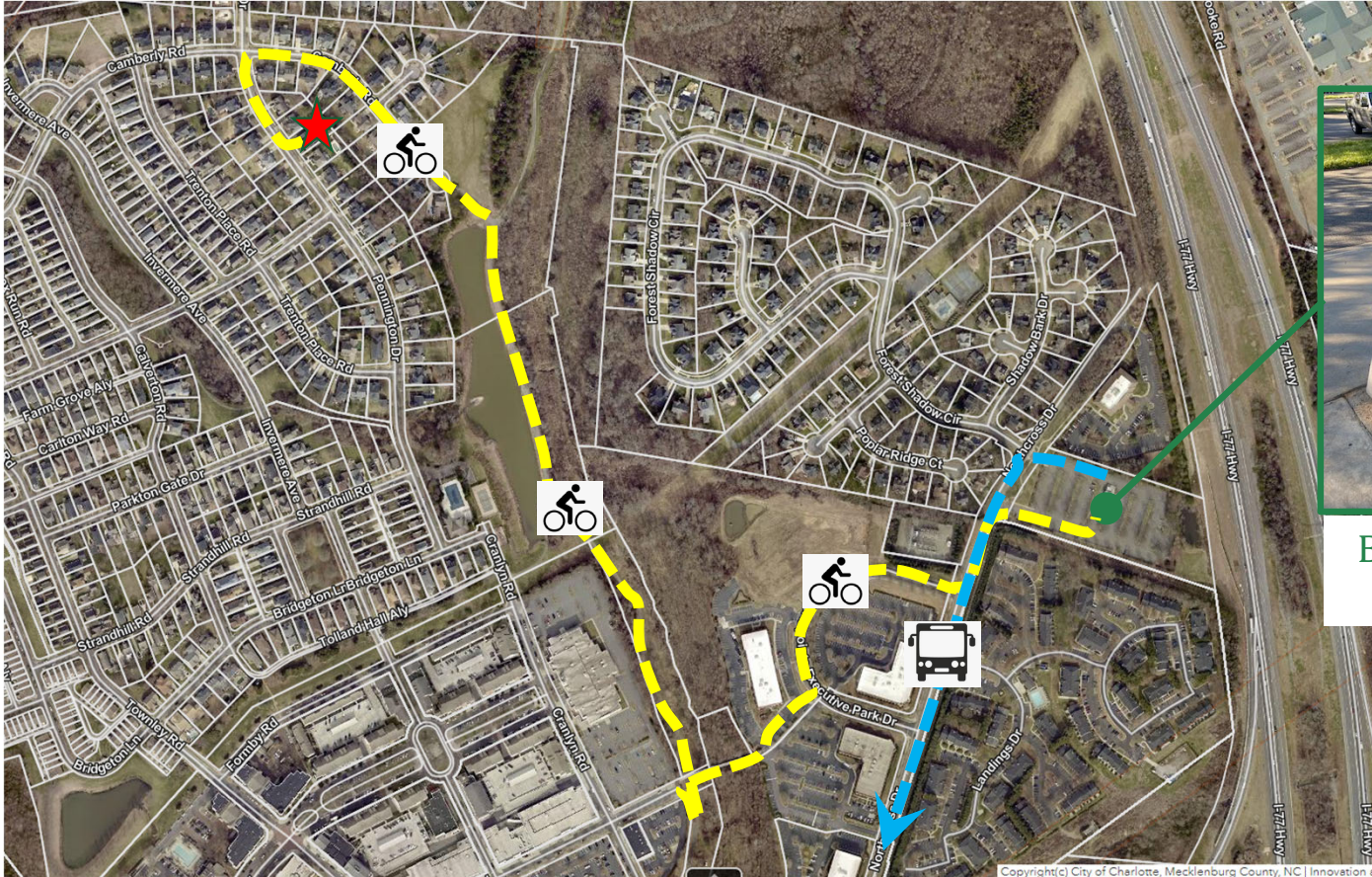


Designing Bicycle Infrastructure for Safety

BICYCLE ADVISORY COMMITTEE, OCTOBER 25, 2022



My Daily Commute



Bike-to-Bus Transfer at CATS
Northcross Park & Ride

Commute Summary:

- 1.2 mi by bike
- 18 mi by express bus

CDOT Design



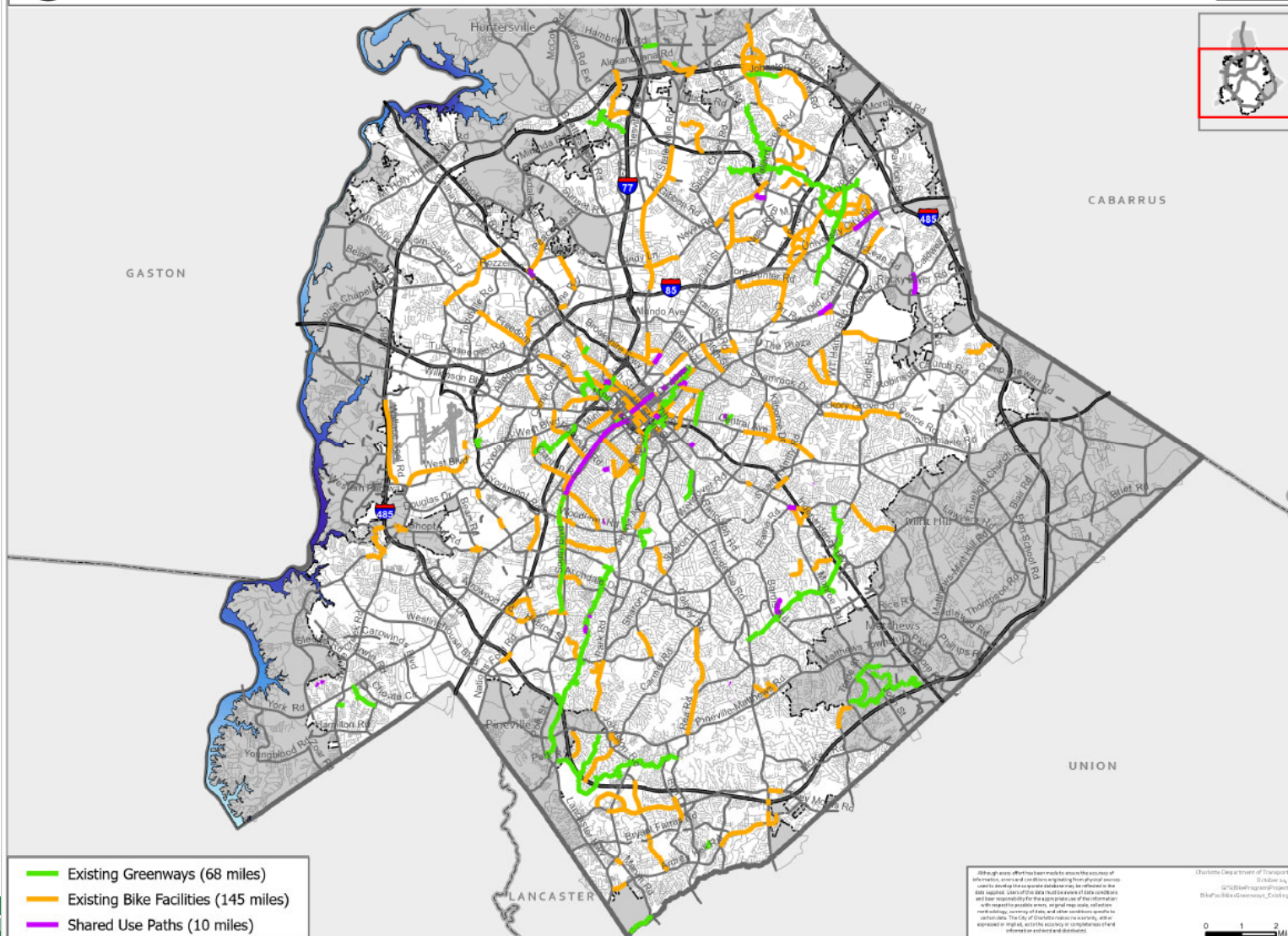
Existing Charlotte Bicycle Infrastructure



