Corridor Improvement Study

# Lee Highway

## US Route 11

From State Route 114 to Radford City Limit

*Pulaski County, Virginia*

Prepared for the
New River Valley Metropolitan Planning Organization
By
Whitman, Requardt & Associates, LLP

*April 8, 2016*

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**Corridor Traffic Study**

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# EXECUTIVE SUMMARY

The New River Valley Metropolitan Planning Organization (MRV-MPO) requested a study of the US Route 11 (Lee Highway) corridor in the Fairlawn Community of Pulaski County from the State Route 114 (Peppers Ferry Road) intersection to the Radford City Limits. The corridor was reviewed to identify potential safety and operational improvements, locations where access management strategies should be used, and potential multi-modal improvements along the Route 11 corridor in the future.

## Safety and Operational Improvements

A review of crash data indicated two high crash areas within the study corridor. The first area (Crash Area A, see Appendix A) is the intersection of Lee Highway with Peppers Ferry Road. Rear-end crashes in this area were the most common crash type. To help alleviate these types of crashes, an additional left-turn lane from Lee Highway to Peppers Ferry Road is recommended (See Figure 2). Along with the physical improvements, signal timing improvements are also recommended. Combined, these changes should reduce crash frequencies at this intersection.

The second area (Crash Area C) is around the commercial entrances surrounding the intersection of Lee Highway with Belspring Road, including the intersection itself. To reduce crashes associated with Belspring Road, re-alignment of the intersection is recommended to eliminate the severe intersection skew. Complementing this improvement, access management strategies would also be included to consolidate and more evenly space commercial entrances within this high crash area (See Figure 3).

While not an area with a significant number of crashes (Crash Area D), two operational improvements are also recommended for the intersection of Lee Highway at Kroger / Warren Newcomb Drive. The first is to provide a right-turn lane into Kroger, which will help reduce congestion and queuing at the intersection. The second is to provide a leading protected-permissive left turn movement from Kroger to Lee Highway, to reduce delays and queues for traffic exiting the Kroger / Radford Shopping Plaza area (See Figure 4).

## Access Management Improvements

Access management improvements were identified along both sides of Lee Highway between Peppers Ferry Road and Hazel Hollow Road (See Figures 4, 5, and 6). The recommendation is to consolidate access points of several businesses with multiple entrances to provide adequate spacing between commercial entrances for improved safety, by reducing the total number of access points by fourteen. Additionally, it is recommended to align consolidated entrances across from each other along Lee Highway whenever and wherever practical.

Access management recommendations also include constructing a median between McDonalds and the Wilco/Hess gas station to physically restrict prohibited left-turn movements into Wilco/Hess (See Figure 6). Additionally, it is recommended to consolidate access to Kroger and Wheatland Hills by combining their closely spaced entrances, and constructing crossover access points from the Wheatland Hills driveway to the rear freight area of Kroger to facilitate deliveries (See Figure 7).

