ROUTE 460 (ORANGE/CHALLENGER AVENUE) OPERATIONAL IMPROVEMENTS STUDY

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Appendix D – Intersection Signal Timings

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1. INTRODUCTION

1.1 BACKGROUND

The Virginia Department of Transportation (VDOT) has initiated this Strategically Targeted Affordable Roadway Solutions (STARS) study to evaluate operational and safety conditions along Orange Avenue/Challenger Avenue (Route 460) from Williamson Road (Route 11) to Route 220 ALT (Cloverdale Road) and identify improvements to address the identified safety and operational deficiencies that can be incorporated into VDOT's Six-Year Improvement Plan (SYIP). This study identifies and evaluates alternatives and technical solutions to mitigate the safety issues and to improve traffic operations and alleviate congestion.

Route 460 between Williamson Road (Route 11) and Route 220 ALT (Cloverdale Road) was identified as part of the STARS Program in response to both safety and operational deficiencies including a lack of access management along the study corridor. Within the study area, Route 460 has 12 signalized intersections which cause rear end crashes due to congestion and stop and go conditions throughout the corridor as well as 16 unsignalized intersections and 7 unsignalized median crossovers which contribute to the number of angle crashes due to the lack of access control.

Additionally, Roanoke City has previously developed the Route 460 (Orange Avenue) Widening Project from 11th Street to east of 24th Street that would widen Route 460 from four to six lanes to provide additional capacity along the corridor and address access management issues in this area. However, this project has not been funded due to the substantial right of way impacts along the corridor and high project costs. This STARS study seeks to identify lower cost improvements that would address the identified near-term capacity and safety deficiencies along the corridor.

The Framework Document (see **Appendix A**) outlines the scope of work of the traffic study including the study area, traffic forecasting and analysis methodology, study assumptions, and general types of improvement alternatives to be considered. The Framework Document was approved by VDOT Salem District, VDOT Transportation Mobility and Planning Division (TMPD), the City of Roanoke, and Roanoke County in October 2019.

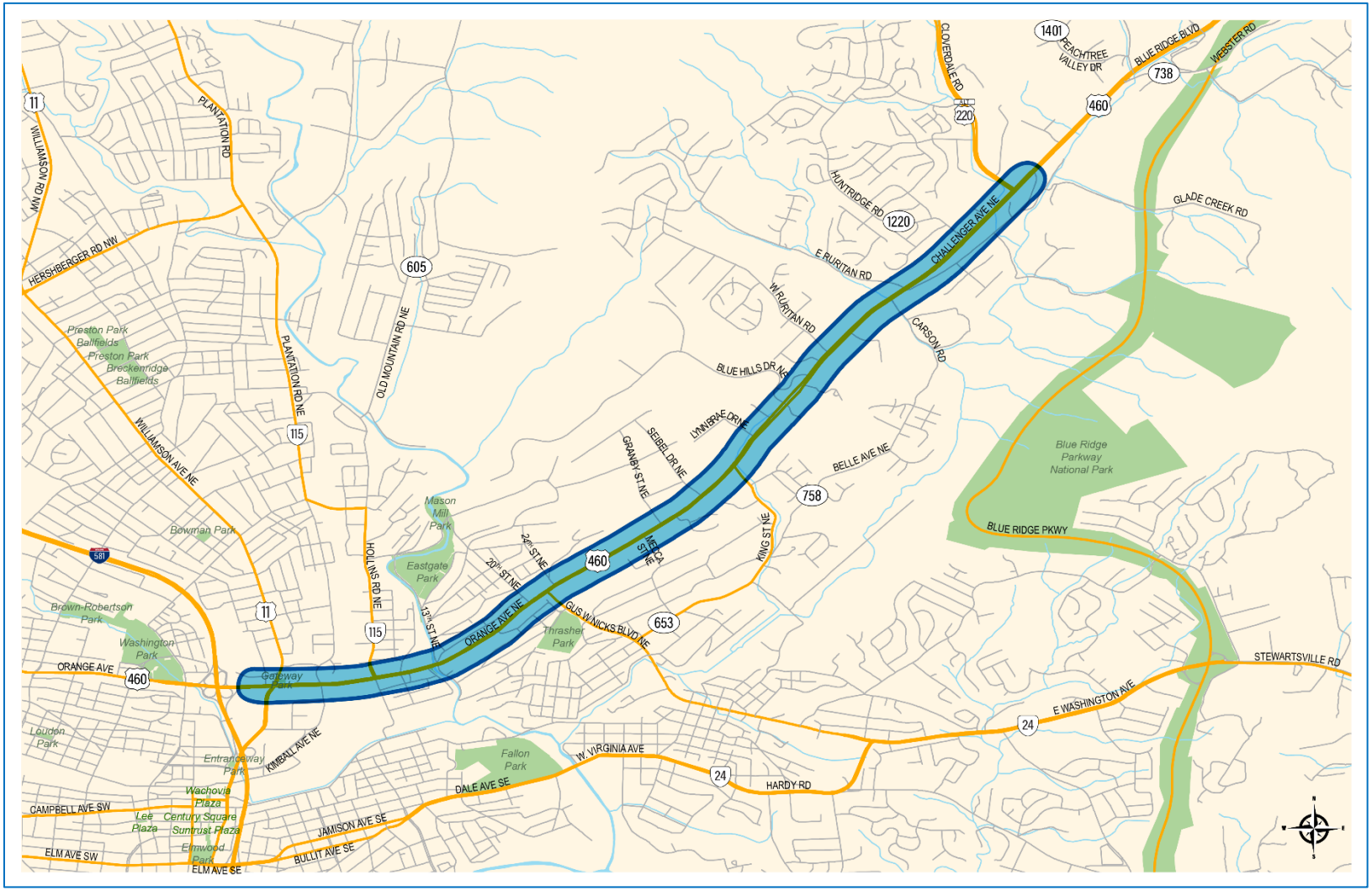
1.2 STUDY AREA/PROJECT LOCATION

As shown in **Figure 1-1**, the study area consists of approximately 4.8 miles of Route 460 between Williamson Road (Route 11) to the west and Route 220 ALT (Cloverdale Road) to the east. The land uses surrounding Route 460 are a mix of civic, residential, commercial, and industrial properties. The Berglund Center is located in the southwest quadrant of the Route 460 at Williamson Road (Route 11) intersection. Large retail developments including Kroger, Walmart, and Lowe's are located along Route 460 in Roanoke County. The Route 460 at I-581 interchange is located just west of the study area.

The following 12 signalized intersections, 1 emergency flashing signal, 16 unsignalized street intersections, and 7 median crossovers that do not serve intersections are included within the study area:

1. Route 460 at Williamson Road (Route 11) (Signalized)
2. Route 460 at Plantation Road/Kimball Avenue (Signalized)
3. Route 460 at Hollins Road (Signalized)
4. Route 460 at 11th Street (Unsignalized)
5. Route 460 at 12th Street (Unsignalized – right in/right out)
6. Route 460 at Rhodes Avenue (Unsignalized)
7. Route 460 at 13th Street (Signalized)
8. Route 460 at Median Crossover 660' east of 13th Street (Unsignalized)
9. Route 460 at Median Crossover 1170' east of 13th Street (Unsignalized)
10. Route 460 at Walton Street (Unsignalized)
11. Route 460 at Median Crossover 700' east of Walton Street (Unsignalized)
12. Route 460 at 20th Street (Unsignalized)
13. Route 460 at Gus Nicks Blvd (Signalized)
14. Route 460 at 24th Street (Unsignalized)
15. Route 460 at Median Crossover 990' east of 24th Street (Unsignalized)
16. Route 460 at Median Crossover 1110' west of Mecca Street (Unsignalized)
17. Route 460 at Mecca Street (Emergency Flashing Signal)
18. Route 460 at Granby Street (Signalized)
19. Route 460 at Hickory Woods Drive (Unsignalized)
20. Route 460 at Seibel Drive (Unsignalized)
21. Route 460 at Median Crossover 520' east of Seibel Drive (Unsignalized)
22. Route 460 at King Street (Signalized)
23. Route 460 at Lynn Brae Drive (Unsignalized)
24. Route 460 at Patrick Road (Unsignalized)
25. Route 460 at Blue Hills Drive/Mexico Way (Signalized)
26. Route 460 at Evan Lane (Unsignalized – right in/right out)
27. Route 460 at Blue Hills Village Drive (Unsignalized)
28. Route 460 at Trail Drive (Unsignalized – right in/right out on both sides of Route 460)
29. Route 460 at West Ruritan Road (Signalized)
30. Route 460 at Valley Gateway Boulevard (Signalized)
31. Route 460 at Carson Road (Unsignalized)
32. Route 460 at Bonsack Road/East Ruritan Road (Unsignalized)
33. Route 460 at Median Crossover 950' east of Bonsack Road/East Ruritan Road (Unsignalized)
34. Route 460 at Huntridge Road (Unsignalized)
35. Route 460 at Walmart/Lowe's (Signalized)
36. Route 460 at Route 220 ALT (Cloverdale Road) (Signalized)

Figure 1-1: Study Area



2. EXISTING CONDITIONS

2.1 EXISTING ROADWAY NETWORK

Route 460 is classified as an Other Principal Arterial and runs east-west with speed limits of 35 mph along the western parts of the corridor from Williamson Road (Route 11) to just past 24th Street, 40 mph from just east of 24th Street to the Roanoke City/Roanoke County line, and 45 mph from the Roanoke City/Roanoke County line to beyond Route 220 ALT (Cloverdale Road). Within the study area, Route 460 has three lanes in each direction with a raised median from Williamson Road (Route 11) to 11th Street and two lanes in each direction with raised or flush medians along the rest of the study corridor. Left-turn lanes are provided at all signalized intersections and several of the unsignalized intersections. Right-turn lanes are provided at high volume right-turn locations along the corridor.

Figures 2-1a and 2-1b depict the existing corridor characteristics within the study area including locations of traffic signals and stop-controlled intersections and driveways. There are twelve traffic signals, one emergency flashing signal, and twenty-four unsignalized intersections and driveways included in the study, as listed in **Section 1.2**. There is also a full cloverleaf interchange at I-581 just beyond the western end of the study area.

Figure 2-1a: Existing Study Intersections

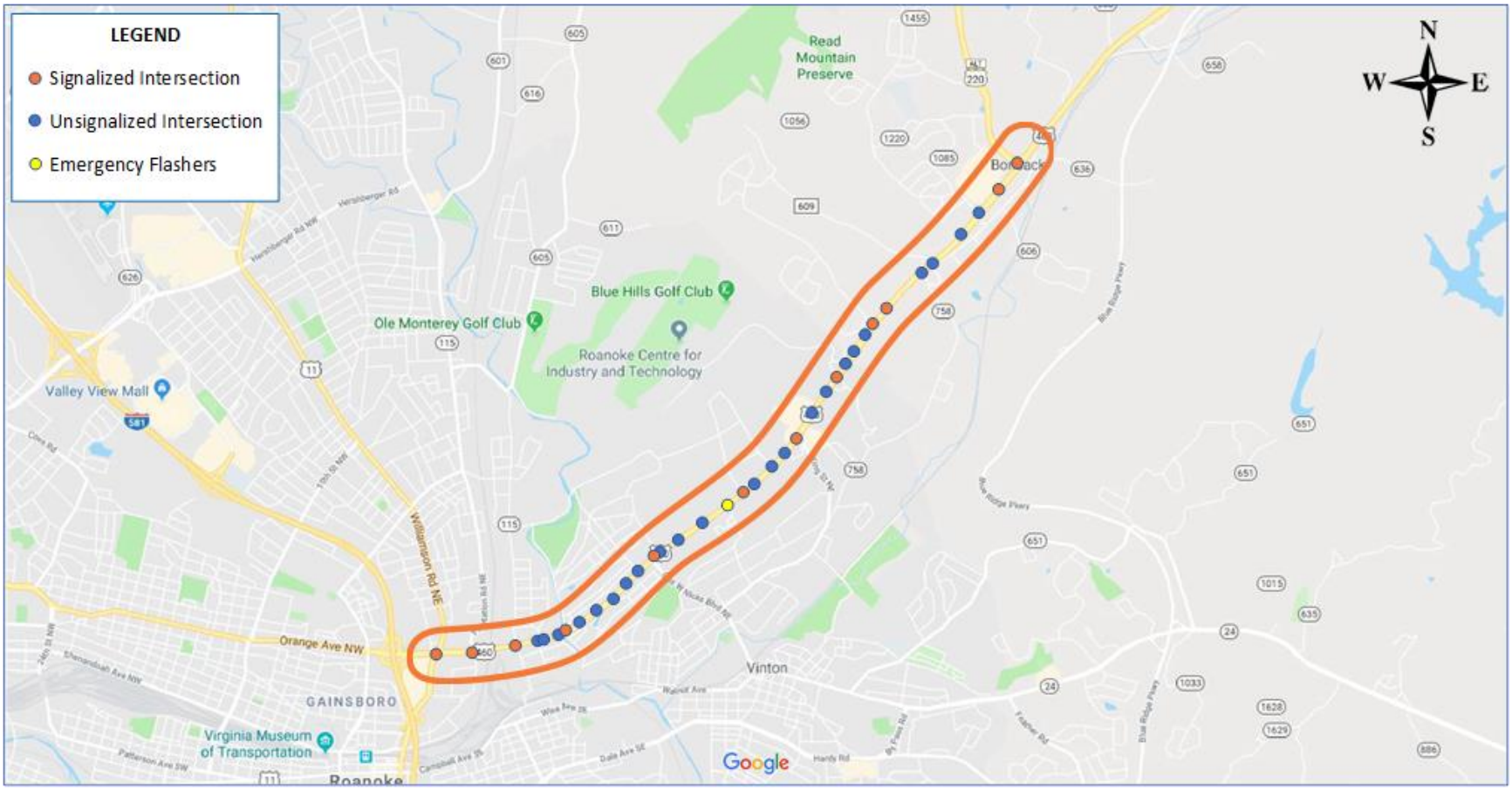


Figure 2-1b: Existing Corridor

The following is a summary of each of the study intersections along Route 460 including key traffic operational and safety observations during peak periods:

Route 460 at Williamson Road (Route 11) (Signalized)

This four-legged signalized intersection is located at the western study limit. The eastbound Route 460 approach includes a left-turn lane, two through lanes, and a shared through/channelized right-turn lane. The westbound Route 460 approach includes a left-turn lane, three through lanes, and a channelized right-turn lane. The northbound Williamson Road (Route 11) approach includes a left-turn lane, two through lanes, and a channelized right-turn lane. The southbound Williamson Road (Route 11) approach includes a left-turn lane, a through lane, and a shared through/channelized right-turn lane. All four left-turn lanes operate with protected-only left-turn phasing. There are signalized pedestrian crossings and marked crosswalks on all four legs of the intersection. During peak times, left-turn queues exceed available storage for the eastbound, northbound, and southbound approaches and through traffic queues regularly extend beyond the left-turn lanes and channelized right-turn movements. The Route 460 eastbound left turn to Williamson Road experiences queues which extend beyond the I-581 interchange which increases the potential for crashes at the interchange. Lane utilization for the westbound Route 460 approach is often unbalanced with the majority of the traffic using the rightmost two through lanes to access the I-581 interchange ramps west of Williamson Road (Route 11).

Route 460 at Plantation Road/Kimball Avenue (Signalized)

This four-legged signalized intersection is located approximately 0.22 miles east of Williamson Road (Route 11). The eastbound and westbound Route 460 approaches include a left-turn lane, two through lanes, and a shared through/right-turn lane. The northbound Kimball Avenue approach includes a shared through/left-turn lane and a right-turn lane. The southbound Plantation Road approach includes a shared left-turn/through lane and a shared through/right-turn lane. The eastbound and westbound approaches operate with flashing yellow arrow protected-permissive left-turn phasing. The northbound and southbound approaches operate with split phasing. There are pedestrian push buttons and signal heads, but no marked crosswalks, for crossing Plantation Road and Kimball Avenue within the intersection. During peak times, the westbound left-turn lane periodically exceeds available storage due to the short turn bay length and the northbound right-turn lane regularly experiences lengthy traffic queues due to the high traffic volume making this movement. Additionally, lane utilization imbalances occur in both the eastbound and westbound directions related to traffic positioning for the lane drop at 11th Street to the east and for accessing the I-581 interchange ramps to the west.

Route 460 at Hollins Road (Signalized)

This signalized four-legged intersection is located approximately 0.26 miles east of Plantation Road/Kimball Avenue. The eastbound and westbound Route 460 approaches include a left-turn lane, two through lanes, and a shared through/right-turn lane. The northbound Hollins Road approach includes a left-turn lane, and a shared through/right-turn lane. The southbound Hollins Road approach includes a left-turn lane, a through lane, and a channelized right-turn lane. All four approaches to the intersection

operate with protected-only left-turn phasing. A significant lane utilization imbalance occurs in the eastbound direction related to traffic positioning for the lane drop at 11th Street immediately to the east of the Hollins Road intersection.

Route 460 at 11th Street (Unsignalized)

This unsignalized four-legged intersection is located approximately 0.13 miles east of Hollins Road. The eastbound Route 460 approach includes a left-turn lane, two through lanes that merge into a single lane at the intersection, and a shared through/right-turn lane. The westbound Route 460 approach includes a left-turn lane, two through lanes, and a shared through/right-turn lane. The northbound 11th Street approach operates under stop control and includes a shared left/through/right-turn lane. The southbound 11th Street approach operates under stop control and includes a shared left/through/right-turn lane. In addition to the lane reduction from three lanes to two lanes along eastbound Route 460, a lane addition from two lanes to three lanes along westbound Route 460 occurs just east of the intersection as Route 460 transitions from the six-lane section to the west to the four-lane section to the east. During the PM peak, periodic traffic congestion occurs at the lane drop along eastbound Route 460.

Route 460 at 12th Street (Unsignalized)

This three-legged unsignalized intersection is located approximately 200 feet east of 11th Street and does not have a median opening, operating as a right-in, right-out intersection. The eastbound Route 460 approach includes a through lane and a shared through/right-turn lane. The westbound Route 460 approach includes two through lanes. The northbound 12th Street approach operates under stop control and includes a right-turn lane.

Route 460 at Rhodes Avenue (Unsignalized)

This unsignalized four-legged intersection is located approximately 0.10 miles east of 12th Street. The eastbound Route 460 approach includes a shared through/left-turn lane and a shared through/right-turn lane. The westbound Route 460 approach includes a short, tapered left-turn lane approximately 50 feet long, a through lane, and a shared through/right-turn lane. The northbound Rhodes Avenue approach operates under stop control and includes a shared left/right-turn lane. The southbound approach to the intersection serves the United Rentals property.

Route 460 at 13th Street (Signalized)

This signalized four-legged intersection is located approximately 0.05 miles east of Rhodes Avenue. The eastbound and westbound Route 460 approaches include a left-turn lane, a through lane, and a shared through/right-turn lane. The northbound and southbound 13th Street approaches include a left-turn lane and a shared through/right-turn lane. The eastbound and westbound approaches operate with flashing yellow arrow protected/permissive left-turn phasing. The northbound and southbound approaches operate with split phasing. There are signalized pedestrian crossings with marked crosswalks on the south and east legs of the intersection. Along the southbound 13th Street approach to Route 460 there is a three-legged intersection with Archbold Avenue located in the northeast quadrant of the intersection. The

westbound Archbold Avenue approach operates under stop control and includes a shared left-turn/right-turn lane. During peak times, long traffic queues occur on both the northbound and southbound 13th Street approaches along with significant mainline traffic queuing which extends through the adjacent unsignalized intersections.

Route 460 at Median Crossover 660' East of 13th Street (Unsignalized)

This unsignalized median crossover intersection is located approximately 0.13 miles east of the 13th Street intersection and does not have any turn lanes along Route 460. The median opening does not serve any occupied properties.

Route 460 at Median Crossover 1170' East of 13th Street (Unsignalized)

This unsignalized median crossover intersection is located approximately 0.13 miles west of Walton Street and does not have any turn lanes along Route 460. The median opening does not serve any occupied properties.

Route 460 at Walton Street (Unsignalized)

This three-legged unsignalized intersection is located approximately 0.35 miles east of 13th Street. The eastbound Route 460 approach includes a through lane and a shared through/right-turn lane. The westbound Route 460 approach includes a left-turn lane and two through lanes. The northbound Walton Street approach operates under stop control and includes a shared left-turn/right-turn lane.

Route 460 at Median Crossover 700' East of Walton Street (Unsignalized)

This unsignalized median crossover intersection is located approximately 0.13 miles east of Walton Street and does not have any turn lanes along Route 460. The eastbound and westbound Route 460 approaches have a shared left-turn/through lane and a through lane. The median opening does not serve any occupied properties.

Route 460 at 20th Street (Unsignalized)

This three-legged unsignalized intersection is located approximately 0.22 miles east of Walton Street. The eastbound Route 460 approach includes a left-turn lane and two through lanes. The westbound Route 460 approach includes a through lane and a shared through/right-turn lane. The southbound 20th Street approach operates under stop control and includes a shared left-turn/right-turn lane.

Route 460 at Gus Nicks Boulevard (Signalized)

This four-legged signalized intersection is located approximately 0.11 miles east of 20th Street. The eastbound Route 460 approach includes a left-turn lane, two through lanes, and a right-turn lane. The westbound Route 460 approach includes a short left-turn lane, a through lane, and a shared through/right-turn lane. The northbound Gus Nicks Boulevard approach includes a left-turn lane, a shared left-turn/through lane, and a right-turn lane. The southbound Roanoke Antique Mall approach includes a

left-turn lane and a shared through/right-turn lane. The eastbound and westbound approaches operate with protected-only left-turn phasing. The northbound and southbound approaches operate with split phasing. There are pedestrian pushbuttons on all four corners of the intersection but no pedestrian signals or marked crosswalks are present. Left-turn traffic queues regularly exceed the available storage for the westbound left-turn lane to southbound Gus Nicks Boulevard, extending through the 24th Street intersection. A significant lane utilization imbalance also occurs in the northbound direction of Gus Nicks Boulevard related to traffic positioning for the right-turn movement at 20th Street immediately to the west of the intersection.

Route 460 at 24th Street (Unsignalized)

This four-legged unsignalized intersection is located approximately 0.05 miles east of Gus Nicks Boulevard. The eastbound Route 460 approach includes a left-turn lane, a through lane, and a shared through/right-turn lane. The westbound Route 460 approach includes a left-turn lane, a through lane, and a shared through/right-turn lane. The northbound Hardees approach operates under stop control and includes a shared left-turn/through/right-turn lane. The southbound 24th Street approach operates under stop control and includes a shared left-turn/through/right-turn lane. Westbound traffic queues from Gus Nicks Boulevard regularly extend through the 24th Street intersection.

Route 460 at District Vue Apartments (West) (Unsignalized)

This four-legged unsignalized intersection is located approximately 0.19 miles east of 24th Street and serves as the western access to the District Vue Apartments. The eastbound Route 460 approach includes a left-turn lane a through lane, and a shared through/right-turn lane. The westbound Route 460 approach includes a shared left-turn/through lane, a through lane, and a right-turn lane. The southbound District Vue Apartments approach operates under stop control and includes a shared left-turn/through lane and a right-turn lane. The northbound BP gas station approach operates under stop control and includes a shared left-turn/through/right-turn lane.

Route 460 at District Vue Apartments (East) (Unsignalized)

This four-legged unsignalized intersection is located approximately 0.19 miles west of Mecca Street and primarily serves as an eastern access to the District Vue Apartments. The eastbound Route 460 approach includes a left-turn lane, a through lane, and a shared through/right-turn lane. The westbound Route 460 approach includes a left-turn lane, two through lanes, and a right-turn taper. The southbound District Vue Apartments approach operates under stop control and includes a left-turn lane and a right-turn lane. The northbound GCR Tire approach operates under stop control and includes a shared left-turn/through/right-turn lane.

Route 460 at Mecca Street (Emergency Flashing Signal)

This four-legged intersection is located approximately 0.52 miles east of 24th Street. The eastbound Route 460 approach includes a shared left-turn/through lane and a shared through/right-turn lane. The westbound Route 460 approach includes a left-turn lane, a through lane, and a shared through/right-turn

lane. The northbound Mecca Street approach and southbound car dealership approach operate under stop control and include a shared left-turn/through/right-turn lane.

Route 460 at Granby Street (Signalized)

This signalized three-legged intersection is located approximately 0.12 miles east of Mecca Street. The eastbound Route 460 approaches include a left-turn lane and two through lanes. The westbound Route 460 approaches include two through lanes, and a right-turn lane. The southbound Granby Street approach includes a left-turn lane and a right-turn lane. The eastbound approach operates with protected-permissive left-turn phasing.

Route 460 at Hickory Woods Drive (Unsignalized)

This four-legged unsignalized intersection is located approximately 0.08 miles east of Granby Street. The eastbound Route 460 approach includes a shared through/left-turn lane, a through lane, and a right-turn lane. The westbound Route 460 approach includes a left-turn lane, a through lane, and a shared through/right-turn lane. The northbound Hickory Woods Drive approach and southbound approach, previously serving a motel and restaurant that is not closed, both operate under stop control and include a shared left-turn/through/right-turn lane.

Route 460 at Seibel Drive (Unsignalized)

This three-legged unsignalized intersection is located approximately 0.17 miles east of Hickory Woods Drive. The eastbound Route 460 approach includes a left-turn lane and two through lanes. The westbound Route 460 approach includes a through lane and a shared through/right-turn lane. The southbound Seibel Drive approach operates under stop control and includes a shared left-turn/right-turn lane.

Route 460 at Median Crossover 520’ East of Seibel Drive (Unsignalized)

This four-legged unsignalized intersection is located approximately 0.10 miles east of Seibel Drive. The eastbound Route 460 approach includes a left-turn lane, a through lane, and a shared through/right-turn lane. The westbound Route 460 approach includes a shared left-turn/through lane and a shared through/right-turn lane. The southbound GCR Tire warehouse approach and northbound Budget Inn motel approach both operate under stop control and include a shared left-turn/through/right-turn lane.

Route 460 at King Street (Signalized)

This four-legged signalized intersection is located approximately 0.23 miles east of Seibel Drive. The eastbound Route 460 approach includes a left-turn lane, two through lanes, and a channelized right-turn lane. The westbound Route 460 approach includes a left-turn lane, two through lanes, and a right-turn lane. The northbound King Street approach includes a shared left-turn/through lane and a right-turn lane. The southbound approach serving McDonald’s includes a shared left-turn/through/right-turn lane. The eastbound and westbound approaches operate with protected-only left-turn phasing. The northbound and southbound approaches operate with split phasing. The westbound left-turn lane regularly

experiences traffic queues exceeding available storage, that periodically extend through the Lynn Brae Drive intersection.

Route 460 at Lynn Brae Drive (Unsignalized)

This four-legged unsignalized intersection is located approximately 0.20 miles east of King Street. The eastbound Route 460 approach includes a left-turn lane, a through lane, and a shared through/right-turn lane. The westbound Route 460 approach includes a shared left-turn/through lane, a through lane, and a right-turn lane. The southbound Lynn Brae Drive approach and northbound church driveway approach both operate under stop control and include a shared left-turn/through/right-turn lane. Traffic queues from the westbound left-turn at King Street periodically extend through the intersection.

Route 460 at Patrick Road (Unsignalized)

This four-legged unsignalized intersection is located approximately 0.14 miles east of Lynn Brae Drive. The eastbound Route 460 approach includes a left-turn lane, a through lane, and a shared through/right-turn lane. The westbound Route 460 approach includes a shared left-turn/through lane, a through lane, and a right-turn lane. The southbound Patrick Road approach and northbound church driveway approach both operate under stop control and include a shared left-turn/through/right-turn lane.

Route 460 at Blue Hills Drive/Mexico Way (Signalized)

This four-legged signalized intersection is located approximately 0.11 miles east of Patrick Road. The eastbound and westbound Route 460 approaches include a left-turn lane, two through lanes, and a right-turn lane. The northbound Mexico Way approach includes a shared left-turn/through lane and a right-turn lane. The southbound Blue Hills Drive approach includes a left-turn lane, a shared left-turn/through/right-turn lane, and a right-turn lane. The eastbound and westbound approaches operate with protected-permissive left-turn phasing. The northbound and southbound approaches operate with split phasing. During the AM peak, the eastbound left-turn traffic queue to Blue Hills Drive periodically exceeds the storage length.

Route 460 at Evan Lane (Unsignalized)

This three-legged unsignalized intersection is located approximately 0.15 miles east of Blue Hills Drive/Mexico Way and does not have a median opening, operating as a right-in, right-out intersection. The eastbound Route 460 approach includes a through lane and a shared through/right-turn lane. The westbound Route 460 approach includes two through lanes. The northbound Evan Lane approach operates under stop control and includes a right-turn lane.

Route 460 at Blue Hills Village Drive (Unsignalized)

This four-legged unsignalized intersection is located approximately 0.20 miles east of Blue Hills Drive/Mexico Way. The eastbound Route 460 approach includes a left-turn lane, a through lane, and a shared through/right-turn lane. The westbound Route 460 approach includes a left-turn lane, two through lanes, and a right-turn lane. The southbound Blue Hills Village Drive approach operates under stop control

and includes a shared left-turn/through/right-turn lane. The northbound Advance Auto Parts approach operates under stop control and includes a shared left-turn/through lane and a right-turn lane.

Route 460 at Trail Drive (Unsignalized)

This four-legged unsignalized intersection is located approximately 0.10 miles east of Blue Hills Village Drive and does not have a median opening, operating as a right-in, right-out intersection along both eastbound and westbound Route 460. The eastbound and westbound Route 460 approaches both include a through lane and a shared through/right-turn lane. The southbound Trail Drive approach and northbound business driveway approach both operate under stop control and include a right-turn lane.

Route 460 at West Ruritan Road (Signalized)

This four-legged signalized intersection is located approximately 0.17 miles east of Blue Hills Village Drive. The eastbound and westbound Route 460 approaches include a left-turn lane, two through lanes, and a right-turn lane. The northbound approach serving CVS Pharmacy includes a shared left-turn/through lane and a right-turn lane. The southbound West Ruritan Road approach includes a shared left-turn/through lane and a right-turn lane. The eastbound and westbound approaches operate with flashing yellow arrow protected-permissive left-turn phasing. The northbound and southbound approaches operate with split phasing. Prior to traffic signal timing improvements implemented by VDOT, the eastbound traffic queue from the Valley Gateway Boulevard intersection periodically extended through the West Ruritan Road intersection during peak times.

Route 460 at Valley Gateway Boulevard (Signalized)

This three-legged signalized intersection is located approximately 0.16 miles east of West Ruritan Road. The eastbound Route 460 approaches include a U-turn lane, two through lanes, and a right-turn lane. The westbound Route 460 approaches include two left-turn lanes and two through lanes. The northbound Valley Gateway Boulevard approach includes two left-turn lanes and a right-turn lane. The eastbound and westbound approaches operate with protected left-turn phasing. A private driveway is located on the north leg of the intersection serving a private residence and operates under stop control. Prior to traffic signal timing improvements implemented by VDOT, the westbound traffic queue from the West Ruritan Road intersection periodically extended through the Valley Gateway Boulevard intersection during peak times.

Route 460 at Carson Road (Unsignalized)

This four-legged unsignalized intersection is located approximately 0.28 miles east of Valley Gateway Boulevard. The eastbound Route 460 approach includes a left-turn lane, a through lane, and a shared through/right turn-lane. The westbound Route 460 approach includes a left-turn lane, two through lanes, and a right-turn lane. The northbound Carson Road approach and southbound church driveway approach both operate under stop control and include a shared left-turn/through/right-turn lane.

Route 460 at Bonsack Road/East Ruritan Road (Unsignalized)

This four-legged unsignalized intersection is located approximately 0.09 miles east of Carson Road. The eastbound Route 460 approach includes a left-turn lane, two through lanes, and a channelized right-turn lane. The westbound Route 460 approach includes a left-turn lane, two through lanes, and a right-turn lane. The northbound Bonsack Road approach and southbound East Ruritan Road approach both operate under stop control and include a shared left-turn/through/right-turn lane.

Route 460 at Median Crossover 950' East of Bonsack Road/East Ruritan Road (Unsignalized)

This four-legged unsignalized median crossover intersection is located approximately 0.18 miles east of Bonsack Road/East Ruritan Road and does not have any turn lanes along Route 460. The eastbound and westbound Route 460 approaches both include a shared left-turn/through lane and a shared through/right-turn lane. The northbound Country Corner Garden Center approach and southbound private residence approach both operate under stop control and include a shared left-turn/through/right-turn lane.

Route 460 at Huntridge Road (Unsignalized)

This three-legged unsignalized intersection is located approximately 0.41 miles east of Bonsack Road/East Ruritan Road. The eastbound Route 460 approach includes a left-turn lane and two through lanes. The westbound Route 460 approach includes two through lanes and a right-turn lane. The southbound Huntridge Road approach operates under stop control and includes a shared left-turn/through/right-turn lane.

Route 460 at Walmart/Lowe's Entrance (Signalized)

This three-legged signalized intersection is located approximately 0.18 miles east of Huntridge Road. The eastbound Route 460 approach includes two left-turn lanes and two through lanes. The westbound Route 460 approach includes a U-turn lane, two through lanes, and a right-turn lane. The southbound approach serving Walmart/Lowe's includes a left-turn lane and a right-turn lane. The eastbound and westbound approaches operate with protected-only left-turn phasing.

Route 460 at Route 220 ALT (Cloverdale Road) (Signalized)

This three-legged signalized intersection is located at the eastern study limit. The eastbound Route 460 approach includes two left-turn lanes and two through lanes. The westbound Route 460 approach includes two through lanes and a channelized right-turn lane. The southbound Route 220 ALT (Cloverdale Road) approach includes two left-turn lanes and a channelized right-turn lane. The eastbound approach operates with protected-only left-turn phasing.

2.2 MULTI-MODAL ACCOMMODATIONS

The Route 460 corridor is a heavily traveled commuter route with a high volume of passenger cars during peak times and a significant percentage of heavy vehicle traffic throughout the day. Sidewalks are

provided mostly along the western end of the corridor in Roanoke City, with sidewalks along both sides of Route 460 from the Williamson Road (Route 11) intersection to approximately the 24th Street intersection. There are additional short segments of sidewalks in front of the District Vue apartments and along the east side of King Street extending along Route 460 to just east of the King Street intersection. A previously approved SMART SCALE project at the King Street intersection will add additional segments of sidewalk and pedestrian actuated crosswalks in the vicinity of the King Street signal.

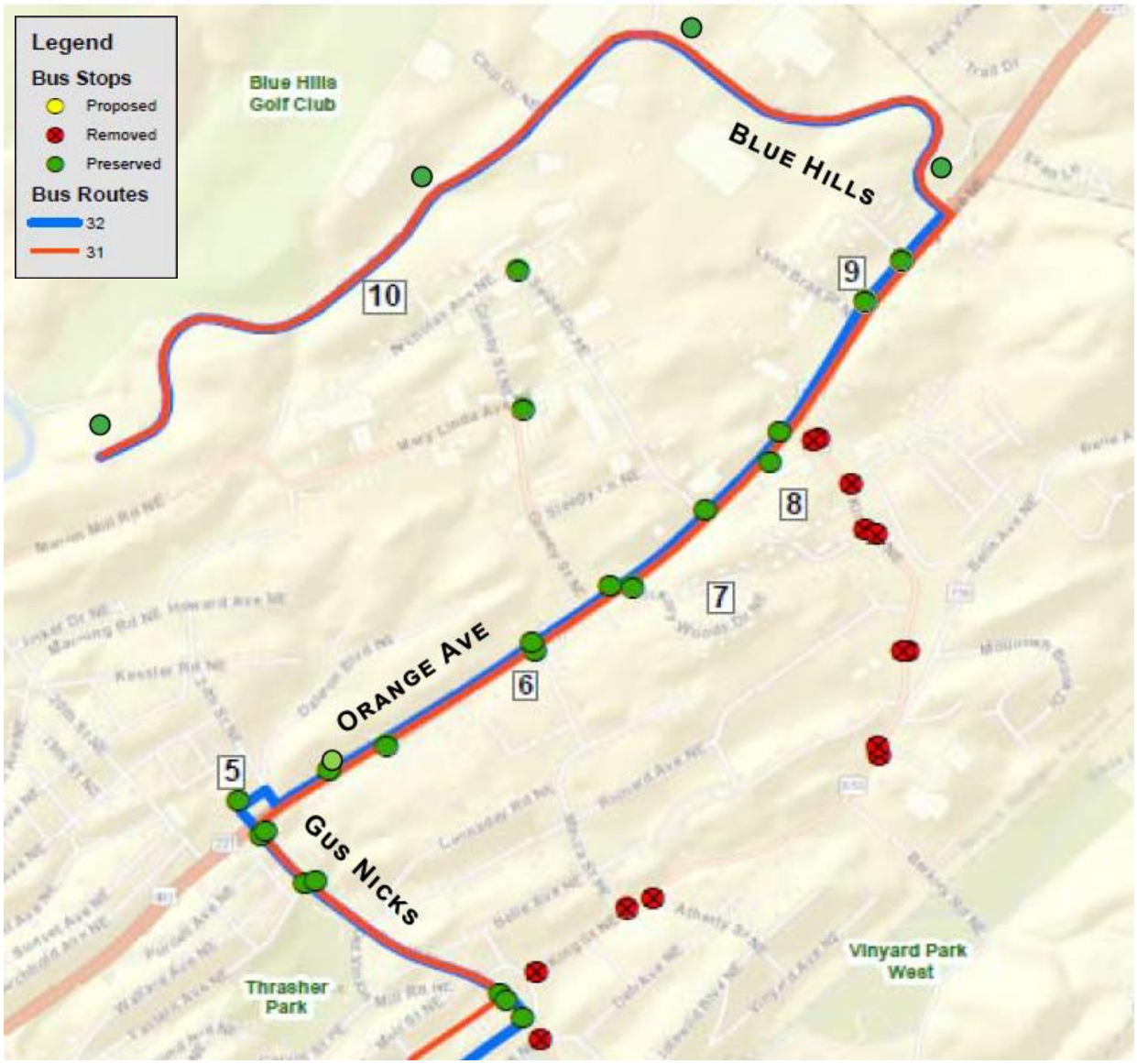
Existing pedestrian actuated crosswalks at signalized intersections are provided at the Williamson Road (Route 11) and 13th Street intersections, while there are pedestrian pushbuttons and pedestrian signal heads provided at the Plantation Road/Kimball Avenue intersection, and pedestrian pushbuttons provided at the Gus Nicks Boulevard intersection. There are no existing bicycle facilities located along or adjacent to the Route 460 corridor; however, the Tinker Creek Greenway Extension is planned to connect Mason Mill Park to East Gate Park and Fallon Park and will parallel Tinker Creek and 13th Street, crossing under the Route 460 bridge located just west of the 13th Street intersection. The Tinker Creek Greenway Extension will also connect to existing sidewalks near the Route 460 at 13th Street intersection.

Additionally, three Valley Metro transit routes either cross or utilize portions of Route 460 in Roanoke City with 11 bus stops provided along the corridor between Gus Nicks Boulevard and Blue Hills Drive/Mexico Way, and another 12 bus stops located on connecting roadways immediately adjacent to Route 460. The 21 & 22 routes utilize Williamson Road (Route 11) to cross Route 460. The 25 & 26 routes utilize Route 460 connecting between Plantation Road/Kimball Avenue to the south and Hollins Road to the north. The 31 & 32 routes utilize Route 460 connecting between Gus Nicks Boulevard to the south and Blue Hills Drive/Mexico Way to the north.

As shown in **Figure 2-2**, there are five bus stops on eastbound Route 460 and six bus stops on westbound Route 460 served by Valley Metro Routes 31 & 32. These routes service the Route 460 corridor hourly with approximately 15 transit buses per day in each direction. Bus stops are located at the following locations:

- Eastbound Route 460, at the BP gas station across from District Vue Apartments
- Eastbound Route 460, southwest corner of the Mecca Street intersection
- Eastbound Route 460, southwest corner of the Hickory Woods Drive intersection
- Eastbound Route 460, west of the King Street intersection
- Eastbound Route 460, southwest corner of the Lynn Brae Drive intersection
- Westbound Route 460, northeast corner of the Lynn Brae Drive intersection
- Westbound Route 460, northwest corner of the King Street intersection
- Westbound Route 460, northeast corner of the Seibel Drive intersection
- Westbound Route 460, northwest corner of the Hickory Woods Drive intersection
- Westbound Route 460, northwest corner of the Mecca Street intersection
- Westbound Route 460, west of District Vue Apartments

Figure 2-2: Valley Metro Bus Stops Along Route 460



2.3 TRAFFIC DATA COLLECTION

Traffic Volumes: Classified 12-hour (7:00 AM to 7:00 PM) turning movement counts were collected in April 2017 at the 12 signalized Route 460 intersections as part of previous studies along the corridor. Peak hour (7:00 AM to 9:00 AM and 4:00 PM to 6:00 PM) turning movement counts were performed at the 24 unsignalized intersections and median crossover intersections in October 2019 by Peggy Malone & Associates (PMA). Counts were performed on a Tuesday, Wednesday, or Thursday under typical traffic conditions and when school were in session. **Appendix B** contains the raw traffic count data.

