Place: Chapel Hill Library, Room A,
Chapel Hill, NC

Date: January 30, 2019 Notes Taken by: VHB

Project #: 38565.14 Re: Kick-Off Meeting and Field Investigation

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ATTENDEES Kumar Neppalli, Nick Pittman, David Phipps, Hanna Cockburn, Donnie Rhoads, Kurt Stolka, Chuck Edwards, Zach Hallock, Brian Thomas, Mark Aldridge, Bill Webster, Lauren Blackburn, Kim Eccles, Tony Wyatt, Joe Seymour

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Compiled Action Items

- Action Item – VHB to share the outreach tools (survey and website) with the Study Team for their feedback
- Action Item – VHB to add the Morgan Creek Greenway extension to Carrboro in the existing plan review
- Action Item – VHB to obtain the feasibility study for U-5304B that describes improvement options
- Action Item – VHB will send out a doodle poll to explore an evening public workshop meeting in March and April
- Action Item – Bill Webster to share Morgan Creek Trail plans to VHB

The meeting began at 1:05pm

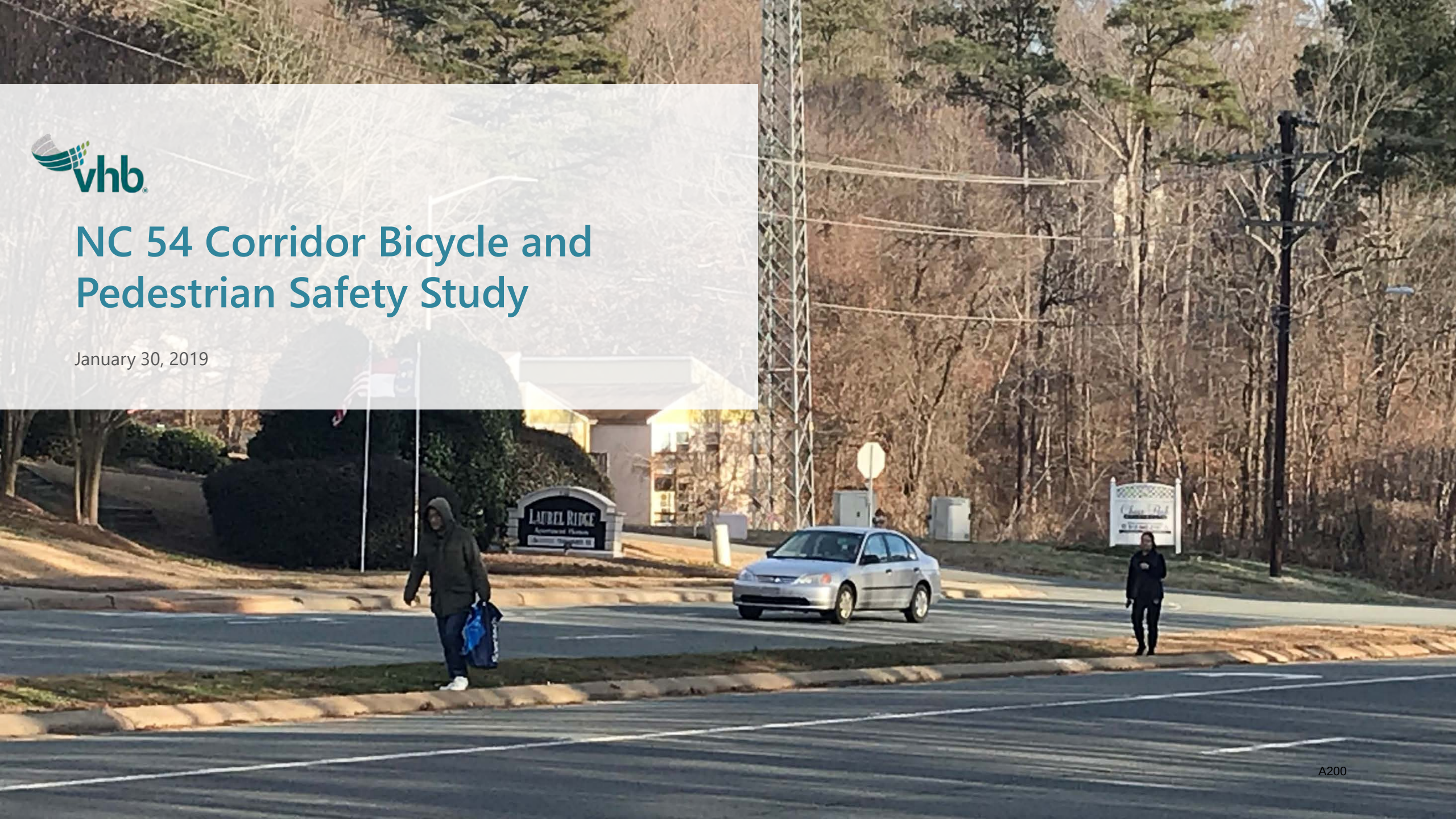
- Welcome and Project Introductions
    - Lauren invited all participants to introduce themselves
- Project History and Origin
    - Brian said that there have been several requests from the town and NCDOT reviews, and there are many systems that interact: transit, vehicles, and pedestrians. The goal is to identify near term improvements
- Scope and Schedule
    - Lauren reviewed the scope. She mentioned that the next meeting will address in-depth crash statistics.
    - The project is short-term and will address how to improve the corridor today. There are outreach elements.
    - There is flexibility for the public workshop dates and venues.
- Engagement and Outreach
    - VHB will share the website and outreach tools with the Study Team for feedback and review
    - VHB will format the safety survey as a paper flyer for distribution.
    - The survey will be available through a period following the first public workshop.
    - The second workshop may involve a polling exercise for participants

        - Action Item – VHB to share the outreach tools (survey and website) with the Study Team for their feedback
- Project
    - Lauren reviewed the existing plans in the corridor's vicinity
        - Zach noted that the existing plan map should include the Morgan Creek Trail Greenway extension in Carrboro to Smith Level Road. The next phase is dependent on funding with UNC for easements.
            - Action Item – VHB to add the Morgan Creek Greenway extension to Carrboro in the existing plan review
        - There is consideration of SUP along the N/S BRT
        - BRT is at 30% design. 2022/2023 implementation with FTA
        - The CHT short range transit plan will be finished in the next few months, though there are no significant changes that will affect the corridor
        - U-5304B may have survived STIP reprogramming. There is potential for widening to six lanes with superstreets or four lanes with traditional intersection.
            - Action Item – VHB to obtain the feasibility study for U-5304B that describes improvement options
- Field Visit
    - The packets are intended to guide data collection, and 15 to 20 minutes is allocated per location
- Next Meeting
    - Lauren asked about weeks in March April that have scheduling conflicts for the Towns of Carrboro and Chapel Hill
        - Zach said that there will be a bike plan meeting in Carrboro in March
        - UNC spring break is March 8 through March 17
        - UNC / Duke basketball game is March 9 at UNC Chapel Hill
        - Action Item – Lauren will send out a doodle poll to explore an evening public workshop meeting in March and April

The formal meeting ended at approximately 1:55PM, and the field investigation began.

NC 54 Corridor Bicycle and Pedestrian Safety Study

January 30, 2019



Meeting Agenda

Welcome and Introductions

Project History and Origin

Scope and Schedule

Engagement and Outreach

Corridor Conditions

Discuss Next Meeting & Workshop

Field Visit

Scope of Work

Apply a systems-based approach to multimodal safety and mobility through short and medium-term improvements (immediate to 10 years).

- Assess existing multimodal travel conditions
- Synthesize short and medium-term traffic and safety impacts
- Develop and plan strategies for near-term multimodal safety improvements
- Review public input and conduct outreach workshops

Schedule

Phase 1 **– Data Collection & Initial Outreach** - Early 2019

Phase 2 **– Existing Conditions & Public Workshop #1** - Spring 2019

Phase 3 **–Concept Development & Service Analysis** – Summer 2019

Phase 4 **–Public Workshop #2 & Recommended Improvements** – Fall 2019

Draft Report

NC54
BICYCLE & PEDESTRIAN CORRIDOR SAFETY STUDY

Study Team Meetings

#1 (January) : Introduction, Field Visit

#2 (early March): Current Conditions; Data Analysis; Introductions to Countermeasures

#3 (May-June): Concept Analysis

#4 (August): Identify Preferred Countermeasures and Operational Improvements

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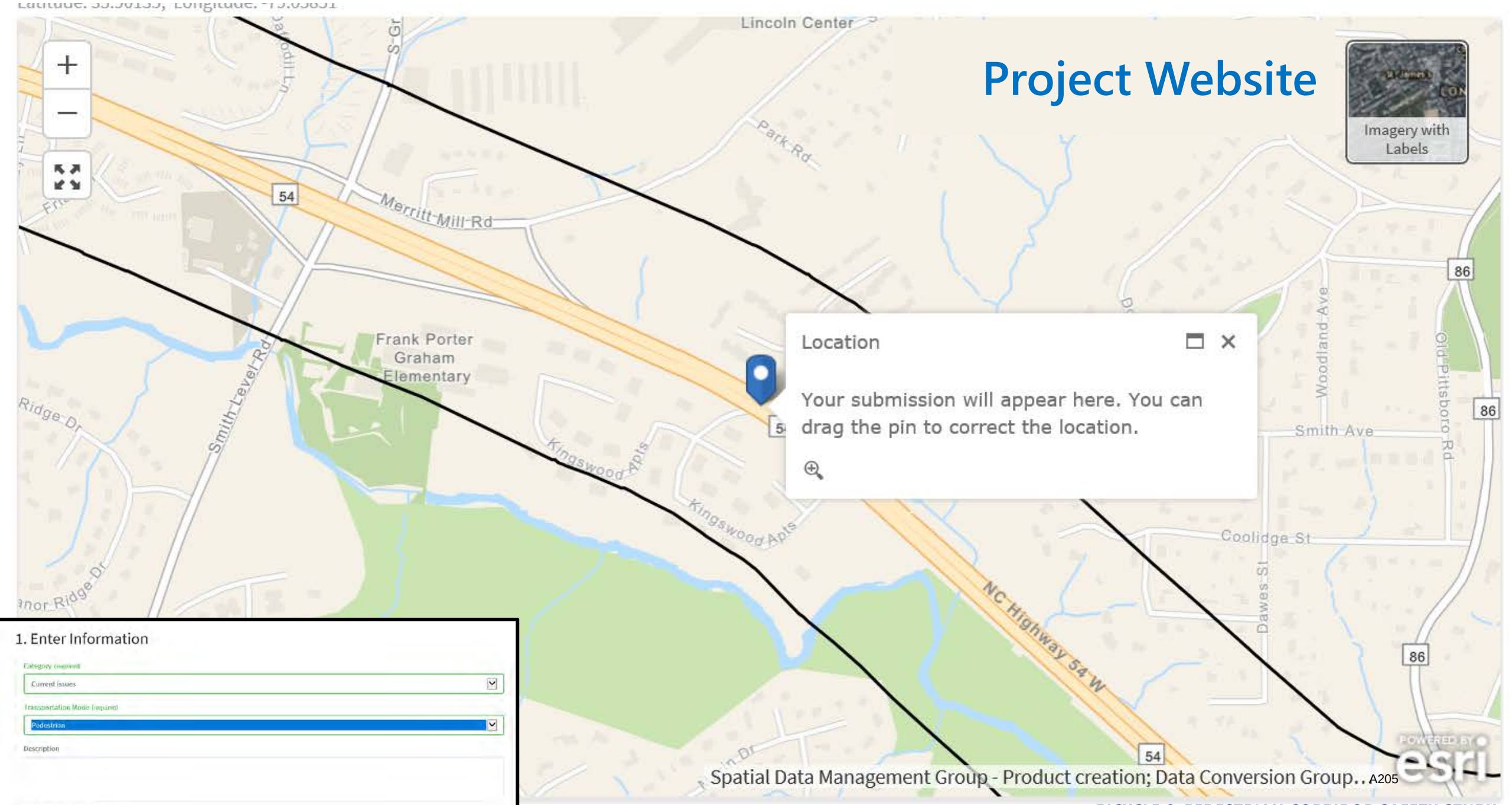
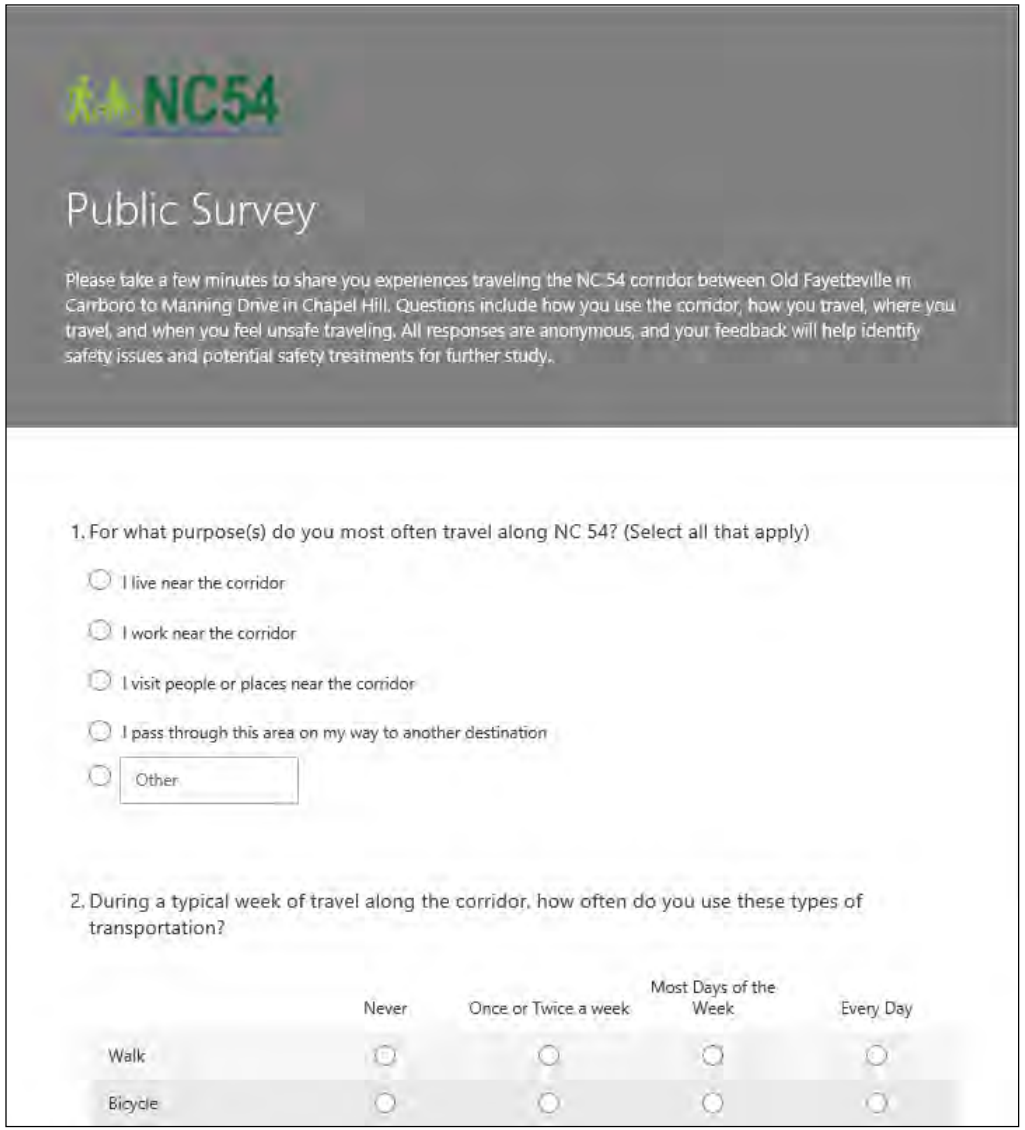
Project Website



A205

Public Survey



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Public Survey

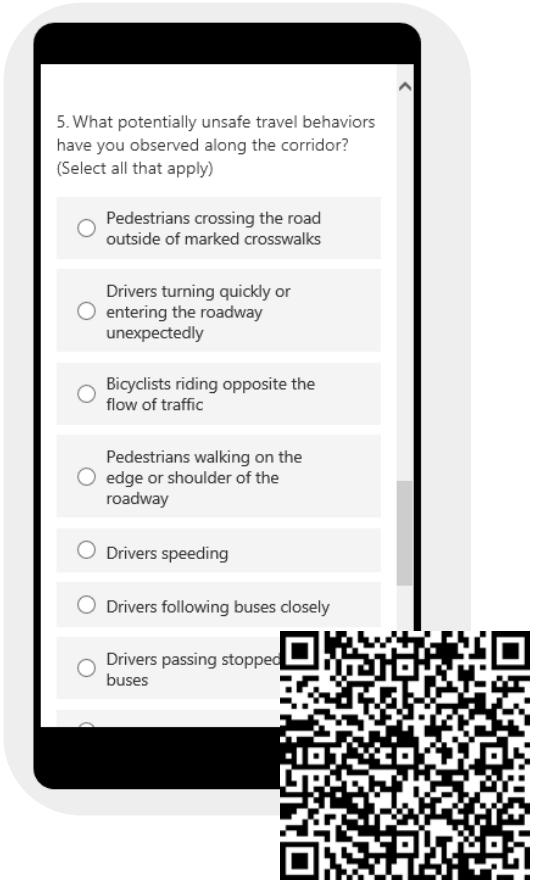
Please take a few minutes to share you experiences traveling the NC 54 corridor between Old Fayetteville in Carrboro to Manning Drive in Chapel Hill. Questions include how you use the corridor, how you travel, where you travel, and when you feel unsafe traveling. All responses are anonymous, and your feedback will help identify safety issues and potential safety treatments for further study.

1. For what purpose(s) do you most often travel along NC 54? (Select all that apply)

- ○ I live near the corridor
- ○ I work near the corridor
- ○ I visit people or places near the corridor
- ○ I pass through this area on my way to another destination
- ○ Other

2. During a typical week of travel along the corridor, how often do you use these types of transportation?

	Never	Once or Twice a week	Most Days of the Week	Every Day
Walk	○	○	○	○
Bicycle	○	○	○	○



5. What potentially unsafe travel behaviors have you observed along the corridor? (Select all that apply)

- ○ Pedestrians crossing the road outside of marked crosswalks
- ○ Drivers turning quickly or entering the roadway unexpectedly
- ○ Bicyclists riding opposite the flow of traffic
- ○ Pedestrians walking on the edge or shoulder of the roadway
- ○ Drivers speeding
- ○ Drivers following buses closely
- ○ Drivers passing stopped buses

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BICYCLE & PEDESTRIAN CORRIDOR SAFETY STUDY

Planned Outreach Events

Workshop #1 – Validate Existing Conditions; Request Public Feedback; Introduce Pedestrian/Bicycle Safety Concepts

Station-based open house?

Workshop #2 – Review public comments; Present Countermeasure Options and Operational Improvements

Presentation followed by polling exercises ?

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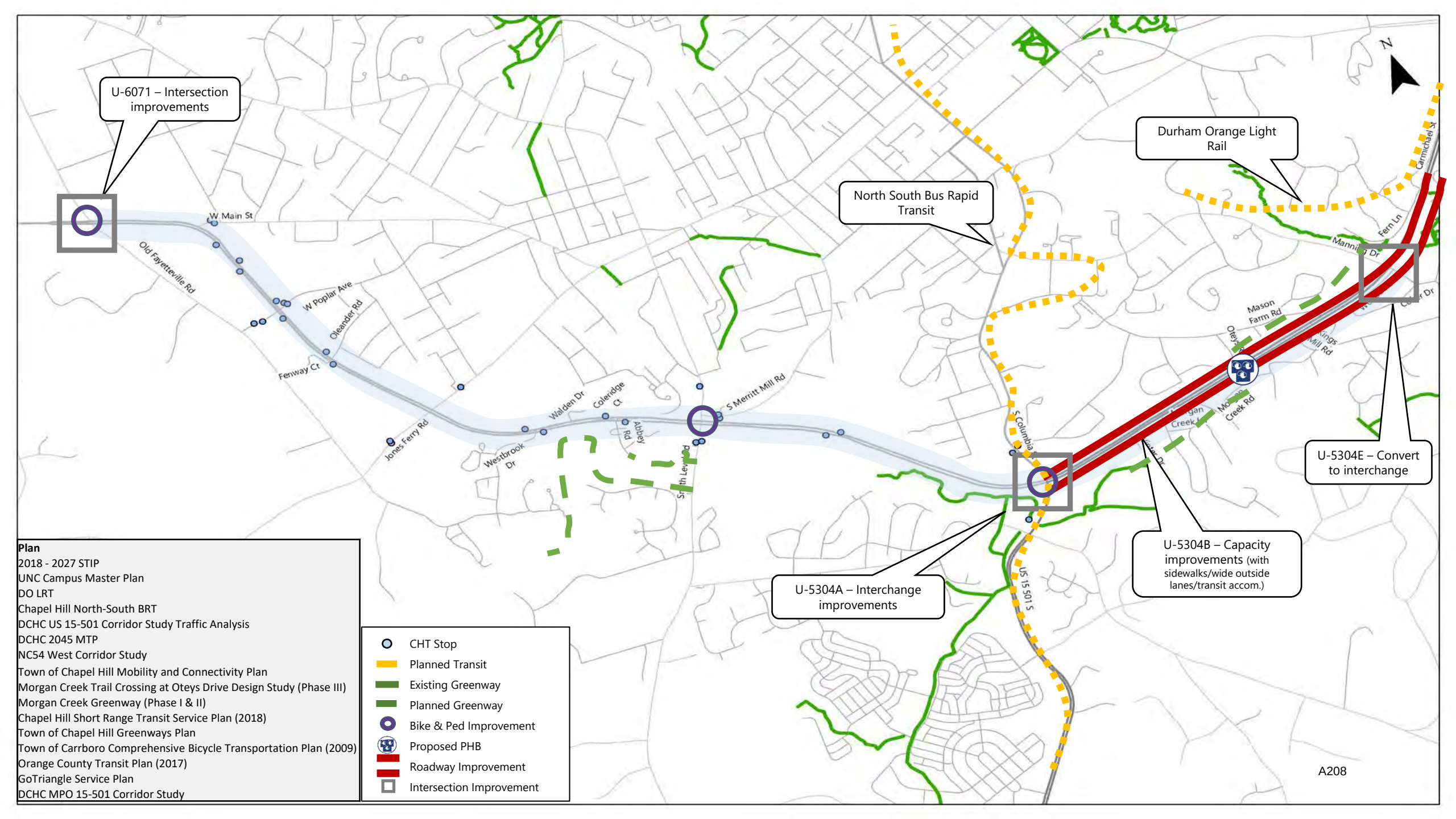
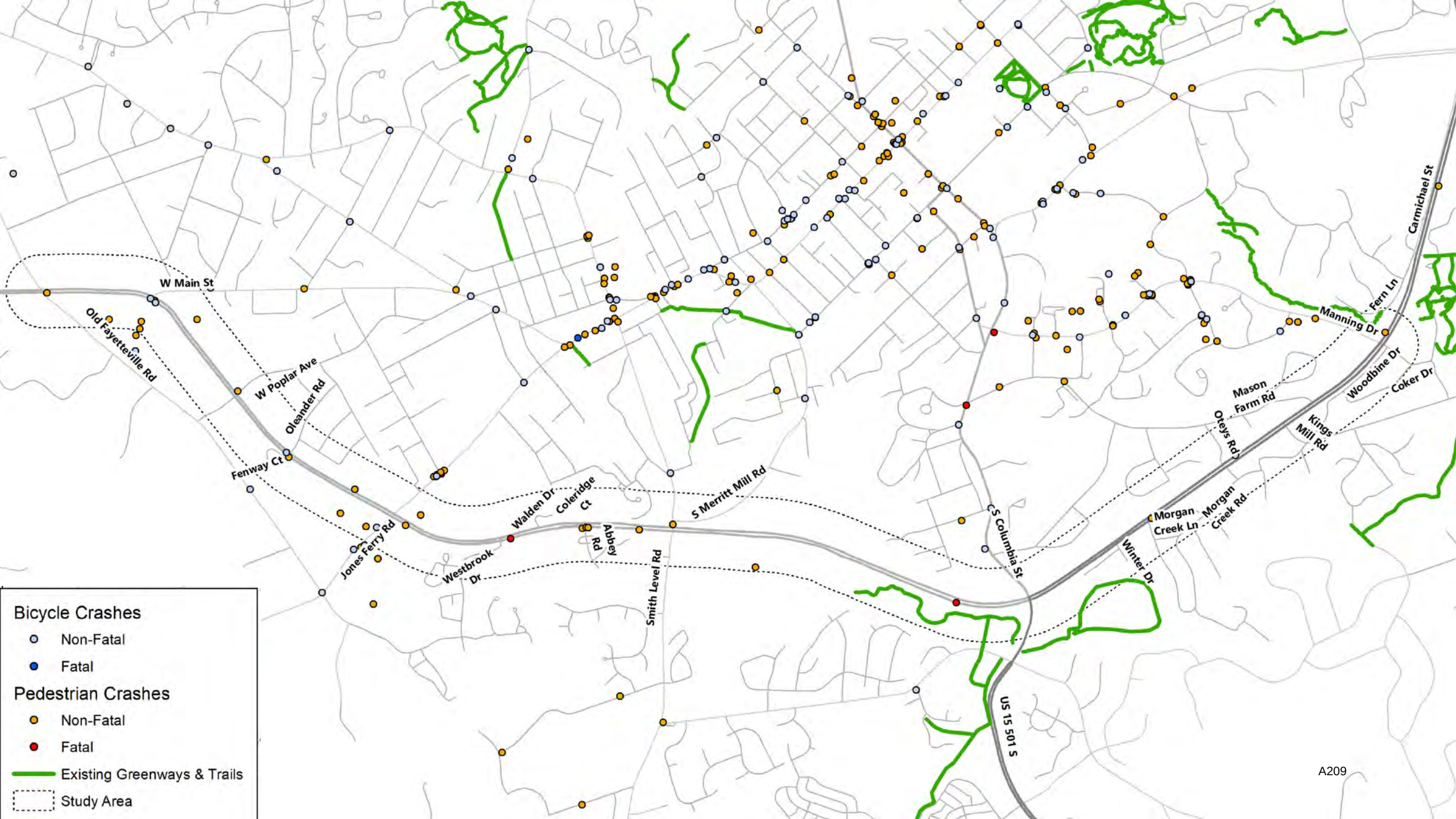
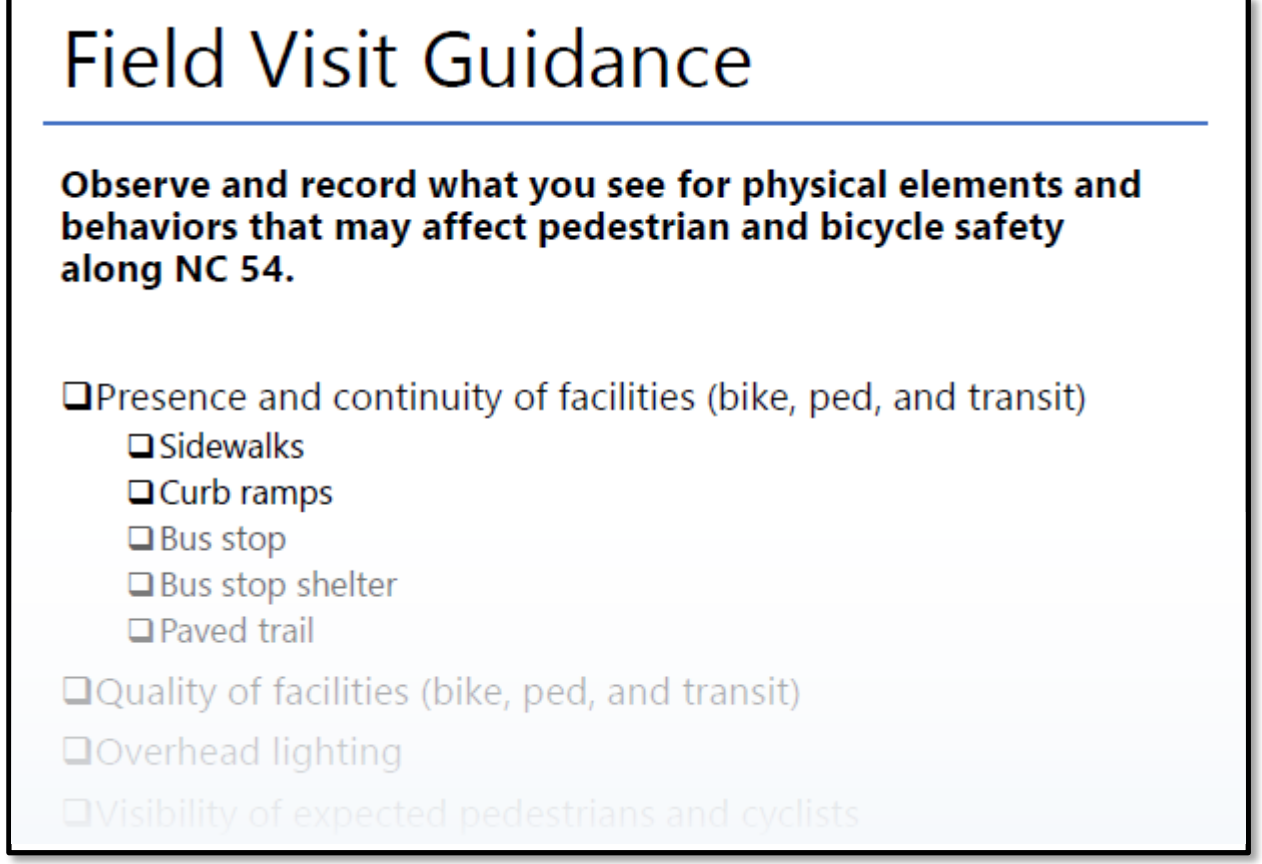

U-6071 – Intersection improvements
North South Bus Rapid Transit
Durham Orange Light Rail
U-5304E – Convert to interchange
U-5304B – Capacity improvements (with sidewalks/wide outside lanes/transit accom.)
U-5304A – Interchange improvements
W Main St
Old Fayetteville Rd
W Poplar Ave
Oleander Rd
Fenway Ct
Jones Ferry Rd
Westbrook Dr
Walden Dr
Coleridge Ct
Abbey Rd
S Merritt Mill Rd
S Columbia St
US 15 501 S
Fern Ln
Mason Farm Rd
Mill Rd
Creek Rd
Plan
2018 - 2027 STIP
UNC Campus Master Plan
DO LRT
Chapel Hill North-South BRT
DCHC US 15-501 Corridor Study Traffic Analysis
DCHC 2045 MTP
NC54 West Corridor Study
Town of Chapel Hill Mobility and Connectivity Plan
Morgan Creek Trail Crossing at Oteys Drive Design Study (Phase III)
Morgan Creek Greenway (Phase I & II)
Chapel Hill Short Range Transit Service Plan (2018)
Town of Chapel Hill Greenways Plan
Town of Carrboro Comprehensive Bicycle Transportation Plan (2009)
Orange County Transit Plan (2017)
GoTriangle Service Plan
DCHC MPO 15-501 Corridor Study
CHT Stop
Planned Transit
Existing Greenway
Planned Greenway
Bike & Ped Improvement
Proposed PHB
Roadway Improvement
Intersection Improvement
A208


W Main St
Old Fayetteville Rd
W Poplar Ave
Oleander Rd
Fenway Ct
Walden Dr
Coleridge Ct
S Merritt Mill Rd
Jones Ferry Rd
Westbrook Dr
Abbey Rd
Smith Level Rd
S Columbia St
Morgan Creek Ln
Morgan Creek Rd
Winter Dr
US 15 501 S
Oteys Rd
Mason Farm Rd
Kings Mill Rd
Woodbine Dr
Coker Dr
Manning Dr
Fern Ln
Carmichael St
Bicycle Crashes
Non-Fatal
Fatal
Pedestrian Crashes
Non-Fatal
Fatal
Existing Greenways & Trails
Study Area
A209

Field Visit

6 Sites

- Manning Drive
- Oteys Road
- Kingswood Apartments
- Jones Ferry Road
- Oleander Road
- Carrboro Plaza / Old Fayetteville Road



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Next Meeting / Workshop #1

Review Current Conditions & Analysis

- Recap Field Visit Findings
- Planned Improvements
- Crash Analysis
- Vehicle, Pedestrian, Transit, and Bicycle Levels of Service
- Pedestrian and Bicycle Safety Risk Factors

Discuss Tools for Evaluating Countermeasures

Prepare for Workshop

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BICYCLE & PEDESTRIAN CORRIDOR SAFETY STUDY

Study Team Meeting #2 Agenda

April 8, 2019

Chapel Hill Public Works Department
6850 Millhouse Rd, Chapel Hill, NC 27516
Building #1, Large Conference Room

10:00AM	Welcome and Introductions
	Recap of Last Meeting
	Summary of Existing Conditions -Crashes -Speed -Volumes -LOS: Intersections, segments, and modes -Survey preview
	Goals and Metrics
	Workshop #1 Format
12:00 p.m.	Adjourn

Place:	Chapel Hill Public Works Department		
Date:	April 8, 2019	Notes Taken by:	Claudio Figueroa - VHB
Project #:	38870.07	Re:	NC 54 Bike Ped Safety Study Team Meeting #2

ATTENDEES

Lauren Blackburn – VHB	Joe Seymour – VHB	Claudio Figueroa – VHB
Mark Aldridge – NCDOT Division 7	Hanna Cockburn – NCDOT	Zach Hallock – Town of Carrboro
Brian Thomas – NCDOT Traffic Safety	David Phipps – NCDOT	Brian Mayhew – NCDOT
Chuck Edwards – NCDOT Division 7	Donnie Rhoads – Town of Chapel Hill	Kumar Neppalli – Town of Chapel Hill
Bill Webster – Town of Chapel Hill		

Meeting began at 10AM ET

Attendees were welcomed, and introductions were made. An agenda was passed out and the meeting followed that agenda. Lauren started with a summary from the site visit. Phase 1, data collection and initial outreach, is completed. The focus of this meeting was to review the current conditions and data analysis. Zach informed the group that the Town of Carrboro will have its bike plan draft available sometime in May 2019.

<u>Site Visit</u>

- Positives:
  - Bus shelter and sidewalks to nearby intersections.
  - Many signalized intersections have pedestrian heads
- Issues
  - Joe presented the various issues found at key intersections along the corridors
  - Brian provided an explanation of the work order notes that will be featured in the Public Workshop
  - Mark asked if lightning of the roadway was looked at. Hanna mentioned that there is a lack of lighting in the corridor. Lauren mentioned that they looked at nighttime crashes and were going to be shown later.
  - Bill asked if Columbia Street was analyzed. Lauren mentioned that as part of the scope of the project, interchanges were not analyzed. Kumar mentioned that the intersections need to be looked at and David agreed.

<u>Crash Analysis</u>

- Lauren proceeded showing the results from the crash analysis performed on NC 54. Ten-years' worth of crash data was collected from NCDOT TEAAS. Rear-end crashes were predominant in the east section of the corridor. Multiple maps were presented showing the crash locations.

AADT and Speed Analysis

- Lauren presented the results from the AADT and Speed analysis. AADT increases as it gets closer to Chapel Hill, while speed increases farther from Chapel Hill towards Carrboro.

LOS Analysis

- Lauren proceeded to present the LOS Analysis for the different transportation modes along the corridor (see slides)
- It was recommended to look at near-future improvements that can be made to improve LOS, which are better done by completing a field investigation.
- It was asked if adding sidewalks to the corridor would improve the Pedestrian LOS. Claudio mentioned that is included in future analysis
- It was asked what was included in the Transit LOS. Claudio mentioned that the Transit LOS analysis included Operational data, such as average number of passengers and delay of the corridor. Claudio also explained that the corridor has bus drop-off/bus pullout areas which reduce the operations of the transit system.

Survey

- Lauren continued presenting preliminary results from the online survey developed for the project with 519 responses as of April 2.
- Joe added that during a quick view of the responses, most of the them made sense and that the presentation does not included a hotspot analysis of unsafe intersections that is part of the survey. The hotspots map will be available for the public workshop.
- It was highlighted that nighttime and crosswalks concern are the top concerns in the survey as of April 2
- Lauren mentioned that a website was developed so the public can identify locations through an interactive map.
- Zach asked if the survey linked to the website. Joe said that it did not to keep the survey under 5 minutes of competition.

Project Goals

- Officer Rhoads mentioned that they do a lot of enforcement in the corridor. The most ticketed offenses are speeding, because the corridor gives a false sense of comfortable speeding.
- It was asked if the gridlock only occurs during the peak time. The police officer agreed. He also added that because of the stop-and-go during peak times there are a lot of crashes which increase the delay.
- It was recommended to reduce the number of pedestrians crossing the road.
- Hanna mentioned that the corridor sends mixed signals.
- It was recommended to ask bus drivers their experience serving this corridor
- Hanna recommended to add lighting in the survey for the public workshop since it is missing
- Zach recommended to look at land uses along the corridor for long-term solutions

- Officer Rhoads added that most vehicles are trying to get to I-40 in the western part, but most of the traffic is local
- It was recommended to report long-term strategies that take into consideration land uses and interconnectivity
- It was recommended the identifying the purpose of the road be a priority
- Zach mentioned that both NC 54 analyses needs to be interconnected.
- Lauren asked how the study can measure success on transit use. Balancing boarding and alighting can be a measure of effectiveness
- It was mentioned that there might be a need to sacrifice mobility to improve other modes

Public Workshop

- Lauren mentioned that the first public workshop will be on April 29 at 5:30-70pm at the Carrboro Century Center.
- It will have a drop-in format with 7 stations.
- Town of Carrboro staff will piggyback on the meeting to ask the public their input on the Carrboro Bike Plan.