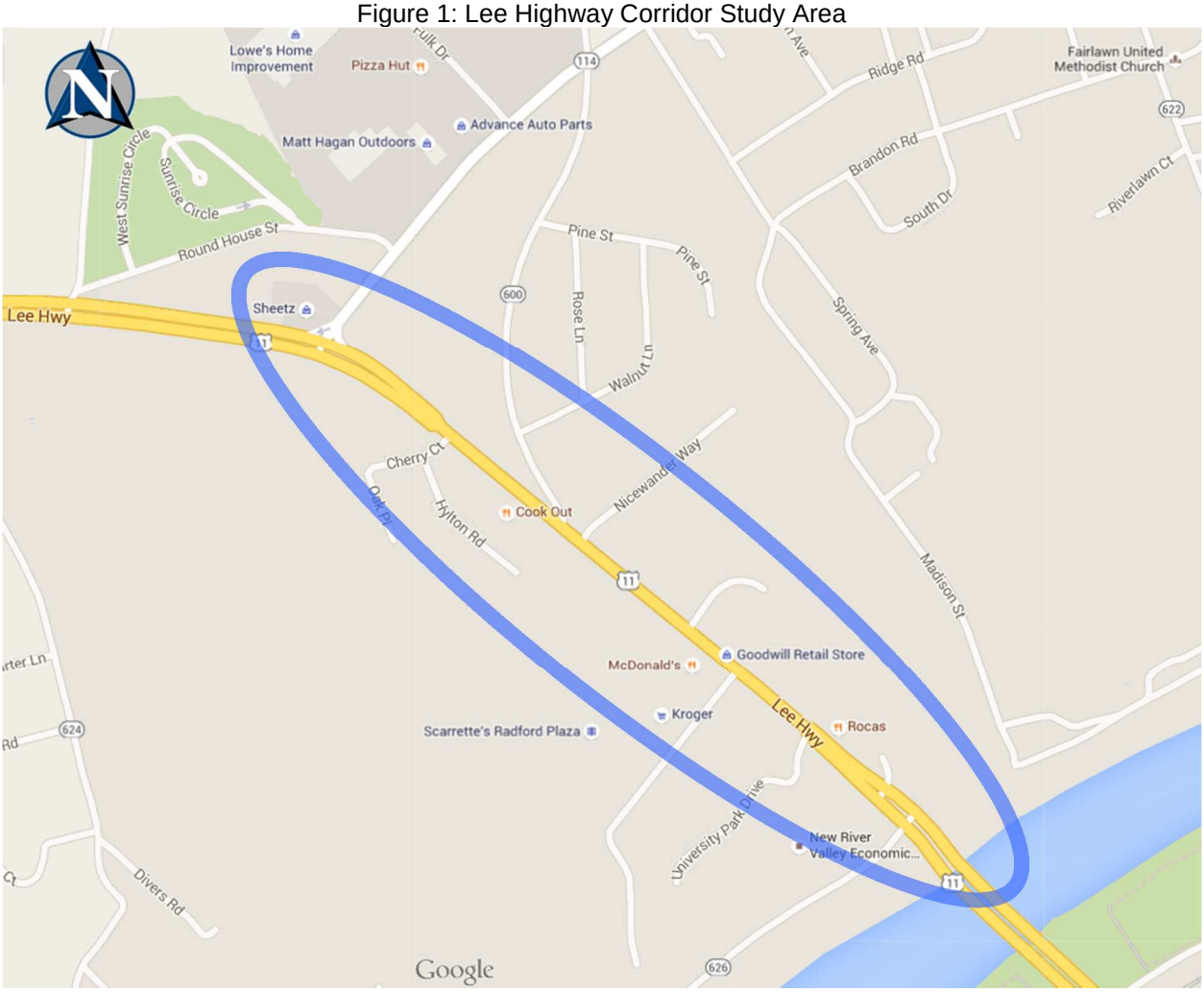
## Multi-Modal Improvements

Sidewalks are recommended along both sides of Lee Highway to connect to existing sidewalk segments constructed as a part of the Memorial Bridge replacement project. Actuated pedestrian crossings of Lee Highway are recommended at the existing signalized intersections. Bike lanes are not recommended along this section of Lee Highway since they would not connect to any existing bike facilities. Existing bus stops in the project area are located in shopping areas immediately adjacent to Lee Highway, and therefore will benefit from operational improvements proposed from this study.

## INTRODUCTION

This study evaluates the operational and safety characteristics of the Route 11 (Lee Highway) corridor from Peppers Ferry Road to the Radford City Limits within Pulaski County, as shown in the map below. This study was conducted to develop recommendations to improve traffic safety and operations along the Lee Highway corridor, including access management strategies to facilitate safety and operational improvements within the corridor study area. Multi-modal transportation along the corridor was also reviewed to identify potential improvements. The study need is driven by existing traffic volumes and patterns, along with safety and access management concerns.

Figure 1: Lee Highway Corridor Study Area



# EXISTING CONDITIONS

## Corridor Description

Lee Highway extends from the Town of Pulaski to the west to the corporate limits with the City of Radford to the east, and serves as an urban minor arterial. In the study area, Lee Highway is a four-lane, roadway with a posted 40 MPH speed limit having median sections varying between grass, raised concrete, and flush with a two-way left-turn lane. The roadway primarily has shoulder and ditch sections, but closer to the City of Radford, there are segments of curb and gutter with sidewalks. Lee Highway directly serves numerous commercial businesses, professional offices, and a retirement home. Adjacent residential areas access Lee Highway via Cherry Court, Belspring Road, Nicewander Way, and Hazel Hollow Road.

Lee Highway looking west from the Hazel Hollow Road Intersection

There are two primary intersections within the study area. At the western end of the corridor is the signalized intersection with State Route 114 (Peppers Ferry Road), which is a three-leg intersection. Northbound Lee Highway has two exclusive through lanes and an auxiliary left-turn lane. Southbound Lee Highway has two exclusive through lanes and an auxiliary, channelized right-turn lane. Westbound Peppers Ferry Road has two exclusive left-turn lanes and an auxiliary, channelized right-turn lane.

