WASHINGTON STREET AND LEE STREET
ROAD SAFETY ASSESSMENT
Regional Intergovernmental Council

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1.0 Executive Summary

The purpose of this study is to analyze the existing safety conditions and to determine potential countermeasures to reduce crash frequency along Washington Street between Leon Sullivan Way and Ruffner Avenue and along Lee Street from Leon Sullivan Way and Brooks Street in Charleston, West Virginia.

Crash data from January 1, 2017 through December 31, 2021 was downloaded from AASHTOWare Safety and the crash reports were obtained through ReportBeam. In the five-year study period, there were 120 crashes with 35 (29 percent) resulting in injury and two fatalities (two percent). One fatality occurred on May 25th, 2017 around 11:30 PM on Lee Steet near Leon Sullivan Way, where a female pedestrian was laying in the crosswalk presumably asleep and under the influence of alcohol. It was dark and raining at the time of the crash. The other fatality occurred on November 23rd, 2018 just before 6:00 PM on Washington Street east of Morris Street, where a pedestrian was crossing Washington Street at an unmarked location and was struck by a distracted driver.

The most prevalent crash types were angle crashes and sideswipe in the same direction. Of the 46 angle collisions, 17 (37 percent) resulted in injury. Many of the angle collisions occurred at the signalized intersections and were a result of a vehicle running a red light. None of the 19 sideswipe crashes resulted in injury. Several (11 crashes) of these crashes occurred at Brooks Street and Lee Street where drivers were confused on the lane configuration when turning from Lee Street to Brooks Street.

Based on the crash patterns in the study corridor, the following countermeasures are recommended:

<u>Short-Term</u>

- Install new reflective backplates on the signal heads.
- Adjust clearance intervals (yellow and all-red times) at each intersection as needed.
- Implement ADA pedestrian accommodations by ensuring consistent push buttons and signal heads along the corridor and providing audible pedestrian signals ($80,000 per signal in 2024 dollars).
- Provide dotted lane line extensions for the left-turn lanes from Lee Street onto Brooks Street.
- Prohibit left-turns on red at the Lee Street and Brooks Street intersection and right-turns on red at the Lee Street and Leon Sullivan Way intersection through signage.
- Modify the signal timings at the intersection of Bradford Street and Washington Street to provide an exclusive phase for each Bradford Street approach (split-phased) and ensure coordination with the other signals along Washington Street.
- Stripe a parking lane on Washington Street between Morris Street and Ruffer Avenue. No additional pavement markings will be modified ($11,700 in 2024 dollars).

<u>Medium-Term</u>

- Provide pedestrian accommodations to cross Ruffner Avenue at the intersection with Washington Street ($329,000 in 2024 dollars).
- Coordinate with the United States Postal Service (USPS) to determine the feasibility of modifying the fence at the corner of Leon Sullivan Way and Lee Street which currently obstructs sight distance at the intersection.
- Install overhead directional signing along Lee Street in advance of Brooks Street to inform motorists of the upcoming lane configurations ($116,000 in 2024 dollars).

Long-Term

- Reconfigure Washington Street between Morris Street and Bradford Street to provide a raised median throughout the corridor for traffic calming and access management. Install Rectangular Rapid Flashing Beacons (RRFBs) at key locations. Improve the crossing at Bradford Street ($1,143,000 in 2024 dollars).
- Complete a comprehensive study of the downtown area to determine a more wholistic view of the travel patterns in the area and the potential to reallocate pavement, convert roadways from one-way to two-way, and accommodate a connected bicycle network.

2.0 Purpose

The purpose of this study is to analyze the existing safety conditions and to determine potential countermeasures to reduce crash frequency along Washington Street between Leon Sullivan Way and Ruffner Avenue and along Lee Street from Leon Sullivan Way to Brooks Street Charleston, West Virginia. The study area is shown below in **Figure 1.**

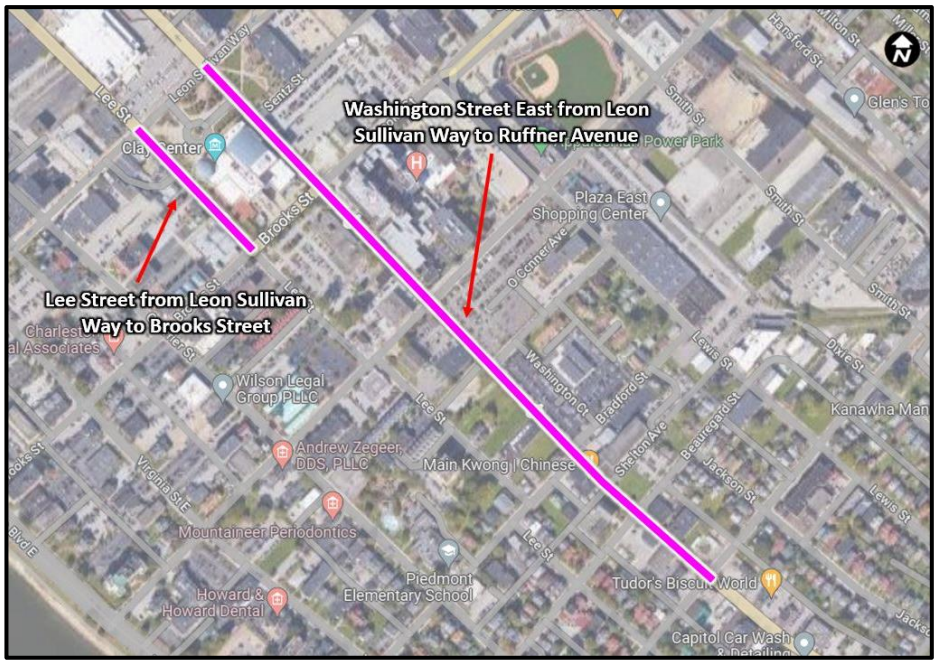

Figure 1: Study Area

3.0 Existing Conditions

The surrounding study area is primarily commercial and serves the Charleston Area Medical Center (CAMC) General Hospital, several other CAMC medical buildings and the Clay Center. A nearby public housing community and resources for vulnerable and unhoused populations generate a high volume of pedestrian and bicycle traffic. The Kanawha Valley Regional Transportation Authority (KRT) operates bus routes along this portion of Washington Street and Lee Street.

