

Asheville
Road Safety Audit 3 Report
US 25
(Merrimon Ave./Broadway/Biltmore Ave.)



November 4 - 5, 2015

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Introduction

Background

The City of Asheville lies in the Blue Ridge Mountains and is the largest city in western North Carolina. According to the 2010 Census, the city has a population of 83,393 with 424,858 people in the four-county metropolitan area. It is a popular tourist destination because of the many attractions in and around the city limits, including the Biltmore Estate, the Blue Ridge Parkway, numerous hiking trails, and many acclaimed restaurants and breweries.

The objective of this effort is to identify potential strategies to improve the pedestrian environment in Asheville. The initial task included conducting a review of pedestrian and bicycle crashes in the City of Asheville to identify contributing factors, trends, and patterns from the ten most recent years of available crash data. Based on this review of crash data along with additional input from a Steering Committee comprised of NCDOT and City representatives, thirteen locations were selected as candidate locations for more detailed study. The Steering Committee further refined the list down to three specific corridors identified for a pedestrian and bicycle-focused road safety audit (RSA) by an independent, multi-disciplinary RSA team. This report summarizes the findings of the third RSA conducted, which included a safety review of US 25 (Merrimon Avenue/Broadway/Biltmore Avenue) from Marcellus Street to Sycamore Street (i.e., milepost (MP) 11.12 - 11.84).

RSA Site Locations

In light of the frequency of severe pedestrian and bicyclist crashes, US 25 was selected as the focus of this effort. As shown in Figure 1 and Figure 2, the segment between Marcellus Street and Sycamore Street was examined as part of this RSA. The Asheville Multimodal Transportation Commission (MMTC) recommended that the RSA study corridor be extended north to include Chestnut Street due to the recent opening of two large grocery stores nearby. While the project team did not have sufficient time to analyze the pedestrian and bicyclist crash data prior to the RSA, it was able to conduct a site observation at the end of the field activities.



Figure 1. Location of RSA 3.

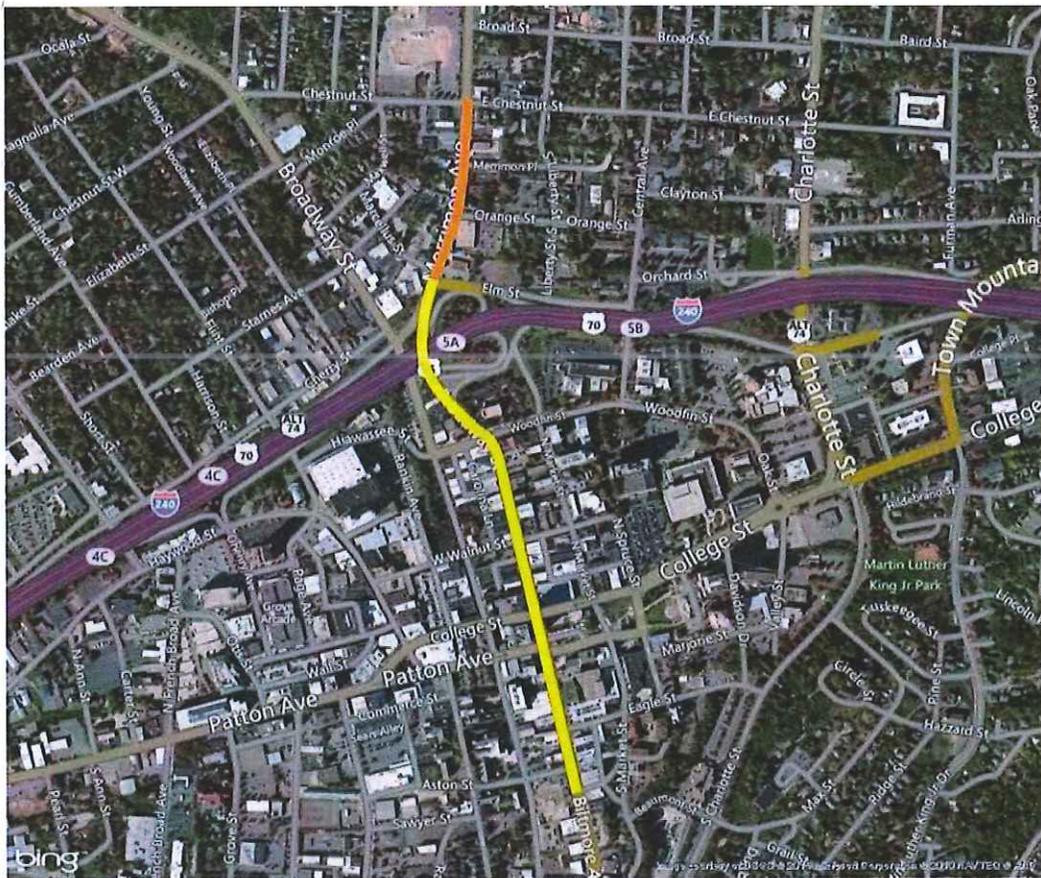


Figure 2. The original RSA corridor (yellow) and extended RSA corridor (orange).

Geometric Conditions and Multimodal Volume Summary

The study corridor comprised a 3,400-foot segment of US 25 that connects downtown Asheville to north Asheville and stretches from Sycamore Street to Marcellus Street. The popular downtown district is characterized by numerous shops and restaurants that draw many pedestrians and bicyclists. The corridor's cross section and characteristics change several times moving from north to south through the study area:

- North of Marcellus Street/the Interstate 240 (I-240) westbound ramps, US 25 is a four-lane undivided facility with no left-turn lanes.
- From Marcellus Street/the I-240 westbound ramps to the I-240 eastbound ramps, US 25 is a four-lane undivided roadway with left-turn lanes.
- From the I-240 eastbound ramps to Patton Avenue/Pack Square, US 25 is a two-lane facility with one lane in each direction and left-turn lanes at a few intersections.
- South of Patton Avenue/Pack Square, US 25 has two southbound lanes and a single northbound lane.
- North of Woodfin Street, the posted speed limit is 35 mph and on-street parking is prohibited; south of Woodfin Street, the posted speed limit is 20 mph and on-street parking is permitted on both sides of the street.

Vehicle Traffic

The 2014 annual average daily traffic (AADT) volume is 23,000 vehicles per day in the northern section of the corridor (between Marcellus Street and the I-240 ramps) and 9,500 vehicles per day between the I-240 ramps and Pack Square in downtown Asheville.

Pedestrian and Bicyclist Traffic

Pedestrian counts were conducted on two sections of US 25 on Tuesday, February 2, 2016. The 12-hour count began at 7:00 a.m. and ended at 7:00 p.m. The northern section (Section 1) was between Marcellus Street and the I-240 eastbound ramps. The southern section (Section 2) was between South Pack Square and Aston Street. It should be noted that pedestrian volumes are generally expected to be higher in the non-winter months when tourists come to the area to enjoy its many amenities.

Section 1

A total of 219 pedestrians were observed crossing US 25 (Merrimon Avenue) in Section 1. As shown in Figure 3, the majority of the pedestrian trips occurred north of the northbound entrance loop ramp to westbound I-240 and southbound entrance ramp to westbound I-240. Also, five bicyclists were observed during the 12-hour count.

