



Vision Zero



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July 25, 2024

Vision Zero Audit

Executive Summary

Purpose

This audit was conducted to determine whether adequate controls have been established to help ensure the City meets its Vision Zero program goals.

Background

Charlotte adopted its Vision Zero program in March 2019. The City's Action Plan included key goals like converting undivided 4 lane streets to 3 lane streets through resurfacing, installing raised intersections, and tracking citations specific to speeding.

The top three causes of serious and fatal crashes are: speeding, distracted driving, and driving while impaired. In Charlotte, the five year average of pedestrian deaths per 100,000 has increased from the previous average. Vision Zero attempts to address this via the new "Safe System" approach, acknowledging that human errors are unavoidable, and roads should be designed for human mistakes while reducing system kinetic energy (i.e., speed).

Conclusion

CDOT needs to establish an adequate control structure to meet its Vision Zero Program goals.

Highlights

SECTION 1: ACCOUNTABILITY

1. CDOT has not fully implemented some key components of the Vision Zero Action Plan.

- CDOT has not clearly identified an individual (with appropriate authority) responsible for ensuring action items get completed.
- To promote accountability and coordination among departments, CDOT should designate someone to ensure all Action Plan items are performed or progressing.

2. City employees' Vision Zero-related safety behaviors are not monitored.

- The City's underutilization of AVL data, recurring sidewalk obstructions, and incomplete representation of closures on the Interactive Street Map are areas where improvements can impact safety.
- The Vision Zero Coordinator should ensure Fleet Management is monitoring City employees' driving behavior; CDOT should develop training curriculum about proper parking locations; CDOT should include closures of all transportation types (sidewalks, greenways, bike lanes, etc.) on its Street Closure Map.

SECTION 2: CHARLOTTE'S HIGH INJURY NETWORK

3. CMPD's enforcement operations are scheduled and distributed evenly around the City rather than by the severity of each corridor's crash history and KSI scores.

- Traffic enforcement operation locations (both speed operations and DUI checkpoints/saturation patrols) are designed to focus on the HIN with CDOT-generated "Enforcement Areas."
- CMPD should schedule enforcement operations where crash data indicates locations with the worst KSI crash scores.

continued...

Vision Zero Audit

Executive Summary - continued

4. CMPD does not consistently enter complete and accurate data into the NC DMV-349 crash forms.

- CDOT- corrected errors are not tracked nor are they shared with CMPD. Data entry issues are not periodically analyzed for trends to identify training needs and/or needed procedure changes.
- A 2025 goal of the Vision Zero Action Plan is to “Implement crash geocoding on DMV-349.” Given the prevalence of City-issued mobile devices (including cellphones and laptops), officers should be including all relevant information, including geocoordinates, at the time they complete the form.

5. Crashes’ contributing factors are not considered in the development of the HIN.

- The ability to filter the HIN and crash data by objective or crash contributing factor(s) would be useful to CDOT, City decision makers, and the public.
- CDOT should develop an interactive dashboard that allows residents and City decision makers the ability to filter available crash data (e.g., mode, time, contributing circumstance, etc.).

6. CMPD enforcement efforts have not been consistent and sustained.

- It’s hard to obtain durable speed-reduction results from enforcement operations only.
- CMPD should establish performance metrics and publish the effectiveness of enforcement operations using these metrics.

Actions Planned

CDOT and CMPD have accepted all recommendations and are working to implement corrective actions in a timely manner. CDOT has prepared a Vision Zero Action Plan status update. Internal Audit will conduct a follow-up audit after all recommendations have been implemented.

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Objective

To determine whether adequate controls have been established to help ensure the City meets its Vision Zero program goals.

Background

In the United States, traffic crashes kill over 42,000 people and injure thousands more every year.¹ As noted by Bloomberg's CityLab, "The US underperformance in road safety is especially dramatic: 11.4 Americans per 100,000 died in crashes in 2020, a number that dwarfs countries including Spain (2.9), Israel (3.3) and New Zealand (6.3). And unlike most developed nations, US roadways have grown more deadly during the last two decades (including during the pandemic), especially for those outside of cars."²

From 2010-2018, pedestrian deaths in the US rose 46%.

A recent report by the [Governors Highway Safety Association](#) states more than 7,500 pedestrians were hit and killed by drivers across the US in 2022, the highest in 41 years.

NC is the 14th deadliest state for pedestrians.

In 2022, there were nearly 275,000 crashes in North Carolina resulting in 1,784 fatalities and 110,544 injuries. The N.C. Department of Transportation (NCDOT) determines its safety performance by measuring the State's fatality rate. This rate is the number of fatalities per 100 million vehicle miles traveled. NCDOT's goal is to have a fatality rate of 1.15 or less; the 2022 rate was 1.50.³ In 2020, the last year data is available nationally, NC ranked 16th nationally in fatalities per vehicle miles traveled⁴ and 14th deadliest for pedestrians.⁵

Per CDOT, on CDOT-managed roads over the 5-year time span of 2016-2020, there were 345 traffic deaths, with 124 being pedestrians. In Charlotte in 2022, there were 32,478 crashes resulting in 125 fatalities and 15,776 injuries. According to CMPD, the top three causes of serious and fatal crashes are:



Speeding



Distracted Driving



Driving While Impaired

Of the 81 traffic fatalities in Charlotte in 2020, 43 were due to crashes that involved speeding.⁶

¹ NHTSA's early estimate of [Traffic Fatalities in 2021](#)

² Bloomberg's CityLab: [Why US Traffic Safety Fell So Far Behind Other Countries](#)

³ NCDOT 2022 [Traffic Crash Facts](#)

⁴ NHTSA's [Overview of Motor Vehicle Crashes in 2020](#)

⁵ Smart Growth America's [Dangerous by Design 2022 Report](#)

⁶ Queen City Nerve [article from 12/15/21](#)

VISION ZERO STRATEGY

To address this problem, many cities – including Charlotte – have adopted a strategy called Vision Zero. Vision Zero aims to eliminate all traffic fatalities and severe injuries, while increasing safe, healthy, equitable mobility for all.⁷

Traditionally, transportation safety has focused on “the three Es”: Engineering, Education, and Enforcement. The Vision Zero strategy attempts a new approach. By acknowledging that human errors are unavoidable, it aims to minimize the damage from such errors by following the “Safe System” approach.⁸ This has three key principles:

1. **People Make Mistakes.** The transportation system should be designed and operated to accommodate inevitable mistakes and to avoid death and severe injuries.
2. **People Are Vulnerable.** Human bodies have limits for tolerating crash forces, so we should design and operate our transportation system to recognize and accommodate human vulnerabilities.
3. **Safety is Proactive.** Strategies should proactively identify and mitigate risks in the transportation system, rather than waiting for crashes to occur.

The Safe System approach is a significant departure from the traditional approach of street design.

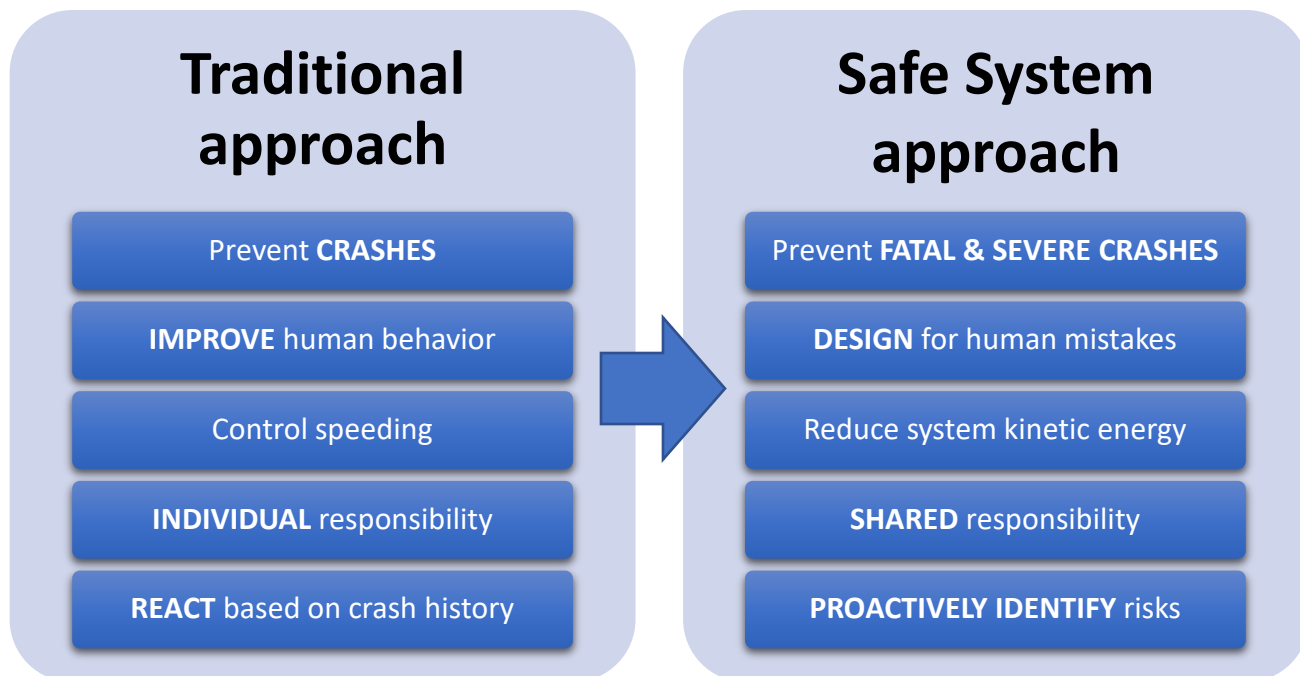


Figure 1

source: Vision Zero Network

⁷ visionzeronetwork.org/about/what-is-vision-zero/

⁸ visionzeronetwork.org/resources/demystifying-the-safe-system-approach/

State of Vision Zero

Charlotte enacted its Vision Zero Program in March of 2019 via a declaration from the Mayor. Following a 2016 Charlotte Transportation survey that showed **“86% of Charlotteans think streets should be designed for all users”**⁹, the City increased funding for recurring transportation bond programs dedicated to advancing safety for all users as shown below.

Fiscal Year	Transportation Safety Related CIP Projects			
	Vision Zero Program	Sidewalk/Pedestrian Program	Bike Program	Total
*2027	*\$4,000,000	*\$17,000,000	*\$8,000,000	*\$29,000,000
*2026	*-	*-	*-	*-
*2025	*\$4,000,000	*\$20,000,000	*\$8,000,000	*\$32,000,000
2024	-	-	-	-
2023	\$17,100,000	\$50,000,000	\$8,000,000	\$75,100,000
2022	-	-	-	-
2021	\$2,000,000	\$15,000,000	\$4,000,000	\$21,000,000
2020	-	-	-	-
2019	\$2,000,000	\$30,000,000	\$4,000,000	\$36,000,000
2018	-	-	-	-
2017	-	\$15,000,000	-	\$15,000,000
2016	-	-	-	-

**planned*

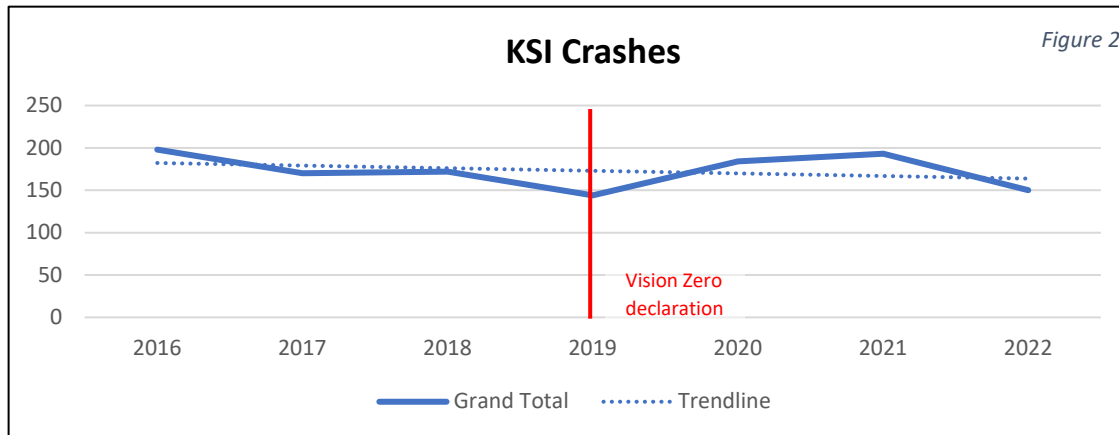
Charlotte’s Vision Zero Action Plan incorporated many of the Vision Zero Network’s recommended best practices, including implementation of many of the strategies that reduce serious and fatal crashes, such as:

- The development of a High-Injury Network (HIN) to drive where engineering, education, and enforcement areas are prioritized.
- The establishment of the Charlotte Streets Map and Urban Street Design Guide to standardize the inclusion of “Complete Streets” and safety features for all road users in City policies.
- The creation of a multi-stakeholder [Vision Zero Task Force](#) to “review actions and progress, advise on implementation, track equity impacts and oversee performance measure reporting.”

