



# Downtown Harrisonburg Operations Study

Harrisonburg, Virginia

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## EX-1 Executive Summary

Due to several programs, plans, and partnerships dedicated to the revitalization of Downtown Harrisonburg, a surge in interest of the Downtown core area has prompted the need for the development a Downtown Master Plan. An important piece of the Downtown Master Plan will focus on what can be done within the existing right-of-way to provide transportation modes that are safe and comfortable for all ages and abilities while fostering an environment that attracts and retains businesses Downtown.

A vibrant Downtown must facilitate several competing needs within a limited amount of space. These needs include parking, pedestrian facilities, micromobility options such as bikes or scooters, the loading of goods, transit stops, automobile trips, and ride share pickups and drop-offs. This study seeks to explore the feasibility of reconfiguring the travel lanes along Main Street and Liberty Street in the Downtown core from two-lanes to one-lane in order to provide the needed right-of- way to facilitate a variety of uses. As the explicit use of this space will be determined in the future Downtown Master plan, this study only serves as a companion towards the development of the Downtown Master Plan.

A team comprised of members from the Harrisonburg Rockingham Metropolitan Planning Organization (HRMPO), City of Harrisonburg, Harrisonburg Department of Public Transportation (HDPT), and Virginia Department of Transportation (VDOT) has been involved in each step of the study to provide input and perform reviews of the analysis.

The study evaluated the impacts of three lane reduction scenarios:

- 1) Lane reconfiguration on Liberty Street resulting in one through lane from N. Main Street to Grattan Street.
- 2) Lane reconfiguration on Main Street resulting in one through lane from Grattan Street to Gay Street.
- 3) Lane reconfigurations on Liberty Street and Main Street resulting in one through lane on each roadway between the aforementioned intersection termini.

Any recommendation that includes the elimination of an automobile lane can only be made responsibly once there is confidence that the proposed configuration can adequately handle traffic demand. To realize the impact to Main Street and Liberty Street, as well as the surrounding transportation network, the study area is comprised of the Downtown core as well as the surrounding street network as shown in Figure EX-1.

*Synchro* and *SimTraffic* were the traffic modeling software used to model the street network. *Synchro* is a macroscopic model that utilizes equations found in the Highway Capacity Manual (HCM) to determine the ultimate capacity of an intersection and applies the Intersection Capacity Utilization (ICU) to compare existing volumes to the ultimate capacity.

Several factors affect the capacity of a roadway, requiring the model inputs to be data intensive. A combination of known and collected inputs were coded into the models as well as a number of assumed or estimated inputs. Known factors included lane use, roadway geometry, turn lane storage lengths, taper lengths and distance between intersections. A growth factor, based on a prediction of anticipated growth, was applied to collected traffic volumes to estimate build year volumes. Where heavy truck percentage data was available, it was used; a default value of 2% was used for intersections where this data was not available. A speed study was not performed for this study. An assumption that free flow speeds equal the speed limit was used. When two or more lanes were available for a certain movement, a lane utilization factor was used to estimate the volumes of each lane for a given volume.

Downtown areas have a unique set of factors that also contribute to the capacity of a roadway. Pedestrian volumes; bicycle use; transit stop frequency and dwell time; the presence of on-street parking (and turn over); and, loading frequency are a handful of features that could contribute to a reduction in capacity for a roadway. A limitation of this study is that data related to these factors were not collected as part of this study. Rather the capacity of the roadways was adjusted in all of the build models to account for these variables. This is discussed in more detail in the body of the report.

Another consideration that is not fully evaluated is the impact of traffic that may choose to re-route on Main Street or Liberty Street during times of congestion along I-81. A preliminary investigation of incidents that are believed to prompt rerouting is described later in this report. While this section of the report provides an overview of the frequency of these incidents, it does not account for congestion that might occur outside an incident that may cause a driver to reroute onto Main Street or Liberty Street. A project for widening I-81 through the City of Harrisonburg from two lanes to three lanes is in the planning stages. It is anticipated this widening will reduce congestion, and provide for better incident management, and therefore reduce the frequency of traffic rerouting through the downtown core. Before implementing any lane reduction scenario within the City, a more in-depth study will be necessary to fully understand the impacts of various types of incidents on I-81.

It is also important to note that this analysis represents a "typical" weekday peak period and does not consider extraordinary circumstances, such as a crash. If an event such as a crash, or an emergency utility repair, were to occur it is likely that significant queuing could result if Main and Liberty Streets are reduced to one through lane.

After a careful analysis of the proposed future conditions, including consideration of any re-routing this new configuration may introduce to parallel routes, this study indicates that the Downtown street network is projected to have sufficient capacity to accommodate any of the three (3) lane reconfiguration scenarios involving Liberty Street and Main Street. All the intersections in the analysis network are anticipated to operate at an acceptable LOS, with the vast majority operating with excess capacity. The lane reconfiguration scenarios are not expected to significantly impact the operations of individual intersections. Due to rerouting traffic volumes, changes to roadway capacity, and modifications to traffic signal optimization, some build intersection movements are projected to add delay or queue length while others are projected to reduce delay or queue length.

At a network analysis level, scenario 2 with the Main Street lane reconfiguration is anticipated to have less of an operational impact on the network than scenario 1 with the Liberty Street lane reconfiguration or scenario 3 with the combination of the Main Street and Liberty Street configurations. While scenarios 1 and 3 are projected to add more delay and corridor travel time in comparison to scenario 2, none of the lane reconfiguration scenarios are projected to lead to either intersection or network failure.





FIGURE EX-1  
VICINITY MAP

Harrisonburg Downtown Enhancements Traffic Impact Analysis  
Harrisonburg, Virginia



## Model Development and Operational Analyses

As part of the study, an operational analysis of 31 key signalized and unsignalized intersections in the Downtown and surrounding area were evaluated. These study intersections are shown in Figure EX-2. The evaluation examined 2030 no build conditions with existing lane configurations as well as 2030 build conditions for three scenarios:

- 4) Lane reconfiguration on Liberty Street resulting in one through lane from N. Main Street to Grattan Street.
- 5) Lane reconfiguration on Main Street resulting in one through lane from Grattan Street to Gay Street.
- 6) Lane reconfigurations on Liberty Street and Main Street resulting in one through lane on each roadway between the aforementioned intersection termini.

Any proposed lane re-configuration will take time before it is constructed and must operate at an acceptable level in the future. To allow time for any proposed improvements to be planned, designed and vetted by the public, a design year of 2030 was chosen by the study team.

VHB worked with the study team to understand roadway capacity and current traffic patterns through downtown Harrisonburg to estimate the likely re-routing of traffic as a result of the proposed lane reconfigurations for each scenario.

After the no build model was analyzed, the study team expressed a desire to ensure the build conditions analysis were appropriately conservative to increase confidence that the modeled conditions would accurately represent factors that are generally present in a Downtown corridor such as parking maneuvers, pedestrian activity, loading activities and other elements that can impact traffic flow within a Downtown urban area. To represent for these factors, a reduction in the saturated flow rate was coded into the model, which reduced the capacity of the roadway. These factors were not included in the no build condition therefore caution should be taken when comparing metrics between the no build and the build conditions.

After the 2030 no build condition and 2030 build scenarios were analyzed, opportunities to mitigate areas with existing or anticipated operational concerns were proposed and analyzed in the 2030 build improved models for the three (3) scenarios. These recommendations are intended to be low-cost and not require right-of-way acquisition.

## Operational Recommendations

VHB and the study team identified three (3) potential operational improvements that may address projected deficiencies in the no build and build intersection operations. The expected deficiencies are predominantly expected to exist in no build 2030 conditions; the lane reconfiguration scenarios analyzed under the build conditions may impact these conditions slightly, but for the most part, they are not responsible for significant degradation of intersection operations. The proposed recommendations are listed below and are discussed in more detail later in this report.

### 1) S. Main Street and MLK Jr. Way intersection:

- Evaluate the operational impact of converting the existing westbound left/through lane to a through only lane to allow for the removal of traffic signal split-phasing in the eastbound and westbound direction
- This recommendation was applied to all three (3) build scenarios.

### 2) Mason Street and E. Market Street intersection:

- Convert the northbound approach to two travel lanes (one left/through and one through/right) for the full length of upstream block. Mason Street north of E. Market Street is already two lanes. It is anticipated that this recommendation can be done within the existing curb space but would require the removal of two parking spots.
- This recommendation was applied to the following build scenarios:
  - Lane reconfiguration on Main Street only
  - Lane reconfiguration on both Liberty Street and Main Street

### 3) S. High Street / MLK Jr. Way intersection:

- Extend the S. High Street southbound left-turn storage bay by 100 feet to fully accommodate anticipated future no build and build southbound left-turn queues. This recommendation can be construction within existing right-of-way but would require the modification of the landscaped median.
- This recommendation was applied to the following build scenarios:
  - Lane reconfiguration on Liberty Street only
  - Lane reconfiguration on both Liberty Street and Main Street

# 1 Introduction and Methodology

## Purpose

The purpose of this report is to evaluate the existing capacity of the Downtown transportation network and anticipate changes in traffic patterns resulting from a change in roadway configuration along Main Street, Liberty Street, or both in order to determine the network capacity's resilience in accommodating the proposed roadway reconfigurations and traffic pattern shifts.

In order to evaluate the existing capacity of the network, and the demand that is anticipated to exist in the future, a model was created to replicate the traffic volumes, travel time, queue data and the overall congestion observed in the field so that a variety of scenarios and improvements can accurately be assessed. The models utilize the traffic modeling software, *Synchro 10*, and were coded according to the procedures outlined in VDOT's *Traffic Operations and Safety Analysis Manual (TOSAM)*.

The 2019 existing conditions model was provided to VHB by the City of Harrisonburg on October 22, 2019. Before utilizing the existing base model to analyze future conditions the model was compared to field observations and was found to be sufficiently calibrated. A detailed technical memo describing the calibration methods and existing model development are provided in Appendix A.

It is important to note that while every effort has been made in this study to replicate future conditions there are inherent limitations in a mathematical traffic model and assumptions of future traffic conditions that are required to be made as described previously in this report.

## Study Background

As discussed previously in this report, this study is being performed to understand the anticipated future transportation demand and analyze if a reduction in roadway capacity for automobiles on Main Street and/or Liberty Street can meet this demand.

In order to evaluate the feasibility of a road reconfiguration along Main Street and/or Liberty Street, 31 key intersections, as shown in Figure EX-2 and listed on the following page, were identified to be studied:

North Liberty Street and South Liberty Street at:

- W. Grattan Street/S. Main Street (unsignalized);
- W. Bruce Street (signalized);

- E. Water Street (signalized);
  - W. Market Street (signalized);
  - E. Elizabeth Street (unsignalized);
  - E. Wolfe Street (unsignalized);
  - Rock Street/E. Noll Drive (unsignalized); and,
  - E. Gay Street (signalized).
- North Main Street and South Main Street at:
    - Martin Luther King Jr. Way (signalized);
    - W. Bruce Street (unsignalized);
    - E. Water Street (signalized);
    - Court Square South (unsignalized);
    - E. Market Street (signalized);
    - E. Elizabeth Street (signalized);
    - E. Wolfe Street (signalized);
    - E. Rock Street (unsignalized);
    - E. Gay Street (signalized);
    - Noll St/Kratzer Avenue (unsignalized); and,
    - N. Mason Street (signalized).
- South High Street and North High Street at:
    - Martin Luther King Jr. Way (signalized);
    - E. Market Street (signalized);
    - E. Wolfe Street (signalized); and,
    - E. Gay Street (signalized).
- West Market Street at:
    - Court Square
- South Mason Street and North Mason Street at:
    - Martin Luther King Jr. Way (signalized);
    - W. Grattan Street (unsignalized);
    - E. Market Street (signalized);
    - E. Elizabeth Street (signalized);
    - E. Wolfe Street (signalized);
    - E. Rock Street (signalized);
    - E. Gay Street (signalized); and,
    - N. Main Street (signalized).



**FIGURE EX-2**  
**STUDY AREA**



## Study Area Roadways – Existing and 2030 No Build Conditions

Below is a brief description of each roadway analyzed within the study area. All provided AADT counts are from the 2018 VDOT Daily Traffic Estimates Including Vehicle Classification Estimates (where available) Special Locality Report 115 for the City of Harrisonburg.

### Main Street

Main Street in the Downtown area between Martin Luther King Jr Way and the intersection with Liberty Street is a one-way roadway with two lanes running in the northbound direction which provide access to commercial businesses in Downtown Harrisonburg. It is identified as a minor arterial street with an AADT of 5,800 vpd. The posted speed limit is 25 mph.

Sidewalks are present on both sides of Main Street and marked or unmarked on-street parking is provided through the study extents until north of Rock Street, where a bike lane is present. Shared lane use markings are present for most of the corridor until north of the intersection at Rock Street, where bike lanes are present.

### Liberty Street

Liberty Street in the Downtown area between Martin Luther King Jr Way and the intersection with Noll Drive is a one-way roadway with two lanes running in the southbound direction which provide access to commercial businesses in Downtown Harrisonburg. It is identified as a minor arterial street with an AADT of 6,500 south of Market Street and 4,800 north of Market Street. The posted speed limit is 25 mph.

Sidewalks are present on both sides of Main Street and marked, or unmarked, on-street parking is provided on most of the study extents. Shared lane use markings are present.

### High Street

High Street is a four-lane principle arterial with left turn lanes at the major intersections that runs north and south and provides access to a variety of residential, community and commercial uses. A center median exists through most of the study area which manages access at mid-block access points. There are sidewalks on both sides of the street through the study area. The AADT between Market Street and Gay Street is 17,000 vpd. The posted speed limit is 35 mph.

### **Mason Street**

Mason Street south of East Market street is a two-lane roadway that runs north and south that serves mostly residential uses and is classified as a major collector. Mason Street north of East Market Street is a four-lane roadway that serves mostly commercial uses and is classified as a minor arterial. Unmarked on-street parking is provided, and shared use lane markings are present through the study area. The posted speed limit is 25 mph.

The AADT is 3,800 vpd between Martin Luther King Jr Way and Paul Street; 4100 between Paul Street and Market Street; and 6,900 between Market Street and Main Street.

### **Martin Luther King Jr. Way**

Martin Luther King Jr. Way is a four-lane minor arterial that runs mostly east and west and provides access to several institutional parking garages serving James Madison University. Left turn lanes are present at the major intersections along the study area. Sidewalks are present along both sides of the street. The posted speed limit is 25 mph.

The ADDT traffic is 8,700 vpd between High Street and Main Street and is 15,000 vpd between Main Street and Reservoir Street through the study area.

### **East/West Grattan Street**

East and West Grattan Street is a two-lane roadway that runs east and west at the intersection where South Main Street splits and becomes a one-way pair of Liberty Street and Main Street. It is classified as a local street and provides access to mostly residential use. On-street parking is permitted through the study area. The posted speed limit is 15 mph. AADT information was not available for this roadway.

### **East/West Bruce Street**

East and West Bruce Street is a two-lane minor collector between High Street and Liberty Street which becomes a one-way east bound street east of Liberty Street. Bruce Street provides access to a variety of commercial uses as well as James Madison University and Downtown parking. The speed limit is 25 mph.

Marked on-street parking is located along the study area extents. Sidewalks are present on both sides of the street through the study area. The AADT is 21,00 vpd between Liberty Street and Mason Street.

### **East Water Street**

East Water Street is a two-lane roadway that becomes a one-way westbound roadway east of Liberty Street. Classified as a local street, East Water Street provides access to a number of commercial businesses. Narrow right-of-way prevents on-street parking. A raised mid-block crosswalk is present in the block between Main Street and Liberty Street. The posted speed limit is 25 mph. No AADT is available for this street.

### **East/West Market Street**

East and West Market Street, also known as Route 33, is a two-lane principle arterial with additional lanes present at the intersection of Mason Street. Marked on-street parking is provided on the block between Federal street and Main Street. The posted speed limit is 25 mph. The AADT is 4,800 between High Street and Court Street; 5,900 between Main Street and Mason Street; and, 12,000 just east of Mason Street.

### **East Elizabeth Street**

East Elizabeth Street is a two-lane local roadway that that runs in the east and west direction and provides access to residential uses and parking lots, including the Elizabeth Street parking deck. The posted speed limit is 25 mph. No AADT is available for this street

No parking signs are present on the north side of the street with the exception of the extents between Main Street and Liberty Street, where the roadway is wider and marked on-street parking is provided on the north side of the roadway. Although parking appears to be allowed on the south side of the street, frequent curb cuts are present where on-street parking would block the driveway.

### **East Wolfe Street**

East Wolfe Street is a two-lane, major collector, that runs in the east and west direction and provides access to commercial and community uses, as well as the Elizabeth Street parking deck, and other large surface parking lots. The AADT is 2,100 vpd between North High Street and North Liberty Street; 2,600 vpd from North Liberty Street to North Main Street; and, 970 vpd from east of Main Street through the study area. Marked on-street parking is available on the south side of the road between Mason Street and Main Street. The posted speed limit is 25 mph

### **East Rock Street**

East Rock Street is a two-lane local street that that runs in the east and west direction and provides access to student housing, commercial, and community uses. Marked on-street spaces are provided on the north side of Rock Street from Main Street to Liberty Street. The posted speed limit is 25 mph. No AADT information was available for this street.



### **East Noll Drive**

East Noll Drive intersects Liberty Street and Main Street and runs in a northeast/southwest direction to connect to North Main Street at North Mason Street. East Noll Drive is a two-lane one-way street in the northbound direction until the intersection of East Gay street, where it becomes a two-way street. Marked on-street parking is available on the right hand side of the roadway. The posted speed limit is 25mph. The AADT is 3,100 vpd between Rock Street and Kratzer Avenue.

### **East Gay Street**

East Gay Street has two eastbound and westbound lanes between Mason Street and Main Street, two eastbound lanes and one westbound lane between North Main Street and East Noll Drive and becomes a two-lane street between North Liberty Street and High Street. East Gay Street is classified as a minor arterial street and provides access to residential uses west of Liberty street and a variety of commercial uses between Liberty and Mason Street. The posted speed limit is 25 mph. The AADT is 4,100 vpd between Mason Street and Main Street and 5,400 vpd between Main Street and High Street.

### **Kratzer Avenue**

Kratzer Avenue is a two-lane roadway that connects North Liberty Street to Noll Drive. The posted speed limit is 25 mph. The AADT is 2,600 vpd between Noll Drive and North Liberty Street to the intersection with Noll Drive and North Main Street.

## Pedestrian Activity

The Downtown core experiences heavy pedestrian activity. Sidewalks are present along each of the study roadways, often on both sides of the roadway through the study area. Each signalized intersection along Main Street and Liberty Street include pedestrian signals. Pedestrian signals are present at all signalized intersections on High Street and Mason Street within the study area. Marked crosswalks are established at most signalized and unsignalized intersections within the study area.

There are several proposed intersection improvements planned in the City of Harrisonburg's Bicycle and Pedestrian plan within the study area that are anticipated to increase pedestrian safety and comfort. These intersections identified for intersection improvements include:

- Liberty Street at:
  - West Gay Street;
  - East Market Street;
  - West Water Street; and,
  - West Bruce Street
  
- South Main Street at
  - East Gay Street; and,
  - Martin Luther King Jr. Way
  
- North Mason Street at
  - East Rock Street;
  - East Wolfe Street; and,
  - East Water Street
  
- High Street at
  - West Water Street; and,
  - West Bruce Street

## Bicycle Accommodations

Liberty Street and Main Street are dedicated shared use routes with shared use markings present. There are marked bike lanes present on Main Street and Liberty Street north of Rock Street. Several of the Downtown area streets have shared use markings, as discussed previously in this report.

There are several recommended bicycle facilities planned in the 2017 version of the City of Harrisonburg Bicycle and Pedestrian Plan within the study area. These include:

- Bike lane segments on Main Street and Liberty Street from Martin Luther King Jr. Way to connect to the existing lanes bike lanes north of East Wolfe Street.
- Bike lanes on South Mason Street throughout the study area.
- Bike lanes on East Market Street from Court Square to the east.

## Transit

Harrisonburg Department of Public Transportation (HDPT) operates a number of bus lines along the study corridors serving several areas throughout the City of Harrisonburg. A transfer point is located on the northeast corner of East Gay Street and North Mason Street which serves as a hub and provides access to all routes in the City of Harrisonburg.

The comprehensive plan that was adopted in 2018 seeks to grow public transit services to provide more routes within the downtown area as well as connecting downtown locations to parking opportunities.

## I-81 Incident Frequency and Incident Management Detour Plans

Interstate I-81 is the primary north-south route from Tennessee to New York connecting the City of Harrisonburg to other nearby cities. Data reported by VDOT shows that in 2018 the northbound average daily traffic (AADT) on I-81 north was 28,000 vehicles per day (vpd) and the AADT in the southbound direction on I-81 south was 29,000 vpd.

The City of Harrisonburg provided an incident detour plan that was created for incidents on I-81 closures that created the need for traffic to detour on the local streets within the City of Harrisonburg. This incident plan is included in Appendix B. These plans provide detour plans for I-81 lane closures between Exit 243 and 245; Exits 245 and 247; between ramps at exit 247; between ramps between exits 247 and 251; and, closures between ramps at exit 247. Scenarios where I-81 southbound traffic detours on Liberty Street are described below:

### I-81 South (detour on Liberty Street)

- Closure between Exits 243 and Exit 245
  - Primary detour route for car and truck traffic
  - Secondary detour route for car traffic only (under stringent situation)
- Closure between Exits 245 and 247
  - Primary detour route for car and truck traffic
  - Secondary detour route for car traffic only (under stringent situation)
- Closure between Ramps at Exit 247
  - Primary detour route for car and truck traffic
- Closure between Ramps between Exits 247 and 251
  - Detour for car and truck traffic

Scenarios where I-81 northbound traffic detours on Liberty Street is described below:

### I-81 North (detour on Main Street)

- Closure between Ramps at Exit 247
  - Primary detour route for car and truck traffic
- Closure between Ramps between Exits 247 and 251
  - Detour for Car and truck traffic north of Market Street only
- Closure between Ramps at Exit 251
  - Detour for car and truck traffic north of Market Street only

An incident summary was created by the HRMPO and VDOT to understand the frequency of I-81 incidents that are anticipated to impact the Downtown study corridors. This report is also included in Appendix B. This report analyzes incidents where two (2) or more lanes were closed for two (2) or more hours. While there is no data indicating whether interstate traffic detoured and impacted downtown streets during these incidents, it is assumed this level of impact to capacity on I-81 will push drivers onto local roads.

In the last five (5) years, 17 (68%) of these incidents were recorded in the northbound direction while only 8 (32%) occurred in the southbound direction. Of those total incidents seven (7) of them occurred in the PM peak period, representing 28% of detour related incidents.

GridSmart cameras, with traffic volume collecting capability, were in place on Main Street and Martin Luther King Jr Way during an incident that occurred in 2019 that caused lane closures on four (4) lanes on I-81 South for approximately three (3) hours between Exits 245 and 247. This allowed the study team to review the traffic volumes on that day and compare them to volumes that occurred exactly one week prior to the incident to see if traffic volumes increased during the I-81 incident. The data showed a significant increase in southbound through traffic on Main Street at Martin Luther King Jr Way as well as westbound left traffic during the time of the incident. This data suggests that the incident on I-81 caused this increase in traffic volumes; but

it is important to note that the incident occurred the Saturday after Thanksgiving; therefore, it would not be considered an average day and a comparison may not be reasonable to make.

As described previously in this report, this preliminary analysis is not likely to represent all incidents where a driver may choose to reroute onto Main Street and Liberty Street. Additionally, a planned widening of I-81 is expected to reduce the incidence of traffic rerouting onto local streets, but the impact is not known. Prior to any lane reconfiguration project, a more in-depth analysis of frequency and operational impacts to Downtown streets should be performed.

## 2 Model Development

As part of this study, an analysis of the operational conditions along the study corridors was conducted to understand current traffic demand and analyze the feasibility of reconfiguring Main Street, Liberty Street, or both Main Street and Liberty Street to one-lane as well as identify areas for improved operations resulting from existing needs or mitigation due to the roadway reconfiguration scenarios. This evaluation examined the 2030 no build condition as well as 2030 build and 2030 build improved conditions based on the following scenarios:

- 1) Lane reconfiguration on Liberty Street resulting in one through lane from N. Main Street to Grattan Street.
- 2) Lane reconfiguration on Main Street resulting in one through lane from Grattan Street to Gay Street.
- 3) Lane reconfigurations on Liberty Street and Main Street resulting in one through lane on each roadway between the aforementioned intersection termini.

