Executive Summary

The City of Orem, along with Utah County, has experienced significant growth and development, which is expected to continue in the future. Orem's population growth from 2010 to 2019 was 9,498 (10.8%). The current population (2019) is slightly below 98,000 according to the U.S. Census Bureau. The population is expected to be approximately 103,000 and 119,000 by the year 2030 and 2050 respectively.

Although the expected population growth is moderate compared to other cities in Utah County, Orem will continue to be a regional attraction throughout the county. In 2050, it is expected that an average of 74% of all vehicles from outside the city using the roadway network will stop somewhere in Orem. Utah Valley University (UVU) is another regional attraction for college students, and as growth within the University continues it will have an impact on the roadway network. The TMP identifies operational, and infrastructure needs within Orem's transportation system. This plan incorporates the goals of the City of Orem regarding the transportation systems within Orem as well as regional facilities maintained by UDOT, UTA, Utah County, and neighboring communities.

2022 Update

The following sections of The City of Orem Transportation Master Plan (TMP), adopted in 2015, were updated in 2022 to include updated information:

- Updated Travel Demand Modeling to update the horizon year from 2040 to 2050.
- Incorporated updated MAG TransPlan50 recommendations
- Removal of State Street Master Plan elements
- Updates to existing data that changed since the original plan was adopted in 2015.

Public Involvement

The City of Orem desired public input to help shape the 2015 Transportation Master Plan. The project was advertised on the project website *www.oremtmp.com*. Included were interactive/commenting maps made available to the public through social media and direct email. The public comment period ran from March 19, 2015, to May 19, 2015, and approximately 150 comments were gathered.

After the draft Transportation Master Plan (TMP) was completed, there was an open house on September 1, 2015. The public involvement team worked with City of Orem staff to provide content for social media outlets, the City of Orem blog and newsletter, and a press release to advertise the open house. Approximately 50 citizens attended the open house with many City staff and elected officials.

Roadway Standards

Transportation planning is a cooperative effort of state and local agencies. All urbanized areas throughout the country are separated into Metropolitan Planning Organizations (MPO). The MPO for Utah, Summit and Wasatch Counties is called the Mountainland Association of Governments (MAG). The responsibility of MAG is to coordinate the transportation planning for these counties.

Functional Classification

All vehicle trips include two distinct functions: mobility and land access. Mobility and land access should share an inverse relationship; meaning, as mobility increases land access decreases. Street facilities are classified by the relative amounts of through and land-access service they provide. There are four primary classifications: Freeway/Expressway, Arterial, Collector and Local Streets. As part of this TMP, the functional classification in Orem was updated to include the following classifications:

- **Principal Arterial** (6-7 Lanes)
- **Major Arterial** (4-5 Lanes)
- **Minor Arterial** (2-3 Lanes)
- **Urban Collector** (2-3 Lanes)
- **Local** (2 Lanes)

Level of Service

The performance of an existing street system can be quantified by assigning Levels of Service (LOS) to major roadways and intersections. LOS serves as the traditional form of measurement of a roadway's functionality. LOS is a term derived from the HCM/AASHTO and is a national standard on gauging operational levels for traffic. LOS is determined by elements, such as: the number of lanes assigned to a roadway, the amount of traffic using the roadway, and the time of delay per vehicle traveling on the roadway and at intersections. Levels of service range from A (free flow where users are virtually unimpeded by other traffic on the roadway) to F (traffic exceeds the operating capacity of the roadway). In Orem, LOS D is the minimum standard for roadways and intersections (meaning 80% of capacity is used during rush hour).

Existing and Future Traffic Projections

On a regional level, future traffic is modeled using a travel demand model developed by MAG, and the results dictate future transportation improvements along the regionally significant streets (i.e., State Street, Geneva Road, University Parkway, etc.). The travel demand model uses land use and zoning for every city to estimate future traffic demand on the transportation system. From this model, MAG produces a Regional Transportation Plan (RTP) which indicates future projects within the MPO.

The MAG RTP projects alone will not alleviate all future congestion in Orem. Therefore, the travel demand model was updated to include specific data in Orem to estimate the future demand on Orem's Street network. This model focuses on all streets in Orem to find other roadway improvements outside the MAG RTP projects necessary in Orem to alleviate congestion. The model was run for both the 10-year conditions (2030) and the 30-year conditions (2050). For both conditions, a No-Build scenario was run. A No-Build scenario looks at what would happen to the roadway network if no improvements were completed (including the MAG RTP projects). Also, an RTP Only scenario was run for both conditions. This investigates what would happen to the roadway network if only the MAG RTP projects were completed.

Roadway Improvements

The outputs from the MAG travel demand models are measured at the Level of Service for each roadway segment throughout the city. It is recommended that roadway segments at LOS E or worse need capacity improvements. The timing of when each road segment transitions from LOS D to LOS E or worse (also with local knowledge) determines the project priority. Using the outputs from the 10-year and 2050 conditions, all roadway segments that perform at LOS E or worse indicate roadways where improvements should be considered.

Orem is not alone financially for the roadway system improvements. Other financial assistance may come from MAG, UDOT, UTA, and private sources based on the project jurisdiction. This funding is not guaranteed, but judgment has been made as to which projects will be eligible for funding.

The adoption of this TMP does not indicate Orem's financial responsibility to complete all projects included in this TMP. The benefit of completing a TMP is to demonstrate to organizations such as UDOT and MAG that improvements are necessary and are eligible to receive financial assistance on projects in the future. As projected growth is an estimated value, Orem is not bound to complete projects included in this TMP if they are not needed in the future. Projects were separated into a 10-year and 30-year window.

10-Year Roadway Improvements (2022-2030)

The 10-year costs for Phase 1 (2022-2030) projects are $250.4 million dollars (including inflation) with Orem financially responsible for approximately $31.2 million dollars (including inflation).

2050 Roadway Improvements

The TMP also includes all projects necessary for the roadway network to perform at LOS D or better for the horizon year 2050. The TMP needs to be regularly updated. All roadway improvements to accommodate projected 2050 traffic volumes. The total cost estimate for Orem to improve the transportation system by 2050 is $313.4 million ($450.8 million with Inflation), with Orem financially responsible for $64.5 million.

Alternative Transportation Modes

Alternative transportation modes play an integral role in alleviating traffic congestion. As Orem continues to develop and the population increases, these alternative modes of transportation will have an increasing role in the transportation system in Orem. Included are the future for transit, bicycle, and pedestrian improvements.

Transit

In Orem, the Utah Transit Authority (UTA) is the provider of public transportation. UTA operates fixed-route buses, express buses, bus rapid transit (BRT), ski buses, Light Rail, and commuter rail. In this capacity, UTA is responsible for the operation of the transit network in Orem. It is the responsibility of both Orem and UTA to cooperate to provide transit planning to accommodate alternative transportation options to residents as demand increases.

Bicycle and Pedestrians

Pedestrian and bicycle safety is an important feature of any transportation master plan. People will be more inclined to walk or ride their bicycle when the experience is pleasant, they feel safe, and their distances are reasonable. High-density housing near high-traffic generators or main street type areas encourages people to use alternative travel options from the automobile. This TMP references The *Orem Bicycle and Pedestrian Plan* adopted in 2010 and includes the improvements desired throughout the city. The plan is online on the City's website www.*orem*.org.

Other Policies and Guidelines

Policies and guidelines govern development throughout Orem. For the roadway network, there are policies to maintain a safe, efficient, and familiar environment for all transportation types. There are national, regional, and local specifications used in Orem. Contact the City for access to these specifications can be accessed by contacting the city. This TMP includes the new and updated policies and guidelines for the following: **Truck Routes**, **Speed Limits**, **Curb Radius**, **Crosswalk Warrants**, **Traffic Signal Warrants**, **Access Management Standards**, and **Traffic Calming Standards**, **Traffic Impact Study Standards**, and **Connectivity**.

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1.0 Introduction

1.1 2022 Update

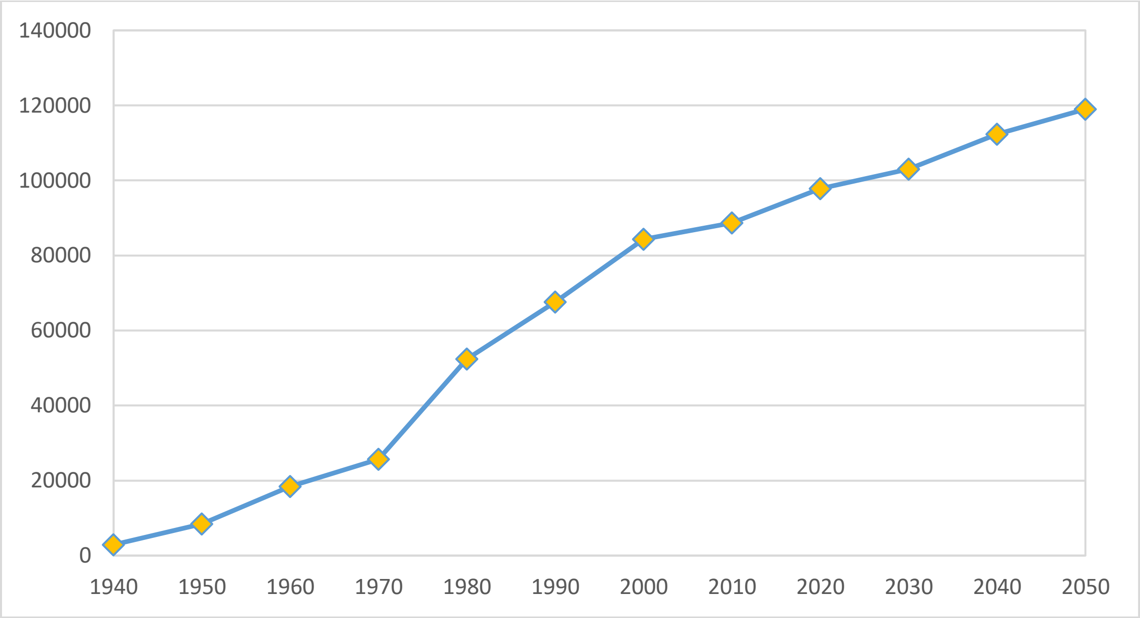
The following sections of The City of Orem Transportation Master Plan (TMP), adopted in 2015, were updated in 2022 to include updated information:

- Updated Travel Demand Modeling to update the horizon year from 2040 to 2050.
- Incorporated updated MAG TransPlan50 recommendations
- Removal of State Street Master Plan elements
- Updates to existing data that changed since the original plan was adopted in 2015.

1.2 The City of Orem

The City of Orem (Orem) and the surrounding communities have recently experienced significant growth and development and will continue, as shown in **Figure 1**. Orem's population grew from 2010 to 2020 by 10,694 (12.11%). According to the U.S. Census Bureau, the current population (2020) is slightly above 99,000. By 2030, the projected population should be around 103,000 and up to 119,000 by 2050. Due to growth within the City and the large growth throughout the county, a comprehensive transportation plan must be developed and regularly maintained to keep pace with projected growth in order to combat congestion, safety hazards, and traffic's impact on neighborhoods. This plan must incorporate the goals of Orem regarding the transportation systems within their jurisdiction and the regional facilities maintained by UDOT, UTA, Utah County, and neighboring communities.

Figure 1: Orem Population



Orem is in Utah County and is bordered to the north by Lindon City, the south and east by Provo City, and west by Vineyard and Utah Lake. Within the City, there is a mix of residential, commercial, and industrial development and undeveloped land. The west portion of the city has the most recently developed land. **Figure 2** shows a map of Orem and the surrounding area.

This Transportation Master Plan (TMP) contains the existing transportation network and conditions analysis. Any deficiencies are itemized, and possible improvement or mitigation alternatives are discussed. The TMP includes an analysis of the future transportation network for 2050. Any major UDOT projects and improvements within Orem, such as the Vineyard Connector, are reflected in the future transportation network. Any deficiencies in the future transportation network that are expected to exist and would not be accommodated by projects that are currently planned will be discussed. A recommended improvements and projects list will be given to help Orem plan for future transportation projects and working with other agencies such as UDOT or neighboring cities. This Transportation Master Plan is a tool to aid Orem in a proactive effort in planning and maintaining the overall transportation network within their city.

1.3 History

Orem was organized in 1919 and named after Walter C. Orem, President of the Salt Lake and Utah Railroad. Orem is now the commercial and technological center for Central Utah and is one of the fastest-growing metropolitan areas in the United States. Housing, educational, and employment opportunities continue to be in high demand as Orem's population approaches 100,000 residents.

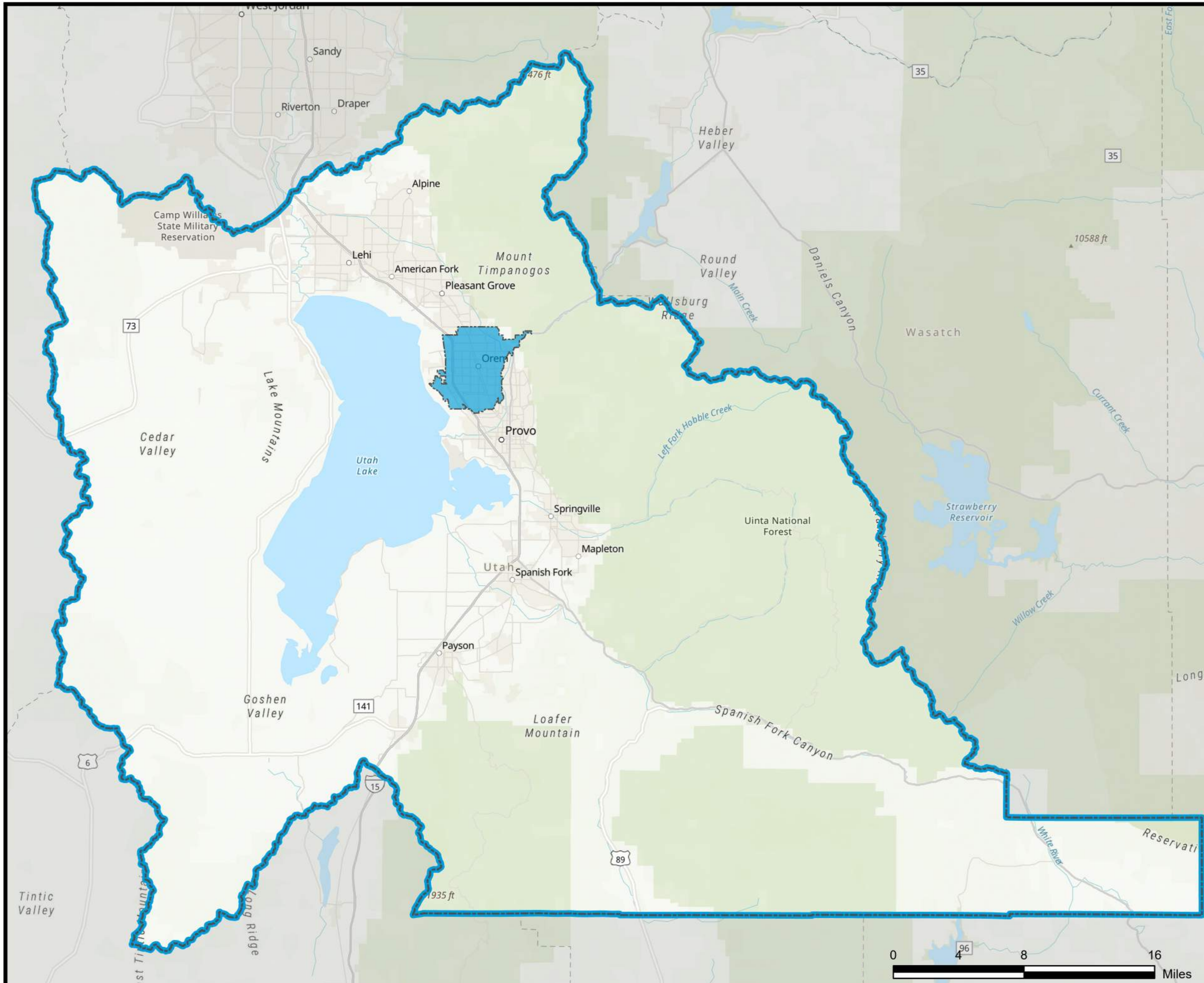
Unlike many Utah towns and cities, Orem was not laid out in regular city blocks with houses clustered closely together. Instead, Orem's origins are in homesteads settled along the territorial highway (now State Street) and along other substantial arteries where area farmers built their homes to live near their fields and orchards. As prime farmland along primary roads was taken, farms sprang up in other parts of the "bench" that is now Orem, and rural roads soon crisscrossed the area connecting the farms. This type of development, known in Utah as the "Gentile manner," differed from typical historical development by Mormons, who were often counseled by church leaders to live in the city and cultivate farmland outside its limits.

The first major evolution of Orem began in the early 1940s when the Geneva Steel Works was constructed by the federal government as an inland producer of steel. Built along the eastern shore of Utah Lake, Geneva has provided employment to many residents, either directly or indirectly. In recent times, Geneva has spawned controversy because of increasing concerns over environmental damage caused by the plant and related concerns about lost employment which would be caused by the shutdown of the plant. USX Corporation, the former owner of Geneva, ceased active production of steel at the plant for a brief period in the mid-1980s and then sold the plant to a small group of investors who revived operations. Under new ownership, the company filed bankruptcy in 1999, but was reorganized with the help of the Emergency Steel Load Guarantee Act, which provided a $110 million loan. The reorganization effort failed, and the company once again filed bankruptcy. It was permanently closed in November 2002.

The second major change to the landscape of Orem came as many of its farms were developed into shopping centers, malls, and housing along State Street and University Parkway. The intersection of these two streets stands as the focal point of the metropolitan Orem/Provo area. First, University Mall and later other malls attracted business away from downtown Provo, historically the central shopping area of Utah Valley. Little successful, central planning has taken place in Orem, and it is as much without a central core now as it was when it was known as the Provo bench. Pockets of commercial and residential development dot the expansive area that is Orem.

The construction of the Geneva Steel plant brought significant growth and change to the City of Orem. What was once a primarily agricultural settlement becoming a bustling center of employment. While Orem's population increased in religious and cultural diversity, it remained a place where people shared a strong sense of community. Over the latter half of the 20th century, Orem became the commercial center of Utah County for two primary reasons: the State Street retail corridor and population growth. Although the City has continued to grow since 1990, other cities in Utah County have grown large enough to have their own local retail; a few have become regional retail hubs that compete directly with Orem. This, combined with the trends of increased online sales and experiential shopping (where shoppers prefer to spend more money in engaging, pedestrian-friendly places and have amenities), has led to a decline in some parts of State Street.

As Orem continues to grow, the city has been working on plans to address future development. While some see growth as negative, most current residents recognize that growth has been an overall positive part of Orem's history. Recent feedback from the public outreach indicates that most residents are supportive of additional growth if it is well planned and strategically located. Recent planning includes the adoption of zoning for student housing near Utah Valley University. In 2018, The Utah Transit Authority opened Utah County's first Bus Rapid Transit (BRT) line, the Utah Valley Express (UVX). This route starts at the FrontRunner Station and travels along University Parkway and Provo. Orem needs to continue to improve the transportation system to sustain the growth caused by commercial and technology development.



OREM

Transportation Master Plan

Figure 02: Area Map

Legend

Utah County Boundaries

UTAH

Orem City

N

Horrocks.

1.4 Public Involvement

It is important for this TMP to be transparent and accessible to the public. Orem residents and business owners benefit when they know future transportation plans. Orem desired public input to help shape the Transportation Master Plan. To fulfill that need, a public involvement team created and implemented the following:

- **Project Branding Package**
- **Project Hotline**
- **Project Email**
- **Social Media Outreach**
    - Twitter
    - Facebook
    - City website
    - City newsletter
    - Mayor's Blog
    - Press Release to Daily Herald about the study and the project website for commenting
- **Generated a contact database (included current city mailing lists)**
- **Met with the Orem Transportation Advisory Committee (OTAC) frequently to discuss outreach methods and receive input on public materials.**
- **Project Website:**
    - Master plan description and purpose
    - Frequently asked questions
    - Project timeline
    - Three interactive maps where citizens could place their comments. This map gathered detail-oriented feedback and included a description of the (MAG) Regional Long-Range Plan. The three maps were:
        - *Roadway/traffic/signals*
        - *Transit and parking*
        - *Bike and pedestrian routes*

The project website and interactive/commenting maps were advertised to the public through social media and direct email. The public comment period ran from March 19, 2015, to May 19, 2015. Approximately 150 comments were gathered.

This information was compiled, analyzed, and categorized as either feasible or not feasible by the project team. Each viable suggestion was forwarded to the appropriate group (e.g., incorporated into the master plan, implemented by Orem traffic department or Public Works, etc.)

Once the Transportation Master Plan was drafted, the project team hosted a public open house on September 1, 2015. A public involvement team worked with Orem to provide content for social media outlets, the mayor's blog and newsletter, and a press release to advertise the open house. In harmony with the OTAC's suggested changes, the public involvement team constructed informative display materials for the public open house. This open house served as a venue to both inform the public of the new Transportation Master Plan and to gather any final feedback about changes to the plan.

In addition to the input gathered at the open house, the project website was updated with a link to the draft master plan and the open house displays. A comment form was also added to allow the public to comment on the published plan for two additional weeks.

2.0 Roadway Standards

Transportation planning in the region is a cooperative effort of state and local agencies. All urbanized areas throughout the country are separated into areas called Metropolitan Planning Organizations (MPO) where the designated agency is responsible for coordinating the transportation planning for the area. The MPO for Utah, Summit and Wasatch Counties is called the Mountainland Association of Governments (MAG). MAG became the MPO for these counties in 1972. Included in this section is a general discussion on the methodologies used for the travel demand modeling process, functional classification of streets, and level of service for streets and intersections. Also included are the existing and future conditions for 2030 and 2050.

2.1 Travel Demand Modeling

Traffic Demand Modelling is used to project existing traffic conditions into the future. Orem's land use plan, socioeconomic data as well as additional data obtained from Orem and MAG serve as valuable input into the travel demand model. MAG uses a regional travel demand model which was also used for this TMP. This section discusses the socioeconomic data, land use, vehicle trip generation as well as the precautions of using the Travel Demand modelling.

2.1.1 Land Use and Zoning

Most of the socioeconomic data used in this study are based on the statewide data provided by the Kem C. Gardener Policy Institute at the University of Utah. This data was supplemented and verified using the data provided by Orem in the form of the current adopted general plan as of 2018 (the most recent version can be found on Orem's website at *www.orem.org*).

This information is the best available data for predicting future travel demands. However, land use planning is a dynamic process and the assumptions made in this report should be used as a guide and should not supersede other planning efforts especially when it comes to localized intersections and roadways. **Figure 3** displays the most recent land use map adopted by the City of Orem in the 2018. The City of Orem's planning website keeps an up-to-date version of this map that can be accessed at *https://orem.org/planning/*.

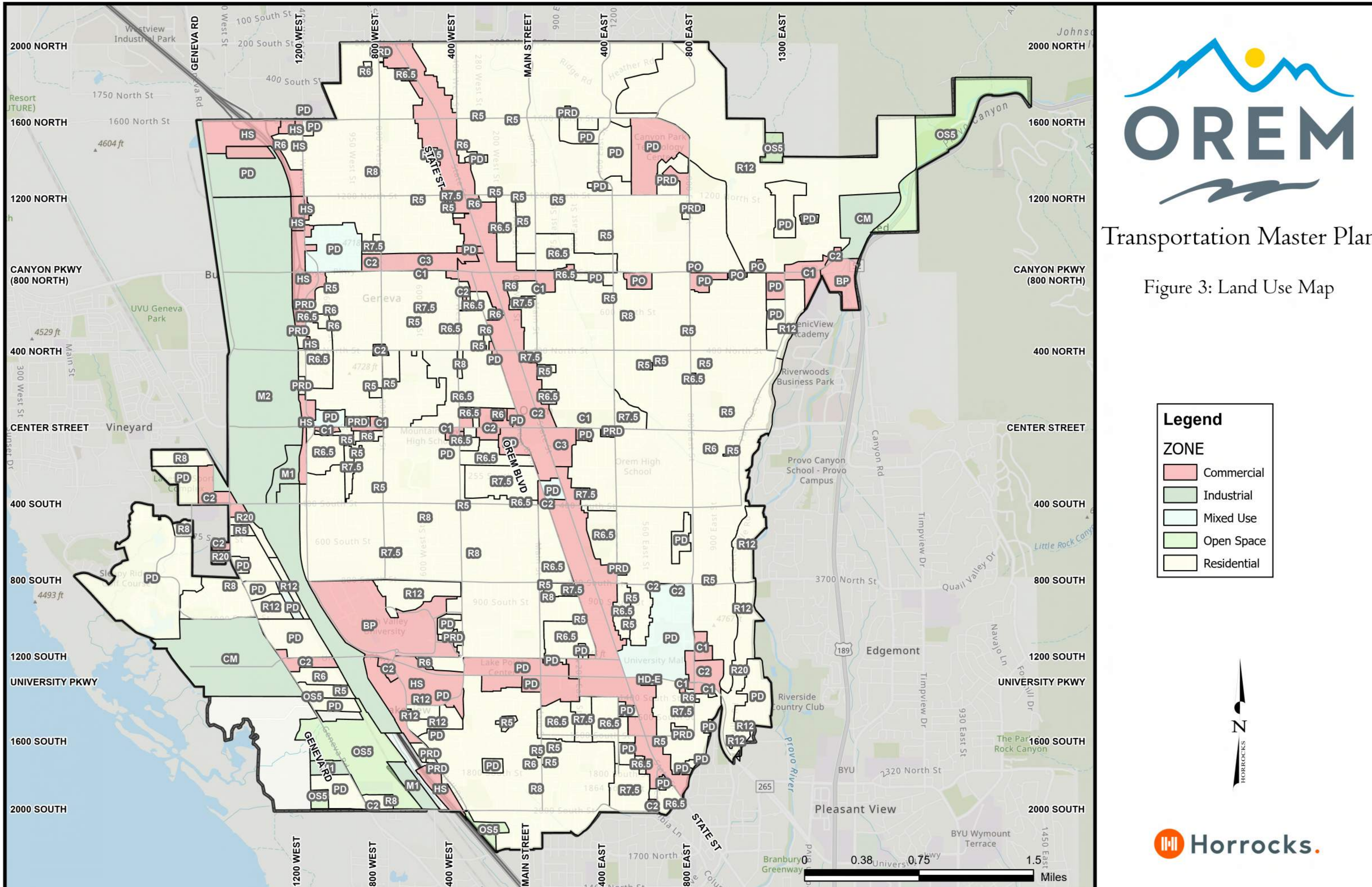


Figure 3: Land Use Map

2.1.2 Socioeconomic Conditions

Currently, Orem's population is estimated to be 98,129 residents with 29,049 households. The median household income in the city is $64,590 and the average household size is 3.27. The median age of Orem residents is 26.5 years. The 2010 to 2020 decade saw rapid growth in Orem, with an increase in population from 88,328 to 98,129 (11.2%). There are more than 10,304 firms in the city, and the average travel time to work for the workforce is 19 minutes.

Based on the current land use, zoning, demographics, and growth patterns, Orem is expected to grow to approximately 118,900 residents by the year 2050. The forecasted growth will place increased pressure on the City's infrastructure, including the street network. Orem is also committed to increasing residential, commercial, office, and retail within Orem so citizens can fulfill all needs within the city boundaries. This growth will therefore have considerable impact on traffic volumes in the city. Future development and plans along major corridors have been implemented into the modeling effort.

2.1.3 Trip Generation

To generate vehicle trips, sections of the city are split into geographical sections called Traffic Analysis Zones (TAZ). Each TAZ contains socioeconomic data including the number of households, employment opportunities, and average income levels. This data is used to generate vehicle trips that originate in the TAZ. All trips generated in the TAZ are assigned to other TAZs based on the data within other zones. Since the MAG travel demand model predicts regional travel patterns, the TAZ structure was updated to obtain more detailed travel demand data for Orem. This was completed by splitting larger TAZ's.

2.1.4 Travel Demand Model Precautions

Orem aims to plan for and encourage responsible and sustainable growth in the city. Part of the commitment to provide a sustainable system includes encouraging a reduction in vehicle trips by providing a balance of roads, trails and bikeways, and public transit facilities. Today's transportation system should not only accommodate existing travel demands but should also have built-in capacity to account for the demand that will be placed on the system in the future. While considering the socioeconomic data used in this report and the anticipated growth in the city, some precautions should be considered. First, the TAZ specific socioeconomic data only approximates the boundary conditions of the City and is based on data provided by MAG and the City's planning documents. Second, actual values may vary somewhat because of the large study area of the regional travel demand model, which includes the unincorporated areas around Orem. Therefore, the recommendations in this report represent a planning level analysis and should not be used for construction of any project without review and further analysis. This document should also be considered a living document and should be updated regularly as development plans, zoning plans, and traffic patterns and trends change.

2.2 Functional Classification System

All trips include two distinct functions: mobility and land access. Mobility and land access should share an inverse relationship, meaning as mobility increases land access decreases. Street facilities are classified by the relative amounts of through and land-access service they provide. There are four primary classifications: Freeway/Expressway, Arterial, Collector and Local Streets. Each classification is explained in further detail in the following paragraphs and is also represented in Figure 4. A more detailed description of the characteristics of the four primary functional classifications of streets are found in Table 1.

- **Freeways and Expressways** – *Freeway and expressway facilities provide service for long distance trips between cities and states. No land access is provided by these facilities. For example, I-15.*
- **Arterials** – *Arterial facilities should provide service primarily for through-traffic movements. All traffic controls and the facility design are intended to provide an efficient through movement. For example, University Parkway.*
- **Collectors –** *Collector facilities are intended to serve both through and land-access functions in relatively equal proportions. They are frequently used for shorter through movements associated with the distribution and collection portion of trips. For example, 400 E.*
- **Local Streets** – *Local Street facilities primarily serve land-access functions. The design and control facilitate the movement of vehicles onto and off the street system from land parcels. For example, 200 N.*

Figure 4: Mobility vs. Land Access Representation

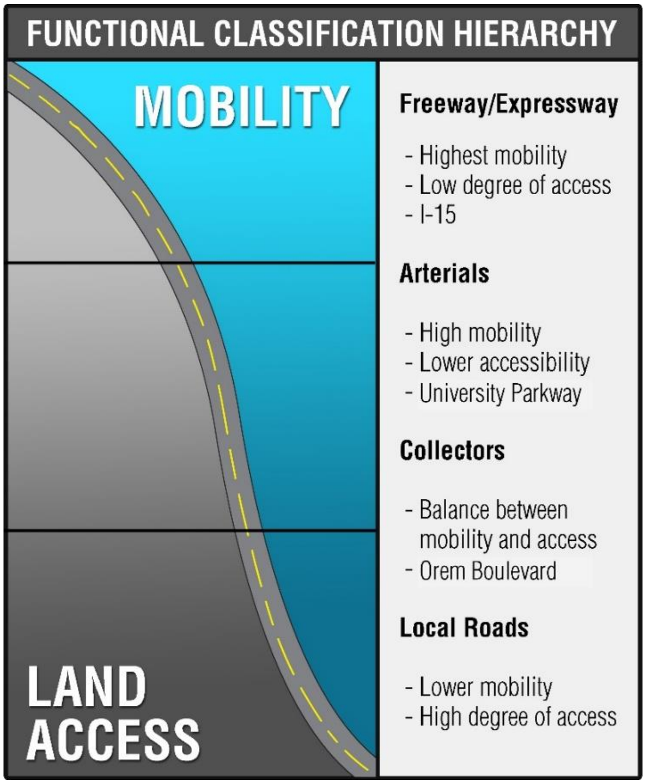


Table 1: Street Functional Classification

Characteristic	Functional Classification: Freeway and Expressway	Arterial	Collector	Local Street
Function	Traffic movement	Traffic movement, land access	Collect and distribute traffic between streets and arterials, land access	Land access
Typical % of Surface Street System Mileage	Not applicable	5-10%	10-20%	60-80 %
Continuity	Continuous	Continuous	Continuous	None
Spacing	4 miles	¼-2 miles	¼-1 mile	As needed
Typical % of Surface Street System Vehicle-Miles Carried	Not applicable	40-65%	10-20%	10-25 %
Direct Land Access	None	Limited: major generators only	Restricted: some movements prohibited; number and spacing of driveways controlled	Safety controls access
Minimum Roadway Intersection Spacing	1 mile	½ mile	300 feet-¼ mile	300 feet
Speed Limit	55-75 mph	40-50 mph in fully developed areas	30-40 mph	25 mph
Parking	Prohibited	Discouraged	Limited	Permitted
Comments	Supplements capacity of arterial street system & provides high-speed mobility	Backbone of street system		Through traffic should be discouraged; Subject to traffic calming

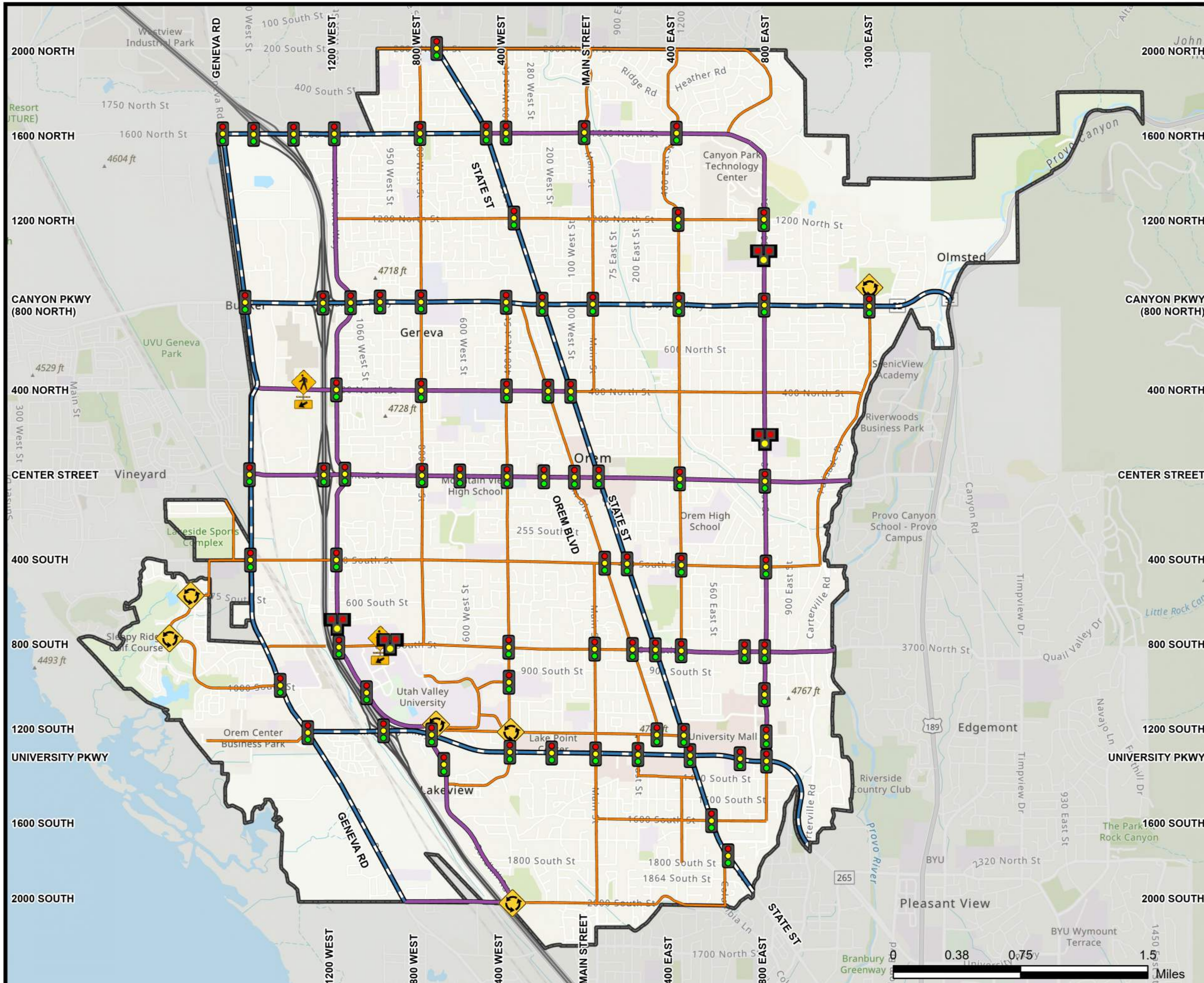
In Orem, there are three functional classifications: Urban Collector, Minor Arterial, and Principal Arterial. These classifications are based on resolution No. R-07-0023 adopted June 26, 2007. The resolution is included in **Appendix A: Resolution No. R-07-0023** is also shown in **Figure 5**. Currently, Urban Collectors have 2 or 3 lanes, Minor Arterials range from 2 to 5 lanes and Principal Arterials range from 2 to 7 lanes. **Figure 6** shows a map with the existing number of lanes in Orem. Within the MAG travel demand model, the functional classification, and the number of lanes dictate the capacity of the roadway. Therefore, it is recommended that Orem update their future functional classification to include the number of lanes as shown in **Table 2**. Based on the new functional classification, any 4-5 lane Minor Arterial in **Figure 5** will be re-classified as a "Major Arterial" in 2050.

Table 2: Proposed Future Functional Classifications

Functional Classification	Number of Lanes
Local and Sub-Local	2 Lanes
Urban Collector	2-3 Lanes
Minor Arterial	2-3 Lanes
Major Arterial	4-5 Lanes
Principal Arterial	6-7 Lanes

Transportation Master Plan

Figure 05: Existing Roadway Network



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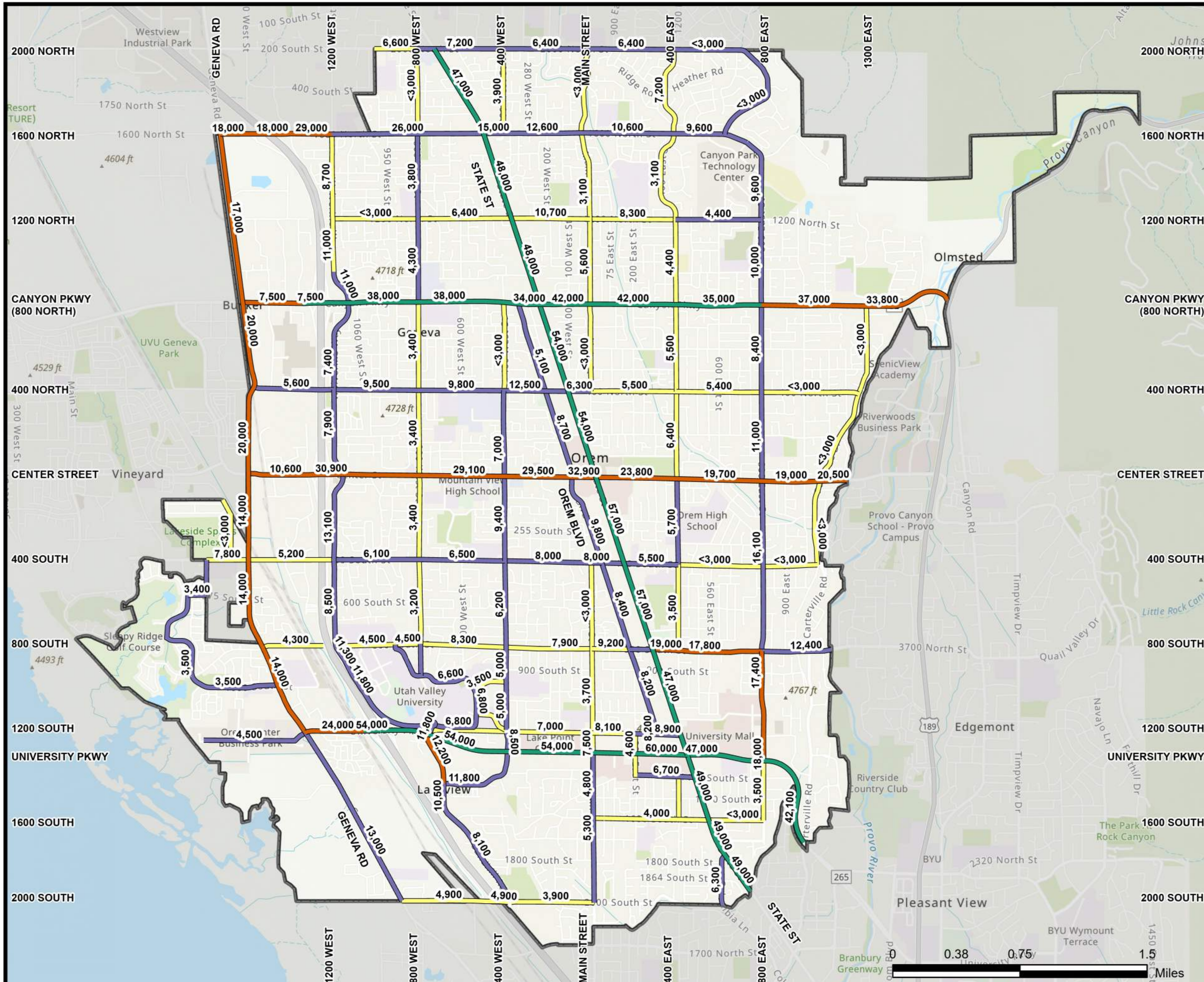

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Transportation Master Plan

Figure 06: Existing Number of Lanes

Legend

- 2-Lanes
- 3-Lanes
- 5-Lanes
- 7-Lanes

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2.2.1 Typical Roadway Cross-Sections

The typical cross-sections for each functional classification in Orem were updated. In Resolution No. R-07-0023 (Found in **Appendix A: Resolution No. R-07-0023**), ranges for Right of Way (ROW) width as well as pavement width for each functional classification are included. It is important for Orem to use specific values for each cross-section. It is recommended that Orem update the ROW and pavement widths used for each cross-section to match the proposed functional classifications above. **Figure 7** shows a representation for each cross-section.

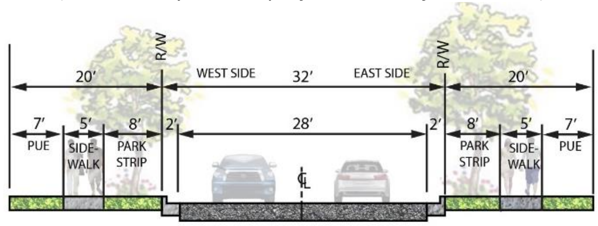
For urban collectors, there is a two-lane and a three-lane configuration which share the same ROW width. The two-lane configuration is for low volume collector roadways with seven-foot shoulders for parking. As volumes increase, the roadway can be restriped to reduce the shoulder to a six-foot bike lane with a center turn lane (also known as Two Lane Left Turn Lane [TWLTL]) to increase capacity.

2.2.2 Cross-Sections for Specific Roadways in Orem

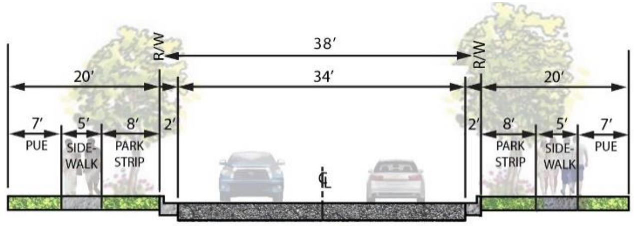
As shown in **Figure 5**, Orem recently annexed land in the southwest corner of the City. In cooperation with Provo, Lakeview Parkway will begin at Geneva Road and travel southwest to the Orem/Provo border. As part of the project, a multi-use path will be installed on Geneva Road as well as Lakeview Parkway, which require different cross-sections from the standard sections shown in **Figure 7**. Orem has adopted cross-sections for Geneva Road and Lakeview Parkway. Since Lakeview Parkway will be designed to attract traffic off Geneva Road, there will be two cross-sections. Geneva Road will be a 5-lane (119' ROW) road and a 3-lane (95' ROW) road north and south of Lakeview Parkway, respectively. Lakeview Parkway will be a 5-lane (110' ROW) road with a multi-use path on the west side of the roadway. Other cross-sections noted are 2000 South, which is shared with Provo City and 800 North, which is now Canyon Parkway. Each cross-section is shown in **Figure 8**. A map showing the southwest street network plan is shown in **Appendix G: Southwest Street Network Plan**.