In the middle of the corridor is the signalized intersection with Kroger and Warren Newcomb Drive. Lee Highway has two through lanes along with both-turn auxiliary lanes in both directions. Both Kroger and Warren Newcomb Drive have a shared left-through lane and a dedicated right-turn lane.

## Upcoming Projects

No short or long-term improvement projects are planned for the Lee Highway corridor within the study area. However, in the early 2000's, the eastern end of the corridor was improved as a part of the Memorial Bridge replacement project. This included the construction of raised median, turn lanes, and sidewalks within the project limits. No bicycle accommodations were developed with the bridge replacement project. Other than minor spot and entrance improvements associated with new commercial developments, no other improvements have been constructed along the corridor since.

## Traffic Volumes

Peak hour turning movement counts were collected as a part of this study along the corridor during the AM, Midday, and PM peak hours by Peggy Malone and Associates in February 2015. Raw data for the counts is contained in Appendix A. AM and PM peak hour counts are depicted at each intersection and commercial entrance along the corridor in a graphic contained at the end of Appendix A.

48-hour bi-directional counts were also collected along the corridor in February 2015 when turning movement count data was collected. These counts indicated an average weekday traffic volume of 22,200 vehicles per day. Raw data for the counts is contained in Appendix A.

Past historical Virginia Department of Transportation (VDOT) data indicates Annual Average Daily Traffic (AADT) volumes of 24,000 in 2013, 28,000 in 2010, 24,000 in 2007, 22,000 in 2004, and 17,000 in 2001. The historical traffic data indicates low annual growth in traffic volumes within the study corridor. An annual growth rate of 0.5% was utilized for the purpose of analyzing the future no-build and proposed improvements for a design year of 2025.

## Crash Analysis

Detailed crash report data along the Lee Highway corridor within the study area was provided by the Virginia Department of Transportation, for the three-year period of January 1, 2012 through December 31, 2014. During this time period, there were 59 reported crashes along the study area corridor. The crash data indicates that Lee Highway experiences a higher than average crash rate (243) compared to similar urban minor arterials (94). However, due to the short length of the corridor and the presence of two signalized intersections, the corridor crash rate may not be an accurate representation of corridor safety.

Individual crash reports for each intersection and commercial entrance along the corridor were examined, to determine where higher crash locations were located and to determine any crash patterns that might be improved through safety, operational, or access management improvements along the corridor. Crash data indicated two areas with a high number of crashes. Summarized crash data is provided in the same graphic as peak hour turning movement counts, and is located in Appendix A.

The first high-crash area (Crash Area A) is the intersection of Lee Highway with Peppers Ferry Road, which had a total of 20 reported crashes within the time period reviewed. The majority of crashes were rear-end collisions, with 14 total among all approaches near the intersection. Three (3) angle crashes occurred involving northbound left-turn traffic from Lee Highway to Peppers Ferry Road disregarding the traffic signal or running a red light.

Lee Highway at Peppers Ferry Road intersection, looking north toward the City of Radford

The second high-crash area (Crash Area C) is concentrated around the commercial entrances between the two signalized intersections along the Lee Highway Corridor, specifically between the entrances of Cookout and TitleMax, with 19 reported crashes within the time period reviewed. The majority of crashes were angle collisions, with 11 total occurring within the area. Six (6) of the angle crashes involved traffic turning left out of Cookout to Lee Highway. Two (2) angle crashes involved traffic turning from Belspring Road to northbound Lee Highway, with an additional two (2) sideswipe crashes also involving this turning movement.

Left-turning vehicle from Belspring Road turning to northbound Lee Highway

The signalized intersection with Kroger and Warren Newcomb Drive (Crash Area D) experienced six (6) total crashes, five (5) of which were rear-end crashes. Additionally, the right-in only entrance to Wilco/Hess experienced four (4) rear-end collisions due to traffic stopping in the northbound lanes of Lee Highway to make a left-turn into the entrance. Near the rear entrance to Kroger and the entrance to Wheatland Hills, there were four (4) crashes, three (3) of which were rear-end crashes and one (1) which was an angle crash. An additional angle crash occurred at the entrance to Goodwill.

At Cherry Court (Crash Area B), only two (2) crashes were reported. Both were rear-end crashes. At Hazel Hollow Road (Crash Area E), only two (2) crashes were reported. One (1) crash was an angle crash, and the other was a collision with a deer.