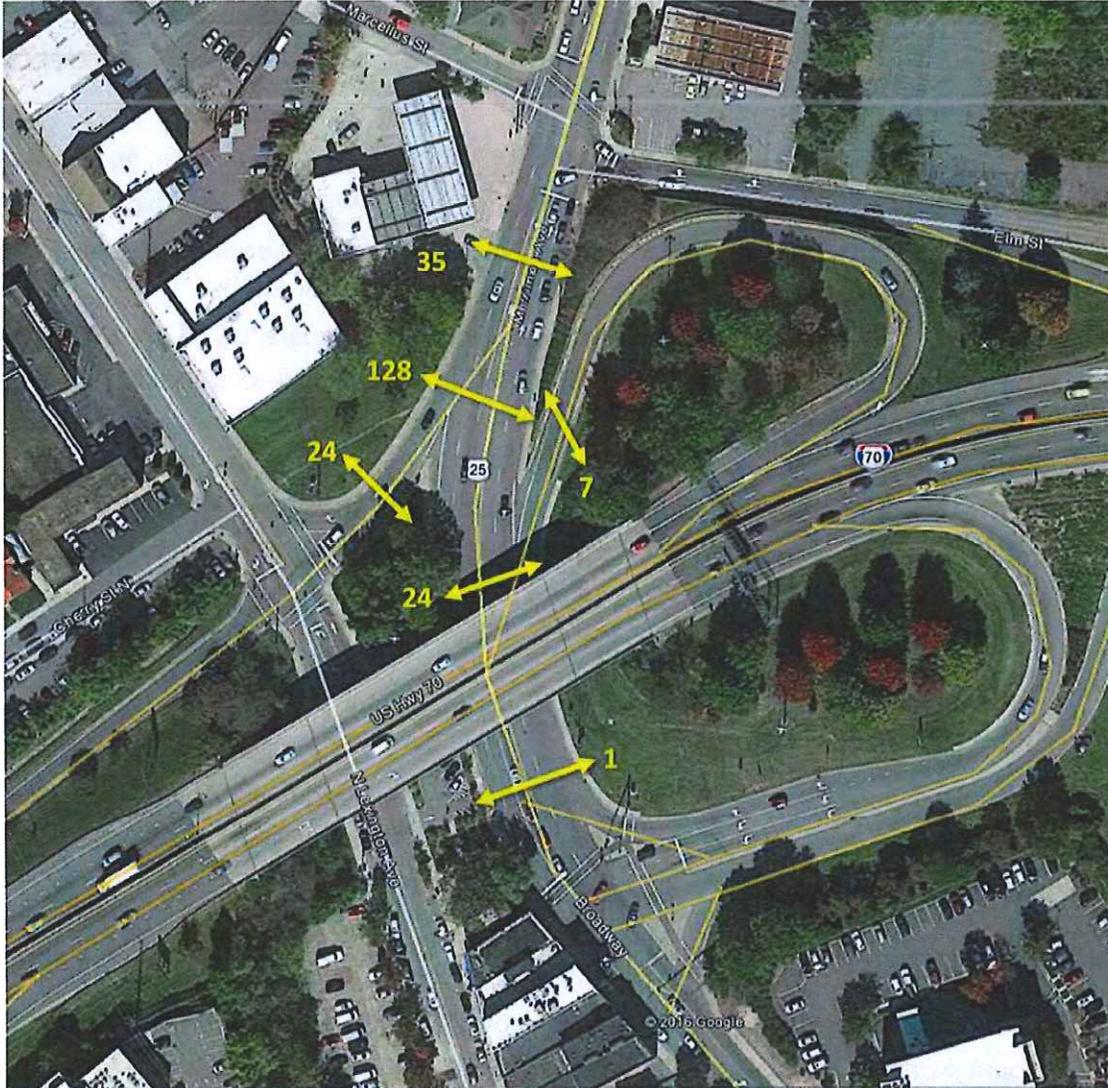


Figure 3. Number of pedestrian trips in Section 1 of the RSA study area (12-hour count).

Section 2

A total of 629 pedestrians were observed crossing the road in Section 2. As shown in Figure 4, pedestrians are not crossing at the crosswalks located at South Pack Square and Aston Street but are instead crossing at uncontrolled locations between South Pack Square and Eagle Street. Bicyclists were not observed crossing the street within this segment.

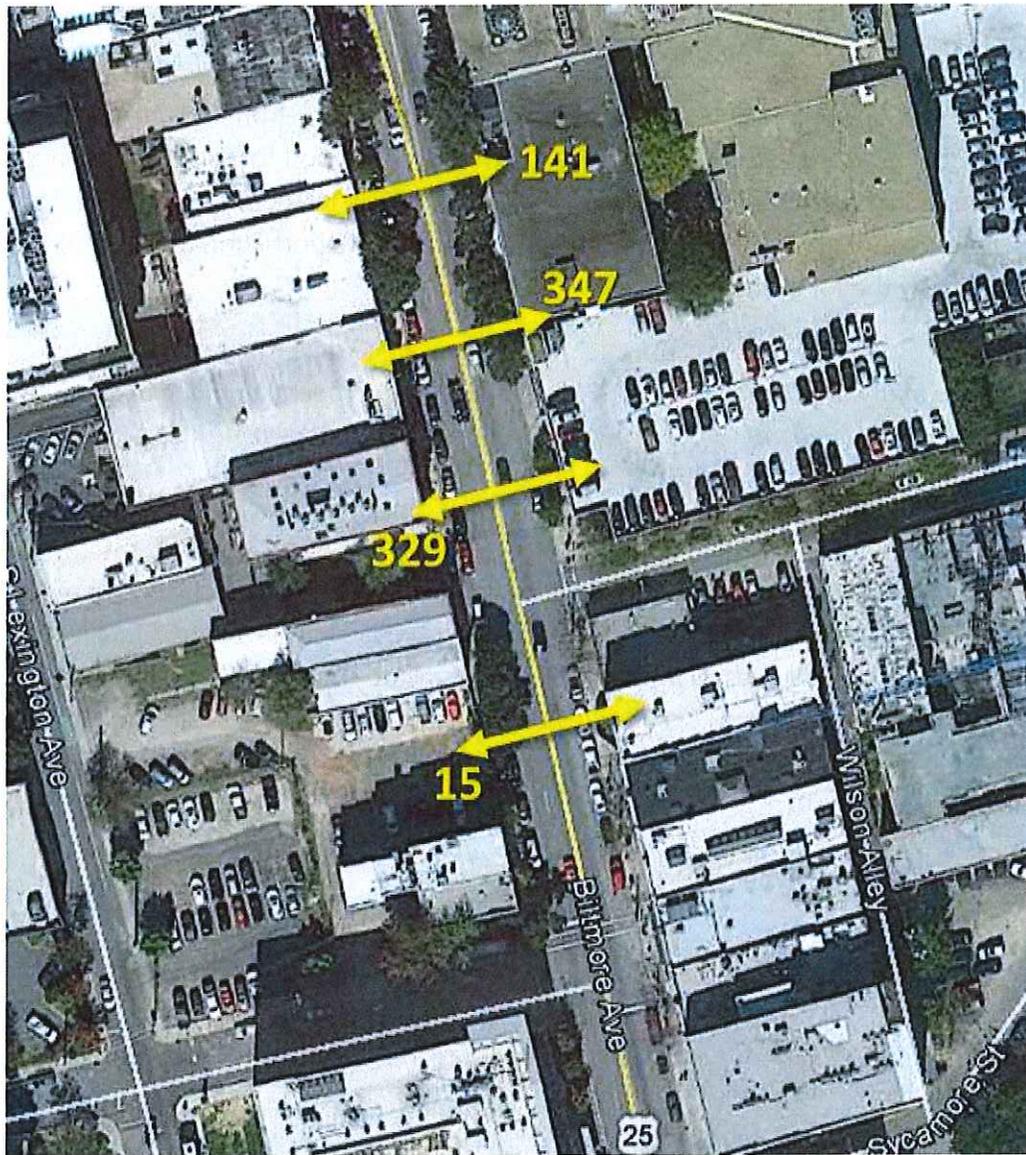


Figure 4. Number of pedestrian trips in Section 2 of the RSA study area (12-hour count).

Transit

The Asheville Redefines Transit (ART) transit system has 10 bus stops within the limits of the study area with an average of 258 boardings and alightings per weekday. Downtown Asheville generates a heavy amount of pedestrian activity because of the high density of available amenities within walking distance (e.g., restaurants, breweries, shops). Also, there is a Fare Free Zone in Downtown Asheville where users do not pay to ride the bus. The Fare Free Zone includes Broadway/Biltmore Avenue, which is in the RSA study area.

Crash History

The vehicle crash analysis period for this RSA spanned five years—from September 1, 2010 to August 31, 2015. The pedestrian and bicyclist crash analysis period for this RSA spanned 10 years—from January 1, 2005 to December 31, 2014. NCDOT’s Traffic Safety Systems Section provided the crash data. Note that the North Carolina Crash Report Form (DMV-349) defines crash severity by the following categories:

- Killed.
- A type injury (disabling).
- B type injury (evident).
- C type injury (possible).
- Property damage only.
- Unknown.

Pedestrian and Bicyclist Crash History

In the past 10 years (2005 – 2014), 27 pedestrian crashes and 10 bicycle crashes were reported within the study corridor (see Figure 5). These 37 reported crashes included 1 fatality, 1 A-injury, 18 B-injuries, and 17 C-injuries. Nineteen (19) of the crashes (51 percent) occurred while it was dark, and 9 crashes (24 percent) occurred when the road was wet. The fatality in 2007 occurred at night. Additional details relating to these crashes are contained in the RSA team packet provided in the Appendix.

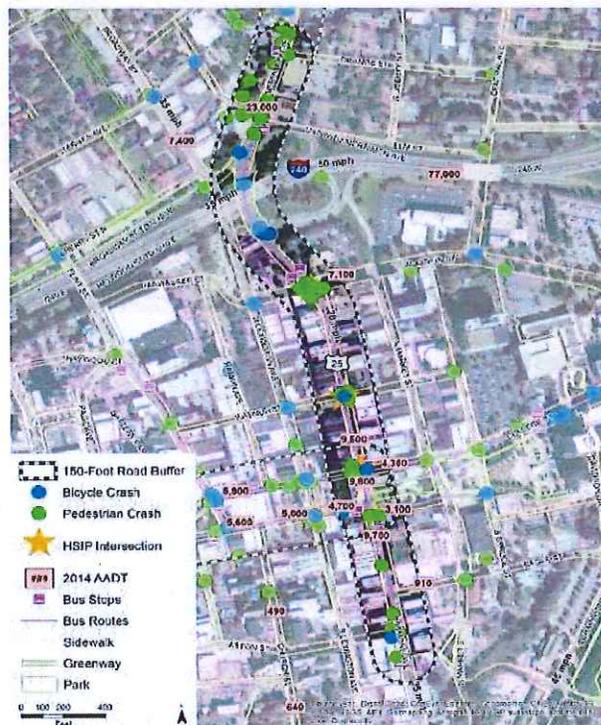


Figure 5. Location of pedestrian and bicyclist crashes on Patton Avenue West.

Vehicle Crash Summary

During the five-year analysis period, there were 237 reported vehicle crashes within the RSA study area. Crash data reveal that rear end crashes are the most common crash type at 32 percent of the total crashes, followed by angle crashes at 19 percent, and sideswipe (same direction) crashes at 14 percent. Table 1 shows the severity and crash type of all collisions in the five-year study period. Rear end and angle crashes account for 51 percent of the crashes.

Table 1. US 25 crash summary (Sept. 2010 – Aug. 2015).