East Boulevard



Existing Bike Facilities and Greenways



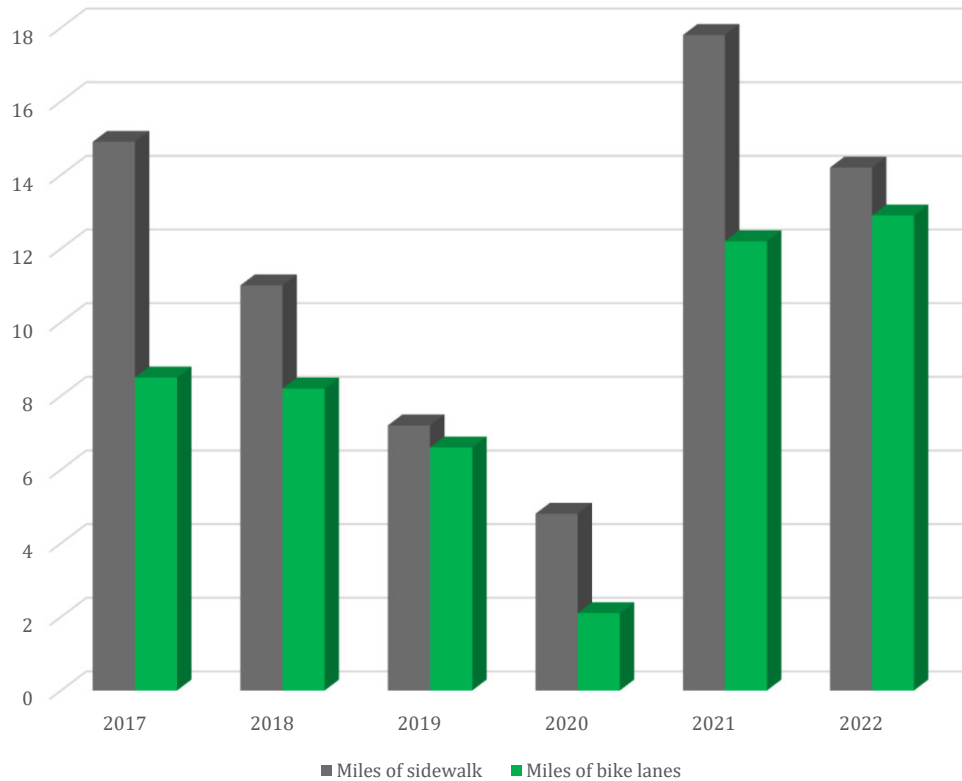
- Existing Greenways (68 miles)
- Existing Bike Facilities (145 miles)
- Shared Use Paths (10 miles)

Charlotte Department of Transportation
October 2014
GIS/Planning and Information
Bike Facilities Greenways, Parking

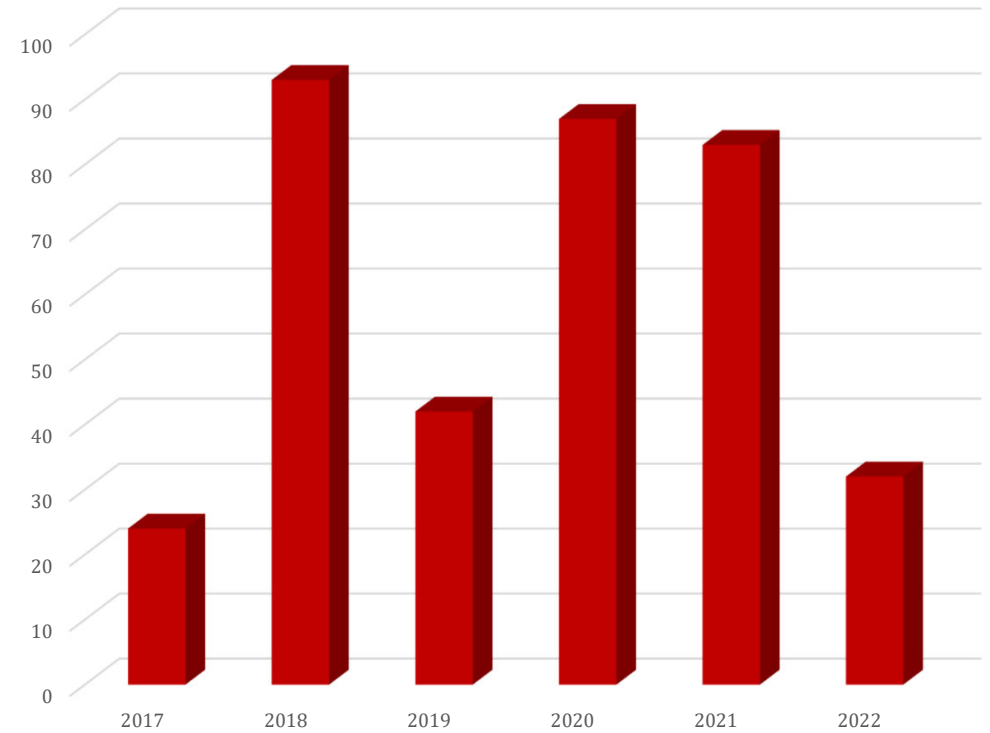
0 1 2 Miles

CDOT Annual Report Card

Total Annual Mileage of Sidewalks and Bicycle Facilities



Total Annual Bike/Ped Safety and Crossing Projects



The Evolution of Bicycle Facility Design



6th Street

Policy Changes: Bicycle Facility Design

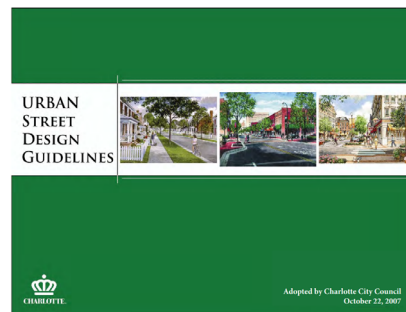
Pre-2007

2007

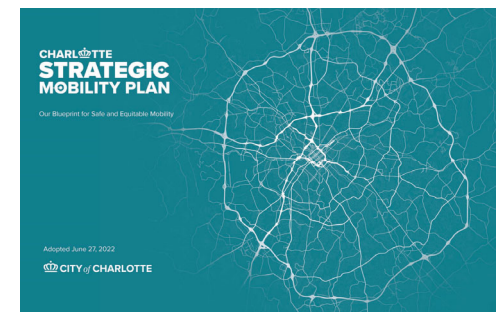
2017

2022

Various
National
Guidance



City of Charlotte
Department of Transportation



Then...



East Boulevard

More of a focus on the 'strong and fearless' rider

Standard bike lanes

Now...