## Traffic Operational and Capacity Analysis

A traffic operational and capacity analysis was conducted using Synchro Version 8.0 to assess traffic operations along the Lee Highway corridor within the study area for both signalized and unsignalized intersections. Signal timing data was provided by VDOT for use in the analysis, and is contained in Appendix A.

Analysis of existing 2015 traffic conditions for the Lee Highway corridor revealed that significant delays and poor levels of service exist for several movements at the signalized intersections within the study area during both the AM and PM peak hour. However, excluding these turning movements, the overall levels of service and delays are acceptable.

Analysis of the future 2025 No-Build scenario for the Lee Highway corridor was conducted to evaluate future traffic operational conditions. This analysis assumes no roadway improvements along the corridor. However, it was assumed that minor signal timing enhancements would be implemented to accommodate increases in traffic volumes. Analysis results indicate that without physical roadway improvements along the corridor, delays at signalized intersections will increase above the existing 2015 conditions.

Analysis of the future 2025 Build scenario for the Lee Highway corridor was conducted to evaluate the future traffic operational conditions. This analysis takes into account the improvements proposed as a part of this study and are detailed in the following section of this report. Analysis results indicate minor improvements in delays at the intersection of Lee Highway at Peppers Ferry Road. Proposed signal phasing changes to accommodate pedestrian movements at the intersection of Lee Highway at Kroger / Warren Newcomb Drive slightly increase delays, but levels of service do not change.

Table 1 summarizes the results of the capacity, delay, and level of service results based on Highway Capacity Manual signalized intersection methodology outputs from Synchro. Detailed traffic analysis results are contained in Appendix C.

**TABLE 1- No Build Signalized Intersection V/C Ratio, Delay, and Level of Service Summary**

| Intersection | Design Year | Peak Hour | Overall Intersection | | |
|---|---|---|---|---|---|
| | | | Volume/ Capacity Ratio | Avg. Delay (sec) | Level of Service |
| Lee Highway at Peppers Ferry Road | 2015 Existing | AM | 0.58 | 17.4 | B |
| | | PM | 0.75 | 26.2 | C |
| | 2025 No-Build | AM | 0.60 | 18.3 | B |
| | | PM | 0.78 | 28.4 | C |
| Lee Highway at Kroger / Warren Newcomb Drive | 2015 Existing | AM | 0.49 | 12.2 | B |
| | | PM | 0.79 | 25.2 | C |
| | 2025 No-Build | AM | 0.51 | 12.5 | B |
| | | PM | 0.83 | 27.1 | C |

**TABLE 2- Future Build Signalized Intersection V/C Ratio, Delay, and Level of Service Summary**

| Intersection | Design Year | Peak Hour | Overall Intersection | | |
|---|---|---|---|---|---|
| | | | Volume/ Capacity Ratio | Avg. Delay (sec) | Level of Service |
| Lee Highway at Peppers Ferry Road | 2025 Build | AM | 0.50 | 13.5 | B |
| | | PM | 0.71 | 20.1 | C |
| Lee Highway at Kroger / Warren Newcomb Drive | 2025 Build | AM | 0.49 | 16.3 | B |
| | | PM | 0.88 | 27.9 | C |