Roadway Conditions

Within the study area, Washington Street is a two-lane two-way roadway with a posted speed limit of 30mph. Northwest of Leon Sullivan Way (outside of the study area), Washington Street becomes a one-way roadway. Washington Street serves many businesses including shops and restaurants as well as the Clay Center and the CAMC General Hospital. Public parking is available on the northeast side of Washington Street. A RRFB is provided between Leon Sullivan Way and Brooks Street for pedestrians parking in the public lots for events at the Clay Center. Sidewalks and street lighting are present along both sides of the roadway throughout the entire corridor. Based on 2020 count data, this segment of Washington Street carries between 4,900 and 5,600 vehicles per day. The following characteristics were noted and may be contributing to crashes and the general safety performance of the Washington Street corridor:

- Between Morris Street and Ruffner Avenue, the roadway is approximately 30 feet wide with two travel lanes, shown in **Photo 1**. The northwestbound lane is 11 feet wide while the southeastbound lane is 19 feet wide. The wide southeastbound lane can promote speeding and increase the crossing distance for pedestrians.
- There is a distance of nearly 800 feet between marked, signalized crosswalks along Washington Street between Morris Street and Bradford Street and between Bradford Street and Ruffner Avenue. This distance incentivizes pedestrians to cross the street at unmarked locations throughout the corridor and increases the potential for vehicle and pedestrian conflicts.

Photo 1: Wide Southeastbound Lane between Morris Street and Bradford Street

Between Leon Sullivan Way and Brook Street, Lee Street in this segment is a one-way roadway with two lanes and a posted speed limit of 30 mph. This segment borders the Clay Center. Metered on-street parking is provided on the southeast side of Lee Street, shown in **Photo 2**. Sidewalks and lighting are provided along this segment. Per WVDOH 2020 count information, Lee Street carries approximately 4,700 vehicles per day.

Photo 2: Clay Center and Parking Along Lee Street

Intersection Conditions

Washington Street and Leon Sullivan Way

The lane configuration for this signalized intersection is illustrated in **Figure 2**. All signal heads are mounted on mast arms. Without backplates or reflective borders, the signal heads can be difficult to see, especially in the northwestbound direction with other visual clutter (buildings, etc.) is present as illustrated in **Photo 3**. Pedestrian push buttons, signal heads and high visibility crosswalks are provided on each corner of the intersection. Pedestrians are served through an exclusive phase if the push button is actuated. Overhead lighting is not provided at the intersection.

Figure 2: Washington Street and Leon Sullivan Way Lane Configuration

Photo 3: Inconspicuous Signal Heads at Washington Street and Leon Sullivan Way

Washington Street and Brooks Street

The lane configuration for this signalized intersection is illustrated in **Figure 3**. All signal heads are mounted on mast arms. Sun glare obscured the view of the signal heads, particularly those for the Brooks Street approach as shown in **Photo 4**. Backplates are not provided on any of the signal heads. Pedestrian push buttons, signal heads and high visibility crosswalks are provided on each corner of the intersection. An exclusive pedestrian phase is provided within the current signal timing plan. Overhead lighting is provided. While it is a viable movement, left-turns are not permitted from southeastbound Washington Street onto Brooks Street as indicated through signage. Signs also prohibit right-turn on red from Brooks Street.

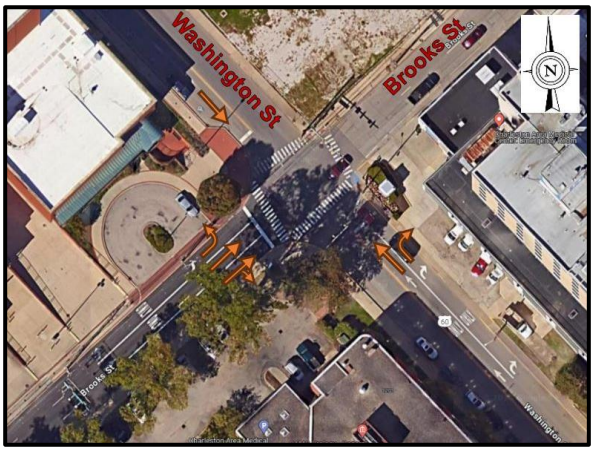

Figure 3: Washington Street and Brooks Street Lane Configuration

Photo 4: Sun Glare Affecting Signal Head Visibility at Washington Street and Brooks Street

Washington Street and Morris Street

The lane configuration for this signalized intersection is illustrated in **Figure 4**. All signal heads are mounted on mast arms and do not have backplates. The Morris Street approaches have protected/permissive left-turn operations. Pedestrian signal heads and high visibility crosswalks are provided on each corner of the intersection. The pedestrian phases are automatically served with the adjacent vehicle phases; therefore, pedestrian push buttons are not provided. Pedestrian-level lighting is provided at the intersection.

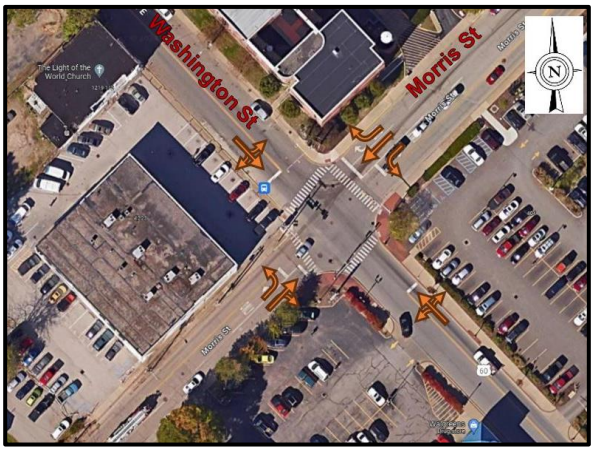

Figure 4: Washington Street and Morris Street Lane Configuration

Washington Street and Bradford Street

The lane configuration for this signalized intersection is illustrated in **Figure 5**. All signal heads are mounted on mast arms and do not have backplates. Pedestrian-level lighting is provided at the intersection. Pedestrian push buttons, signal heads and high visibility crosswalks are provided to cross Washington Street and the northeast leg of Bradford Street. The signal is programmed for an actuated exclusive pedestrian phase. The signal is currently programmed to serve both legs of Bradford Street concurrently. Nearby buildings coupled with the offset Bradford Street approaches creates sight distance obstruction and results in driver confusion when vehicles are on both Bradford Street approaches. Additionally, the sun glare reduces the conspicuity of the signal heads as illustrated in **Photo 5**.

