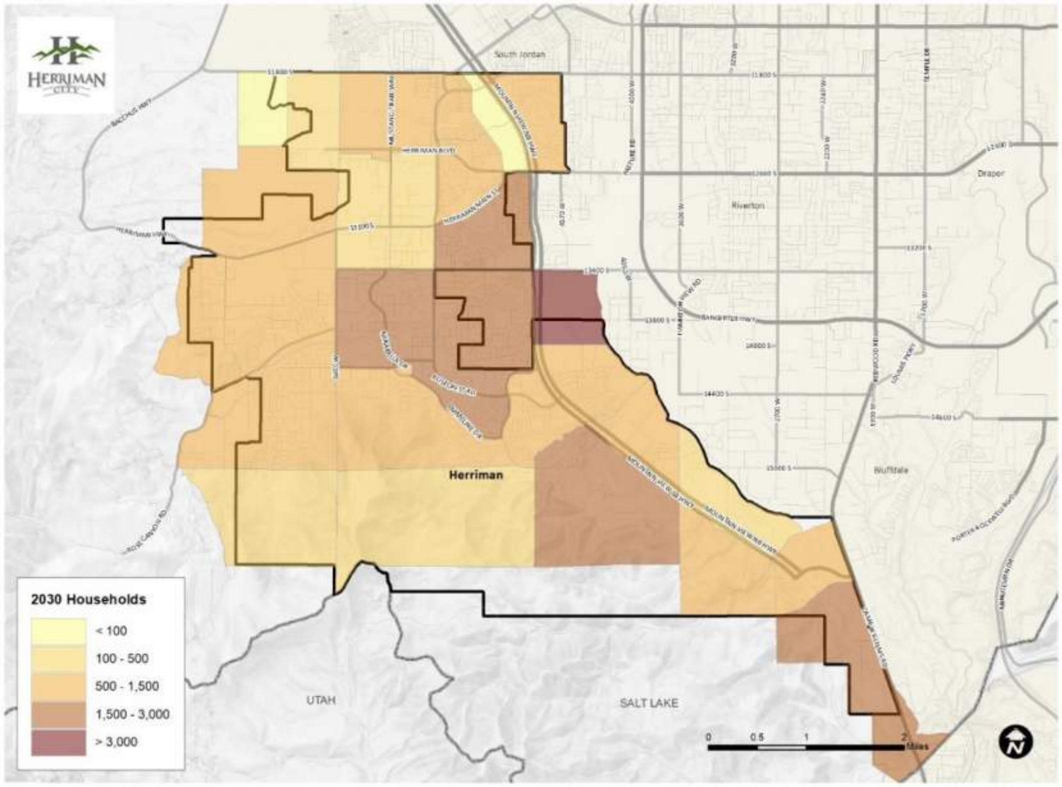


Figure 22: Estimated 2030 Household Numbers by TAZ

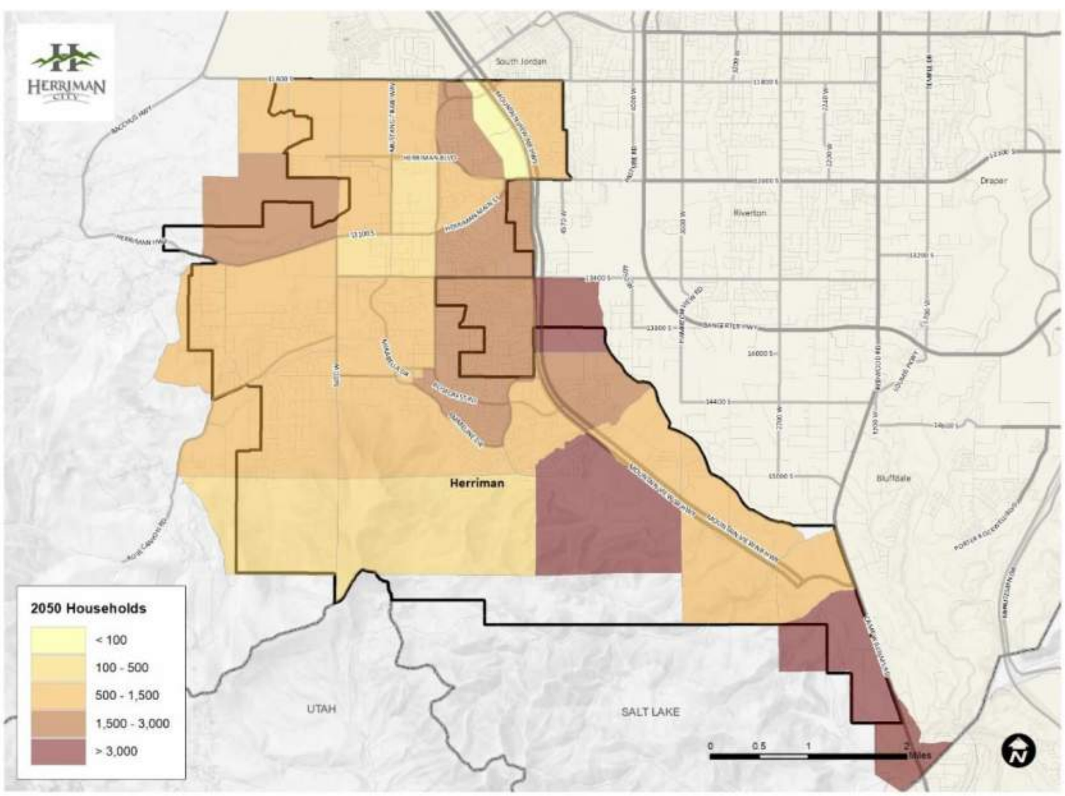


Figure 23: Estimated 2050 Household Numbers by TAZ

Similarly, the growth in the number of employed residents is projected to occur in the currently undeveloped northwest, southeast, and the Herriman Towne Center. Figure 24 and Figure 25 show the number of employed residents in each TAZ for 2030 and 2050 respectively.

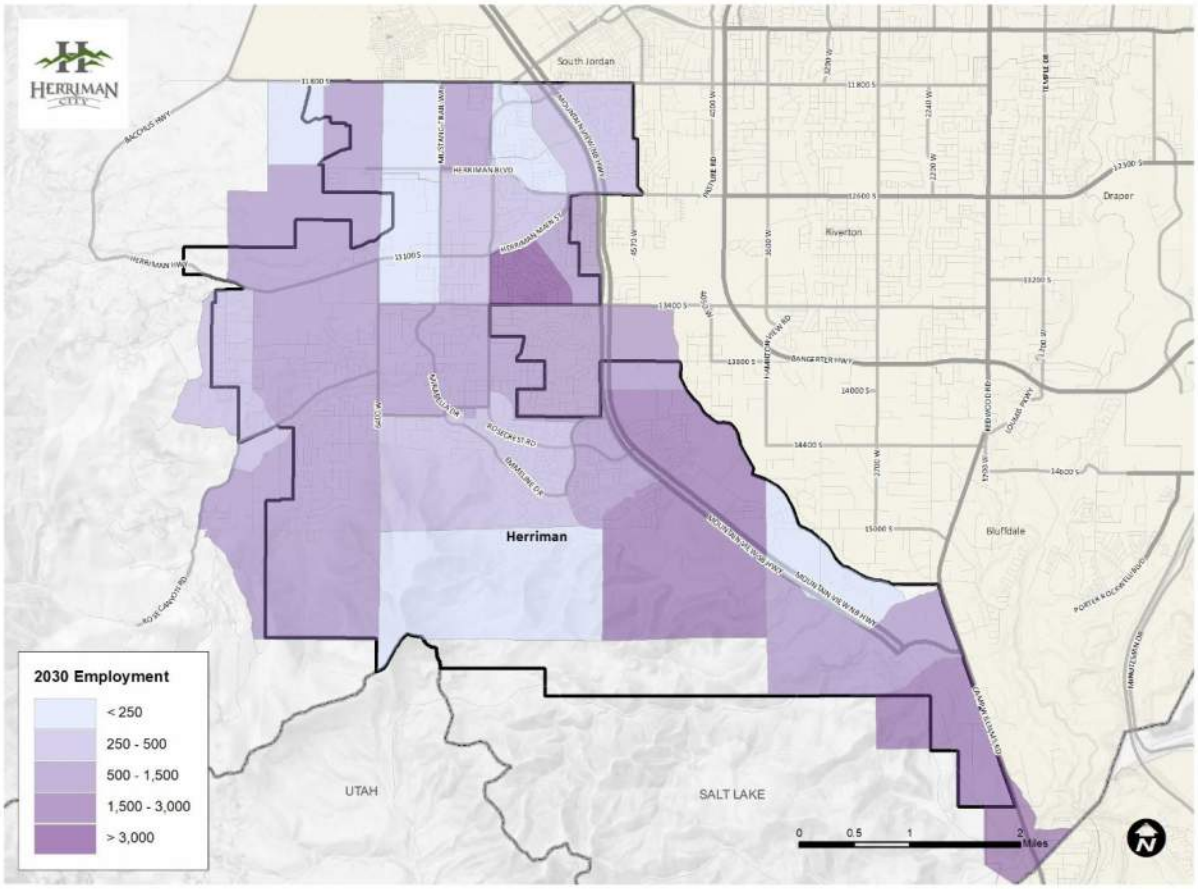


Figure 24: Projected 2030 Employed Residents by TAZ

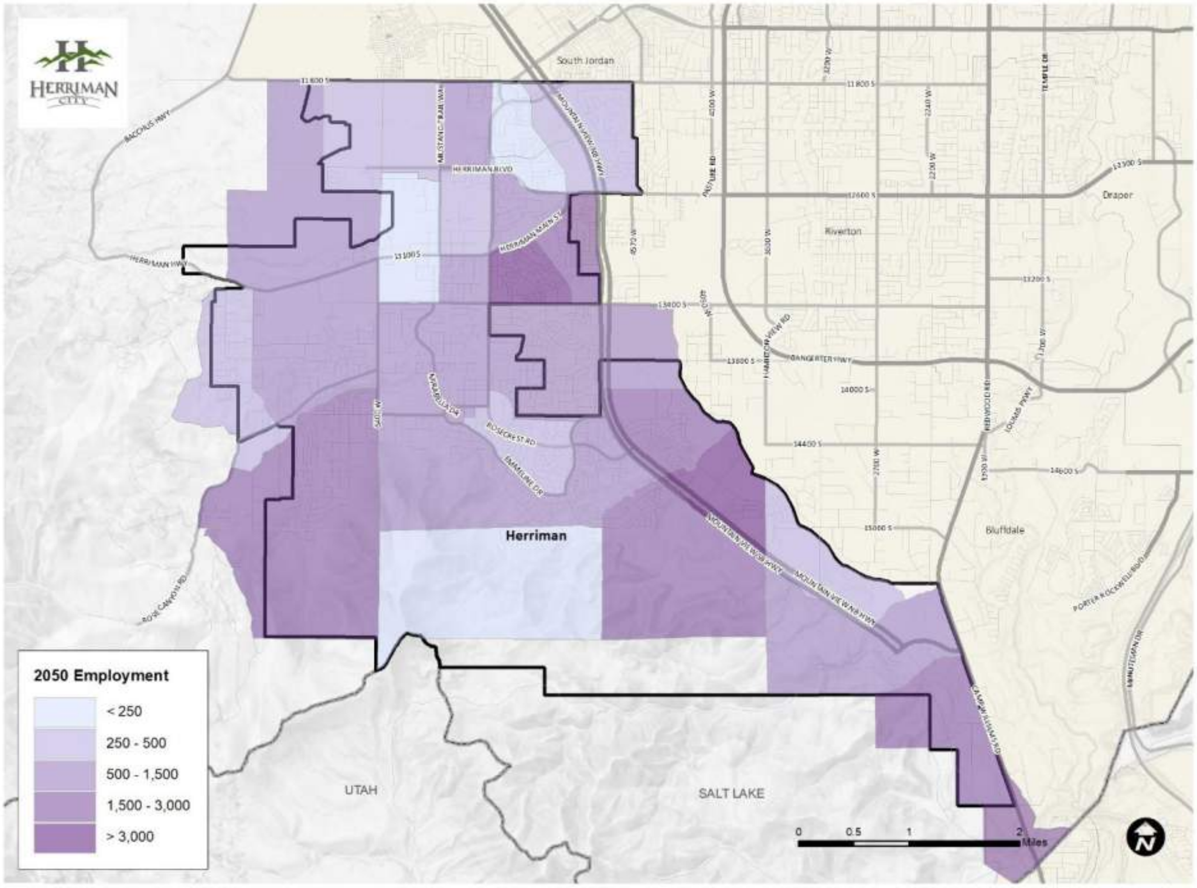


Figure 25: Projected 2050 Employed Residents by TAZ

Herriman City's 2025 Land Use Plan is similar to current zoning. The most notable differences are the conversion of a large portion of the agricultural zones to low density single family, inclusion of the unincorporated land to the west of the City, and the Towne Center plan. Figure 26 shows the Herriman City 2025 Land Use Plan.

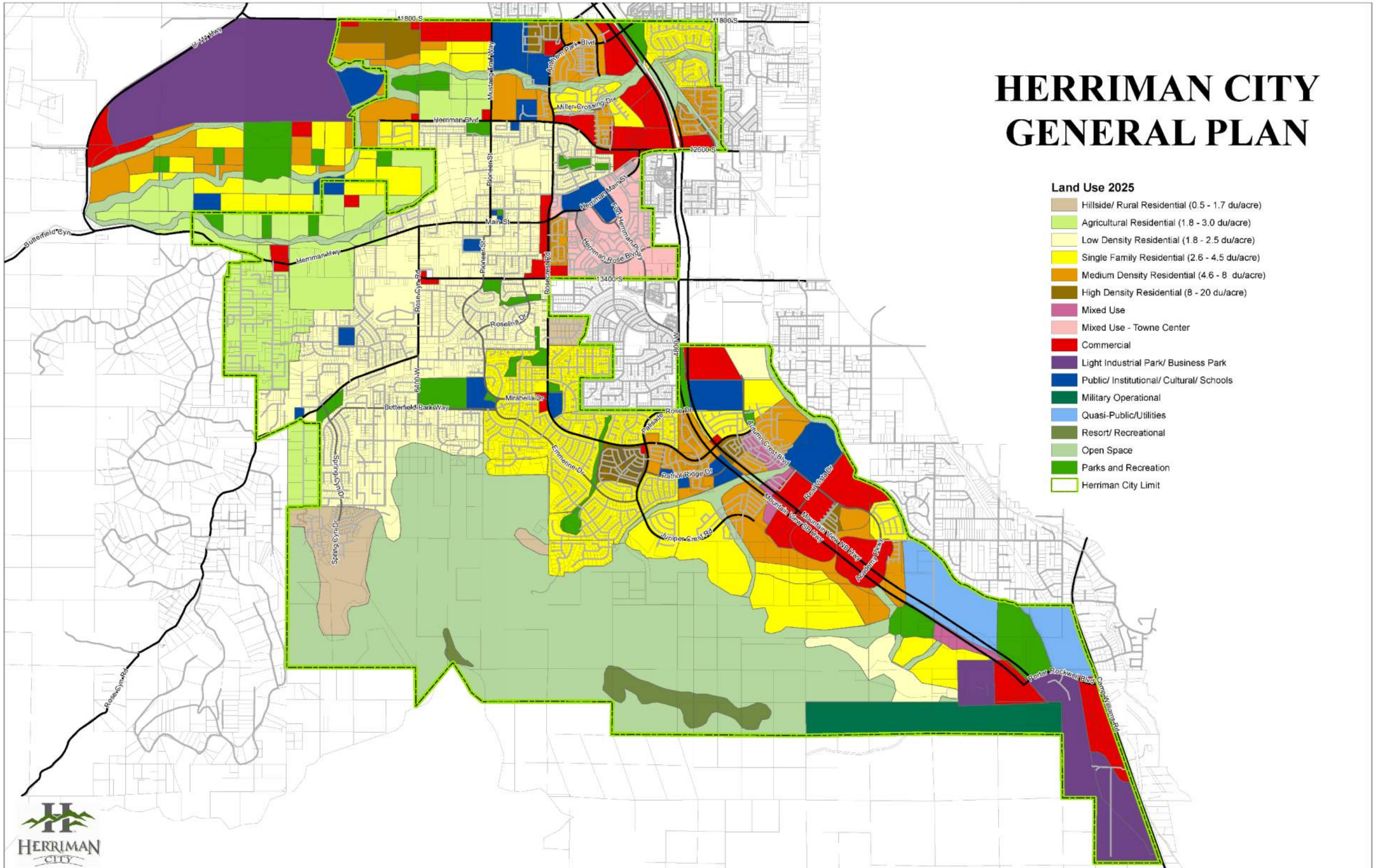
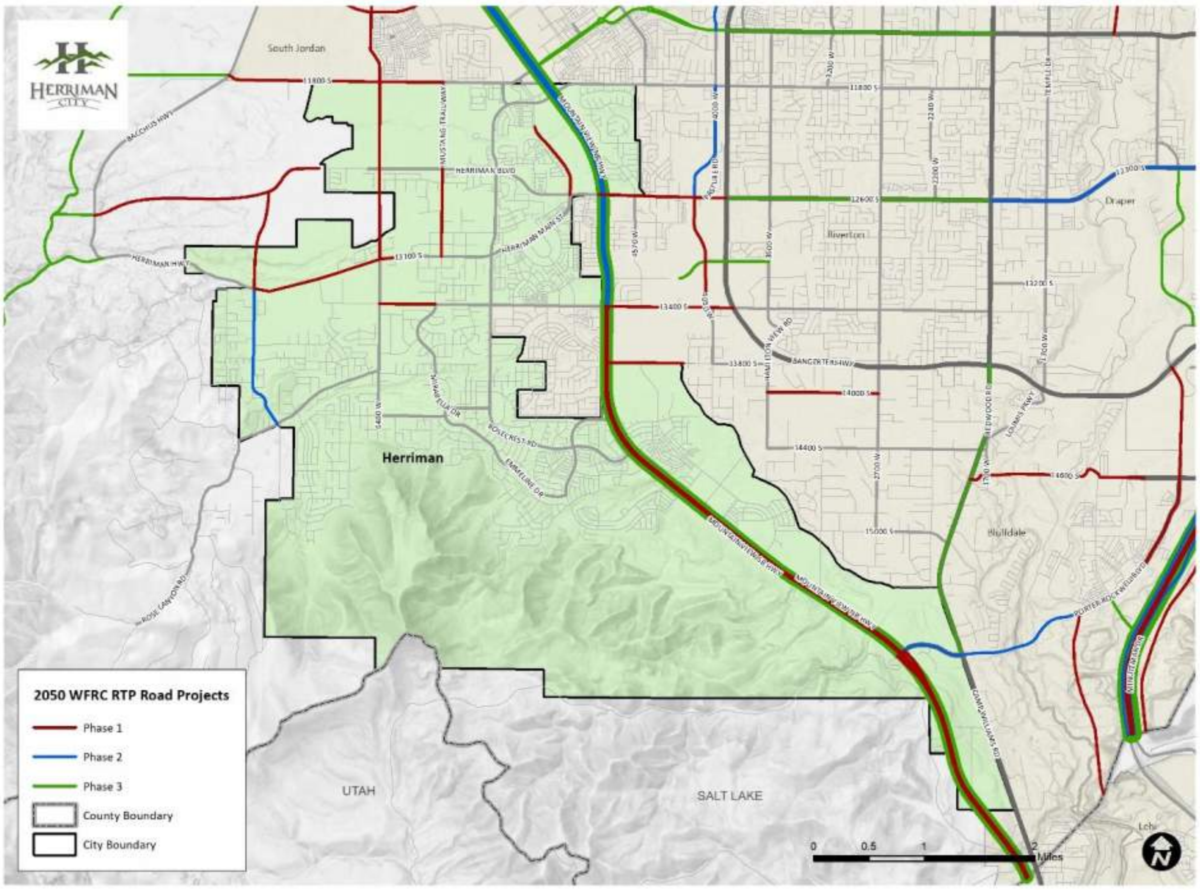


Figure 26: Future (2025) Land Use Plan

REGIONAL PLANS

The forecasting and planning undertaken by Herriman is complimented by regional planning performed by WFRC, UDOT, and UTA. WFRC's Regional Transportation Plan (RTP) includes roadway, transit and active transportation projects for each of the previously stated agencies in three funded stages through the year 2050. Figure 27 shows the recommended RTP roadway projects in or near Herriman. These planned regional projects are consistent with the proposed local projects outlined in this master plan.