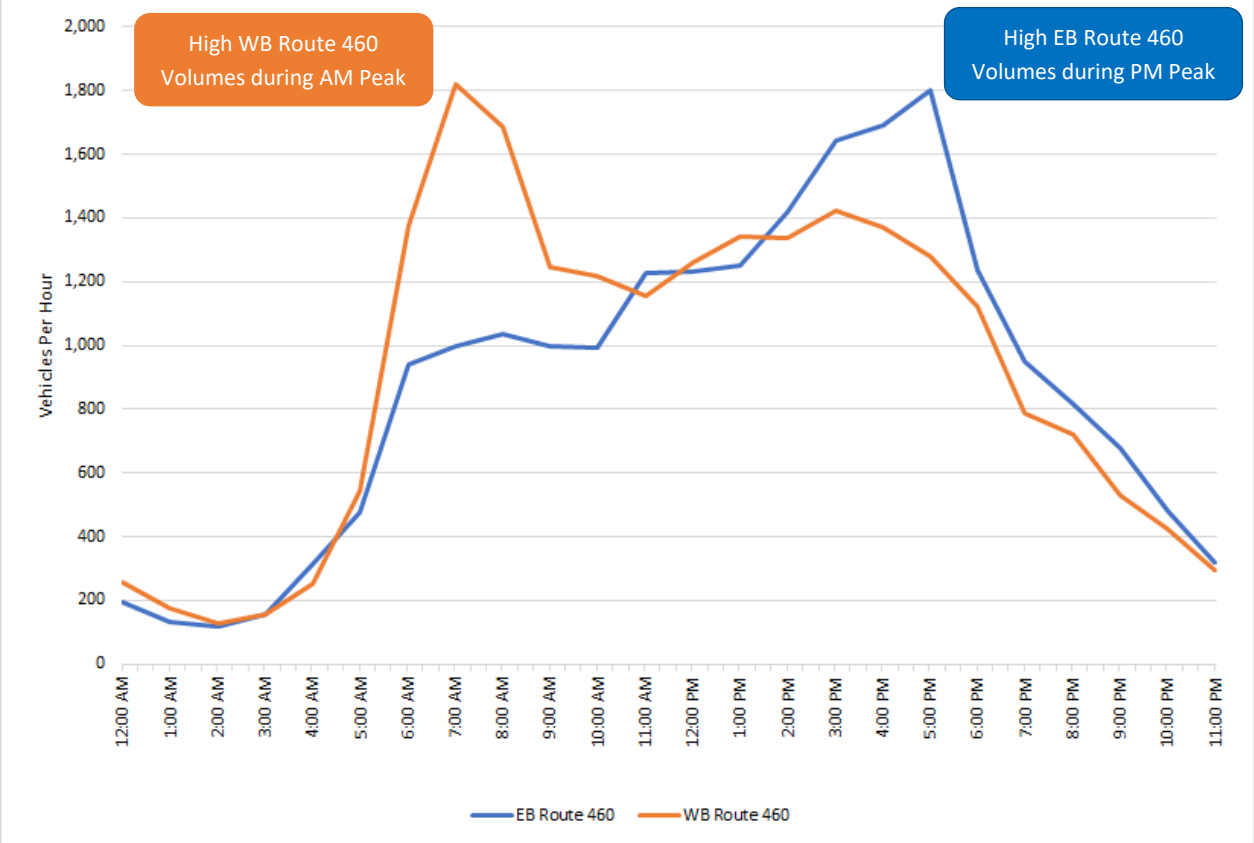
Queues: A field visit was conducted to observe typical traffic conditions and note any existing operational issues including queues exceeding storage lanes as described above in **Section 2.1**.

Travel Times: Travel time runs were performed along eastbound and westbound Route 460 from west of Williamson Road (Route 11) to Route 220 ALT (Cloverdale Road) during both the AM and PM peak hours. Travel time runs were completed in October 2019 and were performed on Tuesday, Wednesday, or Thursday when school was in session using the floating car method where the drivers traveled with the average speed of traffic. GPS devices were used to record vehicle speeds. The speeds and travel times were segmented at each unsignalized and signalized intersection along the Route 460 corridor. At least ten travel time runs per direction were conducted during each peak period.

2.4 EXISTING TRAFFIC VOLUMES

Figure 2-3 depicts hourly traffic volumes on eastbound and westbound Route 460 between Hollins Road and 24th Street. As shown, westbound Route 460 experiences higher traffic volumes during the AM peak hours when motorists are traveling west toward downtown Roanoke while eastbound Route 460 experiences higher traffic volumes during the PM peak hours when motorists are traveling toward more residential areas located along the eastern end of the study corridor in Roanoke County. Peak traffic volumes are approximately 1,800 vehicles per hour (VPH) in the primary travel direction during both AM and PM peak periods.

Figure 2-3: Route 460 Hourly Traffic Volumes – Between Hollins Road and 24th Street



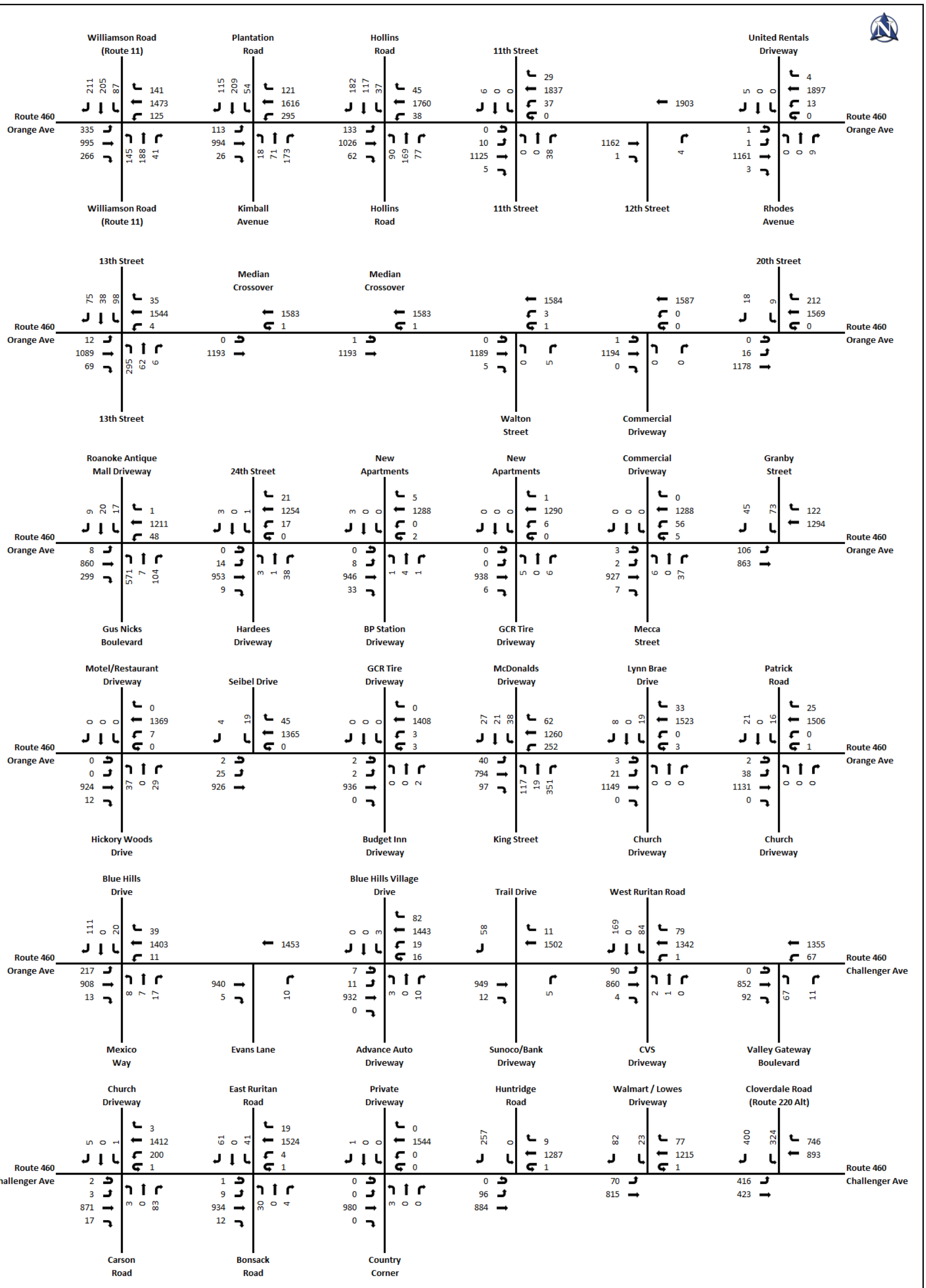
Annual Average Daily Traffic (AADT) values for 2018 along study area segments of Route 460 from Williamson Road (Route 11) to Route 220 ALT (Cloverdale Road) are shown in **Table 2-1**. Route 460 between Hollins Road and 24th Street has the highest AADT with 40,600 vehicles per day while adjacent segments range from 32,400 to 38,300 vehicles per day.

Table 2-1: Route 460 Daily Traffic Volumes

Route 460 Segment	2018 AADT
Williamson Road (Route 11) to Hollins Road	37,500
Hollins Road to 24th Street	40,600
24th Street to King Street	32,400
King Street to Roanoke City/Roanoke County Line	38,300
Roanoke City/Roanoke County Line to Route 220 ALT (Cloverdale Road)	35,000

Signalized intersection traffic count data along Route 460 was reviewed to establish morning and evening peak hours corresponding to the most congested conditions along Route 460 with the highest traffic volumes. Based on this review, the AM peak hour was determined to be from 7:15 AM to 8:15 AM and the PM peak hour was determined to be from 4:30 PM to 5:30 PM. Existing traffic volumes were balanced along Route 460 from Williamson Road (Route 11) to Route 220 ALT (Cloverdale Road) between intersections lacking adjacent high-volume driveways that were not included in traffic data collection. **Figures 2-4a and 2-4b** summarize the existing (2019) AM peak hour and PM peak hour traffic volumes within the study area, respectively.

Figure 2-4a: Peak Hour Volumes – 2019 Existing AM Peak Hour

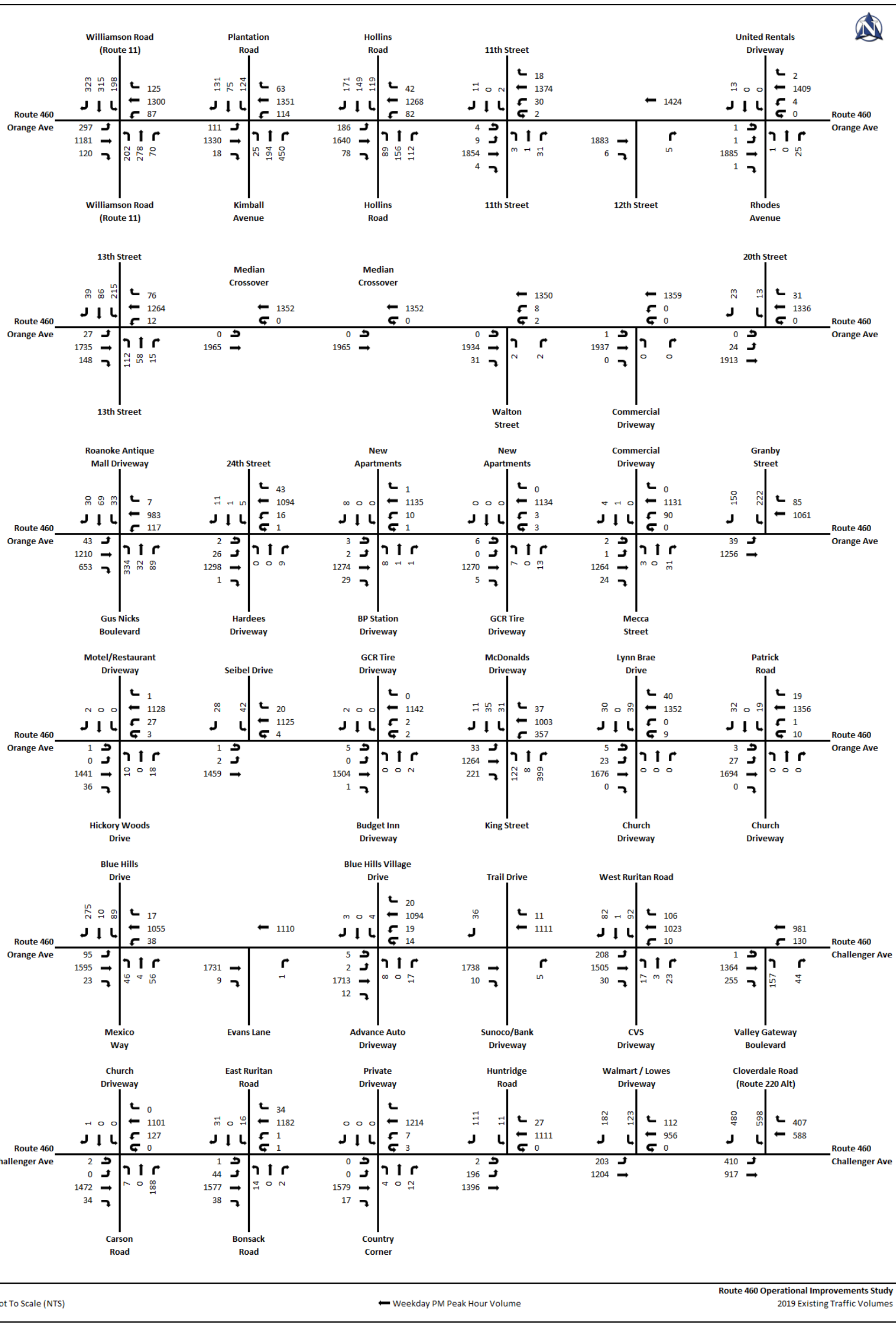


Not To Scale (NTS)

Weekday AM Peak Hour Volume

Route 460 Operational Improvements Study
2019 Existing Traffic Volumes

Figure 2-4b: Peak Hour Volumes – 2019 Existing PM Peak Hour



2.5 EXISTING TRAVEL TIME RUNS

Figures 2-5 and 2-6 show the average travel time runs on eastbound and westbound Route 460, respectively, during the AM and PM peak hours as well as the free-flow travel time at the speed limit. Eight travel time runs were conducted in each direction during each peak period. Two eastbound and two westbound runs were not included in the results during the AM peak due to incomplete or inconsistent data. During the PM peak, one incomplete westbound run was not included in the results. During the AM peak hour, the peak travel direction is westbound toward I-581 and the City of Roanoke. During the PM peak hour, the peak travel direction is eastbound away from I-581 and the City of Roanoke.

As shown in **Figure 2-5**, the eastbound Route 460 travel time is 11.5 minutes during the AM peak and 17.0 minutes during the PM peak. For comparison purposes, the free-flow travel time along eastbound Route 460 with no congestion at signalized intersections is approximately 7.4 minutes.

As shown in **Figure 2-6**, the westbound Route 460 travel time is 19.1 minutes during the AM peak and 13.1 minutes during the PM peak. For comparison purposes, the free-flow travel time along westbound Route 460 with no congestion at signalized intersections is approximately 7.5 minutes.

Figure 2-5: Eastbound Route 460 Cumulative Travel Time Runs

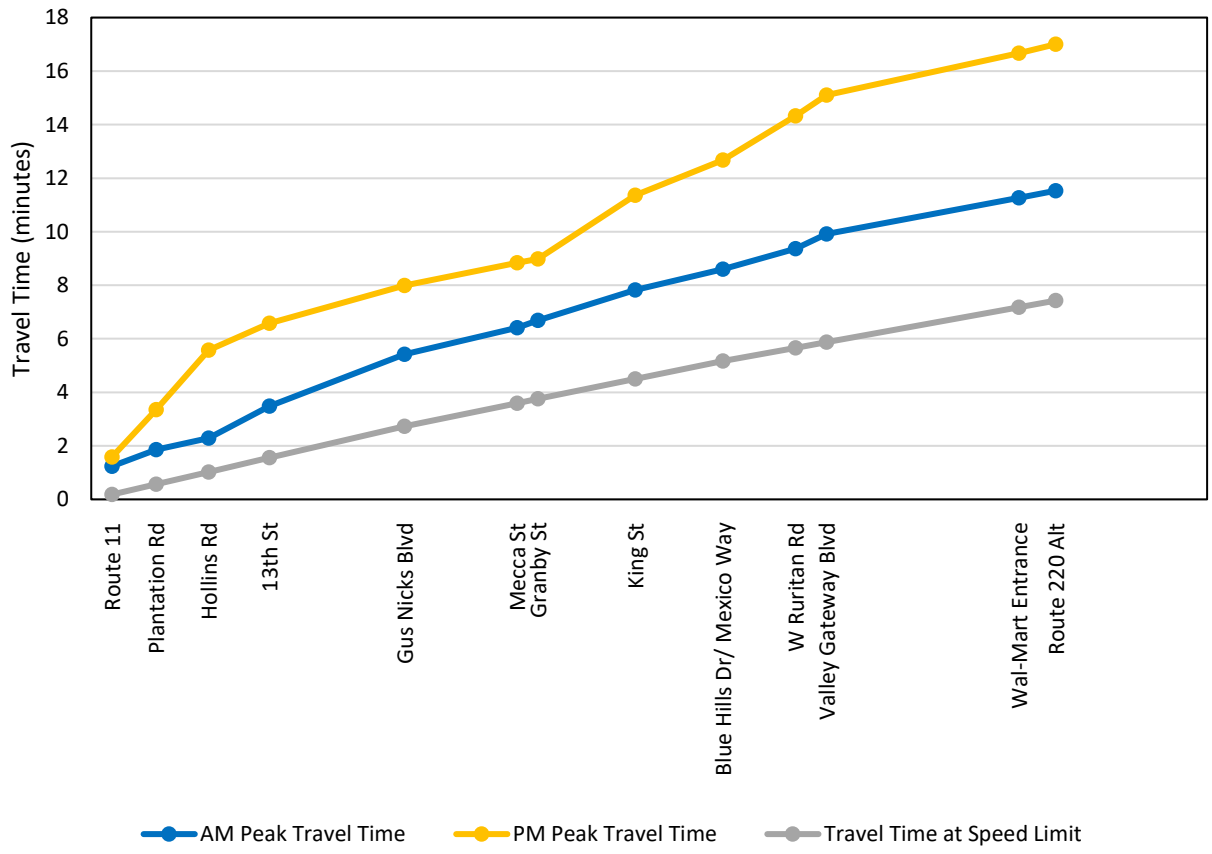
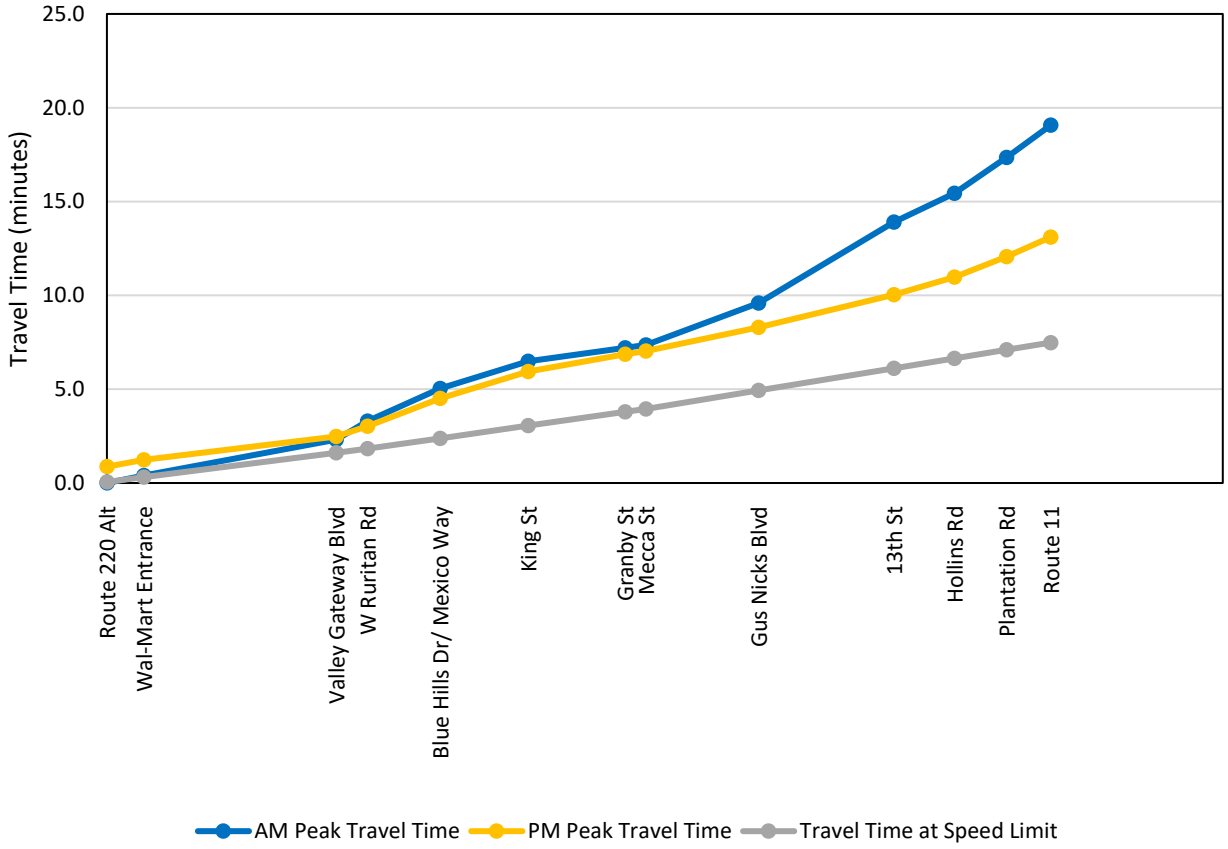


Figure 2-6: Westbound Route 460 Cumulative Travel Time Runs



3. SAFETY AND CRASH ANALYSIS

3.1 CRASH HISTORY

Crash data within the study area was reviewed for a five-year period from January 1, 2014 through December 31, 2018. Crash data was obtained from the VDOT Tableau-Crash Analysis Tool (T-CAT) within the limits of the study area. **Figure 3-1 (Sheets 1 through 5)** depict the crash locations by type and severity.

A total of 865 crashes were reported in the study area between January 1, 2014 and December 31, 2018. **Table 3-2** summarizes the crashes by collision type, severity, surface condition, weather condition, crash year, and time of the day. Six crashes resulted in a fatal injury. Thirty crashes resulted in severe injuries. 470 (54 percent) of the crashes were rear end collisions and 211 (24 percent) were angle crashes. The remaining 22 percent of the crashes were a combination of sideswipe (10 percent), fixed object (4 percent), and other crashes (8 percent). Nine pedestrian and two bicycle crashes were reported. 718 (83 percent) crashes occurred on dry surface conditions and the remaining 147 (17 percent) crashes occurred on wet or snow/icy/slush or other surface conditions. 2015 had the highest number of crashes within the five-year period with 23 percent of all crashes occurring in this year compared to a low of 15 percent of crashes occurring during 2017. The greatest portion of crashes occurred during the PM peak period from 3:00 PM to 6:00 PM with 29 percent of all crashes occurring during this three-hour period.

Of the six fatal crashes, two were angle crashes occurring at the Route 460 and Plantation Road and the Route 460 at Valley Gateway Boulevard intersections. Two fatal crashes resulted from fixed objects including one crash that occurred 0.10 miles east of the Route 460 at Bonsack Road/East Ruritan Road intersection and one crash that occurred 0.05 miles east of the Route 460 at Huntridge Road intersection. Two crashes resulted in fatal injuries to pedestrians both of which occurred near the Route 460 at Williamson Road (Route 11) intersection. Of the 11 bicycle and pedestrian-related crashes, eight occurred between the Williamson Road (Route 11) and Plantation Road/Kimball Avenue intersections.

Calculated crash rates per 100 million vehicle miles traveled (VMT) along various segments of Route 460 were compared to VDOT's annually-published 2018 average crash rates per 100 million VMT for Salem Primary Roads and Statewide Urban Principal Arterials. As shown in **Table 3-1,** the crash rate per 100 million vehicle miles traveled (VMT) for Route 460 within the study limits is 241.6 crashes per 100 million VMT. Route 460 from Williamson Road (Route 11) to Hollins Road had the highest crash rate with 390.2 crashes per 100 million VMT. Route 460 from Blue Hills Drive/Mexico Way to Route 220 ALT (Cloverdale Road) had the next highest crash rate with 331.2 crashes per 100 million VMT. The 2018 Salem Primary Roads average crash rate is 138.0 and the 2018 Statewide Urban Other Principal Arterial average crash rate is 204.5. The Route 460 crash rate within the study area is 18 percent greater than the average crash rate for Statewide Urban Other Principal Arterials and 75 percent greater than the average crash rate for Salem Primary Roads.

Table 3-1: Crash Rate per 100 Million Vehicle Miles Traveled

Facility/Segment of Route 460	Crash Rate per 100 Million Vehicle Miles Traveled (100 MVMT)
Williamson Road (Route 11) to Hollins Road	390.2
Hollins Road to Gus Nicks Boulevard	162.3
Gus Nicks Boulevard to King Street	150.2
King Street to Blue Hills Drive/Mexico Way	122.8
Blue Hills Drive/Mexico Way to Route 220 ALT (Cloverdale Road)	331.2
Overall Route 460 Crash Rate	**241.6**
Salem Primary Roads (2018)	138.0
Statewide Urban Principal Arterials (2018)	204.5

The Potential for Safety Improvement (PSI) rating is used by VDOT to identify locations where VDOT should consider an engineering review for possible mitigating countermeasures. When ranked by total PSI within the Salem District, Route 460 at Valley Gateway Boulevard has a PSI of 7, Route 460 at West Ruritan Road has a PSI of 10, Route 460 at King Street has a PSI of 31, Route 460 at Route 220 ALT (Cloverdale Road) has a PSI of 37, Route 460 at Trail Drive has a PSI of 39, Route 460 at Gus Nicks Boulevard has a PSI of 69,

and Route 460 at Bonsack Road/East Ruritan Road has a PSI of 72. Additionally, 62 percent of the study corridor was identified as a PSI segment.

Figure 3-3 depicts the crashes by intersection and crash type. As shown, the intersection of Route 460 and Williamson Road (Route 11) had the highest number of reported crashes with 84 crashes during the five-year study period including 45 rear end and 22 angle crashes. The West Ruritan Road and Route 220 ALT (Cloverdale Road) intersections had the next highest number of reported crashes each with 81 crashes. The Plantation Road/Kimball Avenue, Hollins Road, and Valley Gateway Boulevard intersections had the next highest number of intersection crashes with 52, 48, and 69 crashes reported, respectively.

Figure 3-1: Crashes by Type and Severity (Sheet 1 of 5)

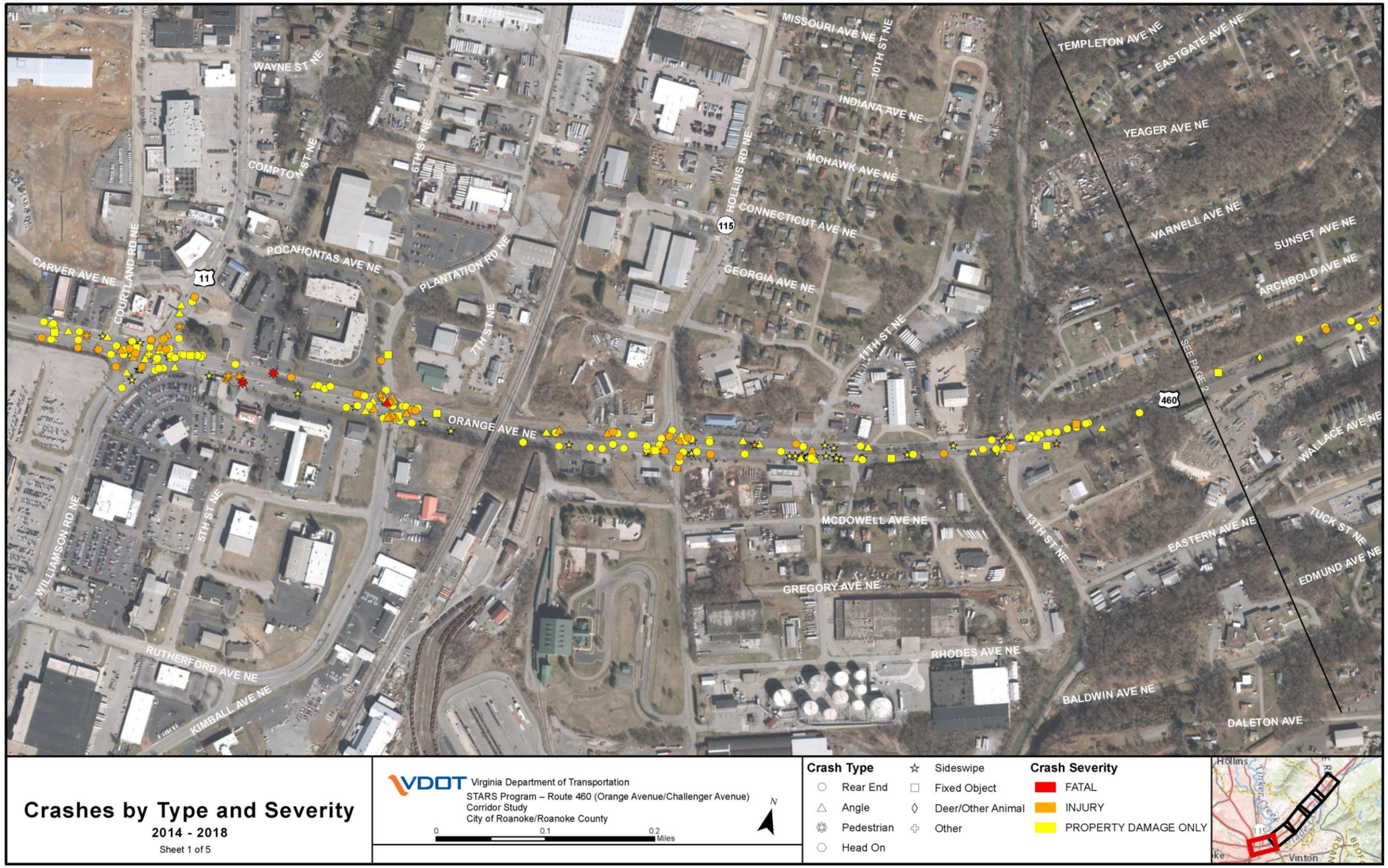


Figure 3-1: Crashes by Type and Severity (Sheet 2 of 5)

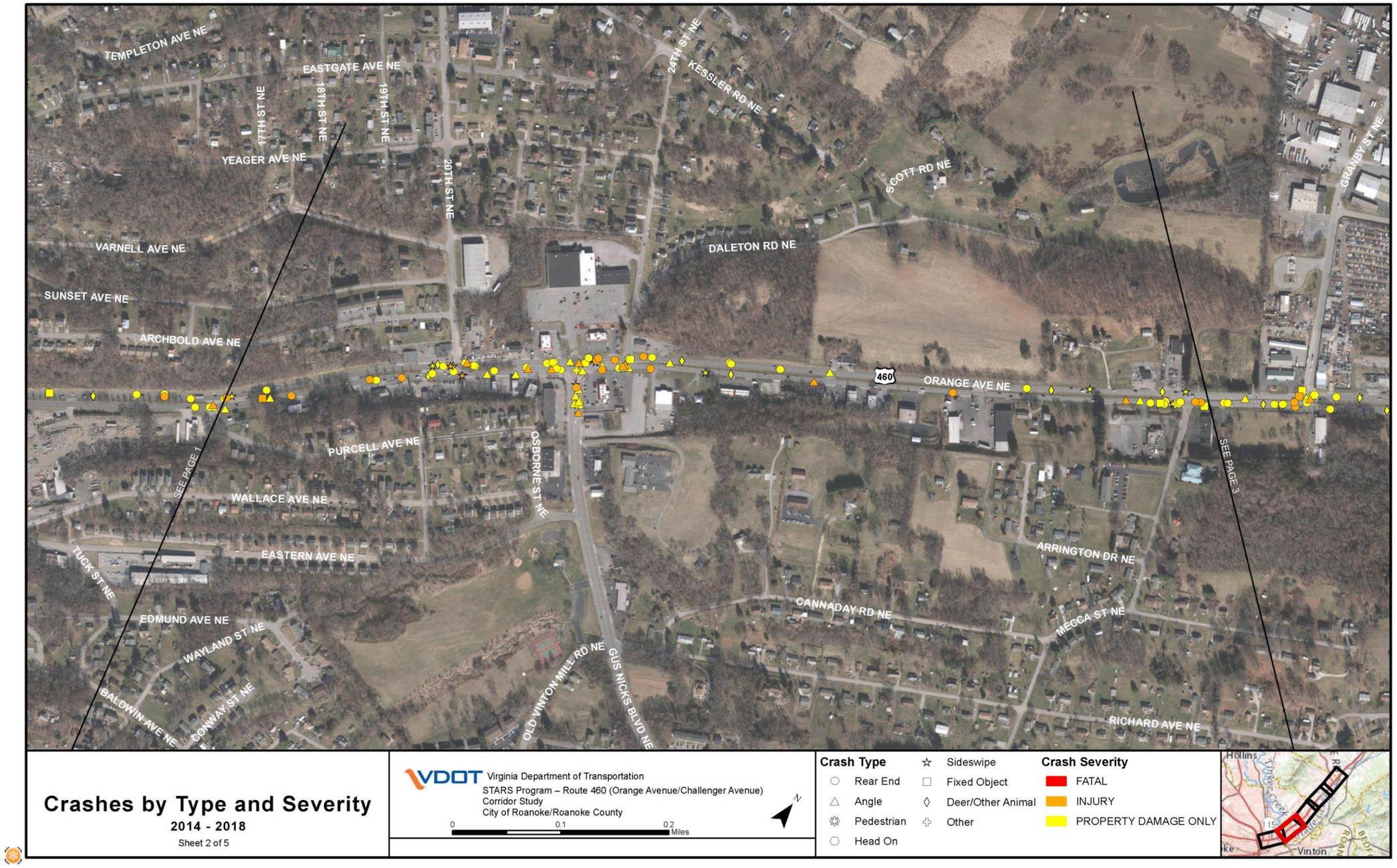


Figure 3-1: Crashes by Type and Severity (Sheet 3 of 5)

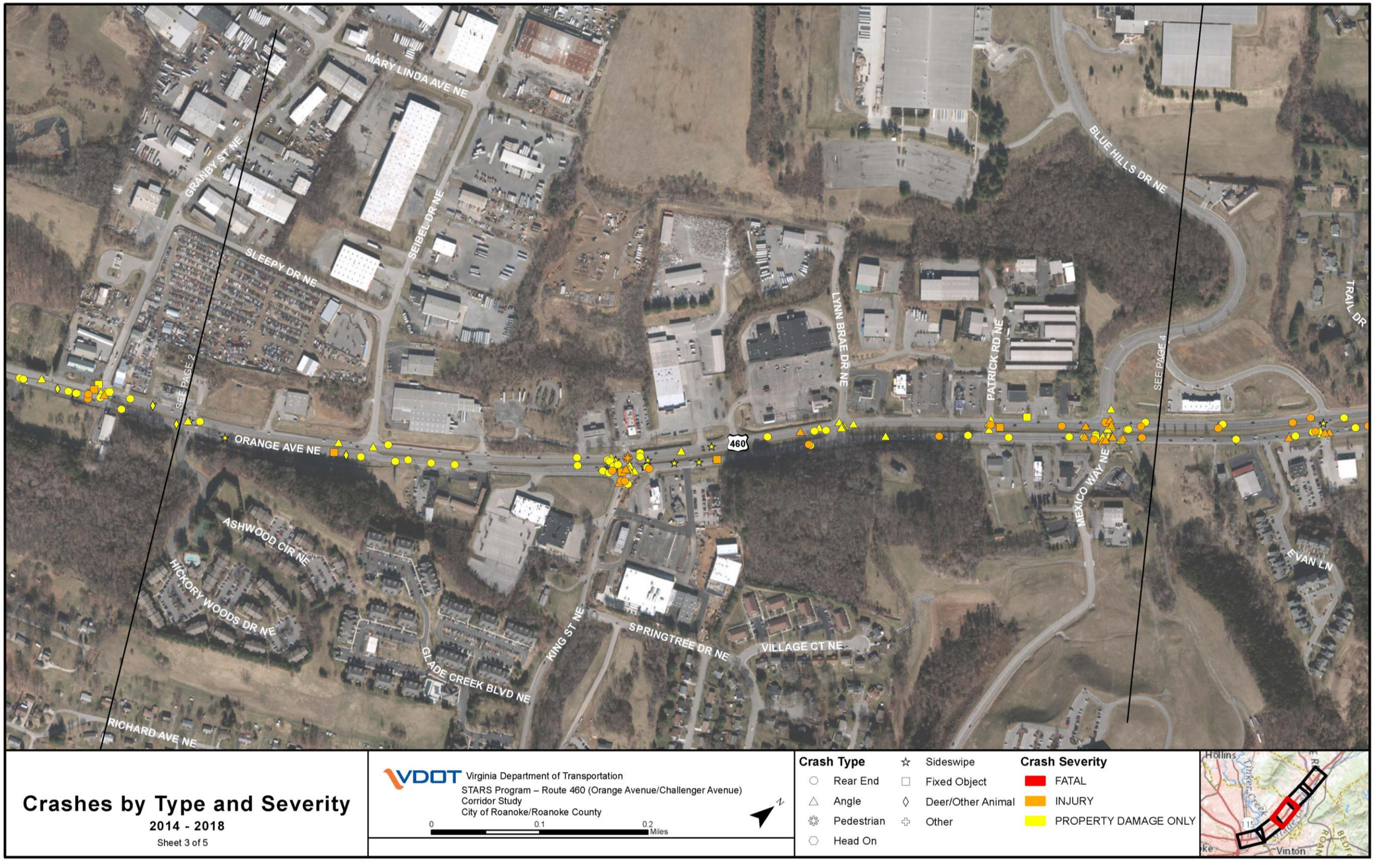


Figure 3-1: Crashes by Type and Severity (Sheet 4 of 5)

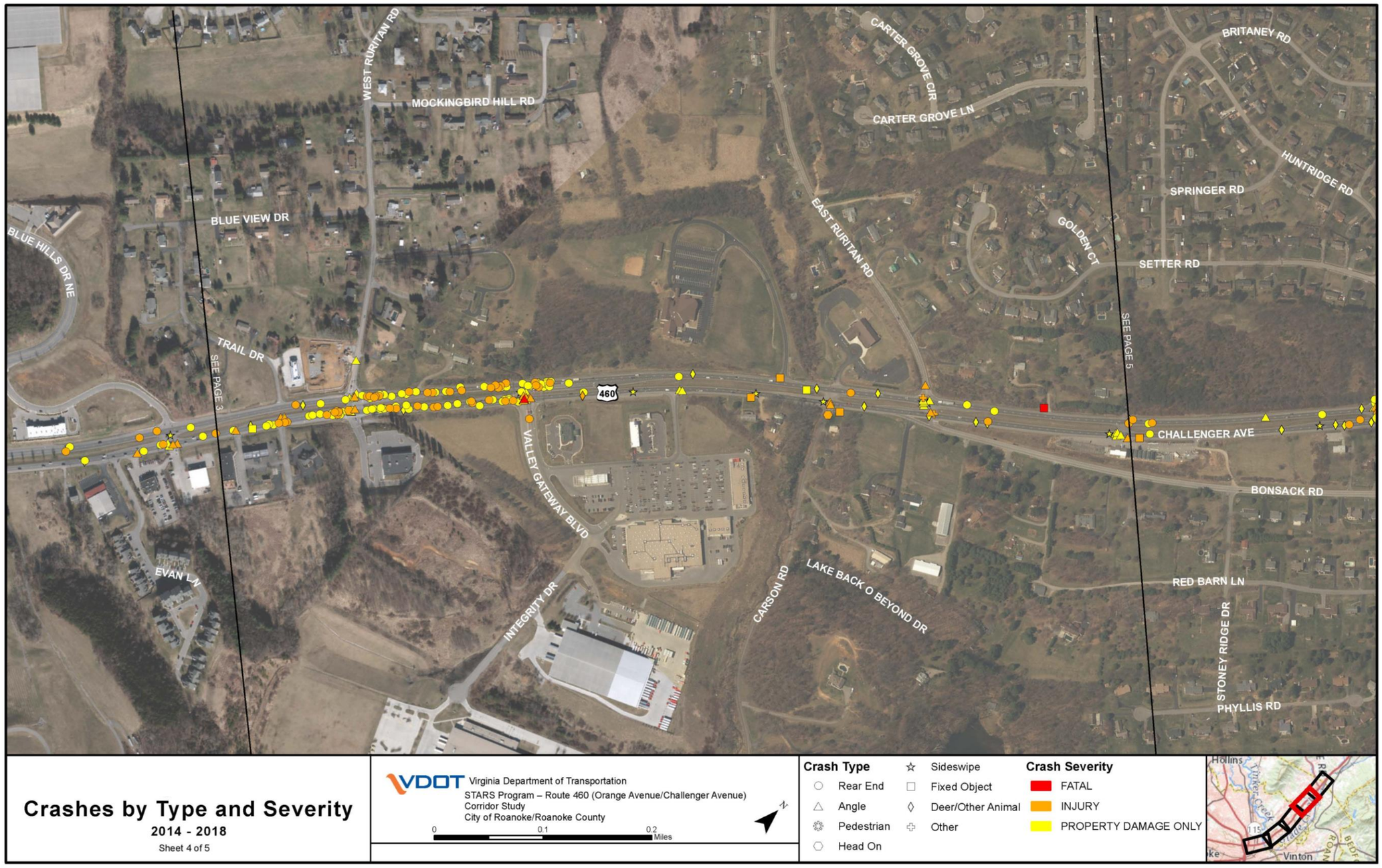


Figure 3-1: Crashes by Type and Severity (Sheet 5 of 5)