Meeting adjourned at 12PM ET

vhb

Meeting Agenda

Meeting Sign-in Sheet

	Name	Dept./Office	Email
1	Mark Aldridge	NCDOT/DIV 7	maldridge@ncdot.gov
2	Hanna Cockburn	NCDOT	jicockburn@ncdot.gov
3	Zach Hallock	Town of Carrboro	zhallock @ townofcarrboro.org
4	BRIAN THOMAS	NCDOT/TRAFFIC SAFETY	bthomas @ ncdot.gov
5	DAVID PHIPPS	NCDOT	dphipps@ncdot.gov
6	Brian Mayhew	NCDOT	bmayhew@ncdot.gov
7	CINDY EDWARDS	NCDOT DIV7/DIST1	CJEDWARDS@NCDOT.GOV
8	Claudio Figueroa	VHB	cfigueroa@vhb.com
9	Downie Rhoads	CHAPEL HILL	drhoads@townofchapelhill.org
10	Kumar Neppalli	Town of Chapel Hill	KNEPPALLI@TOWNOFCHAPELHILL.ORG
11	Bill Webster	" "	bwebster " " "
12	Lauren Blackburn	VHB	
13	Joe Seymour	VHB	
14			
15			

NC 54 Corridor Bicycle and Pedestrian Safety Study

April 8, 2019

Meeting Agenda

Welcome and Introductions

Recap of Last Meeting

Summary of Existing Conditions

- -Crashes
- -Speed
- -Volumes
- -LOS: Intersections, segments, and modes
- -Survey preview

Goals, Objectives, and Metrics

Other Discussion

Schedule Review

Phase 1 **– Data Collection & Initial Outreach** - Early 2019

Phase 2 **– Existing Conditions & Public Workshop #1 – April 29**

Phase 3 **–Concept Development & Service Analysis** – Summer 2019

Phase 4 **–Public Workshop #2 & Recommended Improvements** – Fall 2019

Draft Report

NC54
BICYCLE & PEDESTRIAN CORRIDOR SAFETY STUDY

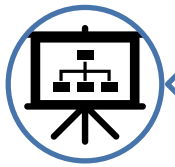
Study Team Meetings

#2 (Today): Current Conditions; Data Analysis;

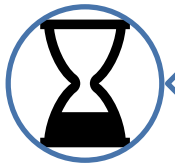
#3 (May-June): Introductions to Countermeasures; Concept Analysis

#4 (August): Identify Preferred Countermeasures and Operational Improvements

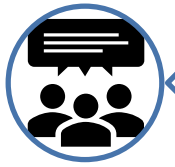
Recap of Last Meeting



Project Overview



Scope and Schedule



Engagement

Existing Plans and Studies

Field Visit

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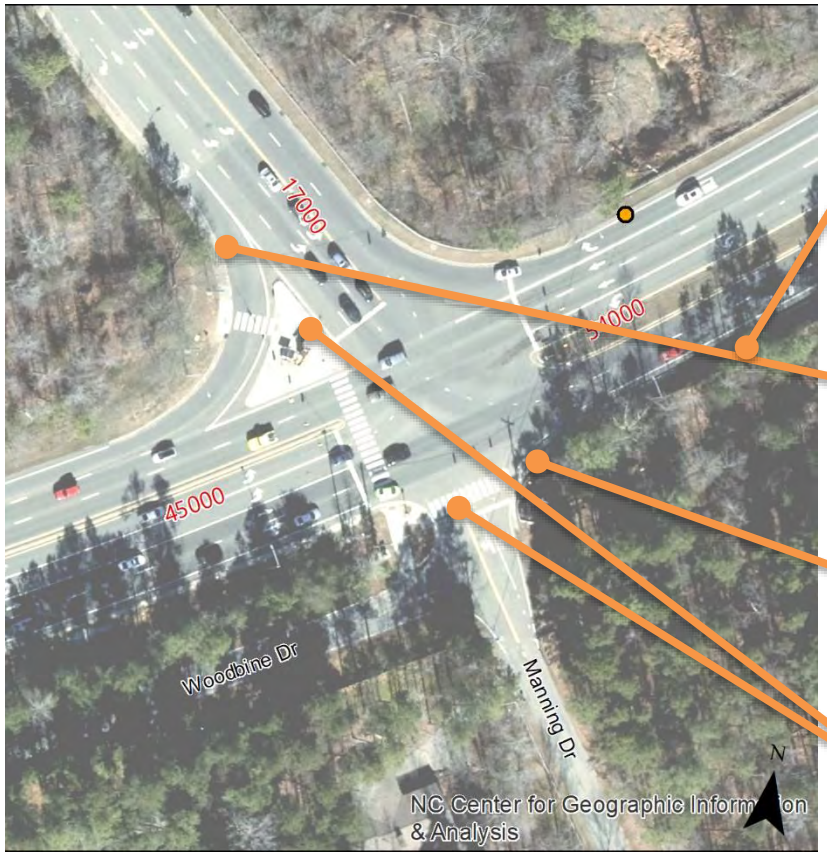
Overall Conditions Observed

Positives

- Bus shelters and sidewalks to nearby intersections
- Jones Ferry, West Poplar, Old Fayetteville, and Manning, and Main Street have ped signals and crosswalks (on most legs of the intersection)

Issues

Manning Dr @ NC 54



- No sidewalk present (south side). Steep slope along Manning Dr. Drainage below guardrail. Very unsafe crossing in any direction.
- Overhead tree canopy on north west corner. Free flow RT lane? If so, move pedestrian crossing nearer to beginning of radius to improve pedestrian conspicuity.
- Could add yield line at pedestrian crossing on right turn slip lane for emphasis. Bike loop signage is faded. Consider moving pedestrian crossing to north to improve visibility for south bound traffic.
- No pedestrian signal head-on south east corner. Long green phase on NC 54. No Sidewalk to the south on Manning Dr. No advance yield line on Manning Drive headed west to NC 54.
- Mysterious curb cuts on Manning Drive north of intersection. Bike markings are faded at Manning Drive north. Overhanding trees may limit visibility of pedestrians on north west side of intersection

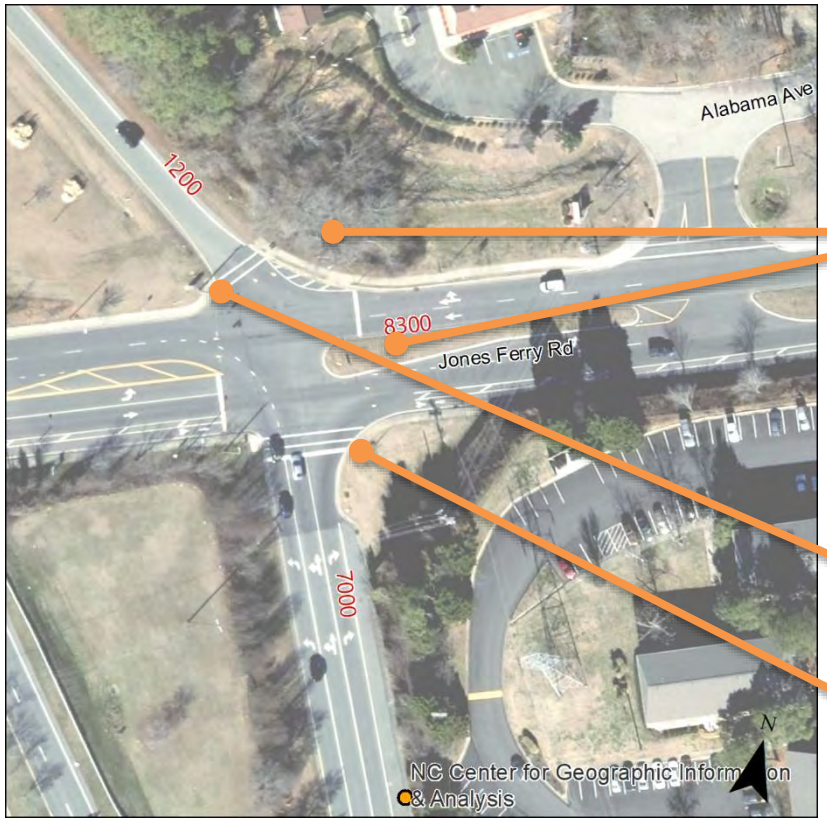
Oteys Rd @ NC 54

- Very steep slope. No visual cues to NC 54 traffic to expect bike ped crossings. No bike ped facilities and network on either side of road.
- Recommend Zig Zag crossing in median to reduce conflict with high speed right turns.
- Crest limits sight distance for east bound traffic (west of intersection). Street lighting in place.
- HAWK signal at intersection? Future Morgan Creek greenway area. Signal impacts gaps (from east)
- Broad median. High curb. Higher travel speed. Street lighting at four comers. Low density walkable neighborhoods. Paved shoulder on NC 54 east ends well before Ottey's Rd.
- Long crossing time. Speed. No pedestrian facilities
- Rise heading east make visibility to cross. No pedestrian lighting.

Kingswood Apts @ NC 54

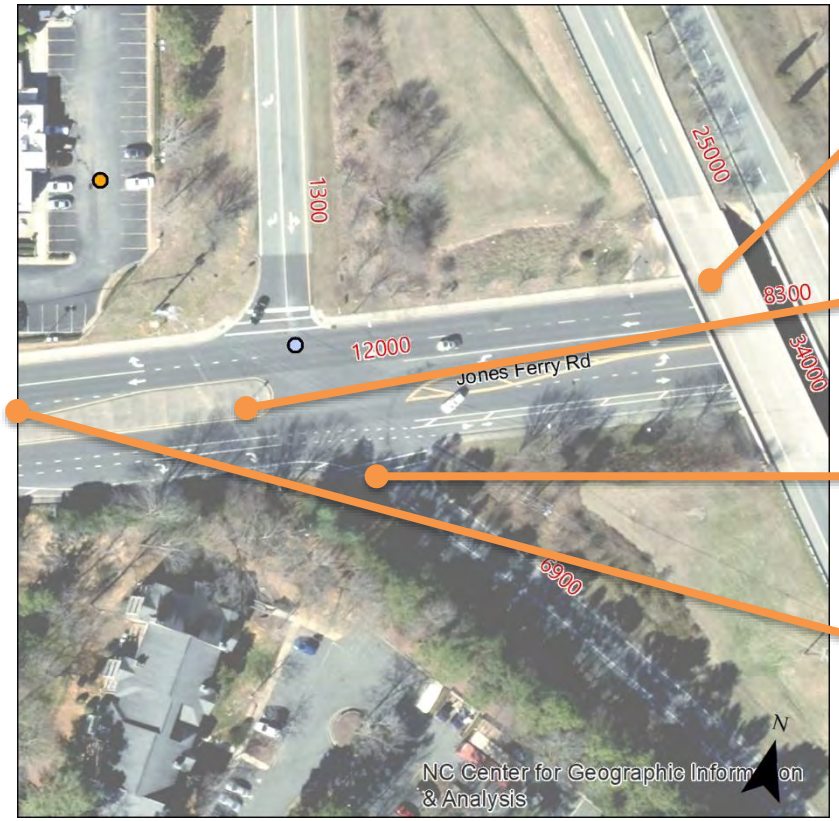
- Consider near side bus stops, (see notes), consider left over for pedestrian refuge. Restripe existing bus lane as right turn acceleration lane
- Consider zig zag concept, moving bus stops [signalized?].
- Talked to people who said dangerous at dark.
- No bus shelter on north side of NC 54. Three pedestrians crossed during visit. Pedestrians using median to stage crossing.
- Need sidewalk with ramps connectivity for bus stops. Rocky goat path in the median, south side connecting to bus stop.
- Consider left over.
- How necessary are bus pullouts?
- 1/4 mile to Morgan Creek Trail parking lot; Poor sight distance

Jones Ferry (North) @ NC 54



- Good sight distance to east and west. Right turns and poor sight distance. Place crossing to the north? Some people crossing at BP gas station.
- Consider adding crosswalk on east left of Jones Ferry road, use island as refuge. Consider remarking crosswalks across ramp to promote pedestrian visibility to right turn motorists. Obtain ROW for sight triangle and vegetation management in North east quad. Over head tree canopy produces shade at pedestrian ramp. Add pedestrian signals. Replace pedestrian sign removed for fiber optical install.
- Revisit crossing configuration on north side of Jones Ferry. Consider no right turn on red.
- No pedestrian heads. Vegetation on south west corner block visibility. Existing street light on south west corner.

Jones Ferry (South) @ NC 54



State bike route? Lighting under bridge? Mismatch of bus stop. North bound bike lane plus separation.

No marked crossing [across Jones Ferry Rd]

Conflict with on ramp and crosswalk.

Lighting on westside. No crosswalks across Jones Ferry. Sidewalks with curb ramps. Bus stop south of intersection. Crosswalks across Jones Ferry at shopping center south of ramps.

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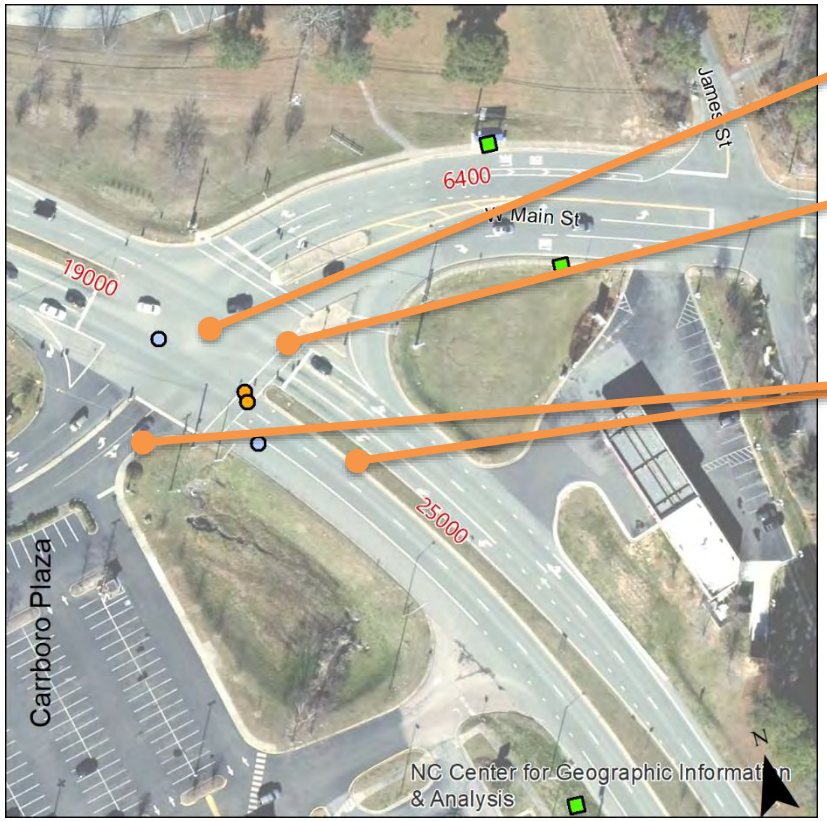
Carrboro Plaza @ NC 54



- Crosswalk could be better with 2 padded white lines. Degraded low viz crosswalks
- Short crossing time for Main St. No protected left for the cross streets so they cross in front of pedestrians . Bus stop away from intersection but close to ABC store.
- Curb cuts across plaza driveway but crosswalks on sidewalk. No sidewalks along NC 54.
- Foot traffic in median. Remove detectable domes to nowhere on southwest corner of intersection. Detectable plates in poor condition in similar location. Bus stop in front of ABC store.
- High crest and sun in drivers' eyes at intersection. Needs protected left from Main St.

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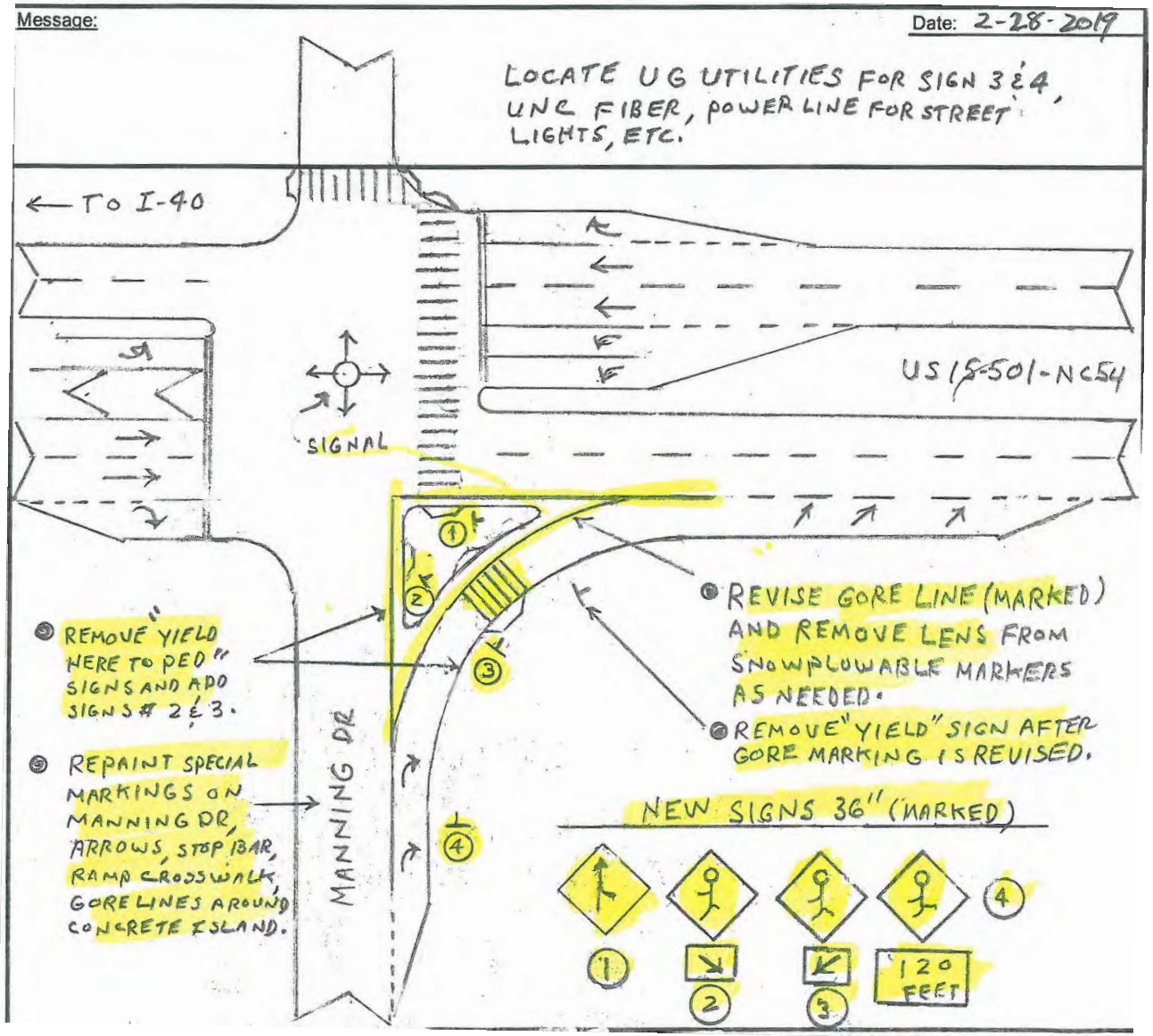
Old Fayetteville Rd @ NC 54

- No crosswalks at porkchop on north side of intersection. Look into peak hour No Turn on Red signage. Re-evaluate signal timing for protected turns and when WALK phase is on.
- No lighting. Pedestrian crossing on NC 54 on permissive Ø, may not be readily visible to SB Old Fayetteville left turn traffic.
- Blank out sign? Left turn on permissive phase during pedestrian phase. This is a long left turn, can turning vehicles see pedestrians? Two stage crossing on NC 54 east of intersection.

Results from Field Visit



- Notes to be featured in Public Workshop
- Work order in for Manning @ NC 54
- High priority modification

NC54 BICYCLE & PEDESTRIAN CORRIDOR SAFETY STUDY

Current Conditions

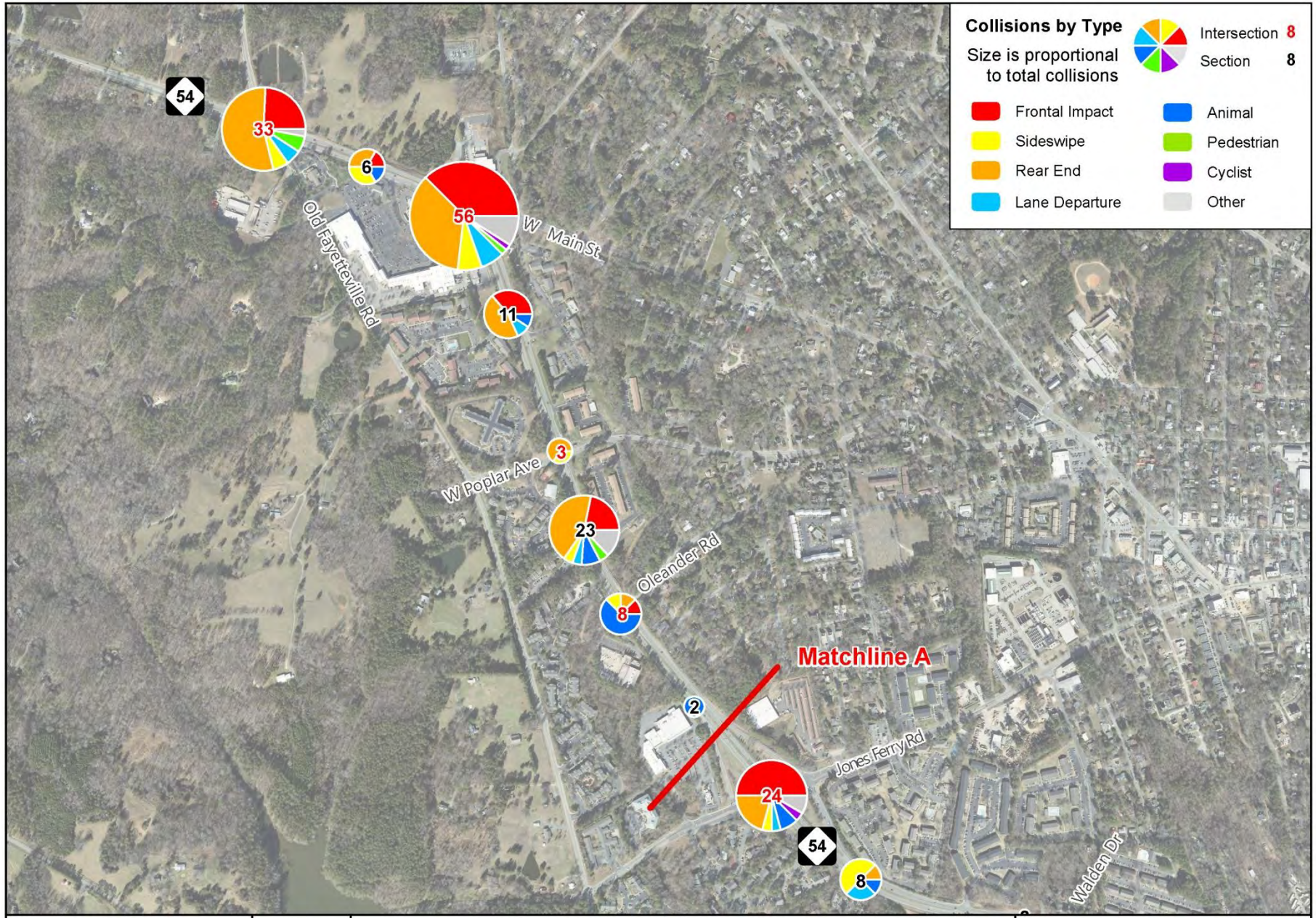
- Crash Analysis
- AADT and Speed
- Multimodal Levels of Service
- Transit Boardings/Alightings
- Daily Pedestrian Crossings

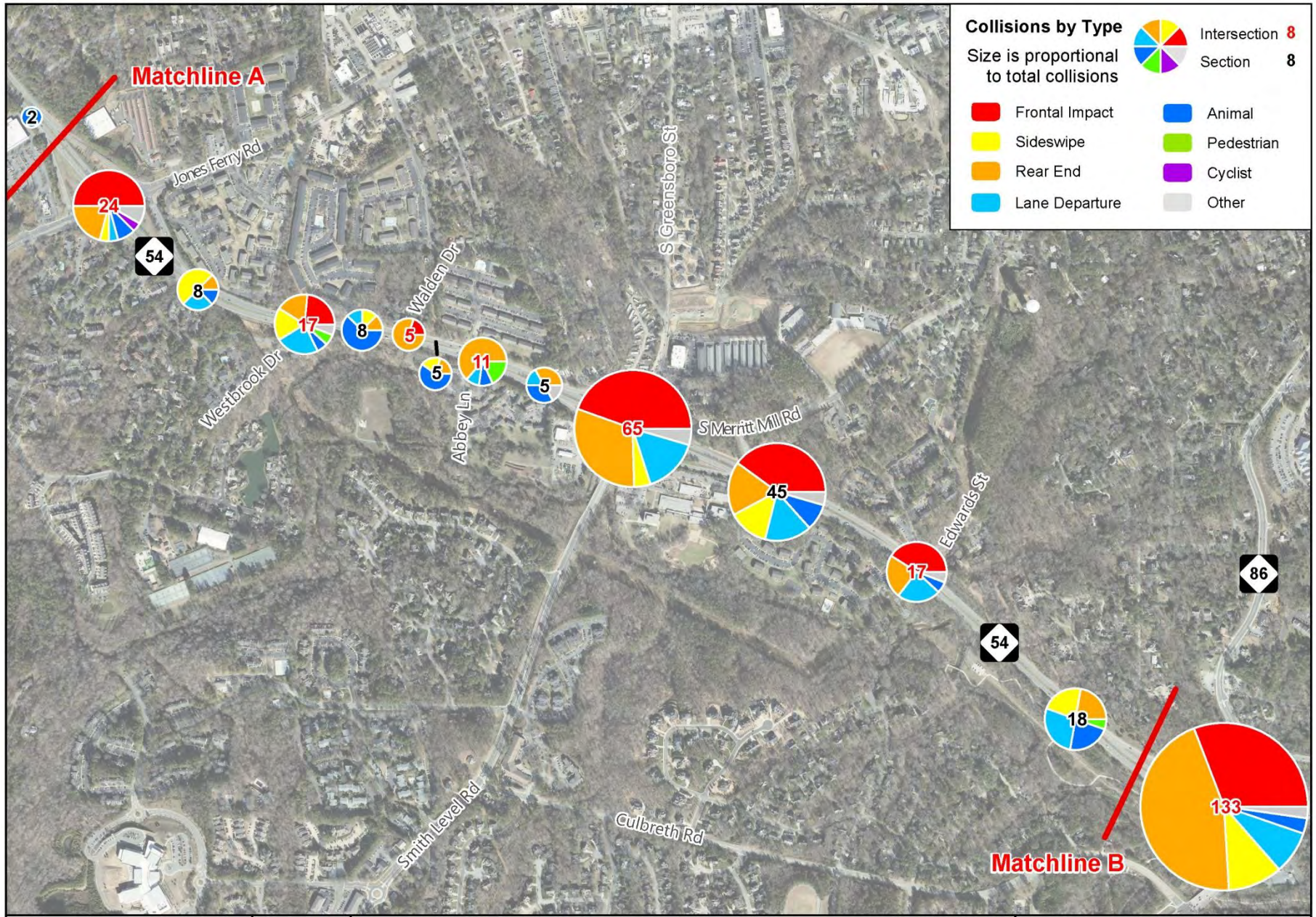
TEAAS 10 Year Crash Analysis

Crash Type Summary

Crash Type	Crashes	%
Angle	53	7%
Animal	51	6%
Backing Up	5	1%
Fixed Object	6	1%
Head On	4	1%
Left Turn	88	11%
Movable Object	6	1%
Other Collision with Vehicle	7	1%
Other Non-Collision	7	1%
Overturn/Rollover	3	0%
Parked Motor Vehicle	2	0%
Pedalcyclist	3	0%
Pedestrian	8	1%
Ran Off Road	54	7%
Rear End	385	49%
Right Turn	16	2%
Sideswipe	87	11%
Unknown	2	0.3%

- Ten-year crash data (12/01/2008 – 11/30/2018) from the NCDOT Traffic Engineering Accident Analysis System (TEAAS)
- 787 total crashes: rear end crashes most frequent (49%), followed by left-turn crashes and sideswipes
- 18 bicycle and pedestrian crashes (TEAAS initially crash typed 11)


Collisions by Type
Size is proportional to total collisions
Intersection 8
Section 8
Frontal Impact
Sideswipe
Rear End
Lane Departure
Animal
Pedestrian
Cyclist
Other
54
33
6
56
W Main St
Old Fayetteville Rd
11
3
W Poplar Ave
23
Oleander Rd
8
Matchline A
2
24
Jones Ferry Rd
54
8
Walden Dr
0 500 1,000 Feet
N
NC 54 Vehicle Crashes
Prepared by: VHB Date: February 2019
Page 1 of 3
NC54
BICYCLE & PEDESTRIAN CORRIDOR SAFETY STUDY


Collisions by Type
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Intersection 8
Section 8
Frontal Impact
Sideswipe
Rear End
Lane Departure
Animal
Pedestrian
Cyclist
Other
Matchline A
Matchline B
Jones Ferry Rd
Westbrook Dr
Walden Dr
Abbey Ln
S Greensboro St
S Merritt Mill Rd
Edwards St
Smith Level Rd
Culbreth Rd
2
54
86
24
8
17
8
5
5
11
5
65
45
17
18
133
0 500 1,000 Feet
NC 54 Vehicle Crashes
Prepared by: VHB Date: February 2019
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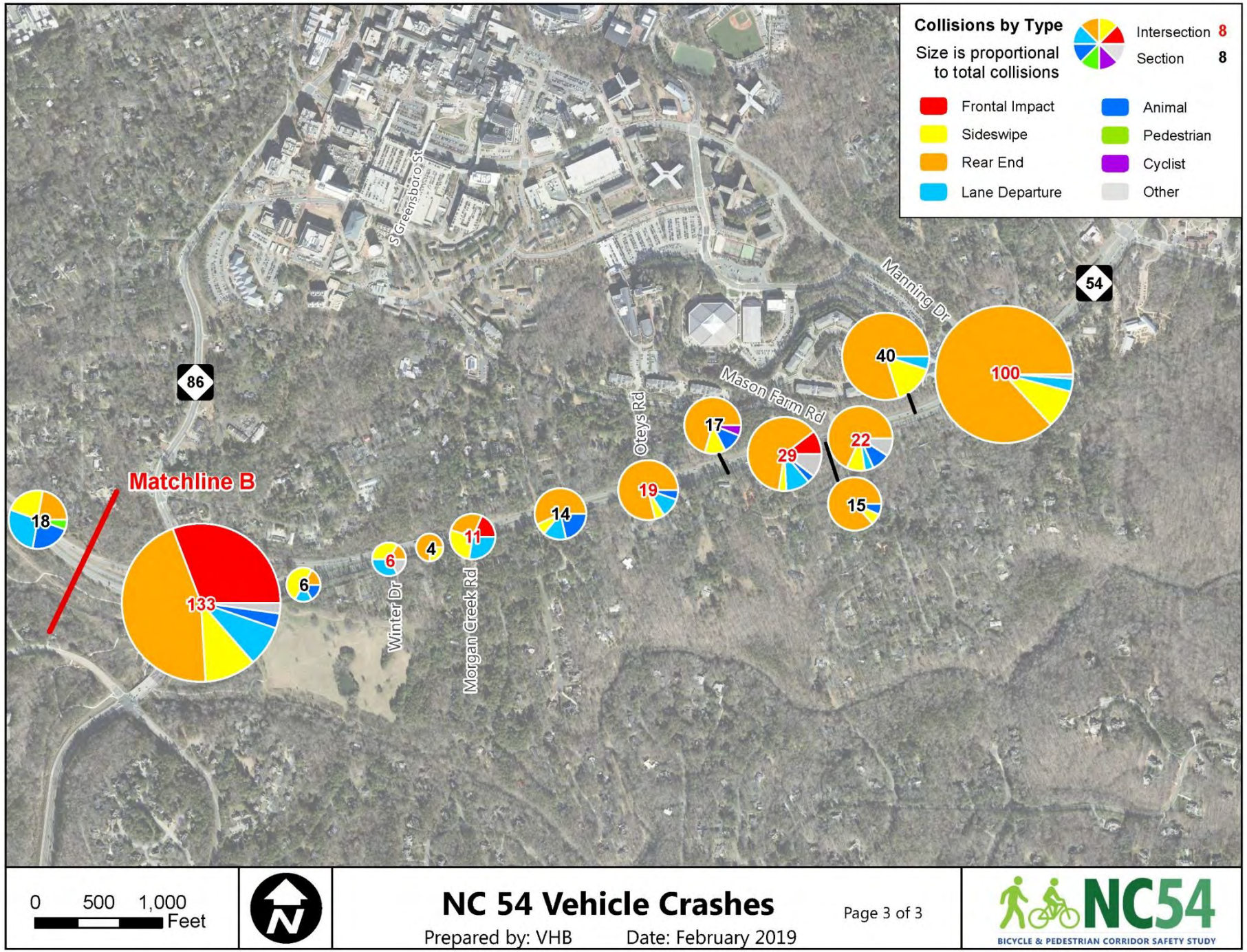
NC54
BICYCLE & PEDESTRIAN CORRIDOR SAFETY STUDY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Intersection 8
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Frontal Impact
Sideswipe
Rear End
Lane Departure
Animal
Pedestrian
Cyclist
Other
S Greensboro St
Manning Dr
Mason Farm Rd
Oteys Rd
Winter Dr
Morgan Creek Rd
86
54
Matchline B
18
133
6
6
4
11
14
19
17
29
22
15
40
100
0 500 1,000 Feet
NC 54 Vehicle Crashes
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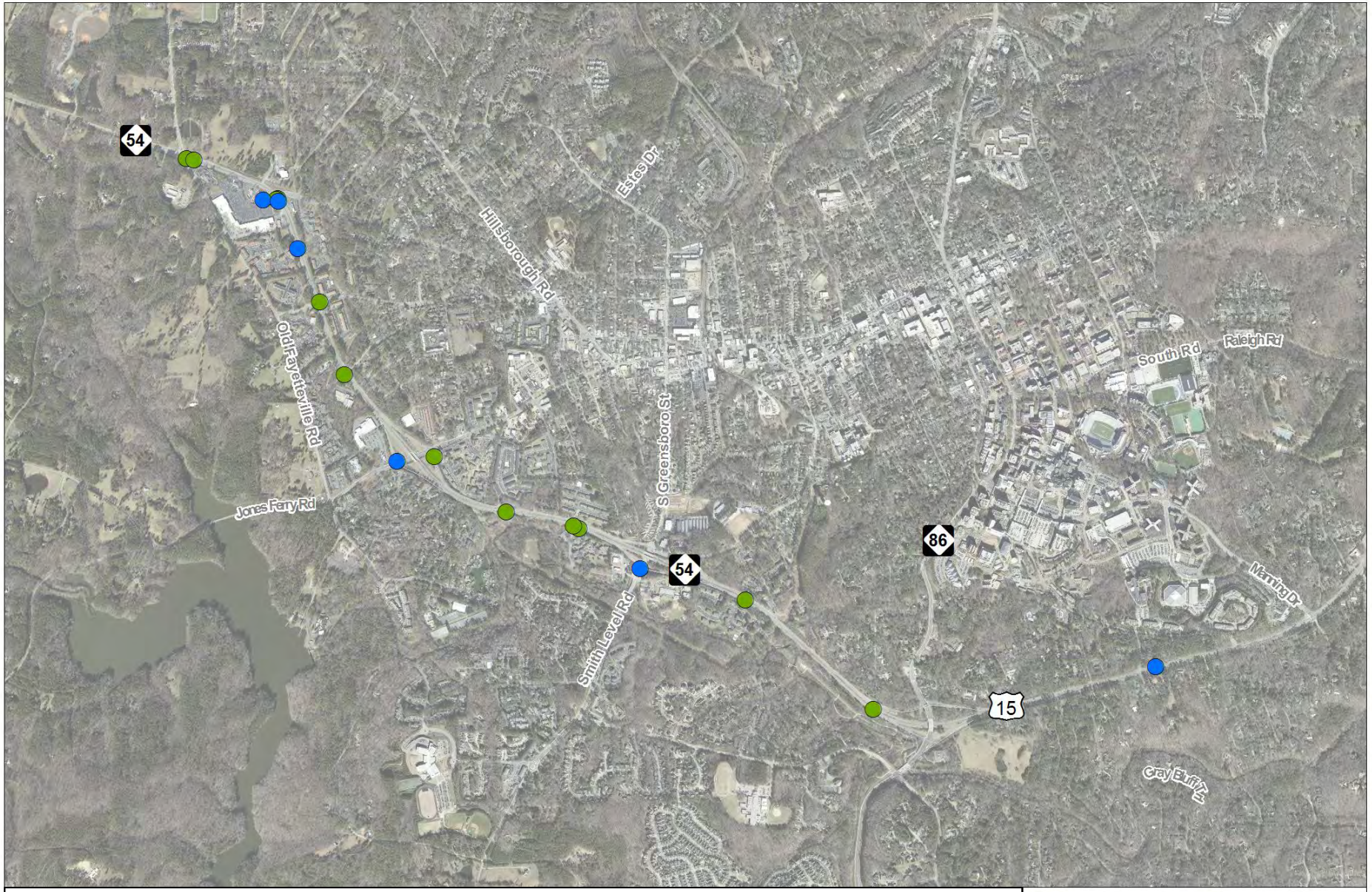
NC54
BICYCLE & PEDESTRIAN CORRIDOR SAFETY STUDY



