

# APPENDIX A

Safety Toolkit

# APPENDIX B

Engagement

# APPENDIX C

Steering Committee

# APPENDIX D

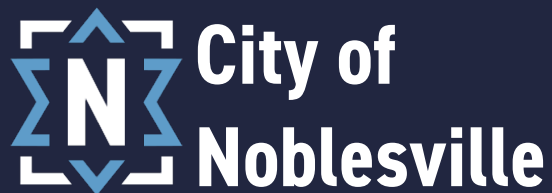
Equity

# APPENDIX E

High Injury Network

# APPENDIX F

Maps



## Safety Action Plan Appendix

Finalized April 2024

# APPENDIX A

## Safety Toolkit





# Countermeasures

Ways to reduce crashes and keep our communities safe



Sources: [U.S. Department of Transportation Federal Highway Administration](#), [National Highway Traffic Safety Administration](#), [NACTO](#), [Caltrans](#)

Images: [Wikipedia](#), [Texas A&M Transportation Institute](#), [LH6](#), [City of Kirkwood](#), [Nevada DOT](#), [NACTO](#), [Unsplash](#), [Florin Roebig Trial Attorneys](#), [WGI](#), [Inclusivity City](#), [Maker](#), [Street Light Data](#), [Sagacom](#), [ABC27](#), [CDN](#), [Wikimedia](#), [CMT](#), [Wired](#), [Regina](#), [NYC Street Design](#), [PGA Design](#), [Journal & Courier](#), [Boston Globe](#)



# Bicycle Lanes

## Purpose

Aligns with the Safe Systems Approach principle of recognizing human vulnerability and separates users in space.

## Description

Bicycle facilities can mitigate or prevent interactions, conflicts, and crashes between bicyclists and motor vehicles, and create a network of safer roadways for bicycling.

## Applicable Locations

New roads/existing roads through modifications. Bicycle facilities can be appropriate within various roadway contexts however, roadway context determines the appropriate facility type and design.

## Safety Benefits

Converting traditional or flush buffered bicycle lanes to a separated bicycle lane with flexible delineator posts can reduce crashes up to **53%** for bicycle/vehicle crashes

Bicycle lane additions can reduce crashes up to **49%** for total crashes on urban 4-lane undivided collectors and local roads

**30%** reduction for total crashes on urban 2-lane undivided collectors and local roads

[More information](#)



## Design Guidance Considerations

In order to maximize a roadway's suitability for riders of all ages and abilities, bicycle lane design should vary according to roadway characteristics (number of lanes, motor vehicle and truck volumes, speed, presence of transit), user needs (current and forecasted ridership, types of bicycles and micromobility devices in use within the community, role within the bicycling network), and land-use context (adjacent land uses, types and intensity of conflicting uses, demands from other users for curbside access). Separated bicycle lanes are recommended on roadways with higher vehicle volumes and speeds, such as arterials.

City and State policies may require minimum bicycle lane widths, although desirable bicycle lane widths can differ by agency and functional classification of the road, current and forecasted bicycle volumes, and contextual attributes such as topography. Studies have found that

roadways did not experience an increase in crashes or congestion when travel lane widths were decreased to add a bicycle lane.

Studies and experience in U.S. cities show that bicycle lanes increase ridership and may help jurisdictions better manage roadway capacity.

In rural areas, rumble strips can negatively impact bicyclists' ability to ride if not properly installed. Agencies should consider the dimensions, placement, and offset of rumble strips when adding a bicycle lane.

Bicycle lanes should be considered on roadways where adjacent land use suggests that trips could be served by varied modes, particularly to meet the safety and travel needs of low-income populations likely to use bicycles to reach essential destinations.





# Leading Pedestrian Intervals

## Purpose

Leading pedestrian intervals allow pedestrians to better establish their presence in the crosswalk before vehicles have priority to turn right or left.

## Description

A leading pedestrian interval gives pedestrians the opportunity to enter the crosswalk at an intersection 3-7 seconds before vehicles are given a green indication.

For more information: <https://highways.dot.gov/sites/fhwa.dot.gov/files/2022-06/fhwasa19040.pdf>

## Applicable Locations

Several cities across the U.S. have decided to install LPIs across systems of signalized intersections to improve pedestrian safety.

Agencies prioritize the intersections in places where there are lots of crashes, high pedestrian crossing volumes, and vulnerable populations.

They may be especially useful at one-way streets or at T-intersections.

## Safety Benefits

- LPIs provide the following benefits:
- Increased visibility of crossing pedestrians.
  - Reduced conflicts between pedestrians and vehicles.
  - Increased likelihood of motorists yielding to pedestrians.
  - Enhanced safety for pedestrians who may be slower to start into the intersection

Leading pedestrian intervals can create a 13% reduction in pedestrian-vehicle crashes at intersections

[More information](#)



# Rectangular Rapid Flashing Beacons

## Purpose

A marked crosswalk or pedestrian warning sign can improve safety for pedestrians crossing the road, but at times may not be sufficient for drivers to visibly locate crossing locations and yield to pedestrians. To enhance pedestrian conspicuity and increase driver awareness at uncontrolled, marked crosswalks, transportation agencies can install a pedestrian actuated Rectangular Rapid Flashing Beacon (RRFB) to accompany a pedestrian warning sign.

## Description

RRFBs consist of two, rectangular- shaped yellow indications, each with a light-emitting diode (LED)-array-based light source. RRFBs flash with an alternating high frequency when activated to enhance conspicuity of pedestrians at the crossing to drivers.

## Applicable Locations

The RRFB is applicable to many types of pedestrian crossings but is particularly effective at multi-lane crossings with speed limits less than 40 miles per hour. Research suggests RRFBs can result in motorist yielding rates as high as 98 percent at marked crosswalks, but varies depending on the location, posted speed limit, pedestrian crossing distance, one-versus two-way road, and the number of travel lanes. RRFBs can also accompany school or trail crossing warning signs. Agencies should consult the Manual on Uniform Traffic Control Devices (MUTCD) for more information.

## Safety Benefits

RRFBs can reduce crashes up to 47% for pedestrian crashes. RRFBs can increase motorist yielding rates up to 98%.

[More information](#)





# Medians

## Purpose

Provides separation between opposing vehicle travel lanes, supports improved safety and traffic flow, and creates space for landscaping or visual enhancements.

## Description

Area between opposing lanes of traffic, excluding turn lanes. Can be defined by pavement markings, raised medians, or islands.

## Applicable Locations

Mid-block crossings, multilane intersections, and areas near transit stops or other pedestrian-focused sites

## Safety Benefits

46% reduction in pedestrian crashes (median with marked crosswalk)

[More information](#)



# Pedestrian Refuge Island

## Purpose

Provides a protected area for pedestrians crossing a road.

## Description

A raised median island with a refuge area intended for pedestrians.

## Applicable Locations

Mid-block crossings, multilane intersections, and areas near transit stops or other pedestrian-focused sites

## Safety Benefits

56% reduction in pedestrian crashes (Median with Marked Crosswalk)

[More information](#)





# Crosswalk Visibility Enhancements

## Description

Poor lighting conditions, obstructions such as parked cars, and horizontal or vertical roadway curvature can reduce visibility at crosswalks, contributing to safety issues. For multilane roadway crossings where vehicle volumes are in excess of 10,000 Average Annual Daily Traffic (AADT), a marked crosswalk alone is typically not sufficient. Under such conditions, more substantial crossing improvements could prevent an increase in pedestrian crash potential.

## Applicable Locations

Mid-block crossings and intersections.

## Design Considerations

High-visibility crosswalks use patterns (i.e., bar pairs, continental, ladder) that are visible to both the driver and pedestrian from farther away compared to traditional transverse line crosswalks. Agencies should use materials such as inlay or thermoplastic tape, instead of paint or brick, for high reflectivity and durability. High visibility crosswalks should be considered at all midblock pedestrian crossings and uncontrolled intersections. These improvements can reduce pedestrian injury crashes up to 40%.

## Improved Lighting

The goal of crosswalk lighting should be to illuminate with positive contrast to make it easier for a driver to visually identify the pedestrian. This involves carefully placing the luminaires in forward locations to avoid a silhouette effect of the pedestrian.

76% of pedestrians were killed in collisions that occurred when it was dark, with another 4% occurring during dusk or dawn (Schneider, 2020). Retting (2021) notes that during the years 2010-2019 —a time when pedestrian fatalities have been increasing—the number of pedestrian fatalities that occurred in the dark increased by 58%, while daylight fatalities increased by 16%.

## Enhanced Signing and Pavement Markings

On multilane roadways, agencies can use "YIELD Here to Pedestrians" or "STOP Here for Pedestrians" signs 20 to 50 feet in advance of a marked crosswalk to indicate where a driver should stop or yield to pedestrians, depending on State law. To supplement the signing, agencies can also install a STOP or YIELD bar (commonly referred to as "shark's teeth") pavement markings.

In-street signing, such as "STOP Here for Pedestrians" or "YIELD Here to Pedestrians" may be appropriate on roads with two- or three-lane roads where speed limits are 30 miles per hour or less.

## More information





# Walkways

## Purpose

Defined space for pedestrians.

## Description

A walkway is any type of defined space or pathway for use by a person traveling by foot or using a wheelchair. These may be pedestrian walkways, shared use paths, sidewalks, or roadway shoulders.

## Applicable Locations

Well-designed pedestrian walkways, shared use paths, and sidewalks improve the safety and mobility of pedestrians. Pedestrians should have direct and connected network of walking routes to desired destinations without gaps or abrupt changes.