Figure 1:
Crashes by Type and Severity
2014 - 2018
Sheet 5 of 5

VDOT Virginia Department of Transportation
STARS Program – Route 460 (Orange Avenue/Challenger Avenue) Corridor Study
City of Roanoke/Roanoke County
0 0.1 0.2 Miles

Crash Type
- Rear End
- Angle
- Pedestrian
- Head On
- Sideswipe
- Fixed Object
- Deer/Other Animal
- Other

Crash Severity
- FATAL
- INJURY
- PROPERTY DAMAGE ONLY

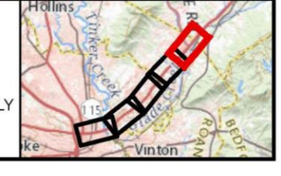
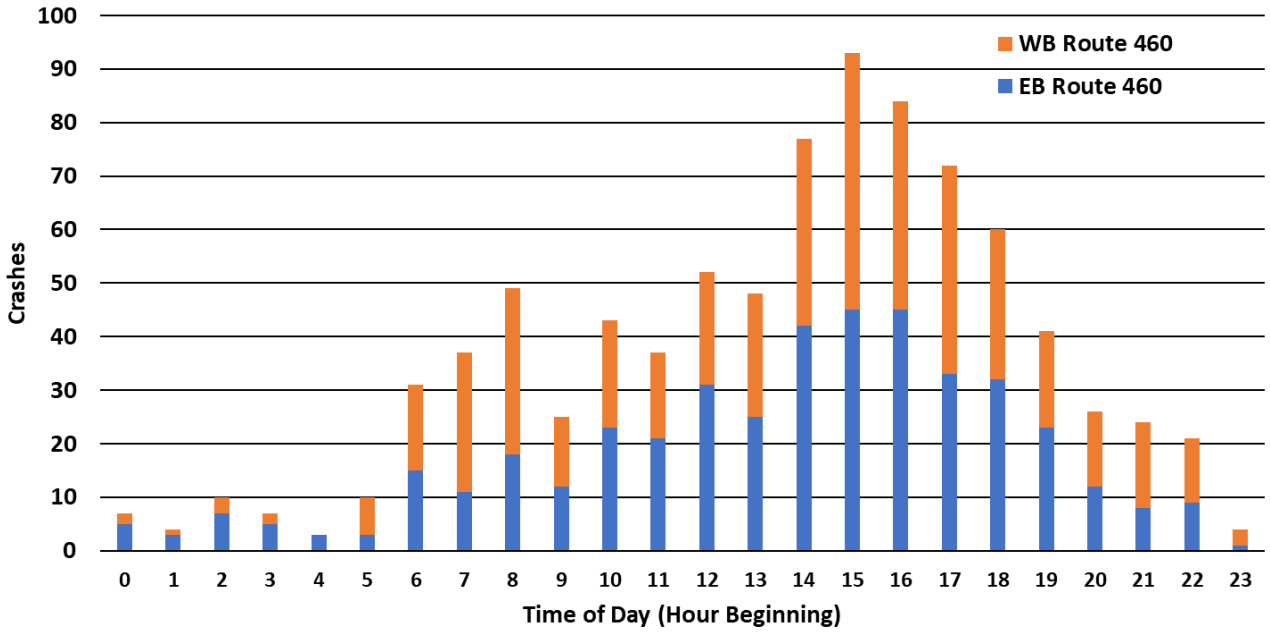


Table 3-2: Crash Summary (2014 – 2018)

Crash Type		Number of Crashes	% of Total Crashes
Collision Type	Rear End	470	**54.3%**
	Sideswipe	85	**9.8%**
	Angle	211	**24.4%**
	Fixed Object	34	**3.9%**
	Pedestrian/Bicycle	11	**1.3%**
	Other	54	**6.2%**
Crash Severity	Fatal Injury	6	**0.7%**
	Severe Injury	30	**3.5%**
	Visible Injury	118	**13.6%**
	Non-Visible Injury	90	**10.4%**
	Property Damage Only	621	**71.8%**
Surface Condition	Dry	718	**83.0%**
	Wet	131	**15.1%**
	Snowy/Icy/Slush	16	**1.8%**
	Other	0	**0.0%**
Weather Condition	No Adverse Conditions (Clear/Cloudy)	730	**84.4%**
	Rain/Mist	116	**13.4%**
	Snow/Sleet/Hail	13	**1.5%**
	Fog	3	**0.3%**
	Other	3	**0.3%**
Crash Year	2014	189	**21.8%**
	2015	202	**23.4%**
	2016	172	**19.9%**
	2017	125	**14.5%**
	2018	177	**20.5%**
Time	12 AM - 3 AM	21	**2.4%**
	3 AM - 6 AM	20	**2.3%**
	6 AM - 9 AM	117	**13.5%**
	9 AM - 12 PM	105	**12.1%**
	12 PM - 3 PM	177	**20.5%**
	3 PM - 6 PM	249	**28.8%**
	6 PM - 9 PM	127	**14.7%**
	9 PM - 12 AM	49	**5.7%**
Total Crashes		**865**	-

Crash data was reviewed by time of day as depicted in **Figure 3-2**. Crashes that occurred along minor street approaches north of Route 460 are included in the "WB Route 460" data and crashes that occurred along the minor street approaches south of Route 460 are included in the "EB Route 460" data. As shown, the highest frequency of crashes occurred along Route 460 during the midday and evening peak periods. Of the 865 total crashes, 466 (54 percent) of the crashes reported along Route 460 occurred within the five hours during the PM peak (2 PM – 7 PM) hours when congestion is heaviest along eastbound Route 460.

Figure 3-2: Crashes by Time of Day



Crashes were spatially located using the X,Y coordinates and a visual review of the crash locations was performed to identify crashes within the influence area of the intersection. Due to the close spacing of many of the study intersections and also long queues that create the potential for rear end crashes several hundred feet from intersections, the standard 250-foot buffer was not used. In accordance with the VDOT Crash Data Analysis Manual, engineering judgment was applied to determine the most appropriate intersection influence area including turn lanes and functional area.

Table 3-3 summarizes the crashes by intersection and severity. Route 460 at Valley Gateway Boulevard had the highest number of injury crashes with 29 injury crashes during the five-year study period. The Route 460 at West Ruritan Road intersection had the next highest number of injury crashes with 26 injury crashes. The Route 460 at Route 220 ALT (Cloverdale Road) intersection had the third highest number of injury crashes with 21 injury crashes. These three intersections account for 36 percent of the injury crashes at the 36 total intersections.

Table 3-3: Intersection Crashes by Severity (January 2014 – December 2018)

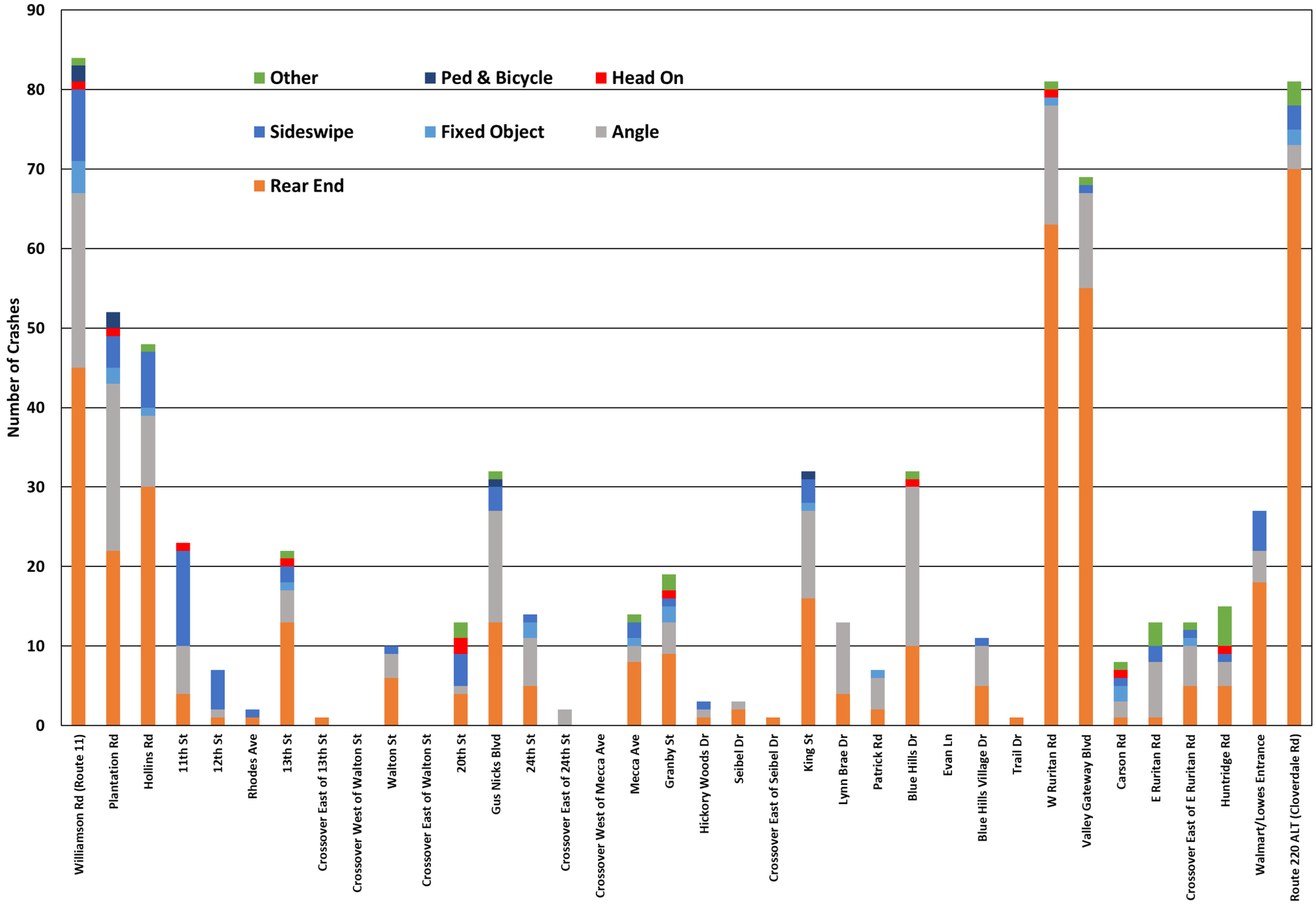
Intersection	Fatal	Severe Injury	Visible Injury	Non-Visible Injury	Property Damage Only	Total
Williamson Road (Route 11)	1	2	14	2	65	**84**
Plantation Road/Kimball Avenue	1	3	11	1	36	**52**
Hollins Road	0	2	7	1	38	**48**
11th Street	0	0	2	0	21	**23**
12th Street	0	0	0	0	7	**7**
Rhodes Avenue	0	0	1	0	1	**2**
13th Street	0	1	1	0	20	**22**
Crossover East of 13th Street	0	0	0	0	1	**1**
Crossover West of Walton Street	0	0	0	0	0	**0**
Walton Street	0	0	1	1	8	**10**
Crossover East of Walton Street	0	0	0	0	0	**0**
20th Street	0	0	3	0	10	**13**
Gus Nicks Boulevard	0	1	8	0	23	**32**
24th Street	0	0	4	0	10	**14**
District Vue Apartments (West)	0	0	1	0	1	**2**
District Vue Apartments (East)	0	0	0	0	0	**0**
Mecca Street	0	1	1	1	11	**14**
Granby Street	0	0	3	1	15	**19**
Hickory Woods Drive	0	0	0	0	3	**3**
Seibel Drive	0	0	0	0	3	**3**
Crossover East of Seibel Drive	0	0	0	0	1	**1**
King Street	0	0	9	1	22	**32**
Lynn Brae Drive	0	0	1	0	12	**13**
Patrick Road	0	1	2	0	4	**7**
Blue Hills Drive/Mexico Way	0	0	10	3	19	**32**
Evan Lane	0	0	0	0	0	**0**
Blue Hills Village Drive	0	1	2	2	6	**11**
Trail Drive	0	0	1	0	0	**1**
West Ruritan Road	0	2	5	19	55	**81**
Valley Gateway Boulevard	1	4	8	16	40	**69**
Carson Road	0	1	0	4	3	**8**
Bonsack Road/East Ruritan Road	0	1	2	1	9	**13**
Crossover East of East Ruritan Rd	0	3	1	1	8	**13**
Huntridge Road	0	0	0	4	11	**15**
Walmart/Lowe's Entrance	0	1	3	6	17	**27**
Route 220 ALT (Cloverdale Road)	0	1	1	19	60	**81**
Total	**3**	**25**	**102**	**83**	**540**	**753**

Table 3-4 summarizes the crashes by intersection and collision type. As shown, rear end crashes are the most predominant crash type at the study intersections with 422 (56 percent) rear end crashes. Of these, 70 (17 percent) occurred at the Route 460 and Route 220 ALT (Cloverdale Road) intersection, 63 (15 percent) occurred at the Route 460 at West Ruritan Road intersection, and 55 (13 percent) occurred at the Route 460 and Valley Gateway Boulevard intersection. Angle crashes were the next most predominant crash type with 197 (26 percent) angle crashes. Of the 197 angle crashes, 22 (11 percent) occurred at the Route 460 and Williamson Road (Route 11) intersection and 21 (11 percent) occurred at the Route 460 and Plantation Road/Kimball Avenue intersection.

Table 3-4: Intersection Crashes by Type (January 2014 – December 2018)

Intersection	Rear End	Angle	Sideswipe	Head On	Fixed Object	Ped & Bicycle	Other	Total
Williamson Road (Route 11)	45	22	9	1	4	2	1	**84**
Plantation Road/Kimball Avenue	22	21	4	1	2	2	0	**52**
Hollins Road	30	9	7	0	1	0	1	**48**
11th Street	4	6	12	1	0	0	0	**23**
12th Street	1	1	5	0	0	0	0	**7**
Rhodes Avenue	1	0	1	0	0	0	0	**2**
13th Street	13	4	2	1	1	0	1	**22**
Crossover East of 13th Street	1	0	0	0	0	0	0	**1**
Crossover West of Walton St	0	0	0	0	0	0	0	**0**
Walton Street	6	3	1	0	0	0	0	**10**
Crossover East of Walton Street	0	0	0	0	0	0	0	**0**
20th Street	4	1	4	2	0	0	2	**13**
Gus Nicks Boulevard	13	14	3	0	0	1	1	**32**
24th Street	5	6	1	0	2	0	0	**14**
District Vue Apartments (West)	0	2	0	0	0	0	0	**2**
District Vue Apartments (East)	0	0	0	0	0	0	0	**0**
Mecca Street	8	2	2	0	1	0	1	**14**
Granby Street	9	4	1	1	2	0	2	**19**
Hickory Woods Drive	1	1	1	0	0	0	0	**3**
Seibel Drive	2	1	0	0	0	0	0	**3**
Crossover East of Seibel Drive	1	0	0	0	0	0	0	**1**
King Street	16	11	3	0	1	1	0	**32**
Lynn Brae Drive	4	9	0	0	0	0	0	**13**
Patrick Road	2	4	0	0	1	0	0	**7**
Blue Hills Drive/Mexico Way	10	20	0	1	0	0	1	**32**
Evan Lane	0	0	0	0	0	0	0	**0**
Blue Hills Village Drive	5	5	1	0	0	0	0	**11**
Trail Drive	1	0	0	0	0	0	0	**1**
West Ruritan Road	63	15	0	1	1	0	1	**81**
Valley Gateway Boulevard	55	12	1	0	0	0	1	**69**
Carson Road	1	2	1	1	2	0	1	**8**
Bonsack Road/East Ruritan Road	1	7	2	0	0	0	3	**13**
Crossover East of East Ruritan Rd	5	5	1	0	1	0	1	**13**
Huntridge Road	5	3	1	1	0	0	5	**15**
Walmart/Lowe's Entrance	18	4	5	0	0	0	0	**27**
Route 220 ALT (Cloverdale Road)	70	3	3	0	2	0	3	**81**
Total	**422**	**197**	**71**	**11**	**21**	**6**	**25**	**753**

Figure 3-3: Intersection Crashes by Type



3.2 INTERSECTION CRASHES

Route 460 at Williamson Road (Route 11)

The Route 460 at Williamson Road (Route 11) intersection had the highest number of total intersection crashes (84 crashes) and angle crashes (22 crashes) within the study area. Route 460 at Williamson Road (Route 11) also had the third highest number of fatal and severe injury crashes (3 crashes) within the study area. In addition, 45 rear end crashes were reported at the intersection including 17 eastbound rear end crashes and 17 westbound rear end crashes. The Route 460 eastbound left turn to Williamson Road experiences queues extending beyond the I-581 interchange which increases the potential for crashes at the interchange during both existing and future conditions.

Two crashes involving pedestrians occurred within the influence area of the intersection. One pedestrian was fatally injured while crossing Route 460 at night, 500 feet to the east of the Route 460 and Williamson Road (Route 11) intersection. Another pedestrian was struck causing visible injuries while trying to cross Williamson Road (Route 11) 100 feet north of the intersection crosswalk.

Four crashes involving pedestrians occurred along eastbound Route 460 between the Williamson Road (Route 11) and Plantation Road/Kimball Avenue intersections.

- One crash involved a pedestrian crossing Route 460 more than 300 feet east of the crosswalk who was struck and fatally injured by a vehicle traveling eastbound.
- One crash involved a pedestrian crossing Route 460 more than 300 feet east of the crosswalk who was struck by a vehicle traveling eastbound causing severe injuries.
- One crash involved two pedestrians crossing Route 460 more than 300 feet east of the crosswalk who was struck by a vehicle traveling eastbound causing visible injuries to both pedestrians.
- One crash involved a pedestrian crossing Route 460 more than 300 feet east of the crosswalk who was struck by a vehicle traveling eastbound causing visible injuries.

Route 460 at Plantation Road/Kimball Avenue

The Route 460 at Plantation Road/Kimball Avenue intersection had 52 total intersection crashes. Of the 52 total crashes, 6 crashes resulted in a fatality or injury. The Route 460 at Plantation Road/Kimball Avenue intersection had the second highest number of angle crashes (21 crashes) in the study area. Of the 52 total crashes, 43 crashes (83 percent) were either angle or rear end crashes. Of the 21 angle crashes, there were six westbound left-turn crashes and four eastbound left-turn crashes involving opposing through vehicles. Two crashes involving pedestrians or bicyclists occurred within the influence area of the intersection. One crash involved a southbound vehicle making a right turn with a green light from Plantation Road to westbound Route 460 and striking a pedestrian causing visible injuries. The other crash involved a vehicle making a right turn with a green light onto Plantation Road from westbound Route 460 and striking a bicyclist resulting in visible injuries. One crash involved a vehicle traveling westbound on Route 460 running a red light and striking a vehicle that was making a left turn from eastbound Route 460 to Plantation Road causing a fatal injury.

Route 460 at Hollins Road

The Route 460 at Hollins Road intersection had 48 total crashes 10 of which resulted in injuries. Of the 48 total crashes, there were 30 rear end crashes, nine angle crashes, and seven sideswipe crashes. Thirty-nine (81 percent) crashes were either rear end or angle crashes. Of the 30 rear end crashes, there were 15 eastbound rear end crashes and 11 westbound rear end crashes.

Route 460 at 11th Street

The Route 460 at 11th Street intersection had the highest number of sideswipe crashes (12 crashes) of all the intersections and the highest number of total crashes (23 crashes) of the unsignalized intersections. The high frequency of sideswipe crashes can be attributed to the lane reduction from two lanes to one lane along eastbound Route 460 that occurs at this intersection. Two crashes resulted in injuries. Of the 23 total crashes, 10 (43 percent) crashes were either rear end or angle crashes. Of the six angle crashes, three involved westbound left-turning vehicles and eastbound through vehicles.

Route 460 at 12th Street

The Route 460 at 12th Street intersection had seven total crashes all of which resulted in property damage only. Of the seven total crashes, five were sideswipe crashes, one was a rear end collision, and one was an angle crash.

Route 460 at Rhodes Avenue

The Route 460 at Rhodes Avenue intersection had two total crashes one of which resulted in an injury. One crash was a rear end collision and one crash was a sideswipe crash.

Route 460 at 13th Street

The Route 460 at 13th Street intersection had 22 total crashes, two of which resulted in injuries. Route 460 at 13th Street had 13 rear end crashes including 11 westbound rear end crashes, 4 angle crashes and 2 sideswipe crashes. Of the 22 total crashes, 17 (77 percent) crashes were either rear end or angle crashes.

Route 460 at Median Crossover 660' East of 13th Street

Route 460 at the median crossover 660 feet east of 13th Street had one crash. This crash resulted in property damage only and was the result of a rear end collision.

Route 460 at Median Crossover 1,170' East of 13th Street

There were no reported crashes along Route 460 at the median crossover 1,170 feet east of 13th Street.

Route 460 at Walton Street

The Route 460 at Walton Street intersection had 10 total crashes, two of which resulted in injuries. Of the 10 total crashes, six were rear end crashes, three were angle crashes, and one was a sideswipe crash. Two

of the three angle crashes involved northbound left-turns from Walton Street and eastbound Route 460 through vehicles.

Route 460 at Median Crossover 700' East of Walton Street

There were no reported crashes along Route 460 at the median crossover 700 feet east of Walton Street.

Route 460 at 20th Street

The Route 460 at 20th Street intersection had 13 total crashes, three which resulted in injuries. Of the 13 total crashes, four were rear end collisions, four were sideswipe crashes, and three angle crashes.

Route 460 at Gus Nicks Boulevard

The Route 460 at Gus Nicks Boulevard intersection had 32 total crashes. Of the 32 total crashes, 27 (84 percent) were either rear end or angle crashes. Nine crashes resulted in injuries. One crash occurred involving a bicyclist crossing Route 460 fifty feet away from the crosswalk and being struck by a vehicle traveling eastbound on Route 460 causing visible injuries. Of the 13 rear end crashes, eight occurred along westbound Route 460 and four occurred along eastbound Route 460.

Route 460 at 24th Street

The Route 460 at 24th Street intersection had 14 total crashes, four of which resulted in injuries. Of the 14 total crashes, five were rear end collisions, six were angle crashes, and two were fixed object crashes.

Route 460 at District Vue Apartments (West) (Unsignalized)

Route 460 at the median crossover serving District Vue Apartments (west) had two total crashes, one of which resulted in an injury. Both crashes were angle crashes.

Route 460 at District Vue Apartments (East) (Unsignalized)

There were no reported crashes along Route 460 at the median crossover serving District Vue Apartments (east).

Route 460 at Mecca Street

The Route 460 at Mecca Street intersection had 14 total crashes 3 of which resulted in injuries. Of the 14 total crashes, eight were rear end collisions including some that referenced motorists unexpectedly stopping for the emergency signal, two were angle crashes, and two were sideswipe crashes.

Route 460 at Granby Street

The Route 460 at Granby Street intersection had 19 total crashes. Of the 19 total crashes, 13 (68 percent) were either rear end or angle crashes. Four crashes resulted in injuries. Eight of the nine rear end crashes occurred along eastbound Route 460.

Route 460 at Hickory Woods Drive

The Route 460 at Hickory Woods Drive intersection had three total crashes, all of which resulted in property damage only. Of the 3 crashes, there was one rear end collision, one angle crash, and one sideswipe crash.

Route 460 at Seibel Drive

The Route 460 at Seibel Drive intersection had three total crashes all of which resulted in property damage only. Of the three crashes, two crashes were rear end collisions and one was an angle crash.

Route 460 at Median Crossover 520' East of Seibel Drive

Route 460 at the median crossover 520 feet east of Seibel Drive had one crash. This crash resulted in property damage only and was the result of a rear end collision.

Route 460 at King Street

The Route 460 at King Street intersection had 32 total crashes. Of the 32 total crashes, there were 16 rear end crashes, 11 angle crashes, and three sideswipe crashes. Of the 32 total crashes, 27 (84 percent) were either rear end or angle crashes. Ten crashes resulted in injuries. One crash involved a vehicle changing lanes and hitting a pedestrian within the intersection causing visible injuries.

Route 460 at Lynn Brae Drive

The Route 460 at Lynn Brae Drive intersection had 13 total crashes, one of which resulted in an injury. Of the 13 total crashes, four were rear end collisions and nine were angle crashes. Of the nine angle crashes, seven involved southbound left turns from Lynn Brae Drive and westbound Route 460 through vehicles.

Route 460 at Patrick Road

The Route 460 at Patrick Road intersection had seven total crashes, three of which resulted in injuries. Of the seven total crashes, two were rear end crashes, four were angle crashes, and one was a fixed object crash.

Route 460 at Blue Hills Drive/Mexico Way

The Route 460 at Blue Hills Drive/Mexico Way intersection had 32 total crashes and the third highest number of angle crashes with 20 crashes. Of the 32 total crashes, 30 (94 percent) were either rear end or angle crashes. Of the 20 angle crashes, 10 were westbound left-turn crashes and five were eastbound left-turn crashes involving opposing through vehicles. Thirteen crashes resulted in injuries.

Route 460 at Evan Lane

There were no reported crashes at the Route 460 at Evan Lane intersection.

Route 460 at Blue Hills Village Drive

The Route 460 at Blue Hills Village Drive intersection had 11 total crashes, five of which resulted in injuries. Of the 11 total crashes, there were five rear end collisions, five angle crashes, and one sideswipe crash.

Route 460 at Trail Drive

The Route 460 at Trail Drive intersection had one crash. The crash resulted in a visible injury and was the result of a rear end collision.

Route 460 at West Ruritan Road

The Route 460 at West Ruritan Road intersection had the second highest number of total crashes with 81 crashes and the second highest number of rear end crashes with 63 crashes. Route 460 at West Ruritan Road had the second highest number of injury crashes with 26 injury crashes. Of the 81 total crashes, 78 (96 percent) were either rear end or angle crashes. There were 34 eastbound rear end and 28 westbound rear end crashes. Of the 15 angle crashes, seven were eastbound left-turn crashes and four were westbound left-turn crashes involving opposing through vehicles.

Route 460 at Valley Gateway Boulevard

The Route 460 at Valley Gateway Boulevard intersection had 69 total crashes. Of the 69 total crashes, 67 (97 percent) were either rear end or angle crashes. 55 (80 percent) crashes were rear ends and 12 (17 percent) were angle crashes. There were 26 eastbound rear end and 27 westbound rear end crashes. Valley Gateway Boulevard had the highest number of fatal and injury crashes with 29 fatal or injury crashes occurring at the intersection. One crash involved a vehicle running a red light while traveling eastbound on Route 460 and striking another vehicle making a left turn from Valley Gateway Boulevard resulting in a fatal injury.

It should be noted that following the implementation of signal timing improvements along Route 460 that occurred in November 2019, crash data was reviewed during the three-month period between December 2019 and February 2020 and there was only one reported rear end crash during the period indicating that the signal timing improvements significantly reduced the potential for rear end crashes, the predominant crash type at the intersection.

Route 460 at Carson Road

The Route 460 at Carson Road intersection had eight total crashes and tied for the highest number of injury crashes for unsignalized intersections with five injury crashes. Of the eight total crashes, there were two fixed object crashes, two angle crashes involving northbound left turns and eastbound through vehicles, and one head on collision.

Route 460 at Bonsack Road/East Ruritan Road

The Route 460 at Bonsack Road/East Ruritan Road intersection had 13 total crashes, four of which resulted in injuries. Of the 13 total crashes, there were seven angle crashes, two sideswipe crashes, and one rear end collision.

Route 460 at Median Crossover 950' East of Bonsack Road/East Ruritan Road

Route 460 at the median crossover 950 feet east of Bonsack Road/East Ruritan Road had 13 total crashes and had the highest number of injury crashes for unsignalized intersections with five injury crashes. Of the five injury crashes, three crashes resulted in severe injuries. Of the 13 total crashes, there were 5 rear end collisions, five angle crashes, and one sideswipe crash. Four of the angle crashes involved eastbound through and northbound vehicles from Country Corner.

Route 460 at Huntridge Road

The Route 460 at Huntridge Road intersection had 15 total crashes, four of which resulted in injuries. Of the 15 total crashes, there were five rear end crashes, three angle crashes, and five "other" crashes involving deer.

Route 460 at Walmart/Lowe's Entrance

The Route 460 and Walmart/Lowe's Entrance intersection had 27 total crashes. Of the 27 total crashes, 18 were rear end crashes including nine along eastbound and nine along westbound Route 460, four were angle crashes, and five were sideswipe crashes. Ten crashes resulted in injuries.

Route 460 at Route 220 ALT (Cloverdale) Road

The Route 460 at Route 220 ALT (Cloverdale Road) intersection had the second highest number of total crashes with 81 crashes and had the highest number of rear end crashes with 70 crashes. The Route 460 at Route 220 ALT (Cloverdale Road) intersection had the third highest number of injury crashes with 21 injury crashes. Of the 81 total crashes, 73 (90 percent) were either rear end or angle crashes.

4. FUTURE TRAFFIC VOLUMES AND NO BUILD IMPROVEMENTS

Traffic volumes were developed for a 2040 design year for both No Build as well as for Build conditions with proposed improvements (see **Section 6.4**).

4.1 TRAFFIC FORECASTING METHODOLOGY

The Traffic Volumes Forecasts Development Memorandum located in **Appendix C** documents the forecast methodology and development of future year forecasts. The existing (2017 and 2019) traffic volume counts, VDOT historic traffic volumes, and VDOT's Statewide Planning System (SPS) data were used to develop a projected annual average growth rate (AAGR). The AAGR was applied to the existing balanced counts to generate the 2040 design year background traffic forecasts. **Table 4-1** depicts the SPS linear

growth rates utilized for the study developed in conjunction with VDOT Salem District Planning. As shown, annual growth rates range from 0.5% along the majority of the corridor to 1.168% on Route 220 ALT (Cloverdale Road).

Table 4-1: Recommended Growth Rates

Facility	From	To	SPS Linear Growth Rate
Route 460	Williamson Rd (Route 11)	Hollins Rd	0.500%
Route 460	Hollins Rd	24th St	0.500%
Route 460	24th St	King St	0.500%
Route 460	King St	ECL Roanoke	0.500%
Route 460	ECL Roanoke	Route 220 ALT (Cloverdale Rd)	0.500%
Williamson Rd (Route 11)	I-581 Ramp	Route 460	0.500%
Williamson Rd (Route 11)	Route 460	Liberty Rd	0.500%
Liberty Rd	Route 460	Indiana Ave	0.500%
Kimball Ave	Williamson Rd (Route 11)	Route 460	0.611%
Hollins Rd	Route 460	Liberty Rd	0.500%
Hollins Rd	Norfolk Ave	Route 460	0.500%
Gus Nicks Blvd	Route 460	SCL Roanoke	0.500%
King St	Gus Nicks Blvd	Route 460	0.635%
Carson Rd	ECL Roanoke	Route 460	0.500%
Route 220 ALT (Cloverdale Rd)	Route 460	Botetourt County Line	1.168%

Additionally, there are three approved developments within the study area that were provided by VDOT and incorporated into the future traffic volumes including:

- East Orange Avenue Apartments (TIA prepared March 26, 2015) (later named District Vue Apartments)
- Richfield Living Site 2 (TIA prepared January 28, 2019)
- Lewis-Gale FSED Facility (TIA revised August 2, 2019)

Site trips from the Traffic Impact Analysis reports (TIAs) for these developments were utilized during the development of design year traffic volumes for the study area. It is assumed that all three developments will be fully built out prior to the 2040 design year. Site trips were added to the calculated future background traffic volumes after background growth rates were applied. Future traffic volumes were rebalanced as necessary along Route 460.

There are no other known or planned developments in the immediate study vicinity that are expected to impact travel patterns along the corridor. As such, no additional factors were applied to the forecasted traffic volumes to account for anticipated development.

4.2 NO BUILD CONDITIONS TRAFFIC VOLUMES

The growth rates were applied to the existing turning movements within the study area to develop future background traffic volumes for the 2040 design year. Future traffic volumes were adjusted based on the three approved developments (East Orange Avenue Apartments, Richfield Living Site 2, and Lewis-Gale FSED Facility) and balanced as necessary between study intersections. **Figures 4-1a and 4-1b** depict the 2040 No Build scenario traffic volumes for the AM and PM peak hours, respectively.

4.3 NO BUILD IMPROVEMENTS

The No Build Alternative has been included for evaluation as a benchmark for the comparison of future conditions and impacts. The No Build Alternative would retain the same geometry as existing conditions with the exception of three approved developments and two separate improvement projects along Route 460 submitted for SMART SCALE funding. The three approved developments within the study area that were provided by VDOT and incorporated into the future traffic volumes include:

- East Orange Avenue Apartments (TIA prepared March 26, 2015)
- Richfield Living Site 2 (TIA prepared January 28, 2019)
- Lewis-Gale FSED Facility (TIA revised August 2, 2019)

It is assumed that all three developments will be fully built out prior to the 2040 design year. Roadway improvements associated with these developments include eastbound left-turn lanes at both entrances to the District Vue Apartments, both of which have been constructed for the apartments, which are now open to residents. The Richfield Living Site 2 development proposes a new traffic signal for the intersection of Route 460 at Mecca Street, to provide access to the development. No roadway improvements along Route 460 are proposed for the Lewis-Gale FSED Facility.

Two separate improvement projects for intersections along Route 460 were previously submitted for SMART Scale funding and awarded funds for proposed improvements. In the first project at the Hollins Road intersection, a new eastbound right-turn lane will be constructed, and the eastbound and westbound Route 460 left-turn lanes will be offset to improve sight distance and will be converted from protected-only operation to flashing yellow arrow protective-permissive operation.

The second project includes intersection improvements at both the King Street and Blue Hills Drive/Mexico Way intersections. At King Street, the westbound left-turn lane will be extended to provide additional storage capacity, and the eastbound and westbound Route 460 left-turn lanes will be offset to improve sight distance and will be converted from protected-only operation to flashing yellow arrow protective-permissive operation. Additionally, new sidewalks along Route 460 are proposed along with a crosswalk and pedestrian push buttons for pedestrians to cross Route 460 to access Valley Metro bus stops near the intersection.

At the Blue Hills Drive/Mexico Way intersection, the eastbound and westbound Route 460 left-turn lanes will be offset to improve sight distance and will be converted from protected-only operation to flashing yellow arrow protective-permissive operation.

While VDOT undertook a traffic signal coordination effort for the signalized intersections located in Roanoke County in November 2019, those timings were not incorporated for the 2019 existing conditions analysis since data collection including travel time runs and field observations were completed prior to the new coordination plans being implemented. Therefore, these improvements are included in the No Build conditions analyses.

Figure 4-1a: Peak Hour Volumes – 2040 No Build AM Peak Hour

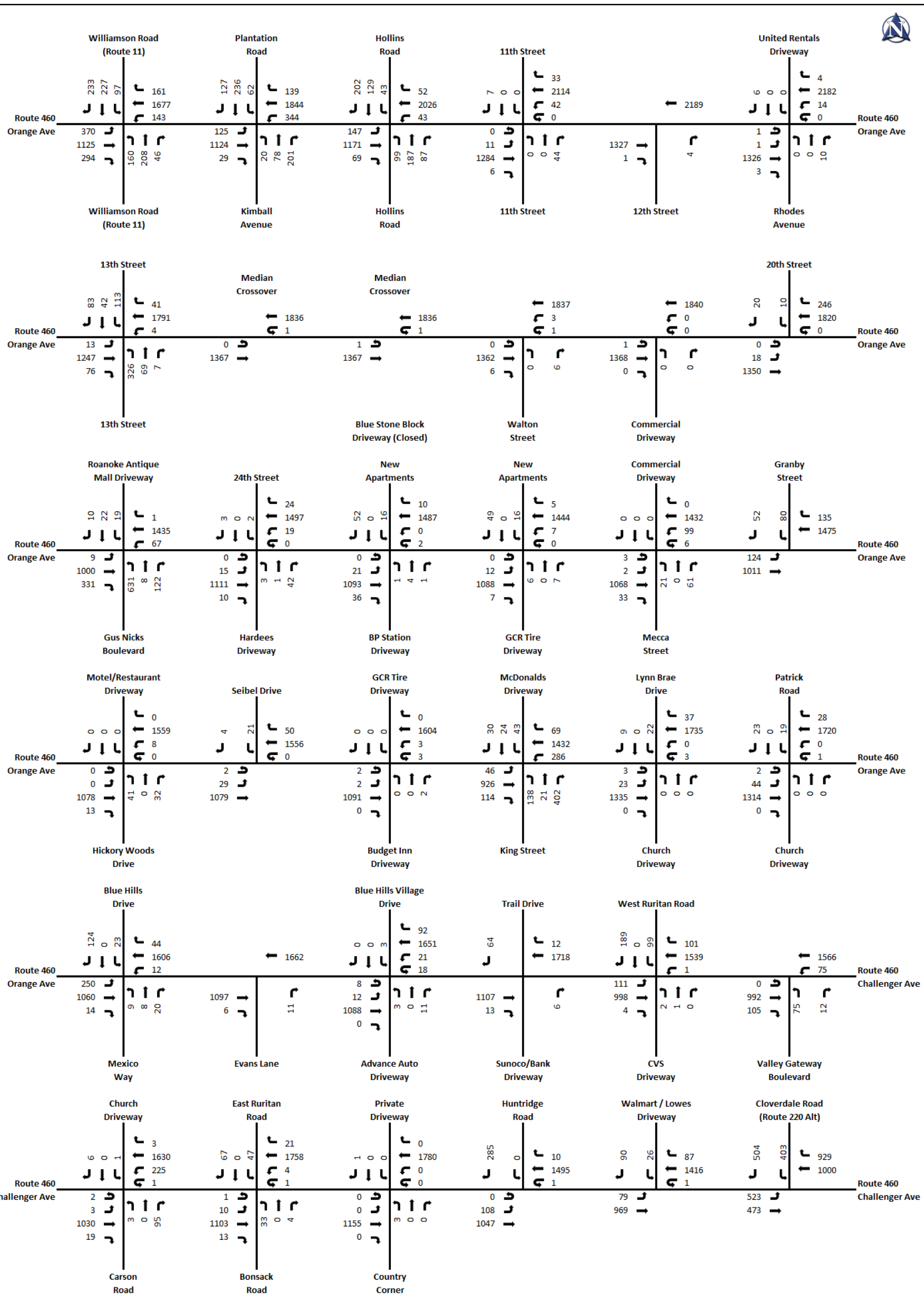
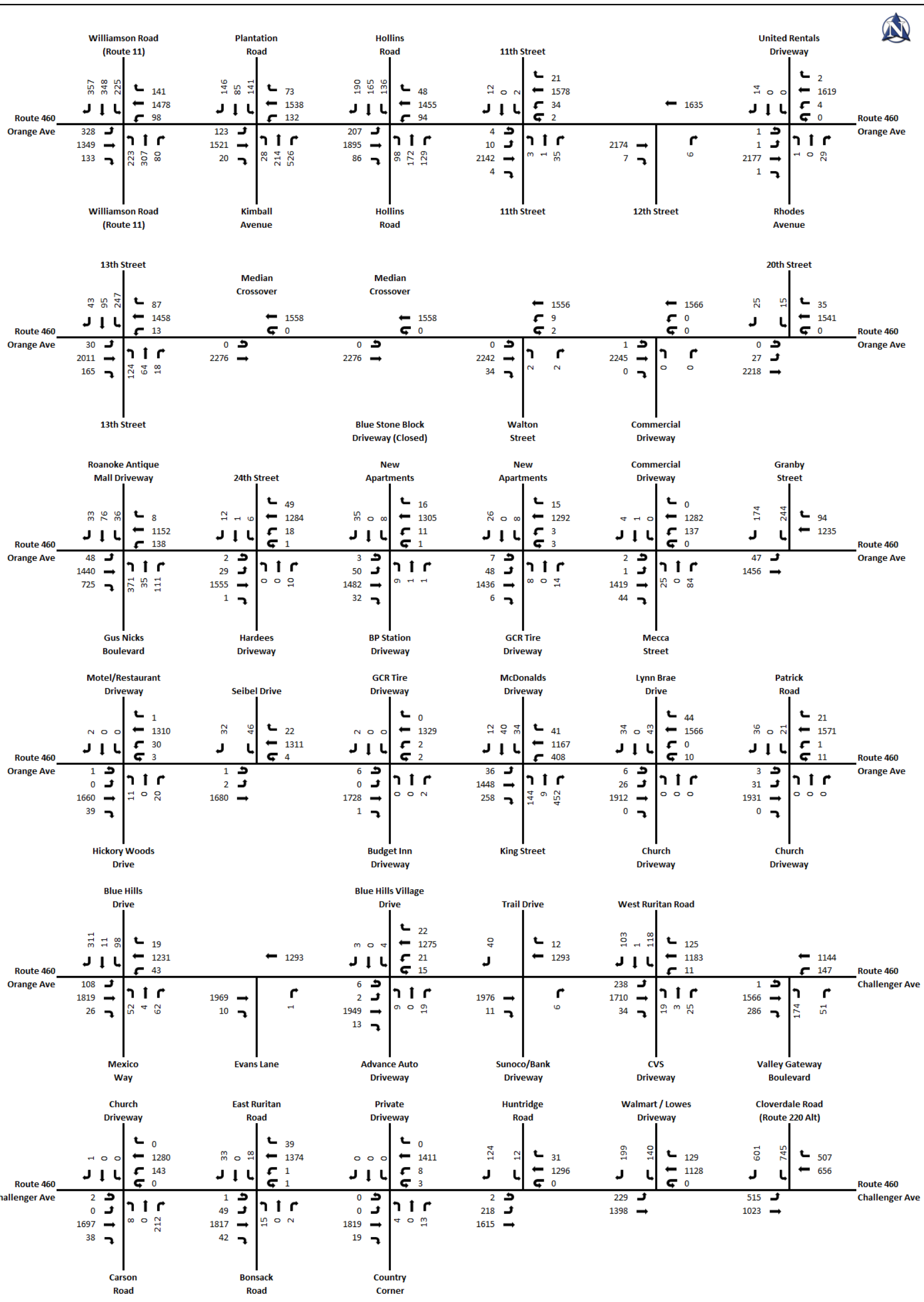


Figure 4-1b: Peak Hour Volumes – 2040 No Build PM Peak Hour



5. EXISTING AND NO BUILD TRAFFIC OPERATIONS ANALYSIS

Traffic operations within the study area were evaluated for the AM and PM peak hours for existing (2019), 2040 No Build, and 2040 Build conditions (see **Chapter 8**). The results of the Synchro traffic analysis and SimTraffic microsimulation are documented for the measures of effectiveness (MOEs) in accordance with VDOT's Traffic Operations and Safety Analysis Manual (TOSAM) as specified in the Framework Document. Synchro and SimTraffic microsimulation results are also located in **Appendix F**.