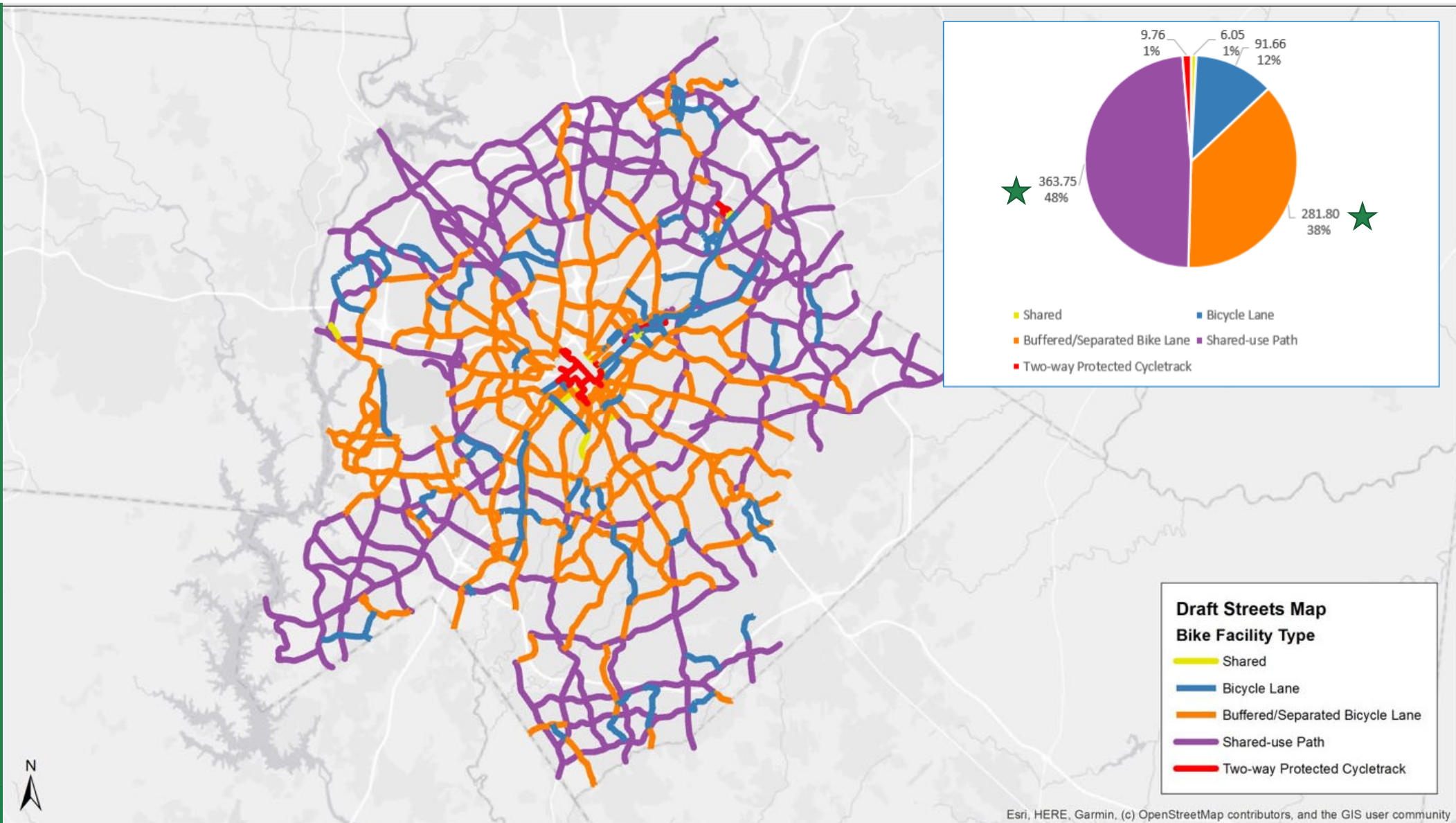


6th Street (Uptown CycleLink)

Look to accommodate the more vulnerable AAA user

Separated bike lanes

Array of facility types



Why Build Separated Bike Lanes on CLT Thoroughfares?

Excerpt from NACTO

- *Protected bike lanes (including raised bikeways) create All Ages & Abilities conditions by using physical separation to create a consistently exclusive, designated bicycling space...Protected bike lanes improve the overall organization of the street, and increase safety for people walking, bicycling, and in motor vehicles.*

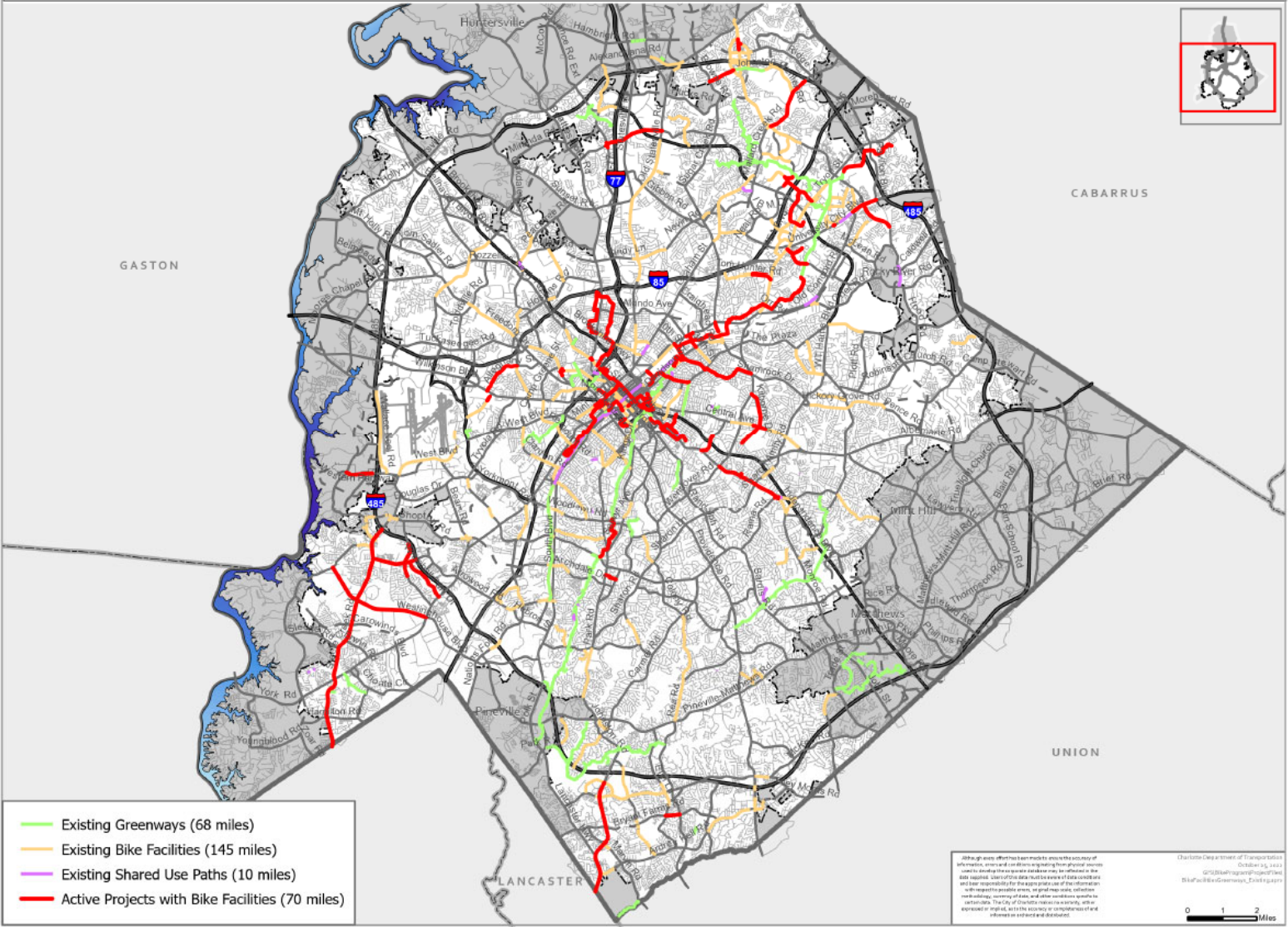
Citation from Why cities with high bicycling rates are safer for all road users, Journal of Transport & Health, Vol 13, June 2019

- *Based on thirteen years of data from twelve large U.S. cities, we investigated over 17,000 fatalities and 77,000 severe injuries across nearly 8700 block groups via multilevel, longitudinal, negative binomial regression models...The results suggest that more bicyclists is not the reason these cities are safer for all road users. Better safety outcomes are instead associated with a greater prevalence of bike facilities – particularly protected and separated bike facilities – at the block group level and, more strongly so, across the overall city.*





Active Projects with Bike Facilities



Street Conversions (a.k.a. Road Diets)



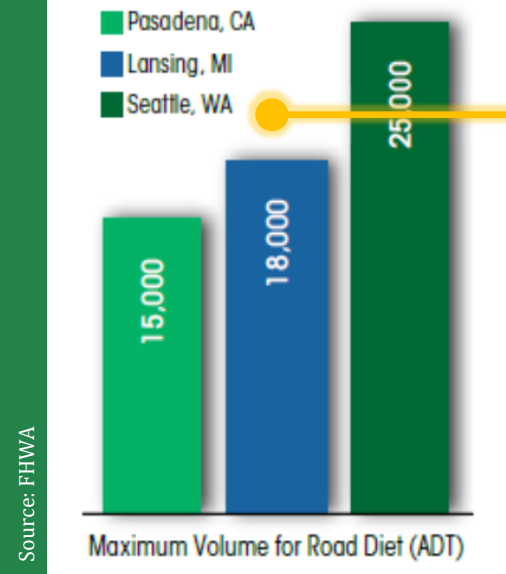
The Plaza

Street Conversion Basics

Easier Path to Attain Complete Streets

- Converts streets with excess vehicular capacity to a complete street
 - *Cheaper*
 - *Quicker*
- Safety benefits
 - *FHWA cites a 19%-47% total crash reduction for a 4-to-3 conversion*
- Traffic calming benefits

Figure 12. Road Diet Implementation Maximum Volume Thresholds by Agency



±20K AADT
for CLT

Since 2000 the city has completed 41 street conversions, totaling ±23 centerline street miles.