Figure 7: Typical Cross-Sections

Sub Local Street – 32' ROW (20' Easement on each side)
(For roadways with a projected ADT of 800 or less)

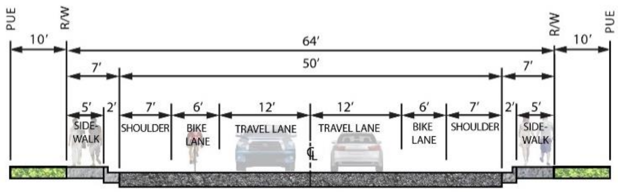


Local Street – 38' ROW



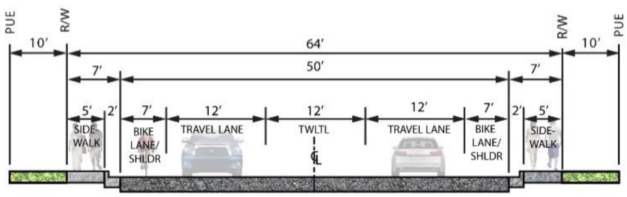
Collector (2 Lanes) – 64' ROW

(8-foot parkstrip on both sides for new streets or new sidewalks)

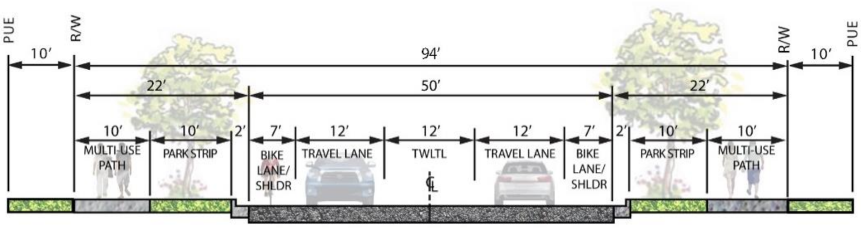


Collector (3 Lanes) – 64' ROW

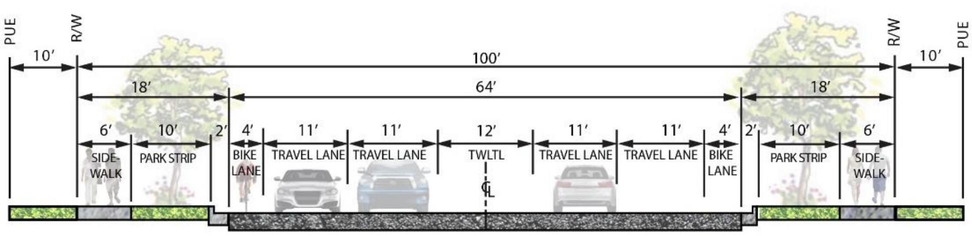
(8-foot parkstrip on both sides for new streets or new sidewalks)



Minor Arterial (2-3 Lanes) – 94' ROW



Major Arterial (4-5 Lanes) – 100' ROW



Principal Arterial (6-7 Lanes) – 141' ROW

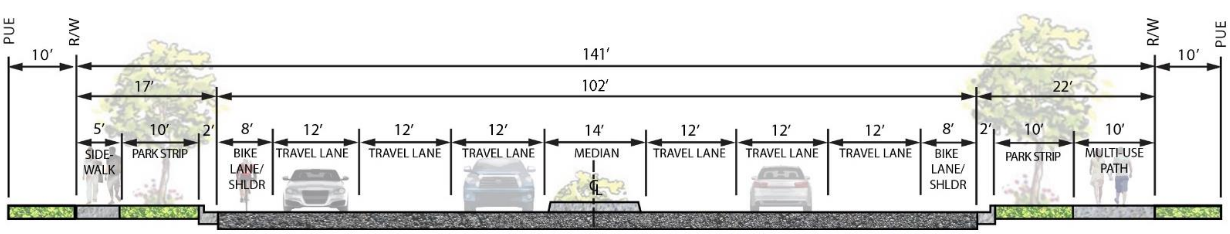
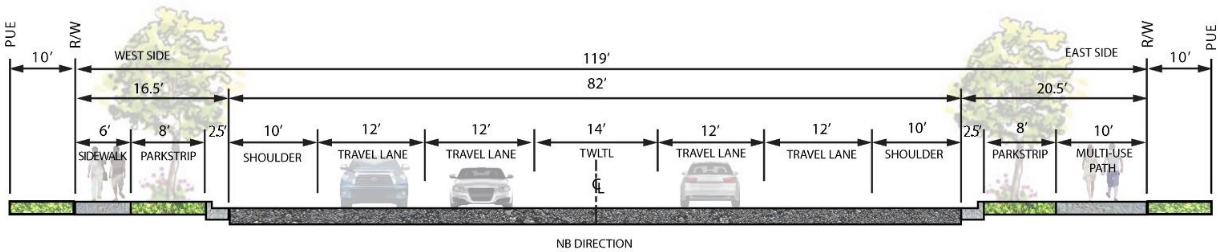
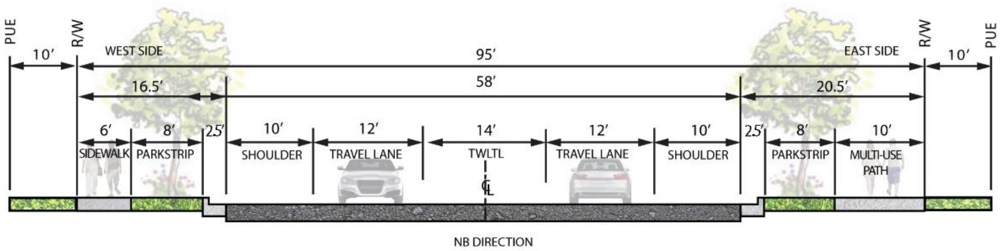


Figure 8: Geneva Road and Lakeview Parkway Cross-Sections

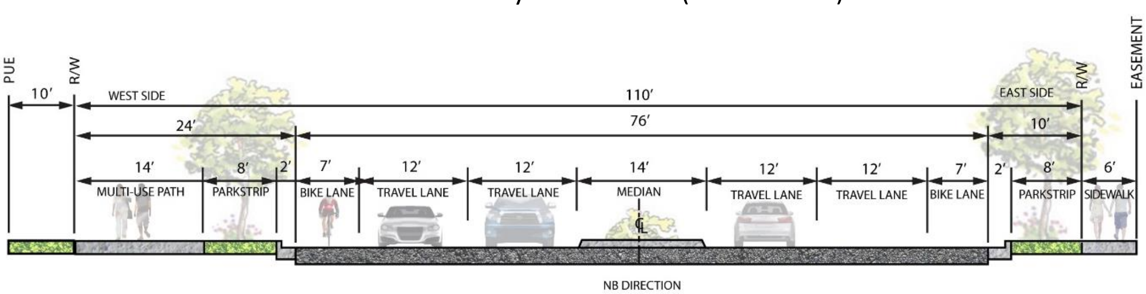
Geneva Road (North of Lakeview Parkway) – 119' ROW



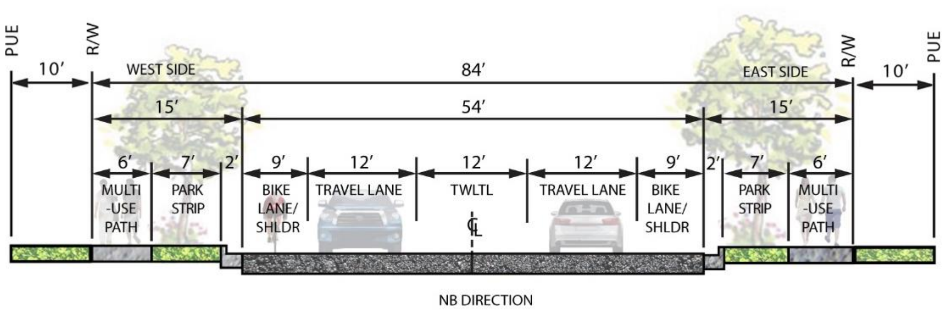
Geneva Road (South of Lakeview Parkway) – 95' ROW



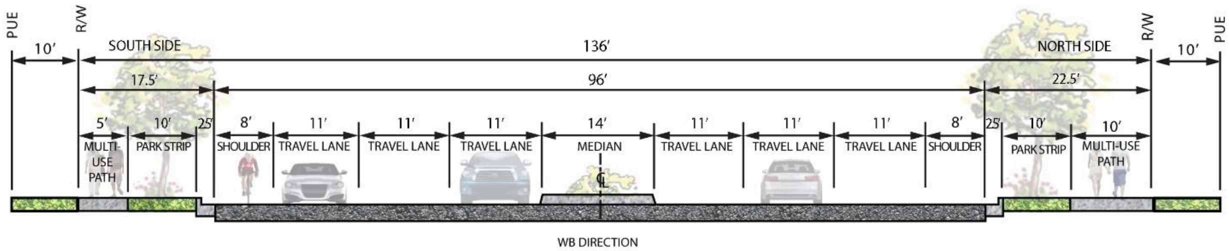
Lakeview Parkway – 110' ROW (6' Easement)



2000 South – 84' ROW



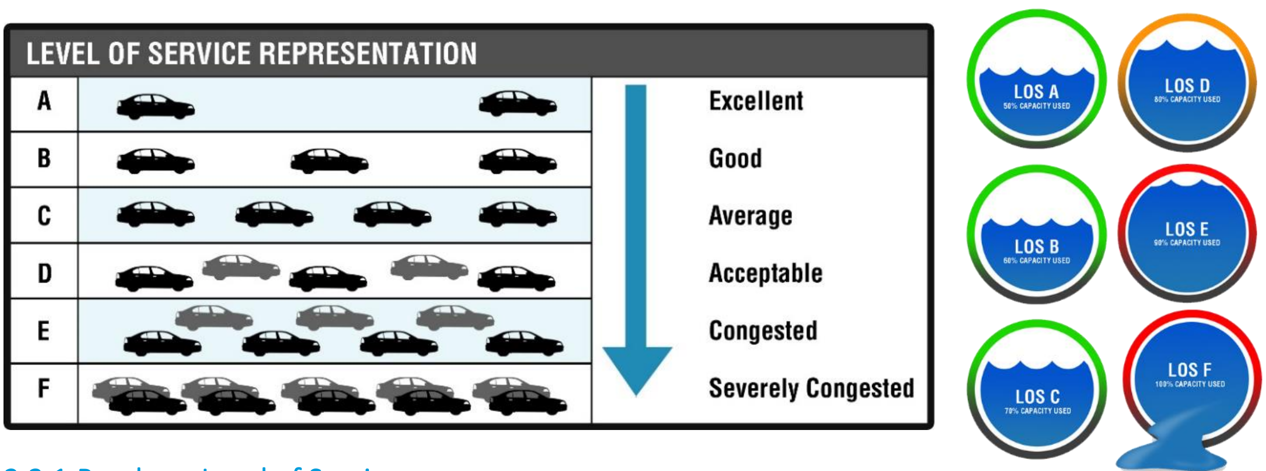
800 North (Canyon Parkway) – 136’ ROW



2.3 Level of Service

The adequacy of an existing street system can be quantified by assigning Levels of Service (LOS) to major roadways and intersections. As defined in the *Highway Capacity Manual (HCM),* a document published by the Transportation Research Board (TRB), LOS serves as the traditional form of measurement of a roadway’s functionality. The TRB identifies LOS by reviewing elements, such as the number of lanes assigned to a roadway, the amount of traffic using the roadway and the time of delay per vehicle traveling on the roadway and at intersections. Levels of service range from A (free flow where users are virtually unimpeded by other traffic on the roadway) to F (traffic exceeds the operating capacity of the roadway) as shown in **Figure 9**. Also shown in **Figure 9** are representations of LOS using pipe flow. As traffic volumes increase, the pipe continues to fill until at LOS F the pipe reaches capacity and begins to overflow.

Figure 9: Level of Service Representation



2.3.1 Roadway Level of Service

Roadway LOS is used as a planning tool to quantitatively represent the ability of a particular roadway to accommodate the travel demand during the peak hours of the day. Typically, the peak hour falls within the 4:00 PM and 6:00 PM hours. The LOS is assigned during the peak hour based on the number of lanes and the lane capacity. Lane capacity is different based on the functional classification of the roadway. Roadway segment LOS can be mitigated with geometry improvements, additional lanes, two-way-left turn lanes, and access management. Intersections are not included when analyzing roadway LOS and therefore the LOS indicates if the existing number of lanes, lane widths and functional classification are adequate for the traffic volumes.

LOS D is approximately 80 percent of a roadway's capacity and is a common goal for urban streets during peak hours. A standard of LOS D for system streets (collectors and arterials) is acceptable for future planning. Attaining LOS C or better on these streets would be potentially cost prohibitive and may present societal impacts, such as the need for additional lanes and wider street cross-sections. LOS D suggests that for most times of the day, the roadways will be operating well below capacity. The peak times of the day will likely experience moderate congestion characterized by a higher vehicle density and slower than free flow speeds. Although the model uses traffic volumes during the peak hour of the day, Table 3 and Table 4 show estimated ADT values for LOS C, LOS D, and LOS E on Arterial and Collector Streets for reference.

Table 3: Estimated LOS based on ADT on Arterial Streets

Lanes	LOS C	LOS D	LOS E
2-3	12,400	15,100	17,700
4-5	28,500	32,800	40,300
6-7	43,000	50,500	63,400

Table 4: Estimated LOS based on ADT on Collector Streets

Lanes	LOS C	LOS D	LOS E
2	9,700	12,100	14,500
3	10,800	13,400	16,100

2.3.1.1 Friction Points within a Roadway System that Cause Delay and Congestion

Traffic volume is not the only cause of delay and congestion. Factors such as speed limit, reduced speed school zones (RSSZ) on-street parking, and access spacing act as "friction points" in a roadway system. These friction points, although not included in the travel demand model are sources of additional congestion and delay. When the City addresses problems on the roadway network, friction points should be assessed as a method to temporarily alleviate congestion and delay. Any mitigations to these friction points will have a minimal effect on congestion and delay. As part of this TMP, an inventory of the on-street parking and RSSZ's in Orem were collected and are included in Figure 10. Speed limits (Figure 31) and access spacing are discussed in the Section 4.0 Other Policies and Guidelines. Mitigating congestion and delay due to the friction points should not be the only measure used to reduce congestion and delay as the effects are minimal.

2.3.2 Intersection Level of Service

Whereas roadway LOS considers an overall picture of a roadways capacity to estimate operating conditions, intersection LOS looks at each individual vehicle movement at an intersection and provides a more precise method for quantifying operations. Since intersections are typically a source of bottlenecks in the transportation network, a detailed look into vehicle delay at each intersection should be performed on a regular basis. The methodology for calculating delay at an intersection is outlined in the *Highway Capacity Manual* (HCM) and the resulting criteria for assigning LOS to signalized and un-signalized intersections are outlined in Table 5. LOS D is considered the industry standard for intersections in an urbanized area. LOS D at an intersection corresponds to an average control delay of 35-55 seconds per vehicle for a signalized intersection and 25-35 seconds per vehicle for an un-signalized intersection.

At a signalized intersection under LOS D conditions, the average vehicle will be stopped for less than 55 seconds. This is considered an acceptable amount of delay during the times of the day when roadways are most congested. As a rule, traffic signal cycle lengths (the length of time it takes for a traffic signal to cycle through each movement in turn) should be below 90 seconds. An average delay of less than 55 seconds suggests that in most cases, no vehicles will have to wait more than one cycle before proceeding through an intersection.

Un-signalized intersections are generally stop-controlled. These intersections allow major streets to flow freely, and minor intersecting streets to stop prior to entering the intersection. In cases where traffic volumes are more evenly distributed or where sight distances may be limited, four-way stop-controlled intersections are common. LOS for an un-signalized intersection is assigned based on the average control of the worst approach (always a stop approach) at the intersection. An un-signalized intersection operating at LOS D means the average vehicle waiting at one of the stop-controlled approaches will wait no longer than 35 seconds before proceeding through the intersection. This delay may be caused by large volumes of traffic on the major street resulting in fewer gaps in traffic for a vehicle to turn, or for queued vehicles waiting at the stop sign. Roundabout LOS is also measured using the stopped controlled LOS parameters.

Table 5: Intersection Level of Service

LOS*	Signalized Intersection (sec)	Stop-Controlled/ Roundabout (sec)
A	≤10	≤10
B	>10-20	>10-15
C	>20-35	>15-25
D	>35-55	>25-35
E	>55-80	>35-50
F	≥80	≥50

*LOS F when traffic volumes exceed capacity

Intersection and roadway segment LOS problems must be solved independently of each other, as the treatment required to mitigate the congestion is different in each case. Intersection problems may be mitigated by adding turn lanes, improving signal timing, and improving corridor signal coordination.

2.3.3 Level of Service F and Future Development

Although it is recommended that Orem maintain LOS D or better on its roadway network if a roadway performs at LOS F it does not necessarily require a capacity improvement. Orem will continue to develop well past the year 2050. As all the remaining land is developed, many existing developments may be redeveloped into larger, or vertical developments. Continual development comes with the price of increased volumes for all transportation types. There are specific cases when a roadway is currently performing at LOS F and will perform at LOS F in the future. Examples of roadways which are currently LOS F are State Street and University Parkway. Although these roadways perform at LOS F, it does not reduce the desire to continue future development along those corridors. For each specific case, Orem will work with the developer to analyze the magnitude of the performance difference along the corridor due to the development to determine if roadway improvements are necessary. See **Section 4.8 Traffic Impact Studies** for more information regarding future development in Orem.

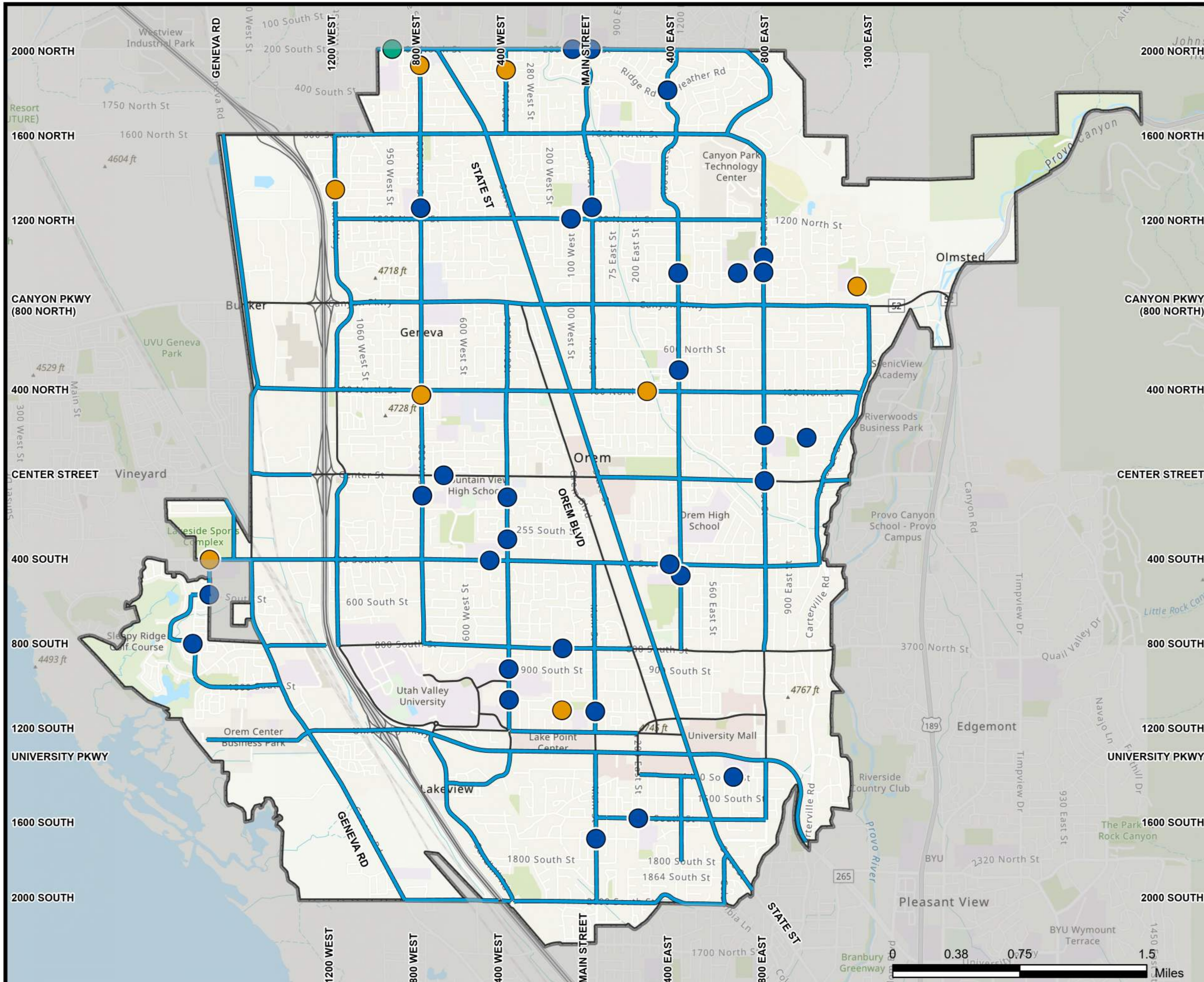


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Figure 10: Friction Points in Orem

Legend

Friction Points

- Existing School Zone
- Future School Zone
- School Zone Maintained by Lindon City
- On Street Parking

Horrocks.

2.4 Existing Roadway Network Conditions

Using existing socioeconomic data as well as traffic data, the MAG Travel Demand Model can be calibrated and prepared to project traffic volumes into the future. It is also important to investigate any existing roadway or intersection deficiencies to determine if any mitigation is necessary on the existing roadway network. This section discusses the methodology used to prepare the model to project future volumes as well as existing deficiencies on the roadway network in Orem.

2.4.1 Travel Demand Model Calibration

As with the TAZ structure, the MAG Travel Demand Model was calibrated to fit existing traffic conditions in Orem. The method used to calibrate the model was to use traffic counts throughout the city. Traffic counts were collected from UDOT and include annual average daily traffic (AADT) volumes as defined in *Traffic on Utah Highways.* On City owned roadways, traffic counts were either provided by Orem or were manually counted as part of this TMP. **Figure 11** shows the count locations throughout the city used for model calibration.

2.4.2 Existing Roadway and Intersection Level of Service

Using the calibrated MAG Travel Demand Model and data provided by Orem, the LOS for each roadway segment as well as each intersection is shown in **Figure 12**. The following roadways and intersections are currently performing at LOS E or worse.

Roadway Segments

- **University Parkway** (State Street to I-15)
- **State Street** (800 North) to 800 South)
- **1600 North** (1200 West to State Street)
- **800 East** (Center Street to 800 South)
- **800 North** (800 East to eastern border)

Intersections

- **Sandhill Rd & University Parkway**
- **State Street & University Parkway**
- **University Parkway & I-15**
- **400 West & University Parkway**
- **200 West & University Parkway**
- **Main Street & University Parkway**
- **200 East & University Parkway**
- **State Street & 800 North**
- **State Street & Center Street**
- **State Street & 1600 North**
- **1200 West & 1600 North**
- **800 West & 1600 North**
- **1300 East & 800 North**
- **800 East & 400 South**

2.4.3 Mitigations to Existing Deficiencies

In most cases, roadway capacity improvements are achieved by adding travel lanes. In some cases, additional capacity can be gained by striping additional lanes where the existing pavement width will accommodate it. This can be accomplished by eliminating on street parking, creating narrower travel lanes, and adding two-way left turn lanes where they do not currently exist. For all roadway capacity improvements, it is recommended to investigate other mitigation methods before widening the roadway.

At signalized intersections, methods to improve intersection LOS include additional left and right turning lanes, grade separation of lanes, correct spacing of signals, and signal timing improvements. It is recommended to investigate signal timing improvements before adding additional turning lanes.

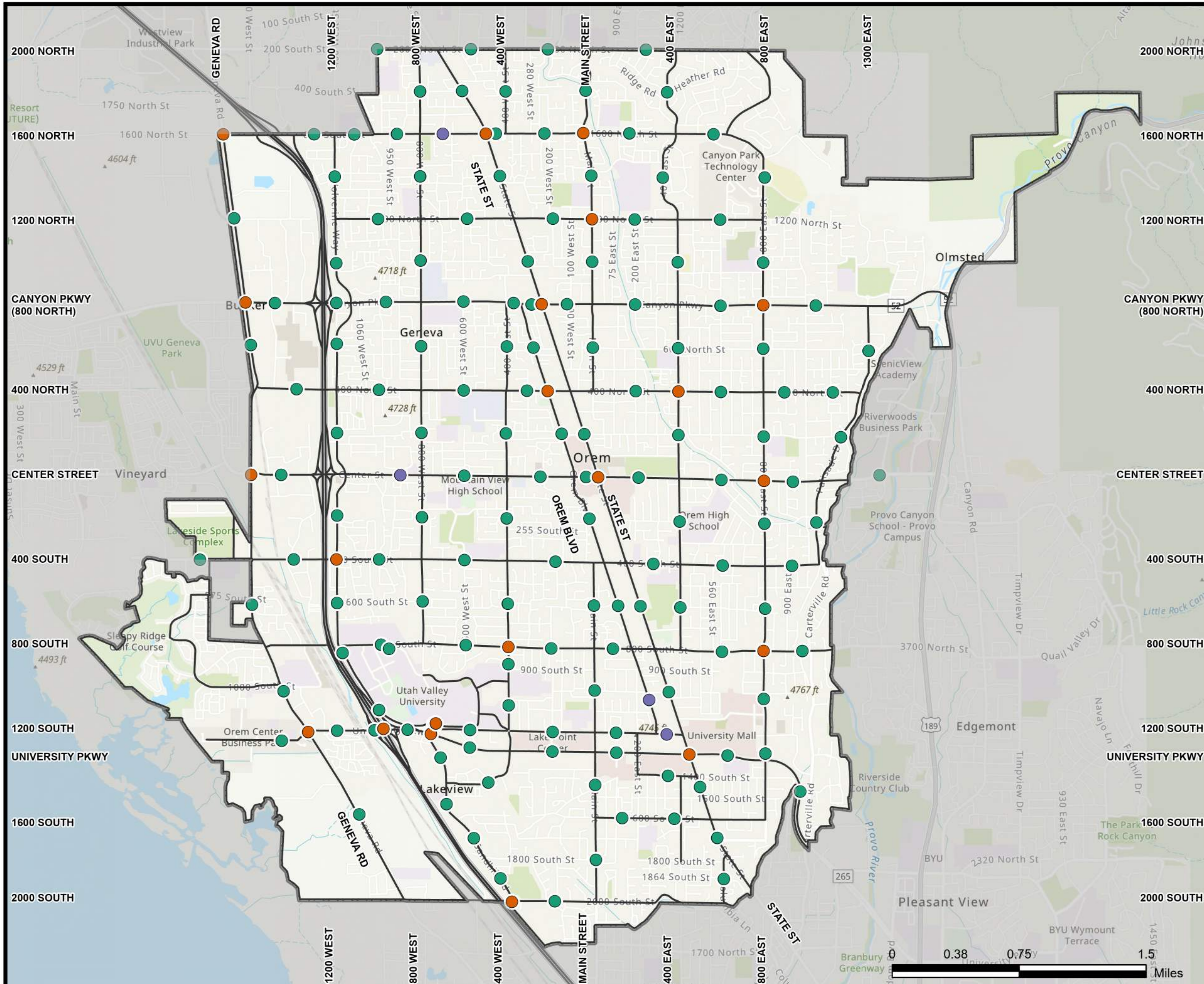

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Figure 11: Traffic Count Locations

Legend

Count Location

- ADT Count - Horrocks
- Peak Hour TM* Count - Horrocks
- ADT Count - Orem

*TM = Turning Movement

Horrocks.

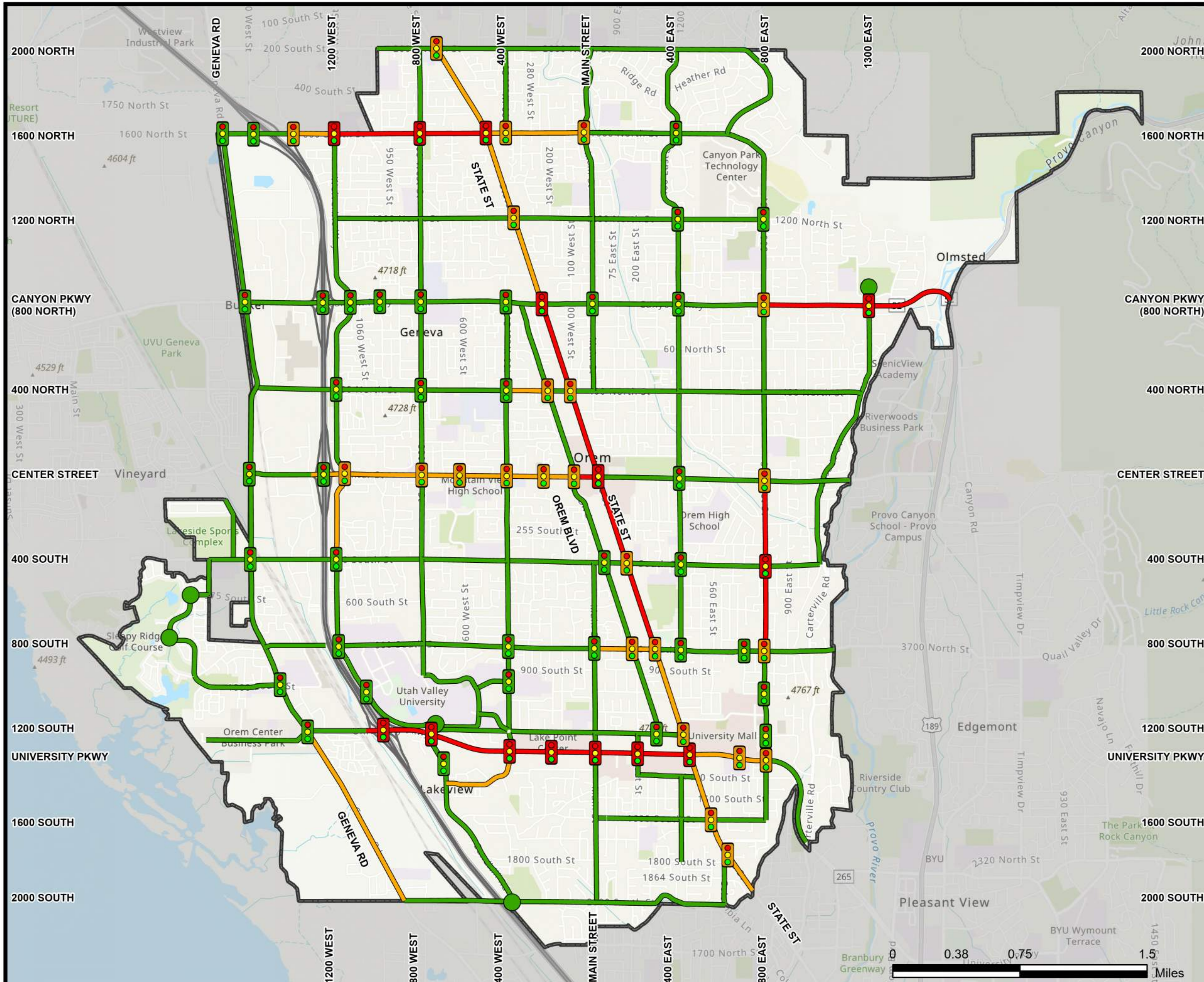

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Figure 12: Existing Level of Service (Peak Hour)

Legend

Existing Level of Service

- Acceptable LOS C or Better)
- Acceptable (LOS D)
- Unacceptable (LOS E or Worse)
- Acceptable (LOS C or Better)
- Acceptable (LOS D)
- Unacceptable (LOS E or Worse)
- Roundabout (LOS C or Better)

Horrocks.

2.5 Future Roadway Network Conditions

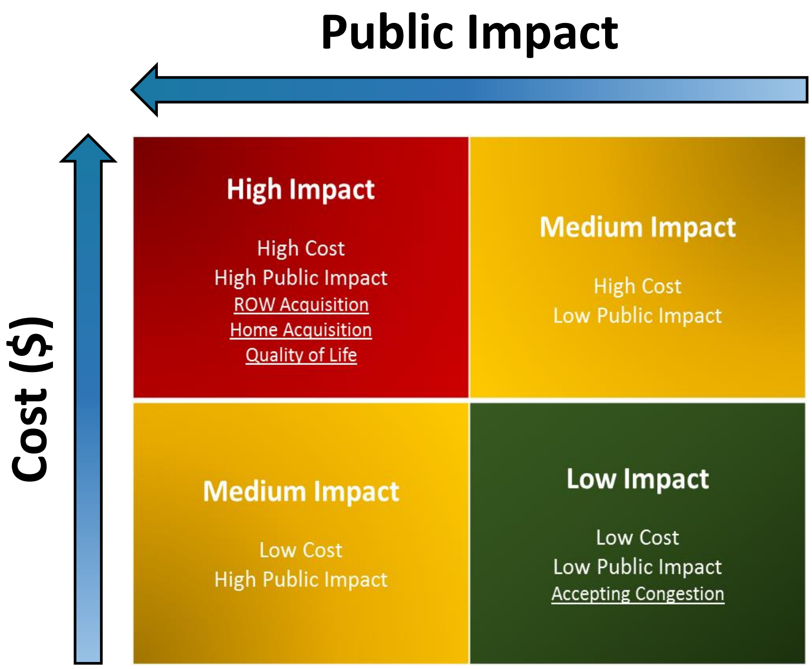
Two future conditions are included in this TMP. The 2030 Capital Improvement Program (CIP) includes all roadway improvements necessary for a horizon year of 2030. The Transportation Improvement Fund (TIF) is included to indicate the funding source for all projects included in the 2030 CIP. The other condition investigates the roadway network and improvements necessary for a horizon year of 2050. Both the 2030 CIP and 2050 conditions are outlined in this section and the methodology used to incorporate the TIF to fund all the projects in the CIP. All projects will be selected based on input from city staff, elected officials as well as the public.

2.5.1 Roadway Improvement Impacts

Since Orem is estimated to have large traffic volumes in the future, it is not recommended to improve all the roadways to LOS D or better. Although this condition is ideal, this would require additional traffic lanes, which requires additional ROW to be bought from landowners and has a large cost to tax paying citizens of Orem. As Orem continues to develop and roadway projects are needed, the impacts caused by these projects need to be addressed. Roadway network project impacts can be separated into two groups: Cost impacts and Public Impacts. Cost impacts deal specifically with the financial burden on Orem and its citizens to finance the roadway projects. Public impacts investigate the right-of-way (ROW), house acquisition, and quality of life impacts.

A simple matrix can be used (as shown in **Figure 13**) to determine whether the project is categorized as a high, medium, or low impact project. High public impact is considered as projects where there is a high cost as well as large amounts of ROW or home acquisition or where the quality of life for Orem citizens are greatly impacted. As shown in **Figure 13**, all projects which are expensive to implement as well as have large public impacts will be considered a High Impact Project. Any project where cost or public impact is high will be considered a Medium Impact project and if both cost and public impact are low, it will be considered a Low Impact Project. Typically, a Low Impact Project will partially mitigate the future deficiency and the remaining congestion is accepted. **Figure 13** can be used as a tool as Orem officials and the public shape the future for the roadway network in Orem.

Figure 13: Cost vs. Public Impact Matrix



2.5.2 Special Considerations

As part of future development, specific "hot spot" locations were modeled throughout the city. These locations investigated specific roadway improvements and the impacts of those improvements on the surrounding roadways and are represented in **Figure 14**. The additional modeling hot spots were in the following locations and the following sections describe the results and if any additional roadway improvements are necessary:

- **1200 West –** (1600 North to 400 North) – *Widen to 5 Lanes*
- **800 West –** (1600 North to 800 South) – *Study 800 West between Center Street and 400 North and determine options to remedy the existing choke point.*

2.5.2.1 1200 West Additional Lanes

Due to the potential future impacts of development in the area around 1200 North and 1200 West, an additional model run was completed to determine if 1200 West requires additional travel lanes. Due to the additional traffic, additional travel lanes will be necessary by 2050. As part of the future Transportation Improvement Program (TIP), 1200 West from 1600 North to 800 North will be widened to 5 lanes.

2.5.2.2 800 South Additional Lanes

A new overpass on I-15 at 800 South is included in Phase 2 of the MAG RTP. With the new overpass, travel lanes were increased from three to five lanes from the interchange to State Street (800 South east of State Street is currently five lanes). An advantage of increasing the number of travel lanes on 800 South is to alleviate traffic at Utah Valley University (UVU) using University Parkway. The analysis indicates that a daily volume increase between 4,000 to 10,000 vehicles along the 800 South corridor with minimal decreases along University Parkway between 1,000 to 2,400 vehicles. Since the additional vehicles on 800 South would be significantly below the LOS D threshold for a five-lane road as well as the small number of vehicles that divert from University Parkway, it is not recommended to increase the lanes to 5 along the 800 South corridor.

2.5.2.3 800 West Additional Lanes

The analysis widens 800 West to 5 lanes from 1600 North to 800 South. The advantage of adding additional lanes along the 800 West corridor is to alleviate traffic congestion on State Street as well as 1200 West. The additional lanes increase traffic volumes up to 18,000 vehicles. Minimal traffic is pulled from State Street, but traffic volumes on 400 West and 1200 West are reduced up to 6,000 vehicles. Although this option is not included in the TMP on the proposed roadway network in **Figure 21**, it is something the city can consider in the future.

2.5.2.4 Pass Through Traffic

Also included was an analysis of the amount of pass-through traffic in 2050. This analysis used the model to determine how much of the traffic generated outside of Orem uses the roadway network but does not stop in Orem. **Figure 15** shows the percent pass through traffic in 2050 at all street locations along the border of the city. The percent pass through traffic ranges from 0-5% to 50-55%. It is understandable for the regional traffic routes such as Canyon Parkway (800 North), University Parkway, and State Street to have higher percentages since the purpose of these roadways is to move traffic long distances. Although most of the developable land has already been developed in Orem, there are many vehicle trips outside the city that contribute to the congestion in Orem in 2050. This suggests that along with the additional traffic generated within the city due to population growth, new development and redevelopment, Orem will continue to be an attraction for vehicle trips outside the city.

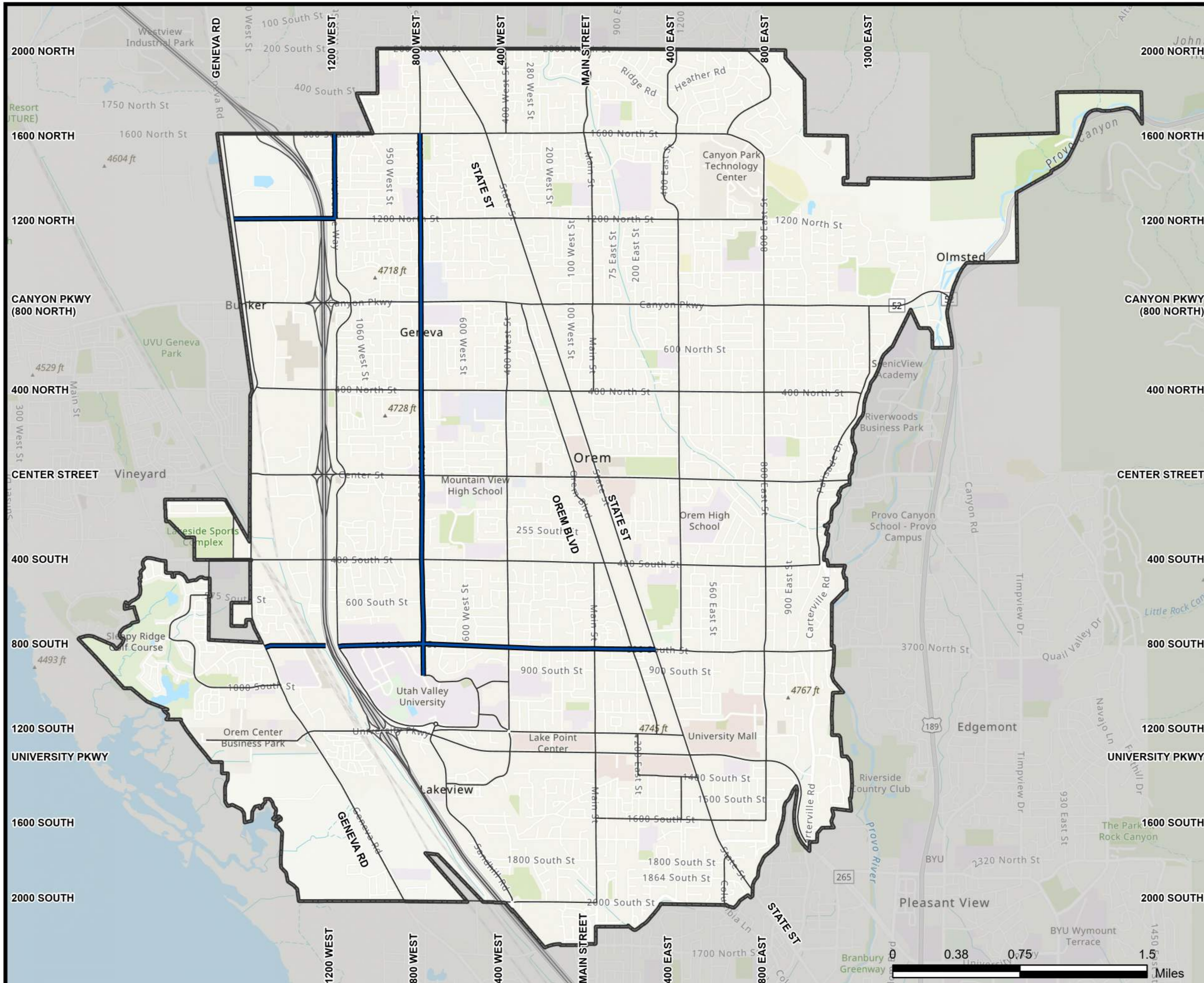


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Figure 14: Special Considerations

Legend

- Special Considerations
- Orem Street Network

Horrocks.

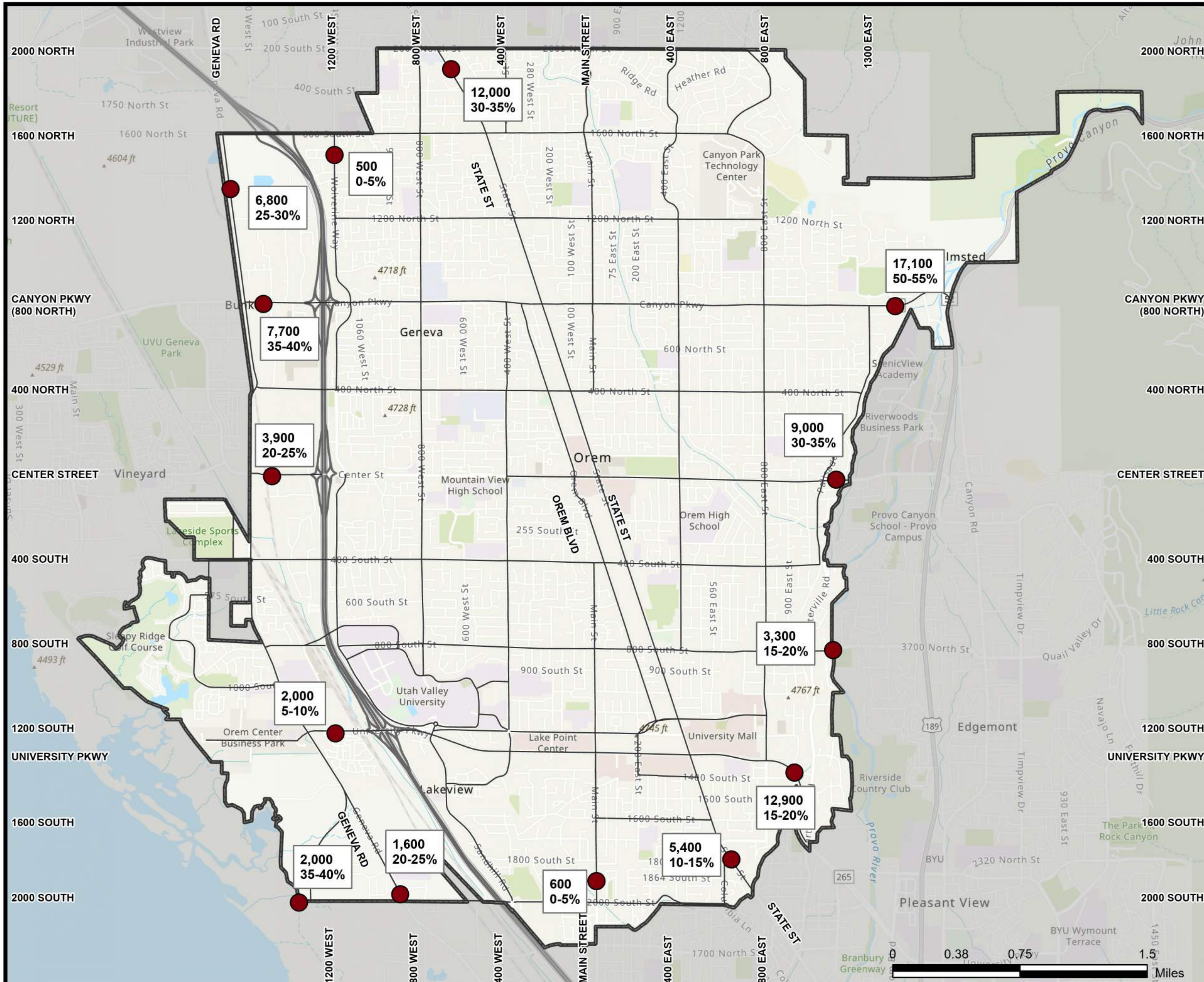

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Figure 15: Percent Pass Through Traffic

XX,XXX Pass Through ADT
%-% Percent of ADT Link Total

Legend

Number of Lanes

Orem Street Network

Horrocks.