## PROPOSED CORRIDOR IMPROVEMENTS

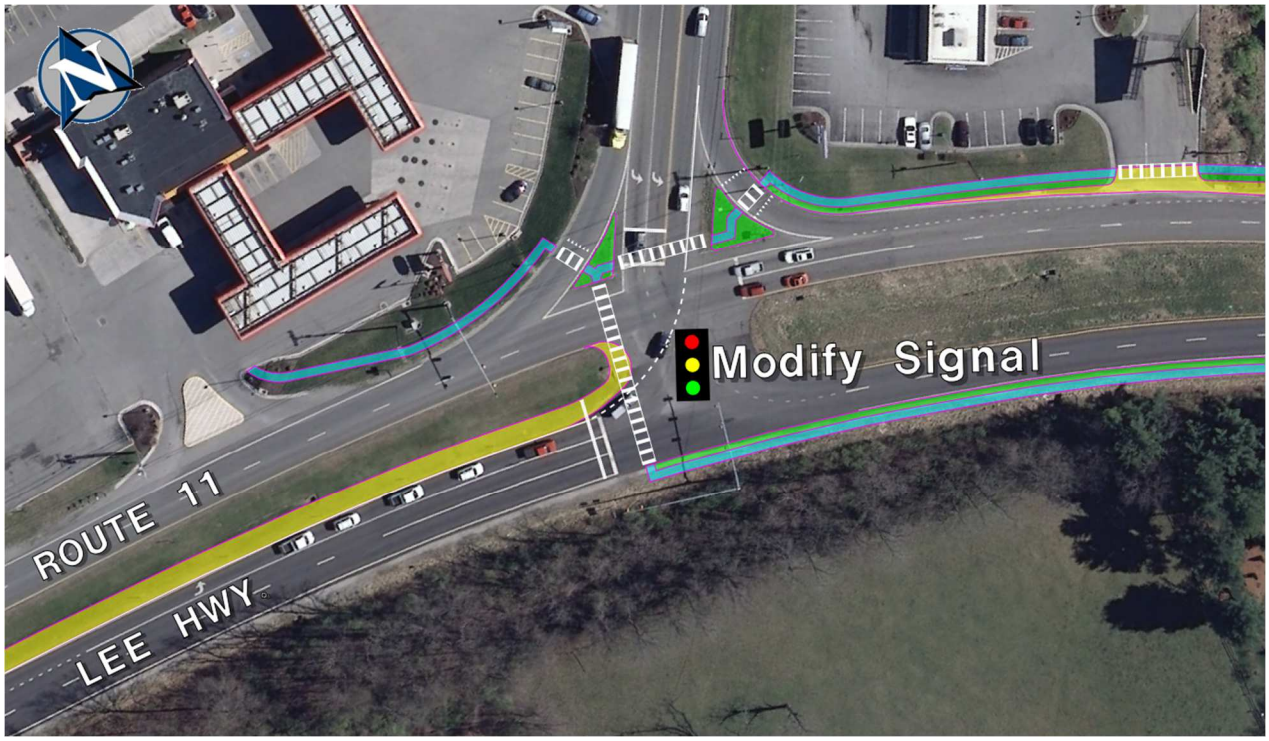
### Safety and Operational Improvements

The intersection of Lee Highway at Peppers Ferry Road experiences the highest number of intersection crashes of any intersection within the study corridor. Eastbound Lee Highway rear-end crashes at the traffic signal are the most prevalent crash type. To improve intersection capacity, an additional eastbound left-turn lane to Peppers Ferry Road is proposed as shown in Figure 2. The additional turn lane improves intersection capacity and delays, and may help to reduce eastbound rear-end crashes by shortening traffic queues. Additional improvements include the addition of pedestrian crossings at the intersection to facilitate safe pedestrian movements within the intersection.

To accommodate these improvements, the existing westbound slip ramp from Lee Highway to Peppers Ferry Road would become yield-controlled, to allow for dual turning lanes from eastbound Lee Highway to Peppers Ferry Road. This ramp movement could also be controlled by the modified traffic signal to improve pedestrian and vehicular safety at the intersection. To accommodate westbound queues, the existing turn lane should be lengthened as depicted in Figure 2.

Additionally, the stop bar for Peppers Ferry Road should be pulled back to both accommodate the new pedestrian crossing, and to improve sight distance for right-turning vehicles to Lee Highway traveling toward Dublin.

Figure 2: Proposed Operational and Safety Improvements at the Lee Highway – Peppers Ferry Road Intersection