In June 2022, City Council adopted the Strategic Mobility Plan (SMP), which continues the City’s commitment to Vision Zero and details a vision of safe and equitable mobility options for all. This vision of safe mobility further reinforces Charlotte’s Vision Zero initiative as more than a CDOT-managed capital program, elevating it to a City-wide goal. While the program that funds individual Vision Zero projects is managed by CDOT, the SMP plants the idea of safe mobility in all transportation projects.

⁹ From Charlotte’s 2017 Transportation Action Plan

The City is finding it difficult to undo decades of automobile-focused development to increase *all* road users' safety. Although safety spending has increased, there hasn't been a significant decrease in crashes resulting in deaths and/or suspected serious injuries ("KSI crashes").



Opportunities to improve the Vision Zero program are detailed in the following Findings and Recommendation section.

Findings and Recommendations

SECTION 1: ACCOUNTABILITY

Vision Zero Network's recommended best practices in developing a Vision Zero Action Plan include identifying a lead agency responsible for each action item and listing budget needs. Relevant COSO components of internal control¹⁰ are Control Environment (setting the tone at the top) and Monitoring (evaluating that processes, policies, and procedures are occurring as expected).

"Clear ownership of Action Plan strategies is important to achieving success and long-term institutionalization of Vision Zero principles and outcomes."

-Vision Zero Network

Despite efforts to establish and fund a Vision Zero Action Plan, some goals have not been met and the City faces challenges in meeting projected timelines. **Clear ownership of actions has not been established nor are stated goal owners held accountable for not meeting performance targets.** Additional attention is needed (as outlined in this section of the report) for the Vision Zero program to achieve its goals.

¹⁰ COSO is defined and discussed in more detail in the **Scope, Methodology, and Compliance** section of this report.

1. CDOT has not fully implemented some key components of the Vision Zero Action Plan.

Accountability and transparency are crucial elements of an effective Vision Zero plan. Below are a few key components that have not been fully implemented.

	Criteria	Source	Condition
Annual Updates	Annual updates, minimum	Vision Zero Network	Last update published in 2020.
Equity	Use data to prioritize equity	Vision Zero Network	Last update to traffic stop demographic data published in 2020.
Performance Metrics	"...gather, analyze, utilize, and share reliable data to understand traffic safety issues and prioritize resources based on evidence of the greatest needs and impact."	Vision Zero Network	CDOT doesn't consistently perform and publish traffic studies on calming projects to show their effectiveness.
	"How do you know if your Complete Streets policy is working? You measure it. And then you share the results publicly."	Smart Growth America	CMPD doesn't consistently perform and publish traffic enforcement metrics (discussed at Finding #6).
	"Complete before and after studies for transportation safety projects."	City of Charlotte Vision Zero Action Plan	
Identifying Projects	Establish a "rapid response protocol" to include project recommendations and delivery timelines for safety improvements when serious crashes occur.	Vision Zero Network; Charlotte's Vision Zero Action Plan; CDOT's Fatal Crash Investigation Form	Crash investigations do not result in project recommendations.

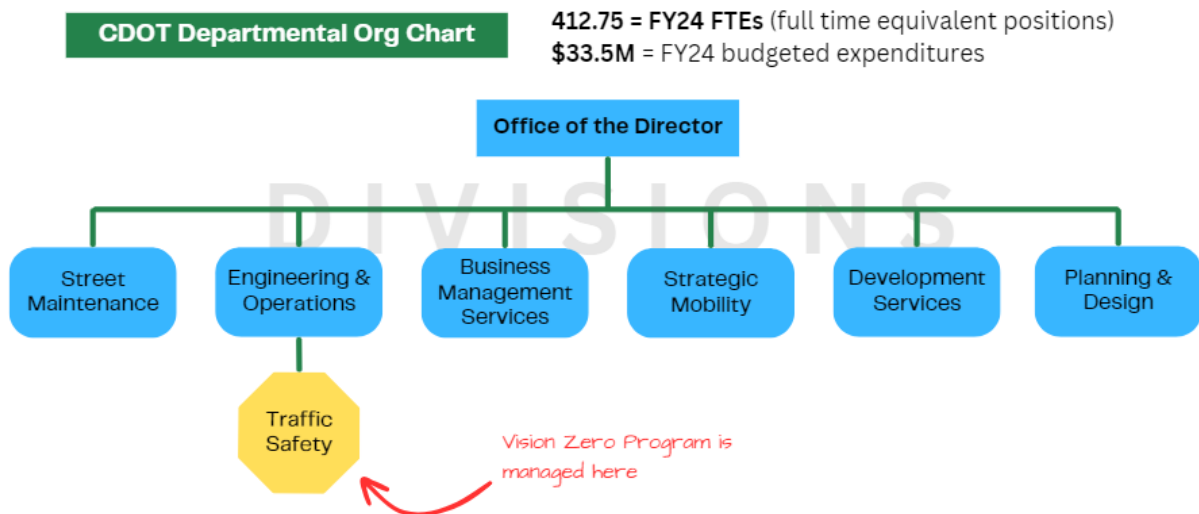
These components are detailed in [Appendix B – Transparency & Accountability Improvement Details](#). **CDOT has not clearly identified an individual (with appropriate authority) responsible for ensuring action items are completed.**

Vision Zero principles span across City departments, including CATS, Planning, Solid Waste Services, and others. Within CDOT, Vision Zero impacts every division as indicated by the examples below:

- **Street Maintenance** – finding efficiencies in installing calming measures during regular repainting and repaving activities;
- **Strategic Mobility** – encouraging residents to take alternative modes of transportation;
- **Planning & Design** – ensuring Complete Street principles are included in new capital improvement projects.

However, as Figure 3 shows, the Vision Zero program and Coordinator are **nested within a single division/section of CDOT without the authority to hold *all* staff accountable for their impact on the transportation network's safety** (either actual safety or users' *perception* of safety).

Figure 3



The Vision Zero Program/Coordinator must also work with entities outside the City. Over the last 10 years, **62% of Charlotte's KSI crashes have occurred on State-maintained roads**, which are generally streets and thoroughfares with higher speed limits and traffic counts. This requires a Vision Zero coordinator or champion with the appropriate experience and authority to resolve potential conflicts that may arise related to differing priorities and goals. See [Appendix A – City vs. State priorities](#) for an example 2021 rezoning request demonstrating the conflict that exists between how the City and the State approach street design.

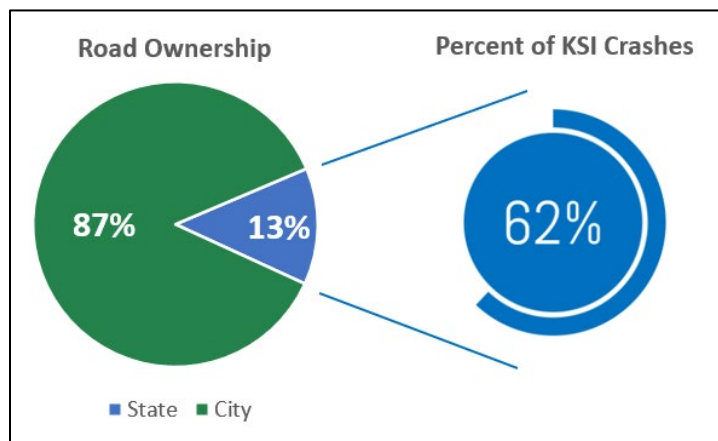


Figure 4

The existing program reports quarterly to the Vision Zero Task Force, a group comprised of various community stakeholders. Although the adopted Action Plan states, “(the) Task Force is empowered to take action...” and “...oversee performance measure reporting,” the Task Force, nor anyone, has held the Vision Zero program accountable for completing assigned tasks and meeting established goals. While the Task Force plays a valuable role in gathering diverse perspectives and providing

recommendations, its structure primarily positions it as an advisory body and not an accountability mechanism. As such, expecting it to rigorously enforce the “empowered to take action” language may be challenging. Dedicated oversight is necessary to ensure effective implementation and progress monitoring of the Vision Zero program. This coupled with an empowered Vision Zero Coordinator could better hold departments accountable for meeting goals. Additionally, CDOT has not reevaluated the Action Plan for any changes that need to be made based on stakeholder feedback and any other relevant factors.

For more details of the effects of not establishing the Vision Zero program with appropriate authority over all City departments and how this has resulted in key action plan components not being implemented, see [Appendix B – Transparency & Accountability Improvement Details](#).

Recommendation 1A: CDOT should designate someone to ensure all Action Plan items are performed or progressing and define a process for escalating concerns to management. This designee should provide annual updates of Action Plan items to the City Manager, CDOT Director, and other stakeholders.

Value Added: Compliance; Efficiency; Risk Reduction; Transparency

Vision Zero Action Plan Focus Area(s): All

CDOT Response: CDOT agrees to publish updated Vision Zero data annually that will include tracking of key metrics. The format and timing of this annual update will be established by July 1, 2024. The Vision Zero Coordinator will work with CMPD and other appropriate agencies to determine which data is available for publication and how it will be used to report on Vision Zero goal progress. The CDOT Deputy Director will be the primary resource for CDOT staff who need to escalate concerns and can assume this role immediately. This includes monitoring department progress and assisting with coordination between departments.

Recommendation 1B: CDOT should periodically assess the need to update the Vision Zero Action Plan.

Value Added: Compliance; Transparency

Vision Zero Action Plan Focus Area(s): All

CDOT Response: CDOT agrees that the Vision Zero Action Plan should be periodically updated and will establish a schedule cadence for future reviews and potential updates by December 1, 2024.

2. *City employees' Vision Zero-related safety behaviors are not monitored.*

Vision Zero calls for a commitment not only in words but also in actions. The City's underutilization of AVL data, recurring sidewalk obstructions, and incomplete representation of closures on the street map reveal areas where improvements can significantly enhance the City's role as a leader by promoting responsible behavior. Although not specifically mentioned in the Action Plan, these missed opportunities to model good behavior hinder a safer and more accountable City.

AUTOMATIC VEHICLE LOCATOR DATA

The City of Charlotte created the Automatic Vehicle Locator (AVL) Policy in June 2020. One of this policy's goals, "Safety and Risk Mitigation," can be used to demonstrate the City's commitment to its Vision Zero goal. The policy outlines minimum standards and guidelines for vehicle speed, harsh cornering, hard braking, and other safety parameters. Per policy, all City vehicles and rolling stock will be equipped with this technology and the information will be used to address patterns of poor driver behavior.

"Require Vision Zero training for frequent drivers, such as fleet operators, taxi drivers, and large vehicle operators to meet certain safety practices. Cities can model good behavior by ensuring their own fleets, and those they contract with, require Vision Zero safety training."

-Vision Zero Network

Currently, AVLs are installed on over 2,000 City vehicles. Reports using this data are available to track driver behavior and identify drivers who may need disciplinary actions or additional training. However, different procedures throughout City departments have led to the inconsistent application of this policy.