Transportation agencies should work towards incorporating pedestrian facilities into all roadway projects unless exceptional circumstances exist. It is important to provide and maintain accessible walkways along both sides of the road in urban areas, particularly near school zones and transit locations, and where there is a large amount of pedestrian activity. Walkable shoulders should also be considered along both sides of rural highways when routinely used by pedestrians.



## Safety Benefits

With more than 6,200 pedestrian fatalities and 75,000 pedestrian injuries occurring in roadway crashes annually, it is important for transportation agencies to improve conditions and safety for pedestrians and to integrate walkways more fully into the transportation system. Research shows people living in low-income communities are less likely to encounter walkways and other pedestrian-friendly features.

Sidewalks can lead to a 65-89% reduction in crashes involving pedestrians walking along roadways. Paved shoulders can lead to a 71% reduction in crashes involving pedestrians walking along roadways.

## Design Guidance

Well-designed pedestrian walkways, shared use paths, and sidewalks improve the safety and mobility of pedestrians. Pedestrians should have direct and connected network of walking routes to desired destinations without gaps or abrupt changes.

Transportation agencies should work towards incorporating pedestrian facilities into all roadway projects unless exceptional circumstances exist. It is important to provide and maintain accessible walkways along both sides of the road in urban areas, particularly near school zones and transit locations, and where there is a large amount of pedestrian activity. Walkable shoulders should also be considered along both sides of rural highways when routinely used by pedestrians.

[More information](#)



# Reverse Angle Parking

## Purpose

Reverse angle parking could be safer than traditional angle parking because drivers have an easier time seeing various vehicles and pedestrians as they leave.

## Description

While parking, drivers back into a parking space. This is easier than parallel parking. Most importantly, when drivers leave these parking spots, they drive forward into active traffic lanes, rather than blindly backing into them as they do in standard diagonal parking.

## Applicable Locations

Reverse angle parking is particularly important on busy roadways, and roadways with many pedestrians.

## Safety Benefits

- Improved sight distance
- Bicyclists dooring risk eliminated
- Bicyclists and motorists have clear sight lines to each other
- Easier loading and unloading of vehicles
- Rear loading occurs at curb instead of in-street
- Wider loading zones are possible
- Passengers are channeled toward the curb
- Easy to incorporate accessible parking spaces and access aisles

## Design Considerations

- On the downhill side of a steep street, there is the possibility of improperly secured vehicles rolling into the street
- A conflict is possible when a driver is reversing into the parking space
- A reverse angle-in parked motor vehicle might overhang more into the sidewalk

[More information](#)





# Reduced Left-Turn Conflict Intersections

## Purpose

These intersections simplify decision-making for drivers and minimize the potential for higher severity crash types, such as head-on and angle.

## Description

Reduced left-turn conflict intersections are geometric designs that alter how left-turn movements occur.

The RCUT intersection, also known as a J-Turn, Superstreet, or Reduced Conflict Intersection, modifies the direct left-turn and through movements from cross-street approaches. Minor road traffic makes a right turn followed by a U-turn at a designated location—either signalized or unsignalized—to continue in the desired direction.

The MUT intersection modifies direct left turns from the major approaches. Vehicles proceed through the main intersection, make a U-turn a short distance downstream, followed by a right turn at the main intersection.

## Applicable Locations

The RCUT is suitable for and adaptable to a wide variety of circumstances, ranging from isolated rural, high-speed locations to urban and suburban high-volume, multimodal corridors. It is a competitive and less costly alternative to constructing an interchange. RCUTs work well when consistently used along a corridor, but also can be used effectively at individual intersections.

The MUT is an excellent choice for intersections with heavy through traffic and moderate left-turn volumes.

## Safety Benefits

Studies have shown that installing an RCUT can result in a 30% increase in throughput and a 40% reduction in network intersection travel time.

[More information](#)

# Dedicated Left- and Right-Turn Lanes at Intersections

## Purpose

Turn lanes can be designed to provide for deceleration prior to a turn, as well as for storage of vehicles that are stopped and waiting for the opportunity to complete a turn.

## Description

Auxiliary turn lanes—either for left turns or right turns—provide physical separation between turning traffic that is slowing or stopped and adjacent through traffic at approaches to intersections.

## Applicable Locations

While turn lanes provide measurable safety and operational benefits at many types of intersections, they are particularly helpful at two-way stop-controlled intersections. Crashes occurring at these intersections are often related to turning maneuvers .

Installing left-turn lanes and/or right-turn lanes should be considered for the major road approaches for improving safety at both three- and four-leg intersections with stop control on the minor road, where significant turning volumes exist, or where there is a history of turn-related crashes. Pedestrian and bicyclist safety and convenience should also be considered when adding turn lanes at an intersection. Specifically, offset left- and right-turn lanes will lengthen crossing distances for pedestrians.

## Safety Benefits

- Left-Turn Lanes: 28-48% reduction in total crashes
- Positive Offset Left-Turn Lanes reduction in fatal and injury crashes
- Right-Turn Lanes: 14-26% reduction in total crashes.

[More information](#)





# Signage

## Purpose

Signs serve a crucial purpose in ensuring the safe and efficient movement of people and vehicles. They provide vital information regarding directions, speed limits, hazards, and regulations, aiding navigation and decision-making for drivers, pedestrians, and cyclists alike. By communicating standardized symbols and messages, signs help to establish order and predictability on roads, highways, railways, and waterways, reducing the risk of accidents and promoting smoother traffic flow. Whether indicating a sharp curve ahead or directing travelers to the nearest exit, the purpose of signs in transportation is ultimately to foster a safer, more organized, and user-friendly environment.

## Description

There are many types of signs. For instance:

Regulatory signs include those used to communicate required or prohibited movements.

Flashing beacons can be used to enhance overhead and other regulatory signage, indicating to drivers and other users when the transit lane is in force.

Overhead signs above transit lanes and transitways alert drivers and other street users by placing critical information about lane use in a prominent location.

Dynamic signs can be used to alert other street users of approaching transit vehicles, and to regulate turns and other movements that are prohibited when transit vehicles are approaching.

## Applicable Locations

Signage finds application in various settings including highways, roads, and streets. They are often particularly important near intersections and busy areas.

## Safety Benefits

A number of types of signs have been shown to provide safety benefits. For instance, advance yield signs have been shown to be effective in decreasing rear end and sideswipe crashes. Fluorescent curve signs have been shown to reduce crashes during nighttime and at non-intersections.

[More information](#)





# Backplates with Retroreflective Borders

## Purpose

Backplates with retroreflective borders improve the visibility of the illuminated face of the signal. Signal heads that have backplates equipped with retroreflective borders are more visible and conspicuous in both daytime and nighttime conditions.

This treatment is recognized as a human factors enhancement of traffic signal visibility, conspicuity, and orientation for both older and color vision deficient drivers. This countermeasure is also advantageous during periods of power outages when the signals would otherwise be dark, providing a visible cue for motorists to stop at the intersection ahead.

## Description

Backplates added to a traffic signal head introduce a controlled-contrast background. The improved visibility of a signal head with a backplate is made even more conspicuous by framing it with a 1- to 3-inch yellow retroreflective border.

## Applicable Locations

The most efficient means of implementing this proven safety countermeasure is to adopt it as a standard treatment for signalized intersections across a jurisdiction or State.

## Safety Benefits

15% reduction in total crashes

[More information](#)



# Yellow Change Intervals

## Purpose

Since red-light running is a leading cause of severe crashes at signalized intersections, it is imperative that the yellow change interval be appropriately timed. Too brief an interval may result in drivers being unable to stop safely and cause unintentional red-light running. Too long of an interval may result in drivers treating the yellow as an extension of the green phase and invite intentional red-light running. Factors such as the speed of approaching and turning vehicles, driver perception-reaction time, vehicle deceleration, and intersection geometry should all be considered in the timing calculation.

## Description

At a signalized intersection, the yellow change interval is the length of time that the yellow signal indication is displayed following a green signal indication. The yellow signal confirms to motorists that the green has ended and that a red will soon follow.