Highest Injury Severity	Crash Type	Number of Crashes	Percent of Total
	Killed	0	0.0
	Class A (Disabling injury)	0	0.0
	Class B (Evident injury)	13	5.5
	Class C (Possible injury)	52	21.9
	Property Damage Only	172	72.6
	TOTAL	237	100.0
Crash Type			
	Rear end, slow or stop	75	31.6
	Angle	45	19.0
	Sideswipe, same direction	33	13.9
	Backing up	16	6.8
	Left turn, same roadway	11	4.6
	Pedestrian	11	4.6
	Rear end, turn	6	2.5
	Left turn, different roadways	5	2.1
	Other collision with vehicle	5	2.1
	Ran off road - right	5	2.1
	Head on	4	1.7
	Parked motor vehicle	4	1.7
	Right turn, different roadways	3	1.3
	Sideswipe, opposite direction	3	1.3
	Fixed object	2	0.8
	Other non-collision	2	0.8
	Overturn/rollover	2	0.8
	Ran off road - straight	2	0.8
	Pedalcyclist	1	0.4
	Ran off road – left	1	0.4
	Right turn, same roadway	1	0.4
	TOTAL	237	100.0

Figure 6 depicts the distribution of crashes along the study area by 1/100th of a mile (52.8 feet) beginning at MP 11.12 (just south of Sycamore Street) and ending at MP 11.84 (just north of Marcellus Street). The key intersections are labeled in Figure 6, where it is evident that crashes occur more frequently at intersections relative to the segments in between.

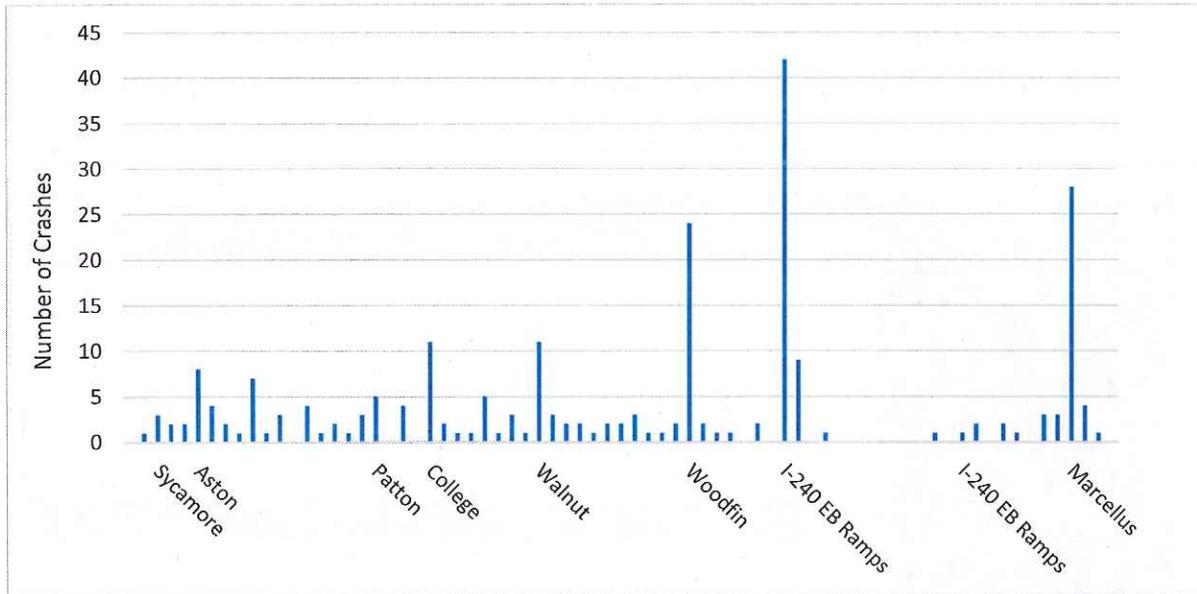


Figure 6. Histogram of vehicle crashes along US 25 (Sept. 2010 – Aug. 2015).

RSA Team

The success of a comprehensive RSA hinges on the strength of the team. The members of the RSA team were chosen to represent an array of transportation professionals. Each person offered a unique perspective based on their line of work and experience. Table 2 includes the names and contact information of the RSA team members.



RSA Team Members. (Not pictured: Officer Meg Pigman)

Table 2. RSA team members.

Name	Organization	Email Address
NCDOT Division Staff		
Steven Buchanan	NCDOT Division 14 Deputy Division Traffic Engineer	sbuchanan@ncdot.gov
NCDOT Regional Staff		
Tony Wyatt	NCDOT Central Regional Field Operations Engineer	adwyatt@ncdot.gov
NCDOT Signals Staff		
Zach Little	NCDOT – Signal Design Section	zmlittle@ncdot.gov
Tim Williams	NCDOT – Signal Design Section	tjwilliams@ncdot.gov
NCDOT Safety Staff		
Susie James	NCDOT – Traffic Safety Unit	sjjames@ncdot.gov
City Staff		
Debbie Smith	City of Charlotte – Engineering & Operations Assistant Division Manager	dsmith@ci.charlotte.nc.us
Asheville Police Department		
Meg Pigman	Asheville Police Department	mpigman@ashevillenc.gov
VHB		
Dan Nabors	VHB Senior Project Manager	dnabors@vhb.com
Jon Soika	VHB Senior Transportation Engineer	jsoika@vhb.com
Matt Albee	VHB Transportation Analyst	malbee@vhb.com

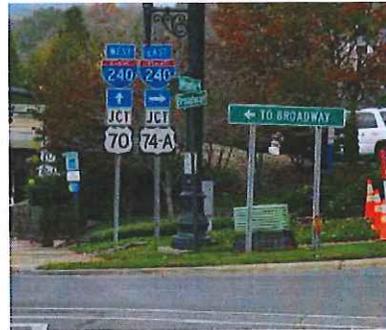
Assessment Findings

The team conducted the RSA on Wednesday, November 4, 2015 and Thursday, November 5, 2015. The team visited the corridor on three different occasions to observe road user behaviors and safety and operational conditions during the PM peak, nighttime, and the AM peak. The RSA team noted both positive features and potential safety concerns found throughout the study area; both are detailed in the following sections.

Positive Existing Features

Based on its review of existing site conditions, the RSA team identified the following positive characteristics of the roadway:

- **Sidewalks** were present along the entire study area.
- **Pedestrian signals** and **pushbuttons** are present at signalized intersections. Pedestrian signals enhance safety by providing a designated crossing time and alerting pedestrians to the appropriate time to cross.
- The **bus stops were well lit**. Since buses generate pedestrian activity, a well-lit bus stop is important to improve pedestrian visibility to all users.
- The **guide signs** along the corridor are useful for unfamiliar drivers. This was especially helpful near the I-240 ramps because the entrances and exits for I-240 are at different intersections.



Capacity Analysis – Woodfin/I-240 EB Ramps

Based on recommendations made by the RSA team, a set of traffic capacity analyses were conducted for the following alternatives:

- Alternative 1: Remove one westbound left-turn lane from the I-240 EB exit ramp.
- Alternative 2: Remove one southbound left-turn lane from US 25 at Woodfin Street.
- Alternative 3: Remove the northbound right-turn lane from US 25 at Woodfin Street and restripe the northbound through lane as a shared through/right-turn lane.
- Alternative 4: Remove one westbound left-turn lane from the I-240 EB ramps at US 25. Between the I-240 EB ramps and Woodfin Street, replace the inside southbound left-turn lane with a second northbound through lane from US 25. Remove the northbound right-turn lane along US 25 at Woodfin Street, and restripe the northbound approach as one shared through/left-turn lane and one shared through/right-turn lane.

The analyses were performed using *Synchro/SimTraffic Professional, Version 9* under existing AM, midday and PM peak hour conditions to determine the impacts of implementing each alternative. Figure 7 summarizes the peak hour volumes counted at these two intersections.

Alternative 1

As reported in Table 3, the removal of one westbound left-turn lane from the intersection of US 25 and the I-240 EB ramps does not significantly increase the overall delay for the intersection or the delay for the westbound approach. The westbound queue does increase, the queue length does not exceed the 550 feet of available storage along the ramp. A trade-off of this improvement is that it does increase potential for spillback onto I-240 as traffic volumes and congestion increase over time, which can potentially result in increased high speed rear end collisions. NCDOT should carefully weigh the trade-offs between reduced pedestrian crossing exposure to increased delay and queuing on the ramp itself.

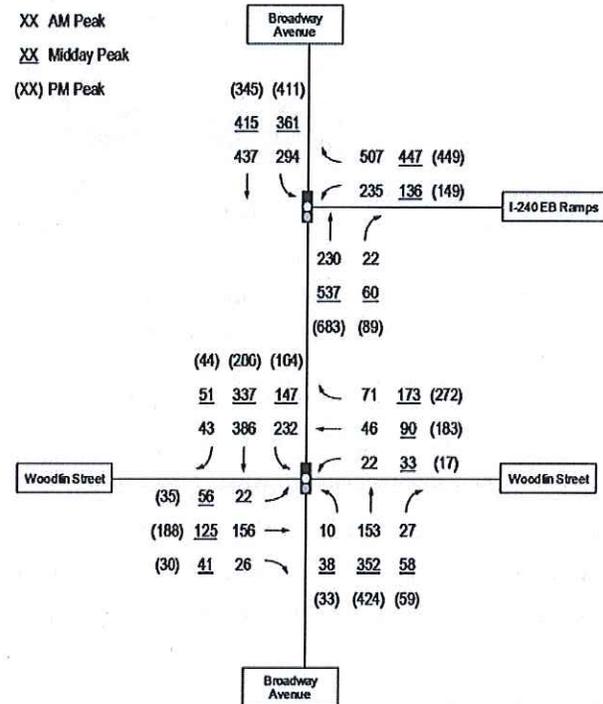


Figure 7. I-240 EB Ramps and Woodfin Street Peak Hour Intersection Volumes

Table 3. Alternative 1 level of service results summary.