The City is responsible for the driving behavior of employees who operate City vehicles as part of their job duties. However, the Vision Zero Coordinator has not been working with Fleet Management to ensure City drivers are aware of, and abiding by, safe driving best practices.

SIDEWALK OBSTRUCTIONS

City ordinances prohibit several behaviors impacting pedestrian and bicyclist travel, such as:

- Parking vehicles on sidewalks,
- Excavating sidewalks without first establishing an alternative suitable walkway, and
- Placing or maintaining an obstruction in the public right-of-way (ROW).

Additionally, the City's Work Area Traffic Control Handbook (WATCH) offers the following guidance to City workers and contractors working on roadway maintenance and/or construction: "Neither portable nor permanent sign supports should obstruct pedestrian or bicycle traffic."

City staff and contractors regularly obstruct sidewalks and bike lanes either with signage (e.g., temporary road closure signs), their vehicle, or other object (e.g., trash bin) – see [Appendix D – sidewalk obstruction examples](#). This appears to be a known problem as “Sidewalk Obstruction” is an option on the City’s CLT+ app for residents to report various violations and per CDOT, 311-reported obstructions have increased 155% over the last 5 years. City Council also recently raised the fines for these types of obstructions from \$25 to \$100.



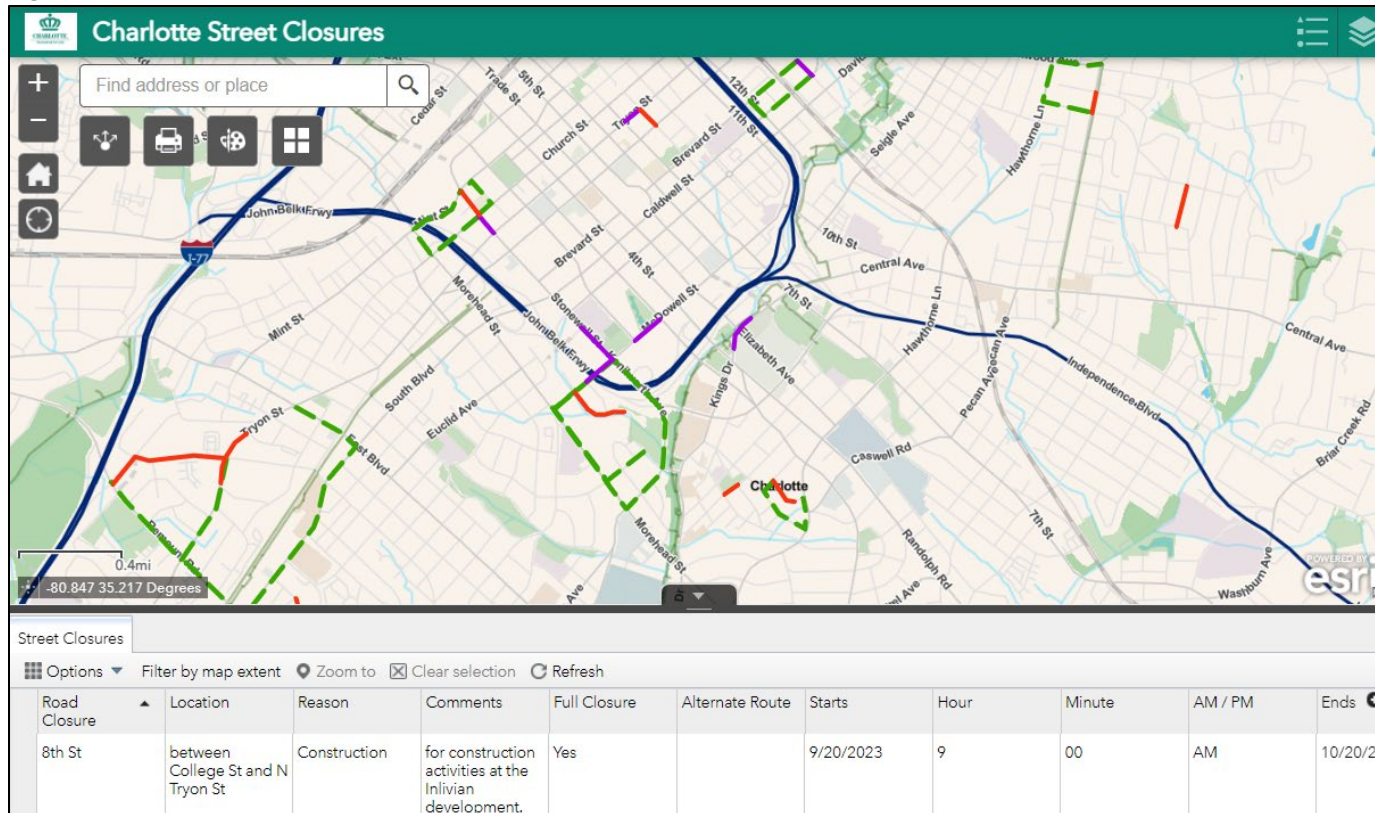
CDOT is not regularly educating City employees and ROW contractors about ROW obstructions. The last outreach effort was conducted several years ago, and staff knowledge of City rules and regulations likely has faded through time and/or employee attrition.

STREET, BIKE LANE, & SIDEWALK CLOSURES

Currently, Charlotte’s Interactive Street Closure Map only shows closed streets, not sidewalks or bike lanes. Residents traveling through the City by non-automotive means may have unnecessarily long or dangerous routes. This potentially makes non-car trips less appealing and, depending on the alternate route used, less safe.



Figure 5



Source: CDOT’s [Interactive Street Closure Map](#)

Recommendation 2A: The Vision Zero Coordinator, or designee, should ensure Fleet Management is consistently monitoring City employees' driving behavior. Ongoing safety issues should guide training offerings and/or requirements either on an individual employee basis or to whole departments/divisions.

Value Added: Compliance; Risk Reduction

Vision Zero Action Plan Focus Area(s): Shape Community Culture of Safety; Analyze the Data; Evaluate Policy and Legislation

CDOT Response: The Vision Zero Coordinator will attend a Fall 2024 meeting of the Fleet Management Advisory Team and begin gathering information on how various City departments utilize the AVL system. The Vision Zero Coordinator, working with the various departmental fleet managers, will provide a white paper outlining the use of AVL technology citywide including departmental analytics, discipline, and overall driver behavior by January 2025. The white paper will be delivered to the Deputy Directors working group in Spring of 2025 broader discussion on AVL monitoring and reporting of driver behavior.

Recommendation 2B: CDOT should work with HR to develop training curriculum, to be offered annually/periodically, to relevant City staff (e.g., CMPD, CDOT, CLTWater, etc.) about the importance of not obstructing sidewalks and bike lanes. CDOT should share the training with various ROW contractors like Duke Energy, fiber installers, etc.

Value Added: Compliance; Risk Reduction

Vision Zero Action Plan Focus Area(s): Shape Community Culture of Safety

CDOT Response: CDOT agrees that it is important and proposes a multi-phased approach to this recommendation. By September 2024, CDOT, working in conjunction with Corporate Communications and Marketing, will produce a 5-10 minute video outlining the need and requirements for clear sidewalks and bike lanes. This video will be posted on the City website and distributed to all master utility permit holders. CDOT utility permitting will include links to the video in all distributed permits. CDOT Street Maintenance will show the video during the street cut permit class required for all persons performing cuts in the ROW (currently offered monthly). CDOT ROW and Implementation groups will include standard language on all submitted traffic control plans regarding sidewalks and bike lanes by December 2024. It should be noted that City Code Section 14-2 includes exemptions for public vehicles. As a part of the FY24 budget, Code Enforcement got additional positions to respond to these types of complaints at a level not previously possible.

Recommendation 2C: CDOT should include closures of all transportation types (sidewalks, greenways, bike lanes, etc.) in addition to roads on its Interactive Street Closure Map. CDOT should also provide signage for alternate routes when closing sidewalks, greenways, and bike lanes.

Value Added: Compliance; Risk Reduction; Transparency

Vision Zero Action Plan Focus Area(s): Create Safe Streets for All Users

CDOT Response: CDOT agrees. CDOT will revise the data used in the closure information to include impacted sidewalk and bicycle facilities. The timeline for this improvement is lengthy and estimated

to be in place by Summer 2025. The time involved includes revising the traffic control plan review process to include identification of additional impacts and how those are coordinated and recorded in the data. This will require additional staff training. Changes to the underlying data and Spatial Data Warehouse will require I&T approval and testing prior to launch. The WATCH handbook and Manual on Uniform Traffic Control Devices (MUTCD) provide the signing requirements for detours related to sidewalks and bicycle facilities. City staff and contractors working in the ROW are held to those requirements.

SECTION 2: CHARLOTTE'S HIGH INJURY NETWORK

The Vision Zero Network recommends following a data-driven approach when implementing related changes. The preferred way of doing this is through the development of a High Injury Network (HIN). By using historical crash data, especially crashes resulting in serious injuries and fatalities¹¹, decision makers are better able to analyze any patterns and address the causes of these crashes.

“Vision Zero communities have found that **developing an HIN helps identify *where* crashes occur repeatedly and *why*...**”

-Vision Zero Network

CDOT's methodology for creating and maintaining a HIN employs a data-driven approach to inform where injuries are occurring most frequently and allow the examination of the conditions causing these KSI collisions. Crashes are assigned a severity based on a scale ranging from “Unknown” to “No Injury – Property Damage Only” to “Suspected Serious Injury” to “Killed.” Crashes are further weighted depending on if they involved a pedestrian or bicycle injury or were vehicle only. **The City's HIN is adequately designed, but improvements (outlined in this section) would better match crash causes with engineering and enforcement solutions.**

¹¹ Crashes resulting in serious injuries and/or fatalities are referred to as “KSI crashes” for *killed* or *seriously injured*.

3. *CMPD's enforcement operations are scheduled and distributed evenly around the City rather than by the severity of each corridor's crash history and KSI scores.*

Each CMPD Division has its own individual traffic enforcement unit, which ensures each division receives the same baseline of service. These division units provide backup and support to CMPD's Transportation Division, which oversees Vision Zero-related enforcement activities.

The COSO component Control Activities is about *how* organizations deploy policies and procedures, in this case: traffic enforcement activities. Traffic enforcement operation locations (both speed operations and DUI checkpoints/saturation patrols) are designed to focus on the HIN with CDOT-generated "Enforcement Areas." **However, enforcement operations are evenly scheduled and distributed around the City by CMPD Division without regard to the severity of each corridor's crash history and KSI scores.**

Prioritized Corridor Examples Blocks of HIN Segments					
Weeks as "Focus Division"	CMPD-assigned Division	Street	Block Min	Block Max	KSI score
4	N Tryon	N Tryon St	4300	7500	60
		W Sugar Creek Rd	100	1250	36
4	Eastway	Eastway Dr	100	3700	52
		The Plaza	3200	4200	46
		Central Av	3800	5200	31
4	Hickory Grove	E W T Harris Bv	4600	6700	34
		N Sharon Amity Rd	4900	5900	15
4	Central	Morehead St	700 W	700 E	22
4	Independence	Monroe Rd	8000	10200	26
		Sardis Rd N	100	1600	15
4	South	Pineville-Matthews Rd	5200	9000	14
		Quail Hollow Rd	5000	7200	12

The Vision Zero Network recommends resources be allocated "...based on evidence of the greatest need and impact." The current control design could be improved to meet those criteria. By spreading patrols evenly geographically, drivers on the worst-rated roads will continue to behave dangerously with disproportionate enforcement.

Recommendation 3: CMPD should schedule enforcement operations where crash data indicates locations with the worst KSI crash scores.