NC 54 Pedestrian and Bicycle Crashes, 2008-2018

N

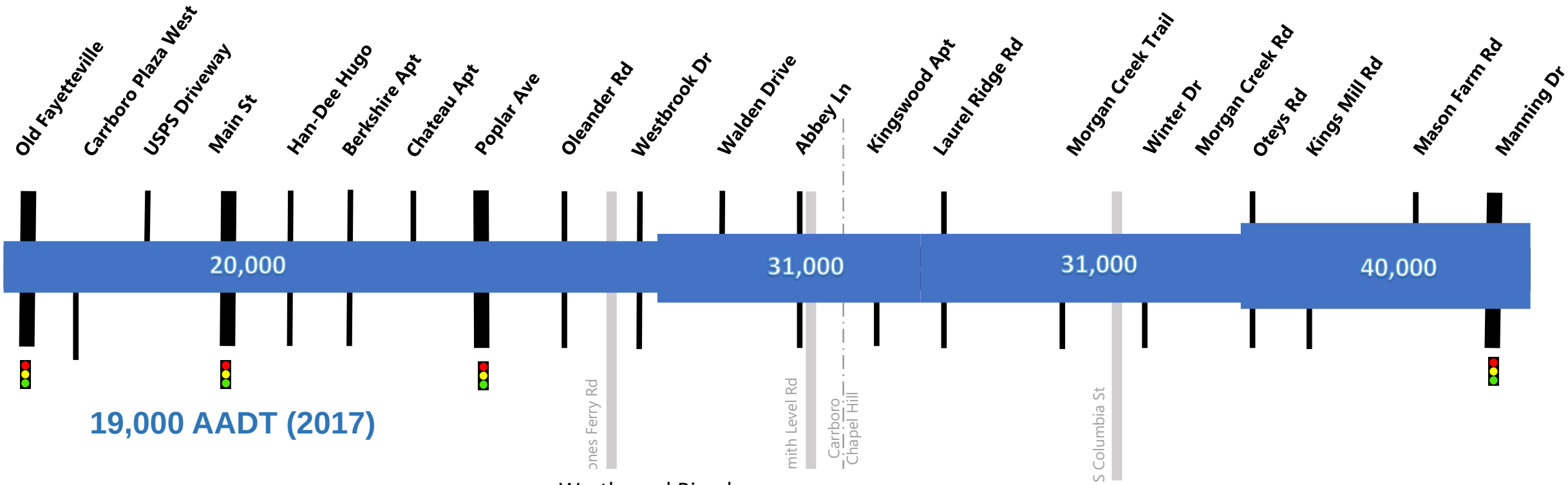
0 0.25 0.5 Miles

Pedestrian Crash

Bicycle Crash

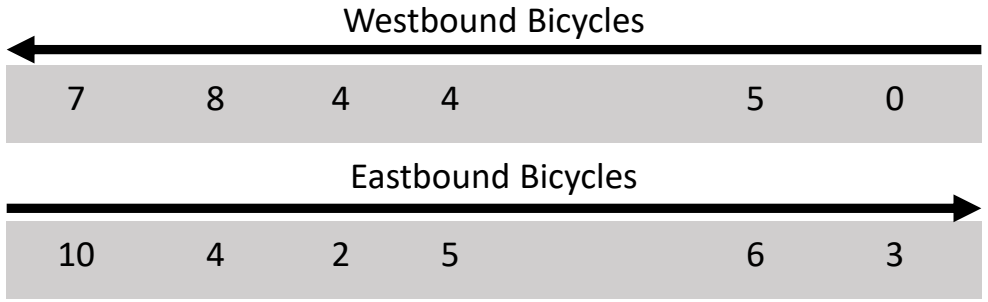
Collision Summary																						
	Type of Collision		Cyclist/Pedestrian Action			Intersection		Time of Day			Lighting				Weather			Severity					
Date	Bicycle	Pedestrian	Crossing Roadway	Walking in Shoulder	Cyclist Traveling Straight	Yes	No	AM Peak (7am - 10am)	PM Peak (4pm - 7pm)	Off-Peak	Dark - Lighted	Dark- Not Lighted	Dusk	Daylight	Clear	Cloudy	Rain	K: Fatal	A: Severe Injury	B: Evident Injury	C: Possible Injury	O: No Injury	Total
2008		1	1				1			1		1				1		1				1
2009	1	2	2		1	2	1		1	2	2		1		2		1				2	1	3
2010		2	1	1		2		1		1				2	2				1	1			2
2011	1	1		1	1	1	1	1		1				2	1	1			1	1			2
2012		2	2			1	1			2	1	1			1		1	1			1		2
2013		1	1			1			1		1				1				1				1
2014		1		1		1				1				1	1						1		1
2015	1				1		1		1					1	1					1			1
2016		1	1			1		1						1	1					1			1
2017	2	1	1		2	1	2	1		2	1			2	1	2			1	1		1	3
2018	1				1		1			1				1	1					1			1
Total	6	12	9	3	6	10	8	4	3	11	5	2	1	10	12	4	2	2	4	6	4	2	18

AADT - 2018 7-Day 16 Hour Average

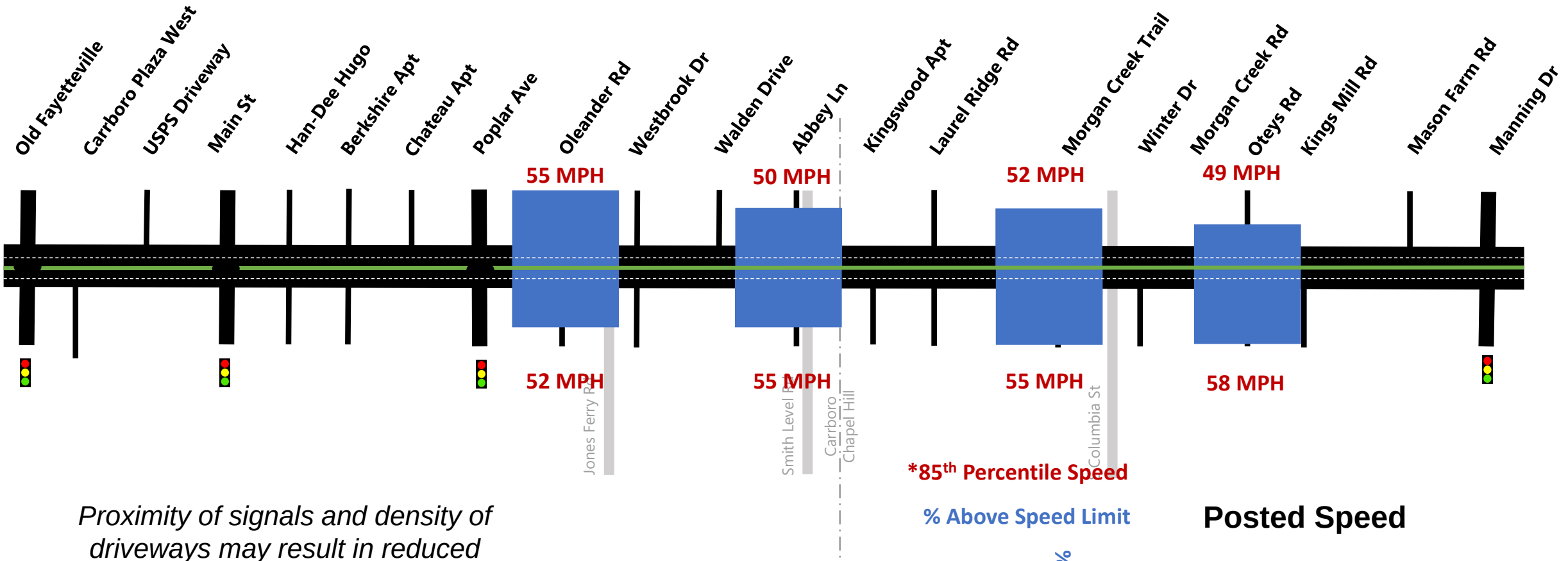


19,000 AADT (2017)

Bicycle traffic west of Poplar Ave may increase due to cross-street bicycle networks and land use context

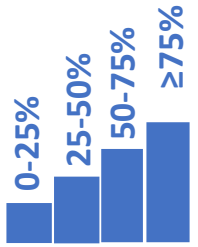


Vehicle Speed – 7 Day Average



*85th Percentile Speed

% Above Speed Limit

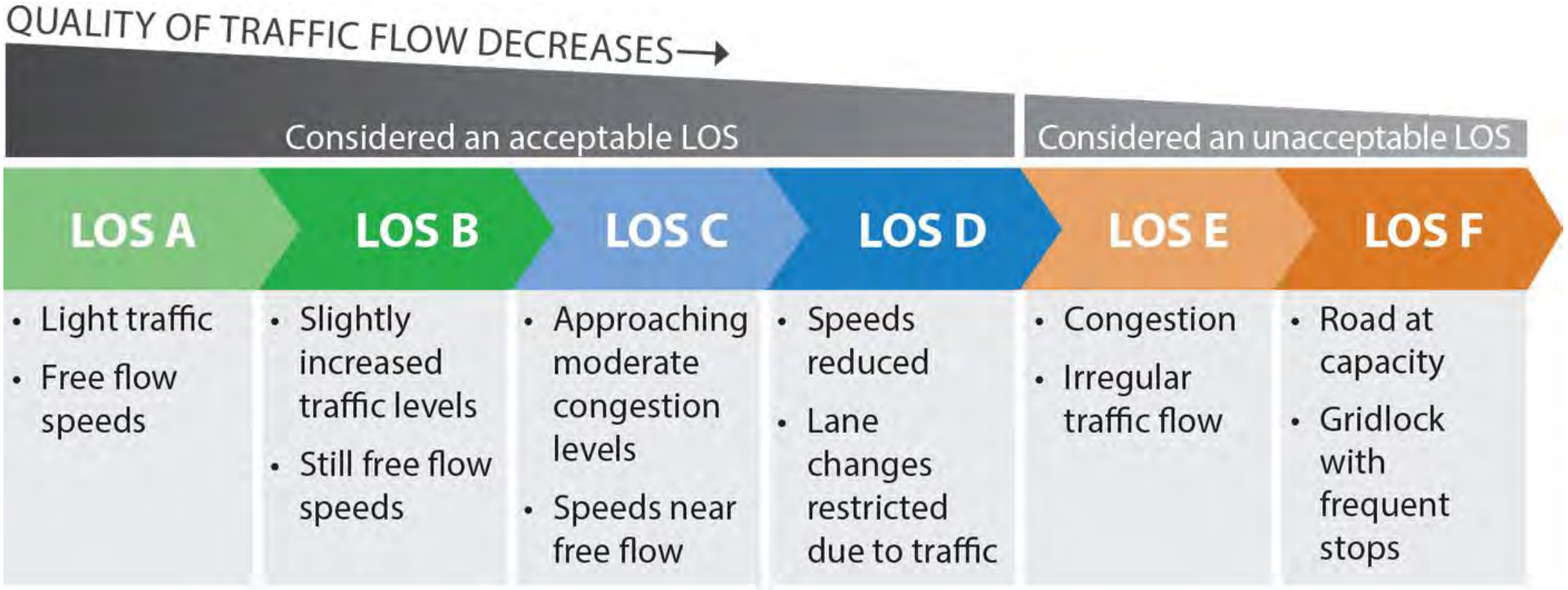


Posted Speed

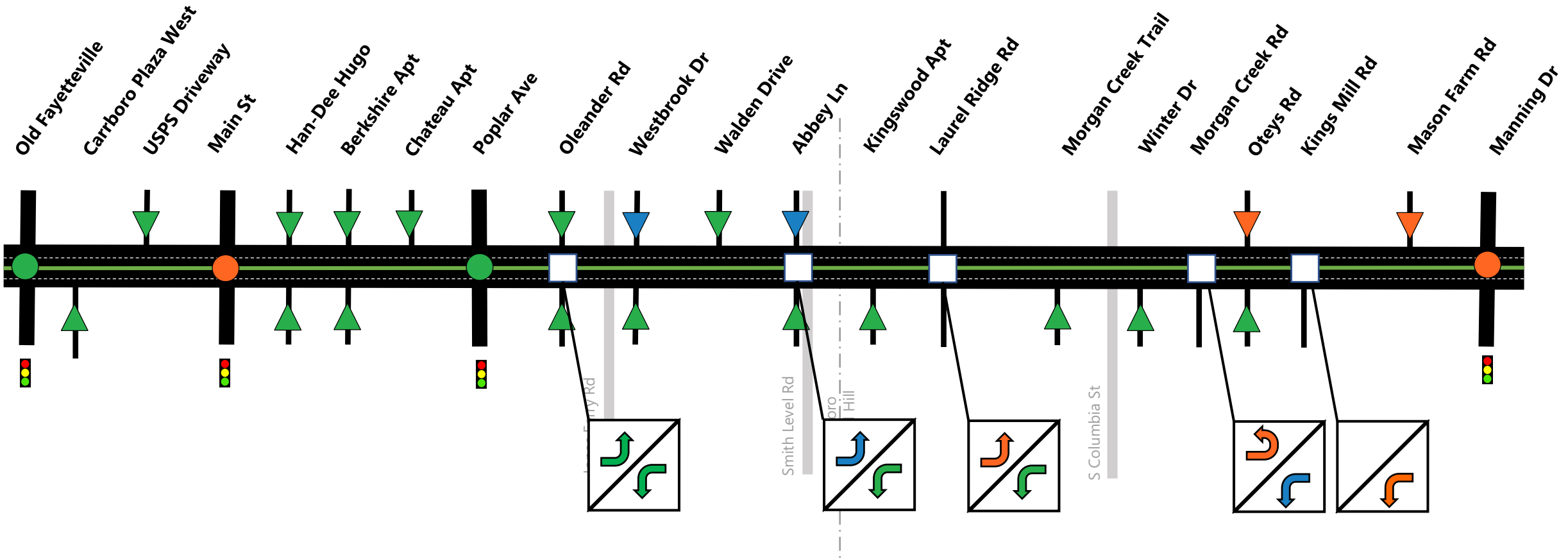
45 mph

Proximity of signals and density of driveways may result in reduced speeds west of Poplar

Traffic Levels of Service



Vehicular LOS – Intersections

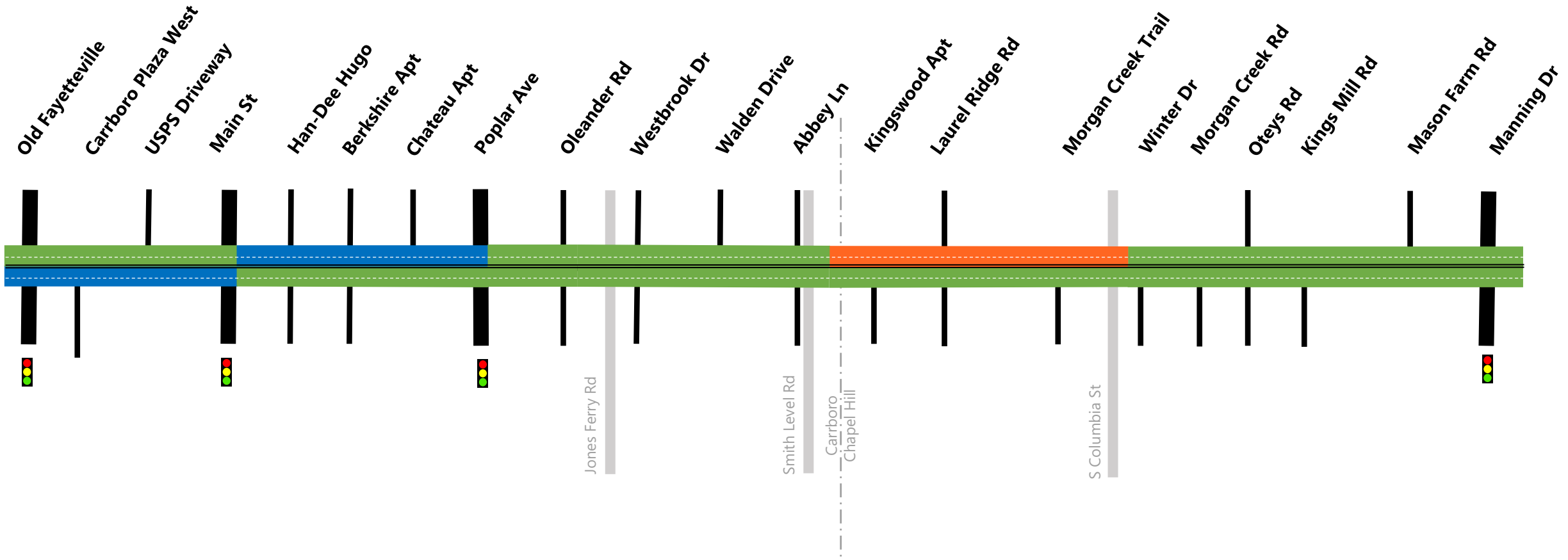


LOS* ● A-C ● D ● E-F

LOS* ▲ A-C ▲ D ▲ E-F

*Worst case from PM peaks

Vehicular LOS – Segment



LOS* A-C D E-F

*Worst case from PM peaks

Multimodal Levels of Service (HCM 2010) Approach

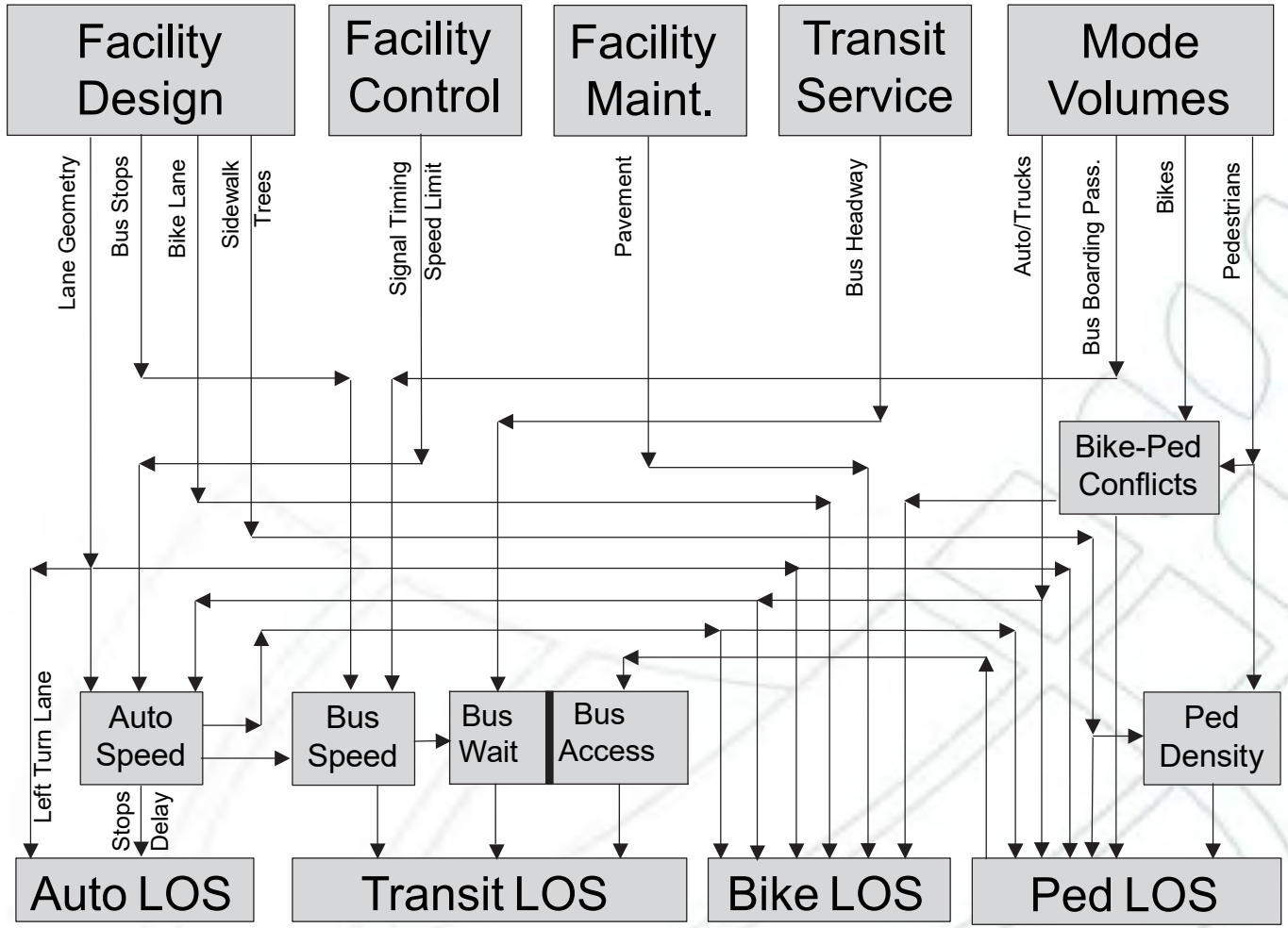
Focus on the traveler perspective

- Quality of Service: perception of how well a facility operates from traveler perspective
- Allow evaluation of intermodal interactions and trade-offs

Mode Affected	Impacting Mode			
	Auto	**Ped**	**Bike**	**Transit**
Auto	Auto & HV volumes Turning patterns Lane configurations	Minimum green time Turn conflicts Mid-block crossings	Turn conflicts Passing delay	Heavy vehicle Blocking delay Signal priority
Ped	Auto & HV volumes Cycle length Driver yielding Turn conflicts Traffic separation	Sidewalk crowding Crosswalk crowding Cross-flows	Shared-path conflicts Bicyclist yielding	Heavy vehicles Transit stop queues Stop cross-flows Vehicle yielding
Bike	Auto & HV volumes Auto & HV speed On-street parking Turn conflicts Traffic separation	Min. green time Shared-path conflicts Turn conflicts Mid-block crossings	Bike volumes	Heavy vehicle Blocking delay Tracks
Transit	Auto volumes Signal timing	Ped. env. Quality Minimum green time Turn conflicts Mid-block crossings	Bike env. Quality Bike volumes	Bus volumes

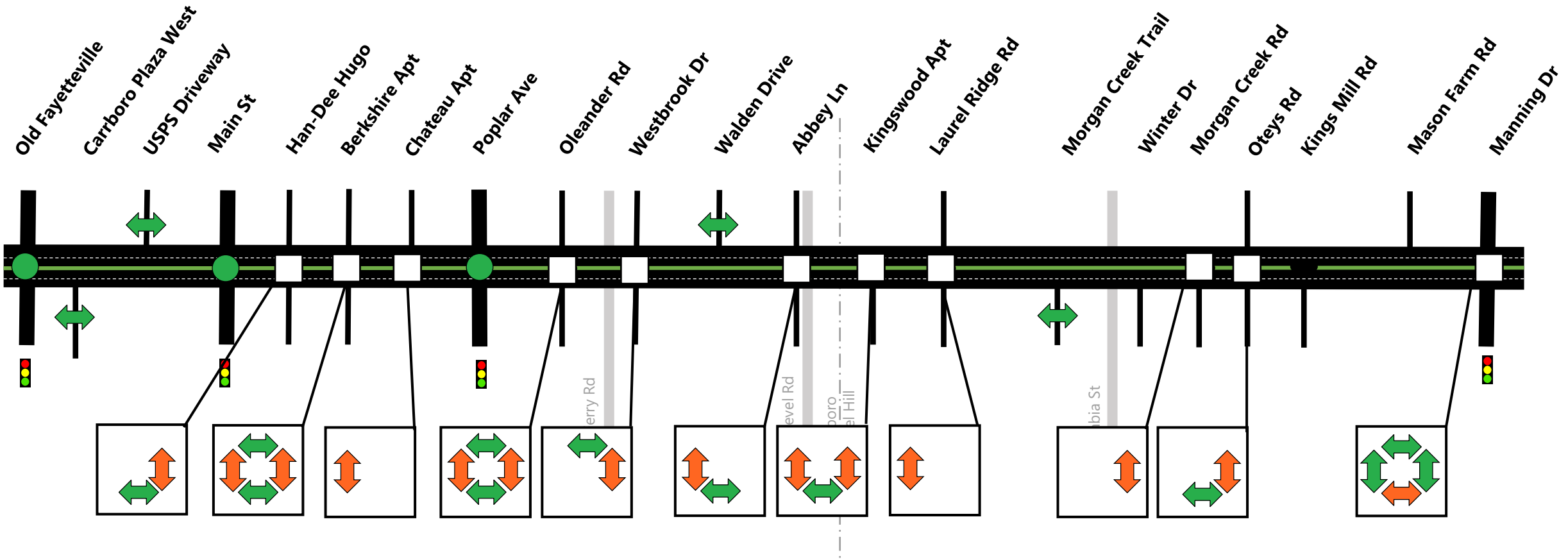
Source: Jamie Parks, 2011

Multimodal Levels of Service (HCM 2010) Mode Interactions



Source: NCHRP Report 616

Pedestrian LOS – Intersection

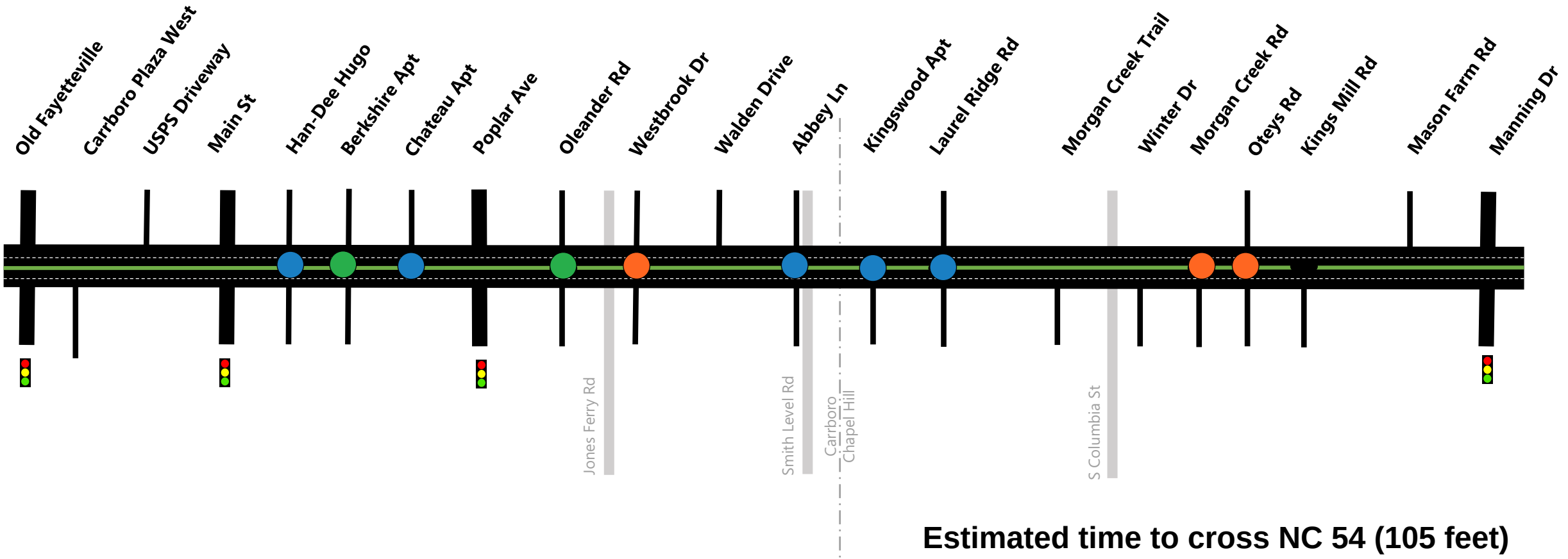


LOS* A-C D E-F

LOS* A-C D E-F

*Worst case from PM peaks

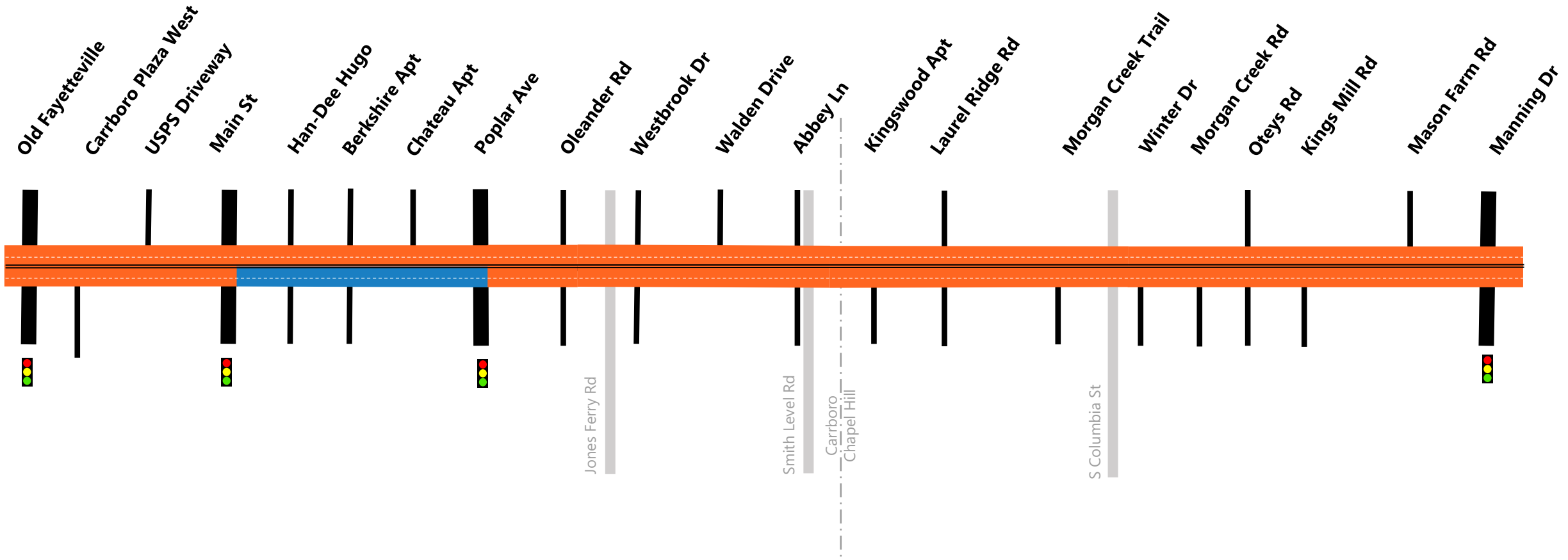
Average Pedestrian Delay Crossing NC 54



Estimated time to cross NC 54 (105 feet)
= 15 seconds each leg (uninterrupted)

Avg Delay (s)*: **<1 min** **1-3 mins** **>3 mins** *Worst case from PM peaks

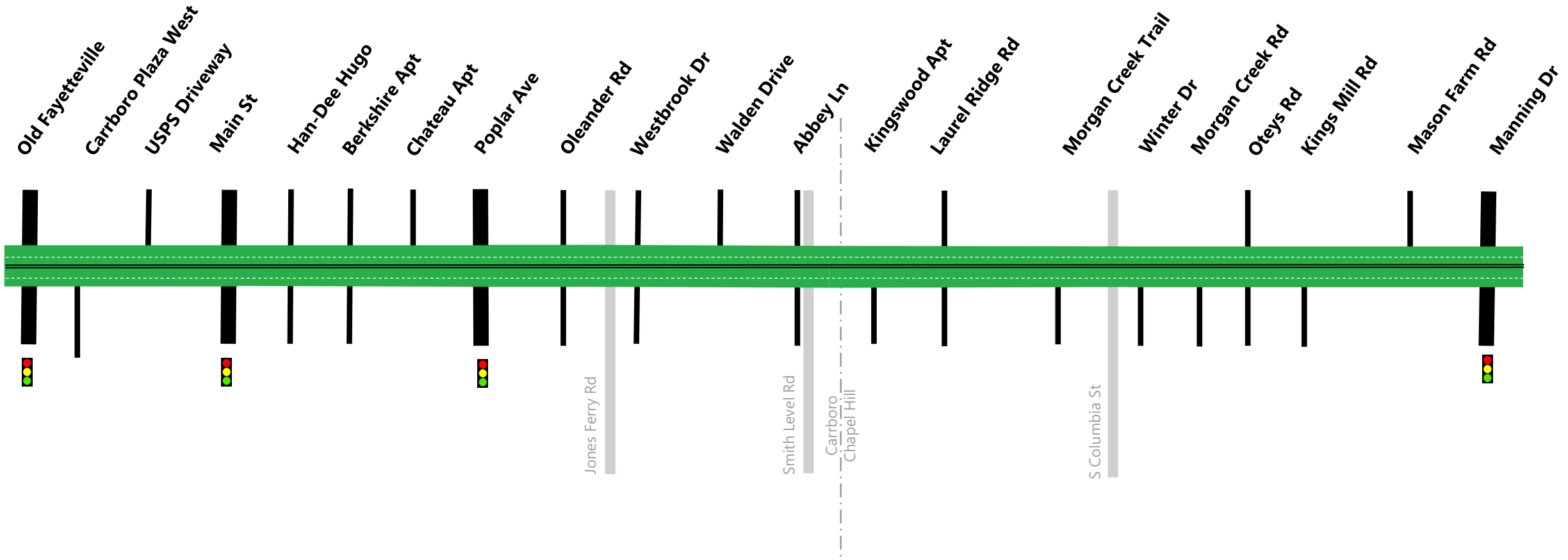
Pedestrian LOS – Segment



LOS* A-C D E-F

*Worst case from PM peaks

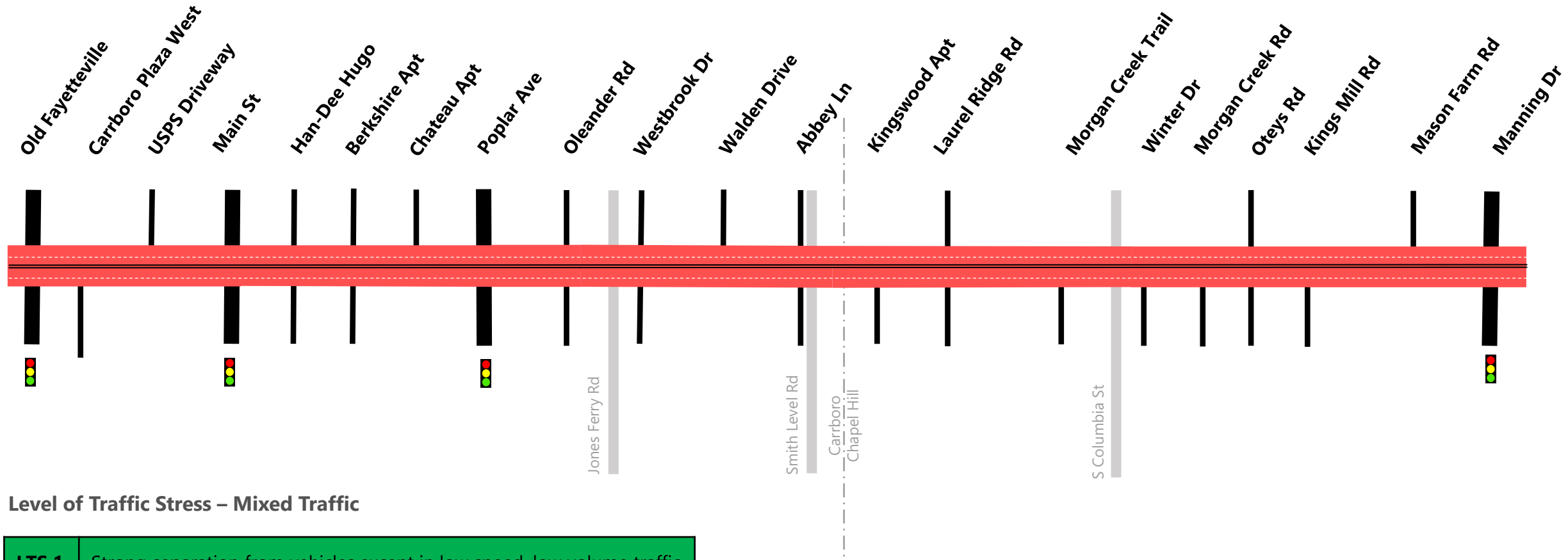
Bicycle LOS – Segment



LOS* A-C D E-F

*Worst case from PM peaks

Bicycle LTS

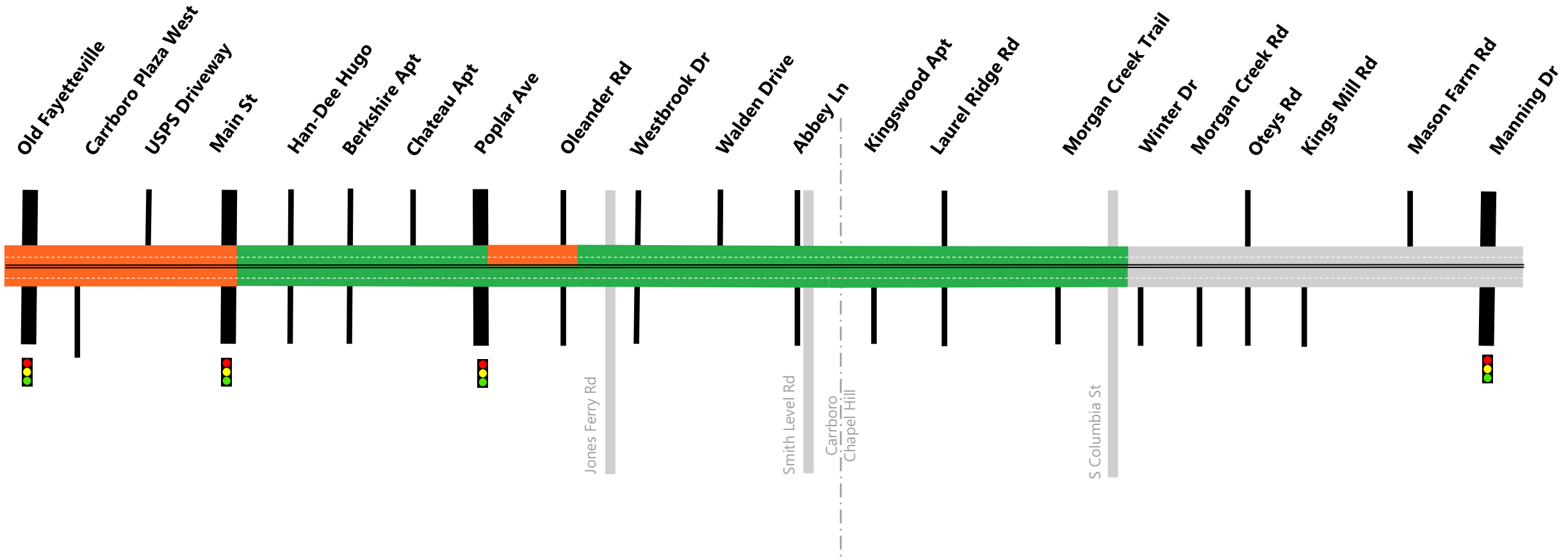


Level of Traffic Stress – Mixed Traffic

LTS 1	Strong separation from vehicles except in low speed, low volume traffic
LTS 2	Dedicated space for bicyclists except at formal crossings
LTS 3	Interaction with moderate speed or multilane traffic, or close proximity to higher speed traffic
LTS 4	Mixed traffic with moderate speeds or close proximity to high speed traffic