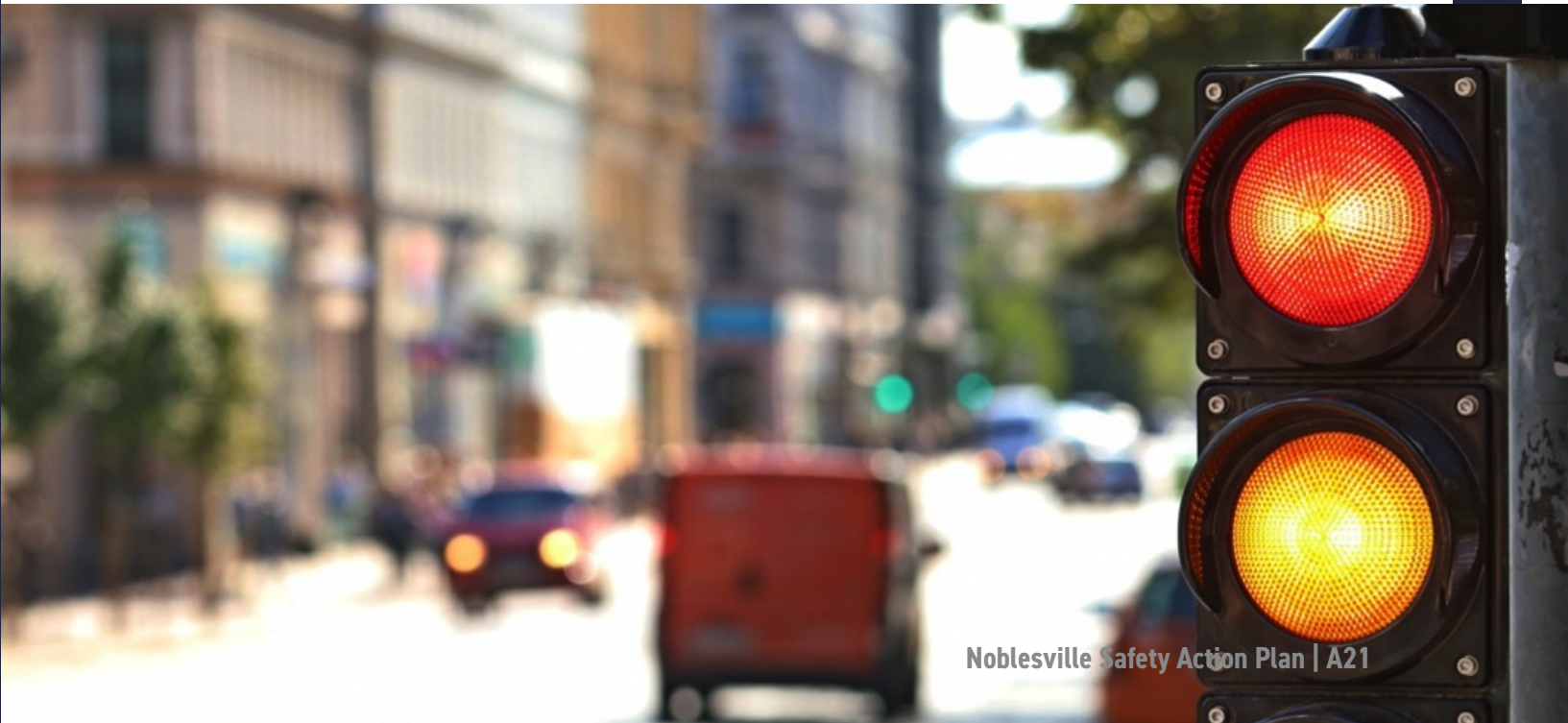
## Applicable Locations

Signalized intersections

## Safety Benefits

36-50% reduction in red light running  
8-14% reduction in total crashes  
12% reduction in injury crashes

[More information](#)





# Dynamic Speed Monitoring Display

## Purpose

Dynamic Speed Monitoring Display (DSMD) signs actively manage vehicle speeds through real-time feedback to drivers. By measuring the speed of approaching vehicles and displaying this information on dynamic message displays, DSMD signs encourage drivers to adjust their speed to comply with posted speed limits, ultimately reducing the risk of accidents and improving overall traffic safety.

## Description

DSMD signs are advanced traffic control devices that utilize Intelligent Transportation System (ITS) technology. These signs incorporate radar sensors to measure the speed of oncoming vehicles and then relay this information to drivers via dynamic message displays. Positioned alongside standard static regulatory speed limit signs, DSMD signs provide drivers with real-time feedback about their current speed compared to the posted speed limit. This interactive approach aims to encourage drivers to adhere to speed limits and promote safer driving behavior, particularly in areas where speed limits change, such as speed reduction transition zones. Dynamic signs can be used to alert other street users of approaching transit vehicles, and to regulate turns and other movements that are prohibited when transit vehicles are approaching.

## Applicable Locations

DSMD signs are applicable in various locations where managing vehicle speeds is crucial for road safety. These signs are particularly effective in speed reduction transition zones, where speed limits change from higher to lower speeds, such as rural highways entering urbanized areas. Additionally, DSMD signs can be beneficial in residential neighborhoods, school zones, work zones, and areas with high pedestrian activity. They are also useful on roads with frequent speed limit changes, curves, or hazardous conditions, where maintaining appropriate speeds is essential for preventing accidents.

## Safety Benefits

By providing real-time feedback to drivers about their vehicle's speed compared to the posted speed limit, DSMD signs encourage drivers to adjust their speed accordingly, promoting compliance with speed limits and reducing the risk of crashes. These signs are particularly effective in speed transition zones and areas with changing road conditions, where maintaining appropriate speeds is critical for road safety. Additionally, DSMD signs enhance driver awareness and promote safer driving behaviors, contributing to overall improvements in traffic safety on both rural and urban roads.

[More information](#)





# Roundabouts

## Purpose

Roundabouts feature channelized, curved approaches that reduce vehicle speed, entry yield control that gives right-of-way to circulating traffic, and counterclockwise flow around a central island that minimizes conflict points. The net result of lower speeds and reduced conflicts at roundabouts is an environment where crashes that cause injury or fatality are substantially reduced.

## Description

The modern roundabout is an intersection with a circular configuration that safely and efficiently moves traffic.

## Applicable Locations

Roundabouts can be implemented in both urban and rural areas under a wide range of traffic conditions. They can replace

signals, two-way stop controls, and all-way stop controls. Roundabouts are an effective option for managing speed and transitioning traffic from high-speed to low-speed environments, such as freeway interchange ramp terminals, and rural intersections along high-speed roads.

## Safety Benefits

Roundabouts are not only a safer type of intersection; they are also efficient at keeping people moving. Even while calming traffic, they can reduce delay and queuing when compared to other intersection alternatives. Furthermore, the lower vehicular speeds and reduced conflict environment can create a more suitable environment for walking and bicycling.

[More information](#)



# Pedestrian Hybrid Beacon

## Purpose

The pedestrian hybrid beacon (PHB) is a traffic control device designed to help pedestrians safely cross higher-speed roadways at midblock crossings and uncontrolled intersections.

## Description

The beacon head consists of two red lenses above a single yellow lens. The lenses remain "dark" until a pedestrian desiring to cross the street pushes the call button to activate the beacon, which then initiates a yellow to red lighting sequence consisting of flashing and steady lights that directs motorists to slow and come to a stop, and provides the right-of-way to the pedestrian to safely cross the roadway before going dark again.

## Applicable Locations

New Roads/Existing roads through modifications



## Safety Benefits

Nearly 74% of pedestrian fatalities occur at non-intersection locations, and vehicle speeds are often a major contributing factor. Pedestrian hybrid beacons also allow motorists to proceed once the pedestrian has cleared their side of the travel lane(s), reducing vehicle delay. 55% reduction in pedestrian crashes, 29% reduction in total crashes, and 15% reduction in serious injury and fatal crashes.

## Design Guidance Considerations

In general, PHBs are used where it is difficult for pedestrians to cross a roadway, such as when gaps in traffic are not sufficient or speed limits exceed 35 miles per hour. They are very effective at locations where three or more lanes will be crossed or traffic volumes are above 9,000 annual average daily traffic. Installation of a PHB must also include a marked crosswalk and pedestrian countdown signal. If PHBs are not already familiar to a community, agencies should conduct appropriate education and outreach as part of implementation. If PHBs are not already familiar to a community, agencies should conduct appropriate education and outreach as part of implementation.

[More information](#)



# Systemic Application of Multiple Low-Cost Countermeasures at Stop-Controlled Intersections

## Purpose

This systemic approach to intersection safety involves deploying a package of multiple low-cost countermeasures, including enhanced signing and pavement markings, at a large number of stop-controlled intersections within a jurisdiction. These countermeasures increase driver awareness and recognition of the intersections and potential conflicts.

There are several benefits to systemically applying multiple low-cost countermeasures at stop-controlled intersections, including:

- Resources are maximized because the treatments are low cost.
- A high number of intersections can receive treatment.
- Improvements are highly cost-effective, with an average benefit-cost ratio of 12:1, even assuming a conservative 3-year service life.



## Description

On the Through Approach:

- Doubled-up (left and right), oversized advance intersection warning signs, with supplemental street name plaques (can also include flashing beacon).
- Retroreflective sheeting on sign posts.
- Enhanced pavement markings that delineate through lane edge lines.

On the Stop Approach:

- Doubled-up (left and right), oversized advance "Stop Ahead" intersection warning signs (can also include flashing beacon).
- Doubled-up (left and right), oversized Stop signs.
- Retroreflective sheeting on sign posts.
- Properly placed stop bar.
- Removal of vegetation, parking, or obstructions that limit sight distance.
- Double arrow warning sign at stem of T-intersections.

## Applicable Locations

Stop-controlled intersections.

## Safety Benefits

10% reduction of fatal and injury crashes at all locations/types/areas.

15% reduction of nighttime crashes at all locations/types/areas.

27% reduction of fatal and injury crashes at rural intersections.

19% reduction of fatal and injury crashes at 2-lane by 2-lane intersections.

[More information](#)





# Road Diet

## Purpose

A Road Diet, or roadway reconfiguration, can improve safety, calm traffic, provide better mobility and access for all road users, and enhance overall quality of life. They may be a low-cost way to reduce an overbuilt street that suggests high speeds to drivers and provide more space for walking, bicycling, and for drivers who need to park their vehicles.

## Description

A Road Diet typically involves decreasing the number of lanes in a roadway. This can be achieved by adding sidewalks, cycle lanes, center turn lanes, or otherwise decreasing the number of car lanes.

## Applicable Locations

A Road Diet can be a low-cost safety solution when planned in conjunction with a simple pavement overlay, and the reconfiguration can be accomplished at no additional cost. Typically, a Road Diet is

implemented on a roadway with a current and future average daily traffic of 25,000 or less.

## Safety Benefits

4-lane to 3-lane road diet conversions can have a 19-47% reduction in total crashes. Benefits of Road Diet installations may include:

- Reduction of rear-end and left-turn crashes due to the dedicated left-turn lane.
- Reduced right-angle crashes as side street motorists cross three versus four travel lanes.
- Fewer lanes for pedestrians to cross.
- Opportunity to install pedestrian refuge islands, bicycle lanes, on-street parking, or transit stops.
- Traffic calming and more consistent speeds.