2.6 2030 Capital Improvement Program

The 2030 Capital Improvement Program (CIP) includes all projects that will be completed by 2030. A "No Build" scenario is modeled to determine the roadways which will perform at LOS E or worse by 2030. Included in the list of projects are projects on the MAG Regional Transportation Plan (RTP). This section describes the process used to produce a list of projects and a description of the Transportation Improvement Fund (TIF) for the 2030 CIP.

2.6.1 2030 No Build Level of Service

A no-build scenario is intended to show what the roadway network would be like in the future if no action is taken to improve the City roadway network (including existing deficiencies). The travel demand model was used to predict this condition by applying the future growth and travel demand to the existing roadway network. As shown in **Figure 16**, the following roadways would perform at LOS E or worse if no action were taken to improve the roadway network:

- **1600 North** (1200 West to 400 West)
- **1200 West** (Center Street to Sandhill Road)
- **800 South** (1200 West to Campus Drive, Main Street to Orem Boulevard)
- **University Parkway** (Main Street to State Street)
- **800 North** (800 East to 1300 East)
- **Center Street** (I-15 to State Street)
- **State Street** (800 North to 800 South)
- **800 East** (Center Street to 800 South)

2.6.2 2030 Roadway Improvements – Regional Transportation Plan

Orem is not alone in improving the roadway network. MAG, in cooperation with UDOT, provides financial assistance for eligible projects on roadways with regional significance. The Regional Transportation Plan (RTP) already includes some of these projects. Projects not included on the RTP of regional significance may receive financial assistance through an application process. On roadways owned and operated by UDOT, the financial responsibility typically falls to UDOT. It is important for Orem to include these projects in this TMP and coordinate with UDOT to ensure these projects are implemented and that the projects follow access management principles. as shown in **Figure 19** shows the projects in Orem included in the RTP; the following is a list of the RTP Phase 1 projects to be completed by 2030.

Phase 1 MAG RTP Projects: 2019-2030

- **Orem 1600 North** (1200 West to State Street) – *Widen to 5 Lanes*
- **Orem Center Street** (Geneva Road to I-15) – *Widen to 5 Lanes*
- **Geneva Road** (Lakeview Parkway to Southern Border) *– Widen to 5 Lanes*
- **Orem 1200 West** (Center Street to Sandhill Road) – *Widen to 5 Lanes*
- **Lakeview Parkway/Geneva Road** (University Parkway to Southern Border) – *New 5 Lane Road*
- **I-15/Orem 800 S/Campus Drive** (Geneva Road to UVU) – *New 5 Lane Road/I-15 Bridge*
- **I-15/Orem Center St –** *Ramp and Lane Improvements*
- **I-15/University Pkwy** – *Grade separated off-ramp (similar to 10600 South in Sandy)*

Although the improvements on the MAG RTP will improve congestion in the specific project areas, there are many other areas of the city where the roadways perform at a LOS E or worse. The burden of the following improvement will fall entirely on Orem to improve.

- **1600 West** (1250 S to Geneva Road) – New Road

The indicated roadway segment as well as the additional modeling results from the **Special Considerations** section form the basis of the improvements included on the 2030 CIP as shown in **Figure 17**. There are segments along both State Street and University Parkway which perform at LOS E or worse in 2030 which are not included in **Figure 17**. Both State Street and University Parkway are seven lane principal arterials and widening would have extreme impacts on the businesses along each corridor and it is **NOT** recommended to widen to a nine-lane principal arterial. Any improvements along these corridors will focus on intersection improvements. Please refer to the **State Street and University Parkway Roadway Improvements** section for further information on improvements along State Street and University Parkway.

The results only indicate the roadway improvements needed based on the travel demand model. In coordination with Orem officials, minor projects (turning lanes, pedestrian crossings, ADA compliance, small roadway realignments, etc.) are not included in **Figure 17**. The costs to implement these projects is found in **Section 2.8.4**.

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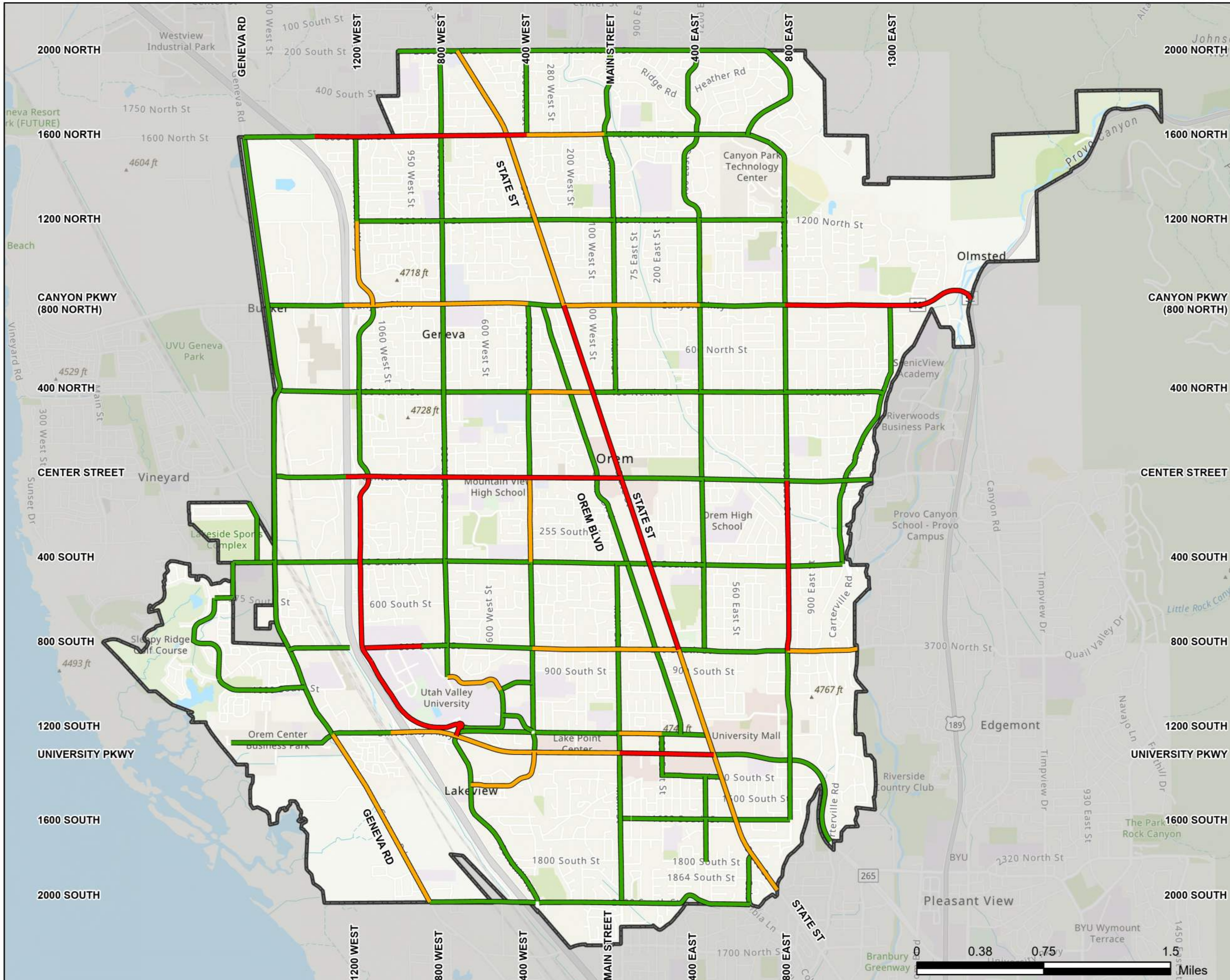
Figure 16: 2030 No Build Level of Service (Peak Hour)



Legend

2030 No Build LOS

- Acceptable (LOS C or Better)
- Acceptable (LOS D)
- Unacceptable (LOS E or Worse)

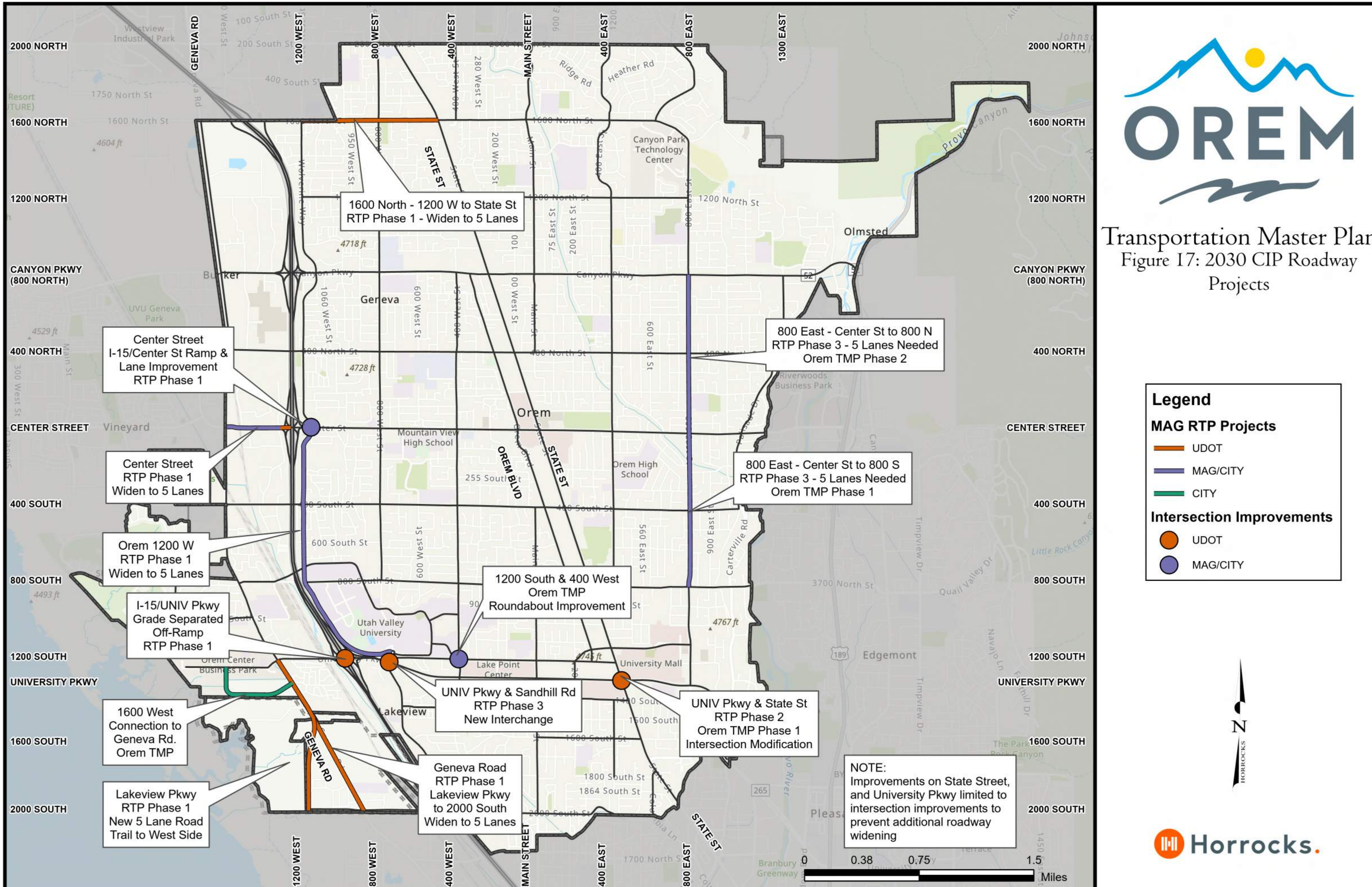


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Figure 17: 2030 CIP Roadway Projects

2.7 2050 Roadway Improvements

The same process was completed with a horizon year of 2050. Planning for projects necessary to improve the roadway network is important for Orem so possible roadways that are not included on MAG's RTP can be added. Roadways eligible for MAG funding can be found on UDOT's Functional Classification Map on their website *www.udot.utah.gov*. All roadways with a four-digit route number are eligible for federal funding (All roadways with 1-3 digits are UDOT owned roadways). To indicate the projects necessary for 2050, a no build scenario as well as the MAG RTP model were analyzed.

2.7.1 2050 No Build Level of Service

As used for the 2030 roadway conditions, the no-build scenario is intended to show what the roadway network would be like in the future if no action were taken to improve the City roadway network. Using the travel demand model, **Figure 18** shows the 2050 No Build LOS. The following roadways would perform at LOS E or worse if no action were taken to improve the roadway network:

- **1600 North** (I-15 Interchange to Main Street)
- **Center Street** (I-15 to State Street)
- **1200 West** (800 North to 1200 North; Center Street to Sandhill Road)
- **University Parkway** (Geneva Road to I-15; Sandhill Road to State Street)
- **Geneva Road** (University Parkway to 2000 South)
- **800 South** (1200 West to Campus Drive; Main St to State St; 800 East to Eastern Border)
- **800 North** (Geneva Road to 400 East; 800 East to Eastern Border)
- **State Street** (800 North to 800 South)
- **800 East** (400 North to 800 South)
- **1200 South** (Main Street to 200 East)
- **Main Street** (University Parkway to 2000 South)

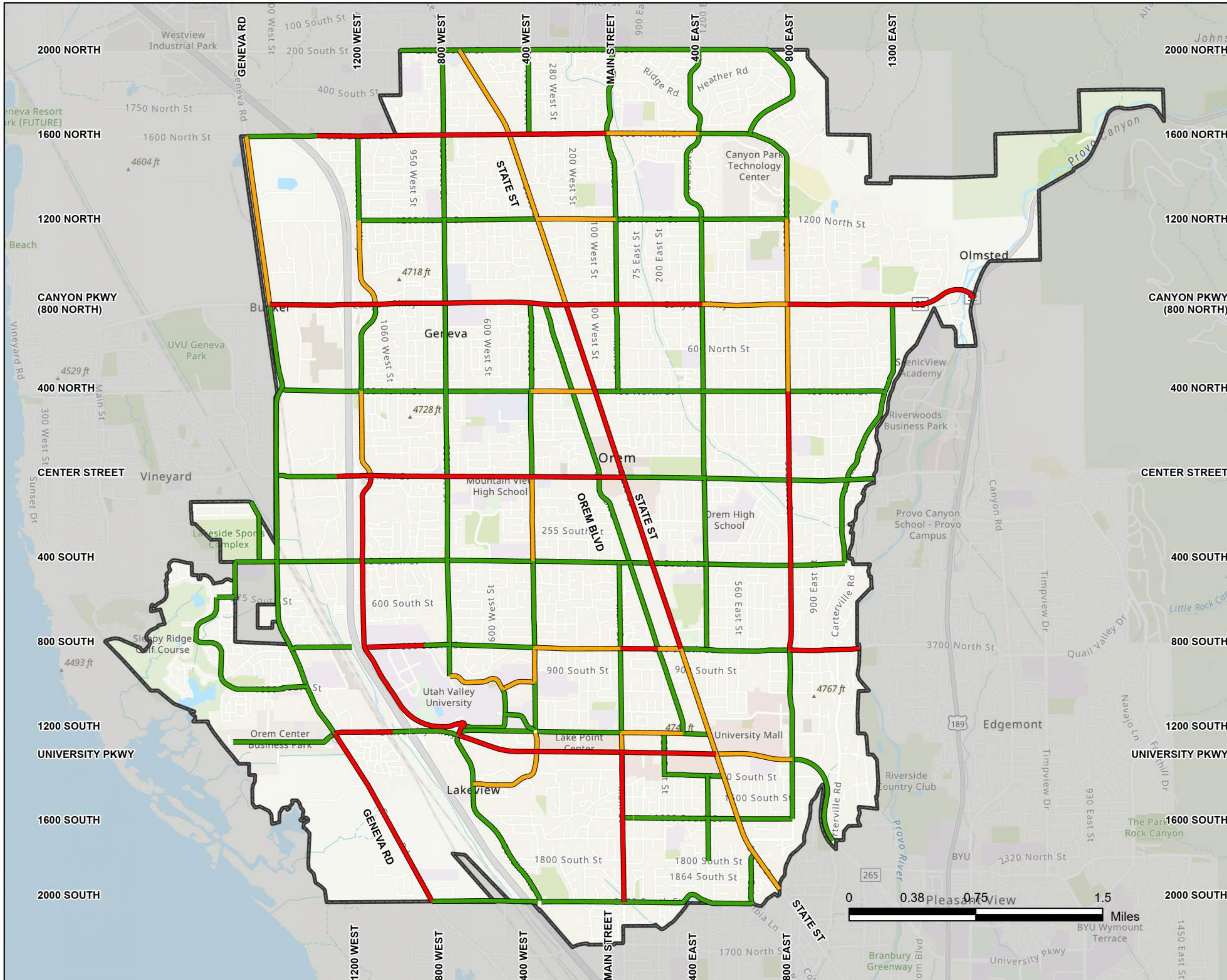

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Figure 18: 2050 No Build Level of Service (Peak Hour)

Legend

2050 NO BUILD LOS

- Acceptable (LOS C or Better)
- Acceptable (LOS D)
- Unacceptable (LOS E or Worse)

N

Horrocks.

2.7.2 Regional Transportation Plan

There are many roadways in Orem that are included on MAG's RTP. The projects included on the RTP are shown in **Figure 19.** Included is a list of the roadway improvements included on the RTP for all three phases (2019-2050).

Phase 1: 2019-2030

- **Orem 1600 North** (1200 West to State Street) – *Widen to 5 Lanes*
- **Orem Center Street** (Geneva Road to I-15) – *Widen to 5 Lanes*
- **Orem 1200 West** (Center Street to Sandhill Road) – *Widen to 5 Lanes*
- **Geneva Road** (Lakeview Parkway to Southern Border) *– Widen to 5 Lanes*
- **Lakeview Parkway/Geneva Road** (University Parkway to Southern Border) – *New 5 Lane Road*
- **I-15/Orem 800 S/Campus Drive** (Geneva Road to UVU) – *New 5 Lane Road/I-15 Bridge*
- **I-15/Orem Center St –** *Ramp and Lane Improvements*
- **I-15/University Pkwy** – *Grade separated off-ramp*

Phase 2: 2031-2040

- **Orem Center St** (1200 W to State St) – *Widen to 7 Lanes*
- **Orem Geneva Rd** (Orem 1600 N to University Pkwy) – *Widen to 7 Lanes*
- **State St/University Pkwy Bridge** – *New Bridge*
- **I-15 Parallel Corridor** (University Pkwy to Payson) **–** *New Freeway*
- **I-15 Parallel Corridor** (Pioneer Crossing Blvd to University Pkwy) – *New Freeway*
- **I-15 Widening** (12 Lane Freeway; University Pkwy to SF US-6 then 8 Lanes to Payson)

Phase 3: 2041-2050

- **Orem 800 E/Orem 1600 N** (State St to 800 S) – *Widen to 5 Lanes*
- **University Pkwy/Sandhill Rd –** *New Interchange*

Although the improvements on the RTP will improve congestion in the specific project areas, there are many other areas of the city where the roadways perform at a LOS E or worse. The burden of the following improvements will fall on Orem to improve unless the city is willing to wait for funding through other sources.

- **1600 North** (I-15 Interchange to Main Street)
- **Center Street** (I-15 to State Street)
- **1200 West** (800 North to 1200 North; Center Street to Sandhill Road)
- **University Parkway** (Geneva Road to I-15; Sandhill Road to State Street)
- **Geneva Road** (University Parkway to 2000 South)
- **800 South** (1200 West to Campus Drive; Main St to Orem Blvd; 800 East to Eastern Border)
- **800 North** (I-15 to 400 East; 800 East to Eastern Border)
- **State Street** (800 North to 800 South)
- **800 East** (400 North to 800 South)
- **1200 South** (Main Street to 200 East)
- **Main Street** (University Parkway to 2000 South)

The indicated roadway segments above as well as the additional modeling results from the **Special Considerations** section form the basis of the improvements included on the 2050 roadway improvement map shown in **Figure 19.** Intersection improvements in 2050 are shown in **Figure 20**. Applying all improvements from **Figure 19** and **Figure 20** will improve the roadway network to function at LOS D or better. Assuming all proposed projects are completed by 2050, **Figure 21** represents the proposed 2050 Orem roadway network. The costs to implement these projects is found in **Section 2.8.4**.

There are additional segments along both State Street and University Parkway which perform at LOS E or worse in 2050 which are not included in **Figure 19.** Both State Street and University Parkway are seven lane principal arterials and widening would have extreme impacts on the businesses along each corridor and it is **NOT** recommended to widen to a nine-lane principal arterial. Other solutions to improve these roadways rely on alternative modes of transportation, specifically transit. Refer to the **Transit** section for more information and maps regarding future transit plans in Orem.

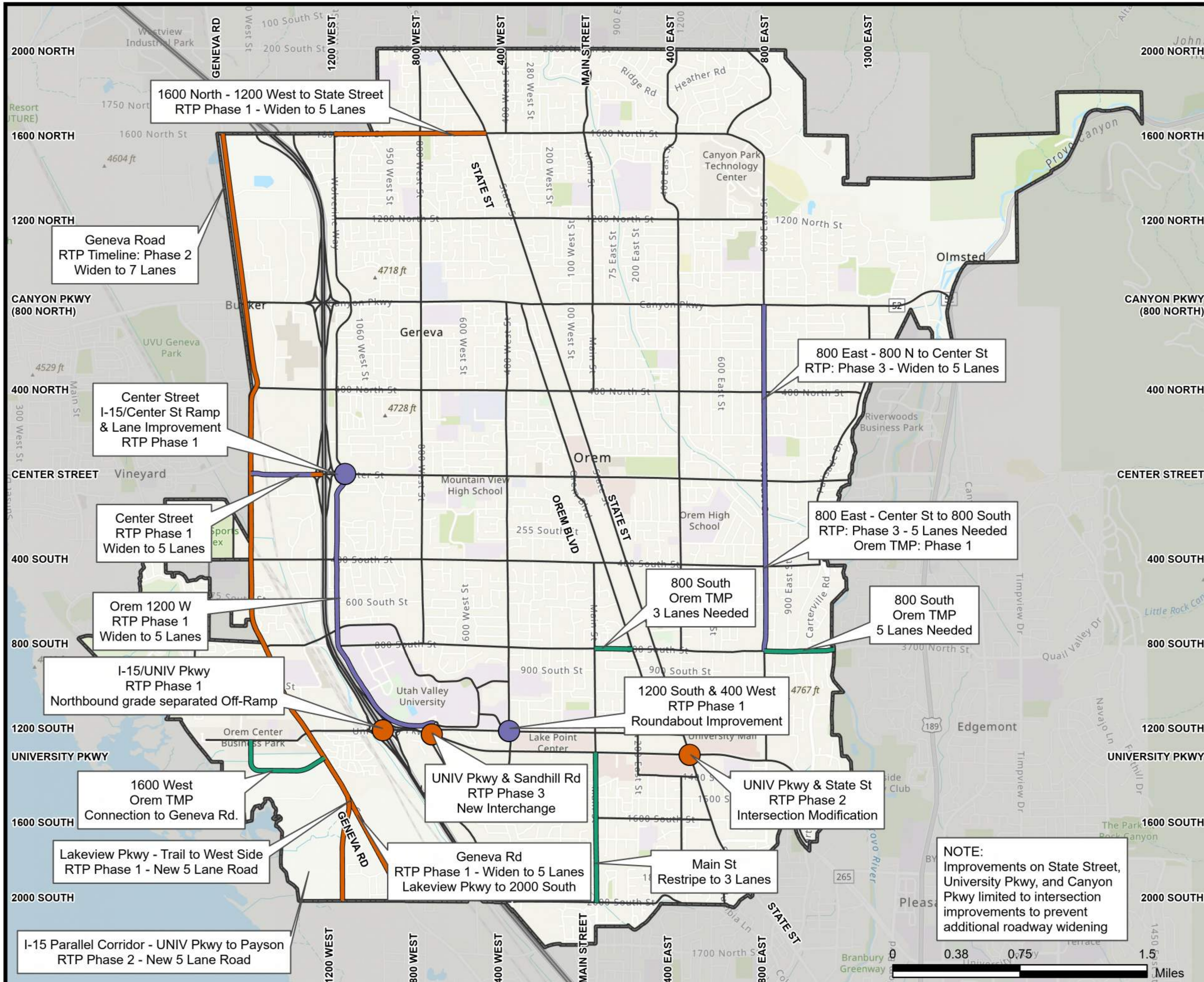

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Figure 19: 2050 Roadway & Intersection Improvements

Legend

Intersection Projects

- UDOT
- MAG/CITY

MAG RTP Projects

- UDOT
- MAG/CITY
- CITY

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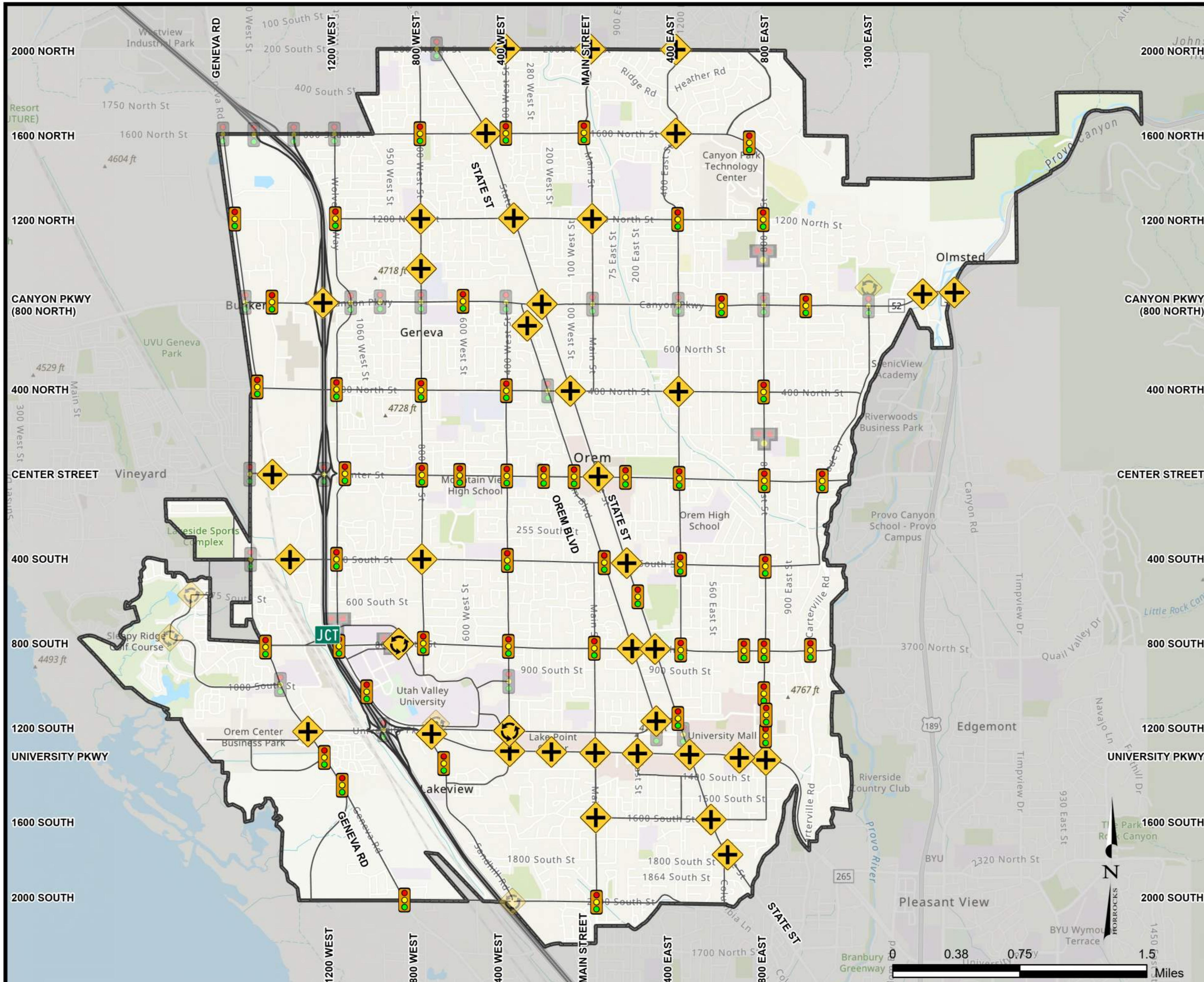
Figure 20: 2050 Intersection Improvements



Legend

- JCT New Interchange
- New/Upgraded Traffic Signal*
- New/Upgraded Roundabout
- Intersection Improvements

Existing Signals

- Existing Traffic Signal
- Existing Roundabout
- Existing HAWK (PED) Signal

* As Warranted

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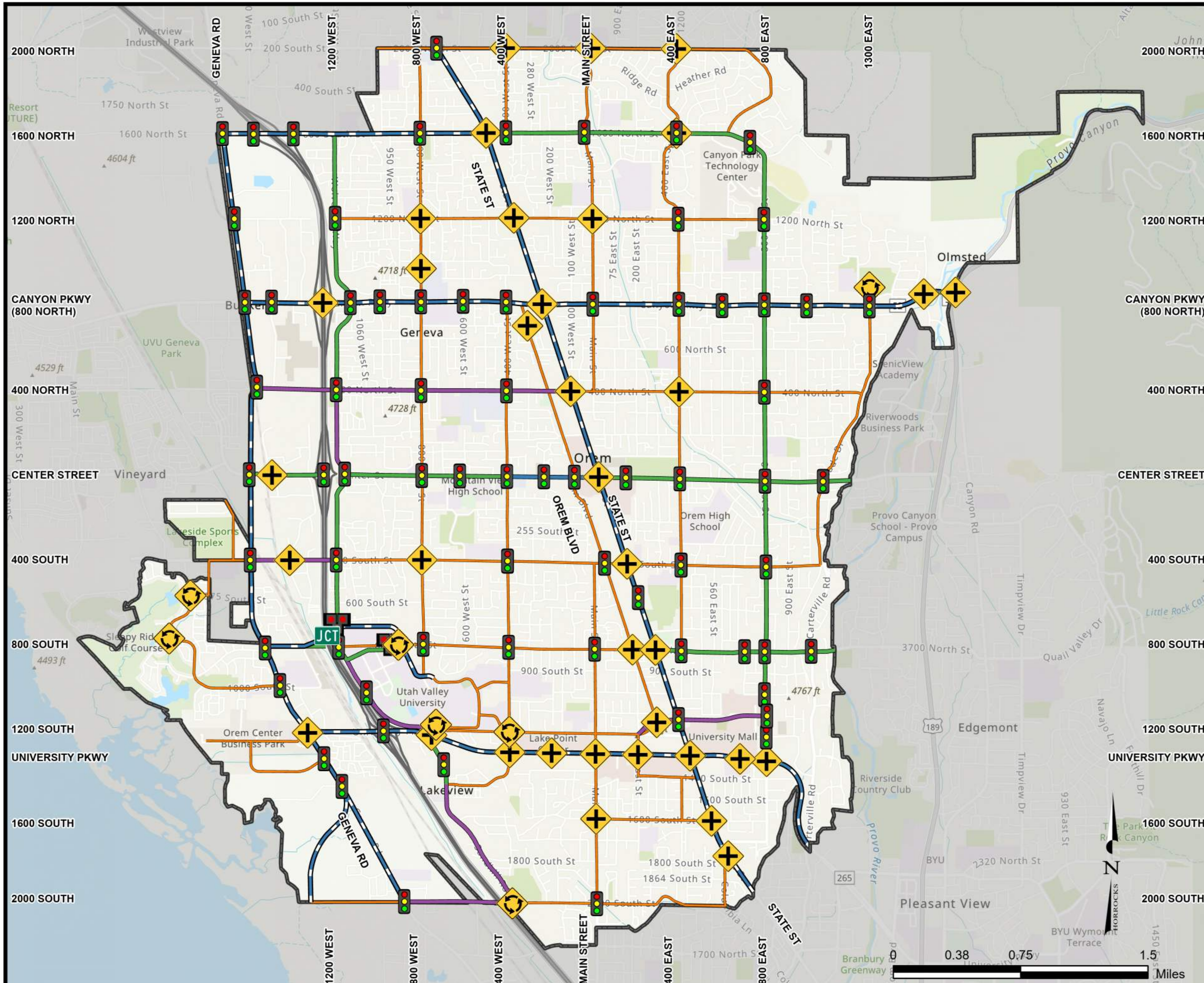

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Figure 21: 2050 Proposed Roadway Network

Legend

- Principal Arterial - UDOT (2-7 Lanes)
- Principal Arterial- Orem (6-7 Lanes)
- Major Arterial - Orem (4-5 Lanes)
- Minor Arterial - Orem (2-3 Lanes)
- Urban Collector- Orem (2-3 Lanes)
- Freeway Interchange
- Traffic Signal
- Roundabout
- Intersection Improvement
- HAWK (PED) Signal

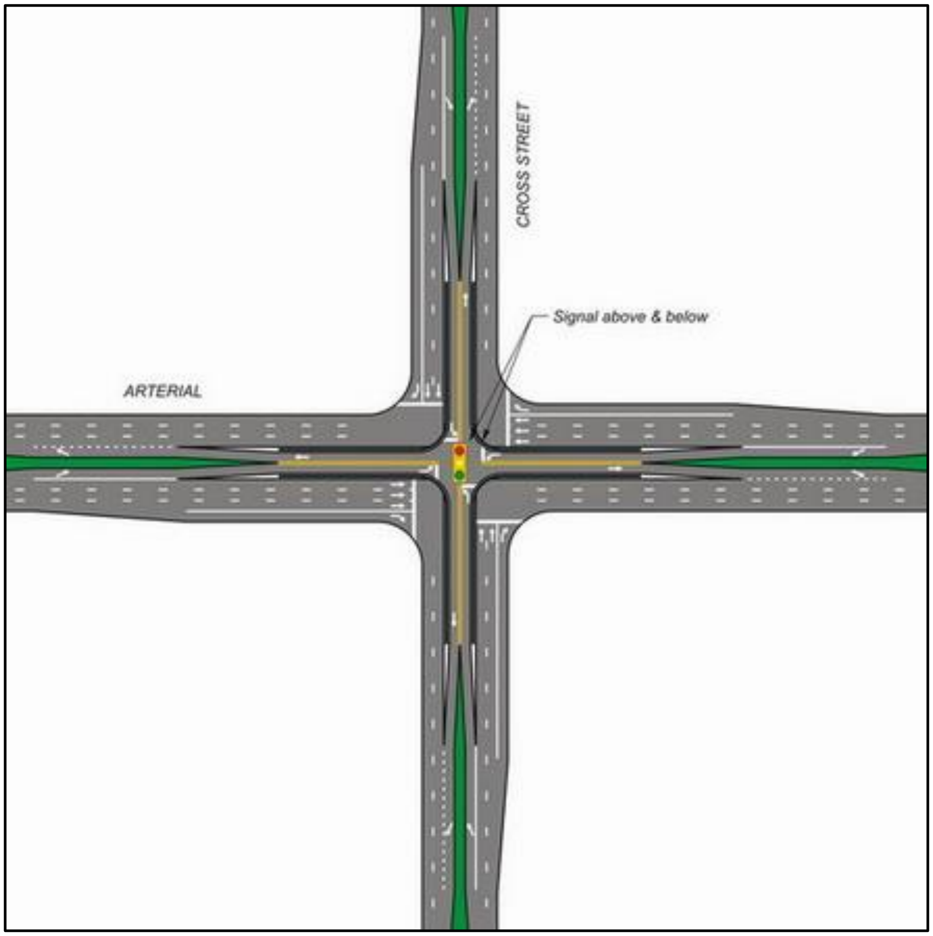
2.7.3 State Street and University Parkway Roadway Improvements

Both State Street and University Parkway are currently 7 lane Principal Arterial roadways with access to most businesses in Orem. Although they both operate at LOS E or worse in all scenarios, it is not feasible to add additional travel lanes as it would impact many businesses along each corridor. One method to improve the operations is to improve the intersections along each corridor (as shown in **Figure 20**). There are five Super Intersections (SI) that have been selected as the best alternatives for Orem to implement along State Street and University Parkway to improve capacity and operations. Although the specific intersection improvement is currently unknown, Orem will have a list of solutions for these intersections. These intersections are Center Turn Overpass (CTO), Continuous Flow Intersection (CFI), Echelon, Quadrant Roadway, ThrU Turn Intersection, and Single Point Urban Interchange (SPUI). The following sections briefly describe the functionality and costs of each SI.

2.7.3.1 Center Turn Overpass (CTO)

A Center Turn Overpass (CTO) creates a grade separated intersection for all left turning traffic. Delay at most intersections is caused by the amount of green time needed to support the left turning movements. **Figure 22** shows an example of a CTO. A traffic signal is installed on both grades to regulate when the traffic passes through the intersection. The estimated cost to install a CTO is 10-12 million dollars.

Figure 22: Center Turn Overpass (CTO) Example



2.7.3.2 Continuous Flow Intersection (CFI)

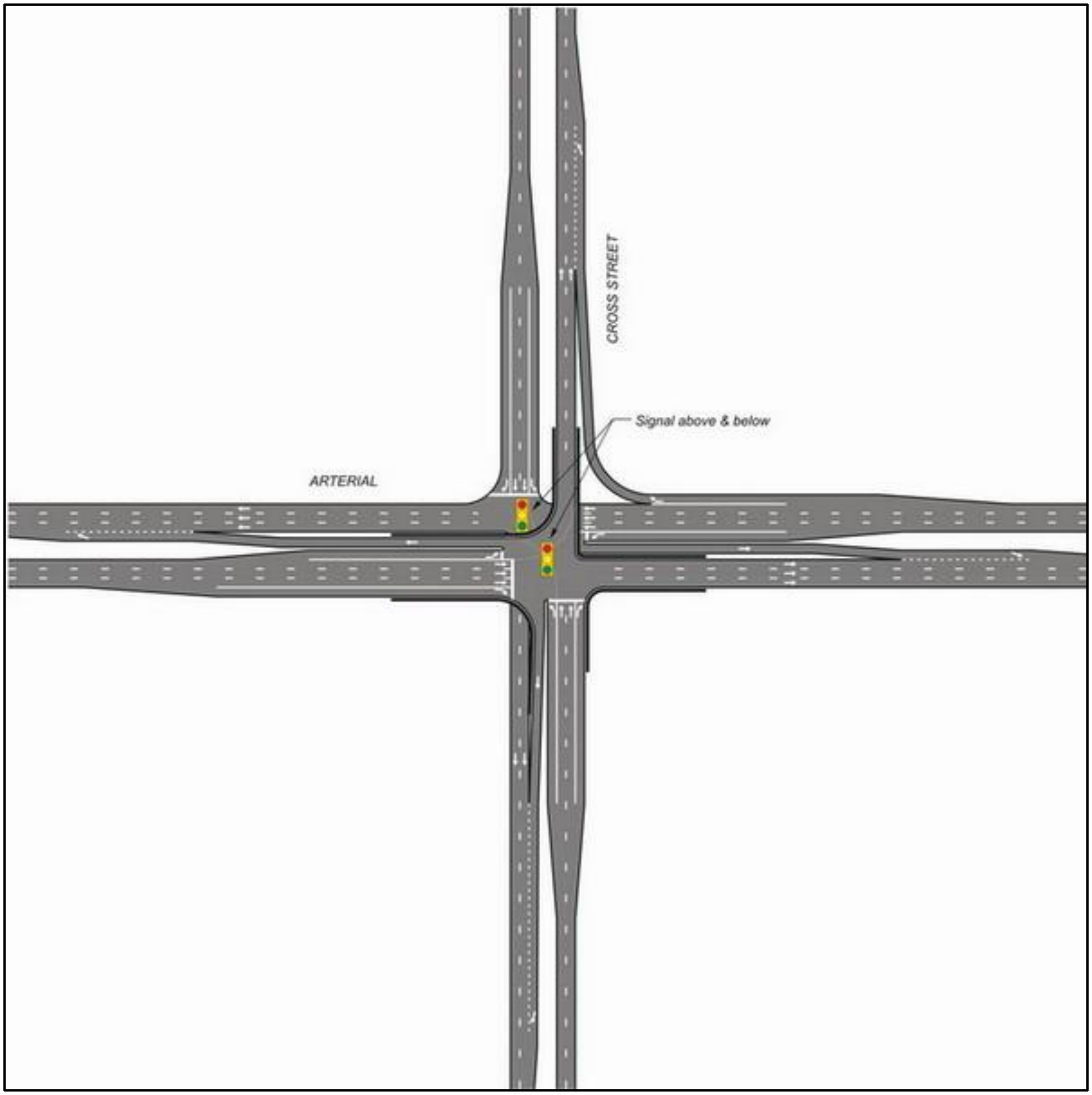
A Continuous Flow Intersection (CFI) that has the same functionality of a CTO at an at grade intersection. An example in Orem (2015) is at University Parkway and Sandhill Road. The left turning movement crosses over to the other side of the opposing through movement as shown in **Figure 23**. This allows more green time for the through movements as both the left and through movements occur at the same time. The estimated cost to implement a CFI is $5-8 million and $10-12 million dollars for two leg and four leg CFI's respectively.

Figure 23: Continuous Flow Intersection (CFI) Example

2.7.3.3 Echelon

An Echelon functions by grade separating approaches with opposing left turn movements as shown in **Figure 24**. The south and west approaches are elevated. This eliminates all additional green time for left turning movements as the green time at both signals (above and below) is used for the through and left turning movements simultaneously. The estimated cost for an Echelon is $12-15 million dollars.

Figure 24: Echelon Example



2.7.3.4 Quadrant Roadway

A quadrant roadway removes the left turning traffic from the intersection and moves it further downstream. As shown in **Figure 25,** the left turning traffic turns on a road past the intersection which loops them back to the cross-street. This allows for development around the intersection. A Quadrant Roadway does not need to be installed on all corners, only on the corners where left turning traffic causes significant delay at the intersection. A Quadrant Roadway can be phased to spread out the cost of the intersection. The estimated costs are approximately $1-3 million dollars.