Source: Peter G Furth, Northeastern University

Transit LOS – Segment

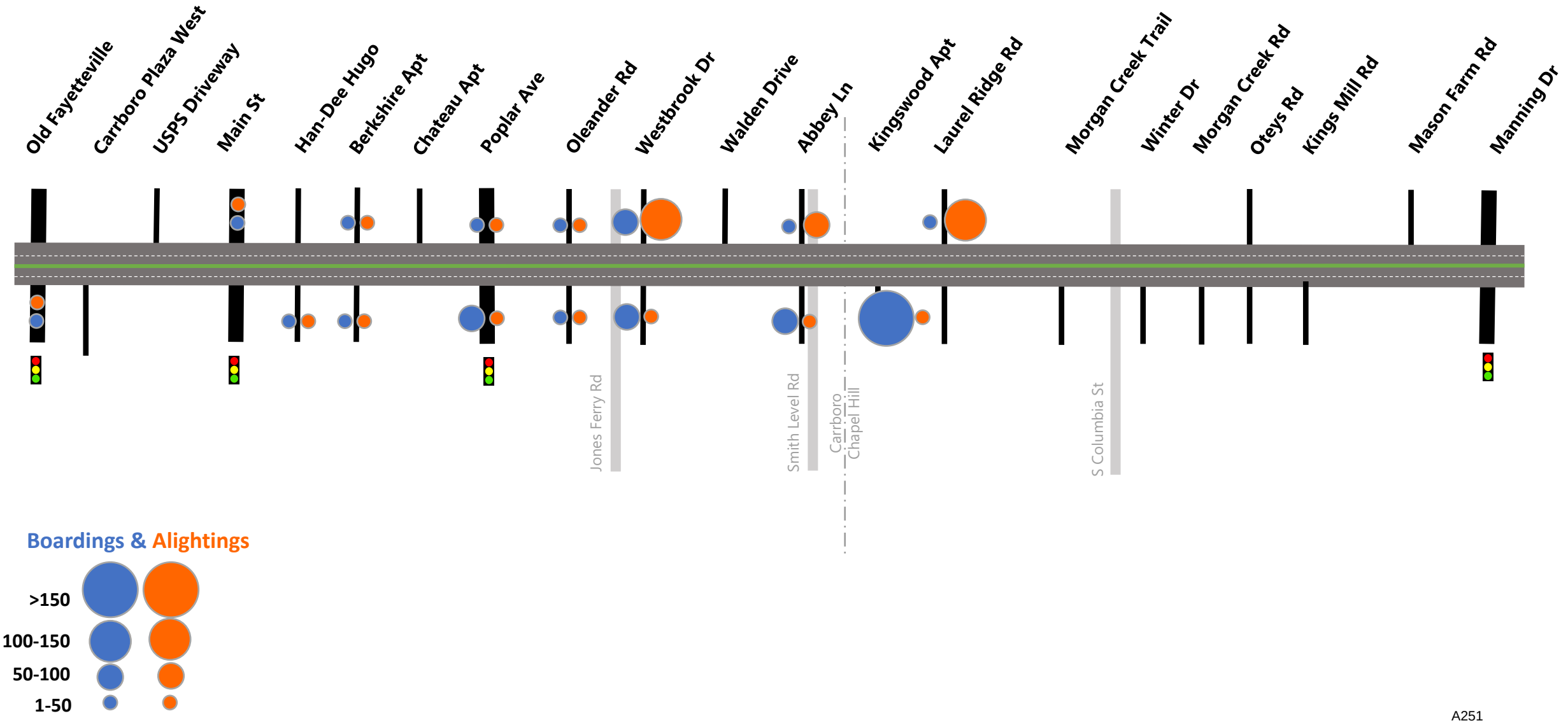


LOS* A-C D E-F

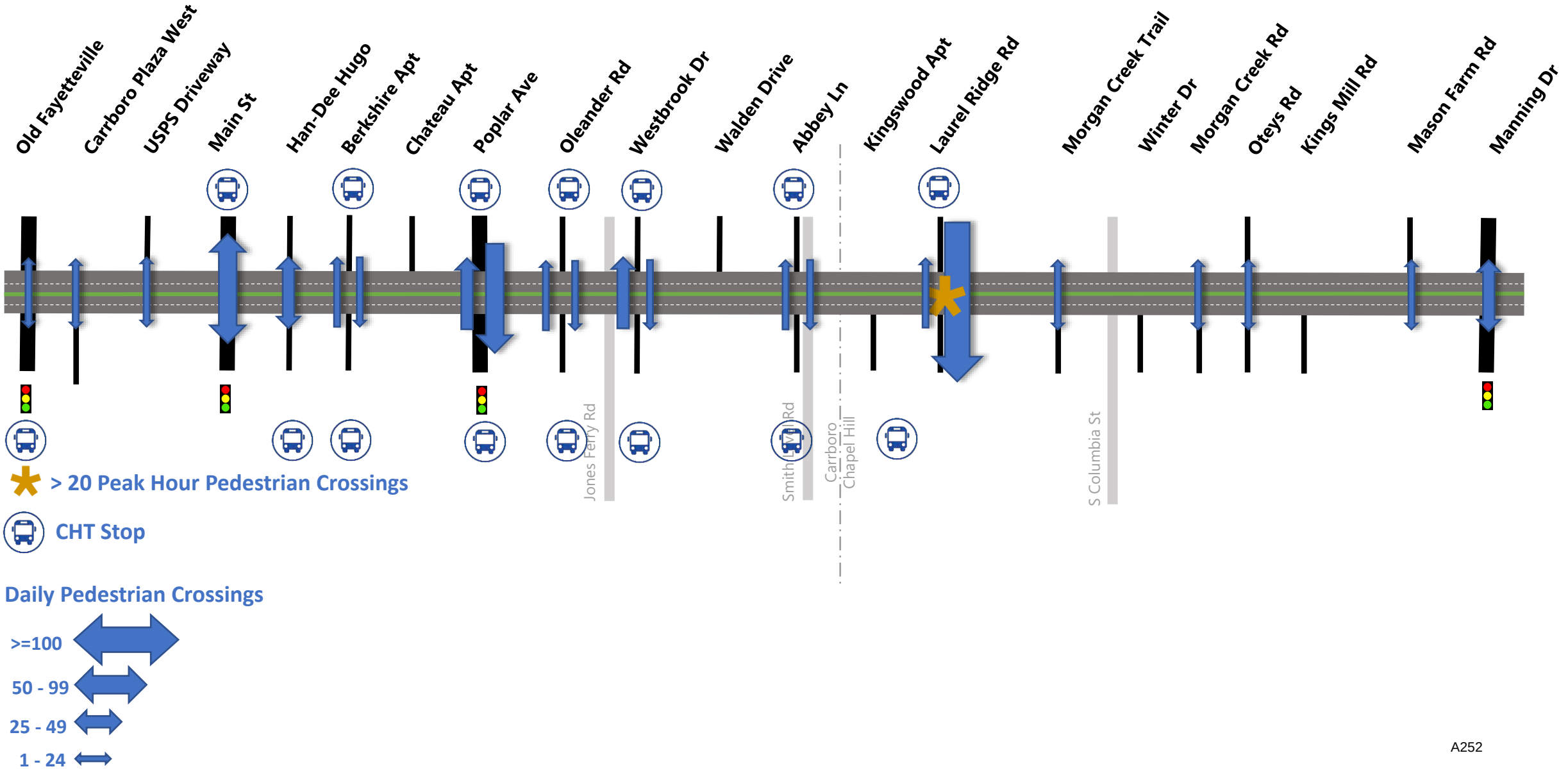
*Worst case from PM peaks

Average Daily CHT Boardings & Alightings

(2016-2018)



Daily Pedestrian Crossings



Online Survey Preview

(519 responses as of April 2)

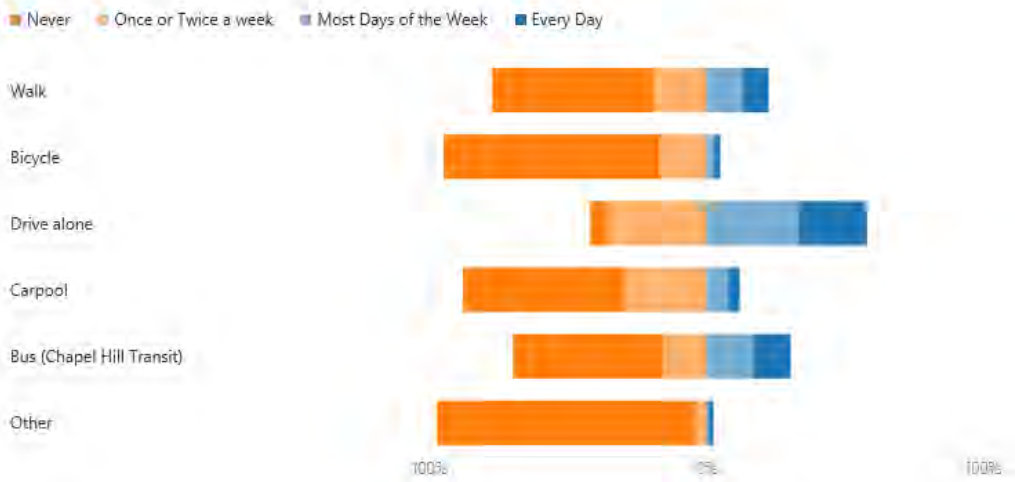
1. For what purpose(s) do you most often travel along NC 54? (Select all that apply)

More Details

I live near the corridor	415
I work near the corridor	193
I visit people or places near th...	235
I pass through this area on my...	313
Other	12

2. During a typical week of travel along the corridor, how often do you use these types of transportation?

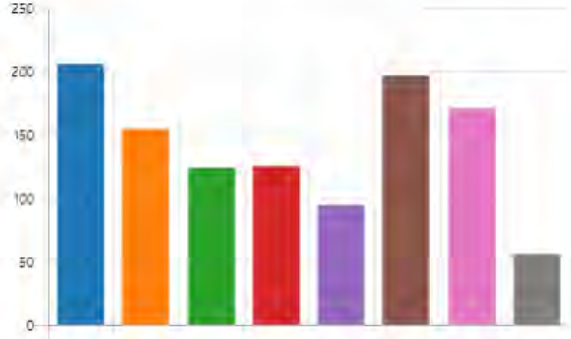
More Details



3. When do you feel most unsafe traveling on the corridor? (Select all that apply)

More Details

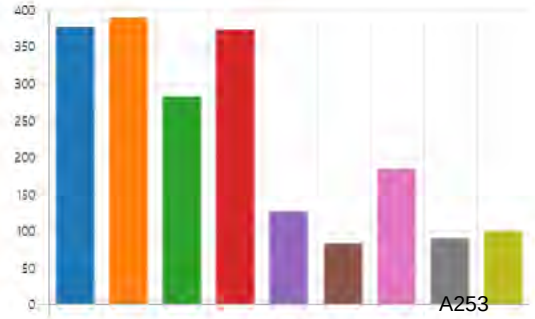
Walking during low light or da...	206
Walking during the day	154
Bicycling during the day	124
Bicycling during low light or d...	125
Driving during the day	94
Driving during low light or dar...	197
Walking to or from a bus stop	171
Other	56



5. What potentially unsafe travel behaviors have you observed along the corridor? (Select all that apply)

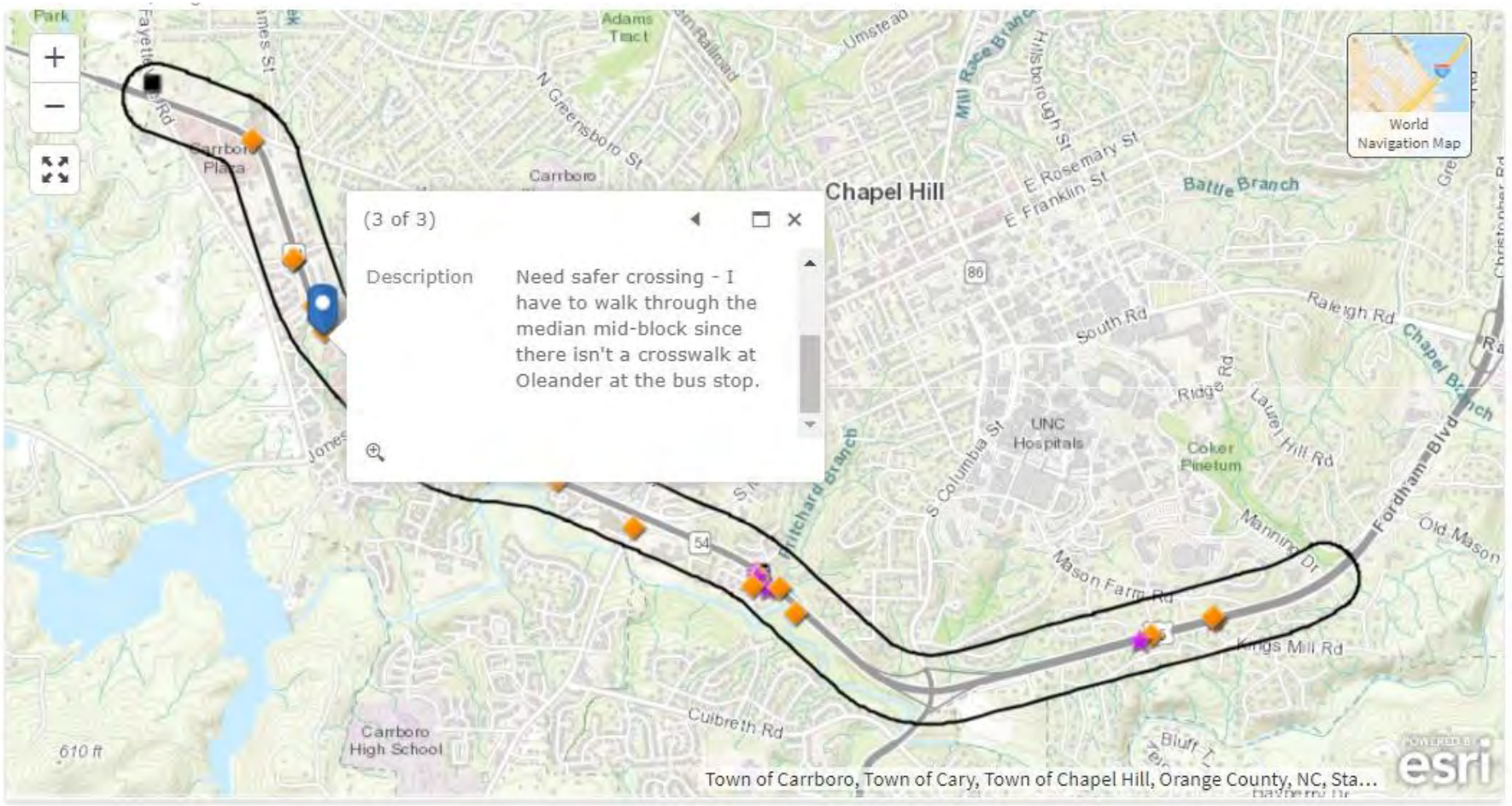
More Details

Drivers speeding	376
Pedestrians crossing the road...	389
Drivers turning quickly or ente...	281
Pedestrians walking on the ed...	373
Drivers following buses closely	126
Drivers passing stopped scho...	81
Drivers passing bicycles closely	184
Bicyclists riding opposite the fl...	90
Other	98



Website & Interactive Map

(Responses as of April 2)



Project Goals Discussion

Short Term Goals

- Reduce actual speeds
- Reducing KA crash risk for pedestrian-bicycles
- Improve pedestrian safety at high crossing locations
- Other?

Long Term Goals

- Connect to existing and planned bicycle networks
- Other?

Project Performance Measures

- ❑ Reduced speeds
- ❑ Reduced KA Crash Risk
- ❑ Reduced crossing delay
- ❑ Connected networks
- ❑ Other
- ❑ Other

1. **Identify Priority Locations**
2. **Select Potential Countermeasures**
3. **Describe Scenarios**
4. **Evaluate Outcomes**
5. **Summarize Benefits**

NC54
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Meeting #3 (June)

Recap Public Feedback

Overview Potential Countermeasures

Brainstorm Concepts

Workshop #1 Format

Date: April 29, 5:30-7:30PM

Location: Carrboro Century Center

Staffing: VHB and Study Team representatives

Format:

-7 stations (welcome, background, 5 stations with segment "dashboards")

-Interactive

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BICYCLE & PEDESTRIAN CORRIDOR SAFETY STUDY

Study Team Meeting #3 Notes

July 12th

Carrboro Town Hall
301 W Main St, Carrboro, NC 27510
Board Room

Attendance

Hanna Cockburn
Jomar Pastorelle
Zach Hallock
Kurt Stolka
Chuck Edwards
Kumar Nepalli
Donnie Rhoads
Nick Pittman
Brian Mayhew
Brian Thomas
Mark Aldridge
Lauren Blackburn
Joe Seymour

Action Items

- Action item - Zach to share the Carrboro bike plan network with VHB
- Action Item – VHB to confirm the status of the study area's TIP projects
- Action Item - VHB will have to look at signal phases and potential impacts of conceptual signal additions
- Action Item – VHB to include pedestrian and bicycle movements across the NC 54 study area ramps as part of the study recommendations

1. Welcome and Introductions
    a. The meeting began at 9:40AM
    b. Zach reported that Carrboro has developed draft bicycle network recommendations part of its new bike plan
    c. Action item - Zach to share the Carrboro bike plan network with VHB
2. Recap April Community Open House and survey data
    a. Joe reviewed the open house and survey data and concluded that those inputs largely confirmed the findings from the plan review and existing conditions analysis
3. Decide approach to site identification
    a. Hot spot approach
        i. Brian said that the project should still focus on Hot Spots, and Hanna said that each approach is a layer to a safety cake and will build upon one another
        ii. Nick said that riding a CHT loop route all the way around is a less appealing than crossing the roadway. Nick said that NC 54 will have high frequency CHT service,

though the service will likely not deter crossings; would likely increase crossing since transit would be more appealing.

iii. Brian said that the route design has its own set of challenges

b. Systemic approach

c. Systems approach

i. Chuck said that U-5304 will remain in the STIP as a development project

ii. Zach said that the Old Fayetteville intersection STIP project has been rejected, but will be resubmitted

1. Action Item – VHB to confirm the status of the study area's TIP projects

iii. Brian said that the distance and uncertainty of the STIP makes site and countermeasure selection difficult given their interdependence

iv. Zach said that Carrboro is working with NCDOT to find places for separated bike lanes on Jones Ferry Rd underneath the NC-54 interchange

1. Zach said that the separation on Jones Ferry is preferred because of speed differential and younger riders.

v. Zach said people bicycle on the wide shoulder in Carrboro, and that used to be seen as an adequate facility.

vi. Brian said that if NC 54 is six lanes as part of U-5304B, the U-turns will be signalized. ITRE has a model guide for when to do that. Chuck said that a superstreet intersection could be a crossing point.

4. Countermeasure presentation

a. Brian said that signalization on superstreets could put downward pressure on high speeds; crossing time for pedestrians is shorter but the physical crossing length is longer.

b. Lauren said that there are tradeoffs to improvements, and there may be a need to move bus stops to other sides of intersections to accommodate Z-crossings

c. Hanna was not in favor of a raised median throughout the corridor without formalized pedestrian crossings as a specific countermeasure

d. Zach wants LPIs applied throughout Carrboro, and Hanna said that it should be a system-wide improvement for driver expectancy

e. Kurt said that UNC has LPIs throughout the UNC campus.

f. Brian said that the default should not be LPI given NC's default of right turn on red and other factors, but along a specific corridor it would make sense.

g. Zach has asked Kumar to implement LPIs throughout Carrboro, and he will likely refine it to Jones Ferry Rd and Smith Level Rd. Brian Thomas recommended incorporating sight distance considerations at Old Fayetteville Rd.

h. Hanna will look back at AASHTO and LPIs

i. Brian said that RTOTR should not be automatically lumped in with LPIs, maybe pair with a time of day time restriction; make the restriction illuminated during pedestrian peak periods instead of 24-hour

j. Brian said that new research on lighting is emerging; that it causes significant shadows, and lighting would have to be consistent and targeted towards the intended effects

k. Chuck mentioned that local governments work with Duke Energy on lighting improvements; NCDOT focuses on AASHTO lighting requirements

l. There was not much support from the group on the RRFBs along the corridor.

m. Brian said that the PHB can be confusing given the roadway context and asked that the Study Team be thoughtful in the application of the PHB
n. Brian said that the jump to a pedestrian signal from PHB requires much higher pedestrian crossing levels.
o. There was not much interest in the tunnel option due to cost and topography challenges
p. Lauren shared the PHB NCDOT policy document, and Brian said that other countermeasures may be more appropriate like a limited movement two-phase signal (no through movements, left in, right out, though must allow for U-turn movements elsewhere or use the interchange)
q. Brian said that the apartment complexes are islands, and there could be other ways to encourage connectivity.
r. Brian Thomas asked about dedicated shuttles, and Nick said that it would be cost prohibitive, and accessing the complexes is difficult.
s. Brian said that the corridor shows North-South demand and is stuck in an East-West world. Brian said that NCDOT crossings need to inform/serve a larger system. Brian said that we want cohesion on recommended improvements.
t. Hanna said to look at more, finer grained connections that would support longer term connections. Chuck said that future land use decisions should incorporate access
u. It was asked if a limited movement intersection be incorporated at Oteys Rd like at Kingswood.
    i. Action Item - VHB will have to look at signal phases and potential impacts of conceptual signal additions.
v. The new UNC South Campus Comprehensive Plan include more development at Odum village north of Oteys Rd.
w. Brian said that linear movement along NC 54 is a decision point that may be not be resolved at this time.
x. Zach said that Carrboro anticipates mixed-use development along NC 54 as the existing residential multifamily buildings reach the of their lifecycles.
y. Brian asked VHB to include a limited analysis of ramps at interchanges to address pedestrian and bicycle safety concerns
    i. Action Item – VHB to include pedestrian and bicycle movements across the NC 54 study area ramps as part of the study recommendations

5. Determine decision-making process for selecting countermeasures
    a. VHB will use the three approaches to identify and begin testing safety and mobility improvements areas throughout the corridor. Conceptual options and the related findings will be shared with the public during the second Community Workshop, but the group agreed it was not appropriate to share a limited set of specific recommendations at the workshop.
6. Next steps
    a. The second Community Workshop is anticipated for late August or early September to coincide with the return of students.
    b. The Study Team discussed options for engaging community members in the process. These included:
        i. Share conceptual improvement options and requesting feedback
        ii. Display North-South transportation demand/connections

iii. Display corridor areas where data and findings show changes are recommended
iv. Ask attendees for feedback on prioritizing and sequencing safety and mobility improvements

7. Adjourn
    a. The meeting ended at 12:20PM

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Study Team #3

	Name	Affiliation
1	Hanna Cockburn	NCDOT
2	Jamar Pastarelle	TOCH
3	Zach Hallock	Town of Carrboro
4	Kurt Stoka	UNC
5	CHUCK EDWARDS	NCDOT DIV 7
6	Kumar Nepalli	
7		
8		
9		
10		

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BICYCLE & PEDESTRIAN CORRIDOR SAFETY STUDY

Study Team #3

	Name	Affiliation
1	DONNIE RHOADS	CHAPEL HILL POLICE
2	Nick Pittman	Chapel Hill Transit
3	Joe Seymour	VHB
4	Brian Mayhew	NCDOT
5	BRIAN THOMAS	NCDOT
6	Mark Aldridge	NCDOT
7		
8		
9		
10		

Meeting Agenda

Welcome, Introductions, and Goals

Recap April Community Open House and survey data

Discuss approach to site identification

Countermeasure Presentation

Application of Countermeasures

Other Discussion

NC54
BICYCLE & PEDESTRIAN CORRIDOR SAFETY STUDY

Online Survey Results

(720 responses as of May 17)

For what purpose(s) do you most often travel along NC 54?" respondents answered:

- **78%** I live near the corridor
- **60%** I pass through this area on my way to another destination
- **46%** I visit people or places near the corridor
- **37%** I work near the corridor
- **2%** Other

During a typical week of travel along the corridor, how often do you use these types of transportation (most days to daily):

- **Drive Alone** 55%
- **Bus (Chapel Hill Transit)** 32%
- **Walk** 24%
- **Carpool** 12%
- **Bicycle** 6%
- **Other** 3%

Potentially unsafe travel behaviors:

- **72%** ***Pedestrians crossing*** the road outside of marked crosswalks
- **70%** ***Pedestrians walking*** on the edge or shoulder of the roadway
- **70%** Drivers ***speeding***
- **54%** Drivers turning quickly or entering the roadway unexpectedly

When do you feel most unsafe traveling on the corridor :

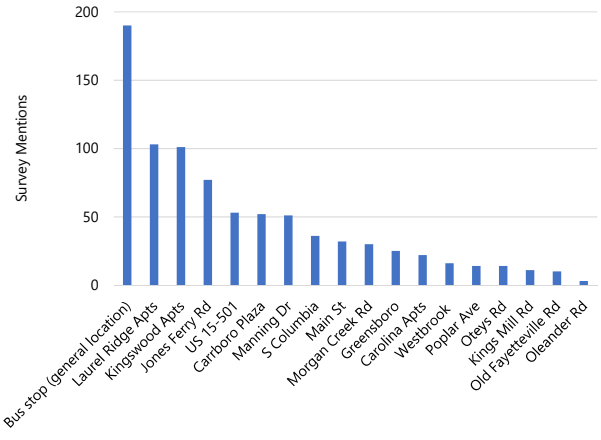
- **39%** ***Walking during low light or dark***
- **36%** ***Driving during low light or dark***
- **32%** Walking to or from a ***bus stop***
- **30%** Walking during the day
- **26%** Bicycling during low light or dark
- **25%** Bicycling during the day

Online Survey Results, Continued

Prominent Destinations

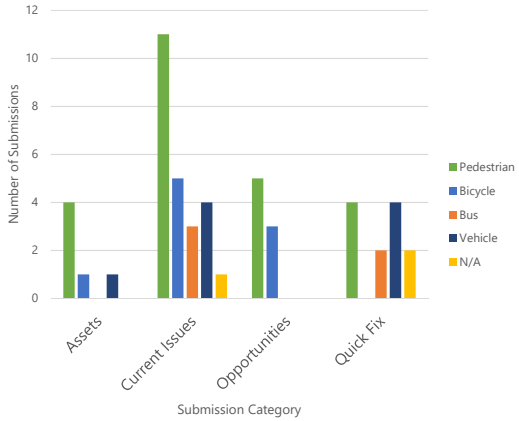
- Carrboro
- UNC
- Carrboro Plaza (not inclusive of stores within plaza)
- "Home" – 78% of survey respondents reported living near the corridor
- "Bus stop"

Safety Concerns: Survey Location Mentions



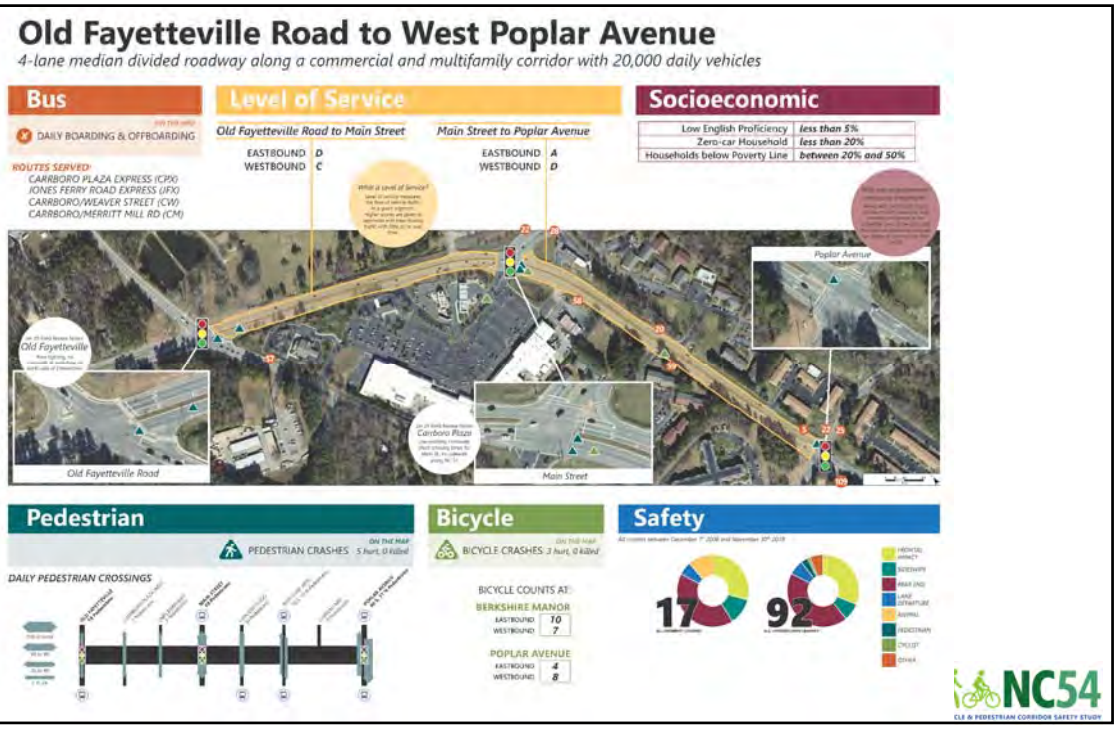
Interactive Map

Comment Categories



Comment Hot Spots

- **Intersection of Kingswood Apartments and NC 54** (15 comments): high vehicle speeds, lack of pedestrian infrastructure, need for a crosswalk and stoplight.
- **Ramps going on/off NC 54 onto 15-501 and Smith Level Road** (8 comments): lack of safe crossings or paths along ramp exits for pedestrians and bicyclists, need for sidewalk along 15-501.
- **Intersection of Westbrook Drive and NC 54** (5 comments): lack of pedestrian infrastructure to connect apartment complexes to bus stops. Multiple requests for a pedestrian bridge to connect the two sides of NC 54.
- **Intersection of Oteys Road and NC 54** (3 comments): large number of bicyclists and pedestrians using Oteys to go north, lack of safe crossing.



West Poplar Avenue to Walden Drive

4-lane median divided roadway along a commercial and multifamily corridor with 20,000 to 31,000 daily vehicles

Bus

DAILY BOARDING & OFFBOARDING

ROUTES SERVED:
CARRBORO PLAZA EXPRESS (CPX)
JONES FERRY ROAD EXPRESS (JFX)
CARRBORO/DOWNTOWN CHAPEL HILL (J)
CARRBORO/MERRITT MILL RD (CM)

Level of Service

	Poplar Avenue to Oleander Road	Jones Ferry Road to Greensboro Street
EASTBOUND	B	C
WESTBOUND	B	C

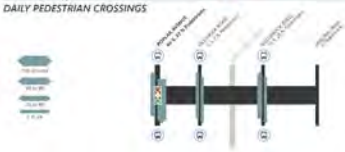
Socioeconomic

Low English Proficiency	more than 25%
Zero-car Household	between 20% and 50%
Households below Poverty Line	between 20% and 50%

Pedestrian

PEDESTRIAN CRASHES 2 hurt, 1 killed

DAILY PEDESTRIAN CROSSINGS



Bicycle

BICYCLE CRASHES 1 hurt, 0 killed

BICYCLE COUNTS AT:

POPLAR AVENUE	
EASTBOUND	4
WESTBOUND	8
OLEANDER ROAD	
EASTBOUND	2
WESTBOUND	4
WESTBROOK DRIVE	
EASTBOUND	5
WESTBOUND	4

Safety

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Walden Drive to West of Kingswood Apartments

4-lane median divided roadway along a multifamily corridor with 31,000 daily vehicles

Bus

DAILY BOARDING & OFFBOARDING

ROUTES SERVED:
CARRBORO/MERRITT MILL RD (CM)
CARRBORO/DOWNTOWN CHAPEL HILL (J)
ESTES PARK/UNC HOSPITALS (JN)

Level of Service

	Jones Ferry Road to Greensboro Street	Greensboro Street to NC 86
EASTBOUND	C	C
WESTBOUND	C	F

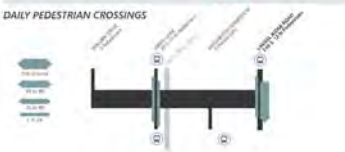
Socioeconomic

Low English Proficiency	between 15% and 25%
Zero-car Household	less than 20%
Households below Poverty Line	between 20% and 50%

Pedestrian

PEDESTRIAN CRASHES 3 hurt, 0 killed

DAILY PEDESTRIAN CROSSINGS



Bicycle

BICYCLE CRASHES 1 hurt, 0 killed

BICYCLE COUNTS AT:

ABBEY LANE	
EASTBOUND	6
WESTBOUND	5
KINGSWOOD APARTMENT	
EASTBOUND	3
WESTBOUND	0

Safety

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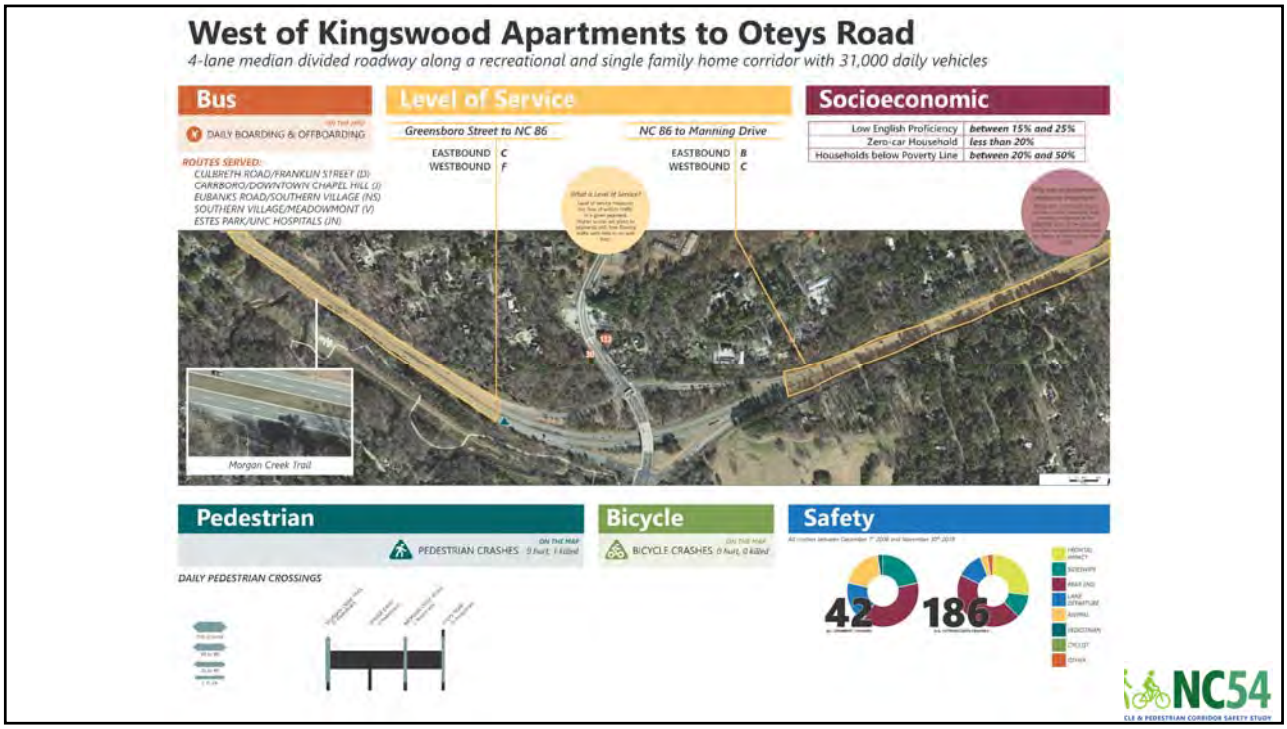
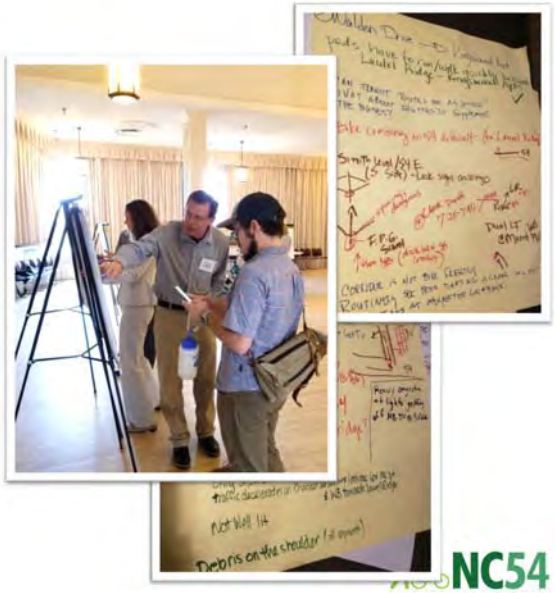

West of Kingswood Apartments to Oteys Road
4-lane median divided roadway along a recreational and single family home corridor with 31,000 daily vehicles
Bus
DAILY BOARDING & OFFBOARDING
ROUTES SERVED:
CULBRETH ROAD/FRANKLIN STREET (D)
CARRBORO/DOWNTOWN CHAPEL HILL (J)
EUBANKS ROAD/SOUTHERN VILLAGE (NS)
SOUTHERN VILLAGE/MEADOWMONT (V)
ESTES PARK/UNC HOSPITALS (JN)
Level of Service
Greensboro Street to NC 86
EASTBOUND C
WESTBOUND F
NC 86 to Manning Drive
EASTBOUND B
WESTBOUND C
Socioeconomic
Low English Proficiency between 15% and 25%
Zero-car Household less than 20%
Households below Poverty Line between 20% and 50%
Morgan Creek Trail
Pedestrian
PEDESTRIAN CRASHES
DAILY PEDESTRIAN CROSSINGS
Bicycle
BICYCLE CRASHES
Safety
42
186
NC54


Oteys Road to Manning Drive
4-lane median divided roadway along an institutional and single family home corridor with 40,000 daily vehicles
Oteys Road
Level of Service
NC 86 to Manning Drive
EASTBOUND B
WESTBOUND C
Socioeconomic
Low English Proficiency less than 5%
Zero-car Household between 20% and 50%
Households below Poverty Line between 20% and 50%
Manning Drive
Pedestrian
PEDESTRIAN CRASHES
DAILY PEDESTRIAN CROSSINGS
Bicycle
BICYCLE CRASHES
Safety
101
141
NC54

Community Open House Themes (April 29, 2019)

- Inadequate and incomplete pedestrian facilities
- Lighting could be improved throughout corridor
- Pedestrians cross NC 54 at uncontrolled crossing locations, often to access transit service
- Inadequate, unsafe, and disconnected bicycle infrastructure
- Hazardous conditions for roadway users: on and off ramps, turning lanes, main intersections, and acceleration / deceleration lanes.