It is anticipated that a lane reduction on Main Street and/or Liberty Street will result in increased travel time through these corridors which may cause traffic to utilize parallel routes to reach their destination. Traffic demand models (TDM) and origin and destination (O-D) data of vehicles entering and exiting the study area were utilized to determine how much, and where, traffic may re-route to. These volumes were used in the 2030 build and 2030 build improved models. Discussion of the methodology used to determine to what degree, and to what location, vehicles may re-route in any of the build scenarios is discussed in further detail later in the report.

For the network operational analysis, VHB evaluated vehicle delay, level of service (LOS), and queue length and travel times for the typical weekday PM peak hour using *Synchro/SimTraffic Professional, Version 10*. VHB followed VDOT's *Traffic Operations and Safety Analysis Manual (TOSAM)* for all analysis standards and methodology.

### Base Model

The analyses utilized the traffic simulation software, Synchro 10.0, which was coded according to the procedures outlined in VDOT's TOSAM. The City of Harrisonburg provided a base model that included links that were coded over aerial imagery within Synchro 10.0 to model accurate 2-D link geometry such as land configurations, including any turn bays, segment length and roadway curvature. Additionally, this base model contains existing traffic control data and signal timing and phasing parameters.

## Traffic Volumes

VHB compiled traffic volume data for this study from a variety of sources including hand counts done by City of Harrisonburg staff, MioVision counts, and GridSmart equipped City traffic signals. The volumes were all collected in fall 2019 over a two-month period (early September through early November). These traffic counts are located in Appendix C. A traffic impact analysis report was also provided so that projected volumes based on a future development located at the intersection of Mason Street and Market Street could be entered into the model. A copy of this traffic impact analysis is located in Appendix D.

City of Harrisonburg staff identified the PM peak hour as the critical analysis condition for the study. From the collected data, the hour between 4:30 PM and 5:30 PM was identified to possess the highest traffic volumes and was therefore used as the analysis period for the study.

Since any roadway reconfiguration project would undergo several years of planning, public engagement, design and construction before being completed, a design year of 2030 was chosen for the analysis. A one percent (1%) annual growth rate was applied to the 2019 traffic volumes to represent anticipated growth. The 2030 no build traffic volumes are shown in Figures 2.1-2.5.

A more detailed version of the traffic data collected, including specific dates and responsible parties of the data collection can be found in the memo located in Appendix A as well as the raw traffic counts located in Appendix C.

## Travel Time

The City of Harrisonburg provided travel time runs between 4:30 PM and 6:30 PM along High Street, Liberty Street, Main Street and Mason Street during the identified peak hour on October 16<sup>th</sup>.

## Observed Queue Lengths

Existing queue lengths were measured at key intersections during the analysis period which include the following:

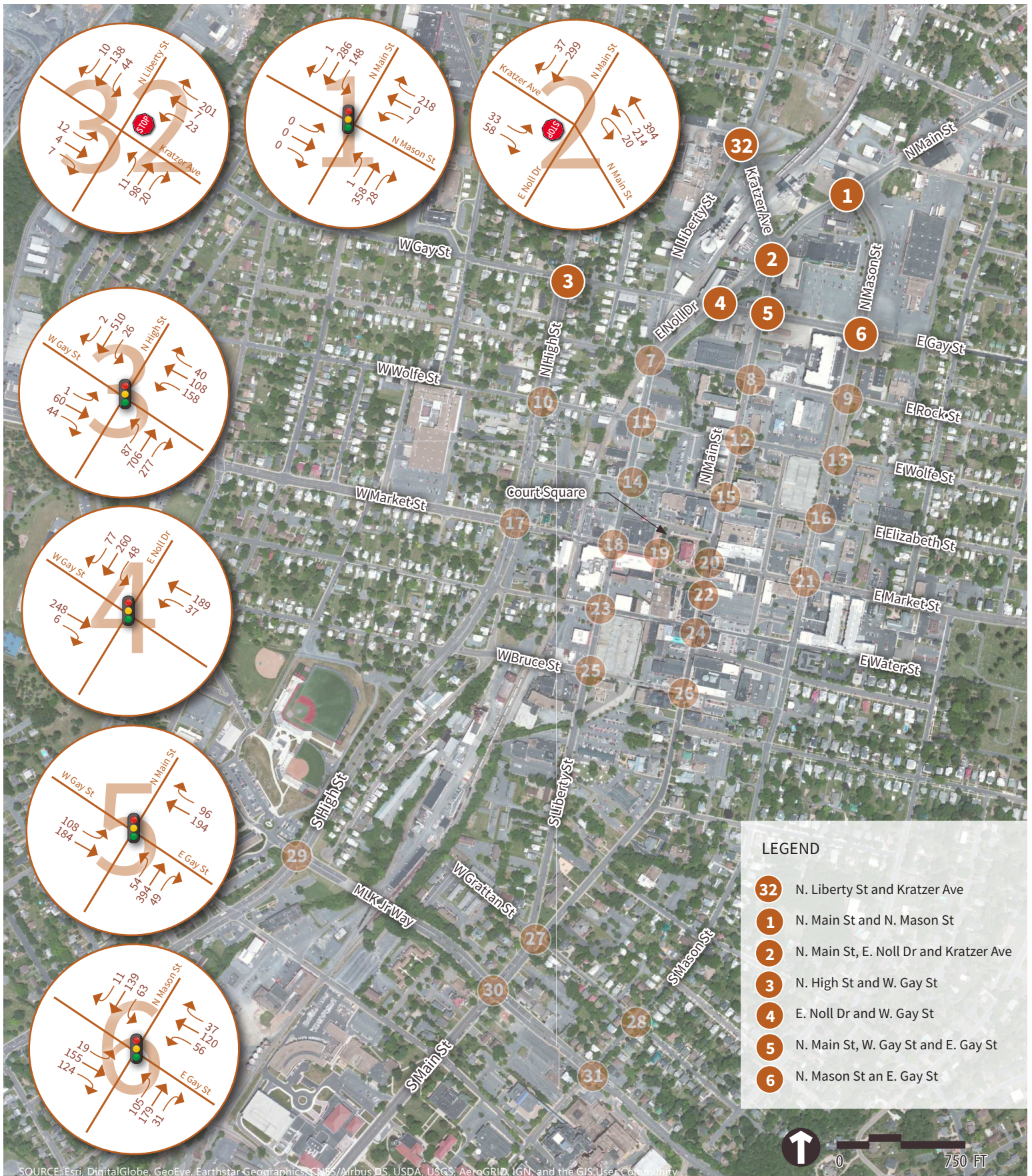
- North Mason Street and East Gay Street;
- South Main Street and Martin Luther King Jr. Way;
- South Mason Street and Martin Luther King Jr. Way;
- South Mason Street and Martin Luther King Jr. Way;
- South High Street and Martin Luther King Jr. Way;
- Liberty Street and West Market Street;
- Main Street and East Market Street;

- Main Street and East Water Street;

### **Model Calibration**

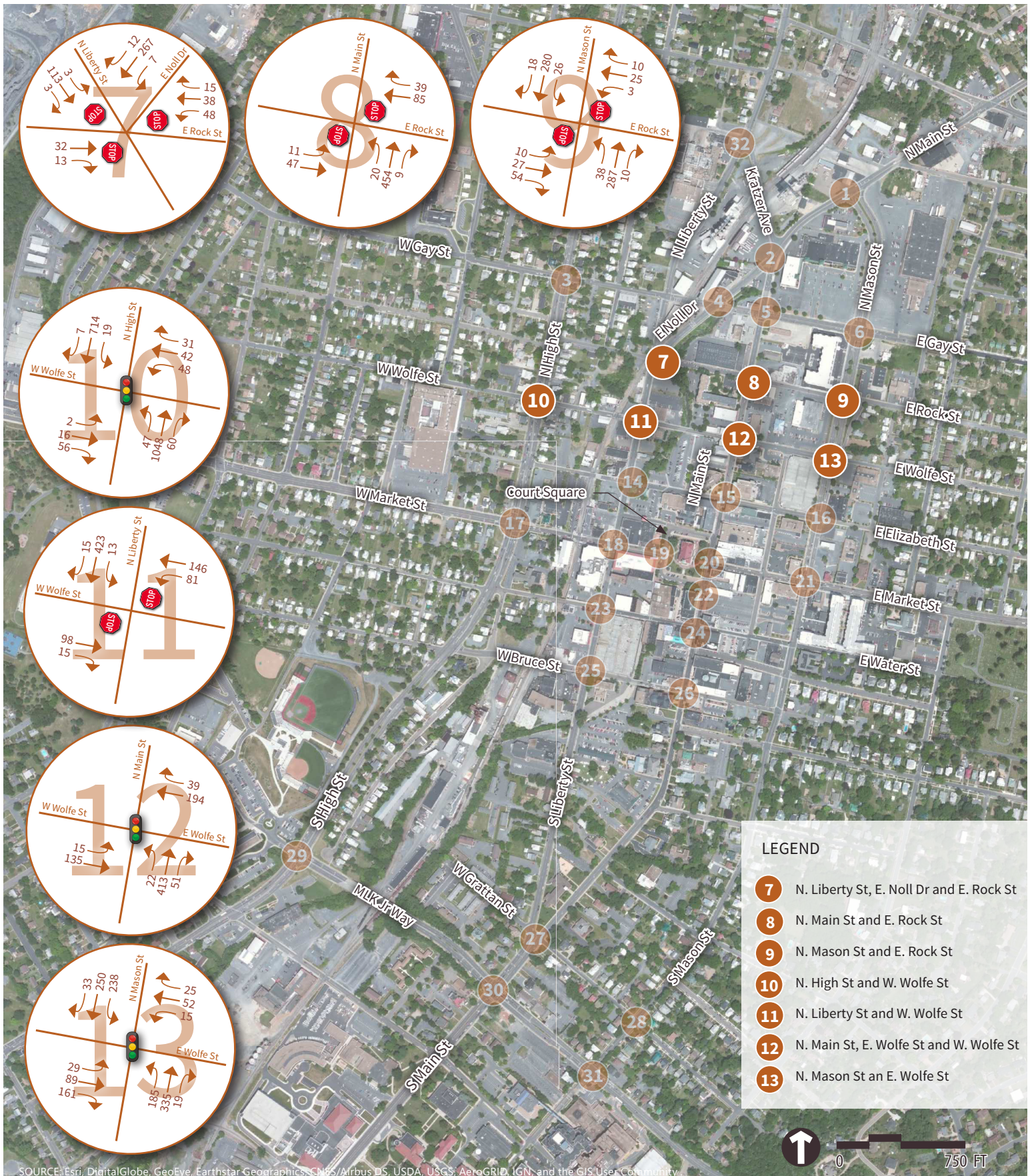
The base Synchro model was analyzed to see if modeled travel times, and queue lengths reflect observed field conditions. The results were found to be reasonable by the study team and the base model was found to be considered calibrated. A more detailed analysis of the calibration methods and results can be found in Appendix A.





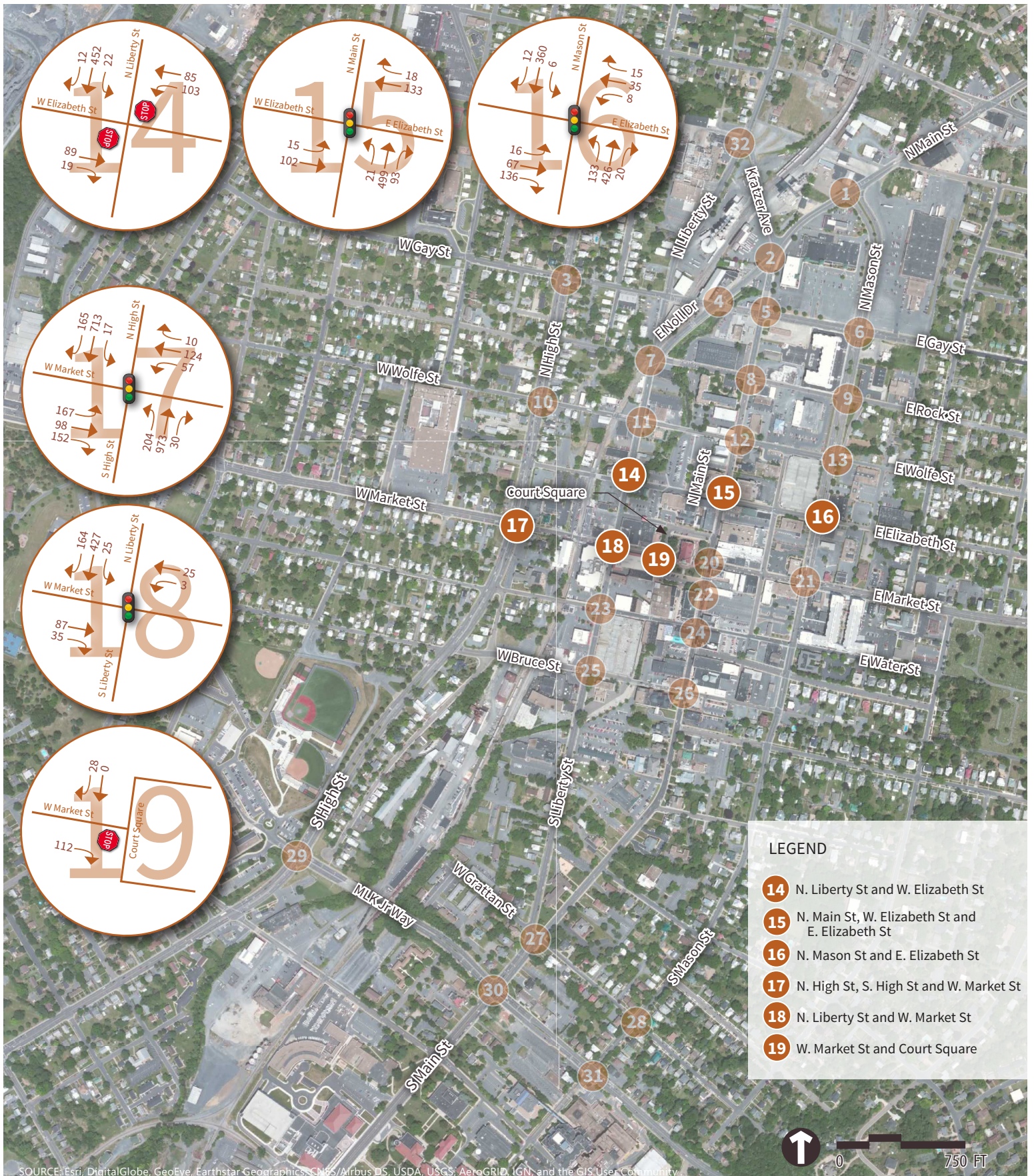
**FIGURE 2.1**  
**2030 NO BUILD TRAFFIC VOLUMES**

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 Harrisonburg, Virginia



**FIGURE 2.2**  
**2030 NO BUILD TRAFFIC VOLUMES**

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 Harrisonburg, Virginia



**FIGURE 2.3**  
**2030 NO BUILD TRAFFIC VOLUMES**

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Harrisonburg, Virginia



**FIGURE 2.4**  
**2030 NO BUILD TRAFFIC VOLUMES**

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Harrisonburg, Virginia



SOURCE: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNRS/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community



**FIGURE 2.5**  
**2030 NO BUILD TRAFFIC VOLUMES**  
 Harrisonburg Downtown Enhancements Traffic Impact Analysis  
 Harrisonburg, Virginia

## 2030 No Build Model

The calibrated base *Synchro* model was utilized as the foundation for the 2030 no build model. No changes to existing lane configurations are represented in the 2030 no build model. A one percent (1%) annual growth rate was used to increase the traffic volumes to represent future traffic volumes. The projected 2030 volumes were computed and coded in *Synchro*. Traffic signal phase splits and offsets were optimized utilizing *Synchro* software's optimization tools to reflect the growth in traffic volumes between the 2019 data collection and the 2030 analysis year. The 2030 no build model *Synchro* reports are located in Appendix E and the *SimTraffic* queuing and blocking reports are located in Appendix F.

## 2030 Build Models

Three (3) 2030 build models were created to perform a capacity analysis for the lane reconfiguration concepts described below:

- 1) Lane reconfigurations resulting in one through lane on Liberty Street from N. Main Street to Grattan Street and on Main Street from Grattan Street to Gay Street.
- 2) Lane reconfiguration on Liberty Street resulting in one through lane from N. Main Street to Grattan Street.
- 3) Lane reconfiguration on Main Street resulting in one through lane from Grattan Street to Gay Street.

VHB optimized the traffic signal timings (i.e., phase splits and offsets) to reflect the change in intersection capacity due to the lane reconfigurations and traffic volumes due to anticipated volume rerouting as described in the section below.

## Traffic Rerouting

Driver routing decisions are driven by a combination of factors including origin, destination, and real, or perceived, trade-offs such as a reduction in travel time versus the number of stops. Robust data, combined with a number of assumptions, was used to estimate the percentage of traffic volume that would re-route and where those vehicles would re-route to.

A comparison of modeled no build and build (assuming no vehicles reroute) conditions was conducted to understand the extent of travel time increases that may occur when Main Street and Liberty Street capacity is reduced by one lane. The Liberty Street and Main Street travel times in the build models (no reroute) are both anticipated to increase approximately 15 seconds (approximately a 7% increase of total corridor travel time). It is anticipated that this expected increase in travel time will result in varying degrees of volume rerouting in and around the Downtown grid.

The first assumption made was that the proposed reconfigurations would not prompt any mode shift; in other words, the loss of road capacity will not prompt personal vehicle drivers to switch to an alternative method of transportation. An additional assumption is that drivers with an origin or destination within the Downtown are unlikely to alter their routing decisions due to a limitation in alternative options. Therefore, this study focused on origins and destinations external to the Downtown area and the travel times of the various route alternatives between those origin-destination pairs. The project team also applied some engineering judgment in regard to driving environment comfort; for example, all things being equal in regard to travel time, a driver may be more likely to select a route around Downtown where there is less pedestrian and on-street parking activity than a route through Downtown where those activities occur in greater abundance. A detailed memo of the traffic rerouting analysis can be found in Appendix A.

## Transportation Demand Model (TDM)

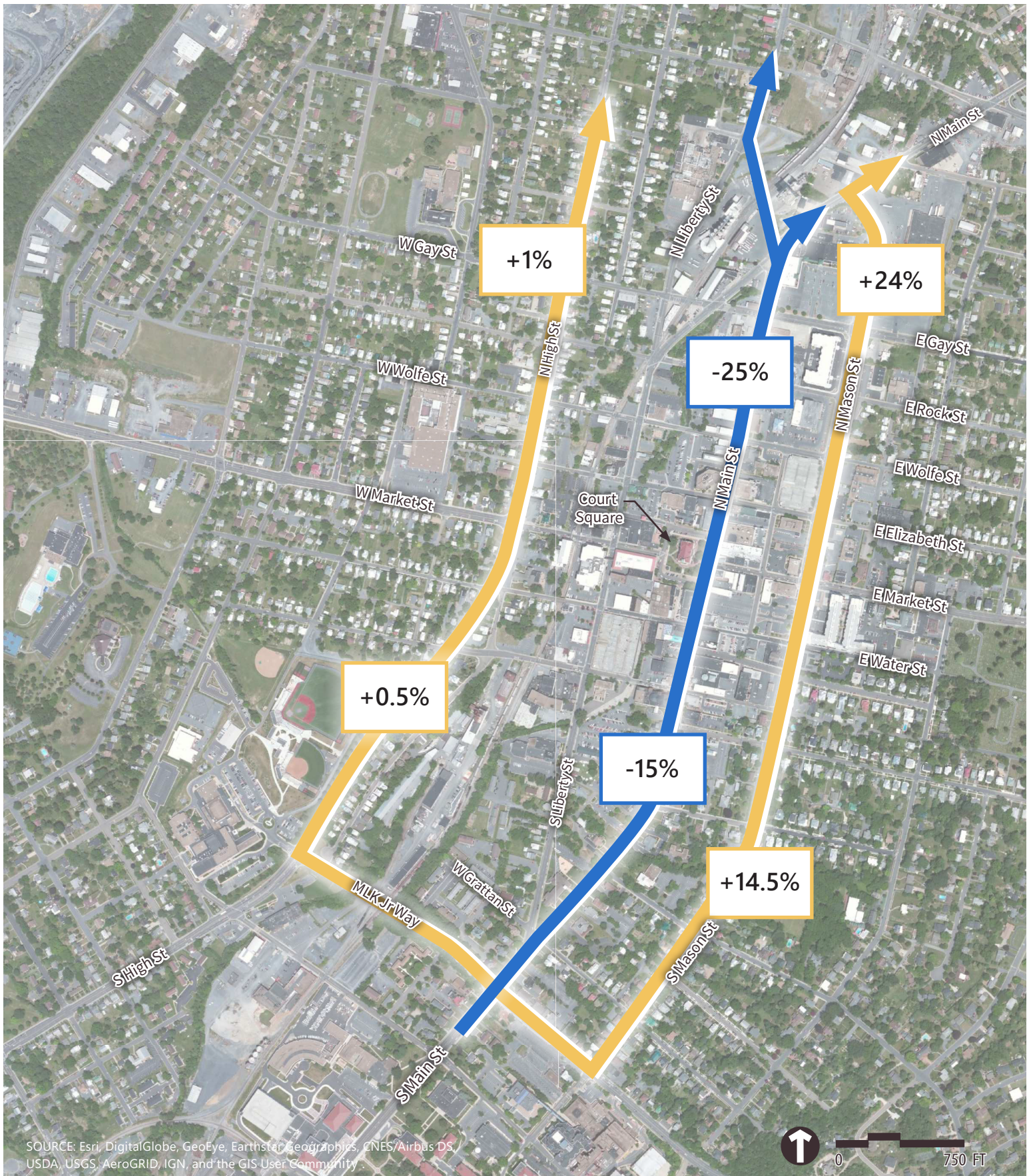
TDMs are mathematical models that forecast future travel demand based on current conditions and future projections of household and employment characteristics. The TDM performs traffic routing assignment based on roadway capacity.

VDOT provided the project team with results from the regional TDM for the City of Harrisonburg. These results are from a capacity analysis of Liberty Street and Main Street where the lane reconfiguration concepts were tested. While TDM traffic assignment is not completely comprehensive (e.g., focuses on high-level roadway capacity and does not consider detailed impedance factors such as pedestrian activity, signal control, street parking, or driveway movements), it provides a starting point for understanding traffic diversion patterns. The TDM

indicated the following results which are described on the next page and shown in Figures 2.6 and 2.7:

- One lane reconfiguration on Liberty Street: Approximately 25% of all traffic diverts off of Liberty Street. Roughly half of the diversion traffic is projected to route onto High Street, then back to S. Main Street via MLK Jr. Way. The other half of the diversion traffic is expected to distribute itself through the network.
- One lane road reconfiguration on Main Street: Approximately 15-25% of all traffic diverts off of Main Street (15% on S. Main Street, 25% on N. Main Street). Almost all the diversion traffic is expected to utilize Mason Street.