Intersection and Approach	Existing (2015)			Existing (2015) Alternative 1		
	AM	MID	PM	AM	MID	PM
US 25 and I-240 EB ramps	B (11.8)	B (17.0)	D (46.3)	B (13.1)	B (18.6)	D (47.1)
Westbound	B-18.0-90'	B-17.4-61'	C-21.9-66'	B-17.6-190'	B-17.5-129'	C-22.1-140'

Legend: **X** - Overall signalized intersection LOS; **(XX)** - Overall signalized intersection delay in sec/veh
(X-XX-XX') - Approach LOS, delay in seconds, 95th percentile *Synchro* queue

Alternative 2

As reported in Table 4, the removal of one southbound left-turn lane from the intersection of US 25 and Woodfin Street does not significantly increase the overall delay for the intersection and marginally improves delay for the southbound approach. Although the southbound queue increases, the queue length does not exceed the available storage along US 25.

Table 4. Alternative 2 level of service results summary.

Intersection and Approach	Existing (2015)			Existing (2015) Alternative 2		
	AM	MID	PM	AM	MID	PM
US 25 and Woodfin Street	B (19.5)	B (18.5)	C (21.7)	B (19.9)	B (19.4)	C (22.8)
Southbound	B-16.0-114'	B-14.4-73'	B-17.7-62'	B-15.5-195'	B-14.3-108'	B-17.1-122'

Legend: **X** - Overall signalized intersection LOS; **(XX)** – Overall signalized intersection delay in sec/veh
(X-XX-XX') – Approach LOS, delay in seconds, 95th percentile *Synchro* queue

An additional test was conducted with the phasing for the southbound left-turn changing from protected-only phasing to permitted/protected left-turn lane phasing with a flashing yellow arrow during the permitted phase. As shown in Table 5, the level of service and delay for the intersection and southbound approach improved during every peak hour. The southbound queue was also reduced or remained the same. Due to the minimal increase in delay and queuing, the removal of the second southbound left-turn lane at this intersection is feasible. The team recommends NCDOT considers updating the phasing to flashing yellow arrow permitted and protected phasing.

Table 5. Alternative 2 (flashing yellow arrow phasing) level of service results summary.

Intersection and Approach	Existing (2015)			Existing (2015) Alternative 2		
	AM	MID	PM	AM	MID	PM
US 25 and Woodfin Street	B (19.5)	B (18.5)	C (21.7)	B (12.7)	B (14.9)	B (18.8)
Southbound	B-16.0-114'	B-14.4-73'	B-17.7-62'	A-3.6-34'	A-5.0-54'	A-7.4-62'

Legend: **X** - Overall signalized intersection LOS; **(XX)** – Overall signalized intersection delay in sec/veh
(X-XX-XX') – Approach LOS, delay in seconds, 95th percentile *Synchro* queue

Alternative 3

As reported in Table 6, the removal of the northbound right-turn lane from the intersection of US 25 and Woodfin Street and restriping the northbound through lane to a shared through/right-turn lane does not significantly increase the overall delay for the intersection or the delay for the northbound approach. Although the northbound queue does increase, the queue length does not exceed the available storage along US 25. Due to the minimal increase in delay and queuing, the removal of the northbound right-turn lane at this intersection is feasible.

Table 6. Alternative 3 level of service results summary.

Intersection and Approach	Existing (2015)			Existing (2015) Alternative 3		
	AM	MID	PM	AM	MID	PM
US 25 and Woodfin Street	B (19.5)	B (18.5)	C (21.7)	B (19.7)	B (19.1)	C (23.0)
Northbound	B-10.1-90'	B-12.4-218'	C-20.6-286'	B-11.4-101'	B-14.9-258'	C-25.8-326'

Legend: **X** - Overall signalized intersection LOS; **(XX)** – Overall signalized intersection delay in sec/veh (X-XX-XX') – Approach LOS, delay in seconds, 95th percentile *Synchro* queue

Alternative 4

As reported in Table 7, alternative 4 significantly reduces the northbound delay along US 25. In addition, the northbound queue at US 25 and the I-240 EB ramps is dramatically reduced. Due to the overall improvement in operations along US 25, it is recommended that NCDOT consider the implementation of alternative 4.

Table 7. Alternative 4 level of service results summary.

Intersection and Approach	Existing (2015)			Existing (2015) Alternative 4		
	AM	MID	PM	AM	MID	PM
US 25 and I-240 EB ramps	B (11.8)	B (17.0)	D (46.3)	B (12.6)	B (12.5)	B (15.9)
Eastbound	-	-	-	-	-	-
Westbound	B-18.0-90'	B-17.4-61'	C-21.9-66'	B-17.5-189'	B-16.9-125'	B-17.4-136'
Northbound	B-11.5-195'	C-25.7-546'	F-88.6-771'	B-12.3-95'	B-15.3-232'	B-18.2-304'
Southbound	A-5.7-80'	A-10.0-63'	C-22.4-52'	A-7.7-88'	A-7.0-68'	B-12.4-55'
US 25 and Woodfin St.	B (19.5)	B (18.5)	C (21.7)	B (13.5)	B (14.9)	B (16.8)
Eastbound	D-38.0-90'	C-34.6-90'	C-32.2-97'	D-38.0-90'	C-34.3-89'	C-32.1-97'
Westbound	C-22.2-78'	C-23.2-120'	C-21.4-169'	C-22.2-78'	C-23.1-120'	C-21.1-169'
Northbound	B-10.1-90'	B-12.4-218'	C-20.6-286'	B-10.7-55'	B-11.1-118'	B-14.5-159'
Southbound	B-16.1-144'	B-14.4-73'	B-17.7-62'	A-5.0-54'	A-5.5-50'	A-7.3-64'

Legend: **X** - Overall signalized intersection LOS; **(XX)** – Overall signalized intersection delay in sec/veh (X-XX-XX') – Approach LOS, delay in seconds, 95th percentile *Synchro* queue

Capacity Analysis – Eagle Street/Aston Street

A single southbound lane exists south of the I-240 ramps, however a second southbound through lane begins at S Pack Square and continues south to I-40. Due to the pedestrian activity immediately south of S Pack Square, the RSA Team believed that if the extra southbound lane was not needed for capacity, then the space could be repurposed to a two-way left-turn lane, hatched out median, or raised median. The RSA team also suggested adding a mid-block crosswalk between the signalized Patton Avenue and Aston Street intersections. By removing

the second through lane, space would be gained for a raised refuge island in the center lane to help calm traffic and improve driver awareness of crossing pedestrians.

To test whether the second southbound lane could be removed, new intersection counts were conducted at the Pack Square deck driveway, Eagle Street and Aston Street intersections. Operations were then compared between a two southbound lanes with one northbound lane cross-section versus a traditional three-lane cross-section with a center left-turn lane. Figure 8 illustrates the peak hour volumes and lane configurations tested as part of this capacity analysis. The traffic capacity analysis was performed using *Synchro/SimTraffic Professional, Version 9* under existing AM, Middy, and PM peak hour conditions.

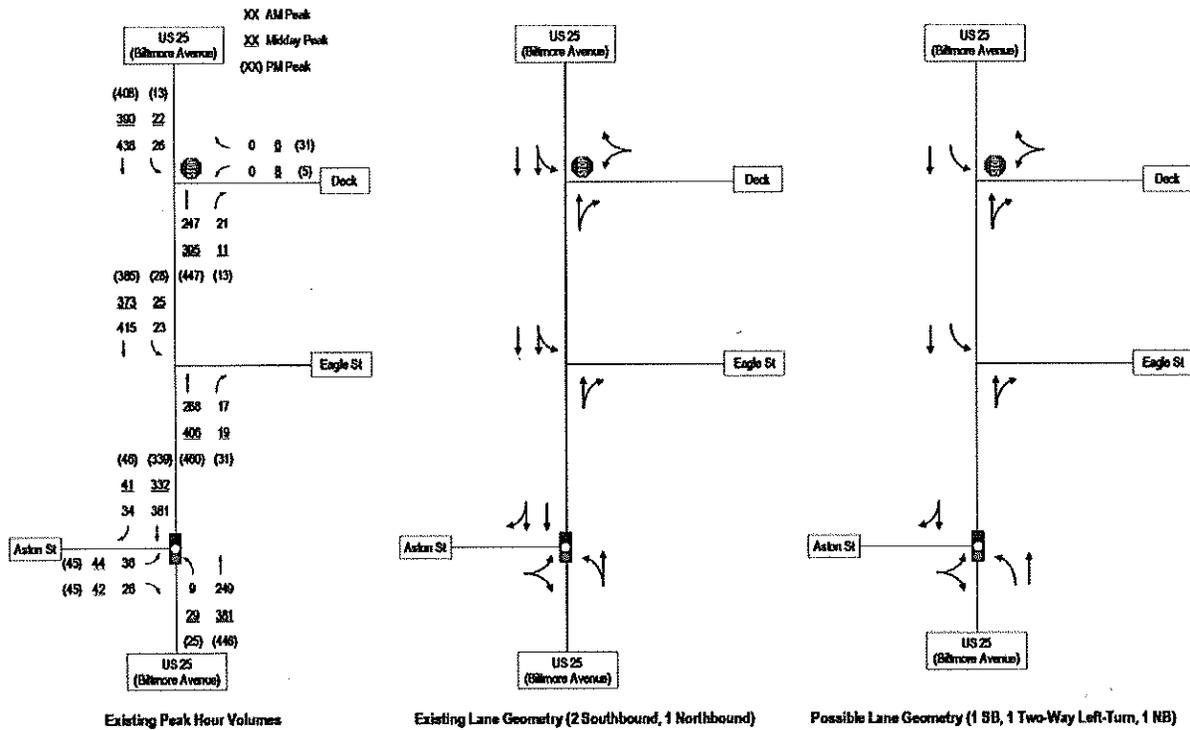


Figure 8. Aston/Eagle/Deck Volumes and Geometry

As shown in Table 8, removing the southbound lane has a fairly minor impact on the delay experienced at each intersection. Although the southbound queue at US 25 and Aston Street increases by approximately 60 feet across each peak period, the impact to the operations along US 25 are minimal as the queue length does not exceed the available storage along US 25. It should be noted that the results are based on existing conditions. If volumes were forecast to grow substantially in the future, then a lane reduction may have a greater negative impact. As a result, a potential lane reconfiguration should be studied in greater detail prior to any lane removal.