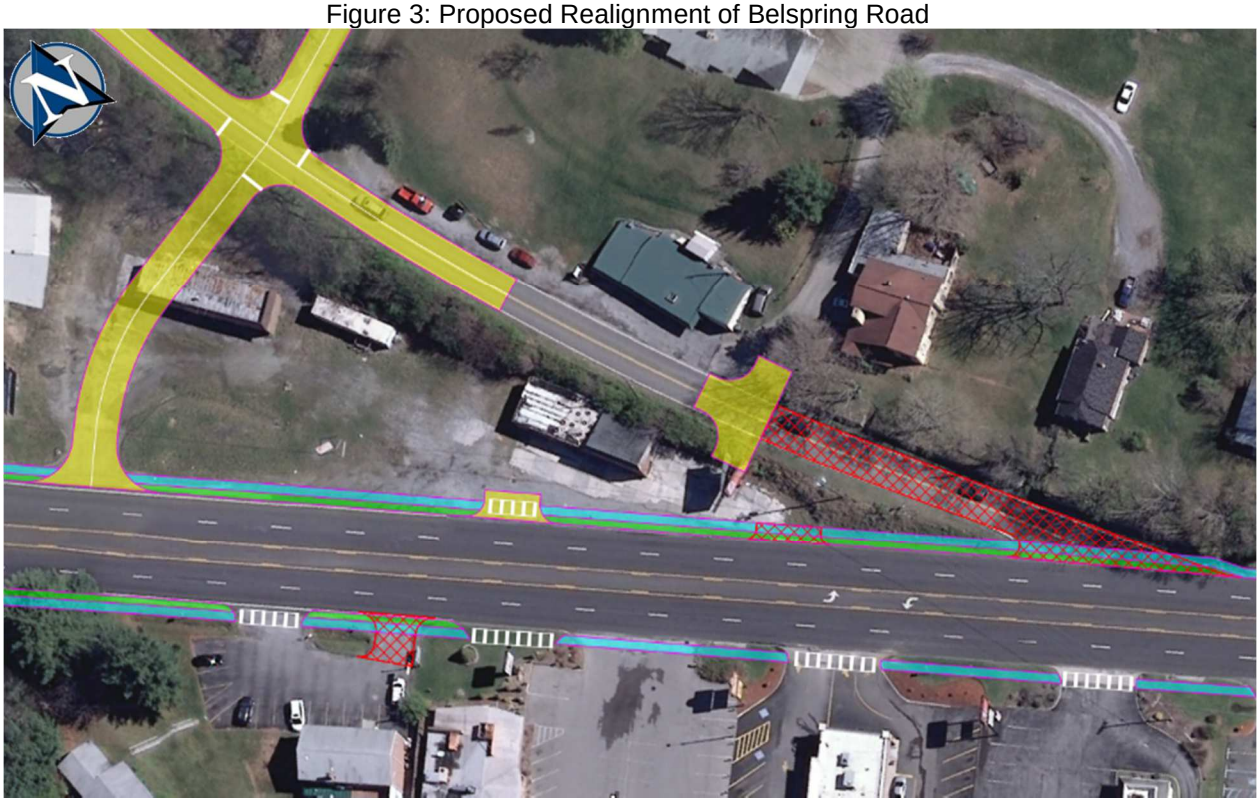


Operational improvements were identified for the intersection of Lee Highway at Belspring Road. Crash frequency is relatively low at this location; however, the configuration of the intersection is atypical with Belspring Road approaching Lee Highway on a steep grade and at a severe skew. The preferred improvement is to realign Belspring Road to a four-way intersection at Walnut Lane, combined with closing the existing intersection with Route 11. Walnut Lane would be extended south to a new intersection with Lee Highway at a more optimal angle, to help improve sight distance and intersection safety. This realignment is shown in Figure 3.

The proposed change may also serve to reduce the amount of cut-through traffic along Belspring Road, which serves as primary access to a number of residential and commercial properties. To further discourage cut-through traffic, no right-turn lane from Lee Highway to Belspring Road is recommended. However, should traffic volumes at this location warrant one following the proposed improvements a right-turn lane could be constructed. Traffic volumes at the intersection do not warrant the installation of a traffic signal at this time.

Minor access management improvements are proposed for the entrances to Dalton TV and the presently vacant parcel adjacent to the Lee Highway at Belspring Road intersection. The access management improvements would consolidate access and provide better spacing and alignment of commercial entrances to improve safety in a high crash area along the Lee Highway corridor.

Figure 3: Proposed Realignment of Belspring Road



Operational improvements were identified for the intersection of Lee Highway at Kroger / Warren Newcomb Drive. Crash frequency is relatively low at this signalized intersection; however, the lack of an eastbound right-turn lane contributes to long queues and may also contribute to eastbound rear-end crashes at this intersection. To improve intersection operations, a right-turn lane into Kroger is proposed as shown in Figure 4. Additionally, signal phasing changes are recommended to provide a leading protected-permissive left-turn movement from Kroger to Lee Highway, and to accommodate new pedestrian crossing movements at the intersection.