Street Conversion Safety Metrics

The Plaza (Central Ave to Parkwood Ave)

- **Traffic Speeds**
 - *Posted Speed: 30 mph (Previously 35)*
 - *May 2017 85th Percentile: 46 mph*
 - *Dec 2021 85th Percentile : 37 mph ($\Delta = -9$ mph)*
- **Crash Reduction:**
 - *Severe Types: Left-turn same roadway (-18%) and angle (-1%).*

Parkwood Ave (N Davidson St to The Plaza)

- **Traffic Speeds**
 - *Posted Speed: 35 mph*
 - *Sept 2019 85th Percentile: 43 mph*
 - *Dec 2021 85th Percentile : 38 mph ($\Delta = -5$ mph)*
- **Crash Reduction:**
 - *Limited 'after' crash data.*
 - Project complete Oct 2021.
 - Crash data only current up to Dec 2021.

Time Ranges

1	January 1, 2017 - February 22, 2020 (1148 days)	K: 0 (0.0%)	A: 0 (0.0%)	B: 9 (10.1%)	C: 24 (27.0%)	O: 56 (62.9%)	89 Crashes
2	February 23, 2020 - December 31, 2021 (678 days)	K: 0 (0.0%)	A: 0 (0.0%)	B: 3 (8.6%)	C: 9 (25.7%)	O: 23 (65.7%)	35 Crashes

K = (K) Fatal Injury, A = (A) Suspected Serious Injury, B = (B) Suspected Minor Injury, C = (C) Possible Injury, O = (O) Property Damage-Only