[More information](#)

# Corridor Access Management

## Purpose

Thoughtful access management along a corridor can simultaneously enhance safety for all modes, facilitate walking and biking, and reduce trip delay and congestion.

## Description

Access management refers to the design, application, and control of entry and exit points along a roadway. This includes intersections with other roads and driveways that serve adjacent properties. The following access management strategies can be used individually or in combination with one another:

- Reduce density through driveway closure, consolidation, or relocation.
- Manage spacing of intersection and access points.
- Limit allowable movements at driveways (such as right-in/right-out only).
- Place driveways on an intersection approach corner rather than a receiving corner, which is expected to have fewer total crashes.
- Implement raised medians that preclude across-roadway movements.

- Utilize designs such as roundabouts or reduced left-turn conflicts (such as restricted crossing U-turn, median U-turns, etc.).
- Provide turn lanes (i.e., left-only, right-only, or interior two-way left).
- Use lower speed one-way or two-way off-arterial circulation roads.

## Applicable Locations

Every intersection, from a signalized intersection to an unpaved driveway, has the potential for conflicts between vehicles, pedestrians, and bicyclists. The number and types of conflict points—locations where the travel paths of two users intersect—influence the safety performance of the intersection or driveway.

## Safety Benefits

Reducing driveway density 5-23% reduction in total crashes along 2-lane rural roads

25-31% reduction in fatal and injury crashes along urban/suburban arterials.

[More information](#)





# Curb Extensions

## Purpose

Curb extensions visually and physically narrow the roadway, creating safer and shorter crossings for pedestrians while increasing the available space for street furniture, benches, plantings, and street trees

## Description

Curb extensions involves extending the curb into the street, decreasing roadway space and increasing pedestrian space.

## Applicable Locations

Curb extensions may be implemented on downtown, neighborhood, and residential streets, large and small.

Mid-block curb extensions, known as pinchpoints or chokers, which may include cut-throughs for bicyclists.

Curb extensions used as gateways to minor streets known as neckdowns.

Offset curb extensions that force vehicles to move laterally, known as chicanes.

Curb extensions at bus (or transit) stops, also known as bus bulbs.

## Safety Benefits

Curb extensions decrease the overall width of the roadway and can serve as a visual cue to drivers that they are entering a neighborhood street or area.

Curb extensions increase the overall visibility of pedestrians by aligning them with the parking lane and reducing the crossing distance for pedestrians, creating more time for preferential treatments such as leading pedestrian interval and transit signal priority.

Used as a bus bulb, curb extensions may improve bus travel times by reducing the amount of time a bus takes to merge with traffic after boarding. Bus bulbs also help to prevent motorists from double parking in the bus stop.

Curb extensions tighten intersection curb radii and encourage slower turning speeds.

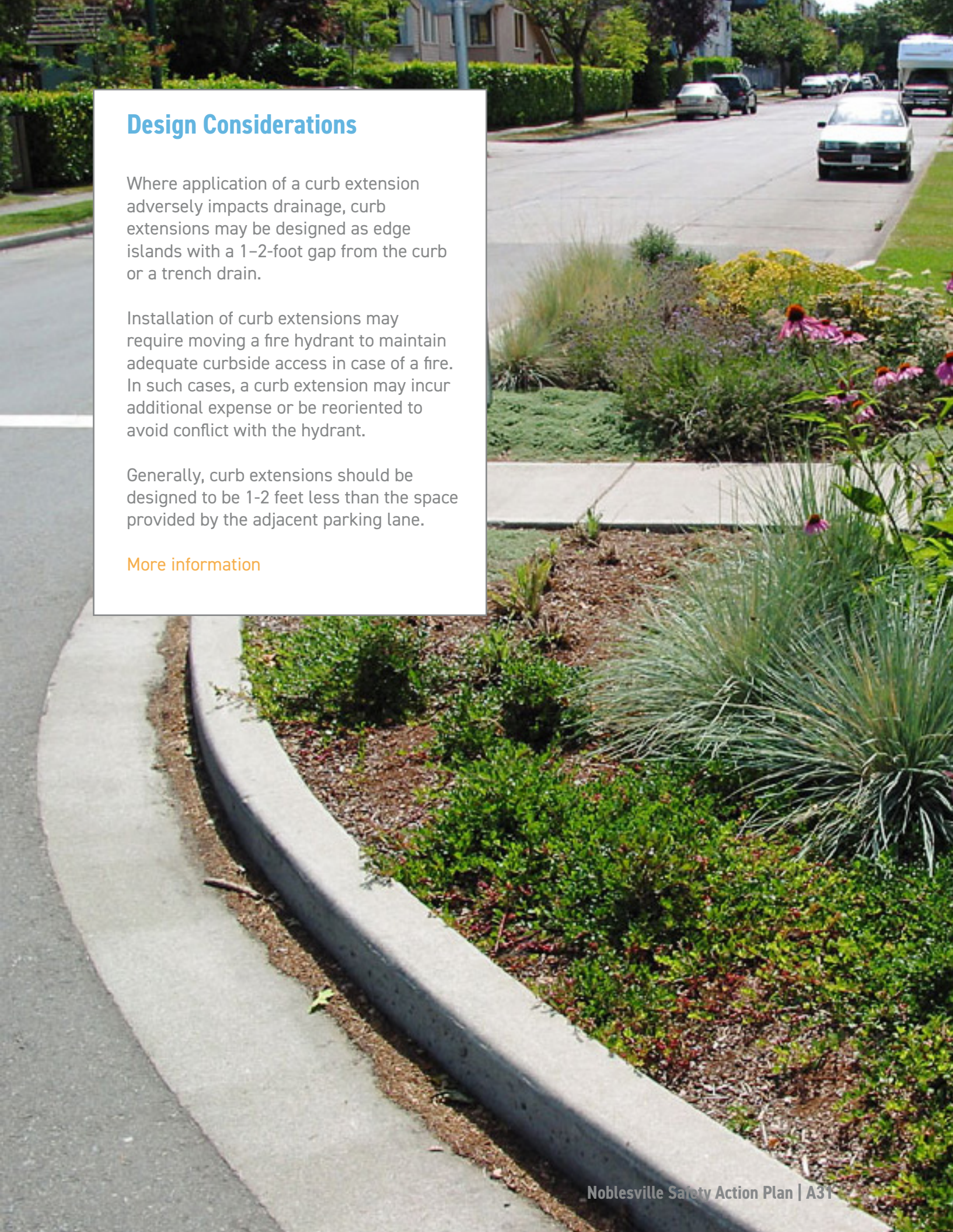
## Design Considerations

Where application of a curb extension adversely impacts drainage, curb extensions may be designed as edge islands with a 1–2-foot gap from the curb or a trench drain.

Installation of curb extensions may require moving a fire hydrant to maintain adequate curbside access in case of a fire. In such cases, a curb extension may incur additional expense or be reoriented to avoid conflict with the hydrant.

Generally, curb extensions should be designed to be 1-2 feet less than the space provided by the adjacent parking lane.

[More information](#)





# Automated Enforcement

## Purpose

Agencies can use speed safety cameras (SSCs) as an effective and reliable technology to supplement more traditional methods of enforcement, engineering measures, and education to alter the social norms of speeding.

## Description

SSCs use speed measurement devices to detect speeding and capture photographic or video evidence of vehicles that are violating a set speed threshold.

## Applicable Locations

Indiana law does not currently permit the use of automated speed enforcement, but this strategy could be used in the future. In that event, agencies should conduct a network analysis of speeding-related crashes to identify locations to implement SSCs. The analysis can include scope (e.g., widespread, localized), location types (e.g., urban/suburban/rural, work zones, residential, school zones), roadway types (e.g., expressways, arterials, local streets), times of day, and road users most affected by speed-related crashes (e.g., pedestrians, bicyclists).

## Safety Benefits

Fixed units can reduce crashes on urban principal arterials up to 54% for all crashes and 47% for injury crashes.

P2P units can reduce crashes on urban expressways, freeways, and principal arterials up to 37% for fatal and injury crashes.

Mobile units can reduce crashes on urban principal arterials up to 20% for fatal and injury crashes.

In New York City, fixed units reduced speeding in school zones up to 63% during school hours.

SSCs can produce a crash reduction upstream and downstream, thus generating a spillover effect.

## Design Considerations

Public trust is essential for any type of enforcement. With proper controls in place, SSCs can offer fair and equitable enforcement of speeding, regardless of driver age, race, gender, or socio-economic status. SSCs should be planned with community input and equity impacts in mind.

Using both overt (i.e., highly visible) and covert (i.e., hidden) enforcement may encourage drivers to comply with limits everywhere, not only at sites they are aware are enforced.

