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TECHNICAL MEMORANDUM

DATE:	May 25, 2022
TO:	HDR
FROM:	Parametrix
SUBJECT:	Existing and 2050 No Build Traffic and Safety Analysis
CC:	
PROJECT NUMBER:	S-R399(310) PIN 17523
PROJECT NAME:	Heber Valley Corridor EIS

INTRODUCTION

This memorandum documents the traffic and safety conditions for existing and 2050 No Build scenarios to support the Heber Valley Corridor EIS. The study area for the EIS is not officially defined at this time but generally focuses on areas within the Heber Valley. It is expected that the study area may be narrowed down during the EIS process as alternatives are developed. As such, some elements of this analysis encompass the entire Heber Valley. Other elements of the analysis focus only on key areas within the Heber Valley, such as major corridors or the Heber downtown.

This memorandum documents the data collected to analyze existing conditions, including traffic data and crash data. The traffic data is input into a traffic simulation program to develop measures of effectiveness for existing conditions. Then, a regional travel demand model is utilized to develop traffic volume forecasts for a 2050 horizon year. While preparing the regional travel demand model, the existing traffic data is used to calibrate the model and improve its accuracy for predicting future traffic volumes. Finally, the 2050 traffic forecasts are inserted into traffic simulation programs to compute 2050 measures of effectiveness. In this report, existing conditions generally represents traffic data from 2019.

DATA COLLECTION

Traffic data for the project were collected by the Utah Department of Transportation (UDOT) in July and August 2019. Traffic data was collected by video for turning movement counts, by roadway tubes for weekly ADT and vehicle classification counts, and by Bluetooth sensors for origin-destination counts and travel times.

Traffic Counts and Vehicle Classifications

Turning movement counts were conducted for weekday AM and PM peak periods at the following intersections:

1. US-40 (Main Street)/500 North
2. US-40 (Main Street)/Center Street
3. US-40 (Main Street)/100 South
4. US-40 (Main Street)/600 South
5. US-40 (Main Street)/US-189

Turning movement counts were collected during the weekday AM and PM peak periods over the following five days in 2019:

- Friday, July 26, 2019
- Sunday, July 28, 2019
- Wednesday, August 14, 2019
- Friday, August 16, 2019
- Sunday, August 18, 2019

Vehicle tube counts were collected for two, one-week periods in July and August 2019. The tube counts collected both vehicle volumes as well as vehicle classification. Tube counts were conducted at locations along US-40, SR-32, and US-189 near the extents of the Heber Valley. Additional tube count data was also collected on eight north-south streets in Heber City, including Main Street, between 300 South and 400 South. The tube count data for the Main Street location between 300 South and 400 South was accompanied by video recordings which helped to refine the accuracy of the tube count vehicle classification.

Bluetooth Origin/Destination and Travel Time Data

Travel time data along the corridor was analyzed using the UDOT's vehicle probe data to summarize average travel times and speeds along the corridor segments. Probe data represents anonymized Bluetooth information from vehicles passing a sensor. When a network of probe data sensors is temporarily setup in a study area, travel time between two points can be calculated based on the difference in times of when a Bluetooth address is detected by two sensors. The travel time segments from the UDOT vehicle probe data include:

A. US-40 From SR-32 to 500 North (southbound)
B. US-40 From 500 North to SR-32 (northbound)
C. Main St (US-40) From 500 North to US-189 (southbound)
D. Main St (US-40) From US-189 to 500 North (northbound)
E. US-189 From US-40 to SR-113 (southbound)
F. US-189 From SR-113 to US-40 (northbound)

Crash Data

Crash data for the most recently available three years of crash data (2016-2018) was obtained from the UDOT Traffic & Safety Division for the Heber Valley. Using three years of crash data represents a balance between normalizing the year-to-year fluctuations in crash patterns and avoiding data that is too old to accurately reflect current roadway and traffic conditions. Data were compiled and analyzed to better understand the safety trends and investigate potential mitigations. Results are presented in a subsequent section.

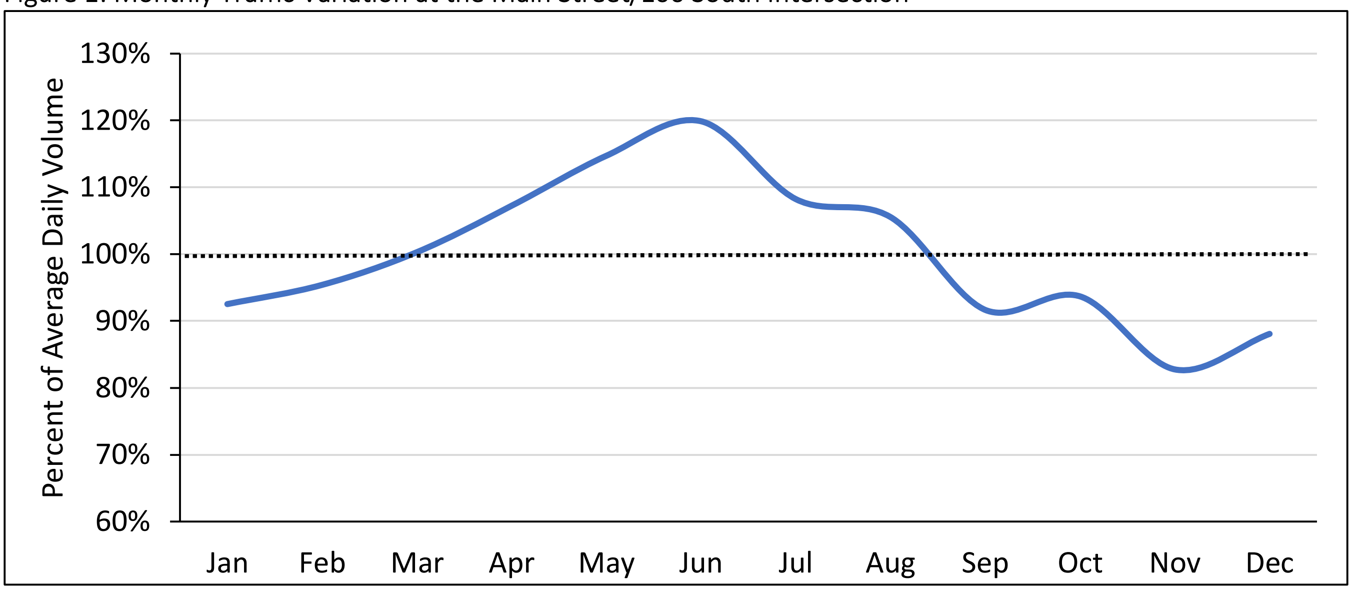
EXISTING CONDITIONS TRAFFIC ANALYSIS

Analysis Time Period

The Heber Valley is subject to seasonal traffic variation with higher traffic volumes in summer months than in winter months. Figure 1 shows the monthly variation of traffic volumes at the Main Street/100 South intersection according to UDOT Automated Traffic Signal Performance Measure (ATSPM) data. As can be seen in Figure 1, traffic volumes are above the annual average for five months of the year in downtown Heber City which is likely related to the high amount of summer recreation-related traffic in the area.

The *Highway Capacity Manual, Version 6* (HCM) states that selection of the appropriate analysis timeframe is a "compromise between providing adequate operations for every hour of the year and providing economic efficiency." In the case of the Heber Valley, choosing a timeframe to represent average seasonal conditions could result in a facility that is below capacity for five months of the years. Thus, the summer timeframe was selected for analysis since it would accommodate most traffic conditions experienced all year and is consistent with past studies conducted by UDOT.

Figure 1: Monthly Traffic Variation at the Main Street/100 South Intersection



Traffic Volumes

Analysis of the weekday peak hour is the typical practice for traffic analysis. The midweek count on Wednesday, August 14 was chosen as the starting point to develop the typical summer weekday traffic volume since it was observed to typically have higher traffic volumes than Monday or Tuesday but lower traffic volumes than Thursday or Friday. From the traffic data, a system-wide peak hour of 5:00 to 6:00 PM was identified as the peak hour of traffic volume for a weekday.

Next, to determine if these were representative of typical summer traffic conditions on Main Street, UDOT ATSPM data for the 100 South/Main Street intersection was gathered for several summer days including Wednesday, August 14. The weekday daily and PM peak hour intersection volumes from the ATSPM data were compared to determine the relative magnitude of August 14 volumes in the context of other summer days. Table 1 summarizes the total entering intersection volume for each time frame.

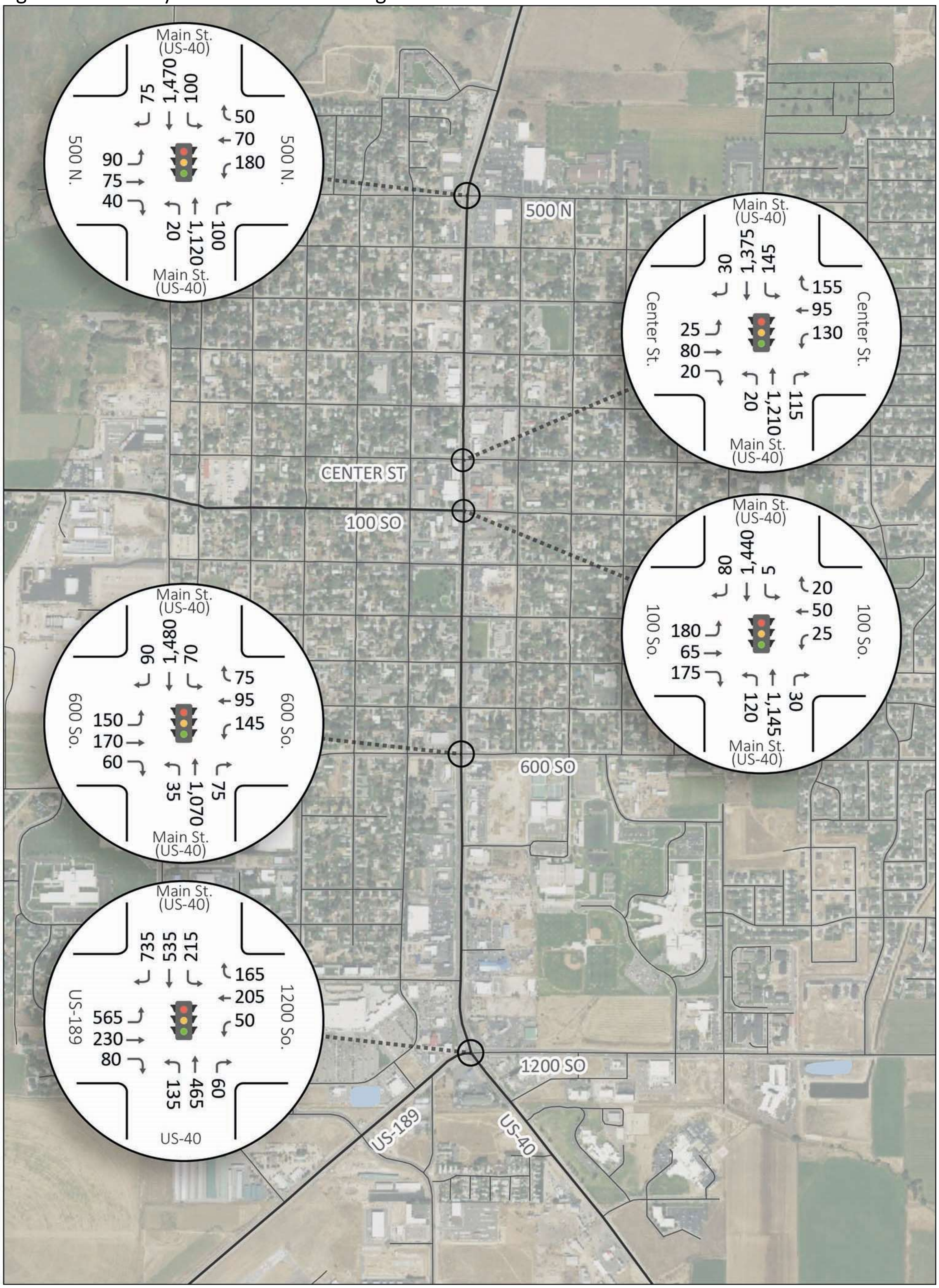
Table 1: UDOT ATSPM Traffic Volume Comparison at 100 South/Main Street

	Weekday Daily			Weekday PM Peak Hour		
Location	Volume	Volume Difference	Percent Difference	Volume	Volume Difference	Percent Difference
Wednesday, August 14, 2019	*32,368*	-	-	*2,481*	-	-
Thursday, June 20, 2019	36,585	4,217	13.0%	2,711	230	9.3%
Thursday, August 1, 2019	36,499	4,131	12.8%	2,496	15	0.6%
Wednesday, June 3, 2020	34,324	1,956	6.0%	2,641	160	6.4%
Thursday, June 18, 2020	36,604	4,236	13.1%	2,800	319	12.9%

As shown in Table 1, the August 2019 weekday had lower daily and weekday PM peak hour traffic volumes than the comparison weekdays in summer 2019 and summer 2020. Daily traffic volumes for the comparison dates were approximately six to 13 percent greater and weekday PM peak hour traffic volumes were approximately 0.5 to 13 percent higher than the August 2019 count date.

Since the August 2019 weekday intersection turning movement counts were lower than the average weekday volumes experienced on other summer weekdays, additional traffic volumes were added to the northbound through and southbound through movements counted along Main Street to better represent the typical summer weekday conditions. These added volumes resulted in an increase in weekday PM peak hour traffic volumes of approximately 15 percent at the Main Street/100 South intersection. The existing weekday PM peak hour traffic volumes are shown in Figure 2.

Figure 2: Weekday PM Peak Hour Turning Movement Volumes

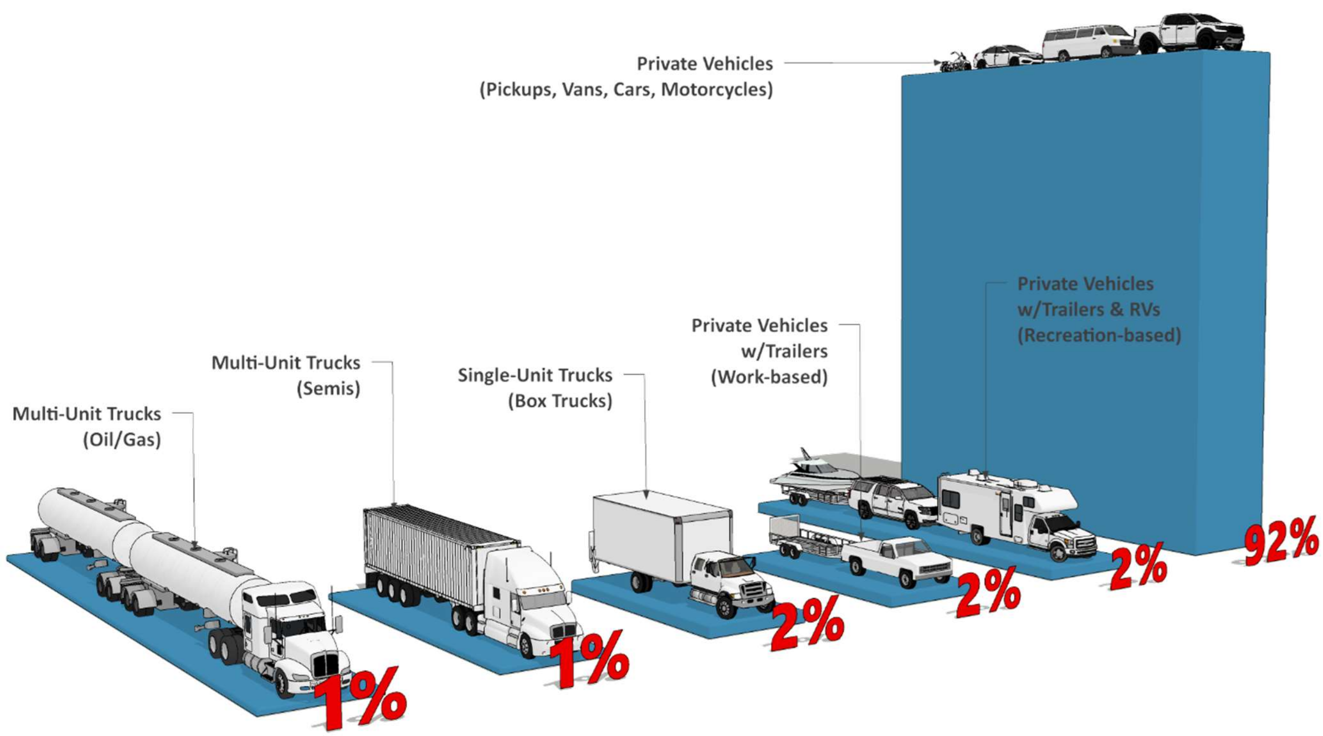


Vehicle Classification

Heber City Main Street experiences a unique traffic flow composition. US-40 is the primary route for oil/gas tanker trucks carrying crude oil from the Uinta Basin to refineries on the Wasatch Front. Likewise, there is a significant amount of recreation traffic on Main Street due to the proximity to several reservoirs, National Forests, and wilderness areas. These vehicles have an impact on traffic flow and the video accompanying the tube count on Main Street between 300 South and 400 South was manually reviewed to further separate vehicle classifications into more detail and better reflect actual conditions.

For example, oil/gas tanker trucks were separated from other multi-unit trucks into their own vehicle classification. Additionally, individual classifications were created for private vehicles towing trailers – whether recreation-based or work-based. These new vehicle classifications help account for how the unique lengths and operational characteristics of these vehicles affect traffic operations. The type and percentage of each vehicle class used in the traffic analysis for weekday PM peak hour conditions is shown in Figure 3.

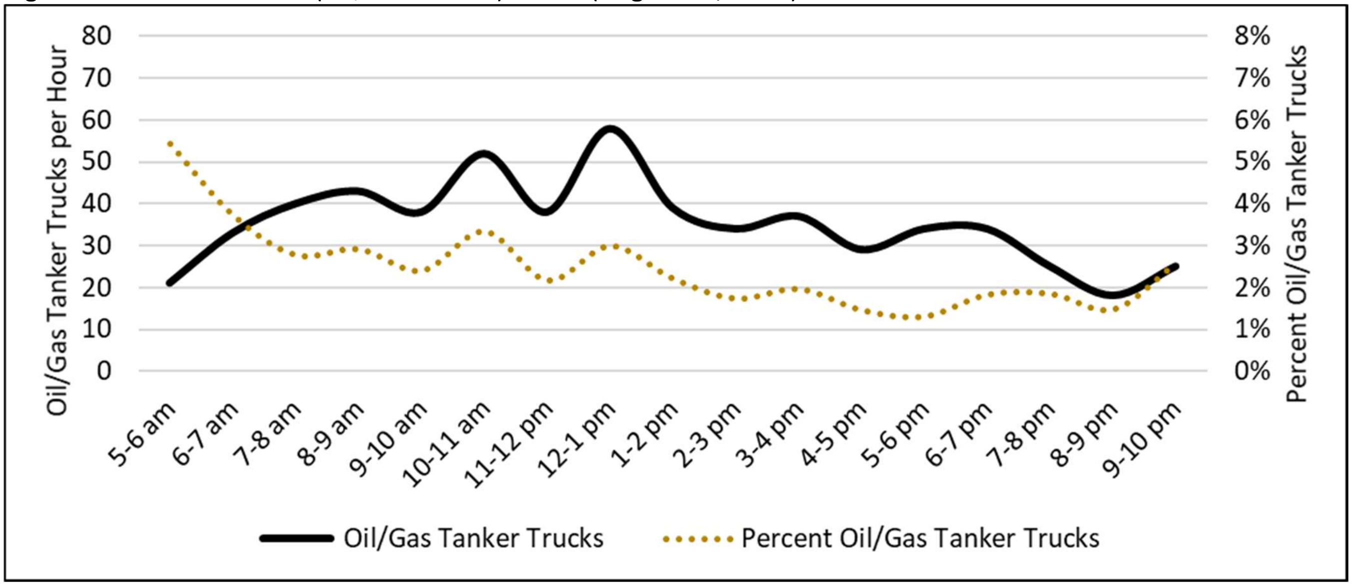
Figure 3: Weekday PM Peak Hour Vehicle Type and Frequency



The volume and percentage of oil/gas tanker trucks varies on Heber Main Street throughout the day. Figure 4 shows the hourly distribution of oil/gas tanker trucks counted from video analysis. Oil/gas tanker truck volumes are highest during the midday hours, approaching nearly 60 trucks per hour. The PM peak hour of 5:00 to 6:00 PM experiences about 30 to 40 oil/gas tanker trucks. Assuming a nominal amount of oil/gas tanker trucks occur outside the hours of the video analysis (before 5:00 AM and after 10:00 PM), the total oil/gas tanker trucks for a 24-hour period is estimated at 600 to 700 trucks.

Figure 4 also shows the percentage of oil/gas tanker trucks as compared to total traffic volumes. The percentage of oil/gas tanker trucks is lower during the PM peak hour of 5:00 to 6:00 PM due to both oil/gas tanker truck volumes being lower than mid-day as well as the influx of private vehicle commuter traffic. During very early morning hours (before 7:00 AM) the percentage of oil/gas tanker trucks can exceed five percent due to the relatively low number of total vehicles on the roadway.

Figure 4: Multi-Unit Truck (Oil/Gas Tanker) Count (August 14, 2019)



Travel Times

Data from the vehicle probe sensors were analyzed for non-holiday, midweek days during July and August 2019 for the weekday PM peak hour. For each of the weekdays analyzed (25 total days), the data provider summarized the travel times into a single average travel time for the peak hour. This allowed the travel times to be summarized on an hourly basis for each day. By summarizing data over the full peak hour, variances in the traffic flow that could be caused by signal cycle failures or faster-than-normal travel conditions prior to or following the heaviest peak congestion periods are averaged out over the entire peak hour. Table 2 shows each of the routes and the average weekday PM peak hour travel time and travel speed.