**FIGURE 2.6**  
**TDM Northbound Main Street Rerouting Results**

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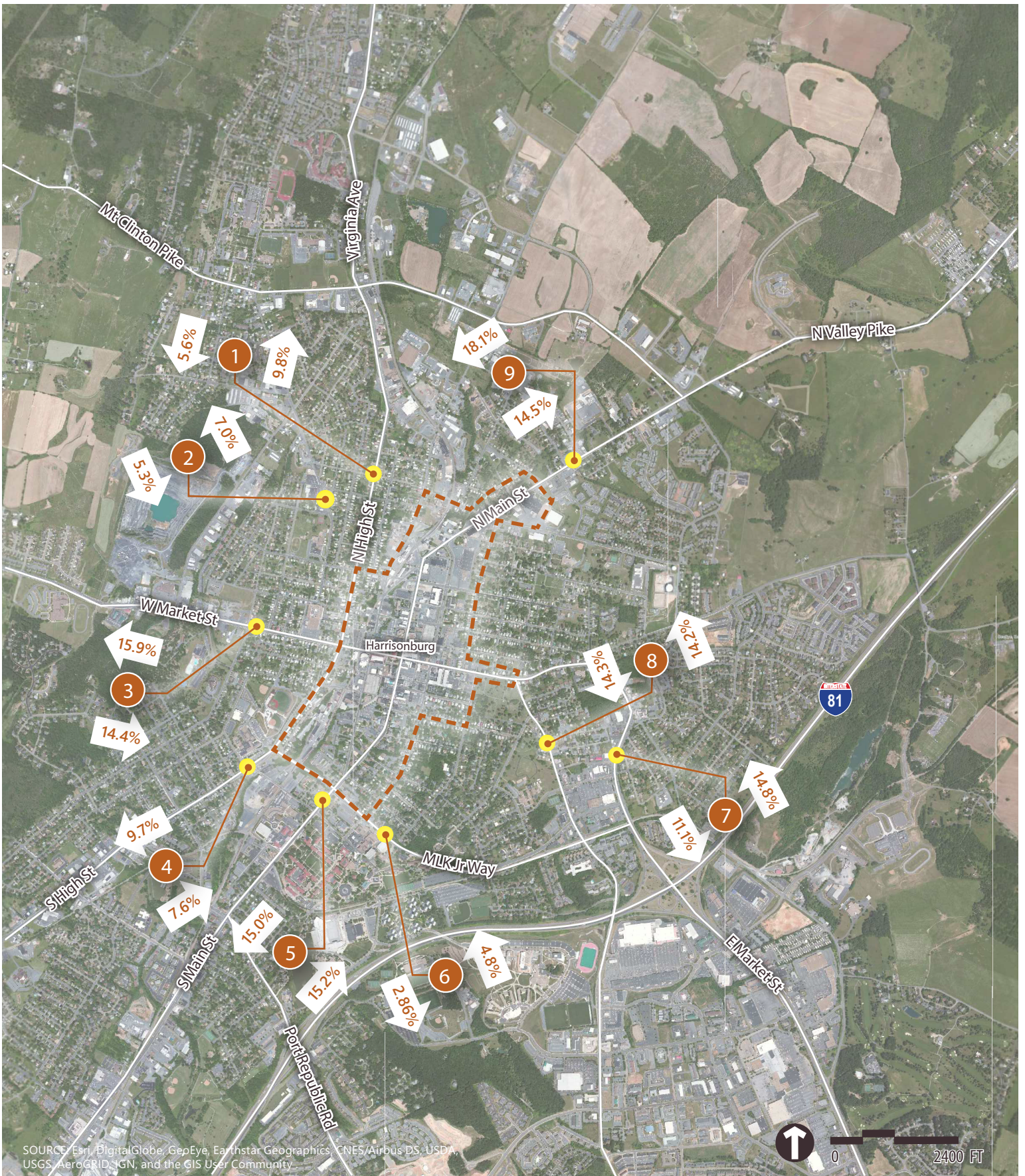
**FIGURE 2.7**  
**TDM Southbound Liberty Street Rerouting Results**  
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 Harrisonburg, Virginia

## StreetLight Data

The TDM results help to understand where a driver may re-route based on available capacity on parallel routes. To better understand a route diversion a driver may choose, it is important to understand the origin and destination of vehicles that pass through the Downtown area.

StreetLight data is an anonymous big data source that utilizes mobile phone location data to report origins and destinations. StreetLight data is based on continual trips, which are defined as trips that do not stop for a period of greater than five minutes. For this study, VHB worked with VDOT to conduct a StreetLight analysis of origin-destination data for drivers that pass directly through the Downtown area without stopping, otherwise known as pass-through traffic.

Nine (9) locations, or "gates," were established outside the Downtown core. These nine (9) exterior gates are located on all the major entry/exit points to the Downtown area. Traffic that passes through one of these gates is tracked to the other defined locations and then reported as a percentage of traffic flow. A "Middle Filter" gate was defined to cover the Downtown area. This type of gate captures the pass-through traffic that enters an exterior gate, passes through the "Middle Filter", and then exits through an exterior gate. Figure 2.8 shows the gate locations and the origins and destinations of the captured Downtown pass-through traffic.



**FIGURE 2.8**  
**STREETLIGHT DOWNTOWN PASS-THROUGH TRAFFIC**  
**ORIGIN AND DESTINATION**  
 Harrisonburg Downtown Enhancements Traffic Impact Analysis  
 Harrisonburg, Virginia



StreetLight data indicates that during the 3-7 PM period on a typical Tuesday-Thursday, a total of 33,801 vehicles enter the Downtown Area via the defined gates. Approximately 24% of these vehicles (8,179 vehicles) are pass-through trips that traverse the Downtown area without stopping; these pass-through trips are the potential vehicles that would reroute. This estimation of the pass-through traffic percentage is nearly identical to the rerouting results of the TDM model as shown previously in Figures 2.6 and 2.7. Therefore, an assumption was made that this percentage represents the volume that is anticipated to re-route if capacity is reduced due to a lane reconfiguration.

Once the amount of traffic that may re-route as a result of the lane reconfiguration was determined, the next step is to understand the alternate route these vehicles may take. A sufficient sample size of the pass-through traffic was found to enter and/or exit through the defined exterior gates which allows us to draw routing conclusions. Table 2.1 breaks down the captured Downtown pass-through traffic by individual origin and destination, showing the percentage of traffic flow between each origin-destination pair.

**Table 2.1: StreetLight Origin-Destination Data by Percentage of Origin**

Origins	Destinations								
	Virginia Avenue	Chicago Avenue	W Market Street	S High Street	S Main Street	Reservoir Street	MLK Way	E Market Street	N Main Street
1. Virginia Avenue	0.00%	1.43%	2.15%	10.39%	34.05%	21.51%	8.24%	19.71%	2.51%
2. Chicago Ave	0.00%	0.00%	2.03%	4.57%	21.83%	36.04%	10.66%	21.32%	3.55%
3. W Market Street	0.44%	0.89%	0.00%	4.89%	12.67%	28.89%	8.89%	32.00%	11.33%
4. S High Street	9.85%	2.19%	7.66%	0.00%	6.57%	13.87%	2.19%	17.15%	40.51%
5. S Main Street	4.46%	3.99%	5.16%	2.82%	0.00%	10.80%	3.76%	15.02%	53.99%
6. Reservoir Street	13.79%	15.27%	36.45%	6.16%	6.16%	0.00%	0.74%	5.67%	15.76%
7. MLK Way	14.10%	10.26%	25.64%	11.54%	7.69%	7.69%	0.00%	5.13%	17.95%
8. E Market Street	10.83%	12.42%	43.63%	8.60%	8.92%	3.82%	2.23%	0.00%	9.55%
9. North Valley Pike	2.20%	2.68%	12.20%	20.24%	38.54%	9.76%	4.88%	9.51%	0.00%

One of the primary takeaways from Table 2.1 (yellow highlights) is that StreetLight data indicates that 41-54% of the northbound pass-through traffic (entering the Downtown area from S. High Street and S. Main Street) is destined for N. Main Street. Another 26-31% of traffic from these two origins is destined for either Reservoir Street or E. Market Street (orange highlights). This origin-destination data suggests Mason Street is a viable routing alternative for approximately 70% of northbound pass-through traffic. An additional conclusion (blue highlight) is that 14-50% (weighted average of 23%) of northbound pass-through traffic (entering the Downtown area from South High Street, S. Main Street, and Martin Luther King Jr. Way) is destined for Virginia Avenue / Chicago Avenue / W Market Street. This data indicates that High Street is a viable routing alternative for this portion of northbound traffic.

In the southbound direction, data indicates (green highlight) that nearly 59% of southbound pass-through trips (from North Valley Pike) are destined for streets south of the Downtown area. These trips are likely to utilize High Street or Mason Street as a routing alternative to Liberty Street. Traffic from the northwest (Virginia Avenue and Chicago Avenue) is predominantly passing through Downtown to head east on East Market Street and Reservoir Street (red highlight). This traffic is likely to distribute throughout the network on various east-west and north-south corridors to percolate southeast towards these two destination corridors.

### Proposed Rerouting

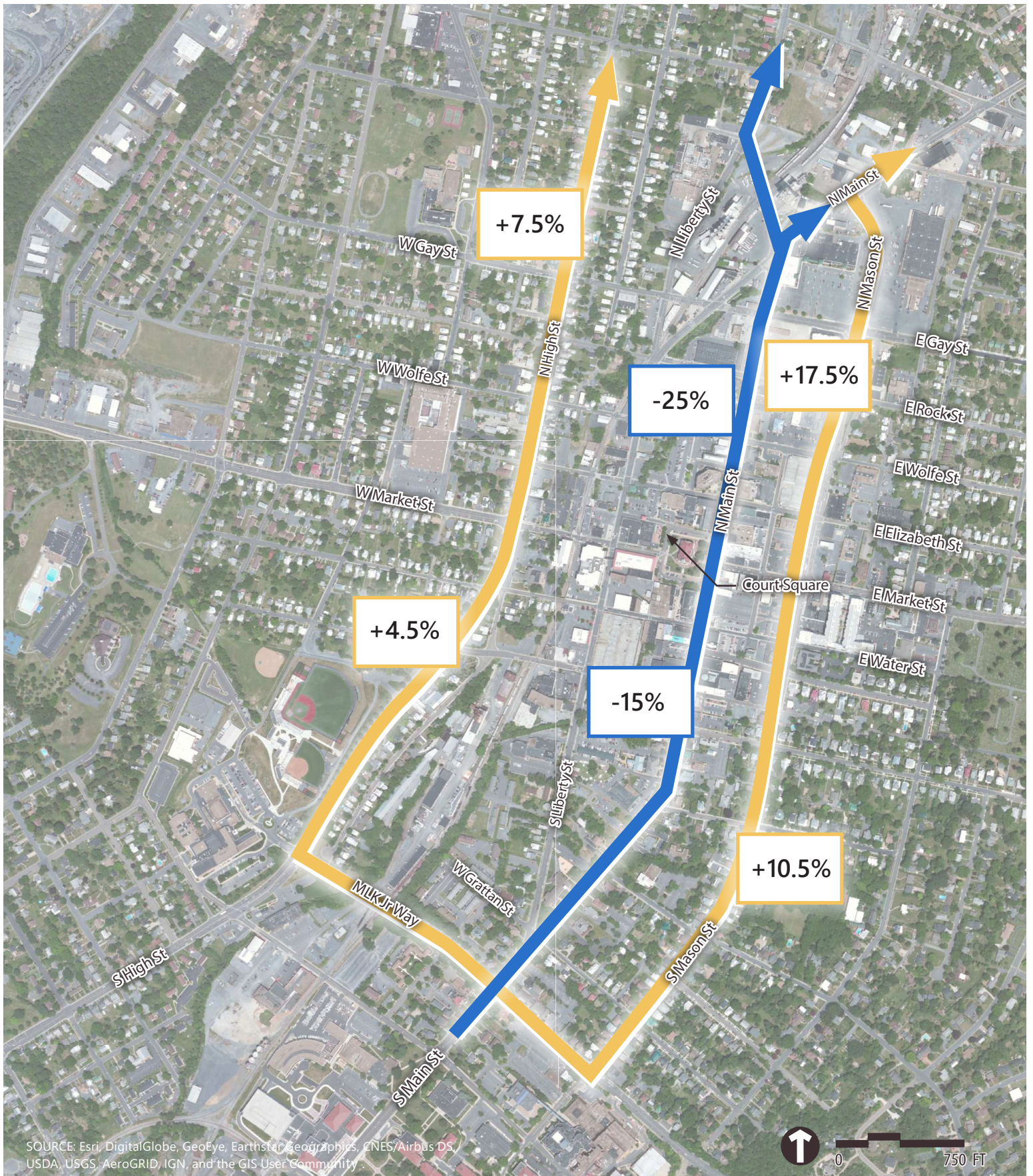
While the percentages shown in Table 2.1 and analyzed in the previous section show the anticipated origin-destination patterns of pass-through traffic on any route through the StreetLight "Middle Filter" (i.e., Downtown); due to the physical extents of the "Middle Filter" (i.e., excluding High Street and N. Mason Street), an assumption is made that the results represent the traffic patterns along Main Street and Liberty Street specifically. Given the data results, the proposed rerouting shown in Figures 2.9 and 2.10 is recommended. Approximately 25% of Liberty Street traffic is proposed to divert with half of this diversion (i.e., 12.5%) shifted onto southbound High Street and the other half split between southbound Mason Street (~6%) and roads outside the study network (~6%). Approximately 15% of South Main Street traffic is proposed to be diverted and 25% of North Main Street traffic is proposed to be diverted. 70% of this diversion shifts to northbound Mason Street with the remaining 30% of the diversion shift onto northbound High Street.

The resultant change in traffic volumes predicted due to re-routing in the northbound and southbound direction are shown in Figures 2.11-2.16. The resultant 2030 Build Volumes are shown in Figures 2.17-2.20.



**FIGURE 2.9**  
**Proposed Southbound Liberty Street Volume Rerouting**

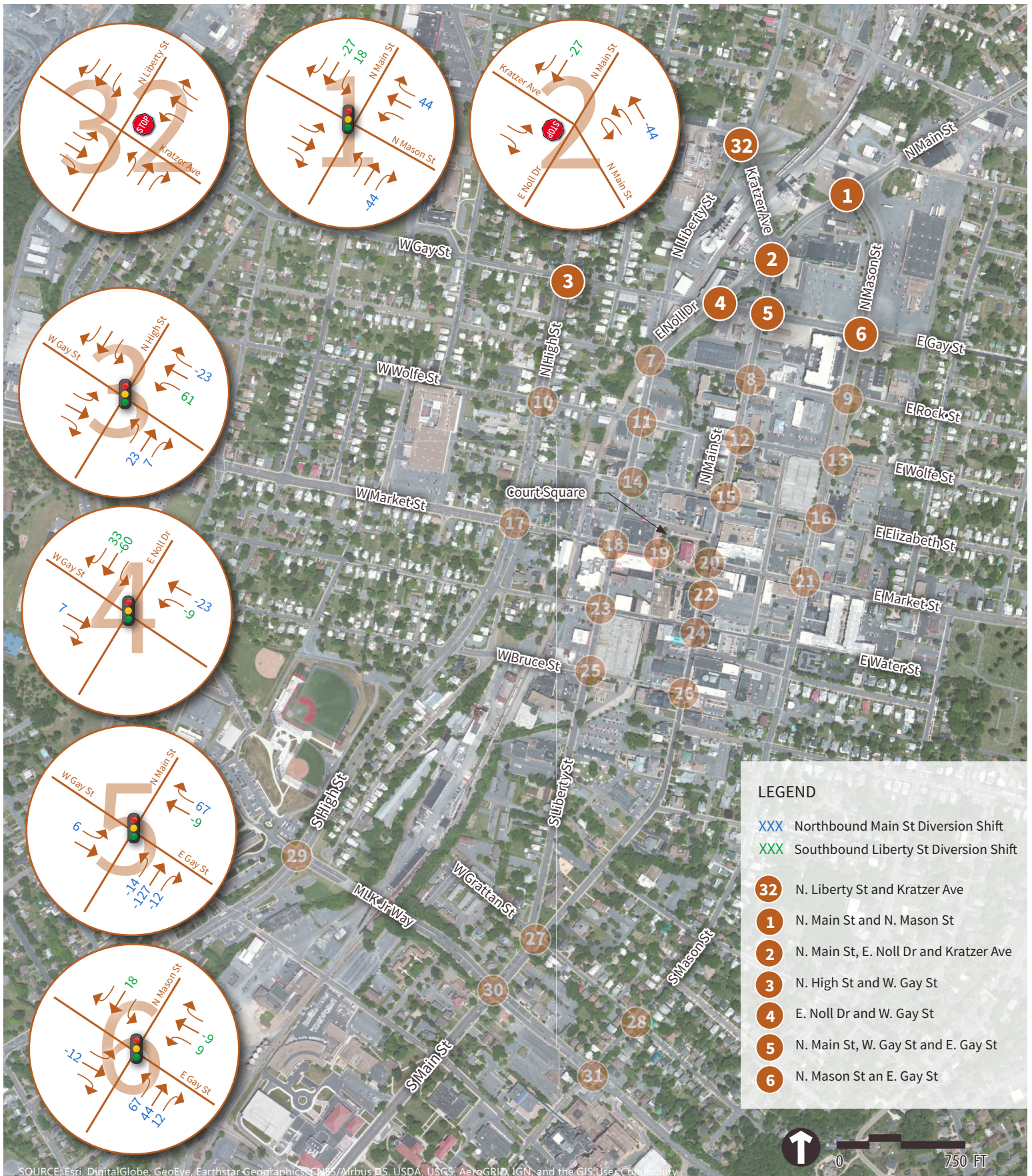
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**FIGURE 2.10**  
**Proposed Northbound Main Street Volume Rerouting**

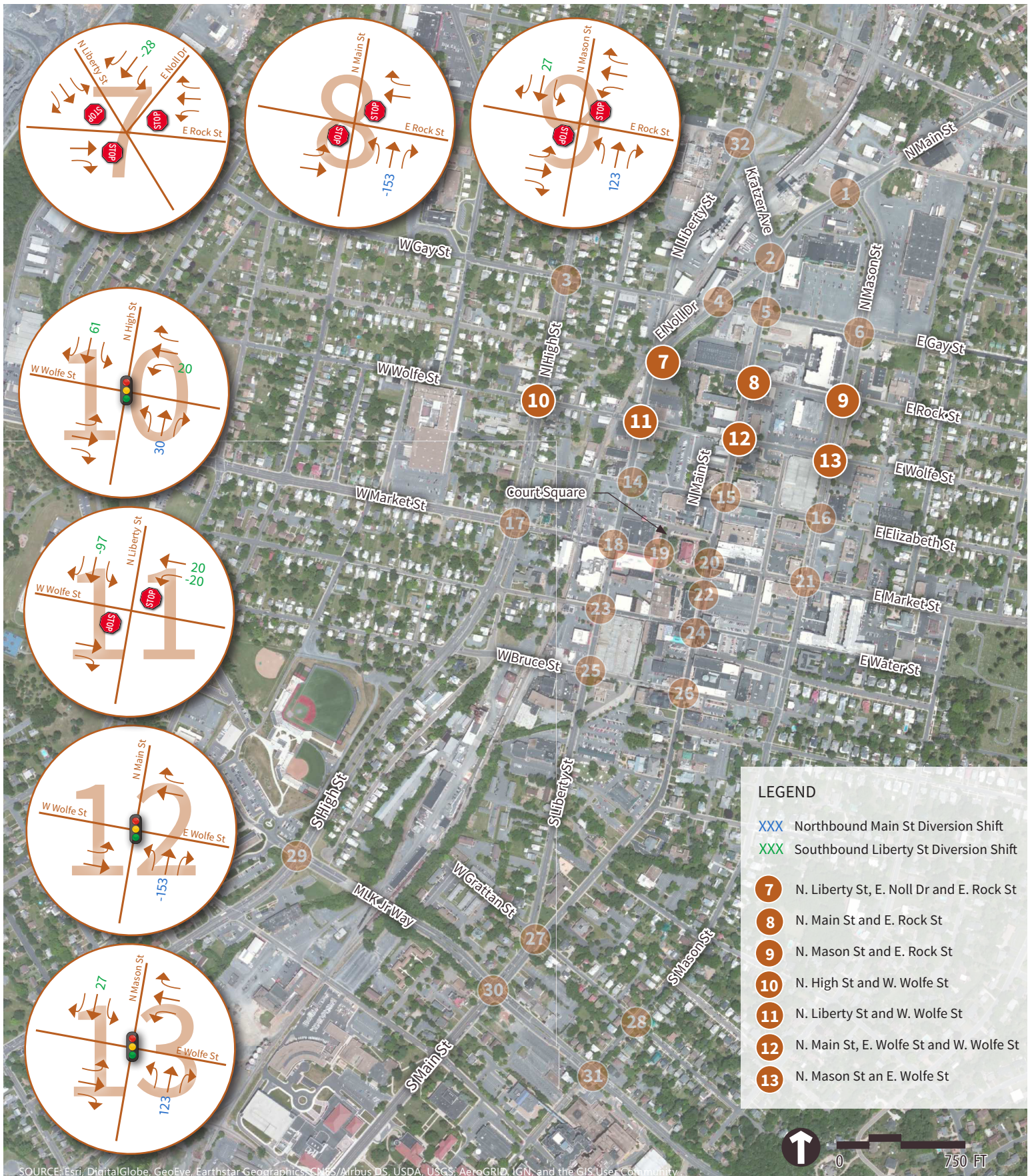
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**FIGURE 2.11**  
**2030 NO BUILD TDM (DELTA)**

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 Harrisonburg, Virginia



**FIGURE 2.12**  
**2030 NO BUILD TDM (DELTA)**  
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 Harrisonburg, Virginia



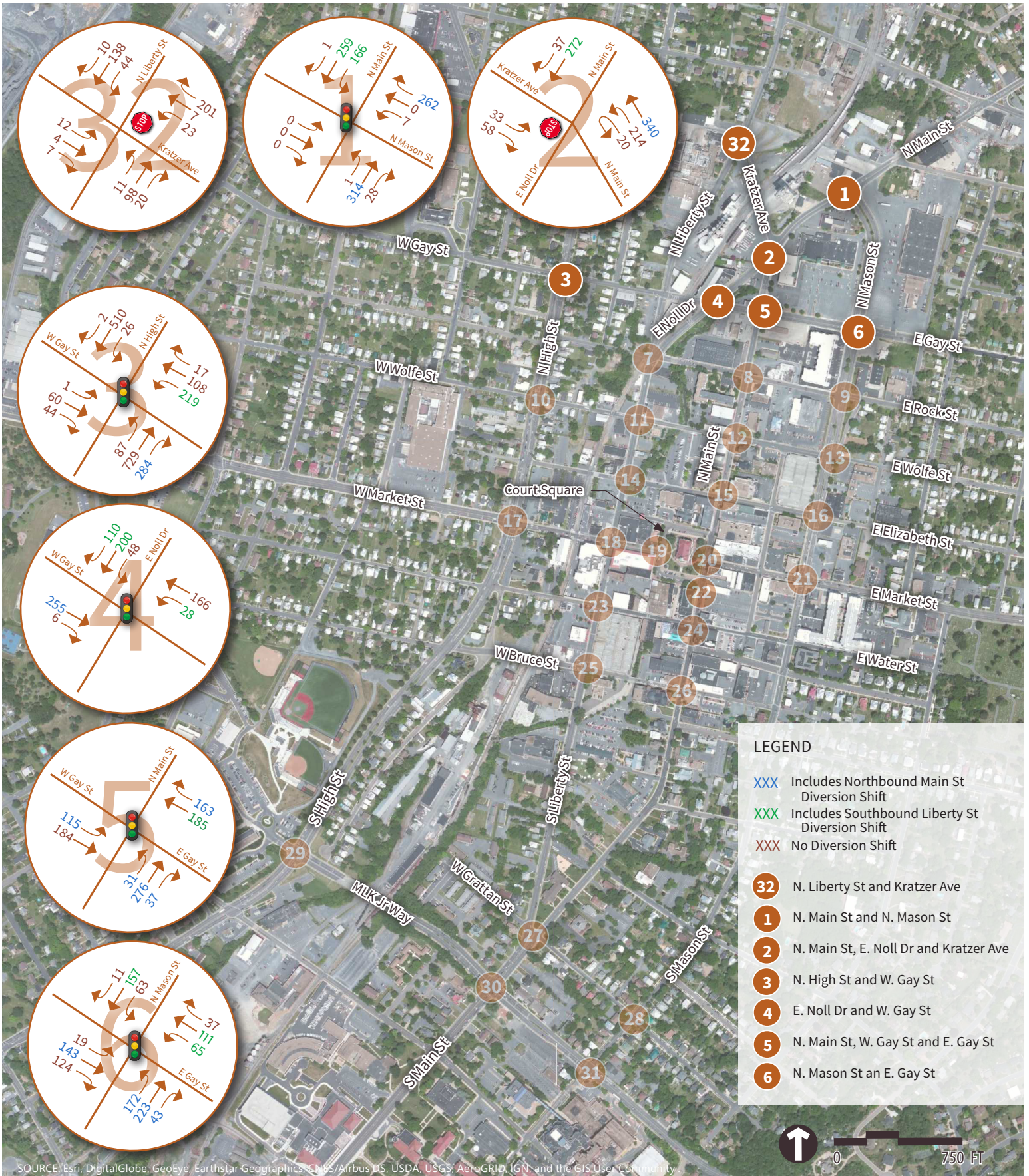
**FIGURE 2.13**  
**2030 NO BUILD TDM (DELTA)**  
 Harrisonburg Downtown Enhancements Traffic Impact Analysis  
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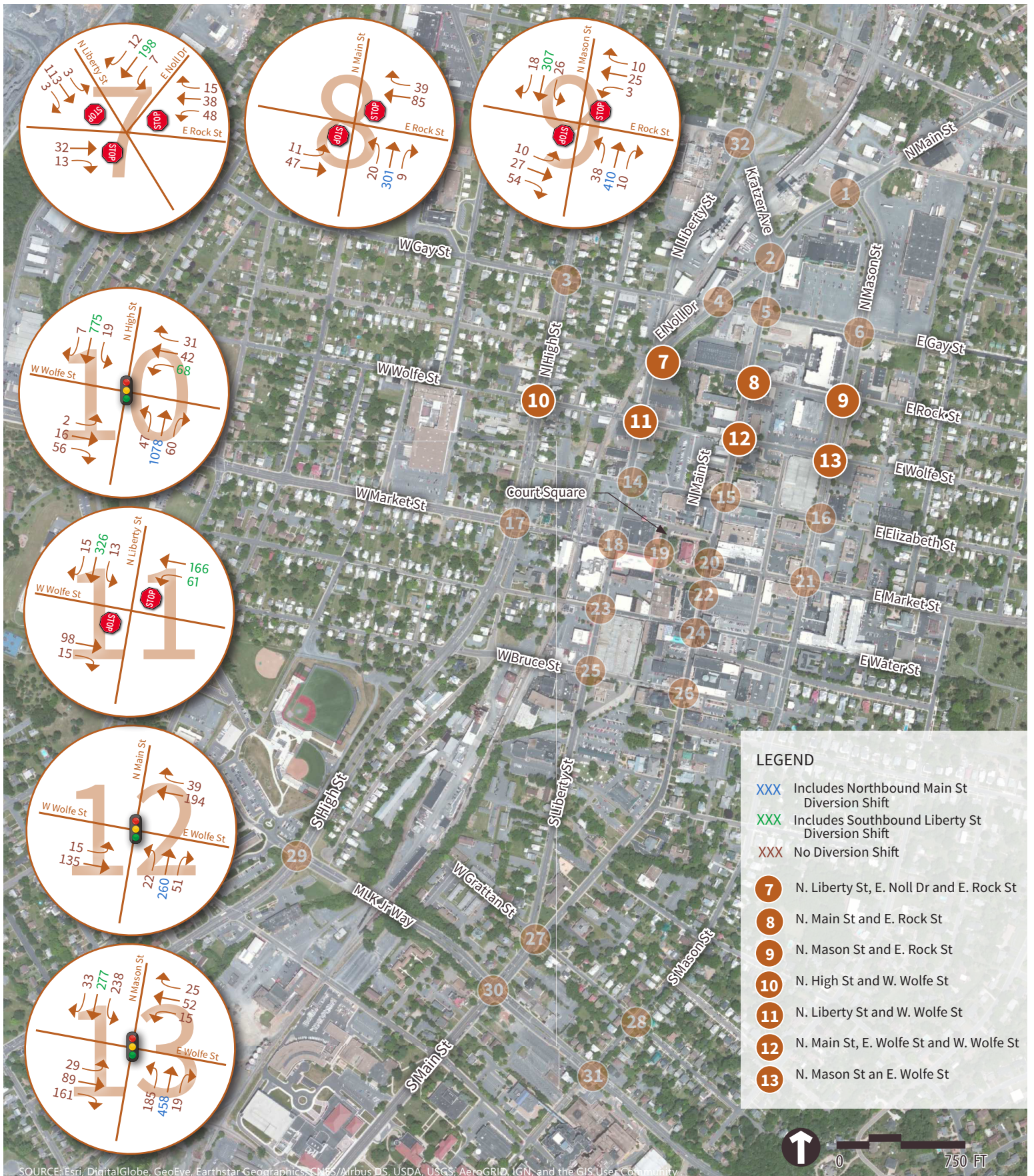
**FIGURE 2.14**  
**2030 NO BUILD TDM (DELTA)**  
 Harrisonburg Downtown Enhancements Traffic Impact Analysis  
 Harrisonburg, Virginia