Table 8. Alternative 1 level of service results summary.

Intersection and Approach	Existing (2015)			Existing (2015) Alternative 1		
	AM	MID	PM	AM	MID	PM
US 25 and Deck Entrance	-	-	-	-	-	-
Westbound	A-0.0-0'	B-13.3-2.5'	B-12.5-5'	A-0.0-0'	C-15.0-2.5'	B-12.9-7.5'
Northbound	A-0.0-0'	A-0.0-0'	A-0.0-0'	A-0.0-0'	A-0.0-0'	A-0.0-0'
Southbound	A-7.9-2.5'	A-8.3-2.5'	A-8.5-0'	A-7.9-2.5'	A-8.3-2.5'	A-8.5-0'
US 25 and Eagle Street	-	-	-	-	-	-
Northbound	A-0.0-0'	A-0.0-0'	A-0.0-0'	A-0.0-0'	A-0.0-0'	A-0.0-0'
Southbound	A-0.2-2'	A-0.2-2'	A-0.3-2'	A-8.0-2'	A-8.4-2'	A-8.7-2'
US 25 and Aston Street	A (4.4)	A (5.6)	A (5.8)	A (5.0)	A (6.0)	A (6.1)
Eastbound	B-16.2-41'	B-15.2-48'	B-15.0-49'	B-16.2-41'	B-15.2-48'	B-15.0-49'
Northbound	A-3.7-66'	A-5.4-119'	A-5.8-144'	A-3.6-63'	A-5.0-106'	A-5.4-131'
Southbound	A-3.0-44'	A-3.6-42'	A-3.6-43'	A-4.2-110'	A-4.9-102'	A-5.0-106'

Legend: **X** - Overall signalized intersection LOS; **(XX)** - Overall signalized intersection delay in sec/veh (X-XX-XX') - Approach LOS, delay in seconds, 95th percentile *Synchro* queue

Identified Safety Issues and Suggestions for Improvement

Upon completing the data analyses and field observations, the RSA team identified a number of overarching safety issues and related suggestions that are summarized in Table 9. When considering the suggested actions, it is important to note that US 25 is a historic route, so major changes could be difficult to implement. Also, the City of Asheville is planning on implementing signal upgrades in April 2017.

For each issue identified, the team proposed one or more countermeasures or mitigating actions to address it, which is also included in Table 9. The suggestions have been categorized as near-term, intermediate, and long-term. Near-term improvements can typically be implemented through maintenance forces, while intermediate and long-term improvements often require additional planning, design, and funding.

Table 9. Noted overarching safety issues and suggestions for improvement.

1. General Observations	
Issue Description	Suggested Action
<ul style="list-style-type: none"> • Pedestrian midblock and uncontrolled crossings throughout the study area 	<p>Near Term</p> <ul style="list-style-type: none"> • Conduct regular maintenance of sidewalks and signs, including trimming vegetation that is obscuring them

<ul style="list-style-type: none"> • Pedestrians trying to cross midblock or at an intersection against a signal, then retreating after seeing turning vehicles • Signs <ul style="list-style-type: none"> - Retroreflectivity is fading - Visibility and placement could be improved • Bicycle racks are scattered and inconsistent • Some sidewalks are in poor condition, which includes fixed objects in the sidewalk and cracks and uneven surfaces throughout 	<ul style="list-style-type: none"> • Apply consistent pavement markings to call attention to beginning of the on-street parking spaces adjacent to the intersections within the study area
<ul style="list-style-type: none"> • Education and enforcement to address culture of drivers and pedestrians who are non-compliant with traffic laws. • Drivers are not adjusting their behavior after exiting the interstate for the urban environment (i.e., lower speed limits and heavy pedestrian activity) • There are no consistent markings to designate the beginning of the on-street parking at the intersections 	<div data-bbox="954 373 1292 625" data-label="Image"> </div> <p data-bbox="850 636 1398 695"><i>Example of pavement markings applied at beginning and ending of on-street parking spaces at intersections</i></p> <p data-bbox="850 747 1146 779">Intermediate/Long Term</p> <ul style="list-style-type: none"> • Install midblock crossings with supporting design elements where defined pedestrian desire lines exist and where feasible • Use signage, branding, and pavement markings to encourage drivers to adjust driving behavior to the urban environment • Position bicycle racks such that they do not obstruct pedestrian facilities

2. Intersection of US 25/Marcellus Street/I-240 westbound exit ramp	
Issue Description	Suggested Action
<ul style="list-style-type: none"> • Shrubs limit sight distance for westbound right-turning vehicles • Vegetation on sidewalk on northeast corner and north of intersection on east side of US 25 	<p data-bbox="850 1236 980 1264">Near Term</p> <ul style="list-style-type: none"> • Trim, replant, or remove vegetation <div data-bbox="938 1304 1308 1650" data-label="Image"> </div>
<ul style="list-style-type: none"> • Pedestrians are using crosswalk but not using push buttons • Midblock crossings in the surrounding area 	<p data-bbox="850 1656 980 1684">Near Term</p> <ul style="list-style-type: none"> • Install push buttons that are appropriately located (e.g., the pushbutton in the northeast quadrant for crossing the I-240 WB exit ramp is far from the curb ramp) so that pedestrians are more inclined to use them



Pedestrians crossing against the signal and midblock

- Vehicles on both minor approaches block the crosswalk



Pedestrian crossing travel lanes without a designated crosswalk and vehicles blocking crosswalk

- Police found that 85% of violations were from westbound right-turning vehicles not yielding to pedestrians
- East leg is coming off I-240 so drivers have not adjusted their behavior (e.g., higher speeds, not yielding to pedestrians) after entering the urban environment

- Geometry
 - Skewed crosswalk leads to longer pedestrian exposure
 - Sight distance limited from Marcellus & Elm St./I-240 WB exit ramp

- Implement a more simple, consistent sign (e.g., R10-3) for push buttons



Push Button for Walk Signal (R10-3) sign

- Install a ground-mounted "Turning Vehicles Yield to Pedestrians" (R10-15) sign for right turns from the I-240 WB ramp



Turning Vehicles Yield to Pedestrians (R10-15) sign

Intermediate

- Consider installing "Pedestrians in Crosswalk" or other blank-out sign activated by pedestrian push buttons; the City of Charlotte has installed these at several locations having high pedestrian volumes
- Increase distance between crosswalk and stop bar for the I-240 WB exit ramp

Long Term

- With redevelopment, better define Shell station sidewalk and driveway

<ul style="list-style-type: none"> - Shell station lacks definition of driveway/curb/sidewalk 	
<ul style="list-style-type: none"> • Operations <ul style="list-style-type: none"> - Vehicles using gas station/restaurant on northeast corner as a cut through to bypass the intersection - Difficult finding gap for northbound left-turning vehicles - Westbound vehicles turning left are stacking through the intersection during high-volume periods  <p style="text-align: center;"><i>Vehicle stacking turning left from WB I-240 exit ramp onto SB US 25</i></p>	<p>Near Term</p> <ul style="list-style-type: none"> • Evaluate signal timing <p>Intermediate</p> <ul style="list-style-type: none"> • Consider flashing yellow arrow signal and protected phase for northbound left-turn movement <p>Long Term</p> <ul style="list-style-type: none"> • In NE quadrant, close driveway access points along Elm Street/I-240 WB exit ramp to eliminate cut-through maneuvers • Consider adding a lane to the westbound approach to allow dual left turns and shorten the queue on the ramp
<ul style="list-style-type: none"> • Continuity and Connectivity of Pedestrian Network <ul style="list-style-type: none"> - Short pedestrian crossing time (especially on east leg) ends well before parallel vehicle green phase, which results in frequent pedestrian crossings during "don't walk" phase - Multiple pedestrians were observed crossing south leg there being no designated crosswalk there - Lack of ADA-compliant ramps on southwest corner 	<p>Near Term</p> <ul style="list-style-type: none"> • Extend the walk interval on east leg <p>Intermediate/Long Term</p> <ul style="list-style-type: none"> • Install ADA-compliant ramps on southwest corner • Consider installing crosswalk on south leg

3. Intersection of US 25/I-240 westbound entrance ramps	
Issue Description	Suggested Action
<ul style="list-style-type: none"> • Southbound left-turn queue at I-240 EB ramp backs up beyond southbound "slip lane" to I-240 WB ramp • Pedestrian facilities on the east side of US 25 are discontinuous across the ramp, where curb 	<p>Near Term/Intermediate</p> <ul style="list-style-type: none"> • Adjust manhole cover as necessary to create a flush surface • Consider the following <u>combination</u> of improvements on the <u>east</u> side of US 25:

ramps are present but there are no signing or pavement markings to identify a pedestrian crossing

- Limited sight distance northbound on US 25 for drivers to see pedestrians crossing ramp because of bridge pillars



SB - The sidewalk ends, leaving pedestrians stranded

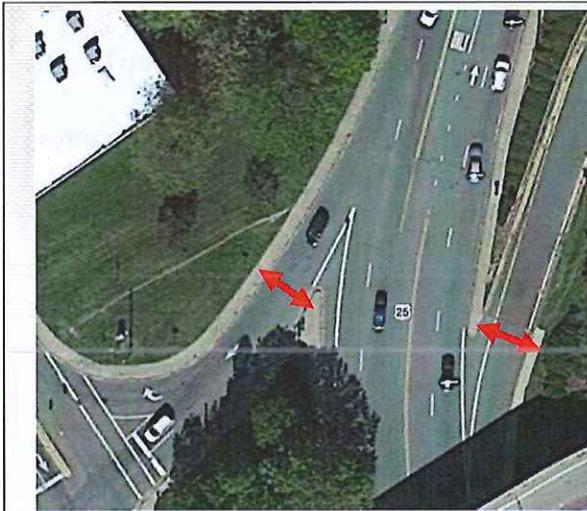
- Pedestrian facilities are also discontinuous on the west side of US 25; instead of walking southwest 115 ft to the signalized crosswalk at Broadway, pedestrians routinely cross the slip lane at the "V," where there are no crosswalk, curb ramps, or signing



NB - The sidewalk ends, leaving pedestrians to cross at their own risk. This particular pedestrian was pushing a stroller and lived close to the intersection. She complained about not feeling safe when crossing the street.