Table 2: Existing Bluetooth Probe Data Travel Times

Travel Time Route	Length (miles)	Weekday PM Peak Hour		Prevailing Posted Speed Limit (mph)
		Average Travel Time	Average Vehicle Speed (mph)	
A. **US-40** From SR-32 to 500 N	3.2	4:30	43	55
B. **US-40** From 500 N to SR-32	3.2	4:10	46	55
C. **Main St (US-40)** From 500 N to US-189	1.5	3:55	21	35
D. **Main St (US-40)** From US-189 to 500 N	1.5	2:50	30	35
E. **US-189** From US-40 to SR-113	4.1	4:50	51	60
F. **US-189** From SR-113 to US-40	4.1	4:40	54	60

As shown in Table 2, the travel time segments outside of the Heber City downtown area on the longer highway segments (Segments A, B, E, and F) typically have higher speeds than those located within the Heber City downtown area. Within the Heber City downtown area, average vehicle speeds along Main Street were shown to be approximately 21 mph traveling southbound and 30 mph traveling northbound.

However, along Main Street traveling northbound, it was found the north half of the corridor had average travel speeds of 44 mph while the southern portion had average travel speeds of 26 mph. Based on conversations with UDOT staff, the probe data along surface streets, such as on Heber City Main Street, which have a higher amount of vehicles starting and stopping due to traffic signals, turning maneuvers, and yielding to other vehicles or pedestrians, have less accuracy than free flow highway segments. Due to this, the probe data was used only for reference and not used for calibration to the travel times within the traffic analysis models.

Traffic Operations

Traffic operations were evaluated using a VISSIM microsimulation model of the area and measured using several performance metrics. An existing weekday PM peak hour VISSIM model was built for UDOT for a previous study and provided to the study team. The model was updated with existing signal timing, traffic volumes, and vehicle routing with the resulting calibrated model and outputs reviewed by the UDOT traffic operations group. Performance operations metrics from the existing weekday PM peak hour model used to evaluate traffic conditions include: vehicle travel times, intersection level of service (LOS), arterial LOS, and queuing. Additional detail about the VISSIM model calibration process can be found in the *Heber Valley Parkway EIS Existing Conditions Calibration Report*.

Vehicle Travel Times

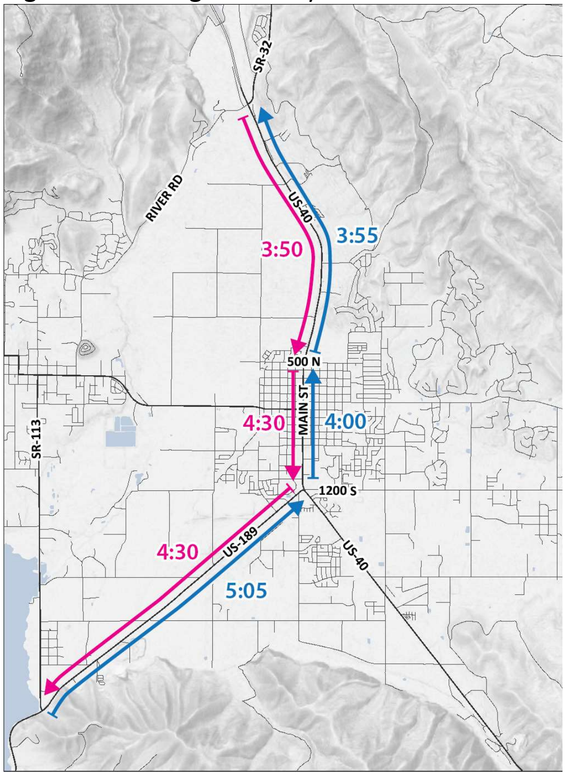
Vehicle travel times were measured throughout the VISSIM network along several northbound and southbound segments. The results of the travel time analysis are shown in Table 3.

Table 3: Existing Weekday PM Peak Hour Travel Time Comparison

Travel Time Segment	Length (miles)	Average Travel Time (mm:ss)	Average Travel Speed (mph)
A. **US-40** From SR-32 to 500 N	3.2	3:50	50
B. **US-40** From 500 N to SR-32	3.2	3:55	49
C. **Main St (US-40)** From 500 N to US-189	1.5	4:30	20
D. **Main St (US-40)** From US-189 to 500 N	1.5	4:00	22
E. **US-189** From US-40 to SR-113	4.1	4:30	56
F. **US-189** From SR-113 to US-40	4.1	5:05	50

As shown in Table 3, north of 500 North (segments A and B) and along US-189 (segments E and F), the average travel speed is close to the posted speed limit on these highway segments. In the downtown Heber City area, the travel speed is lower than the 35 mph posted speed limit. This is due to a combination of slowing caused by traffic signals, closely-spaced intersections, and traffic congestion along the corridor. The travel time results are visualized in Figure 5. It should be noted that these travel times should not be directly compared to the Bluetooth probe travel times presented in Table 2 due to the probe data sampling and data quality issues mentioned previously.

Figure 5: Existing Weekday PM Peak Hour Travel Time



Intersection LOS

Intersection LOS was measured using the node evaluation results from the VISSIM model. Intersection LOS was based on average vehicle delay at each traffic signal with the cutoff thresholds from the HCM used. Intersection LOS is described on an A through F scale with LOS A indicating freeflow conditions with minimal delay and LOS F indicating intersection failure. Typically, LOS A through LOS D represent acceptable operations during the peak hour. A summary of the average vehicle delay cutoff thresholds from the HCM are shown in Table 4. Existing weekday PM peak hour LOS for the signalized intersections from the VISSIM network is summarized in Table 5 and shown graphically in Figure 6.

As shown in Table 5, all of the traffic signals currently operate at LOS C or better during the existing weekday PM peak hour. The Main Street/100 South intersection has the highest amount of average vehicle delay with 30 seconds per vehicle of delay during the weekday PM peak hour.

Table 4: Intersection LOS Definition

LOS	Unsignalized Intersection Average Delay (sec/veh)[1]	Signalized Intersection Average Delay (sec/veh)
LOS A	0 -10	0 - 10
LOS B	10 - 15	10 – 20
LOS C	15 – 25	20 – 35
LOS D	25 - 35	35 – 55
LOS E	35 - 50	55 – 80
LOS F	> 50	> 80

1. Reported for the worst stop or yield-controlled approach
Source: HCM 6th Edition

Table 5: Existing Weekday PM Peak Hour Intersection LOS

Intersection	Average Vehicle Delay (sec/veh)	LOS
Main St (US-40)/500 N	17	LOS B
Main St (US-40)/Center St	24	LOS C
Main St (US-40)/100 S	30	LOS C
Main St (US-40)/600 S	18	LOS B
Main St (US-40)/US-189	29	LOS C
1300 S/US-189	10	LOS A

Arterial LOS

The arterial LOS was also evaluated on each of the street segments between the intersections. Using the segment speeds, LOS was calculated using HCM criteria. Similar to intersection LOS, arterial LOS is based on an A through F scale with thresholds based on the average speed of vehicles compared to the segment's free-flow speed or the posted speed limit. A summary of the LOS definitions is included in Table 6.

Table 6: Arterial LOS Definition

LOS	Base Free-Flow Speed or Speed Limit						
	25 mph	30 mph	35 mph	40 mph	45 mph	50 mph	55 mph
LOS A	>20	>24	>28	>32	>36	>40	>44
LOS B	>17	>20	>23	>27	>30	>34	>37
LOS C	>13	>15	>18	>20	>23	>25	>28
LOS D	>10	>12	>14	>16	>18	>20	>22
LOS E	>8	>9	>11	>12	>14	>15	>17
LOS F	<8	<9	<11	<12	<14	<15	<17

Source: HCM 6th Edition

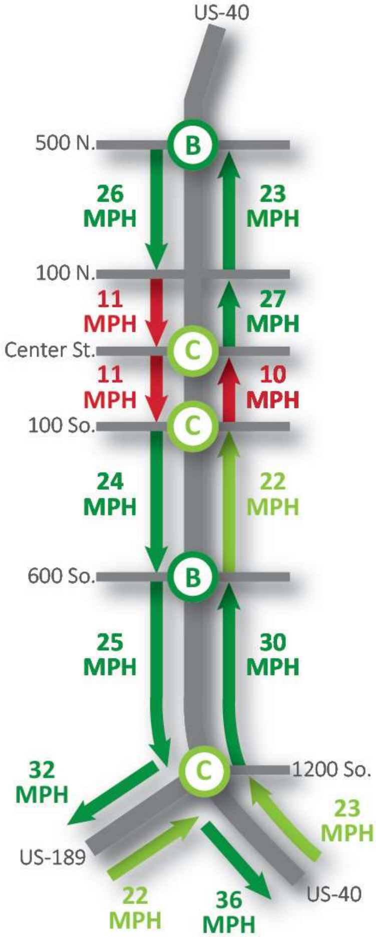
Table 7 and Figure 6 summarize arterial LOS results. As shown in Table 7, the southbound road segments from 500 North to Center Street and from Center Street to 100 South and the northbound segment from 100 South to Center Street currently operate at LOS F during the weekday PM peak hour conditions. This is consistent with observed traffic flow, where queueing and vehicle stoppages were highest in the areas surrounding the 100 South and Center Street intersections. Southbound vehicles were observed to queue back beyond the 100 South and Center Street traffic signals. The rolling queue would typically take two to three signal cycles to clear both intersections with queues of approximately 1,000 to 1,200 feet from 100 South observed. Similarly, for northbound vehicles, stopped and slow-moving vehicles cause the average speed on the 100 South to Center Street segment to operate at LOS F conditions. All other roadway segments currently operate at LOS C or better.

It should be noted that the average speeds reported for the arterial LOS differ from the speeds reported on the similar travel time segments due to differing starting and stopping points for the travel times and inclusions of travel time up to and through intersections.

Table 7: Existing Weekday PM Peak Hour Street Arterial LOS

Street Segment		Average Segment Speed (mph)	LOS
Southbound	US-40: From 500 N to 100 N	26	LOS B
	US-40: From 100 N to Center St	11	LOS F
	US-40: From Center St to 100 S	11	LOS F
	US-40: From 100 S to 600 S	24	LOS B
	US-40: From 600 S to US-189	25	LOS B
	US-40: South of US-189	36	LOS A
	US-189: Southwest of US-40	32	LOS B
Northbound	US-189: Northeast to US-40	22	LOS C
	US-40: North to US-189	23	LOS C
	US-40: From US-189 to 600 S	30	LOS A
	US-40: From 600 S to 100 S	22	LOS C
	US-40: From 100 S to Center St	10	LOS F
	US-40: From Center St to 100 N	27	LOS B
	US-40: From 100 N to 500 N	23	LOS B

Figure 6: Existing PM Peak Hour Intersection and Arterial LOS Summary



Intersection Queuing

In the VISSIM model, vehicle queues were measured at each intersection during the weekday PM peak hour. Consistent with observations from the field and from feedback from project stakeholders, the longest vehicle queues within the model were on southbound approaches. A summary of select significant queues at major intersections at the study intersections from the VISSIM model are shown in Figure 7.

Figure 7: Existing PM Peak Hour Intersection Queuing Summary

For drivers approaching the 500 North intersection in the southbound direction, the average queue is 275 feet with a 95th percentile queue of 375 feet during the weekday PM peak hour. At the 100 South intersection, average southbound queues were measured at 300 feet within the traffic model with the 95th percentile queuing backing through the Center Street intersection. Similarly, at the Center Street intersection, the average vehicle queue in the VISSIM model for the southbound through movement extended approximately 550 feet north of the intersection while the 95th percentile queue extended 750 feet from the intersection stop bar, approximately 1.5 blocks. All other queues within the microsimulation model were determined to typically fit within the designated storage pocket and would dissipate each signal cycle which was consistent with observed conditions in the field.

2050 NO BUILD TRAFFIC ANALYSIS

Traffic Forecasts

The Summit Wasatch travel demand model (v1 2020-06-10) was used for the purposes of generating 2050 No Build traffic forecasts for use in the VISSIM traffic simulation model. Recently, expanded from the previously developed Summit County travel model, the Summit Wasatch model appends Wasatch County to the model area. The model was released in the spring of 2020. During this analysis, amendments were proposed to the UDOT and Wasatch Rural Planning Organization (Wasatch RPO) long range plans. The model was updated accordingly to match the amended project lists. Additionally, some of the model refinements incorporated during this analysis were also adopted into future versions of the Summit Wasatch travel demand model.

The development of the Summit Wasatch model is multi-agency cooperative effort utilizing resources from the Mountainland Association of Governments (MAG), the Wasatch Front Regional Council (WFRC), UDOT, and Summit County. The model is a traditional four-step travel demand model consisting of trip generation, trip distribution, model split, and trip assignment. The following sections document the modeling process, including model revisions, methods and forecasts.

Model Refinements

Refinements were made to the Summit Wasatch model to better represent existing travel patterns and improve forecasts. Revisions were made to traffic analysis zones (TAZ), socioeconomic (SE) inputs, and highway network. The geographical subdivisions within a travel demand model are called TAZs. Each TAZ is populated with SE data representative for its area. SE data includes household, population, and employment estimates. These estimates are originally derived from population projections developed by the Governor's Office of Management and Budget (GOMB) and the Kem C. Gardener Policy Institute at the University of Utah. These agencies also specify county population control totals which identify the projected population for a county for a given forecast year. State of the practice travel demand modeling techniques keep model SE data revisions within the population control totals.

All model refinements discussed in this document were made in consultation with model developers from MAG, WFRC and UDOT and several refinements were adopted into future official versions of the Summit Wasatch model. The revised model is hereafter referred to as the "Heber Valley model" in this document. The following sub-sections document the refinements.

Traffic Analysis Zone (TAZ) Splits

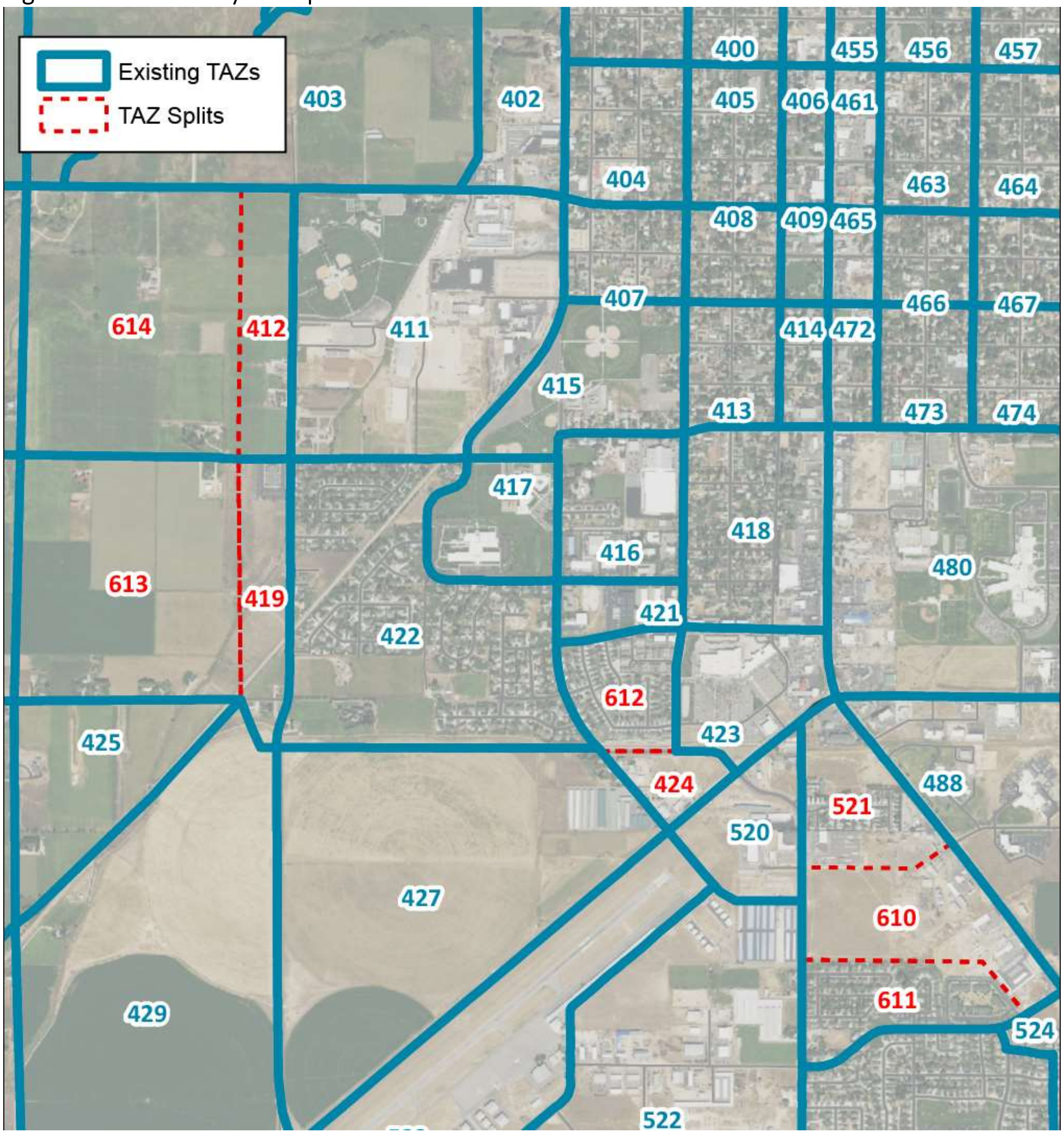
The geographical subdivisions within a travel demand model are called TAZs. Each TAZ is populated with SE data representative for its area. Travel demand model TAZ splits were performed within the Heber Valley to better capture geographic breaks in land uses and to enable appropriate loading of traffic from land uses onto the highway network. Figure 8 shows the TAZ splits that were performed. A total of four zones were split into a resulting nine traffic analysis zones.

Zones 412 and 419 were split along the alignment of the "Heber Bypass" a proposed western bypass as defined in the Wasatch RPO 2050 Regional Transportation Plan (RTP), resulting in new zones 613 and 614. These splits will help the model better translate land use assumptions to traffic forecasts for potential alternative scenarios that may follow the Heber Bypass alignment as defined in the RTP.

Zone 424 was split along 1300 South, resulting in new zone 612.

Zone 521 was split three ways, resulting in new zones 610 and 611. The northern split was intended to align with the eventual extension of 1500 South, which would bisect the zone. The second southern split was intended to separate the existing residential land use, which has access limited to the south and west, with no connectivity to the northern portions of the original zone.

Figure 8: Heber Valley TAZ Splits



Socioeconomic (SE) Revisions

For the purposes of the Heber Valley 2019 base year and 2050 forecast year model runs, SE inputs were largely unchanged from the source model. However, to accommodate the TAZ splits, the SE data for the impacted zones had to be redistributed in the new TAZ structure. Existing land use, SE growth, new TAZ geometries and developable land percentages were all used to inform the reallocation of the data. Table 8 and Table 9 show the original and reassigned SE data by TAZ for 2019 and 2050.

Table 8: 2019 Existing and Reassigned SE Data

Existing				Reassigned			
TAZ	Households	Population	Employment	TAZ	Households	Population	Employment
521	305	1,065	332	521	122	426	50
				610	0	0	265
				611	183	639	17
424	77	439	34	424	0	0	31
				612	77	439	3
419	12	33	0	419	2	6	0
				612	9	26	0
412	18	43	9	412	4	9	2
				614	14	35	7

Table 9: 2050 Existing and Reassigned SE Data

Existing				Reassigned			
TAZ	Households	Population	Employment	TAZ	Households	Population	Employment
521	546	1,749	820	521	181	555	328
				610	181	555	451
				611	183	639	41
424	184	1,010	73	424	0	0	65
				612	184	1,010	7
419	187	458	0	419	37	90	0
				612	150	368	0
412	175	374	9	412	35	299	2
				614	0	0	7

Network Revisions

Network revisions were completed to better represent existing and future No Build conditions. Changes were made to lanes, functional classification and some speed factors. Most notably, future projects affiliated with a planned western Heber Bypass were removed from the model to create the No Build condition. The planned western Bypass is likely to be analyzed as one build alternative in future analysis efforts but is not assumed to be the preferred alternative.

Lanes

Lane changes to the 2019 network consisted of the removal of the Eastern Bypass – a local road planned by Heber City which has not yet been constructed. Figure 9 shows the revised 2019 lanes of the modeled network.

Lanes changes to the 2050 network were made to create a No Build condition without the planned western Heber Bypass included in the base network. Several local agencies, including the Wasatch RPO, Heber City, and Wasatch County, have planned for the western Heber Bypass for many years. The Wasatch RPO 2050 RTP lists the Heber Bypass project in phase 2 (2031-2040). The project follows an alignment that extends 1300 South west from Industrial Parkway, past Southfield Road, then turns north parallel to Southfield to 550 North where then turns back east and reconnects to US-40 at 550 North. In order to represent the 2050 No Build condition, all of the model links for the Heber Bypass were turned off and the associated extension of 1300 South from Industrial Road to South Field Road was removed. Figure 10 shows the revised 2050 lanes of the modeled network. Aside from the Heber Bypass, all projects within the Heber Valley were assumed in the No Build scenario. These projects were coded into the base model network and originate from the UDOT and RPO long range plans and the proposed long range plan amendments discussed previously. Table 10 lists all of the projects assumed in the 2050 No Build scenario.