**Summary memo is on project website*



Public Outreach Summary

- Are you surprised by any of the public comments or input?

Approaches to Selecting Priority Locations

I. Hot Spot approach

II. Systemic approach

III. Systems approach

Source: This Photo by Unknown Author is licensed under CC BY

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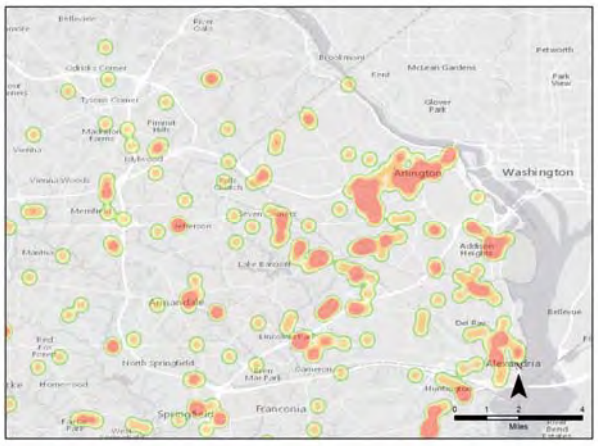
Hot Spot Approach

- Crash frequencies as key variable
- Crash clusters based on distance to other reported incidents
- Retrospective tool for targeted deployment of crash countermeasures
- May not be best suited for low-frequency crash areas



Source: VHB, Virginia PSAP

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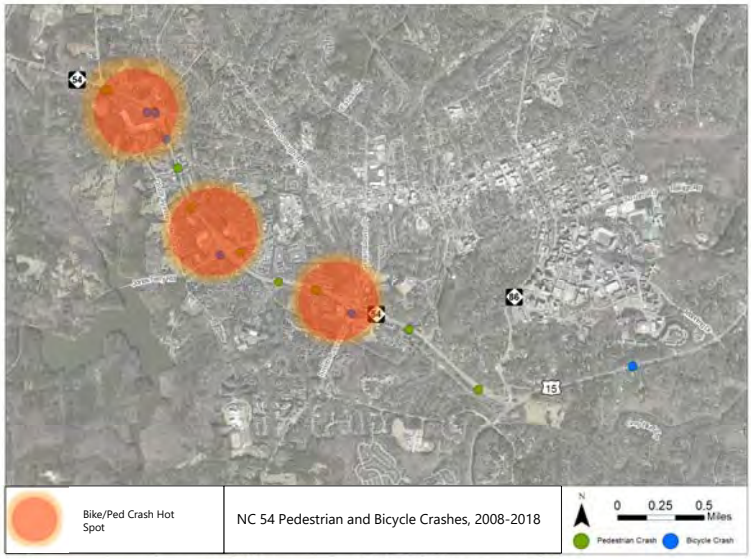
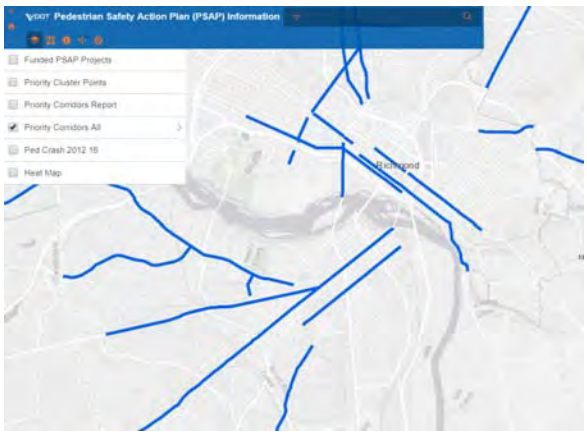
Hot Spot Approach, Continued



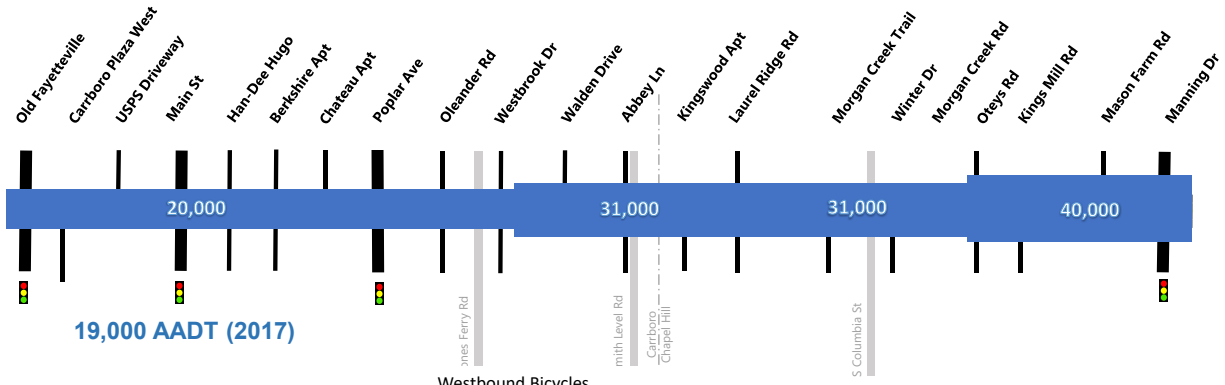
Systemic Approach

- Consideration of roadway and land use variables that are predictive of crashes
- Does not focus on previous crash frequencies like Hot Spot approach
- Factors include: pedestrian activity and generators, AADT, vehicle speeds, etc.
- Categorization of intersections and segments by risk tier



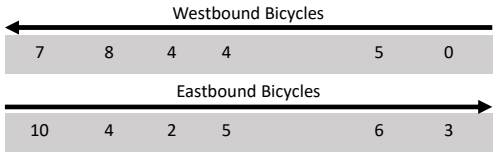
Source: VHB, Virginia PSAP

AADT - 2018 7-Day 16 Hour Average

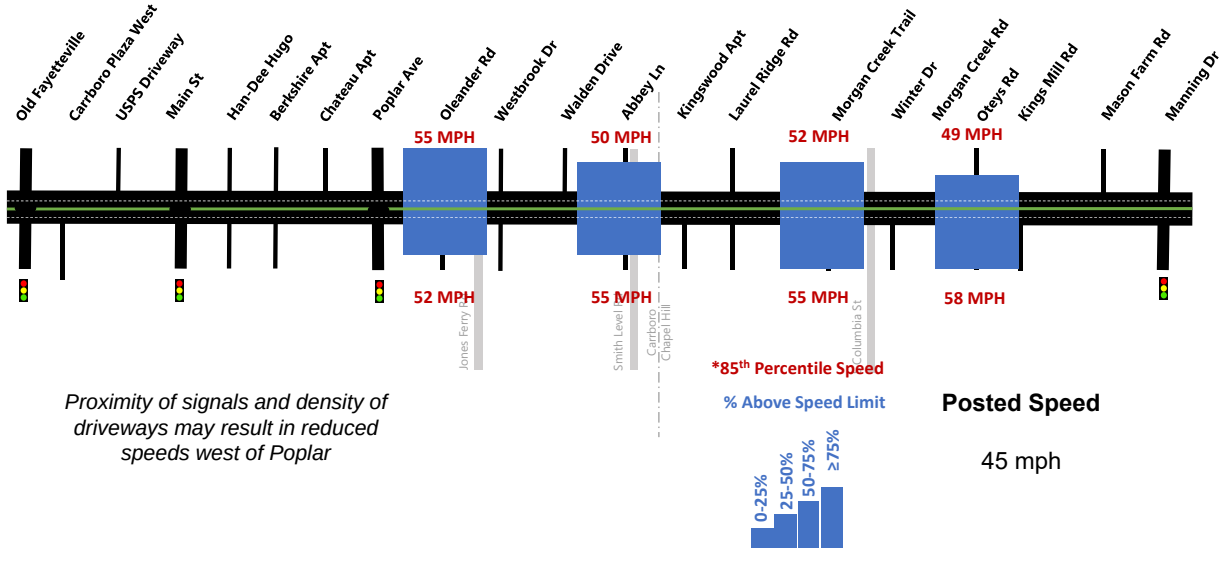


19,000 AADT (2017)

Bicycle traffic west of Poplar Ave may increase due to cross-street bicycle networks and land use context



Vehicle Speed – 7 Day Average



Proximity of signals and density of driveways may result in reduced speeds west of Poplar

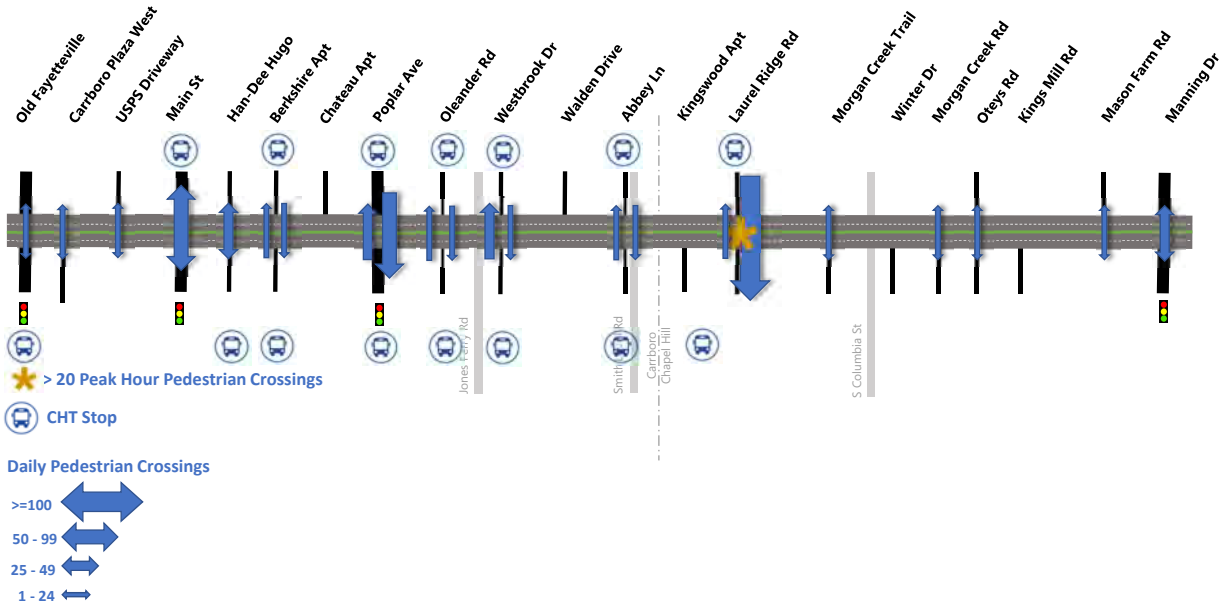
*85th Percentile Speed

% Above Speed Limit

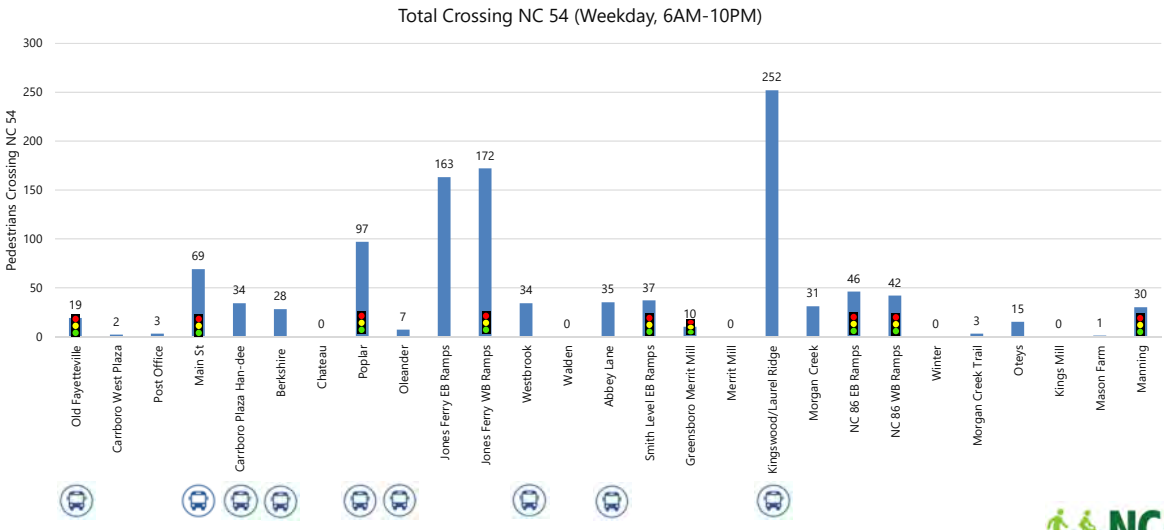
Posted Speed

45 mph

Daily Pedestrian Crossings



Corridor Pedestrian Crossings



Systemic Risk Factors – Segments

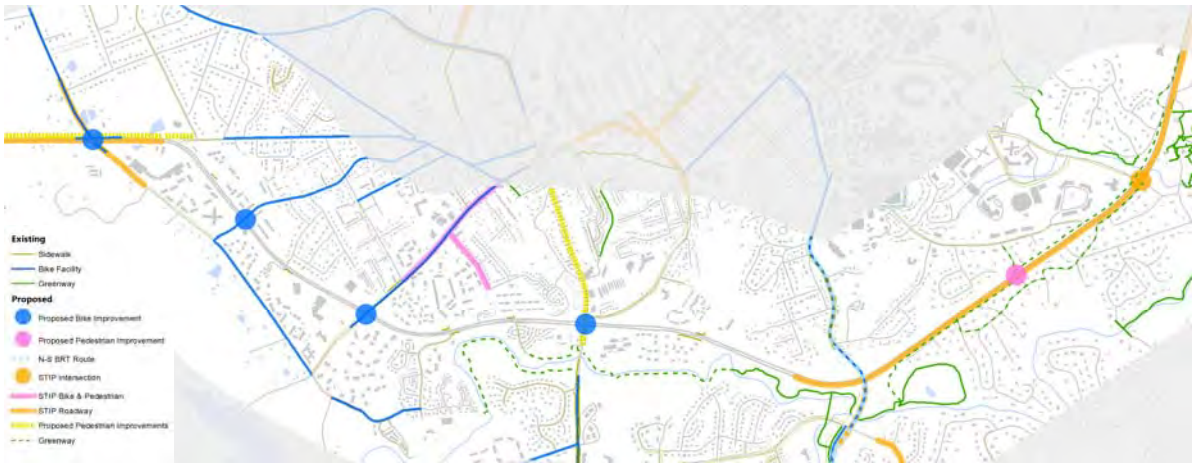
- Four Risk Tiers (**low** to **high**)
  - **Tier 1**: Old Fayetteville Rd to West Poplar Ave
  - **Tier 2**: Oleander St to Westbrook Dr
  - **Tier 3:** NC 86 to Manning Dr
  - **Tier 4**: Westbrook Dr to S Columbia/NC 86

Systems Approach

- Considering planned improvements
- Evaluating impacts across signalized intersections
- Understanding the mobility complexities at interchanges, including N-S mobility demand
- Pedestrian connectivity area-wide
  - Worn Footpaths
  - Significant Bike/Ped Volumes (E-W)

Source: G Boeing: Square Mile Street Network Visualization

Planned Improvements



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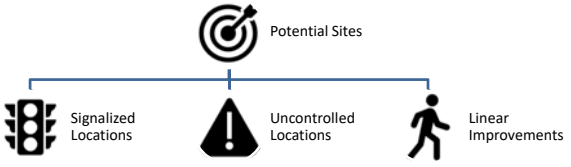
Approach for Selecting Countermeasure and Improvement

- Signalized Crossing Locations (Non-interchange locations)
  - Transit stops
  - Significant known or anticipated pedestrian generator
  - Lack of separate turning movements from WALK phase
  - Lack of leading pedestrian interval
  - Low lighting
- Uncontrolled Crossing Locations
  - Transit stops
  - Significant known or anticipated pedestrian generator
  - Presence of TWLTL
  - Long distance between crossing opportunities
  - Low lighting
- Linear Improvements
  - Sidewalks
  - Sidepaths
  - Parallel networks (bikeways/walkways)



Sources: Adapted from (NCHRP) Research Report 893: Systemic Pedestrian Safety Analysis

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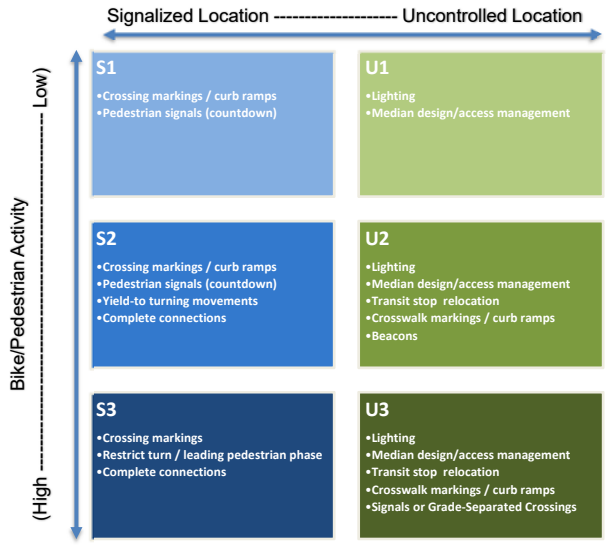
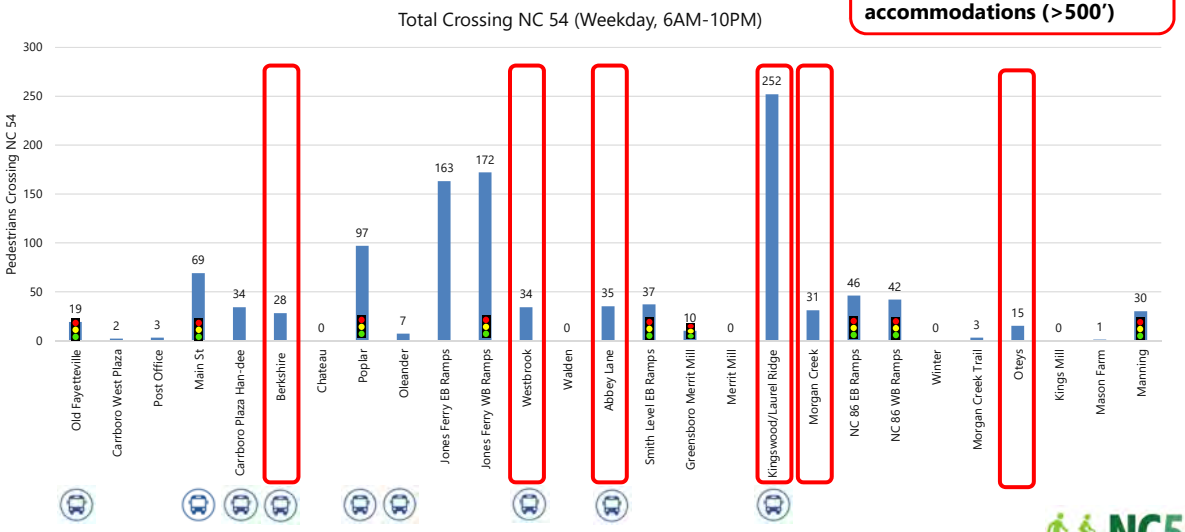
Crossing Treatment Selection Approach



Corridor Pedestrian Crossings

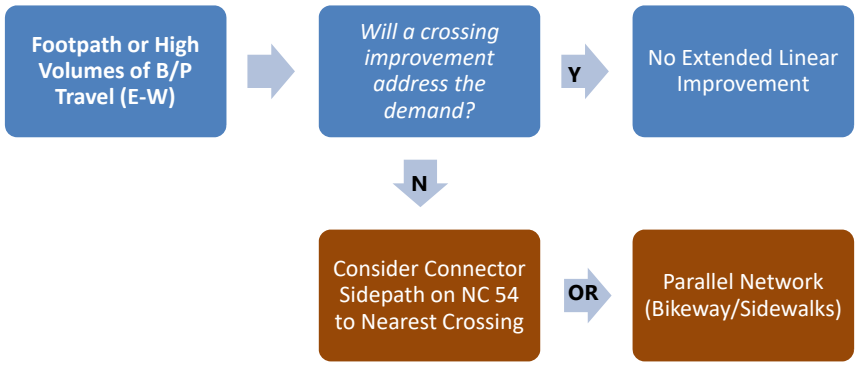
Locations without nearby pedestrian crossing accommodations (>500')



Priority Crossing Improvement Sites & Categories

S1	N/A	U1	Morgan Creek Rd
S2	Old Fayetteville, Manning Dr	U2	Oteys Rd, Abby Ln, Westbrook Dr
S3	Main St, W Poplar Ave	U3	Kingswood/Laurel Ridge

Linear Improvement Decision Approach



Planned Improvements / Demand for Connectivity

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Next Steps

- Test Improvement Options at Select Priority Sites
- Identify opportunities and objectives for Public Workshop #2

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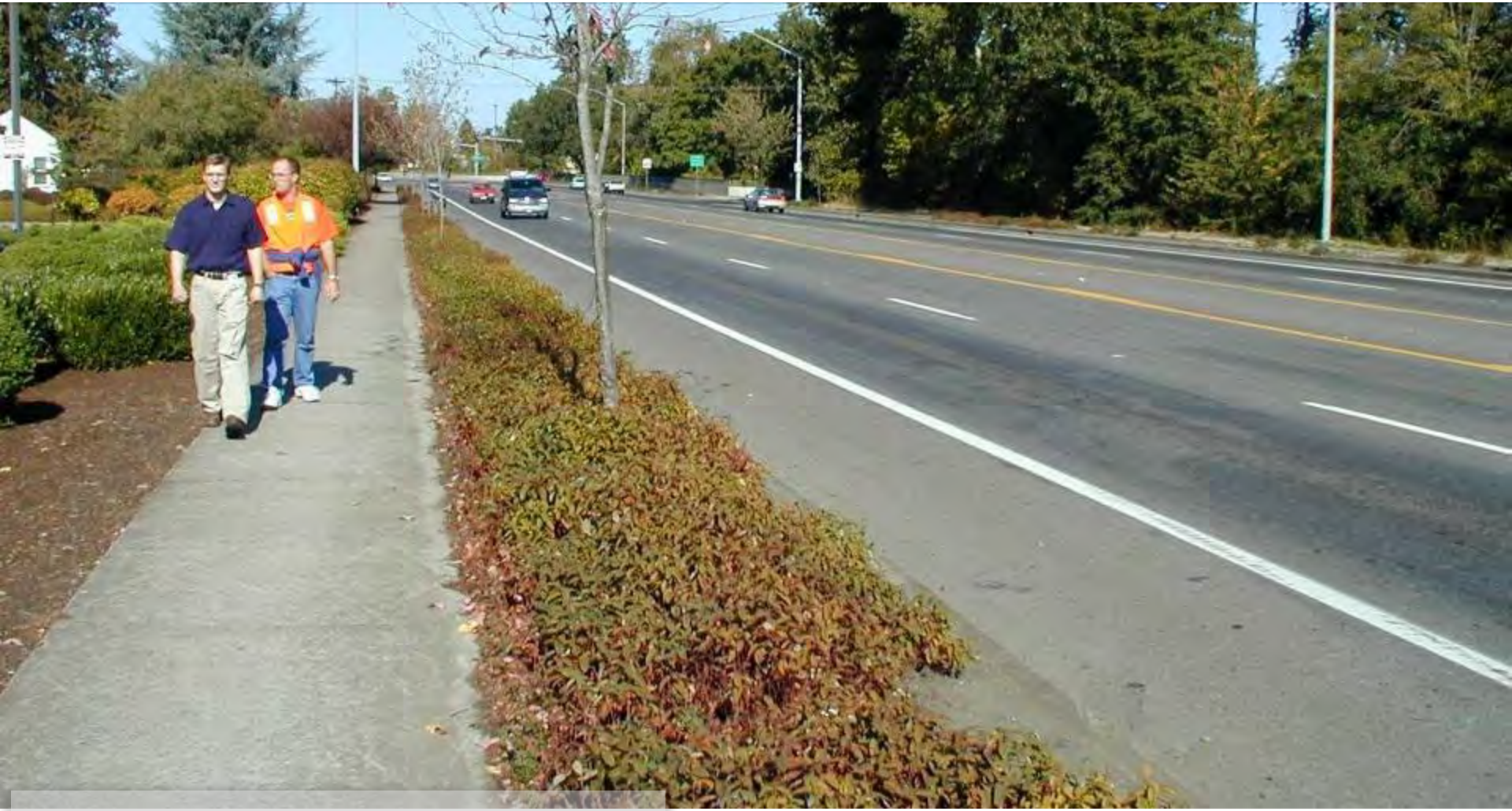
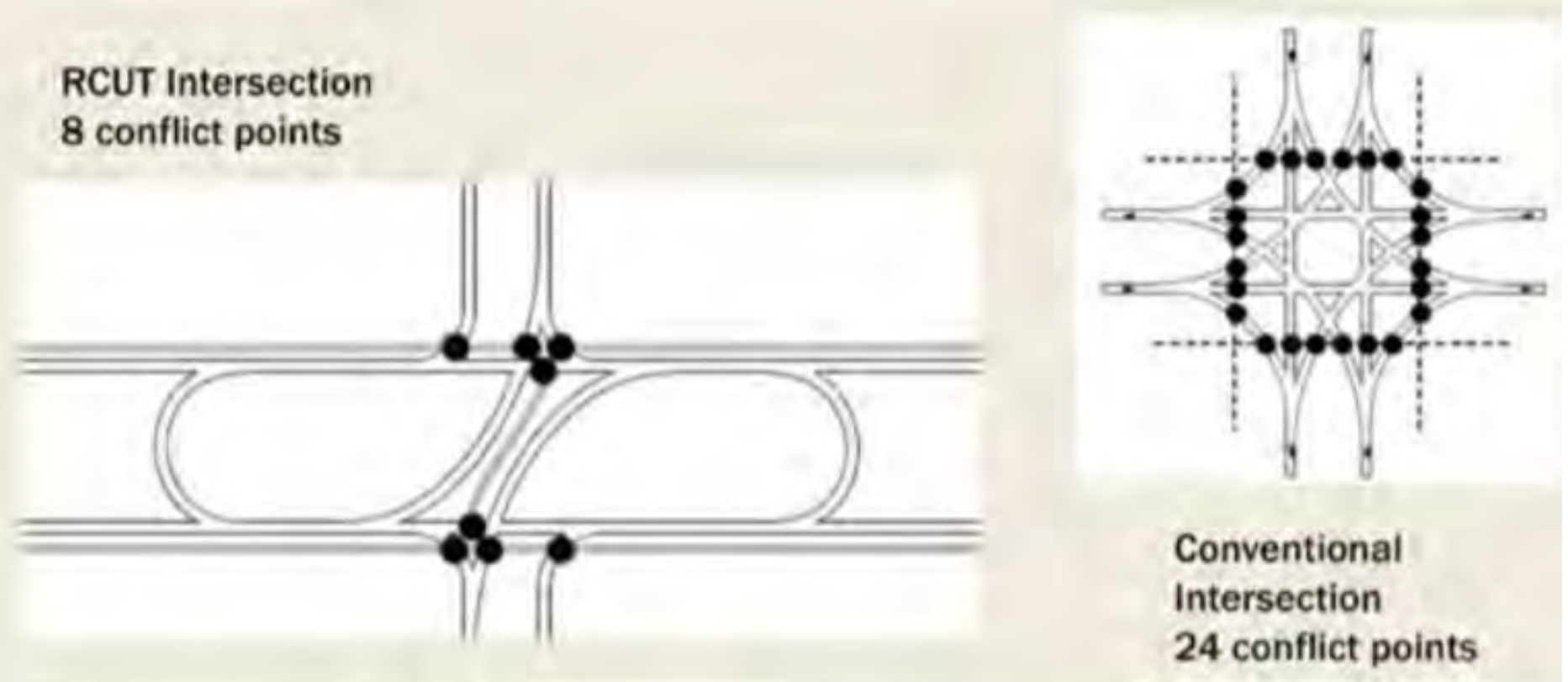
BICYCLE & PEDESTRIAN CORRIDOR SAFETY STUDY

Urban/suburban Environments: Sidewalks



88% Reduction in Pedestrian Crashes

Reduce/Condense Access Points

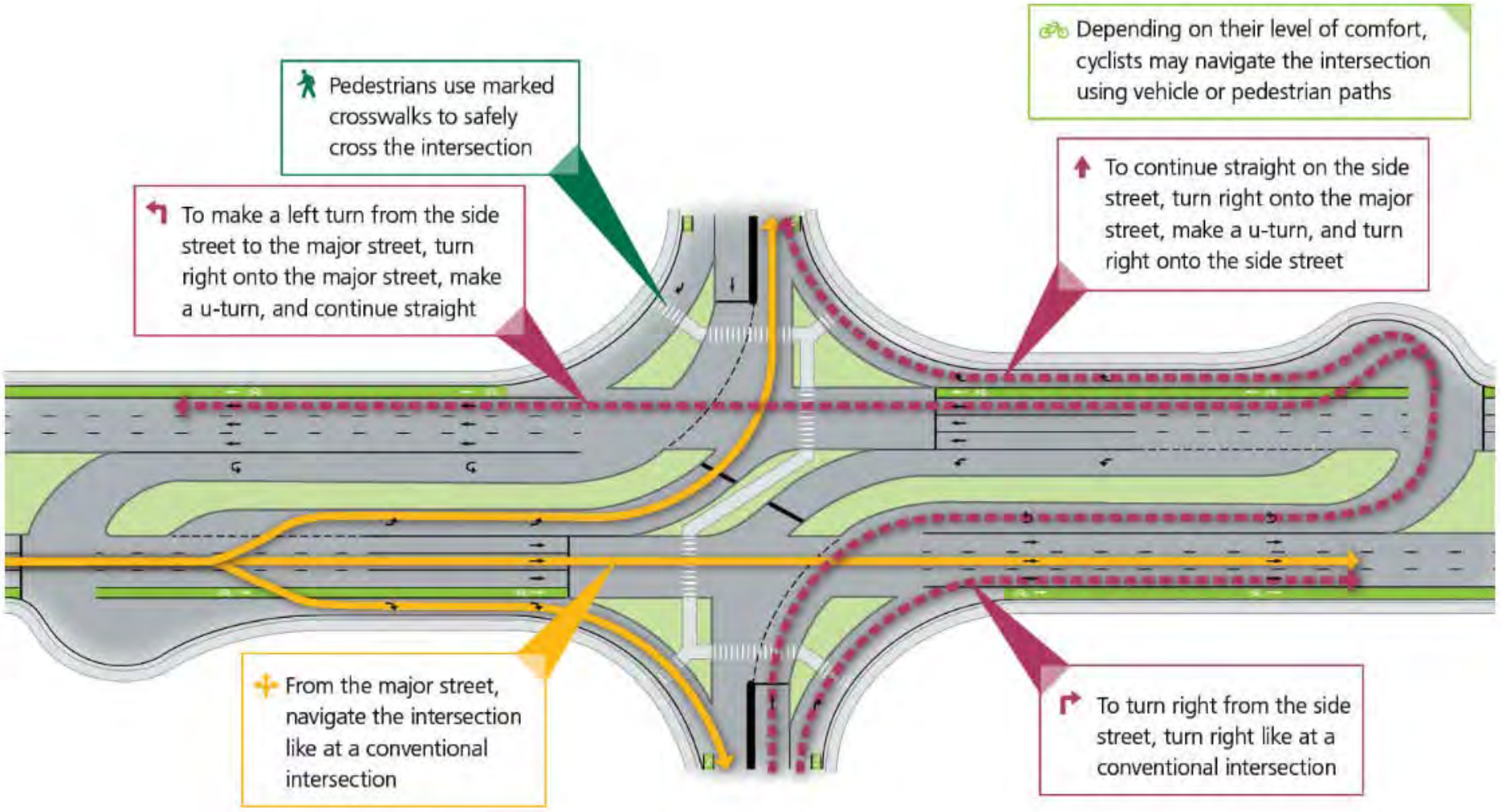


PROS:

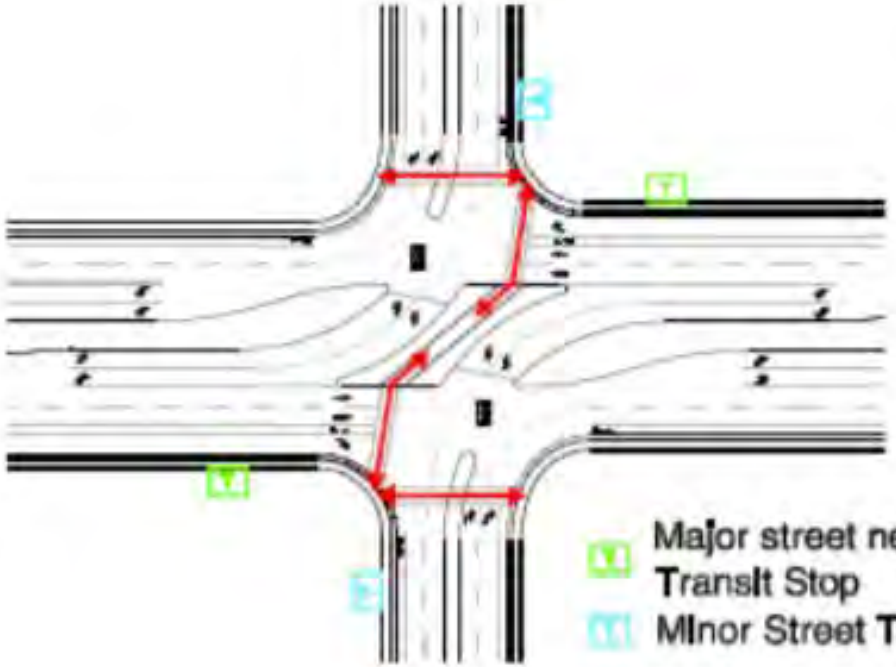
- Fewer conflict points at crosswalks
- Provides for 2-stage crossing