Figure 5: Washington Street and Bradford Street Lane Configuration

Photo 5: Offset Intersection at Bradford Street and Sun Glare Impacting Signal Head Visibility

Washington Street and Ruffner Avenue

The lane configuration for this signalized intersection is illustrated in **Figure 6**. All signal heads are mounted on mast arms and do not have backplates. Sun glare and resulting signal head visibility was also noted to be a challenge at this intersection. All left-turns operate under permissive phasing. Pedestrian push buttons, signal heads and high visibility crosswalks are provided to cross the Washington Street approaches. No pedestrian facilities are available to cross Ruffner Avenue as shown in **Photo 6**. Pedestrian-level lighting is provided at the intersection.

Figure 6: Washington Street and Ruffner Avenue Lane Configuration

Photo 6: Lack of Pedestrian Crossings on Ruffner Avenue and Sun Glare Impacting Signal Head Visibility

Lee Street and Leon Sullivan Way

The lane configuration for this signalized intersection is illustrated in **Figure 7**. All signal heads are mounted on mast arms and backplates are not provided. Pedestrian push buttons, signal heads and high visibility crosswalks are provided on each corner of the intersection. The signal timings include an exclusive pedestrian phase when actuated through the push buttons. Overhead lighting is provided at the intersection. The fence at the United States Postal Service (USPS) lot obstructs sight distance for motorists to see oncoming traffic from the opposing approach. The left-turn lane from Leon Sullivan Way to Lee Street is very narrow (approximately nine feet wide) and the curb on this corner of the intersection has several tire marks.

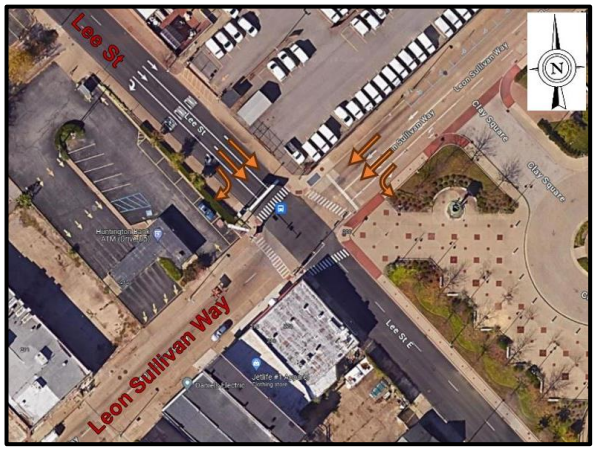

Figure 7: Lee Street and Leon Sullivan Way Lane Configuration

Lee Street and Brooks Street

The lane configuration for this signalized intersection is illustrated in **Figure 8**. All signal heads are mounted on mast arms and do not have backplates. Pedestrian push buttons, signal heads and high visibility crosswalks are provided on each corner of the intersection with pedestrians accommodated through an exclusive phase of the signal. Overhead lighting is provided at the intersection. Field reviews uncovered driver confusion relating to the two left-turn lanes from Lee Street and three receiving lanes on Brooks Street. No markings are provided through the intersection.

Figure 8: Lee Street and Brooks Street

4.0 Existing Safety Analysis

Crash Trends and Analysis

Crash data from January 1, 2017 through December 31, 2021 was downloaded from AASHTOWare Safety and the crash reports were obtained through ReportBeam. Each crash report was reviewed to determine potential factors contributing to crashes. A collision diagram that shows crash patterns by illustrating the approximate location of each reported crash is provided in **Appendix A**. In the five-year study period, there were 120 crashes with 35 (29 percent) resulting in injury and two fatalities (two percent).

One fatality occurred on May 25th, 2017 around 11:30 PM on Lee Steet near Leon Sullivan way, where a female pedestrian was laying in the crosswalk presumably asleep and under the influence of alcohol. It was dark and raining at the time of the crash. The other fatality occurred on November 23rd, 2018 just before 6:00 PM on Washington Street southeast of Morris Street, where a pedestrian was crossing Washington Street at an unmarked location and was struck by a distracted driver.

Figure 9 shows the frequency of crashes by severity per year. The number of crashes decreased in 2019 and 2020 over previous years but rose again in 2021.

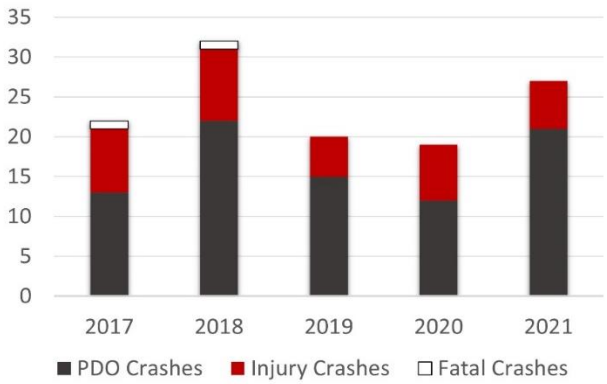

Figure 9: Frequency of Crashes by Year and Severity

Figure 10 shows the crash frequency in the study area by the crash type. The most prevalent crash types were angle crashes and sideswipe in the same direction. Of the 46 angle collisions, 17 (37 percent) resulted in injury. Many of the angle collisions occurred at the signalized intersections and were a result of a vehicle running a red light. None of the 19 sideswipe crashes resulted in injury. Several (11 crashes) of these crashes occurred at Brooks Street and Lee Street where drivers were confused on the lane configuration when turning from Lee Street to Brooks Street.