- Observed northbound vehicles on US 25 making illegal left turn onto Broadway through double yellow lines
- Manhole cover recessed, which could cause bicyclists to lose control

- Install a high-visibility marked crosswalk across the I-240 WB entrance loop between the existing curb ramps
- Install yield line pavement markings across the ramp in advance of the crosswalk
- Install Pedestrian Crossing (W11-2) warning signs and rectangular rapid-flashing beacons (RRFBs) at the crosswalk to increase driver awareness; fluorescent yellow-green sheeting for the signs is preferred
- Consider review of pavement markings to accentuate sightlines between drivers and the pedestrian crossing location. Shifting oncoming drivers even a few feet further from the curb should improve sightlines between northbound drivers and the pedestrian crossing and signing
- Ensure adequate lighting is provided at the crossing
- Consider the following combination of improvements at the sidewalk "V" on the west side of US 25:
 - Install ADA-compliant curb ramps and a high-visibility marked crosswalk across the slip lane to the I-240 WB entrance ramp
 - Install yield line pavement markings across the slip lane in advance of the crosswalk
 - Install Pedestrian Crossing (W11-2) warning signs on either side of the crosswalk to increase driver awareness
 - Ensure adequate lighting is provided at the crossing
- Improve channelization to prevent illegal northbound left-turns from US 25 onto the southbound slip lane



The red arrows indicate the approximate locations at which pedestrian crosswalks and supplemental devices may be considered, although sight distance needs to be verified; at left is the SB slip lane (left), and at right is the I-240 WB entrance loop



Vehicles queued to make southbound left onto I-240 E



Bridge pillars obstructing visibility of pedestrians crossing the street

4. Intersection of US 25/I-240 eastbound ramps

Issue Description

- Absence of yield line pavement markings at the westbound channelized right-turn lane
- Improper application of In-Street Pedestrian Crossing (R1-6) sign, which "shall not be post-mounted on the left-hand or right-hand side of the roadway"

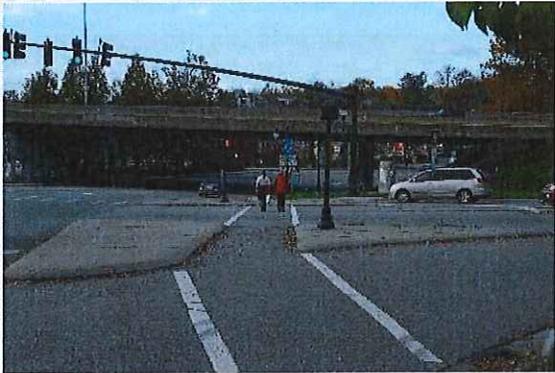
Suggested Action

Near Term

- Install yield pavement markings at the westbound right-turn lane
- Remove In-Street Pedestrian Crossing sign
- Trim or relocate vegetation that is blocking current light fixtures
- Install "Reduce Speed Ahead" sign for vehicles driving southbound toward downtown; supplemental red/orange flags and/or pavement markings could also be considered
- Add 20 mph speed limit sign in location where the speed limit changes from 35 mph to 20 mph



- Five (5) collisions between southbound, left-turning vehicles and northbound bicyclists out of the 10 bicycle crashes in the RSA study area (2005-2014); this is possible because southbound left turns operate under permissive phasing

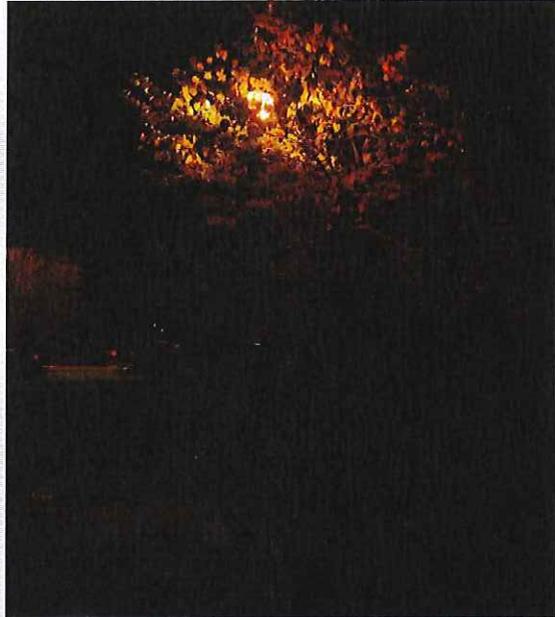


- Insufficient lighting of the pedestrian crossings
- Absence of 20 mph speed limit sign southbound before entering downtown
- Existing retaining wall and vegetation limit sight distance for NB drivers approaching the right turn onto I-240 EB ramp, which is a yield-controlled movement

- If it is structurally suitable, consider installing a "Turning Vehicles Yield to Pedestrians" (R10-15) sign on the existing mast arm for right turns from northbound US 25 onto the I-240 EB ramps to increase awareness of potential pedestrian crossings at that location

Intermediate

- Consider installing flashing yellow arrow signal, which could provide a red indication for the southbound left-turn lane when pedestrians utilize the push button
- Consider adding lighting where needed within the intersection



Vegetation obscuring light fixture at SE corner of US 25/ I-240 EB ramps

Long Term

- Consider reconfiguring the westbound approach and restriping the northbound approach to include a second through lane. With these improvements in place, pedestrian crossing exposure is reduced on the east side of the intersection and level of service is improved from LOS D to LOS B in the PM peak with substantially reduced northbound queuing.
- To improve sightlines between NB right-turning drivers and pedestrians, consider one of the following:



Looking south at crosswalk across NB right-turn onto I-240 EB ramp; existing retaining wall limits sight distance

- If trucks and larger vehicles can be accommodated, consider reconstructing the southeast corner with a smaller radius for the northbound right-turn onto the I-240 EB ramp, which would move the curb ramp further from the retaining wall, as well as slow right-turning vehicles
- Reconstruct the retaining wall further from US 25 to improve sightlines between NB motorists and pedestrians crossing the I-240 EB ramps; additional right-of-way would likely be required, so perhaps this could be considered in conjunction with any future redevelopment of this parcel

5. Intersection of US 25/Woodfin Street

Issue Description

- Under current lane configuration, southbound through lane has to shift one lane to the left within the intersection because of on-street parking that begins at the far side without warning



- Pedestrians were observed crossing midblock and in front of the bus after off-loading on the north leg of intersection

Suggested Action

Near Term

- Consider using striping (i.e., mini-skip pavement markings) to improve positive guidance for the southbound through movement
- Consider disseminating an audible message on local buses to encourage pedestrians to cross the road behind the bus and at a crosswalk after alighting the bus
- Relocate push button post and pedestal on the southeast corner to make them accessible to persons with mobility restrictions

Intermediate/Long-Term

- Based on the RSA observations and subsequent capacity analyses, the team recommends that NCDOT consider reconfiguring some of the through and right-turn lanes to shorten pedestrian crossing distances.
- Consider converting the northbound left-turn lane and southbound inside left-turn to a second northbound through lane via restriping. With these improvements in place, pedestrian crossing exposure is reduced on



- Because the east leg's stop bar and crosswalk are located far from the intersection, right-turning vehicles consistently drive past the stop bar and crosswalk in order to gain better sight distance
- Push buttons on the southeast corner are not in an accessible location for pedestrians with mobility restrictions
- Crosswalk on south leg is not straight, which pedestrians with limited vision could find difficult to cross