Figure 9: 2019 Revised Network by Lanes

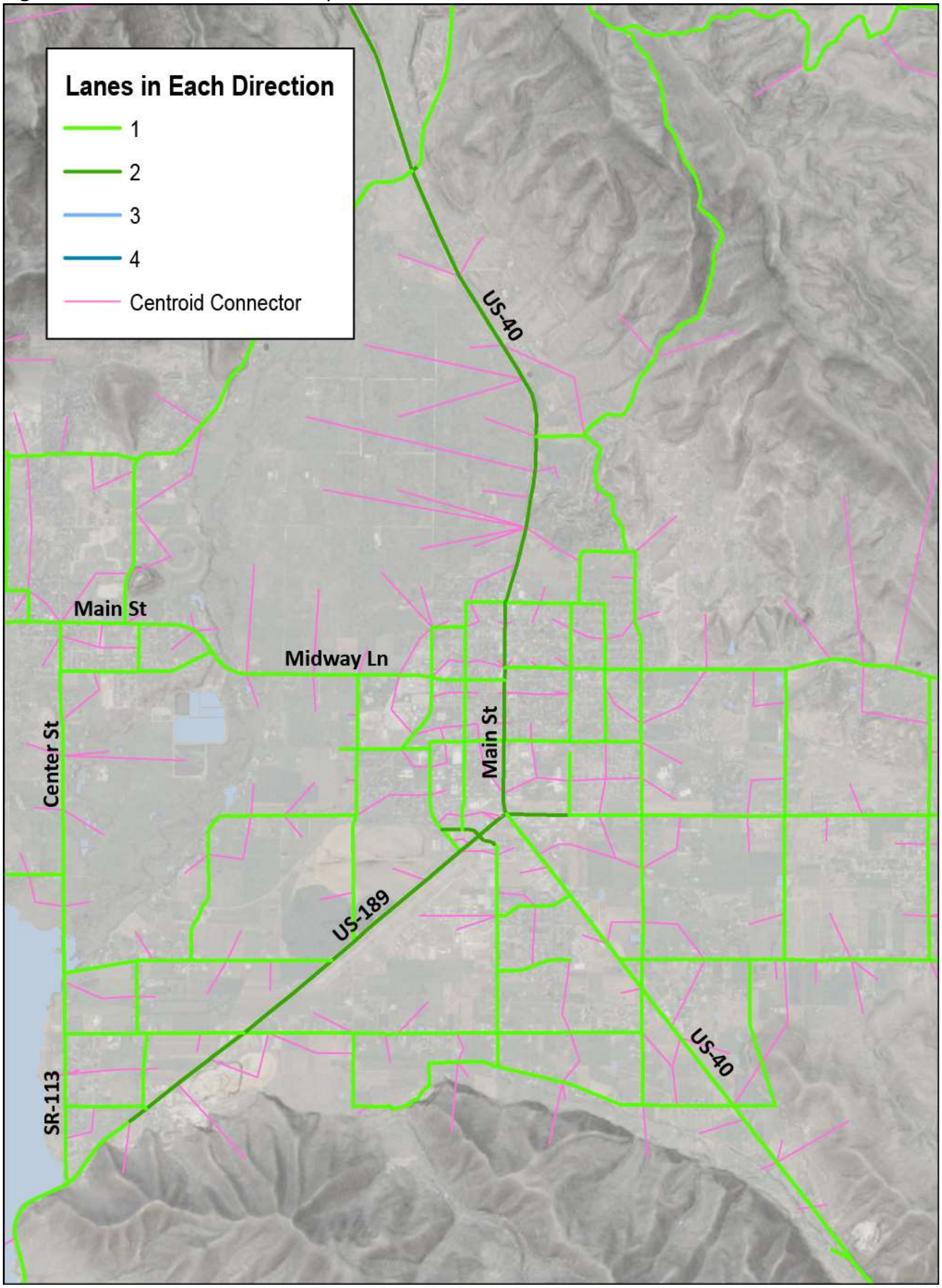


Figure 10: 2050 Revised Modeled Network by Lanes

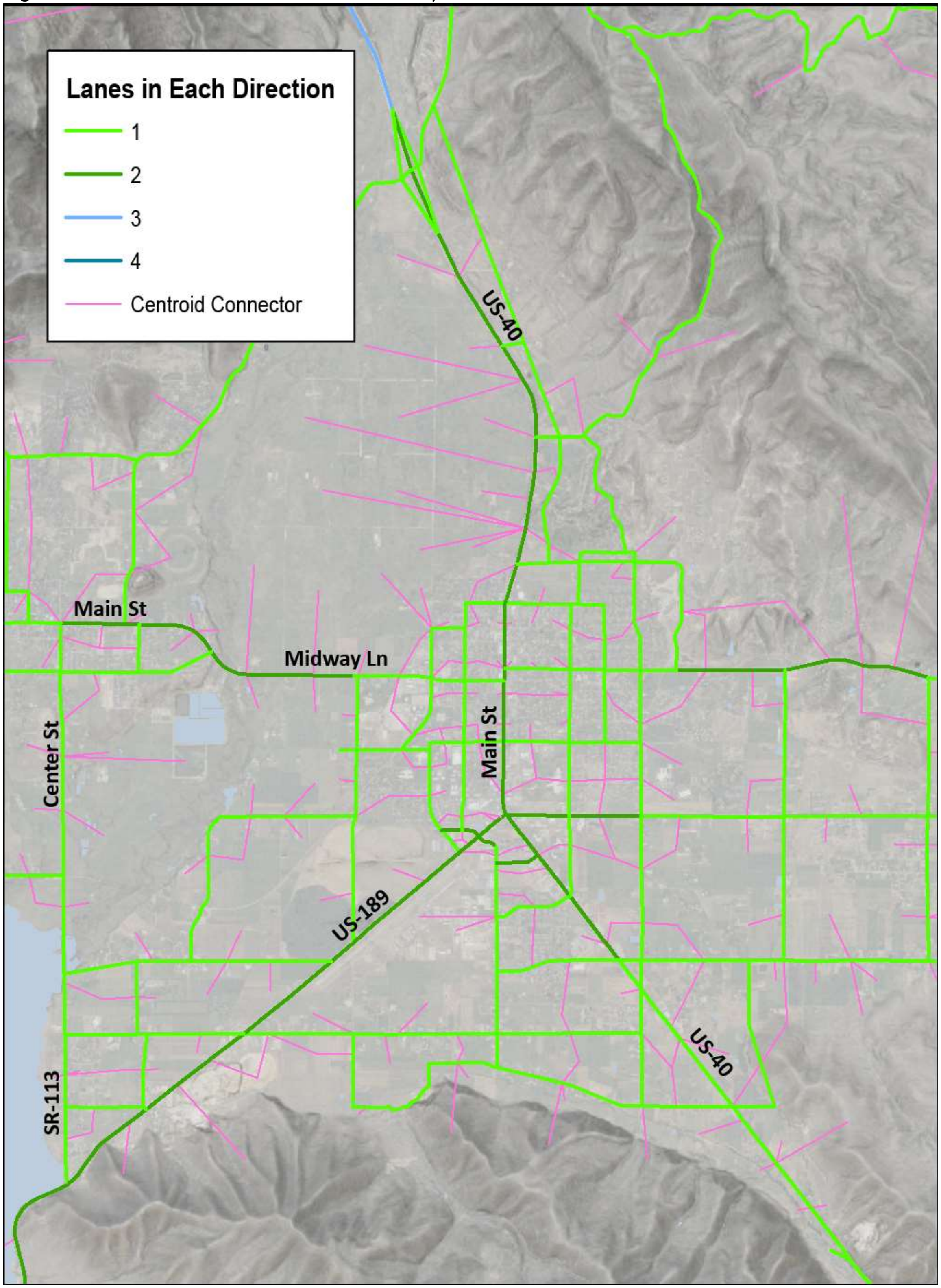


Table 10: Assumed Projects in the Heber Valley 2050 No Build Model

Name	Extent	Improvement
US-40/SR-32 Interchange	US-40 & SR-32	New Interchange
East Bypass	Sections A, B and C	New 2 & 3 lane road
400 East	Valley Hills Drive to Coyote Lane	New 4 lane road
North Village Connector	Coyote Lane to SR32	New 3 lane road
Center Street	1490 East to 3600 East	Widen to 5 lanes
Sleeping Indian Road	1200 South to 2400 East	New 3 lane road
500 East	US-40 to 1200 South	New road
500 East	700 South to 600 South	New road
Daniel Connector	Daniel RD to US-40	New 5 lane road
US-40	MP 18.4 to 19.8	Widen to 5 lanes
US-189	MP 22 to 28.87	Widen to 4 lanes
SR-113	MP 4.2 to 6.3	Widen to 5 lanes
SR-113	MP 6.2 to 7.1	Add turn lane
Cari/Burgi Lane	SR-222 to River Road	Add turn lane
River Road	US-40 to Midway Main Street	Add turn lane
Mitchie Lane	SR-113 to SR-113	Add turn lane
South Field Road	SR-113 to US-189	Add turn lane
650 South	Industrial Pkwy to South Field Rd	Add turn lane
600 South	Mill Road to Industrial Pkwy	Add turn lane
1200 South	600 East to Mill Road	Widen to 5 lanes
1200 South	Mill Road to Lake Creek	Add turn lane
Mill Road	1200 South to US-40	Add turn lane
Duke Lane	2400 South to US-40	Add turn lane
Center Creek	US-40 to Sleeping Indian Road	Add turn lane
Lake Creek	3600 East to Lake Pines	Add turn lane

Functional Classification

The changes made to the functional classification within the Heber Valley model were more substantial. Efforts to revise the functional classification in the 2019 model stemmed from creating consistency with local and UDOT functional classifications. Changes were made to also help calibrate the model to observed traffic patterns. Table 11 summarizes the functional class changes implemented in the 2019 Heber Valley model.

For 2050, the same functional classification changes for 2019 were carried forward. Additionally, Coyote Lane was changed from a major collector to a minor collector from Valley Hills Boulevard into the Jordanelle Ridge area. Given the mountainous terrain and slow speeds in the area, the roadway is not expected to function as a major collector in the future. Also, the Eastern Bypass road was changed from a major collector to a minor arterial to be consistent with Heber City roadway plans. Figure 11 and Figure 12 show the revised functional classification for 2019 and 2050 respectively.

Figure 11: 2019 Revised Modeled Functional Classification

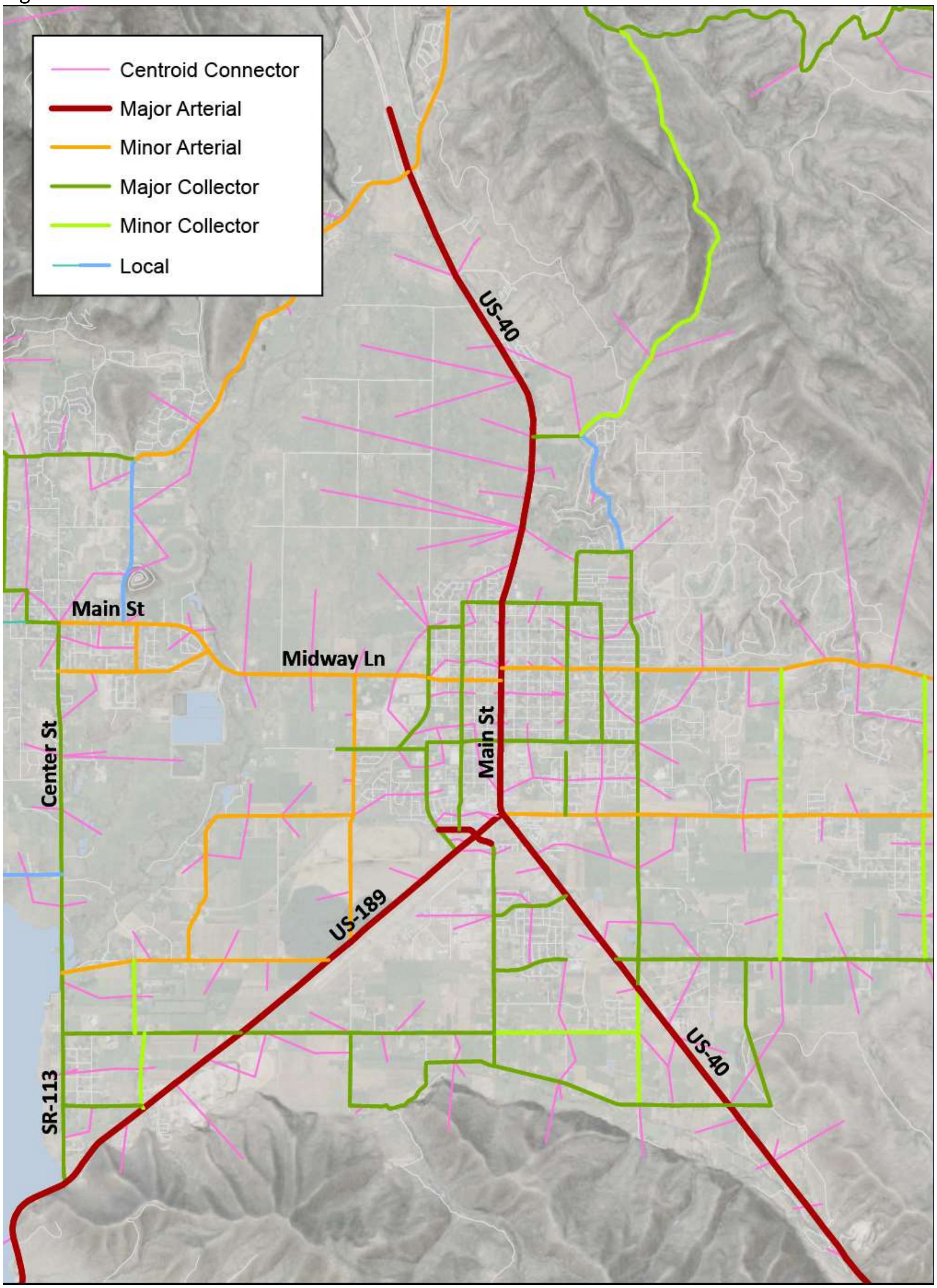


Figure 12: 2050 Revised Modeled Functional Classification

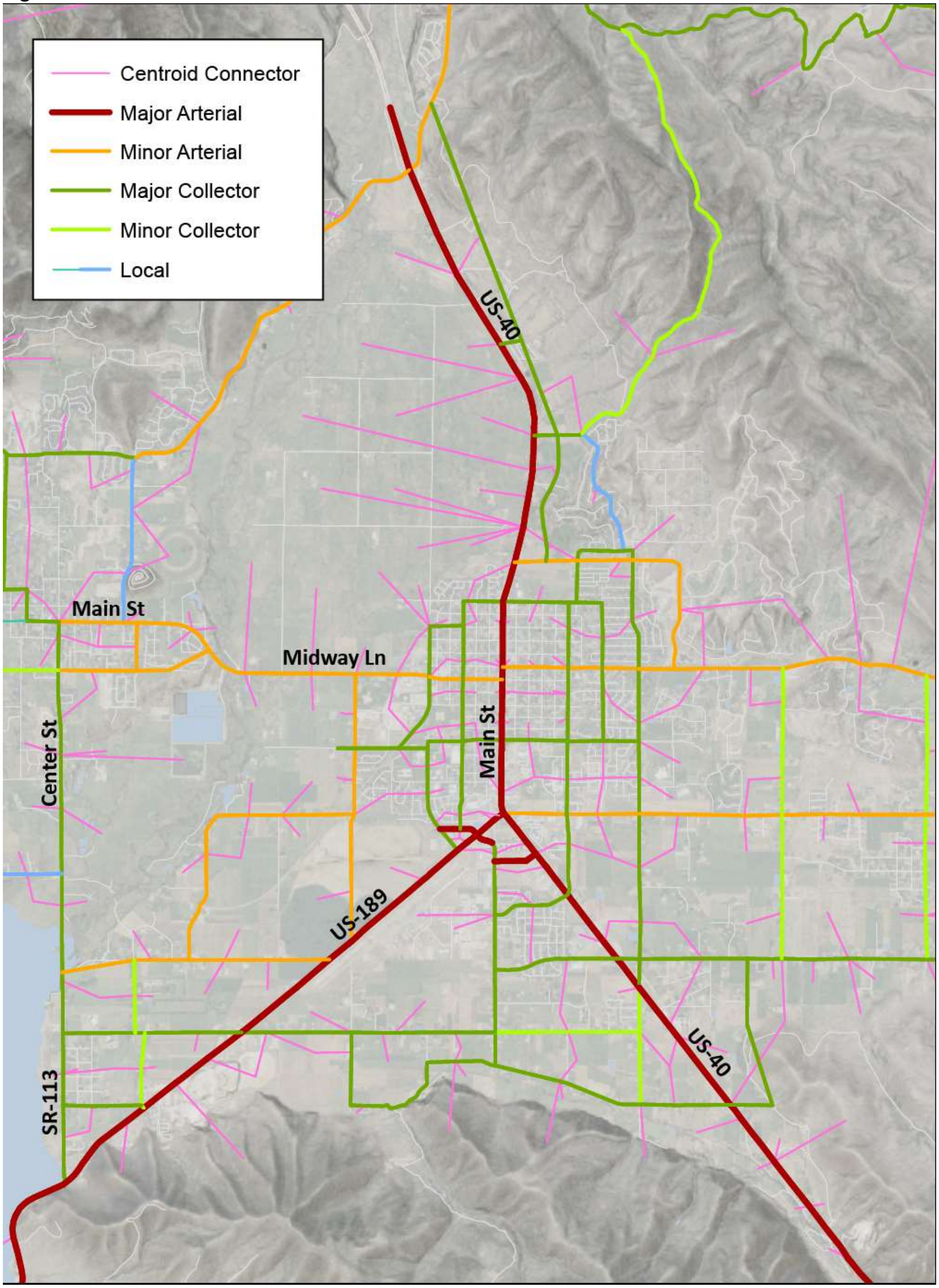


Table 11: 2019 Revised Functional Class

Roadway	Original Functional Class	New Functional Class
1200 East (Mill Rd) – US-40 to Center Street	Minor arterial	Major collector
Valley Hills Blvd – Coyote Ln to Valley Hills Dr	Minor arterial	Local
Coyote Ln – US-40 to Valley Hills Blvd	Minor arterial	Major collector
River Rd – Burgi Ln to US-40	Major arterial	Minor arterial
SR-32 – US-40 to Spring Hollow Rd	Major collector	Minor arterial

Speed Factors

In addition to lane and functional classification changes, speed factors were used to refine travel patterns within the model to better match observed conditions. The speed factors were applied on east-west routes through Daniel to decrease high traffic volumes shown in model results which were by-passing US-40 and US-189 to the north. In the model-defined rural areas (higher speeds), a factor of 0.70 was used, while in model-defined rural-transitioning areas, a factor of 0.75 was used. Additionally, speed factors of 0.7 were applied to model-defined rural areas of Coyote Lane and the future Mill Road alignment to account for the slower speeds likely to be experienced on these roads due to the meandering terrain. Figure 13 and Figure 14 shows the locations of the speed factor implementation.