[More information](#)



## APPENDIX B

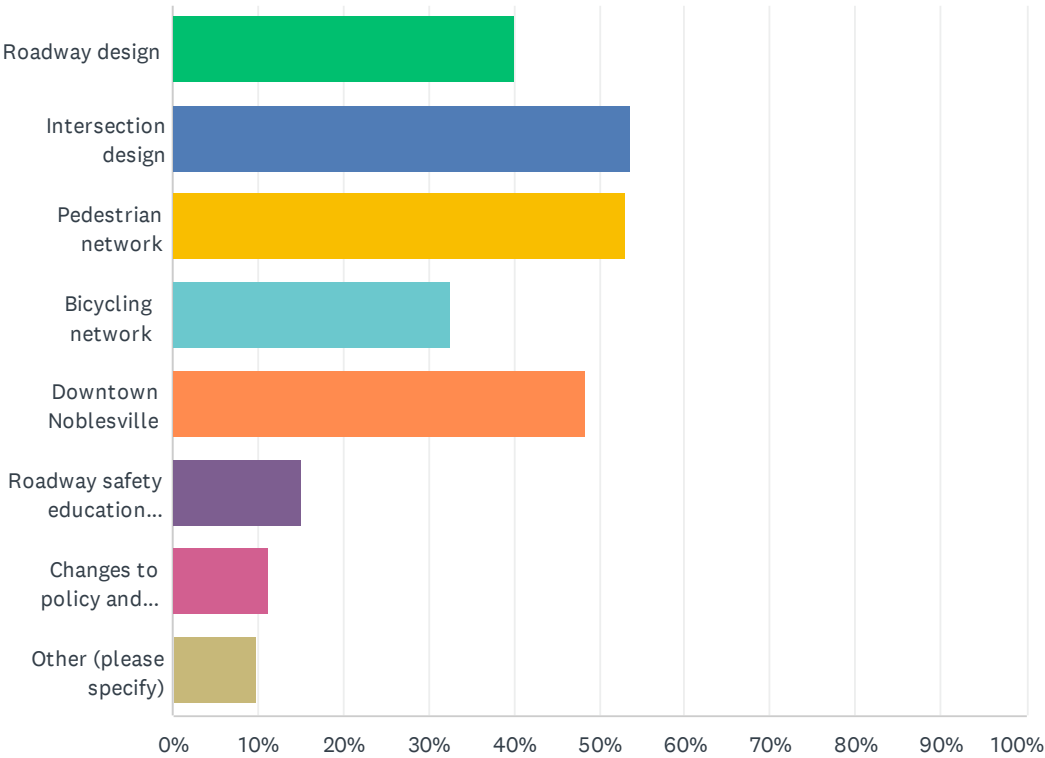
### Engagement





Q1 What topics would you like to see addressed in the Noblesville Safety Action Plan?

Answered: 132    Skipped: 5



Online Survey Results

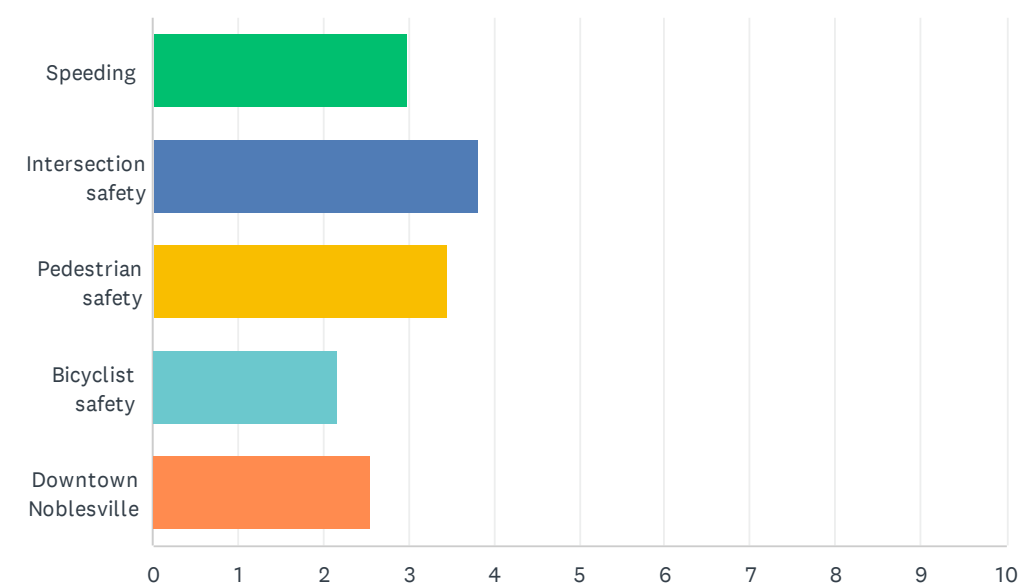
ANSWER CHOICES	RESPONSES	
Roadway design	40.15%	53
Intersection design	53.79%	71
Pedestrian network	53.03%	70
Bicycling network	32.58%	43
Downtown Noblesville	48.48%	64
Roadway safety education campaigns	15.15%	20
Changes to policy and project prioritization process	11.36%	15
Other (please specify)	9.85%	13
Total Respondents: 132		





Q2 Rank the following safety issues in order of what's most important to you. (1 being the most important)

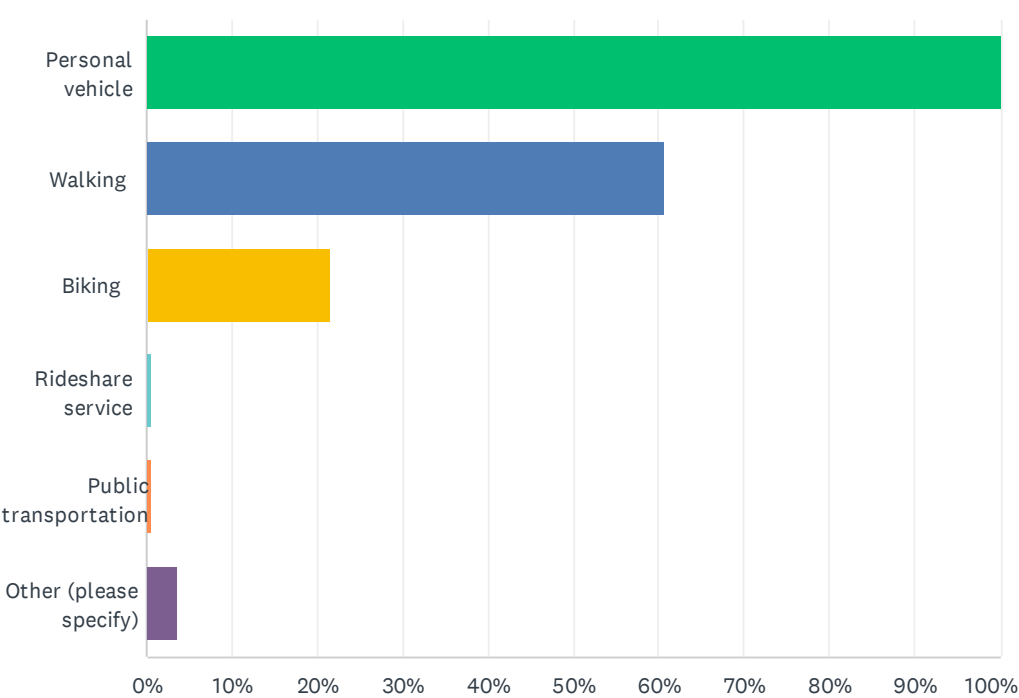
Answered: 136   Skipped: 1



	1	2	3	4	5	TOTAL	SCORE
Speeding	25.00% 34	13.97% 19	19.12% 26	17.65% 24	24.26% 33	136	2.98
Intersection safety	41.18% 56	21.32% 29	19.12% 26	15.44% 21	2.94% 4	136	3.82
Pedestrian safety	21.32% 29	27.21% 37	29.41% 40	19.85% 27	2.21% 3	136	3.46
Bicyclist safety	4.41% 6	16.18% 22	13.97% 19	24.26% 33	41.18% 56	136	2.18
Downtown Noblesville	8.09% 11	21.32% 29	18.38% 25	22.79% 31	29.41% 40	136	2.56

Q3 Which modes of transportation do you use on a weekly basis?

Answered: 135   Skipped: 2

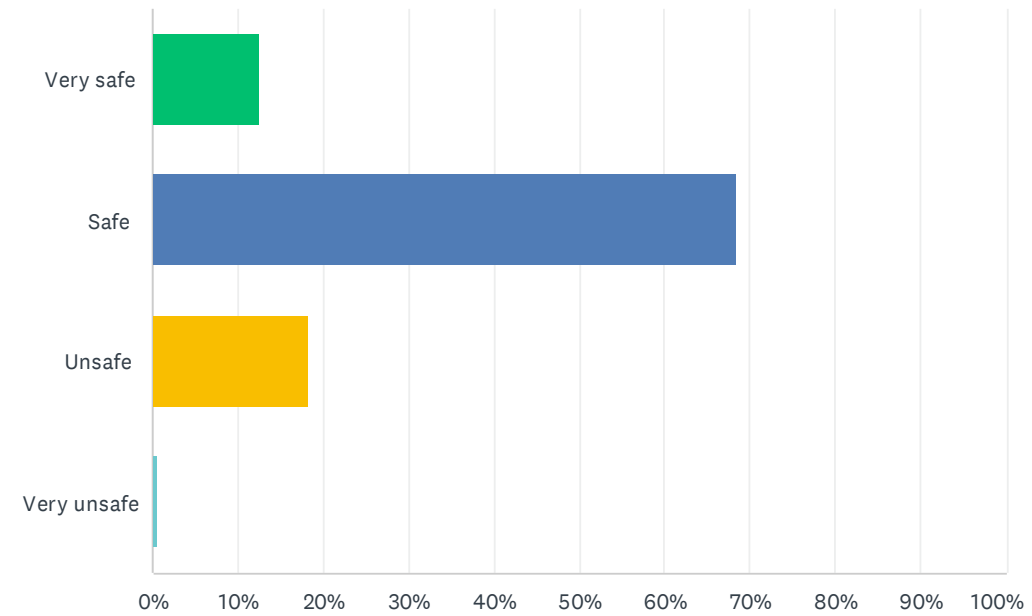


ANSWER CHOICES	RESPONSES
Personal vehicle	100.00% 135
Walking	60.74% 82
Biking	21.48% 29
Rideshare service	0.74% 1
Public transportation	0.74% 1
Other (please specify)	3.70% 5
Total Respondents: 135	



Q4 How safe do you feel traveling on or along the roadways in Noblesville?