Upcoming Project Highlights



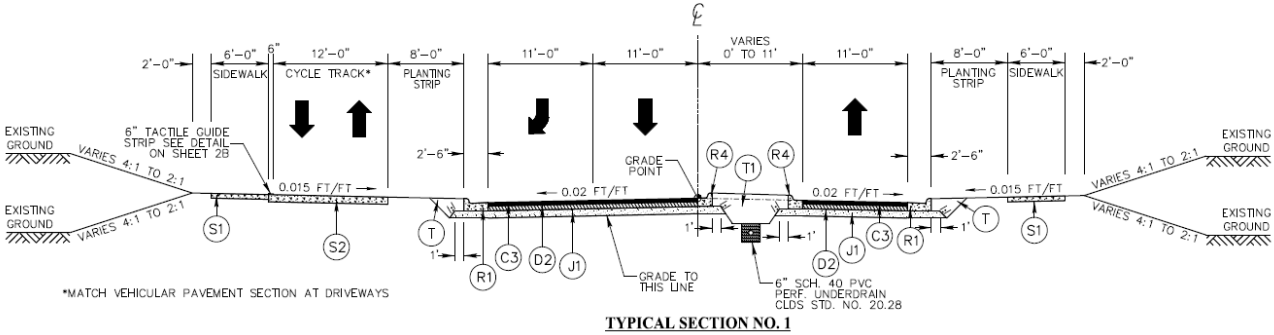
Rendering of the Backlot Trail

I-85 North Bridge

Current Phase: Bid

End Construction:
Summer 2027

Bicycle Facilities: 2-way
cycle track, & MUPs

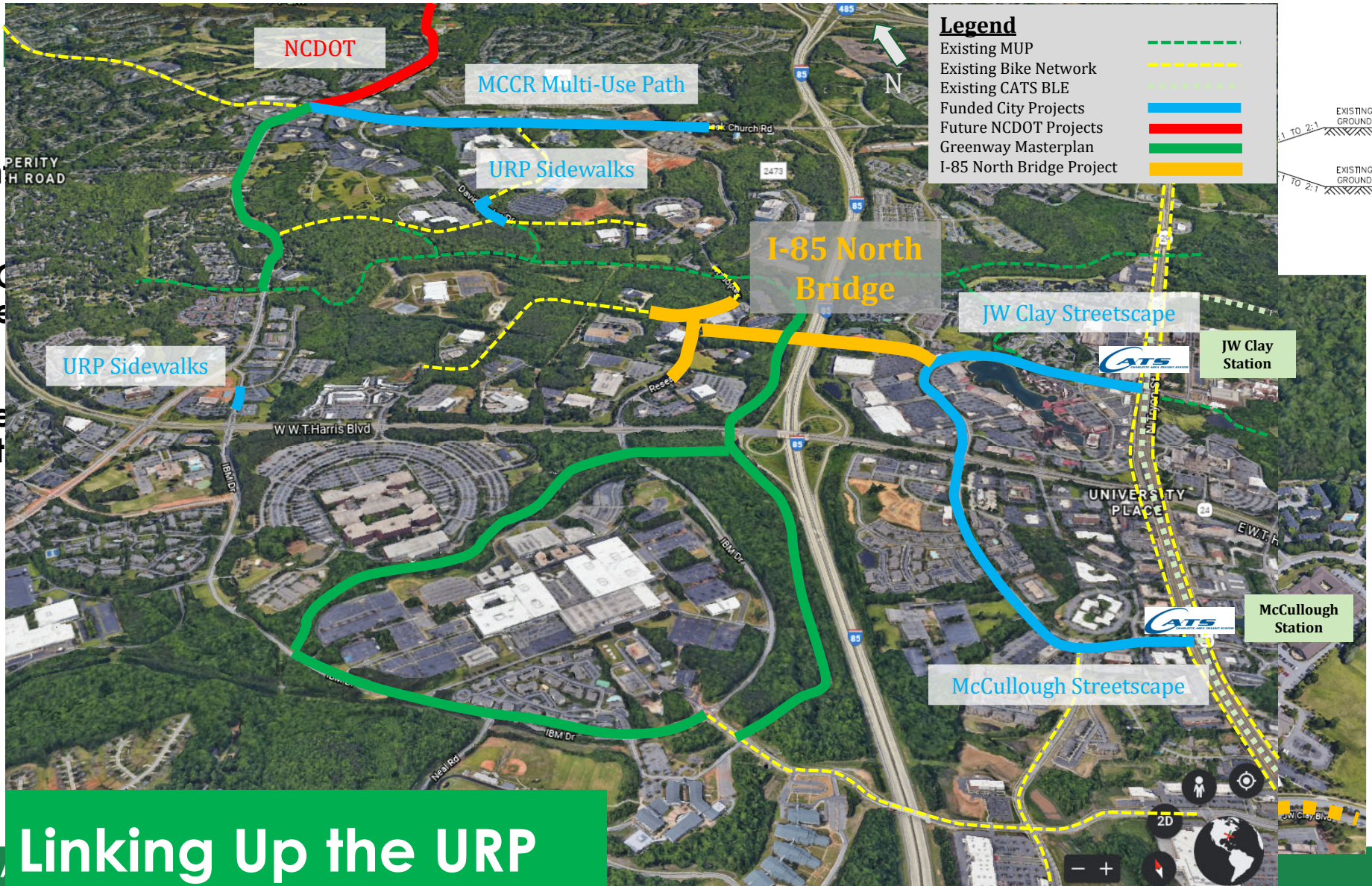


I-85

Current

Begin of
Summer

Bicycle
cycle t

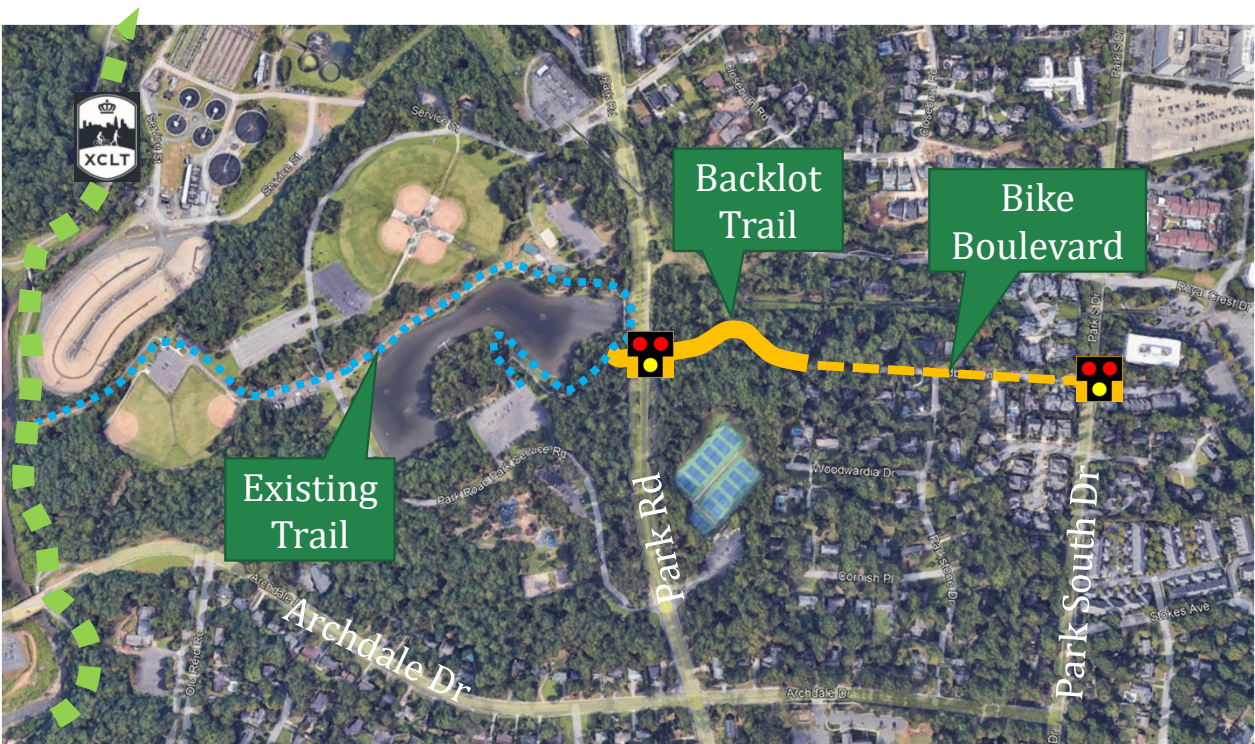
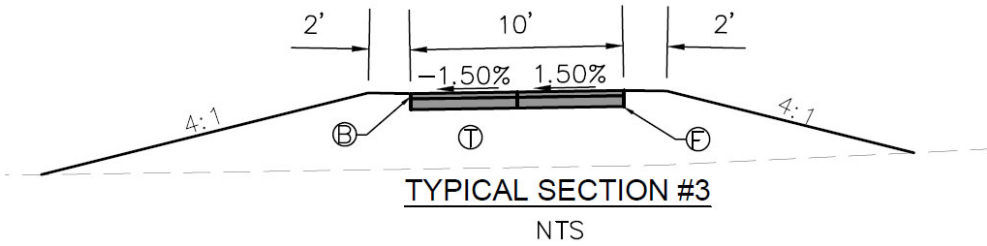


Backlot Trail

Current Phase:
Construction

Begin Construction:
Summer 2022

Bicycle Facilities: Bike
Boulevard, & SUP



Matheson Ave Street Conversion

Current Phase: Planning

Begin Construction: TBD

**Bicycle Facilities:
Separated Bike Lanes**



Matheson
Street

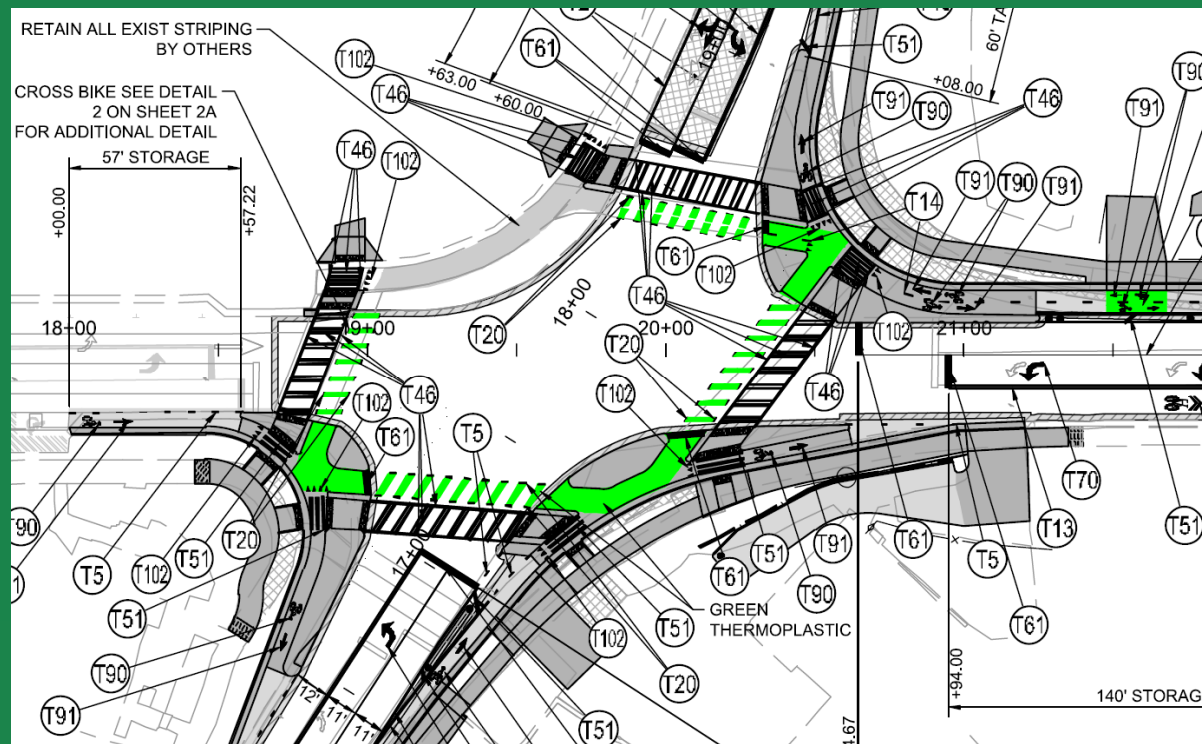
Current

Begin

Bicycle
Separation



Designing Intersections for Safety



Plan Excerpt from N Davidson St & Jordan Pl Intersection Project

Protected Intersection

Key Design Elements

Protective islands

- Refuge, slows turning speeds, visibility

Forward stop bar

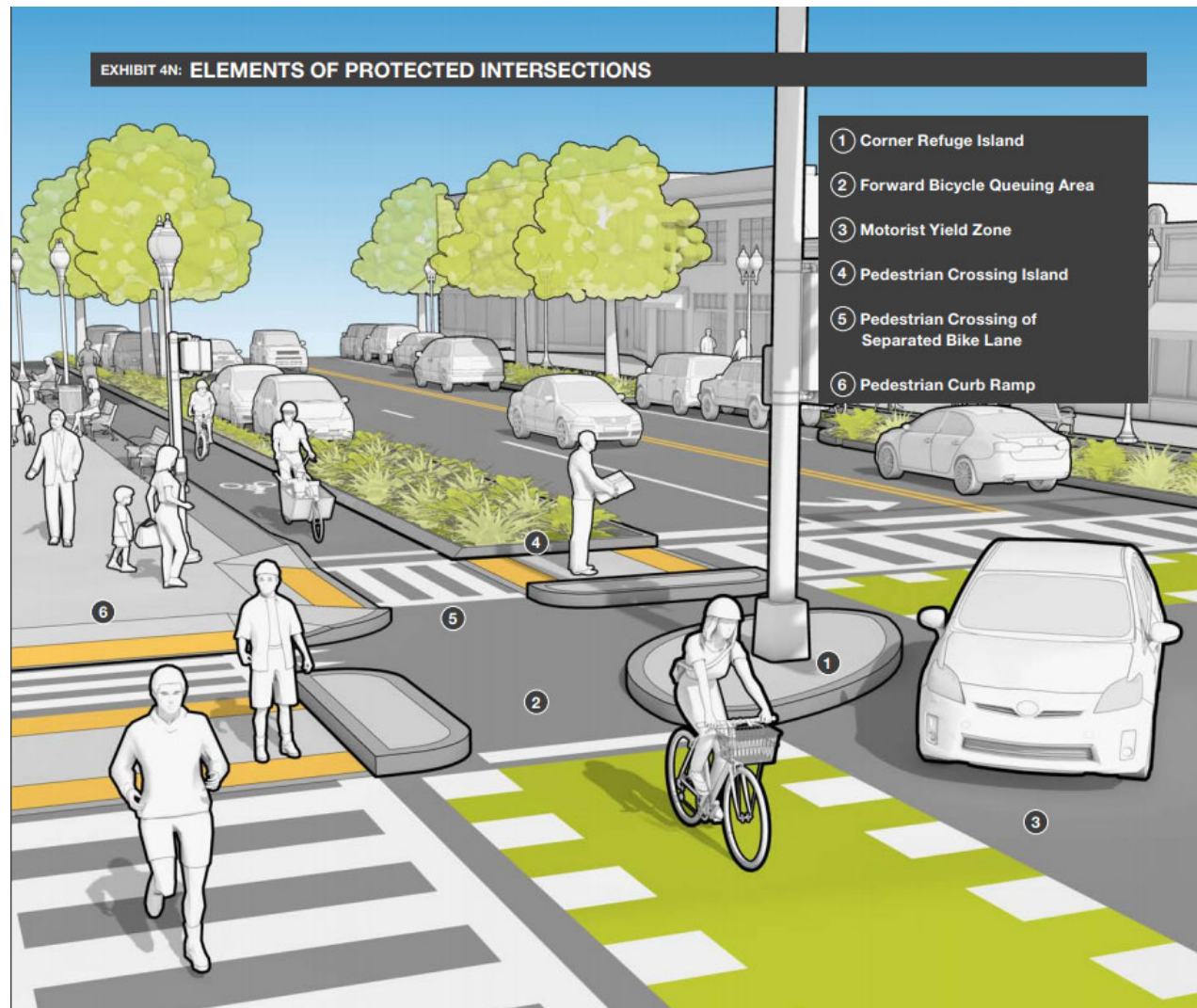
- Clear sight lines for turning vehicles