Figure 13: Modeled Speed Factors near Daniel

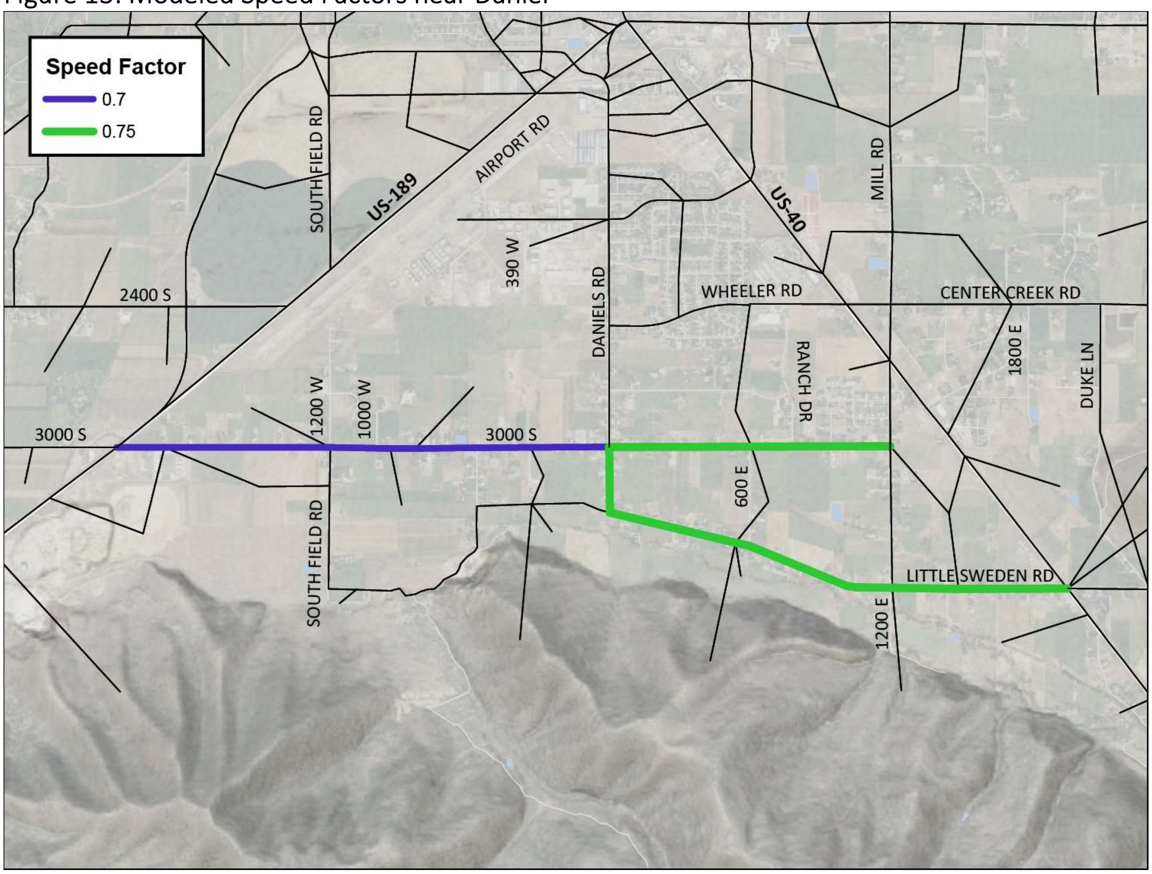
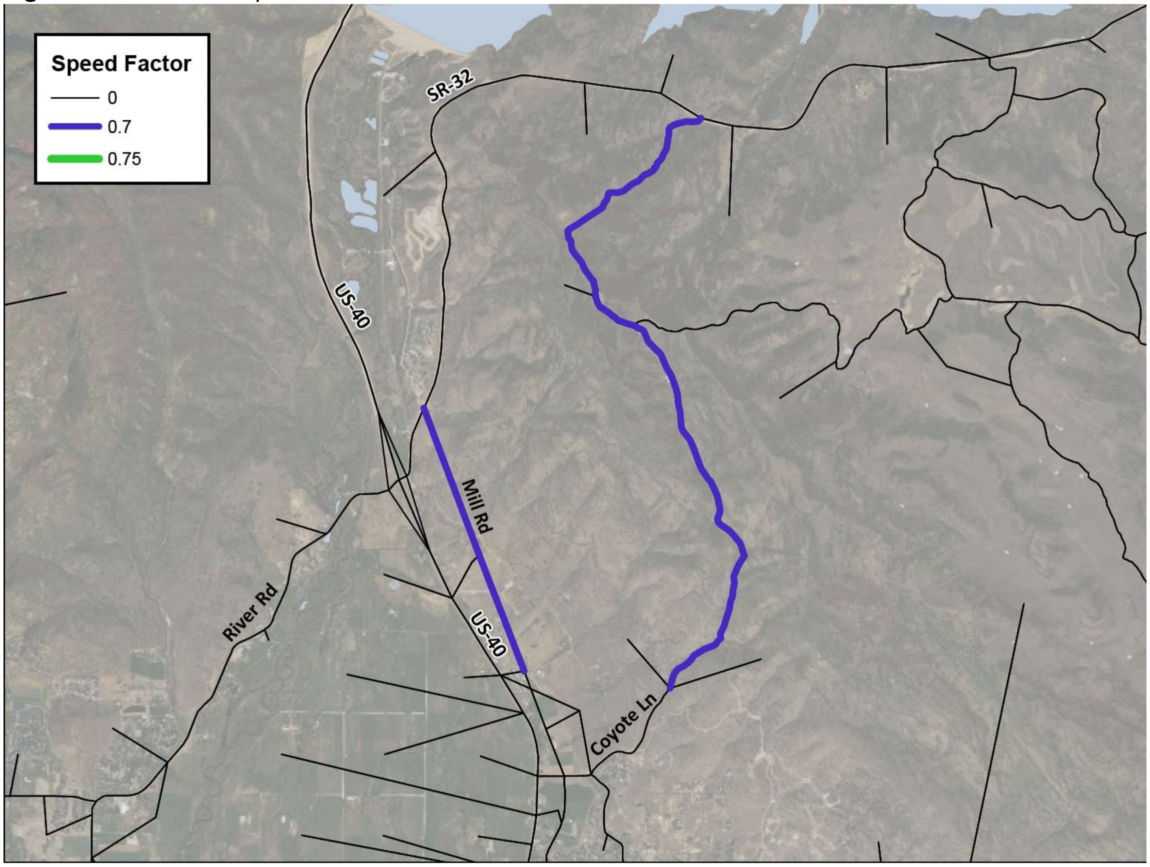


Figure 14: Modeled Speed Factors North of Heber



Model Results

The Summit Wasatch model contains various seasonal parameters to represent trip generation rates and travel patterns for different times of year. For 2019 base year and 2050 No Build forecasts, the "Fiscally Constrained Summer" run parameters were used to model typical weekday conditions consistent with the chosen analysis season discussed previously.

Root Mean Square Error

A root mean square error (RMSE) analysis was performed to measure the model against actual summer 2019 count data. RMSE is a frequently used measure of the differences between values predicted by a model and those observed. RMSE enables the error in predictions for various data points to be aggregated, and easily used for comparison and analysis purposes. This analysis was also used to test the effectiveness of the 2019 base year model. Figure 15 shows the equation used to calculate the RMSE.

Figure 15: Root Mean Squared Error Equation

$$RMSE = \frac{\sqrt{\frac{\sum\left[(x-y)^2\right]}{n}}}{\frac{\sum x}{n}}$$

where:

x = Ground count
y = Calibration volume
n = Number of observations

Figure 16 shows the RMSE for various traffic volume groupings within the Heber Valley for each model. Notable improvements to the Summit Wasatch model are seen with the Heber Valley model revisions when daily volumes are over 10,000 vehicles per day. These improvements appear to be at the tradeoff of lower volume segments between 5,000 and 10,000 vehicles per day having higher RMSE. However, the revised model is also performing better on segments below 5,000 vehicles per day. For reference, the Federal Highway Administration (FHWA) RMSE guidelines for corridors 10,000 to 25,000 and 25,000 to 50,000 daily trips is to remain below 25 and 22 percent respectively. The model revisions bring the RMSE for US-40, US-189 and other major corridors within the model well below these FHWA thresholds.

Figure 17 shows RMSE by corridor. Here it is evident that the model revisions were effective at reducing error on the primary highways in the analysis: US-40 and US-189. Improvements are also seen on 500 North and 600 South while error increases on less critical roads, such as SR-113, South Field Road and Industrial Parkway.

Figure 16: RMSE for Heber Valley Revised and Base Summit Wasatch models

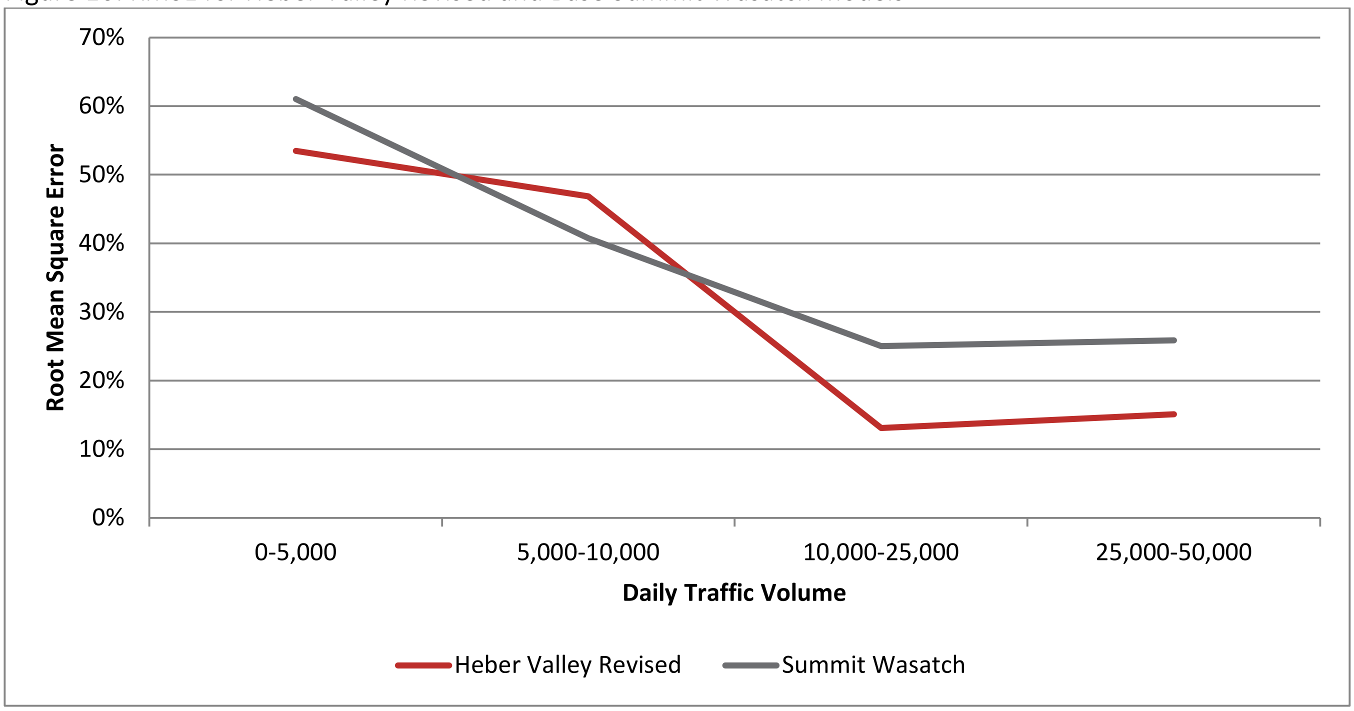
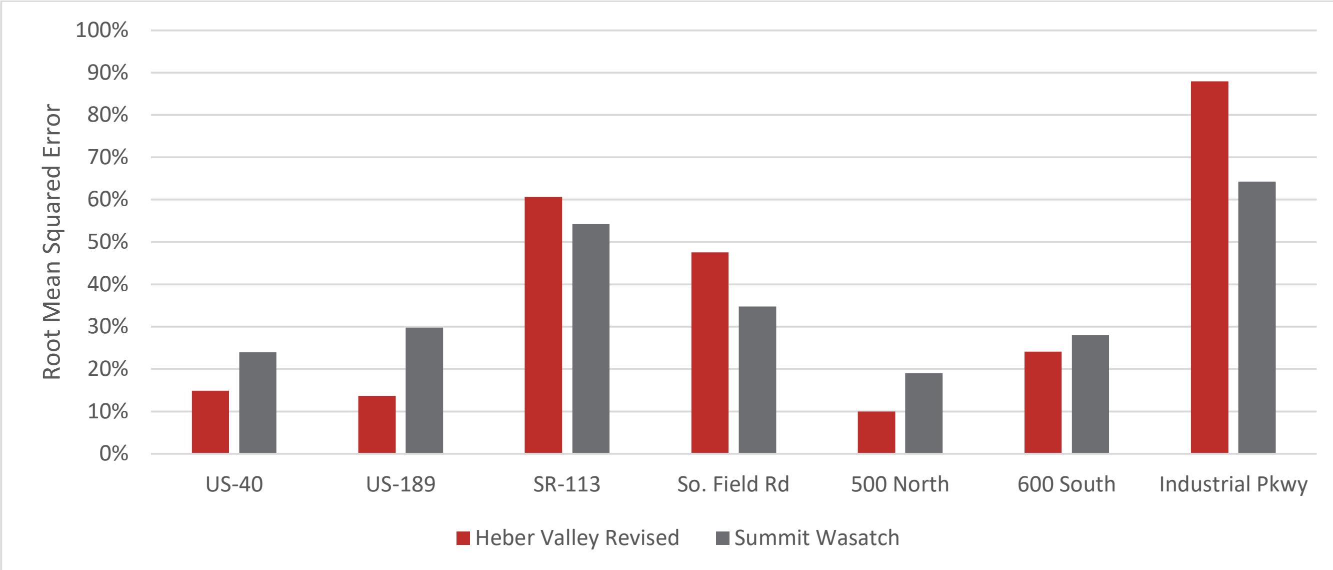


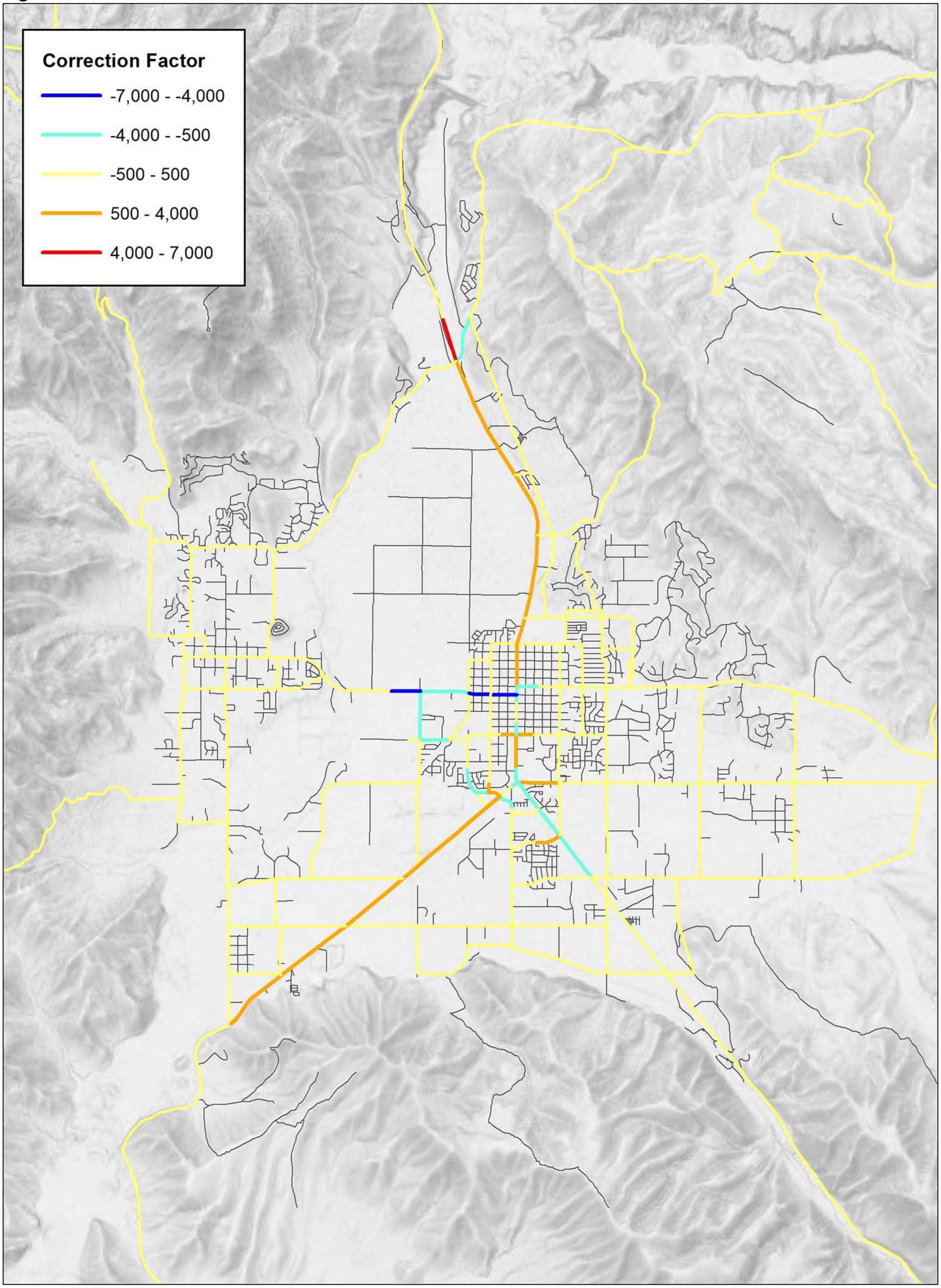
Figure 17: RMSE by Corridor



Base-Year Correction

A base-year correction was developed for model outputs to produce more accurate travel forecasts. The correction was created by comparing the difference between 2019 traffic counts and base year (2019) travel demand model volume outputs. The correction is then carried forward to the 2050 travel demand model outputs, with the assumption being that similar discrepancies will persist through forecast years of the model. Figure 18 shows the base-year corrections applied to generate the 2050 forecasts.

Figure 18: Correction Factor



2050 No Build Forecasts

2050 No Build conditions were modeled using the revised Heber Valley model and forecasts were produced using the correction factor. Figure 19 shows the 2050 Heber Valley No Build forecasts.

Figure 19: 2050 No Build Forecast Volumes

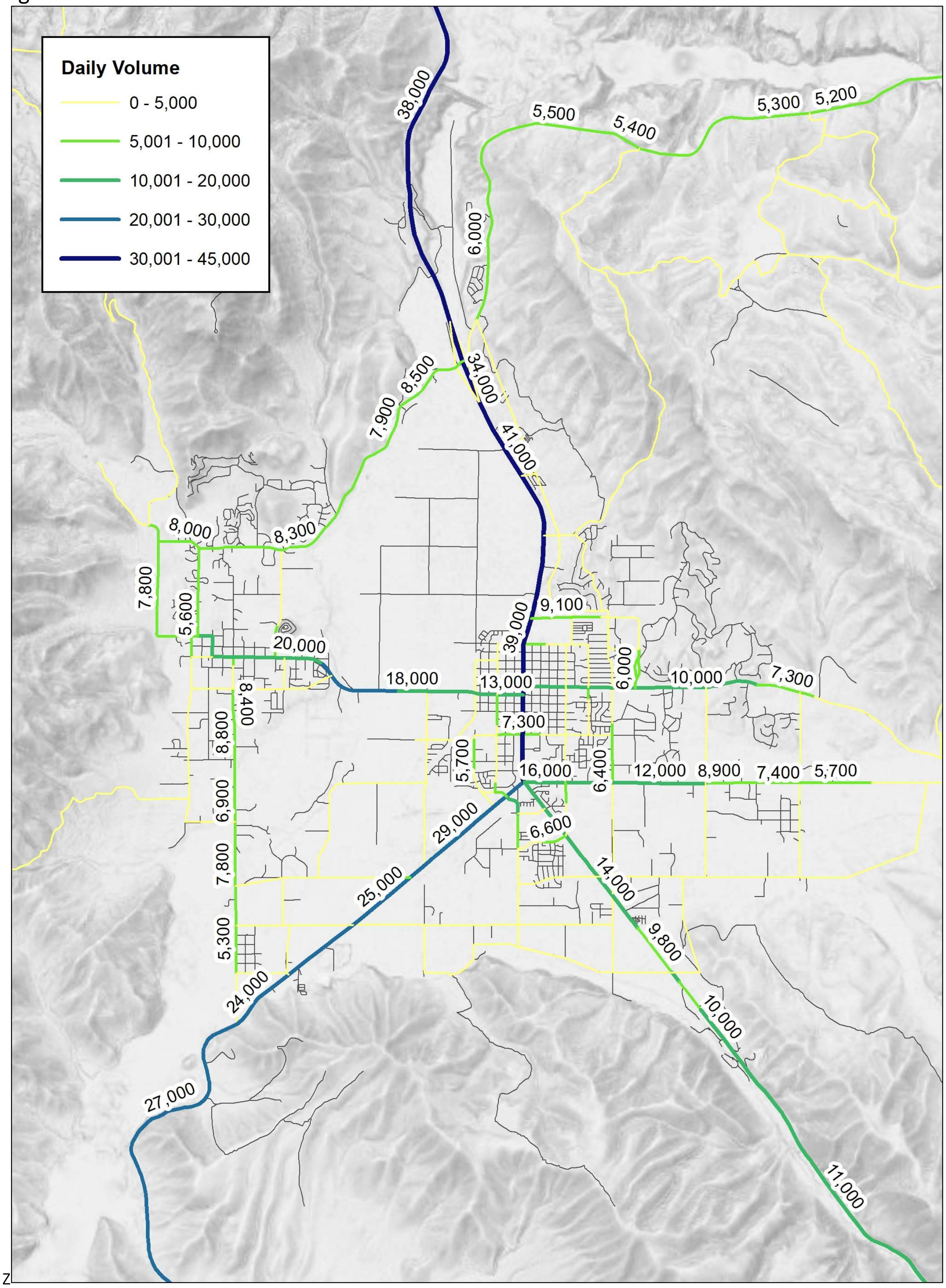
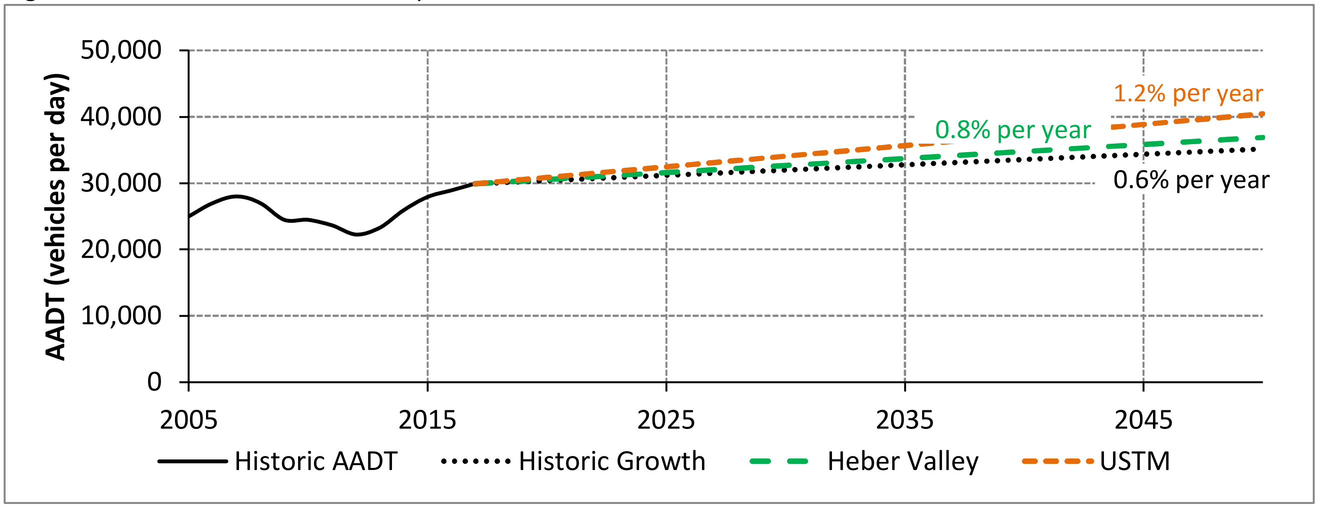


Figure 20 compares the forecasted growth on US-40 from the revised Heber Valley model with historic traffic volumes as well as forecasts produced by the Utah Statewide Travel Model (USTM). USTM is a travel demand model developed and maintained by UDOT and has been deployed for various planning purposes across the state for many years. Although USTM is not as refined in its representation of the Heber Valley, it offers a broader perspective on regional traffic flow through the Heber Valley.