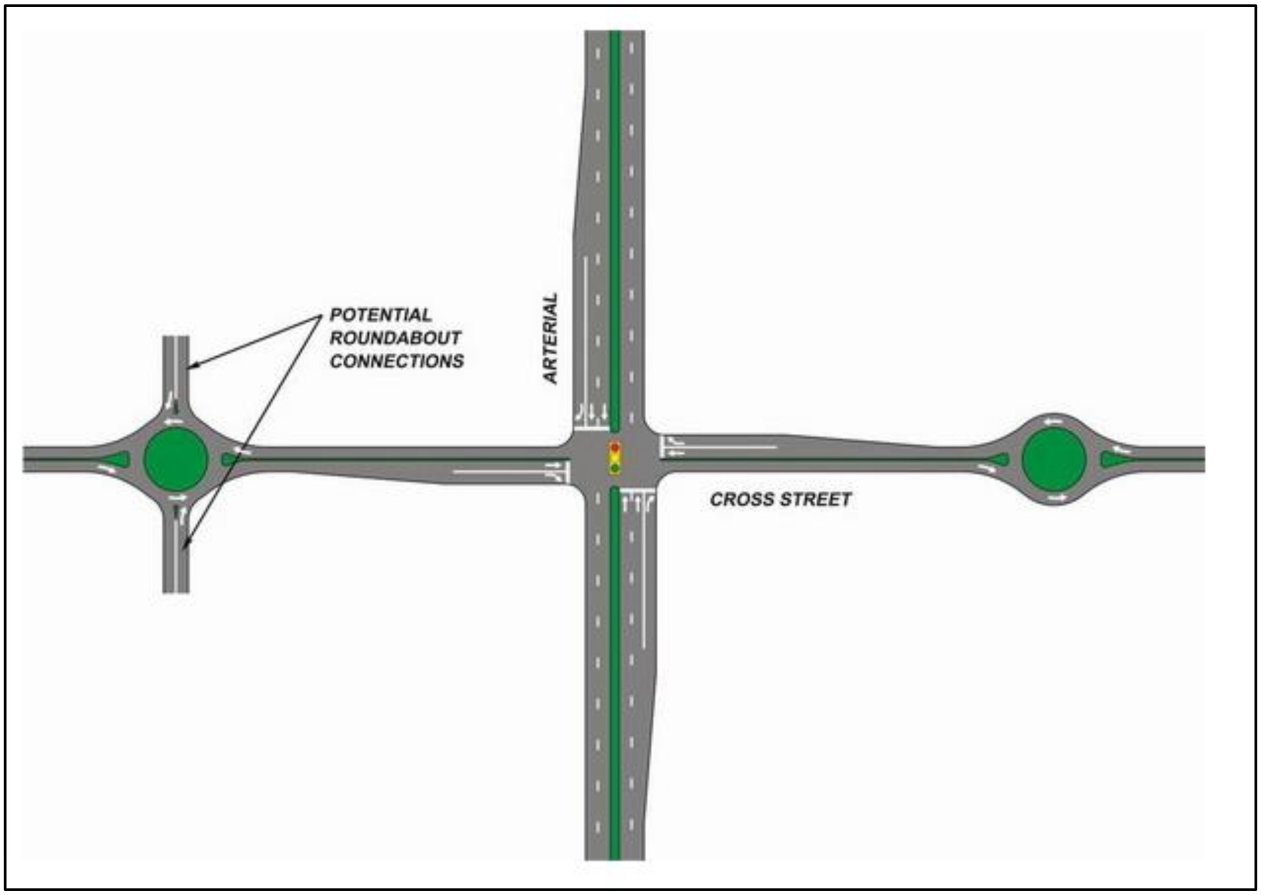
Figure 25: Quadrant Roadway Example

2.7.3.5 ThrU Turn Intersection

A ThrU Turn Intersection functions like a quadrant roadway, with the difference being the left turning traffic passes through in the intersection, makes a U-turn, and then turns right at the intersection. This improves operations because it removes all left turning traffic from the intersection. As shown in **Figure**

26 (A two leg ThrU Turn), the left turning traffic either passes through or turns right at the intersection, U-turns on a road past the intersection, and passes through the intersection. The area allowed for vehicles to U-turn can also be used as an access to businesses, which was utilized in Draper, UT at 12300 South. An advantage to the ThrU Turn intersection is that they are highly flexible in design and where the U-turns are placed and how many U-turn areas are needed. The estimated costs are approximately $3-5 million dollars for all four legs of the intersection.

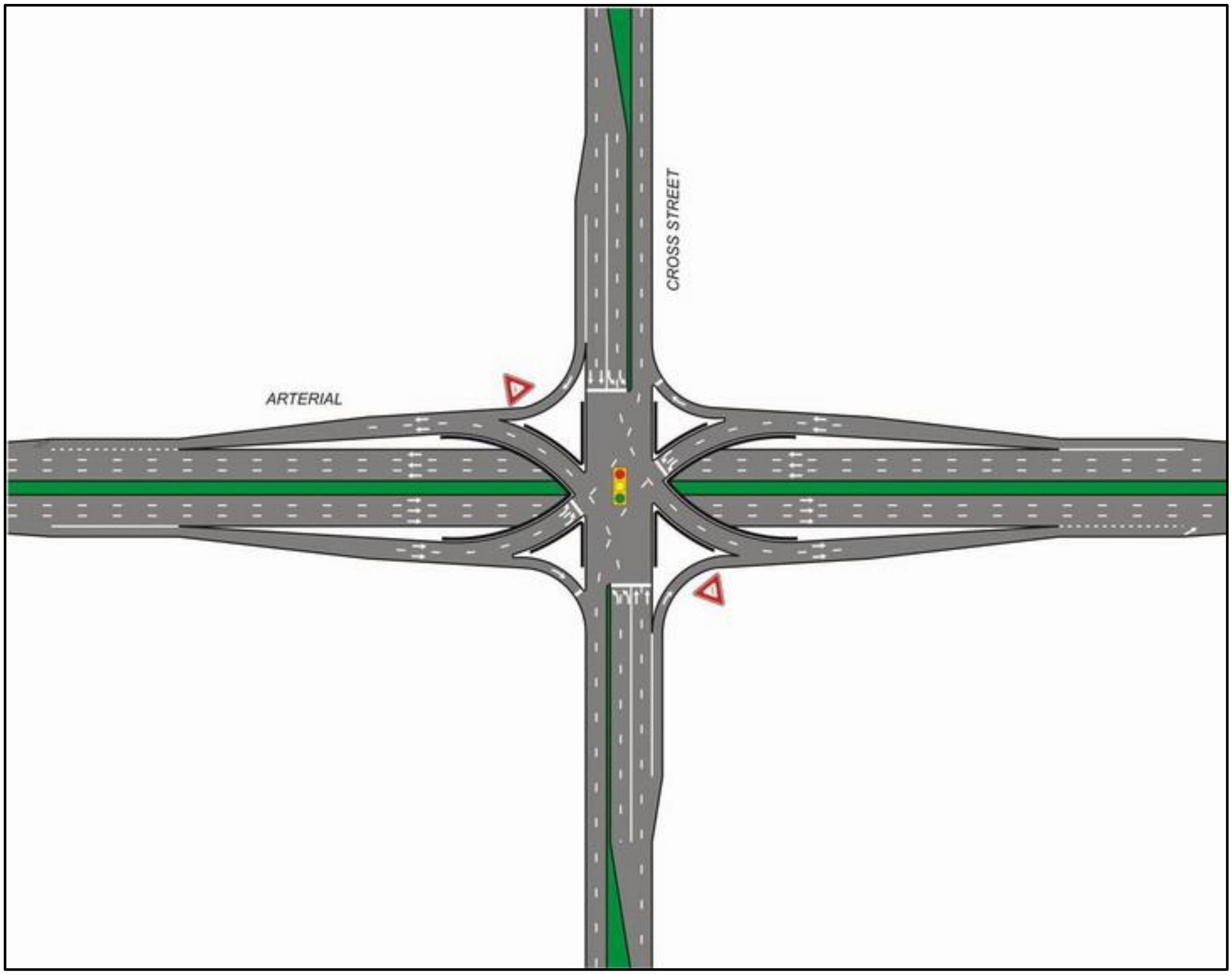
Figure 26: ThrU Turn Example



2.7.3.6 Single Point Urban Interchange (SPUI)

A Single Point Urban Interchange (SPUI) is a grade separated intersection where all movements that are grade separated meet at a single point as shown in **Figure 27**. A SPUI is known by most drivers since they have been implemented along I-15 throughout Utah County. The approximate cost for construction for a SUPI intersection is 18.5 million dollars.

Figure 27: Single Point Urban Interchange (SPUI) Example



2.8 Funding for Roadway Network Improvements

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

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

Funding sources for transportation are essential if Orem recommended improvements are to be built. The following paragraphs further describe the various transportation funding sources available to the city.

2.8.1 Federal Funding

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

The Surface Transportation Program (STP) funds projects for any roadway with a functional classification of a collector street or higher as established on the Functional Classification Map. STP funds can be used for both rehabilitation and new construction. The Joint Highway Committee programs a portion of the STP funds for projects around the state in urban areas. Another portion of the STP funds can be used for projects in any area of the state at the discretion of the State Transportation Commission. Transportation Enhancement funds are allocated based on a competitive application process. The Transportation Enhancement Committee reviews the applications and then a portion of those is passed to the State Transportation Commission. Transportation enhancements include 12 categories ranging from historic preservation, bicycle and pedestrian facilities and water runoff mitigation. Other federal and state trails funds are available from the Utah State Parks and Recreation Program.

MAG accepts applications for federal funds through local and regional government jurisdictions. MAG's Technical Advisory and Regional Planning committees select projects for funding every two years. The selected projects form the Transportation Improvement Program (TIP). To receive funding, projects should include one or more of the following aspects:

- **Congestion Relief** – spot improvement projects intended to improve Levels of Service and/or reduce average delay along those corridors identified in the Regional Transportation Plan as high congestion areas.
- **Mode Choice** – projects improving the diversity and/or usefulness of travel modes other than single occupant vehicles.
- **Air Quality Improvements** – projects showing demonstrable air quality benefits.
- **Safety** – improvements to vehicular, pedestrian, and bicyclist safety.

2.8.2 State/County Funding

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

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

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

A new source of funding for Orem is a new statewide gas tax. As of January 1, 2016, the state began collecting $0.05 per gallon of gas purchased to directly use towards transportation improvements. The inclusion of this gas tax provides Orem with approximately **$440,000** annually to use towards transportation projects.

2.8.3 City Funding

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

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

General fund revenues are typically reserved for operation and maintenance purposes as they relate to transportation. However, general funds could be used if available to fund the expansion or introduction of specific services. City of Orem does not currently have a general fund budgeted line item for transportation improvements. It is recommended that a plan be put in place to address this and to develop an annual budget amount to fund transportation projects should other funding options fall short or the needed amount.

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

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

Grant monies are ideal for funding projects within the City since they do not need to be paid back and the City can greatly benefit from these funds. Grants are not easy to come by and therefore obtaining such funding is not likely for the city and should not be considered a viable revenue source.

2.8.4 Impact Fees

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

To help fund roadway improvements, impact fees should be established. These fees are collected from new developments in the city to help pay for improvements that are needed to the roadway system due to growth. At the culmination of the Transportation Master Planning process, a citywide IFFP will be developed according to state law to determine the appropriate impact fee values for the city.

2.8.5 Capital Improvements Plan (CIP) Overview

After traffic modeling software has generated future roadway conditions, a list of potential inefficiencies is identified so that project improvements can then be created and prioritized. A Capital Improvements Plan (CIP) includes all projects necessary to implement over the short-term horizon to sustain Orem's roadway network. Projects listed in this plan were broken out into the roadway and intersection improvements. This plan also elaborates on and indicates the funding sources for each project.

Figure 17 identifies specific roadway network needs resulting from future growth throughout Orem for the 2030 CIP; and **Figure 19** for the 2050 roadway improvements. Updating these figures is necessary since project scopes change and development occurs throughout the city. All projects for the 2030 CIP and 2050 were compiled into a database, included in **Appendix F: Cost Estimates**.

The total costs for the 2030 CIP projects are $250.4 million dollars (including inflation) with Orem financially responsible for **$34.1 million** dollars and a detailed description of each project is included in **Table 6**. The projects included in **Table 6** are ordered based on the project priority for each year.

Many of the identified projects are for UDOT roads or roads which would be eligible for MAG funding assistance. Where a planned project occurs on a UDOT road, it is assumed that the city would not participate in funding that project. In the case of MAG eligible roadways, the City would be responsible for a 6.77% match of the total project cost. This 6.77% would need to be funded by the City with the funding mechanisms described earlier.

Also included are all projects necessary for the roadway network for 2050. Although this TMP should be regularly updated, it is necessary for all roadway improvements to accommodate projected 2050 traffic volumes. All projects included for the horizon year 2050 are listed in **Appendix F: Cost Estimates**. The total cost estimate for Orem to improve the transportation system by 2050 is $313.4 million dollars ($450.8 million with Inflation) with Orem financially responsible for **$64.5 million** dollars.

Table 6: 2030 CIP Projects

2030 Capital Improvements Plan – The City of Orem Responsibility						
Ref. No.	Location	Total Price (With Inflation)	Funding Source	Year	Orem %	Orem Total (With Inflation)
2	Center Street (Geneva Road to I-15) – Widen to 5 Lanes	$9,425,000	Orem/MAG	2030	6.77%	$638,073
3	1200 West (Sandhill Road to Orem Center Street) - Widen to 5 Lanes	$12,905,000	Orem/MAG	2030	6.77%	$873,669
5	1600 West (Connection to Geneva Rd.)	$2,658,600	Orem	2023	100%	$2,658,600
6	Intersection Improvements (Additional Funds)	$480,000	Orem	2023	100%	$480,000
7	1200 South (State Street to 800 East)	$2,460,260	Orem	2023	100%	$2,460,260
8	Roundabout (700 N - Orem Blvd.) (Safety Improvement)	$685,750	Orem	2023	100%	$685,750
9	Intersection Improvements (Additional Funds)	$506,400	Orem	2023	100%	$506,400
10	Safety Improvement - Turn Lane (WB RTL) 1100 East and 800 North	$2,537,698	UDOT	2023	0%	$0
11	Intersection Improvements (Additional Funds)	$534,252	Orem	2023	100%	$534,252
13	Intersection Improvements (Additional Funds)	$558,293	Orem	2023	100%	$558,293
14	University Parkway and State Street Grade Separated Intersection	$55,424,572	UDOT	2023	0%	$0
16	Enlarge Roundabout (1200 South and 400 West)	$583,416	Orem/MAG/UTA	2023	0%	$0
17	Traffic Signal Update (Geneva Road and 1600 North)	$291,708	UDOT	2023	0%	$0
18	Intersection Improvements (Additional Funds)	$583,416	Orem	2023	100%	$583,416
20	Traffic Signal (800S-1200W)	$289,594	Orem	2023	100%	$289,594
21	Lakeview Parkway (Geneva Road to Southern Border) – New 5 Lane Road	$14,698,200	Orem/MAG	2026	6.77%	$2,839,053
22	Signal Update (400 North and 1200 West)	$304,835	Orem	2023	100%	$304,835
23	Signal Update (400 North and Orem Blvd.)	$304,835	Orem	2023	100%	$304,835
24	Signal Update (Center Street and 400 West)	$304,835	Orem	2023	100%	$304,835
25	Signal Update (Center Street and Orem Blvd.)	$304,835	Orem	2023	100%	$304,835

2030 Capital Improvements Plan – The City of Orem Responsibility						
Ref. No.	Location	Total Price (With Inflation)	Funding Source	Year	Orem %	Orem Total (With Inflation)
26	Signal Update (800 South and Main Street)	$304,835	Orem	2023	100%	$304,835
27	Signal Update (1000 South and College Drive)	$304,835	Orem	2023	100%	$304,835
28	Traffic Signal (400 S - 400 E)	$1,295,549	Orem	2023	100%	$1,295,549
29	Intersection Improvements (Additional Funds)	$609,671	Orem	2023	100%	$609,671
30	Traffic Signal (400N-800E)	$438,010	Orem	2023	100%	$438,010
31	Signal Update (Center Street and Garden Park Dr.)	$318,553	Orem	2023	100%	$318,553
32	Signal Update (400 South and 1200 West)	$318,553	Orem	2023	100%	$318,553
33	800 West 800 North to 800 South) - Intersection Improvements	$2,150,231	Orem	2023	100%	$2,150,231
34	Intersection Improvements (Additional Funds)	$637,105	Orem	2023	100%	$637,105
35	Center Turn Overpass (Center Street and State Street)	$16,644,380	UDOT	2023	0%	$0
36	Intersection Improvements (Additional Funds)	$665,776	Orem	2023	100%	$665,776
38	Signal Update (800 South and 400 East)	$347,868	Orem	2024	100%	$347,868
39	New Signal (800 South and 700 East)	$434,834	Orem	2024	100%	$434,834
40	Intersection Improvements (Additional Funds)	$695,735	Orem	2024	100%	$695,735
41	Signal Update (1200 North and 400 East)	$363,522	Orem	2030	100%	$363,522
42	Roundabout (1100 North and 800 West)	$727,043	Orem	2030	100%	$727,043
43	Signal Update (400 North and 400 West)	$363,522	Orem	2030	100%	$363,522
44	Signal Update (Center Street and 400 East)	$363,522	Orem	2030	100%	$363,522
45	Signal Update (800 South and 400 West)	$363,522	Orem	2030	100%	$363,522
46	New Signal (1430 South Sandhill Road)	$454,402	Orem	2030	100%	$454,402
47	Intersection Improvements (Additional Funds)	$727,043	Orem	2030	100%	$727,043
	Total	**$134,370,010**				**$26,210,831**

3.0 Alternative Transportation Modes

Accommodating alternative modes of transportation is a vital consideration when planning a livable and sustainable community. As a vibrant and growing City, it is important for Orem to continue to plan for improved transit, trails, and pedestrian facilities. These facilities will improve the overall quality of life of the residents while aiding in congestion relief and increasing the lifespan of the City's roadway network.

3.1 Transit

The Utah Transit Authority (UTA) is the provider of public transportation throughout the Wasatch Front. UTA operates fixed route buses, express buses, bus rapid transit (BRT), ski buses, light rail, and commuter rail. In this capacity, UTA is responsible for the operation of the transit network in Orem. It is the responsibility of both Orem and UTA to cooperate to provide transit planning to accommodate alternative transportation options to residents as demand increases. The following are existing transit routes and days of service that are in operation in Orem and is also included in **Figure 28** (UTA maintains up-to-date route information at www.rideuta.com):

- **FrontRunner 750:** Monday – Saturday (No Sunday Service)
- **Route 805:** Monday – Friday (No Weekend Service)
- **Route 806:** Monday – Friday (No Weekend Service)
- **Route 807:** Monday – Friday (No Weekend Service)
- **Route 822:** Monday – Friday (No Weekend Service)
- **Route 830X (UVX):** Monday – Saturday (No Sunday Service)
- **Route 831:** Monday – Saturday (No Sunday Service)
- **Route 841:** Monday – Saturday (No Sunday Service)
- **Route 850:** Monday – Saturday (No Sunday Service)
- **Route 862:** Monday – Saturday (No Sunday Service)

The combined efforts of the Utah Transit Authority (UTA), UDOT, MAG, and Orem will largely dictate the nature of a future expanded transit system. Included in this TMP is the MAG long range transit plan as shown in Error! Reference source not found.. Included in this plan is to enhance bus service with the i ntroduction of BRT on State Street.

3.1.1 Improvements to Transit System

Orem should be involved in supporting transit as a viable and attractive alternative transportation mode in the city. The UTA bus system is versatile as routes and stops can be adjusted as the demand and other factors require it. Close coordination with UTA will improve bus service as well as reduce congestion along major roadways such as University Parkway and State Street.

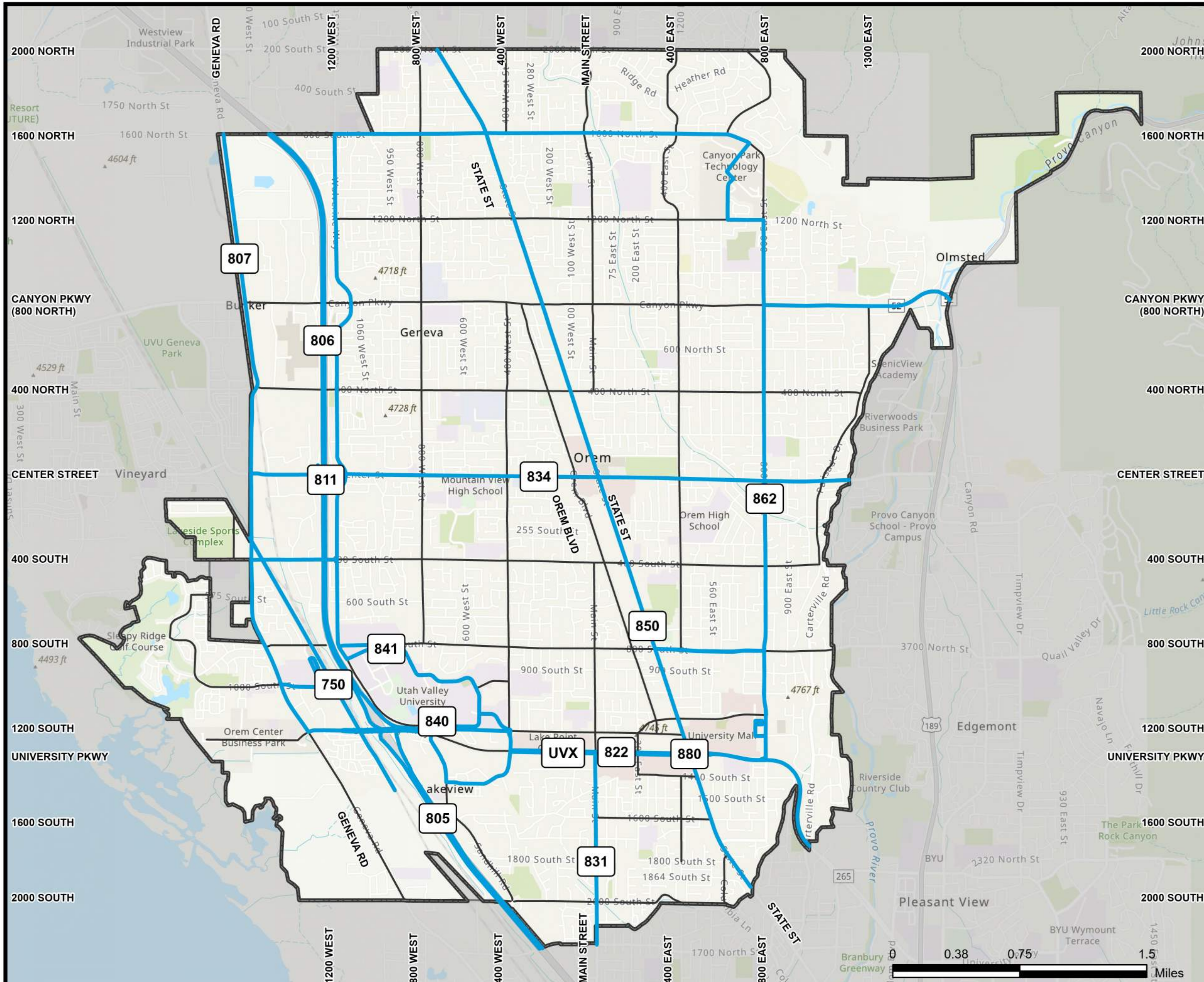


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Figure 28: Existing UTA Transit Routes

Legend

UTA Bus Routes; 834

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3.2 Bicycle and Pedestrians

Pedestrian and bicycle safety is an important feature of any transportation master plan. People will be more inclined to walk or ride their bicycle when the experience is pleasant, they feel safe, and distances are reasonable. High-density housing near high-traffic generators or main street type areas encourages people to use alternative travel options from the automobile. The following descriptions of bicycle-related terms are provided to assist readers who are unfamiliar with bicycle terminology. The terms bicycle and bike are used interchangeably.

- **Bikeway** - A thoroughfare suitable for bicycles that may either exist within the right-of-way of other modes of transportation, such as highways, or along a separate and independent corridor.
- **Bicycle Facilities** - A general term denoting improvements and provisions to accommodate or encourage bicycling, including parking facilities, maps, all bikeways, and shared roadways.
- **Bicycle or Multi-use Path (Bike Path or Class 1)** - A bikeway physically separated from motorized vehicular traffic and either within the highway right-of-way or within an independent right-of-way. Bike path facilities are often excellent recreational routes and can be developed where right-of-way is available. Typically, bike paths are a minimum of 10 feet to 12 feet wide, with an additional graded area maintained on each side of the path.
- **Bicycle Lane (Bike Lane or Class 2)** - A portion of a roadway that has been designated by striping, signing, and pavement markings for the preferential or exclusive use of bicyclists. Bike lanes are ideal for minor thoroughfares or collectors. Under certain conditions, bike lanes may be beneficial on streets with significant traffic volumes and/or speeds. Under ideal conditions, minimum bike lane width is four feet.
- **Signed Bike Route (Class 3)** - A segment of a system of bikeways designated by appropriate directional and/or informational signs. In this plan, a Class 3 signed bike route may be a local or residential street, Bicycle Boulevard, an arterial with wide outside lanes, or a roadway with a paved shoulder.
- **Paved Shoulder** - The part of the highway that is adjacent to the regularly traveled portion of the highway, is on the same level as the highway, and when paved can serve as a bikeway. Paved shoulders should be at least four feet wide, and additional width is desirable in areas where speeds are high and/or a large percentage of trucks use the roadway.
- **Wide Outside Lane** - An outside (curb) lane on a roadway that does not have a striped bike lane but is of sufficient width for a bicyclist and motorist to share the lane with a degree of separation. A width of 14 feet is recommended to safely accommodate both motor vehicles and bicycles.
- **Bicycle Boulevard** - A residential street that has been modified for bicyclist safety and access.

Figure 29 shows the existing and future pedestrian and bike paths in Orem based on the *Orem Bicycle and Pedestrian Plan* adopted in 2010. All updates since the plan was adopted in 2010 are included on the map. The *Orem Bicycle and Pedestrian Plan* can be accessed online on the City's website *www.orem.org*.

Although bike facility projects may appear on **Figure 29**, it does not guarantee that all bike facility projects will be implemented. It has been adopted in the Bicycle and Pedestrian Plan (www.orem.org) that if the addition of a bike facility adds an additional 20% to the total cost of the roadway improvement, it will not be implemented.

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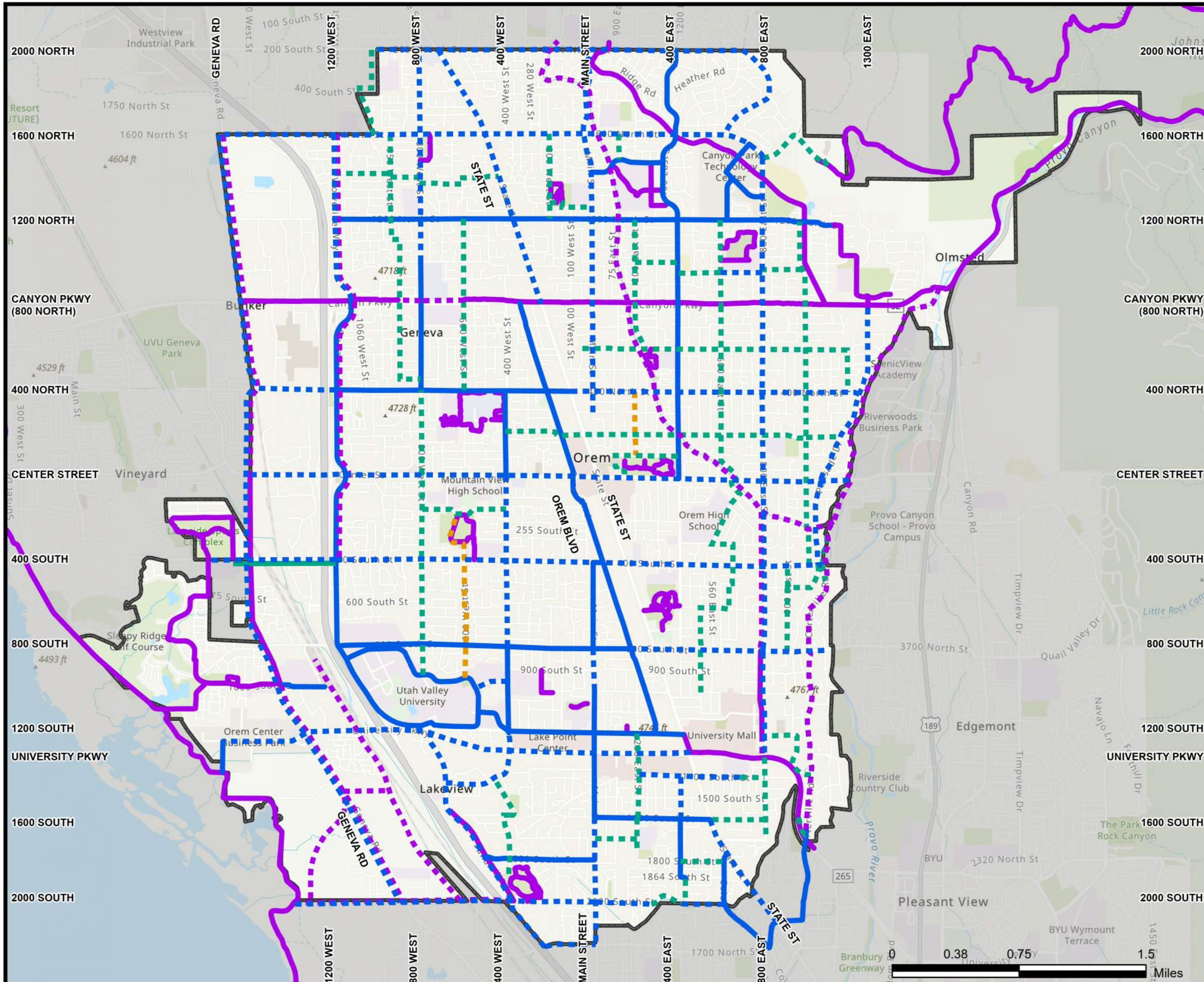

Figure 29: Pedestrian and Bike Paths

Legend

Pedestrian and Bike Paths

- Existing Bike Lane
- Planned Bike Lane
- Existing Multi-Use Path
- Planned Multi-Use Path
- Existing Bike Route
- Planned Bike Route
- Proposed Bike Boulevard

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Horrocks.

4.0 Other Policies and Guidelines

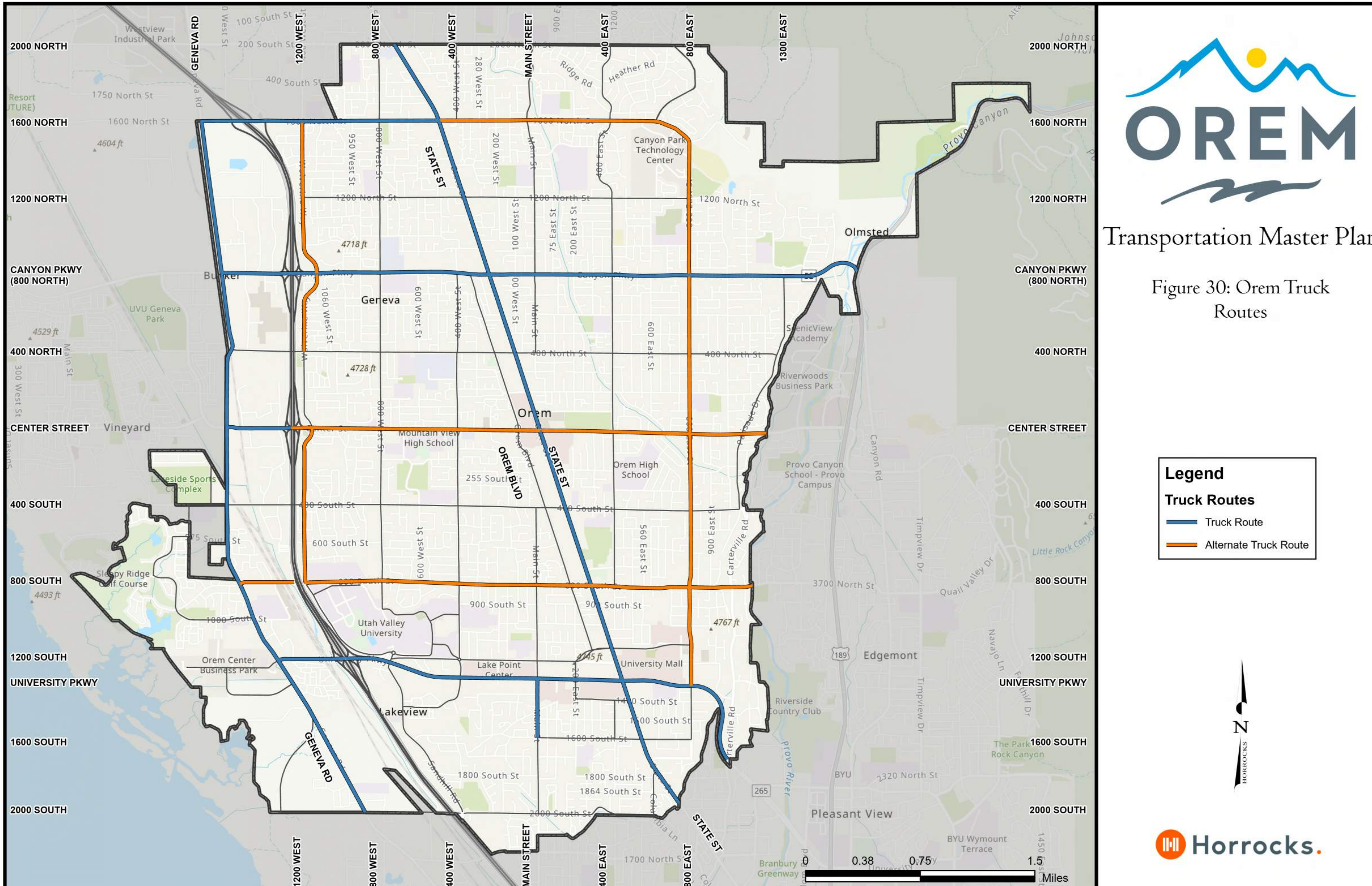
Policies and guidelines govern development throughout Orem. For the roadway network, there are policies provided to maintain a safe, efficient, and familiar environment for all transportation types. There are national, regional, and local specifications which are used in Orem. The national specifications are the standard for all design and implementation and any specification that improves the national standard will be included in the regional and/or local specifications. It is good practice to refer to the local and regional specifications first. If the specification is not included in the local or regional specification, the national standard is to be used.

In Orem, a supplemental document to the 2007 American Public Works Association (APWA) and 2008 UDOT standard specifications is used and is found on their website *www.orem.org*. Please refer to the APWA and UDOT for full specification and standard drawings. Another specification manual used is the Manual on Uniform Traffic Control Devices (MUTCD) published by the Federal Highway Administration (FHWA). There is a national version located online at *www.mutcd.fhwa.dot.gov* and a regional version used in Utah state at *http://mutcd.fhwa.dot.gov/resources/state_info/utah/ut.htm*. Other Policies and Guidelines used in Orem are AASHTO's *A Policy and Geometric Design of Highways and Streets*, the Institute of Transportation's (ITE) *Trip Generation Manual*, and the Transportation research Board's (TRB) *Highway Capacity Manual (HCM)*. For All other policies and guidelines in Orem such as the general plan and other master plans, please contact Orem or refer to their website *www.orem.org*.

Also included in this section are supplemental policies and guidelines specific to this TMP. Included are policies and guidelines on truck routes, speed limits, curb radius, crosswalk warrants, traffic signal warrants, access management, traffic calming, traffic impact studies, and connectivity.

4.1 Truck Routes

Trucks are an important component of the transportation system of any economy and are vital to the movement of goods throughout the region. However, trucks also have some negative characteristics in terms of traffic flow, safety, and noise. To reduce these impacts, it is recommended that trucks travel along arterial and 3 lane collectors as opposed to 2 lane collectors or local streets. To accomplish this goal, several recommended truck routes through the city have been identified and a map showing these is given as **Figure 30**. Orem will work with industrial or large commercial businesses that have a large amount of truck traffic to encourage their trucks to use these routes within Orem.



Transportation Master Plan

Figure 30: Orem Truck Routes

4.2 Speed Limits

Speed limit on streets in Orem is important for both the safety of drivers, bicyclists, and pedestrians, as well as traffic flow throughout Orem. General speed limits based on the typical cross-sections are included in Table 7 with the existing speed limits included in Figure 31. The speeds in Table 7 are not definite but should be used as a guideline when determining the speed limit. According to the guidelines in the Utah MUTCD section 2B, the speed limit should be within 5 mph of the 85th percentile speed. The following are instances where other factors may dictate the speed limit below the 85th percentile speed:

- **High Density Areas**
- **Proximity to Schools**
- **Narrow Lanes**
- **Frequent access points along corridor**
- **Adequate roadway design principles not met** (i.e., turning radius, sight distance, etc.)

Figure 31 and Figure 32 show the existing speed limits and areas where analysis may be required based on 85th percentile speed and public comments, respectively. Testing to determine the 85th percentile speed is completed by taking vehicle speeds when vehicles travel at free flow speed (no congestion). General practice indicates 100 vehicles speeds is required when calculating the 85th percentile speed on a roadway. Other guidelines state that on a roadway with traffic signals, the speeds should be taken outside of the influence area, generally ½ mile, from the traffic signal. Refer to the Utah MUTCD for more guidelines.

Table 7: General Speed Limits for Typical Cross-Sections

Functional Classification	Speed Limit (mph)
Local and Sub-Local	25
Collector	25-30
Minor Arterial	30-35
Major Arterial	35-40
Principal Arterial	40-50

4.3 Curb Radius

Included are guidelines for curb radii on City owned and operated streets. Currently, all City roadways use a radius of 21 feet. Using guidelines outlined in Chapter 9 of AASHTO's *A Policy on Geometric Design of Highways and Streets* as well as regional experience, Table 8 shows the curb radius matrix to be used for future street projects in Orem. The matrix is used by aligning the functional classification of the two roadways. The matrix is based on the vehicle types using each functional classification. For Arterial and Collector Streets, the design vehicle is WB-40 (interstate semi-trailer). On local streets, the design vehicle is SU-30 (2 axle truck).

Table 8: Curb Radius Matrix

	Arterial (ft.)	Collector (ft.)	Local (ft.)
Arterial (ft.)	40	35	30
Collector (ft.)	35	30	25
Local (ft.)	30	25	25

Transportation Master Plan

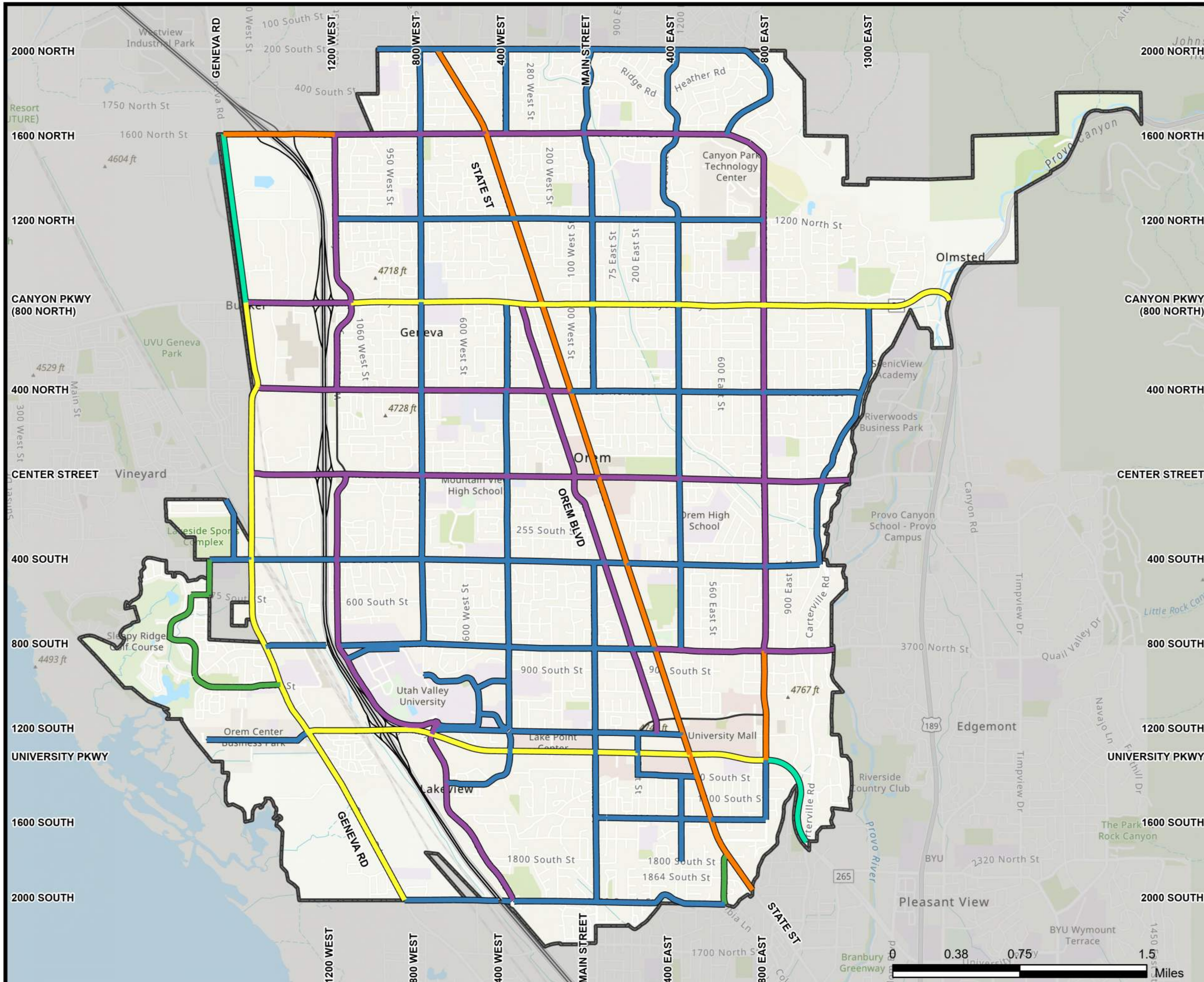


Figure 31: Speed Limits in Orem

Legend

Existing Speed Limits

- 25 mph
- 30 mph
- 35 mph
- 40 mph
- 45 mph
- 50 mph

Transportation Master Plan

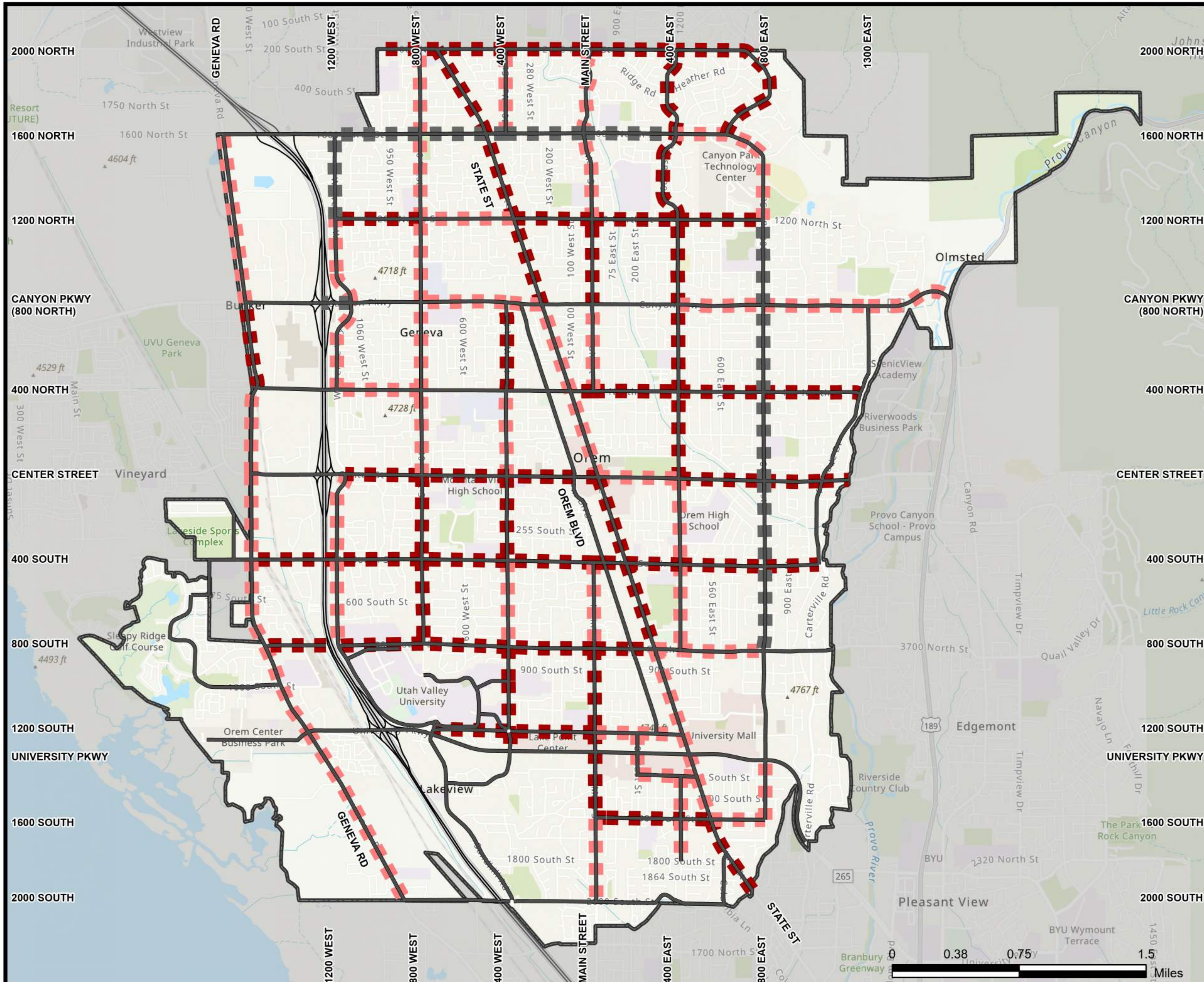


Figure 32: Speed Limit Analysis

Horrocks.