Set-back crossings

- Vehicles must cross paths perpendicular \pm to peds / bikes

Signal phasing

- Depending on context, can go more-or-less-aggressive phasing



Protected Intersection

Key Design Elements

Protective islands

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Forward stop bar

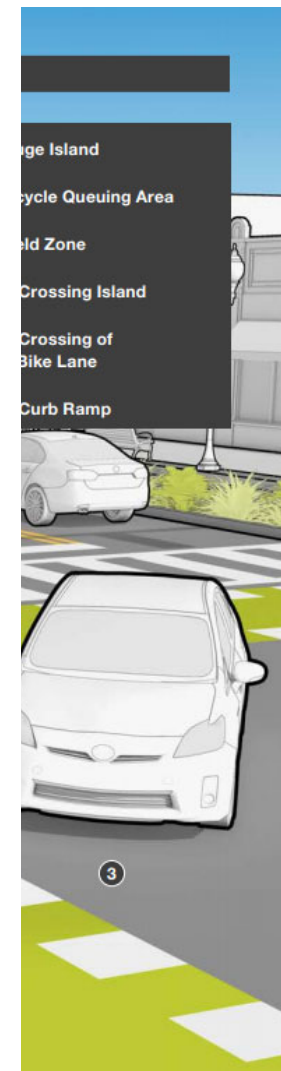
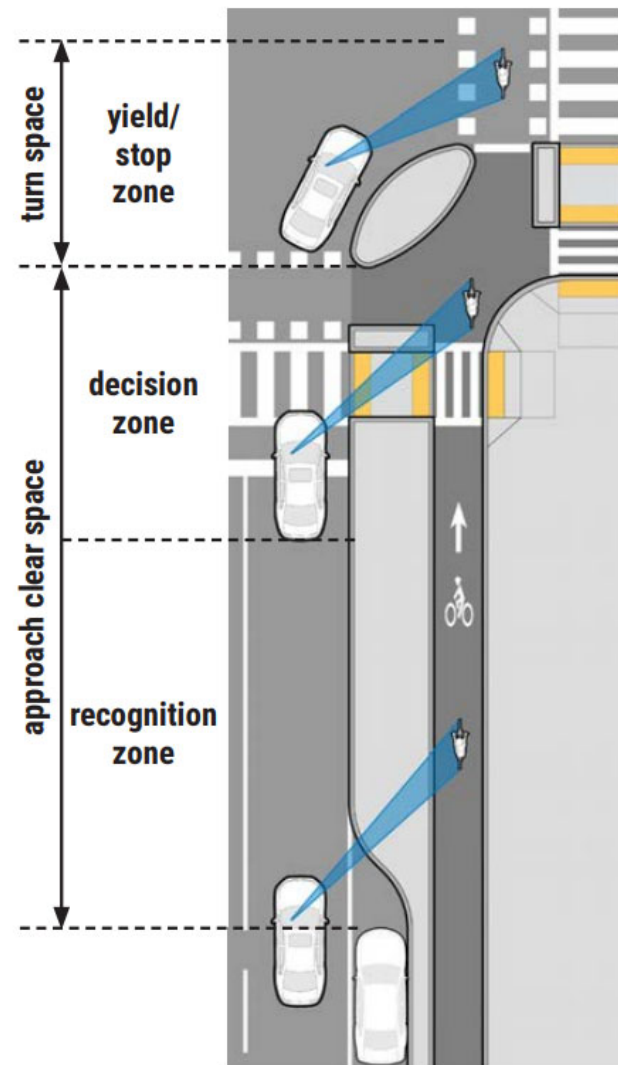
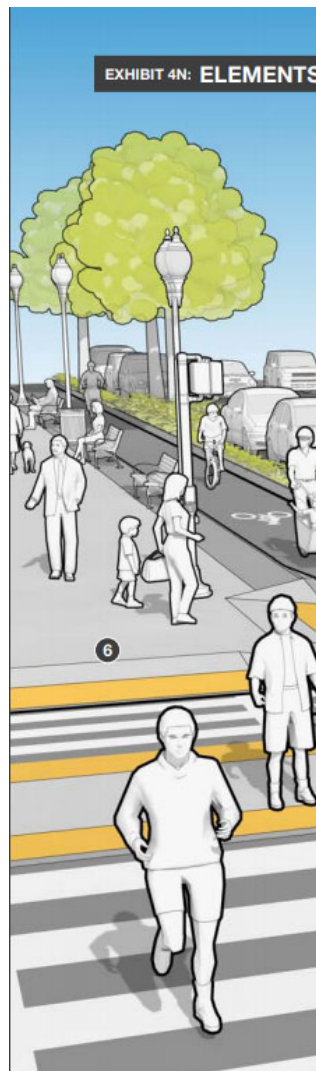
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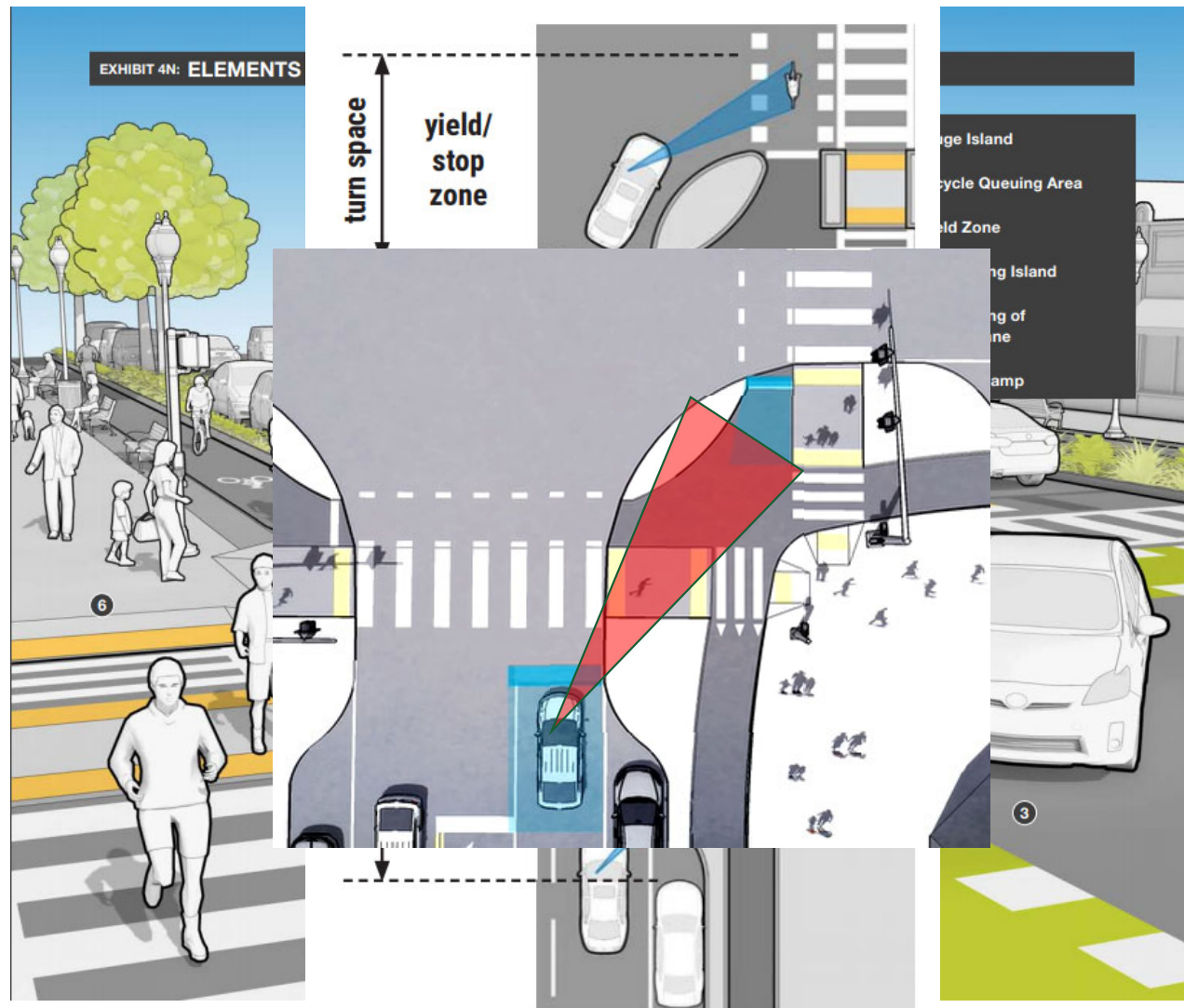
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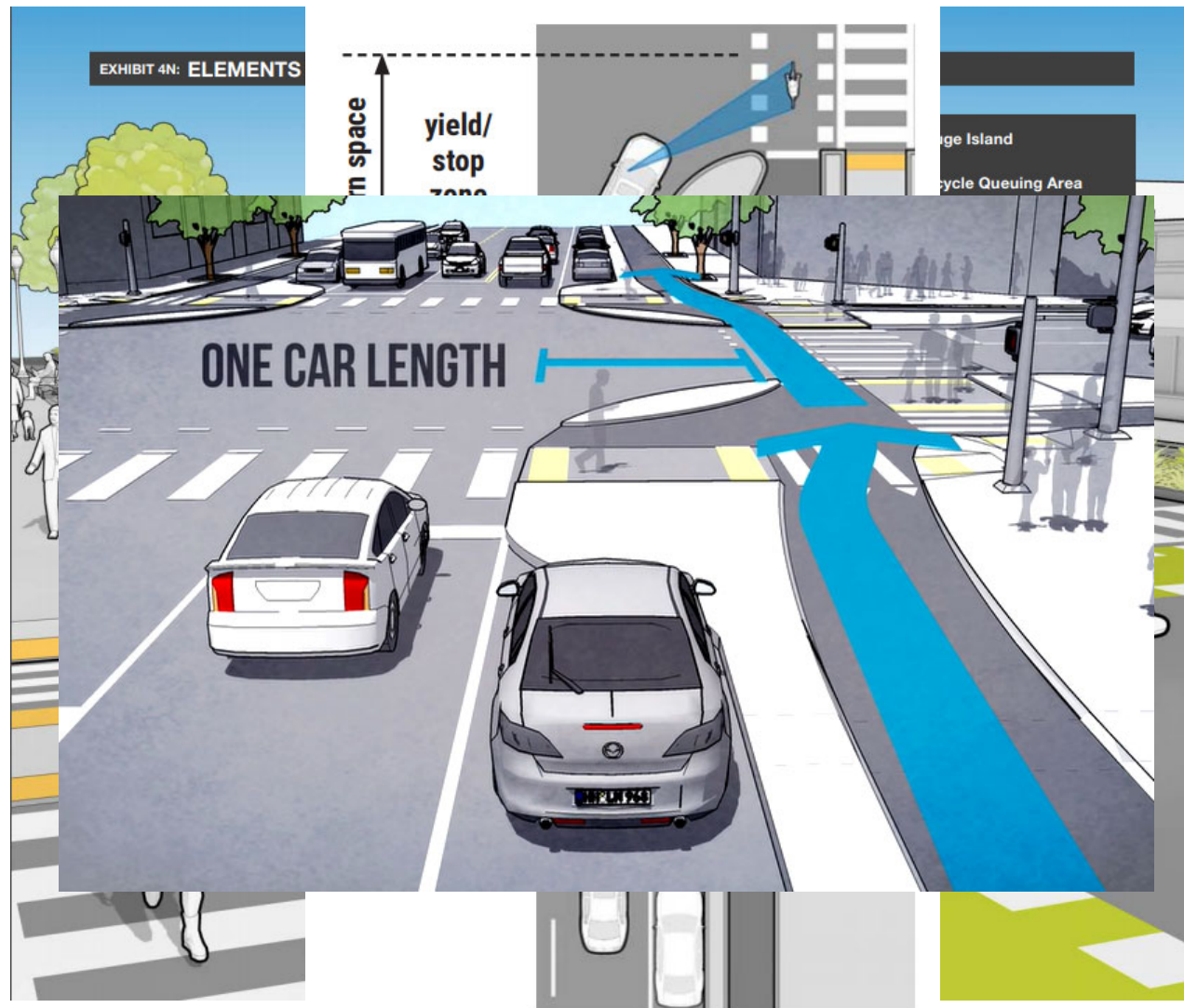
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Signal phasing