This comparison also provides a check for the Heber Valley model since it is based on the newly-developed Summit Wasatch model which continues to be refined in partnership with this study. As seen in Figure 20, the growth rate from the Heber Valley model is in between USTM and the historic growth rate, with a rate of 0.8% per year. This indicates that the forecasts produced for this study are reasonably in line with other available tools and historic trends.

Figure 20: US-40 Growth Rate Comparisons



Jordanelle Ridge Sensitivity Test

The Jordanelle Ridge area is located to the northeast of downtown Heber City and represents a large, potential development area that was recently annexed into Heber City's jurisdiction. The Jordanelle Ridge area contains proposed land uses that could potentially be impactful to Heber Valley traffic patterns. The approved development plans show a great deal of residential growth. However, large developments such as this have historically shown much variability in how and when they are actually realized. This level of growth is difficult to incorporate into the travel model inputs and still remain within the county level control totals set by GOMB and the Kem C. Gardener Policy Institute. The control totals are important because they set a consistent standard for SE input development for travel models statewide. As such, only a modest amount of growth in the Jordanelle Ridge area is accounted for in the Heber Valley model.

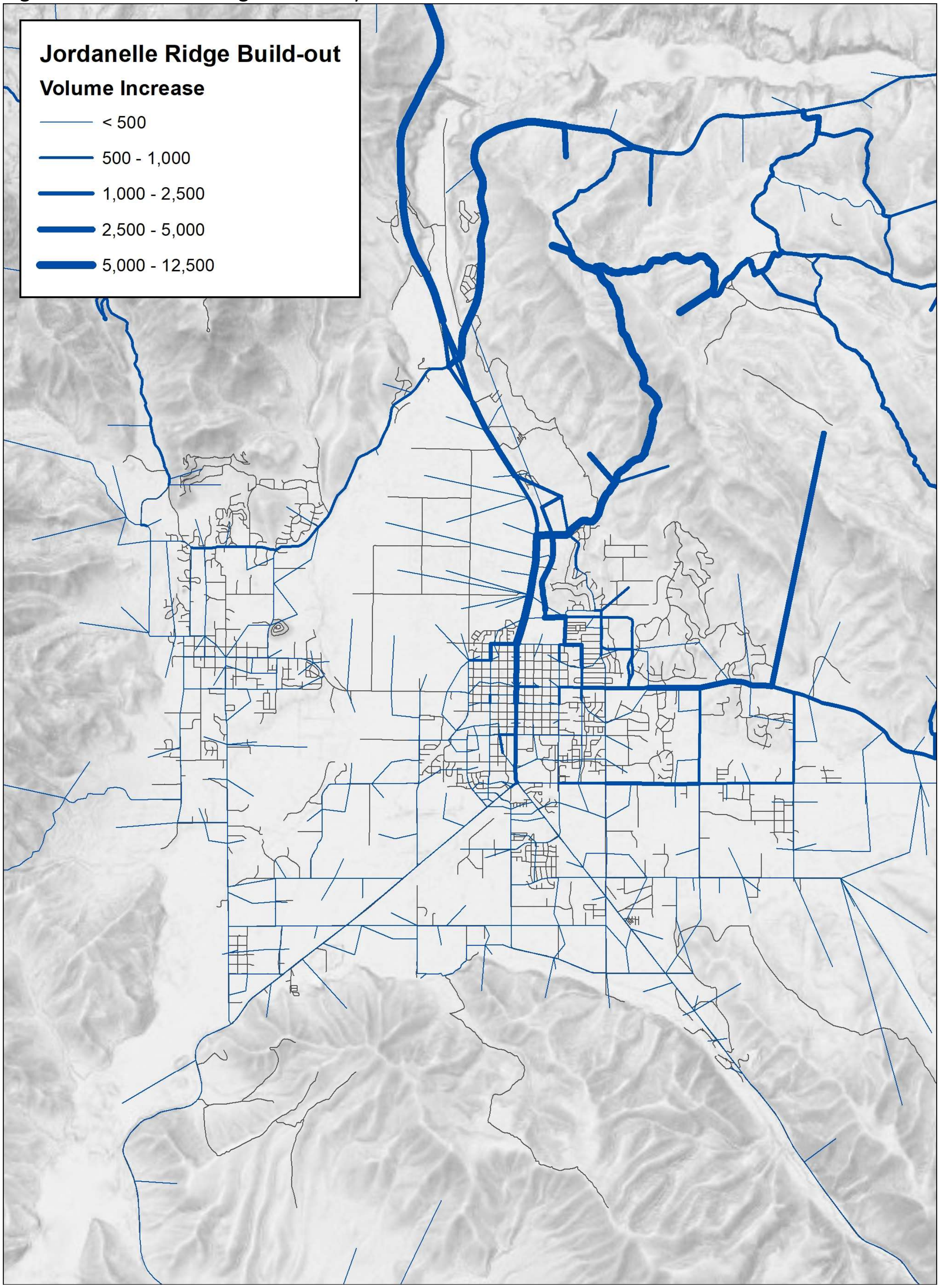
To help inform the question of what happens if Jordanelle Ridge builds out according to the current development plans, a sensitivity analysis was performed. A new set of SE inputs was developed and used in another 2050 No Build model run, with all other SE inputs held constant. The Jordanelle Ridge master development agreement was used to allocate additional households and population to TAZs in the area. Table 12 describes the changes incorporated into the SE inputs. It should be noted that these changes exceed the SE control totals established for Wasatch County.

Table 12: Jordanelle Ridge SE Imputs

TAZ	2050 No Build Heber Valley Model		Jordanelle Ridge Build-out	
	Households	**Population**	**Households**	**Population**
327	98	233	165	400
330	364	915	796	1,926
331	273	703	341	825
332	2	2	427	1,034
333	31	84	48	117
334	26	69	554	1,341
335	32	87	984	2,380
336	8	21	66	160
337	14	20	514	1,243
338	-	-	311	753
339	-	-	105	254
442	-	-	49	118
443	19	27	296	717
444	-	-	853	2,064
446	-	-	664	1,606
Total	867	2,161	6,172	14,937

Figure 21 shows the growth in trips of the Jordanelle Ridge model compared to the 2050 No Build Heber Valley model. The biggest increases are found on Coyote Lane, SR-32, on US-40 north of SR-32 and on US-40 between Coyote Lane and 500 North. In downtown Heber City, increases related to Jordanelle Ridge development are smaller with the range of growth on Main Street between three and 12 percent. It is impossible to know how and at what rate the Jordanelle Ridge area will develop. History indicates that big changes may be unlikely, but recent incorporation of the area into Heber City and the approved development agreement may suggest otherwise. In any case, Jordanelle Ridge will need to be monitored moving forward to ensure that any big shifts in land use can be accounted for.

Figure 21: Jordanelle Ridge Sensitivity Test Volume Increases



Traffic Volumes

The 2050 No Build weekday PM peak hour traffic volumes for downtown Heber City were developed using the existing 2019 weekday PM peak hour traffic volumes and the volume changes between the 2019 and 2050 travel demand model. The 2050 No Build traffic volumes are shown in Figure 22.

North of downtown Heber City, the 2008 UDOT/Wasatch County US-40 corridor agreement specifies that three additional traffic signals may be installed on US-40 in the future. The locations of these signals are at North College Way, Wasatch Commons Boulevard and Coyote Lane. Weekday PM peak hour traffic volumes for these potential signalized intersections were developed using previous traffic counts and growth in the travel demand model. The previous traffic counts were derived from PM peak hour traffic volumes documented in recent development traffic impact studies and a UDOT signal warrant analysis. Figure 23 shows the 2050 No Build traffic volumes for the three potential signalized intersections north of downtown Heber City.

Figure 22: 2050 No Build Weekday PM Peak Hour Traffic Volumes

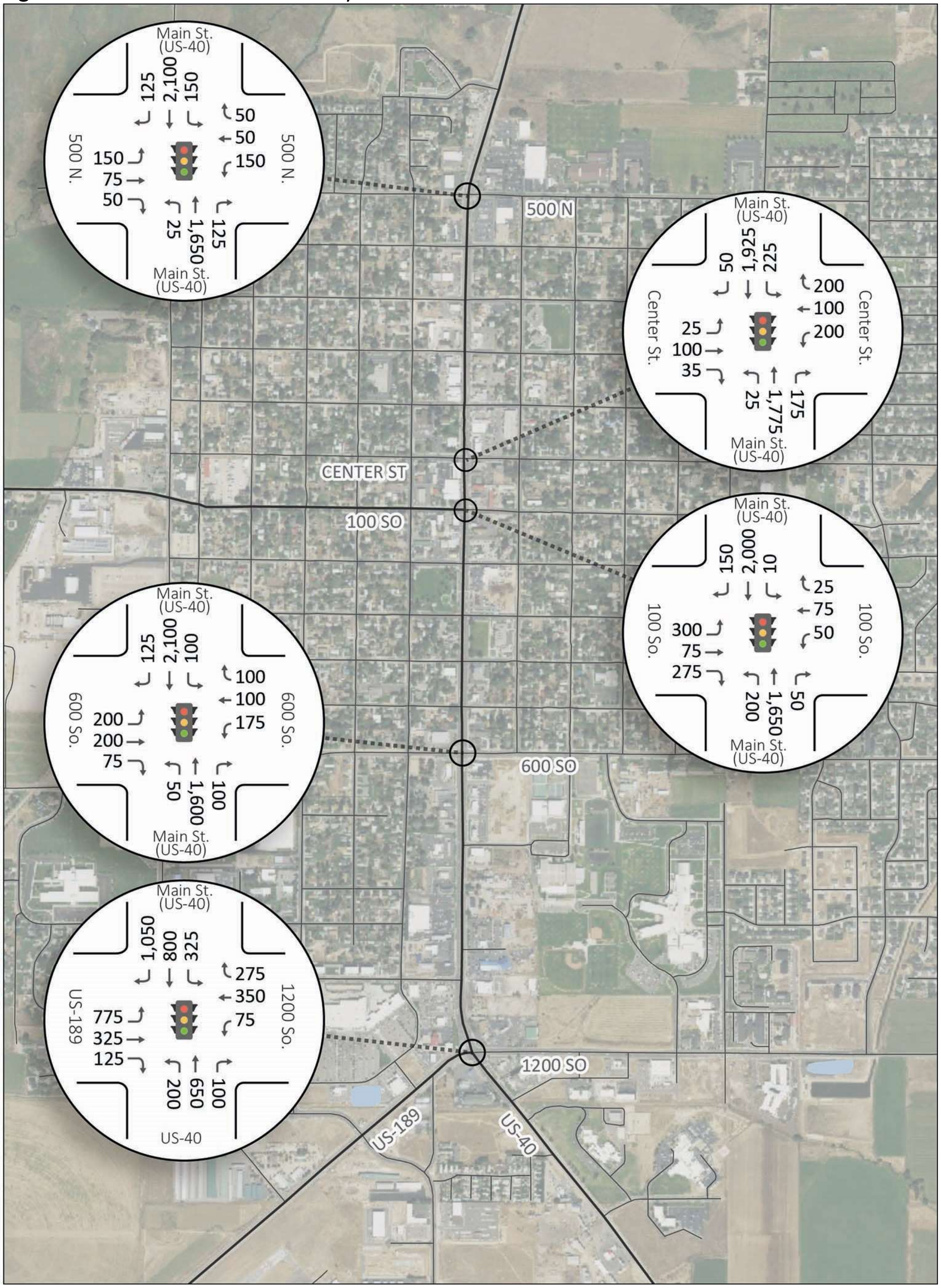


Figure 23: 2050 No Build Weekday PM Peak Hour Traffic Volumes North of Downtown Heber City

Traffic Operations

Traffic operations were evaluated using the same VISSIM microsimulation model which was used for the existing conditions analysis with updates to reflect the 2050 forecast weekday PM peak hour traffic volumes. Traffic signal timing along the corridor was also optimized. The same performance operations metrics used for the existing weekday PM peak hour model were used to evaluate 2050 No Build traffic conditions, including vehicle travel times, intersection LOS, and arterial LOS.

Vehicle Travel Times

Vehicle travel times were measured throughout the VISSIM network along several northbound and southbound segments. The effect of the three potential signalized intersections north of downtown Heber City were included in the travel times for the segment between SR-32 and 500 North for 2050 No Build. This was estimated by modeling the intersections in the traffic analysis program Synchro and adding the delay outputs from Synchro for the southbound and northbound movements to the respective southbound and northbound segment travel times. Synchro was used in favor of VISSM for these intersections because traffic operations outside of downtown Heber City are less complex due to greater signal spacing and less pedestrian activity. The results of the travel time analysis are shown in Table 13.

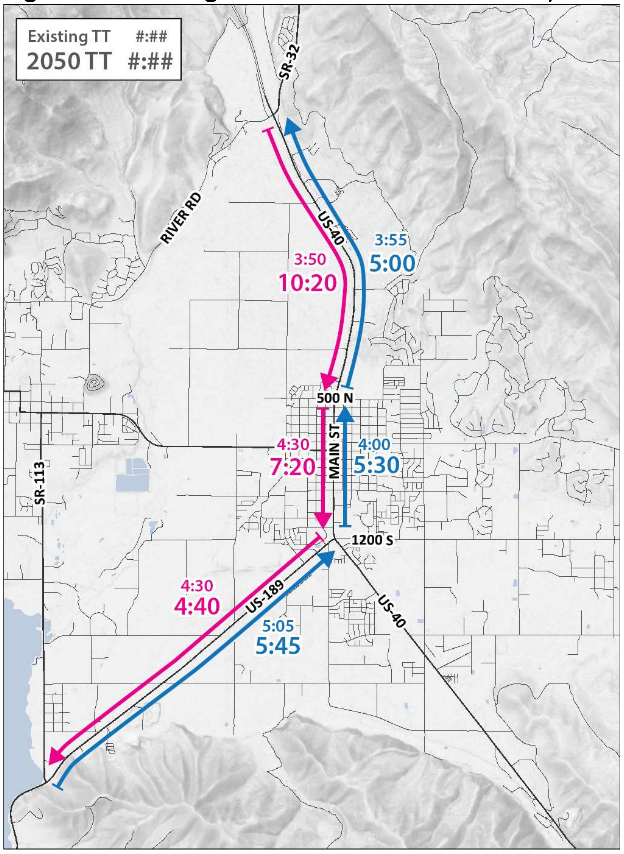
Table 13: Existing and 2050 No Build Weekday PM Peak Hour Travel Time Comparison

Travel Time Segment	Length (miles)	Existing		2050 No Build	
		Average Travel Time (mm:ss)	Average Travel Speed (mph)	Average Travel Time (mm:ss)	Average Travel Speed (mph)
A. **US-40** From SR-32 to 500 N	3.2	3:50	50	10:20	19
B. **US-40** From 500 N to SR-32	3.2	3:55	49	5:00	34
C. **Main St (US-40)** From 500 N to US-189	1.5	4:30	20	7:20	12
D. **Main St (US-40)** From US-189 to 500 N	1.5	4:00	22	5:30	16
E. **US-189** From US-40 to SR-113	4.1	4:30	56	4:40	43
F. **US-189** From SR-113 to US-40	4.1	5:05	50	5:45	44

As shown in Table 13, the average travel time for vehicles traveling southbound between SR-32 and 500 North (Segment A) is anticipated to increase by approximately 6 ½ minutes to 10:20 over the 3.2 mile segment. This is primarily caused by delay of vehicles at the 500 North intersection which is anticipated to be unable to handle the forecasted southbound demand volume. Additionally, drivers traveling southbound along Heber Main Street are anticipated to experience nearly three minutes of additional travel time, an increase of approximately 65 percent over existing conditions.

Along the remaining travel time segments, lesser increases in travel time are expected; however, it should be noted that many of these segments are not serving the full forecasted volume demand due to the overcapacity conditions at the 500 North intersection. In other words, the 500 North intersection is a bottleneck in the traffic simulation model limiting the number of southbound vehicles that can proceed through to other downtown intersections. Finally, a small decrease in travel time is experienced for northbound US-40 from 500 North to SR-32. This is primarily due to the planned US-40/SR-32 interchange which eliminates signal delay for vehicles crossing SR-32 on US-40.

Figure 24: Existing and 2050 No Build Weekday PM Peak Hour Travel Time



Intersection LOS

Intersection LOS was analyzed for each of the intersections using the same methodology as used for the existing conditions. The 2050 No Build weekday PM peak hour intersection LOS results are compared to existing LOS results in Table 14.

As shown in Table 14, during 2050 weekday PM peak hour No Build conditions, the 500 North, Center Street, 100 South, 600 South, and US-189 intersections on US-40 are anticipated to operate at either LOS E or LOS F. At these intersections, it is likely that it would take drivers multiple signal cycles to make it through the intersection.

Table 14: Existing and 2050 No Build Weekday PM Peak Hour Intersection LOS

	Existing		2050 No Build	
Intersection	Average Vehicle Delay (sec/veh)	LOS	Average Vehicle Delay (sec/veh)	LOS
Main St (US-40)/500 N	17	LOS B	>100	LOS F
Main St (US-40)/Center St	24	LOS C	59	LOS E
Main St (US-40)/100 S	30	LOS C	>100	LOS F
Main St (US-40)/600 S	18	LOS B	>100	LOS F
Main St (US-40)/US-189	29	LOS C	59	LOS E
1300 S/US-189	10	LOS A	22	LOS C

Arterial LOS

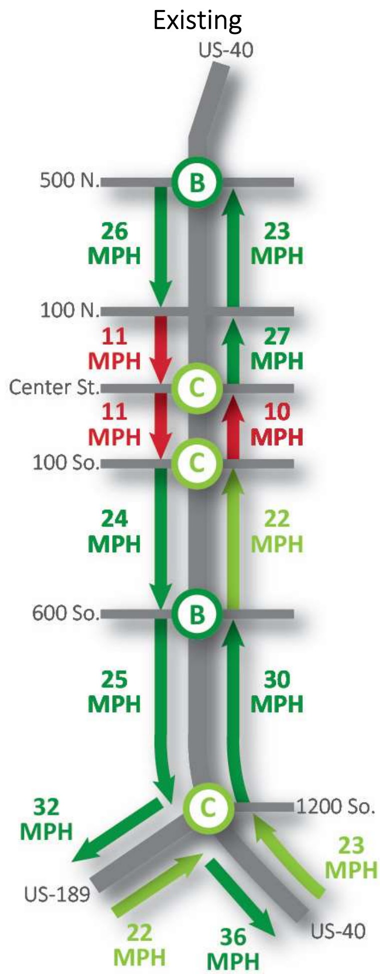
The arterial LOS for the 2050 weekday PM peak hour No Build conditions was analyzed using the same methods used for the existing conditions. The results of the 2050 No Build, along with the existing conditions for comparison, are shown in Table 15.

As shown in Table 15, during the 2050 No Build, the southbound segments of SR-32 to 500 North, 500 North to Center Street, and Center Street to 100 South are all anticipated to operate at LOS E or LOS F. Between SR-32 and Center Street, the average speed for southbound drivers is anticipated to be eight to nine mph over the approximately 3.7 mile segment due to the extreme amount of congestion due to the overcapacity conditions observed at 500 North intersection as well as the Center Street and 100 South intersection. Figure 25 summarizes the existing and 2050 No Build intersection and arterial LOS.

Table 15: Existing and 2050 No Build Weekday PM Peak Hour Arterial LOS

		Existing		2050 No Build	
Street Segment		Average Segment Speed (mph)	LOS	Average Segment Speed (mph)	LOS
Southbound	US-40: From 500 N to 100 N	26	LOS B	9	LOS F
	US-40: From 100 N to Center St	11	LOS F	8	LOS F
	US-40: From Center St to 100 S	11	LOS F	12	LOS E
	US-40: From 100 S to 600 S	24	LOS B	17	LOS D
	US-40: From 600 S to US-189	25	LOS B	22	LOS C
	US-40: South of US-189	36	LOS A	36	LOS A
	US-189: Southwest of US-40	32	LOS B	26	LOS C
Northbound	US-189: Northeast to US-40	22	LOS C	17	LOS D
	US-40: North to US-189	23	LOS C	17	LOS D
	US-40: From US-189 to 600 S	30	LOS A	25	LOS B
	US-40: From 600 S to 100 S	22	LOS C	15	LOS D
	US-40: From 100 S to Center St	10	LOS F	13	LOS E
	US-40: From Center St to 100 N	27	LOS B	26	LOS B
	US-40: From 100 N to 500 N	23	LOS B	26	LOS B

Figure 25: Existing and 2050 No Build Weekday PM Peak Hour Intersection and Arterial LOS Summary



Intersection Queuing

Vehicle queues were measured at intersections during the weekday PM peak hour during the 2050 No Build conditions. A large backup of southbound vehicles US-40 occurs because Main Street intersections are unable to meet the forecasted vehicle demand. Average and 95th percentile vehicle queues as measured in the VISSIM model for movements at key study intersections are shown in Figure 26.