5.1 TRAFFIC OPERATIONS ANALYSIS METHODOLOGY

5.1.1 Analysis Tools

The traffic operations and simulation analyses were performed using Synchro and SimTraffic (version 10.3) to document the operation of the signalized and unsignalized intersections along Peters Creek Road within the study area. Existing signal timing data (see **Appendix D**) was provided by Roanoke City and VDOT, including new signal coordination plans for the traffic signals located in Roanoke County. VDOT also provided base Synchro files for the signalized intersections along the Route 460 corridor. Inputs and analysis methodologies were consistent with VDOT's *TOSAM*.

5.1.2 Synchro and SimTraffic Model Development and Analysis Periods

Existing conditions traffic analysis files were developed for both the AM peak (7:15 AM - 8:15 AM) and PM peak (4:30 PM - 5:30 PM) periods for the Route 460 study corridor using Synchro, while microsimulations were performed using SimTraffic. The VDOT-provided Synchro network files were expanded to incorporate the twenty-four unsignalized intersections included in the study, and then updated to include updated traffic count data and signal timings. While VDOT undertook a traffic signal coordination effort for the signalized intersections located in Roanoke County in November 2019, those timings were not incorporated for the 2019 existing conditions analysis since data collection including travel time runs and field observations were completed prior to the new coordination plans being implemented.

The existing conditions files were developed in accordance with VDOT's Traffic Operations and Safety Analysis Manual (TOSAM) which included lane geometry based on aerial photography and field observations to produce the study area network, traffic count data, speed limits, and traffic signal timings provided by Roanoke City and VDOT. Traffic volume data included vehicular and pedestrian volumes, heavy vehicle percentages, and peak hour factors. As part of the Synchro/SimTraffic calibration process, Route 460 link speeds were adjusted on certain segments of the Route 460 corridor where modifications to other calibration parameters did not produce observed speeds and congestion in SimTraffic. In addition, peak hour factors (PHF) were input for the signalized intersections by movement in order to generate more congestion along the Route 460 corridor rather than using a single overall intersection peak hour factor which tends to dilute the effects of varying peaks on approaches to the intersection which are present along the Route 460 corridor. Ten simulation runs were conducted for each peak hour using SimTraffic.

The 2040 No Build analysis files incorporated projected traffic volumes and proposed roadway improvements associated with the three approved developments located along and adjacent to Route 460. Previously funded SMART SCALE projects were also incorporated into the No Build analysis scenarios. Signal timings, including updates to splits, offsets, and left-turn control types were updated for the No Build analysis to accommodate the increases in traffic volumes along with the roadway improvements assumed to be constructed prior to 2040. It should be noted that as a deviation to the TOSAM, the existing conditions peak hour factors were used in the future No Build conditions analysis in order to continue to produce congestion. Otherwise, at some locations, changing to a peak hour factor of 0.92 in accordance with TOSAM produced less congestion in the No Build conditions compared to existing conditions due to the relatively low growth rates along the Route 460 corridor.

The 2040 Build analysis files incorporated the preferred improvements selected for each intersection along the Route 460 corridor as a part of this STARS study. Signal timings were further adjusted to accommodate the changes in vehicle travel patterns related to the preferred improvements.

5.1.3 Measures of Effectiveness

Measures of effectiveness (MOE's) from the Synchro and SimTraffic outputs were used to document operations. Study area intersections were evaluated using average delay per vehicle (sec/veh), total intersection delay (veh-hours), total delay for minor street movements (veh-hours), and total stops for mainline intersection movements. The Route 460 corridor was evaluated using travel times (minutes), total corridor stops for the mainline through movements, and total network delay (veh-hours). **Table 5-1** summarizes the level of service thresholds for signalized and unsignalized intersections.

Table 5-1: Intersection Measures of Effectiveness

Level of Service	Intersection Control	
	Signalized	Unsignalized
	Average Delay (sec/veh)	Average Delay (sec/veh)
LOS A	≤ 10	≤ 10
LOS B	> 10 – 20	> 10 – 15
LOS C	> 20 – 35	> 15 – 25
LOS D	> 35 – 55	> 25 – 35
LOS E	> 55 – 80	> 35 – 50
LOS F	> 80	> 50

5.2 EXISTING CONDITIONS TRAFFIC OPERATIONS

5.2.1 Route 460 Travel Times

Figures 5-1a and 5-1b summarize the cumulative travel times for eastbound and westbound Route 460, respectively, during the AM peak hour under existing conditions within the study area limits. During the AM peak hour, the peak travel direction along Route 460 is westbound toward the City of Roanoke and I-581. The simulated existing corridor travel times along Route 460 during the AM peak hour are 13.9 minutes in the eastbound direction and 21.8 minutes in the westbound direction. For comparison purposes, the free-flow travel time along Route 460 with no congestion at signalized intersections is approximately 7.5 minutes.

Figure 5-1a: AM Peak Hour – Eastbound Route 460 Cumulative Travel Times (Existing Conditions)

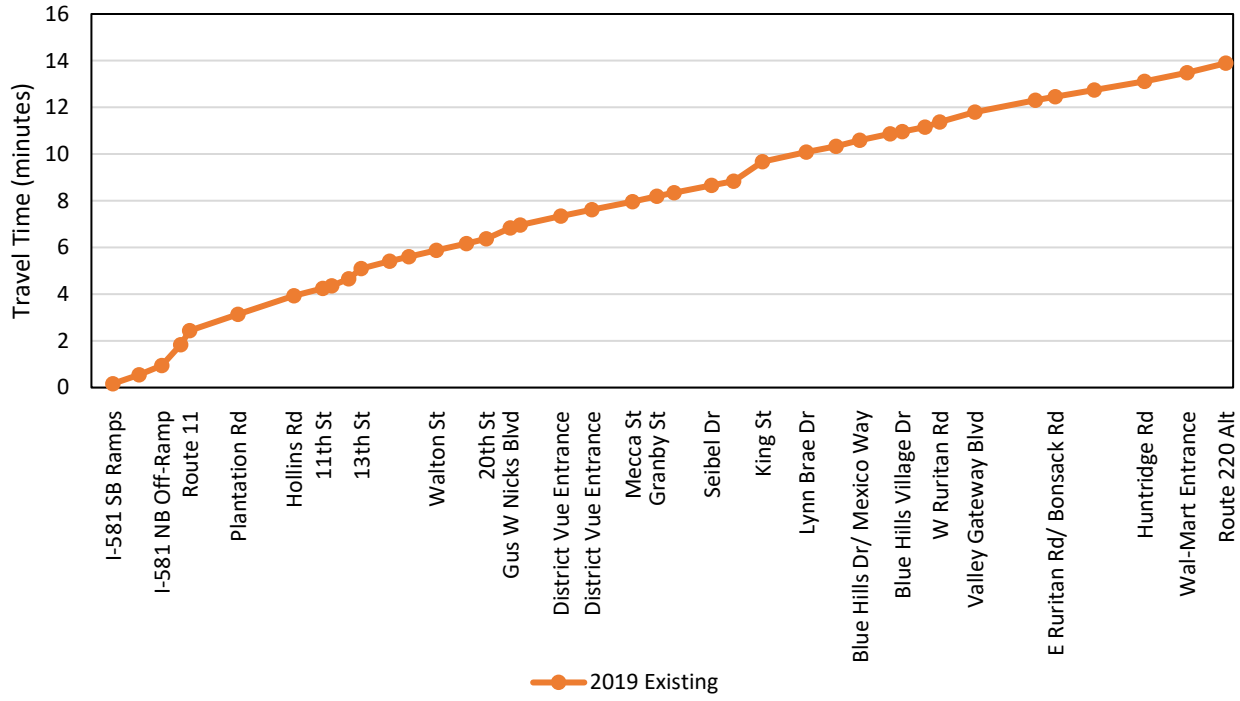
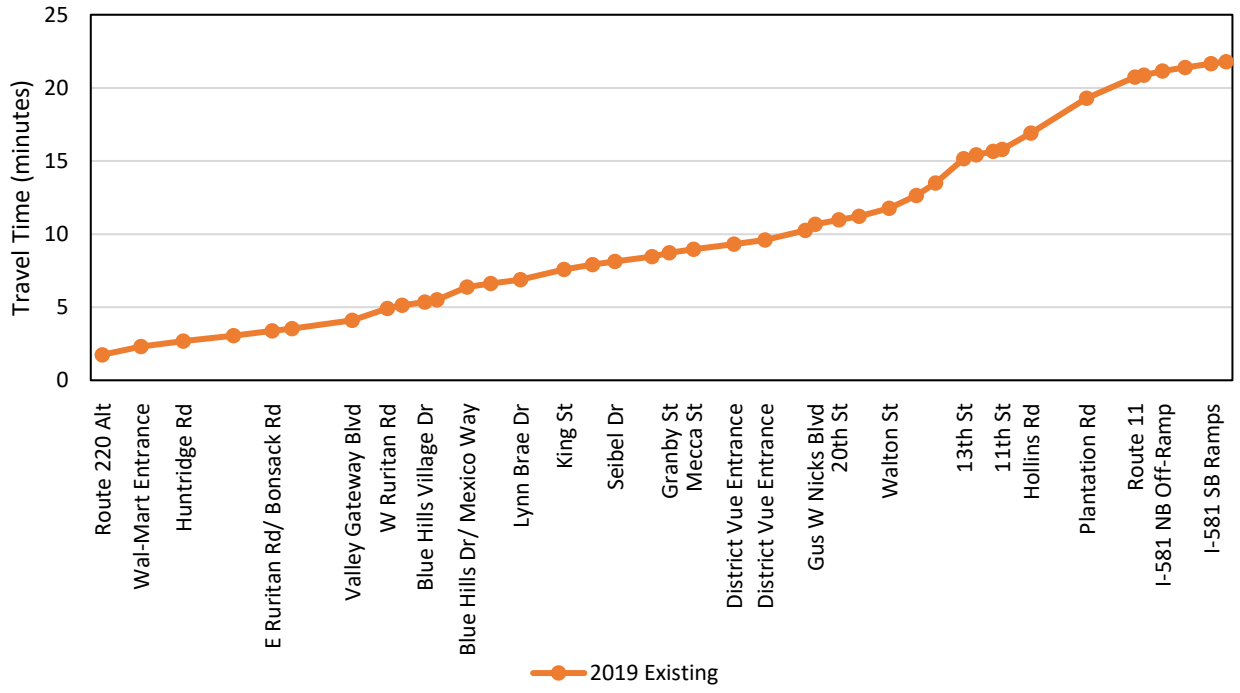


Figure 5-1b: AM Peak Hour – Westbound Route 460 Cumulative Travel Times (Existing Conditions)



Figures 5-2a and 5-2b summarize the cumulative travel times for eastbound and westbound Route 460, respectively, during the PM peak hour under existing conditions within the study area limits. During the PM peak hour, the peak travel direction along Route 50 is eastbound away from the City of Roanoke and I-581. The simulated existing corridor travel times along Route 460 during the PM peak hour are 20.8 minutes in the eastbound direction and 16.3 minutes in the westbound direction. For comparison purposes, the free-flow travel time along Route 50 with no congestion at signalized intersections is approximately 7.5 minutes.

Figure 5-2a: PM Peak Hour – Eastbound Route 460 Cumulative Travel Times (Existing Conditions)

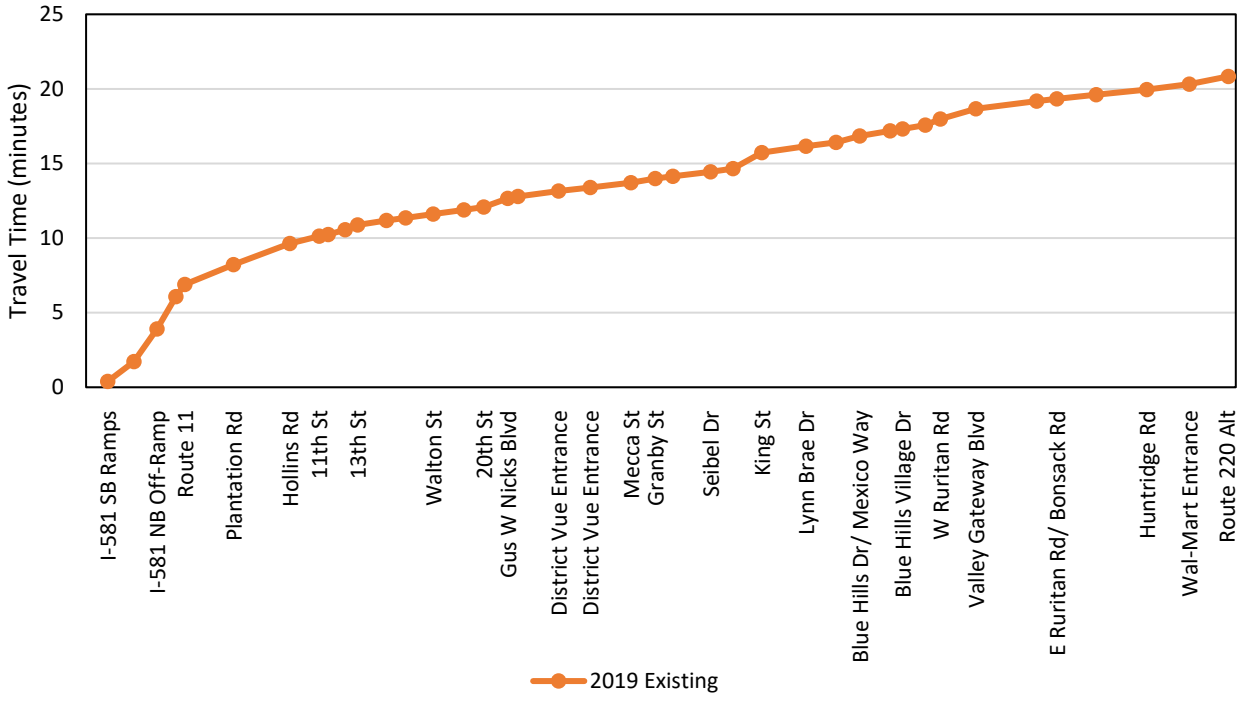
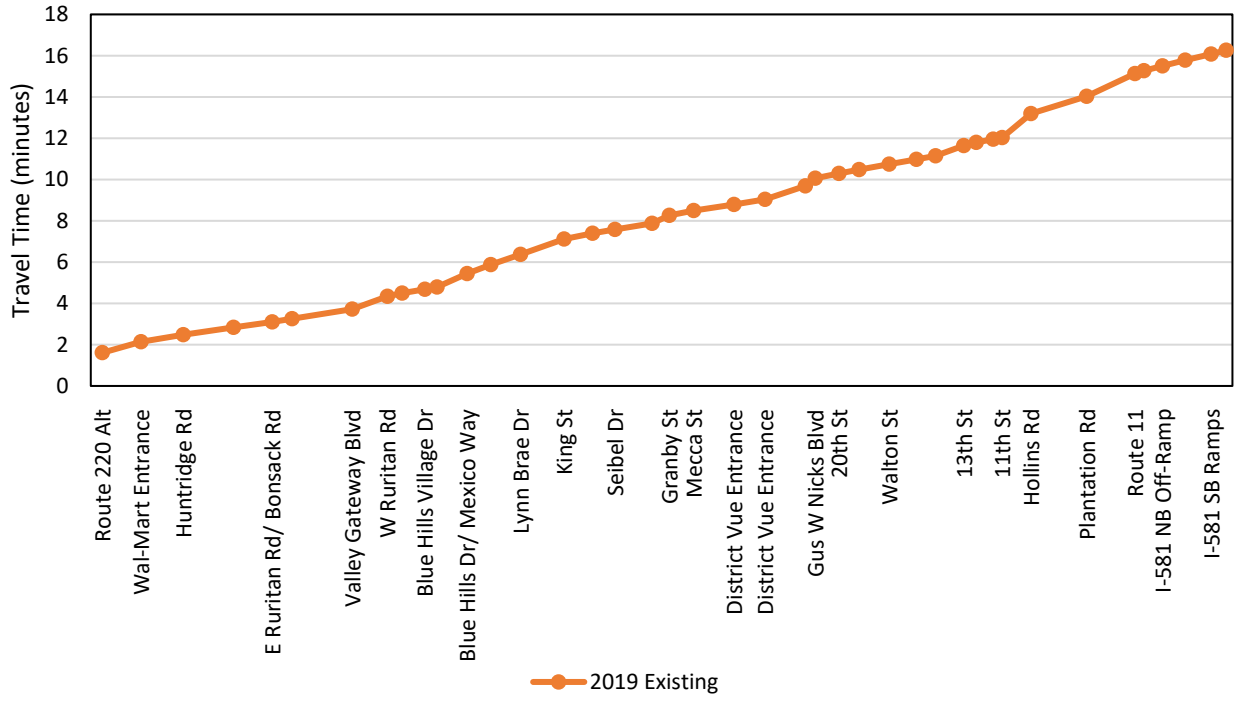


Figure 5-2b: PM Peak Hour – Westbound Route 460 Cumulative Travel Times (Existing Conditions)



5.2.2 Intersection Delays

Table 5-2 depicts overall average intersection delay and Level of Service for signalized intersections within the study area for the AM and PM peak hours for existing conditions. During both the AM and PM peak hours, the signalized intersections from Williamson Road to Gus Nicks Boulevard experience heavy traffic volumes and significant vehicular congestion, and operate at LOS D or E. East of Gus Nicks Boulevard, traffic volumes are generally lighter and Route 460 is less congested than the western end of the corridor, with the signalized intersections generally operating at LOS C or better except for the King Street intersection and the Blue Hills Drive/Mexico Way intersection which operate at LOS D in the PM peak hour.

Tables 5-3 and 5-4 depict overall intersection and minor street approach delays in vehicle-hours for the AM and PM peak hours, respectively. The unsignalized intersections are impacted by congestion along Route 460 during both peak hours, particularly for through and left-turning vehicles that cross Route 460. However, most unsignalized intersections also have a relatively low volume of through or left-turning traffic that experiences those longer delays, and adjacent upstream traffic signals provide gaps in Route 460 traffic to help facilitate minor street through and left-turn movements. The primary exception to this is the I-581 northbound off-ramp to eastbound Route 460, which experiences significant congestion and lengthy delays during both peak hours.

Table 5-2: Signalized Intersection Delay Summary (2019 Existing Conditions)

Intersection	AM Peak Hour		PM Peak Hour	
	Average Delay (sec)	LOS	Average Delay (sec)	LOS
Route 460 & Williamson Road (Route 11)	57.4	E	78.7	E
Route 460 & Plantation Road/Kimball Avenue	37.3	D	43.8	D
Route 460 & Hollins Road	47.3	D	68.7	E
Route 460 & 13th Street	54.4	D	37.9	D
Route 460 & Gus Nicks Boulevard	47.1	D	44.2	D
Route 460 & Granby Street	8.3	A	25.5	C
Route 460 & King Street	30.2	C	50.9	D
Route 460 & Blue Hills Drive/Mexico Way	32.5	C	50.0	D
Route 460 & West Ruritan Road	23.9	C	27.4	C
Route 460 & Valley Gateway Boulevard	10.9	B	16.6	B
Route 460 & Walmart/Lowe's	12.7	B	16.4	B
Route 460 & Route 220 ALT (Cloverdale Road)	22.3	C	23.2	C

Table 5-3: Intersection Total Delays (veh-hr) – AM Peak Hour (Existing Conditions)

Intersection	Intersection Control	2019 Existing Total Delay (veh-hr)		
		Overall Inter-section	NB Side Street	SB Side Street
Route 460 & I-581 NB Off-Ramp	Unsignalized	49.2	49.2	-
Route 460 & Courtland Road	Unsignalized	0.4	-	0.4
Route 460 & Williamson Road (Route 11)	Signalized	67.2	8.4	12.4
Route 460 & Plantation Road/Kimball Avenue	Signalized	39.4	3.0	7.2
Route 460 & Hollins Road	Signalized	49.1	9.9	3.4
Route 460 & 11th Street	Unsignalized	0.3	0.1	0.0
Route 460 & 12th Street	Unsignalized	0.0	0.0	-
Route 460 & Rhodes Avenue	Unsignalized	0.1	0.0	0.0
Route 460 & 13th Street	Signalized	50.3	9.1	6.4
Route 460 & Median Crossover 660’ east of 13th Street	Unsignalized	0.0	-	-
Route 460 & Median Crossover 1170’ east of 13th Street	Unsignalized	0.0	-	-
Route 460 & Walton Street	Unsignalized	0.0	0.0	-
Route 460 & Median Crossover 700’ east of Walton Street	Unsignalized	0.0	-	-
Route 460 & 20th Street	Unsignalized	0.8	-	0.8
Route 460 & Gus Nicks Boulevard	Signalized	41.3	21.1	1.0
Route 460 & 24th Street	Unsignalized	0.3	0.2	0.0
Route 460 & District Vue Apartments (West)	Unsignalized	0.2	0.2	0.0
Route 460 & District Vue Apartments (East)	Unsignalized	0.1	0.1	-
Route 460 & Mecca Street	Unsignalized	0.4	0.2	-
Route 460 & Granby Street	Signalized	5.8	-	2.0
Route 460 & Hickory Woods Drive	Unsignalized	1.5	1.5	-
Route 460 & Seibel Drive	Unsignalized	0.5	-	0.5
Route 460 & Median Crossover 520’ east of Seibel Drive	Unsignalized	0.1	0.0	-
Route 460 & King Street	Signalized	25.8	5.0	1.9
Route 460 & Lynn Brae Drive	Unsignalized	0.2	-	0.2
Route 460 & Patrick Road	Unsignalized	0.4	-	0.2
Route 460 & Blue Hills Drive/Mexico Way	Signalized	24.9	0.4	3.1
Route 460 & Evan Lane	Unsignalized	0.0	0.0	-
Route 460 & Blue Hills Village Drive	Unsignalized	0.1	0.0	0.0
Route 460 & Trail Drive	Unsignalized	0.2	0.0	0.2
Route 460 & West Ruritan Road	Signalized	17.5	0.0	2.1
Route 460 & Valley Gateway Boulevard	Signalized	7.4	0.5	-
Route 460 & Carson Road	Unsignalized	1.2	0.4	0.1
Route 460 & Bonsack Road/East Ruritan Road	Unsignalized	3.8	0.5	3.3

Intersection	Intersection Control	2019 Existing Total Delay (veh-hr)		
		Overall Inter-section	NB Side Street	SB Side Street
Route 460 & Median Crossover 950' east of Bonsack Road/East Ruritan Road	Unsignalized	0.0	0.0	0.0
Route 460 & Huntridge Road	Unsignalized	1.2	-	0.8
Route 460 & Walmart/Lowe's	Signalized	8.1	-	0.6
Route 460 & Route 220 ALT (Cloverdale Road)	Signalized	19.8	-	4.5
Total		**417.4**	**109.9**	**51.3**

Table 5-4: Intersection Total Delays (veh-hr) – PM Peak Hour (Existing Conditions)

Intersection	Intersection Control	2019 Existing Total Delay (veh-hr)		
		Overall Inter-section	NB Side Street	SB Side Street
Route 460 & I-581 NB Off-Ramp	Unsignalized	29.8	29.8	-
Route 460 & Courtland Road	Unsignalized	1.0	-	1.0
Route 460 & Williamson Road (Route 11)	Signalized	98.3	11.4	36.2
Route 460 & Plantation Road/Kimball Avenue	Signalized	48.5	16.9	6.9
Route 460 & Hollins Road	Signalized	78.1	14.0	5.9
Route 460 & 11th Street	Unsignalized	0.5	0.3	0.1
Route 460 & 12th Street	Unsignalized	0.0	0.0	-
Route 460 & Rhodes Avenue	Unsignalized	0.4	0.3	0.0
Route 460 & 13th Street	Signalized	39.9	4.9	10.7
Route 460 & Median Crossover 660’ east of 13th Street	Unsignalized	0.0	-	-
Route 460 & Median Crossover 1170’ east of 13th Street	Unsignalized	0.0	-	-
Route 460 & Walton Street	Unsignalized	0.4	0.3	-
Route 460 & Median Crossover 700’ east of Walton Street	Unsignalized	0.0	-	-
Route 460 & 20th Street	Unsignalized	1.1	-	1.0
Route 460 & Gus Nicks Boulevard	Signalized	44.2	9.8	6.2
Route 460 & 24th Street	Unsignalized	0.6	0.0	0.4
Route 460 & District Vue Apartments (West)	Unsignalized	0.3	0.2	0.0
Route 460 & District Vue Apartments (East)	Unsignalized	0.5	0.5	-
Route 460 & Mecca Street	Unsignalized	0.8	0.3	0.1
Route 460 & Granby Street	Signalized	19.9	-	6.5
Route 460 & Hickory Woods Drive	Unsignalized	0.8	0.7	0.0
Route 460 & Seibel Drive	Unsignalized	2.2	-	2.2
Route 460 & Median Crossover 520’ east of Seibel Drive	Unsignalized	0.0	0.0	0.0
Route 460 & King Street	Signalized	49.8	9.3	2.6
Route 460 & Lynn Brae Drive	Unsignalized	0.4	-	0.4
Route 460 & Patrick Road	Unsignalized	0.4	-	0.3
Route 460 & Blue Hills Drive/Mexico Way	Signalized	45.9	1.5	14.1
Route 460 & Evan Lane	Unsignalized	0.0	0.0	-
Route 460 & Blue Hills Village Drive	Unsignalized	0.2	0.1	0.0
Route 460 & Trail Drive	Unsignalized	0.1	0.0	0.1
Route 460 & West Ruritan Road	Signalized	23.6	0.4	1.8
Route 460 & Valley Gateway Boulevard	Signalized	13.5	2.0	-
Route 460 & Carson Road	Unsignalized	2.6	2.0	0.0
Route 460 & Bonsack Road/East Ruritan Road	Unsignalized	0.8	0.3	0.3

Intersection	Intersection Control	2019 Existing Total Delay (veh-hr)		
		Overall Inter-section	NB Side Street	SB Side Street
Route 460 & Median Crossover 950' east of Bonsack Road/East Ruritan Road	Unsignalized	0.2	0.1	-
Route 460 & Huntridge Road	Unsignalized	1.2	-	0.5
Route 460 & Walmart/Lowe's	Signalized	12.7	-	2.2
Route 460 & Route 220 ALT (Cloverdale Road)	Signalized	21.9	-	6.9
Total		**540.6**	**105.3**	**106.4**

5.2.3 Route 460 Mainline Stops

Route 460 corridor operations were also evaluated using the average number of stops per vehicle and the total number of stops in both the eastbound and westbound directions for both the AM and PM peak hours under existing conditions. **Tables 5-5 and 5-6** depict the average and total stops for both the signalized and unsignalized intersections in the corridor for the AM and PM peak hours, respectively. Mainline stops at unsignalized intersections occur due to congestion and traffic queues from downstream signalized intersections spilling back to adjacent upstream intersections. This trend noticeably occurs in the eastbound direction from the I-581 NB Off-Ramp to 13th Street in both the AM and PM peak hours. This also occurs in the westbound direction from 24th Street to 13th Street during the AM peak hour and from Blue Hills Drive/Mexico Way to King Street and from 24th Street to Gus Nicks Boulevard during the PM peak hour. Along the corridor as a whole, drivers stop an average of approximately 9 times in the primary westbound direction during the AM peak hour and nearly 7 times in the primary eastbound direction during the PM peak hour.

Table 5-5: Intersection Stops – AM Peak Hour (Existing Conditions)

Intersection	Intersection Control	2019 Existing			
		EB Route 460		WB Route 460	
		Stops/ Veh	Total Stops	Stops/ Veh	Total Stops
Route 460 & I-581 NB Off-Ramp	Unsignalized	0.14	137	0.00	7
Route 460 & Courtland Road	Unsignalized	0.45	573	0.06	104
Route 460 & Williamson Road (Route 11)	Signalized	0.27	220	0.87	1213
Route 460 & Plantation Road/Kimball Avenue	Signalized	0.31	248	1.25	1970
Route 460 & Hollins Road	Signalized	0.34	294	0.76	1322
Route 460 & 11th Street	Unsignalized	0.05	46	0.03	53
Route 460 & 12th Street	Unsignalized	0.05	49	0.03	53
Route 460 & Rhodes Avenue	Unsignalized	0.25	261	0.03	54
Route 460 & 13th Street	Signalized	0.39	386	0.77	1195
Route 460 & Median Crossover 660’ east of 13th Street	Unsignalized	0.00	4	0.44	686
Route 460 & Median Crossover 1170’ east of 13th Street	Unsignalized	0.01	15	0.44	689
Route 460 & Walton Street	Unsignalized	0.00	0	0.23	374
Route 460 & Median Crossover 700’ east of Walton Street	Unsignalized	0.00	2	0.02	32
Route 460 & 20th Street	Unsignalized	0.00	2	0.01	16
Route 460 & Gus Nicks Boulevard	Signalized	0.29	224	0.30	369
Route 460 & 24th Street	Unsignalized	0.00	4	0.31	393
Route 460 & District Vue Apartments (West)	Unsignalized	0.00	1	0.00	4
Route 460 & District Vue Apartments (East)	Unsignalized	0.00	1	0.00	0
Route 460 & Mecca Street	Unsignalized	0.01	10	0.00	2
Route 460 & Granby Street	Signalized	0.09	76	0.21	274
Route 460 & Hickory Woods Drive	Unsignalized	0.00	0	0.01	17
Route 460 & Seibel Drive	Unsignalized	0.00	0	0.00	1
Route 460 & Median Crossover 520’ east of Seibel Drive	Unsignalized	0.00	2	0.02	24
Route 460 & King Street	Signalized	0.56	439	0.34	437
Route 460 & Lynn Brae Drive	Unsignalized	0.01	10	0.01	16
Route 460 & Patrick Road	Unsignalized	0.00	0	0.00	2
Route 460 & Blue Hills Drive/Mexico Way	Signalized	0.15	140	0.62	883
Route 460 & Evan Lane	Unsignalized	0.00	1	0.06	93
Route 460 & Blue Hills Village Drive	Unsignalized	0.00	0	0.03	44
Route 460 & Trail Drive	Unsignalized	0.00	2	0.01	14
Route 460 & West Ruritan Road	Signalized	0.26	218	0.65	908
Route 460 & Valley Gateway Boulevard	Signalized	0.33	272	0.21	290
Route 460 & Carson Road	Unsignalized	0.00	1	0.00	0
Route 460 & Bonsack Road/East Ruritan Road	Unsignalized	0.00	0	0.00	0

Intersection	Intersection Control	2019 Existing			
		EB Route 460		WB Route 460	
		Stops/ Veh	Total Stops	Stops/ Veh	Total Stops
Route 460 & Median Crossover 950' east of Bonsack Road/East Ruritan Road	Unsignalized	0.00	0	0.00	0
Route 460 & Huntridge Road	Unsignalized	0.00	0	0.00	5
Route 460 & Walmart/Lowe's	Signalized	0.19	153	0.50	632
Route 460 & Route 220 ALT (Cloverdale Road)	Signalized	0.24	104	0.61	571
Total		4.39	3895	8.83	12747

Table 5-6: Intersection Stops – PM Peak Hour (Existing Conditions)

Intersection	Intersection Control	2019 Existing			
		EB Route 460		WB Route 460	
		Stops/ Veh	Total Stops	Stops/ Veh	Total Stops
Route 460 & I-581 NB Off-Ramp	Unsignalized	0.37	345	0.00	8
Route 460 & Courtland Road	Unsignalized	0.70	932	0.04	63
Route 460 & Williamson Road (Route 11)	Signalized	0.29	275	0.60	794
Route 460 & Plantation Road/Kimball Avenue	Signalized	0.63	702	0.41	558
Route 460 & Hollins Road	Signalized	0.66	988	0.81	1074
Route 460 & 11th Street	Unsignalized	0.38	628	0.00	2
Route 460 & 12th Street	Unsignalized	0.05	92	0.00	0
Route 460 & Rhodes Avenue	Unsignalized	0.18	305	0.00	3
Route 460 & 13th Street	Signalized	0.23	361	0.33	425
Route 460 & Median Crossover 660’ east of 13th Street	Unsignalized	0.00	2	0.00	0
Route 460 & Median Crossover 1170’ east of 13th Street	Unsignalized	0.00	1	0.00	0
Route 460 & Walton Street	Unsignalized	0.00	0	0.00	0
Route 460 & Median Crossover 700’ east of Walton Street	Unsignalized	0.00	1	0.00	0
Route 460 & 20th Street	Unsignalized	0.02	33	0.00	4
Route 460 & Gus Nicks Boulevard	Signalized	0.43	507	0.35	361
Route 460 & 24th Street	Unsignalized	0.00	3	0.39	433
Route 460 & District Vue Apartments (West)	Unsignalized	0.00	1	0.02	19
Route 460 & District Vue Apartments (East)	Unsignalized	0.00	1	0.00	0
Route 460 & Mecca Street	Unsignalized	0.01	14	0.00	1
Route 460 & Granby Street	Signalized	0.15	183	0.35	381
Route 460 & Hickory Woods Drive	Unsignalized	0.00	4	0.03	32
Route 460 & Seibel Drive	Unsignalized	0.00	0	0.01	8
Route 460 & Median Crossover 520’ east of Seibel Drive	Unsignalized	0.03	40	0.03	38
Route 460 & King Street	Signalized	0.70	881	0.54	558
Route 460 & Lynn Brae Drive	Unsignalized	0.00	6	0.19	262
Route 460 & Patrick Road	Unsignalized	0.01	25	0.17	245
Route 460 & Blue Hills Drive/Mexico Way	Signalized	0.33	518	0.42	457
Route 460 & Evan Lane	Unsignalized	0.01	9	0.02	24
Route 460 & Blue Hills Village Drive	Unsignalized	0.00	2	0.02	20
Route 460 & Trail Drive	Unsignalized	0.05	92	0.00	2
Route 460 & West Ruritan Road	Signalized	0.41	598	0.49	527
Route 460 & Valley Gateway Boulevard	Signalized	0.55	735	0.20	208
Route 460 & Carson Road	Unsignalized	0.00	3	0.00	1
Route 460 & Bonsack Road/East Ruritan Road	Unsignalized	0.00	0	0.00	0

Intersection	Intersection Control	2019 Existing			
		EB Route 460		WB Route 460	
		Stops/ Veh	Total Stops	Stops/ Veh	Total Stops
Route 460 & Median Crossover 950' east of Bonsack Road/East Ruritan Road	Unsignalized	0.00	0	0.02	23
Route 460 & Huntridge Road	Unsignalized	0.00	0	0.00	1
Route 460 & Walmart/Lowe's	Signalized	0.20	238	0.56	570
Route 460 & Route 220 ALT (Cloverdale Road)	Signalized	0.40	379	0.67	410
Total		6.79	8904	6.67	7512

5.3 2040 NO BUILD CONDITIONS TRAFFIC OPERATIONS

The 2040 No Build Alternative has been included for evaluation as a benchmark for the comparison of future conditions and impacts. The No Build Alternative retains the same geometry along the Route 460 corridor as existing conditions, except where proposed roadway improvements related to approved developments and funded SMART SCALE projects will be constructed. These "No Build" improvements were incorporated into the Synchro network files along with projected 2040 traffic volumes and revised signal timings to accommodate both the increase in traffic volumes and the No Build projects that will be constructed prior to 2040.

5.3.1 Route 460 Travel Times

AM Peak Hour

A comparison of cumulative corridor travel times for existing conditions and 2040 No Build conditions is summarized in **Figures 5-3a and 5-3b** for eastbound and westbound Route 460 during the AM peak hour. Under 2040 No Build conditions, the eastbound total travel time is 17.7 minutes, which is 3.8 minutes greater than existing conditions. This increase in travel time primarily occurs between the west end of the study corridor and Williamson Road (Route 11) (2.8 minute increase). The Williamson Road (Route 11) signal is the first signal that vehicles entering the study corridor encounter. The intersection meters downstream traffic which results in similar segment travel times east of Williamson Road (Route 11) between Existing and 2040 No Build conditions.

The 2040 No Build westbound travel time of 31.6 minutes is approximately 9.8 minutes greater than existing conditions. The largest westbound increases in travel time occur approaching Blue Hills Drive/Mexico Way (1.5 minute increase), approaching Gus Nicks Boulevard (3.2 minute increase), between Gus Nicks Boulevard and 13th Street (3.2 minute increase), approaching Hollins Road (0.6 minute increase) and approaching Plantation Road/Kimball Avenue (0.4 minute increase).