- Depending on context, can go more-or-less-aggressive phasing

EXHIBIT 4N: ELEMENTS

Phasing Scheme	Description	Pros	Cons
Concurrent Bike Phase with Concurrent Permissive Vehicle Turns (see EXHIBIT 6H)	Provides a bicycle phase that runs concurrently with the parallel vehicle phase.	<ul style="list-style-type: none"> • Increased compliance when compared to following vehicle signals. 	<ul style="list-style-type: none"> • Not appropriate in locations with high vehicle turning volumes. • Requires vehicles to yield when turning.
Concurrent Bike Phase with Leading Interval (see EXHIBIT 6I)	Provides an advanced green indication for the bike signal. Lead interval may provide 3 to 7 seconds of green time for bicycles prior to the green phase for the concurrent vehicle traffic. Lead bike intervals may typically be provided concurrently with lead pedestrian intervals.	<ul style="list-style-type: none"> • Allows bicyclists to enter the intersection prior to vehicles. • Improved visibility for turning vehicles. 	<ul style="list-style-type: none"> • Small increase to delay and queueing for vehicles. • Concurrent turns may not be appropriate with higher vehicle or bike volumes.
Concurrent Protected Bike Phase (see EXHIBIT 6J and EXHIBIT 6K)	Provides a bicycle phase that runs concurrently with the parallel through vehicle phase. Right and left vehicle turns across the bicycle facility operate under protected phases before or after the through phase.	<ul style="list-style-type: none"> • Provides full separation between turning vehicles and bicyclists. • Motorists are not required to yield when turning. 	<ul style="list-style-type: none"> • Additional signal phase may increase delay, require longer cycle length. • Protected right turns require the provision of a right-turn lane.
Protected Bike Phase (see EXHIBIT 6L)	Provides a protected bike phase where all motor vehicle traffic is stopped. This may run concurrently with a parallel pedestrian phase. May be appropriate in locations with complex signal phasing for vehicles and/or unusual geometry for a bicycle facility may result in unexpected conflicts between users.	<ul style="list-style-type: none"> • Provides maximum separation between vehicles and bicyclists. 	<ul style="list-style-type: none"> • Increases delay for motor vehicles. • Increases delay for bicyclists.