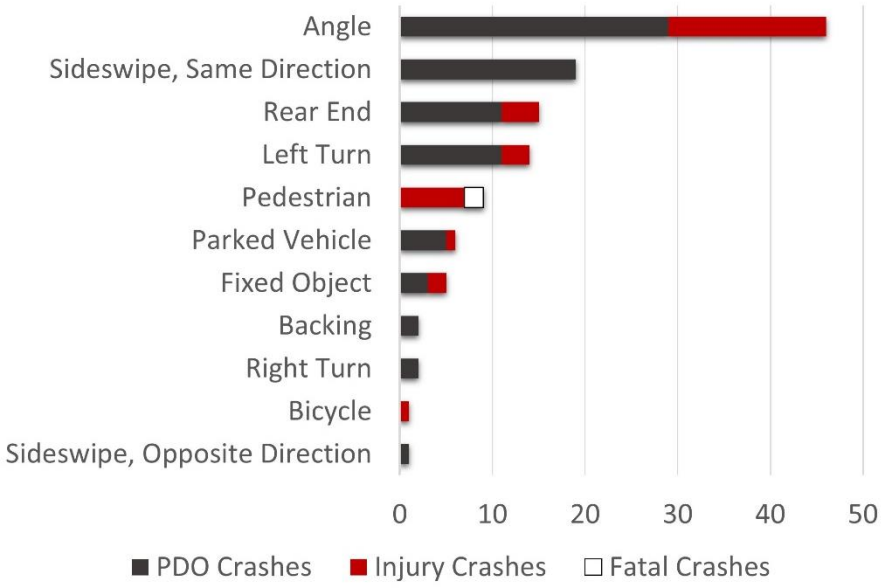

Figure 10: Crashes by Crash Type

The majority of the crashes in the study area occurred at the signalized intersections as detailed below.

Washington Street and Leon Sullivan Way

A total of five crashes occurred at this intersection in the study period. Two of the crashes involved vehicles running a red light and striking an opposing vehicle. In one instance, the vehicle on Leon Sullivan Way ran the light and in the other, fault could not be determined. Both of these crashes resulted in injury. Vehicles traveling on Leon Sullivan Way are often traveling at a high speed as they are exiting the interstate. Two crashes occurred when a vehicle on Leon Sullivan Way improperly went through in the left-turn only lane. One of these crashes resulted in injury.

Washington Street and Brooks Street

The main crash pattern at this intersection was angle collisions. Two angle crashes involved vehicles on Brooks Street running the red light, three involved vehicles on Washington Street disregarding the signal (two northwestbound, one southeastbound). One of the five angle crashes resulted in injury. Three parked car crashes occurred in the vicinity of this intersection as well, all occurring on the southwest corner of the intersection. Two sideswipe crashes were reported with vehicles traveling northwestbound on Washington Street where drivers failed to maintain their lane. One pedestrian crash occurred at this intersection when a pedestrian was crossing Brooks Street in the crosswalk and a vehicle made an illegal southeastbound left turn.

Washington Street and Morris Street

Three crashes occurred between vehicles and vulnerable road users in the vicinity of this intersection, two of which were injuries and one a fatality. Walgreens is located in the southwest corner of the intersection and is a heavy pedestrian generator. The fatality occurred just south of the intersection when a pedestrian crossed outside of a marked crossing and was struck by a southeastbound vehicle. The second pedestrian crash occurred when a pedestrian disregarded the signal when crossing Washington Street and was struck by a vehicle turning left from Morris Street. A bicycle was in the crosswalk across Morris Street and was struck by a northwestbound right-turning vehicle from Washington Street. Other crashes at this intersection include angle (three crashes, no injury) and left-turn (two crashes, one injury) crashes.

Washington Street and Bradford Street

Angle crashes and left turn crashes account for six of the 12 crashes at this intersection with two resulting in injury. As previously detailed, the sight distance obstructions of the buildings likely contribute to these crashes as five involved vehicles on the southern Bradford Street approach. There were also two pedestrian crashes at this intersection. One crash involved an impaired pedestrian while the other crash happened because a pedestrian disregarded the traffic signal and stepped off the curb into oncoming vehicular traffic. Both crashes resulted in injury.

Washington Street and Ruffner Avenue

Three angle crashes, one of which resulted in injury, occurred at this intersection. In all three instances, vehicles from various approaches ran the red light. One pedestrian crash occurred and resulted in injury when a pedestrian crossing Ruffner Avenue was struck by a northwestbound left-turning vehicle.

Lee Street and Leon Sullivan Way

The most crashes in the study area occurred at the intersection of Lee Street and Leon Sullivan Way. Of the 120 total crashes in the study area, 24 crashes (20 percent) were angle collisions that occurred at this intersection. In 14 of these crashes, the vehicle on Leon Sullivan Way ran the red light while in eight instances, it was the vehicle on Lee Street. The fault could not be determined in two of the crashes. Nine of the crashes (38 percent) resulted in injury. Furthermore, three right-turn crashes occurred when right-turning vehicles on Leon Sullivan Way stuck vehicles on Lee Street. The fence on the USPS property obstructs the view of motorists at the signal. These crash patterns indicate that sight distance obstructions may be contributing factors to these crashes. This intersection was also the location of the fatal pedestrian crash where the impaired pedestrian way laying in the crosswalk.

Lee Street and Brooks Street

In total, ten sideswipe crashes occurred at this intersection, none of which resulted in injury. In all instances, the crashes were caused by vehicles turning left from Lee Street onto Brooks Street. With two turn lanes and three receiving lanes, drivers are not maintaining their lane through the turn because of confusion regarding appropriate lane configurations. Three of these crashes involved vehicles changing lanes on the approach, prior to making the turn, which can also be a sign of driver confusion.

5.0 Countermeasures for Consideration

The following countermeasures were identified to mitigate crashes and improve safety within the study area.

Short-Term

- **Install new reflective backplates on the signal heads.** Backplates are proposed on all signal heads to improve signal visibility and help reduce red-light running. None of the intersections in the corridor currently have backplates on the signal heads. In some cases, the existing signal supports cannot accommodate the additional weight and wind load of backplates. Calculations would be required to determine if a new signal support would be required to make these improvements.
- **Adjust vehicular clearance intervals (yellow and all-red times).** Clearance intervals that are too short can contribute to rear end collisions related to drivers stopping abruptly. Short clearance intervals can also lead to angle crashes because vehicles could still be clearing the intersection when a conflicting approach is given the green indication. Conversely, clearance intervals that are too long can encourage drivers to disrespect the interval thereby contributing to angle crashes when vehicles run the red light. To improve safety throughout the study area, it is recommended that clearance intervals be recalculated at all the signalized intersections. Clearance interval calculations based on guidance in the Institute of Transportation Engineer's *Guidelines for Determining Traffic Signal Change and Clearance Intervals* are provided in **Appendix B**.
- **Implement ADA pedestrian accommodations through consistent push buttons and signal heads along the corridor and providing audible pedestrian signals.** As part of the newly adopted Public Right-of-Way Accessibility Guidelines (PROWAG), audible pedestrian signals are now required at signalized intersections. Additionally, the existing pedestrian push button type and ADA-compliance vary throughout the corridor. With the observed pedestrian traffic and reported pedestrian crashes, these facilities should be upgraded to be consistent and meet current standards.
- **Provide dotted lane line extensions for the left-turn lanes from Lee Street onto Brooks Street.** Based on the crashes occurring at this intersection, drivers are confused with the lane configuration especially with two turning lanes and three receiving lanes. It is proposed that striping be provided to better delineate these movements and reduce driver confusion.
- **Prohibit left-turns on red at the Lee Street and Brooks Street intersection and right-turns on red at the Lee Street and Leon Sullivan Way intersection through signage.** These turn prohibitions will improve crashes at these two intersections. At the Lee Street and Brooks Street intersection, some of the driver confusion and resulting crashes occurred when the vehicles turned left on red. At the Lee Street and Leon Sullivan Way intersection, sight distance is obstructed for right-turning vehicles to oncoming traffic. Prohibiting this movement will reduce the potential for crashes involving right-turning vehicles. Capacity analyses were not conducted as part of this study but may be desired to confirm the capacity will not be adversely affected with this modification.
- **Modify the signal timings at the intersection of Bradford Street and Washington Street to provide an exclusive phase for each Bradford Street approach (split-phased) and ensure coordination with the other signals along Washington Street**. The sight distance obstructions from the buildings adjacent to the intersection coupled with the offset Bradford Street