4.4 Crosswalk Warrants

There are established guidelines as to the warranting of crosswalks or pedestrian crossings published by federal and state agencies. There are also specific school crosswalk zone requirements established by the State of Utah. The state has adopted the "Traffic Controls for School Zones" 2009 Edition, which is a supplement to Part 7 of the national MUTCD.

This section provides guidance on when to install or consider crosswalks at intersections or mid-block crosswalks. It is recommended to refer to the national and state publications when considering the installation of crossings since theories, standards, and warrants change. Included are guidelines when to consider crossings

Provided is a reference anyone can quickly refer to as to when to install pedestrian crosswalks in Orem. There may be more complicated applications that will require an engineering study.

Safety always takes precedence! In downtown business areas, campuses, commercial areas, schools, near senior centers, or where pedestrian activity is encourages or likely to occur, engineering judgement can be used to install crosswalks and a higher level of awareness through signage and pavement markings.

4.4.1 General Crosswalk Guidelines

Whether the proposed crosswalk is at an intersection or a mid-block location, the criteria listed below need to be satisfied in addition to warrant criteria detailed below and in the State and Federal versions or supplements of the MUTCD.

1. Marked crosswalks must connect to established sidewalks or paths at both ends.
2. ADA accessible ramps shall be included at both ends of crosswalk installations unless there are engineering reasons why they cannot be provided.
3. Adequate street lighting must be provided for the safety of pedestrians.
4. Street parking must be restricted adjacent to crosswalks to allow for adequate site lines for both the motorists and the pedestrians. The MUTCD requires 50 feet of "no parking" on both the leading and trailing edge of the crosswalk as a minimum. An engineering study may be necessary for more complicated crossings or other roadway features.
5. Marked crosswalks will not be installed on residential streets unless they are part of a Safe Routes to School (SRTS) program.

4.4.1.1 Pedestrian Crosswalks at Intersections

The criteria or guidelines below are in addition to the general items and should be followed when considering installing crosswalks at intersections.

1. Four-way-stop-controlled or "T" intersections require crosswalks on legs that connect pedestrian facilities.
    a. Areas where crosswalks are not required included rural areas where there are gravel or dirt shoulders without pedestrian facilities or paths.
    b. In urban areas, crosswalks at stop-controlled intersections are needed based on pedestrian volumes and connectivity of pedestrian facilities.
    c. Residential areas do not need marked crosswalks, though ADA standards are required in these areas.
2. Uncontrolled or partially controlled intersections are usually in residential areas or low speed/low volume roadways and do not need marked crosswalks.

4.4.1.2 Rectangular Rapid Flash Beacons (RRFB) and High Intensity Activated Crosswalk (HAWK)

Rectangular Rapid Flash Beacons (RRFB) and High Intensity Activated Crosswalks (HAWK) are used at mid-block crossings to compliment the required safety requirements outlined in chapter 4 of the Utah MUTCD (*http://mutcd.fhwa.dot.gov/resources/state_info/utah/ut.htm*). Chapter 4F gives guidelines to warrant pedestrian hybrid beacons for low speed and high-speed roadways. The warrants are based on the traffic and pedestrian volumes during peak hours of the day. In Orem, the warrants outlined in Chapter 4F in the Utah MUTCD are required to be met before an RRFB or HAWK signal is installed.

4.4.2 School Crosswalk Warrants

In locations surrounding public elementary and middle schools, school crosswalks may be warranted to improve crosswalk safety for school children. Part 7 of the Utah MUTCD discusses policies and guidelines for traffic controls in school zones. Included are regulations on signage, markings, and crossing supervision. In Part 7, **Appendix A: Resolution No. R-07-0023** provides guidelines on the placement of signage and pavement markings and **Appendix B: Access Management Standards** provides school zone warrant flowcharts for school crosswalk zones, reduced speed school zone (RSSZ), overhead school speed limit assembly, adult crossing guard, and narrow school routes. For more information regarding school crosswalks, refer to Part 7 of the Utah MUTCD.

4.5 Traffic Signal Warrants

Warrants to install traffic signals is found in Part 4C of the Utah MUTCD. Included are specific requirements to meet each traffic signal warrant as well as guidance as to how to conduct a traffic signal warrant engineering study. **Table 9** describes the warrants included in the Utah MUTCD and further guidance is found in the Utah MUTCD.

Table 9: Utah MUTCD Traffic Signal Warrants

Warrant		Description*
1	**Eight Hour Vehicular Volume**	Warranted if the traffic volume conditions provided are met during eight hours of the day. ⁺
2	**Four Hour Vehicular Volume**	Warranted if the traffic volume conditions provided are met during four hours of the day. ⁺
3	**Peak Hour**	Warranted if the traffic volume conditions provided are met during the peak hour of the day. ⁺
4	**Pedestrian Volume**	Warranted if the total pedestrians and vehicles on the major street meet four hour conditions. ⁺
5	**School Crossing**	Warranted through an engineering study and a minimum of 20 schoolchildren during highest crossing hour⁺
6	**Coordinated Signal System**	An engineering study is necessary to determine if the signal is warranted. Based on if platooning is disrupted along the corridor
7	**Crash Experience**	Warranted it there are 5 or more crashes in the past year at intersection. Other conditions are included in MUTCD for less than 5 crashes.
8	**Roadway Network**	Warranted based on existing and projected traffic volumes and if the signal encourages concentration and organization of traffic flow. ⁺
9	**Intersection Near a Grade Crossing**	Warranted when the other warrants are not met, and the intersections is located near a grade crossing (ex. Railroad).

* Refer to the Utah MUTCD Part 4C for further information regarding traffic signal warrants

⁺ An hour is the sum of four consecutive 15-minute count periods

In Orem, a traffic signal is warranted if at least one of the warrants based on traffic volumes or crash experience are met (Warrant 1-5, 7). In instances where other warrants are met but one of the required warrants are not met, engineering judgment is necessary to determine if a traffic signal is warranted.

4.5.1 Conducting Engineering Studies for Traffic Signal Warrants

In order to collect traffic volumes, turning movement counts at the intersection general are collected during a 12-hour period (7AM to 7PM) in order to include all peak hour traffic times. Based on prior knowledge, duration of data collection is subject to change.

Part of the engineering study indicates the number of approaching lanes to use in the traffic signal warrants. It indicates that engineering judgement should be used to determine the number of approaching lanes. The following guidelines in Orem will be applied with regards to approach lanes used in traffic signal warrants based on the Utah MUTCD as well as general practice.

- A dedicated right turn lane shall **NOT** be counted as an approach lane
- Right turning volumes shall **NOT** be included in approach volumes if the following occur:
    - Dedicated right lane is present
    - Right turn movement enters the major street with minimal conflict
    - Queuing from dedicated turn lane blocks through/left turning lanes
- A dedicated left turn lane where the traffic volume is less than 50% of the total traffic on the approach is **NOT** counted as an additional approach lane (The left turning traffic is always included in the analysis)

4.6 Access Management

Access management is a term that refers to providing and managing access to land development while maintaining traffic flow and being attentive to safety issues. It includes elements such as driveway spacing, signal spacing, and corner clearance. Access management is a key element in transportation planning, helping to make transportation corridors operate more efficiently and carry more traffic without costly road widening projects. Access management offers local governments a systematic approach to decision-making applying principles uniformly, equitably, and consistently throughout the jurisdiction.

An access management program must address the balance between access and mobility. While the functional classification of roads implies the priority of access versus mobility, access management does much the same thing. Freeways move vehicles over long distances at high speeds with very controlled access and great mobility. Conversely, residential streets offer high levels of access but at low speeds and with little mobility. Access management standards must account for these different functions of various facilities. The following gives the principles of access management and the full access management standards are found in **Appendix B: Access Management Standards**.

4.6.1 Principles of Access Management

Constantly growing traffic congestion concerns over traffic safety and the ever-increasing cost of upgrading roads have generated interest in managing access to the highway system and surface streets. Access management is the process that provides access to land development while simultaneously preserving the flow of traffic on the surrounding road system in terms of safety, capacity, and speed. Access management attempts to balance the need to provide good mobility for through traffic with the requirements for reasonable access to adjacent land uses.

Arguably the most important concept in understanding the need for access management is to ensure the movement of traffic and access to the property are not mutually exclusive (See **Figure 4: Mobility vs. Land Access Representation**). No facility can move traffic very well and provide unlimited access simultaneously. The extreme examples of this concept are the freeways and the cul-de-sac. A freeway moves traffic very well with few opportunities for road access, while a cul-de-sac has unlimited opportunities for road access but doesn't move traffic very well. In many cases, accidents and congestion are the results of streets trying to serve both mobility and access at the same time.

A good access management program will accomplish the following:

- **Limit the number of conflict points at driveway locations.**
- **Separate conflict areas.**
- **Reduce the interference of through traffic.**
- **Provide sufficient spacing for at-grade, signalized intersections.**
- **Provide adequate on-site circulation and storage.**

Access management attempts to end the seemingly endless cycle of road improvements followed by increased access, congestion, and the need for more road improvements.

Poor planning and inadequate access control can quickly lead to an unnecessarily high number of direct accesses along roadways. The movements on and off roads at driveway locations, when the spacing of those driveways are too close, can make it very difficult for through traffic to flow smoothly at desired speeds and levels of safety. The American Association of State Highway and Transportation Officials (AASHTO) states, "the number of accidents is disproportionately higher at driveways than at other intersections…thus their design and location merit special consideration." Studies have shown that anywhere between 50 and 70 percent of all crashes on the urban street system are access related.

Fewer direct access, greater separation of driveways, and better driveway design and location are the basic elements of access management. There is less occasion for through traffic to brake and change lanes to avoid turning traffic when these techniques are implemented uniformly and comprehensively.

Consequently, with good access management, traffic flow will be smoother and average travel speeds higher. There will be less potential for accidents. According to the Federal Highway Administration (FHWA), before and after analyses show that routes with well-managed access can experience 50 percent fewer accidents than comparable facilities with no access controls.

4.7 Traffic Calming

Street patterns are typically developed at the time of construction. In Utah, the history of using a grid system for planning and development purposes started with the first settlers and has proven efficient for moving people and goods throughout a network of surface streets. However, the nature of a grid system with wide and often long, straight roads can result in excessive speeds. For that reason, traffic calming measures (TCM) can be implemented to reduce speeds on residential roadways. Orem also follows the Utah grid system with some interruptions due to State Street, I-15, and railroad tracks. Traffic calming is however still applicable to many neighborhood or local streets and should be at least given consideration on the City's local and residential streets on a case-by-case basis where applicable.

Institute of Transportation Engineers (ITE) has established a definition for traffic calming that reads, "*Traffic calming is the combination of mainly physical measures that reduce the negative effects of motor vehicle use, alter driver behavior and improve conditions for non-motorized street users*." Altering driver behavior includes lowering of speeds, reducing aggressive driving, and increasing respect for non-motorized street users. The City of Orem has adopted a Traffic Calming program that addresses the desire of residents and City leaders to organize a method for addressing high speeds through residential neighborhoods. When considering the installation of traffic calming devices, refer to the City's adopted traffic calming program which are outlined in the City adopted traffic calming program, "*Traffic Calming Guidelines*" and its companion volume "*Traffic Calming Toolbox*" found in **Appendix C: Traffic Calming Guidelines** and **Appendix D: Traffic Calming Toolbox** of this document.

4.8 Traffic Impact Studies

As growth occurs throughout the City, the impacts of proposed developments on the surrounding transportation networks will need to be evaluated prior to giving approval to build. This is accomplished by requiring that a Traffic Impact Study (TIS) be performed for any proposed development in the city based on City staff recommendations. A TIS will allow the City to determine the site-specific impacts of a development including internal site circulation, access issues, and adjacent roadway and intersection impacts. In addition, a TIS assists in defining possible impacts to the overall transportation system in the vicinity of the development. The area and items to be evaluated in a TIS include key intersections and roads as determined by the City Engineer on a case-by-case basis.

Each TIS will be conducted by an engineer chosen by the developer with the following qualifications:

- **Have a current Utah PE License**
- **Firm Specializing in Traffic Engineering**
- **Use of Software utilizing most recent Highway Capacity Manual (HCM) Methodologies**

A scoping meeting will be required by the developer/Traffic Engineer with the City Engineer to determine the scope of each TIS. Included in this meeting are the following discussion items:

- **Scope (Submitted to Orem and Developer)**
- **Establish Study Area**
- **Establish Trip Generation**
- **Establish Trip Distribution**
- **Study Intersections**
- **AM/PM Peak Hours and/or Weekend Peak Hours**

TIS requirements are separated into four permit levels based on ADT. The basic requirements for all TIS's are included in Level I with additional requirements necessary for each level (additional ADT). For all TIS's that require Level III or IV requirements (Greater than 3000 trips generated), access to the MAG travel demand model is required.

Orem Traffic Impact Study Requirements are included in **Appendix E: Traffic Impact Study Guidelines** of this report. The City Engineer will review the TIS or assign someone to do so and will respond in writing to the TIS report within 30 days.

Included in **Appendix E: Traffic Impact Study Guidelines**, are guidelines for developers to completing a TIS and submitting it to the city. The requirements include when a TIS will be required and what level of effort must be established in the study, who may or may not perform a TIS, and when certain elements must be included. The TIS guidelines presented follow closely the guidelines outlined by UDOT. It is important that these guidelines be fluid and that each development be treated individually, as special cases may require more information than the standard requires. The City reserves the right to waive all TIS requirements as well as requiring extra information at the discretion of the City Engineer.

4.9 Connectivity

Orem desires a connected street system for all new developments, minimizing the use of cul-de-sacs. Yet greater connectivity may compromise the integrity of Orem's neighborhoods and, in certain circumstances, increase safety risks to pedestrians, cyclists and other motorists. Connectivity and traffic flow will be balanced with these needs (preserving Orem's neighborhoods and safety) moving ahead. Developers should be made aware that proposed transportation changes that open residential neighborhoods to commercial and high-density areas (with flow-through traffic) are inconsistent with the direction of Orem's future growth. Infill parcels may be required to provide future street stubs to adjacent parcels with the potential for development. Retail and office development should provide cross access easements to create circulation patterns to adjacent properties, to eliminate multiple access points to the major street system when feasible. Consequently, this could reduce travel time and congestion by allowing drivers to make shorter and more direct trips. In addition, connectivity will allow the option of walking or bicycling, due to shorter routes to schools, parks, and businesses. Emergency vehicles including police, fire trucks, and ambulances will similarly benefit from connectivity, by use of alternate routes if one is blocked. Overall fuel consumption and pollution will also result by shortening trips through connectivity. An example projects to improve connectivity in Orem is the 1600 West extension to Geneva Road. Orem's Street Connection Master Plan can be found at *http://orem.org/engineering/*.

Appendix A: Resolution No. R-07-0023

RESOLUTION NO. R-07-0023

A RESOLUTION OF THE CITY COUNCIL OF OREM, UTAH, ADOPTING A NEW STREET CLASSIFICATION MAP AS PART OF THE CITY TRANSPORTATION MASTER PLAN

WHEREAS recorded and projected growth in the City of Orem and in Utah County has created the need for several transportation improvements in the city which are not identified in the City's 2001 Street Classification Map or City Transportation Master Plan; and

WHEREAS the City of Orem Transportation Advisory Commission recommends changes to the Street Classification Map and City Transportation Master Plan as shown on Exhibit "A", and Exhibit "B" and,

WHEREAS the primary proposed changes to the Street Classification Map and City Transportation Master Plan are as follows:

- Define principal arterials as streets that have or are intended to have seven lanes instead of five to seven lanes.
- Designate that minor arterials that cross I-15 shall have or are intended to have five lanes instead of three to five lanes.
- 1600 North from Geneva Road to 1200 West – upgrade from a minor arterial to a principal arterial.
- 1200 North from Geneva Road to 1200 West – upgrade from an urban collector to a minor arterial and identify that 1200 North shall be designed to cross I-15.
- Center Street from Geneva Road to 1200 West – upgrade from a Minor Arterial to a Principal Arterial.
- 400 South from Geneva Road to 1200 West – upgrade from an urban collector to a minor arterial.
- 800 South from Geneva Road to 900 West – upgrade from an urban collector to a minor arterial and identify that 800 South should cross I-15 at a new interchange point.
- 2000 South from Geneva Road to Sandhill Road – upgrade from an urban collector to a minor arterial.
- Add I-15 frontage roads from University Parkway southward into Provo.
- Remove the "urban collector to local" street classifications

- New or improved crossings of I-15 shall be designed with separate pedestrian and bicycle pathways.

NOW, THEREFORE, BE IT RESOLVED BY THE CITY COUNCIL OF THE CITY OF OREM, UTAH, as follows:

1. The City of Orem hereby adopts the June 2007 Street Classification Map as detailed in Exhibit "A" and Exhibit "B" as a part of the City Transportation Master Plan.

2. This resolution will take effect immediately upon passage.

3. All other resolutions, ordinances, and policies in conflict herewith, either in whole or in part, are hereby repealed.

PASSED and APPROVED this **26th** day of **June** 2007.

CITY OF OREM CORPORATE SEAL STATE OF UTAH

Jerry C. Washburn, Mayor

ATTEST:

Donna R. Weaver

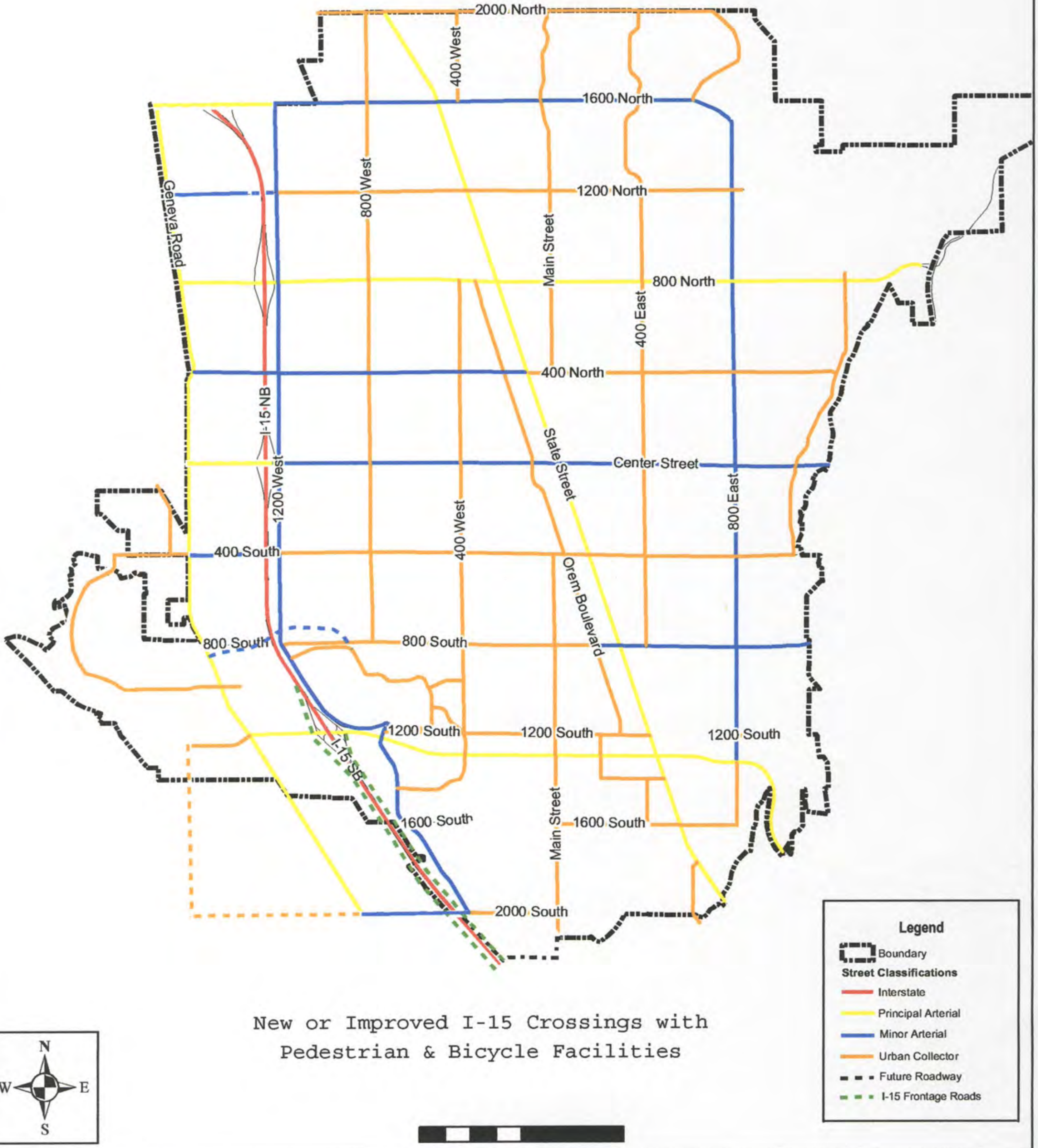
Donna R. Weaver, City Recorder

COUNCIL MEMBERS VOTING "AYE"	COUNCIL MEMBERS VOTING "NAY"
Margaret Black	
Les Campbell	
Dean Dickerson	
Karen McCandless	
Mark Seastrand	
Shiree Thurston	
Jerry C. Washburn	

Exhibit "A"

Street Classification Map

June 26, 2007



New or Improved I-15 Crossings with Pedestrian & Bicycle Facilities

Exhibit "B"

Orem Street Nomenclature and Classification Guidelines

June 26, 2007

Orem Street Nomenclature Changes	
2007 Nomenclature	**2001 Nomenclature**
Interstate	Interstate
Principal Arterial	Principal Arterial
Minor Arterial	Minor Arterial
Urban Collector	Urban Collector
Local	Local

Orem Street Classification Guidelines				
Street Classification	**Maximum Average Daily Traffic (ADT) (vehicles per day)**	**Speed Limit (mph)**	**Asphalt Width (feet)**	**Right-of-Way Width (feet)**
Local (2 Lanes)	800 – 3,000	25	34	46
Urban Collector (2-3 Lanes)	3,000 – 15,000	25 – 35	34 – 50	46 – 62
Minor Arterial * (3 – 5 Lanes)	15,000 – 35,000	30 – 40	50 – 72	76 – 132
Principal Arterial (7 Lanes)	35,000 – 55,000	40 – 55	84 – 104	88 – 164

*** 5 Lanes Crossing I-15**

APPENDIX B: ACCESS MANAGEMENT STANDARDS

OREM CITY

ACCESS MANAGEMENT STANDARDS

ADOPTED 2015

Prepared by

HORROCKS ENGINEERS

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LIST OF TABLES

INTRODUCTION

Access management is the process of establishing and enforcing road and driveway accesses within the City. This includes establishing the location, number, spacing, type, and design of city streets and accesses to minimize vehicle conflicts and maximize the traffic capacity and safety of a roadway. Unmanaged or unorganized development along travel corridors results in poor, unsafe roadways. There are cases where all landowners along a corridor have access. This occurs when landowners do not develop at the same time. Numerous access points along travel corridors create unnecessary conflicts between turning and through traffic, which cause delays and reduce safety. Numerous benefits are derived from controlling the location and number of access points to a roadway. Those benefits include:

- Improving overall roadway safety
- Reducing the total number of vehicle trips on the roadway
- Decreasing interruptions in traffic flow
- Minimizing traffic delays and congestion
- Maintaining roadway capacity
- Extending the useful life of roads
- Avoiding costly highway projects
- Improving air quality
- Encouraging compact development patterns
- Improving access to adjacent land uses
- Enhancing pedestrian and bicycle facilities

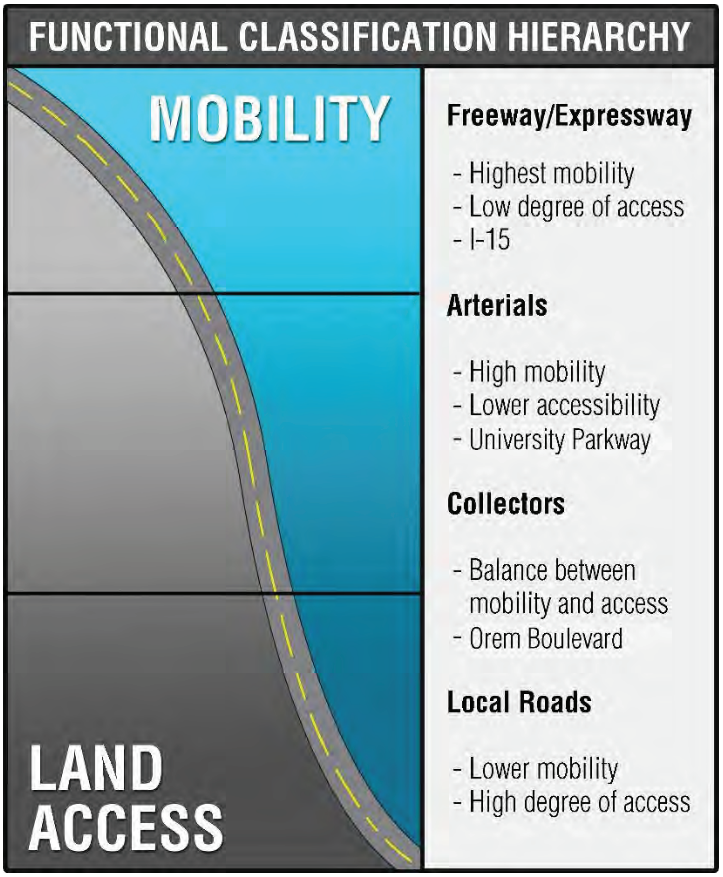
PRINCIPLES OF ACCESS MANAGEMENT

Increasing traffic congestion, improving traffic safety, and minimizing the cost of future road upgrades has generated interest in managing access, not only with the highway system, but on city surface streets as well. Access management is the process that provides access to land development while simultaneously preserving the flow of traffic (mobility) on the surrounding road system in terms of safety, capacity, and speed. Access management attempts to balance the need to provide good mobility for through traffic with the requirements for reasonable access to adjacent land uses.

A very important concept when administering access management standards is to understand that the movement of traffic and access to property are not mutually exclusive. No facility can simultaneously move traffic efficiently and provide unlimited access. Figure 1 shows the relationship between mobility, access, and the functional classification of streets. The extreme examples of this concept are freeways and cul-de-sacs. Freeways move traffic very well with few opportunities for access, while the cul-de-sac has many opportunities for access, but doesn't move traffic very well. In many cases, accidents and congestion are the result of an imbalance in serving both mobility and access at the same time. A good access management program will accomplish the following:

- Limit the number of conflict points at driveway locations
- Separate conflict areas
- Reduce the interference of through traffic
- Provide sufficient spacing for at-grade, signalized intersections
- Provide adequate on-site circulation and storage

Figure 1: Mobility vs. Land Access Representation



Access management strategies attempt to end the cycle of road improvements followed by increased access, increased congestion, and the need for more road improvements.

Poor planning and inadequate control of access can quickly lead to an unnecessarily high number of direct accesses along roadways. The movements that occur on and off roadways at driveways that are too closely spaced make it difficult for through traffic to flow smoothly at desired speeds and levels of safety. An American Association of State Highways and Transportation Officials (AASHTO) publication states, "*the number of accidents is disproportionately higher at driveways than at other intersections…thus their design and location merits special consideration*." Studies have shown that anywhere between 50 and 70 percent of all crashes that occur on the urban street system are access related.

Fewer accesses, greater separation of driveways, and better driveway design and location are the basic elements of access management. There are fewer occasions for through traffic to brake and change lanes in order to avoid turning traffic when these techniques are implemented uniformly and comprehensively.

Consequently, with good access management, the flow of traffic will be smoother and average travel speeds higher, with less potential for crashes. Before and after analyses by FHWA, show that routes with well managed access can experience 50 percent fewer accidents than comparable facilities with no access controls.

ROADWAY FUNCTIONAL CLASSIFICATION

Access management should recognize that access and mobility are competing functions. This recognition is fundamental to the design of roadway systems that preserve public investments, contribute to traffic safety, reduce fuel consumption and vehicle emissions, and do not become functionally obsolete. Suitable functional design of the roadway system also preserves the private investment in residential and commercial development

Roadway classification simply means using each individual street facility to perform the desired mix of the functions of access or movement. This is accomplished by classifying highways and surface streets with respect to the amount of access or mobility they are to provide and then identifying and using the most effective facility to perform that function.

The functional system of classification divides streets into three basic classes identified as arterials, collectors, and local streets. The function of an arterial is to provide for regional mobility of through traffic. Access to an arterial is controlled to reduce interferences and facilitate through movement. Collector streets provide a mix for the functions of mobility and access, and therefore accomplish neither well. The main purpose of local streets is to provide good access. Each class of roadway has its own geometric, traffic control, and spacing requirements.

ROADWAY NETWORK AND ACCESS MANAGEMENT STANDARDS

The access management concepts and standards presented below are consistent with guidelines established by the Federal Highway Administration (FHWA), the American Association of State Highway and Transportation Officials (AASHTO), the Transportation Research Board (TRB), and the Institute of Transportation Engineers (ITE).

There are a number of access management techniques that can be used to preserve or enhance the capacity of a roadway. Specific techniques for managing access are discussed in this section and illustrated with examples. Not all techniques will apply to every situation. Some of them are more appropriate to less developed rural areas of the City, whereas others are more appropriate in the urban areas. It is up to the City's Planning Board to determine what will work best in each situation while considering future growth and functional goals.

NUMBER OF ACCESS POINTS

Controlling the number of access points or driveways from site to roadway reduces conflicts between cars, pedestrians, and bicycles. Each parcel should normally be allowed one access point, and shared access is required were possible. Provisions can be made in the local land use regulations to allow for more than one access point where special circumstances would require additional accesses. Developers should be encouraged to utilize access from existing side roads or to construct side road instead of direct access to arterial or collector roads.

SPACING OF ACCESS POINTS

Establishing a minimum distance between access points reduces the number of points a driver has to observe and reduces the opportunity for conflicts. Spacing requirements would be based on the classification and design speed of the road, the existing and projected volume of traffic as a result of the proposed development, and the physical conditions of the site. Minimum spacing standards should be applied to both residential and commercial/industrial developments.

To ensure efficient traffic flow, new signals should be limited to locations where the progressive movement of traffic will not be impeded significantly. Uniform, or near uniform, spacing of signals is essential for the progression of traffic. As a minimum, signals should be spaced no closer than one-quarter mile (1,320 feet) for collectors and minor arterials. It may be recommended on major and principal arterial streets that signals be spaced at one-third mile (1,760 feet) to one-half mile (2,640 feet).

Unsignalized driveways are far more common than signalized driveways. Traffic operational factors leading toward wider spacing of driveways (especially medium- and higher-volume driveways) include weaving and merging distances, stopping sight distance, acceleration rates, and storage distance for back-to-back left turns. From a spacing perspective, these driveways should be treated the same as public streets. Sound traffic engineering criteria indicates that 500 feet or more should be provided between full-movement unsignalized accesses.

Restricted access movement (i.e., right-in/right-out access) can provide for additional access to promote economic development with minimum impact to the roadway facility. The spacing requirement of accesses is based on the functional classification of the roadway facility and is shown in Table 1. Access spacing shall be measured from center of access to center of access. The spacing of right-turn accesses on each side of a divided roadway can be treated separately; however, where left-turn at median breaks are involved, the access on both sides should line up or be offset from the median break by a minimum of 300 feet. On undivided roadways, access on both sides of the road should be aligned. Where this is not possible, driveways should have an offset distance based on the roadway classification Table 2**.** This offset is the distance from the center of an access to the center of the next access on the opposite side of the road.

Table 1: Access Spacing Based on Functional Classification

Functional Classification	Minimum Signal Spacing (ft)*⁺	Minimum Unsignalized Full-Movement Access Spacing (ft)*	Minimum Right-In/Right-Out Access Spacing (ft)*
Major/Principal Arterial	2,640	660	330
Minor Arterial	1,320	500	250
Collector	1,320	500	250
Commercial Local	1,320	660	330
Residential Local	1,320	125	100
Residential Sub-Local	1,320	100	75

* Distances in table are measured from center to center of driveway.

⁺ Some existing signals do not comply with spacing requirements. All future signals shall follow spacing requirements. Only through an engineering study and permission form The City of Orem can a signal be spaced below minimum values

Table 2: Minimum Offset between Driveways on Opposite Sides of Undivided Roadway

Functional Classification	Minimum Offset (ft)*
Major Arterial	600 for speed ≥ 45 mph⁺ and 300 for speeds < 45 mph⁺
Minor Arterial	220
Collector	200
Commercial Local	200
Residential Local	N/A
Residential Sub-Local	N/A

*Distances in table are measured from center to center of driveway.

⁺ 85th Percentile Speeds

Note: Values are based on TRB Access Management Guidelines.

MEDIANS

Medians control and manage left turns and crossing movements, and separate traffic moving in opposite directions. Restricting left turning movements reduces conflicts, improves safety and improves traffic flow. According to the FHWA technical report FHWA-SA-10-002, the installation of a non-traversable median reduces crashes by 35% when compared to a two way left turn lane (TWLTL) at 33%. Medians are typically used on roadways with high volumes of traffic and four or more lanes of traffic (i.e., arterial streets).

The use and design of a median is determined by the characteristics of the roadway such as: traffic volumes, speed, number and configuration of lanes, right-of-way width and land uses along the roadway. The need for a median can be identified through engineering review, a traffic study assessing the impact of a proposed project, and should be considered on any roadway that has a speed limit greater than 40 MPH.

In addition, medians are often used in commercial and residential developments to separate lanes of traffic and limit conflicts caused by left turns. Medians can also add to the overall aesthetics of a roadway corridor or a development by incorporating landscaping or other items of visual interest. However, care should be taken to maintain sight distance around the intersection/access locations. It is therefore required that only ground cover plantings in a median be planted within 350 feet of an intersection/access opening. Care should be taken to select landscape materials and location of the materials that will not intrude into the roadway, which could result in a safety problem for the motorist. Also care should be taken in selection of trees that when mature will not be larger than a 4 inch diameter.

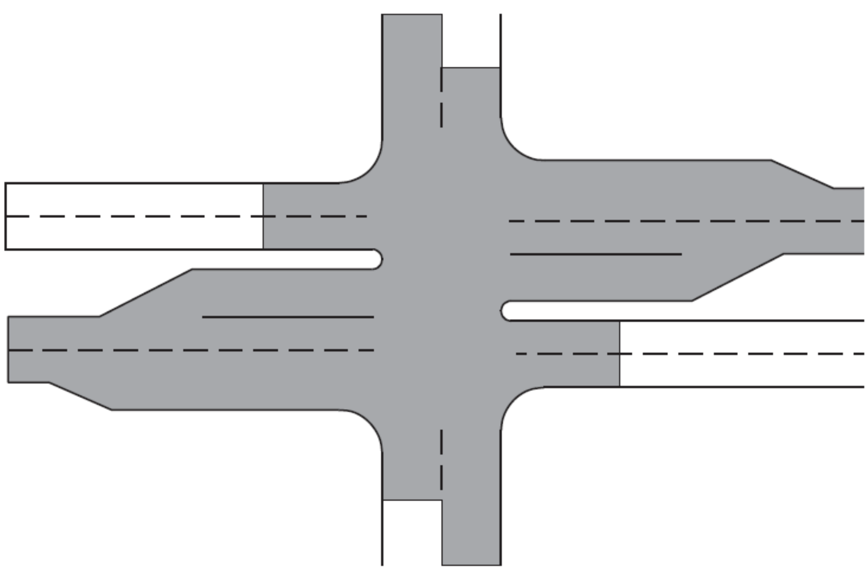
Center Turn Lanes (also known as two way left turn lanes [TWLTL]) can reduce the conflict and delays caused by left turning vehicles crossing on-coming traffic. Left turn lanes also reduce accidents caused by slowing vehicles and traffic passing on the right. Two way left turn lanes should only be used to retrofit areas of existing development. New roads that utilize other access management techniques may not require a two way left turn lane. An engineering analysis should be completed to determine if a TWLTL is needed. Median openings are provided at all signalized at-grade intersections. They are also generally provided at unsignalized junctions of arterial and collector streets. They may be provided at driveways, where they will have minimum impact on roadway flow. The spacing of median openings for signalized driveways should reflect traffic signal coordination requirements and the storage-space needed for left turns. Minimum desired spacing of unsignalized median openings at driveways shall be based on the left turn storage requirements. In AASHTO's *A Policy on Geometric Design of Highways and Streets, 6th Edition*, it suggests that left turn storage lengths require a traffic analysis which calculates the length based on the number of turning vehicles arriving in an average two-minute period within the peak hour with space with at least two passenger cars required. Median openings for left-turn entrances (where there is no left-turn exit from the activity center) should be spaced to allow sufficient storage for left-turning vehicles. Guidance is also found in the AASHTO's *A Policy on Geometric Design of Highways and Streets, 6th Edition* in Chapter 9.

Left-turn ingress or egress requires a median opening when traffic traveling in opposing directions is separated by a barrier median. Median widths in Orem vary from 30 inches to 14 feet. A minimum of a 14 foot median is desirable in order to provide for an adequate left turn lane at intersections. Typically, median widths at intersections are 30 inches formed by two 15 inch curbs back to back with a plowable (tapered) end. Proper signage shall be installed at all median ends.

CORNER CLEARANCE

Corner Clearance is the distance between a driveway and an intersection. Providing adequate corner clearance improves traffic flow and roadway safety by ensuring that the traffic turning into or out of the driveway does not interfere with the function of the intersection. Local regulations should require that driveways be located a minimum distance from an intersection based on roadway classification and speed. Any new access opening shall not be located within the functional area of the intersection as shown in Figure 2.

Figure 2: Functional Area of Intersections



Corner Clearance shall be based on an engineering study that includes the following distances illustrated in Figure 3 and Table 3.

Figure 3: Corner Clearance Type

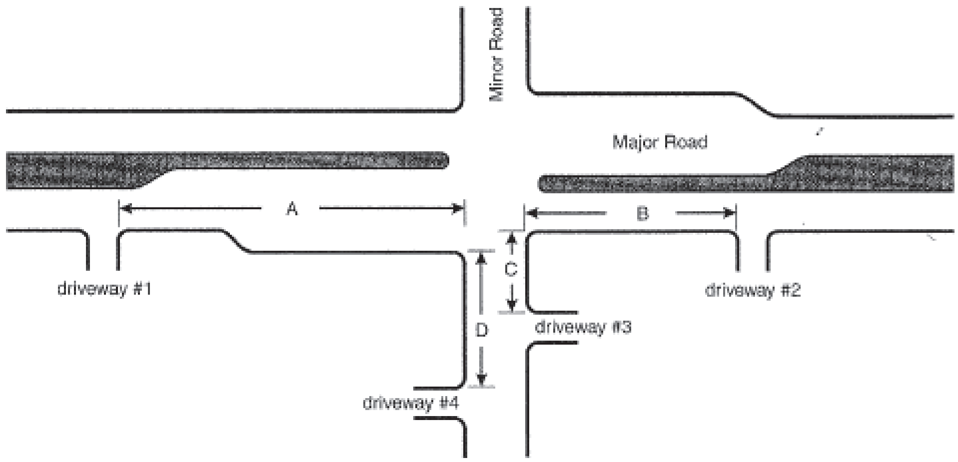


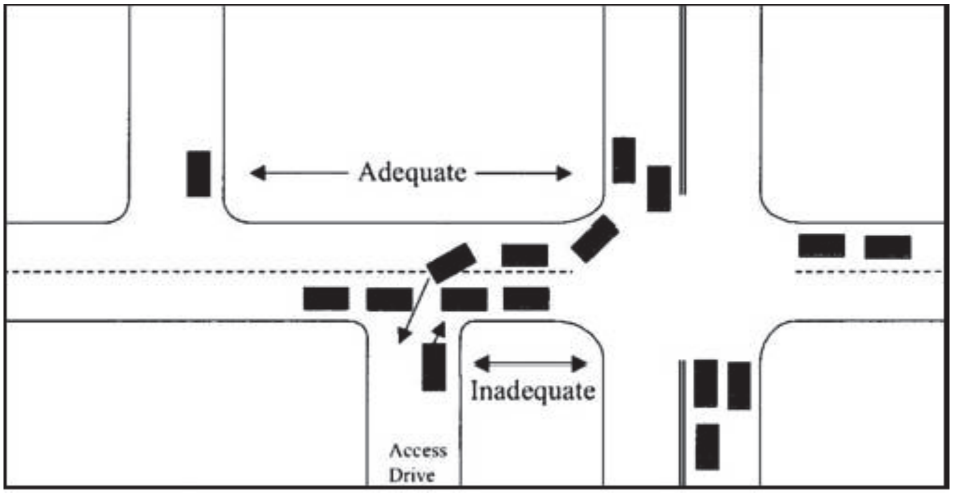
Table 3: Corner Clearance Criteria

A- Approach side on the major roadway	Equal or exceed the functional distance of the intersection d1+d2+d3 (based on engineering study). d1= Distance traveled during perception d2= Distance traveled while driver decelerates to a stop d3= Storage length
B- Departure side on the major roadway	Residential Roadways 260 feet* Collector Roadways 305 feet* Arterial Roadways 380 feet*
C- Approach side on the minor roadway	Shall be a minimum of 100 feet
D- Departure side on the minor roadway	Shall be a minimum of 120 feet

* Based on a spillback rate of 15% from TRB Access Management Manual

Figure 4 shows a representation of inadequate corner clearance if the guidelines in Table 3 are not followed.

Figure 4: Inadequate Corner Clearance



WIDTH OF ACCESS POINTS

In addition to limiting the number of access points, the width of the access point should be restricted based on the use of the site in question. Residential driveways should be limited to a maximum width of 40 feet at the edge of pavement. Please refer to the ***Orem Municipal Code Chapter 16*** for more information on the width of access points.

TURNING RADIUS

The turning radius of a driveway or access road affects both the flow and safety of through traffic as well as vehicles entering and exiting the roadway. In general, the larger the turning radius, the greater the speed at which a vehicle can turn into a site. An excessively small turning radius will require a turning vehicle to reduce speed significantly to make the turn, therefore backing up the traffic flow or encroaching into the other lane. An excessively large turning radius will encourage turning vehicles to travel quickly, thereby creating hazards to pedestrians. Either of these situations increases the potential for accidents.

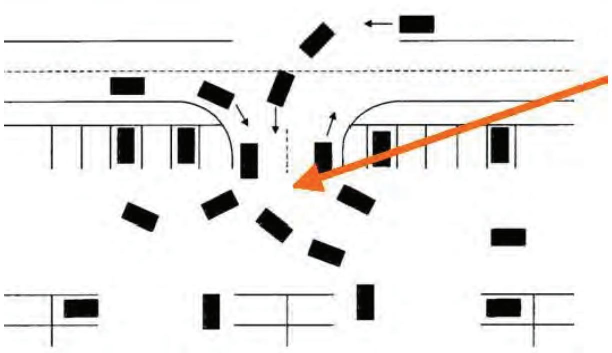
The speed of the roadway, the vehicle class and volume, pedestrian safety, and the site land use should be considered when evaluating the turning radius. Proposed uses that would require deliveries by large trucks (such as major retail establishments and gas stations) should provide larger turning radii to accommodate such vehicles. Other uses such as banks, offices, or areas with high pedestrian traffic could adequately be served with smaller turning radii based on the type of traffic they would generate.