Value Added: Efficiency; Risk Reduction

Vision Zero Action Plan Focus Area(s): Shape Community Culture of Safety; Analyze the Data

CMPD Response: CMPD is agreeable to scaling our HIN enforcement efforts to more closely align with KSI scores and will begin doing so by 07/01/2024. However, the HIN corridors are but one of a number of inputs considered by CMPD when determining traffic enforcement efforts. Other factors include being responsive to community complaints and input about traffic concerns, equitable geographic

distribution of enforcement, ensuring enforcement takes place in known problem areas and addressing other specific issues that do not make it to the HIN list, e.g., street racing and street takeovers.

4. *CMPD does not consistently enter complete and accurate data into the NC DMV-349 crash forms.*

The HIN is only useful if the data it's populated with is accurate and complete. The flow of information is as follows:

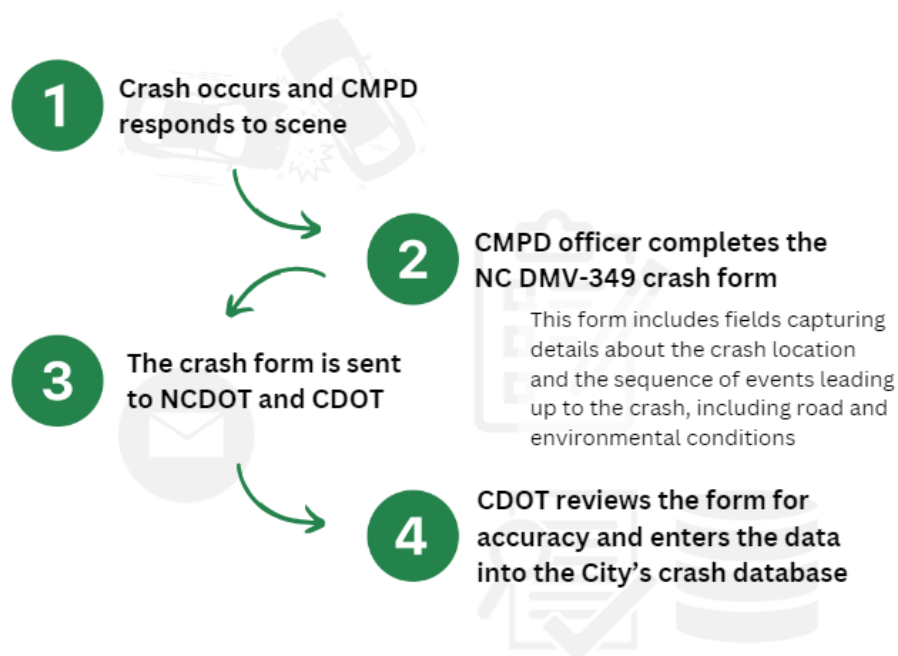


Figure 6

As the flowchart in Figure 6 outlines, CDOT reviews crash data input by CMPD on the NC DMV-349 forms, makes any necessary corrections¹², and adds the crash information to its crash database. However, **corrected errors are not tracked nor are they shared with CMPD. Data entry issues are not periodically analyzed for trends to identify training needs and/or needed procedure changes.**

During data reliability testing, auditors found several errors on officers' submitted crash reports. These were typically corrected by CDOT when entering in the database. Examples include:

- Officer put "Fixed Object" as the first harmful event but based on the narrative it would seem the "Ran off road left" would've been the better first event and the fixed object the "Most Harmful Event"
- Officer put the road as "dark-roadway not lighted" but it appears that section of road has streetlights, per Google Maps' Streetview

¹² Corrections are made during data entry into the CDOT-managed crash database, NOT on the DMV-349 form itself.

- Officer narrative states, "There were no injuries in the crash" however, box 32 was marked "2" for a suspected serious injury
- Officer entered "commercial" but location is more "residential" or "institutional"
- Officer put both vehicles traveling east, yet it was an angle crash on perpendicular roads
- Officer marked "other" for contributing circumstance but didn't describe in the narrative as instructed on pg. 27 of the crash form's instruction manual
- Officer marked vehicle traveling east; narrative and graphic show traveling west

Establishing a quality control or review process that includes feedback would lessen data entry issues. **The most common item officers omit when completing the crash forms are the geocoordinates.** Auditors haphazardly sampled and reviewed 38 crash reports noting 37 lacked full coordinates (97%). Crash data is not complete until CDOT manually adds the crash location based on the officer's narrative and crash diagram. If the officer entered the exact crash coordinates while at the scene, the data would be more accurate and complete. It would also save CDOT time during data review and entry.

The [NC DMV-349 Instruction Manual](#) states, "For those agencies/municipalities which are able to record the geographic location of a crash in terms of latitude, longitude and altitude (elevation), fields exist ... for capturing this information." **A 2025 goal of the Vision Zero Action Plan is to "Implement crash geocoding on DMV-349." Given the prevalence of City-issued mobile devices (including cellphones and laptops), officers should be including all relevant information, including geocoordinates, at the time they complete the form.**

Recommendation 4A: CMPD officers should enter the full geocoordinates for crashes when completing the DMV-349 form.

Value Added: Compliance; Efficiency; Risk Reduction

Vision Zero Action Plan Focus Area(s): Evaluate Policy and Legislation

CMPD Response: CMPD agrees that having officers input geocoordinates on crash reports makes the location data more accurate and assists our partners at CDOT with mapping and analysis. It is important to note that officers are not currently required to enter geocoordinates for the report to be considered complete; and, in fact, this particular field is not currently activated on CMPD's crash form. CDOT has agreed to fund the technical cost of activating this field and CMPD will be able to comply with this recommendation by 12/31/2024.

Recommendation 4B: The Vision Zero Coordinator, or their designee, should periodically report NC DMV-349 errors to the appropriate CMPD supervisor(s) to correct officer data entry performance. Additionally, the Vision Zero Coordinator should periodically analyze data entry errors for any trends to identify training needs and/or needed crash reporting procedure changes.

Value Added: Efficiency; Risk Reduction

Vision Zero Action Plan Focus Area(s): Analyze the Data

CDOT Response: CDOT agrees. The Vision Zero Coordinator will work to determine the appropriate staff member at CMPD to relay this information to and prepare a quarterly summary of errors and trends to be delivered. This staff person will be identified by April 1, 2024.

CMPD Response: CMPD agrees that identifying and addressing common crash data errors would be useful in enhancing the reliability of the data and subsequent CDOT analysis. The CMPD Transportation Division will serve as the conduit for identified crash data errors from CDOT to the Training Academy staff who will use the data to inform and shape DMV-349 training. This can begin immediately.

5. Crashes' contributing factors are not considered in the development of the HIN.

The HIN's road segment scores are weighted based on multiple factors, including if the crashes involve a pedestrian or cyclist. However, the HIN does not include any crash contributing factors.

Factor class	Example variables to collect (and potentially map)
Location-based factors	<ul style="list-style-type: none"> • fatal and serious crashes • roadway characteristics (e.g., number and width of travel lanes, presence of protected bike lanes, sidewalk coverage, crosswalk design, street lighting presence and condition) • nearby land uses, including key destinations (e.g., transit stops, employment centers) • precise location of crashes on the transportation network
Event-based factors	<ul style="list-style-type: none"> • crash types – movement that may have anticipated the crash (e.g., midblock, right- hook, left-turn crash types) • speed of impact of crash • victims' travel modes • drug or alcohol use or other form of "impairment" (e.g., distraction, fatigue, phone use)
Time-based factors	<ul style="list-style-type: none"> • times of year • day of week • time of day
Population-based factors	<ul style="list-style-type: none"> • person-level factors (e.g., victims' age gender, race/ethnicity, and income) • neighborhood-level factors (e.g., poverty rate within Census block groups)

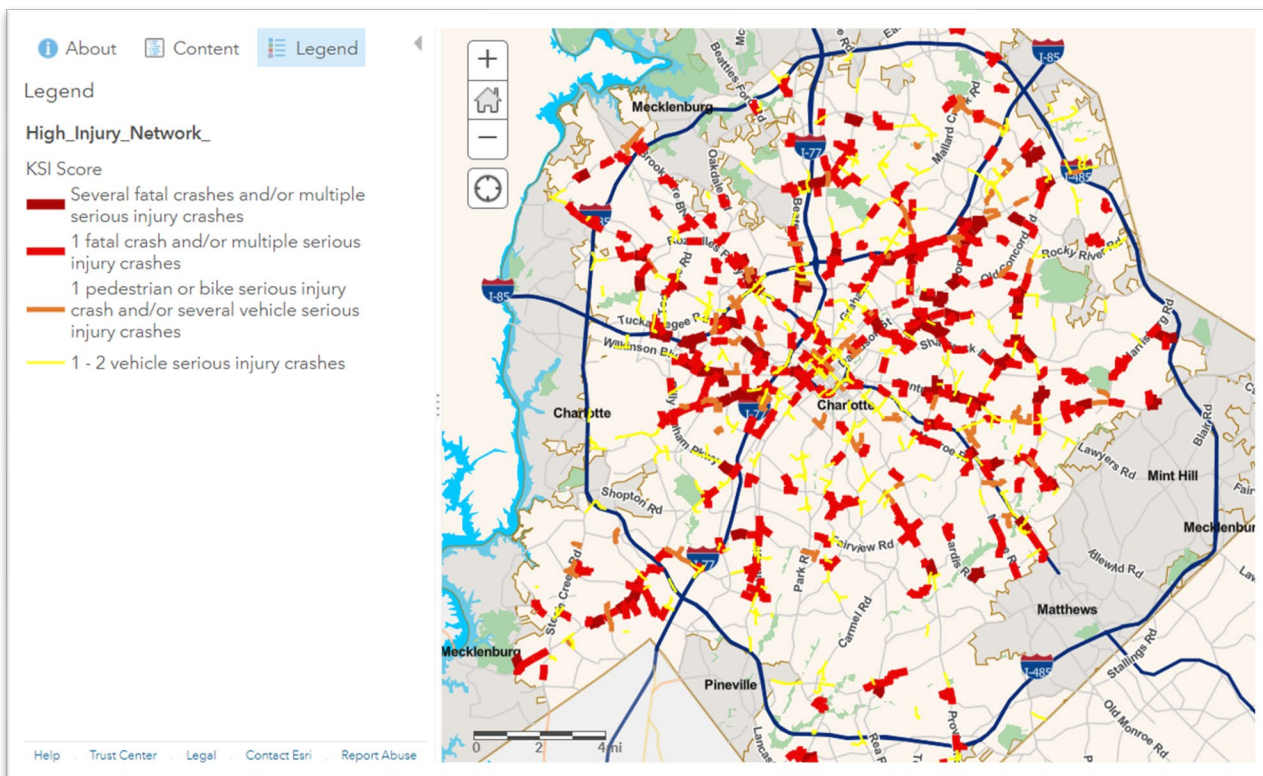
Source: UNC's Guide to Developing a Vision Zero Plan

As Figure 6 outlines, CMPD captures relevant crash data via the State-created DMV-349 crash report form. This form details contributing factor(s), road and lighting conditions, vehicle type, etc. The entire form, including crash causes, is entered in the crash database. CDOT can filter by contributing factors if the data is recorded.

The City's HIN map is a static map showing crash results: quantity of KSI crashes by road segment. The map consists of so many roads that it is difficult to determine what consistently causes crashes on

each road segment. For example, a crash caused by an intoxicated motorist hitting a pedestrian on a sidewalk should not be grouped with a crash caused by a speeding motorist crashing on an unlit road with no calming measures. The former would be addressed with education or enforcement, while the latter could be addressed with engineering or design changes.

Figure 7



Source: [CDOT's Vision Zero webpage](#)

A more useful approach would have multiple HIN maps filtered by crash factor or, ideally, a HIN map that can be filtered via an interactive crash dashboard. Research of how other Vision Zero cities share data with the public provides great examples of how Charlotte can implement this major improvement. See [Appendix E – example dashboards](#).

The ability to filter the HIN and crash data based on objective or contributing factor(s) would be useful to CDOT, City decision makers, and the public. Some example uses are:

- For road segments with excessive speed: focus on engineering solutions or enforcement.
- For road segments with DWIs: focus on checkpoints and/or saturation patrols.
- For road segments with distracted driving: focus on education/outreach efforts.
- For road segments with poor lighting: add lighting.