Source: Wasatch Front Regional Council

Figure 27: Recommended Regional Transportation Plan Projects in Herriman

TRAFFIC CONDITIONS

The traffic volumes in Herriman are generally modest, with average daily traffic (ADT) only rising above 30,000 on a couple of major arterials. This amounts to an overall level of service (LOS) well within the typical LOS D standard typical of urbanized areas. Figure 28 depicts the level of service progression from A "free flow" to F "forced flow."

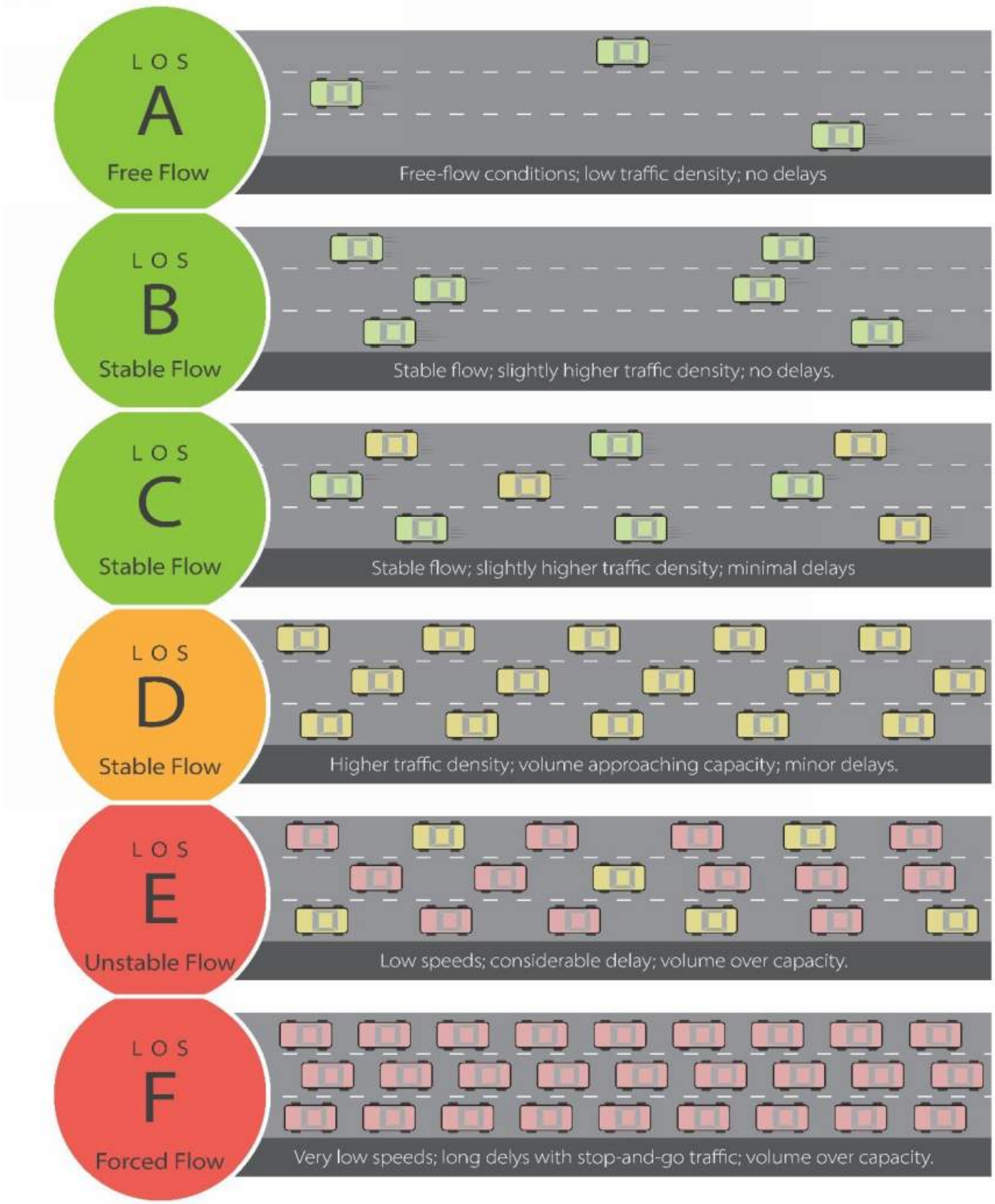


Figure 28: Level of Service Diagram

For application in Herriman, LOS D roadway capacities were adjusted to daily maximums based on various factors consistent with the Highway Capacity Manual. Table 8 summarizes the daily maximum capacities used to define capacity deficiencies as part of this study. Figure 29 shows existing traffic volumes, and Figure 30 shows the existing LOS for arterial roads and major and minor collectors.

Table 8. LOS D Daily Maximum Capacities (Two Way Daily Trips)

Lanes	Arterial Roads (>1/2 mile Signal Spacing)	Arterial Roads (<1/2 mile signal spacing)	Collector Road (>1/2 mile Signal Spacing)	Collector Road (<1/2 mile signal spacing)
2	12,500	11,300	11,200	9,800
3	19,100	16,000	17,500	13,500
4	38,300	32,500	30,900	22,700
5	41,000	35,000	37,200	31,000
6	52,800	46,000	-	-
7	57,000	50,000	-	-

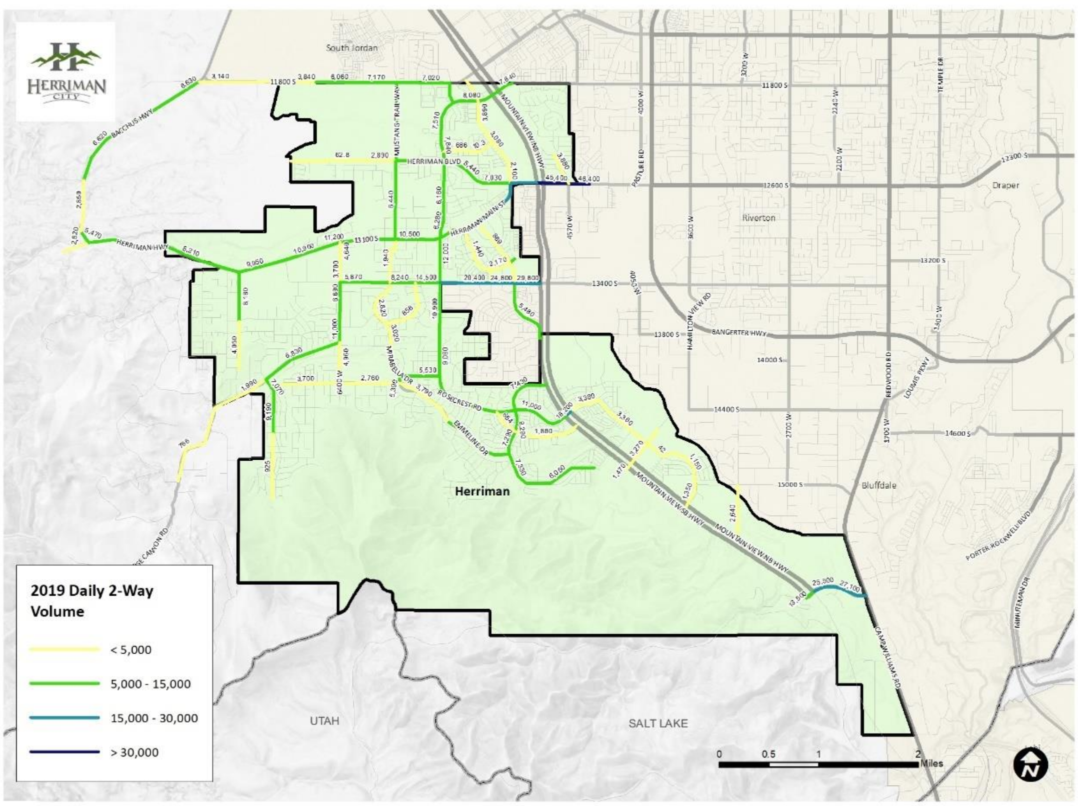


Figure 29: Existing (2019) Traffic Volumes (Two Way Daily Trips)

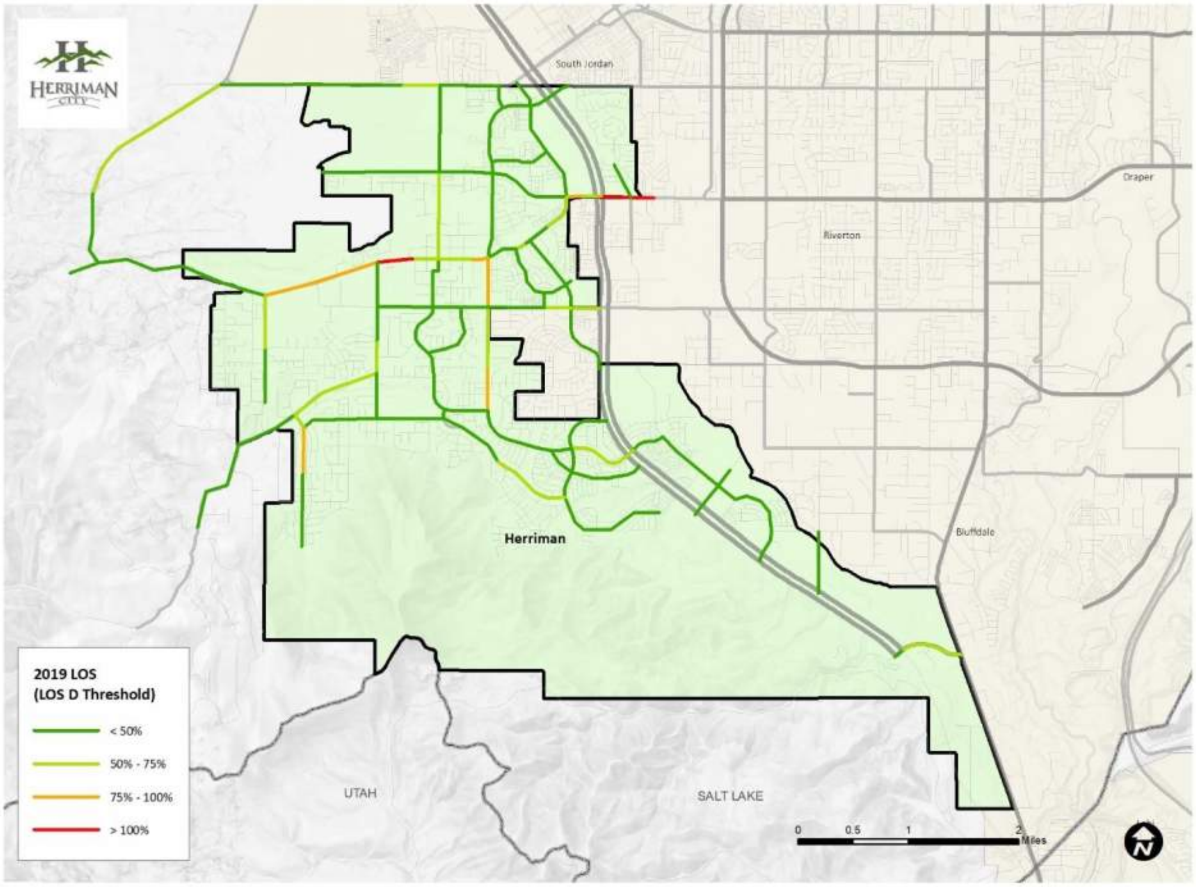


Figure 30: Existing (2019) Level of Service of Major Roads

For the level of service discussion regarding intersections, the Technical Memorandum in Appendix C.

3.2 TRAVEL DEMAND MODELING

Future traffic conditions were forecasted using the WFRC – Mountainland Association of Governments (MAG) regional travel demand computer model (version 8.3). The model base year was 2019 and future conditions were forecasted for 2030 and 2050. As part of the master planning process the base year and future year socioeconomic data for Herriman were updated as part of the model calibration process.

3.2.1 Base Year Model Calibration

The base WFRC-MAG model network was updated to reflect existing conditions more accurately. Changes included modifications to roadway functional type (FT), creating new roadway links, and updates to the underlying socioeconomic data. Additionally, a base year correction was developed from the difference between the 2019 modeled traffic and actual traffic counts provided by the City. This base year correction was then applied to the 2030 and 2050 modeled traffic to produce forecasts which account for any inherent tendencies of the model. Figure 31 shows a summary of the base year traffic count corrections.

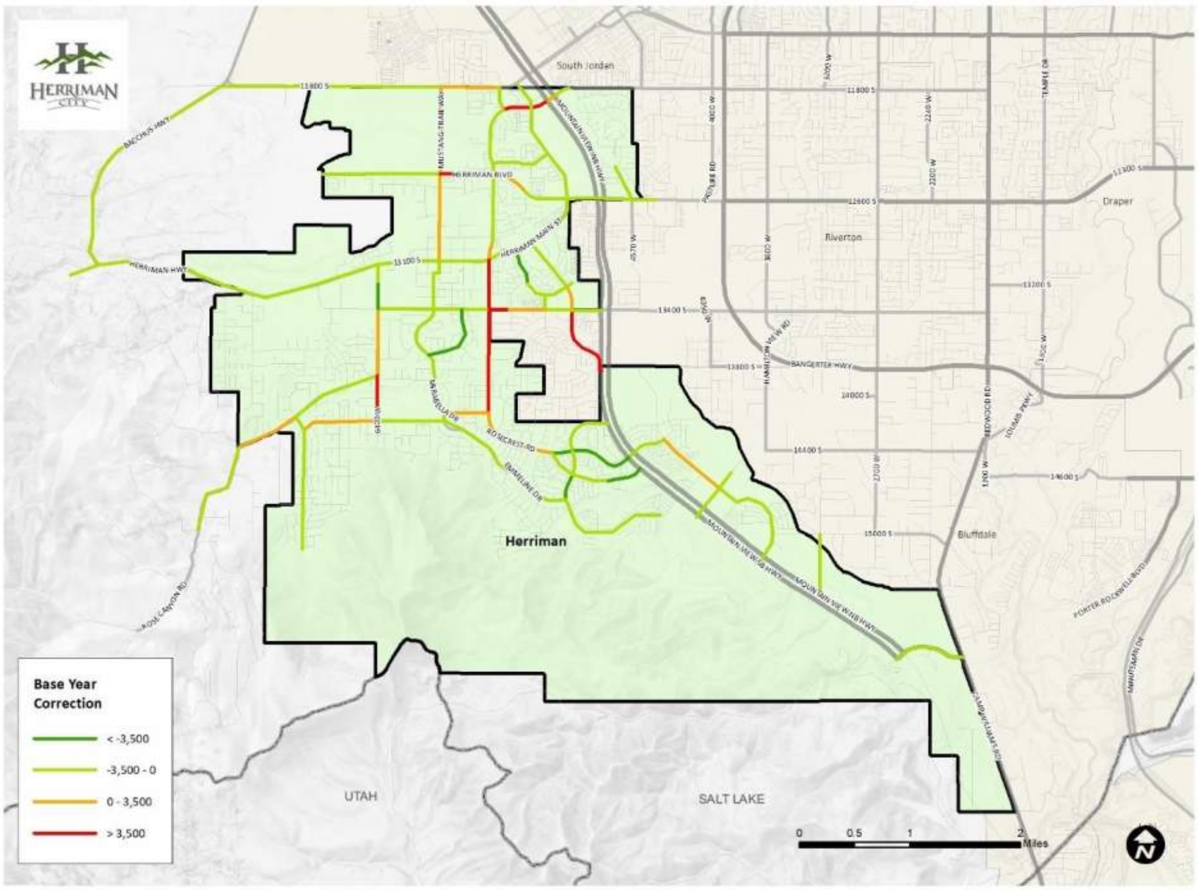


Figure 31: Base Year Traffic Count Correction Summary

3.2.2 Future Volumes

Once the base model was calibrated to reflect current conditions, future population, household and employment data along with future roadway networks were used to model projected future 2030 and 2050 travel volumes on a future Herriman network. Figure 32 depicts projected 2030 daily travel volumes and Figure 33 shows the projected 2030 LOS on the proposed future road network. Model results indicate that daily volumes within the City generally stay below 30,000, with the exception of 12300 South and Porter Rockwell Boulevard where daily volumes breach 50,000. Level of service in 2030 is projected to remain within the LOS D threshold in general, and is only exceeded in a few isolated cases, including 12300 South and Porter Rockwell Boulevard.