THROAT LENGTH

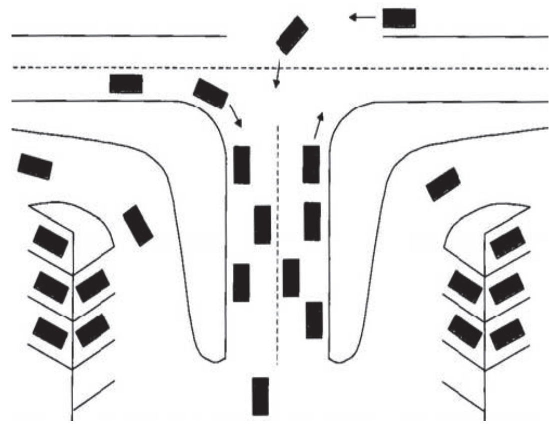
Throat Length is the length of the driveway on a developed site that is restrictive of turning traffic measured from an intersection access. Driveways should be designed with adequate throat length to accommodate queuing of the maximum number of vehicles as defined by the peak period of operation in the traffic study. This will prevent potential conflicts between traffic entering the site and internal traffic flow. Inadequate throat length may cause turning traffic to back up onto the road thereby affecting traffic flow and increasing the potential for accidents. The minimum throat length for an access into a minor commercial property is 50 feet. For major commercial development FHWA recommends a minimum throat length of 150’ for a major driveway entrance, with 300’ desirable. **Figure 5** shows both a poor and good example of driveway throat length.

Figure 5: Driveway Throat Length Examples

Poor Throat Length



Good Throat Length



DRIVEWAY PROFILES

The slope of a driveway can dramatically influence its operation. Usage by large vehicles can have a tremendous effect on operations if slopes are severe. The profile, or grade, of a driveway should be designed to provide a comfortable and safe transition for those using the facility, and to accommodate the storm water drainage system of the roadway. In ***NCHRP Report 659: Guide for the Geometric Design of Driveways***, it states that a minimum slope of 2% is required for water runoff with a maximum slope of 8% for icy/snowy conditions. Please refer to NCHRP Report 659 for additional information on driveway design.

SHARED ACCESS

Access points shall be shared between adjacent parcels to minimize the potential for conflict related to close driveway proximity. Shared access can be used effectively for both residential and nonresidential developments. Since the issues surrounding shared access for residential and nonresidential development are slightly different, they are discussed separately.

RESIDENTIAL ACCESS

Residential subdivisions located along arterial or collector roadways should be required to construct an internal road system rather than be developed along the existing roadway frontage or a single access cul-de-sac. Subdivision proposals should encourage a coordinated street network by providing rights-of-way or stubs for the extension of streets to adjacent parcels. This will prevent the proliferation of driveways on arterial and collector streets and provide for an interconnected street network.

Shared driveways shall also be used to minimize the number of curb cuts in residential districts, particularly along rural arterial and collector roads. If access is necessary from an arterial or collector then shared driveways is required. Shared driveways serving more than two homes will be built to fire lane standards.

COMMERCIAL ACCESS

Joint driveways providing access to adjacent developments, and interconnections between sites, are required for all development proposals on arterial and collector roadways. Interconnections between sites can eliminate the need for additional curb cuts, thereby preserving the capacity of the roadway by reducing the number of conflicting movements on the main road. This is particularly important for commercial/industrial sites and should be used to encourage the development of internal or collector roadway systems servicing more than one parcel or establishment. Future roadway rights-of-way should also be provided to promote interconnected access to vacant parcels or to facilitate the consolidation of access points for existing developments.

Pedestrian access between developments will allow people to walk between establishments, thereby reducing the number of vehicle trips. Every opportunity should be taken to provide for interconnections between existing and future developments for both vehicles and pedestrians.

ALIGNMENT OF ACCESS POINTS

Street and driveway intersections represent points of conflict for vehicles, bicycles and pedestrians. All modes of travel should be able to clearly identify intersections and assess the travel patterns of vehicles and pedestrians through the intersection. To minimize the potential conflicts and improve safety, intersections and driveways shall be aligned opposite each other wherever possible and intersect roadways at a 90 degree angle. Good driveway alignment will provide vehicles, bicycles, and pedestrians with a clear line of sight and allow them to traverse the intersection more safely.

SIGHT DISTANCE

Sight distance is the length of the road that is visible to the driver. A minimum safe sight distance should be required for access points based on the roadway classification. The American Association of State Highway and Transportation Officials (AASHTO) publication, *A Policy on Geometric Design of Highways and Streets* contains recommendations for sight distance based on the roadway design speed and grade. Providing sufficient intersection sight distance at the driveway point for vehicles using a driveway to see oncoming traffic and judge the gap to safely make their movement is essential. Intersection sight distance varies, depending on the design speed of the roadway to be entered, and assumes a passenger car can turn right or left into a two-lane highway and attain 85 percent of the design speed without being overtaken by an approaching vehicle that reduces speed to 85 percent of the design speed. The table below gives intersection sight distance requirements for passenger cars. Sight distances should be adjusted with crossroad grade in accordance with AASHTO policies and are shown in Table 5.

Table 4: Intersection Driveway Sight Distance

Design Speed (85^{th} %) (mph)	Sight Distance Required (ft)**
30	335
35	390
40	445
45	500
50	555
55	610
60	665
65	720

*Based on a 2 lane roadway (for other lane configurations, refer to AASHTO for adjustments). Drivers' eye setback is assumed to be 15 feet measured from the edge of traveled way.

Normally, intersection sight distance will govern the required sight distance for the driveway but it is also important to verify that the main roadway have sufficient stopping sight distance. For example, a driver of a vehicle approaching an intersection should have an unobstructed view of the entire intersection including any traffic control devices and sufficient length along the intersecting highway to permit the driver to anticipate and avoid potential collisions. The safe stopping sight distance should be reviewed to make sure that the approaching vehicle has a clear view of the roadway in the area of the access. Sight distance may be more of a consideration in rural areas because of higher speeds and rolling/hilly terrain. Table 5 gives the safe stopping sight distance that should be provided for a driver on the roadway to have a clear view of the access/driveway. In making this determination for stopping sight distance, it should be assumed that the approaching driver's eye is 3.5 feet above the roadway surface and that the object to be seen is 2 feet above the surface of the road. For horizontal or vertical curves, the stopping sight distance is addressed by an onsite evaluation.

Table 5: Safe Sight Distances on Grades

Design Speed (85^{th} %) (mph)	Safe Stopping Sight Distance (ft)			
	Downhill Grades		Uphill Grades	
	-3%	-6%	3%	6%
25	158	165	147	143
30	205	215	200	184
35	257	271	237	229
40	315	333	289	278
45	378	400	344	331
50	446	474	405	388
55	520	553	469	450

TURNING LANES

Turning lanes remove the turning traffic from the through travel lanes. Left turning lanes are used to separate the left turning traffic from the through traffic. Right turn lanes reduce traffic delays caused by the slowing of right turning vehicles. Designated right or left turn lanes are generally used in high traffic situations on arterial and collector roadways. A traffic impact study will identify the need for and make recommendations on the design of turning lanes or tapers based on the existing traffic volumes, speed, and the projected impacts of the proposed use. At all signalized intersections, both a left and right turning lane will be implemented.

STORAGE LENGTH

The length of the turning lane shall be determined by an intersection traffic analysis based on the number of vehicles arriving in the turning lane during a two minute period within the peak hour. The minimum length shall be the space for two passenger vehicles (50 ft.) and for areas with more than 10 percent truck traffic it shall be the space for one passenger vehicle and one truck (75 ft.). For signalized intersections, the storage length shall be 1 ½ times the average number of vehicles that would queue per cycle during the peak hour based on design year volumes.

LANE WIDTH

Turning lanes shall be a minimum of 12 feet in width. Any exception will require approval from the City Engineer.

LEFT-TURN LANES

The provision of left-turn lanes is essential from both capacity and safety standpoints where left turns would otherwise share the use of a through lane. Shared use of a through lane will dramatically reduce capacity, especially when opposing traffic is heavy. Left-turn lanes shall always be provided at a signalized intersection.

RIGHT-TURN LANES

Right-turn lanes remove the speed differences in the main travel lanes from right turners, thereby reducing the frequency and severity of rear-end collisions. They also increase capacity of signalized intersections and may allow for more efficient traffic signal timing.

PEDESTRIAN AND BICYCLE ACCESS

An aspect of access management is reducing the number of vehicle trips. This can be accomplished by providing safe and appealing pedestrian access within developments and between adjacent developments.

All new development and redevelopment of existing sites should address pedestrian and bicycle access to and within the site. Sidewalks should be provided in all urban residential subdivisions in or adjacent to commercial or industrial developments. Sidewalks and other pedestrian facilities should comply with the Americans with Disabilities Act (ADA) Standards for Accessible Design. Crosswalks should be clearly marked and located in appropriate areas. Paint or paving materials can be used to delineate crosswalks. In addition to traditional brick, an alternative involves imprinting the asphalt with a brick design and then painting the crosswalk.

Parking lot designs need to address pedestrian access to the site and circulation within the site. Five foot wide sidewalks or striped pedestrian crossings should be provided from adjacent sites through parking lots to promote safe pedestrian access. Safe and appealing pedestrian circulation systems allow people to park their cars once and walk to different establishments, resulting in a vehicle trip reduction. Joint and cross access between developments can provide opportunities for shared parking.

GRADE SEPERATIONS

Interchanges in an access management context provide several important functions. Interchanges maximize movement along expressways and principal arterials.

More specifically, a grade separated interchange may be appropriate in the following situations:

1. where two expressways cross, or where an expressway crosses arterial roads;
2. where principal arterials cross and the resulting available green time for any route would be less than 40 to 50 percent;
3. where an existing at-grade signalized intersection along an arterial roadway operates at level of service (LOS) F, and there is no reasonable improvement that can be made to provide sufficient capacity;
4. where a history of accidents indicates a significant reduction in accidents can be realized by constructing a grade separation;
5. where a new at-grade signalized intersection would result in LOS E in urban and suburban settings and LOS D in rural settings;
6. when the location to be signalized does not meet the signal spacing criteria and signalization of the access point would impact the progressive flow along the roadway;
7. where a major public street at-grade intersection is located near a major traffic generator and effective signal progression for both the through and generated traffic cannot be provided; and
8. where the activity center is located along a principal arterial, where either direct access or left turns would be prohibited by the access code, or would otherwise be undesirable.

Minimum interchange spacing along various roadways should be as shown in **Table 8**. Spacing may be closer where access is provided to or from collector-distributor roads. Privately-developed interchanges should become part of a regional transportation plan to ensure they are consistent with local and regional plans.

Table 6: Minimum Interchange Spacing Guidelines

Functional Classification	Minimum Interchange Spacing for Urban/Suburban Areas (miles)	Minimum Interchange Spacing for Rural Areas (miles)
Freeway	1	3
Expressway	1	2
Principal Arterial	1	2

One of the main goals of the Transportation Master Plan is to estimate traffic growth and provide for adequate facilities as the need arises. The safe traffic operations of these future facilities are of equal importance. As a result, all of these facilities should be constructed and maintained to applicable design and engineering standards such as those set forth in Orem City ordinances, AASHTO "Policy on Geometric Design of Highways and Streets," and the Manual on Uniform Traffic Control Devices (MUTCD). This includes implementing applicable Americans with Disabilities Act (ADA) standards and school zone treatments.

RESIDENTIAL DRIVEWAYS ON MAJOR STREETS

Due to population growth, geometric limitations, right-of-way, or funding, residential driveways are sometimes found on collector or arterial streets. If residential driveways have to be on a collector or arterial street, it is recommended to require circular driveway or a turn-around where vehicles don't have to back out on to the street. Backing maneuvers into busy streets can be very dangerous, as this is not a typical action drivers expect. Any new development should restrict any residential access on collector or arterial roadways.

OFFSET INTERSECTIONS

Offset intersections often have negative impacts on traffic flow and can potentially create capacity problems at intersections where the left turn storage areas overlap, forcing queued vehicles into through traffic lanes. Aligning access on both sides of the street will minimize conflict points in the roadway and provide safer and more efficient traffic flow. Offset intersections should be avoided wherever possible and should never be approved with new development.

INTERSECTION IMPROVEMENTS

Proper intersection design will typically facilitate larger traffic flows without widening existing roadway cross-sections. This can minimize impacts to adjacent properties. Therefore, emphasis was placed on identifying critical intersections during the traffic modeling process.

Intersections are a critical element to future roadway functionality and should provide sufficient turn lanes and adequate turn pockets to accommodate vehicle queues. In the future, many intersections throughout the City may require signalization in order to maintain a desirable LOS. Stop signs and traffic signals should not be used when not warranted per the MUTCD. Studies have shown that in areas where intersection control has been installed and not warranted, a higher percentage of the motoring public will disregard the control measure and create a more unsafe condition.

As in the case with the typical roadway cross sections, typical intersection configurations are a helpful planning tool when preserving right-of-way and for project cost estimating. This section includes some typical intersection treatments, including expanded right-of-way requirements, turn pocket configurations, and taper lengths. Each intersection must be considered separately but the guidelines in the following sections should be followed.

At intersections, additional right-of-way may be necessary to include any additional dedicated turning lanes. With the inclusion of additional dedicated turn lanes, the shoulders are reduced to 2 feet and the median or TWLTL is used as one dedicated left turn lane. All intersections should be individually analyzed to determine the correct number of dedicated turn lanes. Table 9 shows the additional right-of-way necessary depending on the functional classification of the approaching roadways based on number of additional turning lanes.

Table 7: Additional ROW at Intersections

Intersection Approach Functional Classification	Left Turn Lanes	Right Turn Lanes	Additional ROW (ft.)
Principal Arterial	2	1	20
Major Arterial	2	1	20
Major Arterial	1	1	8
Minor Arterial	1	1	8
Minor Arterial	1	0	0
3 Lane Urban Collector	1	1	8
3 Lane Urban Collector	1	0	0
2 Lane Urban Collector	0	1	8
2 Lane Urban Collector	1	0	8

TRAFFIC SIGNALS

Traffic signals should not be installed unless at least one or more of the nine traffic signal warrants (as outlined in the MUTCD with exception to Warrant 6) have been met. Even if warrants are met for a particular intersection, justification for installation should still be based on information obtained through engineering studies and comparisons with the requirements set forth in the MUTCD. As stated in the MUTCD, "*the satisfaction of a traffic signal warrant or warrants shall not in itself require the installation of a traffic control signal*." The nine warrants outlined in the MUTCD include the following:

- Warrant 1: Eight-Hour Vehicular Volume
- Warrant 2: Four-Hour Vehicular Volume
- Warrant 3: Peak Hour
- Warrant 4: Pedestrian Volume
- Warrant 5: School Crossing
- Warrant 6: Coordinated Signal System
- Warrant 7: Crash Experience
- Warrant 8: Roadway Network
- Warrant 9: Intersection Near a Grade Crossing (Railroad)

Traffic signals may be warranted at the intersection of any two roadways depending upon the parameters outlined above. The design of the signal and intersection will depend primarily on the amount of traffic passing through the intersection during the peak times of day. Design parameters that are essential to a well-designed signalized intersection include lane configuration, turn radii, turn pocket lengths, and taper lengths. Each of these parameters is a function of the road classification, peak hour volumes, and design speeds.

STOP SIGNS

The MUTCD should be used as the standard for determining how and when a stop sign is installed. As stated in the MUTCD, "*Stop signs should be used if engineering judgment indicates that one or more of the following conditions exist:*

- *Intersection of a less important road with a main road where application of the normal right-of-way rule would not be expected to provide reasonable compliance with the law;*
- *Street entering a through highway or street;*
- *Un-signalized intersection in a signalized area; and*
- *High speeds, restricted view, or crash records indicate a need for control by the stop sign*."

The number of vehicles that are required to stop should be minimized, if at all possible, to preserve capacity and functionality of the roadway network; therefore, when deciding which road to stop, the street carrying the lowest volume of traffic should be chosen. Less restrictive traffic control such as a yield sign can be used as an alternative to stop signs, if at all possible, to minimize delays. Yield signs should also be installed per the MUTCD guidelines. Stop signs should not be used to control speed, but to designate right-of-way at intersecting roadways.

4-way stop control may be used as a safety measure at intersections where the volume of traffic is approximately equal for all approaches and where safety is of concern, or as an interim measure where a traffic signal is justified and has yet to be installed. Engineering judgment and the guidelines outlined in the MUTCD as well as the Utah State policy should be used to determine the appropriate application of stop and yield signs.

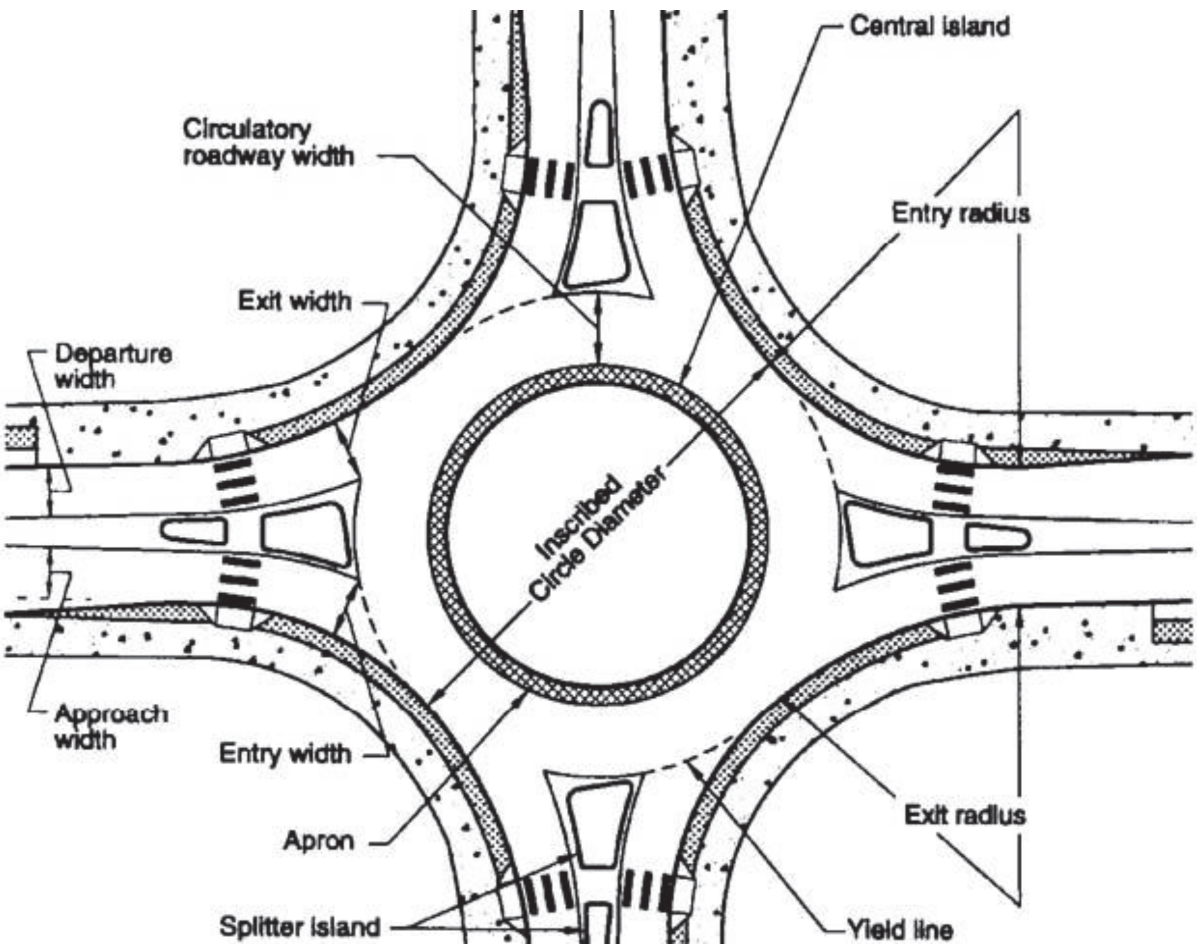
ROUNDABOUTS

Many communities in the United States are beginning to embrace the concept of roundabouts. A roundabout is an intersection control measure used successfully in Europe and Australia for many years. A roundabout is composed of a circular, raised, center island with deflecting islands on the intersecting streets to direct traffic movement around the circle. Traffic circulates in a counter-clockwise direction making right turns onto the intersecting streets. There are no traffic signals; rather, entering traffic yields to vehicles already in the roundabout.

Advantages of roundabouts include reduced traffic delays, increased safety, and reduced number of conflicts. Roundabouts can improve safety because the number of potential impact points and conflict points the driver must monitor are substantially reduced over a conventional four-way intersection. Properly designed roundabouts can also accommodate emergency vehicles, trucks, and snow plowing equipment. The roundabout nearly eliminates "T-bone" accidents at intersections.

Unlike the typical New England "traffic circle" or "rotary," design standards for roundabouts are very specific and FHWA has prepared a design guide for modern roundabouts in the United States (http://www.fhwa.dot.gov/publications/research/safety/00067/00067.pdf). Development of a roundabout will only occur as a result of an intersection study performed by a qualified Traffic Engineer and when the minimum capacity and design criteria are met. The FHWA has determined that the maximum flow rate that a roundabout can accommodate depends on the geometric elements (circle diameter, number of lanes, etc.), the circulating flow (vehicles going around the circle), and entry flow (vehicles entering the circle). A single lane roundabout can accommodate up to 1,800 vehicles per hour and a double lane roundabout can accommodate up to 3,400 vehicles per hour. **Figure 7** shows an example of a typical single lane roundabout design.

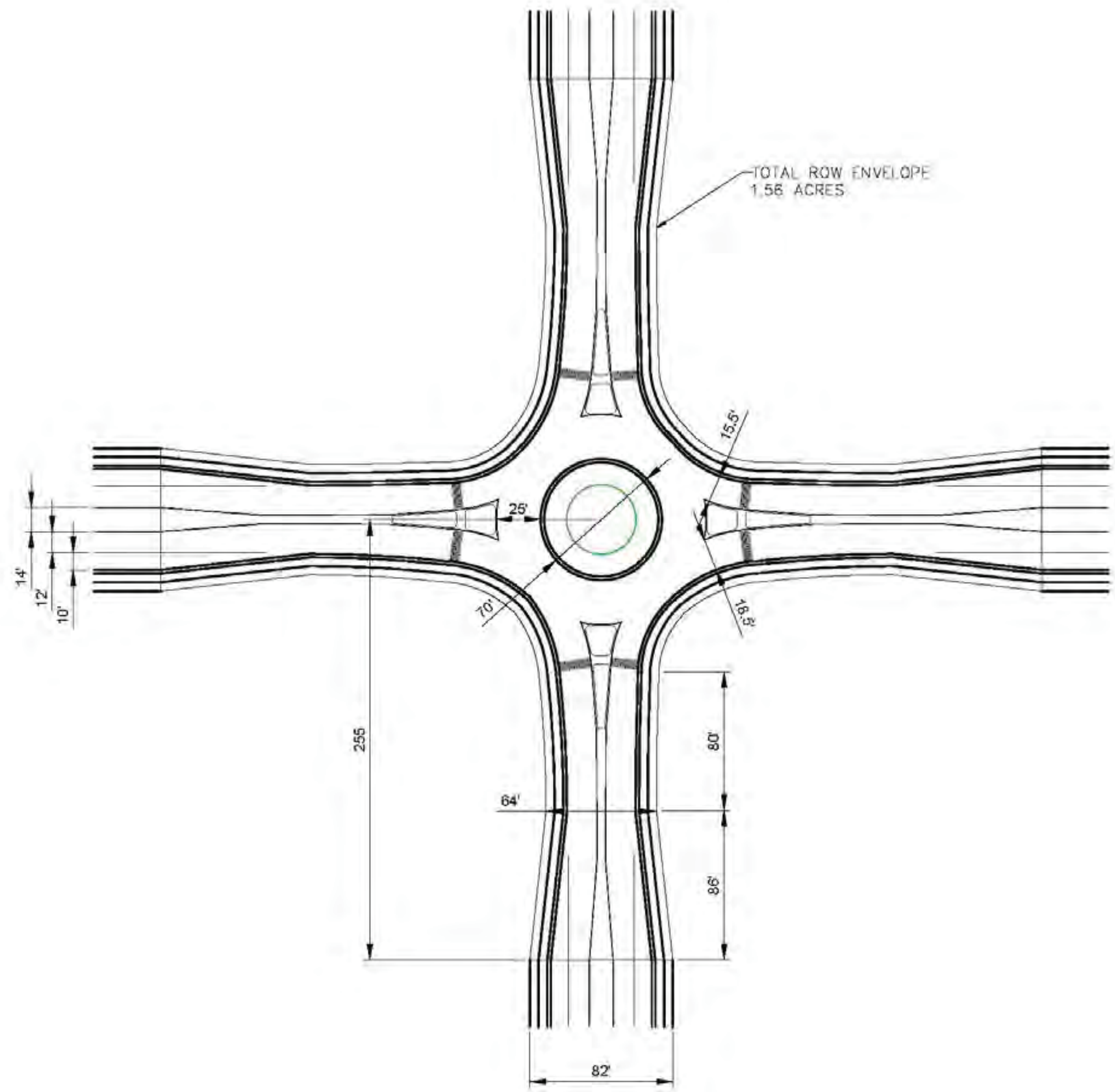
Figure 6 Typical Roundabout Design



The Mississippi DOT claims in their report, ***Performance Evaluation of Roundabouts for Traffic Delay and Crash Reducitons in Oxford, MS*** that roundabouts reduce average delay by 24 percent. The FHWA indicates in its report ***Roundabouts: An Informational Guide*** that the number of personal injury accidents and property damage-only accidents decreased 51 percent and 29 percent, respectively, when roundabouts replaced all way or two way stop controlled intersections.

Figure 8 shows a typical roundabout design with right-of-way envelope area and dimensions. Caution must be taken to design each roundabout in the City on a case by case basis, the information provided here is for illustrative and planning purposes only.

Figure 7 Roundabout Design with Right-of-Way



There are numerous reasons for selecting a roundabout as a preferred alternative, with each reason carrying its own considerations and trade-offs. Below are some potential applications for roundabouts[1]:

[1] Source: NCHRP Report 672, Roundabouts: An Informational Guide Second Edition

- New Residential Subdivisions

  Developers have begun to use roundabouts in residential subdivisions with increasing frequency. Roundabouts provide a variety of operational and aesthetic benefits and create a sense of place that is attractive to developers and homeowners.
- Urban Centers

  Roundabouts may be considered an optimal choice in situations where existing or planned access-management strategies along a corridor facilitate U-turn movements at nearby intersections.
- Suburban Municipalities and Small Towns

  Smaller municipalities are often ideal locations to consider roundabouts. Right-of-way is often less constrained, traffic volumes are lower, and the aesthetic opportunities for landscaping and gateway treatments are enticing. Existing operational and/or safety deficiencies can also often be addressed. Roundabouts can also be less costly to maintain than typical intersections.
- Rural Settings and Small Communities

  Safety may often be the driving factor over capacity in making a roundabout an appealing choice. Within small communities along an extended highway, a roundabout is ideal for supporting speed reductions.
- Interchanges

  Situations where an intersection ramp terminal has the potential for a high proportion of left-turn flows from the off-ramps and to the on-ramps may be ideal candidate for a roundabout.
- Commercial Developments

  Roundabouts in commercial developments provide for a central focus point for a development and enhance aesthetic qualities. They are also capable of processing high volumes of traffic.
- Unusual Geometry

  Intersections with unusual geometric configurations, intersection angles, or more than four legs are often difficult to manage operationally. Roundabouts are a proven traffic control device in such situations, effectively managing traffic flows without the need for costly expenditures on unique signal controller equipment or unusual signal timing.
- Closely Spaced Intersections

  Roundabouts balance traffic flows and manage queue lengths between closely spaced intersections.

The City of Orem will consider roundabouts as an intersection alternative at specific locations, pending more detailed traffic analysis, as needs arise through the development process. It is required that all roundabouts be designed and/or reviewed by qualified engineers.

APPENDIX C: TRAFFIC CALMING GUIDELINES

THE CITY OF OREM

TRAFFIC CALMING GUIDELINES

ADOPTED MAY 2015

PREPARED BY

HORROCKS ENGINEERS

CONTENTS

INTRODUCTION

The concept of traffic calming originated in the 1960s with the publication of ***Traffic in Towns*** by Sir Colin Buchanan. This volume described the potential damages to society and neighborhood livability caused by the motor car and methods to mitigate these impacts. These policies helped shape the development of urban landscape in many countries over the next few decades.

Since the mid 1990s, the Institute of Transportation Engineers (ITE) has seen traffic calming as an institute priority and the industry at large has seen dozens of programs implemented to address the issue of traffic calming. In 1999, ITE, along with the Federal Highway Administration (FHWA), published: ***Traffic Calming: State of the Practice***. This became the authority of traffic calming methods and practices. A second, more recent publication: ***U.S. Traffic Calming Manual****,* was released in 2009 by the American Society of Civil Engineers (ASCE) and the American Planning Association (APA) as a companion volume to ***Traffic Calming: State of the Practice***.

Today, traffic calming programs have been adopted by agencies throughout the United States, as it has become increasingly important to the public, agencies and other interested parties to develop effective neighborhood environments that adequately accommodate motor vehicles, pedestrians and bicyclists. The City of Orem is interested in applying appropriate traffic calming with the goals of improving neighborhood *safety* and *livability* while maintaining traffic circulation and overall user *mobility.*

ITE defines traffic calming as follows:

> *Traffic calming involves changes in street alignment, installation of barriers, and other physical measures to reduce traffic speeds and / or cut-through volumes, in the interest of street safety, livability, and other public purposes.*

Based on ITE's definition, traffic calming is a methodology to influence motorist behavior and prevent undesirable driving practices. Traffic calming is generally achieved with physical measures that reduce speeds, reduce traffic volumes, discourage cut-through traffic on local streets, minimize conflicts between street users, and enhance the environment.

This document presents recommended traffic calming guidelines for use within The City of Orem. The guidelines are applicable for use on existing streets, as well as in new developments. This document presents a comprehensive program for addressing the traffic calming needs of the City, including responding to citizen requests, prioritizing traffic calming needs, selecting the most appropriate type of traffic calming, installing traffic calming measures, and evaluating the effectiveness of traffic calming already in use.

An extensive literary search was conducted of the state-of-the-practice by other agencies and organizations to gather information on the best practices for designing neighborhood traffic calming programs. This information was utilized to develop guidelines for The City of Orem.

PRINCIPLES OF TRAFFIC CALMING

There are several principles of traffic calming that should be considered when implementing traffic calming measures. The following principles are intended to provide guidance and direction for users of this document:

1.0 PROBLEM IDENTIFICATION

Identifying the real traffic problem for a neighborhood roadway is not a simple process. Sometimes the perceived nature of a traffic problem is very different from the real problem. For example, residents often mention both “traffic volume” and “speeding” as problems on their streets, but in many cases the traffic problem is one or the other. It is important to identify the real traffic problem in order to select the appropriate mitigating measure.

1.1 PROBLEM CHARACTERIZATION

In order to ensure that the appropriate traffic calming measures are implemented, it is essential that the extent of problems be characterized and quantified. Roadway information such as width of roadway and intersection dimensions should be collected. Diagrams can also be made to show such items as traffic volumes, speeds, peak hours of travel, turning movement counts, historical crash information, transit routes, bicycle routes, and pedestrian volumes.

1.2 CONSIDER MAJOR ROAD NETWORK IMPROVEMENTS

Before implementing any traffic calming measures for unwanted through traffic on neighborhood roadways, the reason for these movements need to be determined. Sometimes congestion on adjacent arterials encourages motorists to use residential streets as a shortcut. There are a wide range of low-cost options available to improve operations on the major street network, including fine-tuning signal timings, adding turn pockets, and implementing prohibitions and parking restrictions.

1.3 MINIMIZE ACCESS RESTRICTIONS

Residents, businesses, and others who live and work in the community will be more supportive of traffic calming measures that do not restrict their access into and out of a neighborhood. Problems should be addressed with other less restrictive traffic calming measures when possible.

1.4 TARGET PASSENGER VEHICLES

The purpose in implementing traffic calming measures is to minimize impacts to other modes of transportation such as transit, pedestrian and bikes. Designs for traffic calming measures should take into account these modes of transportation.

1.5 TEMPORARY IMPLEMENTATION

When possible, inexpensive temporary measures should be installed to ensure traffic calming measures will achieve the intended results prior to constructing permanent measures. A temporary installation also provides an opportunity to alter the geometrics of a measure or make other changes prior to permanent installation. Temporary measures should resemble permanent measures as much as possible.

1.6 NEIGHBORHOOD INVOLVEMENT

Residents, businesses and others who live and work in the community should be involved in developing traffic calming. Their input is essential in identifying problems and in selecting traffic calming solutions. Involving the neighborhood builds support for traffic calming plans, and enhances the credibility and effectiveness of a plan.

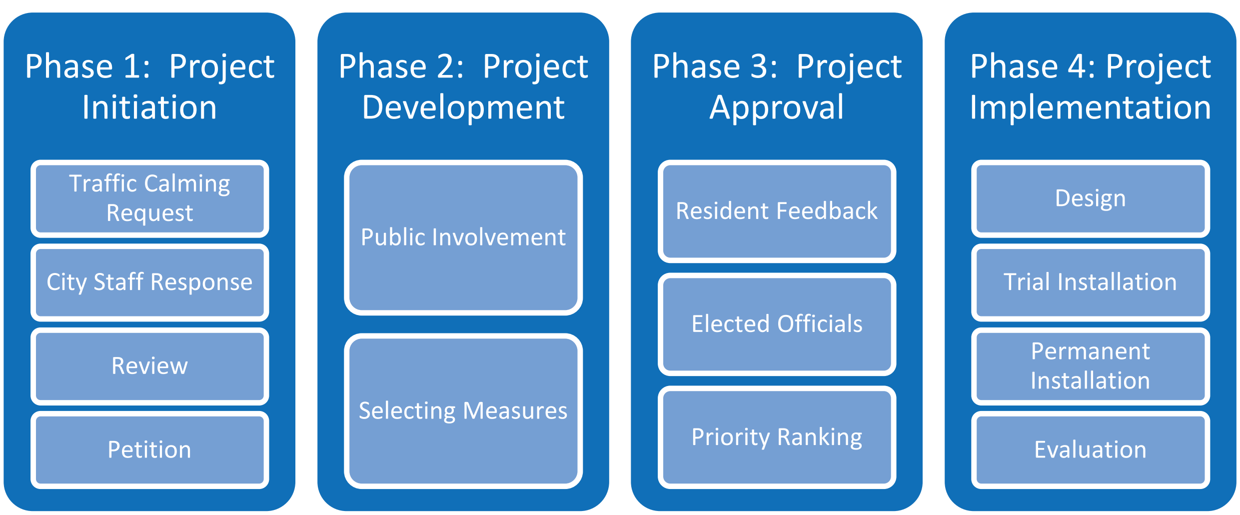
1.7 MONITOR CONDITIONS

Traffic patterns change and consequently it is important that traffic volumes, vehicle speeds, crashes, and other indicators of potential traffic problems are recorded and analyzed continually. Much of this information is already collected and can be stored in a Geographic Information System (GIS) or other easy to manage database. City personnel should monitor conditions on a continual basis.

2.0 TRAFFIC CALMING PROCESS

A successful traffic calming program consists of four phases: project initiation, project development, project approval, and project implementation. Each phase has several tasks associated with it. This section describes the steps in the process of implementing traffic calming in new developments and existing neighborhoods. **FIGURE 1** presents the typical traffic calming process and are described in the following sections.

Figure 1: Traffic Calming Process



2.1 PROJECT INITIATION

The first phase in the traffic calming process is project initiation. This phase begins when a resident, business owner, neighborhood group, or proactive Orem city employee identifies a potential problem area.

TRAFFIC CALMING REQUEST

Upon identifying a potential traffic problem, the concerned party then submits a formal request for traffic calming. This request can come from any concerned individual or group who sees a possible need for traffic calming.

For new developments, The City of Orem will review development plans to identify potential traffic problems such as speeding or cut-through traffic. Often traffic problems can be predicted and prevented by properly reviewing roadway and lot plans for new developments.

For existing neighborhoods, the concerned party should make their concern known to the The City of Orem Public Works Department. The concerned party should identify the location and exact nature of their primary concern such as vehicle safety, pedestrian safety, congestion, speeding, noise, or cut-through traffic. This information should be submitted in written form via the **REQUEST FOR TRAFFIC CALMING FORM** found in **APPENDIX I,** available from the City Public Works Department or accessible via download from the City's website. Requests may also be made via the City's website.

CITY STAFF RESPONSE

Upon receipt of a traffic calming request, The City of Orem staff will have 30 days to respond to the applicant. During this time staff will identify the problem area and whether a request has already been previously submitted for the request location. If this is the case, the applicant will be notified that a study is already underway and will be put in contact with the previous applicant upon their authorization.

REVIEW

If no study is currently in process, staff will identify the limits of the study and the eligibility of the roadway for traffic calming. The **STUDY AREA** should include all streets that may be affected by traffic calming treatments and should generally be bounded by features such as roadways, topography or land use changes. The process of determining eligibility will include a review of the roadway functional type as well as meetings with key stakeholders within the City. Key stakeholders may include but not be limited to the following:

Mayor
City Council
Emergency Response Personnel
City Administrator

Streets Superintendent
Public Works Director
Police and Fire Chief
Bike & Pedestrian Coordinator
City Engineer

PETITION

Upon notification of the study area and determination that the roadway is eligible for traffic calming, the applicant must distribute a **PETITION** to the residents/property owners in the study area for support of the traffic calming request. At least **50%** of the residents/property owners in the study area must sign the petition in order for The City of Orem to proceed with the traffic calming process.

2.2 PROJECT DEVELOPMENT

Once a request passes through phase 1 and is deemed suitable for traffic calming based on the criteria outlined, staff begins the process of selecting an appropriate traffic calming measure in corporation with the community. It is at this stage in the process where budget and resource restraints are identified.

PUBLIC INVOLVEMENT

Early in the project development phase The City of Orem will hold a widely advertised public meeting. At this meeting, staff will present the process used to develop, approve, and implement neighborhood traffic calming plans. The public is encouraged to identify and discuss the traffic problems in the study area. Staff should provide a brief tutorial on traffic calming and encourage the residents to volunteer for the **COMMUNITY TRAFFIC COMMITTEE (CTC)** and select a **NEIGHBORHOOD REPRESENTATIVE.** The CTC should consist of residents and business owners residing in the immediate vicinity of the study area as well as any surrounding affected areas. The neighborhood representative may or may not be the original applicant. City staff act as technical advisors to the CTC throughout the process. The CTC is essential to the process as they provide a contact for feedback to the City and can aid in data collection and public involvement. Data should be collected regarding traffic volume, roadway geometry, speeds, crashes, neighborhood comments, etc.

SELECTING MEASURES

Based on the character of the traffic problem and the data that has been collected, the City will develop possible traffic calming solutions. The solutions shall be evaluated to determine if they meet the required goals and objectives.

Once the measures have been selected they should be discussed with the CTC to solicit feedback and address any concerns or comments from the community. At this point a preferred alternative should be selected by City staff and the CTC.

2.3 PROJECT APPROVAL

Once a preferred alternative has been selected by City staff and the CTC it must be presented to the affected residents and approved by elected officials.

RESIDENT FEEDBACK

A public meeting will be held by the CTC where the preferred alternative is presented to the neighborhood residents and all other interested parties. A standard drawing design of the proposed traffic calming measure as well as maps showing the approximate location of the preferred alternative may be presented. The CTC with the help of the technical advisors should respond to questions and concerns from the general public at this time. Any concerns should be taken into consideration before proceeding to the next step.

ELECTED OFFICIALS

Once a final solution has been developed, the traffic calming measures will be presented to the key City stakeholders for their final input before it is presented to the City Council. **THE APPROVAL OF TRAFFIC CALMING MEASURES IS ULTIMATELY UP TO THE CITY ENGINEER AND CITY COUNCIL.** As part of the solution, a plan should also be included for implementation of the traffic calming measure. The plan should detail the design and construction costs.

PRIORITY RANKING

Due to budget planning, a priority ranking of the particular project may be performed. Founded on a point system, the solution will receive points based on various data including speed, volume, crash data, pedestrian use, and proximity to schools, hospitals, and care facilities. Projects requiring funding will be prioritized in the next fiscal year budget and only those projects with sufficiently high rankings will be implemented.

Costs can also be shared with the neighborhood. For instance, if a community requests a speed hump, which is then approved by City staff, yet it is of low priority, the community can share the burden of the cost in order for the construction to go forward. Costs not only include construction but also maintenance of landscaping. Costs shall be discussed as part of a public meeting.

2.4 PROJECT IMPLEMENTATION

Project implementation is the final phase in the traffic calming process. After the city council has approved and funding has been allocated either by the City Council or cost sharing with the neighborhood, the plan to implement the traffic calming measure can be put in place.

DESIGN

Using the guidelines discussed in this documents companion volume **THE CITY OF OREM – TRAFFIC CALMING TOOLBOX,** the selected traffic calming measure will be designed. The final design will be in accordance to the guidelines (e.g. geometric, landscaping, safety, etc.) presented in said document.

TRIAL INSTALLATION

At the discretion of The City of Orem, a temporary traffic calming measure that closely resembles the proposed solution may be installed to evaluate the potential effectiveness of the permanent measure. Trial installations should be evaluated after a minimum of 6 months of operation. Trial installations will be installed where possible. There may be situations where no trial installation is needed.

PERMANENT INSTALLATION

Once the decision has been made by The City of Orem to proceed with permanent installation of the traffic calming measure, construction will be scheduled and will commence according to the schedule and funding restrictions decided by the City Council. Care must be taken that permanent installations will be effective and are supported by the community.

EVALUATION

If after evaluation of the temporary measure, the desired results are not achieved, the permanent traffic calming measure may not be installed and the process should return to the project development phase. Each project will be eligible for a return to the project development phase one time only.

3.0 TRAFFIC CALMING MEASURES

This section introduces the six main categories of traffic calming measures and presents their studied effectiveness at mitigating traffic problems. For a more detailed description of each of the measures listed, please see the companion document **THE CITY OF OREM – TRAFFIC CALMING TOOLBOX.**

3.1 NON-PHYSICAL MEASURES

Non-Physical Measures are measures such as signage or speed enforcement that do not require any construction or physical modifications to the roadway. These items can be attempted first since they can be economical and easy to remove if they do not solve the problem.

3.1.1 Effectiveness of Non-Physical Measures

Some measures such as speed enforcement signs or trailers have temporary effectiveness. Other measures have inconclusive effectiveness and may not significantly reduce speeds.

3.1.2 Specific Non-Physical Measures

The following list are non-physical measures that can be implemented. Refer to **Appendix D: Traffic Calming Toolbox** for examples and photos of these measures.

- Speed Enforcement
- Radar Speed Signs
- Lane Striping
- Signage
- Speed Legends
- Raised Pavement Markings
- Angled Parking

3.2 VOLUME CONTROL MEASURES

Volume Control Measures reduce the quantity of vehicles that use the roadway. They use barriers to restrict one or more movements at an intersection. Their primary purpose is to divert traffic away from the trouble area thus reducing cut-through traffic.

3.2.1 Effectiveness of Volume Control Measures

Volume control measures are effective in reducing traffic volume by 30-40%. They have also been found to reduce travel speeds by up to 19%.

3.2.2 Specific Volume Control Measures

- Full Closure
- Half Closure
- Median Barrier
- Forced Turn Island

3.3 VERTICAL SPEED CONTROL MEASURES

Vertical Speed Control Measures are usually raised segments of the roadway that vary in height and width. These are designed to force a vehicle to slow down in order to comfortably navigate them.

3.3.1 Effectiveness of Vertical Speed Control Measures

Vertical speed control measures can reduce traffic volumes up to 22% and speeds up to 25%.

3.3.2 Specific Vertical Speed Control Measures

The following list are vertical speed control measures that can be implemented. Refer to **Appendix D: Traffic Calming Toolbox** for examples and photos of these measures.

- Raised Crosswalk
- Raised Intersection

3.4 HORIZONTAL SPEED CONTROL MEASURES

Horizontal Speed Control Measures are segments of roadway where the straight line of travel has been altered to cause a vehicle to change direction and slow down.

3.4.1 Effectiveness of Horizontal Speed Control Measures

Horizontal speed control measures may reduce traffic volumes as much as 20% and vehicle speeds up to 14%.

3.4.2 Specific Horizontal Speed Control Measures

The following list are horizontal speed control measures that can be implemented. Refer to **Appendix D: Traffic Calming Toolbox** for examples and photos of these measures.

- Traffic Circle
- Roundabout
- Chicane
- Lateral Shift

3.5 NARROWING MEASURES

Narrowing Measures are usually short segments of the roadway that have been narrowed to restrict the pavement surface.

3.5.1 Effectiveness of Narrowing Measures

Narrowings have been found to result in an approximate 4% decrease in travel speed and a 10% decrease in traffic volume.