Figure 5-3a: AM Peak Hour – Eastbound Route 460 Cumulative Travel Times (Existing and No Build Conditions)

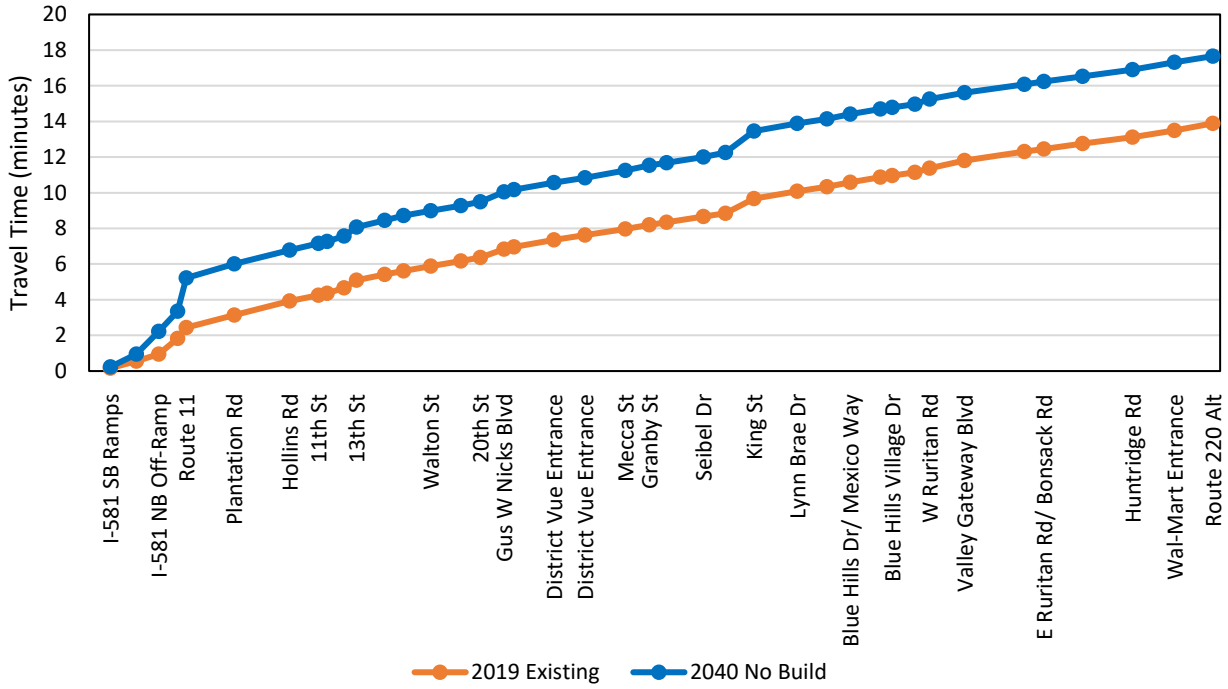
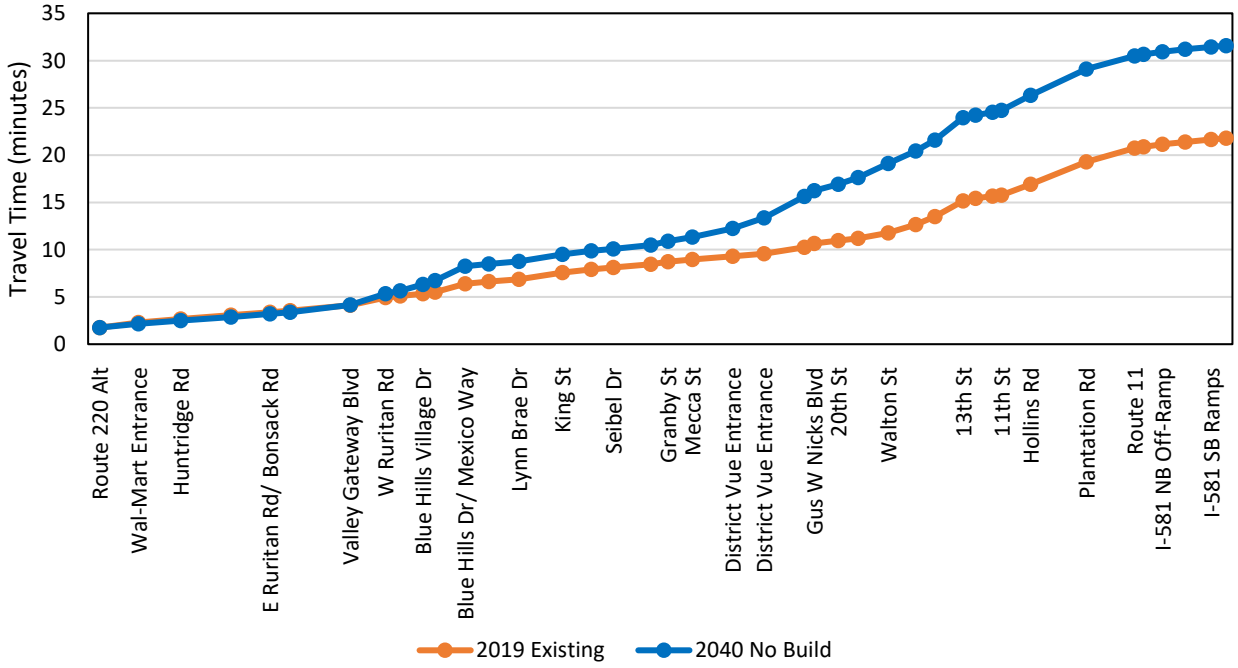


Figure 5-3b: AM Peak Hour – Westbound Route 460 Cumulative Travel Times (Existing and No Build Conditions)



PM Peak Hour

A comparison of cumulative corridor travel times for existing conditions and 2040 No Build conditions is summarized in **Figures 5-4a and 5-4b** for eastbound and westbound Route 460 during the PM peak hour. Under 2040 No Build conditions, the eastbound total travel time is 26.7 minutes, which is 5.8 minutes greater than existing conditions. This increase in travel time primarily occurs between the west end of the study corridor and Williamson Road (Route 11) (4.5 minute increase). The Williamson Road (Route 11) signal is the first signal that vehicles entering the study corridor encounter. The intersection meters downstream traffic which results in similar segment travel times east of Williamson Road (Route 11) between Existing and 2040 No Build conditions. However, there is a 0.3 minute increase approaching 11th Street due to the reduction in eastbound travel lanes from 3 lanes to 2 lanes.

The 2040 No Build westbound travel time of 18.0 minutes is approximately 1.8 minutes greater than existing conditions. The largest westbound increases in travel time occur approaching West Ruritan Road (0.4 minute increase), Blue Hills Drive/Mexico Way (0.6 minute increase), approaching Plantation Road/Kimball Avenue (0.2 minute increase), and approaching Williamson Road (Route 11) (0.2 minute increase).

Figure 5-4a: PM Peak Hour – Eastbound Route 460 Cumulative Travel Times (Existing and No Build Conditions)

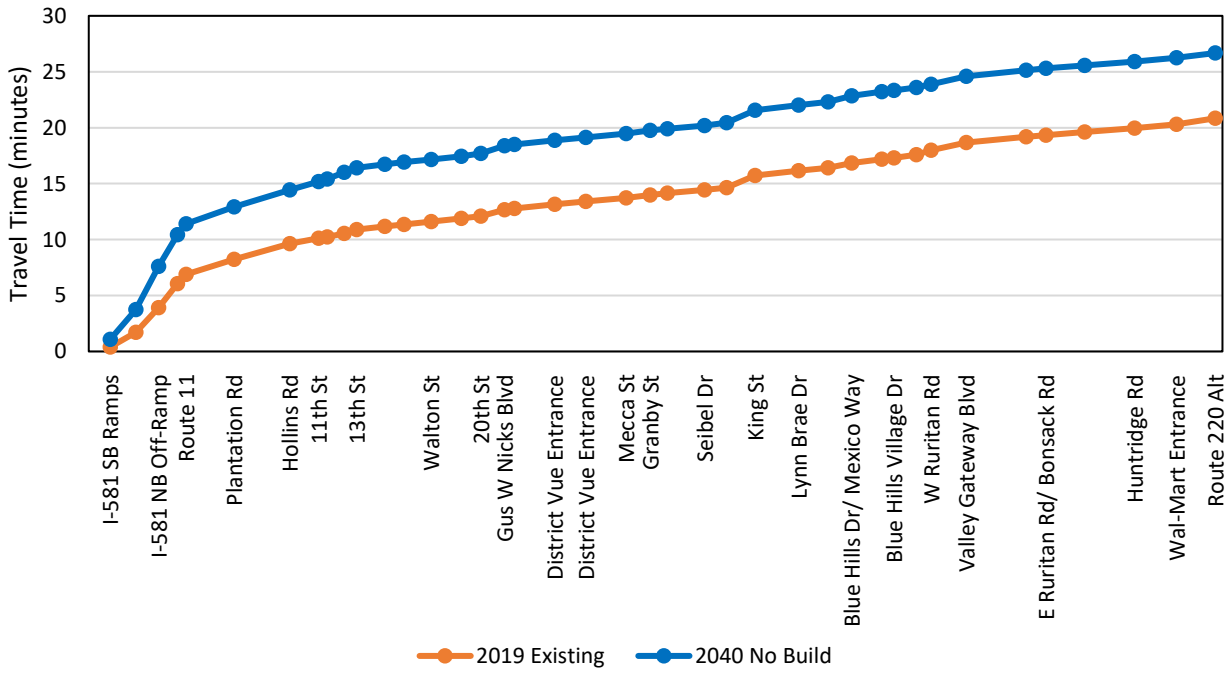
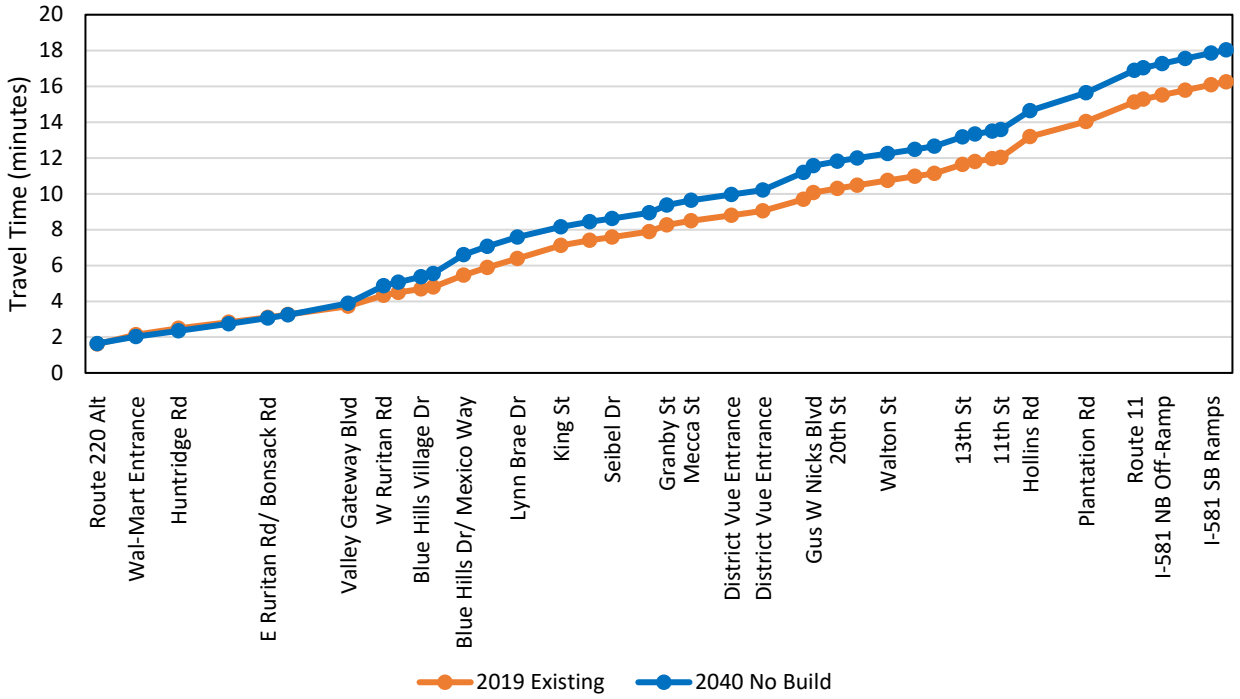


Figure 5-4b: PM Peak Hour – Westbound Route 460 Cumulative Travel Times (Existing and No Build Conditions)



5.3.2 Intersection Delays

Table 5-7 depicts overall average intersection delay and Level of Service for signalized intersections within the study area for the AM and PM peak hours for both existing conditions and 2040 No Build conditions. By 2040, average intersection vehicle delays are projected to increase significantly throughout the corridor with six signalized intersections operating at LOS E or F during at least one of the peak hours. Additionally, the intersection at Mecca Street will be converted from stop control to traffic signal control in conjunction with the Richfield Living development and SMART SCALE improvement projects will be constructed at the Hollins Road, King Street, and Blue Hills Drive/Mexico Way intersections.

Tables 5-8 and 5-9 depict overall intersection delay for both signalized and unsignalized intersections within the study area for the AM and PM peak hours for 2040 No Build conditions, respectively. Overall intersection delays are projected to increase throughout the Route 460 corridor for the majority of the signalized and unsignalized intersections with several intersections projected to more than double their delays compared to existing conditions.

AM Peak Hour

During the AM peak hour, signalized intersection delays under No Build conditions generally experience higher delays and worse levels of service throughout the corridor, with the four signalized intersections from Williamson Road (Route 11) to 13th Street all operating at LOS E or F and average delays increasing by up to 40 seconds compared to existing conditions. The King Street intersection and the Route 220 ALT

(Cloverdale Road) intersection also degrade to LOS D in the AM peak hour from LOS C in existing conditions.

Delays are also projected to increase for the unsignalized intersections along the Route 460 corridor, with five intersections projected to increase total hourly delays by more than 4.5 vehicle-hours during the AM peak hour: the I-581 NB Off-Ramp, the 20th Street intersection, the western entrance to District Vue Apartments, and the Bonsack Road/East Ruritan Road intersection. For the whole corridor including both signalized and unsignalized intersections, total hourly delays are projected to increase by approximately 70% compared to existing conditions with drivers along the Route 460 corridor projected to experience more than 710 vehicle-hours of delay in 2040 compared to 417 vehicle-hours of delay under existing conditions.

PM Peak Hour

During the PM peak hour, signalized intersection delays under No Build conditions also generally experience higher delays and worse levels of service throughout the corridor, with the four signalized intersections from Williamson Road (Route 11) to 13th Street all operating at LOS E or F and average delays increasing by up to 31 seconds compared to existing conditions. The exception is the Hollins Road intersection, which is projected to experience a slight decrease in delays between existing and No Build conditions due to the SMART SCALE improvements that will be constructed. The King Street and Blue Hills Drive/Mexico Way intersections both also degrade to LOS E in the PM peak hour from LOS D in existing conditions.

Similar to the AM peak hour, delays are also projected to increase for the unsignalized intersections along the Route 460 corridor, with three intersections projected to increase total hourly delays by more than 4.5 vehicle-hours during the PM peak hour: the I-581 NB Off-Ramp, the 20th Street intersection, and the Seibel Drive intersection. For the whole corridor including both signalized and unsignalized intersections, total hourly delays are projected to increase by approximately 50% compared to existing conditions with drivers along the Route 460 corridor projected to experience 811 vehicle-hours of delay in 2040 compared to 541 vehicle-hours of delay under existing conditions.

Table 5-7: Signalized Intersection Delay Summary (Existing and No Build Conditions)

Intersection	2019 Existing Average Delay (sec)				2040 No Build Average Delay (sec)			
	AM Peak Hour		PM Peak Hour		AM Peak Hour		PM Peak Hour	
	Delay (sec)	LOS	Delay (sec)	LOS	Delay (sec)	LOS	Delay (sec)	LOS
Route 460 & Williamson Road (Route 11)	57.4	E	78.7	E	83.8	F	109.2	F
Route 460 & Plantation Road/Kimball Avenue	37.3	D	43.8	D	77.3	E	69.9	E
Route 460 & Hollins Road	47.3	D	68.7	E	60.4	E	60.9	E
Route 460 & 13th Street	54.4	D	37.9	D	81.2	F	62.8	E
Route 460 & Gus Nicks Boulevard	47.1	D	44.2	D	53.4	D	50.0	D
Route 460 & Mecca Street	-	-	-	-	9.4	A	4.7	A
Route 460 & Granby Street	8.3	A	25.5	C	12.0	B	26.7	C
Route 460 & King Street	30.2	C	50.9	D	51.1	D	59.7	E
Route 460 & Blue Hills Drive/Mexico Way	32.5	C	50.0	D	33.1	C	61.4	E
Route 460 & West Ruritan Road	23.9	C	27.4	C	20.8	C	21.5	C
Route 460 & Valley Gateway Boulevard	10.9	B	16.6	B	9.3	A	21.9	C
Route 460 & Walmart/Lowe's	12.7	B	16.4	B	8.4	A	14.4	B
Route 460 & Route 220 ALT (Cloverdale Road)	22.3	C	23.2	C	41.8	D	33.9	C

Table 5-8: Intersection Total Delays (veh-hr) – AM Peak Hour (Existing and No Build Conditions)

Intersection	Intersection Control	2019 Existing Total Delay (veh-hr)			2040 No Build Total Delay (veh-hr)		
		Overall Inter-section	NB Side Street	SB Side Street	Overall Inter-section	NB Side Street	SB Side Street
Route 460 & I-581 NB Off-Ramp	Unsignalized	49.2	49.2	-	87.8	87.8	-
Route 460 & Courtland Road	Unsignalized	0.4	-	0.4	0.5	-	0.5
Route 460 & Williamson Road (Route 11)	Signalized	67.2	8.4	12.4	110.4	10.4	17.4
Route 460 & Plantation Road/Kimball Avenue	Signalized	39.4	3.0	7.2	93.0	3.8	8.5
Route 460 & Hollins Road	Signalized	49.1	9.9	3.4	71.4	7.6	4.0
Route 460 & 11th Street	Unsignalized	0.3	0.1	0.0	0.3	0.1	0.0
Route 460 & 12th Street	Unsignalized	0.0	0.0	-	0.0	0.0	-
Route 460 & Rhodes Avenue	Unsignalized	0.1	0.0	0.0	0.1	0.0	0.0
Route 460 & 13th Street	Signalized	50.3	9.1	6.4	86.0	11.9	8.3
Route 460 & Median Crossover 660’ east of 13th Street	Unsignalized	0.0	-	-	0.0	-	-
Route 460 & Median Crossover 1170’ east of 13th Street	Unsignalized	0.0	-	-	0.0	-	-
Route 460 & Walton Street	Unsignalized	0.0	0.0	-	0.0	0.0	-
Route 460 & Median Crossover 700’ east of Walton Street	Unsignalized	0.0	-	-	0.0	-	-
Route 460 & 20th Street	Unsignalized	0.8	-	0.8	5.4	-	5.2
Route 460 & Gus Nicks Boulevard	Signalized	41.3	21.1	1.0	54.2	22.0	1.2
Route 460 & 24th Street	Unsignalized	0.3	0.2	0.0	0.6	0.4	0.1
Route 460 & District Vue Apartments (West)	Unsignalized	0.2	0.2	0.0	5.2	0.6	4.6
Route 460 & District Vue Apartments (East)	Unsignalized	0.1	0.1	-	2.0	0.2	1.7
Route 460 & Mecca Street	Unsignalized/ Signalized	0.4	0.2	-	7.1	0.9	-
Route 460 & Granby Street	Signalized	5.8	-	2.0	9.6	-	2.3
Route 460 & Hickory Woods Drive	Unsignalized	1.5	1.5	-	4.8	4.8	-
Route 460 & Seibel Drive	Unsignalized	0.5	-	0.5	1.3	-	1.1
Route 460 & Median Crossover 520’ east of Seibel Drive	Unsignalized	0.1	0.0	-	0.1	0.0	-
Route 460 & King Street	Signalized	25.8	5.0	1.9	50.1	5.2	2.3
Route 460 & Lynn Brae Drive	Unsignalized	0.2	-	0.2	0.4	-	0.3
Route 460 & Patrick Road	Unsignalized	0.4	-	0.2	0.5	-	0.4
Route 460 & Blue Hills Drive/Mexico Way	Signalized	24.9	0.4	3.1	29.1	0.4	3.6
Route 460 & Evan Lane	Unsignalized	0.0	0.0	-	0.0	0.0	-
Route 460 & Blue Hills Village Drive	Unsignalized	0.1	0.0	0.0	0.2	0.0	0.0

Intersection	Intersection Control	2019 Existing Total Delay (veh-hr)			2040 No Build Total Delay (veh-hr)		
		Overall Inter-section	NB Side Street	SB Side Street	Overall Inter-section	NB Side Street	SB Side Street
Route 460 & Trail Drive	Unsignalized	0.2	0.0	0.2	0.2	0.0	0.2
Route 460 & West Ruritan Road	Signalized	17.5	0.0	2.1	17.6	0.1	4.8
Route 460 & Valley Gateway Boulevard	Signalized	7.4	0.5	-	7.3	1.5	-
Route 460 & Carson Road	Unsignalized	1.2	0.4	0.1	1.7	0.5	0.1
Route 460 & Bonsack Road/East Ruritan Road	Unsignalized	3.8	0.5	3.3	11.4	1.0	10.3
Route 460 & Median Crossover 950' east of Bonsack Road/East Ruritan Road	Unsignalized	0.0	0.0	0.0	0.0	0.0	0.0
Route 460 & Huntridge Road	Unsignalized	1.2	-	0.8	1.6	-	1.1
Route 460 & Walmart/Lowe's	Signalized	8.1	-	0.6	6.2	-	1.1
Route 460 & Route 220 ALT (Cloverdale Road)	Signalized	19.8	-	4.5	44.5	-	8.9
Total		**417.4**	**109.9**	**51.3**	**710.4**	**159.1**	**88.1**

Table 5-9: Intersection Total Delays (veh-hr) – PM Peak Hour (Existing and No Build Conditions)

Intersection	Intersection Control	2019 Existing Total Delay (veh-hr)			2040 No Build Total Delay (veh-hr)		
		Overall Inter-section	NB Side Street	SB Side Street	Overall Inter-section	NB Side Street	SB Side Street
Route 460 & I-581 NB Off-Ramp	Unsignalized	29.8	29.8	-	60.8	60.8	-
Route 460 & Courtland Road	Unsignalized	1.0	-	1.0	1.2	-	1.2
Route 460 & Williamson Road (Route 11)	Signalized	98.3	11.4	36.2	153.7	13.6	54.0
Route 460 & Plantation Road/Kimball Avenue	Signalized	48.5	16.9	6.9	88.3	31.6	8.5
Route 460 & Hollins Road	Signalized	78.1	14.0	5.9	79.1	13.1	7.2
Route 460 & 11th Street	Unsignalized	0.5	0.3	0.1	2.5	2.2	0.1
Route 460 & 12th Street	Unsignalized	0.0	0.0	-	0.0	0.0	-
Route 460 & Rhodes Avenue	Unsignalized	0.4	0.3	0.0	1.1	1.0	0.0
Route 460 & 13th Street	Signalized	39.9	4.9	10.7	76.0	5.8	14.9
Route 460 & Median Crossover 660’ east of 13th Street	Unsignalized	0.0	-	-	0.0	-	-
Route 460 & Median Crossover 1170’ east of 13th Street	Unsignalized	0.0	-	-	0.0	-	-
Route 460 & Walton Street	Unsignalized	0.4	0.3	-	1.0	0.9	-
Route 460 & Median Crossover 700’ east of Walton Street	Unsignalized	0.0	-	-	0.0	-	-
Route 460 & 20th Street	Unsignalized	1.1	-	1.0	5.6	-	5.5
Route 460 & Gus Nicks Boulevard	Signalized	44.2	9.8	6.2	58.0	10.9	8.0
Route 460 & 24th Street	Unsignalized	0.6	0.0	0.4	3.4	0.0	3.3
Route 460 & District Vue Apartments (West)	Unsignalized	0.3	0.2	0.0	1.9	1.1	0.6
Route 460 & District Vue Apartments (East)	Unsignalized	0.5	0.5	-	3.2	2.0	0.9
Route 460 & Mecca Street	Unsignalized/ Signalized	0.8	0.3	0.1	3.9	1.5	0.1
Route 460 & Granby Street	Signalized	19.9	-	6.5	24.1	-	7.4
Route 460 & Hickory Woods Drive	Unsignalized	0.8	0.7	0.0	2.8	2.7	0.0
Route 460 & Seibel Drive	Unsignalized	2.2	-	2.2	8.5	-	8.5
Route 460 & Median Crossover 520’ east of Seibel Drive	Unsignalized	0.0	0.0	0.0	0.1	0.0	0.0
Route 460 & King Street	Signalized	49.8	9.3	2.6	67.1	13.9	3.4
Route 460 & Lynn Brae Drive	Unsignalized	0.4	-	0.4	0.7	-	0.6
Route 460 & Patrick Road	Unsignalized	0.4	-	0.3	0.6	-	0.5
Route 460 & Blue Hills Drive/Mexico Way	Signalized	45.9	1.5	14.1	64.5	1.7	20.0
Route 460 & Evan Lane	Unsignalized	0.0	0.0	-	0.0	0.0	-
Route 460 & Blue Hills Village Drive	Unsignalized	0.2	0.1	0.0	0.9	0.8	0.0

Intersection	Intersection Control	2019 Existing Total Delay (veh-hr)			2040 No Build Total Delay (veh-hr)		
		Overall Inter-section	NB Side Street	SB Side Street	Overall Inter-section	NB Side Street	SB Side Street
Route 460 & Trail Drive	Unsignalized	0.1	0.0	0.1	0.1	0.0	0.1
Route 460 & West Ruritan Road	Signalized	23.6	0.4	1.8	21.3	0.7	3.3
Route 460 & Valley Gateway Boulevard	Signalized	13.5	2.0	-	20.5	4.2	-
Route 460 & Carson Road	Unsignalized	2.6	2.0	0.0	6.0	5.1	0.0
Route 460 & Bonsack Road/East Ruritan Road	Unsignalized	0.8	0.3	0.3	1.2	0.5	0.5
Route 460 & Median Crossover 950' east of Bonsack Road/East Ruritan Road	Unsignalized	0.2	0.1	-	0.4	0.2	-
Route 460 & Huntridge Road	Unsignalized	1.2	-	0.5	1.6	-	0.7
Route 460 & Walmart/Lowe's	Signalized	12.7	-	2.2	12.9	-	4.0
Route 460 & Route 220 ALT (Cloverdale Road)	Signalized	21.9	-	6.9	38.1	-	16.9
Total		**540.6**	**105.3**	**106.4**	**811.0**	**174.5**	**170.3**

5.3.3 Route 460 Mainline Stops

Tables 5-10 and 5-11 depict the average and total stops for both the signalized and unsignalized intersections in the corridor for the AM and PM peak hours, respectively, for both existing and No Build conditions. The previously noted trend regarding mainline stops at unsignalized intersections becomes more apparent under 2040 No Build conditions. This is projected to occur in the eastbound direction from the I-581 NB Off-Ramp to 13th Street in both the AM and PM peak hours similar to existing conditions. In the westbound direction this is projected to occur from Valley Gateway Boulevard to Blue Hills Drive/Mexico Way and from Granby Street to Williamson Road (Route 11) during the AM peak hour, more frequently than existing conditions, and from Blue Hills Drive/Mexico Way to King Street and from 24th Street to Gus Nicks Boulevard during the PM peak hour similar to existing conditions. Along the corridor as a whole, drivers are projected to stop an average of nearly 13 times in the primary westbound direction during the AM peak hour, an increase of 4 stops compared to existing conditions. In the primary eastbound direction during the PM peak hour, drivers are projected to stop an average of approximately 7 times, similar to existing conditions. However, SimTraffic simulations indicate that congestion and traffic queuing along eastbound Route 460 in the PM peak hour at the signalized intersections create a bottleneck from Williamson Road to 13th Street and reduce downstream traffic volumes, leading to fewer stops than would be expected.

Table 5-10: Intersection Stops – AM Peak Hour (Existing and No Build Conditions)

Intersection	Intersection Control	2019 Existing				2040 No Build			
		EB Route 460		WB Route 460		EB Route 460		WB Route 460	
		Stops/ Veh	Total Stops	Stops/ Veh	Total Stops	Stops/ Veh	Total Stops	Stops/ Veh	Total Stops
Route 460 & I-581 NB Off-Ramp	Unsignalized	0.14	137	0.00	7	0.36	360	0.01	10
Route 460 & Courtland Road	Unsignalized	0.45	573	0.06	104	0.40	542	0.05	83
Route 460 & Williamson Road (Route 11)	Signalized	0.27	220	0.87	1213	0.33	271	0.84	1187
Route 460 & Plantation Road/Kimball Avenue	Signalized	0.31	248	1.25	1970	0.38	318	1.36	2144
Route 460 & Hollins Road	Signalized	0.34	294	0.76	1322	0.36	332	0.86	1467
Route 460 & 11th Street	Unsignalized	0.05	46	0.03	53	0.09	89	0.13	232
Route 460 & 12th Street	Unsignalized	0.05	49	0.03	53	0.05	56	0.12	214
Route 460 & Rhodes Avenue	Unsignalized	0.25	261	0.03	54	0.21	234	0.07	121
Route 460 & 13th Street	Signalized	0.39	386	0.77	1195	0.44	465	0.53	790
Route 460 & Median Crossover 660' east of 13th Street	Unsignalized	0.00	4	0.44	686	0.01	17	0.19	278
Route 460 & Median Crossover 1170' east of 13th Street	Unsignalized	0.01	15	0.44	689	0.06	64	0.39	600
Route 460 & Walton Street	Unsignalized	0.00	0	0.23	374	0.00	0	0.57	915
Route 460 & Median Crossover 700' east of Walton Street	Unsignalized	0.00	2	0.02	32	0.01	6	0.46	742
Route 460 & 20th Street	Unsignalized	0.00	2	0.01	16	0.00	2	0.43	716
Route 460 & Gus Nicks Boulevard	Signalized	0.29	224	0.30	369	0.34	290	0.42	498
Route 460 & 24th Street	Unsignalized	0.00	4	0.31	393	0.01	7	0.96	1264
Route 460 & District Vue Apartments (West)	Unsignalized	0.00	1	0.00	4	0.00	2	0.43	576
Route 460 & District Vue Apartments (East)	Unsignalized	0.00	1	0.00	0	0.00	0	0.25	336
Route 460 & Mecca Street	Unsignalized / Signalized	0.01	10	0.00	2	0.12	117	0.19	263
Route 460 & Granby Street	Signalized	0.09	76	0.21	274	0.15	137	0.36	513
Route 460 & Hickory Woods Drive	Unsignalized	0.00	0	0.01	17	0.00	0	0.08	112
Route 460 & Seibel Drive	Unsignalized	0.00	0	0.00	1	0.01	6	0.01	10
Route 460 & Median Crossover 520' east of Seibel Drive	Unsignalized	0.00	2	0.02	24	0.06	55	0.02	31
Route 460 & King Street	Signalized	0.56	439	0.34	437	0.77	674	0.37	528
Route 460 & Lynn Brae Drive	Unsignalized	0.01	10	0.01	16	0.01	10	0.00	6
Route 460 & Patrick Road	Unsignalized	0.00	0	0.00	2	0.00	1	0.00	2

Intersection	Intersection Control	2019 Existing				2040 No Build			
		EB Route 460		WB Route 460		EB Route 460		WB Route 460	
		Stops/ Veh	Total Stops	Stops/ Veh	Total Stops	Stops/ Veh	Total Stops	Stops/ Veh	Total Stops
Route 460 & Blue Hills Drive/Mexico Way	Signalized	0.15	140	0.62	883	0.17	172	0.82	1300
Route 460 & Evan Lane	Unsignalized	0.00	1	0.06	93	0.00	1	0.32	514
Route 460 & Blue Hills Village Drive	Unsignalized	0.00	0	0.03	44	0.00	1	0.42	694
Route 460 & Trail Drive	Unsignalized	0.00	2	0.01	14	0.00	2	0.15	262
Route 460 & West Ruritan Road	Signalized	0.26	218	0.65	908	0.34	324	0.79	1226
Route 460 & Valley Gateway Boulevard	Signalized	0.33	272	0.21	290	0.14	133	0.40	628
Route 460 & Carson Road	Unsignalized	0.00	1	0.00	0	0.00	0	0.00	8
Route 460 & Bonsack Road/East Ruritan Road	Unsignalized	0.00	0	0.00	0	0.00	0	0.00	1
Route 460 & Median Crossover 950’ east of Bonsack Road/East Ruritan Road	Unsignalized	0.00	0	0.00	0	0.00	0	0.00	1
Route 460 & Huntridge Road	Unsignalized	0.00	0	0.00	5	0.00	0	0.00	2
Route 460 & Walmart/Lowe’s	Signalized	0.19	153	0.50	632	0.16	147	0.32	467
Route 460 & Route 220 ALT (Cloverdale Road)	Signalized	0.24	104	0.61	571	0.16	73	0.51	524
Total		4.39	3895	8.83	12747	5.14	4908	12.83	19265
% Change from Existing		-	-	-	-	17%	26%	45%	51%

Table 5-11: Intersection Stops – PM Peak Hour (Existing and No Build Conditions)

Intersection	Intersection Control	2019 Existing				2040 No Build			
		EB Route 460		WB Route 460		EB Route 460		WB Route 460	
		Stops/ Veh	Total Stops	Stops/ Veh	Total Stops	Stops/ Veh	Total Stops	Stops/ Veh	Total Stops
Route 460 & I-581 NB Off-Ramp	Unsignalized	0.37	345	0.00	8	0.29	229	0.00	8
Route 460 & Courtland Road	Unsignalized	0.70	932	0.04	63	0.68	755	0.03	64
Route 460 & Williamson Road (Route 11)	Signalized	0.29	275	0.60	794	0.28	217	0.68	975
Route 460 & Plantation Road/Kimball Avenue	Signalized	0.63	702	0.41	558	0.73	743	0.55	831
Route 460 & Hollins Road	Signalized	0.66	988	0.81	1074	0.74	1113	0.78	1123
Route 460 & 11th Street	Unsignalized	0.38	628	0.00	2	0.60	1035	0.00	6
Route 460 & 12th Street	Unsignalized	0.05	92	0.00	0	0.13	229	0.01	15
Route 460 & Rhodes Avenue	Unsignalized	0.18	305	0.00	3	0.40	726	0.00	7
Route 460 & 13th Street	Signalized	0.23	361	0.33	425	0.27	444	0.32	457
Route 460 & Median Crossover 660’ east of 13th Street	Unsignalized	0.00	2	0.00	0	0.00	4	0.00	2
Route 460 & Median Crossover 1170’ east of 13th Street	Unsignalized	0.00	1	0.00	0	0.00	0	0.00	0
Route 460 & Walton Street	Unsignalized	0.00	0	0.00	0	0.00	1	0.00	0
Route 460 & Median Crossover 700’ east of Walton Street	Unsignalized	0.00	1	0.00	0	0.01	12	0.00	0
Route 460 & 20th Street	Unsignalized	0.02	33	0.00	4	0.06	116	0.00	3
Route 460 & Gus Nicks Boulevard	Signalized	0.43	507	0.35	361	0.52	649	0.34	390
Route 460 & 24th Street	Unsignalized	0.00	3	0.39	433	0.01	10	0.65	813
Route 460 & District Vue Apartments (West)	Unsignalized	0.00	1	0.02	19	0.00	1	0.02	21
Route 460 & District Vue Apartments (East)	Unsignalized	0.00	1	0.00	0	0.00	0	0.00	0
Route 460 & Mecca Street	Unsignalized / Signalized	0.01	14	0.00	1	0.04	47	0.06	70
Route 460 & Granby Street	Signalized	0.15	183	0.35	381	0.17	210	0.39	445
Route 460 & Hickory Woods Drive	Unsignalized	0.00	4	0.03	32	0.00	2	0.05	63
Route 460 & Seibel Drive	Unsignalized	0.00	0	0.01	8	0.00	0	0.02	28
Route 460 & Median Crossover 520’ east of Seibel Drive	Unsignalized	0.03	40	0.03	38	0.07	109	0.01	17
Route 460 & King Street	Signalized	0.70	881	0.54	558	0.74	970	0.36	393
Route 460 & Lynn Brae Drive	Unsignalized	0.00	6	0.19	262	0.00	5	0.18	264

Intersection	Intersection Control	2019 Existing				2040 No Build			
		EB Route 460		WB Route 460		EB Route 460		WB Route 460	
		Stops/ Veh	Total Stops	Stops/ Veh	Total Stops	Stops/ Veh	Total Stops	Stops/ Veh	Total Stops
Route 460 & Patrick Road	Unsignalized	0.01	25	0.17	245	0.06	111	0.18	278
Route 460 & Blue Hills Drive/Mexico Way	Signalized	0.33	518	0.42	457	0.46	762	0.65	794
Route 460 & Evan Lane	Unsignalized	0.01	9	0.02	24	0.01	12	0.05	69
Route 460 & Blue Hills Village Drive	Unsignalized	0.00	2	0.02	20	0.00	6	0.04	55
Route 460 & Trail Drive	Unsignalized	0.05	92	0.00	2	0.01	21	0.03	41
Route 460 & West Ruritan Road	Signalized	0.41	598	0.49	527	0.18	273	0.57	693
Route 460 & Valley Gateway Boulevard	Signalized	0.55	735	0.20	208	0.50	722	0.21	250
Route 460 & Carson Road	Unsignalized	0.00	3	0.00	1	0.00	6	0.03	38
Route 460 & Bonsack Road/East Ruritan Road	Unsignalized	0.00	0	0.00	0	0.00	0	0.02	29
Route 460 & Median Crossover 950' east of Bonsack Road/East Ruritan Road	Unsignalized	0.00	0	0.02	23	0.00	0	0.05	72
Route 460 & Huntridge Road	Unsignalized	0.00	0	0.00	1	0.00	0	0.00	0
Route 460 & Walmart/Lowe's	Signalized	0.20	238	0.56	570	0.14	184	0.45	548
Route 460 & Route 220 ALT (Cloverdale Road)	Signalized	0.40	379	0.67	410	0.22	221	0.55	377
Total		6.79	8904	6.67	7512	7.32	9945	7.28	9239
% Change from Existing		-	-	-	-	8%	12%	9%	23%

6. ALTERNATIVES CONSIDERED

6.1 ALTERNATIVES DEVELOPMENT AND SCREENING PROCESS

A Stakeholder Working Group (SWG) comprised of VDOT representatives, Roanoke City, Roanoke County, Roanoke Valley-Alleghany Regional Commission representatives, and the study team convened to discuss potential improvement alternatives to meet the needs of the corridor and enhance safety and operations.

Based on a review of the existing safety conditions and existing and future year No Build traffic analysis results, conceptual alternatives were developed by the SWG to address the identified deficiencies. Public and stakeholder coordination was then initiated to inform the development and refinement of the conceptual alternatives including a public meeting, an online virtual presentation, and two public surveys.

The following is a summary of the alternatives considered and evaluated including a No Build Alternative in order to provide a baseline for comparison.

6.2 NO BUILD ALTERNATIVE

The No Build Alternative has been included for evaluation as a benchmark for the comparison of future conditions and impacts and includes the improvements noted in **Section 4.3**.

6.3 BUILD IMPROVEMENTS

The alternatives development process included the identification of alternatives for each of the study intersections along the Route 460. Reasonable design alternatives were considered with a goal of addressing the identified safety and operational deficiencies. An Alternatives Screening Meeting was held on February 11, 2020 to discuss alternatives considered and the preferred alternative to be carried forward for detailed analysis. **Appendix E** contains the meeting presentation including the range of alternatives considered. The following is a summary of the alternatives considered and the proposed Build Alternative for each study intersection.

Route 460 at Williamson Road (Route 11) (see Figure 6-1)

At the Route 460 at Williamson Road (Route 11) intersection, a dual left-turn lane is proposed to accommodate the high eastbound left-turn volume from eastbound Route 460 to northbound Williamson Road (Route 11) and increase capacity for this movement allowing for the reallocation of green time to the westbound through movement and other over-capacity movements at the intersection. Due to the heavy northbound left-turn volume from Williamson Road (Route 11) to Carver Avenue serving the Sheetz located on the northwest corner of the Route 460 and Williamson Road (Route 11) intersection, installation of a northbound left-turn lane is proposed. The majority of the northbound U-turn vehicles on Williamson Road (Route 11) at Carver Avenue are destined for the Sheetz entrance on Williamson Road (Route 11). This will improve lane utilization for the proposed dual left turn from eastbound Route 460 to northbound Williamson Road (Route 11). To eliminate the weave along eastbound Route 460 between the ramp from I-581 at Williamson Road (Route 11), signalizing the northbound right turn from Route 581 to eastbound Route 460 and realigning the ramp is also proposed. Additionally, a southbound Williamson Road (Route 11) right-turn lane to westbound Route 460 is also proposed to increase capacity for this heavy right-turn movement.

The Central Roanoke Mobility Study evaluated several interchange alternatives for the I-581 at Route 460 interchange with a diverging diamond interchange (DDI) recommended as the preferred alternative. Although the timing and funding for the proposed interchange improvements is unknown at this time, the proposed improvements to the ramp from northbound I-581 to eastbound Route 460 should be considered in conjunction with the ultimate interchange improvements.

Route 460 at Plantation Road/Kimball Avenue (see Figure 6-2)

The proposed improvements at the Route 460 at Plantation Road/Kimball Avenue intersection include widening the northbound Kimball Avenue and southbound Plantation Road approaches to Route 460 to provide three approach lanes. The northbound approach would be widened within the median along Kimball Avenue to provide a left-turn lane, a through lane, and a right-turn lane. The southbound

approach would be widened to provide a left-turn lane, a through lane, and a shared through/right-turn lane. In addition, the westbound Route 460 left turn lane is proposed to be extended to the railroad crossing to reduce the potential for left-turning vehicles extending out of the turn lane which was observed under existing conditions.

Route 460 at Hollins Road

There are no additional recommendations at the Route 460 at Hollins Road intersection beyond what was proposed and previously approved as part of the SMART SCALE project that includes installation of a new eastbound right-turn lane and shifting the eastbound and westbound Route 460 left-turn lanes into the median to improve sight distance and converting the left-turn phasing from protected-only operation to flashing yellow arrow protective-permissive operation.