Most of the necessary data is collected via the crash forms and exists in the crash database. By filtering the HIN data based on objectives, CMPD and CDOT could more effectively and efficiently use the HIN and crash data as tools to address traffic engineering and enforcement issues. Refining the HIN would also greatly improve transparency.

Recommendation 5: CDOT should, in consultation with I&T, develop an interactive dashboard for residents and City decision makers to use. It should include available data and filterable elements including, but not limited to:

- Contributing circumstance (e.g., speed, DUI, other behavioral causes, etc.)
- Mode (i.e., car, bus, bike, ped)
- Severity (i.e., fatalities, serious injuries)
- Day/time/year
- Road type and/or speed limit
- Road conditions (e.g., lighted/unlighted/dark, wet, etc.)
- Equity/demographic data
- Installed calming measures (incl. type)
- Geography (e.g., council district, police division, neighborhood)

Value Added: Efficiency; Risk Reduction; Transparency

Vision Zero Action Plan Focus Area(s): Analyze the Data

Action Planned: CDOT is working with a new crash data vendor that will enable public access to historical crash data and analytics tools.

CDOT Response: Agree that the ability to easily filter crash data is important and the dashboard will enable many of the filtering actions above to be possible. The dashboard will be available to the public and staff by the end of calendar year 2024.

6. CMPD enforcement efforts have not been consistent and sustained.

CDOT has occasionally measured the effectiveness of individual CMPD enforcement operations by measuring “excessive speeding” using probe data, but this type of analysis is not performed or published regularly (see [Appendix C – examples of measuring enforcement operations’ effectiveness](#)). Auditors reviewed traffic enforcement analyses and noted that enforcement operations do not have lasting impacts on traffic safety. They do, however, impact traffic speeds when they are in action. Per CMPD, **it’s hard to obtain durable speed-reduction results from enforcement operations only**. There will be a temporary reduction in speed on corridors with recent police activity, but nothing lasting.

Enforcement should be:

- **Highly visible;**
- **Consistent and sustained;**
- **Widespread.**

This means it must be applied as part of routine hourly and daily traffic enforcement, as opposed to occasional seasonal actions. If not, drivers will revert to dangerous behavior.

-Fordham Urban Law Journal

This evidence can be placed in the context of general deterrence theory. As the Fordham Urban Law Journal¹³ details, deterrence can be understood as the threat or expectation of undesirable consequences discouraging individuals from certain behavior – in Vision Zero’s case: dangerous driving.

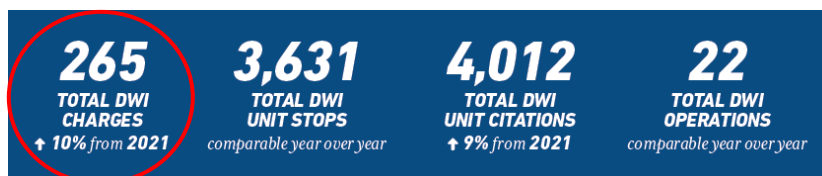
As stated in the Fordham Law Journal, “The least effective deterrent outcome is when a policy measure achieves only initial specific deterrence—impacting a single person for a short period of time—and the optimal outcome is achieving residual general deterrence where the general public is disincentivized for a longer period of time from committing a harmful act.”

CMPD has limited reported performance measures tied to enforcement activities and none of the department’s budget performance measures relate to traffic enforcement. CMPD does, however, publish an Annual Report, including a page dedicated to Vision Zero.



The most recent report shows **unexplained decreases** of two Vision Zero-related enforcement metrics.

CMPD **only highlights citations given out for DWI violations**. A more complete Vision Zero message would also highlight citations written for the other two highest KSI crash causes: speeding and distracted driving.



¹³ [Fordham Urban Law Journal 2017 article](#) “Traffic Justice: Achieving Effective and Equitable Traffic Enforcement in the Age of Vision Zero”



To better aid the public and other stakeholders, CMPD could also break out citations by division and/or some other geographic categorization (e.g., zip code, Council district, etc.).

Some examples of additional performance measures CMPD could regularly publish:

- Number/percentage of traffic stops conducted in HIN areas
- Number/percentage of traffic stops related to the top contributing factors for KSI crashes (i.e., speeding, DWI, distracted driving)
- Number/percentage of traffic stops involving certain populations
- Number/percentage of traffic stops resulting in citations, warnings, arrests, etc. compared against speed probe data
- Percentage of citations voluntarily dismissed by the District Attorney's Office

Current North Carolina general statutes make it financially difficult or not legally permissible to use automated traffic enforcement to control speeding, red-light running, and distracted driving. The City knew of these challenges when adopting the Vision Zero Action Plan. The plan includes the following future goals with desired timelines:

- 2020 – “Explore legislation on automated speed enforcement citywide”
- 2025 – “Implement speed cameras citywide”

Police department staffing levels make it hard to have a continual presence along all the HIN's enforcement corridors. **Without a change to NC state law regulating the use of more-permanent, automated enforcement measures, lasting traffic safety effects from existing enforcement activities alone are unlikely to ever be achieved.** By establishing metrics and monitoring performance, CMPD could use this information to help stakeholders better understand the impact of Vision Zero enforcement strategies, including:

- Locations where enforcement operations are more effective
- Which enforcement activities are most effective
- Could build the case for additional resources that may more effectively enforce traffic safety (e.g., automated enforcement, speed vans, speed feedback signs, etc.)
- Allows the public and advocates to hold City and State agencies and elected officials accountable
- Affords elected officials better communication with the public to help build broader support for Vision Zero and increased traffic enforcement

Recommendation 6A: CMPD, using CDOT traffic data, should establish performance metrics and periodically evaluate and publish the effectiveness of enforcement operations using established metrics.

Value Added: Efficiency; Risk Reduction; Transparency

Vision Zero Action Plan Focus Area(s): Shape Community Culture of Safety; Analyze the Data

CMPD Response: CMPD agrees with the importance of measuring and being transparent about our traffic enforcement efforts. Our Transportation Division will work with CDOT to identify best practices for establishing relevant and accurate performance metrics by 12/31/2024. Additionally, CMPD will

continue to utilize social media, traditional media briefings, the Open Data Portal and our quarterly and annual reports to share the results of our enforcement efforts with the public.

Recommendation 6B: CDOT should monitor enforcement performance metrics.

Value Added: Efficiency; Transparency

Vision Zero Action Plan Focus Area(s): Analyze the Data

CDOT Response: CDOT agrees to monitor enforcement metrics provided by CMPD and will include this data in the annual report.

Conclusion

CDOT has not established an adequate control structure to meet its Vision Zero Program goals.

Distribution of Report

This report is intended for the use of the City Manager's Office, City Council, CDOT, and CMPD. Following issuance, audit reports are sent to City Council via the Council Memo and subsequently posted to the [Internal Audit website](#).

Scope, Methodology, and Compliance

Scope

The audit covered street design guidelines, traffic safety policies and procedures, and any related action plans in place during the audit period, FY 2023. Crash data was obtained for the period 2010 through 2022. Auditors excluded the following from the audit's scope:

- Interstates
 - Per the National Highway Traffic Safety Association (NHTSA), "Although much of the public concern about speeding has been focused on high-speed Interstates, only 14 percent (1,344) occurred on interstate highways, rural and urban combined, while 86 percent of speeding-related fatalities occurred on non-interstate roadways."
- Land use decisions / Zoning / Unified Development Ordinance (UDO)
 - Land use, zoning, and Charlotte's UDO are complex topics and beyond the scope of this document. Nonetheless, it's crucial to recognize their impact on certain aspects of pedestrian and bicycle safety, helping to enhance our understanding of current challenges.

Methodology

To achieve the audit objectives, auditors performed the following:

- Interviewed key staff in the Charlotte Department of Transportation (CDOT) and the Charlotte Mecklenburg Police Department (CMPD)
- Analyzed crash data from 2018 through 2022
- Reviewed crash reports (form DMV-349) and other analyses of crash causes
- Reviewed City of Charlotte Ordinances regarding motor vehicles, traffic, parking, streets, and sidewalks
- Reviewed relevant CDOT policies and procedures, including the Charlotte Streets Manual
- Reviewed CMPD policies and procedures related to traffic enforcement
- Reviewed CMPD's traffic enforcement locations
- Reviewed the City of Charlotte Vision Zero Action Plan, the Pedestrian Plan (Charlotte WALKS), the Bicycle Plan (Charlotte BIKES), and the Strategic Mobility Plan (SMP)
- Performed various analyses, including of the City's High Injury Network (HIN)

Compliance

We conducted this performance audit in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

Government auditing standards require that we determine which internal controls are material to the audit objective(s) and obtain an understanding of those controls. To evaluate internal controls, the City Auditor's Office follows the Committee of Sponsoring Organizations of the Treadway Commission's Internal Control – Integrated Framework (COSO Framework) as included in Standards for Internal Control in the Federal Government (GAO Green Book).

In planning and performing the audit, auditors obtained an understanding of CDOT and CMPD's processes related to Vision Zero and the associated internal controls, assessed the internal control risks, and determined the following internal control components were significant:

- **Control Environment** – The set of standards, processes, and structures that provide the basis for carrying out internal control across the organization.
- **Risk Assessment** – The process for identifying and assessing risks that may limit the achievement of objectives.
- **Control Activities** – The actions management establishes through policies and procedures to achieve objectives and respond to risks.
- **Information & Communication** – The quality of information which management and personnel communicate and use to support the internal control system.
- **Monitoring** – The activities management uses to assess the quality of performance over time.

The internal control deficiencies that are significant within the context of the audit objective are discussed in the Findings and Recommendations section of this report.

Appendix A – City vs. State priorities

It will be difficult to achieve the Vision Zero goal while the City has to rely on coordination with other entities.

A 2021 zoning request being recently amended demonstrates the problem the City has when the State controls how a road is designed. Rezoning request [RZP-2021-015](#) was filed to rezone a parcel off West Boulevard to accommodate more density in the form of townhomes. CDOT staff sent it back to the developer to add in bike lanes, extend sidewalk connections, add a bus shelter, among other things.

5. Revise the site plan and conditional notes by constructing an 8-foot buffered bike lane, 3-foot buffer with 5-foot travel lane, along the site's West Boulevard frontage.

Label and dimension from the centerline of West Boulevard.

7. Revise the site plan and conditional notes by committing to extending the 8-foot planting strip and 6-foot sidewalk, along Holabird Lane, to the existing sidewalk at the cul-de-sac of Holabird Lane. This sidewalk will provide a pedestrian connection from West Boulevard to the Southwest Recreation Center where a gap currently exists and would assist CDOT in finishing an important pedestrian connection.

The developer agreed;

Transportation Summary

This site is located at the corner of West Boulevard, a State-maintained major thoroughfare, and Holabird Lane, a City-maintained local street. There is an ongoing project, West Boulevard Corridor Implementation, in the area constructing bicycle and pedestrian improvements. Additionally, in-line with the City's WALKS & BIKES policies, and City Ordinances, the petitioner has agreed to construct a buffered bike lane along the site's West Boulevard frontage as well as pedestrian improvements along West Boulevard and Holabird Lane. Lastly, the petitioner has committed to improve Holabird Lane and include on-street parking. CDOT has no remaining issues with this petition.

[NCDOT did not.](#)

Project Description:

Exponential Equity

Administrative amendment to RZP-2021-015 to remove the turn lane / bike lane and bus shelter per the request of NCDOT.

The State's ability to dictate how streets within the City limits are managed has ripple effects that impact many of the City's stated goals, not just Vision Zero. As such, until the City gains autonomy over these roads or gets buy-in from NCDOT, achieving Vision Zero will be difficult.

Appendix B – Transparency & Accountability Improvement Details

ANNUAL UPDATES

The Vision Zero Network's *Guidelines for an Effective Action Plan* outlines best practices around transparency and requires updates to be published annually, at a minimum. These updates should highlight a variety of metrics including updates on CMPD's enforcement activities.