Figure 26: 2050 No Build PM Peak Hour Intersection Queuing Summary

At 500 North, a 95th percentile vehicle queue of over two miles long is expected during the weekday PM peak hour with an average vehicle queue greater than 6,500 feet. The speed limit transitions from 55 mph to 35 mph approximately 1,110 feet north of the 500 North intersection which could result in drivers traveling on the 55 mph segment of the roadway to approach a stopped queue during peak conditions. At Center Street, the average southbound vehicle queue is anticipated to be 2,400 feet which would spill back to the 500 North intersection. At the 100 South intersection, average vehicle queues are anticipated to spill into the Center Street intersection. Additionally, the eastbound queue is expected to be greater than 2,500 feet. Consistent with the intersection LOS results, these intersections are expected to have inadequate capacity to handle project volumes and queues would result in drivers waiting multiple cycles to clear intersections.

SAFETY

Crash analysis was conducted with the most recently available three years of crash data (2016-2018) from the UDOT Traffic & Safety Division for the Heber Valley. There were approximately 1,000 total crashes over the three-year period, with four fatal crashes, and 36 serious injury crashes. There were 59 crashes involving a commercial motor vehicle which accounted for 5.8 percent of total crashes. Table 16 summarizes crash statistics for the Heber Valley.

Table 16: Heber Valley Crashes Summary 2016-2018

	Total Crashes	Fatal	Serious Injury	Commercial Motor Vehicle-Related	% Commercial Motor Vehicle-Related
2016	324	1	9	18	5.6%
2017	356	1	11	22	6.2%
2018	331	2	16	19	5.7%
Total	1,011	4	36	59	5.8%

Crash Concentrations

Figure 27 and Figure 28 show crash frequency and clustering across the Heber Valley. Figure 27 shows crashes valley-wide and Figure 28 shows crashes on Heber Main Street. As shown in Figure 27, crashes within the valley cluster along Main Street, generally in the area from US-40/US-189 to 500 North. Figure 28 shows a closer view of Heber Main Street, in which several crash clusters can be identified, at the 100 South intersection, 600 South intersection, and US-40/US-189 intersections.

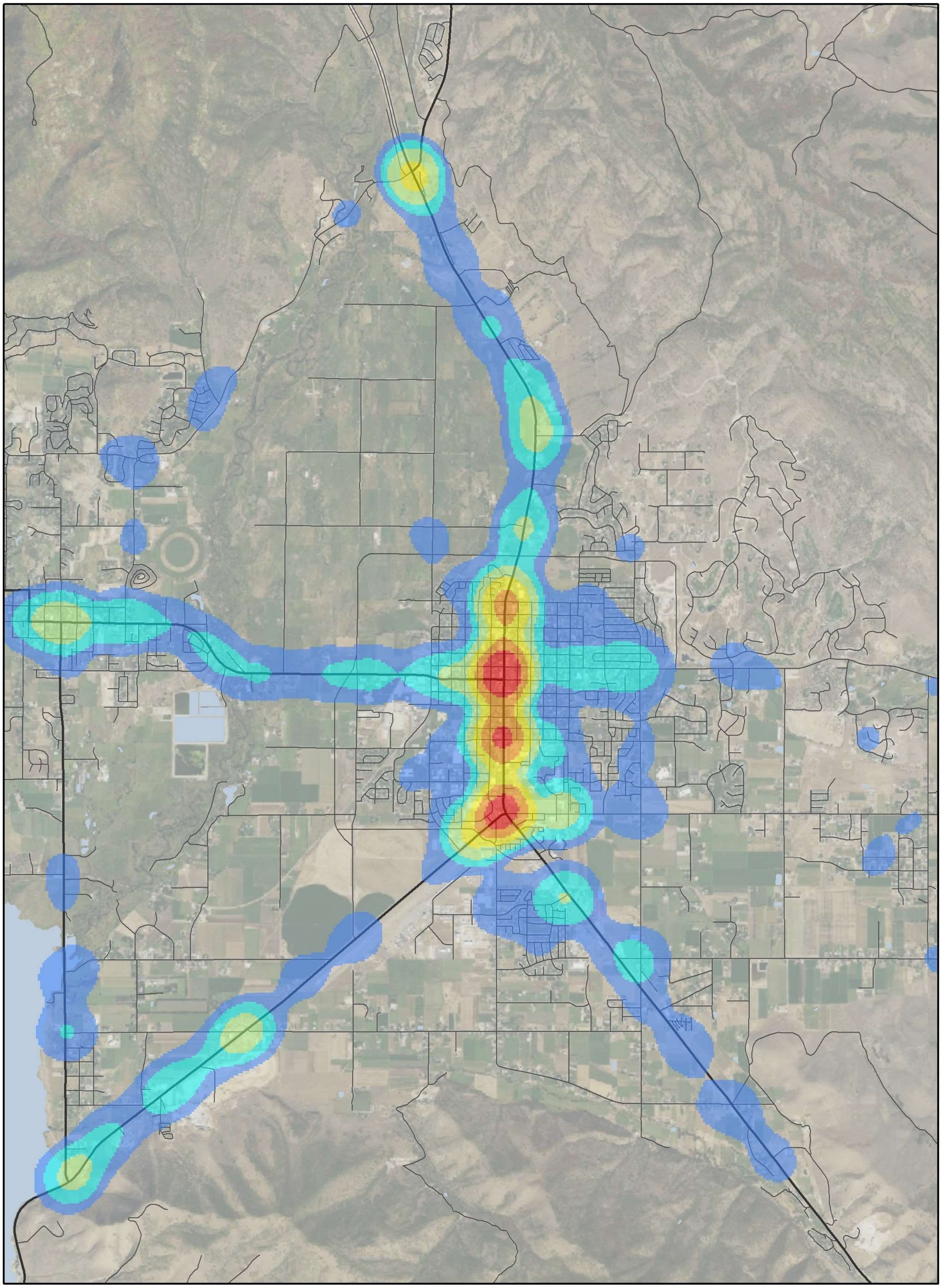
Severe Crashes

For the last several years, UDOT has focused on reducing statewide fatal and serious injury crashes. Within this report, these crash types will be jointly referred to as “severe” crashes. There were four fatal crashes and 36 serious injury crashes within the Heber Valley for the three-year period 2016 to 2018. Figure 29 shows the location of the severe crashes.

There were several patterns among the severe crashes during the three-year analysis period. The most common manner of collision among severe crashes were crashes involving single vehicles (13 of 40) which include crashes where a vehicle runs off the roadway, collides with a fixed object, or collides with a wild animal. Nearly half of severe crashes were intersection-related (17 of 40). Six severe crashes involved a commercial motor vehicle, including two of the four fatal crashes. Three of the four fatal crashes were head-on collisions and there were four total severe head-on collisions on US-40 north of Heber.

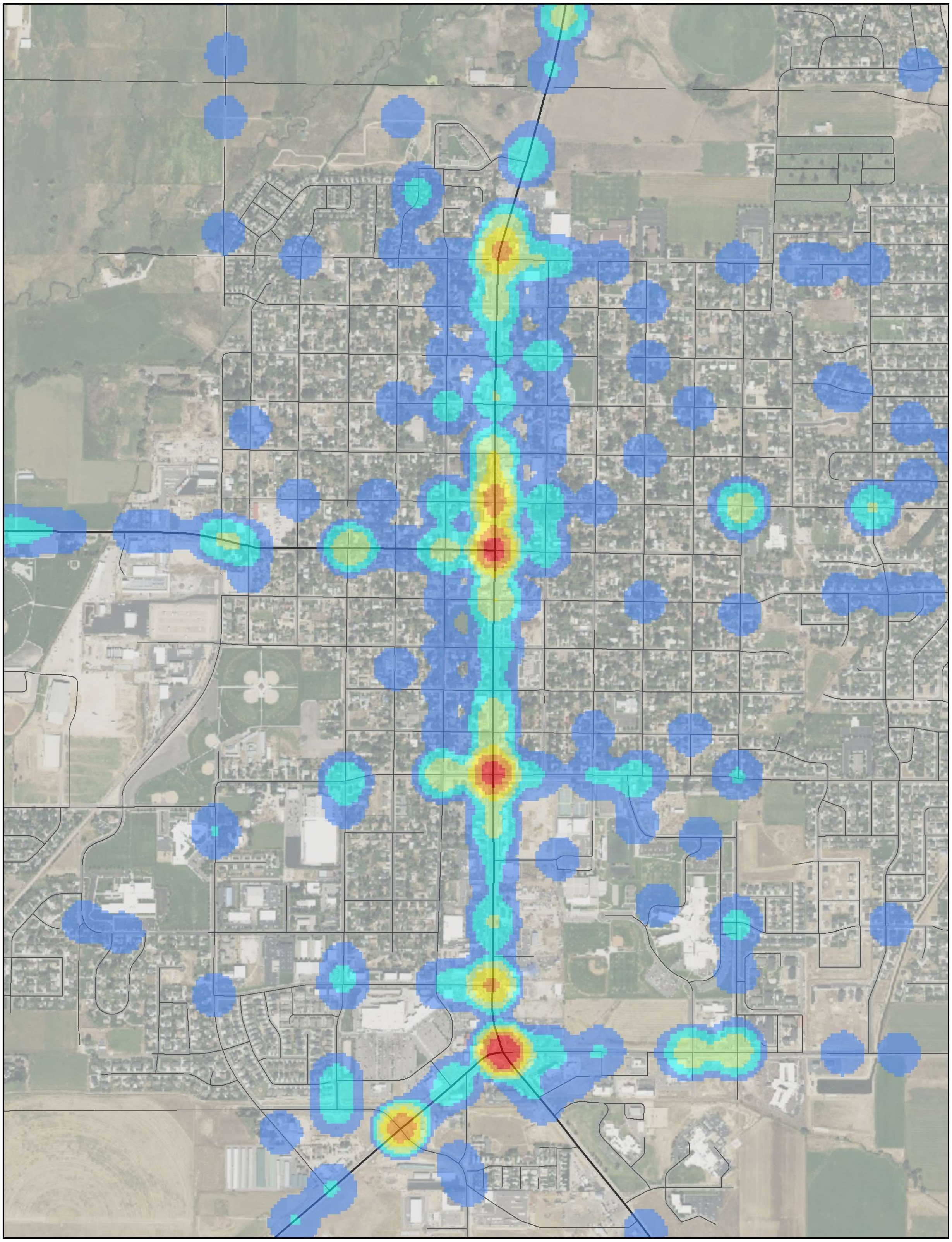
There were two clusters of severe crashes on US-40 north of Heber consisting of six total severe crashes. Of the crashes in these clusters, three were drowsy driver crashes resulting in an overturn/rollover, one was a truck/pedestrian fatality, one was a DUI head-on collision, and one was a curve-related head-on collision. The cluster of severe crashes on US-40 north of Heber is likely due to higher roadway speeds, roadway geometry (curve), and no center barrier along the segment.

Figure 27: Heber Valley Crash Concentration Heat Map



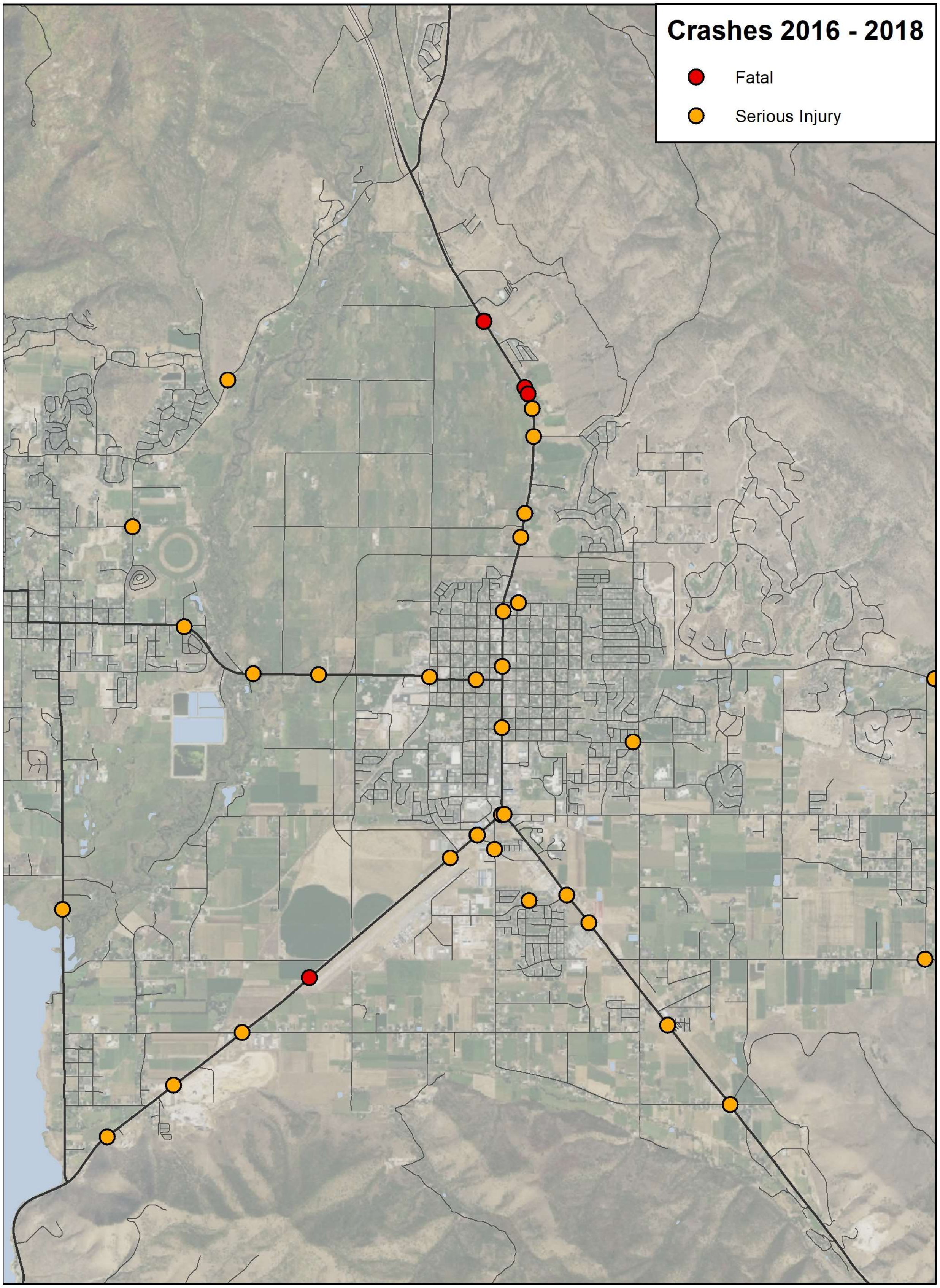
Note: These data may be protected by under 23 USC 409

Figure 28: Downtown Heber City Crash Concentration Heat Map



Note: These data may be protected by under 23 USC 409

Figure 29: Heber Valley Severe Crashes



Note: These data may be protected by under 23 USC 409

Crash Rates

Crash rates normalize crash frequencies by roadway volume in order to account for the fact that roadway segments with higher volumes can be expected to have more crashes than lower volume segments due to the increased vehicle conflicts. Table 17 summarizes the crash rates and severe crash rates for roadway segments and compares them to the statewide averages for roadways segments of similar functional class and volume.

As shown in Table 17, overall crash rates on US-40 were generally lower than the statewide average range, except for the segment from 500 North to 100 South, which had a crash rate of 4.11, and on US-189 from the US-40 (Hub) intersection to 3000 South with a crash rate of 3.50. Severe crash rates were higher than the state average on several segments, including on US-40 from SR-32 to 1200 North, 500 North to 100 South, and US-189 to 3600 South; and on US-189 from US-40 to SR-113. The severe crash rate on US-40 from US-189 to 3600 South, and on US-189 from US-40 to 3000 South were well above the statewide average.

Table 17: Heber Valley Crash Rate Summary 2016-2018

Route	Segment	Crash Rate[1]		Severe Crash Rate[2]	
		Actual	Statewide Average[3]	Actual	Statewide Average[3]
US-40	SR-32 to 1200 North	1.34	3.52 – 4.10	12.1	7.3 – 8.7
	1200 North to 500 North	2.37	3.52 – 4.10	7.4	7.3 – 8.7
	500 North to 100 South	4.11	3.52 – 4.10	12.3	7.3 – 8.7
	100 South to US-189	3.75	3.52 – 4.10	3.2	7.3 – 8.7
	US-189 to 3600 South	2.35	2.69 – 3.23	19.6	6.9 – 9.5
US-189	US-40 to 3000 South	3.50	2.69 – 3.23	18.1	6.9 – 9.5
	SR-113 to 3000 South	1.12	1.19 – 1.57	8.4	4.3 – 6.1

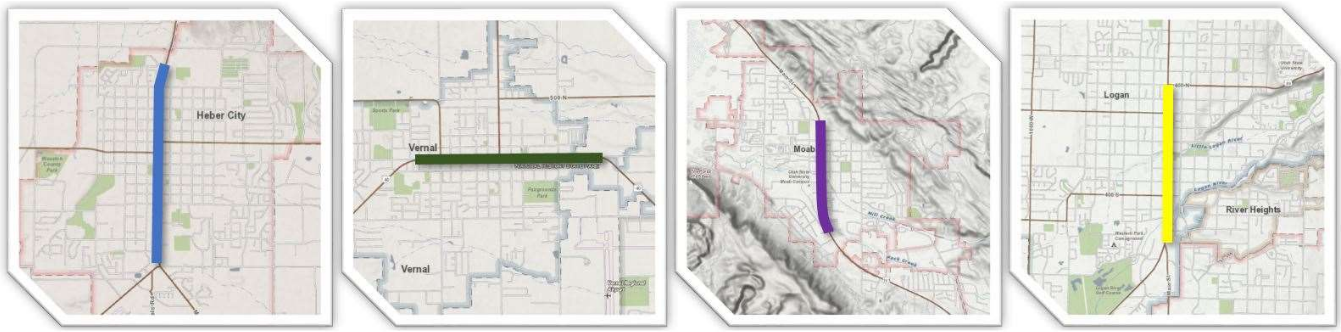
1. Crashes per year per million vehicle miles
2. Severe crashes per year per hundred million vehicle miles
3. UDOT statewide average for roadways of similar volume and functional class (2013-2017) (95% confidence interval)
Note: These data may be protected by under 23 USC 409

Peer City Main Street Crash Rate Comparison

Crash Rates on Heber Main Street were compared with several peer city Main Streets within Utah: Vernal, Moab and Logan. Sections of each peer city's Main Street were defined based on similar land use characteristics and length to develop a reasonable comparison between crash rates. Figure 30 shows the analysis segment for each peer city. Table 18 details the overall crash rates, severe crash rates and truck crash rates for each of the peer city's Main Street in comparison to Heber Main Street. Table 18 also compares each of the peer city crash rates to the statewide average.

As shown in Table 18, Heber Main Street's crash rate is higher than Vernal's Main Street, but lower than Moab and Logan. Heber's Main Street crash rate is just above the statewide average as are Moab and Logan. Heber has the highest severe crash rate of the peer cities but all peer city severe crash rates are below or near their respective statewide average. Finally, Heber's Main Street has a higher commercial motor vehicle crash rate than Vernal or Logan but is lower than Moab.