Route 460 at 11th Street (see Figure 6-3 - Sheet 1)

At the Route 460 at 11th Street intersection, a Restricted Crossing U-turn (RCUT) is proposed that would restrict left turns and through movements from northbound and southbound 11th Street to Route 460. These left turns, which are relatively low volumes during peak periods, would use the Hollins Road intersection to access Route 460 or make downstream U-turns.

Roanoke City has submitted a SMART SCALE application for funding for improvements along Route 460 from 11th Street to 24th Street.

Route 460 at 12th Street (Unsignalized – right in/right out)

No improvements are recommended at the Route 460 at 12th Street intersection due to right in/right out configuration and minimal crash history.

Route 460 at Rhodes Avenue and 13th Street (see Figure 6-3 - Sheet 2)

At the Route 460 at Rhodes Avenue intersection, channelizing the median opening to allow eastbound Route 460 left turns only is proposed to reduce conflict points. Left turns to and from Rhodes Avenue which are a very low traffic volume would use the Hollins Road intersection to access Route 460 or make downstream U-turns. Additionally, left turns from United Rentals located on the north leg of the Rhodes Avenue intersection would be diverted to alternate routes including the Route 460 at 11th Street and Hollins Road intersections. Proposed improvements also include a new eastbound Route 460 left-turn lane to United Rentals where there is currently no turn lane.

At the 13th Street intersection, an additional left-turn lane is proposed along both northbound and southbound 13th Street approaching Route 460 to provide dual left turns and shared through/right-turn lanes on both approaches. Due to the close proximity of the Archbold Avenue intersection in relation to the 13th Street signal at Route 460, a cul de sac is proposed that would require travelers to use alternate routes to use 13th Street or 20th Street to access Route 460. Additionally, the westbound Route 460 left-turn lane to 13th Street will be extended to provide additional storage in conjunction with the intersection

improvements. Proposed improvements also include the extension of the eastbound Route 460 left-turn lane to 13th Street.

Roanoke City has submitted a SMART SCALE application for funding for improvements along Route 460 from 11th Street to 24th Street.

Route 460 at Median Crossovers 660 feet and 1,170 feet east of 13th Street (see Figure 6-3 - Sheet 3)

Two median openings are located along Route 460 east of the 13th Street intersection that do not currently have any turn lanes serving the intersections and also do not currently serve any occupied properties. Closing the median openings is proposed to minimize the potential for turning conflicts at these intersections.

Roanoke City has submitted a SMART SCALE application for funding for improvements along Route 460 from 11th Street to 24th Street.

Route 460 at Walton Street (see Figure 6-3 - Sheet 4)

At the Route 460 at Walton Street intersection, median channelization is proposed that would restrict left turns from Walton Street to westbound Route 460. These left turns which are very low during peak hours would be diverted to the 13th Street or Gus Nicks Boulevard intersections to access Route 460.

Route 460 from West of 20th Street to 24th Street (see Figure 6-3 - Sheets 5 and 6)

The proposed improvements from west of 20th Street to 24th Street were considered together due to the close proximity of the 20th Street, Gus Nicks Boulevard and 24th Street intersections along Route 460. At the Gus Nicks Boulevard intersection, a Thru-Cut is proposed that would prohibit through movements from northbound Gus Nicks Boulevard and southbound from the Roanoke Antiques Mall. Northbound through movements would be redirected to make right turns and then U-turns at the District Vue Apartments entrance. Southbound through movements would be redirected to make U-turns at the median opening west of 20th Street where a left-turn lane and a turnaround area is proposed to accommodate the U-turns. The median opening at 24th Street would be closed to allow the extension of the westbound Route 460 left turn lane to Gus Nicks Boulevard because it fills up under existing conditions with left-turning vehicles extending into the through lanes. At the 20th Street intersection, the median opening is proposed to be channelized to accommodate eastbound left turns only. Left turns from 20th Street would use the turnaround at the median located to the west of the 20th Street intersection. In order to provide additional access to Route 460 for the 20th Street and 24th Street intersections and minimize U-turns along Route 460, a connection is proposed through the Roanoke Antiques Mall parking lot between 20th Street and 24th Street that would also provide access to the signalized intersection at Gus Nicks Boulevard. The proposed improvements at the Route 460 at Gus Nicks Boulevard intersection would also include a signalized pedestrian crossing of Route 460 as well as signalized pedestrian crossings on the north and south legs of the intersection.

Roanoke City has submitted a SMART SCALE application for funding for improvements along Route 460 from 11th Street to 24th Street.

Route 460 at Median Crossovers serving District Vue Apartments (see Figure 6-4)

At the recently constructed Route 460 at District Vue Apartments entrances, RCUTs are proposed to minimize conflict points, improve safety, and provide consistent treatment for median openings in this segment of the Route 460 corridor. Left turns from the District Vue Apartments would use the eastern entrance to exit and then make a U-turn at the western entrance to access eastbound Route 460.

Route 460 at Mecca Street

As part of the No Build improvements, a traffic signal will be installed at Route 460 at Mecca Street to provide access to the Richfield Living Site. Although the traffic signal will not be constructed by the developer, it is warranted in the future based on the northbound Mecca Street approach having a single shared lane for left turns and right turns. No additional recommendations are proposed at the Route 460 at Mecca Street intersection

Route 460 at Granby Street

No improvements are proposed at the intersection of Route 460 and Granby Street; however; if the property on the south side of the intersection is redeveloped in the future, the traffic signal operation should remain a three-phase operation and intersection options should be pursued that would not add an additional signal phase to accommodate the northbound approach to the intersection (e.g., Thru-Cut, RCUT, etc.).

Route 460 at Hickory Woods Drive and Seibel Drive (see Figure 6-5)

At the Hickory Woods Drive and Seibel Drive intersections, proposed improvements include channelization to accommodate left turns from Route 460 only including westbound left turns to Hickory Woods Drive and eastbound left turns to Seibel Drive. Motorists wanting to make a left turn from Hickory Woods Drive would make a right turn and then a U-turn at Seibel Drive. Left turns from Seibel Drive would make a right turn and then a U-turn at Hickory Woods Drive or could use alternate routes to access Granby Street, the signalized intersection to the west, to turn left on Route 460.

Roanoke City has submitted a SMART SCALE application for funding for improvements along Route 460 at Hickory Woods Drive and Seibel Drive.

Route 460 from Median Opening West of King Street to Lynn Brae Drive (see Figure 6-6 - Sheets 1 and 2)

At the King Street intersection, a Thru-Cut is proposed that would prohibit northbound through movements from King Street to the McDonalds and from the McDonalds to King Street. These movements would be redirected to the median openings to the west at GCR Tire and to the east at Lynn Brae Drive to make U-turns. Both of these median openings would be converted to RCUTs to minimize conflict points

at these intersections. In addition, westbound left-turn lanes to accommodate the U-turn movements are proposed at both RCUTs. The proposed improvements at the Route 460 at King Street intersection would also include a signalized pedestrian crossing of Route 460 as well as signalized pedestrian crossings on the north and south legs of the intersection.

Roanoke City has submitted a SMART SCALE application for funding for improvements along Route 460 from west of King Street to Lynn Brae Drive.

In addition to these improvements, Roanoke City previously obtained SMART SCALE funding at the Route 460 at King Street intersection to shift the Route 460 left-turn lanes farther into the median to improve sight distance for left turns from Route 460 and extend the westbound left-turn lane at King Street. Additionally, the left-turn phasing for eastbound and westbound Route 460 will be converted from protected-only operation to flashing yellow arrow protective-permissive operation. New sidewalks along Route 460 are also proposed along with a crosswalk and pedestrian push buttons for pedestrians to cross Route 460 to access Valley Metro bus stops near the intersection

Route 460 from Patrick Road to Blue Hills Village Drive including Blue Hills Drive/Mexico Way (see Figure 6-7 - Sheets 1 through 3)

A Thru-Cut is proposed for the Route 460 at Blue Hills Drive/Mexico Way intersection that would redirect northbound and southbound through movements to RCUTS that are proposed to the west at Patrick Road and to the east at Blue Hills Village Drive. Left turns from Blue Hills Village Drive would use Blue Hills Drive to access eastbound Route 460 and left turns from Patrick Road would make a U-turn at Lynn Brae Drive to access eastbound Route 460. The proposed improvements at the Route 460 at Blue Hills Village Drive/Mexico Way intersection would also include a signalized pedestrian crossing of Route 460 as well as signalized pedestrian crossings on the north and south legs of the intersection.

Roanoke City has submitted a SMART SCALE application for funding for improvements along Route 460 from Lynn Brae Drive to Blue Hills Village Drive.

In addition to these improvements, Roanoke City previously obtained SMART SCALE funding to shift the Route 460 left-turn lanes farther into the median at Blue Hills Village Drive/Mexico Way to improve sight distance for left turns from Route 460 and convert the left-turn phasing from protected-only operation to flashing yellow arrow protective-permissive operation.

Route 460 at Evan Lane

No improvements are recommended at Route 460 at Evan Lane due to right in/right out configuration and minimal crash history.

Route 460 at Trail Drive (see Figure 6-8)

No improvements are recommended at Route 460 at Trail Drive due to right in/right out configuration and minimal crash history.

Route 460 at West Ruritan Road (see Figure 6-8)

At the Route 460 at West Ruritan Road intersection, a Thru-Cut is proposed. Northbound through vehicles would be redirected to the Valley Gateway Boulevard intersection to make a U-turn and southbound vehicles would be diverted to the planned RCUT at Blue Hills Village Drive to make a U-turn. In addition, the eastbound and westbound left-turn lanes on Route 460 would be shifted into the median to improve sight distance for left turns. The Thru-Cut will affect very few through vehicles during peak hours. The proposed improvements at the Route 460 at West Ruritan Road intersection would also include a signalized pedestrian crossing of Route 460 as well as signalized pedestrian crossings on the north and south legs of the intersection.

Roanoke County has submitted a SMART SCALE application for funding for improvements along Route 460 at West Ruritan Road.

Route 460 at Valley Gateway Boulevard

The recent signal timing improvements including coordination along Route 460 have reduced the potential for rear end crashes which account for 80 percent of the crashes at the Route 460 at Valley Gateway Boulevard intersection. Following the implementation of signal timing improvements along Route 460 that occurred in November 2019, crash data was reviewed during the three-month period between December 2019 and February 2020 and there was only one reported rear end crash during the period indicating that the signal timing improvements significantly reduced the potential for rear end crashes, the predominant crash type at the intersection. Therefore, there are no additional recommendations for improvements at the Valley Gateway intersection.

If the property on the north side of the intersection is developed in the future, the traffic signal operation should remain a three-phase operation and intersection options should be pursued that would not add an additional signal phase to accommodate the southbound approach to the intersection (e.g., Thru-Cut, RCUT, etc.).

Route 460 at Carson Road to Huntridge Road (see Figure 6-9 - Sheets 1 and 2)

Along Route 460 from Carson Road to Huntridge Road, a series of three RCUTs and median channelization is proposed that would redirect left turns from the side street approaches to U-turns at adjacent median openings. RCUTs are proposed along Route 460 at Carson Road, Bonsack Road/East Ruritan Road, and the median opening serving Country Corner. At Huntridge Road, only eastbound Route 460 left turns would be permitted within the median opening. Left-turn lanes are proposed along eastbound and westbound Route 460 at the median opening serving Country Corner where there are currently no turn lanes. The westbound left-turn lane to Carson Road is also proposed to be extended.

Roanoke County has submitted a SMART SCALE application for funding for improvements along Route 460 from Carson Road to Huntridge Road.

Route 460 at Walmart/Lowe's

No recommendations for improvements are proposed at the Route 460 at Walmart/Lowe's entrance; however; if the property on the south side of the intersection is developed in the future, the traffic signal operation should remain a three-phase operation and intersection options should be pursued that would not add an additional signal phase to accommodate the northbound approach to the intersection (e.g., Thru-Cut, RCUT, etc.).

Route 460 at Route 220 ALT (Cloverdale Road) (see Figure 6-10)

A Displaced Left Turn intersection is proposed as part of the Route 220 ALT (Cloverdale Road) Corridor Study. A new signalized intersection would be constructed on Route 220 ALT (Cloverdale Road) just north of Route 460, where vehicles traveling from southbound Route 220 ALT (Cloverdale Road) to eastbound Route 460 would cross over to the other side of the road in advance of Route 460. Eastbound Route 460 left turns to northbound Route 220 ALT (Cloverdale Road) would turn onto the left-hand side of the road and then return to the right side of the road after crossing through the new signal. This configuration allows left turns to and from Route 220 ALT (Cloverdale Road) to turn simultaneously at Route 460 and improves the efficiency of the intersection along Route 460. This design was developed and evaluated as part of the Route 220 ALT Corridor Study.

Roanoke County has submitted a SMART SCALE application for funding for improvements along Route 460 at Route 220 ALT (Cloverdale Road).

6.4 BUILD ALTERNATIVE TRAFFIC VOLUMES

As discussed in **Section 4.1**, growth rates were applied to the existing turning movements within the study area and projected development-related traffic volumes were distributed over the network to develop future 2040 No Build conditions traffic volumes. Traffic volumes were developed for the Build Alternative by reassigning traffic to the study area roadways depending on the proposed improvements and movement restrictions under consideration. **Figures 6-11a and 6-11b** depict the 2040 Build scenario traffic volumes for the AM and PM peak hours, respectively.

Figure 6-1: Route 460 at Williamson Road (Route 11)

Figure 6-2: Route 460 at Plantation Road/Kimball Avenue

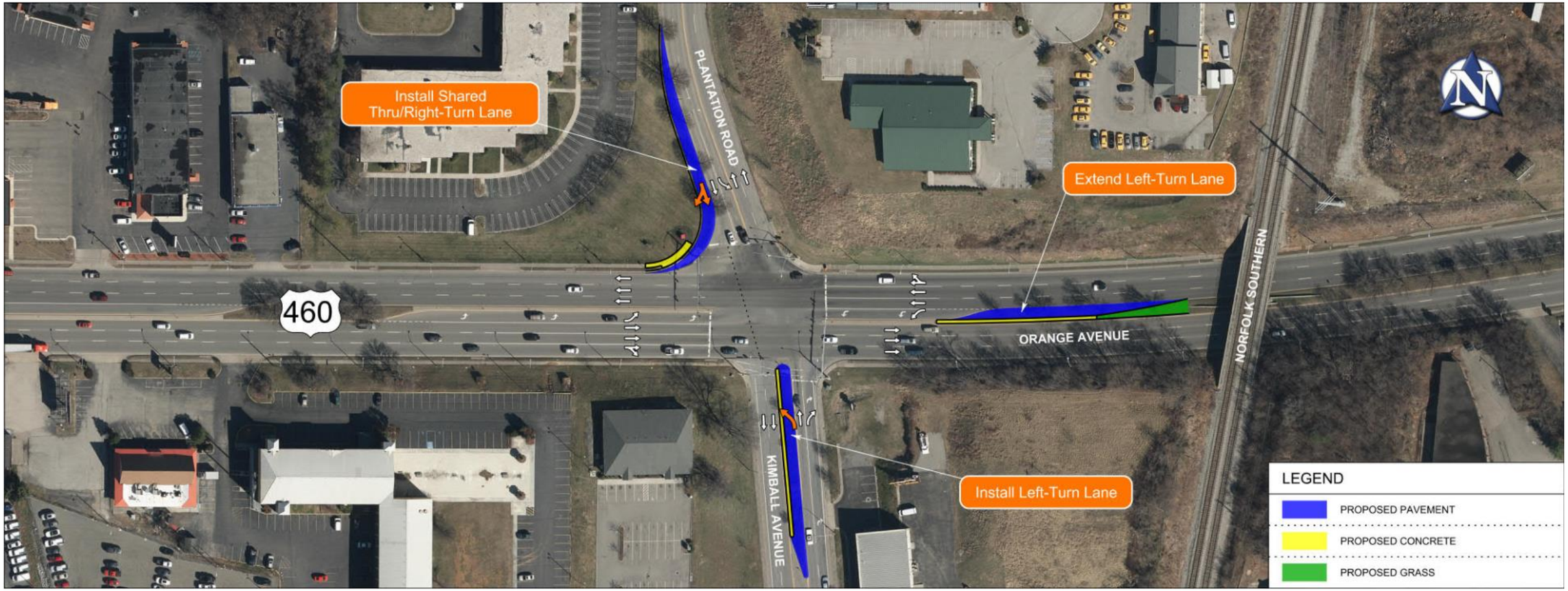


Figure 6-3: Route 460 from 11th Street to 24th Street (Sheet 1 of 6)

Figure 6-3: Route 460 from 11th Street to 24th Street (Sheet 2 of 6)

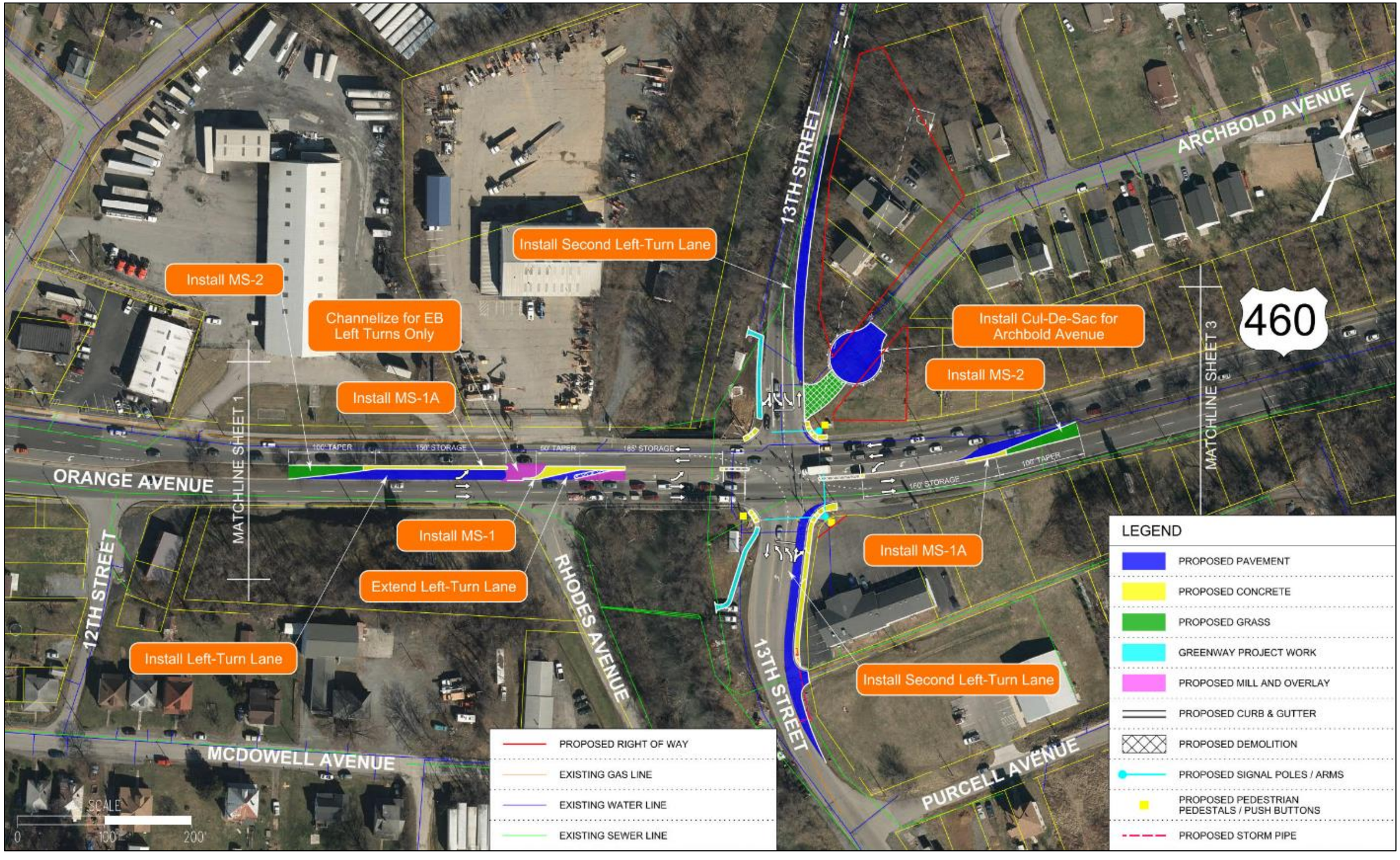


Figure 6-3: Route 460 from 11th Street to 24th Street (Sheet 3 of 6)

Figure 6-3: Route 460 from 11th Street to 24th Street (Sheet 4 of 6)

Figure 6-3: Route 460 from 11th Street to 24th Street (Sheet 5 of 6)

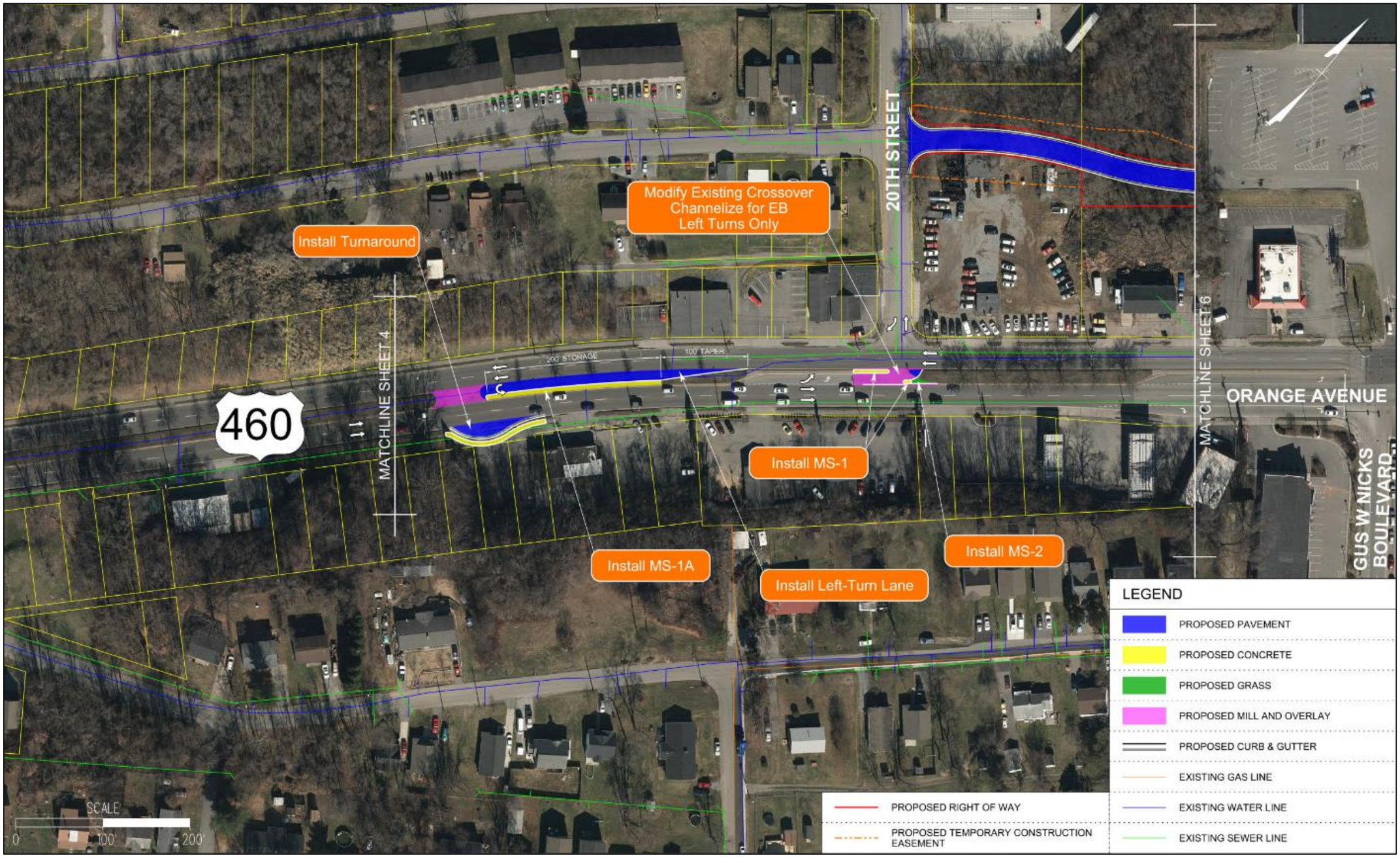


Figure 6-3: Route 460 from 11th Street to 24th Street (Sheet 6 of 6)

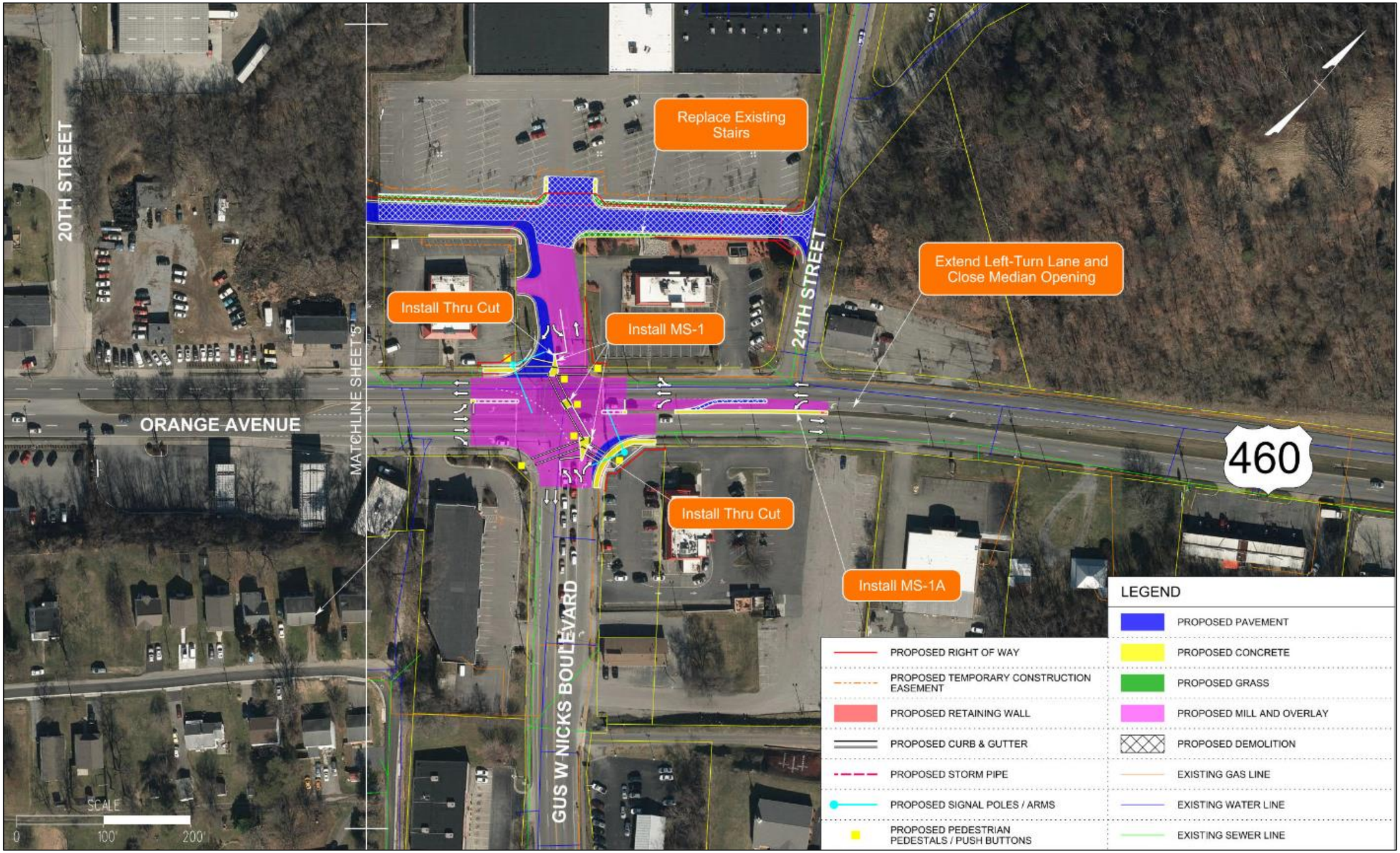


Figure 6-4: Route 460 at Median Crossovers Serving District Vue Apartments

Figure 6-5: Route 460 at Hickory Woods Drive and Seibel Drive

Figure 6-6: Route 460 from Median Opening West of King Street to Lynn Brae Drive (Sheet 1 of 2)

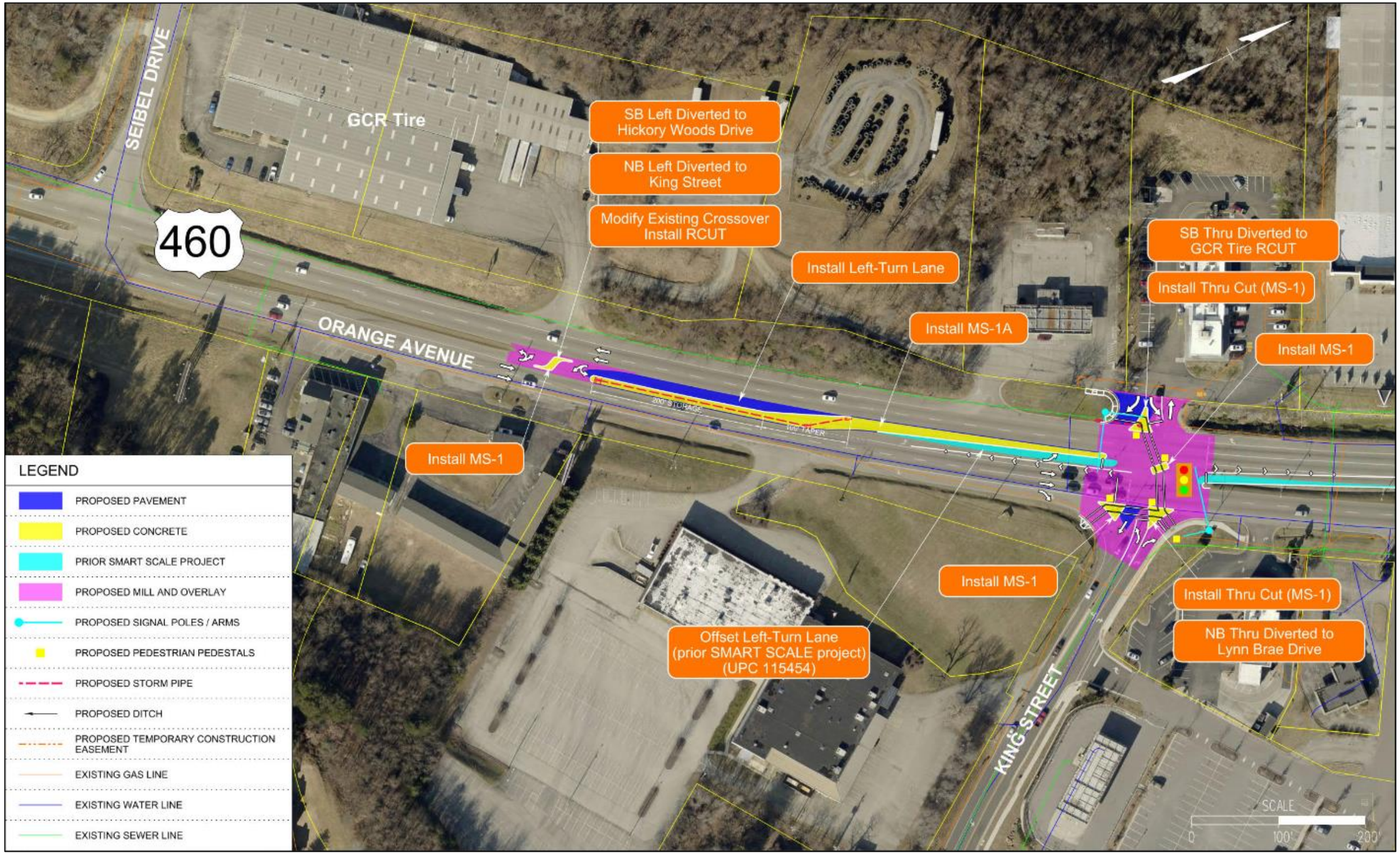


Figure 6-6: Route 460 from Median Opening West of King Street to Lynn Brae Drive (Sheet 2 of 2)

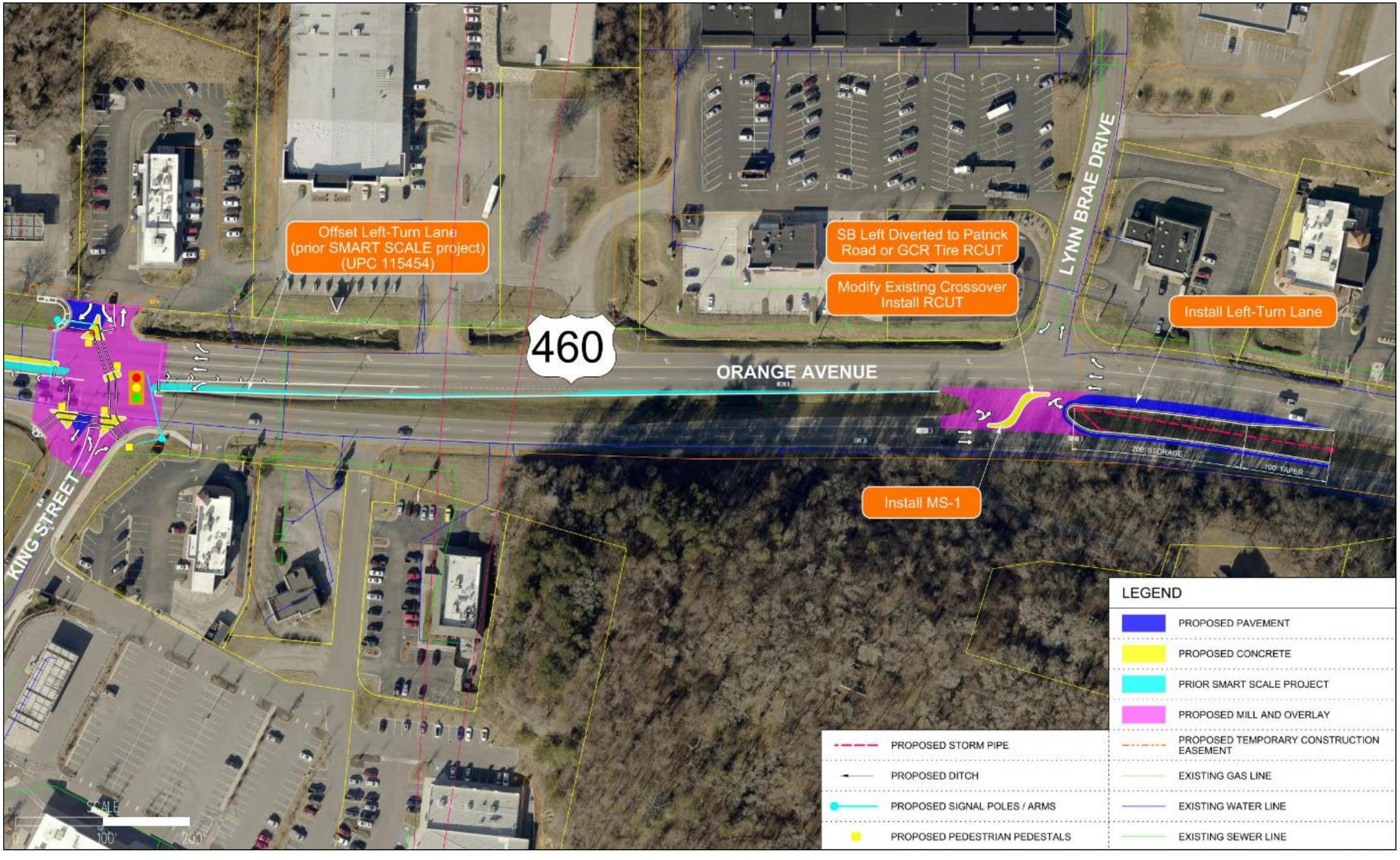


Figure 6-7: Route 460 from Lynn Brae Drive to Blue Hills Village Drive (Sheet 1 of 3)

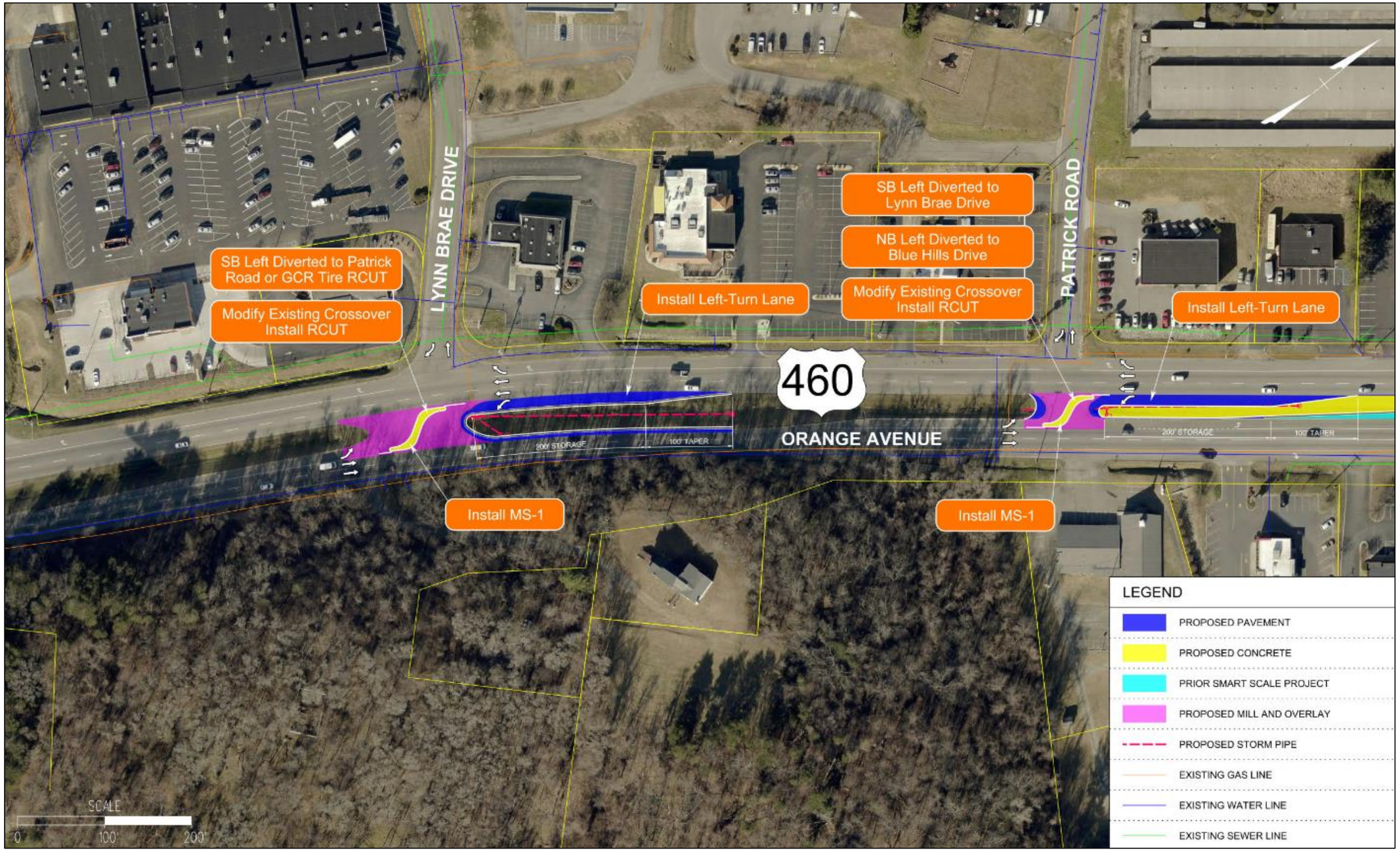


Figure 6-7: Route 460 from Lynn Brae Drive to Blue Hills Village Drive (Sheet 2 of 3)