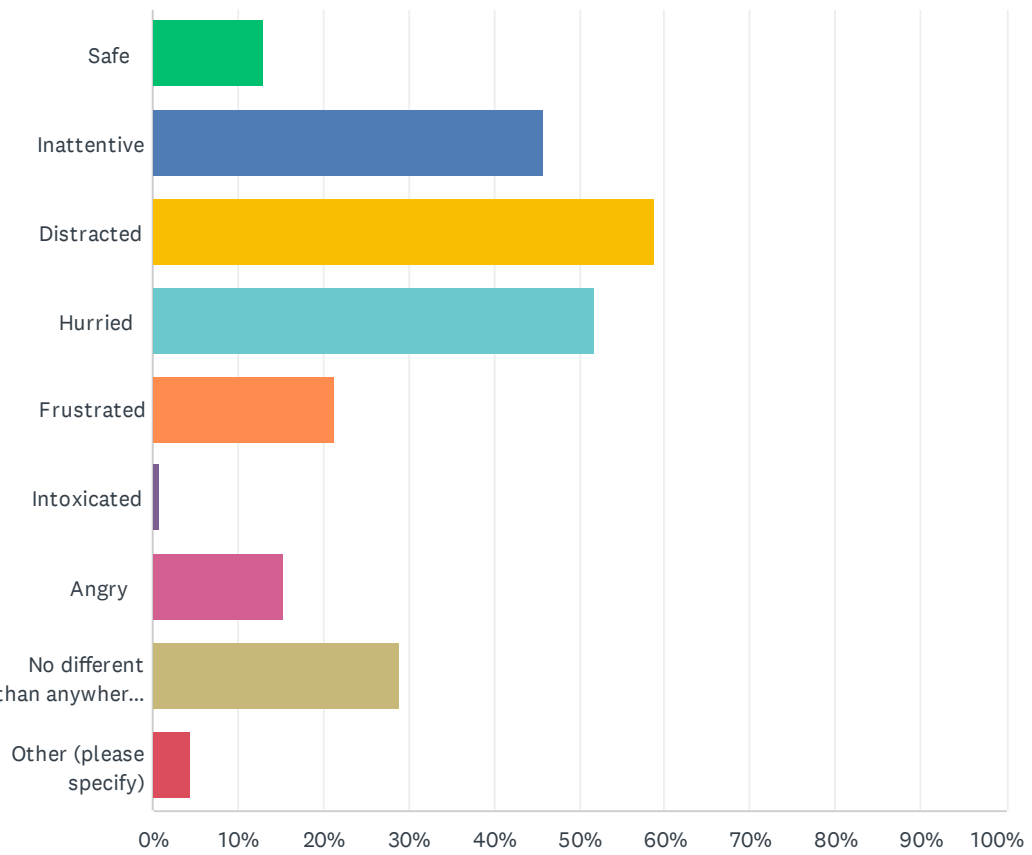
Answered: 136    Skipped: 1



ANSWER CHOICES	RESPONSES	
Very safe	12.50%	17
Safe	68.38%	93
Unsafe	18.38%	25
Very unsafe	0.74%	1
TOTAL		136

Q5 What words best describe the behavior of drivers on streets in Noblesville?

Answered: 131    Skipped: 6

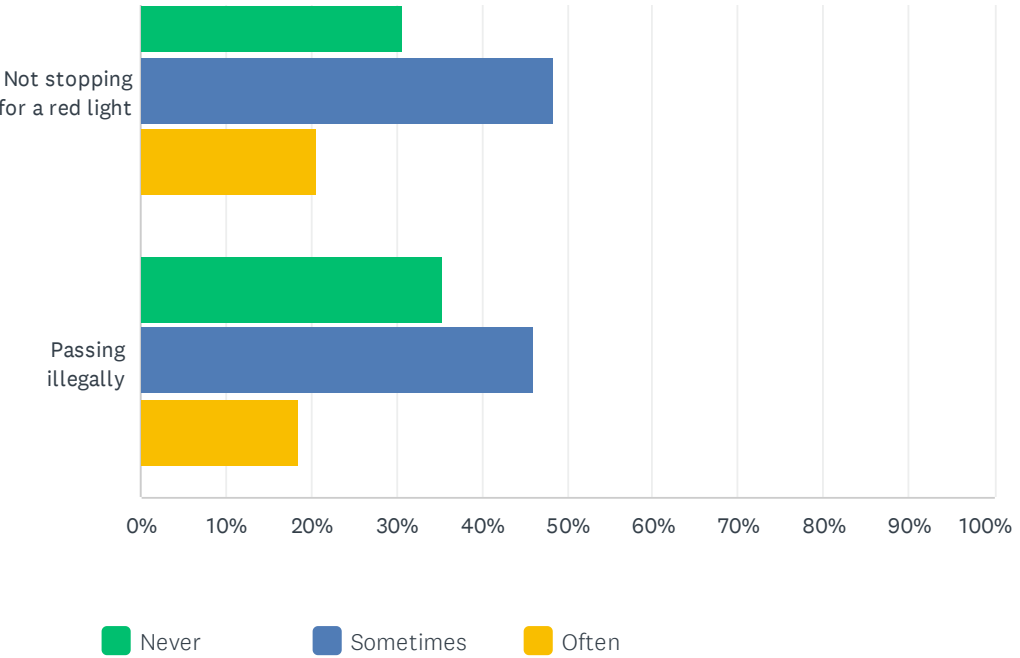
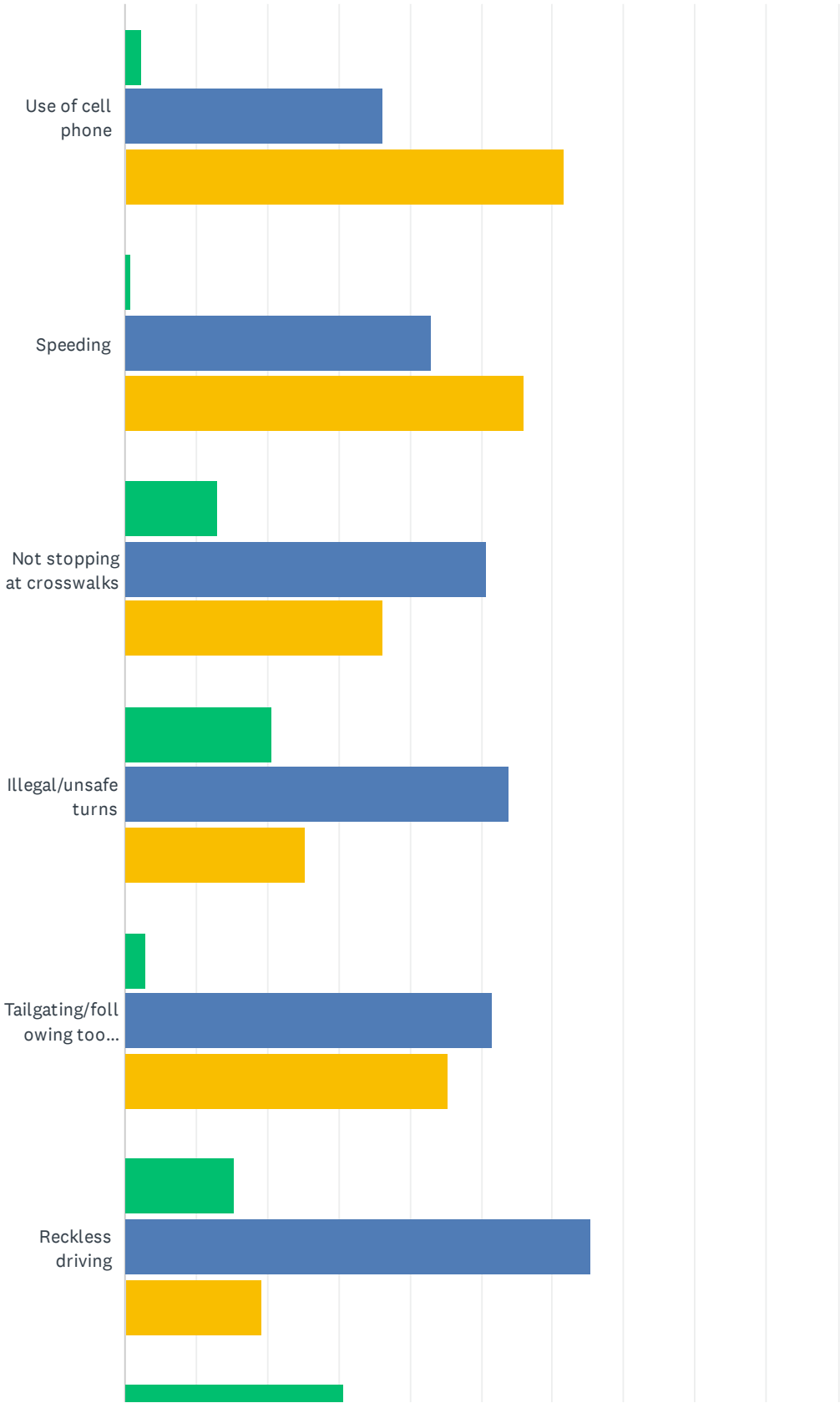


ANSWER CHOICES	RESPONSES	
Safe	12.98%	17
Inattentive	45.80%	60
Distracted	58.78%	77
Hurried	51.91%	68
Frustrated	21.37%	28
Intoxicated	0.76%	1
Angry	15.27%	20
No different than anywhere else	29.01%	38
Other (please specify)	4.58%	6
Total Respondents: 131		



Q6 How often do you observe the following?