**FIGURE 2.15**  
**2030 NO BUILD TDM (DELTA)**  
 Harrisonburg Downtown Enhancements Traffic Impact Analysis  
 Harrisonburg, Virginia

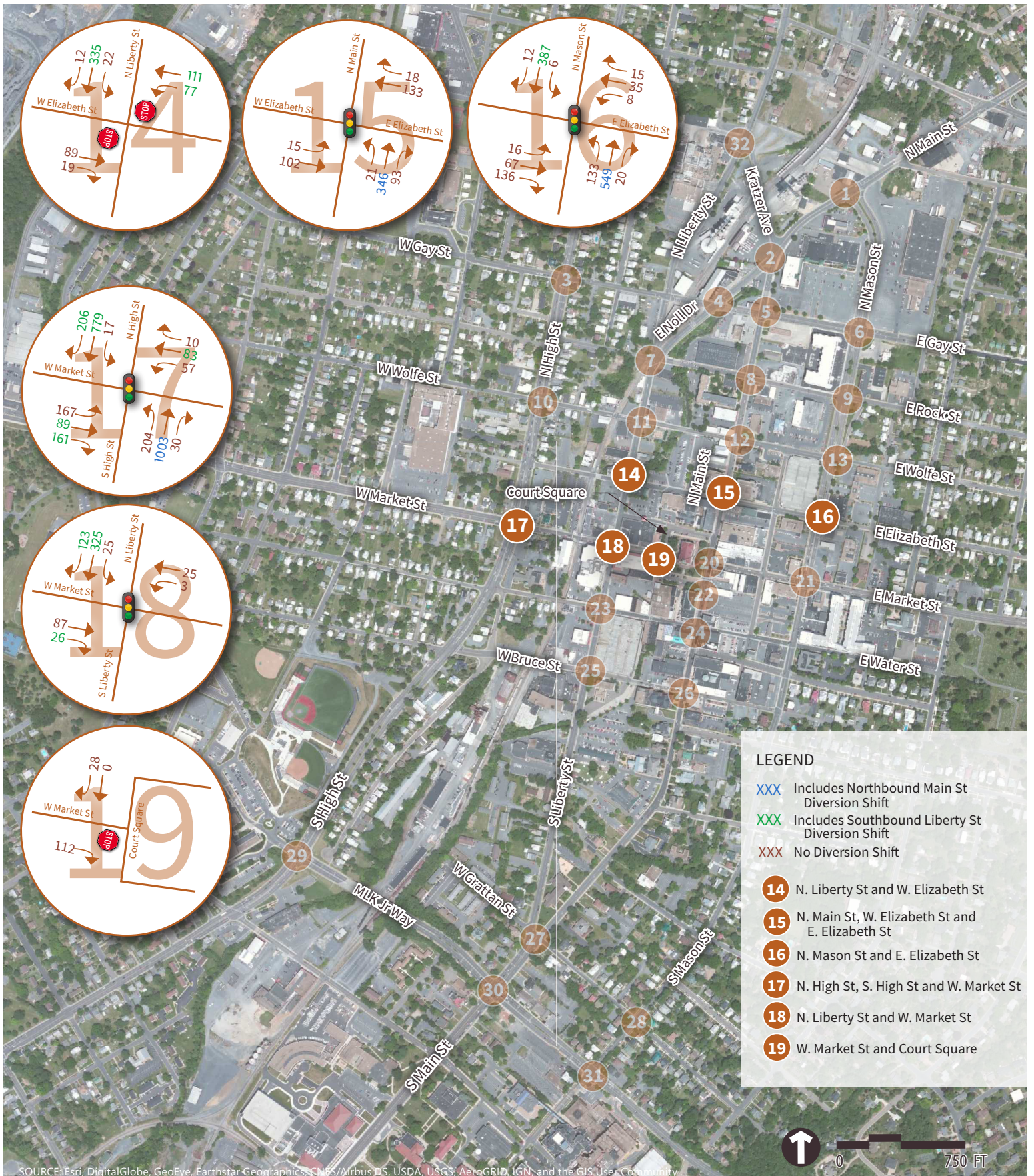


**FIGURE 2.16**  
**2030 BUILD TDM (TOTAL)**  
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**FIGURE 2.17**  
**2030 BUILD TDM (TOTAL)**

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 Harrisonburg, Virginia



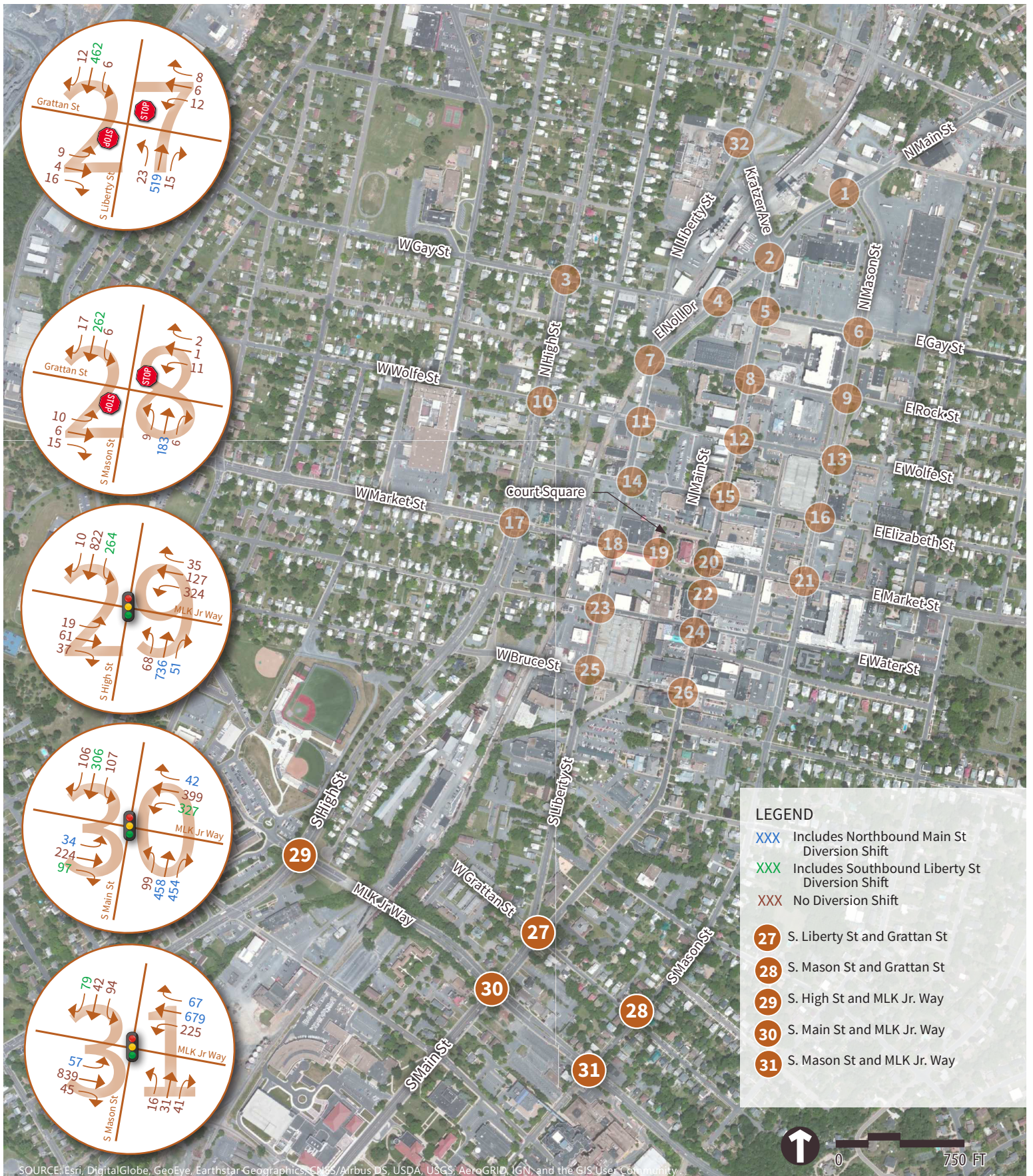
**FIGURE 2.18**  
**2030 BUILD TDM (TOTAL)**

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FIGURE 2.19  
2030 BUILD TDM (TOTAL)



**FIGURE 2.20**  
**2030 BUILD TDM (TOTAL)**

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## Build Model Adjustment Factors

In order to estimate the average worst case impact to travel conditions with the implementation of any of the three (3) scenarios, changes were made to the factors used within the Synchro model. These changes were made to reflect how driver behavior would change due to the anticipated lane modifications. The saturated flow rate, or capacity available per lane, was reduced on the streets in the Downtown area between Bruce Street and Gay Street to represent anticipated conditions in the build models. The saturated flow rate, or capacity, of a roadway is a critical element in estimating the capacity of an intersection. Saturation flow rate describes the number of passenger cars that could pass through an intersection in a dense flow under ideal conditions. The HCM has established methods for estimating the saturation flow rate that includes several adjustment factors which influence the saturated flow rate at an intersection. Several of these factors are expected in a Downtown corridor, such as parking maneuvers, pedestrian activity, loading activities and other elements that can impact traffic flow within a Downtown urban area. Additionally, the capacity was further reduced for Main Street and Liberty Street in the scenarios where a one-lane section was proposed.

The 2030 build model *Synchro* reports are located in Appendix G and the *SimTraffic* queuing and blocking reports are located in Appendix H.

## 2030 Build Improved Models

Intersection capacity analysis for the 2030 build improved conditions was performed using models that contain the three (3) roadway configurations used in the build models as well as approved operational improvements that may alleviate projected deficiencies in the no build and build intersection operations. As discussed previously, many of these intersection operation deficiencies are existing conditions that are expected to exist in the no build condition, prior to any lane reconfiguration.

The 2030 build improved models contain the same adjustment factors in the 2030 build models.

## Operational Recommendations

- 1) S. Main Street and MLK Jr. Way intersection:
  - Evaluate the operational impact of converting the existing westbound left/through lane to a through only lane to allow for the removal of traffic signal split-phasing in the eastbound and westbound direction
  - This recommendation was applied to all three (3) build scenarios.

2) Mason Street and E. Market Street intersection:

- Convert the northbound approach to two travel lanes (one left/through and one through/right) for the full length of upstream block. Mason Street north of E. Market Street is already two lanes. It is anticipated that this recommendation can be done within the existing curb space but would require the removal of two parking spots.
- This recommendation was applied to the following build scenarios:
  - Lane reconfiguration on Main Street only
  - Lane reconfiguration on both Liberty Street and Main Street

3) S. High Street / MLK Jr. Way intersection:

- Extend the S. High Street southbound left-turn storage bay by 100 feet to fully accommodate anticipated future no build and build southbound left-turn queues. This recommendation can be construction within existing right-of-way but would require the modification of the landscaped median.
- This recommendation was applied to the following build scenarios:
  - Lane reconfiguration on Liberty Street only
  - Lane reconfiguration on both Liberty Street and Main Street

### 3 Operational Analysis

As part of the study, an operational analysis of signalized and key unsignalized intersections along the Downtown and surrounding corridors was conducted. The evaluation examined 2030 no build, 2030 build conditions under three build scenarios and 2030 build improved conditions under three build scenarios. The analysis of the 2030 no build, build and build conditions demonstrate that several intersections within the corridor are anticipated to operate within capacity and are able accommodate the lane reconfiguration scenarios as described previously in this report.

#### Measures of Effectiveness

The measures of effectiveness (MOEs) obtained from the model include control delay (and corresponding level of service), 95<sup>th</sup> percentile queue lengths for critical intersections and travel time. These MOE's are described in detail below.

#### Delay and Level of Service Analysis

Capacity analysis results are expressed in terms of Level of Service (LOS). LOS is a qualitative measurement of traffic operations. It is translated from a measure of delay to drivers in units of time, seconds per vehicle. The Transportation Research Board's Highway Capacity Manual (HCM) defines six levels of service for intersections with LOS "A" representing operating conditions with minimal constraints on traffic movements and LOS "F" representing extremely congested operating conditions. LOS "D" is considered the threshold of acceptable operations for an overall intersection as it balances the need for peak hour capacity with infrastructure needs. Exhibit 18-4 of the HCM gives the criteria for signal-controlled intersections, while HCM Exhibit 19-1 gives the criteria for unsignalized intersections.

**Table 3.1 HCM Level of Service Criteria**

HCM Exhibit 18-4: Level of Service Criteria		HCM Exhibit 19-1: Level of Service Criteria	
Signalized Level of Service	Signal Delay per Vehicle (sec/veh)	Unsignalized Level of Service	Stopped Delay per Vehicle (sec/veh)
A	≤ 10.0	A	≤ 10.0
B	> 10.0 and ≤ 20.0	B	> 10.0 and ≤ 15.0
C	> 20.0 and ≤ 35.0	C	> 15.0 and ≤ 25.0
D	> 35.0 and ≤ 55.0	D	> 25.0 and ≤ 35.0
E	> 55.0 and ≤ 80.0	E	> 35.0 and ≤ 50.0
F	> 80.0	F	> 50.0

*Synchro 10.0* was the software tool used in determining the delay, capacity and corresponding LOS for most of the study intersections. There were 10 intersections identified that are believed to operate at an oversaturated condition in the peak hour. These are locations where queues are anticipated to impact certain movements. To better understand the conditions at these locations, delay was calculated using *SimTraffic*. *SimTraffic* is a microscopic analysis tool that simulates the characteristics and interactions of individual simulated vehicle travel times as opposed to Highway Capacity Manual equations and is believed to be a more accurate representation of traffic conditions. Intersections where *SimTraffic* was used to report delay and LOS are listed below:

- North Main Street and North Mason Street/Entrance
- North High Street and West Gay Street
- North Mason Street and East Gay Street
- North High Street and West Wolfe Street
- North Mason and East Wolfe Street
- South/North High Street and West Market Street
- North Main Street and East Market Street
- South High Street and Martin Luther King Jr. Way
- South Main Street and Martin Lither King Jr. Way
- South Mason Street and Martin Luther King Jr. Way

The delay and LOS information for the 2030 no build, build, and build improved conditions for the three scenarios are presented in Table 3.2.

Table 3.2 No Build, Build and Build Improved Scenarios Delay and LOS Summary

Intersection Number:		1		Intersection ID:		1		Intersection Name: N Main St & N Mason St/Entrance **											
Scenario	Overall Delay (LOS)	Delay per Lane Group by Approach [sec/veh]																	
		(Level of Service)																	
		Eastbound			Westbound			Northbound			Southbound								
LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT					
<b>PM Peak Hour - Base Models</b>																			
No Build 2030	11 (B)	38.4 (D)	21.2 (C)	6.3 (A)	5.8 (A)	1.5 (A)	1.5 (A)	68.1 (E)	0.4 (A)	2.4 (A)	0 (I)	0 (I)	0 (I)	0 (I)	0 (I)				
Optimized		18.3 (B)						2.7 (A)					4.6 (A)		0 (I)				
Build Liberty Street Only	4.8 (A)	6.1 (A)	6.1 (A)	2.9 (A)	5 (A)	1.5 (A)	1.5 (A)	57.7 (E)	0.6 (A)	4.6 (A)									
Build Main Street Only	8 (A)	32.5 (C)	17.6 (B)	6 (A)	4.2 (A)	1.4 (A)	3 (A)	69.9 (E)	0.5 (A)	3.1 (A)									
Build Both Rerouting	8.2 (A)	17.6 (B)	17.6 (B)	5.1 (A)	4.2 (A)	1.5 (A)	1.3 (A)	66.1 (E)	0.5 (A)	3 (A)									
<b>PM Peak Hour - Improved Build Models</b>																			
Improved Liberty Only	4.8 (A)	6 (A)	6 (A)	2.6 (A)	4.8 (A)	1.6 (A)	1.7 (A)	59.1 (E)	0.9 (A)	4.6 (A)									
Improved Main Only	7.8 (A)	25.1 (C)	16.8 (B)	5.1 (A)	4 (A)	1.4 (A)	0.4 (A)	65 (E)	0.5 (A)	3.1 (A)									
Improved Both	7.9 (A)	16.4 (B)	16.4 (B)	4.7 (A)	4.5 (A)	1.5 (A)	1 (A)	74.5 (E)	0.6 (A)	3.1 (A)									

Intersection Number:		2		Intersection ID:		2		Intersection Name: Noll St/N Main St & Kratzer Ave											
Scenario	Overall Delay (LOS)	Delay per Lane Group by Approach [sec/veh]																	
		(Level of Service)																	
		Eastbound			Westbound			Northbound			Southbound								
LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT					
<b>PM Peak Hour - Base Models</b>																			
No Build 2030	1.4 (I)																		
Optimized																			
Build Liberty Street Only	1.2 (I)																		
Build Main Street Only	1.5 (I)																		
Build Both Rerouting	1.5 (I)																		
<b>PM Peak Hour - Improved Build Models</b>																			
Improved Liberty Only	1.2 (I)																		
Improved Main Only	1.5 (I)																		
Improved Both	1.5 (I)																		

Intersection Number:		3		Intersection ID:		3		Intersection Name: N High St & W Gay St **											
Scenario	Overall Delay (LOS)	Delay per Lane Group by Approach [sec/veh]																	
		(Level of Service)																	
		Eastbound			Westbound			Northbound			Southbound								
LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT					
<b>PM Peak Hour - Base Models</b>																			
No Build 2030	28.3 (C)	84.8 (F)	59.8 (E)	35.1 (D)	51.6 (D)	44.4 (D)	35.2 (D)	35.8 (D)	33.4 (C)	5.1 (A)	24 (C)	17 (B)	17 (B)						
Optimized		44.6 (D)			47.2 (D)			23.9 (C)				18.3 (B)							
Build Liberty Street Only	32.4 (C)	53.2 (E)	53.2 (E)	25 (C)	57.5 (E)	47.2 (D)	35.5 (D)	39 (D)	39.5 (D)	5.6 (A)	27.2 (C)	19.4 (B)	10.2 (B)						
Build Main Street Only	24.9 (C)	47 (D)	53.9 (E)	26.2 (C)	55.7 (E)	44 (D)	31 (C)	26.9 (C)	25.5 (C)	4.3 (A)	25.6 (C)	18 (B)	8.1 (A)						
Build Both Rerouting	32.6 (C)	34.7 (C)	57.5 (E)	31.5 (C)	63.8 (E)	47.8 (D)	39.4 (D)	39 (D)	37.8 (D)	5.9 (A)	27.4 (C)	19.6 (B)	10.1 (B)						
<b>PM Peak Hour - Improved Build Models</b>																			
Improved Liberty Only	31.5 (C)	52.1 (D)	52.1 (D)	26.8 (C)	60.5 (E)	47.6 (D)	38.3 (D)	36 (D)	36.8 (D)	5.2 (A)	25.6 (C)	18.6 (B)	9.2 (A)						
Improved Main Only	26.2 (C)	52.5 (D)	52.5 (D)	27.8 (C)	58.8 (E)	44.4 (D)	33.4 (C)	28.4 (C)	27.7 (C)	4.7 (A)	25.4 (C)	17.8 (B)	12.7 (B)						
Improved Both	30.8 (C)	45.6 (D)	57 (E)	28.6 (C)	58.7 (E)	44.8 (D)	32.5 (C)	38.5 (D)	35.7 (D)	5.6 (A)	25.2 (C)	19.6 (B)	8.3 (A)						

Intersection Number:		4		Intersection ID:		4		Intersection Name: Noll St & W Gay St											
Scenario	Overall Delay (LOS)	Delay per Lane Group by Approach [sec/veh]																	
		(Level of Service)																	
		Eastbound			Westbound			Northbound			Southbound								
LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT					
<b>PM Peak Hour - Base Models</b>																			
No Build 2030	10.1 (B)																		
Optimized																			
Build Liberty Street Only	14.1 (B)																		
Build Main Street Only	10.9 (B)																		
Build Both Rerouting	12.1 (B)																		
<b>PM Peak Hour - Improved Build Models</b>																			
Improved Liberty Only	14.3 (B)																		
Improved Main Only	10.9 (B)																		
Improved Both	12.1 (B)																		

Intersection Number:		5		Intersection ID:		5		Intersection Name: E Gay St & N. Main St											
Scenario	Overall Delay (LOS)	Delay per Lane Group by Approach [sec/veh]																	
		(Level of Service)																	
		Eastbound			Westbound			Northbound			Southbound								
LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT					
<b>PM Peak Hour - Base Models</b>																			
No Build 2030	11.3 (B)	16.4 (B)	16.4 (B)																
Optimized		16.4 (B)											0 (A)						
Build Liberty Street Only	10.9 (B)	14.2 (B)	14.2 (B)																
Build Main Street Only	17.2 (B)	18.3 (B)	18.3 (B)																
Build Both Rerouting	17.6 (B)	18.3 (B)	18.3 (B)																
<b>PM Peak Hour - Improved Build Models</b>																			
Improved Liberty Only	10.9 (B)	14.2 (B)	14.2 (B)																
Improved Main Only	17.2 (B)	18.3 (B)	18.3 (B)																
Improved Both	17.5 (B)	18.3 (B)	18.3 (B)																

Intersection Number:		6		Intersection ID:		6		Intersection Name: N Mason St & E Gay St **											
Scenario	Overall Delay (LOS)	Delay per Lane Group by Approach [sec/veh]																	
		(Level of Service)																	
		Eastbound			Westbound			Northbound			Southbound								
LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT					
<b>PM Peak Hour - Base Models</b>																			
No Build 2030	18.1 (B)	15.5 (B)	12 (B)	6.3 (A)	14.8 (B)	18.7 (B)	7.5 (A)	26.7 (C)	27.7 (C)	17.1 (B)	25.1 (C)	21.8 (C)	2.1 (A)						
Optimized		11 (B)			17.7 (B)			24.7 (C)				24.5 (C)							
Build Liberty Street Only	19.2 (B)	12.8 (B)	13.8 (B)	8.5 (A)	17.5 (B)	18.6 (B)	10.1 (B)	23.8 (C)	27 (C)	17.4 (B)	23.5 (C)	24.3 (C)	8.5 (A)						
Build Main Street Only	21.4 (C)	9.4 (A)	11.8 (B)	6.2 (A)	18.7 (B)	19.4 (B)	12.3 (B)	29.1 (C)	30.6 (C)	23.5 (C)	24.2 (C)	26.2 (C)	7.9 (A)						
Build Both Rerouting	20.6 (C)	8.9 (A)	10.6 (B)	5.3 (A)	17.6 (B)	19.6 (B)	10.1 (B)	28.8 (C)	28.7 (C)	19.9 (B)	26.8 (C)	26.3 (C)	8.9 (A)						
<b>PM Peak Hour - Improved Build Models</b>																			
Improved Liberty Only	19.1 (B)	10.6 (B)	13.7 (B)	7.5 (A)	18.3 (B)	19 (B)	10.3 (B)	24.2 (C)	26.6 (C)	18.5 (B)	22.1 (C)	24.1 (C)	8.8 (A)						
Improved Main Only	20.6 (C)	9.5 (A)	11.5 (B)	5.6 (A)	17.6 (B)	19.2 (B)	10.3 (B)	28 (C)	29 (C)	23.5 (C)	25.1 (C)	26.3 (C)	6.7 (A)						
Improved Both	21.3 (C)	9 (A)	11.6 (B)	5.6 (A)	19 (B)	18.5 (B)	10 (B)	29.7 (C)	29 (C)	23.7 (C)	26.6 (C)	27.1 (C)	11.9 (B)						

\*\* Intersection is oversaturated; therefore, the delay metrics from SimTraffic microsimulation are presented. If not noted, the intersection results from Synchro are presented.