3.5.2 Specific Narrowing Measures

The following list are narrowing measures that can be implemented. Refer to **Appendix D: Traffic Calming Toolbox** for examples and photos of these measures.

- Neckdown
- Choker
- Center Island

3.6 COMBINED MEASURES

Sometimes one traffic calming measure may not sufficiently address specific traffic problems like excess speeding. Combined Measures are a combination of two or more of the previously mentioned measures that are installed concurrently to accomplish the design goals.

APPENDIX I: PROCESS DOCUMENTATION

TRAFFIC CALMING PROGRAM INSTRUCTIONS

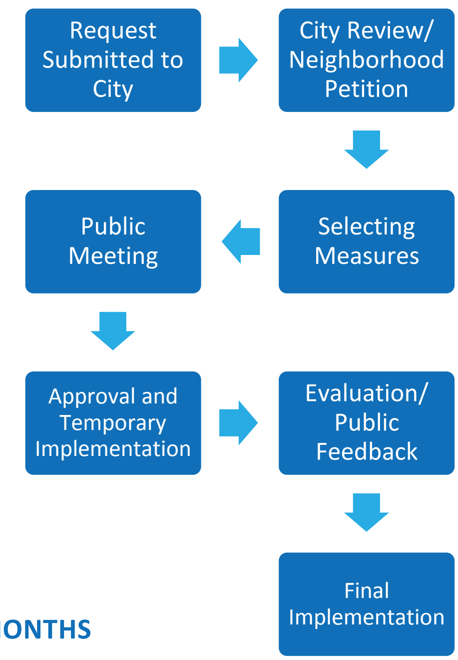
1 INTRODUCTION

Welcome to the Orem traffic calming program! These instructions outline the steps in the traffic calming request process. Please read and understand these instructions before filling out the Request for Traffic Calming form or Petition.

2 IMPLEMENTATION PROCESS/TIME FRAME

The implementation process and time frame depend on the number of traffic calming requests running concurrently and the complexity of the traffic analyses. The time frames shown here represent the estimated maximum time taken from neighborhood request to installation. The City of Orem will accept traffic calming requests at any time throughout the year. Requests will be processed in the order they are received. However, in order for traffic calming measures to be properly budgeted the timeframe from petition to project implementation may vary.

Request submitted in person or online.	
City to accept and review request:	1 month
Petitioner completes petition:	2 months
City reviews petition and confirm signatures:	2 months
City accepts petition and performs traffic study:	4 months
City presents calming options to neighborhood and presents recommendations to City Council:	4 months
Temporary measures installed:	*3-5 months
Permanent installation if temporary measures are deemed effective:	*2-6 months
POSSIBLE TOTAL TIME FRAME:	**18-24 MONTHS**



**Some traffic calming measures may be beyond the budget of the traffic calming program and require the project to be added to the Capital Improvement Program (CIP). This could extend the project timeline by 12 months in order to be considered in the next fiscal year's CIP funding.*

3 TRAFFIC CALMING REQUEST

3.1 ESTABLISHING A NEIGHBORHOOD REPRESENTATIVE

Communication with the City will be through a "Neighborhood Representative" and neighborhood meetings.

The neighborhood representative **MUST BE A HOME OWNER, 18 YEARS OF AGE OR OLDER, LIVING ON THE STREET WHERE TRAFFIC CALMING IS BEING REQUESTED.** Endorsement from other neighborhood residents is NOT required for someone to initiate a traffic calming request and become the neighborhood representative. The neighborhood representative fills out the **REQUEST FOR TRAFFIC CALMING** form and will work with his/her neighbors to sign the **THE CITY OF OREM TRAFFIC CALMING PETITION.**

3.2 REQUEST FOR TRAFFIC CALMING

The **REQUEST FOR TRAFFIC CALMING** form (request form) establishes communication between the City and the neighborhood representative. The request form is to be completed by the neighborhood representative and needs to be filled out completely in order for the City to review it. Please attach any other supporting pictures and/or drawings as needed to explain your traffic calming request. Written forms should be returned to the Orem Public Works Department at:

Orem Public Works
1450 West 550 North
Orem, Utah 84057

3.3 MINIMUM QUALIFYING CRITERIA

Once the request form is completed and submitted to the City, the City will confirm that the request meets the following minimum criteria:

a. The study street is classified as a neighborhood street by The City of Orem.
b. The roadway must front residential, park, and/or schools over 66% of its length.
c. The posted speed limit does not exceed 25 mph.
d. The street is **NOT** a major emergency response route as determined by emergency response agencies and the City.
e. The longitudinal grade of the roadway or intersection approaches does not exceed 5%.

For assistance, please contact the The City of Orem Public Works Department at (801-229-7070).

Once the City determines that the above minimum criteria are met, the neighborhood representative will be informed to proceed with the petition process.

3.4 NEIGHBORHOOD PETITION

The purpose of the **TRAFFIC CALMING PETITION** is to establish minimum neighborhood support to proceed with the Orem traffic calming program. One petitioner per household may sign the petition and petitioners must reside on the street where traffic calming is requested. A minimum of ten (10) signatures are required for the City to perform a traffic study and start reviewing traffic issues on the study street. A completed petition doesn't necessarily ensure that calming measures will be installed on the study street, but it does allow the City to continue with a traffic study and scoring process. The City Public Works

Department accepts traffic petitions at any time during the year and petitions are processed on a first-come first-served basis.

The neighborhood representative should be the first to sign the petition and is the liaison between the City and the neighborhood and is responsible for obtaining the required minimum number of signatures (ten) for the traffic calming request to be accepted by the City.

3.5 REVIEW AND RANKING

3.5.1 Traffic Study

The City of Orem will verify petition signatures and perform a traffic analysis to evaluate neighborhood concerns. Depending on the traffic issues in the neighborhood various traffic study components may include: traffic volumes, travel speeds, signing and striping, circulation, vehicle queuing, intersection operations, driver sight distance, accidents, proximity to sensitive facilities, pedestrian safety, etc.

3.5.2 Scoring

The purpose of the scoring process is to determine which neighborhood traffic calming project has the most need. If there are multiple traffic calming requests being processed by the City concurrently a scoring and ranking system will be used to prioritize projects. Scoring will be performed by City staff after the traffic analysis is complete.

3.5.3 Ranking

Once the traffic study is complete and the request has been scored, projects are ranked. The highest ranked projects will be accommodated first depending on the availability of funding resources.

3.6 SELECTING MEASURES

Based on the character of the traffic problem and the collected data, the City will develop possible calming measures. Public neighborhood meetings will be held to discuss the appropriate measure. The neighborhood representative, original petitioners, other impacted residents, home owner association representatives, police, fire, etc., shall be in attendance. Certain measures may affect more residents than the original petitioners. If this is the case, the City will notify the affected residents and an additional public meeting may be required.

The affected neighborhood residents (as determined by the City) will then vote on whether the chosen measure and location is acceptable. **SEVENTY-FIVE PERCENT (75%)** or more of the residents need to approve the recommended measure in order to proceed with submittal to the City Council. In instances where a temporary measure is to be installed, **FIFTY PERCENT (50%)** of affected residents must approve a temporary measure and **SEVENTY-FIVE PERCENT (75%)** are needed to approve permanent installation.

3.7 APPROVAL AND IMPLEMENTATION

The selected traffic calming measure will then be presented to the City Council for approval. Large traffic calming projects may be required to be included in the next years Capital Improvement Plan (CIP).

3.8 CONSTRUCTION

Some measures may require temporary installation in order to evaluate the effectiveness and impact to an area prior to final design. Other measures may be able to be installed permanently without a trial period. This decision is left to the discretion of the City Engineer and City Council.

3.9 EVALUATION

After the traffic calming measure has been constructed, The City of Orem may evaluate the effectiveness of the installed traffic calming device. This is to ensure the effectiveness of the measure. If ineffective, the City may decide to remove the traffic calming measure or in the case of temporary installation the City may decide not to install a permanent measure.

REQUEST FOR TRAFFIC CALMING

Please read "*Traffic Calming Program Instructions*" before starting the traffic calming request process!

Date:_______________ Neighborhood Representative:____

The neighborhood representative will serve as the liaison between the neighborhood and The City of Orem and is responsible for obtaining the appropriate petition signatures.

Daytime Phone Number:___________________________ Alternate Phone Number:___________________

Address: ____

____

Name and phone number of Home Owners Association Representative if applicable:

____

Neighborhood Name: ____

Council Representative: ____

Please indicate traffic issues that concern the residents in your neighborhood.

	Speeding		Traffic Volumes
	Pedestrian/Bicycle Safety		Accidents
	Blocked Line of Sight		Access/Traffic Operations
	Other (explain):		
Description/Location of Problem			

Return to: The City of Orem Public Works, 1450 West 550 North, Orem, UT 84057

PETITION

Please read "*Traffic Calming Program Instructions"* before starting the traffic calming request process!

Come Now, the residents on ____ (street) located between ____ (cross street) and ____ (cross street), hereinafter referred to as the "Petitioners", hereby petition The City of Orem to consider the installation of traffic calming measures to mitigate traffic issues on our above referenced street and detailed on the submitted "Request Form".

Petitioners must be at least 18 years of age and reside in separate households. By signing this petition you agree to allow traffic calming measures to be installed on your street that may permanently restrict access or parking along your street. There must be a minimum of ten petitioners to process this request.

Signature	Printed Name	House #	Phone #

1.____

2.____

3.____

4.____

5.____

6.____

7.____

8.____

9.____

10.____

11.____

12.____

13.____

14.____

15.____

Return to: The City of Orem Public Works, 1450 West 550 North, Orem, UT 84057

SCORING

85th Percentile Speed (20 points maximum) ___________pts

The 85th percentile speed represents the speed, at or below which, 85 percent of the free flowing vehicles are traveling. Points will be assigned based on the difference between the posted speed limit and the 85th percentile speed as follows:

0 points, less than or equal to 5 mph difference	or	(30 mph)
5 points, greater than 5 mph and less than or equal to 7 mph	or	(32 mph)
10 points, greater than 7 mph and less than or equal to 9 mph	or	(34 mph)
15 points, greater than 9 mph and less than or equal to 11 mph	or	(36 mph)
20 points, greater than 11 mph	or	(37 mph+)

Traffic Volume (25 points maximum) ___________pts

Average Daily Traffic (20 points maximum) ___________pts

Points for Average Daily Traffic (ADT) will be assigned as follows:

0 points, less than 800 ADT
5 points, 801 ADT to 1,500 ADT
10 points, 1,501 ADT to 2,500 ADT
15 points, 2,501 ADT to 3,500 ADT
20 points, more than 3,500 ADT

Peak Hour Volume (5 points maximum) ___________pts

The percent of the daily traffic occurring during the peak hour will be assigned points as follows:

0 points, peak hour traffic is less than 10% of Average Daily Traffic
5 points, peak hour traffic is equal to or greater than 10% of Average Daily Traffic

3-Year Crash Data (20 points maximum) ___________pts

0 points, less than 7 crashes over the last 3 years
10 points, 7 to 12 crashes over the last 3 years
20 points, more than 12 crashes over the last 3 years

Pedestrian Facilities (5 points maximum) ___________pts

0 points, sidewalks are present and continuous on BOTH sides of the street throughout the project limits
2 points, sidewalks are discontinuous or do not exist on ONE side of the street throughout the project limits
5 points, sidewalks are discontinuous or do not exist on BOTH sides of the street throughout the project limits

Sensitive Facilities (30 points maximum) ___________pts

Sensitive facilities include schools, senior centers, libraries, community centers, and sites with significant pedestrian activity.

0 points, no sensitive facilities or pedestrian crossings
10 points, roadway is within **High School** Safe Route to School boundary or other sensitive facility
20 points, roadway is within **Middle School** Safe Route to School boundary
30 points, roadway is within **Elementary School** Safe Route to School boundary

Total Points Maximum (100) **Total Score ___________pts**

APPENDIX D: TRAFFIC CALMING TOOLBOX

THE CITY OF OREM

TRAFFIC CALMING TOOLBOX

ADOPTED 2015

PREPARED BY

HORROCKS ENGINEERS

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LIST OF FIGURES

INTRODUCTION

The process of selecting suitable traffic calming measures involves, first, identifying the nature and location of the traffic problem i.e. speeding, congestion, and then selecting the appropriate traffic calming measure capable of solving the identified problems. The traffic calming measures should be selected from a "toolbox" of possible alternatives that describes the possible measures with their application and effectiveness at solving specific traffic problems.

This document, designed as a companion to **THE CITY OF OREM – GUIDELINES FOR TRAFFIC CALMING** describes the traffic calming measures that may be considered by The City of Orem as alternatives to solving traffic problems. In this document the following five groups of traffic calming measures will be described in detail:

- Non-Physical Measures
- Volume Control Measures
- Vertical Speed Control Measures
- Horizontal Speed Control Measures
- Narrowing Measures

Specific measures within each group will be identified and their application, cost and effectiveness described. In addition, a summary of the appropriateness of each type of traffic calming measure in dealing with different traffic problems will be presented. Finally an overview of the design principles that should be applied in designing each type of traffic control measure will be explained. In some cases it may be appropriate to combine two or more specific types of traffic calming method to either enhance the effectiveness of one or the other or to potentially address two separate problems. A scenario such as this one should be identified and analyzed on a case by case basis.

1.0 NON-PHYSICAL MEASURES

Non-Physical Measures are measures such as signage or speed enforcement that do not require any construction or physical modifications to the roadway. These items can be attempted first since they can be economical and easy to remove if they do not solve the problem. Non-physical measures have been shown to have negligible success when used as traffic calming measures.

1.1 SPEED ENFORCEMENT

For areas where speed has been determined as being excessive (generally an 85th percentile speed 7 mph above the posted speed limit), speed enforcement can be a temporary traffic calming measure.

TARGETED SPEED ENFORCEMENT can be attempted on areas where speeding is observed be neighborhood residents and/or agency representatives. Limited personnel can be cost-effectively deployed on major roadways. For low volumes streets, periodic daytime speed enforcement is the best option. Because of the expense to maintain increased levels of police enforcement, targeted speed enforcement should only be used temporarily and/or in conjunction with other new traffic calming measures to help drivers become aware of new restrictions.

Another available enforcement option is a **RADAR TRAILER DEVICE**, which measures and displays a vehicles speed as it approaches. The posted speed limit is shown in clear view next to the digital readout showing the actual speed of the oncoming vehicle. This reminds drivers to slow to the appropriate speed and often it comes as a surprise to the driver to see how fast they are travelling. These devices can be easily transported and deployed at different locations.

Effectiveness: Negligible

Figure 1: Radar Trailer Device

Advantages
Inexpensive if used temporarily
Does not require time for design
Does not slow trucks and emergency vehicles

Disadvantages
Expensive to maintain for a long period
Trailer subject to vandalism

1.2 RADAR SPEED SIGN

Figure 2: Radar Speed Sign

The **RADAR SPEED SIGN** is very similar in nature to the radar trailer device. The notable difference between this device and the radar speed trailer is that the radar speed sign in not portable. The device can also have the ability to store data over time to provide speed data to the City. This device measures and records a vehicles speed and displays it next to the posted speed limit sign reminding vehicles to slow to the appropriate speed

Effectiveness: Negligible

Advantages
Can mount to existing poles
Does not require much time for design
Does not slow trucks and emergency vehicles

Disadvantages
Has not been shown to significantly reduce speeds
High cost of long-term maintenance

1.3 LANE STRIPING

LANE STRIPING can be used to create formal bicycle lanes, parking lanes and/or edge lines. The striping "narrows" the travel lane for vehicles and may encourage drivers to lower their speeds.

Effectiveness: Negligible

Figure 3: Bike Lane Narrowing

ADVANTAGES	DISADVANTAGES
Inexpensive	Increases regular maintenance
Can be used to create bicycle lanes or delineate on-street parking	Has not been shown to significantly reduce travel speeds
Does not require much time for design	
Does not slow trucks and emergency vehicles	

1.4 SIGNAGE

SIGNAGE such as speed limit and various restriction type signs can be used as a traffic calming measure. Speed limit signs should only be placed after an engineering study is performed. Restriction type signs include: NO TRUCKS, CROSS TRAFFIC DOES NOT STOP, NO RIGHT TURN, NO LEFT TURN, NO THRU TRAFFIC.

Effectiveness: Negligible

Figure 4: Typical Signage

ADVANTAGES	DISADVANTAGES
Inexpensive	Ineffective if not accompanied by enforcement
Turn restrictions can reduce cut-through traffic	Speed must be set at a reasonable value for drivers to follow
Does not slow trucks and emergency vehicles	Has not been shown to significantly reduce travel volume or speeds

1.5 SPEED LEGEND

SPEED LEGENDS are numbers painted on the roadway indicating the current speed limit. These are usually painted near the speed limit signposts. Speed legends may be useful for reinforcing speed reduction between different roadway segments (e.g., from one functional class to another or at major residential entry points).

Effectiveness: Negligible

Figure 5: Speed Legend

ADVANTAGES	DISADVANTAGES
Inexpensive	Has not been shown to significantly reduce travel speeds
May help reinforce a change in speed limit	
Does not require much time for design	
Does not slow trucks and emergency vehicles	

1.6 ANGLED PARKING

Figure 6: Angled Parking

ANGLED PARKING can be used to reduce the width of a travel lane, which will likely reduce vehicle speeds. Angled parking may also increase the number of parking spaces available on a roadway. Angled parking changes the parking position from parallel to a 30°-60° angle.

Another option available is called Reverse Angled Parking. Like parallel parking, the driver enters the stall by stopping and backing up. In contrast to standard angled parking, the visibility with exiting reverse angle stalls is much improved. When exiting, the driver does not blindly back the rear half of the vehicle into the travel, rather they are able to pull forwards out of the parking stall.

Effectiveness: Negligible

ADVANTAGES	DISADVANTAGES
Reduces speeds by narrowing travel lanes	Does not allow for bike lanes
Increases the number of parking spaces	Ineffective on roadways with frequent driveways
Makes parking maneuvers easier than parallel parking	Potential safety concerns when backing out
Favored by businesses and multi-family residences	

2.0 VOLUME CONTROL MEASURES

VOLUME CONTROL MEASURES reduce the quantity of vehicles that use the roadway. They use barriers to restrict one or more movements at an intersection. Their primary purpose is to divert traffic away from the trouble area thus reducing cut-through traffic. Typical volume control measures are full street closures, half street closures, diagonal diverters, median barriers, and forced turn islands. Volume Control Measures are typically applied only after other measures have failed or been determined inappropriate. Pedestrian and bicycle traffic can usually be accommodated. Volume Control Measures are often used in sets to make travel through neighborhoods more circuitous, and are typically staggered internally in a neighborhood, which leaves through movement possible but less attractive than alternative (external) routes. Volume Control Measures have also been used as a crime prevention tool.

2.1 FULL CLOSURE

FULL STREET CLOSURES are barriers are placed across a street to completely close the street to through-

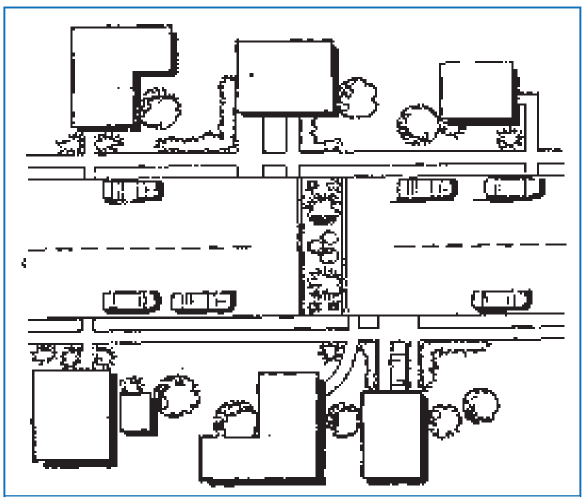


Figure 7: Full-Street Closure Diagram

Figure 8: Full-Street Closure

traffic, usually leaving only sidewalks open. Pedestrian and bicycle traffic are usually unrestricted. Typical barriers include: landscaped islands, walls, gates, side-by-side bollards, posts, etc. The barrier should be designed to eliminate vehicles (e.g. passenger cars) from entering.

Effectiveness: Average 44% decrease in traffic volume

ADVANTAGES	DISADVANTAGES
Able to maintain pedestrian and bicycle access	Cause indirect routes for local residents and emergency vehicles
Does not adversely affect access by children	May limit access to businesses
Very effective in reducing traffic volumes	May be expensive

2.2 HALF CLOSURE

HALF CLOSURES are barriers that block travel in one direction for a short distance on otherwise two-way

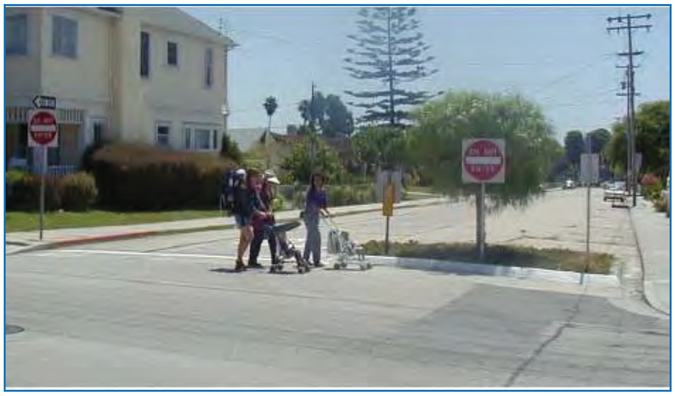


Figure 9: Half Closure

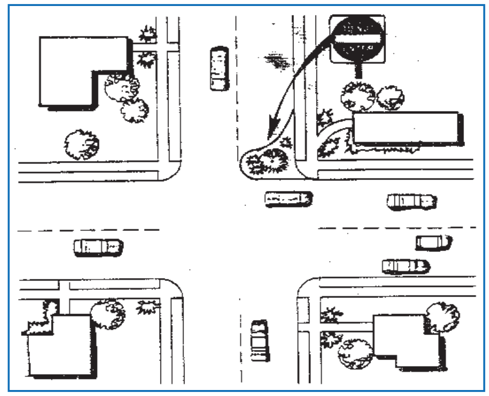


Figure 10: Half Closure Diagram

streets; they are sometimes called partial closures, entrance barriers, or one-way closure. Typical barriers include: landscaped islands, walls, gates, side-by-side bollards, posts, etc.

Effectiveness: Average 42% decrease in traffic volume

ADVANTAGES
Able to maintain pedestrian and bicycle access
Does not affect emergency vehicles
Effective in reducing traffic volumes

DISADVANTAGES
Cause indirect routes for local residents
May limit access to businesses
May be expensive
Drivers can circumnavigate barrier

2.3 MEDIAN BARRIER

MEDIAN BARRIERS are raised islands in the centerline of a street and continuing through an intersection that block the left turn movement from all intersection approaches and the through movement at the cross street.

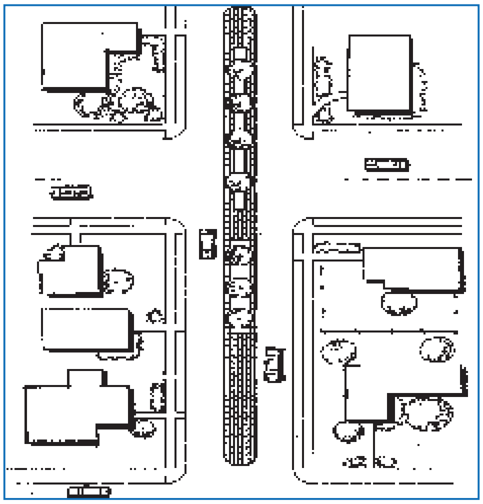


Figure 12: Median Barrier Diagram

Figure 11: Median Barrier

Effectiveness: Average 31% decrease in traffic volume

ADVANTAGES	DISADVANTAGES
Can improve safety at intersection by prohibiting dangerous turning movements	May require right-of-way acquisition
Can reduce traffic volumes on a cut-through route that crosses the major street	Limits turns to and from side street for local residents
	May limit access for emergency vehicles

2.4 FORCED TURN ISLAND

FORCED TURN ISLANDS are barrier islands that block certain movements on approaches to an intersection. Designs can vary significantly depending on the installation location. Forced turn islands are best when used on residential streets at intersections with larger streets. The larger street can accommodate the diverted and will cut down on the number of vehicles that might attempt to circumnavigate the measure. Occasionally additional center line barriers or channelization required to keep drivers from circumnavigating islands.

Figure 13: Forced Turn Island

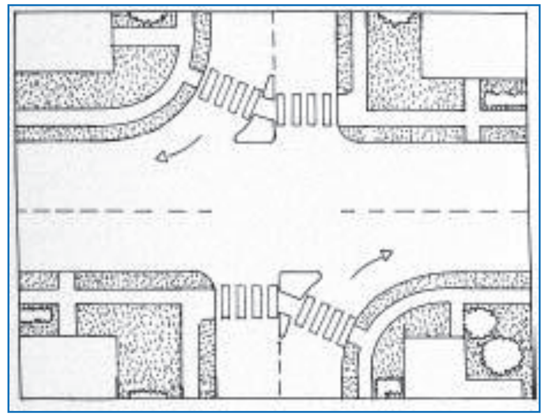


Figure 14: Forced Turn Island Diagram

Effectiveness: No Data

ADVANTAGES	DISADVANTAGES
Can improve safety at intersection by prohibiting dangerous turning movements	May simply divert traffic problem to a different street
	May limit access for local residents

3.0 HORIZONTAL SPEED CONTROL MEASURES

HORIZONTAL SPEED CONTROL MEASURES are segments of roadway where the straight line of travel has been altered to cause a vehicle to change direction and slow down. Typical horizontal speed control measures include chicanes, traffic circles, roundabouts, and lateral shifts.

3.1 TRAFFIC CIRCLE

A **TRAFFIC CIRCLE** is a raised island placed in an intersection which traffic circulates. Generally, traffic circles are circular in shape and have some type of landscaping in its center. Also, traffic circles have outer rings (truck aprons or lips) that are mountable so large vehicles can circumnavigate the small radius traffic circle.

Effectiveness: 11% reduction in 85th percentile travel speed. 29%-73% reduction in accidents.

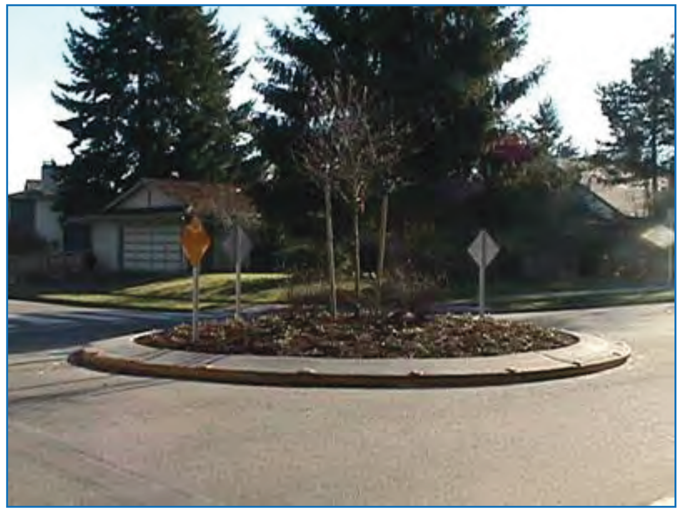


Figure 15: Traffic Circle

ADVANTAGES	DISADVANTAGES
Provides increased access to street from side street	Landscaping must be maintained
Breaks up sight-lines on straight street	Difficult for large vehicles (e.g. fire truck) to circumnavigate
Effective at lowering travel speeds	Potential loss of on-street parking
	May require modifications to curb, gutter and sidewalks

3.2 ROUNDABOUT

Figure 16: Roundabout

A **ROUNDABOUT** is similar to a traffic circle. It also has a raised island placed at an intersection with circulating traffic. However, there are differences. Roundabouts generally are much larger than traffic circles and thus need more land for construction. Roundabouts are used at intersections with higher traffic volumes and are designed for higher speeds. Roundabouts generally have raised splitter islands that direct traffic to the right, this helps form gaps in traffic. Roundabouts may also have flared entry lanes, which increase the capacity of the intersection. Roundabouts may also have bypass lanes to allow driver to travel through the area without entering the intersection at all.

Effectiveness: 29% reduction in accidents.

ADVANTAGES	DISADVANTAGES
Enhanced safety compared to traffic signal	Landscaping must be maintained
Minimizes queuing at approaches	May require major reconstruction and extensive right-of-way
May be effective at slowing travel speed	Potential loss of on-street parking
	Increase pedestrian distance and travel time on crosswalks

3.3 CHICANE

CHICANES are curb extensions or edge islands that alternate from one side of roadway to the other. These curb extensions or edge islands give the roadway more 'winding' attribute. Curb extensions or edge islands can be semi-circular, triangular or squared off. Trapezoidal islands have been found to be more effective at reducing speeds than semi-circular shapes. Curb extensions or edge islands should have a vertical element to draw attention to them. Trees and other landscape materials are an option. For low speed roadways or roadways that lack right-of-way, mountable curbs are also an option to allow larger vehicles to maneuver through the chicanes.

Figure 17: Chicane

Chicanes can also be formed by alternative on-street parking from one side of the roadway to the other. Parking bays can be created using striping or by installing landscaped islands at each end.

Effectiveness: No Data

ADVANTAGES	DISADVANTAGES
Discourages high speeds by forcing horizontal deflection	Landscaping must be maintained
Negotiable by large vehicles (e.g. fire truck)	Require major reconstruction and extensive right-of-way
	Potential loss of on-street parking

3.4 LATERAL SHIFT

Figure 18: Lateral Shift

A **LATERAL SHIFT** is like a chicane, however the roadway alignment only shifts once. It is only one curb extension or edge island rather than a series of alternating curb extensions or edge islands. Because the road alignment shifts only once, the crossing speed is approximately 5 mph higher than a series of chicanes. A higher speed means that lateral shifts can be placed on higher functional classification roadways (collectors and arterials) .

Typical lateral shifts incorporate a landscaped center island to separate opposing traffic. This prohibits drivers from veering into the opposite lane.

Effectiveness: No Data

ADVANTAGES	DISADVANTAGES
Can accommodate higher traffic volumes	Potential loss of on-street parking
Negotiable by large vehicles (e.g. fire truck)	May require additional design effort

4.0 NARROWING MEASURES

NARROWING MEASURES are short roadway segments that are narrower than the typical roadway section. Typical narrowing measures are neckdowns, chokers, and island narrowing.

4.1 NECKDOWN

NECKDOWNS are curb extensions at an intersection. These neckdowns reduce the roadway width from curb to curb and provide shorter pedestrian crossing distances and times. The short curb return radius also reduces the speeds of turning vehicles.

Effectiveness: 7% reduction in 85^{th} percentile speed.

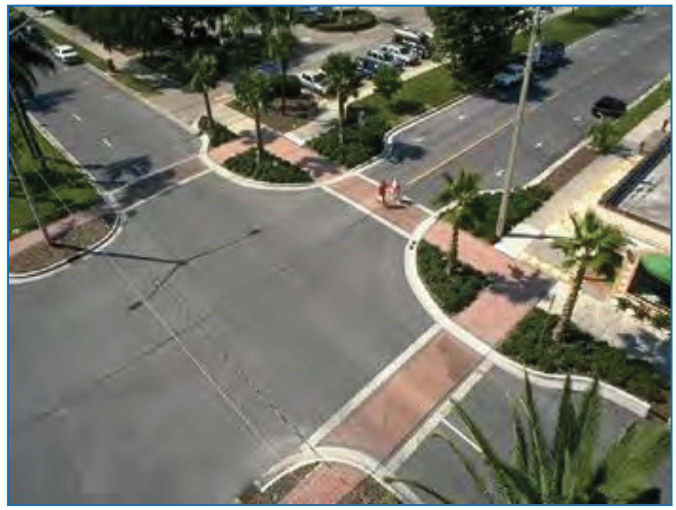


Figure 19: Neckdown

ADVANTAGES	DISADVANTAGES
Improves pedestrian comfort and safety	Effectiveness may be limited because there is no vertical or horizontal deflection
Through and left turn movements are negotiable by large vehicles (e.g. fire trucks)	Right turn not easily negotiable by large vehicles (e.g. fire trucks)
Can create protected on-street parking	Potential loss of on-street parking
May reduce speeds and traffic volumes	May bring bicycle lanes in closer proximity with travel lanes
	May change or restrict drainage

4.2 CHOKER

CHOKERS are curb extensions at mid-block that narrow the roadway by widening the sidewalk, planting strip, or centerline. A typical two-lane choker is 20 feet from curb to curb. One-lane chokers narrow the roadway to just one travel lane. This is similar to a one-lane bridge condition. The constricted length in the direction of travel varies but should be kept short enough not to block the driveways or accesses.

Effectiveness: 7% reduction in 85th percentile speed.

Figure 20: Choker

ADVANTAGES	DISADVANTAGES
Negotiable by large vehicles (e.g. fire trucks)	Effectiveness may be limited because there is no vertical or horizontal deflection
May reduce travel speeds and volumes	May bring bicycle lanes in closer proximity with travel lanes
Can have positive aesthetic value	Potential loss of on-street parking
	One-lane choker can only be used on extremely low volume roadways without causing safety concerns or traffic congestion
	May limit driveway access

4.3 CENTER ISLAND

CENTER ISLANDS are raised barriers in the center of the roadway that narrow the travel lanes. The center island should be large enough to draw attention (e.g. 6 feet wide by 20 feet long). The center island can also be offset to the left from the perspective of approaching traffic. They are often landscaped and can be used as refuge for pedestrians crossing the roadway. Center islands create intermittent left turn areas rather than a continuous median. Center islands placed at intersections or entrances to neighborhoods are often called gateways.

Effectiveness: 7% reduction in 85th percentile speed.

Figure 21: Center Island

ADVANTAGES	DISADVANTAGES
Increases pedestrian safety	Effectiveness may be limited because there is no vertical or horizontal deflection
May reduce travel speeds and volumes	Potential loss of on-street parking
Can have positive aesthetic value	If center island is too long, channelized traffic may increase travel speed
	Plants and irrigation must be kept to a minimum due to pavement deterioration from water runoff

5.0 APPROPRIATENESS OF TRAFFIC CALMING MEASURES

After identifying and characterizing the traffic problem, one can select the appropriate traffic calming measure to be implemented. The major types of traffic problems are:

- Speed – vehicle speeds are too high.
- Traffic Volume – vehicle usage levels are too high and are affecting level of service.
- Safety – vehicles have excessive level of risk (e.g. accident history). Pedestrians and bicyclists are at unnecessary risk due to vehicles.
- Pollution – vehicles cause excessive levels of noise, vibration, and air pollution.

Besides the traffic problem types, there are other issues such as location and traffic constraints that can be investigated. The following **TABLE 1** and **TABLE 2** present each traffic calming measure and its appropriateness versus problem type, location type and traffic constraints. The appropriateness is an assessment derived from the literature search of the state of the industry and results from other agencies.

Table 1: Traffic Calming Measures versus Traffic Problem Type

Traffic Calming Measure	Traffic Problem Type			
	Speed	Traffic Volume	Safety	Pollution
1.0 Non-Physical				
1.1 Speed Enforcement	🟢	🟠	🔵	🔵
1.2 Lane Striping	🟢	🟠	🟠	🟠
1.3 Signage	🟢	🟠	🟠	🟠
1.4 Speed Legend	🟢	🟠	🟠	🟠
1.5 Raised Pavement Marker	🟠	🟠	🟢	🟠
1.6 Angled Parking	🟢	🔵	🟠	🟠
2.0 Volume Control				
2.1 Full Closure	🟢	🟢	🟠	🟠
2.2 Half Closure	🟢	🟢	🟠	🟠
2.3 Diagonal Diverter	🟢	🟢	🟠	🟠
2.4 Median Barrier	🟠	🟢	🔵	🟠
2.5 Forced Turn Island	🟠	🟢	🔵	🟠
3.0 Vertical Speed Control				
3.1 Speed Hump	🟢	🟢	🔵	🔴
3.2 Speed Table	🟢	🔵	🔵	🔴
3.3 Raised Crosswalk	🟢	🔵	🔵	🔴
3.4 Raised Intersection	🟢	🔵	🔵	🔴
4.0 Horizontal Speed Control				
4.1 Traffic Circle	🟢	🔵	🟢	🟠
4.2 Roundabout	🔵	🔵	🟢	🟢
4.3 Chicane	🟢	🔵	🟠	🟠
4.4 Lateral Shift	🔵	🔵	🟠	🟠
5.0 Narrowing				
5.1 Neckdown	🟢	🔵	🟢	🟠
5.2 Choker	🟢	🔵	🔵	🟠
5.3 Center Island	🟢	🔵	🟢	🟠

Legend:

🟢 Strongly Appropriate; 🔵 Moderately Appropriate; 🟠 Moderately Inappropriate; 🔴 Inappropriate

Table 2: Traffic Calming Measure versus Location Type

Traffic Calming Measure	Traffic Problem Type			
	Residential		Non-Residential	
	Mid-Block	Intersection	Mid-Block	Intersection
1.0 Non-Physical				
1.1 Speed Enforcement	🟢	🟢	🟢	🟢
1.2 Lane Striping	🟢	🔴	🟢	🔴
1.3 Signage	🟢	🟢	🟢	🟢
1.4 Speed Legend	🟢	🟢	🟢	🟢
1.5 Raised Pavement Marker	🟢	🔴	🟢	🔴
1.6 Angled Parking	🟢	🔴	🟢	🔴
2.0 Volume Control				
2.1 Full Closure	🔴	🟢	🔴	🔴
2.2 Half Closure	🔴	🟢	🔴	🔴
2.3 Diagonal Diverter	🔴	🟢	🔴	🔴
2.4 Median Barrier	🔴	🟠	🔴	🔴
2.5 Forced Turn Island	🔴	🟠	🔴	🟢
3.0 Vertical Speed Control				
3.1 Speed Hump	🟢	🔴	🔴	🟠
3.2 Speed Table	🟢	🔴	🔴	🟢
3.3 Raised Crosswalk	🟢	🟠	🟢	🔴
3.4 Raised Intersection	🔴	🟢	🟢	🔴
4.0 Horizontal Speed Control				
4.1 Traffic Circle	🔴	🟢	🔴	🟠
4.2 Roundabout	🔴	🟠	🔴	🟢
4.3 Chicane	🟢	🔴	🟢	🔴
4.4 Lateral Shift	🟢	🔴	🟢	🔴
5.0 Narrowing				
5.1 Neckdown	🔴	🟢	🔴	🟢
5.2 Choker	🟢	🔴	🟢	🔴
5.3 Center Island	🟢	🟢	🟢	🟢

Legend:

🟢 Applicable; 🟠 Applicable in Some Cases; 🔴 Not Applicable

6.0 GENERAL DESIGN PRINCIPLES

The following are general design principles that should be considered before and after traffic calming measure implementation.

6.1 DATA COLLECTION

One of the initial steps that should be considered prior to traffic calming measure implementation is data collection. The following data items can be collected:

1. Twenty-four (24) hour directional approach volumes for each leg of an intersection should be obtained to identify the heaviest eight hours.
2. Twenty-four (24) hour directional volumes for the roadway should be obtained to identify the heaviest eight hours.
3. Percentage of large trucks that would be using the roadway or intersection.
4. Posted speeds for all roadways.
5. 85^{th} percentile speed for all intersection approaches and roadways.
6. Miscellaneous data, such as existing roadway geometry, drainage information, area population, land uses, distances to intersections, and intersection control treatments.
7. Bicycle and pedestrian counts for intersections and midblock locations.
8. Detailed accident data to analyze the frequency and types of collisions occurring at intersections or along roadways.
9. Community considerations should be investigated, including the need for parking, the landscaping character of the area and existence of other existing traffic calming measures.
10. Transit routes and frequencies in the study area.

6.2 APPLICATION GUIDELINES

Criteria that should be considered are listed below for the different physical traffic calming measures.

6.2.1 VOLUME CONTROL

The following criteria should be considered when installing volume control measures:

1. Roadway segments with daily traffic volumes less than 5,000 vehicles per day.
2. Intersections with only one lane per approach.
3. 25% of traffic is non-local traffic.

6.2.2 VERTICAL SPEED CONTROL

The following criteria should be considered when installing vertical speed control measures:

1. Daily traffic volume less than 7,500 vehicles per day.

2. Speed humps should be considered if the daily traffic volume is less than 4,000 vehicles per day.
3. Posted speed limit is 25 mph or less.
4. Approach or street grades of less than 5%.

6.2.3 HORIZONTAL SPEED CONTROL

The following criteria should be considered when installing horizontal speed control measures:

1. All roadway functional classes.
2. Traffic circles and chicanes should only be considered if the daily entering traffic volume is less than 5,000 vehicles per day.
3. Traffic circles should be considered on intersections where there is one lane per approach.
4. Low volumes of buses and trucks (less than 2%).
5. Posted speed limit of 25 mph or less.
6. Roundabouts should only be considered where the grade on the approach streets is less than 5%.

6.2.4 NARROWING CONTROL

The following criteria should be considered when installing narrowing control measures:

1. All roadway functional classes.
2. One lane chokers should only be considered if the daily entering traffic volume is less than 3,000 vehicles per day.
3. Posted speed limit of 25 mph or less.
4. Bicycle and pedestrian traffic should be accommodated in design.

6.2.5 OTHER CONSIDERATIONS

The following are other considerations that are applicable to all traffic calming measures:

1. Community sentiment.
2. Number and types of accidents.
3. Presence of pedestrian crosswalks.
4. Presence of curb and gutter.
5. Drainage.
6. Presence of parking.
7. Location within roadway network (e.g., minimum distance from other intersections).
8. Emergency vehicles, bus routes, snow plowing routes.
9. Previously attempted traffic calming measures (e.g., targeted speed enforcement, painted speed legends etc.).

6.3 GEOMETRY

The following are general criteria that should be considered when installing traffic calming measures.

1. Examine as-is geometry of roadway or intersection.
2. Check physical feasibility of installing traffic calming measure.
3. Determine desired crossing speed (i.e., design speed) at slow points of traffic calming measure.
    a. For vertical speed control measures (e.g., speed humps), the typical design speed is 25 to 30 mph. Speed versus vertical curvature relationships can be found in ITE's *Traffic Calming State of Practice.*
    b. For horizontal speed control measures, (e.g., traffic circles and roundabouts), the center islands and circular perimeters need to be determined. Speed versus horizontal curvature relationships can be found in AASHTO's *A Policy on Geometric Design of Highways and Streets.*

6.4 SAFETY

As part of installing any traffic calming measure, signing and pavement markings should be incorporated as well. Agencies use the *Manual on Uniform Traffic Control Devices* (MUTCD) as general guidance; however, the MUTCD is not specific on any traffic calming measure.

1. Signage and pavement markings shall be designed using the latest *Manual on Uniform Traffic Control Devices* (MUTCD) as guidance. The following items should be considered:
    - Warning signs need not be used where hazards are self-evident.
    - Signs must be legible, which requires high visibility, lettering or symbols of adequate size and short legends for quick comprehension.
    - Sign lettering must be in upper-case letters of the type approved by the City and FHWA.
    - Signs must be reflectorized or illuminated to show the same shape and color by day and night.
    - Signs are ordinarily placed on the right-hand side of the road, where the driver is looking for them.
    - Signs are ordinarily mounted separately, except where one sign supplements another, as advisory speed plates supplement warning signs.
    - Before any street is opened to traffic, all hazardous conditions must be signed and marked.
    - Signs should be used conservatively.
    - Symbol signs are preferred to word signs when an appropriate symbol exists.
    - New symbols not readily recognizable should be accompanied by educational plaques.
    - Analogous signs shall be used for new situations similar to those for which standard signs already exist.
2. Signs should be limited to minimize confusion.
3. Signs should be placed in advance to warn drivers. Placement of advance warning signs should conform to guidance provided in the latest MUTCD.
4. Check sight distances by visiting sight before and after traffic calming measure installation.

5. Depending on the characteristics of the intersection, pedestrian crosswalk signs and pavement markings may be needed and should follow guidance provided in the latest MUTCD (*Section 3B.17* & *Section 2C.37).*
6. Depending on the characteristics of the intersection, bicycle lane signs and pavement markings may be needed and should follow guidance provided in the latest MUTCD.
7. If sidewalk ramps are needed, they should be constructed according the latest City standards and be ADA compliant.
8. Depending on the characteristics of the intersection, “no parking” signs may be needed as well as red painted curbs to properly mark the intersection.
9. Lighting should be installed to provide safe illumination. The following items should be considered:
    - Good illumination should be provided on the approach nose of the splitters islands, the conflict area where traffic enters the circulating stream and places where traffic streams separate at points of exits.
    - If applicable, pedestrian crossing areas should be illuminated.