Figure 30: Peer City Main Street Analysis Segments



Heber Vernal Moab Logan

Table 18: Peer City Main Street Crash Rate Comparison

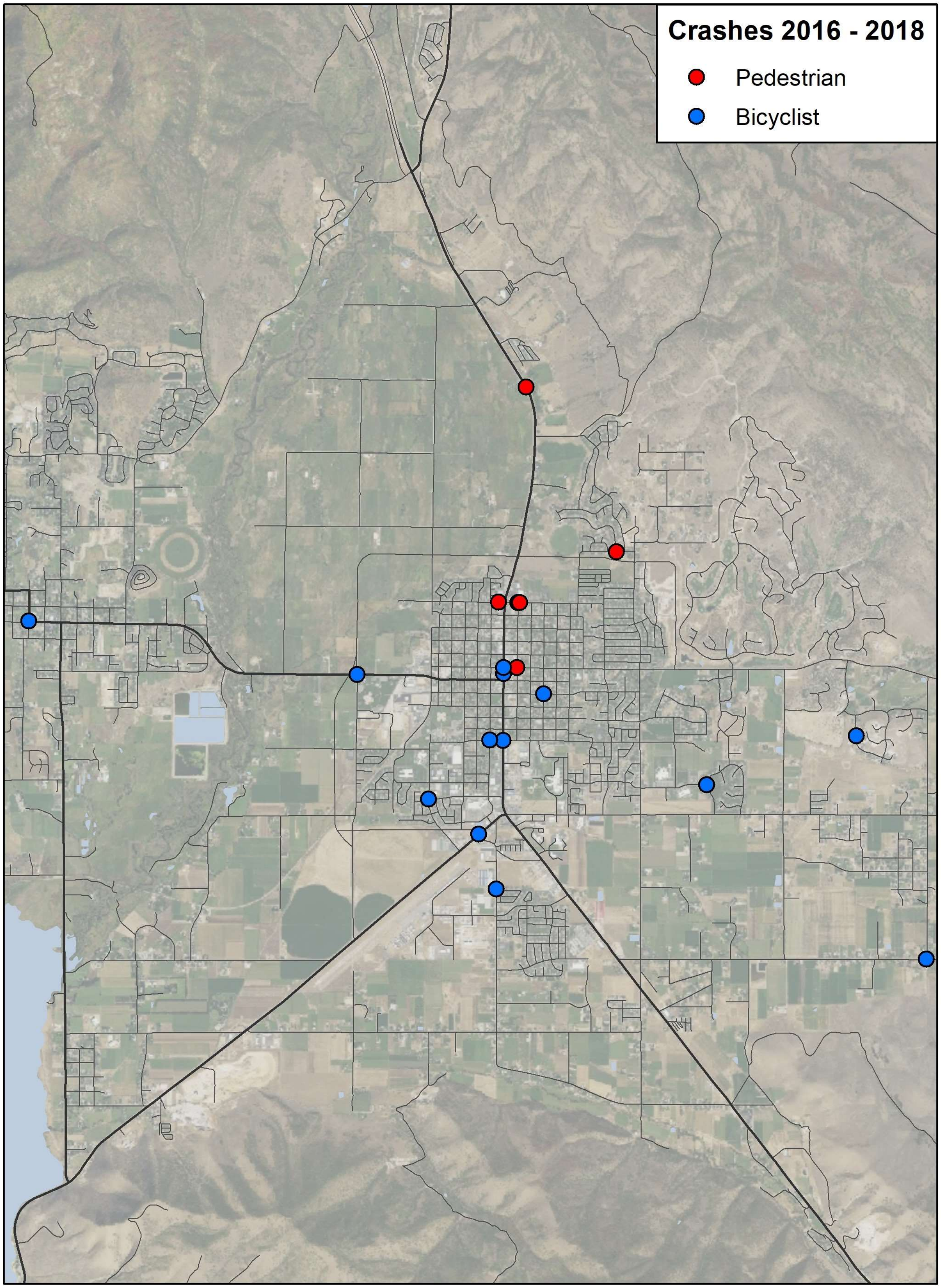
	Heber (750 N to US-189		Vernal (US-40) (Main St W to Main St E)		Moab (US-191) Kane Creek Blvd to 400 N)		Logan (US-89/91) (SR-165 to 400 N)	
	Crash Rate	Statewide Avg	Crash Rate	Statewide Avg	Crash Rate	Statewide Avg	Crash Rate	Statewide Avg
All Crashes[1]	4.21	3.52 – 4.10	1.96	3.52 – 4.10	6.21	2.69 – 3.23	7.60	3.52 – 4.10
Severe Crashes	5.7	7.3 – 8.7	0.0	7.3 – 8.7	5.5	6.9 – 9.5	1.5	7.3 – 8.7
Commercial Motor Vehicle Crashes[1]	0.38	N/A	0.23	N/A	0.65	N/A	0.15	N/A

1. Crashes per year per million vehicle miles
2. Severe crashes per year per hundred million vehicle miles
3. UDOT statewide average for roadways of similar volume and functional class (2013-2017) (95% confidence interval)
Note: These data may be protected by under 23 USC 409

Bike and Pedestrian Crashes

From 2016 to 2018 there were 13 bicycle-related crashes and six pedestrian-related crashes within the Heber Valley. Figure 31 shows the location of each bicycle and pedestrian crash. Focusing in on Heber Main Street, there were relatively few pedestrian or bicycle crashes, with only three crashes involving bicyclists and one crash involving a pedestrian. Of the three bicycle crashes on Main Street, two involved vehicles turning onto Main Street and colliding with a bicyclist in a crosswalk, and one involved a vehicle turning onto Main Street from an alley and colliding with a bicyclist on the sidewalk. One pedestrian was hit on US-40 north of Heber Main Street at 3 a.m. by a commercial motor vehicle. The crash patterns on Main Street may be indicative of the unfriendliness of bicyclists on Main Street, which has also been expressed by local citizens, as well as indicating that bicyclists are choosing to ride on sidewalks rather than in travel lanes on Main Street.

Figure 31: Heber Valley Pedestrian and Bicycle Crashes



Note: These data may be protected by under 23 USC 409

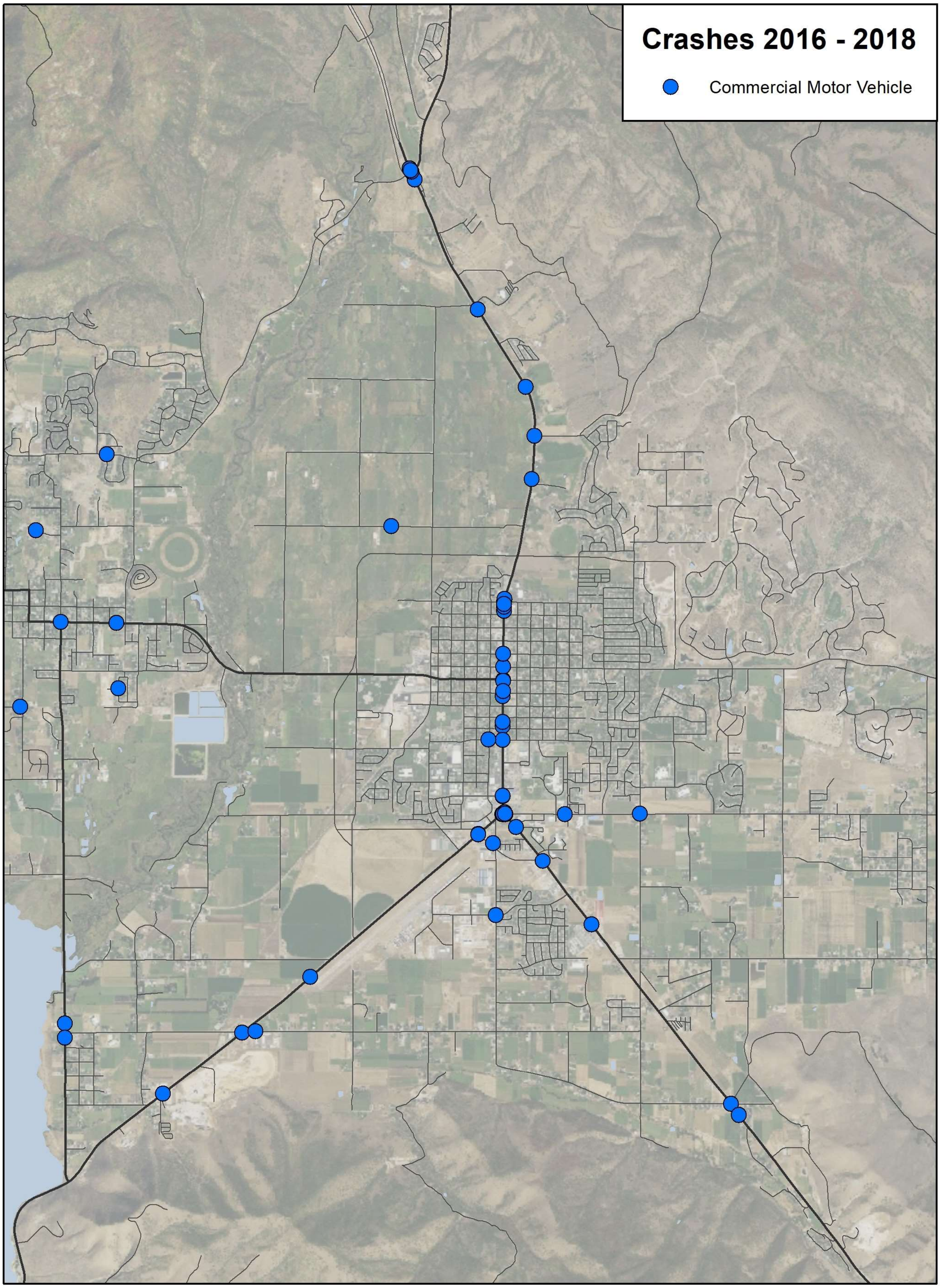
Commercial Motor Vehicle Crashes

There were 59 commercial motor vehicle crashes within the Heber Valley from 2016 to 2018. This represented about six percent of total crashes. Figure 32 show the location of each crash involving a commercial motor vehicle within the Heber Valley. The crash attribute “commercial motor vehicle” in the crash database usually refers to large heavy trucks, but can also include flatbed trucks, dump trucks, and other smaller commercial vehicles such as commercial passenger vans.

Of the 59 commercial motor vehicle crashes, four were serious injury crashes and two were fatal injury crashes. The most common manner of collision with commercial motor vehicle crashes were angle crashes which resulted in 21 of the 59 crashes. One commercial motor vehicle crash was alcohol-related and one commercial motor vehicle crash involved a pedestrian.

On Heber Main Street, there were 21 commercial motor vehicle crashes, with a little over half (11 of 21) occurring at intersections. Six of the 21 crashes were vehicles pulling onto Main Street from a side street or driveway and colliding with a commercial motor vehicle traveling northbound or southbound. In only seven of the 21 crashes was the crash the fault of the commercial motor vehicle driver. Most of the crashes where the commercial motor vehicle driver was at fault occurred at intersections and were the result of a commercial motor vehicle rear-ending vehicles at an intersection or a commercial motor vehicle turning too wide and hitting other vehicles.

Figure 32: Heber Valley Commercial Motor Vehicle Crashes



Note: These data may be protected by under 23 USC 409

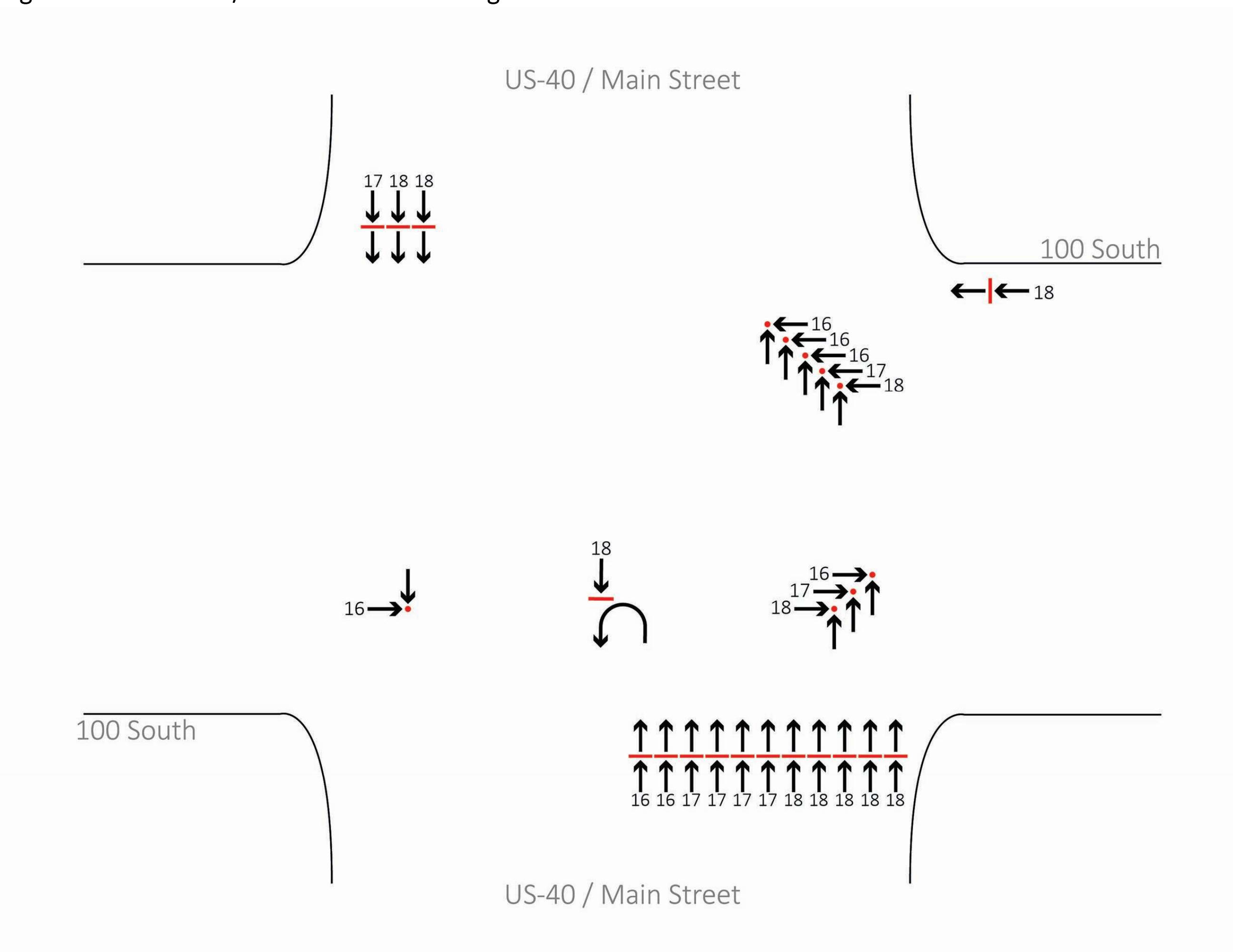
Crash Hot Spots

Several crash "hot spots" on Heber Main Street in the downtown area were investigated. Crash hot spots are helpful in identifying areas with a potential safety problem and determining where crash mitigations may be the most effective. However, care should be taken to ensure that crash hot spots do not simply reflect areas with greater traffic volumes and their coincident crashes. As mentioned in the crash heat map discussion, there were three hot spots on Main Street chosen for further analysis: 100 South/Main Street intersection, 600 South/Main Street intersection and the US-40/US-189 intersection.

100 South/Main Street

Figure 33 shows a crash diagram for the 100 South/Main Street intersection, which details manner of collision, direction of travel and the year each crash occurred at the intersection. Most crashes at the 100 South/Main Street intersection were front-to-rear crashes in the northbound direction. The second most common crash type was angle crashes involving northbound and westbound vehicles. The high number of northbound rear-end crashes are likely due to the heavy congestion in the area. Several of the northbound crashes also involved running the red light but no visual obstructions for traffic lights were observed at the intersection.

Figure 33: 100 South/Main Street Crash Diagram

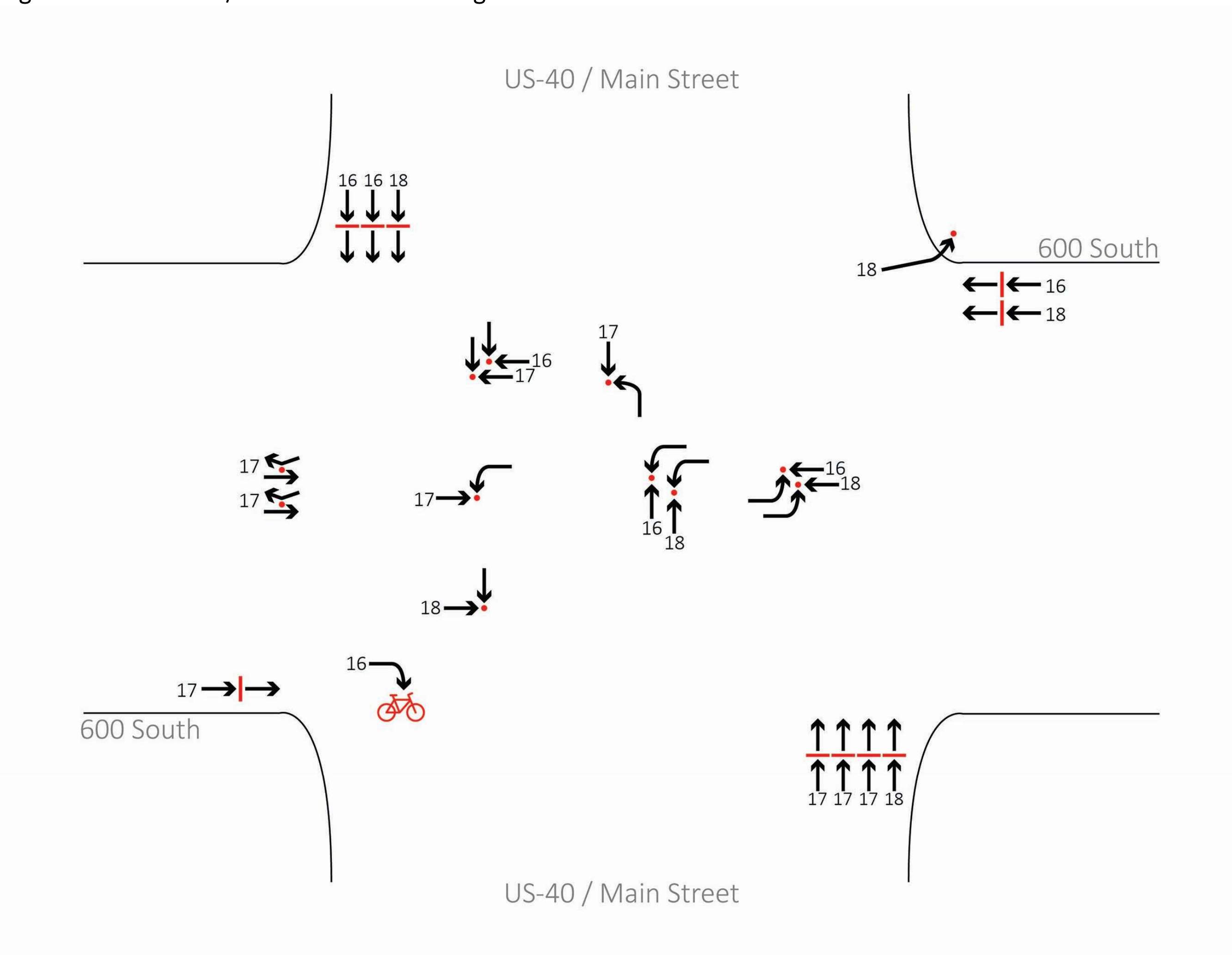


Note: These data may be protected by under 23 USC 409

600 South/Main Street

Figure 34 shows a crash diagram for the 600 South/Main Street intersection. As shown in the crash diagram, there was no dominant crash pattern, with northbound and southbound rear-end crashes being slightly more common than other crash types. Approximately 25 percent of the crashes involved an older driver, and winter precipitation was a contributing factor in the run-off-roadway and sideswipe crashes. Again, heavy traffic flows northbound and southbound on Main Street were a likely contributor to the rear-end crashes.

Figure 34: 600 South/Main Street Crash Diagram



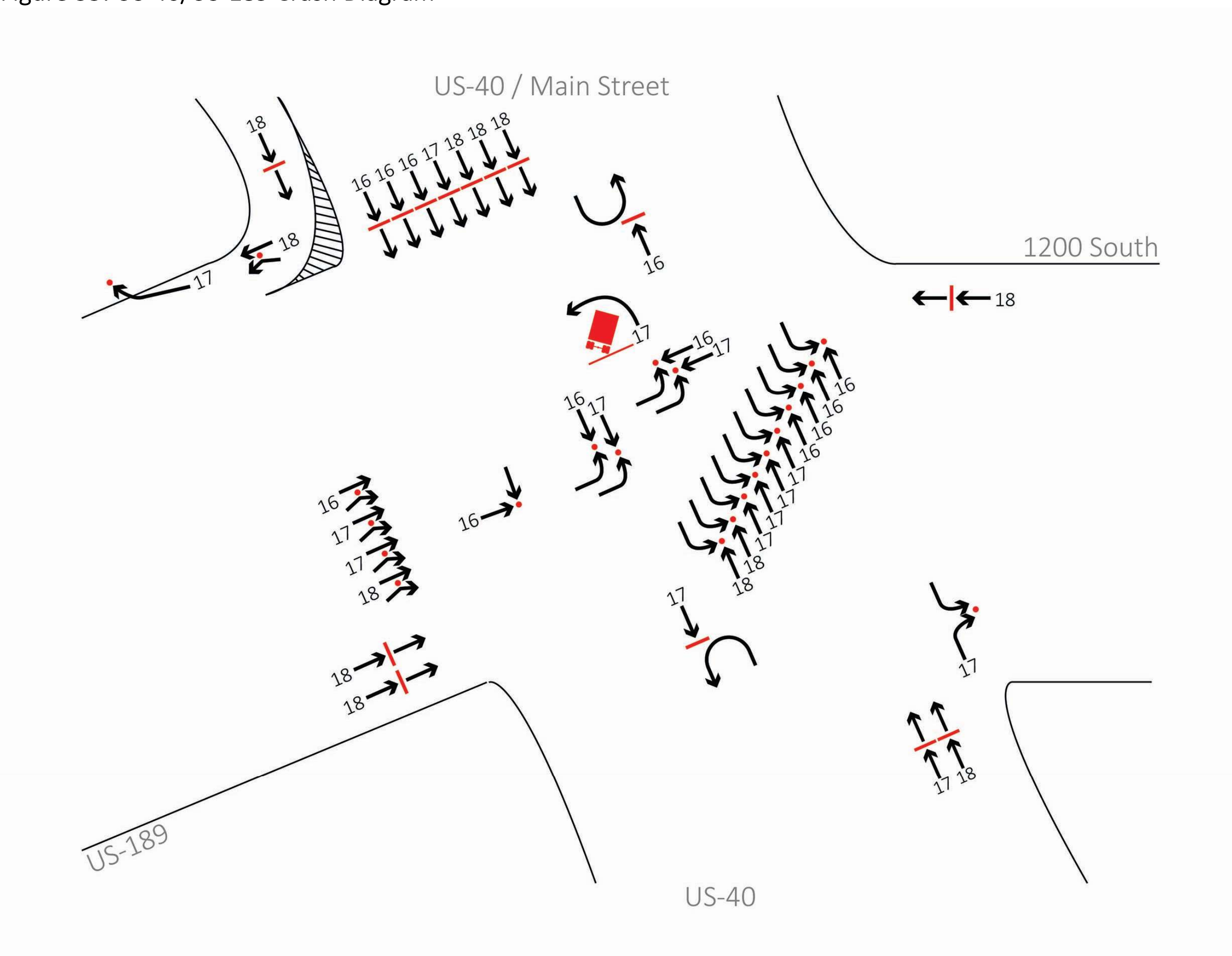
Note: These data may be protected by under 23 USC 409

US-40/US-189

Figure 35 shows a crash diagram for the US-40/US-189 intersection. As shown in the diagram, southbound left-turn crashes with oncoming northbound vehicles was the most common crash type at the intersection. A likely contributing factor to the southbound left-turn crashes is the large intersection footprint and skew angle, which results in a long turning path and high exposure time. Visibility and speed of northbound traffic may also be a contributing factor since northbound vehicles are approaching the intersection on a curve and are transitioning from a higher speed limit to the lower speed limits on Main Street.