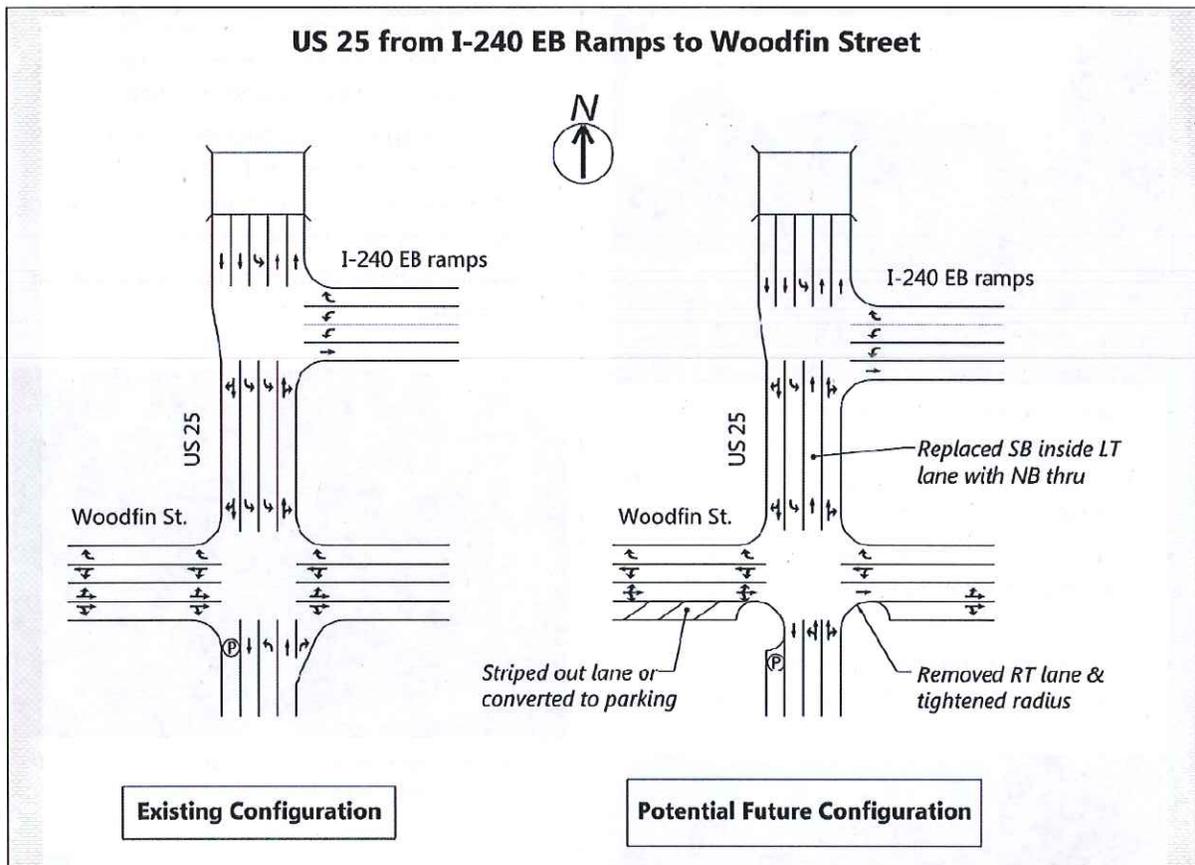
- Multiple drivers were observed to treat the northbound right-turn lane like a free-flow turn, as they failed to stop when their signal indication was red
- Intersection was not adequately lit during the night observation
- The crosswalk on the west leg is long and skewed

three intersection approaches and the intersection delay and queueing is reduced during all three peak periods studied.

- At the WB approach: consider installing "Stop Here on Red," "No Right Turn on Red," 5-section signal head with right-turn overlap, or "No Turn on Red" blank-out sign
- Improve lighting at intersection, especially at crosswalks



Westbound vehicle making a right-turn driving past the stop bar and crosswalk on a red light

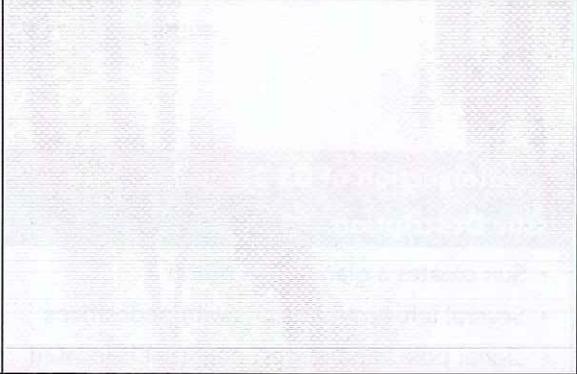


6. Midblock Crosswalk between Woodfin Street and Walnut Street

Issue Description	Suggested Action
<ul style="list-style-type: none"> Crosswalk is faded and difficult for drivers to see  <ul style="list-style-type: none"> Many motorists are not yielding to pedestrians Crossing was dark during night observations Cars parked adjacent to bulb-out obstructed sightlines between drivers and pedestrians 	<p>Near Term</p> <ul style="list-style-type: none"> Consider installing in-street yield to pedestrians sign and pedestrian warning sign on bulb-out Install high-visibility crosswalk Install yield line pavement markings in advance of the crosswalk Eliminate at least one parking space on each approach to the crossing and any unnecessary clutter on curb extension to increase sightlines between drivers and pedestrians; consider putting bicycle parking in that space instead

	<p>Intermediate/Long Term</p> <ul style="list-style-type: none"> • Install overhead pedestrian warning signage, possibly with a flashing beacon • Install lighting
<p>7. Intersection of US 25/Walnut Street</p>	
<p>Issue Description</p>	<p>Suggested Action</p>
<ul style="list-style-type: none"> • Sun creates a glare in afternoon • Several left-turn collisions with pedestrians • Signal pole in northwest quadrant is located within the street with no protection or visual cue 	<p>Near Term</p> <ul style="list-style-type: none"> • Consider incorporating a leading pedestrian interval to mitigate the left-turn collisions • To combat the sun glare, consider installing backplates with retroreflective borders to the signal heads <p>Intermediate</p> <ul style="list-style-type: none"> • Consider constructing a bulb-out according to original signal plans such that existing signal pole is located behind curb and not within street

<p>8. Intersection of US 25/College Street</p>	
<p>Issue Description</p>	<p>Suggested Action</p>
<ul style="list-style-type: none"> • Positive: three-second leading pedestrian interval • Northbound left-turn queueing is an issue because of the close proximity to the intersection of Patton/Pack Square • A positive feature is the post-mounted "No Right Turn" sign for northbound drivers, but there is no signing alerting drivers that southbound left turns are prohibited • Pedestrian signal pole is unstable and will sway at the touch 	<p>Near Term</p> <ul style="list-style-type: none"> • If it is structurally suitable, install "No Right Turn" sign on mast arm of northbound approach • If it is structurally suitable, install "No Left Turn" sign on mast arm of southbound approach • Stabilize pedestrian signal pole



9. Intersection of US 25/Patton Avenue/Pack Square

Issue Description | **Suggested Action**

- Queues forming from eastbound left turns because of close proximity to College Street intersection



- Short pedestrian walk time across east leg is resulting in pedestrians frequently crossing on "don't walk" phase because parallel vehicular phase is still green
- Lane configuration changes south of College Street
- Conflicts with eastbound left-turns and pedestrians

Near Term

- Extend walk interval to align more closely with parallel green interval
- If acceptable in terms of maintaining the aesthetics associated with the Vance Memorial, consider mounting a Turning Vehicles Yield to Pedestrians (R10-15) sign to the signal pole on the east side of US 25 near the monument
- Consider removing the two parking spaces at the southwest corner of S. Pack Square/US 25 and install a bulb-out to decrease the pedestrian crossing distance

Intermediate

- Consider prohibiting eastbound left turns (as designated on the signal plan) and directing vehicles desiring to go north on US 25 to proceed straight through the intersection and make a U-turn beyond the monument on N. Pack Square, then turn right onto northbound US 25

10. US 25 segment between Patton Avenue / Pack Square and Aston Street

Issue Description

- The many shops and restaurants and the numerous parking accommodations via on-street and deck parking generate many pedestrians in this segment. Over 800 pedestrians were counted crossing from 6 AM – 7 PM at midblock locations between the signalized crosswalks at S. Pack Square and Aston Street, which are separated by 600 ft. The majority of crossings were made at sporadic locations between the crosswalks, many originating between parked cars.



General vicinity of a potential marked crosswalk (north or south of deck driveway appear to be viable options)

Suggested Action

Intermediate

To better accommodate pedestrian crossings and raise driver expectation for those crossings, consider the following:

- Install crosswalk in the vicinity of the Pack Square Parking Deck that comprises the following at a minimum:
 - High-visibility crosswalk pavement markings
 - Pedestrian Crossing (W11-2) warning signs
 - Eliminate parking spaces adjacent to crosswalk

Long Term

- Consider reconfiguring pavement to reduce pedestrian exposure within this segment

11. Intersection of US 25/Aston Street

Issue Description

- Crosswalk does not align with curb ramp on north leg



- No crosswalk on south leg



- Short pedestrian walk time on minor streets, resulting in pedestrians crossing on "don't walk" phase because parallel vehicle phase is still green

Suggested Action

Near Term

- Remove and replace existing crosswalk pavement markings across north leg such that they align with curb ramp on east side
- Add crosswalk pavement markings on south leg
- Extend pedestrian walk interval to coincide with parallel vehicle green interval

12. Intersection of US 25/Sycamore Street

Issue Description

- Brick sidewalk along left side of Sycamore Street tapers and ends in the street



Suggested Action

Intermediate

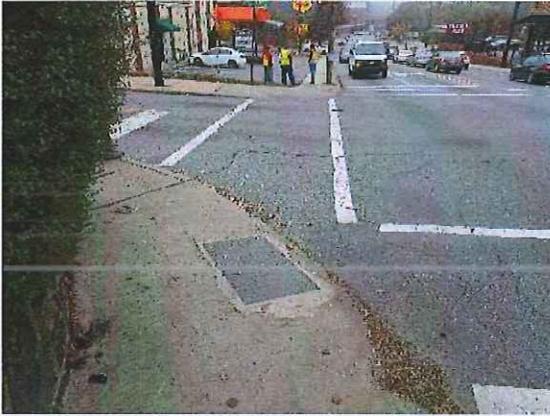
- Consider removal of this segment of sidewalk

As stated in the Introduction, the Asheville Multimodal Transportation Commission (MMTC) recommended that the RSA study corridor be extended north to include Chestnut Street due to an increase in pedestrian activity. Two large grocery stores have opened recently, which has generated more pedestrians and bicyclists. Although the project team did not have sufficient time to analyze the pedestrian and bicyclist crash data in advance of the RSA, it was able to conduct site observations (see Table 10).