The last City-wide Vision Zero update was published in 2020. Auditors did notice relevant "Performance Measure Highlights" under the Transportation section of the [FY24 Adopted Budget](#) (e.g., miles of new sidewalks/bikeways, number of new pedestrian safety projects, etc.), but these are not explicitly tied to Vision Zero or the Strategic Mobility Plan.

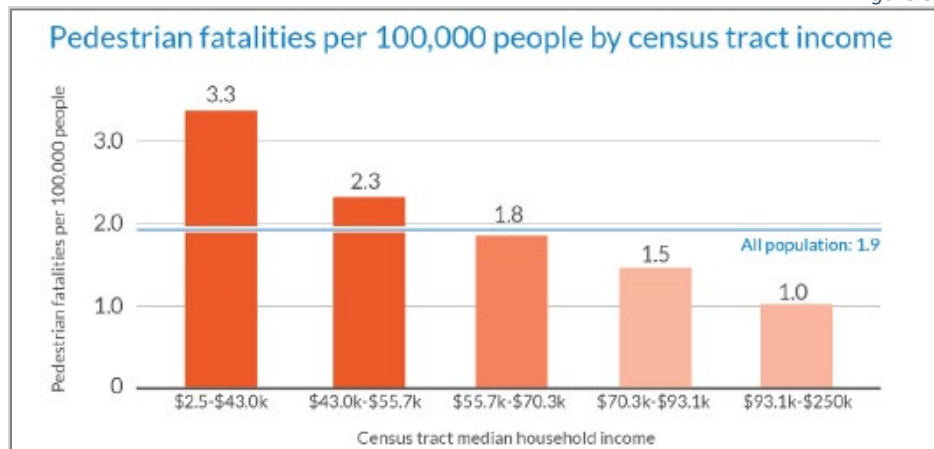
In addition to the best practices mentioned in Finding 1, the Federal Highway Administration's (FHWA) recommended best practices in implementing pedestrian and/or bicycle action plans include establishing and reporting on safety goals and progress made in achieving those goals. Some examples are:

- Fatality/Injury rate per 100,000 vehicle miles traveled (VMT)
- Adherence to traffic laws
- Average travel time; average trip length
- Crossing opportunities
- Miles of pedestrian/bike facilities
- Population served by walk/bike/transit
- Street trees
- User perceptions/community ratings
- Percent of crashes w/ "big 3" violations (i.e., speeding, DWI, distracted driving)

EQUITY

A foundational element of a strong Vision Zero commitment is Equity. Nationally, Black pedestrians are twice as likely to be killed by drivers than white pedestrians.¹⁴ Communities of color are among the least likely to have access to safe walking and cycling infrastructure. Residents of low-income neighborhoods and older people are similarly overrepresented in traffic deaths. Many lower-income households rely on walking, cycling, or public transportation to get around. Poor infrastructure, including a lack of safety features, puts people traveling in low-income neighborhoods at higher risk.

Figure 8



Source: Smart Growth America

As best practices recommend, outreach efforts do appear to be focused on the HIN, largely including Charlotte's Corridors of Opportunity. However, **auditors found only one file posted to the City's Vision Zero website available in an alternate language (Spanish).**



Additionally, the Vision Zero Network recommends as part of having an equity priority, "Utilize(ing) data to determine if people of color are being disproportionately targeted by law enforcement." This includes a commitment to report publicly to build trust with the community. **CMPD has not updated traffic stop demographic data on the City's Open Data Portal since 2020.**

¹⁴ Smart Growth America's [Dangerous by Design 2022 Report](#)

PERFORMANCE METRICS

Two of the Vision Zero Network's components of a strong Vision Zero commitment are being data-driven and transparent. Being data-driven is the commitment "... to gather, analyze, utilize, and share reliable data to understand traffic safety issues and prioritize resources based on evidence of the greatest needs and impact." Being transparent to city stakeholders and the community includes, not only the regular updates on Action Plan progress as discussed above but establishing and reporting on performance measures.

Smart Growth America outlines how jurisdictions with the strongest Complete Streets policies take four clear, concrete steps:

1. **Establish specific performance measures** across a range of categories, including implementation and equity.
2. **Set a timeline** for the recurring collection of performance measures.
3. **Require performance measures to be publicly shared** (perhaps most importantly, this information is only valuable if it is made publicly available on a consistent basis).
4. **Assign responsibility** for collecting and publicizing performance measures.

"How do you know if your Complete Streets policy is working? You measure it. And then you share the results publicly."

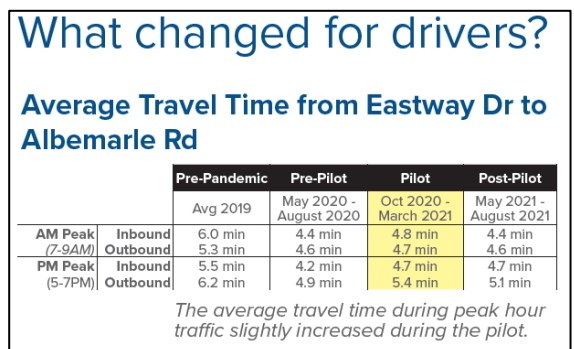
-Smart Growth America

One of the City's 2020 Vision Zero Action Plan goals was to "Complete before and after studies for transportation safety projects." However, **CDOT doesn't consistently perform and publish traffic studies on calming projects to show their effectiveness.** This is due to many of the Vision Zero-related projects CDOT installs being categorized by the FHWA as [Proven Safety Countermeasures](#). These countermeasures have been well researched and proven to produce positive safety results. Because of this, CDOT does not routinely evaluate projects that incorporate these tools, as their benefits are well established.

However, CDOT's transportation professionals being aware of the safety benefits of proven countermeasures is different than the public knowing of the trade-offs typically inherent in traffic calming measures – namely to perceived congestion and slow traffic.

The Central Avenue bus/bike lane pilot project is a good example of how important messaging is in getting the public to buy-in to changes to historically car-centric road designs. The data¹⁵ shows only a modest increase in travel time for drivers (0.1-0.5 minute increase), yet most of the *driver* feedback was about congestion and increased travel times. Most *drivers* surveyed (52%) think dedicated bus and bike space is not an effective way to increase safety and comfort.

Figure 9



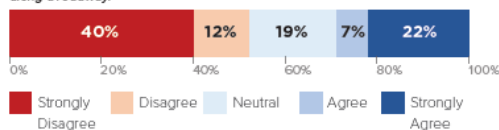
¹⁵ CATS' Envision My Ride: Bus Priority Study

What did people say?

We conducted a public survey during the pilot to learn more about how the bike/bus lane was received

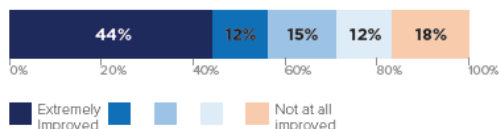
Drivers: Indicate how much you agree or disagree:

Dedicated spaces for buses and bikes are an effective way to provide a safer and more comfortable environment for cyclists, buses, and cars traveling along a roadway.



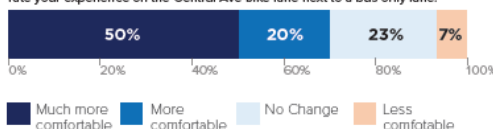
Bus Drivers:

Did you feel you commute improved because of the bus-only lane?



Bike riders:

Compared to your biking experience in a bike lane next to a lane with cars, rate your experience on the Central Ave bike lane next to a bus-only lane.



When people first experienced the pilot...



Figure 10

Some cities are raising the bar for how transportation departments can highlight calming devices' impact to road user safety. Two examples from San Francisco include the results of installing [No Turn On Red](#) signs at over 50 intersections and a [Quick-Build Project](#). Emphasis is given to speed reduction, sign compliance rates, vehicle-pedestrian "close calls," and the decrease in vehicles blocking crosswalks.

CDOT is not consistently monitoring and reporting project effectiveness, including any lasting impacts on vehicle speed and/or driver behavior. By not regularly studying and publishing the impacts of installed calming infrastructure, CDOT and other stakeholders (the public, City Council, etc.) don't know if installed projects are achieving their desired outcomes. Additionally, **without publishing relevant routine (annual) metrics, CDOT and CMPD are not accountable for setting and meeting specific traffic safety performance goals.** This could help drive the types of infrastructure that are most effective at calming traffic, thus reducing the likelihood of crashes being fatal.

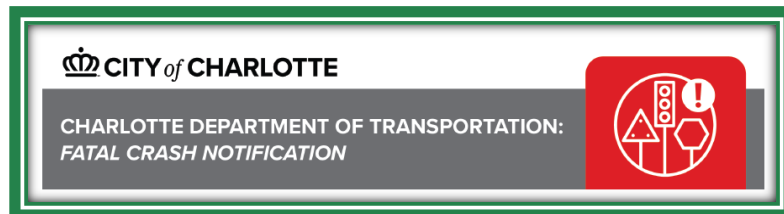
IDENTIFYING PROJECTS



As Vision Zero Network’s recommended best practice suggests, the City has conducted Safe Routes programming. Through the Safe Routes to Schools Toolkit Case Studies, various traffic safety solutions at specific locations were identified but were not added to any sort of master project planning list. Without being tracked, the related infrastructure will likely never be installed. The underlying staff time spent analyzing school areas and identifying risks and assigning relevant solutions was wasted. If tracked and referenced during street maintenance planning, paint-intensive project recommendations could be efficiently completed during regular street resurfacings.

An additional area of improvement around project identification involves the Vision Zero Network’s recommended best practice of establishing a “rapid response protocol.” This should include project recommendations and delivery timelines for safety improvements when serious crashes occur.

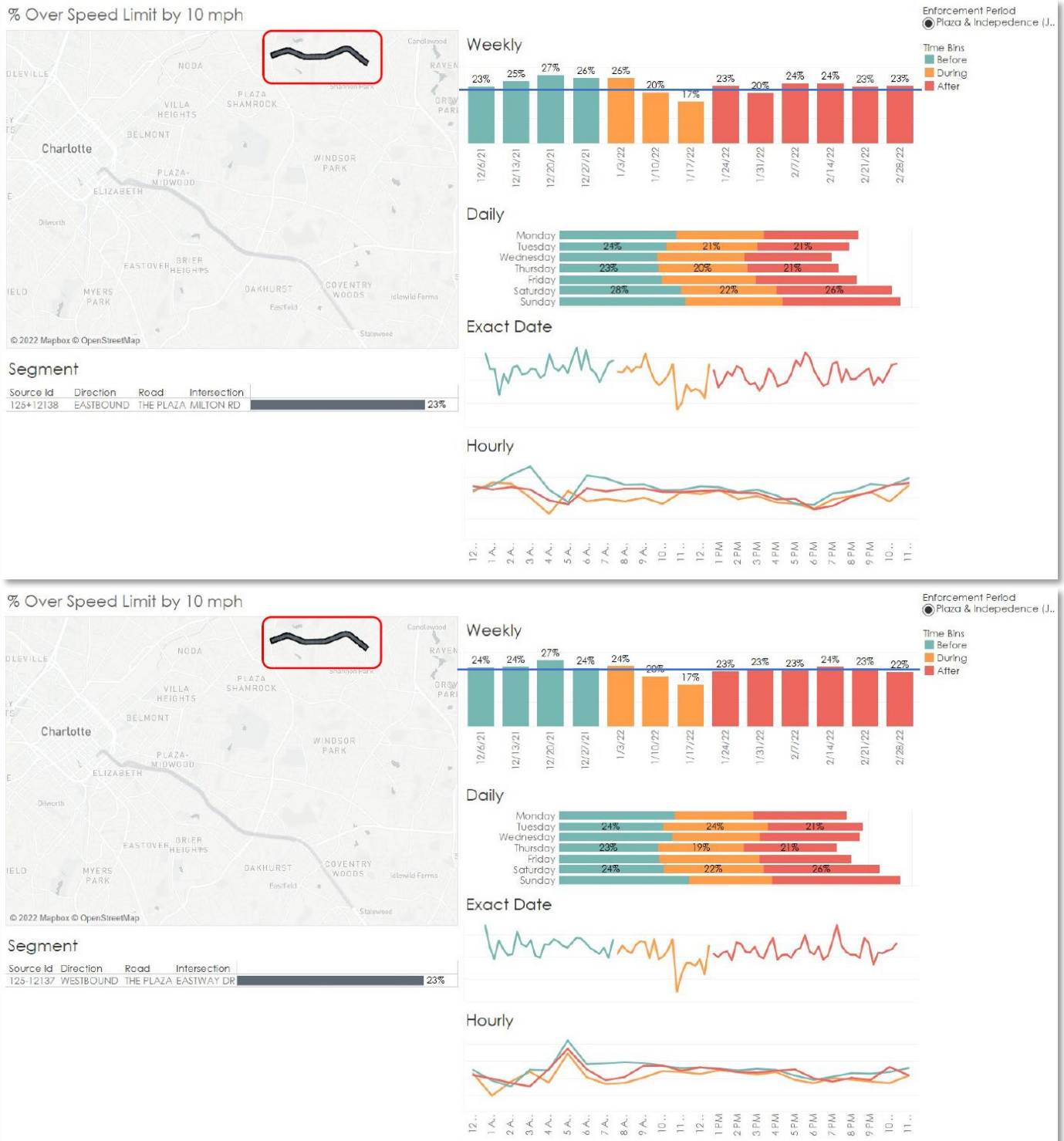
Currently, **CDOT Traffic Safety staff perform crash investigations following only fatal crashes.** These include site visits, crash history analysis, analyzing signage and pavement marking conditions, etc. They do not include an analysis of road geometry (e.g., lane width) which could directly influence driver behavior. The crash investigation form has a field for project recommendations, but it is rarely used. Auditors examined 13 CDOT crash investigations noting none resulted in project recommendations. **CDOT is not recommending projects (either temporary, quick-build pilots, or permanent) as part of fatal crash investigations.**