Intersection Number:		7		Intersection ID:		7		Intersection Name: N Liberty St & W Rock St & Noll St											
Scenario	Overall Delay (LOS)	Delay per Lane Group by Approach [sec/veh]																	
		(Level of Service)																	
		Eastbound			Westbound			Northbound			Southbound								
LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT					
<b>PM Peak Hour - Base Models</b>																			
No Build 2030 Optimized	5.4 (0)		8.3 (A)	4.5 (A)	9 (A)	8.4 (A)	5.9 (A)					3.9 (A)	9.4 (A)	4.1 (A)					
Build Liberty Street Only	4.7 (0)	7.5 (A)	7.5 (A)	6 (A)	7.9 (A)	8.1 (A)	6.4 (A)					8.3 (A)	7.5 (A)	5 (A)					
Build Main Street Only	4.9 (0)		9.6 (A)	5.1 (A)	9.1 (A)	10.1 (B)	8.6 (A)					6.7 (A)	9 (A)	5.9 (A)					
Build Both Rerouting	4.9 (0)		8.2 (A)	5.4 (A)	8.3 (A)	8.2 (A)	6.2 (A)					7.9 (A)	7.9 (A)	5.9 (A)					
<b>PM Peak Hour - Improved Build Models</b>																			
Improved Liberty Only	5 (0)		7.8 (A)	5.8 (A)	9.3 (A)	8.8 (A)	6.4 (A)					7.7 (A)	8.1 (A)	5.3 (A)					
Improved Main Only	4.8 (0)		9.3 (A)	4.5 (A)	8.3 (A)	9.3 (A)	7.6 (A)					6.6 (A)	9.1 (A)	5.4 (A)					
Improved Both	4.8 (0)		7.7 (A)	5.6 (A)	8.7 (A)	8.1 (A)	6 (A)					7.2 (A)	7.9 (A)	6 (A)					

Intersection Number:		8		Intersection ID:		8		Intersection Name: N Main St & W Rock St/E Rock St											
Scenario	Overall Delay (LOS)	Delay per Lane Group by Approach [sec/veh]																	
		(Level of Service)																	
		Eastbound			Westbound			Northbound			Southbound								
LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT					
<b>PM Peak Hour - Base Models</b>																			
No Build 2030 Optimized	4 (0)	14.3 (B)	14.3 (B)				14.6 (B)	14.6 (B)	- (-)	- (-)	- (-)								
Build Liberty Street Only	4 (0)	14.3 (B)	14.3 (B)				14.6 (B)	14.6 (B)	- (-)	- (-)	- (-)								
Build Main Street Only	4.6 (0)	12.8 (B)	12.8 (B)				12.8 (B)	12.8 (B)	- (-)	- (-)	- (-)								
Build Both Rerouting	4.6 (0)	12.8 (B)	12.8 (B)				12.8 (B)	12.8 (B)	- (-)	- (-)	- (-)								
<b>PM Peak Hour - Improved Build Models</b>																			
Improved Liberty Only	4 (0)	14.3 (B)	14.3 (B)				14.6 (B)	14.6 (B)	- (-)	- (-)	- (-)								
Improved Main Only	4.6 (0)	12.8 (B)	12.8 (B)				12.8 (B)	12.8 (B)	- (-)	- (-)	- (-)								
Improved Both	4.6 (0)	12.8 (B)	12.8 (B)				12.8 (B)	12.8 (B)	- (-)	- (-)	- (-)								

Intersection Number:		9		Intersection ID:		9		Intersection Name: N Mason St & E Rock St											
Scenario	Overall Delay (LOS)	Delay per Lane Group by Approach [sec/veh]																	
		(Level of Service)																	
		Eastbound			Westbound			Northbound			Southbound								
LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT					
<b>PM Peak Hour - Base Models</b>																			
No Build 2030 Optimized	3.1 (0)	14.8 (B)	14.8 (B)	14.8 (B)	16.8 (C)	16.8 (C)	16.8 (C)	8.1 (A)	- (-)	- (-)	8 (A)	- (-)	- (-)						
Build Liberty Street Only	3.1 (0)	15.2 (C)	15.2 (C)	15.2 (C)	17.4 (C)	17.4 (C)	17.4 (C)	8.2 (A)	- (-)	- (-)	8 (A)	- (-)	- (-)						
Build Main Street Only	3.1 (0)	16.4 (C)	16.4 (C)	16.4 (C)	19.5 (C)	19.5 (C)	19.5 (C)	8.1 (A)	- (-)	- (-)	8.3 (A)	- (-)	- (-)						
Build Both Rerouting	3 (0)	16.9 (C)	16.9 (C)	16.9 (C)	20.3 (C)	20.3 (C)	20.3 (C)	8.2 (A)	- (-)	- (-)	8.3 (A)	- (-)	- (-)						
<b>PM Peak Hour - Improved Build Models</b>																			
Improved Liberty Only	3.1 (0)	15.2 (C)	15.2 (C)	15.2 (C)	17.4 (C)	17.4 (C)	17.4 (C)	8.2 (A)	- (-)	- (-)	8 (A)	- (-)	- (-)						
Improved Main Only	3.1 (0)	16.4 (C)	16.4 (C)	16.4 (C)	19.5 (C)	19.5 (C)	19.5 (C)	8.1 (A)	- (-)	- (-)	8.3 (A)	- (-)	- (-)						
Improved Both	3 (0)	16.9 (C)	16.9 (C)	16.9 (C)	20.3 (C)	20.3 (C)	20.3 (C)	8.2 (A)	- (-)	- (-)	8.3 (A)	- (-)	- (-)						

Intersection Number:		10		Intersection ID:		10		Intersection Name: N High St & W Wolfe St**											
Scenario	Overall Delay (LOS)	Delay per Lane Group by Approach [sec/veh]																	
		(Level of Service)																	
		Eastbound			Westbound			Northbound			Southbound								
LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT					
<b>PM Peak Hour - Base Models</b>																			
No Build 2030 Optimized	9.7 (A)	13.5 (B)	46.1 (D)	13.1 (B)	45.5 (D)	31.8 (C)	34.8 (C)	15 (B)	8.8 (A)	3.6 (A)	24.3 (C)	4.2 (A)	3.3 (A)						
Build Liberty Street Only	13.7 (B)	41.5 (D)	39 (D)	11.4 (B)	51.8 (E)	28.5 (C)	39.3 (D)	22.9 (C)	14.8 (B)	6.7 (A)	32.2 (C)	5.6 (A)	4.7 (A)						
Build Main Street Only	10.1 (B)	37.8 (D)	42.8 (D)	13.3 (B)	48.7 (D)	26.7 (C)	33.5 (C)	14.3 (B)	8.4 (A)	3.7 (A)	33.6 (C)	5.5 (A)	4.1 (A)						
Build Both Rerouting	14.2 (B)	38.1 (D)	44.1 (D)	13.6 (B)	50.9 (D)	27 (C)	36.7 (D)	23.1 (C)	15.6 (B)	7.4 (A)	33.9 (C)	5.7 (A)	4.6 (A)						
<b>PM Peak Hour - Improved Build Models</b>																			
Improved Liberty Only	11.4 (B)	44.5 (D)	41.3 (D)	12.8 (B)	46.7 (D)	24.9 (C)	32.9 (C)	17.6 (B)	11.1 (B)	5.4 (A)	31.4 (C)	5.2 (A)	3.7 (A)						
Improved Main Only	10.7 (B)	50.8 (D)	43.3 (D)	12.7 (B)	46.8 (D)	27.6 (C)	33.3 (C)	16.7 (B)	9.4 (A)	4.8 (A)	27.7 (C)	5.8 (A)	3.9 (A)						
Improved Both	12.7 (B)	31.2 (C)	41.3 (D)	11.8 (B)	51.4 (D)	27.6 (C)	40.9 (D)	21.1 (C)	13.2 (B)	7.1 (A)	34.1 (C)	5.3 (A)	3 (A)						

Intersection Number:		11		Intersection ID:		11		Intersection Name: N Liberty St & W Wolfe St											
Scenario	Overall Delay (LOS)	Delay per Lane Group by Approach [sec/veh]																	
		(Level of Service)																	
		Eastbound			Westbound			Northbound			Southbound								
LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT					
<b>PM Peak Hour - Base Models</b>																			
No Build 2030 Optimized	7.5 (0)		14.2 (B)	14.2 (B)	18.9 (C)	18.9 (C)							- (-)	- (-)	- (-)				
Build Liberty Street Only	7.9 (0)		13 (B)	13 (B)	17.8 (C)	17.8 (C)							- (-)	- (-)	- (-)				
Build Main Street Only	7.5 (0)		14.2 (B)	14.2 (B)	18.9 (C)	18.9 (C)							- (-)	- (-)	- (-)				
Build Both Rerouting	7.9 (0)		13 (B)	13 (B)	17.8 (C)	17.8 (C)							- (-)	- (-)	- (-)				
<b>PM Peak Hour - Improved Build Models</b>																			
Improved Liberty Only	7.9 (0)		13 (B)	13 (B)	17.8 (C)	17.8 (C)							- (-)	- (-)	- (-)				
Improved Main Only	7.5 (0)		14.2 (B)	14.2 (B)	18.9 (C)	18.9 (C)							- (-)	- (-)	- (-)				
Improved Both	7.9 (0)		13 (B)	13 (B)	17.8 (C)	17.8 (C)							- (-)	- (-)	- (-)				

Intersection Number:		12		Intersection ID:		12		Intersection Name: N Main St & W Wolfe St/E Wolfe St											
Scenario	Overall Delay (LOS)	Delay per Lane Group by Approach [sec/veh]																	
		(Level of Service)																	
		Eastbound			Westbound			Northbound			Southbound								
LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT					
<b>PM Peak Hour - Base Models</b>																			
No Build 2030 Optimized	10 (B)	15.8 (B)	15.8 (B)				17 (B)	17 (B)	4.9 (A)	4.9 (A)	4.9 (A)								
Build Liberty Street Only	10.2 (B)	16.6 (B)	16.6 (B)				17.6 (B)	17.6 (B)	4.7 (A)	4.7 (A)	4.7 (A)								
Build Main Street Only	15.7 (B)	22.6 (C)	22.6 (C)				24.2 (C)	24.2 (C)	6.6 (A)	6.6 (A)	6.6 (A)								
Build Both Rerouting	16 (B)	22.4 (C)	22.4 (C)				24.2 (C)	24.2 (C)	7.4 (A)	7.4 (A)	7.4 (A)								
<b>PM Peak Hour - Improved Build Models</b>																			
Improved Liberty Only	10.8 (B)	16.6 (B)	16.6 (B)				17.6 (B)	17.6 (B)	5.7 (A)	5.7 (A)	5.7 (A)								
Improved Main Only	15.9 (B)	22.6 (C)	22.6 (C)				24.2 (C)	24.2 (C)	7 (A)	7 (A)	7 (A)								
Improved Both	15.7 (B)	22.4 (C)	22.4 (C)				24.2 (C)	24.2 (C)	6.8 (A)	6.8 (A)	6.8 (A)								

\*\* Intersection is oversaturated; therefore, the delay metrics from SimTraffic microsimulation are presented. If not noted, the intersection results from Synchro are presented.



Intersection Number:		13		Intersection ID:		13		Intersection Name:		N Mason St & E Wolfe St **									
Scenario	Overall Delay (LOS)	Delay per Lane Group by Approach [sec/veh]																	
		(Level of Service)																	
		Eastbound			Westbound			Northbound			Southbound								
LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT								
<b>PM Peak Hour - Base Models</b>																			
No Build 2030 Optimized	14.2 (B)	26.6 (C)	24.7 (C)	14.8 (B)	24.7 (C)	18.5 (B)	7.4 (A)	12 (B)	15.3 (B)	4.2 (A)	12.7 (B)	10.9 (B)	5.9 (A)						
Build Liberty Street Only	14.5 (B)	21.9 (C)	23.1 (C)	12.8 (B)	25.5 (C)	20.2 (C)	9.3 (A)	13.3 (B)	15.8 (B)	9.6 (A)	12.7 (B)	12.7 (B)	7.4 (A)						
Build Main Street Only	15.3 (B)	23.5 (C)	24 (C)	14.2 (B)	23 (C)	20.5 (C)	10.5 (B)	13.5 (B)	16.6 (B)	13.1 (B)	14.3 (B)	12.7 (B)	5.1 (A)						
Build Both Rerouting	15.4 (B)	24.2 (C)	24.8 (C)	14.4 (B)	24.9 (C)	20.8 (C)	9.2 (A)	14.2 (B)	16.1 (B)	12 (B)	14.1 (B)	13.2 (B)	5.9 (A)						
<b>PM Peak Hour - Improved Build Models</b>																			
Improved Liberty Only	14.9 (B)	24 (C)	23.7 (C)	14.5 (B)	20.2 (C)	17.5 (B)	7.4 (A)	13.3 (B)	16 (B)	9.7 (A)	13.2 (B)	13.3 (B)	7.1 (A)						
Improved Main Only	15 (B)	23.2 (C)	22.3 (C)	12.7 (B)	24 (C)	21.3 (C)	9.3 (A)	14 (B)	16.3 (B)	12.2 (B)	13.9 (B)	12.5 (B)	6.6 (A)						
Improved Both	15.4 (B)	23.2 (C)	24.4 (C)	15.3 (B)	28.5 (C)	21.3 (C)	9.2 (A)	14.7 (B)	16.1 (B)	11 (B)	13.9 (B)	12.8 (B)	6.8 (A)						

Intersection Number:		14		Intersection ID:		14		Intersection Name:		N Liberty St & W Elizabeth St									
Scenario	Overall Delay (LOS)	Delay per Lane Group by Approach [sec/veh]																	
		(Level of Service)																	
		Eastbound			Westbound			Northbound			Southbound								
LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT								
<b>PM Peak Hour - Base Models</b>																			
No Build 2030 Optimized	6.6 (I)	15 (C)	15 (C)	18.9 (C)	18.9 (C)	18.9 (C)													
Build Liberty Street Only	7.3 (I)	13.4 (B)	13.4 (B)	18.3 (C)	18.3 (C)	18.3 (C)													
Build Main Street Only	6.6 (I)	15 (C)	15 (C)	18.9 (C)	18.9 (C)	18.9 (C)													
Build Both Rerouting	7.3 (I)	13.4 (B)	13.4 (B)	18.3 (C)	18.3 (C)	18.3 (C)													
<b>PM Peak Hour - Improved Build Models</b>																			
Improved Liberty Only	7.3 (I)	13.4 (B)	13.4 (B)	18.3 (C)	18.3 (C)	18.3 (C)													
Improved Main Only	6.6 (I)	15 (C)	15 (C)	18.9 (C)	18.9 (C)	18.9 (C)													
Improved Both	7.3 (I)	13.4 (B)	13.4 (B)	18.3 (C)	18.3 (C)	18.3 (C)													

Intersection Number:		15		Intersection ID:		15		Intersection Name:		N Main St & W Elizabeth St/E Elizabeth St									
Scenario	Overall Delay (LOS)	Delay per Lane Group by Approach [sec/veh]																	
		(Level of Service)																	
		Eastbound			Westbound			Northbound			Southbound								
LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT								
<b>PM Peak Hour - Base Models</b>																			
No Build 2030 Optimized	13.6 (B)	21.1 (C)	21.1 (C)		20.9 (C)	20.9 (C)	10.3 (B)	10.3 (B)	10.3 (B)										
Build Liberty Street Only	12.5 (B)	21.3 (C)	21.3 (C)		22.1 (C)	22.1 (C)	8.5 (A)	8.5 (A)	8.5 (A)										
Build Main Street Only	16.2 (B)	29 (C)	29 (C)		30.6 (C)	30.6 (C)	8.2 (A)	8.2 (A)	8.2 (A)										
Build Both Rerouting	16 (B)	28.9 (C)	28.9 (C)		30.6 (C)	30.6 (C)	7.9 (A)	7.9 (A)	7.9 (A)										
<b>PM Peak Hour - Improved Build Models</b>																			
Improved Liberty Only	11.3 (B)	21.3 (C)	21.3 (C)		22.1 (C)	22.1 (C)	6.7 (A)	6.7 (A)	6.7 (A)										
Improved Main Only	16.2 (B)	29 (C)	29 (C)		30.6 (C)	30.6 (C)	8.1 (A)	8.1 (A)	8.1 (A)										
Improved Both	16.2 (B)	28.9 (C)	28.9 (C)		30.6 (C)	30.6 (C)	8.2 (A)	8.2 (A)	8.2 (A)										

Intersection Number:		16		Intersection ID:		16		Intersection Name:		N Mason St & E Elizabeth St									
Scenario	Overall Delay (LOS)	Delay per Lane Group by Approach [sec/veh]																	
		(Level of Service)																	
		Eastbound			Westbound			Northbound			Southbound								
LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT								
<b>PM Peak Hour - Base Models</b>																			
No Build 2030 Optimized	8.8 (A)	19.1 (B)	19.1 (B)	19.1 (B)	17.8 (B)	17.8 (B)	17.8 (B)	6.3 (A)	6.3 (A)	6.3 (A)	5.1 (A)	5.1 (A)	5.1 (A)						
Build Liberty Street Only	8.8 (A)	19.1 (B)	19.1 (B)	19.1 (B)	18 (B)	18 (B)	18 (B)	6.4 (A)	6.4 (A)	6.4 (A)	5.2 (A)	5.2 (A)	5.2 (A)						
Build Main Street Only	8.9 (A)	20.2 (C)	20.2 (C)	20.2 (C)	18.9 (B)	18.9 (B)	18.9 (B)	6.7 (A)	6.7 (A)	6.7 (A)	5 (A)	5 (A)	5 (A)						
Build Both Rerouting	8.9 (A)	20.2 (C)	20.2 (C)	20.2 (C)	18.9 (B)	18.9 (B)	18.9 (B)	6.8 (A)	6.8 (A)	6.8 (A)	5.1 (A)	5.1 (A)	5.1 (A)						
<b>PM Peak Hour - Improved Build Models</b>																			
Improved Liberty Only	8.8 (A)	19.1 (B)	19.1 (B)	19.1 (B)	18 (B)	18 (B)	18 (B)	6.4 (A)	6.4 (A)	6.4 (A)	5.2 (A)	5.2 (A)	5.2 (A)						
Improved Main Only	8.9 (A)	20.2 (C)	20.2 (C)	20.2 (C)	18.9 (B)	18.9 (B)	18.9 (B)	6.7 (A)	6.7 (A)	6.7 (A)	5 (A)	5 (A)	5 (A)						
Improved Both	8.9 (A)	20.2 (C)	20.2 (C)	20.2 (C)	18.9 (B)	18.9 (B)	18.9 (B)	6.8 (A)	6.8 (A)	6.8 (A)	5.1 (A)	5.1 (A)	5.1 (A)						

Intersection Number:		17		Intersection ID:		17		Intersection Name:		S High St/N High St & W Market St **									
Scenario	Overall Delay (LOS)	Delay per Lane Group by Approach [sec/veh]																	
		(Level of Service)																	
		Eastbound			Westbound			Northbound			Southbound								
LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT								
<b>PM Peak Hour - Base Models</b>																			
No Build 2030 Optimized	29.6 (C)	43.1 (D)	43 (D)	29.9 (C)	35.4 (D)	48.4 (D)	30 (C)	46.6 (D)	22.1 (C)	13.5 (B)	42.7 (D)	29 (C)	23.8 (C)						
Build Liberty Street Only	30.2 (C)	49.8 (D)	49.3 (D)	30.7 (C)	39.5 (D)	49.6 (D)	29.1 (C)	45.9 (D)	19.9 (B)	13.4 (B)	37 (D)	31.1 (C)	27.7 (C)						
Build Main Street Only	27.7 (C)	48 (D)	45.2 (D)	26.6 (C)	33.7 (C)	44.9 (D)	26.1 (C)	39.5 (D)	18.7 (B)	13.2 (B)	33.5 (C)	28.4 (C)	22.9 (C)						
Build Both Rerouting	36.4 (D)	47.3 (D)	48.6 (D)	30.6 (C)	40 (D)	45.2 (D)	28.9 (C)	54 (D)	30.2 (C)	22 (C)	35.6 (D)	37.1 (D)	34.4 (C)						
<b>PM Peak Hour - Improved Build Models</b>																			
Improved Liberty Only	30.8 (C)	49.5 (D)	47.6 (D)	28.9 (C)	38.2 (D)	47.9 (D)	30.5 (C)	47.3 (D)	20.7 (C)	12 (B)	40.7 (D)	32.4 (C)	28 (C)						
Improved Main Only	29.3 (C)	49 (D)	46.8 (D)	29.2 (C)	32.8 (C)	46.4 (D)	30.9 (C)	44.2 (D)	19.9 (B)	12.9 (B)	36.2 (D)	29.4 (C)	26.1 (C)						
Improved Both	34.6 (C)	47.6 (D)	49.5 (D)	30.1 (C)	37.2 (D)	46.4 (D)	33.8 (C)	50.3 (D)	27.9 (C)	21.7 (C)	35.1 (D)	35.3 (D)	31.5 (C)						

Intersection Number:		18		Intersection ID:		18		Intersection Name:		S Liberty St/N Liberty St & W Market St									
Scenario	Overall Delay (LOS)	Delay per Lane Group by Approach [sec/veh]																	
		(Level of Service)																	
		Eastbound			Westbound			Northbound			Southbound								
LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT								
<b>PM Peak Hour - Base Models</b>																			
No Build 2030 Optimized	19.7 (B)	26.5 (C)	26.5 (C)	23.9 (C)	30 (C)	29.4 (C)						18 (B)	18 (B)						
Build Liberty Street Only	20.1 (C)	33.3 (C)	33.3 (C)	19.3 (B)	25.2 (C)	24.6 (C)						16.7 (B)	16.7 (B)						
Build Main Street Only	19.2 (B)	27.9 (C)	27.9 (C)	16.5 (B)	22.6 (C)	22 (C)						17.3 (B)	17.3 (B)						
Build Both Rerouting	21 (C)	33.3 (C)	33.3 (C)	24.5 (C)	28.8 (C)	28.4 (C)						17.6 (B)	17.6 (B)						
<b>PM Peak Hour - Improved Build Models</b>																			
Improved Liberty Only	20 (C)	33.3 (C)	33.3 (C)	18.3 (B)	24 (C)	23.5 (C)						16.7 (B)	16.7 (B)						
Improved Main Only	19.1 (B)	27.9 (C)	27.9 (C)	15.8 (B)	22 (C)	21.4 (C)						17.3 (B)	17.3 (B)						
Improved Both	20.7 (C)	33.3 (C)	33.3 (C)	21.8 (C)	25.9 (C)	25.5 (C)						17.3 (B)	17.3 (B)						

\*\* Intersection is oversaturated; therefore, the delay metrics from SimTraffic microsimulation are presented. If not noted, the intersection results from Synchro are presented.