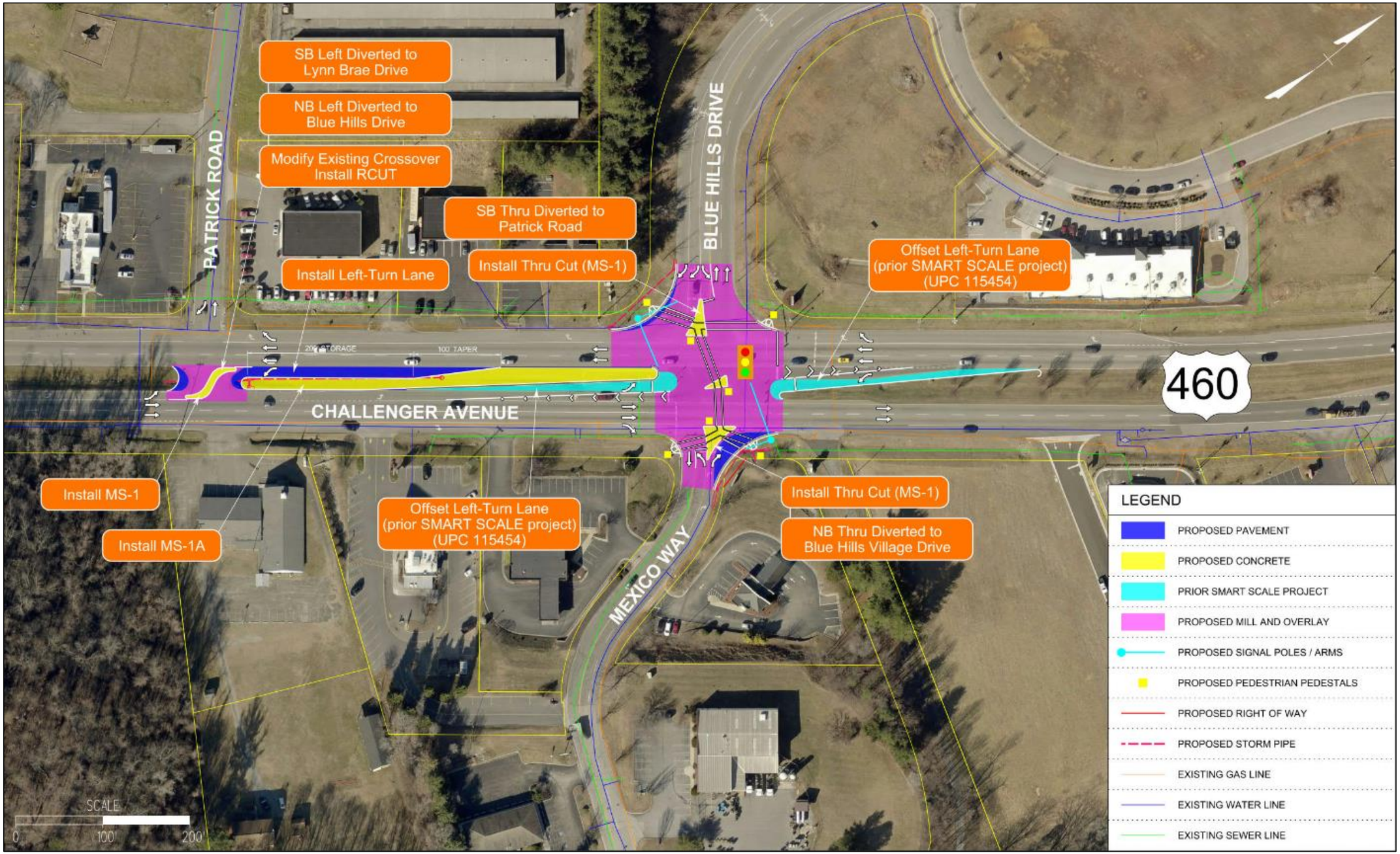


Figure 6-7: Route 460 from Lynn Brae Drive to Blue Hills Village Drive (Sheet 3 of 3)

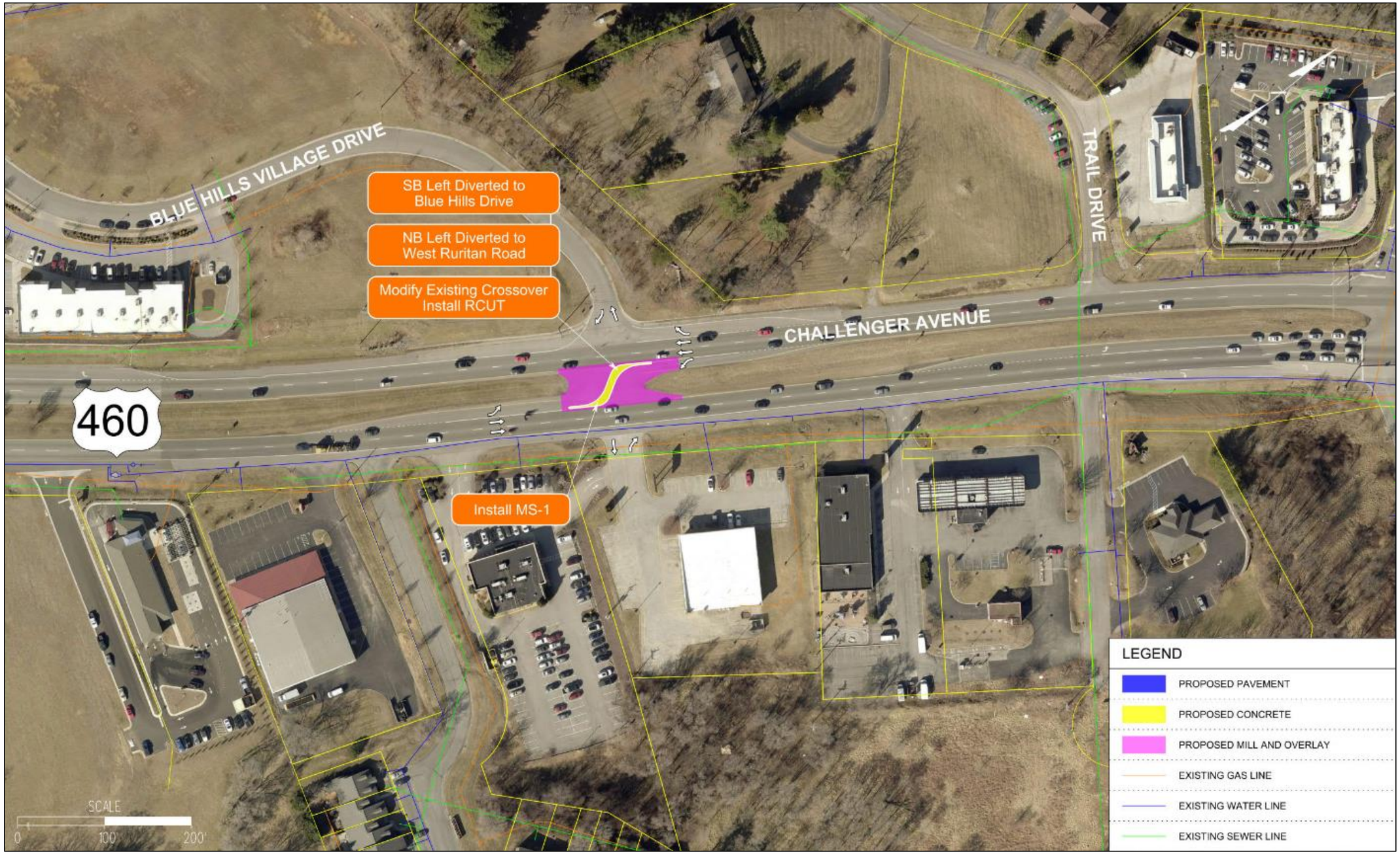


Figure 6-8: Route 460 at West Ruritan Road

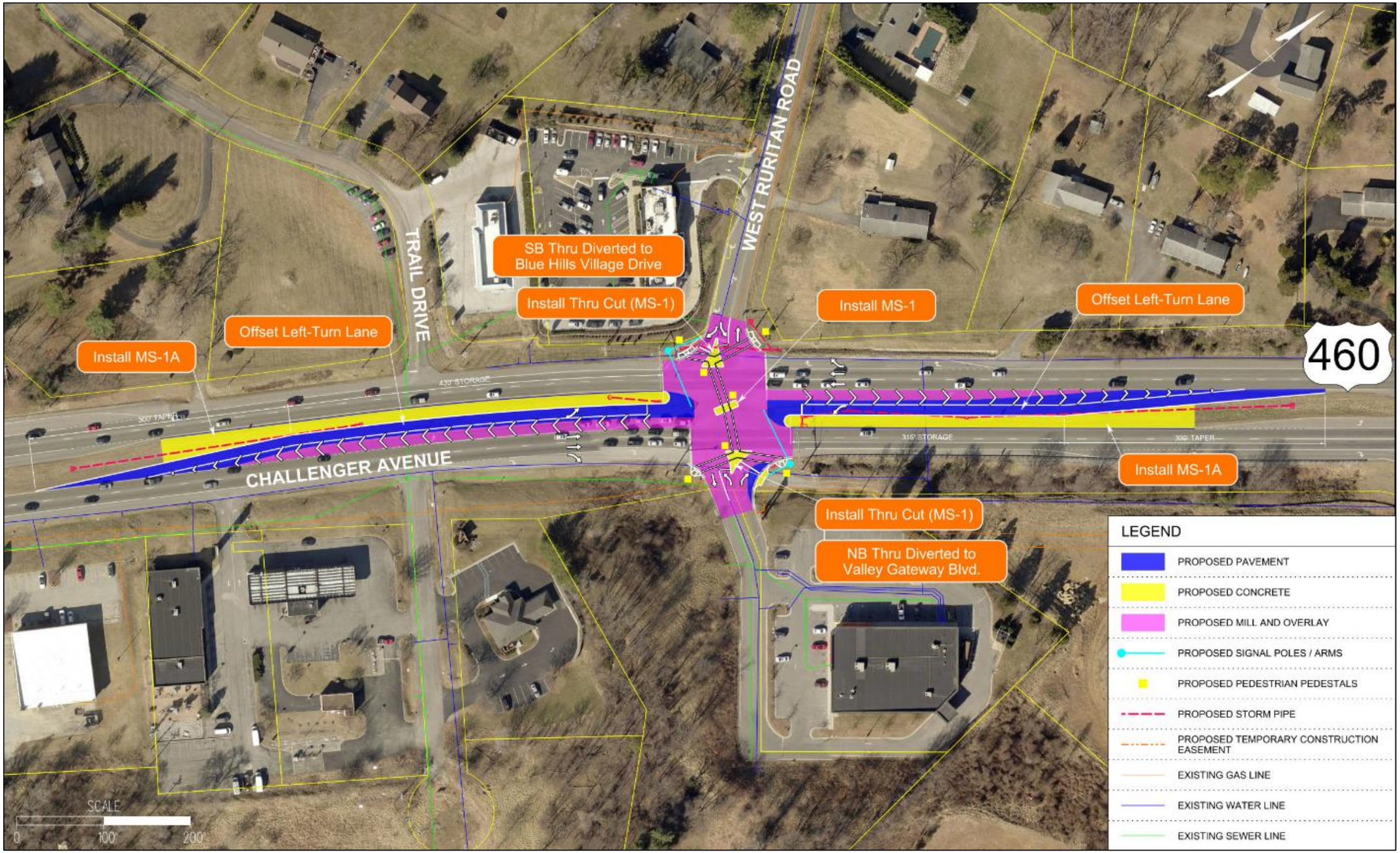


Figure 6-9: Route 460 from Carson Road to Huntridge Road (Sheet 1 of 2)

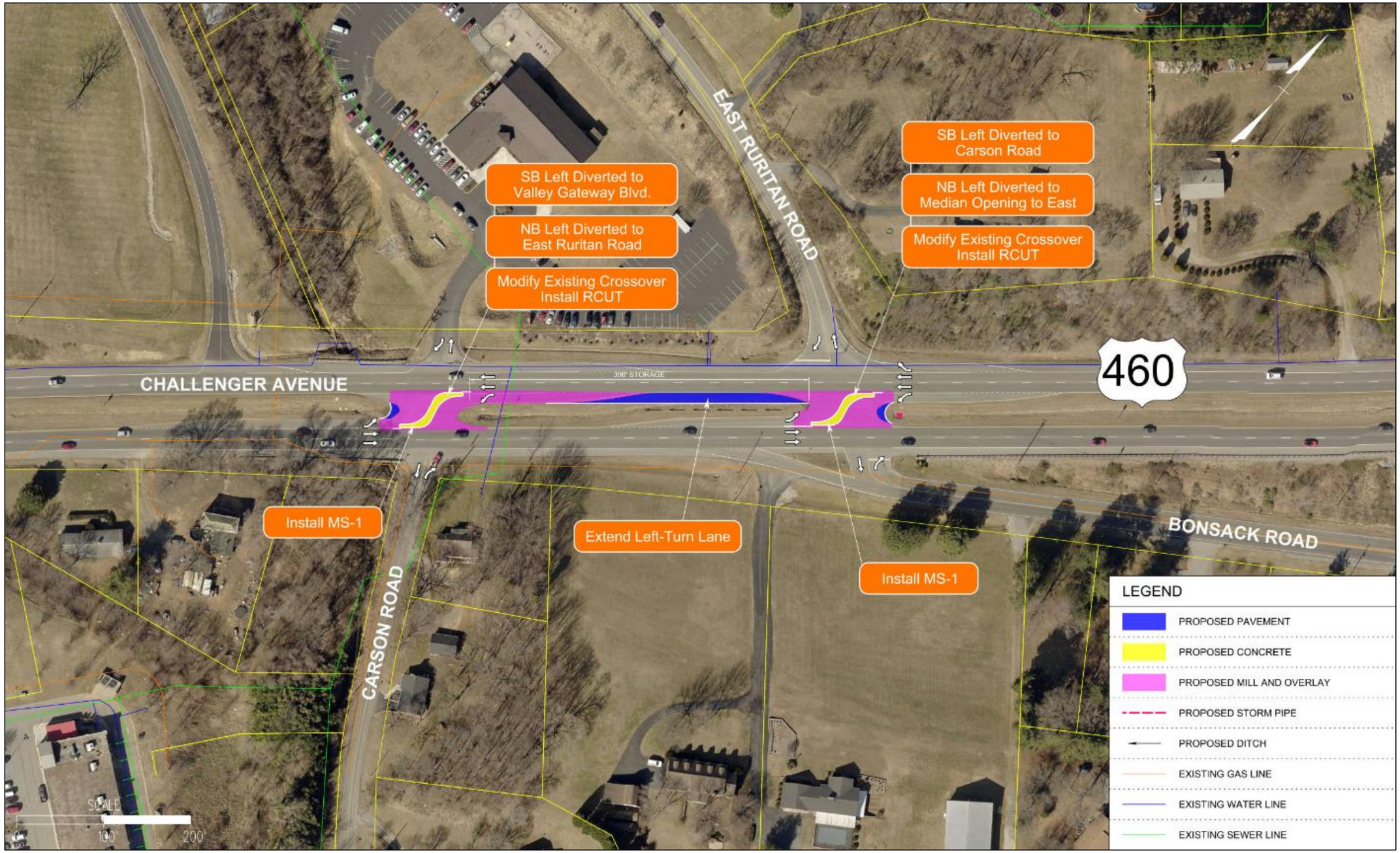


Figure 6-9: Route 460 from Carson Road to Huntridge Road (Sheet 2 of 2)

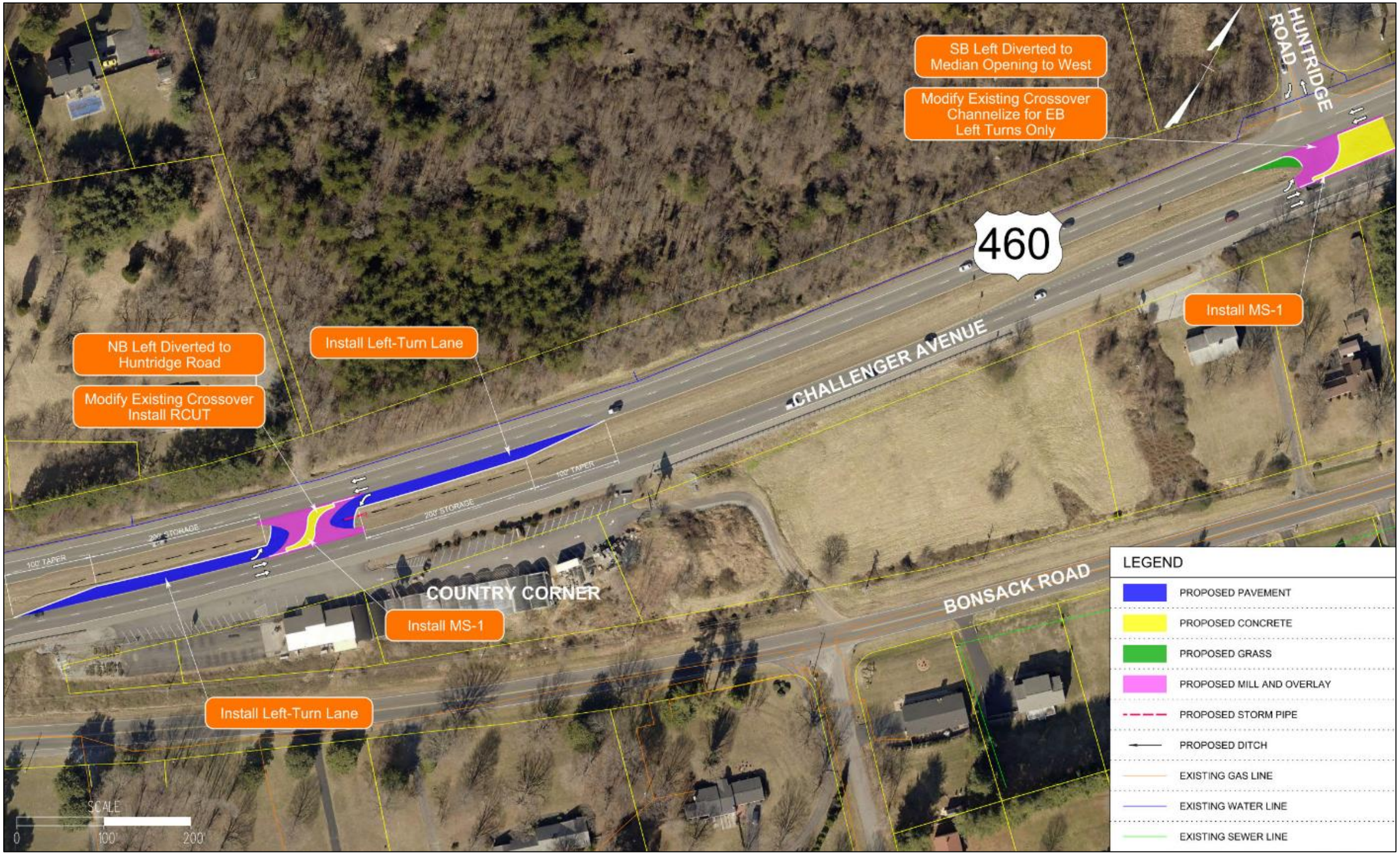


Figure 6-10: Route 460 at Route 220 ALT (Cloverdale Road)

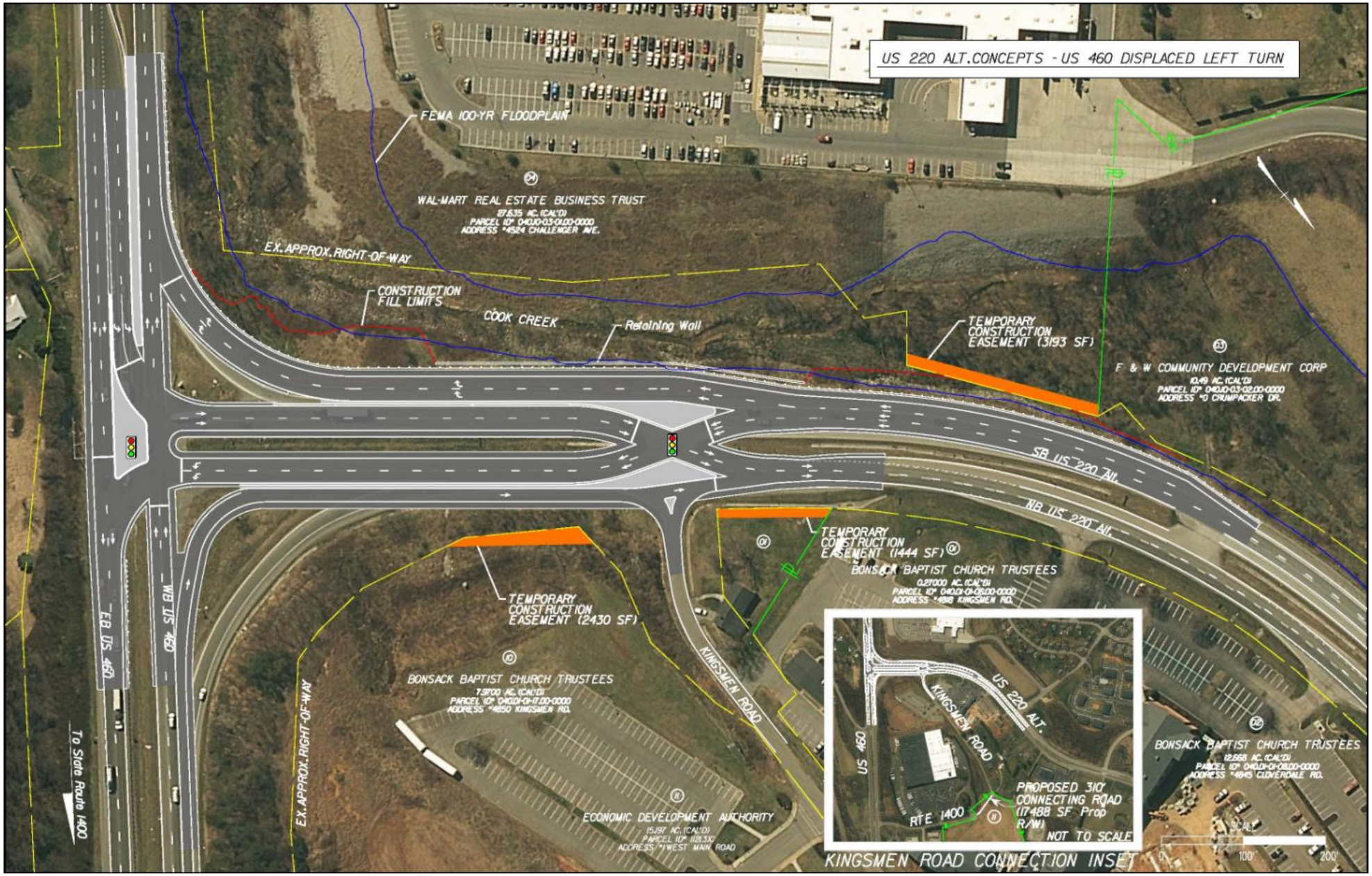


Figure 6-11a: Peak Hour Volumes – 2040 Build AM Peak Hour

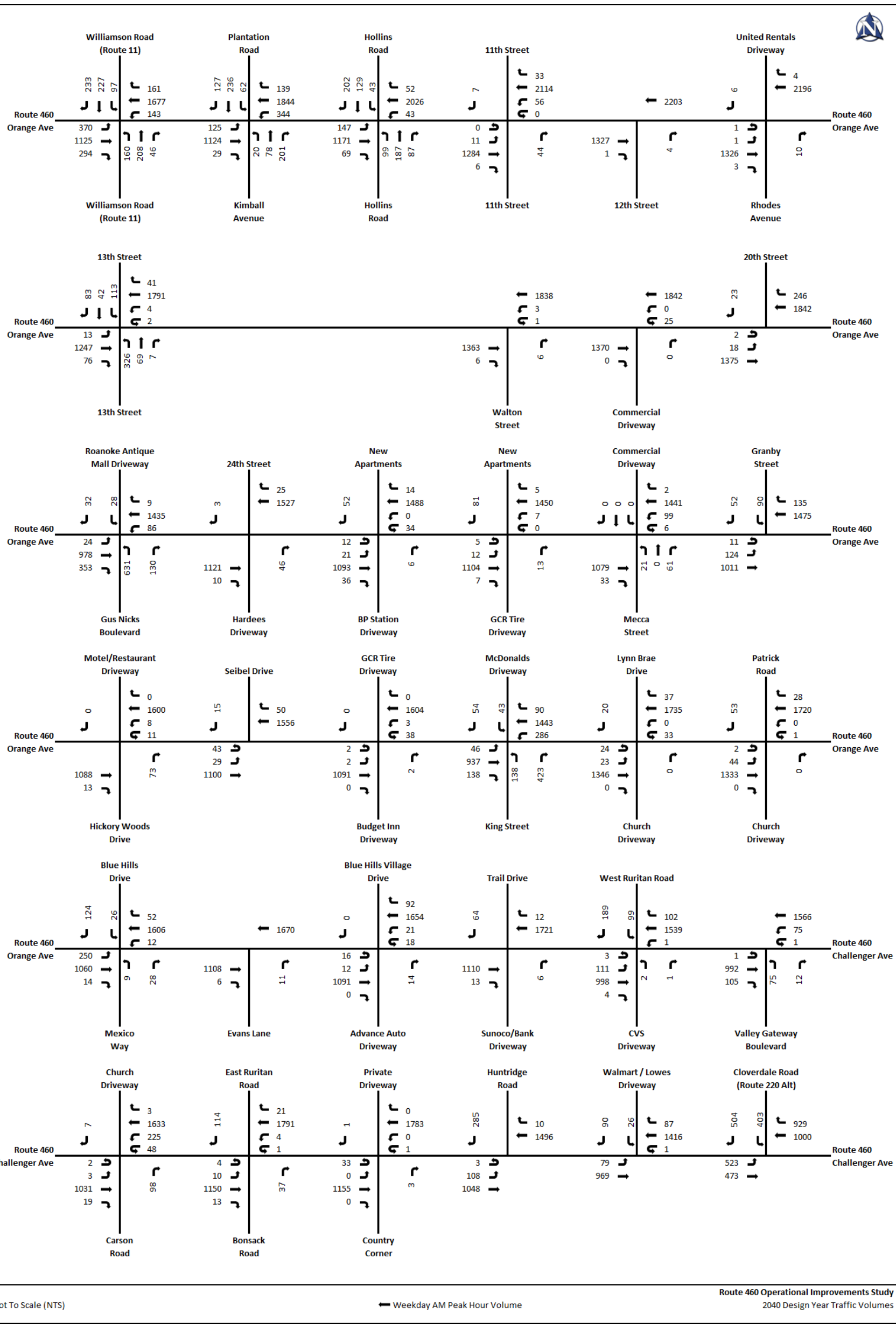
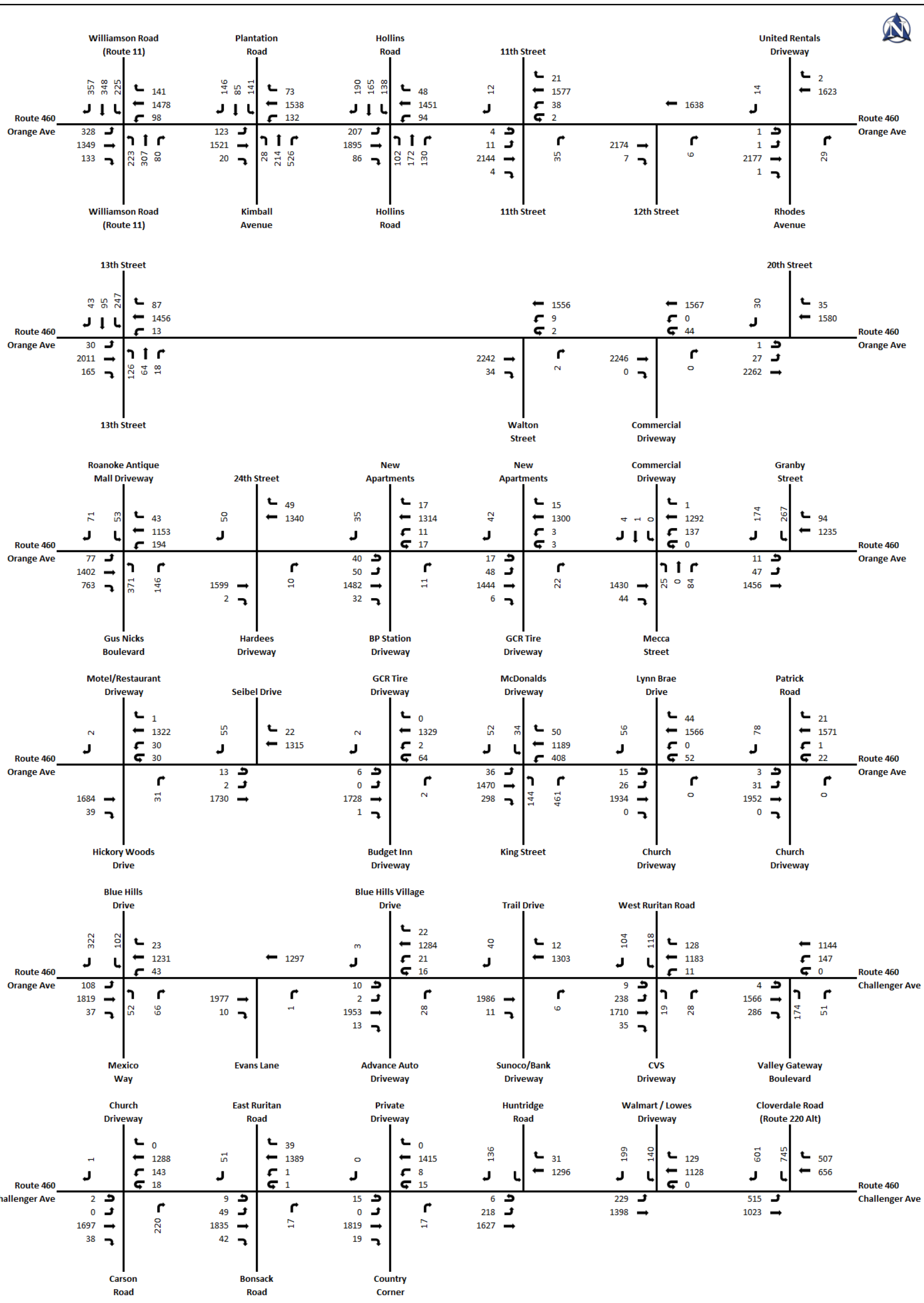


Figure 6-11b: Peak Hour Volumes – 2040 Build PM Peak Hour



7. SAFETY ASSESSMENT OF THE BUILD ALTERNATIVE

With the anticipated growth in travel demand along Route 460, congestion will increase and correspondingly, crash frequency will increase under future No Build conditions. The improvements under consideration will improve safety, reduce conflict points, and reduce the potential for crashes.

7.1 SUMMARY OF CONFLICT POINTS

Table 7-1 summarizes the conflict points under No Build and Build conditions for each of the study intersections. As shown, there are currently a total of 805 conflict points at the 36 intersections along Route 460. The Build improvements will reduce the total number of conflict points by 38% (309 conflict points). Installing 10 RCUT's throughout the corridor will reduce a total of 180 conflict points. Each RCUT intersection reduces the number of intersection conflict points by 56% as a result of limiting the through and left-turn movements from side streets. At the seven intersections where median channelization is proposed in order to limit left turns only from the mainline, conflict points are reduced between 22% and 78%, depending on the number of legs and movements at the intersection. A total of 56 conflict points are eliminated due to the median channelization and limiting left-turns. Installation of Thru-Cut intersections reduces the number of conflict points at each intersection by 25% as a result of eliminating the through movements from side streets. Installing Thru-Cuts at four intersections along the corridor will eliminate 32 total conflict points. Closing two median openings along the corridor would reduce 100% of the conflict points at those median access locations and eliminate eight conflict points in the corridor. Installing one right-in-right-out intersection in the corridor would reduce 28 conflict points (88%) as a result of eliminating mainline left-turn movements as well as through and left-turn movements from the side streets. At the proposed Route 220 ALT (Cloverdale Road) innovative intersection, 28% of the conflict points (5 conflict points) would be eliminated as a result of the displaced left-turn lanes.

Table 7-1: Conflict Point Summary

Intersection	Conflict Points		
	No Build	Build	% Reduction
1. Route 460 at Williamson Road (Route 11)	32	32	0%
2. Route 460 at Plantation Road/Kimball Avenue	32	32	0%
3. Route 460 at Hollins Road	32	32	0%
4. Route 460 at 11th Street	32	14	56%
5. Route 460 at 12th Street	2	2	0%
6. Route 460 at Rhodes Avenue	32	7	78%
7. Route 460 at 13th Street	32	32	0%
8. Route 460 at Median Crossover 660' east of 13th Street	4	0	100%
9. Route 460 at Median Crossover 1170' east of 13th Street	4	0	100%
10. Route 460 at Walton Street	9	7	22%
11. Route 460 at Median Crossover 700' east of Walton Street	4	2	50%
12. Route 460 at 20th Street	9	7	22%
13. Route 460 at Gus Nicks Blvd	32	24	25%
14. Route 460 at 24th Street	32	4	88%
15. Route 460 at District Vue Apartments (West)	32	14	56%
16. Route 460 at District Vue Apartments (East)	32	14	56%
17. Route 460 at Mecca Street	32	32	0%
18. Route 460 at Granby Street	9	9	0%
19. Route 460 at Hickory Woods Drive	32	11	66%
20. Route 460 at Seibel Drive	9	7	22%
21. Route 460 at Median Crossover 520' east of Seibel Drive	32	14	56%
22. Route 460 at King Street	32	24	25%
23. Route 460 at Lynn Brae Drive	32	14	56%
24. Route 460 at Patrick Road	32	14	56%
25. Route 460 at Blue Hills Drive/Mexico Way	32	24	25%
26. Route 460 at Evan Lane	2	2	0%
27. Route 460 at Blue Hills Village Drive	32	14	56%
28. Route 460 at Trail Drive	4	4	0%
29. Route 460 at West Ruritan Road	32	24	25%
30. Route 460 at Valley Gateway Boulevard	9	9	0%
31. Route 460 at Carson Road	32	14	56%
32. Route 460 at Bonsack Road/East Ruritan Road	32	14	56%
33. Route 460 at Median Crossover 950' east of Bonsack Road/East Ruritan Road	32	14	56%
34. Route 460 at Huntridge Road	9	7	22%
35. Route 460 at Walmart/Lowe's	9	9	0%
36. Route 460 at Route 220 ALT	18	13	28%
TOTAL	**805**	**496**	**-38%**

8. BUILD CONDITION TRAFFIC OPERATIONS ANALYSIS

Following the Alternatives Development and Screening Process and the selection of preferred improvements along the Route 460 corridor by the Stakeholder Working Group, the 2040 No Build Synchro traffic analysis networks were updated to reflect the recommended improvements proposed for intersections along the study corridor. For intersections where turning movements would be restricted, the affected traffic volumes were generally redistributed to the nearest adjacent intersections to perform U-turn movements or rerouted between intersections where parcel interconnections or parallel routes exist. Traffic signal timings and coordination offsets were also updated to reflect changes in intersection operations where additional travel lanes are proposed or where permitted turning movements and signal phasing will change due to implementation of Thru-Cuts. The results of the Synchro traffic analysis and SimTraffic microsimulation are documented for the measures of effectiveness (MOEs) in accordance with the TOSAM as specified in the Framework Document.

Along Route 460, corridor travel times (minutes) are presented. Signalized and unsignalized intersections within the study area were evaluated using average intersection delay (seconds/vehicle), overall intersection delay (vehicle-hours), stops per vehicle, and total stops. Overall intersection level of service is also provided for the signalized intersections. Detailed analysis and simulation outputs containing delay, stop, and LOS results for Build conditions are provided in **Appendix F**.

8.1 2040 BUILD CONDITIONS TRAFFIC OPERATIONS

8.1.1 Route 460 Travel Times

AM Peak Hour

A comparison of cumulative corridor travel times for 2040 No Build and Build conditions is summarized in **Figures 8-1a and 8-1b** for eastbound and westbound Route 460 during the AM peak hour. Under 2040 Build conditions, the eastbound total travel time is 15.7 minutes, which is 2.0 minutes less than No Build conditions. This decrease in travel time primarily occurs between the west end of the study corridor and Williamson Road (Route 11) (1.3 minute decrease) as well as the approach to King Street (0.7 minute decrease). Improvements proposed at the Williamson Road (Route 11) intersection alleviate the congestion which occurs at this signal under No Build conditions. The proposed installation of a Thru-Cut at King Street reduces the number of signal phases, allowing for more green time on the mainline Route 460 movements and improving the travel time under Build conditions.

The 2040 Build westbound travel time of 22.9 minutes is approximately 8.7 minutes less than No Build conditions. The largest westbound decreases in travel time occurred approaching Blue Hills Drive/Mexico Way (1.7 minute decrease), approaching Gus Nicks Boulevard (2.6 minute decrease), between Gus Nicks Boulevard and 13th Street (1.4 minute decrease), approaching Hollins Road (0.5 minute decrease) and approaching Plantation Road/Kimball Avenue (1.2 minute decrease).

Figure 8-1a: AM Peak Hour – Eastbound Route 460 Cumulative Travel Times (Existing, No Build, and Build Conditions)

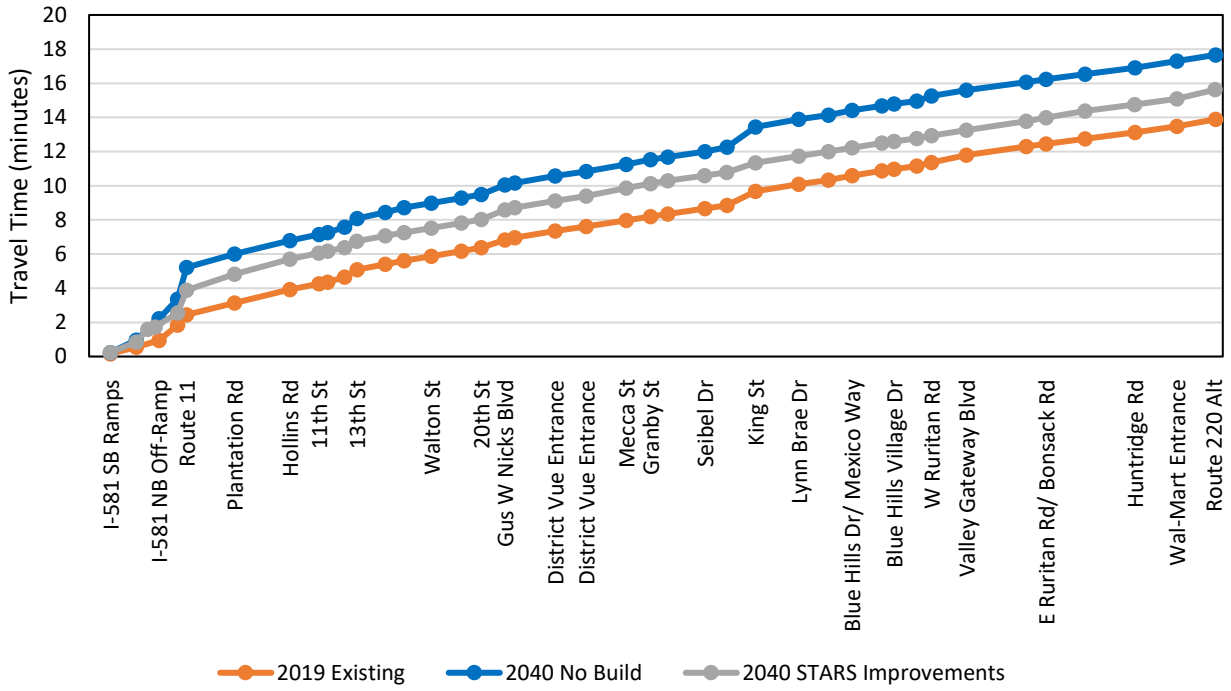
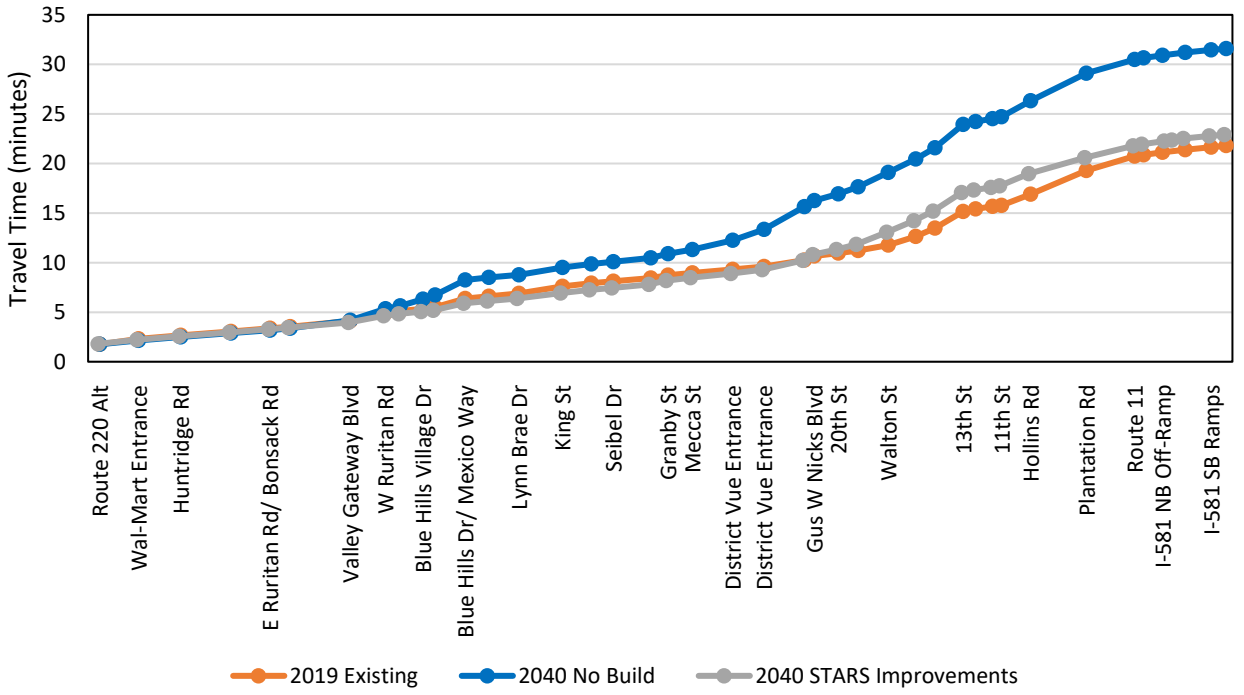


Figure 8-1b: AM Peak Hour – Westbound Route 460 Cumulative Travel Times (Existing, No Build, and Build Conditions)



PM Peak Hour

A comparison of cumulative corridor travel times for 2040 No Build and Build conditions is summarized in **Figures 8-2a and 8-2b** for eastbound and westbound Route 460 during the PM peak hour. Under 2040 Build conditions, the eastbound total travel time is 18.0 minutes, which is 8.7 minutes less than No Build conditions. This decrease in travel time primarily occurs between the west end of the study corridor and Williamson Road (Route 11) (9.5 minute decrease). Improvements proposed at the Williamson Road (Route 11) intersection alleviate the congestion which occurs at this signal under No Build conditions. It should be noted there is a travel time increase of 1.0 minute approaching 11th Street where the number of eastbound lanes is reduced from three lanes to two lanes. This travel time increase occurs at this bottleneck at 11th Street under Build conditions due to the increase in throughput upstream.