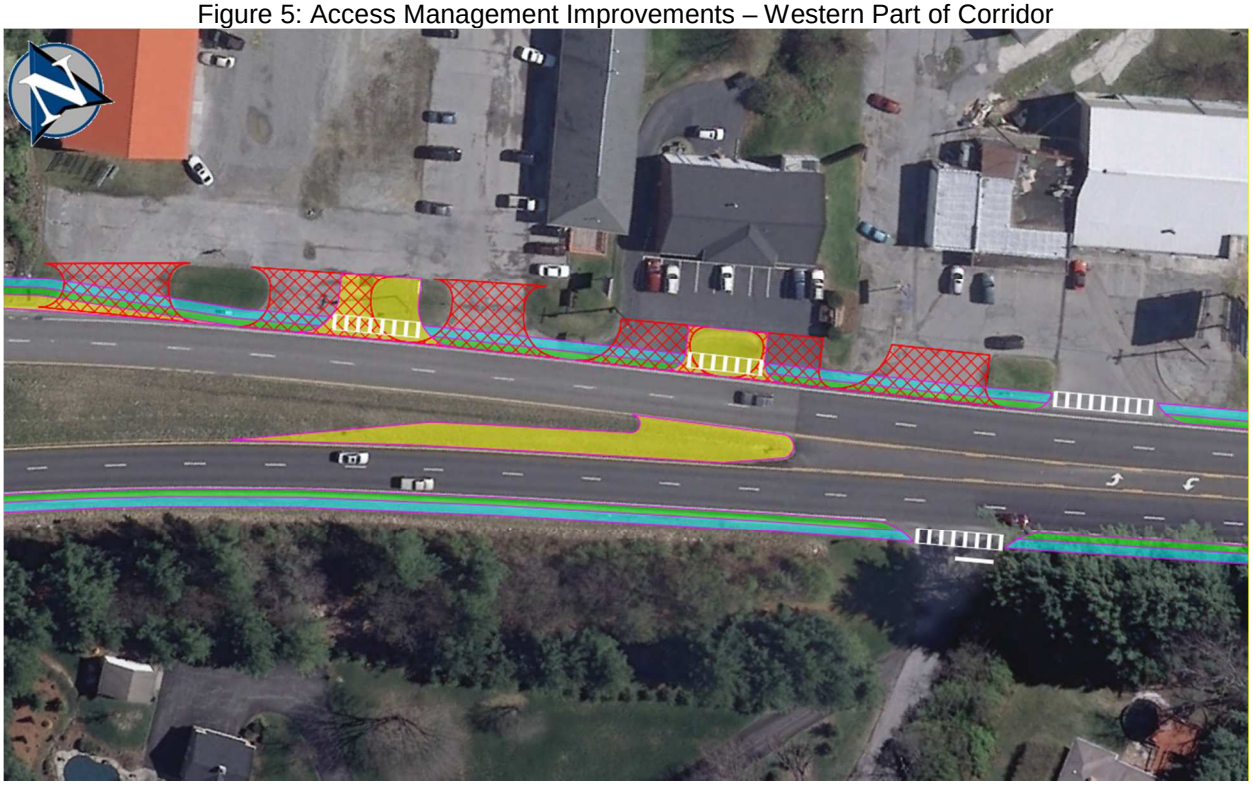
Additional access management improvements are proposed near the intersection to consolidate business access points and provide better sight distance and spacing between entrance locations. An additional improvement is proposed for the intersection of Lee Highway with Nicewander Way. This intersection has inadequate width and geometry, and proposed improvements would correct both conditions.

Figure 4: Proposed Improvements near Kroger/Radford Shopping Plaza

## Access Management Improvements

In addition to proposed safety and operational improvements along the Lee Highway corridor, several additional locations were identified along the corridor where access management strategies should be utilized. On the western end of the corridor closest to Peppers Ferry Road, there are seven access points to properties to the north side of Lee Highway within the area shown in Figure 5. Most of these entrances serve low volumes of traffic primarily as right-in, right-out entrances. Recommendations include consolidating entrances to the properties of Power's Fence and the adjacent mixed-use building, consolidating access to Radford Animal Hospital, and consolidating access to Radford Pawn. Additionally, to facilitate safer turns to the consolidated entrances, a left-turn lane is proposed along eastbound Lee Highway.

Figure 5: Access Management Improvements – Western Part of Corridor



Along the eastern end of the Lee Highway study corridor, where the previously constructed road improvements end, there are additional opportunities to utilize access management strategies. As shown in Figure 6, there are eleven access points to properties along Lee Highway within this area, and several of these entrances serve low volumes of traffic. Recommendations include closing the rear entrance to Kroger, consolidating access to the Executive Motel, consolidating access to the vacant building adjacent to Roca's, and closing one of the three entrances to Roca's.

Additionally, a median is proposed from the traffic signal at Lee Highway at Kroger / Warren Newcomb Drive to the Wheatland Hills Driveway. This median would physically prohibit left-turn movements into the right-in only entrance to the Wilco/Hess gas station. This location experiences a high frequency of rear-end crashes due to traffic stopping in the eastbound through lanes to execute this unsafe turning movement. The median would help to eliminate this condition and direct drivers to utilize the existing traffic signal that serves the Wilco/Hess.