Intersection Number:		19		Intersection ID:		19		Intersection Name:		W Market St & Court Sq									
Scenario	Overall Delay (LOS)	Delay per Lane Group by Approach [sec/veh]																	
		(Level of Service)																	
		Eastbound			Westbound			Northbound			Southbound								
LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT					
<b>PM Peak Hour - Base Models</b>																			
No Build 2030 Optimized	7.0			8.8 (A)										- (-)	- (-)				
Build Liberty Street Only	7.0			8.8 (A)										- (-)	- (-)				
Build Main Street Only	7.0			8.8 (A)										- (-)	- (-)				
Build Both Rerouting	7.0			8.8 (A)										- (-)	- (-)				
<b>PM Peak Hour - Improved Build Models</b>																			
Improved Liberty Only	7.0			8.8 (A)										- (-)	- (-)				
Improved Main Only	7.0			8.8 (A)										- (-)	- (-)				
Improved Both	7.0			8.8 (A)										- (-)	- (-)				

Intersection Number:		20		Intersection ID:		20		Intersection Name:		N. Main St & E. Market St **									
Scenario	Overall Delay (LOS)	Delay per Lane Group by Approach [sec/veh]																	
		(Level of Service)																	
		Eastbound			Westbound			Northbound			Southbound								
LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT					
<b>PM Peak Hour - Base Models</b>																			
No Build 2030 Optimized	5.7 (A)													6.3 (A)	8.9 (A) 1.7 (A)				
Build Liberty Street Only	9.7 (A)													14.4 (B)	14.4 (B) 6.2 (A) 9.5 (A)				
Build Main Street Only	9.6 (A)													11.9 (B)	11.9 (B) 8.1 (A) 9.7 (A)				
Build Both Rerouting	14.5 (B)													18.8 (B)	18.8 (B) 11.3 (B) 13.6 (B)				
<b>PM Peak Hour - Improved Build Models</b>																			
Improved Liberty Only	10 (B)													15.8 (B)	5.9 (A) 9.3 (A)				
Improved Main Only	10.2 (B)													15.8 (B)	7.6 (A)				
Improved Both	13.9 (B)													13.9 (B)	8.1 (A) 10.2 (B)				
														20.4 (C)	9.1 (A)				
														20.4 (C)	9.6 (A) 12.1 (B)				
															0 (A)				

Intersection Number:		21		Intersection ID:		21		Intersection Name:		S Mason St/N Mason St & E Market St									
Scenario	Overall Delay (LOS)	Delay per Lane Group by Approach [sec/veh]																	
		(Level of Service)																	
		Eastbound			Westbound			Northbound			Southbound								
LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT					
<b>PM Peak Hour - Base Models</b>																			
No Build 2030 Optimized	33.5 (C)			29.1 (C)	29.1 (C)	25.5 (C)	29.9 (C)	29.9 (C)	18.5 (B)	43.1 (D)	43.1 (D)	45.1 (D)	20 (B)	20 (B)					
Build Liberty Street Only	33.3 (C)			29.2 (C)	29.1 (C)	25.5 (C)	30 (C)	30 (C)	18.5 (B)	43 (D)	43 (D)	44.9 (D)	20.3 (C)	20.3 (C)					
Build Main Street Only	41.8 (D)			29.6 (C)	29.6 (C)	26.7 (C)	36.8 (D)	36.8 (D)	17.6 (B)	51.5 (D)	51.5 (D)	67.1 (E)	19 (B)	19 (B)					
Build Both Rerouting	41.4 (D)			29.6 (C)	29.6 (C)	26.7 (C)	36.8 (D)	36.8 (D)	17.6 (B)	51.5 (D)	51.5 (D)	67 (E)	19.3 (B)	19.3 (B)					
<b>PM Peak Hour - Improved Build Models</b>																			
Improved Liberty Only	33.3 (C)			29.2 (C)	29.1 (C)	25.5 (C)	30 (C)	30 (C)	18.5 (B)	43 (D)	43 (D)	44.9 (D)	20.3 (C)	20.3 (C)					
Improved Main Only	33.6 (C)			28.2 (C)	28.1 (C)	23.9 (C)	30.3 (C)	30.3 (C)	30 (C)	36.25 (D)	42.5 (D)	50.2 (D)	16.2 (B)	16.2 (B)					
Improved Both	33.3 (C)			28.2 (C)	28.1 (C)	23.9 (C)	30.3 (C)	30.3 (C)	30 (C)	36.25 (D)	42.5 (D)	50.2 (D)	16.5 (B)	16.5 (B)					

Intersection Number:		22		Intersection ID:		22		Intersection Name:		S Main St/N. Main St & Court Sq S									
Scenario	Overall Delay (LOS)	Delay per Lane Group by Approach [sec/veh]																	
		(Level of Service)																	
		Eastbound			Westbound			Northbound			Southbound								
LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT					
<b>PM Peak Hour - Base Models</b>																			
No Build 2030 Optimized	7.2 (A)			25.3 (C)											3.5 (A)				
Build Liberty Street Only	7.6 (A)			24.4 (C)	24.4 (C)										4.2 (A)				
Build Main Street Only	11.4 (B)			29 (C)	29 (C)										7.1 (A)				
Build Both Rerouting	11.4 (B)			29 (C)	29 (C)										7.1 (A)				
<b>PM Peak Hour - Improved Build Models</b>																			
Improved Liberty Only	7.6 (A)			24.4 (C)	24.4 (C)										4.2 (A)				
Improved Main Only	11.4 (B)			29 (C)	29 (C)										7.1 (A)				
Improved Both	11.3 (B)			29 (C)	29 (C)										7 (A)				

Intersection Number:		23		Intersection ID:		23		Intersection Name:		S Liberty St & W Water St									
Scenario	Overall Delay (LOS)	Delay per Lane Group by Approach [sec/veh]																	
		(Level of Service)																	
		Eastbound			Westbound			Northbound			Southbound								
LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT					
<b>PM Peak Hour - Base Models</b>																			
No Build 2030 Optimized	9.2 (A)					18.5 (B)	24.5 (C)	14.7 (B)						3.5 (A)	3.5 (A)				
Build Liberty Street Only	9.9 (A)					18.2 (B)	24.7 (C)	17.2 (B)	19.4 (B)					3.4 (A)	3.4 (A)				
Build Main Street Only	6.5 (A)					19.2 (B)	6.4 (A)	13.6 (B)						3.9 (A)	3.9 (A)				
Build Both Rerouting	8.3 (A)					24.7 (C)	8.3 (A)	18.2 (B)						3.8 (A)	3.8 (A)				
<b>PM Peak Hour - Improved Build Models</b>																			
Improved Liberty Only	10 (A)					24.7 (C)	24.7 (C)	17.2 (B)	18.2 (B)					3.4 (A)	3.4 (A)				
Improved Main Only	6.5 (A)					19.2 (B)	19.2 (B)	6.1 (A)	13.4 (B)					4 (A)	4 (A)				
Improved Both	8 (A)					24.7 (C)	24.7 (C)	7.5 (A)	17.6 (B)					3.6 (A)	3.6 (A)				

Intersection Number:		24		Intersection ID:		24		Intersection Name:		S Main St & W Water St/E Water St									
Scenario	Overall Delay (LOS)	Delay per Lane Group by Approach [sec/veh]																	
		(Level of Service)																	
		Eastbound			Westbound			Northbound			Southbound								
LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT					
<b>PM Peak Hour - Base Models</b>																			
No Build 2030 Optimized	25.1 (C)													21.4 (C)	21.4 (C) 25.9 (C) 26.1 (C)				
Build Liberty Street Only	25.2 (C)													22.8 (C)	22.8 (C) 26.3 (C) 25.4 (C)				
Build Main Street Only	29 (C)													33.1 (C)	33.1 (C) 27.7 (C) 27.7 (C)				
Build Both Rerouting	29 (C)													33.1 (C)	33.1 (C) 27.7 (C) 27.7 (C)				
<b>PM Peak Hour - Improved Build Models</b>																			
Improved Liberty Only	25.2 (C)													22.8 (C)	22.8 (C) 26.3 (C) 25.4 (C)				
Improved Main Only	29 (C)													33.1 (C)	33.1 (C) 27.7 (C) 27.7 (C)				
Improved Both	29 (C)													33.1 (C)	33.1 (C) 27.7 (C) 27.7 (C)				

\*\* Intersection is oversaturated; therefore, the delay metrics from SimTraffic microsimulation are presented. If not noted, the intersection results from Synchro are presented.

Intersection Number:		25		Intersection ID:		25		Intersection Name:		S Liberty St & W Bruce St										
Scenario	Overall Delay (LOS)	Delay per Lane Group by Approach [sec/veh]																		
		(Level of Service)																		
		Eastbound			Westbound			Northbound			Southbound									
		LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT							
<b>PM Peak Hour - Base Models</b>																				
No Build 2030 Optimized	9 (A)		22.6 (C)	22.6 (C)			0 (A)			0 (A)		4.9 (A)	4.9 (A)	4.9 (A)						
Build Liberty Street Only	15.2 (B)		36.3 (D)	36.3 (D)			0 (A)			0 (A)		7.7 (A)	7.7 (A)	7.7 (A)						
Build Main Street Only	8.6 (A)		23.3 (C)	23.3 (C)			0 (A)			0 (A)		4.1 (A)	4.1 (A)	4.1 (A)						
Build Both Rerouting	15.3 (B)		36.3 (D)	36.3 (D)			0 (A)			0 (A)		7.7 (A)	7.7 (A)	7.7 (A)						
<b>PM Peak Hour - Improved Build Models</b>																				
Improved Liberty Only	15.1 (B)		36.3 (D)	36.3 (D)			0 (A)			0 (A)		7.5 (A)	7.5 (A)	7.5 (A)						
Improved Main Only	8.6 (A)		23.3 (C)	23.3 (C)			0 (A)			0 (A)		4.1 (A)	4.1 (A)	4.1 (A)						
Improved Both	15.4 (B)		36.3 (D)	36.3 (D)			0 (A)			0 (A)		7.9 (A)	7.9 (A)	7.9 (A)						

Intersection Number:		26		Intersection ID:		26		Intersection Name:		S Main St & W Bruce St/E Bruce St										
Scenario	Overall Delay (LOS)	Delay per Lane Group by Approach [sec/veh]																		
		(Level of Service)																		
		Eastbound			Westbound			Northbound			Southbound									
		LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT							
<b>PM Peak Hour - Base Models</b>																				
No Build 2030 Optimized	22.7 (C)	28.9 (C)	28.9 (C)									19.5 (B)	19.5 (B)							
Build Liberty Street Only	23.8 (C)	30.1 (C)	30.1 (C)									20.5 (C)	20.5 (C)							
Build Main Street Only	26 (C)	39.3 (D)	39.3 (D)									17.9 (B)	17.9 (B)							
Build Both Rerouting	26 (C)	39.3 (D)	39.3 (D)									17.9 (B)	17.9 (B)							
<b>PM Peak Hour - Improved Build Models</b>																				
Improved Liberty Only	23.8 (C)	30.1 (C)	30.1 (C)									20.5 (C)	20.5 (C)							
Improved Main Only	26 (C)	39.3 (D)	39.3 (D)									17.9 (B)	17.9 (B)							
Improved Both	26 (C)	39.3 (D)	39.3 (D)									17.9 (B)	17.9 (B)							

Intersection Number:		27		Intersection ID:		27		Intersection Name:		S Main St & Grattan St & S Liberty St										
Scenario	Overall Delay (LOS)	Delay per Lane Group by Approach [sec/veh]																		
		(Level of Service)																		
		Eastbound			Westbound			Northbound			Southbound									
		LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT							
<b>PM Peak Hour - Base Models</b>																				
No Build 2030 Optimized	3.4 0	12.1 (B)	23 (C)	7.6 (A)	26.6 (D)	25.9 (D)	2.7 (A)	7.2 (A)	3.9 (A)	3.9 (A)	5.1 (A)	1.6 (A)	1.4 (A)							
Build Liberty Street Only	4.2 0	20.5 (C)	24.8 (C)	5.5 (A)	16 (B)	27 (C)	9.9 (A)	7.2 (A)	2 (A)	4 (A)	9.8 (A)	2.9 (A)	2 (A)							
Build Main Street Only	4.1 0	6 (A)	6.9 (A)	3.7 (A)	5.5 (A)	9.7 (A)	5 (A)	2.7 (A)	0.7 (A)	0.5 (A)	4.2 (A)	2.2 (A)	2.2 (A)							
Build Both Rerouting	4.1 0	18.9 (B)	14.7 (B)	4.5 (A)	16 (B)	23 (C)	7.7 (A)	9.3 (A)	3 (A)	4.2 (A)	8.5 (A)	2.9 (A)	2.1 (A)							
<b>PM Peak Hour - Improved Build Models</b>																				
Improved Liberty Only	3.9 0	19.6 (B)	22.1 (C)	4.8 (A)	22.3 (C)	32.2 (D)	15 (C)	6.7 (A)	2.7 (A)	3.3 (A)	10.7 (B)	2.7 (A)	2.5 (A)							
Improved Main Only	3.9 0	26.6 (D)	24.8 (C)	7.6 (A)	23.9 (C)	44 (E)	10.1 (B)	10.7 (B)	2.5 (A)	4 (A)	10.1 (B)	2.1 (A)	2.3 (A)							
Improved Both	4.1 0	19.2 (C)	18.6 (C)	8.1 (A)	16 (C)	26.2 (D)	9.8 (A)	8.8 (A)	4.2 (A)	3.8 (A)	11.7 (B)	3 (A)	2.8 (A)							

Intersection Number:		28		Intersection ID:		28		Intersection Name:		Mason St & Grattan St										
Scenario	Overall Delay (LOS)	Delay per Lane Group by Approach [sec/veh]																		
		(Level of Service)																		
		Eastbound			Westbound			Northbound			Southbound									
		LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT							
<b>PM Peak Hour - Base Models</b>																				
No Build 2030 Optimized	1.4 0	11.1 (B)	11.1 (B)	11.1 (B)	11.8 (B)	11.8 (B)	11.8 (B)	7.8 (A)	0 (A)	- (-)	7.5 (A)	0 (A)	- (-)							
Build Liberty Street Only	1.4 0	11.4 (B)	11.4 (B)	11.4 (B)	12.1 (B)	12.1 (B)	12.1 (B)	7.9 (A)	0 (A)	- (-)	7.5 (A)	0 (A)	- (-)							
Build Main Street Only	1.3 0	11.6 (B)	11.6 (B)	11.6 (B)	12.6 (B)	12.6 (B)	12.6 (B)	7.8 (A)	0 (A)	- (-)	7.6 (A)	0 (A)	- (-)							
Build Both Rerouting	1.3 0	11.9 (B)	11.9 (B)	11.9 (B)	13 (B)	13 (B)	13 (B)	7.9 (A)	0 (A)	- (-)	7.6 (A)	0 (A)	- (-)							
<b>PM Peak Hour - Improved Build Models</b>																				
Improved Liberty Only	1.4 0	11.4 (B)	11.4 (B)	11.4 (B)	12.1 (B)	12.1 (B)	12.1 (B)	7.9 (A)	0 (A)	- (-)	7.5 (A)	0 (A)	- (-)							
Improved Main Only	1.3 0	11.6 (B)	11.6 (B)	11.6 (B)	12.6 (B)	12.6 (B)	12.6 (B)	7.8 (A)	0 (A)	- (-)	7.6 (A)	0 (A)	- (-)							
Improved Both	1.3 0	11.9 (B)	11.9 (B)	11.9 (B)	13 (B)	13 (B)	13 (B)	7.9 (A)	0 (A)	- (-)	7.6 (A)	0 (A)	- (-)							

Intersection Number:		29		Intersection ID:		29		Intersection Name:		S High St & MLK **										
Scenario	Overall Delay (LOS)	Delay per Lane Group by Approach [sec/veh]																		
		(Level of Service)																		
		Eastbound			Westbound			Northbound			Southbound									
		LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT							
<b>PM Peak Hour - Base Models</b>																				
No Build 2030 Optimized	35 (C)	31.4 (C)	39.2 (D)	18.7 (B)	35.9 (D)	19.3 (B)	28.9 (C)	49.3 (D)	43.3 (D)	31.9 (C)	47.1 (D)	28.1 (C)	36.2 (D)							
Build Liberty Street Only	35.7 (D)	24.4 (C)	37.8 (D)	22.2 (C)	44.4 (D)	19 (B)	25.2 (C)	40.9 (D)	47.7 (D)	35 (D)	51.9 (E)	21.9 (C)	19.5 (B)							
Build Main Street Only	31.8 (C)	23.3 (C)	36.1 (D)	19.9 (B)	36.4 (D)	17.9 (B)	23.7 (C)	40.1 (D)	41.4 (D)	30.9 (C)	44.9 (D)	22.8 (C)	16 (B)							
Build Both Rerouting	37.4 (D)	29.1 (C)	38 (D)	23.3 (C)	44.7 (D)	19.5 (B)	20.9 (C)	41.7 (D)	49.1 (D)	36.9 (D)	48.8 (D)	27.3 (C)	25.1 (C)							
<b>PM Peak Hour - Improved Build Models</b>																				
Improved Liberty Only	35.1 (D)	25.9 (C)	36.9 (D)	20.7 (C)	42.7 (D)	17.7 (B)	25.8 (C)	43.1 (D)	49.8 (D)	37.1 (D)	47.3 (D)	20.4 (C)	17.9 (B)							
Improved Main Only	32.5 (C)	24.6 (C)	37.3 (D)	20.3 (C)	36 (D)	17.8 (B)	24.8 (C)	41.7 (D)	43.3 (D)	30.8 (C)	46 (D)	23 (C)	19.3 (B)							
Improved Both	35.8 (D)	25.3 (C)	36.3 (D)	18.6 (B)	38.9 (D)	18.7 (B)	25.7 (C)	41.4 (D)	48.6 (D)	36.5 (D)	41 (D)	27.4 (C)	25.1 (C)							

Intersection Number:		30		Intersection ID:		30		Intersection Name:		S Main St & MLK **										
Scenario	Overall Delay (LOS)	Delay per Lane Group by Approach [sec/veh]																		
		(Level of Service)																		
		Eastbound			Westbound			Northbound			Southbound									
		LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT							
<b>PM Peak Hour - Base Models</b>																				
No Build 2030 Optimized	34.7 (C)	57.9 (E)	61.1 (E)	51.4 (D)	35.6 (D)	40 (D)	33 (C)	34.8 (C)	35.4 (D)	17.3 (B)	38.4 (D)	28.8 (C)	26.8 (C)							
Build Liberty Street Only	37.2 (D)	50.2 (E)	51.6 (E)	37.9 (D)	32.3 (C)	35.1 (D)	27.6 (C)	45.7 (D)	47.5 (D)	24 (C)	39.4 (D)	33.2 (C)	24.1 (C)							
Build Main Street Only	31.5 (C)	57.5 (E)	54.8 (E)	39.6 (D)	25.5 (C)	27.7 (C)	20.3 (C)	42 (D)	38.1 (D)	12.5 (B)	40.4 (D)	33.6 (C)	29 (C)							
Build Both Rerouting	33.7 (C)	49.2 (D)	51.3 (E)	41.3 (D)	26.6 (C)	28.4 (C)	20.6 (C)	47.8 (D)	44.5 (D)	16.4 (B)	42.1 (D)	36.3 (D)	27 (C)							
<b>PM Peak Hour - Improved Build Models</b>																				
Improved Liberty Only	33.3 (C)	35.7 (D)	52.1 (D)	43.4 (D)	52.5 (D)	29.3 (C)	17.7 (B)	33.3 (C)	34.5 (C)	15.1 (B)	32.7 (C)	27.3 (C)	21.7 (C)							
Improved Main Only	32.5 (C)	39 (D)	54.3 (D)	45.8 (D)	61.6 (E)	35.8 (D)	24.8 (C)	32.7 (C)	29 (C)	10.9 (B)	31.3 (C)	26.2 (C)	22.7 (C)							
Improved Both	28.1 (C)	33.1 (C)	52.4 (D)	42.4 (D)	22.1 (C)	17.9 (B)	12 (B)	37.1 (D)	36.4 (D)	13.6 (B)	34.5 (C)	31 (C)	22.9 (C)							

\*\* Intersection is oversaturated; therefore, the delay metrics from SimTraffic microsimulation are presented. If not noted, the intersection results from Synchro are presented.

Intersection Number:		31		Intersection ID:		31		Intersection Name:		Mason St & MLK **					
Scenario	Overall Delay (LOS)	Delay per Lane Group by Approach [sec/veh]													
		(Level of Service)													
		Eastbound			Westbound			Northbound			Southbound				
		LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT		
<b>PM Peak Hour - Base Models</b>															
No Build 2030 Optimized	34.2 (C)		42.1 (D)	42.3 (D)	49.8 (D)	22.3 (C)	13.1 (B)	60.2 (E)	65.6 (E)	30.4 (C)	39.1 (D)	16.8 (B)	14.7 (B)		
			39.7 (D)		30.2 (C)				43.6 (D)			20.3 (C)			
Build Liberty Street Only	28.6 (C)		30.8 (C)	29.6 (C)	46.2 (D)	22.7 (C)	13 (B)	50.4 (E)	62.4 (E)	28.2 (C)	34.8 (C)	12.9 (B)	15.4 (B)		
			30.8 (C)		27.6 (C)				44.2 (D)			20.4 (C)			
Build Main Street Only	31.9 (C)		28.6 (C)	33.8 (C)	33.1 (C)	49.1 (D)	27.5 (C)	18.9 (B)	52.8 (E)	63.8 (E)	28.6 (C)	34.5 (C)	12.7 (B)	16.9 (B)	
			33.5 (C)		31.9 (C)				46.3 (D)			21.4 (C)			
Build Both Rerouting	29.5 (C)		25.9 (C)	31.1 (C)	27.4 (C)	46.8 (D)	25.5 (C)	16.8 (B)	44.1 (D)	62.5 (E)	26.6 (C)	34.3 (C)	12.6 (B)	16 (B)	
			30.6 (C)		30.1 (C)				43.5 (D)			19.9 (B)			
<b>PM Peak Hour - Improved Build Models</b>															
Improved Liberty Only	37.1 (D)		48.5 (D)	48.2 (D)	51.3 (D)	26.5 (C)	16.1 (B)	43.4 (D)	62.7 (E)	27.7 (C)	31.5 (C)	12 (B)	16.9 (B)		
			48.5 (D)		31.6 (C)				43.3 (D)			19.6 (B)			
Improved Main Only	38.1 (D)		35.5 (D)	47.6 (D)	45.4 (D)	52.7 (D)	29.4 (C)	19.1 (B)	45.6 (D)	59.1 (E)	27.3 (C)	33.3 (C)	11.5 (B)	15.6 (B)	
			46.7 (D)		34 (C)				42.1 (D)			20 (C)			
Improved Both	37.4 (D)		34.3 (C)	46.2 (D)	43.9 (D)	50.5 (D)	30.3 (C)	19.6 (B)	44 (D)	58.5 (E)	29.9 (C)	32.2 (C)	11.9 (B)	17.1 (B)	
			45.4 (D)		34.2 (C)				42.8 (D)			19.8 (B)			

Intersection Number:		32		Intersection ID:		32		Intersection Name:		N Liberty St & Kratzer Ave					
Scenario	Overall Delay (LOS)	Delay per Lane Group by Approach [sec/veh]													
		(Level of Service)													
		Eastbound			Westbound			Northbound			Southbound				
		LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT		
<b>PM Peak Hour - Base Models</b>															
No Build 2030 Optimized	5.7 (0)		13.6 (B)	13.6 (B)	13.6 (B)	11 (B)	11 (B)	11 (B)	7.5 (A)	0 (A)	- (-)	7.6 (A)	0 (A)	- (-)	
			13.6 (B)		13.6 (B)				11 (B)			0.6 (A)		1.7 (A)	
Build Liberty Street Only	5.7 (0)		13.6 (B)	13.6 (B)	13.6 (B)	11 (B)	11 (B)	11 (B)	7.5 (A)	0 (A)	- (-)	7.6 (A)	0 (A)	- (-)	
			13.6 (B)		13.6 (B)				11 (B)			0.6 (A)		1.7 (A)	
Build Main Street Only	5.7 (0)		13.6 (B)	13.6 (B)	13.6 (B)	11 (B)	11 (B)	11 (B)	7.5 (A)	0 (A)	- (-)	7.6 (A)	0 (A)	- (-)	
			13.6 (B)		13.6 (B)				11 (B)			0.6 (A)		1.7 (A)	
Build Both Rerouting	5.7 (0)		13.6 (B)	13.6 (B)	13.6 (B)	11 (B)	11 (B)	11 (B)	7.5 (A)	0 (A)	- (-)	7.6 (A)	0 (A)	- (-)	
			13.6 (B)		13.6 (B)				11 (B)			0.6 (A)		1.7 (A)	
<b>PM Peak Hour - Improved Build Models</b>															
Improved Liberty Only	5.7 (0)		13.6 (B)	13.6 (B)	13.6 (B)	11 (B)	11 (B)	11 (B)	7.5 (A)	0 (A)	- (-)	7.6 (A)	0 (A)	- (-)	
			13.6 (B)		13.6 (B)				11 (B)			0.6 (A)		1.7 (A)	
Improved Main Only	5.7 (0)		13.6 (B)	13.6 (B)	13.6 (B)	11 (B)	11 (B)	11 (B)	7.5 (A)	0 (A)	- (-)	7.6 (A)	0 (A)	- (-)	
			13.6 (B)		13.6 (B)				11 (B)			0.6 (A)		1.7 (A)	
Improved Both	5.7 (0)		13.6 (B)	13.6 (B)	13.6 (B)	11 (B)	11 (B)	11 (B)	7.5 (A)	0 (A)	- (-)	7.6 (A)	0 (A)	- (-)	
			13.6 (B)		13.6 (B)				11 (B)			0.6 (A)		1.7 (A)	

\*\* Intersection is oversaturated; therefore, the delay metrics from SimTraffic microsimulation are presented. If not noted, the intersection results from Synchro are presented.