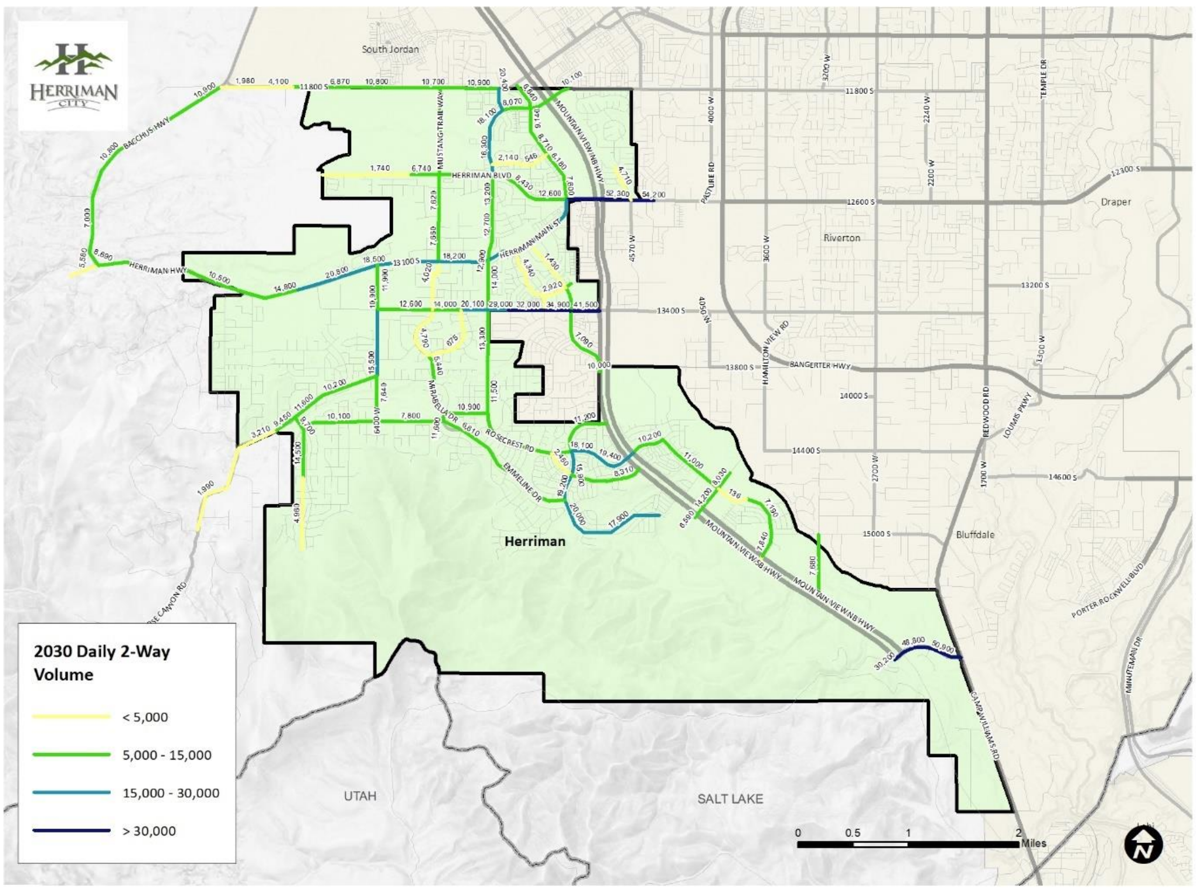


Figure 32: Projected 2030 Daily Travel Volumes

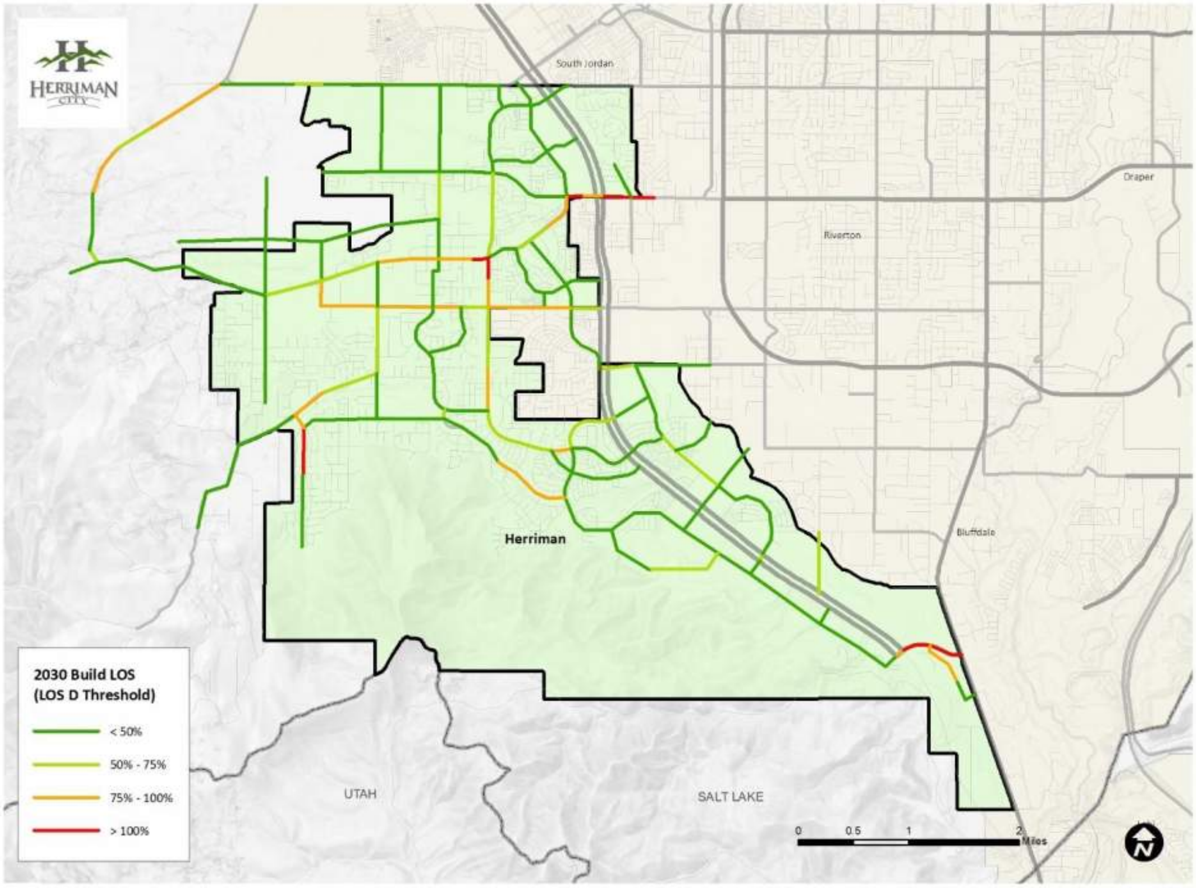


Figure 33: Projected 2030 Level of Service

Figure 34 depicts projected 2050 daily travel volumes and Figure 35 shows the projected 2050 LOS on the proposed future road network. Projected 2050 traffic volumes increase throughout the City, but as in 2030, most roads stay below 30,000 daily trips. Roads that exceed 30,000 daily trips now include 13400 South and Real Vista Drive. The2050 model results indicate that there are more instances of isolated overcapacity road segments, and the most problematic corridor is 13400 South.

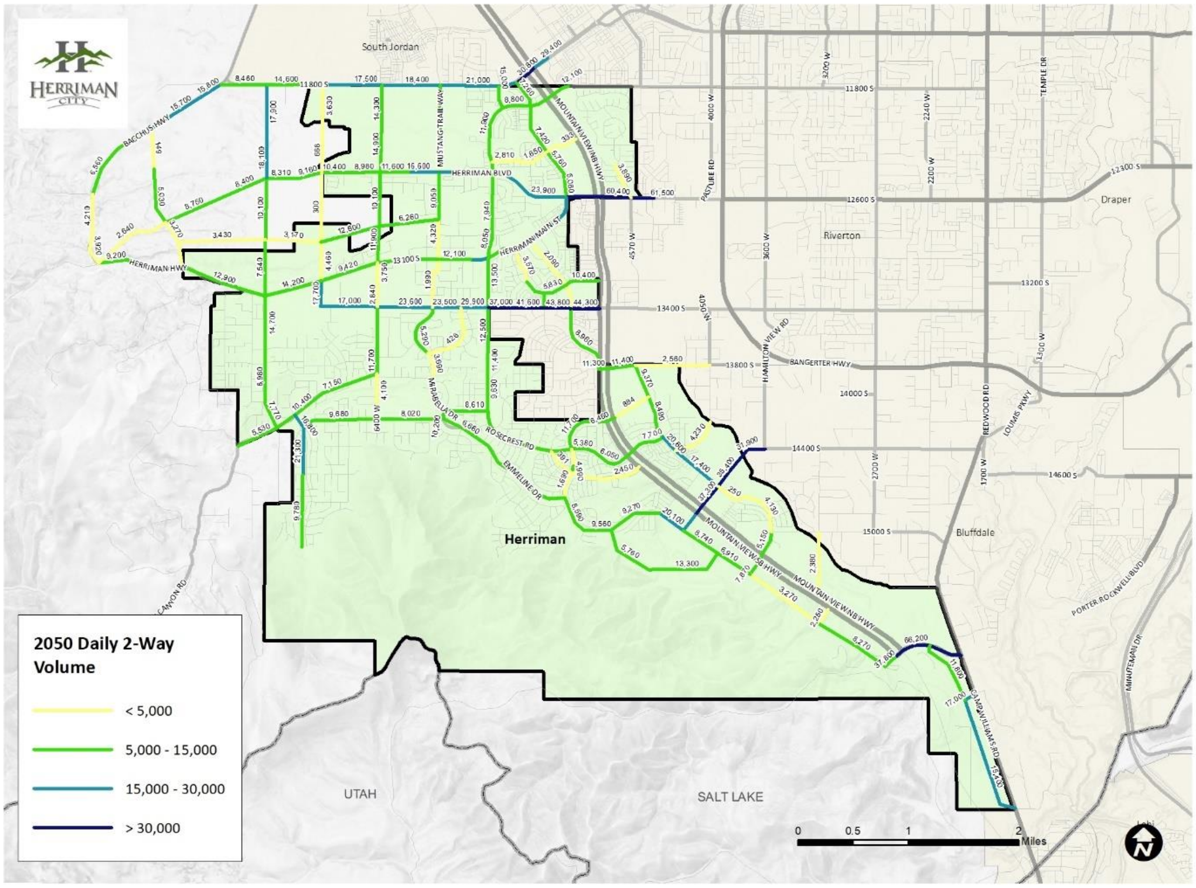


Figure 34: Projected 2050 Daily Travel Volumes

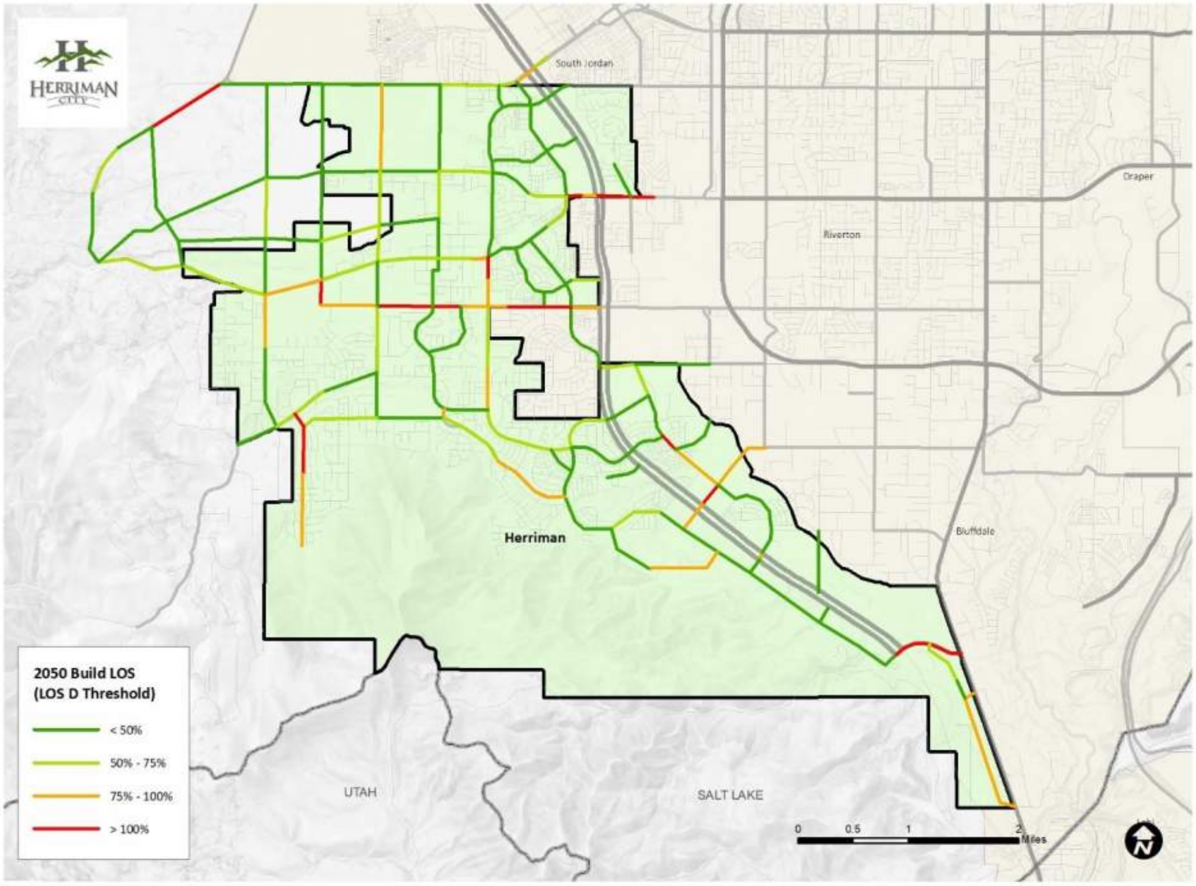


Figure 35: Projected 2050 Level of Service

4 PLAN RECOMMENDATIONS

Standard street layouts and locations are an important part of a city's Transportation Master Plan. Traffic controls, corner radii and access spacing are also defined.

4.1 Functional Classification

A functional classification of streets is used to group roadways into classes according to the volume of traffic they are intended to serve. The classes are based upon the degree of mobility (speed and trip length) and land access that they are designed to serve. Roadway functional classifications are generally comprised of a mix of arterials, collectors, and local streets. Arterials are designed to serve higher volumes of traffic at higher speeds, while collectors are designed to balance land access with traffic speeds and traffic capacity. Local streets are intended to provide low speed access to individual properties. Figure 36 summarizes the hierarchy of the functional classification of streets based upon mobility and access.

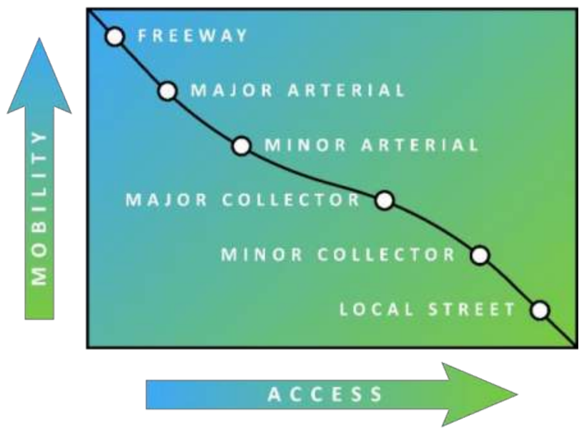


Figure 36: Mobility Vs Access

Table 9 provides general characteristics for the traffic operations of each functional classification. The definitions outlined include speed, average trip length, accident rate, and access control. Access control refers to the number of intersections, driveways, etc., interrupting the roadway.

Table 9. Street Functional Classification Summary

Street Functional Group	ROW Width (ft)	Speed (mph)	Average Trip Length (miles)	Expected Accident Rate (accidents per million vehicle miles)	Access Control
Arterial	>90	45+	3-15	3-5	Significant
Collector/Minor Collector	66 - 90	25-45	1-5	2-4	Moderate
Local and Minor Local	<66	<30	<0.5	Varies	None

4.1.1 Local and Minor Local Streets

Local streets are designed to provide access from residences to the roadway network. They serve many driveways and provide a collection point to collector or arterial roadways. Local streets should be designed to minimize speed and cut-through traffic while meeting the requirements of emergency vehicles. They are typically placed with driveways on both sides and have posted speed limits of 25 miles per hour. Generally, no striping is proposed on local streets. However, the City Engineer may recommend roadway striping as needed as a traffic calming measure. Parking may be restricted on local streets near intersections, in high density or commercial areas, where snow removal or storage issues arise, or at other locations deemed necessary by the City Engineer. Herriman plans to approve two construction standards for local and minor streets: one for a 53-foot right-of-way (ROW), shown in Figure 37; and one for a 60-foot ROW, shown in Figure 38. The 53-foot minor local cross section roads are best limited to single family residential access, whereas the wider 60-foot local cross section can accommodate higher density residential, neighborhood commercial, schools, churches and institutional land uses. Developers are responsible for the full cost of design and constructing local and minor local streets including the drainage facilities (storm drain pipes, inlets, manholes, etc.). For private roadways, emphasis needs to be placed on inclusion of sidewalks on both sides of the roadway and connectivity to the larger public sidewalk network. Requirements for private roadways should also include minimum lane widths to accommodate two-way traffic in a setting such as alleys for rear-loaded residential units.

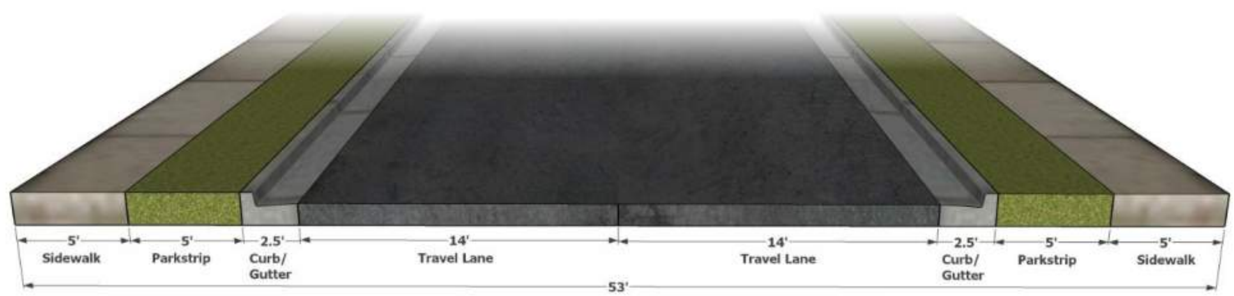


Figure 37: Minor Local Street Standard – 53 Foot ROW

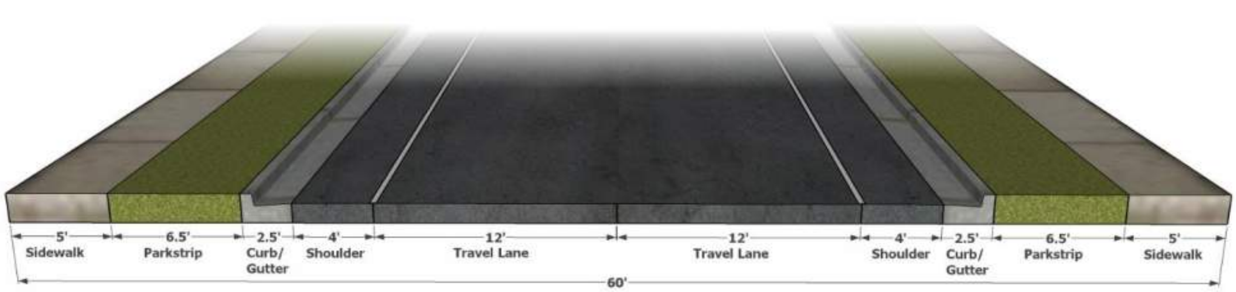


Figure 38: Local Street Standard – 60 Foot ROW

4.1.2 Minor Collector Streets

Minor collector streets within Herriman serve local trips and provide local access. Minor collectors have one through travel lane in each direction, a center turn lane, curb and gutter on both sides, sidewalk on both sides, and park strips on both sides within a 68-foot ROW. The center turn lane may be eliminated to allow for the addition of a bike lane in each direction. Additional details about roadway access spacing standards can be found in section 4.3.2 of this plan. The typical design cross section for a minor collector is shown in Figure 39.

In areas where a minor collector street is required, a developer will pay to design the new street and construct and install all of the improvements associated with the Local Street Standard with a 60-ft ROW, as shown in Figure 38. The City will generally be responsible for paying for the costs associated with constructing the additional (about 11 feet) of pavement between the lips of gutter to meet the minor collector street standard and the striping associated with the center turn lane.

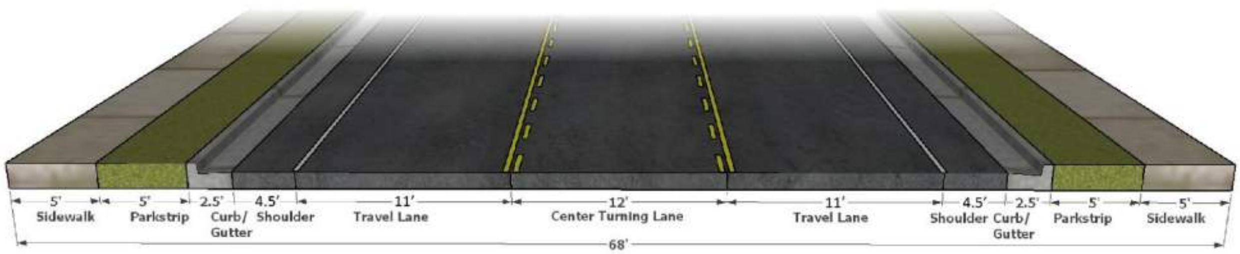


Figure 39: Minor Collector Streets Standard

4.1.3 Major Collector Streets

Major collector streets, like minor collectors, have one through travel lane in each direction and a center turn lane, as well as a wide shoulder on each side. The recommended collector cross section has 12-foot travel lanes in each direction, a 13-foot center turn lane, and 9-foot shoulders within an 80-foot ROW. The shoulders are intended to have bike lanes, but could be striped for parking if needed as shown in Figure 40. The 80-foot ROW is wide enough that if increased capacity is needed, two travel lanes in each direction could be accommodated with the elimination of the center turn lane and/or reduction of the lane and shoulder widths. At major intersections, the shoulder and travel lane can be modified to 10-foot lanes to accommodate right turn lanes, provided motorists are cautioned to share the road with bicyclists (when a bicycle lane is marked in the shoulder area). In areas where a major collector street is required, a developer will pay to design the new street and construct and install all of the improvements associated with the Local Street Standard with a 60-ft ROW, as shown in Figure 38. The City will be responsible for paying for the costs associated with constructing the pavement width in excess of 37 feet, any raised median, and additional striping associated with the center turn lane and a bike lane.

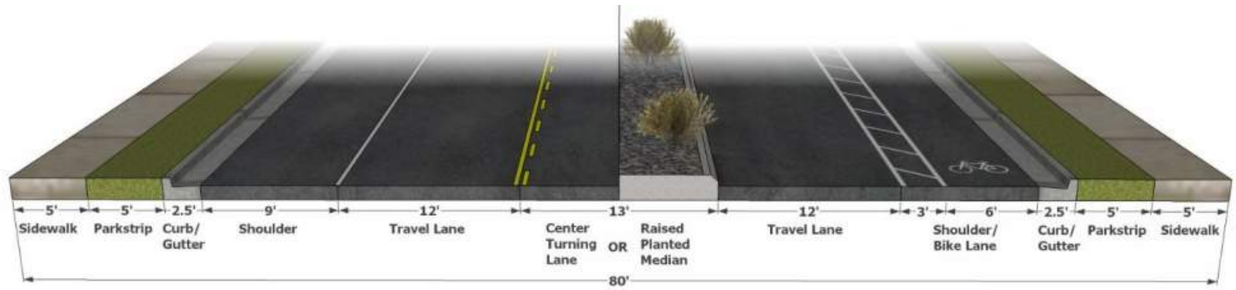


Figure 40: Major Collector Street Standard

4.1.4 Minor Arterial Streets

Minor arterial streets balance regional travel and local access. Minor arterials have two through travel lanes, a center turn lane, and wide shoulders within a 106-foot ROW. The shoulders are intended to have bike lanes but could be striped for parking is needed. The 106-foot ROW is wide enough that if increased capacity is needed, three travel lanes in each direction could be accommodated with the elimination of the center turn lane and/or a reduction of the lane and shoulder widths. Figure 41 shows the standard 106-foot arterial cross section.