APPENDIX E: TRAFFIC IMPACT STUDY GUIDELINES

OREM CITY

TRAFFIC IMPACT STUDY REQUIREMENTS

ADOPTED 2015

PREPARED BY

HORROCKS ENGINEERS

TRAFFIC IMPACT STUDY REQUIREMENTS

When a Traffic Impact Study is required prepare the study according to the appropriate TIS level as shown below. The traffic study shall, at a minimum, incorporate Orem City principles and standards and national practices. Additional requirements and investigation may be imposed upon the applicant as necessary.

GENERAL REQUIREMENTS TO PERFORM A TIS

Orem city has provided general requirements to perform a TIS. The first requirements is to verify the Mountainland Association of Governments (MAG) travel demand model for future traffic growth. This is implemented since all growth in Orem City is different. Included below are qualifications for the group performing the TIS.

- Have a current Utah PE License
- Firm Specializing in Traffic Engineering
- Use of Software utilizing most recent Highway Capacity Manual (HCM) Methodologies

As part of the TIS, a pre-application meeting with the Orem City Engineer is required to cover basic information as listed below:

- Scope (Submitted to Orem City and Developer)
- Establish Study Area
- Establish Trip Generation
- Establish Trip Distribution
- Study Intersections
- AM/PM Peak Hours and/or Weekend Peak Hours

In Orem City, it is determined that all single family detached residential homes generate 14 trips per day unless otherwise noted by Orem. For all other residential types (condominium, apartments, townhomes, etc.), it is necessary to calculate an equivalent trip generation rate based on the difference between the current trip generation rate found in the Trip Generation Manual and the Orem City value of 14 trips per day.

PERMIT LEVEL / TRAFFIC STUDY LEVEL I

PROJECT ADT < 100 TRIPS

No proposed modifications to traffic signals or roadway elements or geometry.

1. STUDY AREA.

The study area, depending on the size and intensity of the development and surrounding development, may be identified by parcel boundary, area of immediate influence or reasonable travel time boundary.

The study area may be limited to or include property frontage and include neighboring and adjacent parcels. Identify site, cross, and next adjacent up and down stream access points within access category distance of property boundaries.

2. DESIGN YEAR.

Opening day of project

3. ANALYSIS CONDITIONS AND PERIOD

Identify site traffic volumes and characteristics.

Identify adjacent street(s) traffic volume and characteristics.

4. IDENTIFY RIGHT-OF-WAY, GEOMETRIC BOUNDARIES AND PHYSICAL CONFLICTS.

Investigate existence of federal or state, no access or limited access control line.

5. GENERATE ACCESS POINT CAPACITY ANALYSIS AS NECESSARY.

Analyze site and adjacent road traffic for the following time periods: weekday A.M. and P.M. peak hours including Saturday peak hours if required by the City Engineer. Identify special event peak hour as necessary (per roadway peak and site peak).

6. DESIGN AND MITIGATION.

Identify operational concerns and mitigation measures to ensure safe and efficient operation pursuant to appropriate state highway access category.

PERMIT LEVEL / TRAFFIC STUDY LEVEL II

PROJECT ADT 100 TO 500 TRIPS

1. STUDY AREA.

The study area, depending on the size and intensity of the development and surrounding development, may be identified by parcel boundary, area of immediate influence or reasonable travel time boundary.

Intersection of site access drives with state highways and any signalized and unsignalized intersection within access category distance of property line. Include any identified queuing distance at site and study intersections

2. DESIGN YEAR

Opening day of project

3. ANALYSIS PERIOD

Identify site and adjacent road traffic for weekday A.M. and P.M. peak hours (Saturdays if required by the City Engineer).

4. DATA COLLECTION

Identify site and adjacent street roadway and intersection geometries.

Identify adjacent street(s) traffic volume and characteristics.

5. CONFLICT / CAPACITY ANALYSIS

Diagram flow of traffic at access point(s) for site and adjacent development.

Perform capacity analysis as determined by the City Engineer.

6. RIGHT-OF-WAY ACCESS

Identify right-of-way, geometric boundaries and physical conflicts.

Investigate existence of federal or state, no access or limited access control line.

7. DESIGN AND MITIGATION

Determine and document safe and efficient operational design needs based on site and study area data. Identify operational concerns and mitigation measures to ensure safe and efficient operation pursuant to appropriate state highway access category.

PROJECT ADT 500 TO 3,000 TRIPS OR PEAK HOUR < 500 TRIPS.

1. STUDY AREA

The study area, depending on the size and intensity of the development and surrounding development, may be identified by parcel boundary, area of immediate influence or reasonable travel time boundary. An acceptable traffic study boundary is 1/4-1/2 mile on each side of the project site per the City Engineer.

Intersection of site access drives with state highways and any signalized and unsignalized intersection within access category distance of property line. Include any identified queuing distance at site and study intersections.

2. DESIGN YEAR

Opening day of project and five year after project completion.

Document and include all phases of development (includes out pad parcels).

3. ANALYSIS PERIOD

Analyze site and adjacent road traffic for weekday A.M. and P.M. peak hours including Saturday peak hours if identified as a high Saturday use.. Identify special event peak hour as necessary (adjacent roadway peak and site peak).

4. DATA COLLECTION

a. Daily and Turning Movement counts.

b. Identify site and adjacent street roadway and intersection geometries.

c. Traffic control devices including traffic signals and regulatory signs.

d. Traffic accident data

5. TRIP GENERATION

Use equations or rates available in latest edition of ITE Trip Generation. Where developed equations are unavailable for intended land use, perform trip rate study and estimation following ITE procedures or develop justified trip rate agreed to by the Department.

6. TRIP DISTRIBUTION AND ASSIGNMENT

Document distribution and assignment of existing, site, background, and future traffic volumes on surrounding network of study area.

7. CONFLICT / CAPACITY ANALYSIS

Diagram flow of traffic at access point(s) for site and adjacent development.

Perform capacity analysis for daily and peak hour volumes

8. TRAFFIC SIGNAL IMPACTS

For modified and proposed traffic signals:

a. Traffic Signal Warrants as identified.

b. Traffic Signal drawings as identified.

c. Queuing Analysis

9. DESIGN AND MITIGATION.

Determine and document safe and efficient operational design needs based on site and study area data. Identify operational concerns and mitigation measures to ensure safe and efficient operation pursuant to appropriate state highway access category.

PERMIT LEVEL / TRAFFIC STUDY LEVEL III

PROJECT ADT 3,000 TO10,000 TRIPS OR PEAK HOUR TRAFFIC 500 TO 1,200 TRIPS.

1. STUDY AREA

The study area, depending on the size and intensity of the development and surrounding development, may be identified by parcel boundary, area of immediate influence or reasonable travel time boundary.

An acceptable traffic study boundary should be based on travel time or by market area influence. Intersection of site access drives with state highways and any intersection within 1/2 mile of property line on each side of project site.

2. DESIGN YEAR

Opening day of project, five years and twenty years after opening.

Document and include all phases of development (includes out pad parcels).

3. ANALYSIS PERIOD

For each design year analyze site and adjacent road traffic for weekday A.M. and P.M. peak hours including Saturday peak hours if identified as needed per the City Engineer. Identify special event peak hour as necessary (adjacent roadway peak and site peak).

4. DATA COLLECTION

a. Daily and Turning movement counts.

b. Identify site and adjacent street roadway and intersection geometries.

c. Traffic control devices including traffic signals and regulatory signs.

d. Automatic continuous traffic counts for at least 48 hours.

e. Traffic accident data.

5. TRIP GENERATION

Use equations or rates available in latest edition of ITE Trip Generation. Where developed equations are unavailable for intended land use, perform trip rate study and estimation following ITE procedures or develop justified trip rate agreed to by the Department.

6. TRIP DISTRIBUTIONS AND ASSIGNMENT

Document distribution and assignment of existing, site, background, and future traffic volumes on surrounding network of study area.

7. CAPACITY ANALYSIS

a. Level of Service (LOS) for all intersections.

b. LOS for existing conditions, design year without project, design year with project.

8. TRAFFIC SIGNAL IMPACTS. FOR PROPOSED TRAFFIC SIGNALS:

a. Traffic Signal Warrants as identified.

b. Traffic Signal drawings as identified.

c. Queuing Analysis.

d. Traffic Systems Analysis. Includes acceleration, deceleration and weaving.

e. Traffic Coordination Analysis

9. ACCIDENT AND TRAFFIC SAFETY ANALYSIS

Existing vs. as proposed development.

10. DESIGN AND MITIGATION

Determine and document safe and efficient operational design needs based on site and study area data. Identify operational concerns and mitigation measures to ensure safe and efficient operation pursuant to appropriate state highway access category.

PERMIT LEVEL / TRAFFIC STUDY LEVEL IV

PROJECT ADT GREATER THAN 10,000 TRIPS OR PEAK HOUR TRAFFIC > 1,200 VEHICLES PER HOUR.

1. STUDY AREA

The study area, depending on the size and intensity of the development, will include the surrounding roadways ½ mile from the parcel boundary or reasonable travel time boundary.

2. DESIGN YEAR

Opening day of project, five years and twenty years after opening.

Document and include all phases of development (includes out pad parcels).

3. ANALYSIS PERIOD

For each design year analyze site and adjacent road traffic for weekday A.M. and P.M. peak hours including Saturday peak hours as needed per the City Engineer. Identify special event peak hour as necessary (adjacent roadway peak and site peak).

4. DATA COLLECTION

a. Daily and Turning movement counts.

b. Identify site and adjacent street roadway and intersection geometries.

c. Traffic control devices including traffic signals and regulatory signs.

d. Automatic continuous traffic counts for at least 24 hours or obtain ADT from local or state agencies

e. Traffic accident data.

5. TRIP GENERATION

Use equations or rates available in latest edition of ITE Trip Generation. Where developed equations are unavailable for intended land use, perform trip rate study and estimation following ITE procedures or develop justified trip rate agreed to by the Department.

6. TRIP DISTRIBUTIONS AND ASSIGNMENT

Document distribution and assignment of existing, site, background, and future traffic volumes on surrounding network of study area.

7. CAPACITY ANALYSIS

a. Level of Service (LOS) for all intersections.

b. LOS for existing conditions, design year without project, design year with project.

8. TRAFFIC SIGNAL IMPACTS. FOR PROPOSED TRAFFIC SIGNALS:

a. Traffic Signal Warrants as identified.

b. Traffic Signal drawings as identified.

c. Queuing Analysis.

d. Traffic Systems Analysis. Includes acceleration, deceleration and weaving.

e. Traffic Coordination Analysis.

10. DESIGN AND MITIGATION

Determine and document safe and efficient operational design needs based on site and study area data.

Identify operational concerns and mitigation measures to ensure safe and efficient operation pursuant to appropriate state highway access category.

APPENDIX F: COST ESTIMATES

The City of Orem Transportation Project Database - 5 Year Projects

	A	B	E	C	D	G	H	I	J	K	L	M	N
Ref #	Proj #	Project Location	Actual Year	Planning Year (Range)	Total Cost (2023)	Total Cost (With Inflation)	Funding Assistance	Funding %	Total not Included in the Funding Assistance (2023)	Orem Total Cost (With Inflation) (Without Soft Match)	Soft Match %	Soft Match Total	Orem Total Cost (With Inflation) (With Soft Match)
1	2	**Center Street** (Geneva Road to I-15) – *Widen to 5 Lanes*	2030	2023-2032	$ 6,500,000	$ 9,425,000	MAG	6.77%	$ -	$ 638,073	35%	$ 224,110	$ 413,962
2	3	**1200 West** (Sandhill Road to Center Street)	2030	2023-2032	$ 8,900,000	$ 12,905,000	MAG	6.77%	$ -	$ 873,669	0%	$ -	$ 873,669
3	4	**800 South/I-15 Overpass** (Geneva Road to Campus Drive)	2030	2023-2032	$ 80,000,000	$ 116,000,000	MAG	6.77%	$ -	$ 7,853,200	0%	$ -	$ 7,853,200
4	5	**1600 West** (Connection to Geneva Rd.)	2023	2023-2032	$ 2,520,000	$ 2,658,600	-	100.00%	$ -	$ 2,658,600	0%	$ -	$ 2,658,600
5	6	**Intersection Improvements** (Additional Funds)	2023	2023-2032	$ 454,976	$ 480,000	-	100.00%	$ -	$ 480,000	0%	$ -	$ 480,000
6	7	**1200 South** (State Street to 800 East) **10.1 1200 South** (State Street to 800 East) **10.2 Signal Update** (1200 South and 800 East) **10.3 New Signal** (1150 South and State Street)	2023	2023-2032	$ 2,332,000	$ 2,460,260	Private	100.00%	$ 200,000	$ 2,460,260	100%	$ 2,249,260	$ 211,000
7	8	**Roundabout** (700 N - Orem Blvd.) (Safety Improvement)	2023	2023-2032	$ 650,000	$ 685,750	-	100.00%	$ -	$ 685,750	0%	$ -	$ 685,750
8	9	**Intersection Improvements** (Additional Funds)	2023	2023-2032	$ 480,000	$ 506,400	-	100.00%	$ -	$ 506,400	0%	$ -	$ 506,400
9	10	**Safety Improvement - Turn Lane** (WB RTL) 1100 East and 800 North	2023	2023-2032	$ 2,405,401	$ 2,537,698	UDOT	0.00%	$ -	$ -	0%	$ -	$ -
10	11	**Intersection Improvements** (Additional Funds)	2023	2023-2032	$ 506,400	$ 534,252	-	100.00%	$ -	$ 534,252	0%	$ -	$ 534,252
11	12	**1200 West** (1600 North to 800 North) - *Widen to 3 Lanes*	2023	2023-2032	$ 992,227	$ 1,046,800	-	100.00%	$ -	$ 1,046,800	0%	$ -	$ 1,046,800
12	14	**University Parkway and State Street Grade Separated Intersection**	2023	2023-2032	$ 52,535,139	$ 55,424,572	UDOT	0.00%	$ -	$ -	0%	$ -	$ -
13	15	**University Parkway** (800 East to Southern Border) – *Widen to 7 Lanes*	2023	2023-2032	$ 21,235,256	$ 22,403,195	UDOT	0.00%	$ -	$ -	0%	$ -	$ -
14	16	**Enlarge Roundabout** (1200 South and 400 West)	2023	2023-2032	$ 553,001	$ 583,416	UTA	100.00%	$ -	$ 583,416	90%	$ 525,074	$ 58,342
15	17	**Traffic Signal Update** (Geneva Road and 1600 North)	2023	2023-2032	$ 276,500	$ 291,708	UDOT	0.00%	$ -	$ -	0%	$ -	$ -
16	18	**Intersection Improvements** (Additional Funds)	2023	2023-2032	$ 553,001	$ 583,416	-	100.00%	$ -	$ 583,416	0%	$ -	$ 583,416
17	21	**Lakeview Parkway** (Geneva Road to Southern Border) – *New 5 Lane Road* **6.1 Geneva Road** (Univeristy Parkway to Lakeview Parkway)	2026	2023-2032	$ 34,502,242	$ 41,935,789	MAG	6.77%	$ -	$ 2,839,053	30%	$ 851,716	$ 1,987,337
18	22	**Signal Update** (400 North and 1200 West)	2023	2023-2032	$ 288,943	$ 304,835	-	100.00%	$ -	$ 304,835	0%	$ -	$ 304,835
19	23	**Signal Update** (400 North and Orem Blvd.)	2023	2023-2032	$ 288,943	$ 304,835	-	100.00%	$ -	$ 304,835	0%	$ -	$ 304,835
20	24	**Signal Update** (Center Street and 400 West)	2023	2023-2032	$ 288,943	$ 304,835	-	100.00%	$ -	$ 304,835	0%	$ -	$ 304,835
21	25	**Signal Update** (Center Street and Orem Blvd.)	2023	2023-2032	$ 288,943	$ 304,835	-	100.00%	$ -	$ 304,835	0%	$ -	$ 304,835
22	26	**Signal Update** (800 South and Main Street)	2023	2023-2032	$ 288,943	$ 304,835	-	100.00%	$ -	$ 304,835	0%	$ -	$ 304,835
23	27	**Signal Update** (1000 South and College Drive)	2023	2023-2032	$ 288,943	$ 304,835	-	100.00%	$ -	$ 304,835	0%	$ -	$ 304,835
24	28	**Traffic Signal** (400 S - 400 E)	2023	2023-2032	$ 1,228,009	$ 1,295,549	-	100.00%	$ -	$ 1,295,549	0%	$ -	$ 1,295,549
25	29	**Intersection Improvements** (Additional Funds)	2023	2023-2032	$ 577,887	$ 609,671	-	100.00%	$ -	$ 609,671	0%	$ -	$ 609,671
26	30	**Traffic Signal** (400N-800E)	2023	2023-2032	$ 415,175	$ 438,010	-	100.00%	$ -	$ 438,010	0%	$ -	$ 438,010
27	31	**Signal Update** (Center Street and Garden Park Dr.)	2023	2023-2032	$ 301,946	$ 318,553	-	100.00%	$ -	$ 318,553	0%	$ -	$ 318,553
28	32	**Signal Update** (400 South and 1200 West)	2023	2023-2032	$ 301,946	$ 318,553	-	100.00%	$ -	$ 318,553	0%	$ -	$ 318,553
29	33	**800 West** 800 North to 800 South) - *Intersection Improvements* **13.1 Signal Update** (400 North and 800 West) **13.2 Roundabout** (400 South and 800 West) - *Possible Signal* **13.3 Intersection Improvement** (800 South and 800 West)	2023	2023-2032	$ 2,038,134	$ 2,150,231	-	100.00%	$ -	$ 2,150,231	0%	$ -	$ 2,150,231
30	34	**Intersection Improvements** (Additional Funds)	2023	2023-2032	$ 603,891	$ 637,105	-	100.00%	$ -	$ 637,105	0%	$ -	$ 637,105
31	35	**Center Turn Overpass** (Center Street and State Street)	2023	2023-2032	$ 15,776,664	$ 16,644,380	UDOT	0.00%	$ -	$ -	0%	$ -	$ -
32	36	**Intersection Improvements** (Additional Funds)	2023	2023-2032	$ 631,067	$ 665,776	-	100.00%	$ -	$ 665,776	0%	$ -	$ 665,776
33	37	**Traffic Signal** (400W-400S)	2024	2023-2032	$ 468,813	$ 521,801	-	100.00%	$ -	$ 521,801	0%	$ -	$ 521,801
34	38	**Signal Update** (800 South and 400 East)	2024	2023-2032	$ 312,543	$ 347,868	-	100.00%	$ -	$ 347,868	0%	$ -	$ 347,868
35	39	**New Signal** (800 South and 700 East)	2024	2023-2032	$ 390,678	$ 434,834	-	100.00%	$ -	$ 434,834	0%	$ -	$ 434,834
36	40	**Intersection Improvements** (Additional Funds)	2024	2023-2032	$ 625,085	$ 695,735	-	100.00%	$ -	$ 695,735	0%	$ -	$ 695,735
37	41	**Signal Update** (1200 North and 400 East)	2030	2023-2032	$ 250,800	$ 363,660	-	100.00%	$ -	$ 363,660	0%	$ -	$ 363,660

The City of Orem Transportation Project Database - 5 Year Projects

	A	B	E	C	D	G	H	I	J	K	L	M	N
Ref #	Proj #	Project Location	Actual Year	Planning Year (Range)	Total Cost (2023)	Total Cost (With Inflation)	Funding Assistance	Funding %	Total not Included in the Funding Assistance (2023)	Orem Total Cost (With Inflation) (Without Soft Match)	Soft Match %	Soft Match Total	Orem Total Cost (With Inflation) (With Soft Match)
38	42	**Roundabout** (1100 North and 800 West)	2030	2023-2032	$ 501,600	$ 727,320	-	100.00%	$ -	$ 727,320	0%	$ -	$ 727,320
39	43	**Signal Update** (400 North and 400 West)	2030	2023-2032	$ 250,800	$ 363,660	-	100.00%	$ -	$ 363,660	0%	$ -	$ 363,660
40	44	**Signal Update** (Center Street and 400 East)	2030	2023-2032	$ 250,800	$ 363,660	-	100.00%	$ -	$ 363,660	0%	$ -	$ 363,660
41	45	**Signal Update** (800 South and 400 West)	2030	2023-2032	$ 250,800	$ 363,660	-	100.00%	$ -	$ 363,660	0%	$ -	$ 363,660
42	46	**New Signal** (1430 South Sandhill Road)	2030	2023-2032	$ 313,500	$ 454,575	-	100.00%	$ -	$ 454,575	0%	$ -	$ 454,575
43	47	**Intersection Improvements** (Additional Funds)	2030	2023-2032	$ 501,600	$ 727,320	-	100.00%	$ -	$ 727,320	0%	$ -	$ 727,320
		Total Costs			**$ 243,121,541**	**$ 300,732,788**				**$ 35,369,440**			**$ 31,519,279**

11	**1200 South Realignment** (200 East to new University Mall alignment) **11.1 1200 South Realignment** (200 East to New University Mall Alignment) **11.2 Signal Realignment**	2024	2023-2032	$ 10,000,000	$ 11,130,250	MAG	6.77%	$ 500,000	$ 1,272,355	0%	$ -	$ 1,272,355
12	**800 West** (800 South to College Dr)	2039	2033-2040	$ 720,000	$ 1,551,483	-	100.00%	$ -	$ 1,551,483	0%	$ -	$ 1,551,483
25	**Traffic Signal Center St-Palisade Dr**	2030	2023-2032	$ 275,000	$ 398,750	-	100.00%	$ -	$ 398,750	0%	$ -	$ 398,750
32	**Roundabout** (400 N 400 E Possible Traffic Signal)	2026	2023-2032	$ 850,000	$ 1,033,133	-	100.00%	$ -	$ 1,033,133	0%	$ -	$ 1,033,133
40	**Roundabout** (2000 S- Columbia Lane or Possible Traffic Signal)	2028	2023-2032	$ 475,000	$ 630,469	-	100.00%	$ -	$ 630,469	0%	$ -	$ 630,469
41	**Roundabout** (1200 S Main St or Possible Traffic Signal)	2027	2023-2032	$ 850,000	$ 1,079,624	-	100.00%	$ -	$ 1,079,624	0%	$ -	$ 1,079,624
42	**ADA Code Compliance at 2 Existing Signal Locations**	2020	2023-2032	$ 15,000	#N/A	-	100.00%	$ -	#N/A	0%	#N/A	#N/A
43	**Turn Lane** (SB RTL) (400 North and Orem Blvd)	2026	2023-2032	$ 150,000	$ 182,318	-	100.00%	$ -	$ 182,318	0%	$ -	$ 182,318
44	**Turn Lane** (NB RTL) (400 North and Orem Blvd)	2030	2023-2032	$ 150,000	$ 217,500	-	100.00%	$ -	$ 217,500	0%	$ -	$ 217,500
45	**Turn Lane** (SB RTL) (400 South and Orem Blvd)	2026	2023-2032	$ 150,000	$ 182,318	-	100.00%	$ -	$ 182,318	0%	$ -	$ 182,318
46	**Turn Lane** (WB RTL) (400 South and Orem Blvd)	2026	2023-2032	$ 150,000	$ 182,318	-	100.00%	$ -	$ 182,318	0%	$ -	$ 182,318
47	**Turn Lane** (NB RTL) (800 South and Orem Blvd)	2021	2023-2032	$ 150,000	#N/A	-	100.00%	$ -	#N/A	0%	#N/A	#N/A
48	**Turn Lane** (SB RTL) (800 South and Orem Blvd)	2021	2023-2032	$ 150,000	#N/A	-	100.00%	$ -	#N/A	0%	#N/A	#N/A
49	**Turn Lane** (EB RTL) (800 South and Orem Blvd)	2021	2023-2032	$ 150,000	#N/A	-	100.00%	$ -	#N/A	0%	#N/A	#N/A
50	**Turn Lane** (WB RTL) (800 South and Orem Blvd)	2021	2023-2032	$ 150,000	#N/A	-	100.00%	$ -	#N/A	0%	#N/A	#N/A
51	**Turn Lane** (WB RTL) (800 North and 1630 East	2026	2023-2032	$ 150,000	$ 182,318	UDOT	0.00%	$ -	$ -	0%	$ -	$ -
52	**Turn Lane** (EB RTL) (800 North and 1560 East)	2026	2023-2032	$ 150,000	$ 182,318	UDOT	0.00%	$ -	$ -	0%	$ -	$ -
53	**High T Intersection** (1550 East and 800 North	2030	2023-2032	$ 400,000	$ 580,000	UDOT	0.00%	$ -	$ -	0%	$ -	$ -
54	**FYA Upgrade** (1300 East and 800 North)	2030	2023-2032	$ 300,000	$ 435,000	UDOT	0.00%	$ -	$ -	0%	$ -	$ -
56	**Traffic Signal** (1000 East and 800 North)	2028	2023-2032	$ 300,000	$ 398,191	UDOT	0.00%	$ -	$ -	0%	$ -	$ -
57	**Widen NB & SB Lanes** (1000 East and 800 North)	2028	2023-2032	$ 300,000	$ 398,191	UDOT	0.00%	$ -	$ -	0%	$ -	$ -
58	**Turn Lane** (WB RTL) 1000 East and 800 North	2021	2023-2032	$ 150,000	#N/A	UDOT	0.00%	$ -	#N/A	0%	#N/A	#N/A
70	**Intersection Improvement** (650 South and 600 West)	2025	2023-2032	$ 200,000	$ 232,622	-	100.00%	$ -	$ 232,622	0%	$ -	$ 232,622
77	**Intersection Improvement** (Geneva Rd and 800 North)	2020	2023-2032	$ 150,000	#N/A	UDOT	0.00%	$ -	#N/A	0%	#N/A	#N/A
78	**Bike Project** (Lakeview Parkway & Geneva to Intermodoal Center)	2024	2023-2032	$ -	$ -	-	100.00%	$ -	$ -	0%	$ -	$ -
79	**Bike Project** (Universtiy Parkway from State Street to 400 West & 1200 S)	2024	2023-2032	$ -	$ -	-	100.00%	$ -	$ -	0%	$ -	$ -
80	**Bike Project** (Center Street at Eastern Border to Orem Boulevard)	2024	2023-2032	$ -	$ -	-	100.00%	$ -	$ -	0%	$ -	$ -
81	**Center Street** (800 West to State Street) –*Widen to 7 Lanes*	2026	2023-2032	$ 10,920,000	$ 13,272,726	MAG	6.77%	$ -	$ 898,564	0%	$ -	$ 898,564
83	**800 North** (800 East to Eastern Border) – *Widen to 7 Lanes*	2035	2033-2040	$ 12,900,000	$ 23,309,833	UDOT	0.00%	$ -	$ -	0%	$ -	$ -
84	**1600 North/800 East** (State Street to 800 South) – *Widen to 5 Lanes* **84.1 800 East** (Center Street to 800 South) **84.2 Signal Update** (800 South and 800 East) **84.3 Signal Update** (400 South and 800 East) **84.4 Signal Update** (Center Street and 800 East)	2040	2033-2040	$ 20,500,000	$ 46,162,016	MAG	6.77%	$ 600,000	$ 4,384,784	30%	$ 910,110	$ 3,474,673
85	**1600 North** (I-15 Interchange) - *Widen to 7 Lanes*	2027	2023-2032	$ 1,800,000	$ 2,286,264	MAG	6.77%	$ -	$ 154,780	0%	$ -	$ 154,780
86	**800 South** (800 East to Eastern Border)	2028	2023-2032	$ 1,920,000	$ 2,548,422	MAG	6.77%	$ -	$ 172,528	0%	$ -	$ 172,528
87	**University Parkway** (Geneva Road to I-15)	2029	2023-2032	$ 2,691,193	$ 3,734,191	UDOT	0.00%	$ -	$ -	0%	$ -	$ -

The City of Orem Transportation Project Database - 5 Year Projects

OREM

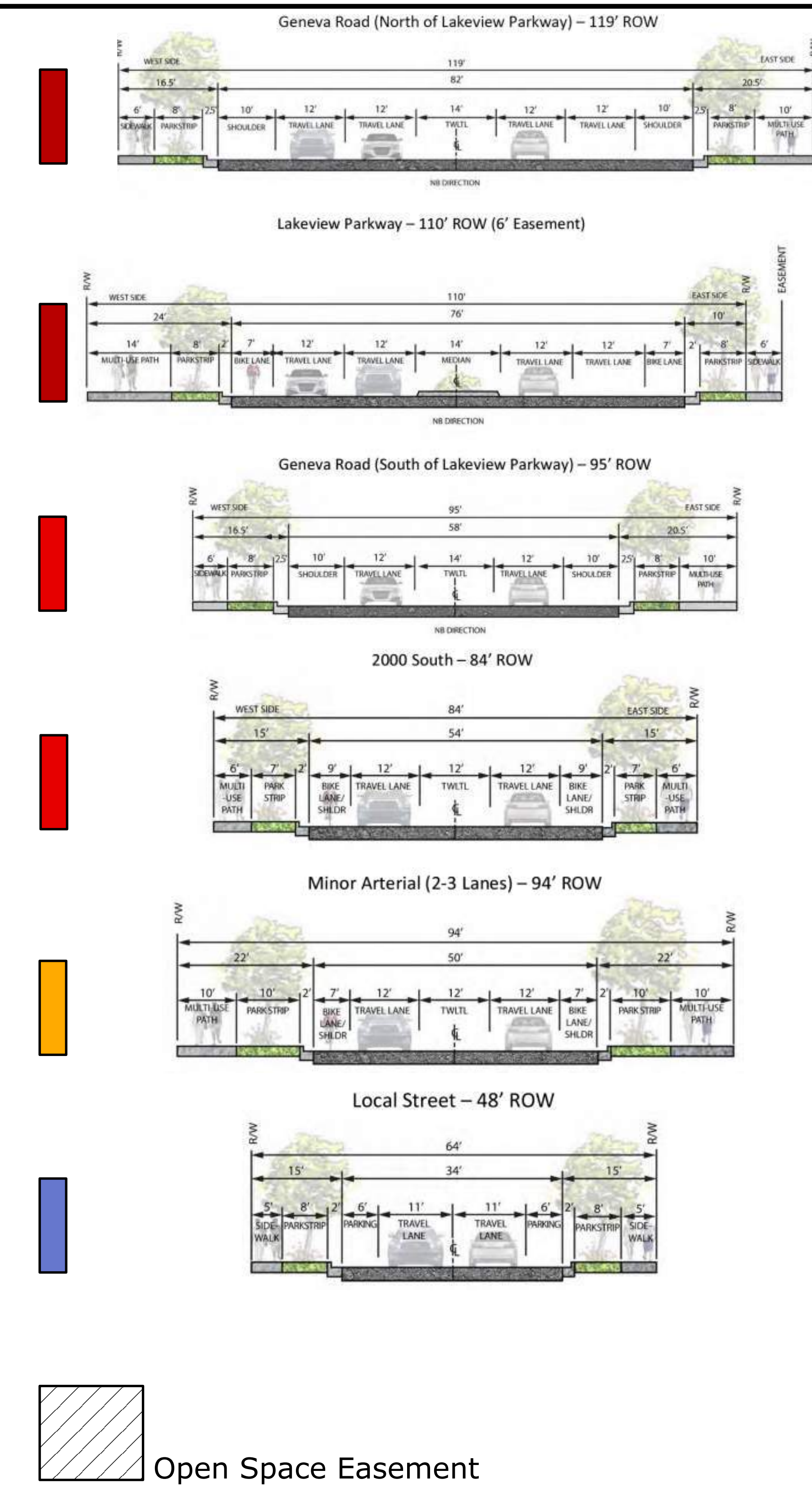
Ref #

A	B	E	C	D	G	H	I	J	K	L	M	N
Proj #	Project Location	Actual Year	Planning Year (Range)	Total Cost (2023)	Total Cost (With Inflation)	Funding Assistance	Funding %	Total not Included in the Funding Assistance (2023)	Orem Total Cost (With Inflation) (Without Soft Match)	Soft Match %	Soft Match Total	Orem Total Cost (With Inflation) (With Soft Match)
88	**College Drive** (Campus Drive to Wolverine Way)	2032	2023-2032	$ 6,240,000	$ 9,880,642	MAG	6.77%	$ -	$ 668,919	0%	$ -	$ 668,919
89	**800 East** (800 North to Center Street)	2028	2023-2032	$ 4,800,000	$ 6,371,054	MAG	6.77%	$ -	$ 431,320	0%	$ -	$ 431,320
90	**800 East** (800 South to University Parkway)	2028	2023-2032	$ 3,360,000	$ 4,459,738	MAG	6.77%	$ -	$ 301,924	0%	$ -	$ 301,924
91	**Main Street** (1600 South to 2000 South)	2029	2023-2032	$ 13,500	$ 18,732	-	100.00%	$ -	$ 18,732	0%	$ -	$ 18,732
92	**1200 West** (1600 North to 800 North) - Widen to 3 Lanes	2025	2023-2032	$ 750,000	$ 872,333	-	100.00%	$ -	$ 872,333	0%	$ -	$ 872,333
96	**Roadway Connection** (600 East to 800 North)	2038	2033-2040	$ 204,545	$ 421,782	-	100.00%	$ -	$ 421,782	0%	$ -	$ 421,782
97	**Traffic Signal** (600 East and 800 North)	2038	2033-2040	$ 300,000	$ 618,614	UDOT	0.00%	$ -	$ -	0%	$ -	$ -
98	**Turn Lane** (SB RTL) Main Street and 800 North	2035	2033-2040	$ 150,000	$ 271,045	UDOT	0.00%	$ -	$ -	0%	$ -	$ -
99	**Turn Lane** (NB RTL) Main Street and 800 North	2035	2033-2040	$ 150,000	$ 271,045	UDOT	0.00%	$ -	$ -	0%	$ -	$ -
100	**Turn Lane** (WB RTL) 500 West and 800 North	2028	2023-2032	$ 150,000	$ 199,095	UDOT	0.00%	$ -	$ -	0%	$ -	$ -
101	**Road Connection** (600 West to 800 North)	2038	2033-2040	$ 360,682	$ 743,742	-	100.00%	$ -	$ 743,742	0%	$ -	$ 743,742
102	**Traffic Signal** (600 West and 800 North)	2030	2023-2032	$ 300,000	$ 435,000	UDOT	0.00%	$ -	$ -	0%	$ -	$ -
103	**Turn Lane** (WB RTL) 600 West and 800 North	2030	2023-2032	$ 150,000	$ 217,500	UDOT	0.00%	$ -	$ -	0%	$ -	$ -
104	**Turn Lane** (EB RTL) 600 West and 800 North	2030	2023-2032	$ 150,000	$ 217,500	UDOT	0.00%	$ -	$ -	0%	$ -	$ -
105	**Turn Lane** (WB RTL) 700 West and 800 North	2031	2023-2032	$ 150,000	$ 227,288	UDOT	0.00%	$ -	$ -	0%	$ -	$ -
106	**Realign Intersection** (800 West and 800 North)	2029	2023-2032	$ 250,000	$ 346,890	UDOT	0.00%	$ -	$ -	0%	$ -	$ -
107	**Turn Lane** (WB RTL) 800 West and 800 North	2027	2023-2032	$ 150,000	$ 190,522	UDOT	0.00%	$ -	$ -	0%	$ -	$ -
108	**Turn Lane** (WB RTL) 900 West and 800 North	2027	2023-2032	$ 150,000	$ 190,522	UDOT	0.00%	$ -	$ -	0%	$ -	$ -
109	**Turn Lane** (WB RTL) 1200 West and 800 North	2027	2023-2032	$ 150,000	$ 190,522	UDOT	0.00%	$ -	$ -	0%	$ -	$ -
110	**Interchange Improvement** (800 North and I-15)	2028	2023-2032	$ 500,000	$ 663,652	UDOT	0.00%	$ -	$ -	0%	$ -	$ -
111	**Traffic Signal** (1500 West and 800 North)	2031	2023-2032	$ 300,000	$ 454,575	UDOT	0.00%	$ -	$ -	0%	$ -	$ -
112	**Intersection Improvement** (2000 North and 400 West)	2039	2033-2040	$ 200,000	$ 430,968	-	100.00%	$ -	$ 430,968	0%	$ -	$ 430,968
113	**Intersection Improvement** (2000 North and Main Street)	2039	2033-2040	$ 200,000	$ 430,968	-	100.00%	$ -	$ 430,968	0%	$ -	$ 430,968
114	**Intersection Improvement** (2000 North and 400 East)	2039	2033-2040	$ 200,000	$ 430,968	-	100.00%	$ -	$ 430,968	0%	$ -	$ 430,968
115	**Intersection Improvement** (1600 North and State Street)	2035	2033-2040	$ 500,000	$ 903,482	UDOT	0.00%	$ -	$ -	0%	$ -	$ -
116	**New Traffic Signal** (1200 North and Geneva Rd.)	2037	2033-2040	$ 250,000	$ 493,312	UDOT	0.00%	$ -	$ -	0%	$ -	$ -
117	**New Traffic Signal** (1200 North and 1200 West)	2027	2023-2032	$ 250,000	$ 317,537	-	100.00%	$ -	$ 317,537	0%	$ -	$ 317,537
118	**Intersection Improvement** (1200 North and 800 West)	2032	2023-2032	$ 200,000	$ 316,687	-	100.00%	$ -	$ 316,687	0%	$ -	$ 316,687
119	**Intersection Improvement** (1200 North and State Street)	2032	2023-2032	$ 500,000	$ 791,718	UDOT	0.00%	$ -	$ -	0%	$ -	$ -
120	**Intersection Improvement** (1200 North and Main Street)	2036	2033-2040	$ 200,000	$ 377,655	-	100.00%	$ -	$ 377,655	0%	$ -	$ 377,655
121	**Intersection Improvement** (800 North and I-15)	2030	2023-2032	$ 500,000	$ 725,000	UDOT	0.00%	$ -	$ -	0%	$ -	$ -
122	**New Traffic Signal** (800 North and 600 West)	2029	2023-2032	$ 250,000	$ 346,890	UDOT	0.00%	$ -	$ -	0%	$ -	$ -
123	**Intersection Improvement** (800 North and State Street)	2028	2023-2032	$ 500,000	$ 663,652	UDOT	0.00%	$ -	$ -	0%	$ -	$ -
124	**New Traffic Signal** (400 North and Geneva Rd.)	2031	2023-2032	$ 250,000	$ 378,813	UDOT	0.00%	$ -	$ -	0%	$ -	$ -
125	**Roundabout** (Orem Blvd. and 700 North**)**	2029	2023-2032	$ 300,000	$ 416,268	-	100.00%	$ -	$ 416,268	0%	$ -	$ 416,268
126	**Intersection Improvement** (400 North and State Street)	2032	2023-2032	$ 200,000	$ 316,687	UDOT	0.00%	$ -	$ -	0%	$ -	$ -
127	**Intersection Improvement** (400 North and 400 East)	2039	2033-2040	$ 200,000	$ 430,968	-	100.00%	$ -	$ 430,968	0%	$ -	$ 430,968
128	**Traffic Circle** (500 North and Paliasades Drive)	2038	2033-2040	$ 200,000	$ 412,409	-	100.00%	$ -	$ 412,409	0%	$ -	$ 412,409
129	**Traffic Circle** (400 North and Paliasades Drive)	2038	2033-2040	$ 200,000	$ 412,409	-	100.00%	$ -	$ 412,409	0%	$ -	$ 412,409
130	**Traffic Circle** (200 North and Paliasades Drive)	2038	2033-2040	$ 200,000	$ 412,409	-	100.00%	$ -	$ 412,409	0%	$ -	$ 412,409
131	**HAWK Signal** (100 North and 800 East)	2035	2033-2040	$ 100,000	$ 180,696	-	100.00%	$ -	$ 180,696	0%	$ -	$ 180,696
132	**New Traffic Signal** (200 South and State Street)	2030	2023-2032	$ 300,000	$ 435,000	UDOT	0.00%	$ -	$ -	0%	$ -	$ -
133	**Intersection Improvement** (400 South and State Street)	2029	2023-2032	$ 200,000	$ 277,512	UDOT	0.00%	$ -	$ -	0%	$ -	$ -
134	**New Traffic Signal** (800 South and Geneva Road)	2037	2033-2040	$ 250,000	$ 493,312	UDOT	0.00%	$ -	$ -	0%	$ -	$ -
135	**Roundabout** (College Drive and UVU Connection)	2027	2023-2032	$ 400,000	$ 508,059	-	100.00%	$ -	$ 508,059	0%	$ -	$ 508,059
136	**Intersection Improvement** (800 South and State Street)	2030	2023-2032	$ 200,000	$ 290,000	UDOT	0.00%	$ -	$ -	0%	$ -	$ -
137	**New Traffic Signal** (800 South and Carterville Road)	2040	2033-2040	$ 250,000	$ 562,951	-	100.00%	$ -	$ 562,951	0%	$ -	$ 562,951

The City of Orem Transportation Project Database - 5 Year Projects

Ref #	Proj #	Project Location	Actual Year	Planning Year (Range)	Total Cost (2023)	Total Cost (With Inflation)	Funding Assistance	Funding %	Total not Included in the Funding Assistance (2023)	Orem Total Cost (With Inflation) (Without Soft Match)	Soft Match %	Soft Match Total	Orem Total Cost (With Inflation) (With Soft Match)
	A	B	E	C	D	G	H	I	J	K	L	M	N
	139	**Intersection Improvement** (University Pkway and Sandhill Road)	2026	2023-2032	$ 200,000	$ 243,090	UDOT	0.00%	$ -	$ -	0%	$ -	$ -
	140	**Intersection Improvement** (University Pkway and 400 West)	2029	2023-2032	$ 200,000	$ 277,512	UDOT	0.00%	$ -	$ -	0%	$ -	$ -
	141	**Intersection Improvement** (University Pkway and 200 West)	2030	2023-2032	$ 200,000	$ 290,000	UDOT	0.00%	$ -	$ -	0%	$ -	$ -
	142	**Intersection Improvement** (University Pkway and Main Street)	2030	2023-2032	$ 200,000	$ 290,000	UDOT	0.00%	$ -	$ -	0%	$ -	$ -
	143	**Intersection Improvement** (University Pkway and 200 East)	2030	2023-2032	$ 200,000	$ 290,000	UDOT	0.00%	$ -	$ -	0%	$ -	$ -
	144	**Intersection Improvement** (University Pkway and 750 East)	2035	2033-2040	$ 200,000	$ 361,393	UDOT	0.00%	$ -	$ -	0%	$ -	$ -
	145	**Intersection Improvement** (University Pkway and 800 East)	2031	2023-2032	$ 200,000	$ 303,050	UDOT	0.00%	$ -	$ -	0%	$ -	$ -
	146	**New Traffic Signal** (1600 West Extension and Geneva Road)	2038	2033-2040	$ 250,000	$ 515,511	UDOT	0.00%	$ -	$ -	0%	$ -	$ -
	147	**New Traffic Signal** (Lakeview Parkway and Geneva Road)	2026	2023-2032	$ 250,000	$ 303,863	UDOT	0.00%	$ -	$ -	0%	$ -	$ -
	148	**New Traffic Signal** (2000 South and Geneva Road)	2028	2023-2032	$ 250,000	$ 331,826	UDOT	0.00%	$ -	$ -	0%	$ -	$ -
	149	**New Traffic Signal** (1600 South and Main Street)	2027	2023-2032	$ 250,000	$ 317,537	-	100.00%	$ -	$ 317,537	0%	$ -	$ 317,537
	150	**New Traffic Signal** (2000 South and Main Street)	2029	2023-2032	$ 250,000	$ 346,890	-	100.00%	$ -	$ 346,890	0%	$ -	$ 346,890
	151	**Intersection Improvement** (1600 South and State Street)	2029	2023-2032	$ 200,000	$ 277,512	UDOT	0.00%	$ -	$ -	0%	$ -	$ -
	152	**Intersection Improvement** (Columbia Lane and State Street)	2031	2023-2032	$ 200,000	$ 303,050	UDOT	0.00%	$ -	$ -	0%	$ -	$ -
	153	**Campus Drive** (Sandhill Road to 800 South)	2030	2023-2032	$ 6,240,000	$ 9,048,000	-	100.00%	$ -	$ 9,048,000	0%	$ -	$ 9,048,000

Appendix G: Southwest Street Network Plan



OREM

DRAFT SOUTHWEST STREET NETWORK PLAN

September 7, 2022

Drawn By: MJT