Crashes should be investigated for infrastructure improvements or enforcement activities that would directly address the specific cause(s) of each crash and related projects should be scored as part of the project prioritization process. Additionally, these investigations should be extended to serious crashes that involve pedestrians and bicyclists, the two most vulnerable road users. Extending investigations was also a stated goal for 2020 on the City’s Vision Zero Action Plan.

Appendix C – examples of measuring enforcement operations' effectiveness

The following analysis¹⁶ looks at the percent of traffic exceeding the speed limit by 10 mph.



¹⁶ Source: Vision Zero Task Force meeting presentation on January 25, 2023

Appendix D – sidewalk obstruction examples

Auditors observed the following examples of sidewalk obstructions during audit testing:



City vehicles (CDOT, CLTWater, CMPD) parking on sidewalks and/or in bike lanes

ROW contractors parking on sidewalks and/or in bike lanes



Other obstructions

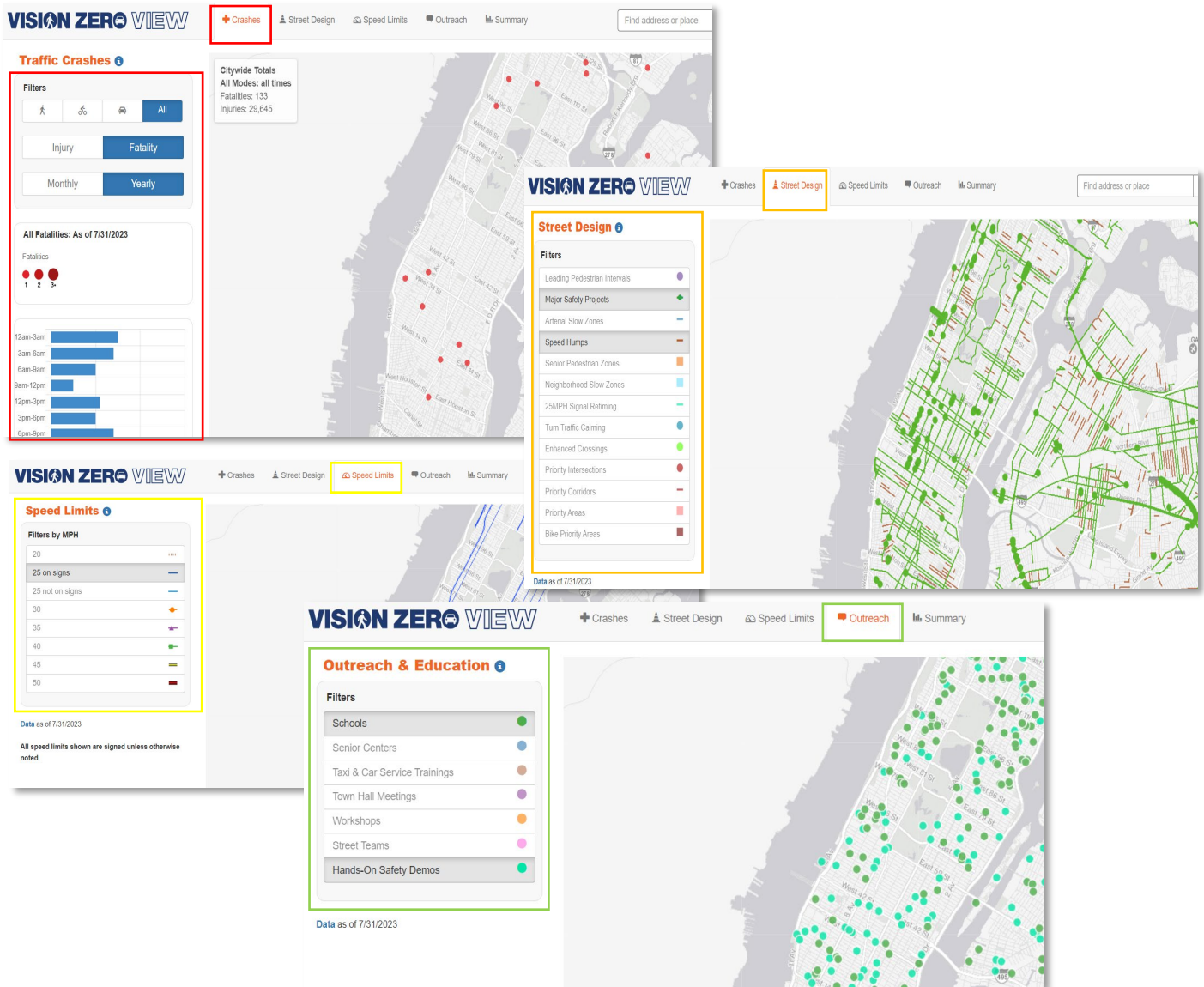
Examples:

- Signs placed by either City staff or contractors
- Solid Waste Service trash and recycling bins picked up from a yard off the sidewalk, but placed back on sidewalk after being emptied

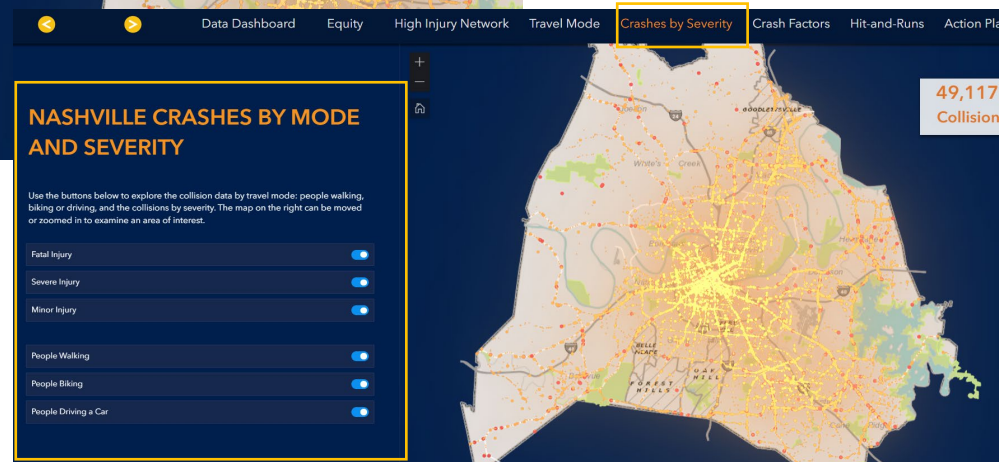
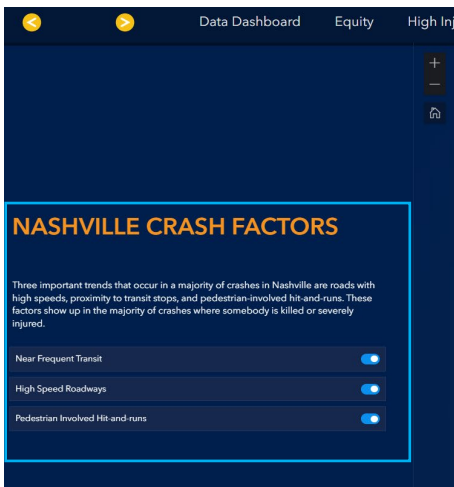
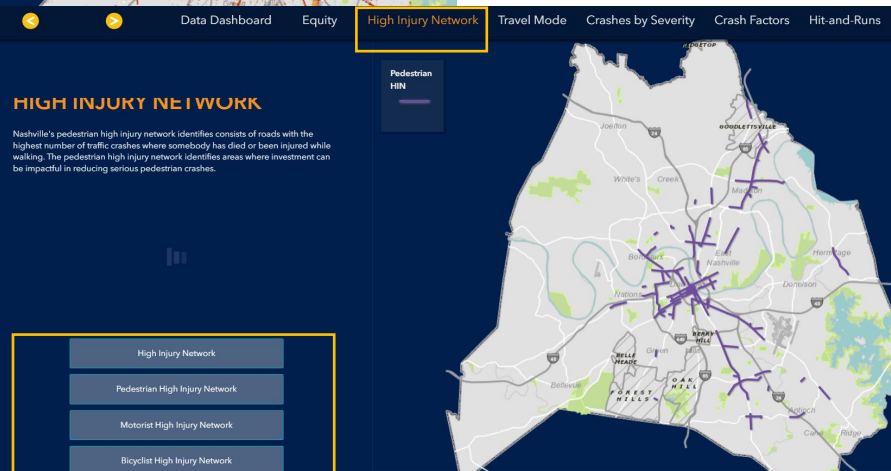
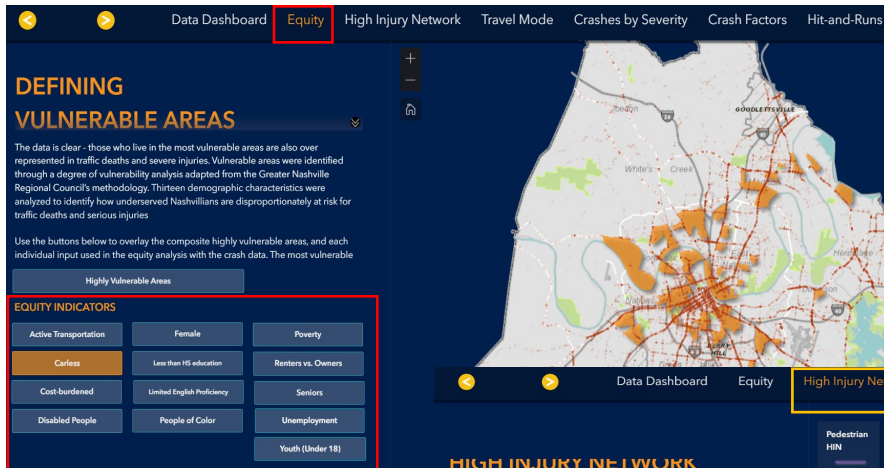