When it comes to funding the construction of arterial streets, the City is responsible for the costs associated with designing and constructing the full street cross-section.

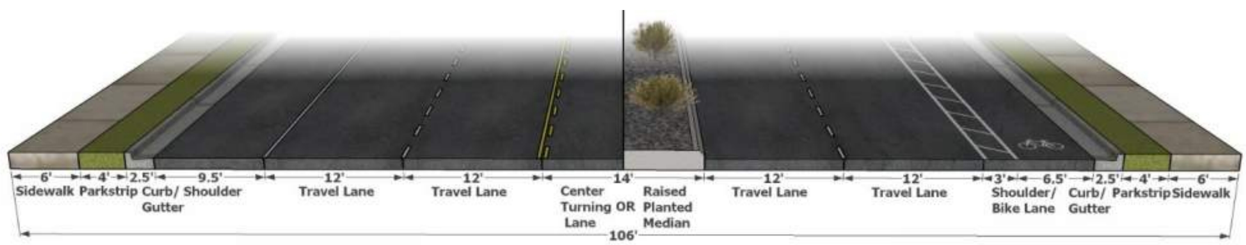


Figure 41: Minor Arterial Standard

4.1.5 Major Arterial

Similar to minor arterials, major arterial streets balance regional travel and local access. Arterials have two through travel lanes, a center turn lane, and wide shoulders within a 116-foot ROW. The shoulders are intended to have bike lanes but could be striped for parking if needed. The 116-foot ROW is wide enough that if increased capacity is needed, three travel lanes in each direction could be accommodated with the elimination of the center turn lane and/or a reduction of the lane and shoulder widths. The recommended typical design cross section of an arterial street with a 116-ft ROW is shown in Figure 42.

When it comes to funding arterial streets, the City is responsible for the costs associated with designing and constructing the full cross-section.

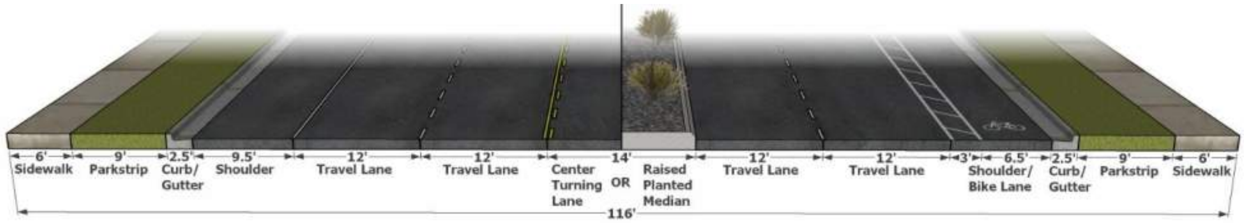


Figure 42: Major Arterial Street Standard

4.2 Proposed Future Network

The existing and recommended future network of arterial, collector, and minor collector streets is shown in Figure 43.

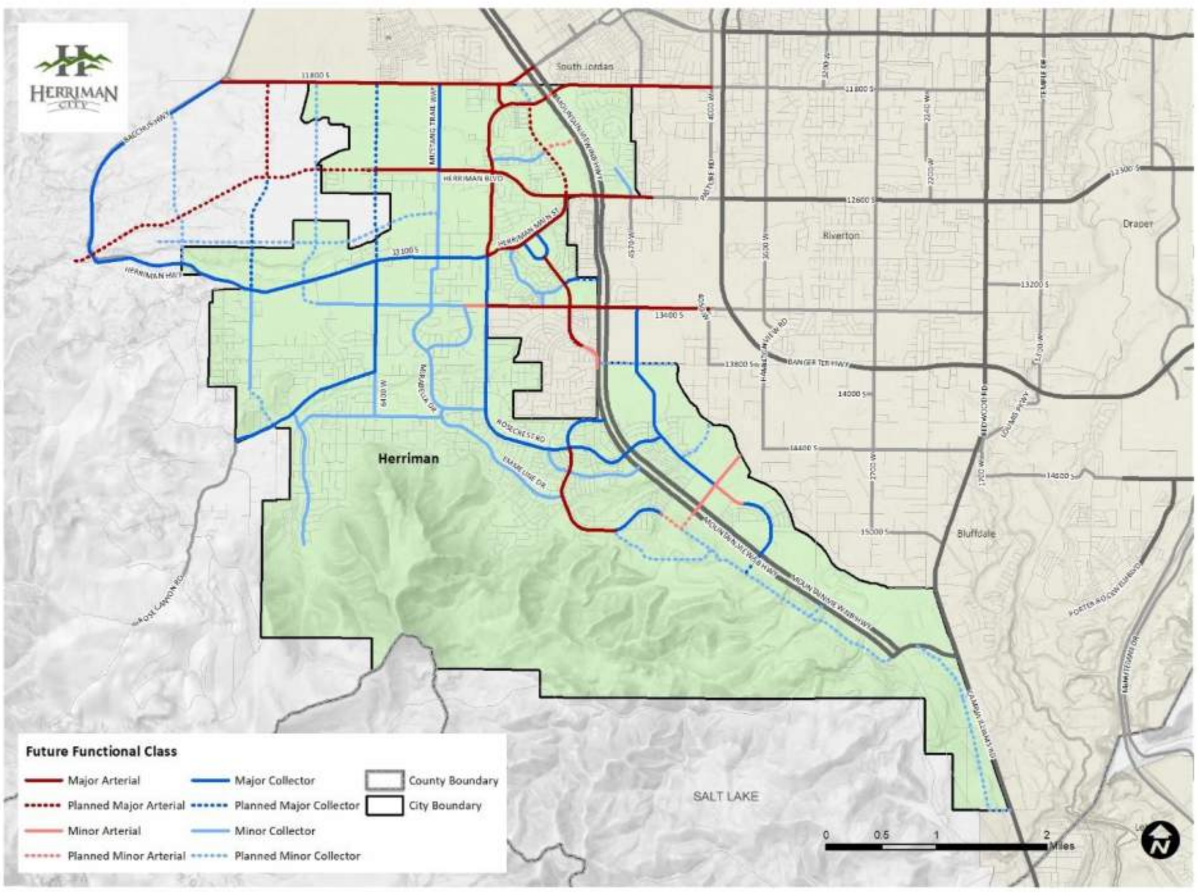


Figure 43: Existing and Recommended Major Street Network

4.3 Transportation Standards

4.3.1 Traffic Control

The need for traffic signals will increase as traffic volume and the road network throughout Herriman continues to grow. The Manual on Uniform Traffic Control Devices (MUTCD) states: “an engineering study of traffic conditions, pedestrian characteristics, and physical characteristics of the location shall be performed to determine whether installation of a traffic control signal is justified at a particular location.” There are eight different traffic signal warrants that the MUTCD indicates should be considered when investigating the need for a traffic control signal. These warrants look at vehicular volumes, pedestrian volumes, school crossings, signal coordination, vehicular crashes, and the adjacent road network.

The recommended improvements are separated into Phase 1 (0-10 years), Phase 2 (11-20 years), and Phase 3 (21-30 years). Anticipated signal needs by phase are shown in Figure 44.

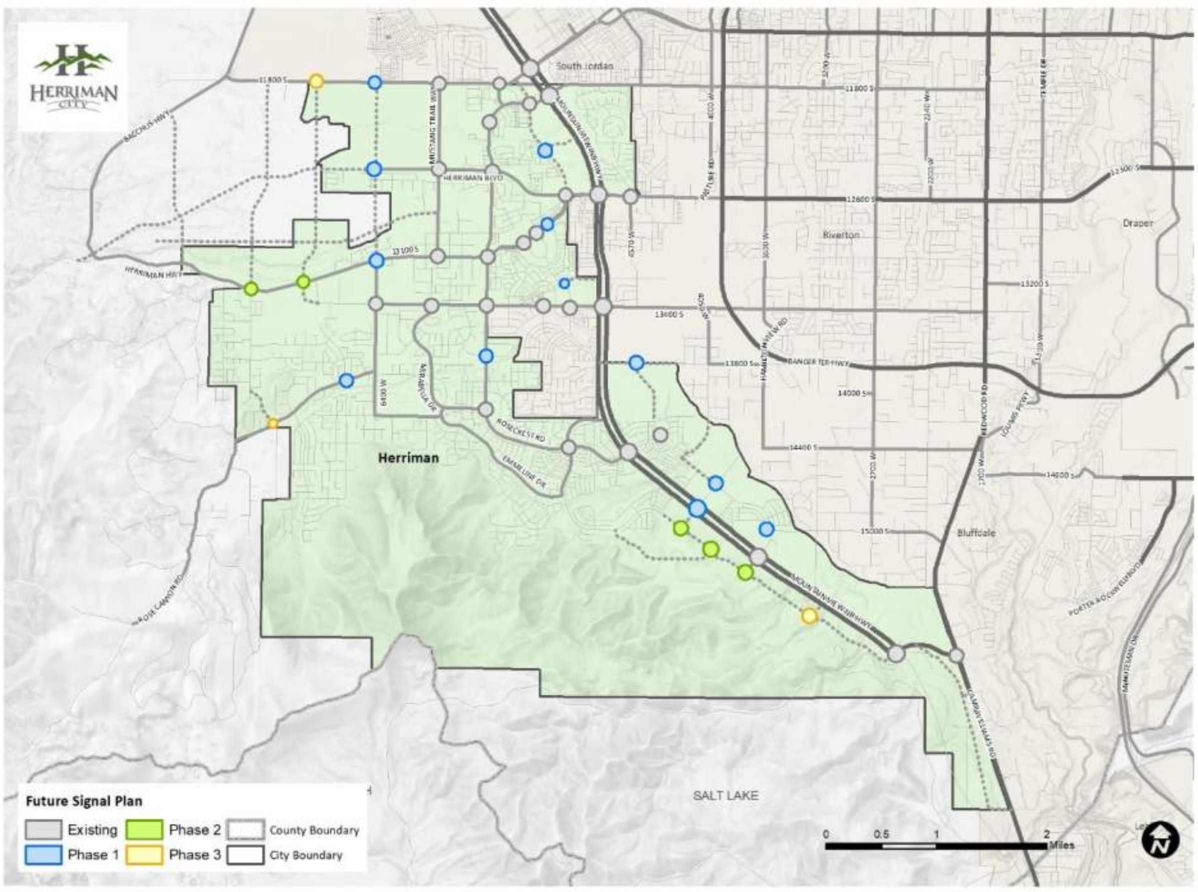


Figure 44: Locations of Existing and Recommended Future Traffic Signals

4.3.2 Access Spacing

In addition to incorporating the access spacing and related permit requirements on state highways based on UDOT Administrative Rule R930-6 by reference, this Transportation Master Plan has summarized the allowable access spacing for all City streets in Herriman. On non-state routes, access spacing may be adjusted by the City Engineer based on localized conditions. Requests to decrease access spacing standards may be granted by the City Engineer or City Council provided a traffic impact study is prepared by the developer documenting the preservation of safety, capacity, and speed with reduced access spacing. Table 10 lists the Herriman access spacing standards for signals, public streets, and private areas. Figure 45 illustrates spacing categories.

Table 10. Summary of Minimum Spacing Requirements

	Minimum Signal Spacing (feet)	Minimum Public Street Spacing (feet)	Minimum Private Access Spacing (feet)
Arterial Streets	2,640	660	250
Collector Streets	1,320	300	150
Local Streets	N.A.	150	No Minimum

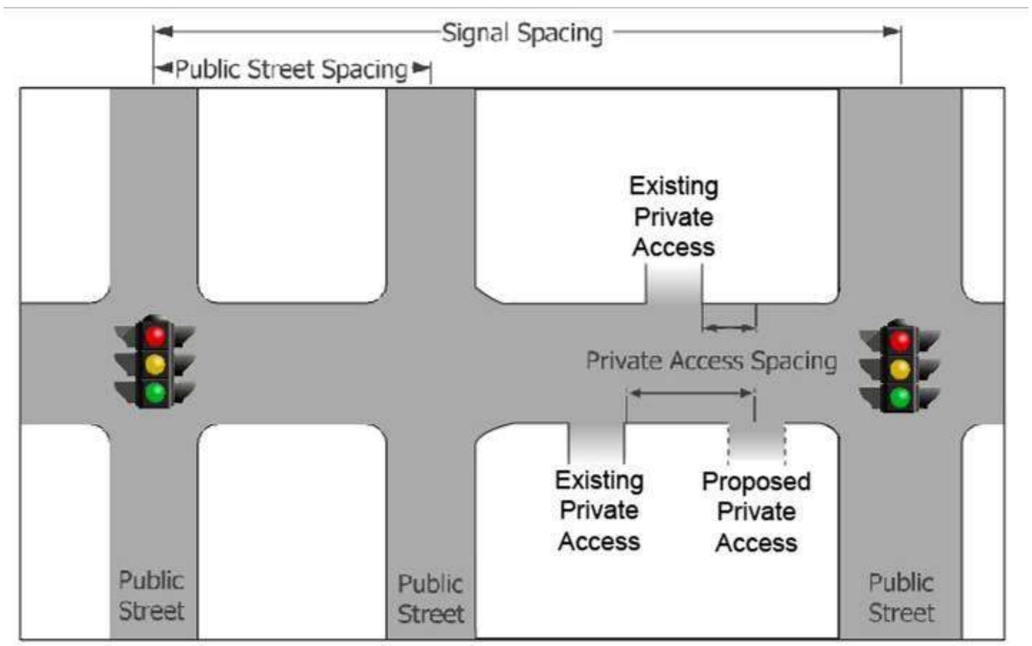


Figure 45: Spacing Illustration

Access spacing, also referred to as driveway spacing, is measured from the closest edge (perpendicular tangent section) of the nearest driveway to the center of the proposed driveway. Access spacing standards allow drivers to process one decision at a time. Through proper spacing, drivers may monitor upcoming points of conflict with other vehicles and react accordingly to each conflict.

4.3.3 Corner Radii

The dimensions of curb radii directly affect the speed of turning motor vehicles. Large radii are needed to accommodate large trucks and busses, but also allow cars to make high-speed turns and create increased crossing distances for pedestrians. A network of intersections with short curb radii would create the most welcoming pedestrian environment, but would hinder the movement of fire trucks; thus creating a hazardous situation. Therefore, curb radii standards are needed in order to accommodate all user types. Recommended back of curb corner radii for each street classification are presented in Table 11.

Table 11. Recommended Back of Curb Radii for Street Intersections

Type of Intersection Street	Type of Through Street				
		Local	Minor Collector	Major Collector	Arterial
	Local	25 ft	25 ft	30 ft	30 ft
	Minor Collector	25 ft	30 ft	30 ft	30 ft
	Major Collector	30 ft	30 ft	40 ft	40 ft
	Arterial	30 ft	30 ft	40 ft	40 ft

The recommended radii listed in Table 11 may be adjusted based on traffic volumes, scale of large vehicle uses, and the needs of specific lane uses/truck routing. Changes to curb radii are subject to the approvals from the City Engineer and Fire Marshal.

4.4 Future Bicycle Infrastructure

Herriman recognizes the need for an extensive and cohesive bicycle path network in order to accommodate all modes of travel its residents utilize. With this in mind, the transportation standards for collector and arterial streets were developed to incorporate wide shoulders to allow for striping of bicycle lanes. Figure 46 shows the existing bicycle path network as well as future multi-use pathways, trails, and bicycle lanes. This map also accounts for bicycle facilities on new collector and arterial streets. This network is comprehensive and it would allow for greater bicycle access throughout the City for commuter and recreational cyclists.

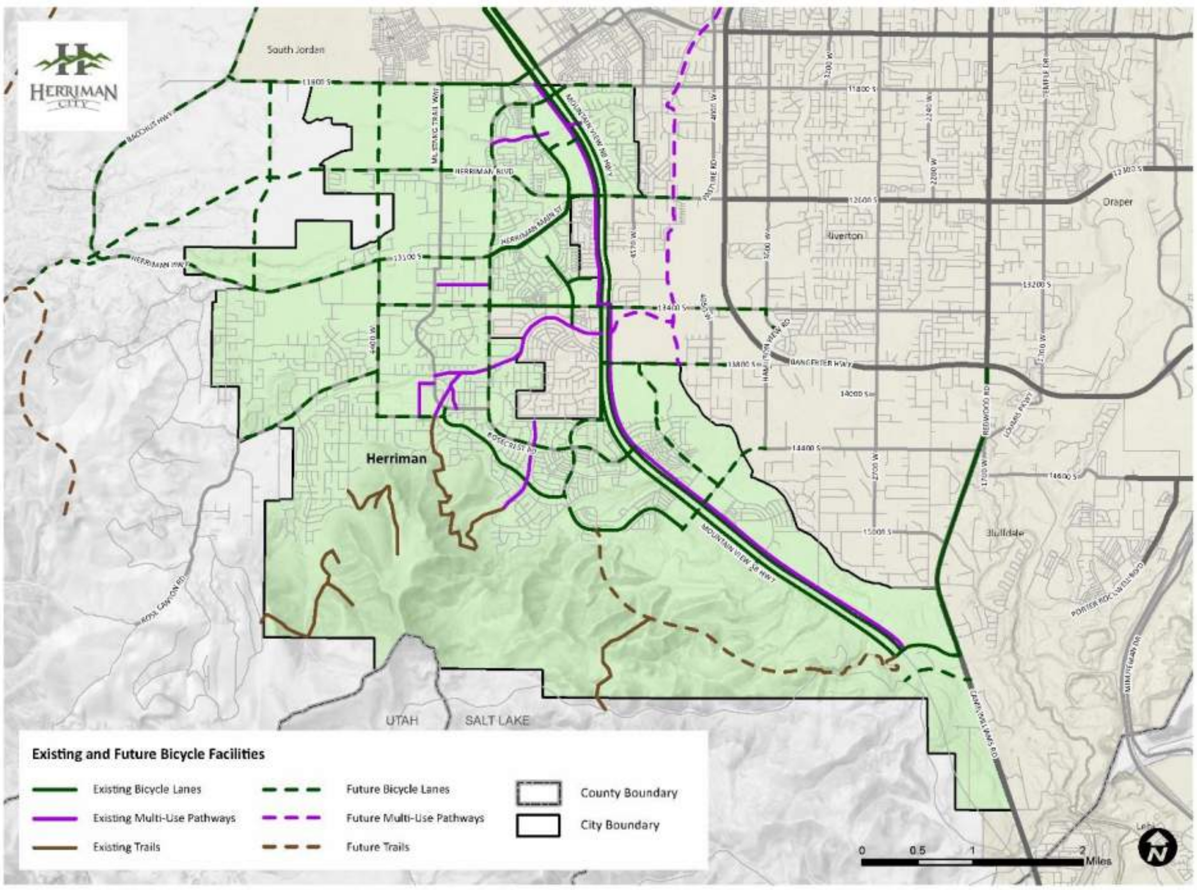


Figure 46: Future Bicycle Network

4.5 FUTURE TRANSIT

As population densities increase and Herriman grows as a city, and as more business and job opportunities are created, the transit system will need to be upgraded to meet the City's needs. Currently, the two existing bus routes in Herriman are infrequent and have limited operating hours. Expanding schedules to the weekends and extended operating hours, as well as increasing to 30- or 15-minute service should be considered as demand dictates. Beyond this, new routes should be explored. Figure 47 shows the WFRC's existing and planned RTP transit projects. There are two future projects that will impact Herriman. The first is a Phase 3 (2041-2050) project for a new route extending south from the Daybreak TRAX Station through northern Herriman, then west through Riverton, and into Draper. The second is corridor preservation for future transit. The corridor follows the same route as the new bus line, but also has an alternative which runs further south to Real Vista Drive. Presumably this corridor preservation is intended for the eventual extension of the TRAX Red Line, however there are no light rail projects included in the WFRC RTP in this area.