approaches make this intersection a good candidate for split-phasing. Each Bradford Street approach would be provided an exclusive phase and will not conflict with any other vehicular movements. This modification would reduce driver confusion and may even enhance the efficiency of the signal. Operational analysis should be conducted prior to implementing new signal timings to ensure that the signal can be coordinated with the adjacent intersections to maintain efficient traffic flow in the corridor.

- **Strip a parking lane on Washington Street between Morris Street and Ruffner Avenue**. This short-term improvement will narrow the wide lane along Washington Street in an effort to better delineate the roadway lanes and slow traffic speeds. This stripe can be installed without any additional modifications to other pavement markings. If on-street parking is not desired in certain sections, the area could be striped as a buffer or large planters could be installed to add a vertical narrowing of the roadway. Flex post delineators could be installed on the lane lines but would also need to be maintained as they are often easily damaged and require replacement. None of these modifications would be require changes to drainage or curb lines. The typical section of Washington Street with this proposed marking is illustrated in **Figure 11**. A plan view layout of this configuration is provided in **Appendix C**.

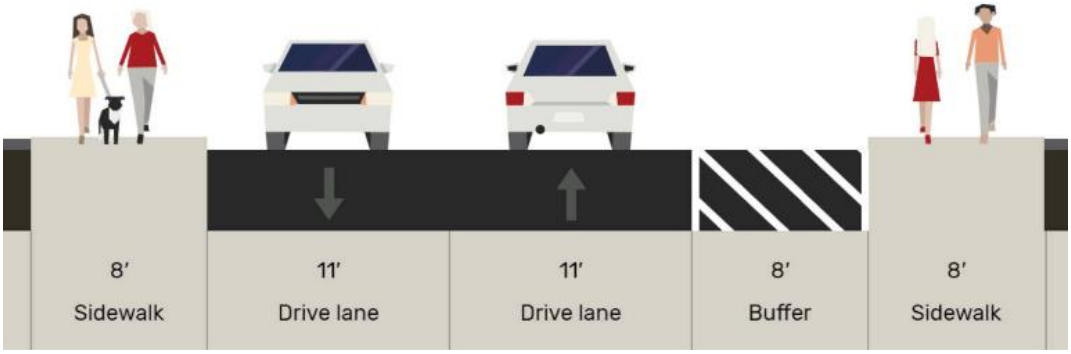

Figure 11: Short-Term Striping Alternative along Washington Street

Medium-Term

- **Provide pedestrian accommodations to cross Ruffner Avenue at the intersection with Washington Street.** Currently, pedestrian accommodations (crosswalks, signal heads, push buttons, curb ramps, etc.) are not provided to cross Ruffner Avenue. Given the amount of pedestrian traffic in the corridor and the pedestrian crash that occurred at the intersection, these improvements are recommended.
- **Coordinate with the United State Postal Service (USPS) to determine the feasibility of modifying the fence at the corner of Leon Sullivan Way and Lee Street which currently obstructs the sight distance at this intersection.** As previously detailed, there is an existing crash pattern associated with this intersection and the sight obstructions from the fence. While modified clearance intervals may reduce crashes, the sight distance obstruction prevents motorists from seeing oncoming vehicles who may be violating the clearance intervals. **Figure 12** illustrates the worst-case sight distance needed to see a vehicle along Lee Street at the stop bar from Leon Sullivan Way. The red triangle indicates that the vehicle on Leon Sullivan Way must be in the crosswalk to see oncoming traffic from Lee Street. To see Lee Street traffic from stop bar, the blue triangle indicates the fence needs to be relocated with about 2 parking spaces lost. Additionally, the shed in the parking lot would need to be relocated for optimal sight distance.
- **Install overhead directional signing along Lee Street in advance of Brooks Street to inform motorists of the upcoming lane configurations.** This improvement will supplement the additional striping. A concept layout is provided in **Figure 13**. Given the amount of visitors in the area from the CAMC and Clay Center, these overhead signs will provide additional direction to drivers as they navigate the downtown roadways toward the interstate. These signs could be mounted via a cantilever over the roadway. Appropriate sign placement should be determined so to provide adequate distance for lane changes before the intersection and to not block the view of the signal heads at Brooks Street.