As shown in Table 3.2, all the signalized intersections in the no build (2030) condition are expected to operate at a LOS C or better.

Delay at four (4) of the signalized intersections that are anticipated to operate at LOS C in the no build condition are approaching the LOS D threshold. All four of these intersections are major intersections where two primary routes cross. LOS C/D conditions for intersections of this type are typical during peak traffic periods and should not be considered as congested conditions. These four (4) intersections include:

- S. Main Street and Martin Luther King Jr. Way (LOS C – 34.7 seconds/vehicle)
- S. High Street and Martin Luther King Jr. Way (LOS C – 35.0 seconds/vehicle)
- Mason Street and Martin Luther King Jr. Way (LOS C – 34.2 seconds/vehicle)
- Mason Street and E. Market Street (LOS C – 33.5 seconds/vehicle)

There are six (6) movements that are anticipated to operate at a LOS E in the no build condition. These movements include:

- Northbound left at N. Main St and N Mason St (LOS E – 68.1 seconds/vehicle)
- Eastbound through at N. High St and W. Gay St (LOS E – 59.8 seconds/vehicle)
- Eastbound left at S. Main St. and Martin Luther King Jr. Way (LOS E – 57.9 seconds/vehicle)
- Eastbound through at S. Main St. and Martin Luther King Jr. Way (LOS E – 61.1seconds/vehicle)
- Northbound left at Mason St. and Martin Luther King Jr. Way (LOS E – 60.2 seconds/vehicle)
- Northbound through at Mason St. and Martin Luther King Jr. Way (LOS E – 65.6 seconds/vehicle)

There is one (1) movement that is anticipated to operate at a LOS F in the 2030 no build condition. This movement is:

- Eastbound left at N. High Street and W. Gay Street (LOS F – 84.8 seconds/vehicle)

In comparison, the signalized intersections within Downtown along Liberty and Main Streets, which only serve one direction of traffic due to the one-way street grid, operate with lower vehicle delay and higher LOS of A, B or C. At the unsignalized intersections, all of which are two-way stop-controlled intersections, all controlled movements operate at LOS C or better.

### 2030 Build and Build Improved Conditions

As seen Table 3.1 the majority of the three (3) build and build improved scenarios, with the proposed re-routing and the adjustment factors, are expected to continue to operate at an overall LOS of C or better with the exception of five (5) intersections under certain build and build improved conditions. These intersections and their corresponding delay and LOS designation by condition and scenario is shown in Table 3.3. Conditions where the overall intersection LOS is a D are shown highlighted.

**Table 3.3 – 2030 Build and Build Improved Models Overall Delay and LOS with LOS D**

Intersection	Build – Liberty Street Only	Build – Main Street Only	Build – Both	Build Improved Liberty Street Only	Build Improved Main Street Only	Build Improved Both
N./S. High Street. and W. Market St.	30.2 (C)	27.7 (C)	36.4 (D)	30.8 (C)	29.3 (C)	34.6 (C)
N./S. Mason St. and E. Market St.	33.3 (C)	41.8 (D)	41.4 (D)	33.3 (C)	33.6 (C)	33.3 (C)
S. High Street and MLK Jr. Way	35.7 (D)	31.8 (C)	37.4 (D)	35.1 (D)	32.5 (C)	35.8 (D)
S. Main Street and MLK Jr. Way	37.2 (D)	31.5 (C)	33.7 (C)	33.3 (C)	32.5 (C)	28.1 (C)
S. Mason Street and MLK Jr. Way	33.3 (C)	41.8 (D)	41.4 (D)	33.3 (C)	33.6 (C)	33.3 (C)

As stated previously, all these intersections, with the exception of N./S. High Street and W. Market Street were approaching a LOS D in the 2030 no build condition.

There are six (6) movements that are anticipated to operate at a LOS E in the 2030 build or build improved conditions. These movements are shown and highlighted in Table 3.4.

**Table 3.4 – 2030 Build and Build Improved Models Movements with LOS with LOS E**

Intersection	Movement	Build – Liberty Street Only	Build – Main Street Only	Build – Both	Build Improved Liberty Street Only	Build Improved Main Street Only	Build Improved Both
N. Main St. and Mason St.	NB Left	57.7 (E)	69.9 (E)	66.1 (E)	59.1 (E)	65 (E)	74.5 (E)
N. High Street and W. Gay St.	EB Through	53.2 (E)	53.9 (E)	57.5 (E)	52.1 (D)	52.5 (D)	57 (E)
N./S. Mason St. and E. Market St.	SB Left	44.9 (D)	67.1 (E)	67 (E)	44.9 (D)	50.2 (D)	50.2 (D)
S. Main St. and MLK Jr. Way	EB Left	50.2 (E)	57.5 (E)	49.2 (D)	35.7 (D)	39 (D)	33.1 (C)
	EB Through	51.6 (E)	54.8 (E)	51.3 (E)	52.1 (D)	54.3 (D)	52.4 (D)
	WB Left	32.3 (C)	25.5 (C)	26.6 (C)	52.5 (D)	61.6 (E)	22.1 (C)
S. Mason St. and MLK Jr. Way	NB Left	50.4 (E)	52.8 (E)	44.1 (D)	43.4 (D)	45.6 (D)	44 (D)
	NB Through	62.4 (E)	63.8 (E)	62.5 (E)	62.7 (E)	59.1 (E)	58.5 (E)

As shown the Main Street build Improved model is anticipated to operate at a LOS of C or better for all study intersections.

## Queue Analysis

Queue length, expressed as feet and represented as the number of vehicles queued in a lane behind the stop line at an intersection, measures the level of congestion on an intersection approach. *SimTraffic* was used to estimate the queues at the 31 intersections in the study area. *SimTraffic* uses a hot spot, 20 feet in length, at the top of each lane or approach just prior to the adjacent intersection to help identify possible queuing or spillback issues on adjacent intersections. If a vehicle is in that hot spot and is traveling less than 10 mph, it is assumed to be queued. The queuing and blocking reports are the average of 10 runs. The 95<sup>th</sup> percentile queue lengths represent the length of queue that should not be exceeded in 95% of all cycles. It is a useful parameter in a planning level document. Locations where the 95<sup>th</sup> percentile queue lengths extend beyond the available storage are highlighted.

The queuing analysis indicates that queuing within the Downtown network is not anticipated to be a critical concern. The vast majority of vehicle queues are confined within the available storage length approaching the intersection. Twelve (12) intersections were identified to have movements that exceed the storage length or are anticipated to be blocking through lanes or upstream intersections (which will be detailed below) and two (2) that are approaching their storage capacity. Table 3.5 shows the simulated 95<sup>th</sup> percentile queue lengths for all movements of these 12 selected intersections.

As shown in Table 3.5 there are movements that are anticipated to exceed their available storage. Many of these movements are just over their storage capacity and are expected to experience little delay/high LOS. Therefore, it is anticipated that these queues of the reported length are infrequent and are expected to clear out quickly.

Table 3.5 – Intersection Queue Summary of Selected Intersections

Intersection Number:	1		Intersection ID:	1		Intersection Name: N Main St & N Mason St/Entrance				
Scenario	95th % Queue per Lane Group by Approach (storage bay length) [ft]									
	Does the Queue Exceed the Storage?									
	Eastbound			Westbound		Northbound		Southbound		
LT/TH		RT	LT	TH/RT	LT/TH	RT	LT	TH	TH/RT	
<b>PM Peak Hour - Base Models</b>										
No Build 2030	275 (352)	83 (80)	70 (100)	54 (780)	32 (181)	43 (181)	--	--	--	
	No	Yes	No	No	No	No	--	--	--	
Build Liberty Street Only	180 (352)	60 (80)	69 (100)	50 (780)	34 (181)	136 (181)	--	--	--	
	No	No	No	No	No	No	--	--	--	
Build Main Street Only	241 (352)	86 (80)	66 (100)	45 (780)	30 (181)	73 (181)	--	--	--	
	No	Yes	No	No	No	No	--	--	--	
Build Both Rerouting	237 (352)	78 (80)	69 (100)	48 (780)	32 (181)	76 (181)	--	--	--	
	No	No	No	No	No	No	--	--	--	
<b>PM Peak Hour - Improved Build Models</b>										
Improved Liberty Only	174 (352)	55 (80)	73 (100)	41 (780)	33 (181)	135 (181)	--	--	--	
	No	No	No	No	No	No	--	--	--	
Improved Main Only	224 (352)	76 (80)	62 (100)	45 (780)	33 (181)	79 (181)	--	--	--	
	No	No	No	No	No	No	--	--	--	
Improved Both	227 (352)	84 (80)	70 (100)	48 (780)	32 (181)	89 (181)	--	--	--	
	No	Yes	No	No	No	No	--	--	--	

Intersection Number:	5		Intersection ID:	5		Intersection Name: E Gay St & N Main St					
Scenario	95th % Queue per Lane Group by Approach (storage bay length) [ft]										
	Does the Queue Exceed the Storage?										
	Eastbound			Westbound		Northbound		Southbound			
LT/TH		TH	RT	LT	TH	RT	LT/TH/RT	LT	TH	RT	
<b>PM Peak Hour - Base Models</b>											
No Build 2030	122 (190)	125 (190)	--	--	144 (396)	63 (396)	72 (261)	82 (261)	--	--	--
	No	No	--	--	No	No	No	No	--	--	--
Build Liberty Street Only	125 (190)	131 (190)	--	--	146 (396)	69 (396)	66 (261)	92 (261)	--	--	--
	No	No	--	--	No	No	No	No	--	--	--
Build Main Street Only	134 (190)	128 (190)	--	--	166 (396)	86 (396)	115 (261)	--	--	--	
	No	No	--	--	No	No	No	No	--	--	--
Build Both Rerouting	157 (190)	127 (190)	--	--	158 (396)	80 (396)	115 (261)	--	--	--	
	No	No	--	--	No	No	No	No	--	--	--
<b>PM Peak Hour - Improved Build Models</b>											
Improved Liberty Only	116 (190)	130 (190)	--	--	141 (396)	71 (396)	55 (261)	101 (261)	--	--	--
	No	No	--	--	No	No	No	No	--	--	--
Improved Main Only	148 (190)	134 (190)	--	--	164 (396)	84 (396)	120 (261)	--	--	--	
	No	No	--	--	No	No	No	No	--	--	--
Improved Both	148 (190)	122 (190)	--	--	154 (396)	84 (396)	110 (261)	--	--	--	
	No	No	--	--	No	No	No	No	--	--	--

Intersection Number:	10		Intersection ID:	10		Intersection Name: N High St & W Wolfe St				
Scenario	95th % Queue per Lane Group by Approach (storage bay length) [ft]									
	Does the Queue Exceed the Storage?									
	Eastbound			Westbound		Northbound		Southbound		
LT/TH/RT		LT	TH/RT	LT	TH	TH/RT	LT	TH	TH/RT	
<b>PM Peak Hour - Base Models</b>										
No Build 2030	84 (709)			160 (449)	73 (110)	311 (597)	237 (597)	52 (110)	97 (553)	116 (553)
	No			No	No	No	No	No	No	No
Build Liberty Street Only	80 (709)			221 (449)	108 (110)	479 (597)	437 (597)	75 (110)	130 (553)	150 (553)
	No			No	No	No	No	No	No	No
Build Main Street Only	86 (709)			171 (449)	75 (110)	273 (597)	186 (597)	50 (110)	91 (553)	105 (553)
	No			No	No	No	No	No	No	No
Build Both Rerouting	88 (709)			183 (449)	89 (110)	465 (597)	378 (597)	53 (110)	101 (553)	122 (553)
	No			No	No	No	No	No	No	No
<b>PM Peak Hour - Improved Build Models</b>										
Improved Liberty Only	86 (709)			186 (449)	81 (110)	319 (597)	265 (597)	48 (110)	94 (553)	112 (553)
	No			No	No	No	No	No	No	No
Improved Main Only	83 (709)			163 (449)	74 (110)	303 (597)	240 (597)	51 (110)	100 (553)	115 (553)
	No			No	No	No	No	No	No	No
Improved Both	81 (709)			192 (449)	84 (110)	417 (597)	326 (597)	47 (110)	97 (553)	114 (553)
	No			No	No	No	No	No	No	No

Intersection Number:	3		Intersection ID:	3		Intersection Name: N High St & W Gay St				
Scenario	95th % Queue per Lane Group by Approach (storage bay length) [ft]									
	Does the Queue Exceed the Storage?									
	Eastbound			Westbound		Northbound		Southbound		
LT/TH/RT		LT	TH/RT	LT	TH	RT	LT	TH	TH/RT	
<b>PM Peak Hour</b>										
No Build 2030	162 (572)	119 (100)	290 (669)	154 (150)	566 (553)	259 (553)	55 (190)	202 (591)	173 (591)	
	No	Yes	No	Yes	Yes	No	No	No	No	
Build Liberty Street Only	153 (572)	113 (100)	392 (669)	158 (150)	629 (553)	333 (553)	59 (190)	200 (591)	171 (591)	
	No	Yes	No	Yes	Yes	No	No	No	No	
Build Main Street Only	154 (572)	119 (100)	273 (669)	144 (150)	509 (553)	191 (553)	64 (190)	203 (591)	169 (591)	
	No	Yes	No	No	No	No	No	No	No	
Build Both Rerouting	164 (572)	113 (100)	433 (669)	154 (150)	632 (553)	369 (553)	63 (190)	209 (591)	180 (591)	
	No	Yes	No	Yes	Yes	No	No	No	No	
<b>PM Peak Hour - Improved Build Models</b>										
Improved Liberty Only	158 (572)	112 (100)	432 (669)	156 (150)	582 (553)	227 (553)	60 (190)	199 (591)	165 (591)	
	No	Yes	No	Yes	Yes	No	No	No	No	
Improved Main Only	152 (572)	119 (100)	326 (669)	137 (150)	528 (553)	222 (553)	75 (190)	210 (591)	165 (591)	
	No	Yes	No	No	No	No	No	No	No	
Improved Both	155 (572)	113 (100)	377 (669)	151 (150)	606 (553)	328 (553)	67 (190)	212 (591)	178 (591)	
	No	Yes	No	Yes	Yes	No	No	No	No	

Intersection Number:	6		Intersection ID:	6		Intersection Name: N Mason St & E Gay St				
Scenario	95th % Queue per Lane Group by Approach (storage bay length) [ft]									
	Does the Queue Exceed the Storage?									
	Eastbound			Westbound		Northbound		Southbound		
LT		TH/RT	LT	TH/RT	LT	TH	TH/RT	LT	TH	TH/RT
<b>PM Peak Hour - Base Models</b>										
No Build 2030	32 (396)	157 (396)	77 (379)	140 (379)	93 (90)	107 (275)	152 (275)	73 (75)	104 (394)	64 (394)
	No	No	No	No	Yes	No	No	No	No	No
Build Liberty Street Only	32 (396)	162 (396)	84 (379)	124 (379)	94 (90)	104 (275)	141 (275)	74 (75)	127 (394)	81 (394)
	No	No	No	No	Yes	No	No	No	No	No
Build Main Street Only	31 (396)	111 (396)	72 (379)	137 (379)	103 (90)	183 (275)	188 (275)	75 (75)	118 (394)	78 (394)
	No	No	No	No	Yes	No	No	Yes	No	No
Build Both Rerouting	29 (396)	102 (396)	88 (379)	127 (379)	104 (90)	178 (275)	182 (275)	78 (75)	130 (394)	80 (394)
	No	No	No	No	Yes	No	No	Yes	No	No
<b>PM Peak Hour - Improved Build Models</b>										
Improved Liberty Only	33 (396)	159 (396)	82 (379)	127 (379)	94 (90)	108 (275)	146 (275)	74 (75)	139 (394)	85 (394)
	No	No	No	No	Yes	No	No	No	No	No
Improved Main Only	29 (396)	115 (396)	80 (379)	131 (379)	104 (90)	188 (275)	186 (275)	74 (75)	114 (394)	67 (394)
	No	No	No	No	Yes	No	No	No	No	No
Improved Both	32 (396)	110 (396)	82 (379)	121 (379)	105 (90)	188 (275)	179 (275)	78 (75)	135 (394)	82 (394)
	No	No	No	No	Yes	No	No	Yes	No	No

Intersection Number:	13		Intersection ID:	13		Intersection Name: N Mason St & E Wolfe St				
Scenario	95th % Queue per Lane Group by Approach (storage bay length) [ft]									
	Does the Queue Exceed the Storage?									
	Eastbound			Westbound		Northbound		Southbound		
LT/TH/RT		LT	TH	RT	LT	TH	TH/RT	LT	TH	TH/RT
<b>PM Peak Hour - Base Models</b>										
No Build 2030	193 (402)			87 (364)	109 (100)	161 (269)	137 (269)	111 (100)	160 (252)	107 (252)
	No			No	Yes	No	No	Yes	No	No
Build Liberty Street Only	179 (402)			87 (364)	109 (100)	154 (269)	133 (269)	112 (100)	162 (252)	111 (252)
	No			No	Yes	No	No	Yes	No	No
Build Main Street Only	200 (402)			90 (364)	117 (100)	194 (269)	166 (269)	112 (100)	157 (252)	99 (252)
	No			No	Yes	No	No	Yes	No	No
Build Both Rerouting	204 (402)			95 (364)	115 (100)	209 (269)	156 (269)	111 (100)	162 (252)	118 (252)
	No			No	Yes	No	No	Yes	No	No
<b>PM Peak Hour - Improved Build Models</b>										
Improved Liberty Only	201 (402)			89 (364)	109 (100)	160 (269)	132 (269)	113 (100)	165 (252)	115 (252)
	No			No	Yes	No	No	Yes	No	No
Improved Main Only	190			87 (364)	115 (100)	214 (269)	167 (269)	111 (100)	161 (252)	105 (252)
	No			No	Yes	No	No	Yes	No	No
Improved Both	210 (402)			91 (364)	119 (100)	211 (269)	163 (269)	112 (100)	160 (252)	113 (252)
	No			No	Yes	No	No	Yes	No	No



Intersection Number:	17	Intersection ID:	17	Intersection Name:	S High St/N High St & W Market St						
Scenario	95th % Queue per Lane Group by Approach (storage bay length) [ft]										
	Does the Queue Exceed the Storage?										
	Eastbound			Westbound			Northbound		Southbound		
	LT	TH/RT	LT	TH/RT	LT	TH	TH/RT	LT	TH	TH/RT	
<b>PM Peak Hour - Base Models</b>											
No Build 2030	214 (869)	254 (869)	84 (270)	173 (270)	162 (150)	243 (315)	232 (999)	65 (140)	289 (597)	301 (597)	
	No	No	No	No	Yes	No	No	No	No	No	
Build Liberty Street Only	219 (869)	265 (869)	84 (270)	143 (270)	171 (150)	290 (315)	239 (999)	66 (140)	343 (597)	356 (597)	
	No	No	No	No	Yes	No	No	No	No	No	
Build Main Street Only	205 (869)	239 (869)	87 (270)	179 (270)	160 (150)	307 (315)	258 (999)	70 (140)	279 (597)	291 (597)	
	No	No	No	No	Yes	No	No	No	No	No	
Build Both Rerouting	199 (869)	259 (869)	85 (270)	144 (270)	183 (150)	518 (315)	372 (999)	69 (140)	390 (597)	404 (597)	
	No	No	No	No	Yes	Yes	No	No	No	No	
<b>PM Peak Hour - Improved Build Models</b>											
Improved Liberty Only	207 (869)	262 (869)	90 (270)	147 (270)	171 (150)	350 (315)	311 (999)	80 (140)	359 (597)	374 (597)	
	No	No	No	No	Yes	Yes	No	No	No	No	
Improved Main Only	203 (869)	262 (869)	74 (270)	180 (270)	166 (150)	330 (315)	277 (999)	78 (140)	304 (597)	315 (597)	
	No	No	No	No	Yes	Yes	No	No	No	No	
Improved Both	205 (869)	281 (869)	85 (270)	140 (270)	182 (150)	459 (615)	397 (999)	81 (140)	356 (597)	370 (597)	
	No	No	No	No	Yes	Yes	No	No	No	No	

Intersection Number:	21	Intersection ID:	21	Intersection Name:	S Mason St/N Mason St & E Market St						
Scenario	95th % Queue per Lane Group by Approach (storage bay length) [ft]										
	Does the Queue Exceed the Storage?										
	Eastbound		Westbound			Northbound		Southbound			
	TH	TH/RT	LT	TH/RT	LT	TH/RT	LT	TH/RT	LT	TH/RT	
<b>PM Peak Hour - Base Models</b>											
No Build 2030	114 (185)	116 (185)	179 (999)	394 (999)	40 (135)	260 (300)	260 (310)	125 (310)			
	No	No	No	No	No	No	No	No			
Build Liberty Street Only	85 (185)	98 (185)	228 (999)	468 (999)	36 (135)	278 (300)	273 (310)	122 (310)			
	No	No	No	No	No	No	No	No			
Build Main Street Only	89 (185)	103 (185)	213 (999)	443 (999)	46 (135)	461 (300)	251 (310)	104 (310)			
	No	No	No	No	No	Yes	No	No			
Build Both Rerouting	74 (185)	82 (185)	185 (999)	443 (999)	29 (135)	405 (300)	263 (310)	127 (310)			
	No	No	No	No	No	Yes	No	No			
<b>PM Peak Hour - Improved Build Models</b>											
Improved Liberty Only	83 (185)	95 (185)	204 (999)	448 (999)	33 (300)	285 (300)	261 (310)	119 (310)			
	No	No	No	No	No	No	No	No			
Improved Main Only	89 (185)	104 (185)	143 (999)	395 (999)	124 (300)	250 (300)	259 (310)	101 (310)			
	No	No	No	No	No*	No	No	No			
Improved Both	69 (185)	78 (185)	168 (999)	381 (999)	123 (300)	233 (300)	270 (310)	138 (310)			
	No	No	No	No	No*	No	No	No			

\*Improvement modifies northbound approach to two lanes for full length of block. Left/Through and Through/Right lanes

Intersection Number:	26	Intersection ID:	26	Intersection Name:	S Main St & Bruce						
Scenario	95th % Queue per Lane Group by Approach (storage bay length) [ft]										
	Does the Queue Exceed the Storage?										
	Eastbound		Westbound			Northbound		Southbound			
	LT/TH	TH	TH/RT	LT/TH	TH	RT	LT	TH	TH/RT	LT	TH/RT
<b>PM Peak Hour - Base Models</b>											
No Build 2030	214 (515)	--	--	--	--	--	--	244 (170)	304 (170)	--	--
	No	--	--	--	--	--	--	Yes	Yes	--	--
Build Liberty Street Only	151 (515)	--	--	--	--	--	--	268 (170)	329 (170)	--	--
	No	--	--	--	--	--	--	Yes	Yes	--	--
Build Main Street Only	215 (515)	--	--	--	--	--	--	--	454 (170)	--	--
	No	--	--	--	--	--	--	--	Yes	--	--
Build Both Rerouting	173 (515)	--	--	--	--	--	--	--	486 (170)	--	--
	No	--	--	--	--	--	--	--	Yes	--	--
<b>PM Peak Hour - Improved Build Models</b>											
Improved Liberty Only	151 (515)	--	--	--	--	--	--	256 (170)	314 (170)	--	--
	No	--	--	--	--	--	--	Yes	Yes	--	--
Improved Main Only	220 (515)	--	--	--	--	--	--	--	442 (170)	--	--
	No	--	--	--	--	--	--	--	Yes	--	--
Improved Both	179 (515)	--	--	--	--	--	--	--	479 (170)	--	--
	No	--	--	--	--	--	--	--	Yes	--	--