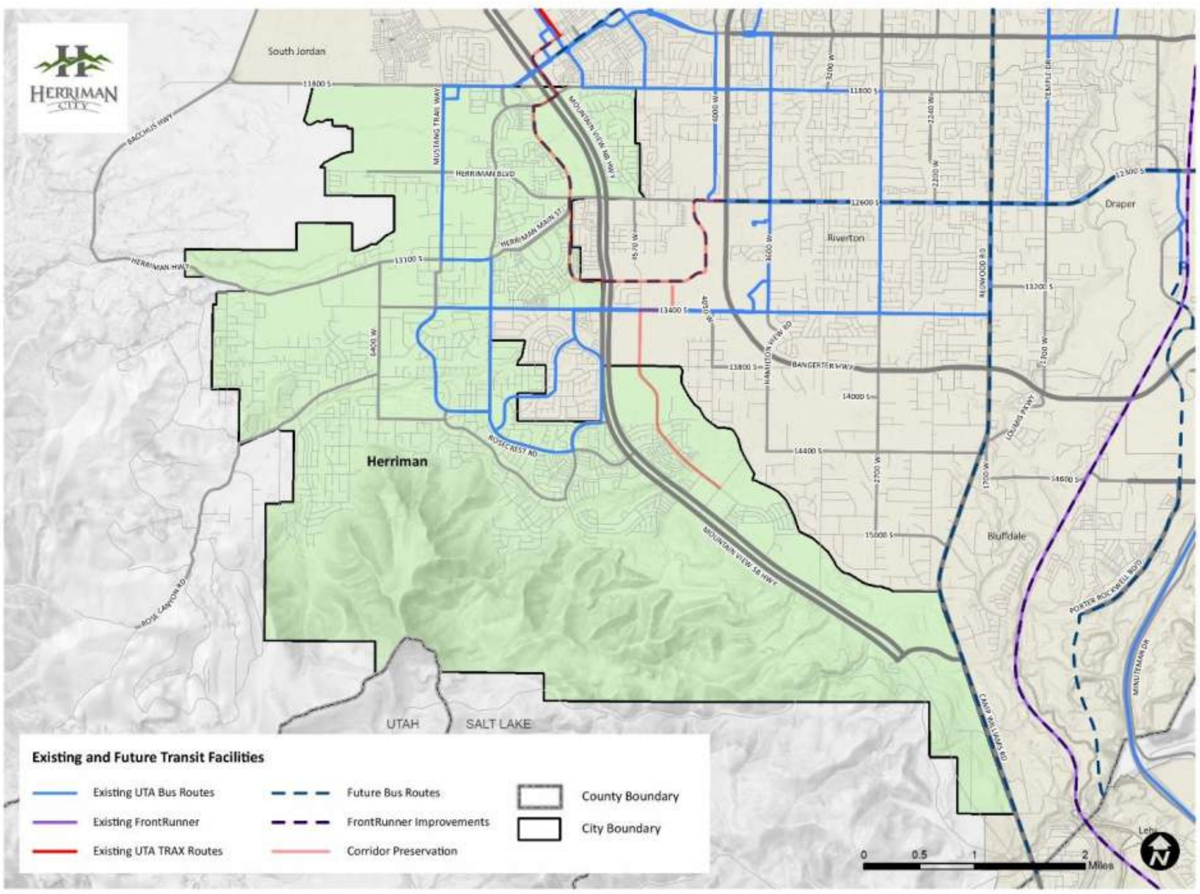


Figure 47: Existing and Planned Transit Projects

The anticipated expansion of the UTA TRAX Red line into Herriman will likely be the biggest change to the existing transit service. Extending from its existing terminus in the Daybreak development, a potential future line would continue on Daybreak Parkway and turn south on the future extension of Main Street.

A future TRAX station within central Herriman would provide excellent transit service to residents and excellent connections to destinations across the valley.

Figure 47-Figure 50 illustrate example road design cross sections for a future Main Street that includes TRAX light rail.

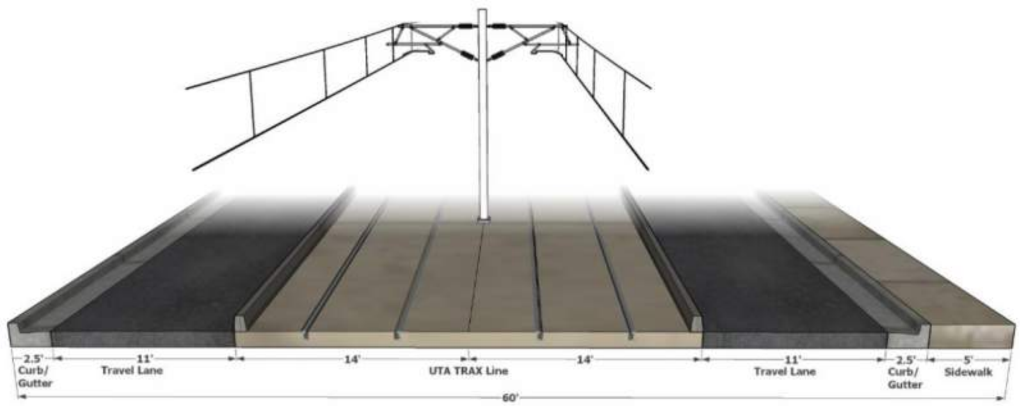


Figure 48: Main Street with TRAX – 60-foot ROW

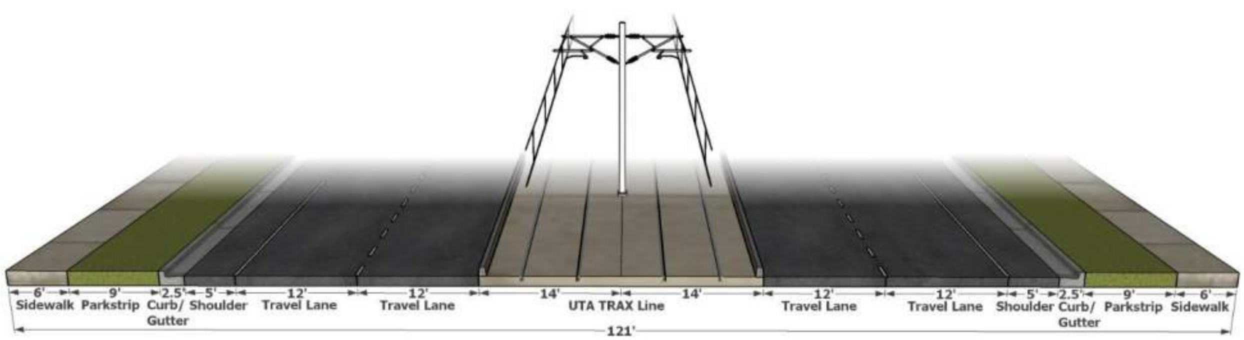


Figure 49: Main Street with TRAX – 121-foot ROW

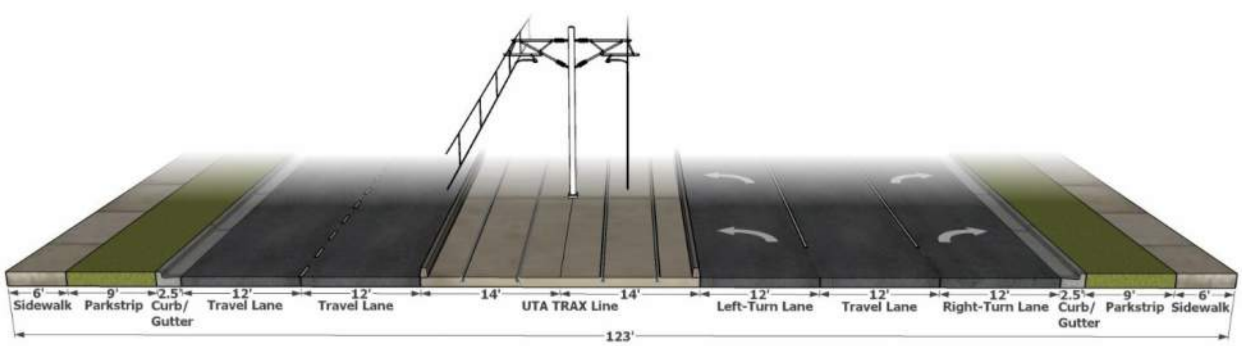


Figure 50: Main Street with TRAX Intersection – 123-foot ROW

5 STREET FACILITIES PLAN

The Street Facilities Plan presents the projected phasing and estimated construction costs of the recommended major street improvement projects.

5.1 STREET FACILITIES PLAN

The street facilities plan (SFP) identifies recommended transportation project needs by priority and includes a conceptual planning level cost estimate (2019 dollars) for each improvement. The recommended improvements are separated into Phase 1 (0-10 years), Phase 2 (11-20 years), and Phase 3 (21-30 years). The recommended projects only include collector and arterial streets and projects that increase the capacity of the road network.

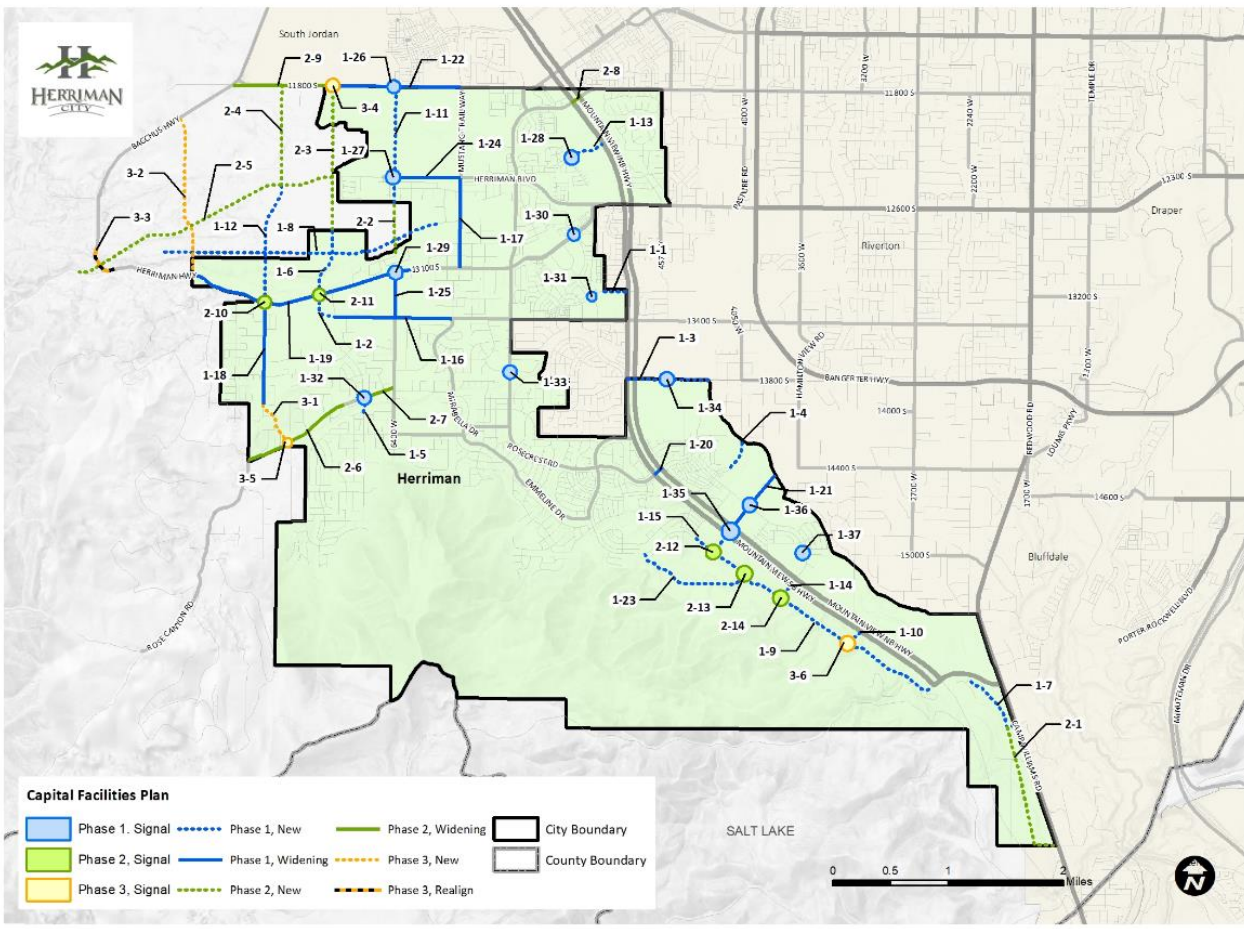


Figure 51: Recommended Street Improvement By Phase

Figure 51 shows the locations of recommended street improvements by phase. It is important to note that some of the Phase 2 and Phase 3 projects are outside the current city corporate limit. Those projects will only be needed if the City annexes, and expands its municipal boundary.

Table 12 lists the recommended SFP projects by phase. The SFP project costs include street improvements from back-of-curb to back-of-curb, sidewalks, park strips, and drainage. Cross-section cost details can be found in Appendix B.

Table 12. Recommended Phased Facilities Plan

2020 SFP Project List						
Phase 1 (2020-2030)						
#	Name	From	To	Type	Functional Class	Cost
1-1	Herriman Rose Boulevard	Herriman Rose Dead End	MVC Frontage Road	New	Major Collector	$700,000
1-2	13400 South	Herriman Highway	13400 South Existing	New	Minor Collector	$1,500,000
1-3	13800 South	Mountain View Corridor	13800 South Bluffdale	New	Minor Collector	$2,300,000
1-4	4000 West	4000 West Dead End	4000 West Bluffdale	New	Minor Collector	$900,000
1-5	6600 West	Desert Lily Circle	Desert Wash Way	New	Minor Collector	$800,000
1-6	6900 West	City Boundary	Herriman Highway	New	Minor Collector	$3,800,000
1-7	Mcdougall Road	Porter Rockwell Blvd	Redwood Road	New	Minor Collector	$3,300,000
1-8	Silver Sky Drive	7900 West	Silver Sky Existing/6000 West	New	Minor Collector	$9,500,000
1-9	South Hills Boulevard	Juniper Crest Road	Mountain View Corridor	New	Minor Collector	$8,800,000
1-10	South Hills Connection	Juniper Crest Road	Mountain View Corridor	New	Minor Collector	$5,500,000
1-11	6400 West	11800 South	City Boundary	New	Major Collector	$6,900,000
1-12	7300 West	Herriman Parkway	Herriman Highway	New	Major Collector	$7,500,000
1-13	Miller Crossing Drive	Herriman Main Street	MVC Frontage Road	New	Minor Arterial	$1,100,000
1-14	Academy Parkway	Juniper Crest Road	Mountain View Corridor	New	Major Collector	$600,000
1-15	Juniper Crest Road	Juniper Crest Road Dead End	Mountain View Corridor	New	Minor Arterial	$5,000,000
1-16	13400 South	6800 West	6000 West	Widening	Minor Collector	$1,500,000
1-17	6000 West	Herriman Parkway	Herriman Main Street	Widening	Minor Collector	$1,500,000
1-18	7300 West	Herriman Highway	Hawthorn Leaf Drive	Widening	Minor Collector	$1,900,000
1-19	Herriman Main St	7900 West	6225 West	Widening	Major Collector	$7,700,000
1-20	Rosecrest Road	MVC South	MVC North	Widening	Major Collector	$200,000

2020 SFP Project List						
Phase 1 (2020-2030)						
#	Name	From	To	Type	Functional Class	Cost
1-21	Real Vista Drive	Mountain View Corridor	City Boundary	Widening	Minor Arterial	$2,500,000
1-22	11800 South	6900 West	6000 West	Widening	Major Arterial	$5,000,000
1-23	South Hills Loop	Juniper Crest Road	South Hills Boulevard	New	Minor Collector	$3,300,000
1-24	Herriman Parkway	6400 West	6000 West	Widening	Major Arterial	$2,100,000
1-25	6400 West	Herriman Main Street	13400 South	Widening	Minor Collector	$900,000
1-26	11800 S & 6400 W			Signal (Shared)		$125,000
1-27	Herriman Blvd & 6400 W			Signal		$250,000
1-28	Miller Crossing Dr & Herriman Main St			Signal		$250,000
1-29	Herriman Main St & 6400 W			Signal		$250,000
1-30	Herriman Main St & Brundisi Way			Signal		$250,000
1-31	Herriman Rose Blvd & Fort Herriman Pkwy			Signal		$250,000
1-32	Rose Canyon Rd & 6600 W			Signal		$250,000
1-33	Rosecrest Rd & Rocky Point Dr			Signal		$250,000
1-34	13800 S & Autumn Crest Blvd			Signal (Shared)		$125,000
1-35	Real Vista Dr & MVC			Signal (UDOT)		$125,000
1-36	Real Vista Dr & Autumn Crest Blvd			Signal		$250,000
1-37	15000 S & Academy Pkwy			Signal		$250,000
Total Cost						$87,425,000

Phase 2 (2031-2040)						
#	Name	From	To	Type	Functional Class	Cost
2-1	Mcdougall Road	McDougall Road Existing	Dead End	New	Minor Collector	$4,100,000
2-2	6400 West	City Boundary	City Boundary	New	Major Collector	$1,700,000
2-3	6900 West	11800 South	City Boundary	New	Minor Collector	$4,800,000
2-4	7300 West	11800 South	Herriman Parkway	New	Major Arterial	$4,600,000
2-5	Herriman Parkway	Butterfield Canyon Road	Herriman Boulevard Existing	New	Major Arterial	$12,600,000
2-6	Rose Canyon Road	Rose Canyon Road SB	Smoky Oaks Lane	Widening	Major Collector	$2,800,000
2-7	Rose Canyon Road	Blayde Drive	6400 West	Widening	Major Collector	$800,000

2-8	11800 South	MVC Southbound	MVC Northbound	Widening	Minor Arterial	$300,000
2-9	11800 South	Bacchus Highway	6900 West	Widening	Major Arterial	$3,800,000
2-10	Herriman Hwy & 7300 W			Signal		$250,000
2-11	Herriman Main St & 6900 W			Signal		$250,000
2-12	South Hills Blvd & Juniper Crest Rd			Signal		$250,000
2-13	South Hills Blvd & Juniper South Hills Loop			Signal		$250,000
2-14	South Hills Blvd & Academy Pkwy			Signal		$250,000
Total Cost						$36,750,000

Phase 3 (2041-2050)						
#	Name	From	To	Type	Functional Class	Cost
3-1	7300 West	7300 West	Rose Canyon Road	New	Minor Collector	$1,300,000
3-2	7900 West	Bacchus Highway	Herriman Highway	New	Minor Collector	$4,600,000
3-3	Herriman Main St			Realign	Realign	$1,100,000
3-4	11800 S & 6900 W			Signal		$250,000
3-5	Rose Canyon Rd & 7300 West			Signal		$250,000
3-6	South Hills Blvd & South Hills Connection			Signal		$250,000
Total Cost						$7,750,000

Appendix A – Growth Projections for Herriman City Technical Memorandum

TECHNICAL MEMORANDUM DRAFT

TO:	Blake Thomas, P.E. Herriman City Engineer 5355 W Herriman Main St Herriman, UT 84096
COPIES:	Brynn MacDonald, Justun Edwards, Gordon Haight
FROM:	Andrew McKinnon, Keith Larson Bowen Collins & Associates
DATE:	August 12, 2019
SUBJECT:	Growth Projections for Herriman City Planning Documents
JOB NO.:	483-18-01

INTRODUCTION

Herriman City is one of the fastest growing communities in the State of Utah. As a result, City planning documents need regular updates to keep up with changes to planning conditions within the City. The fast pace of growth needs to be supported by improvements in the City's infrastructure or utility systems (roads, pipelines, parks, etc.) The purpose of this document is to summarize existing population estimates within the City and to document projections of growth that will be used for The City's next round of future planning documents.

EXISTING RESIDENTIAL POPULATION

The U.S. Census Bureau publishes estimates of City population. Table 1 lists the current U.S. Census Bureau's estimates. The City's planning department also prepares its own population estimates. The City estimate of population within the City is based on the number of housing unit permits issued by July 1st of each year and the American Community Survey of household size for Herriman City (3.91 persons/household for 2013-2017). These estimates are also shown in Table 1.

Table 1
Historical and Existing Population Estimates

Date	US Census Estimate	Herriman City Planning Department Estimate	Percent Difference
April 1, 2010	21,785	21,785	0%
July 1, 2017	39,224	44,465	13%
July 1, 2018	44,877	51,681	15%
July 1, 2019		58,287	

City personnel are more confident in their internal population estimates than in the estimates prepared by the U.S. Census Bureau. It appears that the Census Bureau may be underestimating the rapid growth that has been occurring within Herriman City based on building permits. The more rapid growth estimated by the City planning department appears to be supported by historic growth numbers. The average annual growth rate of the City from 2000 to 2010 (based on census data) was approximately 30.5 percent.