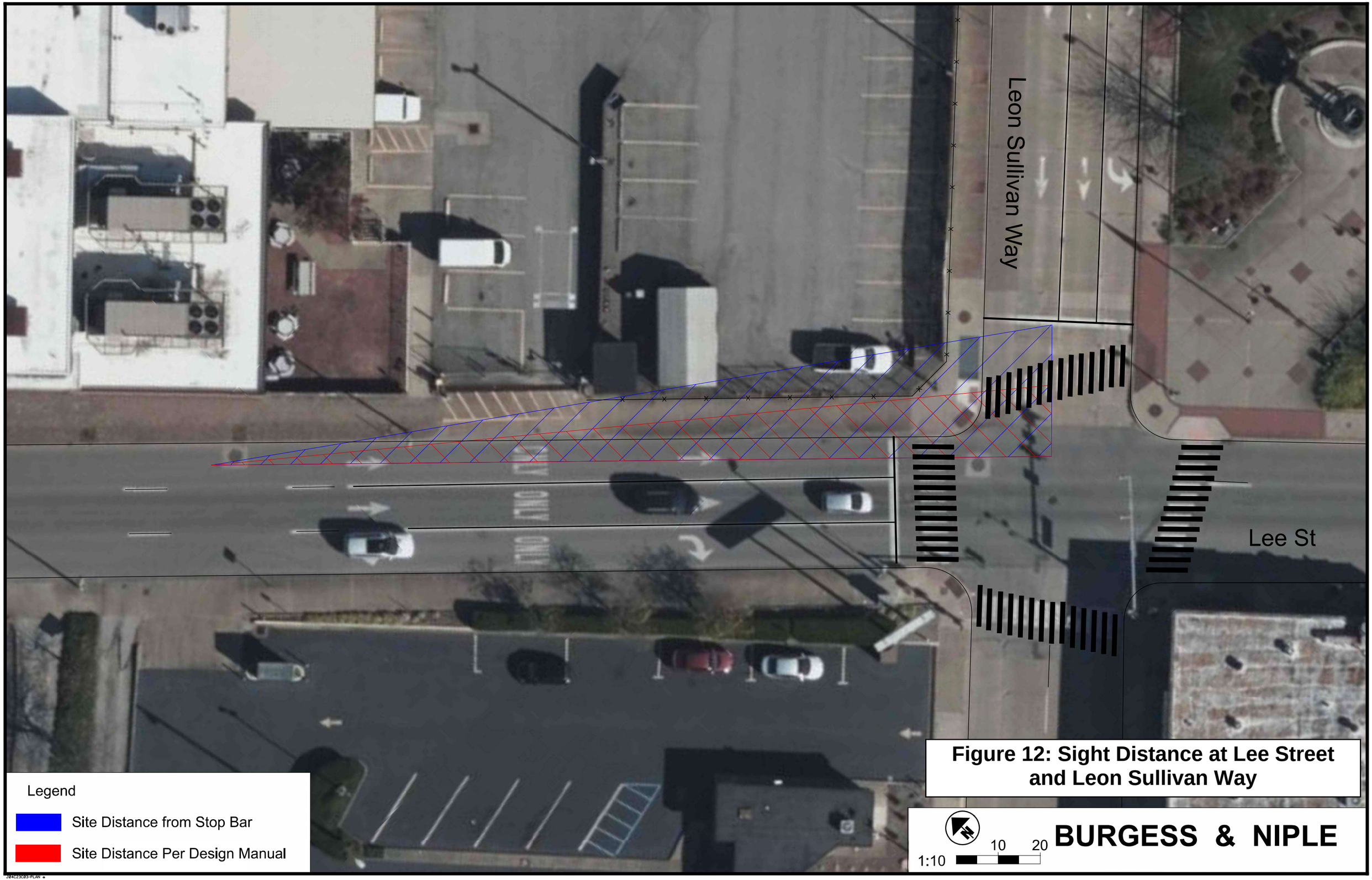

Figure 12: Sight Distance at Lee Street and Leon Sullivan Way

1:10 10 20

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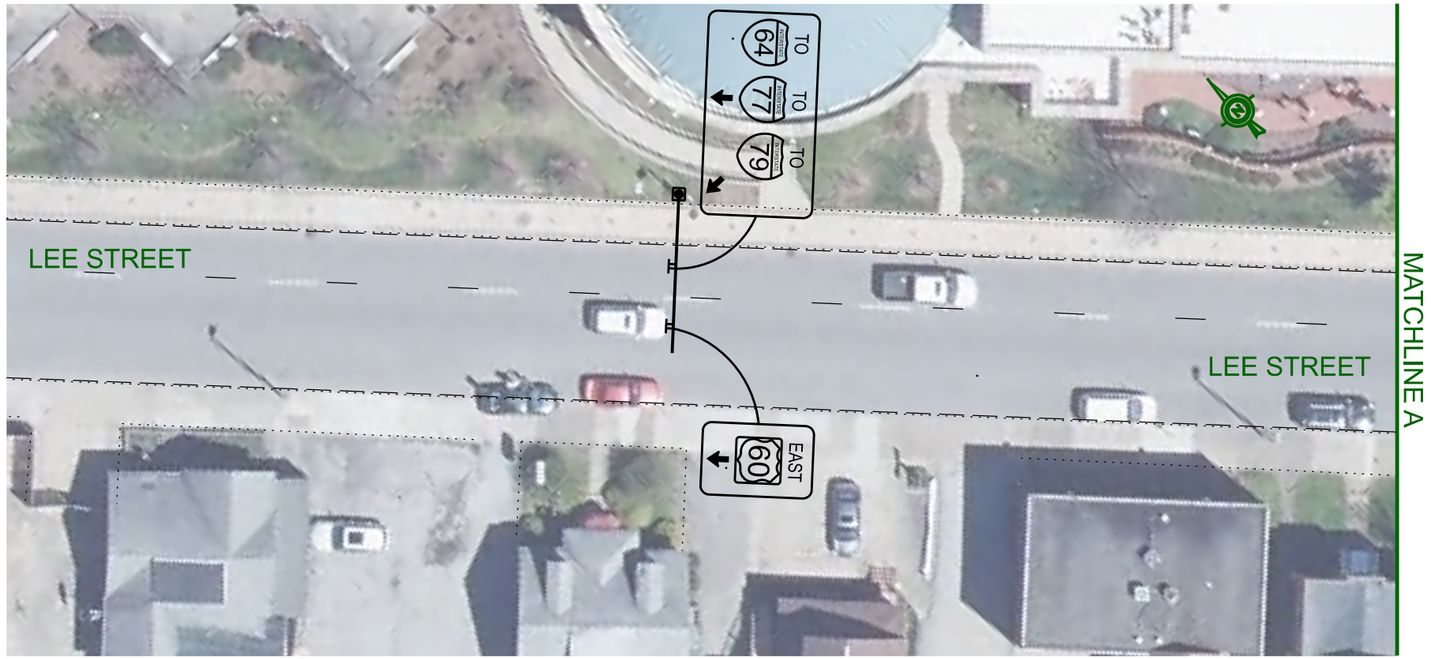