Answered: 130    Skipped: 7

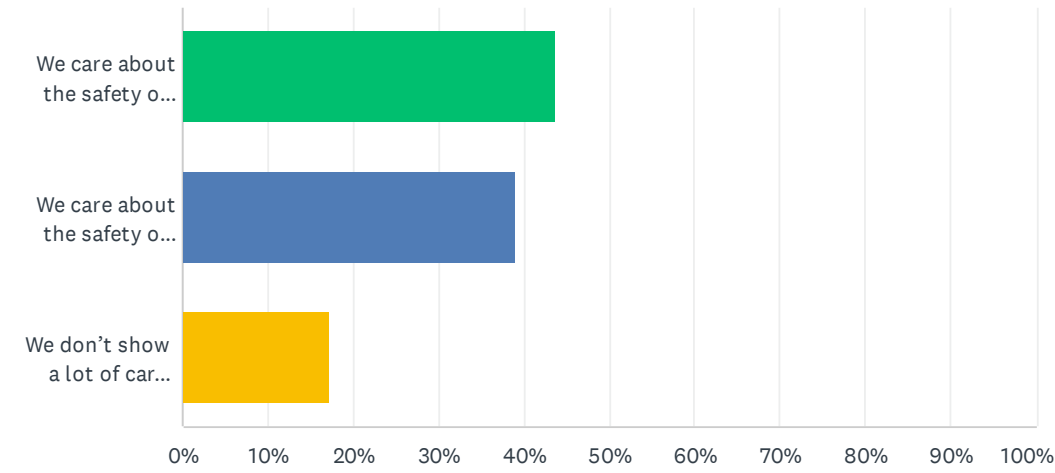


	NEVER	SOMETIMES	OFTEN	TOTAL
Use of cell phone	2.31% 3	36.15% 47	61.54% 80	130
Speeding	0.77% 1	43.08% 56	56.15% 73	130
Not stopping at crosswalks	13.08% 17	50.77% 66	36.15% 47	130
Illegal/unsafe turns	20.77% 27	53.85% 70	25.38% 33	130
Tailgating/following too closely	3.08% 4	51.54% 67	45.38% 59	130
Reckless driving	15.38% 20	65.38% 85	19.23% 25	130
Not stopping for a red light	30.77% 40	48.46% 63	20.77% 27	130
Passing illegally	35.38% 46	46.15% 60	18.46% 24	130



Q7 What is the current attitude of your community towards roadway safety?

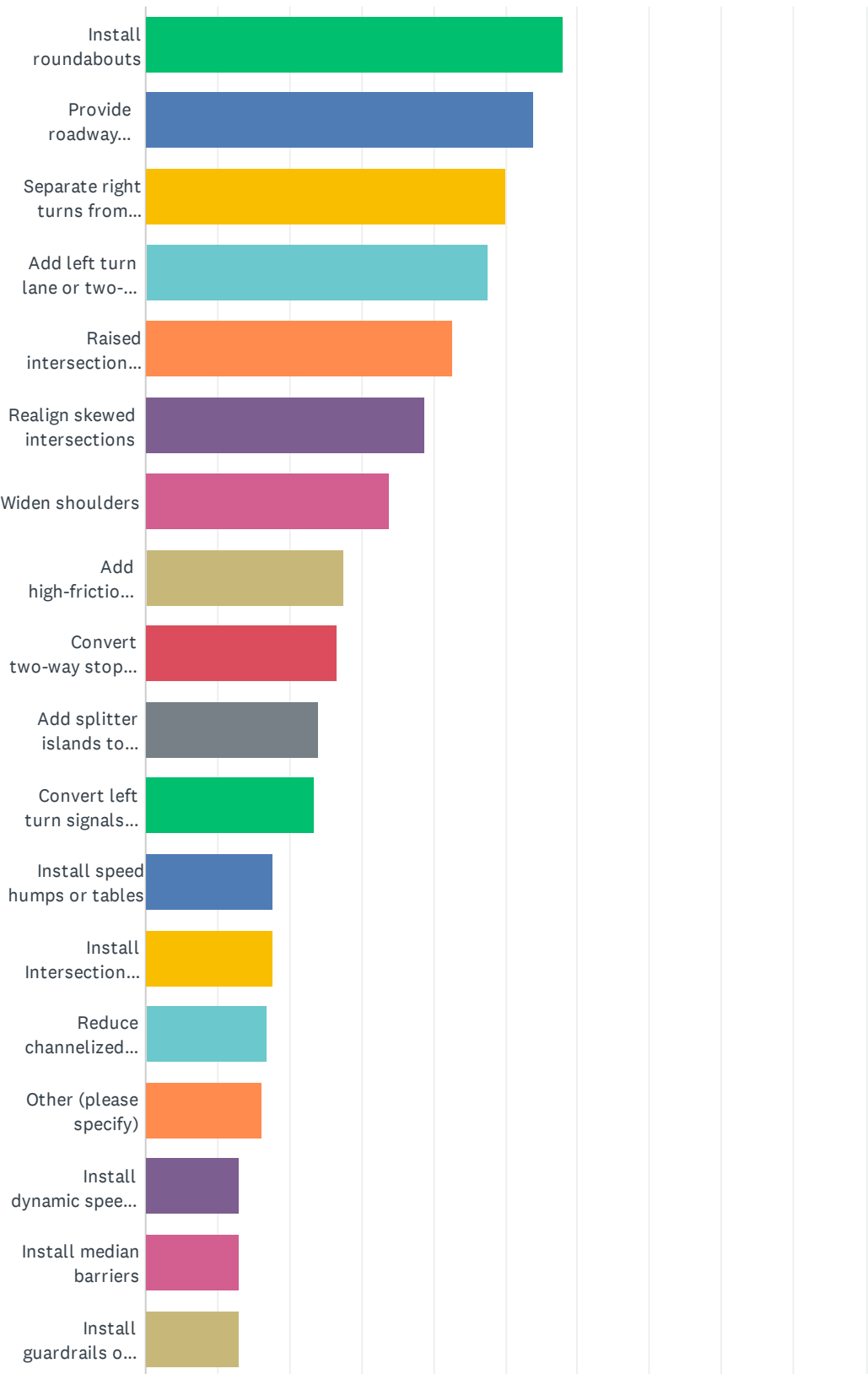
Answered: 128    Skipped: 9



ANSWER CHOICES	RESPONSES	
We care about the safety of all road users and are willing to take steps to improve roadway safety.	43.75%	56
We care about the safety of drivers, but vulnerable road users are left out (pedestrians/walkers/joggers, bicyclists, elderly, disabled).	39.06%	50
We don't show a lot of care about road safety, and it would be difficult to get the public support needed to implement safety improvements.	17.19%	22
TOTAL		128

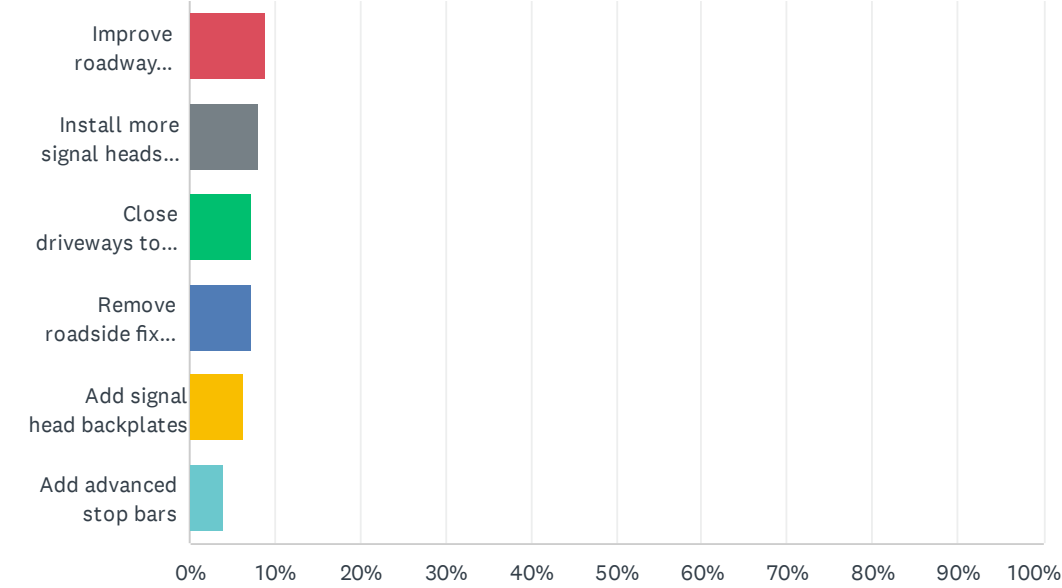
Q8 Which of the following safety improvements targeting drivers would you support in your community?