LANDUSE AND BUILDOUT POPULATION

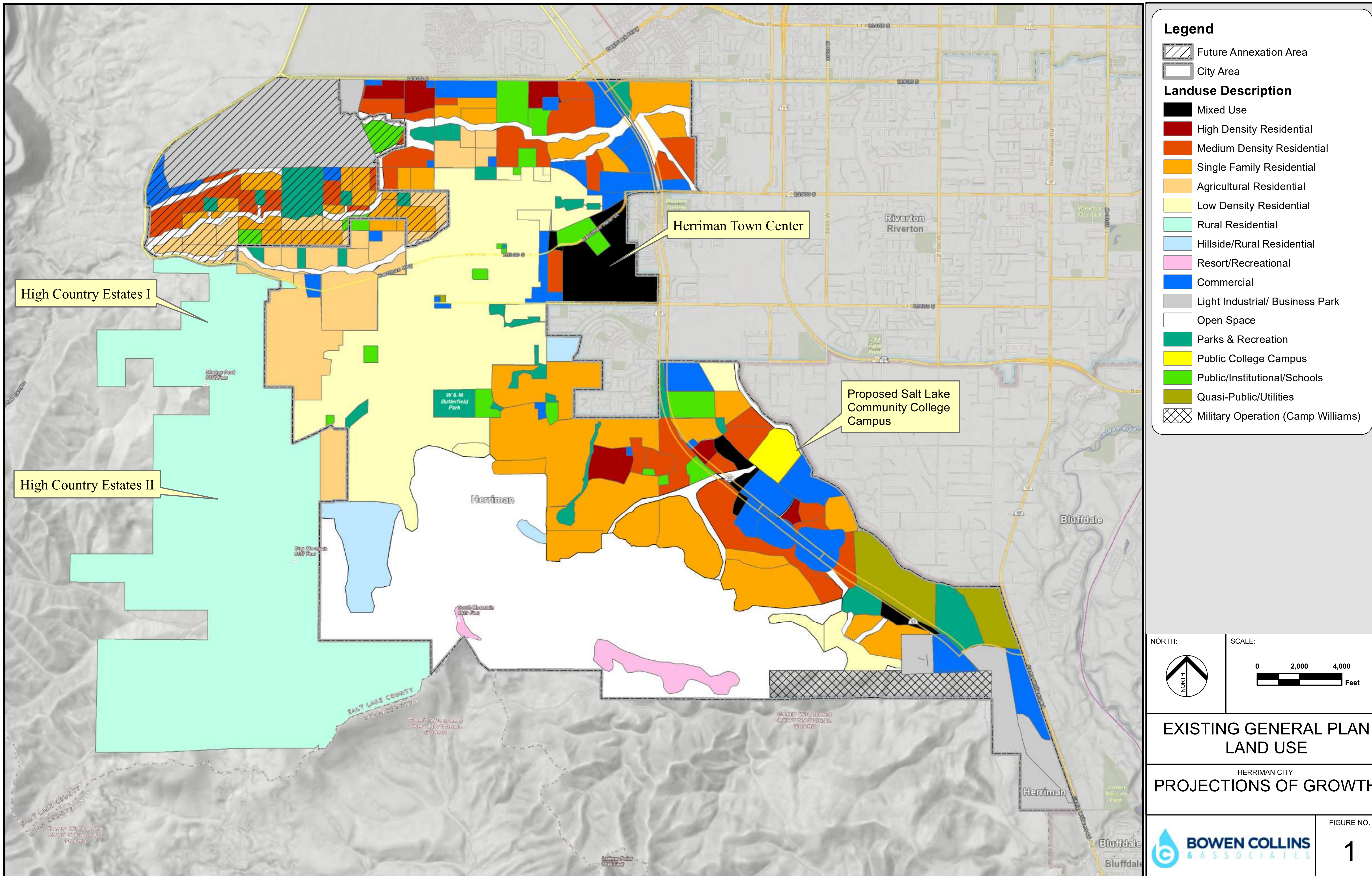
The City's most recently adopted general plan includes the land uses shown in Figure 1. Included in Figure 1 is the City's planned annexation area boundary. Total acreage associated with each land use type and the corresponding population of each land use type at buildout is summarized in Table 2. The total projected buildout population for the City (including areas projected to be annexed) is 116,000.

Table 2
Herriman City Land Use and Buildout Residential Population Estimate

Herriman City and Annexation Area	Acres	Average Density of Residential Units	Number of Residential units	Buildout Residential population
Agricultural Residential (1.8 - 3.0 du/acre)	1,124	2.40	2,697	10,545
High Density Residential (8 to 20 du/acre)	221	14.00	3,087	12,071
Hillside/Rural Residential (0.5 to 1.7 du/acre)	325	1.10	357	1,396
Low Density Residential (1.8 to 2.5 du/acre)	2,513	2.15	5,403	21,126
Medium Density Residential (4.6 to 8 du/acre)	1,095	6.30	6,901	26,984
Mixed Use (maximum 15 du/acre)	86	7.50	643	2,513
Mixed Use (Towne Center)	317	5.50	1,741	6,808
Resort/Recreational (maximum 0.4 du/acre)	154	0.20	31	121
Rural Residential (1 unit per 5 acres)	4,469	0.20	894	3,495
Single Family Residential (2.6 to 4.5 du/acre)	2,218	3.55	7,874	30,786
Non-residential Land Uses	7,697	0	0	0
Total:	**20,218**		**29,628**	**115,844**

RESIDENTIAL GROWTH PROJECTIONS

In 2002, the Wasatch Front Regional Council (WFRC) predicted the Herriman City population in 2010 would be 8,600. When compared to actual census data of 21,785, this represents an under prediction of more than 60 percent. In 2012, the State of Utah Governor's Office of Management and Budget projected that the Herriman City 2017 population would be 32,800 people. The US Census projection for the population in 2017 was 39,224. When compared to Herriman City's estimate of 44,465 people that actual lived in the City in 2017, this represents an under prediction of between 17 percent and 27 percent. While these two planning groups are regularly used for predicting residential population



EXISTING GENERAL PLAN LAND USE

HERRIMAN CITY
PROJECTIONS OF GROWTH

BOWEN COLLINS & ASSOCIATES

FIGURE NO.
1

P:\Herriman\2019 Water Master Plan Update\4.0 GIS\4.1 Projects\TM1-Fig1-LandUse.mxd AMcKinnon 7/10/2019 across the Wasatch Front, Herriman City is reluctant to rely exclusively on State of Utah or WFRC projections of growth for its internal planning requirements.

The City's preferred approach for predicting population growth is based on the following observations:

- **2018 Population** –The City's 2018 population estimate (based on building permits and the American Community Survey of household size) is believed to be more accurate than recent U.S. Census estimates. Correspondingly, the City's own 2018 estimate will be used as the basis for projections moving forward.
- **2019 Population** – The average growth rate of the residential population from 2015 to 2018 within the City was 12.8 percent per year. The City's 2019 population was correspondingly estimated by applying the recent 4-year average growth rate to the 2018 population estimate.
- **Expected Future Slowing of Growth –** If growth continued within Herriman City at 12.8 percent per year, the City would reach its buildout population estimate by the year 2035. However, the City does not expect future growth rates within the City to continue at the same aggressive rates observed in recent years. Private property availability and other logistical issues (such as construction of roads, utilities) will prevent such rapid growth continuing indefinitely. As a result, the City anticipates that growth rates will gradually decline as the readily developable areas of the City are reduced.
- **Logistic Growth Model –** Because of slowing growth as discussed above, the City expects that future growth within Herriman will follow a logistic growth curve[1].

Using the logistic growth equation with an initial growth rate of 12.8 percent and a buildout population of 116,000, projected population growth in the City is summarized in Table 3 and shown in Figure 2. Based on these projections, the City is expected to reach 99.5 percent of its buildout population by the year 2060.

Table 3
Herriman City Residential Population Projection

Year	Residential Population Projection
2010	21,785
2018	51,681
2019	58,287
2020	62,010
2025	79,568
2029	91,047
2030	93,465
2035	102,904
2040	108,668
2045	111,961
2050	113,772
2055	114,746
2060	115,265
2065	115,539

[1] When land and resources are limited, population projections will a logistic growth curve. In logistic growth, population expansion decreases as resources become scarce, leveling off when the carrying capacity of the area is reached, resulting in an S-shaped curve.

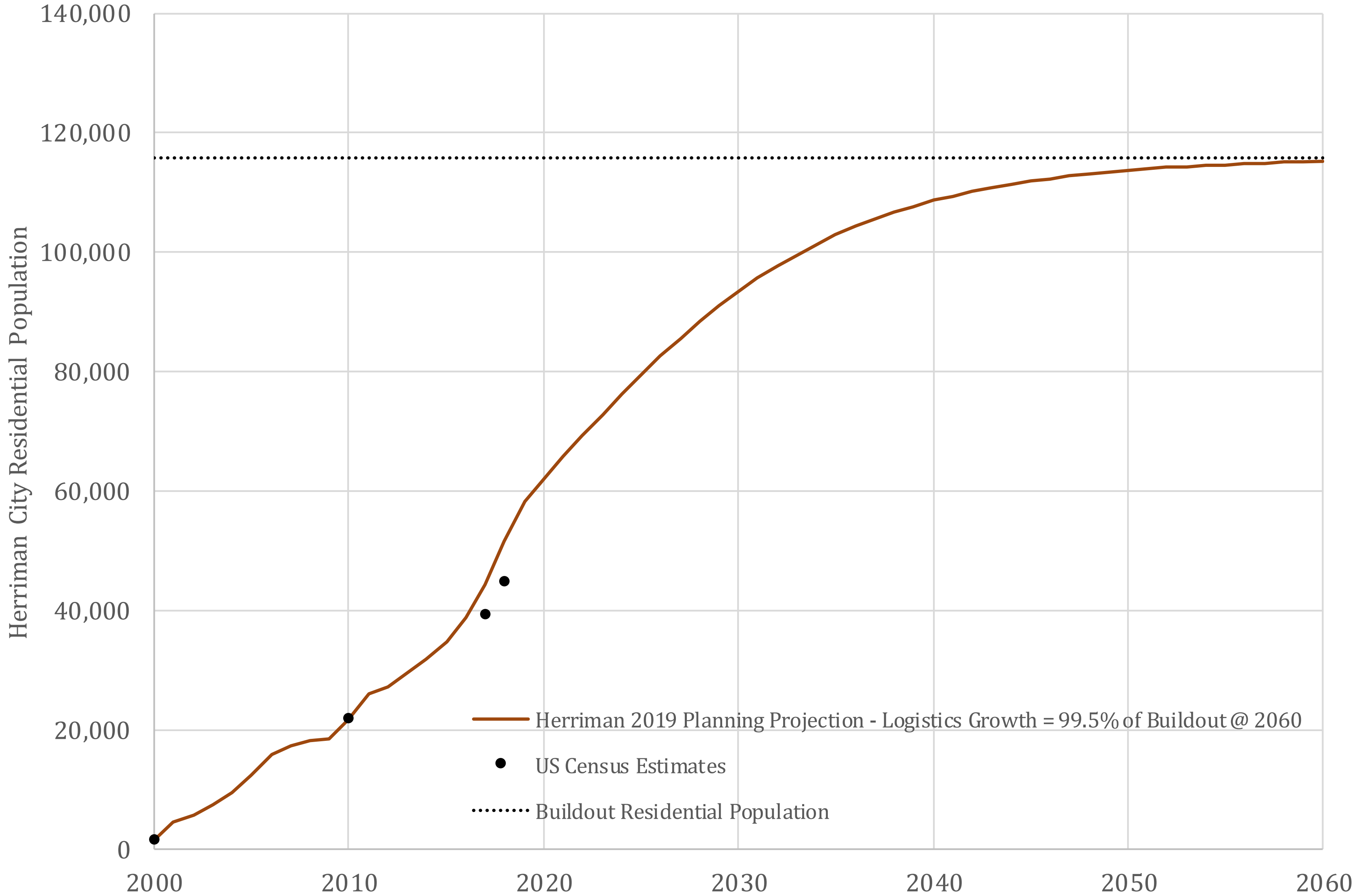


Figure 2 – Herriman City Population Projection

EQUIVALENT NON-RESIDENTIAL PROJECTIONS

Thus far, growth projections have only addressed residential growth. However, non-residential development will also place significant demands on City utilities and must be accounted for. Non-residential growth can sometimes be difficult to quantify because demands associated with non-residential development will vary depending on the type of development and the utility involved. For the purpose of this memo, projections of non-residential growth have been based on the projected indoor water demand associated with non-residential use and its equivalency in terms of residential indoor water use[2].

Following the same approach outlined for residential growth, non-residential growth projections are as follows:

- **Existing Non-Residential Development** – Based on indoor water use records, existing non-residential development used the same amount of water as approximately 1,336 equivalent residential units (ERUs). This was based on the recommended planning value for per capita indoor water use of 54.2 gallons per capita per day (gpcd) and a household size of 3.91. This is equivalent to a residential population of 5,225.

- **Non-Residential Development at Buildout –** Projected non-residential development at buildout based on land use is summarized in Table 4. Non-residential development expressed in terms of both equivalent residential units (ERUs) and equivalent residential population. Total non-residential development projected at buildout is 18,020 ERUs, or an equivalent population of 70,460.
- **Projected Non-Residential Growth –** Using similar assumptions to those identified previously for residential growth (e.g. logistic growth curve, buildout as calculated in Table 4, etc.), non-residential growth has been projected for the City and is summarized in Table 5.

[2] The effects of non-residential growth on Herriman City services such as water, transportation, parks, fire, and safety can be significantly different depending on the type of infrastructure. For example, the proposed public college campus near Mountain View Corridor on the east side of Herriman may have a significantly higher impact on roads into and out of the City than on water use within the City. Each type of infrastructure or utility should consider how the growth of non-residential development may uniquely affect its facilities in planning documents.

Table 4
Herriman City Land Use and Non-Residential Development at Buildout

Herriman City and Annexation Area	Acres	Average Density of ERUs	Number of ERUs	Equivalent Residential population
Commercial	1,024	3.44	3,521	13,767
Light Industrial/Business Park	333	3.44	4,022	15,727
Military Operation (Camp Williams)	308	0.19	59	231
Mixed Use (maximum 15 du/acre)	86	4.58	392	1,534
Mixed Use (Towne Center)	317	6.58	2,083	8,144
Open Space	3,761	0	0	0
Parks & Recreation	598	0	0	0
Public/Institutional/Schools	418	12.44	5,201	20,337
College Campus	87	18.43	1,601	6,260
Quasi-Public/Utilities	332	3.44	1,141	4,459
Residential Land Uses (not including mixed use)	12,119	0	0	0
Total:	**20,218**		**18,020**	**70,460**

Table 5
Equivalent Non-Residential Population Projection

Year	Residential Population Projection	Equivalent Non-Residential Population	Residential + Equivalent Residential Population	Percentage of Non-residential
2010	21,785	2,202[a]	23,987	9.2%
2018	51,681	5,225	56,906	9.2%
2019	58,287	6,522	64,808	10.1%
2020	62,010	7,607	69,618	10.9%
2025	79,568	14,054	93,622	15.0%
2029	91,047	20,011	111,059	18.0%
2030	93,465	21,551	115,016	18.7%
2035	102,904	29,280	132,184	22.2%
2040	108,668	36,782	145,450	25.3%
2045	111,961	43,937	155,898	28.2%
2050	113,772	50,786	164,558	30.9%
2055	114,746	57,411	172,158	33.3%
2060	115,265	63,889	179,154	35.7%
2065	115,539	70,275	185,814	37.8%

[a] Herriman City records do not include a breakdown between residential and non-residential use for the year of 2010. Value reported here has been estimated assuming the same ratio of development as observed in 2018.

As can be seen in the last column, the percentage of non-residential contributions to the City's overall water demand is expected to increase significantly through the year 2065. This is not unexpected as the City is still young and currently heavy on residential development. As the City matures, a greater portion of commercial and industrial development is expected. Addition of an expected college campus in the City will also add significantly to the portion of water used by non-residential development.

TOTAL ERU PROJECTIONS

For the purpose of water demand modeling, it is also convenient to covert these growth projections into ERUs as summarized in Table 6.

Table 6
Total ERU Projection

Year	Residential Units	Non-Residential ERUs	Total ERUs
2010	5,572	563	6,135
2018	13,218	1,336	14,554
2019	14,907	1,668	16,575
2020	15,859	1,946	17,805
2025	20,350	3,594	23,944
2029	23,286	5,118	28,404
2030	23,904	5,512	29,416
2035	26,318	7,488	33,807
2040	27,792	9,407	37,199
2045	28,635	11,237	39,872
2050	29,098	12,989	42,086
2055	29,347	14,683	44,030
2060	29,480	16,340	45,820
2065	29,550	17,973	47,523
Buildout	29,668	18,020	47,688

SHORT-TERM GROWTH DISTRIBUTION

In addition to projecting overall growth in the City, planning efforts for City infrastructure must also consider where this growth will occur. Based on information provided by developers and the availability of developable lands, the City's planning department has identified where it anticipates growth will occur within existing City limits over the next 10-years. Figure 3 shows the general location and timing of future growth while Table 7 summarizes the amount of growth possible within the areas identified based on the land use type.

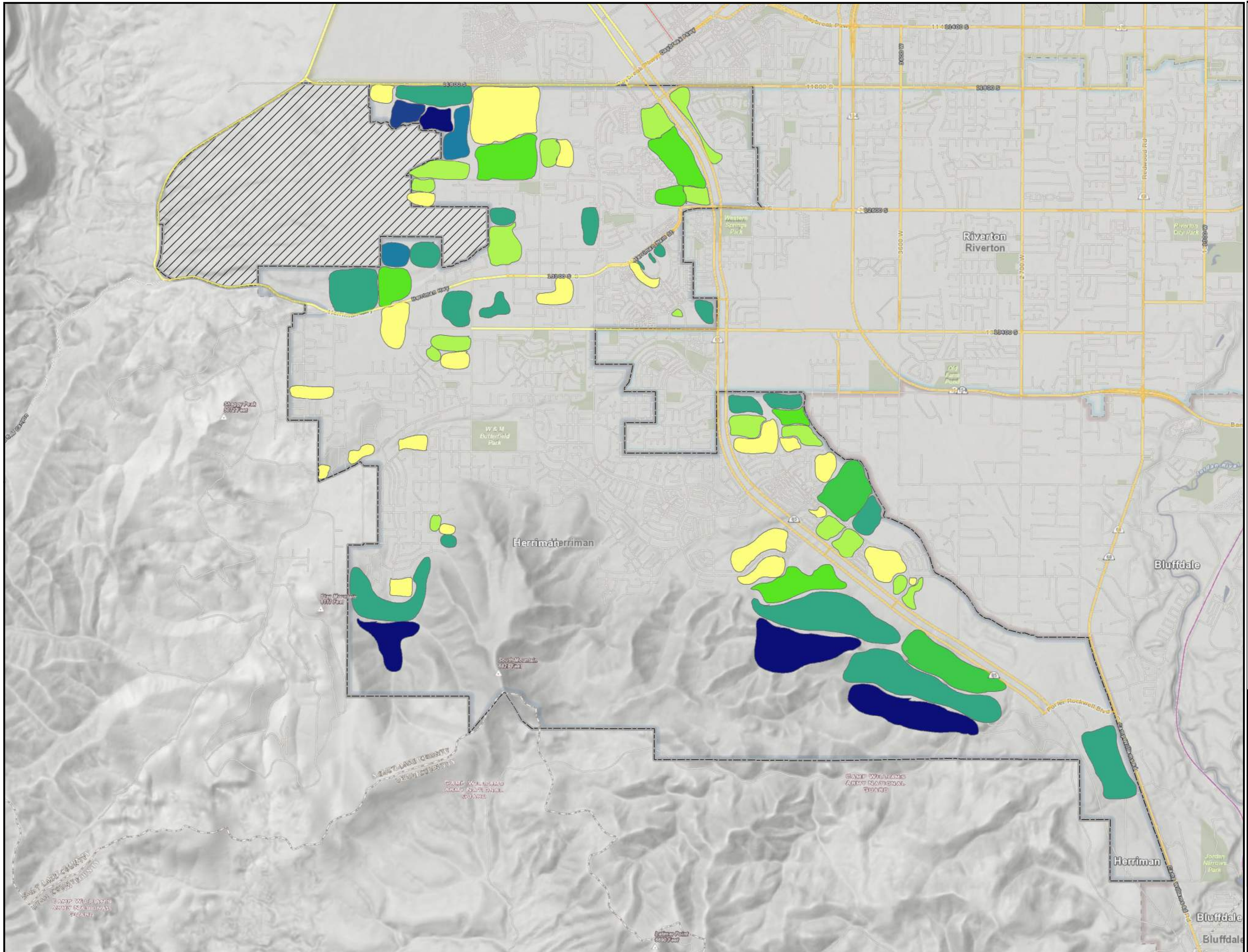
Table 7
10-Year Population Growth and Non-Residential Growth
(New Development Inside Existing City Limits)

Landuse Description	Area (acres)	Residential Units	Residential Population	Equivalent Non-Residential Units	Equivalent Non-Residential Population
Open Space	420	0	0	0	0
Medium Density Residential	323	2,035	7,958	0	0
Commercial	402		0	1,384	5,413
Single Family Residential	468	1,660	6,490	0	0
Agricultural Residential	274	658	2,574	0	0
Parks & Recreation	92	0	0	0	0
Public College Campus	20		0	400	6,260
Mixed Use	55	343	1,340	321	1,255
High Density Residential	72	1,003	3,923	0	0
Low Density Residential	412	885	3,462	0	0
Hillside/Rural Residential	125	137	538	0	0
Military Operation (Camp Williams)	9		0	59	233
Public/Institutional/Schools	65		0	985	3,851
Light Industrial/ Business Park	87			299	1,169
Total	**2,824**	**6,722**	**26,284**	**3,449**	**18,180**

Based on the areas of expected growth in the next 10 years identified by the City, a few observations about 10-year growth are identified below:

- **Growth Rate Projection –** The City's projected growth rate would predict future development of 28,404 ERUs by the year 2029. This is an expected increase in residential development of 13,850 ERUs.
- **10-Year Areas of Growth –** The development identified by the City to grow within the next 10-years includes an increase of only 10,171 ERUs (6,722 residential ERUs and 3,449 non-residential ERUSs). This would result in 2019 total development of 26,746. This is 1,658 ERUs short of the 2029 total population projection.
- **Additional Growth Distribution –** It is expected that the remaining projected growth of 1,658 ERUs will occur as infill in other parts of the City or as part of annexation of additional properties into the City within the next 10-years. The ratio of infill to annexation is difficult to predict but has been assumed to be 20 percent infill (332 ERUs) and 80 percent annexation (1,326 ERUs)[3]. Growth associated with annexation would likely be distributed close to the City's current corporate boundary in the future annexation area identified in Figure 3.