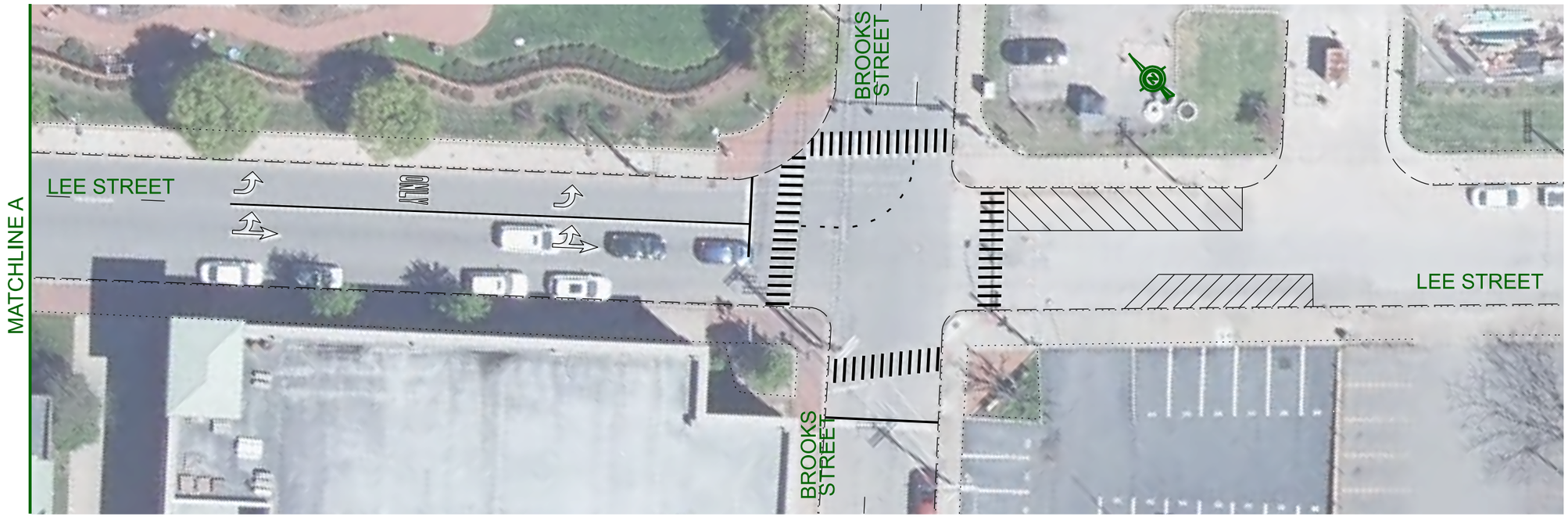

Figure 13: Overhead Advanced Signing at Lee Street and Brooks Street

Long-Term

- **Install more permanent lane width reductions along Washington Street between Morris Street and Ruffner Avenue.** The striping alternative will provide short-term, low-cost improvements to safety and travel speeds, but will not be as effective as more permanent solutions. Two options were considered to permanently reduce the lane widths and have more effect on reducing travel speeds. Both options include Rectangular Rapid Flashing Beacons (RRFBs) at key areas in the corridor. These devices will flash when a pedestrian actuates it with a push button and will indicate to drivers that a pedestrian may be crossing. RRFBs are a Federal Highway Administration (FHWA) proven safety countermeasure and have been shown to reduce pedestrian crashes by up to 47 percent. Additionally, both alternatives would modify the crosswalks and curb ramps the Bradford Street intersection to provide a more traditional crossing, shortening the length of the crosswalk and providing a more direct path. The two options for the roadway reconfiguration include:
    - Provide curb extensions at intersections and the RRFB locations throughout the corridor. A plan view of this configuration is provided in **Appendix D**. The curb extensions will require large sections of curb to be reconstructed to narrow the roadway footprint. Parking could still be maintained except around intersections. These curb extensions shorten pedestrian crossing distances and enhance pedestrian visibility, especially in areas of on-street parking. A secondary benefit is that the roadway width is narrowed with the construction of these curb extensions and can result in slower vehicular travel speeds. The vertical component of the curb is more effective at slowing traffic than paint alone. A typical section of this configuration is illustrated in **Figure 14**. This illustration is in the area of a curb extension, where the sidewalk may be widened to a width of 16 feet.

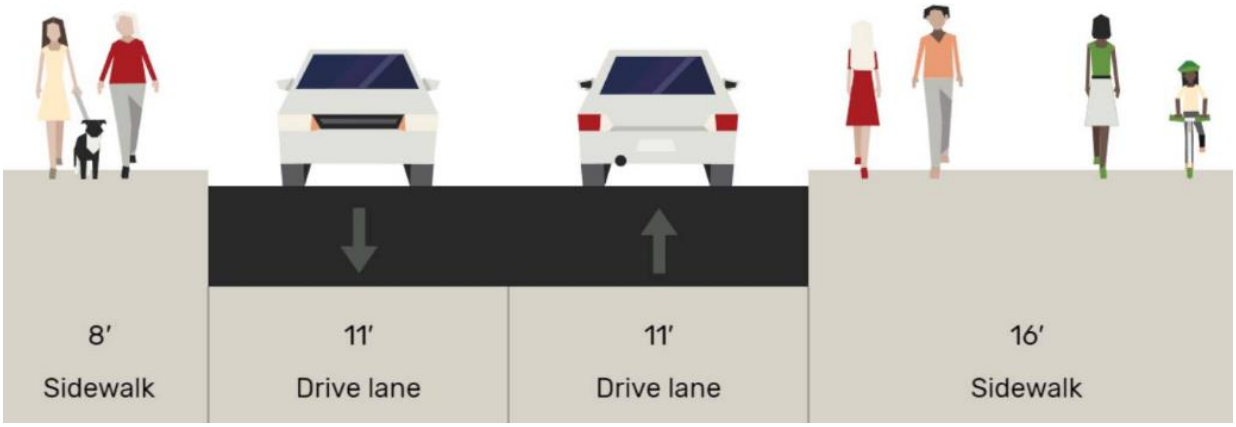

Figure 14: Long-Term Curb Extensions Alternative along Washington Street

- Construct a raised median along the length of the corridor. A plan view of this configuration is provided in **Appendix E**. A raised median could be constructed throughout the length of the corridor. In areas where parking should be maintained, the median can be removed or narrowed (as is illustrated near Beauregard Street in the layout). There are several benefits of this alternative. First, pedestrian refuge islands could be provided for pedestrians crossing Washington Street. Refuge islands are also an FHWA proven safety countermeasure and have an estimated reduction in pedestrian crashes of 46 percent at marked crosswalks and 39 percent at unmarked crossing locations. The raised medians allow for pedestrians to cross one direction of traffic at a time which reduces the complexity of the crossing maneuver. Secondly, the raised curb throughout the entire segment narrows the feel of the roadway more than curb extensions alone. With the raised medians, curbs are provided on both sides of the travel lane whereas with curb extensions, curbs are only provided on the right side of the travel lane. A third benefit is that the medians can provide access management and prevent left-turning movements out of driveways. The roadway in this area is grid network so traffic can easily use adjacent roadways to access the businesses. As a temporary condition, until the raised medians could be constructed, the roadway could be reconfigured to provide a striped median and planters could be installed to simulate the feel of raised medians without the costs of reconstructing curb and drainage facilities. A typical section of this configuration is illustrated in **Figure 15**.