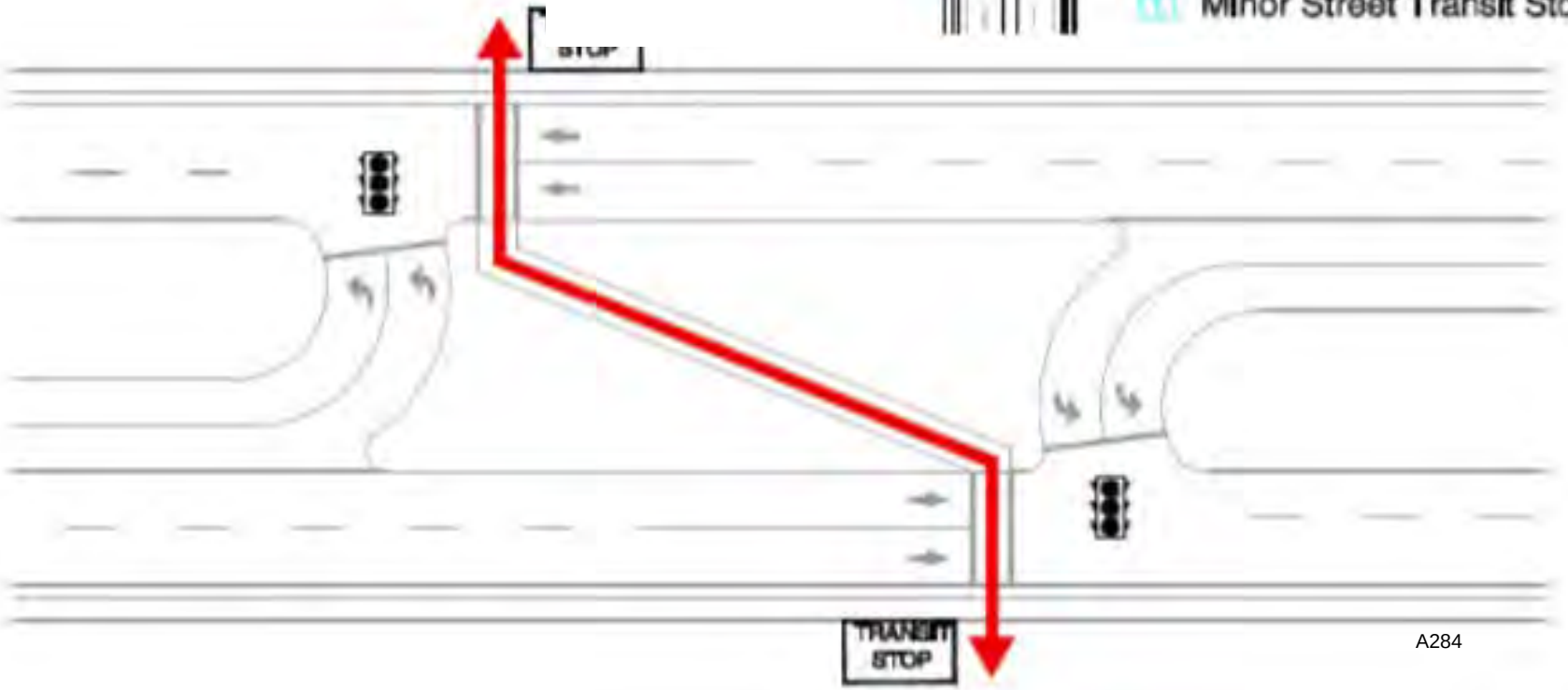
CONS:

- Less direct or longer crossing distance may yield crossings outside of crosswalks
- Integration with bus stops is not well-tested in NC


Depending on their level of comfort, cyclists may navigate the intersection using vehicle or pedestrian paths
Pedestrians use marked crosswalks to safely cross the intersection
To continue straight on the side street, turn right onto the major street, make a u-turn, and turn right onto the side street
To make a left turn from the side street to the major street, turn right onto the major street, make a u-turn, and continue straight
From the major street, navigate the intersection like at a conventional intersection
To turn right from the side street, turn right like at a conventional intersection

A283

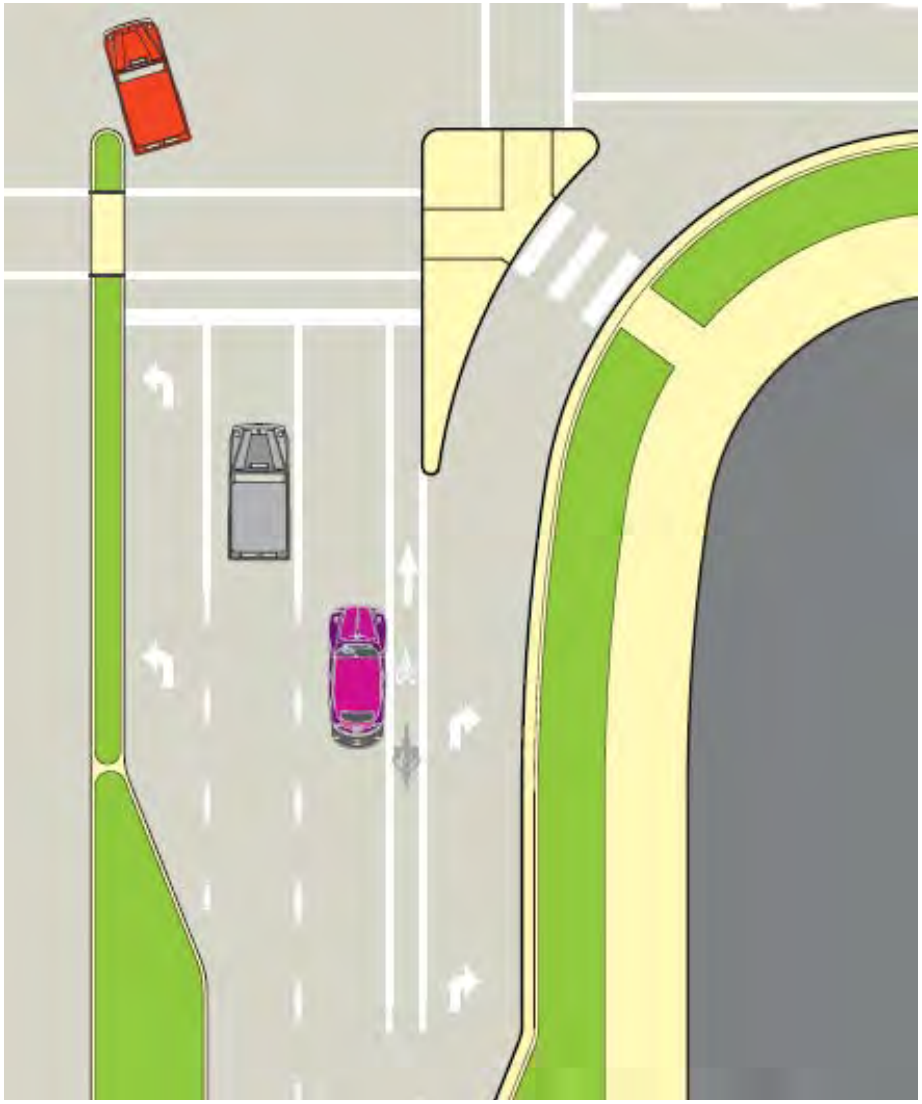

Major street near-side
Transit Stop
Minor Street Transit Stop


TRANSIT
STOP

Islands at Intersections

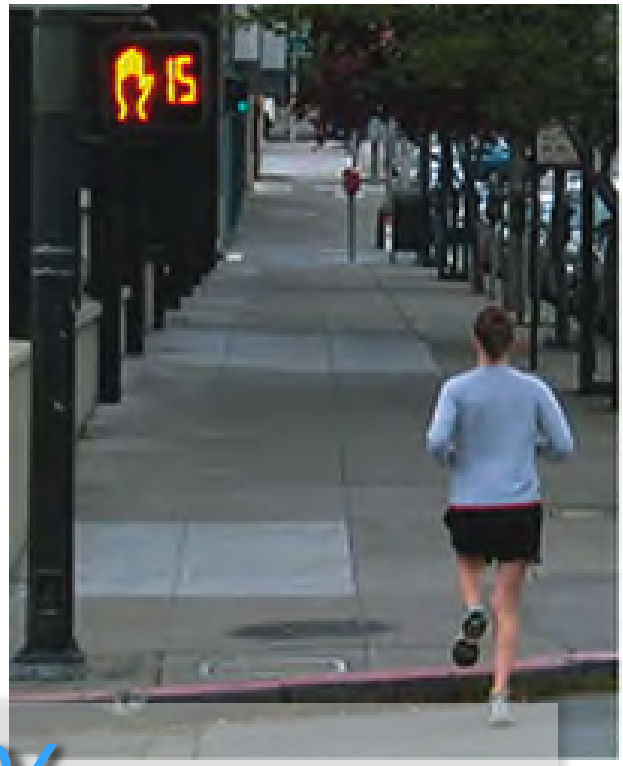
Benefits:

- Separate conflicts and decision points
- Reduce crossing distance
- Improve signal timing
- Reduce crashes



A285

Pedestrian Countdown Signal



25% Reduction in Pedestrian Crashes

Leading Pedestrian Interval

3+ Second
Advance Start

59% Reduction in Pedestrian Crashes

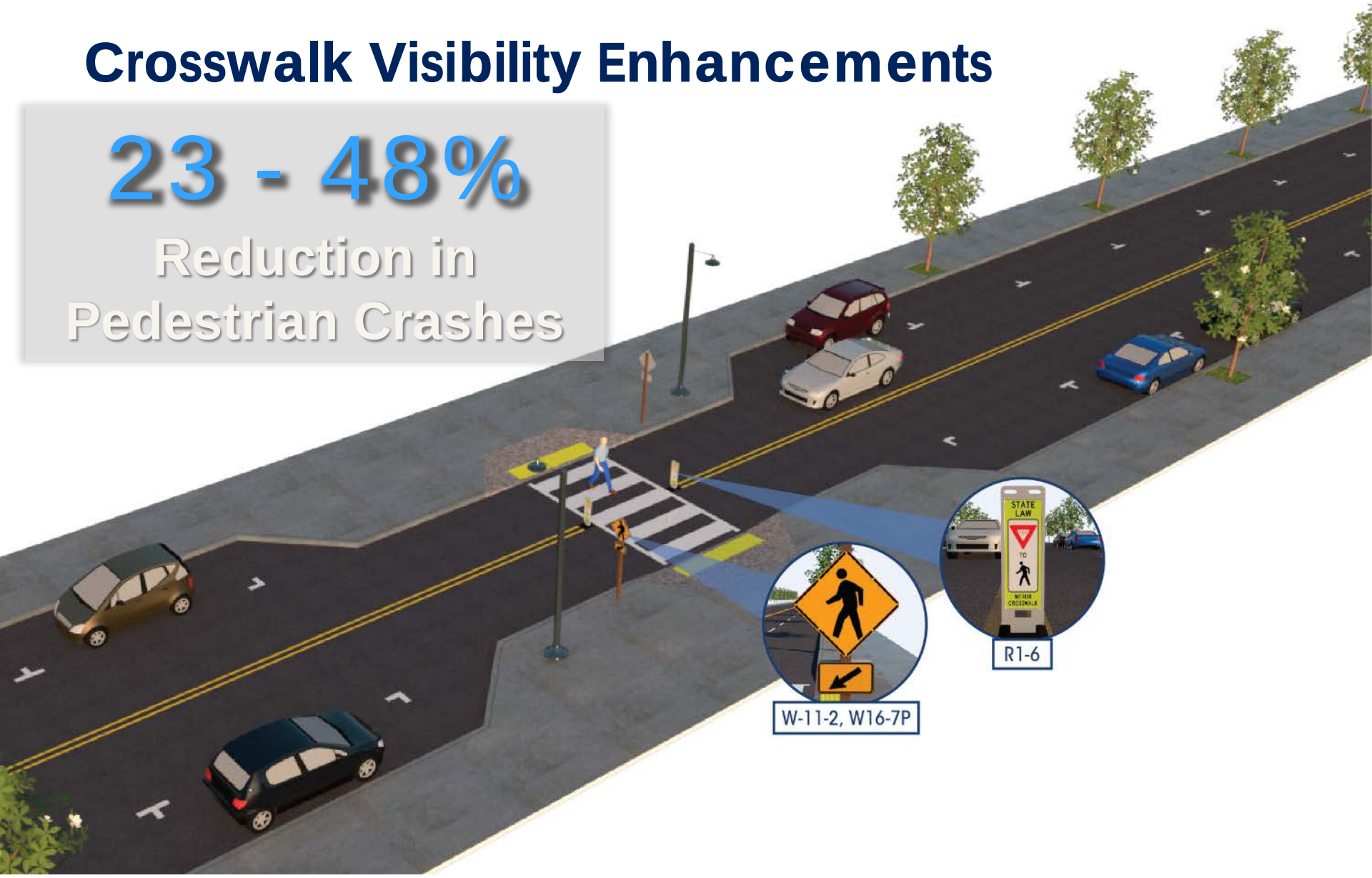
A287

Yield-To Signs, Right-Turn Restrictions at Intersections

Crosswalk Visibility Enhancements

23 - 48%

Reduction in Pedestrian Crashes



Advance Signage and Markings

R1-5

R1-5a

(Use where local law says yield to pedestrians)

R1-5b

R1-5c

(Use where local law says stop for pedestrians)

MUTCD Sec. 2B.11 and Figure 2B-2

- Advance yield line (shark's teeth) & sign
- Consider double white lines for no passing

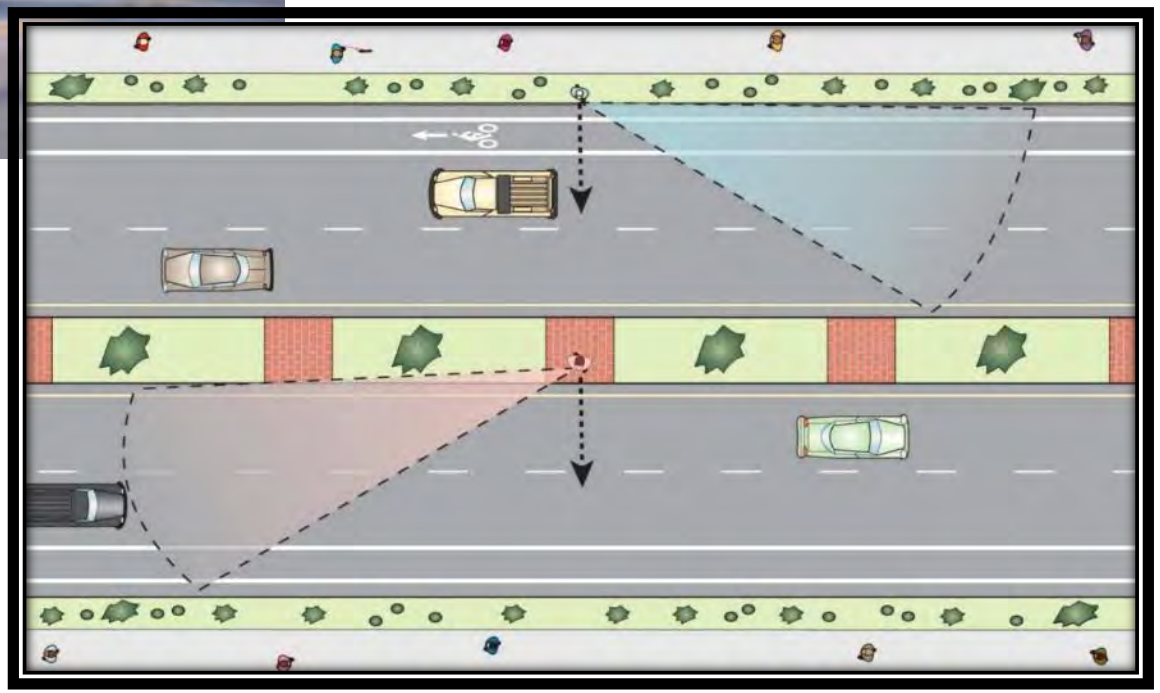
2009 MUTCD Section 3B.16 and Figure 3B-17


42-59% Reduction
in Pedestrian Crashes

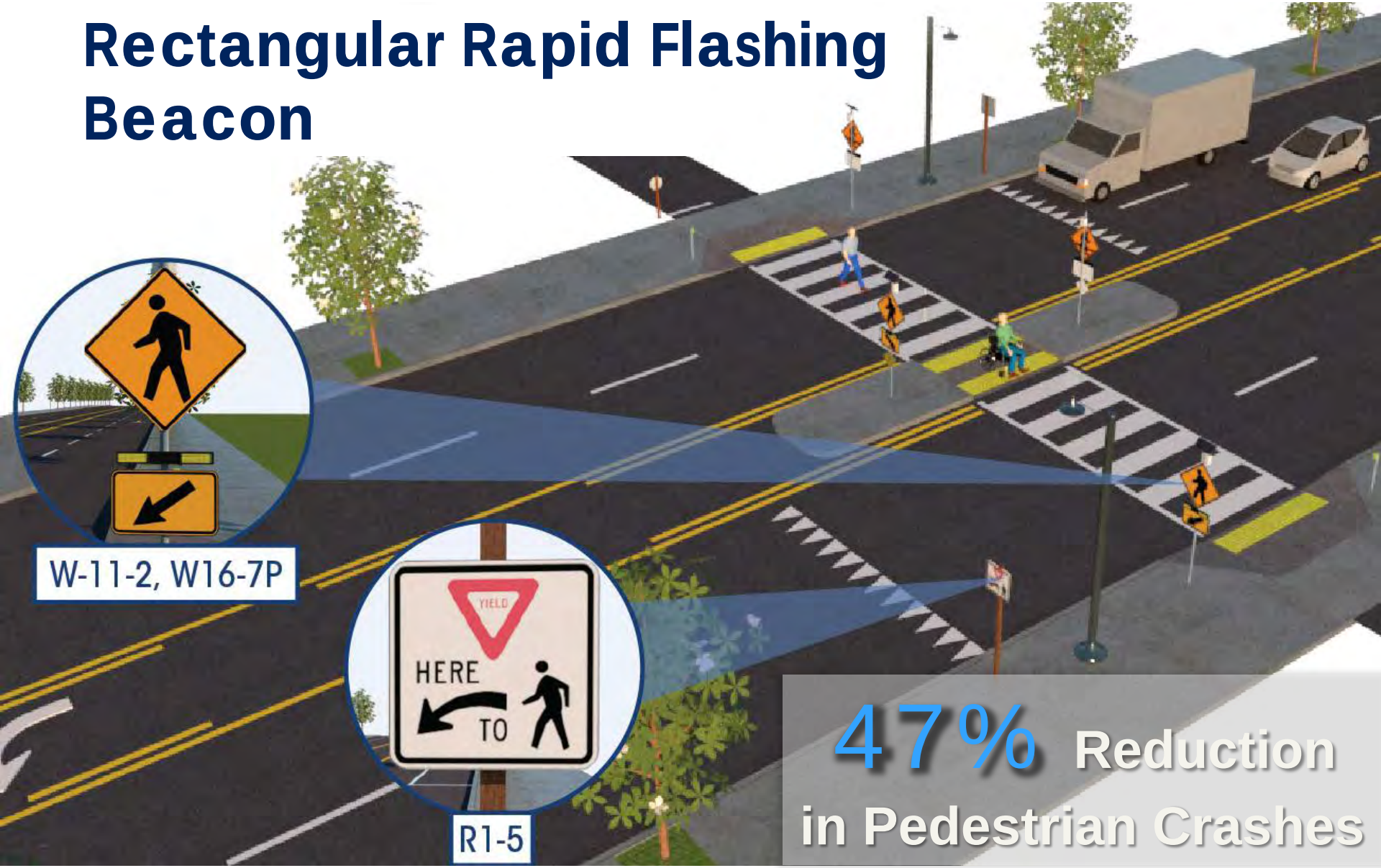
Pedestrian Refuge Islands

32% Reduction in Pedestrian Crashes

Continuous Raised Median

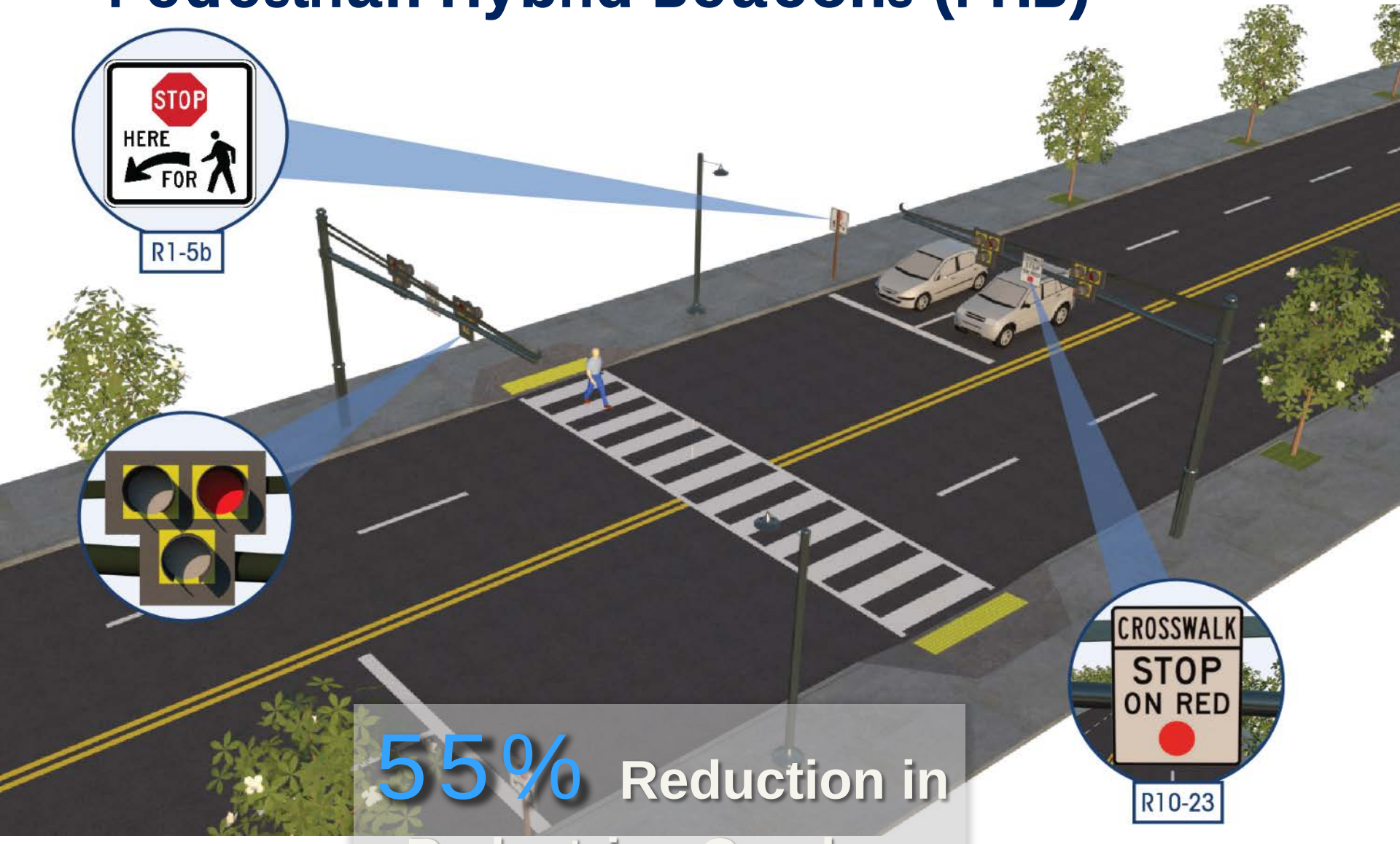


Rectangular Rapid Flashing Beacon



RRFB Video IA-21Flash Pattern

Pedestrian Hybrid Beacons (PHB)



55% Reduction in Pedestrian Crashes

A297

Pedestrian Hybrid Beacons (PHB)

1

Blank for drivers

2

Flashing yellow

3

Steady yellow

4

Steady red

5

Wig-Wag

Return to 1

Bike “Hawk” PHB

“BIKES WAIT”/”BIKES OK”

A300

Hierarchy of Bikeways

- Shared-Use Paths
- Separated Bike Lanes
- Bike Lanes
- Shoulders
- Shared Roadway

Bike Lanes

- Preferred in urban/suburban
- Rural for high demand for bicycle travel
- Preferential space for bicyclists delineated
- Bicyclists may leave lane
  - Passing
  - Turning
  - Avoid debris
  - Avoid buses
- Priority for uphill

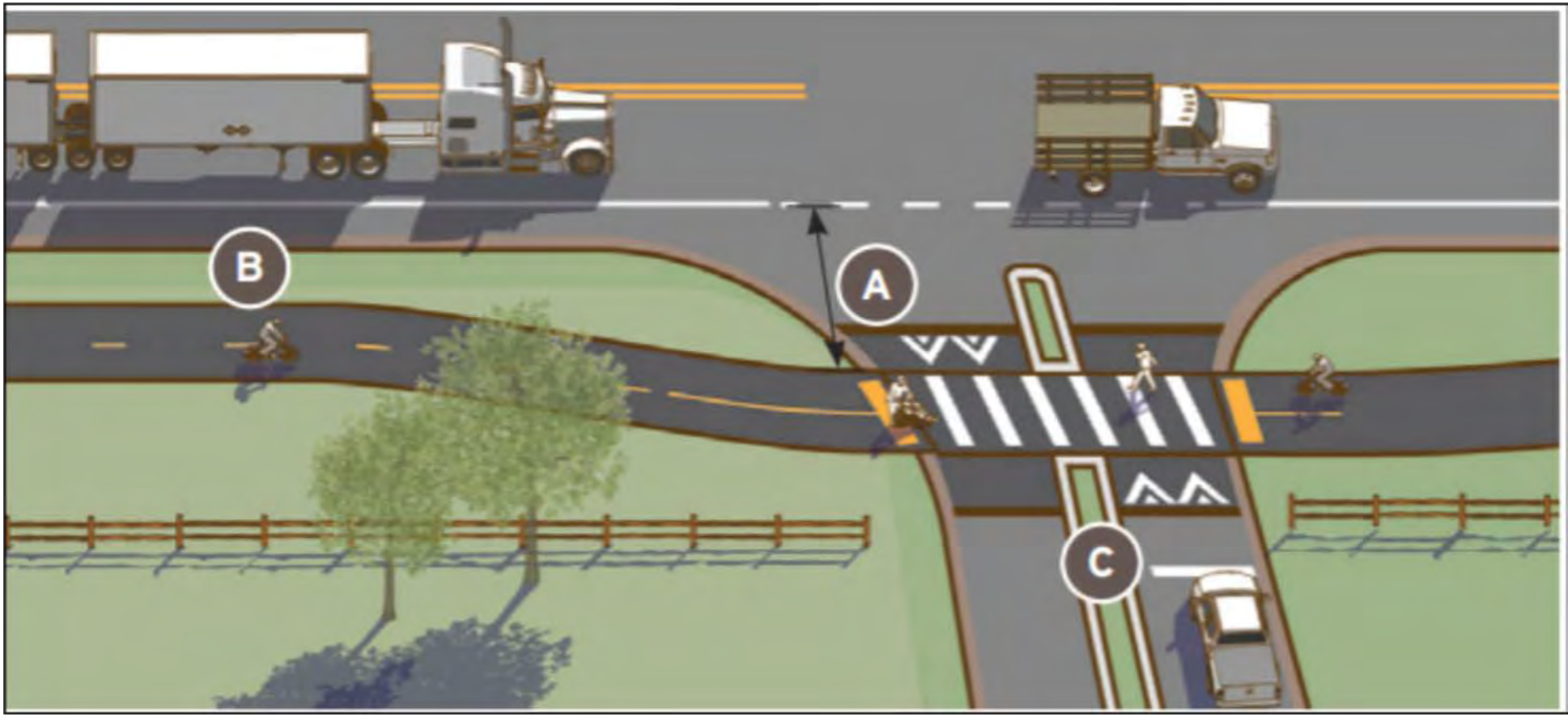
Buffered Bike Lane

- Shy distance
- Bike passing
- Door zone
- Wider w/out confusing motorists
- More comfortable

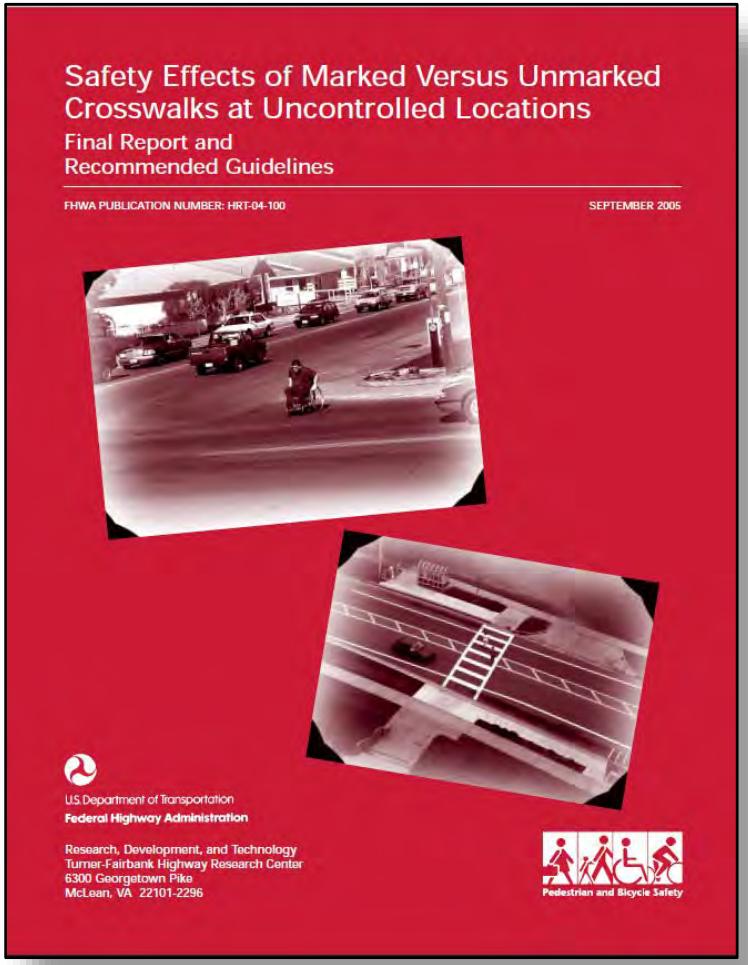
Separated Bike Lanes

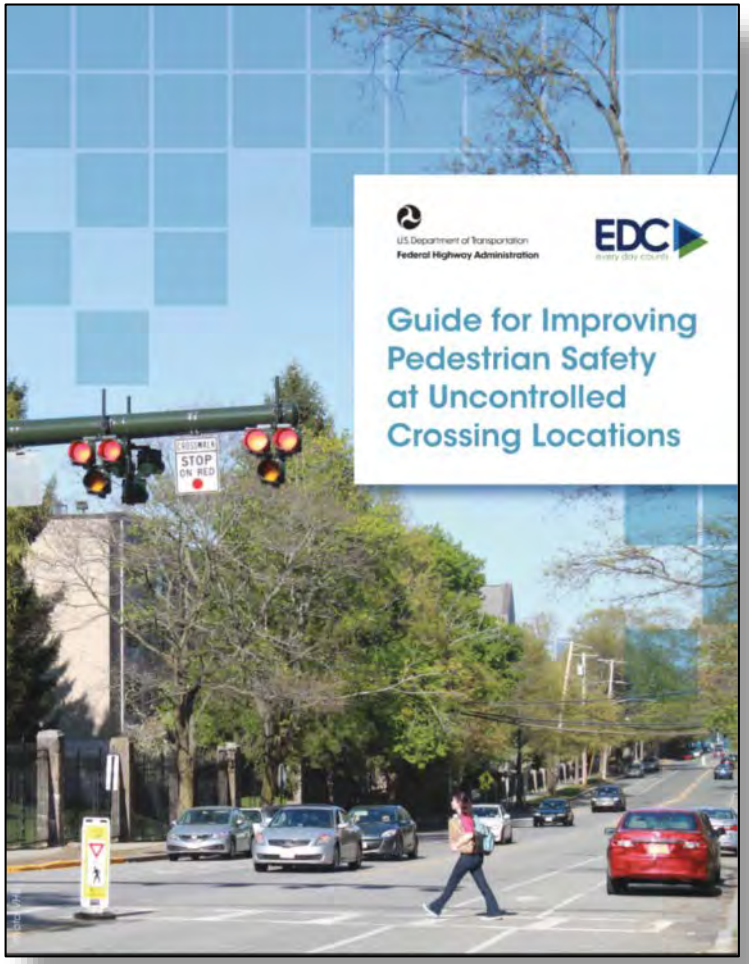
- Exclusive bike facility
- Adjacent to or on roadway
- One-way or contra-flow
- Separated from traffic by vertical element
  - Delineators
  - Bollards
  - Barrier
  - Median
  - Raised bike lane
  - Planters
  - Wheel stops
  - Parked cars

Side-Street Crossings



Guide for Improving Pedestrian Safety at Uncontrolled Crossing Locations





2018

A307

https://www.fhwa.dot.gov/innovation/everydaycounts/edc_4/step.cfm

Table 1. Application of pedestrian crash countermeasures by roadway feature.

Roadway Configuration	Posted Speed Limit and AADT								
	Vehicle AADT <9,000			Vehicle AADT 9,000–15,000			Vehicle AADT >15,000		
	≤30 mph	35 mph	≥40 mph	≤30 mph	35 mph	≥40 mph	≤30 mph	35 mph	≥40 mph
2 lanes (1 lane in each direction)	❶ 2 4 5 6	❶ 5 6 7 9	① 5 6 ❼ ❾	❶ 4 5 6	❶ 5 6 7 9	① 5 6 ❼ ❾	❶ 4 5 6 7 9	① 5 6 7 9	① 5 6 ❾
3 lanes with raised median (1 lane in each direction)	❶ 2 3 4 5	❶ ❸ 5 7 9	① ❸ 5 ❼ ❾	① 3 4 5	① ❸ 5 ❼ ❾	① ❸ 5 ❼ ❾	① ❸ 4 5	① ❸ 5 7 ❾	① ❸ 5 ❾
3 lanes w/o raised median (1 lane in each direction with a two-way left-turn lane)	❶ 2 3 4 5 6 7 9	❶ ❸ 5 6 7 9	① ❸ 5 6 ❾	① 3 4 5 6 7 9	① ❸ 5 6 ❼ ❾	① ❸ 5 6 ❾	① ❸ 4 5 6 7 9	① ❸ 5 6 ❾	① ❸ 5 6 ❾
4+ lanes with raised median (2 or more lanes in each direction)	❶ ❸ 5 7 8 9	❶ ❸ 5 7 8 9	① ❸ 5 8 ❾	① ❸ 5 7 8 9	① ❸ 5 ❼ 8 ❾	① ❸ 5 8 ❾	① ❸ 5 ❼ 8 ❾	① ❸ 5	① ❸ 5
4+ lanes w/o raised median (2 or more lanes in each direction)	❶ ❸ 5 6 7 8 9	① ❸ 5 ❻ 7 8 9	① ❸ 5 ❻ 8 ❾	① ❸ 5 ❻ 7 8 9	① ❸ 5 ❻ ❼ 8 ❾	① ❸ 5 ❻ 8 ❾	① ❸ 5 ❻ ❼ 8 ❾	① 5	

Given the set of conditions in a cell,

\# Signifies that the countermeasure is a candidate treatment at a marked uncontrolled crossing location.

● Signifies that the countermeasure should always be considered, but not mandated or required, based upon engineering judgment at a marked uncontrolled crossing location.

○ Signifies that crosswalk visibility enhancements should always occur in conjunction with other identified countermeasures.*

The absence of a number signifies that the countermeasure is generally not an appropriate treatment, but exceptions may be considered following engineering judgment.

1 High-visibility crosswalk markings, parking r… crosswalk approach, adequate nighttime lig… and crossing warning sign
2 Raised crosswalk
3 Advance Yield Here To (Stop Here For) Pedestrians sign and yield (stop) line
4 In-Street Pedestrian Crossing sign
5 Curb extension
6 Pedestrian refuge island
7 Rectangular Rapid-Flashing Beacon (RRFB)**
8 Road Diet
9 Pedestrian Hybrid Beacon (PHB)**

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*Refer to Chapter 4, "Using Table 1 and Table 2 to Select Countermeasures," for more information about using multiple countermeasures.

Table 2. Safety issues addressed per countermeasure.