No improvements at the intersection of Lee Highway and Hazel Hollow Road are recommended. This intersection was improved as a part of the previous Memorial Bridge replacement project. Auxiliary turning lanes are already provided along Lee Highway, and the existing median is wide enough to accommodate storage of vehicles turning to and from Hazel Hollow Road. Additionally, traffic volumes at the intersection do not warrant the installation of a traffic signal at this time.

Figure 6: Access Management Improvements – Eastern Part of Corridor

For the closely spaced entrances to the rear of Kroger and to Wheatland Hills, proposed improvements include closing the rear Kroger entrance to provide better spacing from the signalized intersection of Lee Highway at Kroger / Warren Newcomb Drive. As shown in Figure 7, two crossover entries are proposed between the Wheatland Hills driveway and Kroger to facilitate deliveries. However, the grade differential between the Wheatland Hills driveway and the rear of the Kroger property is significant, and would require substantial re-grading of the Wheatland Hills driveway to construct.

Figure 7: Access Management Improvements – Kroger and Wheatland Hills

No additional access management improvements are proposed within the limits of the previously completed road construction project associated with the Memorial Bridge. Access management strategies were employed during the construction project to remove access points and provide median openings with turning lanes to facilitate safer turning movements. No improvements in this area are required, and the crash frequency is the lowest along the Lee Highway study area.

A decision matrix was developed to evaluate existing median openings and access locations to review the impacts to traffic operations, access and traffic circulation, vehicular conflicts, and vehicular safety based on potential strategies at each location. The decision matrix is contained in Appendix B.

## Multi-Modal Improvements

To create a more pedestrian friendly corridor within the study area, construction of new sidewalks is recommended along both sides of Lee Highway. These would connect to existing segments of sidewalks that were constructed as a part of the Memorial Bridge replacement project in the early 2000's. Proposed sidewalk locations and alignments are depicted in the recommended improvements contained in Appendix D.

To facilitate pedestrian movements across Lee Highway, actuated signalized pedestrian crossings of Lee Highway are recommended across the northern leg of the intersection with Peppers Ferry Road and the southern leg of the intersection with Warren Newcomb Drive at the existing traffic signals.

Bicycle facilities, either on-road bike lanes or a shared-use path, are not recommended along the study area for the Lee Highway corridor. The previous roadway improvements associated with the Memorial Bridge replacement did not incorporate any bicycle facilities. Any new bike accommodations along Lee Highway would not connect to any existing facilities. Additionally, the addition of on-road bike lanes or a mixed-use trail would result in significant right-of-way impacts due to existing development along Lee Highway.

Existing transit stops for Radford Transit and Pulaski Area Transit are located immediately off the Lee Highway corridor in the adjacent shopping areas. Proposed operational, safety, and access management improvements will help reduce route delays for both agencies and facilitate safer movements to and from areas where their stops are located.

## SUMMARY OF FINDINGS/CONCLUSION

The proposed improvements for the US Route 11 (Lee Highway) corridor will serve to improve roadway safety and vehicular operations by reducing the number of conflict points, and to provide for multi-modal transportation options within the study area by providing a connected network of pedestrian and facilities that will access commercial, residential, and recreational destinations along and near the corridor. Improvements are depicted graphically in Appendix D

Operational, safety, access management, and multi-modal improvements recommended as a part of this study could also be broken out into a stand-alone projects.

Operational and safety improvements could occur as either a single project, or as segmental projects, and include:

- Construct a second left-turn lane from Lee Highway to Peppers Ferry Road
- Re-align Belspring Road to eliminate the skewed intersection and steep grade
- Construct a right-turn lane from Lee Highway into Kroger / Radford Shopping Plaza

Access management improvements could occur as either a single project, or as segmental projects, and include:

- Consolidate commercial entrances along both sides of Lee Highway to reduce the number of conflict points created by multiple entrances to the same businesses, and to provide more uniform spacing of commercial entrances
- Construct a left-turn lane from Lee Highway to approximately the consolidated Radford Animal Hospital entrance to provide a safe method to conduct U-turn movements at this location where U-turns and a lack of storage create a safety challenge

Multi-modal improvements could occur as either a single project, or as segmental projects, and include:

- Construct sidewalks along both northbound and southbound Lee Highway, connecting to existing sidewalk segments.