[3] A high level assessment of remaining units available for infill estimates that infill could account for between 20 and 50 percent of the remaining growth. To be conservative, this study recommends using the low end of this estimate (and correspondingly, the hig h end estimate of annexation) to make sure the City is adequately prepared for potential annexation.



Legend

- Future Annexation Area
- Existing City Area

10-Year Growth Areas

Year

- 2019
- 2020
- 2021
- 2022
- 2023
- 2024
- 2025
- 2026 - 2029

NORTH:

SCALE: 0 2,000 4,000 Feet

PROJECTED AREAS OF GROWTH WITHIN 10-YEARS

HERRIMAN CITY

PROJECTIONS OF GROWTH

BOWEN COLLINS & ASSOCIATES

FIGURE NO. 3

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CONCLUSIONS

Based on the growth projections discussed above, the following conclusions and recommendations can be made regarding future planning of Herriman City growth:

- **Existing Population** – The City has developed its own estimate of its residential population. This should be used rather than the US Census estimate which is lower and has historically underestimated City growth.
- **City Growth Projections** – The projection of growth within the City shown in Table 6 should be used at the basis for infrastructure planning documents.
- **10-Year Growth Distribution –** The City has identified where growth is expected to occur over the next 10-years as a result of new development within the City corporate boundary. This is shown in Figure 3 and Table 7. Growth not associated with new development identified in this table will be assumed to be infill (20%) and future annexation (80%).
- **Non-residential Growth –** The effects of non-residential growth on City infrastructure may vary depending on the type of infrastructure or utility. As the proportion of non-residential areas in Herriman develop, planners should account for the effects of non-residential growth in planning documents accordingly.

Appendix B – Miscellaneous Transportation Information and Cost Estimates

This appendix includes:

Land Use and Transportation

Neighborhood Traffic Management

Travel Demand Management

Signal Spacing and Coordination

Truck Routes

TAZ Projections

Road Section Detailed Cost Estimates

LAND USE AND TRANSPORTATION DESCRIPTION

As post, World War II-style suburban, single-family residential development gives way to more comprehensive and sustainable ways of considering resources, the relationship between transportation and land use becomes extremely important. Different types of land uses require diverse modes of transportation to support them. For example, large lot, single use, residential development often necessitates a personal vehicle where walking is not efficient and public transit service is not cost-effective. On the other end of the spectrum, college/university settings are often particularly well suited for walk and bike trips while on campus and the use of transit to get to and from campus. These disparate land uses offer a stark view of the relationship between land use and transportation.

Universities and colleges are often well suited to rely on walking and biking to get around campus.

To better integrate land use and transportation planning, a broader perspective of the impacts on each other is important. This involves the consideration of trip generation characteristics of a development, as well as the range of transportation options that would serve the development. There are continuing efforts throughout the Wasatch Front to better integrate land use and transportation planning. WFRC's *Wasatch Choice 2050* is the highest profile of these efforts and seeks to link land use planning and shifting attitudes about physical space to a long-term plan for transportation that supports that land use vision.

Often, efforts that are specifically intended to provide better linkage between transportation and land use planning are the result of the public demanding better design of roadways that are more sensitive to their context. Additionally, there is often a strong desire for thoughtful growth and development. Concepts that support a better land use and transportation relationship are often summarized by the "three Ds" of density, diversity, and design.

Density

In land use planning, density refers to how intensely the land is being used. For example, a mixed-use development that includes retail, commercial, and residential uses is higher "density" than single-family residential land uses or parks and open space at the other end of the spectrum.

Density impacts the relationship of land use and transportation because when land uses are more dense, those areas are more amenable to a wider range of transportation options, including transit and active transportation (biking and walking). Transit runs most efficiently when it serves higher-density areas and biking and walking are more viable transportation options when a range of land uses are located close together.

Diversity

Diversity refers to a range of different types of land uses in an area and is able to fulfill a myriad of needs, such as housing, work, and retail spaces in a small area. Similar to density, areas with more diverse land uses are more easily and efficiently served by a range of transportation options, such as transit, biking, and walking, in addition to cars. Diversity in land uses encourages shorter trips that are more easily accommodated on foot and parking once and walking to many distinct destinations is more attractive. Visiting a downtown area of any large city is a great example of diversity. Parking is often difficult and expensive, and therefore transit is often an easier option to get there.

Design

For transportation and land use, design of both the streets and neighborhoods are important considerations. At the street level, accommodations for biking and walking should be provided using such elements such as sidewalks, bicycle lanes, trails, shoulders, or a combination of these options. It is important to consider the range of potential users of a street, including students, elderly, bicyclists, and disabled population, in addition to vehicles. While not every single mode necessarily needs to be accommodated on a given street, there should be some accommodation for all users in nearby corridors or alignments.

At the neighborhood level, design becomes even more important because design can greatly affect travel patterns and behaviors. For example, a house can be located ¼ mile from a school "as the crow flies." However, to travel to the school on streets or sidewalks is 1.5 miles due to neighborhood design that includes cul-de-sacs, curvilinear streets, and other inefficient street designs. Absent trail connections from the neighborhood to the school causes a short walk or bike ride to school to become a car trip to school. This adds to already congested areas around schools and takes away opportunities for kids to get more physical activity.

NEIGHBORHOOD TRAFFIC MANAGEMENT DESCRIPTION

The concept of "neighborhood traffic management" refers to a comprehensive method of addressing traffic concerns on residential streets through an array of traffic calming tools. An overall program of neighborhood traffic management identifies a process by which various traffic calming tools are considered and how they are prioritized. Together, a traffic management program armed with innovative traffic calming tools helps Herriman City make sound long-term decisions to improve safety and aesthetics on residential streets.

Generally, traffic calming and traffic management refers to a system of improvements or alterations to local streets to improve safety, especially for non-motorized users. Often referred to as "traffic calming," these improvements are typically geared toward reducing vehicle speeds by physically or visually narrowing the roadway. The aim of traffic calming and traffic management programs is improved conditions for all street users, most importantly pedestrians and bicyclists on residential streets. Programs like these aim to mitigate the impact of either too many vehicles, vehicles going too fast, or both.

Chicanes are effective ways to physically narrow the roadway and slow vehicle speeds.

Traffic Management Programs

A traffic management program is adopted by a municipality, provides a common set of regulations, and outlines the process by which individual traffic calming measures may be implemented. In some cities, there is a committee of city staff and residents that consider requests by neighborhoods for specific traffic calming treatments. They often require that engineering speed studies be completed to determine to what extent there is a problem and to help inform what types of measures would be most effective.

A program also refers to consideration of the physical, education, and enforcement measures that reduce the negative impacts of motor vehicle use, alter driver behavior, and improve the safety conditions for non-motorized traffic in residential neighborhoods. Effective use of traffic management measures will improve the quality of life in Herriman City.

Traffic Calming Measures

Traffic calming uses mainly physical measures and reduces the negative effects of motor vehicle use, alters driver behavior, and improves conditions for non-motorized street users. Traffic calming measures are distinguished from traffic control devices such as signals, speed limits, and stop signs, as it is designed to be self-enforcing and does not require law enforcement, but instead relies upon the laws of physics to slow traffic. In practice, a review of traffic control devices is often a first step in evaluating traffic calming measures. While streetscape elements such as trees, lighting, and street furniture are often complementary to traffic calming efforts, they do not compel drivers to slow down and are not considered as traffic calming measures.

There are many traffic calming methods. Selection of a particular method should be based on a formally adopted methodology as outlined in a traffic management program.

Methods of Traffic Calming

Traffic calming measures may work by limiting traffic volume or slowing traffic, although most measures have some effect on both volume and speed. While not exhaustive, the following list is a description of some of the commonly used techniques in each category. Other methods are typically variations on these techniques or simply known by other names. Although each method may be implemented case-by-case, implementation should be viewed at a larger neighborhood level so that problems are not simply moved from one street to the next.

Volume Control Measures

- Complete Street Closures
- Partial Street Closures

Speed Control Measures

- Vertical Measures
  - Speed Humps
  - Speed Tables
  - Raised Intersections
- Horizontal Measures
  - Traffic Circles / Roundabouts
  - Chicanes
  - Narrowing
    - Curb Extensions
    - Bulb-outs
    - Chokers
- Median Islands

Median islands serve to reduce the travel way on local streets and add aesthetic qualities.

Next Steps for Herriman

The first step for Herriman is to conduct a review of city streets to determine the extent of the neighborhood traffic problem. If the problem is pervasive, many cities will budget an annual funding level to mitigate any problem slowly. If the problem is not pervasive, many cities document their policies to ensure that implementation can be supplied by rational engineering procedures in the event of a pedestrian injury or related problem.

Second, Herriman City should develop a neighborhood traffic management program, which specifically outlines the process in which traffic calming tools will be implemented. For example, will a citizens committee be used to help determine which locations are in greatest need? Will a neighborhood-wide ballot be used when funding improvements (or removal of improvements) are in question? This program should identify parameters at which traffic calming tools will be considered, such as 85th percentile speeds, documented safety concerns, or other issues.

Examples of Similar Programs

- West Jordan's *Neighborhood Traffic Management Program* (2009)

- Park City's *Neighborhood Traffic Management Program*
- Madison, Wisconsin's *Neighborhood Traffic Management Program*

Additional Information/Resources

- National Traffic Calming Institute: www.welovetrafficcalming.org
- Complete Streets Coalition: www.completestreets.org

TRAVEL DEMAND MANAGEMENT DESCRIPTION

Travel demand management (TDM) refers to a large group of strategies to reduce traffic congestion. Congestion is the natural product of too many vehicles attempting to use the same road at the same time and consequently travel demand exceeds the road's available capacity. Traffic congestion has negative impacts on air quality and results in reduced economic productivity. Hence, by managing the demand to travel at peak times on certain roadways, congestion is reduced. Travel demand management strategies fall into five broad categories:

- Mode Strategies
- Route Strategies
- Departure-time Strategies
- Trip-reduction Strategies
- Location/Design Strategies

This appendix is intended to serve as an introduction to these strategies. TDM, as a whole, is most effective when a diverse set of strategies is implemented.

Mode Strategies

One way municipalities can manage travel demand is through strategies that reduce the number of automobile trips. Strategies in this category largely relate to reducing the number of single occupant vehicle trips. Below are several examples of how municipalities can encourage non-automobile transportation

- Offer incentives to developers and businesses to provide facilities, such as bicycle storage and showers.
- Rideshare Programs and Services – Ridesharing is a common and simple alternative mode for transportation, where two or more people share a single vehicle during trips. Ridesharing programs and services can manifest themselves in several ways, including carpools, vanpools, and "schoolpools." These programs involve matching services, helping individuals find and coordinate with others with like trip origins and destinations.
- Promote Public Transit Usage – Municipalities can collaborate with local transit agencies to enhance local public transportation service. Such collaboration can occur in multiple forms.
  - Subsidize transit fares
  - Connect large local employers with transit service
  - Work with UTA to make transit service readily available at popular destinations, such as town centers, schools, libraries, or senior centers

Route Strategies

Route strategies describe a set of principles that seek to motivate drivers to choose certain routes and avoid others. Strategies that influence route choice reduce congestion in prone areas and are often cheaper than adding lanes to a roadway. Local drivers are most likely well acquainted with areas prone to congestion and strive to avoid said congestion on their own. TDM route strategies seek to reinforce these behaviors through diverse means, such as public information or even instituting toll roads.

Departure Time Strategies

Standard business hours are from 8:00 AM to 5:00 PM. Predictably, the times around these hours are when the greatest concentration of trips occur. Encouraging local employers to allow employees to opt for alternative work schedules shifts their scheduled hours so fewer people are driving when the larger peak occurs. This can also take the form of extended workdays, producing weekdays where employees don't need to travel to work altogether. In many cities, the start and end of school times can be shifted by only minutes but can result in significant traffic improvements.

Trip Reduction Strategies

As is implied in the name, trip reduction strategies encourage people to reduce the number of trips taken or eliminate the need for a trip altogether. For the most part these are public education programs designed to promote trip reduction thinking, such as encouraging the public to inquire with their employers about teleworking or combining multiple errands into a single trip before returning home.

Next Steps for Herriman

- Incorporated land use and transportation elements
- Work with UTA to develop a long-range transit plan
- Work with UDOT TravelWise program
- Develop comprehensive trail and bicycle plan

Examples of Similar Programs

- TravelWise is a UDOT program that provides more information about TDM strategies.
- Numerous local entities have developed a bicycle and pedestrian master plan to guide future development of these facilities.
- Denver Regional Council of Governments – Regional Travel Demand Management Short-Range Plan

Additional Information/Resources

- UDOT's TravelWise program (www.travelwise.utah.gov)
- Denver Regional Council of Governments (http://www.drcog.org/index.cfm?page=TravelDemandManagement(TDM))
- Salt Lake City Transportation Division (http://www.slcgov.com/transportation)
- Federal Highway Administration Travel Demand Management Toolbox (http://www.ops.fhwa.dot.gov/tdm/)
- Complete Streets Coalition (http://www.smartgrowthamerica.org/complete-streets)
- CEOs for Cities (http://www.ceosforcities.org/research)
- Utah Division of Air Quality Choose Clean Air Program (http://www.cleanair.utah.gov/)

SIGNAL SPACING AND COORDINATION DESCRIPTION

Traffic control devices, such as signs and traffic signals, govern the flow of vehicles, pedestrians, and bicyclists throughout a city, and are one of the most significant factors that influence urban mobility. Growing cities that adequately plan a future traffic signal network are better prepared to accommodate land development and population increases as their community urbanizes.

Proper Signal Spacing

The proper spacing and coordination of traffic signals is key to establishing a road network that safely and efficiently aids the flow of people and vehicles. Uniform traffic signal spacing of at least 1/2 mile for major arterial roadways and 1/2 mile or 1/4 mile for minor arterial roadways leads to better coordination and vehicle throughput (see *Transportation and Land Development, 2nd Edition*, Institute of Transportation Engineers). Long uniform spacing allows for greater flexibility in timing plans and is more likely to accommodate coordination for both directions of travel. In contrast, short irregular signal spacing interrupts vehicle flow and creates more delay.

Often, the purpose of a traffic signal is misunderstood. The primary purpose of a traffic signal is to assign the ROW to vehicles and individuals with conflicting travel paths. However, many view traffic signals as a traffic calming device or a suitable method to reduce vehicle speed. With this view, traffic signal decisions can take a political course and lead to signal implementation in inappropriate places. Improperly placed traffic signals are difficult to remove or relocate. Once in place, the detrimental effects of a poorly placed signal are usually permanent. Thus, jurisdictions should prepare a future signals plan as a companion to the future road network plan to guide land development and community mobility decisions.

Coordination Across Agencies

In Utah communities, signal ownership and maintenance are often distributed among municipal, county, and state governments. Optimal signal coordination cannot be achieved unless these agencies partner together to identify target corridors and establish uniform cycle lengths among their respective traffic signals.

Next Steps for Herriman

- Use plan as a guide
- Work with the county and UDOT to provide for hardwire coordination
- Evaluate roundabouts as a strategy to reduce signal spacing
- Evaluate changes to left turn signal phasing and timing as a coordination strategy
- Evaluated innovative intersections

Additional Information/Resources

- UDOT Traffic Signals Brochure: http://www.udot.utah.gov/main/uconowner.gf?n=200702020919251
- Salt Lake City Signal Synchronization Project: http://www.slcgov.com/transportation/transportation-signal-timing-report
- *Transportation and Land Development, 2nd Edition,* Institute of Transportation Engineers

TRUCK ROUTES DESCRIPTION

Safety concerns, roadway maintenance issues, and the desire to improve traffic operations have promoted a number of state and local governments in the United States to implement truck restrictions or controls on segments of roadway under their jurisdiction. Route and speed restrictions are the most common type of controls.

Vehicles of different sizes and weights have different operation characteristics and impacts to roadways. Besides being heavier, trucks are generally slower and occupy more roadway space. Consequently, trucks have a greater individual effect on roadway maintenance and traffic operations than do passenger vehicles.

To protect and preserve roadway infrastructure, enhance safety, and facilitate the efficient flow of traffic, Herriman City may want to consider adopting an ordinance to identify truck routes within its city limits.

Ordinance Elements

- Description of vehicles, which the ordinance governs. Typically includes dimensional and weight criteria.
- List or map of routes identified trucks must adhere to.
- Description of exceptions for trucks, which by nature cannot adhere to the route described.
- Hazardous Material Requirement - All trucks, which contain hazardous materials must only use designated routes regardless of dimensional and weight characteristics.