Pedestrian Crash Countermeasure for Uncontrolled Crossings	Safety Issue Addressed				
	Conflicts at crossing locations	Excessive vehicle speed	Inadequate conspicuity/ visibility	Drivers not yielding to pedestrians in crosswalks	Insufficient separation from traffic
Crosswalk visibility enhancement	✓	✓	✓	✓	✓
High-visibility crosswalk markings*	✓		✓	✓	
Parking restriction on crosswalk approach*	✓		✓	✓	
Improved nighttime lighting*	✓		✓		
Advance Yield Here To (Stop Here For) Pedestrians sign and yield (stop) line*	✓		✓	✓	✓
In-Street Pedestrian Crossing sign*	✓	✓	✓	✓	
Curb extension*	✓	✓	✓		✓
Raised crosswalk	✓	✓	✓	✓	
Pedestrian refuge island	✓	✓	✓		✓
Pedestrian Hybrid Beacon	✓	✓	✓	✓	
Road Diet	✓	✓	✓		✓
Rectangular Rapid-Flashing Beacon	✓		✓	✓	✓

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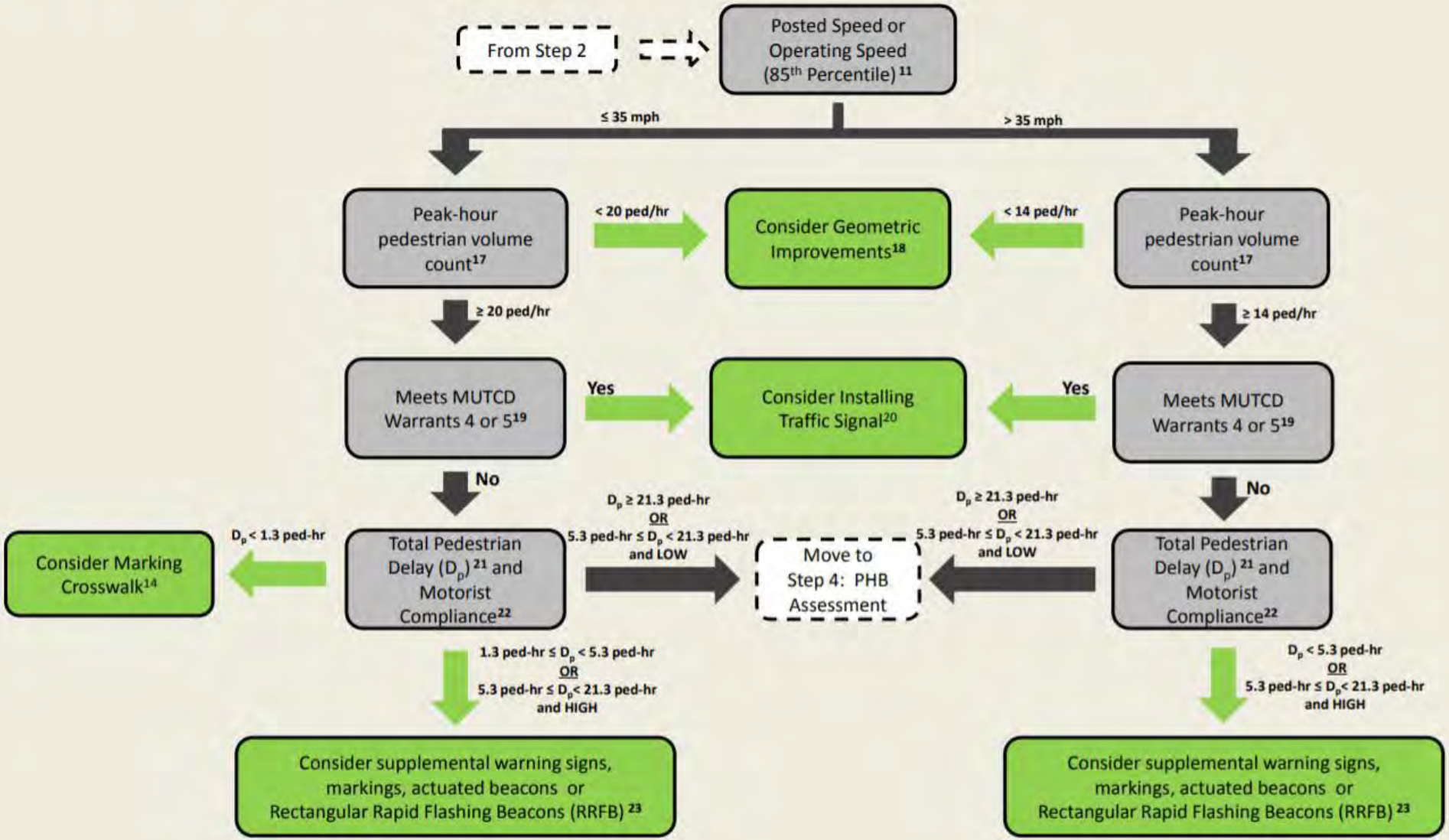
Step 3: Additional/Alternative Treatments Assessment[16]



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NC54
BICYCLE & PEDESTRIAN CORRIDOR SAFETY STUDY

Study Team Meeting #4 Notes

September 17th

Attending: Kumar Neppali, Hanna Cockburn, Zach Hallock, Bergen Watterson, Javier Guillen, Jomar Pastorelle, Mark Aldridge, Brian Litchfield, Chuck Edwards, Nick Pittman, David Phipps, Brian Mayhew, Lauren Blackburn, Brian Thomas, Andrew Topp, Kurt Stolka, Linda Smith, Joe Seymour

The meeting began at 9:33 AM

- Welcome and Introductions
- Recap July Study Team Meeting
    - Lauren reviewed the previous meeting content and restated the timeframe for improvements is up to 10 years
- Draft Connectivity Plan
    - Lauren and Joe presented the draft Connectivity Plan, a component of the Safety Study that defines the existing non-motorized network and identifies planned and recommended non-motorized connections from municipal plans and VHB.
    - Kumar asked bout the proposed connection at Oteys
    - Brian shared that the corridor study was intended to take a step back and look at everything along the corridor to harmonize improvements. There is a recognized need to find a formal crossing (at grade or grade-separated). Due to speed and volume, there are concerns with at grade crossing, but not eliminated from consideration, understand need for safe crossing, don't have a greenway network in place. With 45,000 vpd and 45 mph – needs to be a controlled crossing,
    - Kumar said that the Town of Chapel Hill was concerned that NCDOT did not put in a HAWK signal in when we requested it near the Connectivity Study in 2017.
    - Ped volumes are lower at Oteys, no bus stop, no sidewalk connectivity,
    - Chuck said that there is interest in transit service here, buy little demand, lack of connections
    - What was the public interest here? Lauren reported that this didn't get a lot of input, though not highly attended from Chapel Hill end of corridor
        - There are crossing during special events (e.g. basketball games)
- Lloyd Farms & Other Developments
    - Zach described the Lloyd Farms site plan. The updated site plan is going before Carrboro in October.
    - Chuck added that the directional left-over from NC 54 would help access to the site and would take pressure off of access from Old Fayetteville Road. The TIA had not tested the left-over as a signalized intersection; it was modeled and worked fine without a signal; NCDOT guidelines stipulate a preference for unsignalized left-overs between signalized intersections.

    - There was discussion on how to accommodate the SUP crossing at the left-over on NC 54 into the Lloyd Farms development. NCDOT is working with Carrboro on the placement of the SUP along the north side of NC 54.
- Discussion about bicycle crossing treatments preferences
    - Carrboro said that there is little expectation that bicyclists will dismount at intersections (as seen from its other SUPs). If the SUP is 10′ wide, there may not be enough space for separate crossings. Prefer 12′ rather than 10′ wide.
    - Lauren said best practice for bicycle crossings until two years ago was a combined facility, but now the thinking is not to separate them, instead mark the bicycle area with green markings.
        - A bike signal is not required at an intersection, and there are many options for including signage to indicate safe movement through the intersection. AASHTO, NACTO, and FHWA Bikeway Selection Guide are all useful resources.
        - Carrboro and Chapel Hill will continue to consider through how bicycles will use the SUPs without dismounting
- Transit Discussion
    - Joe showed the results of changing routes to minimize pedestrian crossings at Kingswood. The J Route – 15 min headways.
        - Split the route at interchange (24min to 3-4 min wait times until bus returns to initial side of road)
        - Separate NC54 and Smith Level (24min to 15 min wait times until bus returns to initial side of road for both Kingswood and Westbrook apartment riders)
        - No guarantee these shorter wait times will decrease incentive to cross NC 54.
    - Brian L – seeing this everywhere – pedestrians jump off at earlier stop to then walk across – it's faster that way. The J is the second most productive route now, difficult to change. No funding to add routes or hours at this time.
- Preliminary Pedestrian Crossing Recommendations (by major location)
    - Manning Drive
        - Introduction of pedestrian signal heads to the N, W, and S quadrants and extending the WALK phase wouldn't impact significantly vehicle LOS
        - The crosswalk at in the northwest quadrant of Manning Drive was moved northbound to increase pedestrian visibility
    - Oteys Road
        - Analysis showed that introducing a two-phase signal (proxy for a PHB) would generate queues to ~2000′ in both directions during the AM and PM peaks.
        - Kumar noted that the queue lengths towards Durham are already stretching back towards Oteys Road in the PM. Can the Manning Dr signal and the PHB be coordinated? Town of Chapel Hill has a different perspective on the tradeoffs of delay and crossing NC 54 at Oteys Road
        - Kumar wants to share the signal choices with the community on the trade-offs
    - Kingswood Laurel Ridge
        - VHB shared that introducing a two-phase signal wouldn't affect LOS significantly
        - Kumar asked about the U-turn locations with the introduction of a restricted median (Kingswood is currently a full access intersection); the interchange could support U-turns
        - Kumar asked about whether the signal as created was a two-stage pedestrian crossing and if that two-stage would affect on the safety of the Z crossing.
            - The tested signal had pedestrians crossing in one-stage.

        - Brian said that the bus stops could be closer clustered so as to avoid encouraging crossings.
- Smith Level Road
    - Carrboro said that new sidewalk will be on the west side of Smith Level Road under the bridge.
- Abbey Lane and Westbrook
    - Zach added that the signal at Westbrook would introduce gaps for pedestrian crossings at Abbey Lane (one direction)
    - Brian L mentioned that the walk to the existing bus stops is already long, and shifting the stops further may not support ridership
    - Brian L said that paths are seen behind the complexes and may take pressure off crossing NC 54
    - Brian M said that the signal at Westbrook would be similar to the one established at Kingswood. Abbey Lane could be so expensive that it may not win funding (due to terrain) and its relation to the WB on ramps
    - David Phipps said that the Abbey Lane crossing could be shifted west—without consolidating—and away from the WB on ramps.
    - Chuck asked if the WB merge lane would be treated as a 3rd lane, and that would remove the need for drivers to look over shoulders to merge and conflict with crossing. The scale of the project would lead to a STIP level project. Could the ramp be metered to coordinate with the pedestrian signal?
    - Brian M said the report may put a question mark on the Abbey Lane crossing
- West Poplar Ave
    - Carrboro has plans for bike loops at West Poplar Ave
    - Brian M said that NCDOT may be able to support sidewalks and transit stops at that location
- West Main St
    - As the SUP develops with the Lloyd Farm project, Carrboro to reflect on the crossing type
    - Hanna said to consider yield markings at the eastbound right turn lane on W Main St
    - Brian M said that the channelized right into Carrboro Plaza may not be necessary.
- Old Fayetteville Road
    - Zach said that the recommendations of the widening should be consistent with other planned improvements
    - There were questions about the right turn on red blank-out sign. Blank out sign for no right on red may be time of day related to school.
    - Brian M said there are opportunities to improve the phasing of the signals.
    - Chuck said that the Lloyd Farm developer will install a double left to EB NC 54 and will include a protected left
    - The TIA has been reviewed, but the driveway permits have not been issued.
    - Zach said that the developer is addressing right turns into the site and the color of pavement across driveways
        - NCDOT and Carrboro are working with the Lloyd Farms developer on a bus pullout location.
        - Brian L said there are potential stops from the CHT Short Range Transit Plan on Old Fayetteville.

        - Action Item - Zach and CHT to review how the transit system will coordinate with the Lloyd Farms development.
- Planning Community Workshop #2
    - Recommendations for workshop locations included the UNC Botanical Garden, Kingswood/Laurel Ridge Apartments, Frank Porter Graham school, and schools and churches along Culbreth. Brian L and Kumar asked about doing two small workshops. The workshops would be scheduled for the first two weeks in November.
    - Next steps – preparation for the public meetings.
        - Brian L asked that VHB prepare an update for the elected bodies on the project's status
        - Lauren said that VHB should use the project website and prepare it into a document for distribution.

The meeting ended at 12:30PM

Other notes: Brian L stated that the timeline for bus stop relocation depends on usage of the affected stop. 120 days for small stops is a reasonable estimate for relocating or removing a low usage stop. Hover, for higher usage stops, there is a longer timeline that includes notification and public engagement with riders and coordination with the system's transportation advisory boards and funding partners.

NC 54 Corridor Bicycle and Pedestrian Safety Study

September 17, 2019

Meeting Agenda

Welcome and Introductions

Recap July Study Team Meeting

Draft Connectivity Plan

- Lloyd Farms & Other Developments
- Discussion about bicycle crossing treatments preferences

Preliminary Pedestrian Crossing Recommendations

Planning Community Workshop #2

Next Steps

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Review: Approaches to Selecting Priority Locations

I. Hot Spot approach

II. Systemic approach

III. Systems approach

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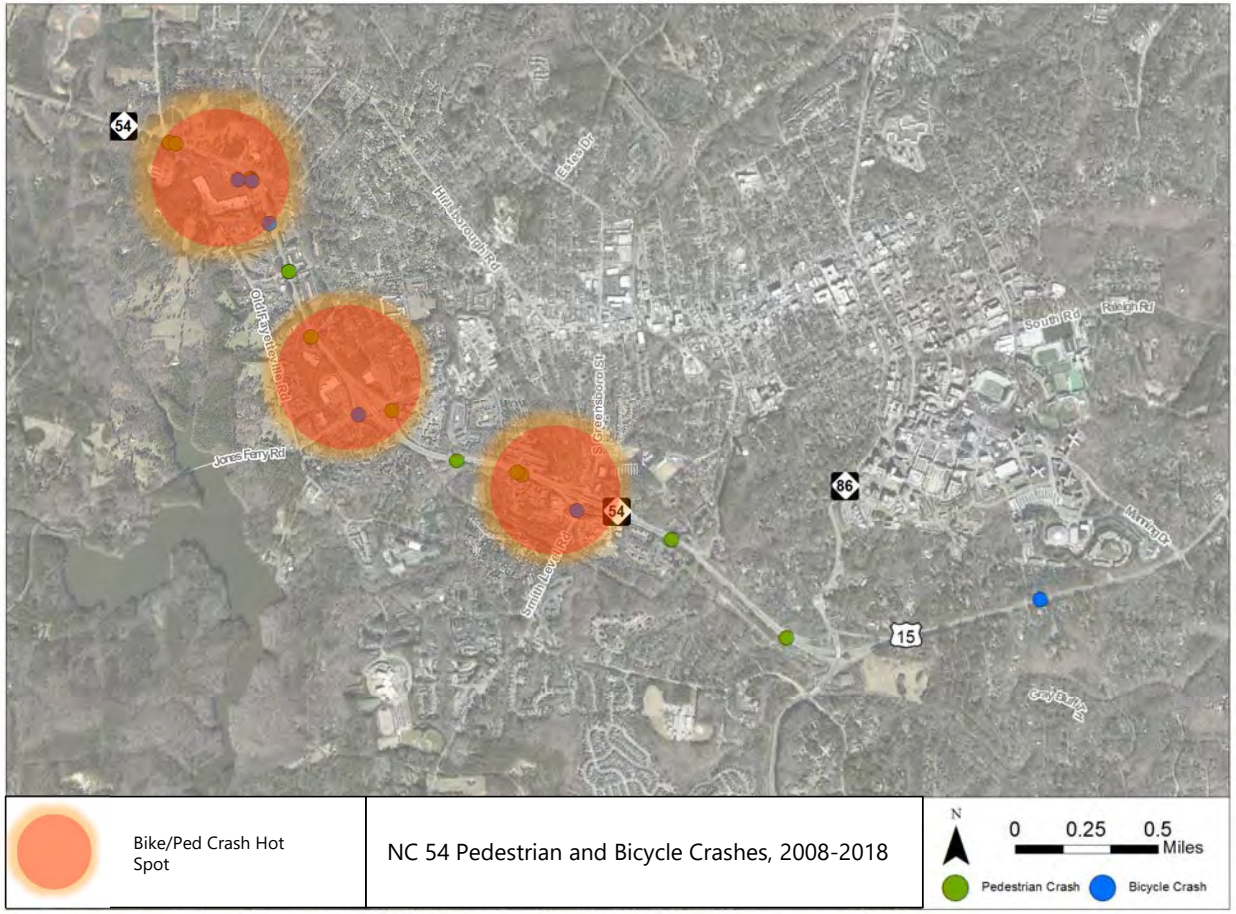
Hot Spot Approach, Continued



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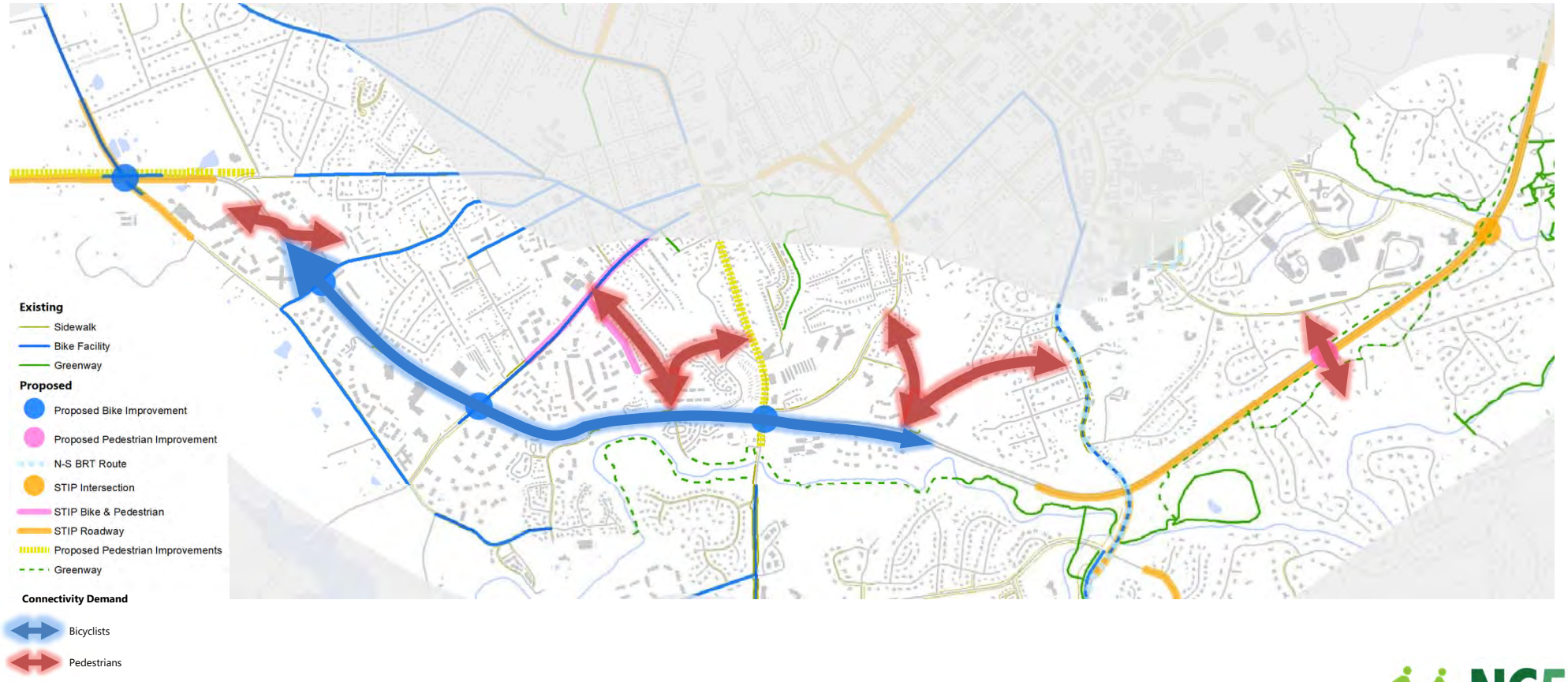
Systemic Risk Factors – Segments

- Four Risk Tiers (**low** to **high**)
  - **Tier 1**: Old Fayetteville Rd to West Poplar Ave
  - **Tier 2**: Oleander St to Westbrook Dr
  - **Tier 3:** NC 86 to Manning Dr
  - **Tier 4**: Westbrook Dr to S Columbia/NC 86

Planned Improvements / Demand for Connectivity



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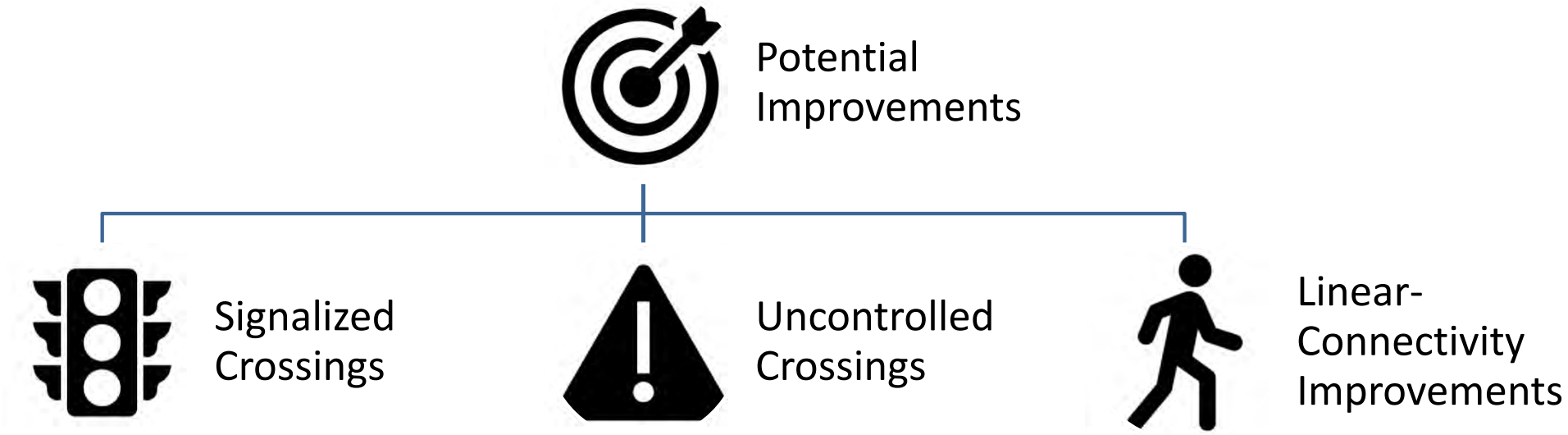
Systems Approach



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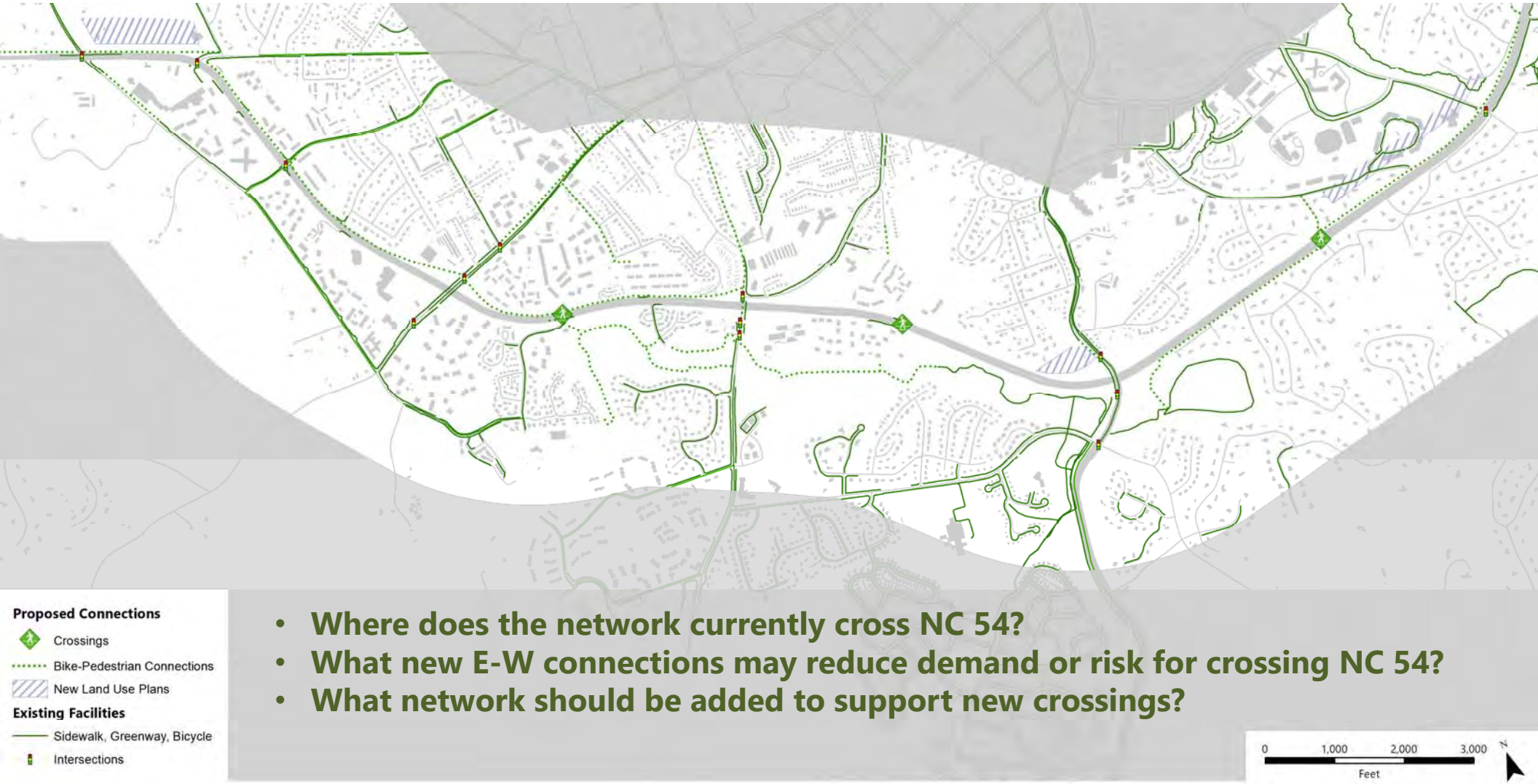
Draft Connectivity Plan



- **Where does the network currently cross NC 54?**
- **What new E-W connections may reduce demand or risk for crossing NC 54?**
- **What network should be added to support new crossings?**

Draft Connectivity Plan, NC 86 to Manning Dr

Proposed Connections
- Crossings
- Bike-Pedestrian Connections
- New Land Use Plans

Existing Facilities
- Sidewalk, Greenway, Bicycle
- Intersections

Manning:
Consider crossing across northern leg concurrent with sidepath construction

Oteys Crossing: Future
- **concurrent with NC 54 widening or independent greenway project**
- **at grade or tunnel crossing**

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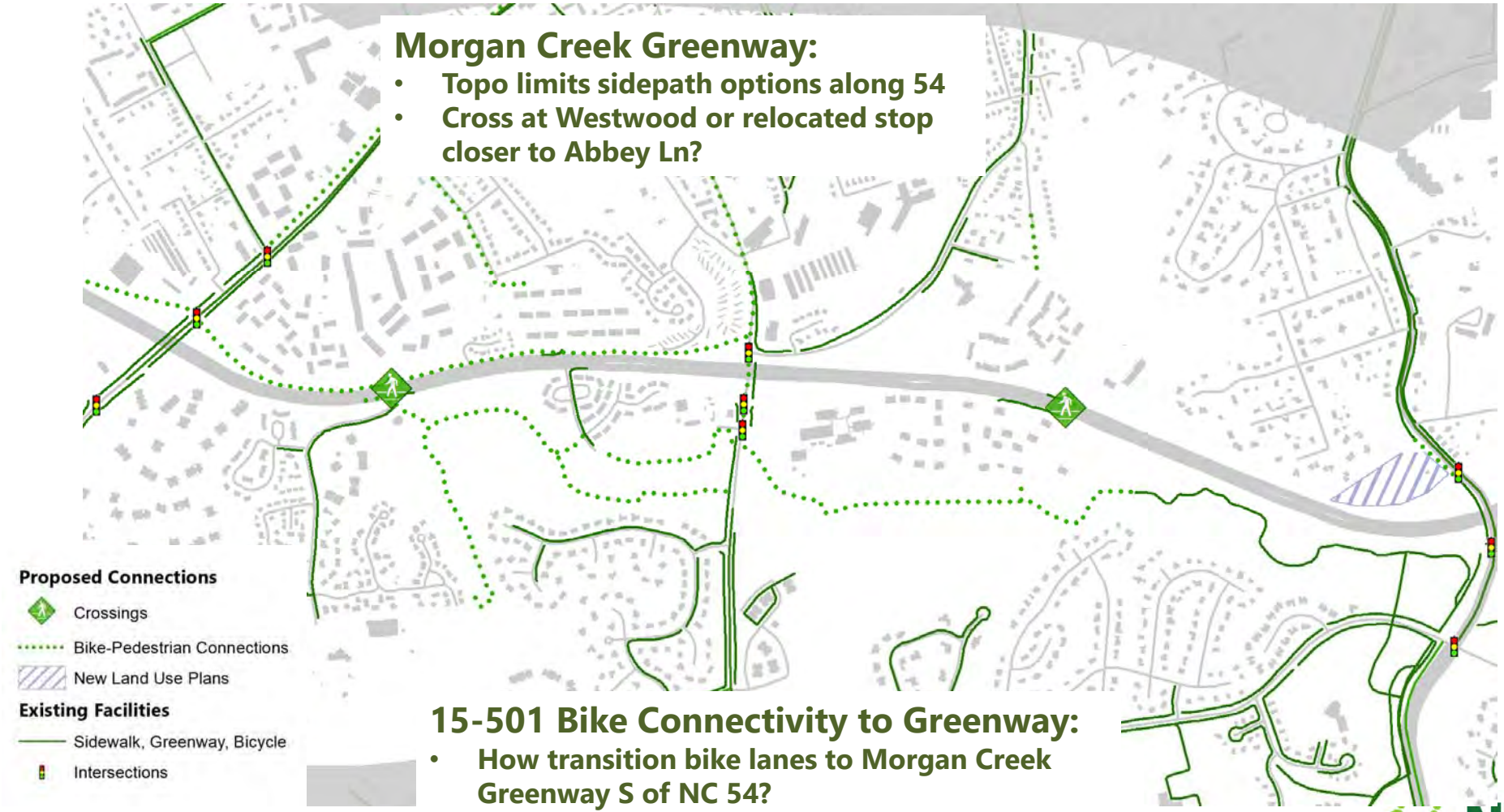
Draft Connectivity Plan, Jones Ferry to NC 86



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Draft Connectivity Plan, Old Fayetteville to Jones Ferry

- **Look for gaps in network**
- **Consider bike crossings**
- **Evaluate planned development**

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Bicycle Crossing Preferences

- How do Carrboro and Chapel Hill envision bicycles crossing intersections?
  - Dedicated bicycle crossing?
  - Dismount and cross as pedestrian?
- Locations along NC 54:
  - Old Fayetteville
  - W Main St
  - W Poplar
  - Oleander
  - NC 54 WB on-ramp
  - Westbrook Drive/Walden/Abbey Lane

Source: People for Bikes

Source: G Boeing: Square Mile Street Network Visualization

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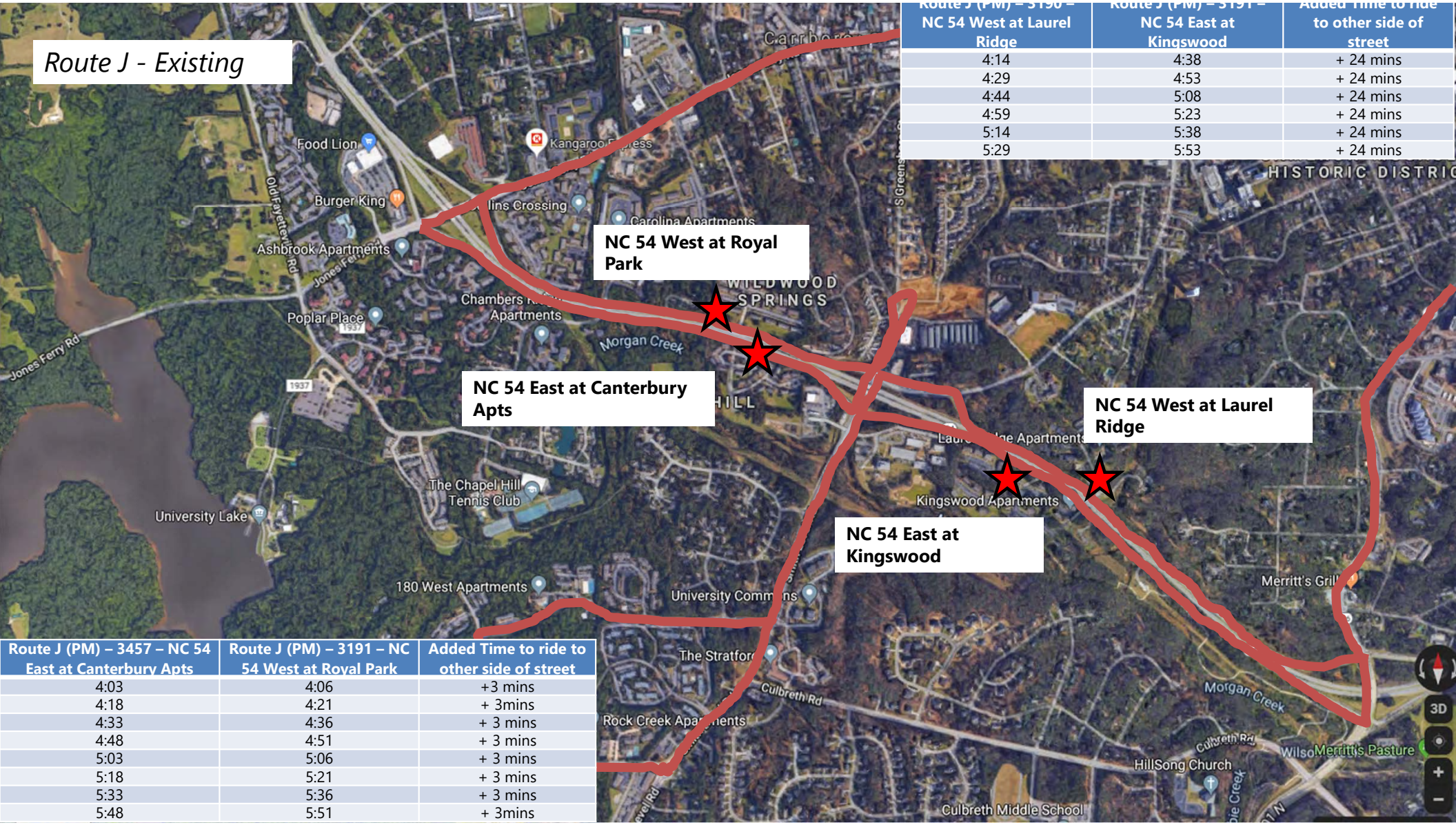
Route J - Existing