The 2040 Build westbound travel time of 14.7 minutes is approximately 3.3 minutes less than No Build conditions. The largest westbound decreases in travel time occurred approaching West Ruritan Road (0.5 minute decrease), approaching Blue Hills Drive/Mexico Way (1.0 minute decrease), approaching King Street (0.7 minute decrease), approaching Gus Nicks Boulevard (0.6 minute decrease), and approaching Williamson Road (Route 11) (0.3 minute decrease). Each of these reductions in travel time are attributed to the proposed improvements along the corridor at signalized as well as unsignalized intersections.

Figure 8-2a: PM Peak Hour – Eastbound Route 460 Cumulative Travel Times (Existing, No Build and Build Conditions)

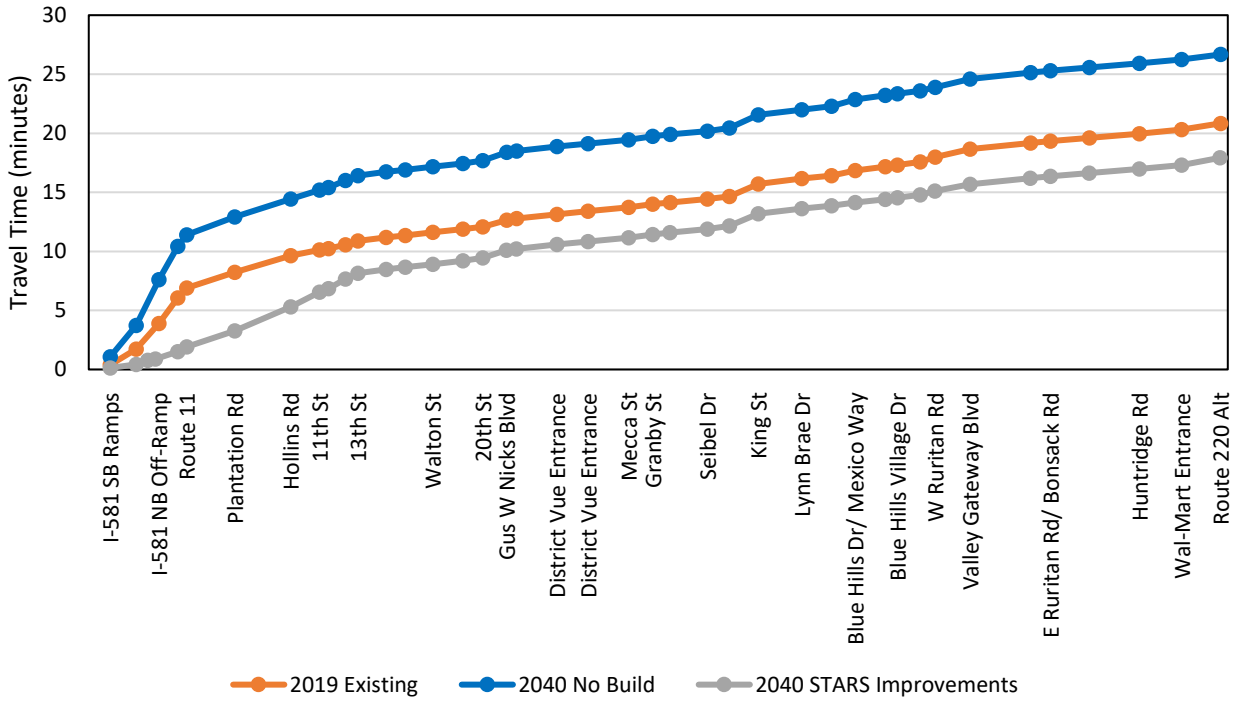
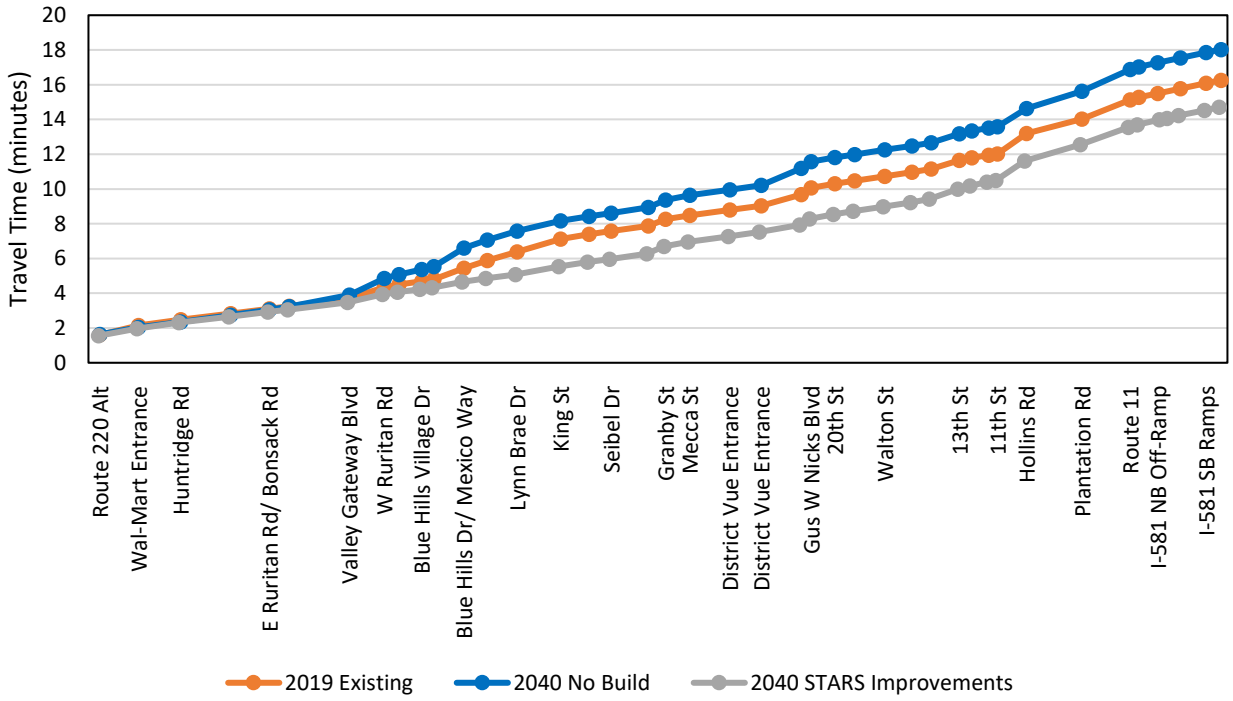


Figure 8-2b: PM Peak Hour – Westbound Route 460 Cumulative Travel Times (Existing, No Build, and Build Conditions)



8.1.2 Intersection Delays

Table 8-1 depicts overall average intersection delay and Level of Service for signalized intersections within the study area for the AM and PM peak hours for both 2040 No Build and 2040 Build conditions to evaluate the impact of the proposed improvements along Route 460. Average vehicle delays and level of service are projected to notably improve for each of the signalized intersections where improvements such as additional lanes, offset mainline left-turns with protective-permissive operations, and/or Thru-Cuts are proposed.

Tables 8-2 and 8-3 depict overall intersection delay for both signalized and unsignalized intersections within the study area for the AM and PM peak hours for both 2040 No Build and 2040 Build conditions. Overall intersection delays are also projected to notably improve throughout the Route 460 corridor for both signalized and unsignalized intersections, with several intersections projected to experience less than half the overall delay as compared to No Build conditions. Notable improvements in delays for the unsignalized intersections where RCUTs are proposed are projected, with delays in many cases being reduced by over 90%.

AM Peak Hour

During the AM peak hour, six signalized intersections are projected to experience significantly reduced delays compared to No Build conditions and improved levels of service with five of those projected to experience delay reductions of 40% or greater, two of which are projected to see delay reductions

exceeding 50%. Additionally, only the Hollins Road intersection is projected to operate at LOS E, the same as No Build conditions, while all other intersections are projected to operate at LOS D or better.

Delays are also projected to decrease for the unsignalized intersections along the Route 460 corridor under Build conditions, with several unsignalized intersections experiencing significant vehicle delay reductions as a result of the proposed RCUTs at those locations. For the whole corridor including both signalized and unsignalized intersections, total hourly delays are projected to decrease by approximately 44% compared to No Build conditions with the Route 460 corridor projected to experience delays slightly lower than existing conditions.

More specifically, at individual intersections, the following notable operational improvements are projected to occur under 2040 Build conditions compared to No Build conditions:

- Williamson Road (Route 11)
  - 50% reduction in average delays (42 second decrease)
  - LOS improves from F to D
  - 50% reduction in overall delay (55.2 hour decrease)
  - 53% reduction in southbound delay (9.3 hour decrease)

- Plantation Road/Kimball Avenue
  - 55% reduction in average delays (43 second decrease)
  - LOS improves from E to C
  - 55% reduction in overall delay (51.2 hour decrease)

- 13th Street
  - 46% reduction in average delays (37 second decrease)
  - LOS improves from F to D
  - 46% reduction in overall delay (39.4 hour decrease)
  - 29% reduction in northbound delay (3.4 hour decrease)

- 20th Street
  - 99% reduction in southbound delay (5.1 hour decrease)

- Gus Nicks Boulevard
  - 27% reduction in average delays (14 second decrease)
  - 26% reduction in overall delay (13.9 hour decrease)
  - 27% reduction in northbound delay (6.0 hour decrease)

- District Vue Apartments (West)
  - 90% reduction in southbound delay (4.3 hour decrease)

- Hickory Woods Drive
  - 95% reduction in northbound delay (4.5 hour decrease)

- King Street
  - 55% reduction in average delays (28 second decrease)
  - LOS improves from D to C
  - 54% reduction in overall delay (27.2 hour decrease)

- Blue Hills Drive/Mexico Way
  - 48% reduction in average delays (16 second decrease)
  - LOS improves from C to B
  - 48% reduction in overall delay (13.9 hour decrease)

- Bonsack Road/East Ruritan Road
  - 88% reduction in southbound delay (9.1 hour decrease)

PM Peak Hour

During the PM peak hour, seven signalized intersections are projected to experience significantly reduced delays compared to No Build conditions and improved levels of service with six of those projected to experience delay reductions of 36% or greater, with the Blue Hills Drive/Mexico Way intersection projected to have delay reductions of over 65%. Additionally, only the Williamson Road (Route 11) and Plantation Road/Kimball Avenue intersections are projected to operate at LOS E, while all other intersections are projected to operate at LOS D or better.

Delays are also projected to decrease for the unsignalized intersections along the Route 460 corridor under Build conditions, with several unsignalized intersections experiencing significant vehicle delay reductions as a result of the proposed RCUTs at those locations. For the whole corridor including both signalized and unsignalized intersections, total hourly delays are projected to decrease by approximately 39% compared to No Build conditions with the Route 460 corridor projected to experience delays slightly lower than existing conditions.

More specifically, at individual intersections, the following notable operational improvements are projected to occur under 2040 Build conditions compared to No Build conditions:

- Williamson Road (Route 11)
  - 43% reduction in average delays (48 second decrease)
  - LOS improves from F to E
  - 43% reduction in overall delay (66.9 hour decrease)
  - 66% reduction in southbound delay (35.8 hour decrease)

- 11th Street
  - 95% reduction in northbound delay (2.1 hour decrease)

- 13th Street
  - 36% reduction in average delays (23 second decrease)
  - LOS improves from E to D
  - 36% reduction in overall delay (27.6 hour decrease)
  - 24% reduction in southbound delay (3.6 hour decrease)

- 20th Street
  - 98% reduction in southbound delay (5.4 hour decrease)

- Gus Nicks Boulevard
  - 41% reduction in average delays (20 second decrease)
  - LOS improves from D to C
  - 39% reduction in overall delay (22.7 hour decrease)
  - 87% reduction in southbound delay (7.0 hour decrease)

- 24th Street
  - 95% reduction in southbound delay (3.2 hour decrease)

- Hickory Woods Drive
  - 97% reduction in northbound delay (2.6 hour decrease)

- Seibel Drive
  - 98% reduction in southbound delay (8.3 hour decrease)

- King Street
  - 40% reduction in average delays (24 second decrease)
  - LOS improves from E to D
  - 39% reduction in overall delay (26.2 hour decrease)
  - 32% reduction in northbound delay (4.5 hour decrease)

- Blue Hills Drive/Mexico Way
  - 67% reduction in average delays (41 second decrease)
  - LOS improves from E to C
  - 67% reduction in overall delay (43.1 hour decrease)
  - 52% reduction in southbound delay (10.4 hour decrease)

- West Ruritan Road
  - 37% reduction in average delays (8 second decrease)
  - LOS improves from C to B
  - 37% reduction in overall delay (7.9 hour decrease)

- Carson Road
  - 34% reduction in northbound delay (1.7 hour decrease)

Table 8-1: Signalized Intersection Delay Summary (2040 No Build and Build Conditions)

Intersection	2040 No Build Average Delay (sec)				2040 Build Average Delay (sec)			
	AM Peak Hour		PM Peak Hour		AM Peak Hour		PM Peak Hour	
	Delay (sec)	LOS	Delay (sec)	LOS	Delay (sec)	LOS	Delay (sec)	LOS
Route 460 & Williamson Road (Route 11)	83.8	F	109.2	F	41.9	D	61.7	E
Route 460 & Plantation Road/Kimball Avenue	77.3	E	69.9	E	34.7	C	57.6	E
Route 460 & Hollins Road	60.4	E	60.9	E	61.0	E	50.5	D
Route 460 & 13th Street	81.2	F	62.8	E	44.0	D	40.0	D
Route 460 & Gus Nicks Boulevard	53.4	D	50.0	D	39.2	D	29.7	C
Route 460 & Mecca Street	9.4	A	4.7	A	9.7	A	5.1	A
Route 460 & Granby Street	12.0	B	26.7	C	13.7	B	22.1	C
Route 460 & King Street	51.1	D	59.7	E	22.9	C	35.6	D
Route 460 & Blue Hills Drive/Mexico Way	33.1	C	61.4	E	17.2	B	20.3	C
Route 460 & West Ruritan Road	20.8	C	21.5	C	17.4	B	13.5	B
Route 460 & Valley Gateway Boulevard	9.3	A	21.9	C	9.5	A	17.2	B
Route 460 & Walmart/Lowe's	8.4	A	14.4	B	12.5	B	19.3	B
Route 460 & Route 220 ALT (Cloverdale Road)	41.8	D	33.9	C	28.1	C	21.8	C
					14.6	B	18.6	B

Table 8-2: Intersection Total Delays (veh-hr) – AM Peak Hour (2040 No Build and Build Conditions)

Intersection	Intersection Control	2040 No Build Total Delay (veh-hr)			2040 Build Total Delay (veh-hr)		
		Overall Inter-section	NB Side Street	SB Side Street	Overall Inter-section	NB Side Street	SB Side Street
Route 460 & I-581 NB Off-Ramp	Unsignalized/ Signalized	87.8	87.8	-	12.7	7.2	-
Route 460 & Courtland Road	Unsignalized	0.5	-	0.5	0.5	-	0.5
Route 460 & Williamson Road (Route 11)	Signalized	110.4	10.4	17.4	55.2	9.5	8.1
Route 460 & Plantation Road/Kimball Avenue	Signalized	93.0	3.8	8.5	41.7	3.5	8.3
Route 460 & Hollins Road	Signalized	71.4	7.6	4.0	72.1	8.1	4.9
Route 460 & 11th Street	Unsignalized	0.3	0.1	0.0	0.4	0.1	0.0
Route 460 & 12th Street	Unsignalized	0.0	0.0	-	0.0	0.0	-
Route 460 & Rhodes Avenue	Unsignalized	0.1	0.0	0.0	0.1	0.0	0.0
Route 460 & 13th Street	Signalized	86.0	11.9	8.3	46.6	8.5	8.8
Route 460 & Median Crossover 660’ east of 13th Street	Unsignalized	0.0	-	-	0.0	-	-
Route 460 & Median Crossover 1170’ east of 13th Street	Unsignalized	0.0	-	-	0.0	-	-
Route 460 & Walton Street	Unsignalized	0.0	0.0	-	0.0	0.0	-
Route 460 & Median Crossover 700’ east of Walton Street	Unsignalized	0.0	-	-	0.0	-	-
Route 460 & 20th Street	Unsignalized	5.4	-	5.2	0.2	-	0.1
Route 460 & Gus Nicks Boulevard	Signalized	54.2	22.0	1.2	40.4	16.0	0.3
Route 460 & 24th Street	Unsignalized	0.6	0.4	0.1	0.2	0.1	0.0
Route 460 & District Vue Apartments (West)	Unsignalized	5.2	0.6	4.6	0.5	0.0	0.3
Route 460 & District Vue Apartments (East)	Unsignalized	2.0	0.2	1.7	0.4	0.0	0.3
Route 460 & Mecca Street	Signalized	7.1	0.9	-	7.4	0.9	-
Route 460 & Granby Street	Signalized	9.6	-	2.3	11.0	-	2.5
Route 460 & Hickory Woods Drive	Unsignalized	4.8	4.8	-	0.2	0.2	-
Route 460 & Seibel Drive	Unsignalized	1.3	-	1.1	0.2	-	0.0
Route 460 & Median Crossover 520’ east of Seibel Drive	Unsignalized	0.1	0.0	-	0.0	0.0	-
Route 460 & King Street	Signalized	50.1	5.2	2.3	22.9	10.1	1.0
Route 460 & Lynn Brae Drive	Unsignalized	0.4	-	0.3	0.2	-	0.1
Route 460 & Patrick Road	Unsignalized	0.5	-	0.4	0.4	-	0.2
Route 460 & Blue Hills Drive/Mexico Way	Signalized	29.1	0.4	3.6	15.2	0.3	2.2
Route 460 & Evan Lane	Unsignalized	0.0	0.0	-	0.0	0.0	-
Route 460 & Blue Hills Village Drive	Unsignalized	0.2	0.0	0.0	0.2	0.0	-

Intersection	Intersection Control	2040 No Build Total Delay (veh-hr)			2040 Build Total Delay (veh-hr)		
		Overall Inter-section	NB Side Street	SB Side Street	Overall Inter-section	NB Side Street	SB Side Street
Route 460 & Trail Drive	Unsignalized	0.2	0.0	0.2	0.2	0.0	0.2
Route 460 & West Ruritan Road	Signalized	17.6	0.1	4.8	14.7	0.0	5.6
Route 460 & Valley Gateway Boulevard	Signalized	7.3	1.5	-	7.5	1.5	-
Route 460 & Carson Road	Unsignalized	1.7	0.5	0.1	1.5	0.4	0.0
Route 460 & Bonsack Road/East Ruritan Road	Unsignalized	11.4	1.0	10.3	1.5	0.2	1.2
Route 460 & Median Crossover 950’ east of Bonsack Road/East Ruritan Road	Unsignalized	0.0	0.0	0.0	0.0	0.0	0.0
Route 460 & Huntridge Road	Unsignalized	1.6	-	1.1	1.6	-	1.1
Route 460 & Walmart/Lowe’s	Signalized	6.2	-	1.1	9.3	-	1.1
Route 460 & Route 220 ALT (Cloverdale Road)	Signalized	44.5	-	8.9	19.5	-	7.7
					11.4	-	5.3
Total		**710.4**	**159.1**	**88.1**	**395.7**	**67.0**	**59.9**

Table 8-3: Intersection Total Delays (veh-hr) – PM Peak Hour (2040 No Build and Build Conditions)

Intersection	Intersection Control	2040 No Build Total Delay (veh-hr)			2040 Build Total Delay (veh-hr)		
		Overall Inter-section	NB Side Street	SB Side Street	Overall Inter-section	NB Side Street	SB Side Street
Route 460 & I-581 NB Off-Ramp	Unsignalized/ Signalized	60.8	60.8	-	12.4	6.8	-
Route 460 & Courtland Road	Unsignalized	1.2	-	1.2	1.3	-	1.3
Route 460 & Williamson Road (Route 11)	Signalized	153.7	13.6	54.0	86.8	14.0	18.3
Route 460 & Plantation Road/Kimball Avenue	Signalized	88.3	31.6	8.5	72.8	35.8	5.7
Route 460 & Hollins Road	Signalized	79.1	13.1	7.2	65.6	8.9	10.2
Route 460 & 11th Street	Unsignalized	2.5	2.2	0.1	0.3	0.1	0.0
Route 460 & 12th Street	Unsignalized	0.0	0.0	-	0.0	0.0	-
Route 460 & Rhodes Avenue	Unsignalized	1.1	1.0	0.0	0.2	0.2	0.0
Route 460 & 13th Street	Signalized	76.0	5.8	14.9	48.4	7.1	11.3
Route 460 & Median Crossover 660' east of 13th Street	Unsignalized	0.0	-	-	0.0	-	-
Route 460 & Median Crossover 1170' east of 13th Street	Unsignalized	0.0	-	-	0.0	-	-
Route 460 & Walton Street	Unsignalized	1.0	0.9	-	0.1	0.0	-
Route 460 & Median Crossover 700' east of Walton Street	Unsignalized	0.0	-	-	0.0	-	-
Route 460 & 20th Street	Unsignalized	5.6	-	5.5	0.2	-	0.1
Route 460 & Gus Nicks Boulevard	Signalized	58.0	10.9	8.0	35.3	8.4	1.0
Route 460 & 24th Street	Unsignalized	3.4	0.0	3.3	0.2	0.0	0.2
Route 460 & District Vue Apartments (West)	Unsignalized	1.9	1.1	0.6	0.4	0.0	0.1
Route 460 & District Vue Apartments (East)	Unsignalized	3.2	2.0	0.9	0.5	0.1	0.1
Route 460 & Mecca Street	Signalized	3.9	1.5	0.1	4.3	1.5	0.1
Route 460 & Granby Street	Signalized	24.1	-	7.4	20.2	-	7.7
Route 460 & Hickory Woods Drive	Unsignalized	2.8	2.7	0.0	0.3	0.1	0.0
Route 460 & Seibel Drive	Unsignalized	8.5	-	8.5	0.2	-	0.2
Route 460 & Median Crossover 520' east of Seibel Drive	Unsignalized	0.1	0.0	0.0	0.0	0.0	0.0
Route 460 & King Street	Signalized	67.1	13.9	3.4	41.0	9.4	0.8
Route 460 & Lynn Brae Drive	Unsignalized	0.7	-	0.6	0.3	-	0.2
Route 460 & Patrick Road	Unsignalized	0.6	-	0.5	0.4	-	0.3
Route 460 & Blue Hills Drive/Mexico Way	Signalized	64.5	1.7	20.0	21.4	1.9	9.5
Route 460 & Evan Lane	Unsignalized	0.0	0.0	-	0.0	0.0	-
Route 460 & Blue Hills Village Drive	Unsignalized	0.9	0.8	0.0	0.2	0.1	0.0

Intersection	Intersection Control	2040 No Build Total Delay (veh-hr)			2040 Build Total Delay (veh-hr)		
		Overall Inter-section	NB Side Street	SB Side Street	Overall Inter-section	NB Side Street	SB Side Street
Route 460 & Trail Drive	Unsignalized	0.1	0.0	0.1	0.1	0.0	0.1
Route 460 & West Ruritan Road	Signalized	21.3	0.7	3.3	13.4	0.4	3.8
Route 460 & Valley Gateway Boulevard	Signalized	20.5	4.2	-	16.1	4.2	-
Route 460 & Carson Road	Unsignalized	6.0	5.1	0.0	4.3	3.4	0.0
Route 460 & Bonsack Road/East Ruritan Road	Unsignalized	1.2	0.5	0.5	0.5	0.1	0.2
Route 460 & Median Crossover 950' east of Bonsack Road/East Ruritan Road	Unsignalized	0.4	0.2	-	0.1	0.1	-
Route 460 & Huntridge Road	Unsignalized	1.6	-	0.7	1.4	-	0.4
Route 460 & Walmart/Lowe's	Signalized	12.9	-	4.0	17.3	-	4.0
Route 460 & Route 220 ALT (Cloverdale Road)	Signalized	38.1	-	16.9	16.9	-	3.8
					15.1	-	10.5
Total		**811.0**	**174.5**	**170.3**	**497.9**	**102.6**	**89.9**

8.1.3 Route 460 Mainline Stops

Tables 8-4 and 8-5 depict the average and total stops for both the signalized and unsignalized intersections in the corridor for the AM and PM peak hours, respectively, for both 2040 No Build and Build conditions. The previously noted trend regarding mainline stops at unsignalized intersections generally becomes less apparent under 2040 Build conditions due to capacity improvements at the signalized intersections, which reduces congestion and stopping along the Route 460 corridor. However, the number of stops increases in the eastbound direction during both peak hours. As noted in **Section 5.3.3**, severe congestion in the No Build conditions along eastbound Route 460 in the western portion of the study area reduces traffic volumes in the network, which leads to a lower number of stops than would have been expected. The capacity improvements proposed along Route 460 reduce congestion and bottlenecks for eastbound traffic, particularly in the vicinity of the Williamson Road (Route 11) intersection, resulting in more traffic entering and traversing eastbound Route 460 and leading to projected increases in vehicle stops of approximately 9% in the AM peak hour and approximately 25% in the PM peak hour for the eastbound direction. For example, the throughput increases by 506 vehicles (38%) during the AM peak hour along eastbound Route 460 west of Williamson Road (Route 11) and 313 vehicles (33%) east of Williamson Road (Route 11), contributing to an increase in stops. During the PM peak hour, the eastbound Route 460 throughput increases by 770 vehicles (72%) west of Williamson Road (Route 11) and 560 vehicles (52%) east of Williamson Road (Route 11).

The westbound Route 460 direction does not experience bottlenecks that prevent vehicles from entering the Route 460 corridor, and therefore vehicle stops are projected to decrease by approximately 26% in both the AM and PM peak hours.

Along the corridor as a whole, drivers are projected to stop an average of approximately 9 times in the primary westbound direction during the AM peak hour, a decrease of 4 stops compared to No Build conditions. In the primary eastbound direction during the PM peak hour, drivers are projected to stop an average of approximately 7 times, similar to No Build conditions. However, as previously noted, capacity improvements in the western end of the Route 460 corridor are projected to reduce upstream congestion and bottlenecks for eastbound traffic, resulting in more traffic entering and traversing eastbound Route 460, leading to average stops projected to be slightly higher than No Build conditions.

Table 8-4: Intersection Stops – AM Peak Hour (No Build and Build Conditions)

Intersection	Intersection Control	2040 No Build				2040 Build			
		EB Route 460		WB Route 460		EB Route 460		WB Route 460	
		Stops/ Veh	Total Stops	Stops/ Veh	Total Stops	Stops/ Veh	Total Stops	Stops/ Veh	Total Stops
Route 460 & I-581 NB Off-Ramp	Unsignalized/ Signalized	0.36	360	0.01	10	0.54	556	0.00	1
Route 460 & Courtland Road	Unsignalized	0.40	542	0.05	83	0.38	711	0.09	164
Route 460 & Williamson Road (Route 11)	Signalized	0.33	271	0.84	1187	0.26	302	0.80	1261
Route 460 & Plantation Road/Kimball Avenue	Signalized	0.38	318	1.36	2144	0.46	515	0.81	1410
Route 460 & Hollins Road	Signalized	0.36	332	0.86	1467	0.43	511	0.87	1648
Route 460 & 11th Street	Unsignalized	0.09	89	0.13	232	0.14	176	0.07	131
Route 460 & 12th Street	Unsignalized	0.05	56	0.12	214	0.06	83	0.05	100
Route 460 & Rhodes Avenue	Unsignalized	0.21	234	0.07	121	0.06	79	0.04	84
Route 460 & 13th Street	Signalized	0.44	465	0.53	790	0.31	404	0.55	905
Route 460 & Median Crossover 660’ east of 13th Street	Unsignalized	0.01	17	0.19	278	0.00	4	0.20	329
Route 460 & Median Crossover 1170’ east of 13th Street	Unsignalized	0.06	64	0.39	600	0.00	1	0.39	657
Route 460 & Walton Street	Unsignalized	0.00	0	0.57	915	0.00	0	0.56	985
Route 460 & Median Crossover 700’ east of Walton Street	Unsignalized	0.01	6	0.46	742	0.00	1	0.38	680
Route 460 & 20th Street	Unsignalized	0.00	2	0.43	716	0.00	3	0.29	538
Route 460 & Gus Nicks Boulevard	Signalized	0.34	290	0.42	498	0.37	373	0.35	489
Route 460 & 24th Street	Unsignalized	0.01	7	0.96	1264	0.05	56	0.45	691
Route 460 & District Vue Apartments (West)	Unsignalized	0.00	2	0.43	576	0.00	1	0.05	82
Route 460 & District Vue Apartments (East)	Unsignalized	0.00	0	0.25	336	0.00	1	0.02	23
Route 460 & Mecca Street	Signalized	0.12	117	0.19	263	0.20	211	0.06	95
Route 460 & Granby Street	Signalized	0.15	137	0.36	513	0.11	117	0.32	476
Route 460 & Hickory Woods Drive	Unsignalized	0.00	0	0.08	112	0.00	0	0.04	59

Intersection	Intersection Control	2040 No Build				2040 Build			
		EB Route 460		WB Route 460		EB Route 460		WB Route 460	
		Stops/ Veh	Total Stops	Stops/ Veh	Total Stops	Stops/ Veh	Total Stops	Stops/ Veh	Total Stops
Route 460 & Seibel Drive	Unsignalized	0.01	6	0.01	10	0.00	1	0.00	1
Route 460 & Median Crossover 520' east of Seibel Drive	Unsignalized	0.06	55	0.02	31	0.00	1	0.02	38
Route 460 & King Street	Signalized	0.77	674	0.37	528	0.42	404	0.23	343
Route 460 & Lynn Brae Drive	Unsignalized	0.01	10	0.00	6	0.02	33	0.00	6
Route 460 & Patrick Road	Unsignalized	0.00	1	0.00	2	0.00	0	0.02	36
Route 460 & Blue Hills Drive/Mexico Way	Signalized	0.17	172	0.82	1300	0.10	113	0.51	833
Route 460 & Evan Lane	Unsignalized	0.00	1	0.32	514	0.02	28	0.00	3
Route 460 & Blue Hills Village Drive	Unsignalized	0.00	1	0.42	694	0.00	2	0.00	2
Route 460 & Trail Drive	Unsignalized	0.00	2	0.15	262	0.00	0	0.04	78
Route 460 & West Ruritan Road	Signalized	0.34	324	0.79	1226	0.14	139	0.43	683
Route 460 & Valley Gateway Boulevard	Signalized	0.14	133	0.40	628	0.15	146	0.12	191
Route 460 & Carson Road	Unsignalized	0.00	0	0.00	8	0.02	17	0.00	0
Route 460 & Bonsack Road/East Ruritan Road	Unsignalized	0.00	0	0.00	1	0.02	20	0.00	6
Route 460 & Median Crossover 950' east of Bonsack Road/East Ruritan Road	Unsignalized	0.00	0	0.00	1	0.04	46	0.00	0
Route 460 & Huntridge Road	Unsignalized	0.00	0	0.00	2	0.00	1	0.00	1
Route 460 & Walmart/Lowe's	Signalized	0.16	147	0.32	467	0.09	93	0.44	642
Route 460 & Route 220 ALT (Cloverdale Road)	Signalized	0.16	73	0.51	524	0.35	179	.01	14
						0.01	7	0.48	490
Total		5.14	4908	12.83	19265	4.75	5335	8.69	14175
% Change from Existing		17%	26%	45%	51%	-	-	-	-
% Change from No Build		-	-	-	-	-8%	9%	-32%	-26%

Table 8-5: Intersection Stops – PM Peak Hour (No Build and Build Conditions)

Intersection	Intersection Control	2040 No Build				2040 Build			
		EB Route 460		WB Route 460		EB Route 460		WB Route 460	
		Stops/ Veh	Total Stops	Stops/ Veh	Total Stops	Stops/ Veh	Total Stops	Stops/ Veh	Total Stops
Route 460 & I-581 NB Off-Ramp	Unsignalized/ Signalized	0.29	229	0.00	8	0.43	516	0.00	4
Route 460 & Courtland Road	Unsignalized	0.68	755	0.03	64	0.36	675	0.08	168
Route 460 & Williamson Road (Route 11)	Signalized	0.28	217	0.68	975	0.24	329	0.44	670
Route 460 & Plantation Road/Kimball Avenue	Signalized	0.73	743	0.55	831	0.64	982	0.43	681
Route 460 & Hollins Road	Signalized	0.74	1113	0.78	1123	1.10	2088	0.82	1211
Route 460 & 11th Street	Unsignalized	0.60	1035	0.00	6	0.99	2027	0.02	30
Route 460 & 12th Street	Unsignalized	0.13	229	0.01	15	0.20	399	0.03	54
Route 460 & Rhodes Avenue	Unsignalized	0.40	726	0.00	7	0.42	864	0.03	44
Route 460 & 13th Street	Signalized	0.27	444	0.32	457	0.28	505	0.43	642
Route 460 & Median Crossover 660’ east of 13th Street	Unsignalized	0.00	4	0.00	2	0.00	6	0.02	31
Route 460 & Median Crossover 1170’ east of 13th Street	Unsignalized	0.00	0	0.00	0	0.00	1	0.01	8
Route 460 & Walton Street	Unsignalized	0.00	1	0.00	0	0.00	1	0.00	0
Route 460 & Median Crossover 700’ east of Walton Street	Unsignalized	0.01	12	0.00	0	0.00	1	0.00	0
Route 460 & 20th Street	Unsignalized	0.06	116	0.00	3	0.03	62	0.05	76
Route 460 & Gus Nicks Boulevard	Signalized	0.52	649	0.34	390	0.49	653	0.33	393
Route 460 & 24th Street	Unsignalized	0.01	10	0.65	813	0.05	71	0.09	128
Route 460 & District Vue Apartments (West)	Unsignalized	0.00	1	0.02	21	0.00	1	0.01	16
Route 460 & District Vue Apartments (East)	Unsignalized	0.00	0	0.00	0	0.00	0	0.00	0
Route 460 & Mecca Street	Signalized	0.04	47	0.06	70	0.05	64	0.04	47
Route 460 & Granby Street	Signalized	0.17	210	0.39	445	0.14	193	0.40	490
Route 460 & Hickory Woods Drive	Unsignalized	0.00	2	0.05	63	0.00	0	0.04	57
Route 460 & Seibel Drive	Unsignalized	0.00	0	0.02	28	0.00	2	0.00	0
Route 460 & Median Crossover 520’ east of Seibel Drive	Unsignalized	0.07	109	0.01	17	0.13	207	0.04	49
Route 460 & King Street	Signalized	0.74	970	0.36	393	0.68	980	0.25	300

Intersection	Intersection Control	2040 No Build				2040 Build			
		EB Route 460		WB Route 460		EB Route 460		WB Route 460	
		Stops/ Veh	Total Stops	Stops/ Veh	Total Stops	Stops/ Veh	Total Stops	Stops/ Veh	Total Stops
Route 460 & Lynn Brae Drive	Unsignalized	0.00	5	0.18	264	0.02	34	0.01	10
Route 460 & Patrick Road	Unsignalized	0.06	111	0.18	278	0.00	0	0.02	31
Route 460 & Blue Hills Drive/Mexico Way	Signalized	0.46	762	0.65	794	0.15	267	0.17	213
Route 460 & Evan Lane	Unsignalized	0.01	12	0.05	69	0.03	53	0.00	0
Route 460 & Blue Hills Village Drive	Unsignalized	0.00	6	0.04	55	0.00	4	0.00	1
Route 460 & Trail Drive	Unsignalized	0.01	21	0.03	41	0.01	24	0.06	78
Route 460 & West Ruritan Road	Signalized	0.18	273	0.57	693	0.28	473	0.23	278
Route 460 & Valley Gateway Boulevard	Signalized	0.50	722	0.21	250	0.30	461	0.07	84
Route 460 & Carson Road	Unsignalized	0.00	6	0.03	38	0.00	3	0.00	0
Route 460 & Bonsack Road/East Ruritan Road	Unsignalized	0.00	0	0.02	29	0.00	1	0.00	0
Route 460 & Median Crossover 950’ east of Bonsack Road/East Ruritan Road	Unsignalized	0.00	0	0.05	72	0.00	0	0.00	0
Route 460 & Huntridge Road	Unsignalized	0.00	0	0.00	0	0.00	8	0.00	1
Route 460 & Walmart/Lowe’s	Signalized	0.14	184	0.45	548	0.10	146	0.58	694
Route 460 & Route 220 ALT (Cloverdale Road)	Signalized	0.22	221	0.55	377	0.35	368	0.02	10
						0.01	10	0.46	310
Total		7.32	9945	7.28	9239	7.48	12479	5.18	6809
% Change from Existing		8%	12%	9%	23%	-	-	-	-
% Change from No Build		-	-	-	-	2%	25%	-29%	-26%

9. PUBLIC INVOLVEMENT

A public meeting was held in November 2019 to introduce the public to the study and inform the public about existing safety and traffic operational conditions in the corridor. An online survey was conducted from November 7 to December 6 to collect the public’s opinions on the current issues and prioritization of their concerns. As a result of the restrictions on holding in-person public involvement activities, a virtual presentation was provided on the VDOT Study website beginning in June 2020 to update the public on the study’s progress and present the improvement alternatives under consideration. A second survey was conducted to collect the public’s feedback on the proposed alternatives from June 15 to June 30, 2020.

In the November 2019 survey, a total of 1,055 survey participants submitted feedback on issues in the corridor. When asked to rank their priorities, traffic congestion was ranked as the highest priority followed by roadway safety and then travel time reliability. In response to survey questions regarding mobility in the corridor, respondents identified two main concerns along the corridor: (1) lack of traffic signal coordination; and (2) difficulty merging and making left turns. This public feedback was considered by the Stakeholder Working Group when developing potential improvement alternatives.

During the second public survey conducted June 15 through June 30, 2020, a total of 119 survey participants submitted their comments on each of the proposed intersection improvements. Participants' responses were sorted by positive comments, negative comments, and suggestions. Overall, there were 361 positive comments, 122 unfavorable comments, and 336 neutral comments or other suggestions.

10. NEXT STEPS/PROJECT FUNDING

Roanoke City and Roanoke County submitted seven applications to VDOT in August 2020 to apply for SMART SCALE funding. SMART SCALE allocates funding from the construction District grants Program (DGP) and High-Priority Projects Program (HPPP) to transportation projects based on a scoring process. The scoring process evaluates, scores, and ranks projects based on congestion mitigation, economic development, accessibility, safety, environmental quality, and land use factors. The location of the project determines the weight of each of these scoring factors in the calculation of the total score.

The study area improvements were segmented into logical groupings based on the interactions and proximity between the various study intersections and in order to provide projects that would be competitive in the SMART SCALE scoring process as follows:

- Route 460 from 11th Street to 24th Street
- Route 460 at Hickory Woods Drive and Seibel Drive
- Route 460 from west of King Street to Lynn Brae Drive
- Route 460 from Lynn Brae Drive to Blue Hills Village Drive
- Route 460 at West Ruritan Road
- Route 460 from Carson Street to Huntridge Road
- Route 460 at Route 220 ALT (Cloverdale Road)

Once project applications are approved for funding through SMART SCALE or other funding sources, the projects would be incorporated into the VDOT Six-Year Improvement Plan, so they can enter the project development process.