Next Steps for Herriman

- Conduct further study to determine if truck routes are needed in Herriman
- If needed, develop routes
- Draft and adopt truck route ordinance

TAZ PROJECTIONS

TAZID	2030			2050		
	Households	Population	Employment	Households	Population	Employment
1414	1,215	4,210	474	1,080	3,494	942
1419	242	698	137	367	986	245
1418	118	328	1,068	183	482	2,181
1403	979	2,858	893	2,463	6,618	838
1398	1,227	3,328	-	1,819	4,555	-
1406	490	1,558	120	598	1,725	116
1395	359	1,051	564	1,382	3,671	470
1397	577	1,584	617	666	1,745	546
1407	435	1,302	266	488	1,355	357
1396	635	1,813	249	1,266	3,378	371
1408	645	2,043	371	657	1,913	577
1409	206	632	207	231	650	195
1410	275	895	458	252	762	539
2883	1,639	4,744	1,475	1,779	4,749	2,021
1416	1,357	4,160	569	1,473	4,160	509
1565	1,312	4,456	306	1,157	3,665	318
1607	645	1,899	2,462	1,213	3,327	3,723
1606	1,483	4,240	1,703	2,386	6,207	2,476
1626	304	860	159	576	1,530	479
2887	1,356	3,854	965	2,615	6,863	976
1627	599	1,737	620	1,303	3,542	1,209
1628	1,050	2,891	671	1,399	3,583	1,108
1412	1,553	5,304	557	1,389	4,427	650
1415	2,122	7,047	391	1,839	5,717	422
1629	2,174	6,001	2,134	3,226	8,339	2,499
2886	1,353	4,519	558	1,500	4,624	598
1404	757	2,388	334	905	2,493	373
1411	1,639	4,744	3,441	1,779	4,749	4,717
2884	1,227	3,328	-	1,819	4,555	-
2885	-	-	376	-	-	458
2882	-	-	376	-	-	458
1405	1,171	3,694	1,181	1,052	3,087	2,392
1608	904	2,569	643	1,743	4,575	651

ROAD SECTION COST ESTIMATES

68' ROW				
ITEM	**COST**	**UNIT**	**Quantity**	**COST**
Roadway Excavation	$7.00	C.Y.	2.89	$20.23
Clearing and Grubbing	$2,500.00	Acre	0.0017	$4.25
Granular Borrow (Plan Quantity)	$25.00	C.Y.	1.7	$42.50
Untreated Base Course (8" thick)	$16.00	Ton	1.79	$28.64
Hot Mix Asphalt, 1/2 Inch or 3/4 Inch Max.	$60.00	Ton	2.04	$122.40
Concrete Curb and Gutter Type A	$18.00	ft	2	$36.00
Concrete Sidewalk	$38.00	S.Y.	0.5277	$20.05
Pavement Marking Paint	$1.50	ft	1	$1.50
			Subtotal	$275.57
Signage and Lighting	calculated percent of subtotal		10percent	$27.56
Drainage (Inc. Structures)	calculated percent of subtotal		25percent	$68.89
Environmental and Design	calculated percent of subtotal		25percent	$68.89
Mobilization and Traffic Control	calculated percent of subtotal		20percent	$55.11
			Subtotal	$496.03
Contingency for anticipated Incidental Costs	calculated percent of subtotal		25percent	$124.01
TOTAL COST				$620.04

* Based on 2018 bid tabulations provided by the City.

80' ROW				
ITEM	**COST**	**UNIT**	**Quantity**	**COST**
Roadway Excavation	$7.00	C.Y.	3.40	$23.80
Clearing and Grubbing	$2,500.00	Acre	0.0020	$5.00
Granular Borrow (Plan Quantity)	$25.00	C.Y.	2	$50.00
Untreated Base Course (8" thick)	$16.00	Ton	2.2375	$35.80
Hot Mix Asphalt, 1/2 Inch or 3/4 Inch Max.	$60.00	Ton	2.55	$153.00
Concrete Curb and Gutter Type A	$18.00	ft	2	$36.00
Concrete Sidewalk	$38.00	S.Y.	0.5277	$20.05
Pavement Marking Paint	$1.50	ft	1	$1.50
			Subtotal	$325.15
Signage and Lighting	calculated percent of subtotal		10percent	$32.52
Drainage (Inc. Structures)	calculated percent of subtotal		25percent	$81.29
Environmental and Design	calculated percent of subtotal		25percent	$81.29
Mobilization and Traffic Control	calculated percent of subtotal		20percent	$65.03
			Subtotal	$585.27
Contingency for anticipated Incidental Costs	calculated percent of subtotal		25percent	$146.32
TOTAL COST				$731.59

* Based on 2018 bid tabulations provided by the City.

90' ROW				
ITEM	COST	UNIT	Quantity	COST
Roadway Excavation	$7.00	C.Y.	3.83	$26.78
Clearing and Grubbing	$2,500.00	Acre	0.0023	$5.63
Granular Borrow (Plan Quantity)	$25.00	C.Y.	2.25	$56.25
Untreated Base Course (8" thick)	$16.00	Ton	2.2375	$35.80
Hot Mix Asphalt, 1/2 Inch or 3/4 Inch Max.	$60.00	Ton	2.55	$153.00
Concrete Curb and Gutter Type A	$18.00	ft	2	$36.00
Concrete Sidewalk	$38.00	S.Y.	0.5277	$20.05
Pavement Marking Paint	$1.50	ft	1	$1.50
			Subtotal	$335.00
Signage and Lighting	calculated percent of subtotal		10percent	$33.50
Drainage (Inc. Structures)	calculated percent of subtotal		25percent	$83.75
Environmental and Design	calculated percent of subtotal		25percent	$83.75
Mobilization and Traffic Control	calculated percent of subtotal		20percent	$67.00
			Subtotal	$603.00
Contingency for anticipated Incidental Costs	calculated percent of subtotal		25percent	$150.75
TOTAL COST				$753.76

* Based on 2018 bid tabulations provided by the City.

106' ROW				
ITEM	COST	UNIT	Quantity	COST
Roadway Excavation	$7.00	C.Y.	4.51	$31.54
Clearing and Grubbing	$2,500.00	Acre	0.0027	$6.63
Granular Borrow (Plan Quantity)	$25.00	C.Y.	2.65	$66.25
Untreated Base Course (8" thick)	$16.00	Ton	3.207083333	$51.31
Hot Mix Asphalt, 1/2 Inch or 3/4 Inch Max.	$60.00	Ton	3.655	$219.30
Concrete Curb and Gutter Type A	$18.00	ft	2	$36.00
Concrete Sidewalk	$38.00	S.Y.	0.5277	$20.05
Pavement Marking Paint	$1.50	ft	1	$1.50
			Subtotal	$432.58
Signage and Lighting	calculated percent of subtotal		10percent	$43.26
Drainage (Inc. Structures)	calculated percent of subtotal		25percent	$108.14
Environmental and Design	calculated percent of subtotal		25percent	$108.14
Mobilization and Traffic Control	calculated percent of subtotal		20percent	$86.52
			Subtotal	$778.64
Contingency for anticipated Incidental Costs	calculated percent of subtotal		25percent	$194.66
TOTAL COST				$973.30

* Based on 2018 bid tabulations provided by the City.

116' ROW				
ITEM	**COST**	**UNIT**	**Quantity**	**COST**
Roadway Excavation	$7.00	C.Y.	4.93	$34.51
Clearing and Grubbing	$2,500.00	Acre	0.0029	$7.25
Granular Borrow (Plan Quantity)	$25.00	C.Y.	2.9	$72.50
Untreated Base Course (8" thick)	$16.00	Ton	3.21	$51.31
Hot Mix Asphalt, 1/2 Inch or 3/4 Inch Max.	$60.00	Ton	3.655	$219.30
Concrete Curb and Gutter Type A	$18.00	ft	2	$36.00
Concrete Sidewalk	$38.00	S.Y.	0.5277	$20.05
Pavement Marking Paint	$1.50	ft	1	$1.50
			Subtotal	$442.43
Signage and Lighting	calculated percent of subtotal		10percent	$44.24
Drainage (Inc. Structures)	calculated percent of subtotal		25percent	$110.61
Environmental and Design	calculated percent of subtotal		25percent	$110.61
Mobilization and Traffic Control	calculated percent of subtotal		20percent	$88.49
			Subtotal	$796.37
Contingency for anticipated Incidental Costs	calculated percent of subtotal		25percent	$199.09
TOTAL COST				$995.46

* Based on 2018 bid tabulations provided by the City.

Appendix C – Technical Memorandum Addressing Intersection Level of Service

Parametrix
ENGINEERING . PLANNING . ENVIRONMENTAL SCIENCES

4179 RIVERBOAT ROAD, SUITE 130 | SALT LAKE CITY, UT 84123 | P 801.307.3400

MEMORANDUM

DATE:	March 20, 2020
TO:	Herriman City
FROM:	Kai Tohinaka, AICP Elizabeth Healy, EIT
SUBJECT:	MTP Intersection LOS
CC:	
PROJECT NUMBER:	344-7524-005
PROJECT NAME:	Herriman City MTP Intersection Level of Service and MTP Supplement

PURPOSE

This memorandum documents the methodologies used in the evening peak analysis of 13 intersections within Herriman City, Utah. This document supplements the 2020 update of the Herriman City Transportation Master Plan.

BACKGROUND

Intersections included within this analysis were identified by Herriman City staff. These intersections are perceived to experience less than ideal traffic conditions during weekday evening peaks. Table 1 lists intersections included in this analysis.

Table 1: Project Intersections and Traffic Control

East / West Approach	North / South Approach	Control
Herriman Boulevard	*6000 W*	Signal
Herriman Boulevard	*5600 W*	Signal
Herriman Boulevard / 12600 S	*Main Street*	Signal
12600 S	*MVC NB*	Signal
12600 S	*MVC SB*	Signal
Main Street	*5600 W*	Signal
13400 S	*5600 W / Rosecrest Road*	Signal
13400 S	*Morning Cloak Way / 5200 W*	Signal
13400 S	*MVC NB*	Signal
13400 S	*MVC SB*	Signal
Rosecrest Road	*MVC NB*	Signal
Rosecrest Road	*MVC SB*	Signal
Rosecrest Road	*Sentinel Ridge Road*	Signal

STUDY AREA

Figure 1 shows a map of intersections included in the analysis.

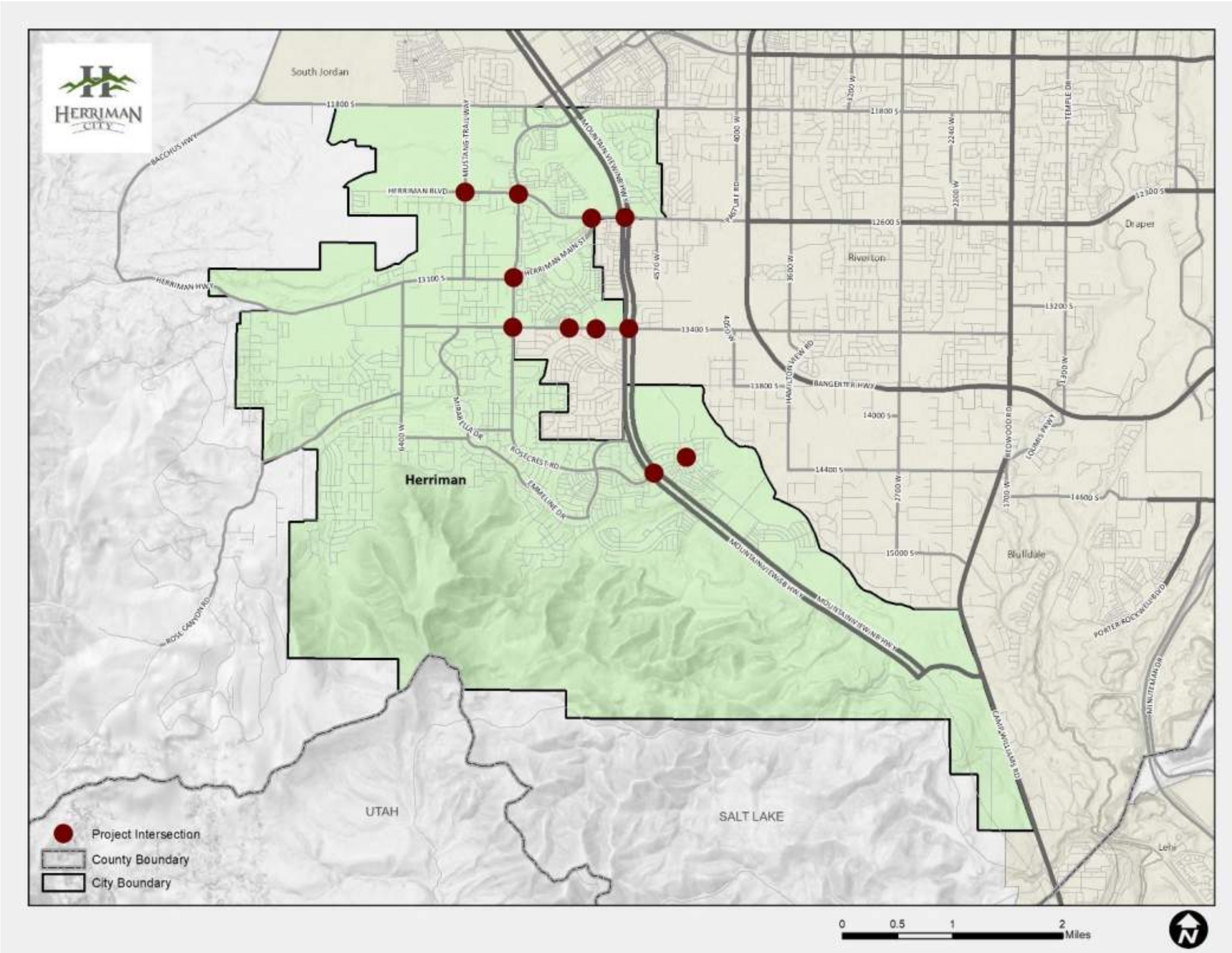

Figure 1: Map of Study Intersections (Not to Scale)

TRAFFIC VOLUMES

Turning movement counts were collected between 4:30 PM and 6:00 PM by L2 Data Collection on Wednesday, January 15, 2020. Turning movement counts show that the corridor peak hour is from 5:00 PM to 6:00 PM.

To ensure that appropriate traffic volumes were reflected in the analysis, turning movement counts were compared to 3-hour travel demand model (TDM) peak flows, and to flow values from UDOT's Performance Measurement System (PeMS). TDM peak volumes represent values from 3:00 PM to 6:00 PM. PeMS volumes were obtained for January 15, 2020, and were used to distribute TDM peak volumes between 3:00 PM and 6:00 PM.

SIGNAL TIMING

Existing signal timing information was provided by Utah Department of Transportation's (UDOT) Traffic Operations Center and Salt Lake County Public Works.

ANALYSIS

Software

Synchro 9 was used to conduct operational analyses for this study. Synchro 9 utilizes concepts within the Highway Capacity Manual (HCM) to provide calculations for Level of Service (LOS) and delay.

Existing signal timing and peak hour traffic volumes were entered into Synchro 9 to replicate weekday evening peak conditions.

Highway Capacity Manual Concepts

Level of Service

The HCM defines Level of Service (LOS) as a quality measure that characterizes operational conditions within a traffic stream. Table 2 displays LOS criteria for signalized intersections as defined within the HCM.

Table 2: LOS Criteria (Signalized Intersections)

LOS	Delay (s)	Description
A	≤10	*Free flow*
B	> 10 - 20	*Stable flow with slight delays*
C	> 20 - 35	*Stable flow with acceptable delays*
D	> 35 - 55	*Approaching unstable flow with tolerable delays*
E	> 55 - 80	*Unstable flow with intolerable delays*
G	> 80	*Forced flow with congestion and lingering queues*

This analysis identifies overall intersection LOS and intersection movements that operate at LOS D or worse.

Volume to Capacity

Volume to capacity (V/C) ratios compare a roadway facility's volume to its sustainable capacity. V/C ratios provide an approximate indicator of how well a facility accommodates demand. Contributing factors that may affect the calculation of an intersection's capacity include, and are not limited to, geometry, signal timing, and phasing. Table 3 displays ranges of V/C ratios and respective descriptions.

Table 3: V/C Descriptions

V/C	Description
< 0.85	*Under capacity (No excessive delays)*
0.85 - 0.95	*Near capacity (Higher delays / No lingering queues)*
0.95 - 1.0	*At capacity (Unstable flow)*
> 1.0	*Over Capacity (Excessive delays and queueing)*

This analysis identifies intersection movements that operate at V/C of 0.70 or greater.

95th Percentile Queue

The term "queue" is defined as the length of vehicles waiting to be served by a traffic system. Planning and transportation agencies utilize queue lengths to determine storage lengths necessary for adequate operation of traffic movements. 95th percentile queue lengths are defined as queue lengths that have a 5-percent probability of being exceeded within an analysis period.

This analysis identifies 95th percentile queue lengths that exceed existing storage, are affected by upstream signalized intersections, and/or those in which volumes exceed capacity.

ANALYSIS RESULTS

Intersection

Overall intersection LOS and delay values were calculated within Synchro 9 and are summarized in Table 4.

Table 4: LOS and Delay Summary

East / West Approach	North / South Approach	Control	Analysis Methodology	LOS	Delay (s)
Herriman Boulevard	*6000 W*	Signal	HCM 2000	B	13
Herriman Boulevard	*5600 W*	Signal	HCM 2000	C	21
Herriman Boulevard / 12600 S	*Main Street*	Signal	HCM 2000	A	9
12600 S	*MVC NB*	Signal	HCM 2000	C	24
12600 S	*MVC SB*	Signal	HCM 2000	C	21
Main Street	*5600 W*	Signal	HCM 2000	C	20
13400 S	*5600 W / Rosecrest Road*	Signal	HCM 2010	C	31
13400 S	*Morning Cloak Way / 5200 W*	Signal	HCM 2010	B	17
13400 S	*MVC NB*	Signal	HCM 2000	C	25
13400 S	*MVC SB*	Signal	HCM 2000	C	31
Rosecrest Road	*MVC NB*	Signal	HCM 2000	B	19
Rosecrest Road	*MVC SB*	Signal	HCM 2000	B	17
Rosecrest Road	*Sentinel Ridge Road*	Signal	HCM 2010	B	12

Movement Performance Measures

Because Synchro 9 calculates intersection LOS and delay values for an entire analysis period, overall intersection LOS and delay measures may not accurately reflect conditions for poor performing movements. For this reason, performance measures for individual movements are summarized in the following sections.

The below sections summarize intersection movements with LOS D or worse, V/C ratios greater than or equal to 0.70, and 95th percentile queues that exceed existing storage, are affected by upstream signalized intersections, and/or those in which volumes exceed capacity.

Level of Service

Within the HCM, LOS D is associated with "tolerable" delay values between 35 and 55 seconds, and with conditions that approach unstable flow. Table 5 summarizes intersection movements within this analysis earning LOS D or worse.

Table 5: Intersection Movements with LOS D or Worse

East / West	North / South	Movement	Movement LOS	Movement Delay (s)
12600 S	*MVC NB*	WBT	D	42
12600 S	*MVC SB*	EBT	D	43
		EBR	D	37
		WBL	E	63
13400 S	*5600 W / Rosecrest Road*	EBT	D	37
		WBL	D	40
		WBT	D	41
		NBT	D	36
		SBT	D	37
13400 S	*MVC NB*	NBT	D	35
13400 S	*MVC SB*	SBT	E	74
		SBL	D	41

Volume to Capacity

Within the HCM, V/C values greater than 0.85 are indicative of roadway segments that are nearing sustainable capacity limits. To provide a conservative representation of movements at or near capacity, a V/C threshold of 0.70 was used to identify potential intersection movements that may require capacity improvements in the near future. Table 6 summarizes intersection movements earning V/C ratios greater than or equal to 0.70.

Table 6: Intersection Movements with V/C ≥ 0.70

East / West	North / South	Movement	Movement V/C
Herriman Boulevard / 12600 S	*Main Street*	WBL	0.77
12600 S	*MVC NB*	WBT	0.91
		WBR	0.70
		NBT	0.72
12600 S	*MVC SB*	EBT	0.76
		WBT	0.73
		SBT	0.81
Main Street	*5600 W*	WBL	0.75
13400 S	*5600 W / Rosecrest Road*	SBT	0.74
		WBL	0.81
		WBT	0.76
13400 S	*MVC NB*	NBT	0.73
13400 S	*MVC SB*	WBL	0.76
		WBT	0.76
		SBT	1.01

95th Percentile Queue

95th percentile queue lengths are used by transportation agencies to determine storage lengths necessary for adequate intersection operations. Synchro 9 was used to determine 95th percentile queue lengths and whether they are affected by upstream signals, exceed existing storage lengths, or are a result of volumes that exceed capacity. Table 7 identifies these intersection movements and their respective queue lengths.

Table 7: 95th Percentile Queues

East / West	North / South	Movement	95th % Queue (ft)
Herriman Boulevard / 12600 S	*Main Street*	WBL	#350
12600 S	*MVC NB*	WBT	#425
		WBR	300
		NBL	m75
		NBR	m25
12600 S	*MVC SB*	WBL	m125
		WBT	m75
Main Street	*5600 W*	WBL	#225
		NBL	100
13400 S	*5600 W / Rosecrest Road*	EBL	125
		WBL	#350
		NBR	100
		SBL	175
13400 S	*Morning Cloak Way / 5200 W*	WBT	#600
13400 S	*MVC SB*	WBL	m#300
		WBT	m100
		SBT	#500
		SBL	m100
		SBR	m200
Rosecrest Road	*MVC SB*	SWTL	m25 / 200

 # (95th percentile volume exceeds capacity. Queue may be longer.)

m (Volume for 95th percentile queue is metered by upstream signal.)

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& ASSOCIATES