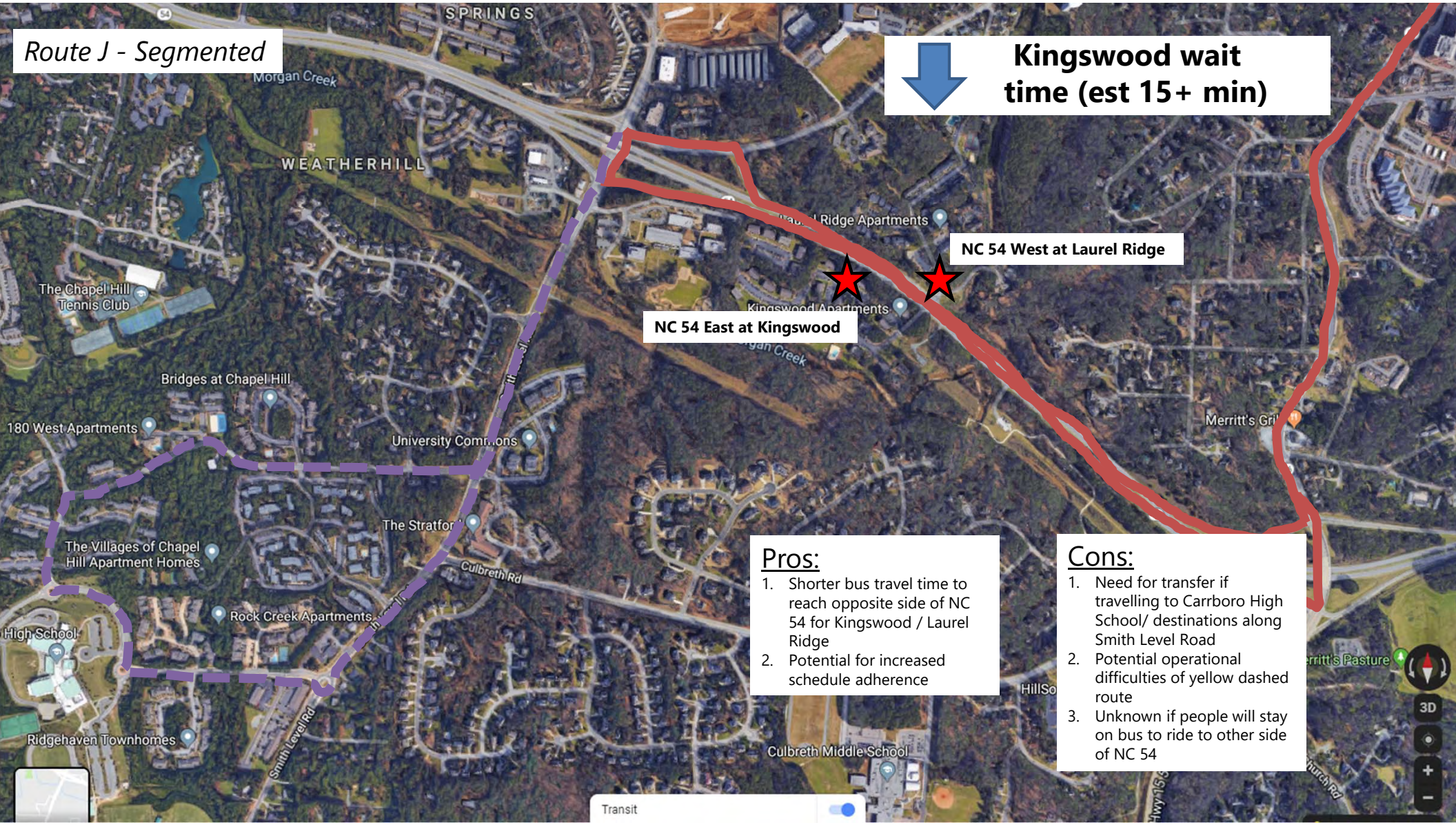


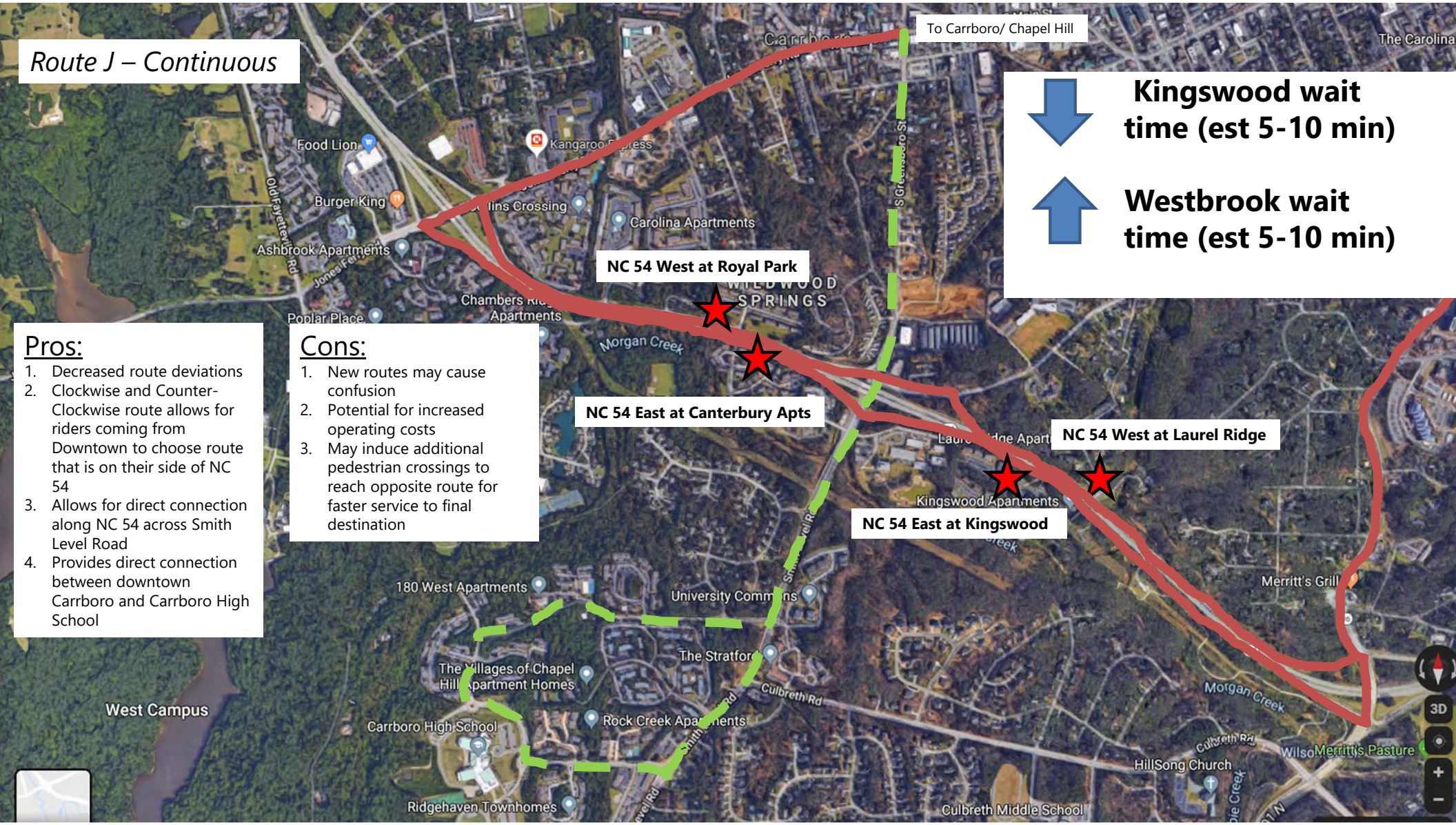
Route J (PM) – 3457 – NC 54 East at Canterbury Apts	Route J (PM) – 3191 – NC 54 West at Royal Park	Added Time to ride to other side of street
4:03	4:06	+3 mins
4:18	4:21	+ 3mins
4:33	4:36	+ 3 mins
4:48	4:51	+ 3 mins
5:03	5:06	+ 3 mins
5:18	5:21	+ 3 mins
5:33	5:36	+ 3 mins
5:48	5:51	+ 3mins

Route J (PM) – 3190 – NC 54 West at Laurel Ridge	Route J (PM) – 3191 – NC 54 East at Kingswood	Added Time to ride to other side of street
4:14	4:38	+ 24 mins
4:29	4:53	+ 24 mins
4:44	5:08	+ 24 mins
4:59	5:23	+ 24 mins
5:14	5:38	+ 24 mins
5:29	5:53	+ 24 mins

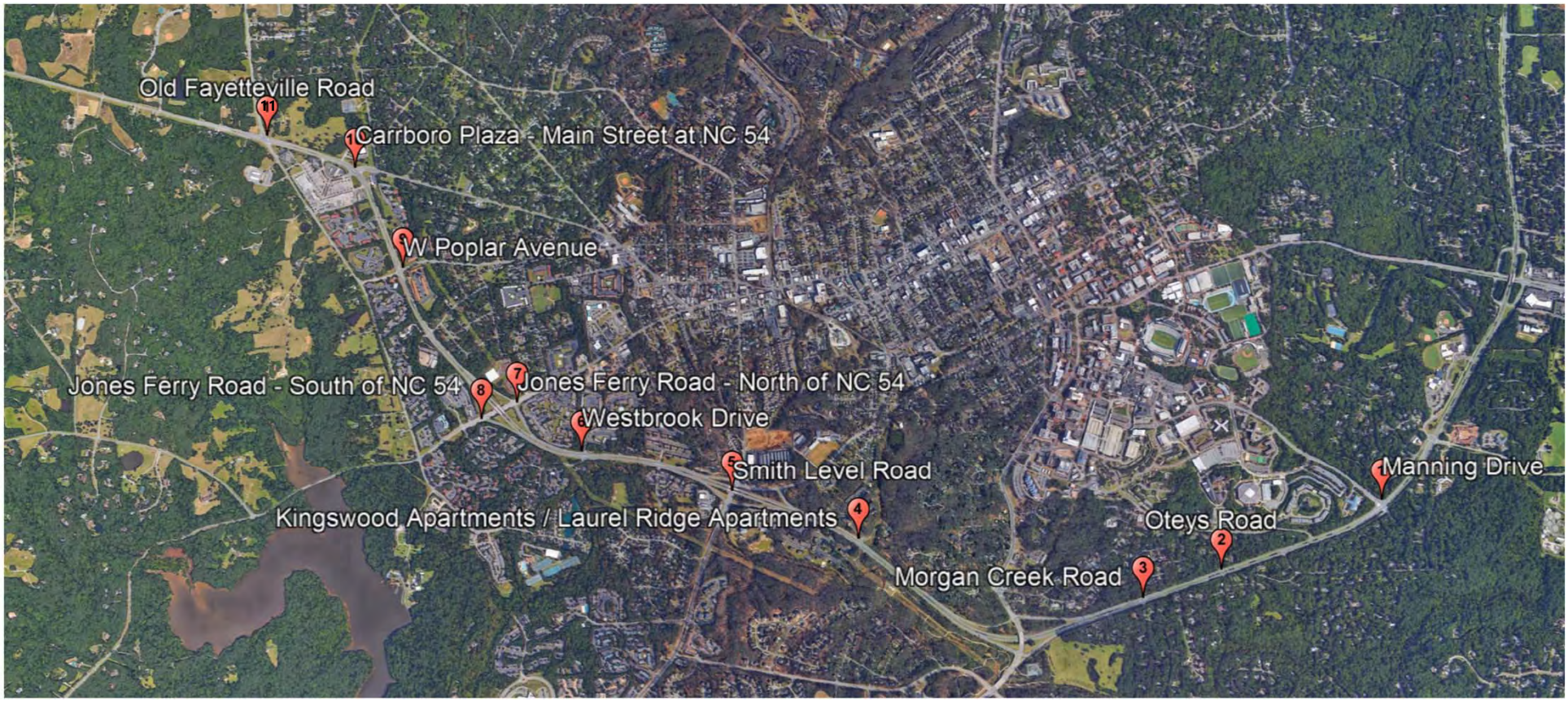
Route J - Existing

Route J (PM) – 3190 – NC 54 West at Laurel Ridge	Route J (PM) – 3191 – NC 54 East at Kingswood	Added Time to ride to other side of street
4:14	4:38	+ 24 mins
4:29	4:53	+ 24 mins
4:44	5:08	+ 24 mins
4:59	5:23	+ 24 mins
5:14	5:38	+ 24 mins
5:29	5:53	+ 24 mins


Route J - Segmented
Kingswood wait time (est 15+ min)
NC 54 West at Laurel Ridge
NC 54 East at Kingswood
Pros:
1. Shorter bus travel time to reach opposite side of NC 54 for Kingswood / Laurel Ridge
2. Potential for increased schedule adherence
Cons:
1. Need for transfer if travelling to Carrboro High School/ destinations along Smith Level Road
2. Potential operational difficulties of yellow dashed route
3. Unknown if people will stay on bus to ride to other side of NC 54
SPRINGS
Morgan Creek
WEATHERHILL
The Chapel Hill Tennis Club
Bridges at Chapel Hill
180 West Apartments
University Commons
The Stratford
The Villages of Chapel Hill Apartment Homes
Culbreth Rd
Rock Creek Apartments
High School
Ridgehaven Townhomes
Smith Level Rd
Culbreth Middle School
Kingswood Apartments
Merritt's Pasture
Transit
3D


Route J – Continuous
To Carrboro/ Chapel Hill
Kingswood wait time (est 5-10 min)
Westbrook wait time (est 5-10 min)
NC 54 West at Royal Park
NC 54 East at Canterbury Apts
NC 54 West at Laurel Ridge
NC 54 East at Kingswood
Pros:
1. Decreased route deviations
2. Clockwise and Counter-Clockwise route allows for riders coming from Downtown to choose route that is on their side of NC 54
3. Allows for direct connection along NC 54 across Smith Level Road
4. Provides direct connection between downtown Carrboro and Carrboro High School
Cons:
1. New routes may cause confusion
2. Potential for increased operating costs
3. May induce additional pedestrian crossings to reach opposite route for faster service to final destination
Food Lion
Burger King
Ashbrook Apartments
Carolina Apartments
Poplar Place
Morgan Creek
Kingswood Apartments
180 West Apartments
University Commons
The Stratford
Culbreth Rd
Carrboro High School
Ridgehaven Townhomes
Culbreth Middle School
HillSong Church
Merritt's Grill
West Campus

Conceptual Crossing Improvements



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Improvement Table

- Signalized Crossing Improvements
  - Crosswalk markings
  - Pedestrian signals
  - Overhead lighting
  - Consideration for longer ped phases
- Uncontrolled Crossing Improvements
  - New pedestrian/traffic signals
  - New PHB
  - Access controls
  - High viz crosswalks
  - Overhead lighting
  - Bus stop relocations
  - Warning signs

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Location 4 – Kingswood / Laurel Ridge

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Location 6b – Westbrook Drive

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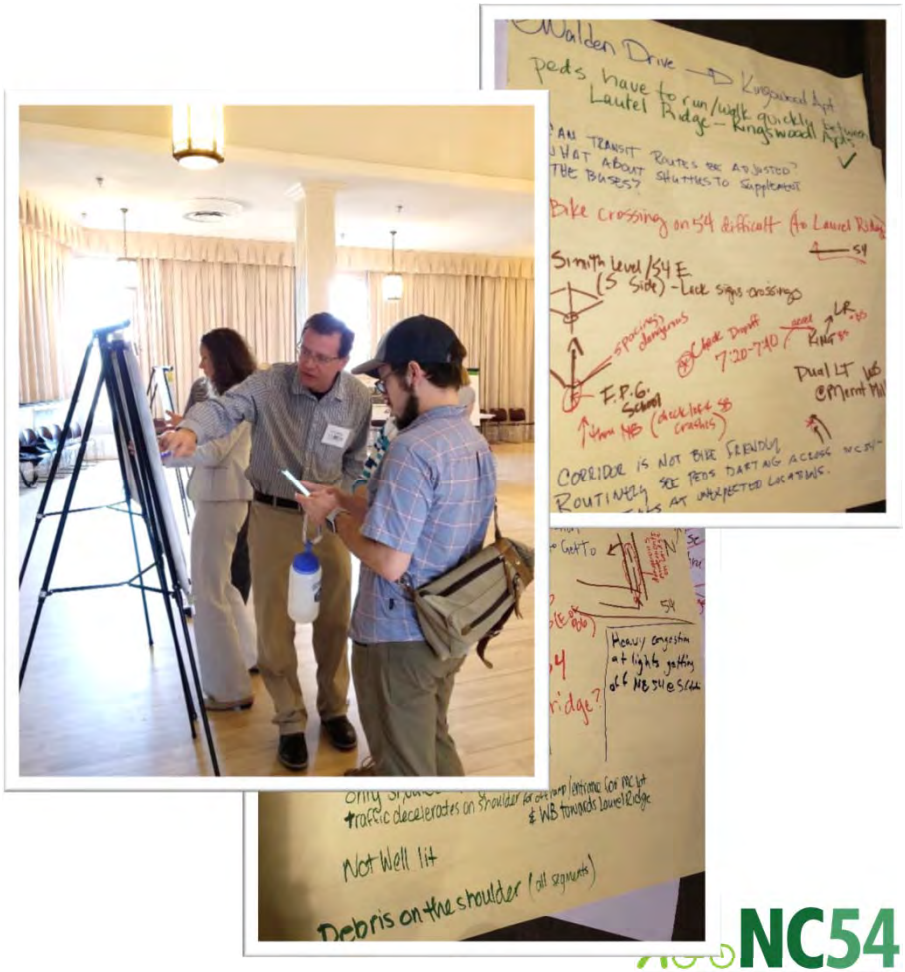
Public Workshop

- Early-mid November
- Location Options:
  - Chapel Hill
  - Pop Ups at Apartments, Shopping, Bus Stops
  - Elementary School
- Objective – Preview recommendations for general feedback



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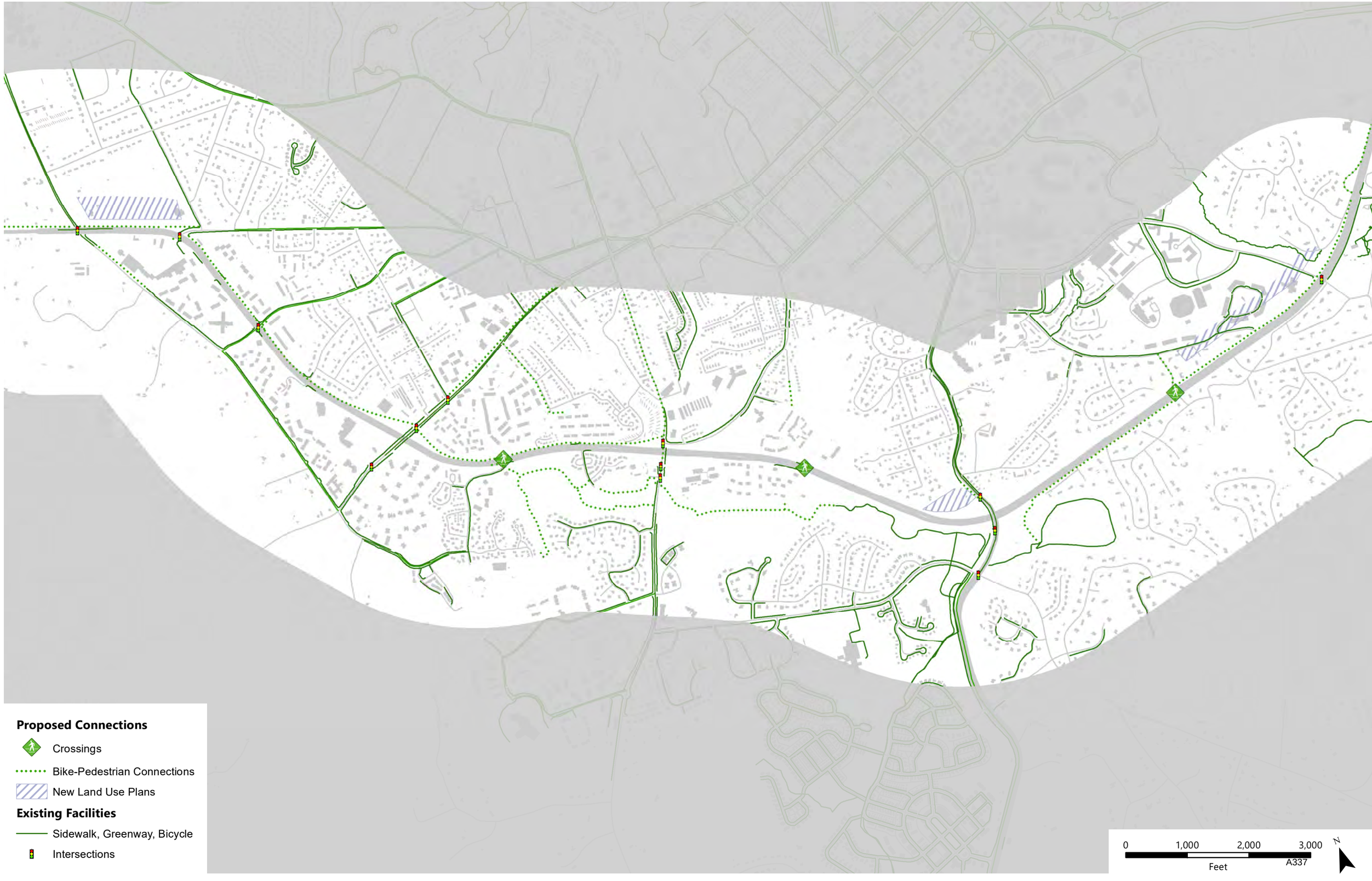
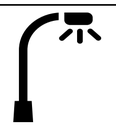

Proposed Connections
Crossings
Bike-Pedestrian Connections
New Land Use Plans
Existing Facilities
Sidewalk, Greenway, Bicycle
Intersections
0
1,000
2,000
3,000
Feet
A337
N
Prepared by: VHB
Date: September 2019

ID	Location	RSA Comments	Tested Recommendations and Assumptions	Approach	LOS Comparison NB-AM	NB-PM	Bld-AM	Bld-PM	Findings and Conclusions	Additional Comments	Status and Future Considerations
1	Manning Drive	Consider moving pedestrian crossing to north to improve visibility for south bound traffic	Relocate the pedestrian crossing on the north leg to improve the visibility of the crossing for drivers traveling southbound along Manning Dr	Overall					The location of the pedestrian phase already exists and cannot be adjusted. No results reported.		
				Eastbound							
				Westbound							
				Northbound							
				Southbound							
		Add pedestrian signal head-on south east corner	Add pedestrian phases to all legs at the intersection of NC 54 at Manning Drive	Overall	**F (99.2 sec/veh)**	**F (144.4 sec/veh)**	**F (147.0 sec/veh)**	**F (161.6 sec/veh)**	Adding a pedestrian phase to all legs increases the splits for some movements (NB). East leg ped phase would be problematic since there are no sidewalks on the east side (currently).		Future sidewalk on east side of Manning Drive to support future east leg crosswalk and ped signal.
				Eastbound	F-158.6	E-75.6	F-248.7	F-142.7			
				Westbound	C-32.3	F-215.0	D-41.8	F-230.1			
				Northbound	F-80.6	E-67.5	E-62.8	E-58.4			
				Southbound	E-70.3	F-120.7	E-59.0	E-65.2			
2	Oteys Road	Add PHB/ HAWK connect to Morgan Creek Trail	Add two-phase signal at the intersection to simulate a PHB/HAWK. Signal will be pretimed and optimized based on volumes experienced at the intersection	Overall	-	-	**E (68.8 sec/veh)**	**D (41.7 sec/veh)**	Signal added shows NB queueing under 50 feet for AM and PM peak hour, SB queueing 48 ft and 412 ft for AM and PM respectively. Heavy directional peaking for EB and WB movements. EB in AM 1967 ft, WB in PM 1531 ft.		Consider PHB or tunnel with future greenway extension
				Eastbound	-	-	F-95.7	B-14.4			
				Westbound	-	-	A-8.3	E-58.2			
				Northbound	E-42.0	C-20.6	D-51.2	D-46.0			
				Southbound	C-15.0	F-475.0	D-52.5	F-82.5			
		- Install limited movement cross over - Limited movement intersection with two-phase signal (no through movements, left in, right out, though must allow for U-turn movements elsewhere or use the interchange)	Evaluate using ITRE Two-Phase Signalization Guidelines	Overall	-	-			No further consideration of a signal is recommended using the ITRE two-phase signalization guidelines.		
				Eastbound	-	-					
				Westbound	-	-					
				Northbound	E-42.0	C-20.6					
				Southbound	C-15.0	F-475.0					
		Consider form of signalization	Run signal warrant analysis using the HCS 2010 warrants software	Overall	-	-	**E (68.8 sec/veh)**	**D (41.7 sec/veh)**	Only meets peak hour warrant; potential additional analysis could be explored for the intersection. See previous comment in regards to queueing at the new intersection.		
				Eastbound	-	-	F-95.7	B-14.4			
				Westbound	-	-	A-8.3	E-58.2			
				Northbound	E-42.0	C-20.6	D-51.2	D-46.0			
				Southbound	C-15.0	F-475.0	D-52.5	F-82.5			
3	Morgan Creek Road	- Close intersection for cross over at Oteys Rd - Limited movement intersection with two-phase signal (no through movements, left in, right out, though must allow for U-turn movements elsewhere or use the interchange)	No further analysis was conducted at this intersection due to the proximity of Morgan Creek Road to the ramps at US 15-501	Overall					A limited movement intersection at Oteys Road was tested		
				Eastbound							
				Westbound							
				Northbound							
				Southbound							
4	Kingswood Apartments/ Laurel Ridge Apartments	Consider left over for pedestrian refuge; zig zag concept or Z crossing. Limited movement intersection with two-phase signal (no through movements, left in, right out, though must allow for U-turn movements elsewhere or use the interchange)	Evaluate using ITRE Two-Phase Signalization Guidelines. Zig zag crossing will not be tested due to inability to test a crossing of that type in Synchro	Overall	-	-	**C (22.9 sec/veh)**	**A (8.8 sec/veh)**	Westbound left-over at Kingswood Apartments - recommended futher investigation of signalization for AM peak hour. Two signalized intersection improvements analyzed.	B: Full-Access with ped phase **C: Left-over access with right-only off of the side-streets**. 90 sec cycle length	Left-over median + ped signal
				Eastbound	-	-	C-29.2	A-7.2			
				Westbound	-	-	A-3.4	A-8.9			
				Northbound	F-11543.7	F-7299.5	D-46.3	D-43.8			
				Southbound	F-577.7	F-5999.6	D-41.0	D-38.5			
		Restripe existing bus lane as right turn acceleration lane	Add an additional lane along NC 54 where the current bus lane is located. The lane will merge into the main thoroughfare approximately 150 feet west of the intersection	Overall	-	-			Does not significantly impact results at the intersection. The majority of vehicles continue to align in the left-most lanes due to the short length of the merge lane.		Potential improvement
				Eastbound	-	-					
				Westbound	-	-					
				Northbound	F-11543.7	F-7299.5					
				Southbound	F-577.7	F-5999.6					
		Add traffic signal with [guardrails?]	Conduct a signal warrant analysis for the 4 leg intersection of NC 54 at Kingswood Apartments/Laurel Ridge Apartments	Overall	-	-	**D (38.3 sec/veh)**	**D (45.8 sec/veh)**	Signal not warranted based on HCS 2010 analysis. A coordinated signal was tested at this location with ped phases included on each leg.	**B: Full-Access with ped phase** C: Left-over access with right-only off of the side-streets	
				Eastbound	-	-	D-48.8	B-19.1			
				Westbound	-	-	A-7.4	E-64.5			
				Northbound	F-11543.7	F-7299.5	E-57.3	C-24.6			
				Southbound	F-577.7	F-5999.6	D-53.8	C-23.4			
5	Smith Level Road	Mark intersection legs with crosswalks and include pedestrian signal heads	Add crosswalks and pedestrian phases to all legs at the Smith Level Road intersection with the NC 54 EB Ramps	Overall	**C (27.3 sec/veh)**	**C (33.4 sec/veh)**	**C (27.3 sec/veh)**	**C (33.4 sec/veh)**	The inclusion of an additional ped phase on all legs does not change split length or create any additional impacts to the signal and therefore does not impact the LOS or delay for intersection in the AM peak hour. For the PM peak hour, the signal was forced into the splits which had the same impact.		Ped crossing + signals on all legs
				Eastbound	---	---	---	---			
				Westbound	E-65.2	D-53.5	E-65.2	D-53.5			
				Northbound	B-15.1	B-15.4	B-15.1	B-15.4			
				Southbound	C-21.9	C-24.4	C-21.9	C-24.4			
		Consider LPI at intersection for pedestrian crossings	Add a 7 sec LPI to both N/S and E/W movements at the intersection	Overall	**C (27.3 sec/veh)**	**C (33.4 sec/veh)**	**C (27.2 sec/veh)**	**D (36.8 sec/veh)**	Inclusion of the LPI has minimal impact on the AM peak hour due to the long cycle length. During the PM peak hour more substantial influences to the signal are felt due to the short cycle length, but overall the signal doesn't degrade to unacceptable levels.		Under further review per crash analysis and current conditions.
				Eastbound	---	---	---	---			
				Westbound	E-65.2	D-53.5	E-65.6	E-61.5			
				Northbound	B-15.1	B-15.4	B-15.0	B-19.9			
				Southbound	C-21.9	C-24.4	C-21.5	B-18.1			
6a	Abbey Ln	Consider relocating bus stops	Move bus stops to Westbrook Dr or consolidate to central location (Walden Dr.)	Overall	-	-	-	-	Relocation requires increased pedestrian travel to alternate bus stop		Consider in concert with Westbrook site (6b)
				Eastbound	-	-	-	-			
				Westbound	-	-	-	-			
				Northbound	-	-	-	-			
				Southbound	-	-	-	-			
6b	Westbrook Drive	Consider form of signalization	Run signal warrant analysis and test a signal as the intersection control in Synchro	Overall	-	-	**C (30.5 sec/veh)**	**A (7.5 sec/veh)**	Meets 8, 4, and peak hour warrants. Signal tested for AM and PM peak hours.		Potential full access signal + ped phases and crosswalks
				Eastbound	-	-	D-35.4	A-5.3			
				Westbound	-	-	B-11.9	A-7.0			
				Northbound	F-120.8	C-16.1	E-58.5	D-39.9			
				Southbound	B-14.0	E-35.9	E-57.4	D-37.1			
		Place pedestrian crossing to the north of NC 54 across Jones Ferry Rd	Add pedestrian crossing on the north leg of the NC 54 Ramp at Jones Ferry Road intersection	Overall	**B (12.8 sec/veh)**	**C (21.5 sec/veh)**	**B (12.7 sec/veh)**	**C (21.6 sec/veh)**	Forces the WB split to be longer due to the addition of the pedestrian walk time. This improves the LOS and delay for the WB approach and degrades the NB and SB approaches in the AM, but slightly degrades overall and WB approach in the PM peak hour.		Add ped crossing / signal
				Eastbound	---	---	---	---			
				Westbound	C-21.2	C-32.6	B-18.5	C-32.7			
				Northbound	A-7.1	A-8.5	A-8.4	A-8.5			
				Southbound	A-8.4	B-13.2	A-9.9	B-13.2			
		Consider adding crosswalk on east left of Jones Ferry road, use island as refuge. Align with curb cuts	Add pedestrian crossing on the eastbound left-turn of Jones Ferry Road at NC 54	Overall	**B (12.8 sec/veh)**	**C (21.5 sec/veh)**			See previous comment (Island on north leg of intersection)		Add ped crossing / signal
				Eastbound	---	---					
				Westbound	C-21.2	C-32.6					
				Northbound	A-7.1	A-8.5					

ID	Location	RSA Comments	Tested Recommendations and Assumptions	Approach	LOS Comparison NB-AM	NB-PM	Bld-AM	Bld-PM	Findings and Conclusions	Additional Comments	Status and Future Considerations
7	Jones Ferry Road - North of NC 54			Southbound	A-8.4	B-13.2					
		Add pedestrian signals	Add pedestrian phases to all legs at the NC 54 WB Ramps intersection with Jones Ferry Road	Overall	**B (12.8 sec/veh)**	**C (21.5 sec/veh)**	**B (12.5 sec/veh)**	**C (21.6 sec/veh)**	Forces the WB split to be longer due to the addition of the pedestrian walk time. This improves the LOS and delay for the WB approach and degrades the NB approach in the AM, but slightly degrades overall and WB approach in the PM peak hour.		Add ped crossing / signal
				Eastbound	---	---	---	---			
				Westbound	C-21.2	C-32.6	C-20.6	C-32.7			
				Northbound	A-7.1	A-8.5	A-7.3	A-8.5			
				Southbound	A-8.4	B-13.2	A-7.6	B-13.2			
		Consider no right turn on red	Prohibit Right-Turn on Red for all approaches at the NC 54 WB Ramps intersection with Jones Ferry Road	Overall	**A (9.9 sec/veh)**	**B (17.9 sec/veh)**	**B (12.8 sec/veh)**	**C (21.5 sec/veh)**	Additional delay added to the ramp and degrades overall LOS at intersection during both peak hours.	NCDOT standards assume No RTOR for all approaches, so all intersections analyzed with this assumption in place to produce more conservative results across the entire corridor.	Under further review per crash analysis and current conditions.
				Eastbound	---	---	---	---			
				Westbound	B-15.6	C-25.3	C-21.2	C-32.6			
				Northbound	A-6.1	A-8.5	A-7.1	A-8.5			
				Southbound	A-6.8	B-12.6	A-8.4	B-13.2			
8	Jones Ferry Road - South of NC 54	No marked crossing	Add pedestrian phases to all legs at the NC 54 EB Ramps intersection with Jones Ferry Road	Overall					Unsignalized and cannot test in Synchro		Add ped crossing / signal
				Eastbound							
				Westbound							
				Northbound							
				Southbound							
9	W Poplar Avenue	Consider modifications to signal phases to restrict turns during WALK phases or LPI	Add a 7 sec LPI to both N/S and E/W movements at the intersection	Overall	**B (11.5 sec/veh)**	**B (15.2 sec/veh)**	**B (10.6 sec/veh)**	**B (14.5 sec/veh)**	Heavy WB movement influences the EB LOS and Delay. The lower split experienced by adding the LPI most likely improves the efficiency of the EB movement and does not degrade the WB movement substantially.		Under further review per crash analysis and current conditions.
				Eastbound	A-9.4	B-13.3	A-8.2	B-11.1			
				Westbound	B-11.7	B-14.6	B-11.7	B-14.6			
				Northbound	C-29.9	C-31.5	C-29.9	C-31.5			
				Southbound	C-28.9	C-33.7	C-28.9	C-33.7			
		Consider marking all legs of intersection.	Add crosswalks to all legs at the W Poplar Avenue intersection with NC 54	Overall	**B (11.5 sec/veh)**	**B (15.2 sec/veh)**			Crosswalks/ped phases present currently on all legs except for the south leg. The inclusion of an additional ped phase on the south leg does not change split length or create any additional impacts to the signal and therefore does not impact the LOS or delay for intersection.	Addition of crosswalks on all legs increases the splits, but if allowed to optimize cycle length and splits substantial degradation is not experienced at the intersection	Add ped crossing / signal
				Eastbound	A-9.4	B-13.3					
				Westbound	B-11.7	B-14.6					
				Northbound	C-29.9	C-31.5					
				Southbound	C-28.9	C-33.7					
10	Carrboro Plaza - Main Street at NC 54	Extend time of pedestrian WALK phase across Main St	Time extended to accommodate a longer WALK phase across Main Street	Overall	**D (40.7 sec/veh)**	**D (41.6 sec/veh)**	**D (45.4 sec/veh)**	**D (44.9 sec/veh)**	Extension of walk time will increase LOS and delay for the overall intersection and the southbound movement if the cycle length is held to the existing timings.	If updated cycle length and splits allowed, increased walk time may not be an issue	Potential improvement
				Eastbound	C-27.1	C-33.5	C-28.3	D-40.5			
				Westbound	D-43.4	C-34.4	D-50.5	D-36.5			
				Northbound	D-54.7	E-57.0	D-44.6	D-49.9			
				Southbound	F-98.2	E-66.9	F-122.9	E-73.6			
		Add protected left	Add protected left-turn phasing at intersection where appropriate	Overall	**D (40.7 sec/veh)**	**D (41.6 sec/veh)**			Eastbound and Westbound NC 54 movements are already coded as protected left-turns. The Northbound and Southbound Main Street/Carrboro Plaza movements are split phasing.		
				Eastbound	C-27.1	C-33.5					
				Westbound	D-43.4	C-34.4					
				Northbound	D-54.7	E-57.0					
				Southbound	F-98.2	E-66.9					
		Consider modifications to signal phases to restrict turns during WALK phases or LPI	Add a 7 sec LPI to both N/S and E/W movements at the intersection	Overall	**D (40.7 sec/veh)**	**D (41.6 sec/veh)**	**D (37.4 sec/veh)**	**D (53.6 sec/veh)**	The low volume northbound movement includes a ped phase and therefore has a higher split than the southbound movement. The lower split experienced by adding the LPI most likely improves the efficiency of the SB movement and does not degrade the NB movement substantially.		Under further review per crash analysis and current conditions.
				Eastbound	C-27.1	C-33.5	C-34.8	D-43.9			
				Westbound	D-43.4	C-34.4	D-37.3	E-61.8			
				Northbound	D-54.7	E-57.0	D-54.7	E-57.0			
				Southbound	F-98.2	E-66.9	D-42.9	D-42.0			
		Consider marking all legs of intersection; Eliminate EB right turn lane into shopping center	Add pedestrian crossings at all legs of the intersection, including receiving curb SW quad of entry to shopping center.	Overall	**D (40.7 sec/veh)**	**D (41.6 sec/veh)**	**D (40.2 sec/veh)**	**D (47.4 sec/veh)**	The southbound split is increased with the inclusion of a ped phase, and therefore more vehicles are cleared and LOS and delay are improved on that leg. The opposite is true for the eastbound and westbound approaches.	No present receiving sidewalks on northwest quadrant	Enhance crossings with Shared Use Path on N side of NC 54 as part of new development;
				Eastbound	C-27.1	C-33.5	C-33.9	D-42.0			
				Westbound	D-43.4	C-34.4	E-56.7	D-50.6			
				Northbound	D-54.7	E-57.0	D-46.5	D-52.1			
				Southbound	F-98.2	E-66.9	D-38.8	D-43.5			
11	Old Fayetteville Road	Re-evaluate signal timing for protected turns and when WALK phase is on. (Pedestrian crossing on NC 54 on permissive Ø, may not be readily visible to SB Old Fayetteville left turn traffic; Blank out sign? Left turn on permissive phase during pedestrian phase.)	Add a 7 sec LPI to both N/S and E/W movements at the intersection	Overall	**E (74.7 sec/veh)**	**D (35.8 sec/veh)**	**E (65.9 sec/veh)**	**C (34.7 sec/veh)**			Under further review per crash analysis and current conditions.
				Eastbound	C-28.8	C-20.7	C-32.0	C-24.8			
				Westbound	C-21.0	C-20.1	D-37.7	C-29.5			
				Northbound	D-46.1	D-51.2	D-45.9	D-40.9			
				Southbound	F-192.1	E-74.1	F-144.1	D-51.0			
		Consider peak hour No Turn on Red signage	Prohibit Right Turn on Red during the peak hours for all approaches at the Old Fayetteville Road intersection with NC 54	Overall	**E (64.9 sec/veh)**	**C (34.0 sec/veh)**	**E (74.7 sec/veh)**	**D (35.8 sec/veh)**	Increase in overall and approach delay during both peak hours.		Under further review per crash analysis and current conditions.
				Eastbound	C-30.4	B-19.9	C-28.8	C-20.7			
				Westbound	B-12.2	B-17.9	C-21.0	C-20.1			
				Northbound	D-45.1	D-53.1	D-46.1	D-51.2			
				Southbound	F-161.1	E-70.1	F-192.1	E-74.1			
		Add crosswalks at splitter island on north side of intersection	Add pedestrian phase to north leg at the Old Fayetteville Road intersection with NC 54	Overall	**E (74.7 sec/veh)**	**D (35.8 sec/veh)**			Inclusion of the pedestrian phase does not impact the already lengthy split, therefore does not degrade the LOS or delay because it does not change drastically the timings of the signal. Additionally the low number of calls at the intersection make the impact minimal.		Future sidewalk or sidepath along north side of 54 (as part of Lloyd Farm and independent bike/ped project) will require consideration for crosswalk and ped signal across northern leg of intersection
				Eastbound	C-28.8	C-20.7					
				Westbound	C-21.0	C-20.1					
				Northbound	D-46.1	D-51.2					
				Southbound	F-192.1	E-74.1					
		Consider marking all legs of intersection	Add crosswalks to all legs at the Old Fayeteville Road intersection with NC 54	Overall					Depending on length of time tested, inclusion of the pedestrian phase does not impact the already lengthy split and therefore does not degrade the LOS or delay because it does not change drastically the timings of the signal. Additionally, the low number of calls at the intersection does not significantly impact the operations.		
				Eastbound							
				Westbound							
				Northbound							
				Southbound							