Intersection Number:	20	Intersection ID:	20	Intersection Name:	N Main St & E Market St						
Scenario	95th % Queue per Lane Group by Approach (storage bay length) [ft]										
	Does the Queue Exceed the Storage?										
	Eastbound			Westbound			Northbound		Southbound		
	LT	TH	RT	LT	TH	RT	TH	RT	LT	TH	RT
<b>PM Peak Hour - Base Models</b>											
No Build 2030	--	--	--	--	--	114 (237)	76 (58)	80 (58)	81 (58)	--	--
	--	--	--	--	--	No	Yes	Yes	Yes	--	--
Build Liberty Street Only	--	--	--	--	--	215 (237)	85 (58)	82 (58)	91 (58)	--	--
	--	--	--	--	--	No	Yes	Yes	Yes	--	--
Build Main Street Only	--	--	--	--	--	137 (237)	--	93 (58)	91 (58)	--	--
	--	--	--	--	--	No	--	Yes	Yes	--	--
Build Both Rerouting	--	--	--	--	--	200 (237)	--	93 (58)	91 (58)	--	--
	--	--	--	--	--	No	--	Yes	Yes	--	--
<b>PM Peak Hour - Improved Build Models</b>											
Improved Liberty Only	--	--	--	--	--	221 (237)	85 (58)	81 (58)	90 (58)	--	--
	--	--	--	--	--	No	Yes	Yes	Yes	--	--
Improved Main Only	--	--	--	--	--	136 (237)	--	93 (58)	91 (58)	--	--
	--	--	--	--	--	No	--	Yes	Yes	--	--
Improved Both	--	--	--	--	--	199 (237)	--	94 (58)	90 (58)	--	--
	--	--	--	--	--	No	--	Yes	Yes	--	--

Intersection Number:	24	Intersection ID:	24	Intersection Name:	S Main St & Water						
Scenario	95th % Queue per Lane Group by Approach (storage bay length) [ft]										
	Does the Queue Exceed the Storage?										
	Eastbound		Westbound			Northbound		Southbound			
	LT	TH	RT	LT	TH/RT	LT/TH	TH	RT	LT	TH/RT	
<b>PM Peak Hour - Base Models</b>											
No Build 2030	--	--	--	--	132 (260)	59 (75)	90 (75)	--	--	--	
	--	--	--	--	No	No	Yes	--	--	--	
Build Liberty Street Only	--	--	--	--	138(260)	58 (75)	102 (75)	--	--	--	
	--	--	--	--	No	No	Yes	--	--	--	
Build Main Street Only	--	--	--	--	156 (260)	327 (75)	--	--	--	--	
	--	--	--	--	No	Yes	--	--	--	--	
Build Both Rerouting	--	--	--	--	156 (260)	244 (75)	--	--	--	--	
	--	--	--	--	No	Yes	--	--	--	--	
<b>PM Peak Hour - Improved Build Models</b>											
Improved Liberty Only	'--	'--	'--	'--	144 (260)	65 (75)	124 (75)	--	--	--	
	'--	'--	'--	'--	No	No	Yes	--	--	--	
Improved Main Only	'--	'--	'--	'--	135 (260)	161 (75)	--	--	--	--	
	'--	'--	'--	'--	No	Yes	--	--	--	--	
Improved Both	'--	'--	'--	'--	154 (260)	295 (75)	--	--	--	--	
	'--	'--	'--	'--	No	Yes	--	--	--	--	

\* Improvement extended southbound left turn bay by 100 feet

Intersection Number:	29	Intersection ID:	29	Intersection Name:	S High St & MLK						
Scenario	95th % Queue per Lane Group by Approach (storage bay length) [ft]										
	Does the Queue Exceed the Storage?										
	Eastbound		Westbound			Northbound		Southbound			
	LT	TH/RT	LT	TH/RT	LT	TH	TH/RT	LT	TH	TH/RT	
<b>PM Peak Hour - Base Models</b>											
No Build 2030											
Build Liberty Street Only	38 (934)	123 (934)	385 (999)	170 (999)	190 (175)	431 (843)	393 (843)	216 (190)	313 (999)	289 (999)	
	No	No	No	No	Yes	No	No	Yes	No	No	
Build Main Street Only	41 (934)	115 (934)	345 (999)	201 (999)	186 (175)	396 (843)	368 (843)	199 (190)	269 (999)	271 (999)	
	No	No	No	No	Yes	No	No	Yes	No	No	
Build Both Rerouting	44 (934)	129 (934)	379 (999)	210 (999)	198 (175)	431 (843)	403 (843)	226 (190)	396 (999)	376 (999)	
	No	No	No	No	Yes	No	No	Yes	No	No	
<b>PM Peak Hour - Improved Build Models</b>											
Improved Liberty Only	41 (934)	117 (934)	370 (999)	165 (999)	195 (175)	456 (843)	419 (843)	249 (290)	232 (999)	240 (999)	
	No	No	No	No	Yes	No	No	No*	No	No	
Improved Main Only	40 (934)	118 (934)	360 (999)	213 (999)	186 (175)	403 (843)	375 (843)	198 (190)	269 (999)	271 (999)	
	No	No	No	No	Yes	No	No	Yes	No	No	
Improved Both	43 (934)	116 (934)	347 (999)	199 (999)	199 (175)	440 (843)	409 (843)	278 (290)	362 (999)	358 (999)	
	No	No	No	No	Yes	No	No	No*	No	No	

\* Improvement extended southbound left turn bay by 100 feet



Table 3.6 highlights critical queue data for the Downtown network that is anticipated to be critical. comparing No Build and Build 95<sup>th</sup> percentile queue lengths to the available storage length / block length. Notes are included in the table to describe the impact of the queues. The majority of these critical queuing locations are less than anticipated no build queue lengths or are increased by no more than one car length (25') of the anticipated 2030 no build queue with the exception of the cells shown in orange.

**Table 3.6: Critical Queue Length [ft] Comparison**

Intersection	Movement	Available Storage / Block Length	No Build	Build			Build Improved			Notes
				Liberty Street	Main Street	Both	Liberty Street	Main Street	Both	
S. Main Street and MLK Jr. Way	NB T/R	415	444	536	368	449	415	327	413	Exceeds block length & blocks NBL and NBR turn bays in no build conditions
	SBT	330	261	219	276	232	214	273	233	Blocks 150' SBL turn bay
N. High Street and W. Gay Street	WBL	100	119	113	119	113	112	119	113	Exceeds storage
	WB T/R	500 (225) *	290	392	273	433	432	326	377	Blocks WBL bay & Collicello St
	NBT	625 (275) *	566	629	509	632	582	528	606	Blocks W. Rock Street
High Street and W. Market Street	NBL	150	162	171	160	183	171	166	182	Exceeds storage
	NBT	2,200 (315) *	243	290	307	518	350	330	459	Blocks NBL bay & W. Water St
S. High Street and MLK Jr. Way	NBT	400	435	431	396	431	456	403	440	Exceeds block length **
	SBL	190	206	216	199	226	249	198	278	Exceeds storage
	SBT	2,200 (1,400) *	274	313	269	396	232	269	362	Blocks SBL turn bay
S. Mason Street and MLK Jr. Way	WBL	250	270	266	278	274	287	291	291	Exceeds storage
S. Main Street and East Market Street	NBT	58	80	82	93	93	81	93	94	Blocks Court Street
S. Main Street and Court Square	NBT	200	119	167	187	202	185	182	205	Blocks East/West Water Street
S. Main Street and East/West Water Street	NBT	75	90	102	327	244	124	161	295	Blocks East/West Bruce Street
S. Main Street and East/West Bruce Street	NBT	170	304	329	454	486	314	442	479	Blocks Franklin Street

As shown in Table 3.6 it is anticipated that queues for the southbound left movement at High Street and Martin Luther King Jr. Way will increase in the Liberty Street and both improved scenarios. This is likely because queues in the no build and build conditions were being blocked by the southbound through movement and the proposed increase in the southbound turn lane storage length has allowed more turning traffic to enter the lane. The decrease in the southbound through queue lengths in the Liberty Street and both improved models (the scenarios that included the recommendation) are reduced, which would support this theory.

The queue lengths at Mason Street and Martin Luther King Jr Way are increased slightly in the westbound direction in the build improved models as well. The reason for this is expected to originate from the change in signal operation recommended at Main Street and Martin Luther King Jr Way which has modified the progression/arrival pattern of vehicles at the South Mason and Martin Luther King Jr Way intersection.

The slight queue increase between the build and build improved models in the Main Street and Liberty Street scenario shown at High Street and Gay Street and High Street and Market Street can only be explained by differences in *SimTraffic* microsimulation runs as the volumes, signal inputs (cycle length, splits and offset), and lane configurations are similar in the build and build improved models.

There are a variety of ways that the transition from two northbound lanes to one lane on Main Street may occur. Since the design of this transition has not been finalized, an assumption was made that the roadway configuration would remain two lanes until approximately Campbell Street. Prior to this lane drop the outside lane would taper off, requiring a vehicle in the outside through lane to merge into the inside lane. *SimTraffic* is not able to provide a comprehensive merge analysis to fully understand the queuing impact at the location where two lanes become one lane; however, a review of the traffic simulation at this location, along with a comparison of traffic volumes in comparison to the anticipated capacity indicates there should not be significant queuing at this location.

Another critical section reviewed was the portion of Main Street from East Market Street to south of Bruce Street. Queues have been observed spilling back and blocking upstream intersections which can affect pedestrian movements. There is a concern that these queues will be increased significantly if capacity on Main Street is reduced from two lanes to one lane. As shown in Table 3.6 it is anticipated these queues will increase in the build and build improved models. Northbound queues at South Main Street and East Market Street are not anticipated but increase more than 14 feet but given the short distance between East Market Street and Court Square, these queues are expected to spill into the Court Square intersection. Northbound queues increase by approximately 65 feet in the Main Street only and Main street only improved models and by nearly 85 feet. Queues in the build and build improved models where both Liberty and Main Streets are reduced to one lane, this increase is anticipated to spill into the intersection of South Main Street and Water Street. Queue lengths in the no build, build and build improved models in the northbound direction at Main Street and East/West Bruce Street extend south of Franklin Street, completely blocking Franklin Street. The queues in the Main Street and Main Street and Liberty Street reconfiguration increase the queue length approximately 150 feet up to 182 feet. This being said, the anticipated delay in the northbound direction on Main Street and East Market Street is not anticipated to exceed 12.5 seconds (LOS B) in any scenario; 7.1 seconds (LOS A) at Court Square, 27.7 seconds (LOS C) at Water Street;

and, 20.5 seconds (LOS C) at Bruce Street. What this indicates is that while queuing is a concern that needs to be considered when evaluating the feasibility of a lane reconfiguration on Main Street, the queue is anticipated to clear each cycle.

Comparing projected queue lengths between the three (3) lane reconfiguration scenarios, the Main Street only reconfiguration scenario has the least queueing impact of the three build scenarios.

## Recommended Improvement Results

As previously described, recommendations to improve operations were included in the build improved analysis. A description of these recommendations and the resultant anticipated operational improvements are described below:

### 1) S. Main Street and MLK Jr. Way intersection:

- Evaluate the operational impact of converting the existing westbound left/through lane to a through only lane to allow for the removal of traffic signal split-phasing in the eastbound and westbound direction
- This recommendation was applied to all three (3) build scenarios.

Overall intersection delay is slightly improved in the Liberty Street only reconfiguration scenario and the scenario where both Main Street and Liberty Street are reconfigured. The decrease in the delay for the Liberty only scenario is anticipated to improve from a LOS D to a LOS C. There is a slight increase (one (1) second) in the overall LOS in the Main Street only reconfiguration scenario. In general, the delay for eastbound and westbound directions is anticipated to increase while delay in the northbound and southbound direction is anticipated to decrease for all scenarios.

The eastbound and southbound queues in the Liberty Street only condition is expected to remain relatively the same while westbound queues increase slightly. Northbound queues in the through and right turn lanes decrease significantly, by over 100 feet. This reduction prevents the blocking of Grace Street. Queues remain relatively the same in the Main Street only scenario except for the westbound through queue length, which increases by 100 feet. Queues in the scenario where lane configurations are applied to both Main Street and Liberty Street remain relatively the same.

This improvement is low-cost and can be implemented quickly. Therefore, it is recommended to monitor traffic after the reconfiguration and consider this improvement at that time.

### 2) Mason Street and E. Market Street intersection:

- Convert the northbound approach to two travel lanes (one left/through and one through/right) for the full length of upstream block. Mason Street north of E.

Market Street is already two lanes. It is anticipated that this recommendation can be done within the existing curb space but would require the removal of two parking spots.

- This recommendation was applied to the following build scenarios:
  - Lane reconfiguration on Main Street only
  - Lane reconfiguration on both Liberty Street and Main Street

With the addition of a second northbound lane, and optimization of the signal timing, the overall delay is anticipated to be reduced by about 8 seconds, and is improved from a LOS D to a LOS C in both the Main Street reconfiguration scenario and the Main Street and Liberty Street reconfiguration scenario. Movements in all directions are expected to see some improvement.

Queues in the westbound left turn lane are expected to be improved by 70 feet in the Main Street only reconfiguration. The westbound through movement in the Main Street only and Main Street and Liberty Street reconfigurations are anticipated to be moderately improved. Northbound queue lengths are significantly improved by approximately 200 feet. Without this improvement northbound queues were estimated to queue past the intersection of East Water Street.

The mitigation is low cost will only result in the removal of two parking spots. If any scenario where Main Street is reconfigured to one lane, this mitigation is recommended.

### 3) S. High Street / MLK Jr. Way intersection:

- Extend the S. High Street southbound left-turn storage bay by 100 feet to fully accommodate anticipated future no build and build southbound left-turn queues. This recommendation can be construction within existing right-of-way but would require the modification of the landscaped median.
- This recommendation was applied to the following build scenarios:
  - Lane reconfiguration on Liberty Street only
  - Lane reconfiguration on both Liberty Street and Main Street

Modest changes in delay are anticipated in the Liberty Street reconfiguration scenario and Main Street and Liberty Street reconfiguration. SimTraffic delays were used at this intersection due to predicted oversaturation of the intersection. The modest changes in the build and build improved models are likely to be a result of variance that is inherent with microsimulation results.

As discussed in the queuing section, this mitigation may create an increase in queuing length in the southbound left turn lane. This increase is anticipated to be caused due to the increase in storage length allowing more vehicles to enter the turn lane, where they were blocked by southbound through traffic previously.

This mitigation will not require right-of-way to construct as the existing median can be modified to extend the turn lane. If a lane reconfiguration strategy that includes Liberty Street reconfiguration is implemented, this mitigation is recommended.

### Travel Time Analysis

Travel times to traverse the four north/south corridors in the 2030 future conditions were modeled utilizing *SimTraffic* software. The travel time analysis extents are:

- High Street Corridor from Martin Luther King Jr. Way to W. Gay Street
- Main Street Corridor from Martin Luther King Jr. Way to N. Mason Street
- Liberty Street Corridor from N. Mason Street to Martin Luther King Jr. Way
- Mason Street Corridor from Martin Luther King Jr. Way to N. Main Street

Table 3.7 shows the corridor travel times in the 2030 no build, build, and build improved models.

**Table 3.7: Corridor Travel Times**

Segment	Travel Times (min:sec)						
	No Build	Build - Liberty	Build Improved Liberty	Build - Main	Build Improved Main	Build Both	Build Improved Both
High St NB	02:00.6	02:14.1	02:08.5	01:52.1	01:56.3	02:24.3	02:17.2
High St SB	02:04.8	01:57.1	01:56.3	01:53.3	01:54.8	02:12.7	02:10.4
Main St NB	03:23.8	03:27.7	03:27.3	03:46.1	03:46.9	03:57.1	03:56.7
Liberty St SB	03:09.7	03:37.9	03:32.2	03:36.1	03:29.6	03:42.7	03:41.2
Mason St NB	04:30.9	04:45.4	04:45.8	05:31.8	04:48.0	05:07.3	04:49.4
Mason St SB	03:06.9	03:26.5	03:24.3	03:24.0	03:22.9	03:23.5	03:22.7
Corridor Sum	18:16.7	19:28.7	19:14.4	20:03.4	19:18.5	20:47.6	20:17.6

Table 3.8 compares the travel time in the 2030 build scenarios to the 2030 no build condition; Table 3.9 compares the travel time in the 2030 build scenarios to the 2030 build improved scenarios and Table 3.10 shows the comparison between the 2030 build improved scenarios and the 2030 no build condition. In each of these tables, the value in the parenthesis shows the time increase or decrease (if shown as a negative number) between the models being compared. The percentage shown on the bottom of these tables shows the percent increase or decrease (if shown as a negative number) of the sum of the corridor travel times.

**Table3.8: Travel Time Comparison No Build and Build Models**

Segment	Travel Times [min:sec] (Delta in Comparison to No Build Models)		
	Build - Liberty	Build - Main	Build Both
High St NB	2:14.1 (0:13.5)	1:52.1 (-0:08.5)	2:24.3 (0:23.7)
High St SB	1:57.1 (-0:07.7)	1:53.3 (-0:11.5)	2:12.7 (0:07.9)
Main St NB	3:27.7 (0:03.9)	3:46.1 (0:22.3)	3:57.1 (0:33.3)
Liberty St SB	3:37.9 (0:28.2)	3:36.1 (0:26.4)	3:42.7 (0:33.0)
Mason St NB	4:45.4 (0:14.5)	5:31.8 (1:00.9)	5:07.3 (0:36.4)
Mason St SB	3:26.5 (0:19.6)	3:24.0 (0:17.1)	3:23.5 (0:16.6)
Corridor Sum	19:28.7 (1:12.0)  6.57%	20:03.4 (1:46.7)  9.73%	20:47.6 (2:30.9)  13.76%



**Table 3.9: Travel Time Comparison Build and Build Improved Models**

Segment	Travel Times [min:sec] (Delta in Comparison to Build Models)		
	Improved Build Liberty	Improved Build Main	Improved Build Both
High St NB	02:08.5 (-0:05.6)	01:56.3 (0:04.2)	02:17.2 (-0:07.1)
High St SB	01:56.3 (-0:00.8)	01:54.8 (0:01.5)	02:10.4 (-0:02.3)
Main St NB	03:27.3 (-0:00.4)	03:46.9 (0:00.8)	03:56.7 (-0:00.4)
Liberty St SB	03:32.2 (-0:05.7)	03:29.6 (-0:06.5)	03:41.2 (-0:01.5)
Mason St NB	04:45.8 (0:00.4)	04:48.0 (-0:43.8)	04:49.4 (-0:17.9)
Mason St SB	03:24.3 (-0:02.2)	03:22.9 (-0:01.1)	03:22.7 (-0:00.8)
Corridor Sum	19:14.4 (-0:14.3) -1.22%	19:18.5 (-0:44.9) -3.73%	20:17.6 (-0:30.0) -2.40%

**Table 3.10: Travel Time Comparison No Build and Build Improved Models**

Segment	Travel Times [min:sec] (Delta in Comparison to No Build Models)		
	Improved Build Liberty	Improved Build Main	Improved Build Both
High St NB	02:08.5 (0:07.9)	01:56.3 (-0:04.3)	02:17.2 (0:16.6)
High St SB	01:56.3 (-0:08.5)	01:54.8 (-0:10.0)	02:10.4 (0:05.6)
Main St NB	03:27.3 (0:03.5)	03:46.9 (0:23.1)	03:56.7 (0:32.9)
Liberty St SB	03:32.2 (0:22.5)	03:29.6 (0:19.9)	03:41.2 (0:31.5)
Mason St NB	04:45.8 (0:14.9)	04:48.0 (0:17.1)	04:49.4 (0:18.5)
Mason St SB	03:24.3 (0:17.4)	03:22.9 (0:16.0)	03:22.7 (0:15.8)
Corridor Sum	19:14.4 (0:57.7) 5.26%	19:18.5 (1:01.8) 5.64%	20:17.6 (2:00.9) 11.02%

Examining travel time comparisons between the 2030 build improved models and the 2030 no build models found in Table 3.10 along these six directional corridors, the scenario where roadway configurations which narrow Main Street and Liberty Street to one lane in each direction has the greatest negative impact (two minute and 0.9 seconds or an 11.02% increase), followed by the Main Street reconfiguration (one minute and 0.8 seconds second or 5.64% increase), and the Liberty Street only reconfiguration (57.7 second increase or 5.26%).

While the major arterial travel time is an important metric, it is not a complete reflection of network delay due to the potential impact on the east-west corridors throughout the Downtown area. It is also important to note that *SimTraffic* only provides an approximate travel time that provides a basis to compare scenarios and it is not considered to be a comprehensive microsimulation software.

## 4 Conclusion

After a careful analysis of the proposed future conditions, including consideration of any rerouting this new configuration may introduce to parallel routes, this study indicates that the Downtown street network is projected to operate at acceptable level of services under any of the three lane reconfiguration scenarios involving Liberty Street and Main Street. Due to rerouting traffic volumes, changes to roadway capacity, and modifications to traffic signal optimization, some build intersection movements are projected to add delay or queue length while others are projected to decrease delay or queue length.

While overall operations under each scenario are expected to be acceptable, it is anticipated that the lane configuration scenarios that include the removal of a lane on Main Street may increase queuing lengths from East Market Street to south of Bruce Street. This queueing may block upstream intersections and impact pedestrian movements during peak periods.

At a network analysis level, scenario 2 with the Main Street lane reconfiguration is anticipated to have less of an operational impact on the network than scenario 1 with the Liberty Street lane reconfiguration or scenario 3 with the combination of the Main Street and Liberty Street configurations. While scenarios 1 and 3 are projected to add more delay and corridor travel time in comparison to scenario 2, none of the lane reconfiguration scenarios are projected to lead to either intersection or network failure.

Most of the additional network delay that is anticipated with the lane reconfiguration concepts occurs on High Street and Martin Luther King Jr. Way. The proposed improvements serve to reduce delay, but it should be noted that the improvement proposed at Main Street and Martin Luther King Jr. Way, which is to convert the existing westbound left/through lane to a through only lane to allow for the removal of traffic signal split-phasing in the eastbound and westbound direction, while anticipated to improve operations locally it is anticipated to have a slightly negative impact on operations at South Mason Street and Martin Luther King Jr. Way. The reason for this is the change in signal operation from split phase has modified the progression/arrival pattern of vehicles at the South Mason Street and Martin Luther King Jr. Way intersection. While operations are anticipated to be acceptable, this trade off must be considered before the improvement is implemented.

While implementation of a roadway reconfiguration on Main Street, Liberty Street, or both is anticipated to contribute to a vibrant downtown environment, there are a number of factors that must also be considered before a recommendation can be made. For example, rerouted traffic volumes and routes were assumed based on tools like the TDMs, StreetLight data and travel time increases under no-rerouting scenarios; however, drivers choose their route by them self and accurately forecasting which route they ultimately take is challenging. Additionally, applying

the various factors that influence driver behavior, and therefore street capacity, is also challenging. Any assumption coded into the model that does not materialize may result in an overestimation of queueing and delays at some locations and an underestimation of queueing and delays at other locations.

While every attempt was made to accurately model the operations of traffic in the study area, a number of assumptions were made and critical inputs that are anticipated to be present in a Downtown environment were not explicitly entered into the models. The model outcomes are based on planning assumptions and modeling capabilities. The study team examined the most reasonable approximations while understanding the limitations of the modeling software and the ability to predict future conditions. As discussed previously in this report, the capacity of the intersections in the Downtown area was reduced in an attempt to capture these conditions based on a literature review and engineering judgement. Additionally, conditions that may cause rerouting of I-81 traffic onto Main Street and Liberty Street, and how a one lane roadway would handle this traffic, must be further analyzed and scenarios where crashes or other incidents may block the only available lane must be considered.

In conclusion, the traffic models developed for all three scenarios suggest operational levels will be acceptable. While understanding how the trips will be diverted after a lane reconfiguration is implemented will be an ongoing challenge, this study provides a strong foundation for the City of Harrisonburg's future downtown scenario planning.