Given the numerous benefits of the raised median, this alternative is the proposed solution for the corridor in the long-term.

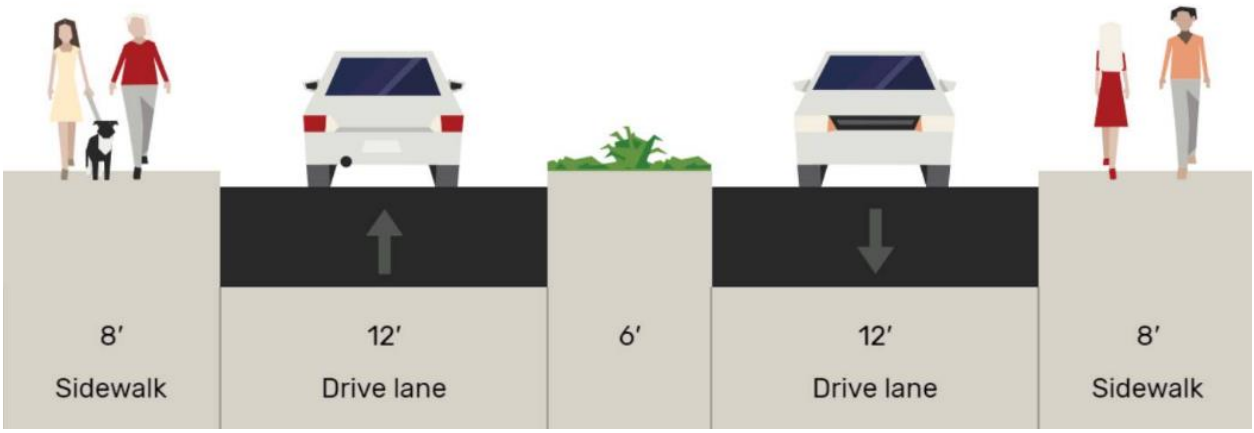

Figure 15: Long-Term Raised Median Alternative along Washington Street

- **Complete a comprehensive study of the downtown area**. While the proposed improvements will have safety benefits for the roadway segment, a more wholistic view of the travel patterns in the area would be beneficial for the network as a whole. This study could evaluate the potential to reallocate pavement, convert roadways from one-way to two-way, and accommodate a connected bicycle network. Through this analysis, the entire downtown area should be studied to determine the effects of the roadway changes and to ensure a connected network for all road users is provided.

6.0 Countermeasure Cost Estimates

The cost estimates for the proposed improvements are summarized in **Table 1**. A detailed breakdown of the construction cost estimates is provided in **Appendix F**. Cost estimates include a 30 percent contingency and 20 percent design cost. The cost estimates do not include utility relocation which may be required as a result of the improvements. Right-of-way is not anticipated for any of these improvements. For the purposes of this study, the costs have not been inflated – all costs are in 2024 dollars.

Table 1: Cost Estimate Summary

Short-Term Improvements	
	Cost Estimate (FY 2024)
Reflective backplates	Maintenance Activity
Adjust clearance intervals	--
Implement ADA pedestrian accommodations	Assume $80,000 per signal
Provide dotted lane line extensions	Maintenance Activity
Turn prohibition signing	Maintenance Activity
Modify signal timings at Bradford Street	Maintenance Activity
Stripe parking lane on Washington Street	$11,700
Medium-Term Improvements	
	Cost Estimate (FY 2024)
Provide pedestrian accommodations to cross Ruffner Avenue	$329,000
USPS coordination	--
Install overhead directional signing on Lee Street	$116,000
Long-Term Improvements	
	Cost Estimate (FY 2024)
Reconfiguration of Washington Street – Curb Extensions	$889,000
Reconfiguration of Washington Street – Raised Medians	$1,143,000
Comprehensive Study	--

7.0 Conclusions and Recommendations

Based on the crash patterns in the study corridor, the following countermeasures are recommended:

<u>Short-Term</u>

- Install new reflective backplates on the signal heads.
- Adjust clearance intervals (yellow and all-red times) at each intersection as needed.
- Implement ADA pedestrian accommodations by ensuring consistent push buttons and signal heads along the corridor and providing audible pedestrian signals.
- Provide dotted lane line extensions for the left-turn lanes from Lee Street onto Brooks Street

- Prohibit left-turns on red at the Lee Street and Brooks Street intersection and right-turns on red at the Lee Street and Leon Sullivan Way intersection through signage.
- Modify the signal timings at the intersection of Bradford Street and Washington Street to provide an exclusive phase for each Bradford Street approach (split-phased) and ensure coordination with the other signals along Washington Street.
- Stripe a parking lane on Washington Street between Morris Street and Ruffer Avenue. No additional pavement markings will be modified.

Medium-Term

- Provide pedestrian accommodations to cross Ruffner Avenue at the intersection with Washington Street.
- Coordinate with the United States Postal Service (USPS) to determine the feasibility of modifying the fence at the corner of Leon Sullivan Way and Lee Street which currently obstructs sight distance at the intersection.
- Install overhead directional signing along Lee Street in advance of Brooks Street to inform motorists of the upcoming lane configurations.

Long-Term

- Reconfigure Washington Street between Morris Street and Bradford Street to provide a raised median throughout the corridor for traffic calming and access management. Install Rectangular Rapid Flashing Beacons (RRFBs) at key locations. Improve the crossing at Bradford Street.
- Complete a comprehensive study of the downtown area to determine a more wholistic view of the travel patterns in the area and the potential to reallocate pavement, convert roadways from one-way to two-way, and accommodate a connected bicycle network.