Appendix E – example dashboards

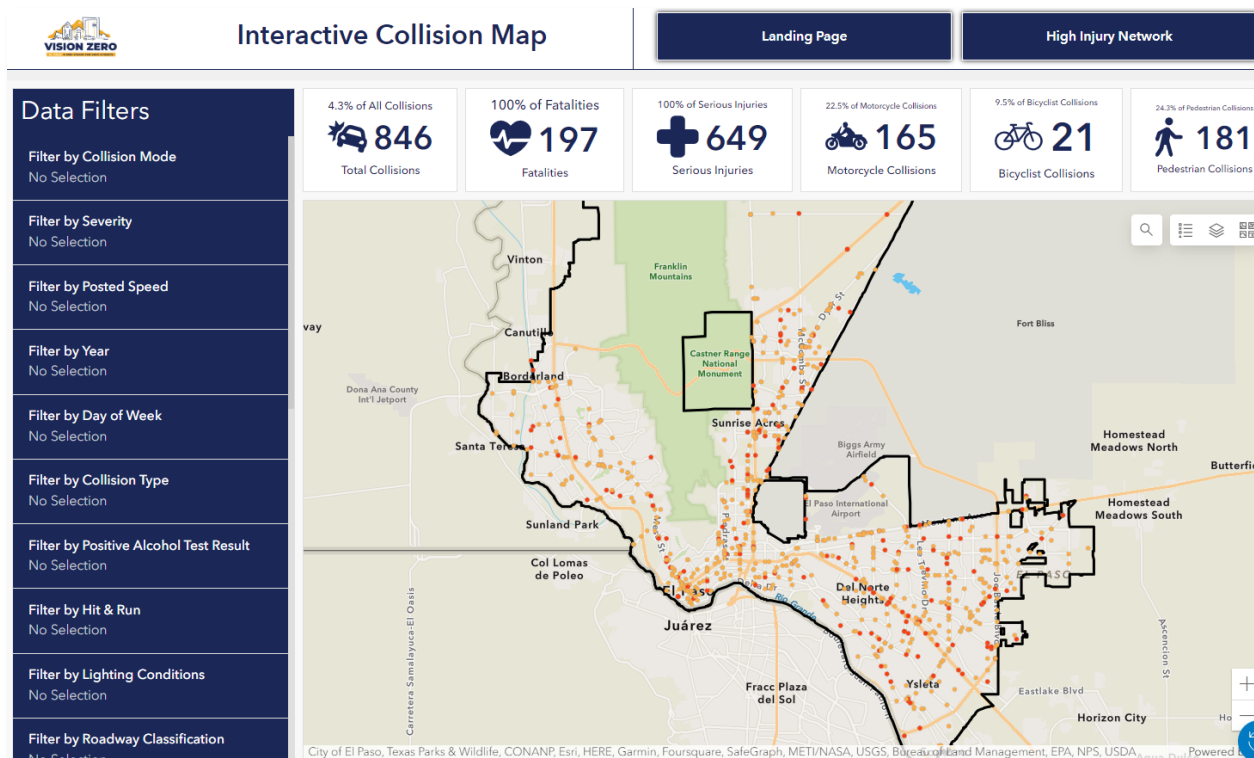
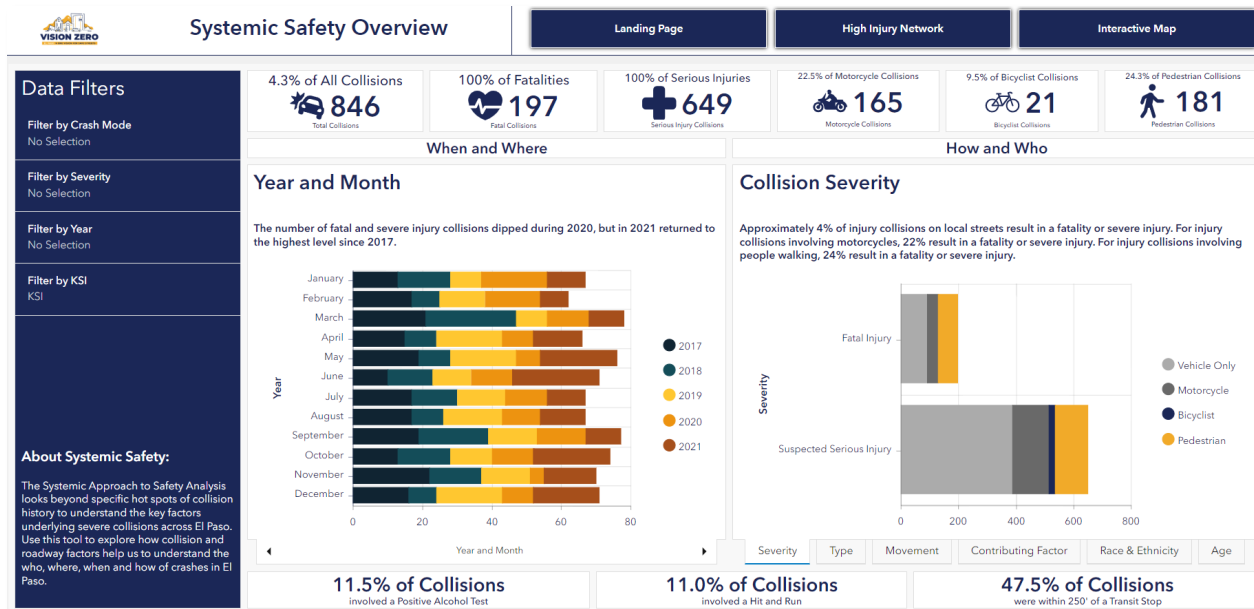
- New York City's [Vision Zero View](#) allows crashes to be filtered by:
 - Mode, severity, time of day (red)
 - Calming measures (orange)
 - Speed limits (yellow)
 - Outreach effort types (green)
 - Police precinct, council district, neighborhood (not shown)



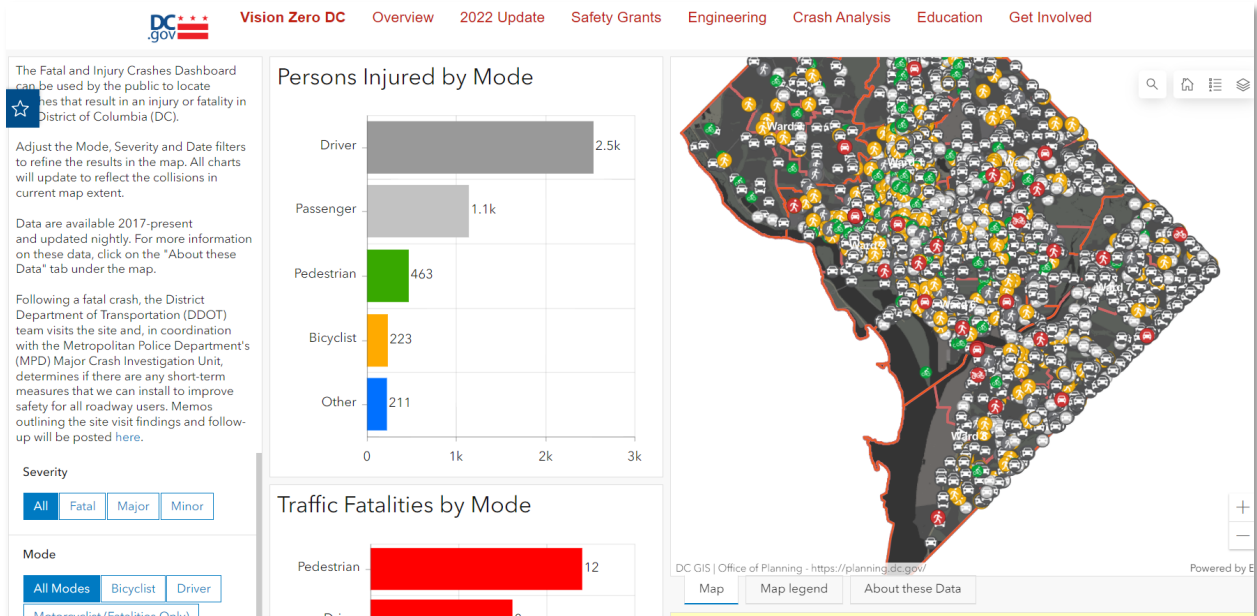
- Nashville's [Vision Zero Data Dashboard](#) allows crashes to be filtered by:
 - Various equity/demographic criteria (red)
 - Injury type: motorist, ped, bike (orange x2)
 - "Crash factors" like proximity to transit, road speed (blue)



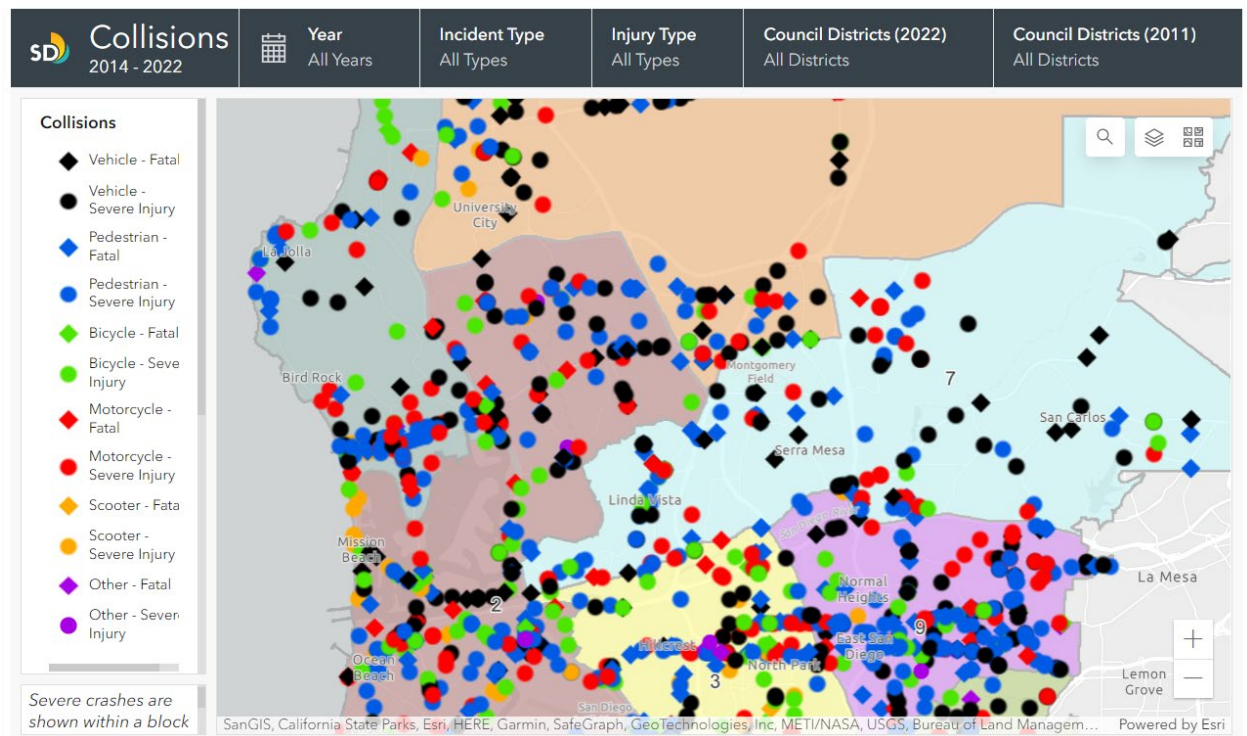
- El Paso's [Systemic Safety Overview](#) and [Interactive Collision Map](#) allow crashes to be filtered by:
 - Mode (bike, ped, etc)
 - Severity
 - Year
 - Posted speed
 - Day of week,
 - Various factors (e.g., DUI, lighting and roadway conditions, etc.)



- Washington, D.C.'s Crash Dashboard allows users to filter by:
 - Mode
 - Severity



- San Diego's [Vision Zero webpage](#) allows users to filter by:
 - Mode
 - Severity
 - Year
 - Council district
 - Vision Zero roadway improvements



Vision Zero: High Crash Analysis & Improvements (since 2015)