The second most common crash type at the intersection is sideswipe crashes on the eastbound approach. Crashes may be happening at this location due to vehicles not recognizing the dual-left turn lanes or maintaining lane discipline as they negotiate the left turn. There was also a large amount of southbound rear-end crashes, likely due to congestion at intersection. It should also be noted that the southbound right-turn lane is 30 feet wide and contributed to two crashes at the intersection which were caused when drivers mistakenly thought the wide right-turn lane was two right-turn lanes.

Figure 35: US-40/US-189 Crash Diagram



Note: These data may be protected by under 23 USC 409

FREIGHT

Highway Freight

There are three freight routes in or near the Heber Valley including I-80, US-40, and US-189. All three roadways are listed on Utah's Highway Freight Network as defined in the Utah Freight Plan 2017 (see Figure 36). Of course, I-80 is an Interstate and both US-40 and US-189 are both identified as secondary, but important freight routes in Utah.

Aside from some light industry on the east side of Park City, on Heber City's southwest side, and in the Kamas area, there is little freight generated in this area. Most freight traveling in the Heber Valley is passing through, or providing deliveries to local supermarkets, home improvement centers, and local businesses.

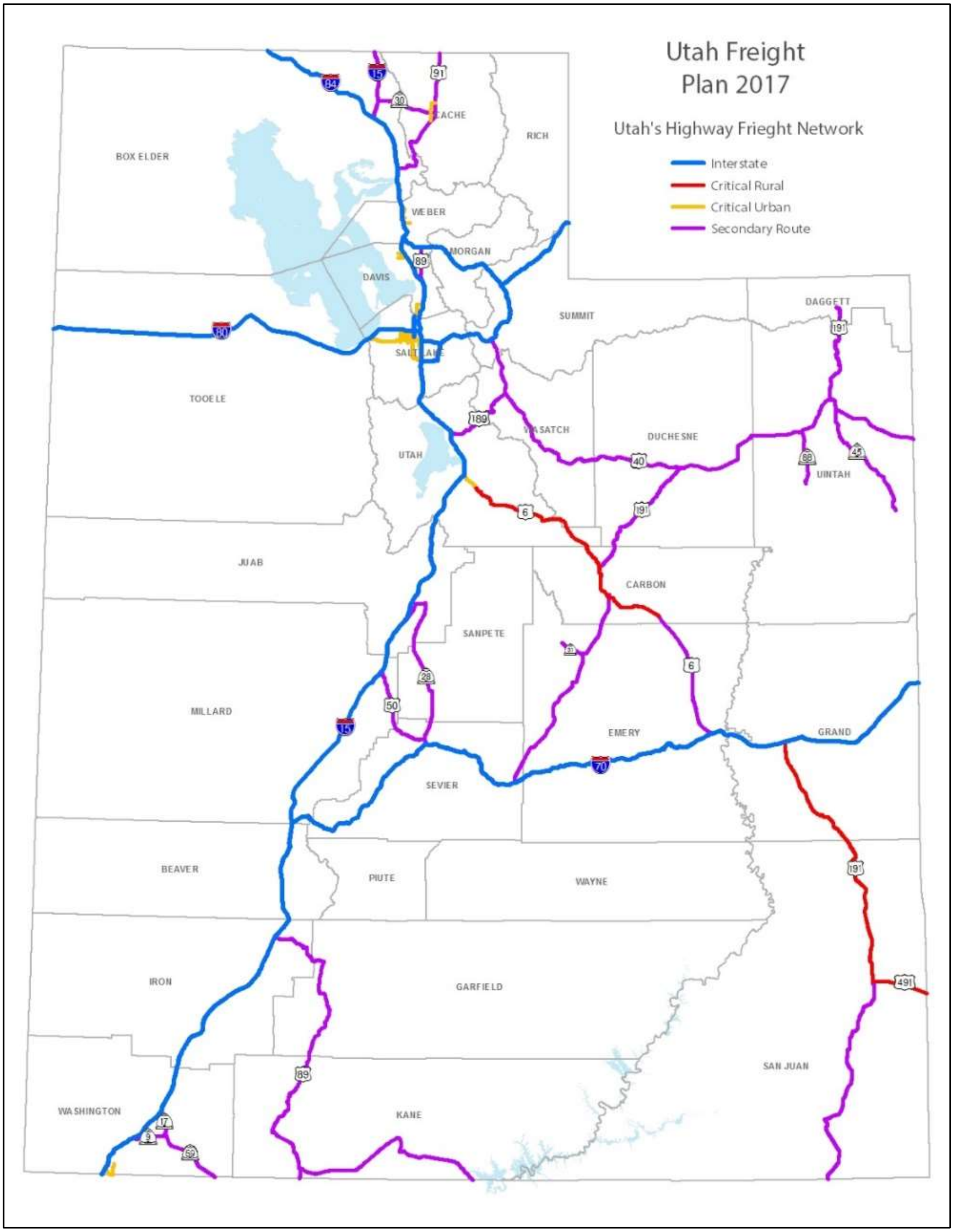
I-80 is the primary transcontinental freight route across western America. With high truck volume percentages east of Salt Lake City, much of I-80's freight is perishable foodstuff being transported in temperature-controlled trucks that originated in California. I-80 also has nonperishable foodstuff and other goods in "dry van" trucks. Most of this traffic does not pass through Heber Valley as it usually stays on I-80 to Salt Lake City before continuing on I-80 west or south on I-15.

US-40 is classified as a principal arterial. It serves as an important facility for transporting people, goods, and services to and from the Wasatch Front via I-80 and US-189 to I-15. US-40 is a major regional freight corridor providing local access and energy-related shipments passing through Heber City and up the steep grade around the Jordanelle Reservoir en route to and from I-80. Large combination vehicles (LCV's) known as "Supertankers" carry crude oil from Uinta Basin oil fields to Wasatch Front refineries via US-40 through Heber City. Oil field support equipment and supplies also travel on this highway. Further, US-40 provides connection to northwest Colorado, which provides some regional truck traffic. There is one truck chain-up location on US-40 near the Heber Valley located northbound at milepost 13 just north of SR-32.

Truck traffic on US-40 is very consistent as 600 to 700 supertankers frequent the route daily, as determined from the video analysis discussed in the Data Collection section of this report. This consists of approximately only one percent of the PM peak hour traffic and only two to three percent of daily traffic. However, because of their weight, slow starts at traffic signals, and loudness of the engines, they are very noticeable. Other semi-trucks account for about the same percentages during PM peak hour and daily traffic. Smaller trucks called single-unit or box trucks account for about two percent of the PM peak hour traffic.

US-189 is a secondary freight route but does connect US-40 with I-15 via Provo Canyon. US-189 has restrictions and prohibits vehicles and loads over 10 feet wide. However, some trucks use the Provo Canyon route as an alternative to the steep grades on I-80 and US-40 going to and from Salt Lake City. Aside from local delivery runs, most of the freight traffic on US-189 is passing through the area.

Figure 36: Utah Freight Network



Source: Utah Freight Plan 2017

Air Freight

The Heber City Municipal Airport, also known as Russ McDonald Field, is a city-owned, public-use airport located one mile south of Heber City. However, this airport does not have air cargo service.

Rail Freight

There are no freight railroads that serve the Heber Valley. However, the Heber Valley Historic Railroad operates a tourist railroad based in Heber City. It operates passenger excursion trains along a 16-mile line between Heber City and Vivian Park, which is located in Provo Canyon. The tourist railroad is not connected to the national rail network.

ACTIVE TRANSPORTATION

The Heber Valley is a scenic area rich with recreational opportunities. The surrounding mountains feature many hiking and mountain biking opportunities. However, the existing active transportation (AT) infrastructure is inconsistent and lacks connectivity. As growth occurs in this area, so too will demand for access to these recreational opportunities.

Existing Facilities

Heber City, the population center of the valley, is in the process of growing beyond its rural origins. This transition is particularly visible through the presence or absence of sidewalks. Heber Main Street and adjacent parallel roadways feature contiguous sidewalks. However, the sidewalk consistency and continuity rapidly declines further to the east and west of Main Street. Within the belt of newer residential developments ringing the traditional town center, however, sidewalks once again become frequent, contiguous sidewalks. Pedestrian and bicycle infrastructure is also somewhat more common outside in these areas. Figure 37 displays the existing trail infrastructure in the Heber Valley. Two paved multi-use trails extend to the east and west from the center of Heber. The western pathway follows SR-113 and connects into the Midway Main Street pathway using sidewalks. The eastern pathway follows Center Street to the Red Ledges trailhead.

Heber Main Street

Heber Main Street features contiguous sidewalks on both sides of the roadway from 750 North to 1000 South. Traffic signals at 500 North, Center Street, 100 South, and 600 South offer opportunities to cross Main Street at a signalized location. Additionally, a pedestrian-activated overhead flashing beacon is located at 100 North and a High-Intensity Activated Crosswalk (HAWK) beacon is located at 250 South. Beyond the vicinity of Center Street, east-west AT mobility is limited, requiring multi-block detours to access designated crossing opportunities.

There is no designated bicycle infrastructure on Main Street creating a low-comfort experience for all but the most confident riders due to the large traffic volumes, numerous trucks, and parallel parking on the shoulders.

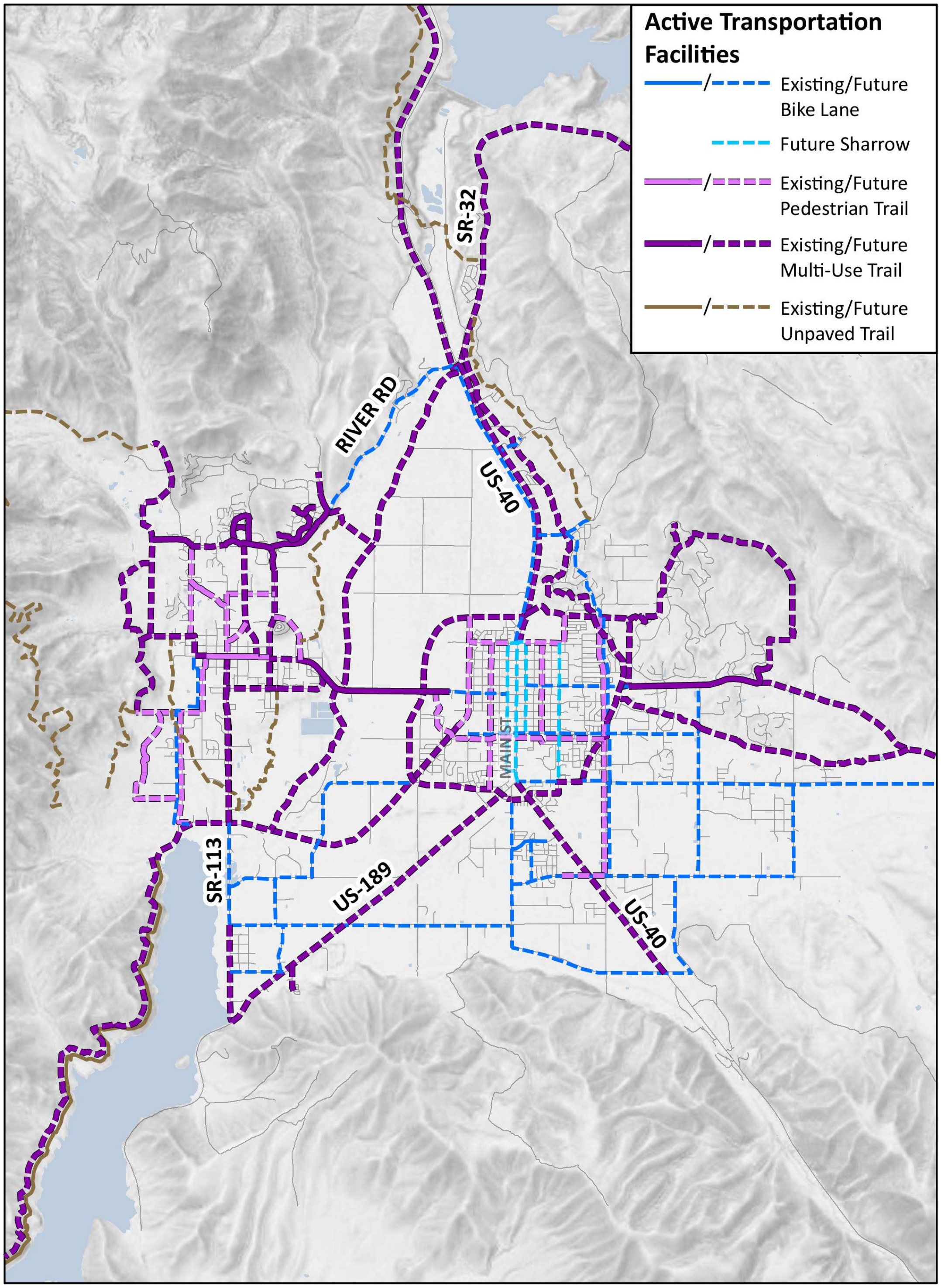
Midway

The greatest concentration of existing pathways in the Heber Valley is located in Midway, particularly in the vicinity of SR-32. The Midway Main Street trail is categorized as a paved pedestrian trail in the Wasatch County Regional Trails Master Plan (WCRTMP). This typology encompasses several configurations including: wide sidewalks, trails through parks or developments, and narrow paths separate from roadways.

Deer Creek Trail

To the west of Deer Creek Reservoir is an unpaved trail that connects Soldier Hollow to the trailhead of the Deer Creek Reservoir trail.

Figure 37: Heber Valley Existing and Planned AT Facilities



Source: WCRTMP, UDOT Region 3 Bicycle Pedestrian Plan, MAG 2050 RTP, Railroad Trail Feasibility Study

Existing Bicycle Activity

Popular routes with bicyclists can be identified using data from GPS-based, ride-tracking smartphone applications. UDOT purchases such a dataset from an application developer and then made available for analysis. Figure 38 illustrates the data for the Heber Valley in 2019. It is worth noting that these applications are particularly popular among competitive cyclists and mountain bike trail riders, hence the activity displayed in Figure 38 does not include the full range of ongoing bicycle activity.

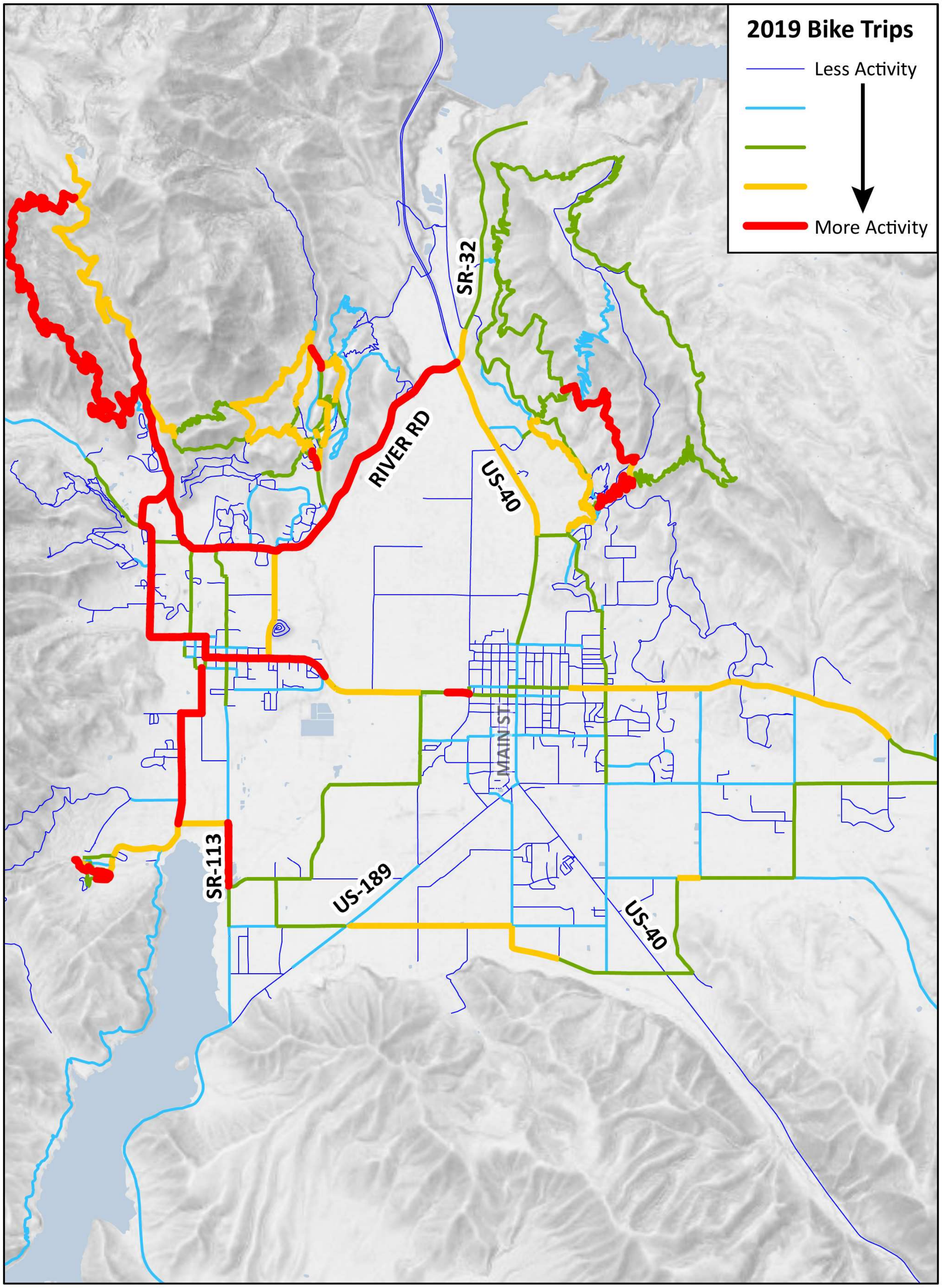
As seen in Figure 38, the most significant ridership in the Heber Valley is in the vicinity of Midway and to the northeast of US-40. Recreational areas such as Soldier Hollow to the southwest, Coyote Canyon to the northeast, or Wasatch Mountain State Park and Dutch Hollow to the northwest are the most popular. Routes connecting to these areas feature significant ridership which indicates much of the bicycle activity in this data set is more recreational than commuter based.

As previously mentioned, these datasets are produced by smartphone applications that many competitive cyclists use to track their times and training routes. The 2019 Tour of Utah bicycle race crossed through the Heber Valley using Center Street, the road to Midway, SR-222 around the west side of Midway, and Pine Canyon. This race and related training or recreational rides may partially explain the higher ridership on these routes.

US-40 to the north is another route to Summit County and the Park City area, however it has a fraction of the ridership compared to Pine Canyon or SR-32, indicating less favorable conditions. The highest ridership on US-40 is between the SR-32 intersection and 500 North. This area features wide paved shoulders and limited parallel alternatives. Closer to Heber on US-40 the ridership appears to disperse onto parallel routes. The low ridership between the 500 North and the US-40/US-189 South intersections reflects the uncomfortable riding conditions mentioned earlier: large traffic volumes, numerous trucks, and parallel parking on the shoulders.

To the west of Heber City is a series of routes that have moderate ridership. The use of these routes indicates demand for north-south mobility to the west of town and within the approximate vicinity of the Heber Valley Railroad.

Figure 38: Heber Valley Crowd-sourced Mobile App Bicycle Activity



Future Facilities

Several of the fragmented existing AT facilities in the Heber Valley are planned to be linked together in the future. The projects outlined in the WCRTMP, Railroad Trail Feasibility Study, and Region 3 Bicycle Pedestrian Plan are displayed in Figure 37.

Wasatch County Regional Trails Master Plan

Completed in 2016, the Wasatch County Regional Trails Master Plan proposes a series of improvements that will create a comprehensive AT network in the Heber Valley. One significant component of this plan is a proposed multi-use pathway to the west of Heber, that connects to the south of the US-40/US-189 intersection and loops to the eastern existing multi-use trail. This trail would be an important component of a loop route that will ring the city as well as connect the existing improved multi-use trails. Similar AT facilities are proposed to improve connectivity to other communities within Wasatch County and beyond. A grid of improved pedestrian trails, bike lanes, and shared lane pavement markings (sharrows) are proposed to further enhance AT mobility within Heber City.

Region Plans and Studies

The Provo River Parkway is a route that will eventually connect the Wasatch Front to the Wasatch Back. The trail is currently paved from the mouth of Provo Canyon to Vivian Park. The MAG 2050 RTP proposes to improve the unpaved sections and fill gaps that exist in the route between Vivian Park and the Deer Creek Trail trailhead. This project has since received funding and started design. Following the western shore of the reservoir--from the trailhead to Soldier Hollow--the Deer Creek trail is currently unpaved. The UDOT Region 3 Bicycle Pedestrian Plan proposes to pave this segment of the trail. From Soldier Hollow, the trail would extend further east and eventually connect to western Heber City by following the route of the Heber Valley Railroad. The Railroad Trail Feasibility Study proposes a paved multi-use trail following the existing tracks to Soldier Hollow, providing a direct connection to these recreation areas. Once all three projects are completed a paved trail will connect Heber City to Provo.