Less Aggressive

More Aggressive

N Davidson St & Jordan Pl Intersection

Project Info

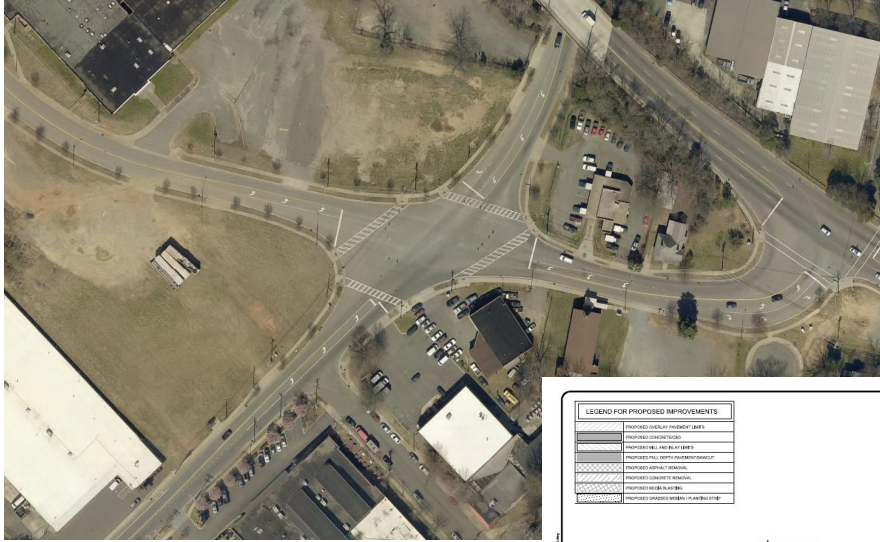
- **Classification:** Street Conversion
- **Facility Type:** Protected Intersection

Schedule & Budget

- **Schedule:**
 - *Paint-and-Post:* <1.0 year
 - *Permanent:* 6 years
- **Budget:**
 - *Paint-and-Post:* +/- \$30K
 - *Permanent:* \$4.5M



Before & After



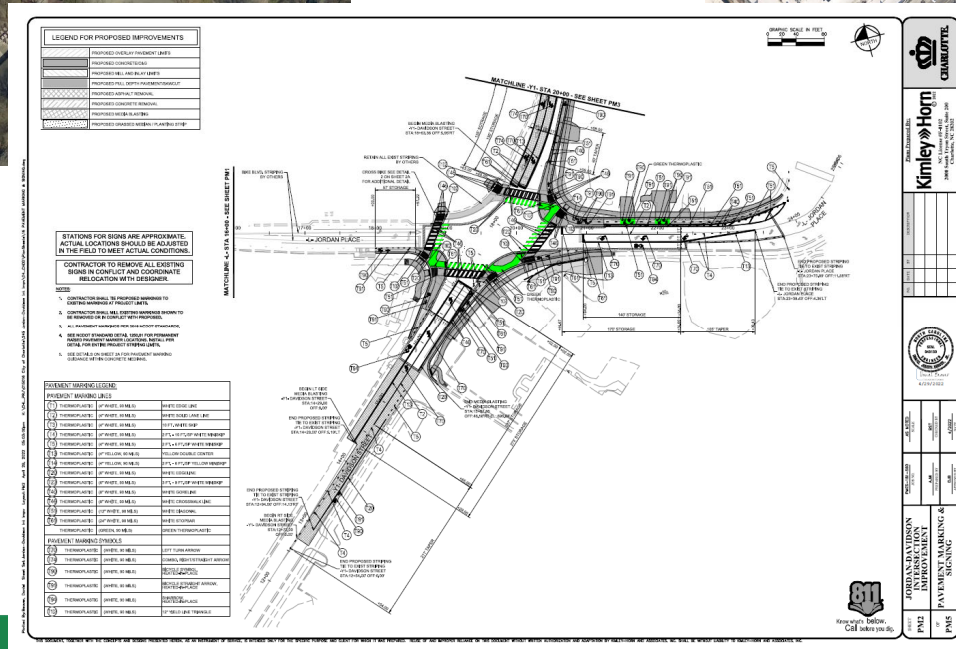
2016



2020 Paint-and Post



2024 Final Project



Miscellaneous Bike-Related Updates



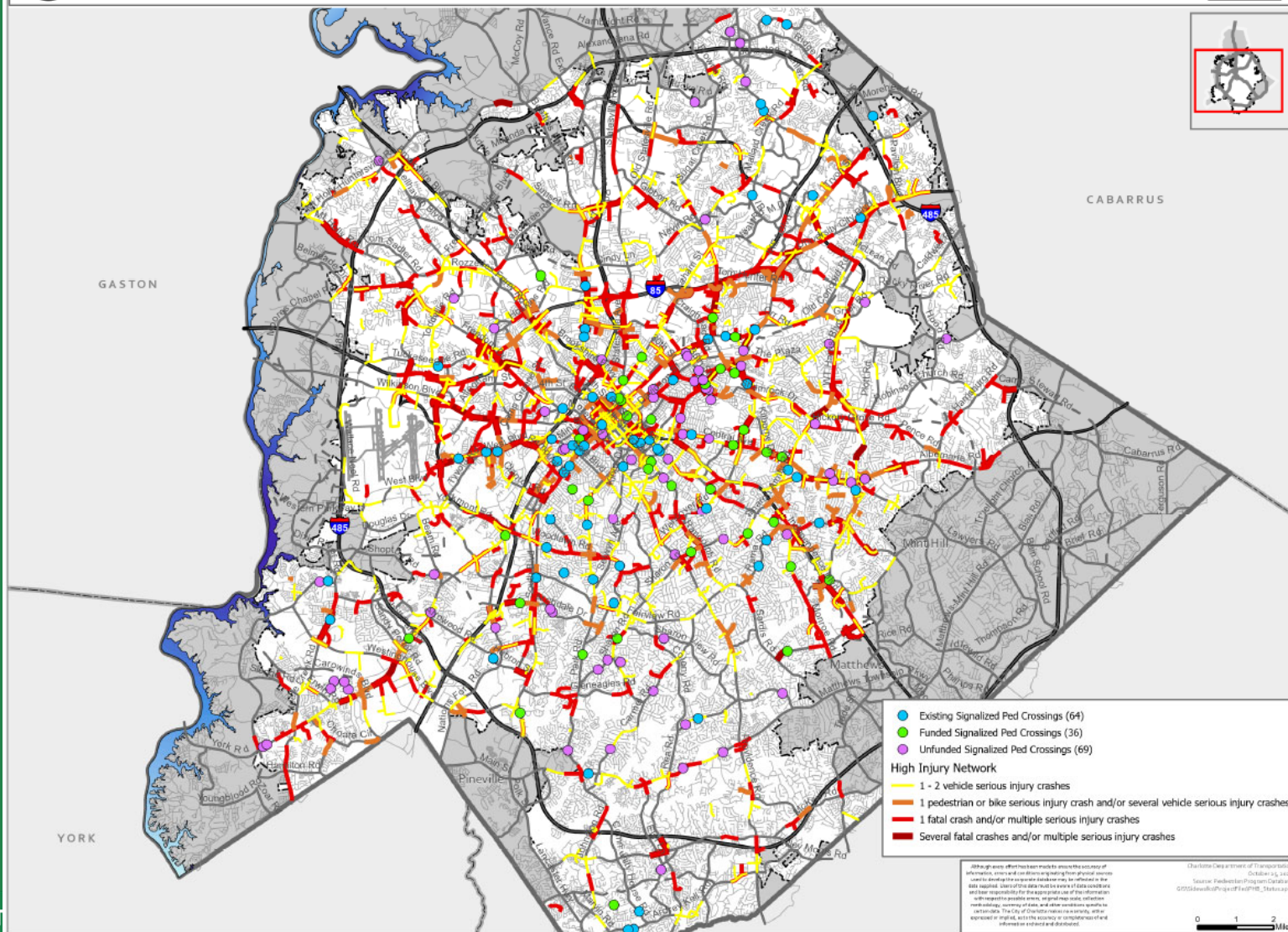
Upcoming Speed Limit Reductions w/ Bicycle Facilities

Street	Limit 1	Limit 2	Posted Speed	Recommended Speed	Miles of Bike Lane
East Blvd	South Blvd	Queens Rd	30	Lower to 25 mph	1.6
Donald Ross/Clanton	Wilkinson	South Blvd	35	Lower to 30 mph all the way to South Blvd	1.6
Remount	Wilkinson	S. Tryon	35	Lower to 30 mph	1.93





Vision Zero Pedestrian Crossing Projects



CDOT Bicycle Program + Street Maintenance Partnership



Thank You!

Contact Info

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LinkedIn – Keith Bryant

Work – 980.214.7076