Table 10. Noted overarching safety issues and suggestions for improvement for the extended study area (Chestnut Street).

13. Intersection of US 25/Chestnut Street	
Issue Description	Suggested Action
<ul style="list-style-type: none"> Westbound and eastbound Chestnut Street had significant queuing due to vehicles yielding to make left turns; only two westbound vehicles were able to make it through the intersection in one particular phase that was observed 	<p>Near Term</p> <ul style="list-style-type: none"> Relocate sharrows to the center of the travel lanes in each direction on Chestnut Street
 <p><i>The westbound left-turning vehicles running the red light</i></p> <ul style="list-style-type: none"> Push buttons on northwest corner are difficult to access because of the position of the signal controller cabinet and pole, especially if pedestrian has mobility restrictions Crest vertical curve limits sight distance for northbound left in permissive phase Right-turn only sign is posted at Broad Street; are drivers compliant? Sharrows on west leg of Chestnut Street are inappropriately placed in the middle of the road Bus stop (northwest corner) has an additional seating area that is disconnected from the sidewalk and is only accessible by stairs Multiple driveways between Orange and Chestnut and no turn lanes lead to queuing in through lanes 	 <ul style="list-style-type: none"> Connect seating area at the bus stop on northwest corner to sidewalk  <ul style="list-style-type: none"> Trim or remove vegetation on northeast corner Add walk time to minor street to coincide with parallel green

- Vegetation encroaches upon sidewalk in northeast corner



- Short pedestrian walk time on minor streets, result in pedestrians crossing on "don't walk" phase because parallel vehicle phase is still green
- The "Be Prepared to Stop" sign on southbound Merrimon Avenue before the intersection of Chestnut Street begins to flash 4 seconds before yellow. This could be an issue if spillback occurs from the intersection because the crest vertical curve limits drivers' line of sight

Intermediate

- Move push button on northwest corner to a more accessible location in relation to the curb ramp



Improvements Suggested for Consideration

Intersection of US 25/Chestnut Street (Extended Corridor near Trader Joe's and Harris Teeter)

- Relocate sharrows to the center of the travel lanes in each direction on Chestnut Street
- Connect seating area at the bus stop on northwest corner to sidewalk
- Trim or remove vegetation on northeast corner
- Add walk time to minor street to coincide with parallel green
- Move push button on northwest corner to a more accessible location in relation to the curb ramp

Signalized Intersection of US 25/I-240 WB/Marcellus Street

- Various improvements for the westbound right-turn movement:
 - Install a ground-mounted "Turning Vehicles Yield to Pedestrians" sign
 - Consider "Pedestrian in Crosswalk" or other similar blank-out sign activated by pedestrian push buttons
 - Increase distance between crosswalk and stop bar
 - Extend the walk interval to match parallel green phase
- Consider flashing yellow arrow signal for northbound left-turn movement
- Install ADA-compliant ramps on southwest corner
- Replant or trim vegetation on northeast corner

US 25 near the I-240 West On-Ramp

- Adjust manhole cover as necessary to create a flush surface
- Consider the following combination of improvements on the east side of US 25; sight distance must be verified:
 - Install a high-visibility marked crosswalk across the I-240 WB entrance loop
 - Install yield line pavement markings across the ramp in advance of the crosswalk
 - Install Pedestrian Crossing (W11-2) warning signs and RRFBs at the crosswalk
 - Consider review of pavement markings to accentuate sight distance of the pedestrian ramp crossing location
 - Ensure adequate lighting is provided at the crossing
- Consider the following combination of improvements at the sidewalk "V" on the west side of US 25:
 - Install ADA-compliant curb ramps and a high-visibility marked crosswalk across the slip lane to the I-240 WB entrance ramp

- Install yield line pavement markings in advance of the crosswalk
- Install Pedestrian Crossing (W11-2) warning signs on either side of the crosswalk
- Ensure adequate lighting is provided at the crossing
- Improve channelization to prevent illegal northbound left-turns from US 25 onto the southbound slip lane

Signalized Intersection of US 25/I-240 EB Ramps

- Install yield line pavement markings at the westbound right-turn lane before the crosswalk
- Trim or relocate vegetation that is blocking current light fixtures, and provide adequate lighting at pedestrian crossings
- Install 20 mph speed limit sign (at location of speed limit change) and advance "Reduce Speed Ahead" sign for southbound vehicles entering the downtown area; consider including supplemental red/orange flags and/or pavement markings
- Consider incorporating a flashing yellow arrow for southbound left turns, which could provide a red indication for the southbound left-turn lane when pedestrians utilize the push button
- If it is structurally suitable, consider installing a "Turning Vehicles Yield to Pedestrians" (R10-15) sign on the existing mast arm for right turns from northbound US 25 onto the I-240 EB ramps
- Based on the RSA observations and subsequent capacity analyses, the team recommends that NCDOT considers potentially reconfiguring the westbound approach and restriping the northbound approach to include a second through lane. With these improvements in place, pedestrian crossing exposure is reduced on the east side of the intersection and level of service is improved from LOS D to LOS B in the PM peak with substantially reduced northbound queuing.

Signalized Intersection of US 25/Woodfin Street

- Consider applying mini-skip pavement markings to improve positive guidance for the southbound through movement when the facility is resurfaced.
- Consider disseminating an audible message on local buses to encourage pedestrians to cross the road behind the bus and at a crosswalk after alighting the bus
- Relocate push button post and pedestal on the southeast corner to make them more accessible
- For the WB approach, consider installing "Stop Here on Red" sign, "No Right Turn on Red" sign, 5-section signal head with right-turn overlap, and/or "No Turn on Red" blank-out sign
- Improve lighting at intersection, especially at crosswalks

- Based on the RSA observations and subsequent capacity analyses, the team recommends that NCDOT consider reconfiguring the through and right-turn lane to reduce pedestrian exposure and possibly shorten pedestrian crossing distances. In addition, consider converting the northbound left-turn lane and southbound inside left-turn to a second northbound through lane via restriping. With these improvements in place, pedestrian crossing exposure is reduced on three intersection approaches and the intersection delay and queuing is reduced during all three peak periods studied.

US 25 Midblock Crossing between Woodfin Street and Walnut Street

- Consider installing appropriate Pedestrian Crossing warning signs and remove unnecessary clutter on bulb-outs
- Consider installing a high visibility crosswalk and yield line pavement markings on each approach when resurfaced
- Eliminate at least one parking space on each approach in advance of the crossing; consider putting bicycle parking in these locations

Signalized Intersection of US 25/Walnut Street

- Incorporate a leading pedestrian interval
- Consider installing backplates with retroreflective borders to the signal heads
- Construct curb extension on northwest corner according to original signal plans such that existing signal pole is located behind curb and not within street

Signalized Intersection of US 25/College Street

- If it is structurally suitable, install "No Right Turn" sign on mast arm of northbound approach
- If it is structurally suitable, install "No Left Turn" sign on mast arm of southbound approach
- Stabilize pedestrian signal pole

Signalized Intersection of US 25/Patton Avenue/Pack Square

- Extend walk interval to align more closely with parallel green interval
- Consider mounting a Turning Vehicles Yield to Pedestrians (R10-15) sign to the signal pole on the east side of US 25 near the monument if consistent with the aesthetics and historical context of the Vance Memorial

- Consider removing the two parking spaces at the southwest corner of S. Pack Square/US 25 and install a bulb-out
- Consider prohibiting eastbound left turns and directing vehicles desiring to go north on US 25 to proceed straight through the intersection and make a U-turn beyond the monument on N. Pack Square, then turn right onto northbound US 25

Potential US 25 Crosswalk north of Eagle Street

- Consider installation of a formal marked crosswalk near the Pack Square Parking Deck driveway that comprises the following or additional measures, as appropriate:
 - Raised pedestrian refuge island
 - High-visibility crosswalk pavement markings
 - Pedestrian Crossing (W11-2) warning signs
 - Elimination of parking spaces adjacent to crosswalk
- Consider options to reconfigure pavement to reduce pedestrian exposure within this segment

Signalized Intersection of US 25/Aston Street

- Remove and replace existing crosswalk pavement markings across north leg such that they align with curb ramp on east side
- Add crosswalk pavement markings on south leg
- Extend pedestrian walk interval to coincide with parallel vehicle green interval

Intersection of US 25/Sycamore Street

- Remove sidewalk that dead-ends within Sycamore Street

Conclusions

US 25 (Merrimon Avenue/Broadway/Biltmore Avenue) between Sycamore Street and Marcellus Street connects downtown Asheville to north Asheville. There are high volumes of pedestrian and bicyclist traffic in the study area as the downtown area attracts both visitors and local residents with the large amount of amenities in a relatively small area. There were 27 pedestrian crashes and 10 bicycle crashes from 2005 - 2014. There were 237 vehicle crashes during the five-year analysis period (September 1, 2010 – August 31, 2015), with the majority being rear end crashes, angle crashes, and sideswipe crashes.

The RSA organizers composed a multidisciplinary team with various transportation-centered backgrounds and experiences. After reviewing data and making observations along US 25, the RSA team identified a list of safety issues and potential countermeasures to address these issues. In light of the complex nature of traffic safety issues, the countermeasures include engineering, enforcement, and education strategies to enhance vehicle, pedestrian, and bicycle safety. The recommendations made for US 25 could be used at corridors that share similar characteristics, such as AADT, cross section, and crash patterns. Some general measures suggested by the RSA team include the following:

- Use signage and pavement markings to increase drivers' awareness of pedestrians.
- Increase pedestrian walk intervals to coincide with the parallel green intervals at several signalized intersections in the study area.