Answered: 124    Skipped: 13





Noblesville Safety Action Plan



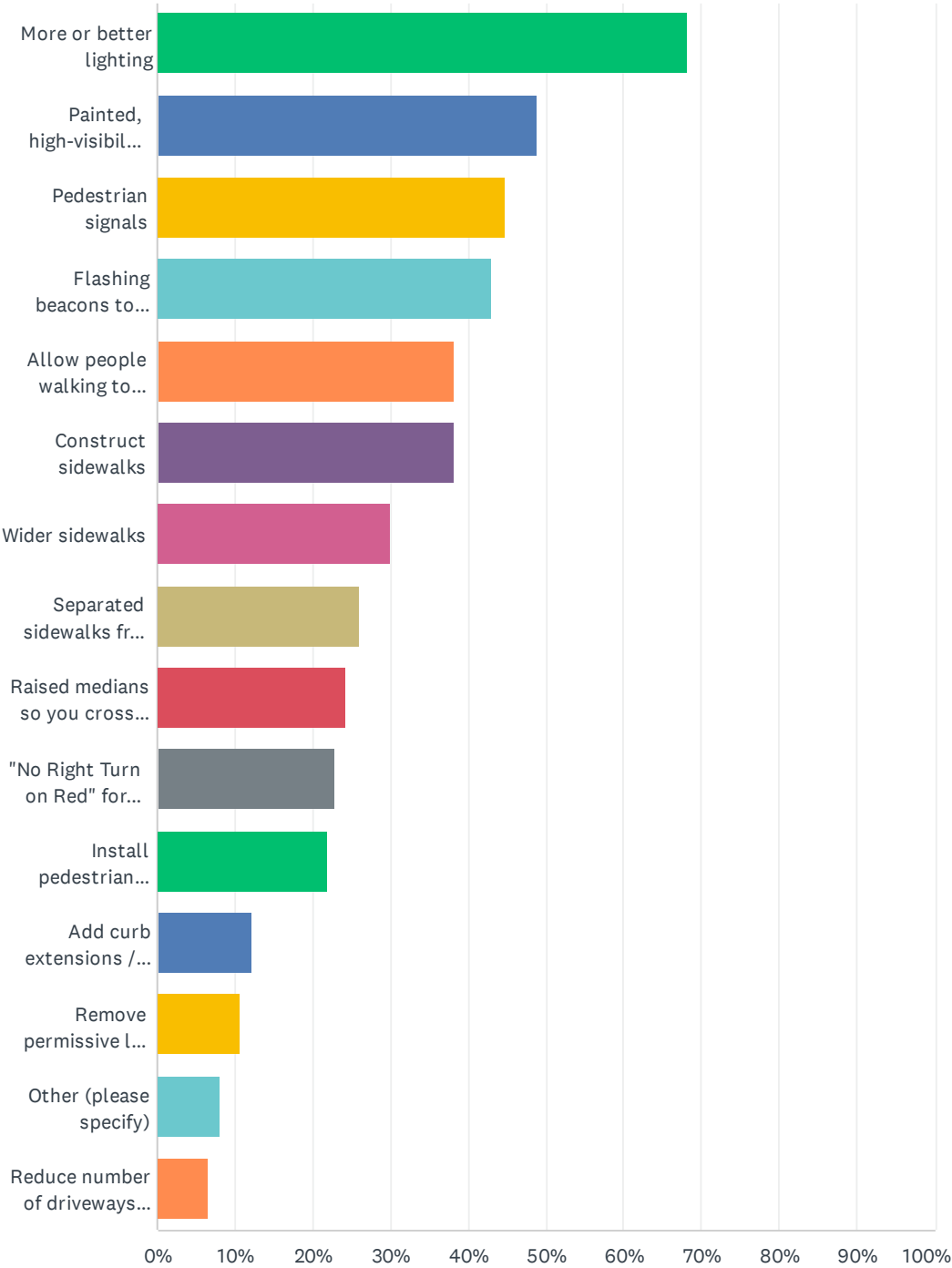
Noblesville Safety Action Plan

ANSWER CHOICES	RESPONSES	
Install roundabouts	58.06%	72
Provide roadway lighting	54.03%	67
Separate right turns from through lanes	50.00%	62
Add left turn lane or two-way left turn lanes where none exist	47.58%	59
Raised intersections, raised crosswalks	42.74%	53
Realign skewed intersections	38.71%	48
Widen shoulders	33.87%	42
Add high-friction surface treatments and centerline or edgeline rumble strips	27.42%	34
Convert two-way stop to all-way stop	26.61%	33
Add splitter islands to separate two directions of traffic	24.19%	30
Convert left turn signals to Flashing Yellow Arrow indicators rather than green arrows	23.39%	29
Install speed humps or tables	17.74%	22
Install Intersection Conflict Warning Systems or Advanced Signal Warning Systems	17.74%	22
Reduce channelized right turn angle for better visibility of oncoming traffic	16.94%	21
Other (please specify)	16.13%	20
Install dynamic speed feedback signs	12.90%	16
Install median barriers	12.90%	16
Install guardrails or flatten slopes adjacent the road	12.90%	16
Improve roadway curvature	8.87%	11
Install more signal heads at traffic signals	8.06%	10
Close driveways to reduce number of conflicts	7.26%	9
Remove roadside fixed objects	7.26%	9
Add signal head backplates	6.45%	8
Add advanced stop bars	4.03%	5
Total Respondents: 124		



Q9 Which of the following safety improvements would you support for walking in your community?

Answered: 123 Skipped: 14

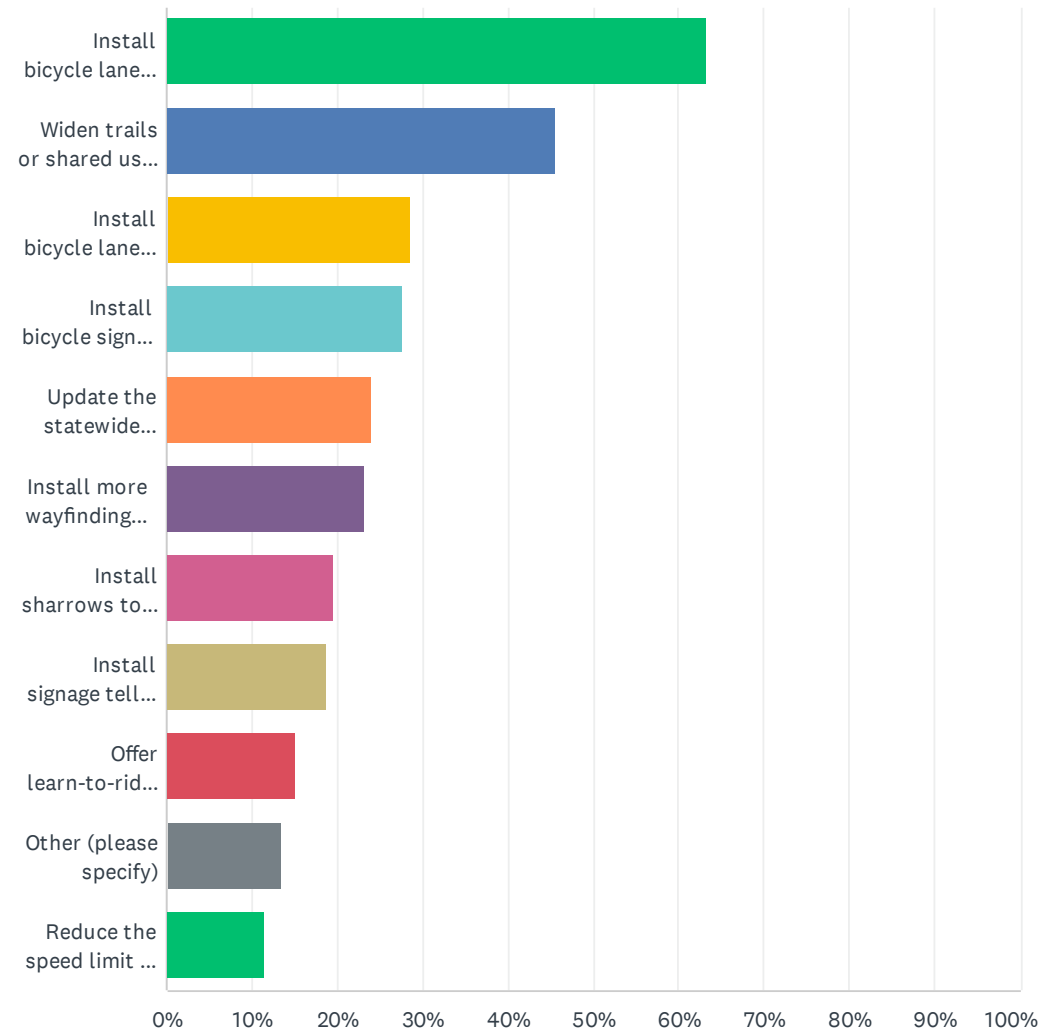


ANSWER CHOICES	RESPONSES	
More or better lighting	68.29%	84
Painted, high-visibility, or raised crosswalks	48.78%	60
Pedestrian signals	44.72%	55
Flashing beacons to alert cars to your presence at mid-block locations	43.09%	53
Allow people walking to start crossing street before cars get a green indication	38.21%	47
Construct sidewalks	38.21%	47
Wider sidewalks	30.08%	37
Separated sidewalks from bicycle paths	26.02%	32
Raised medians so you cross one direction of traffic at a time	24.39%	30
"No Right Turn on Red" for cars at traffic signals	22.76%	28
Install pedestrian scramble (all pedestrian movements go at once, including diagonally)	21.95%	27
Add curb extensions / bump-outs to shorten crossing distance	12.20%	15
Remove permissive left turns by cars in heavily trafficked areas	10.57%	13
Other (please specify)	8.13%	10
Reduce number of driveways crossing a pedestrian path	6.50%	8
Total Respondents: 123		



Q10 Which of the following safety improvements would you support for bicycling in your community?

Answered: 112    Skipped: 25

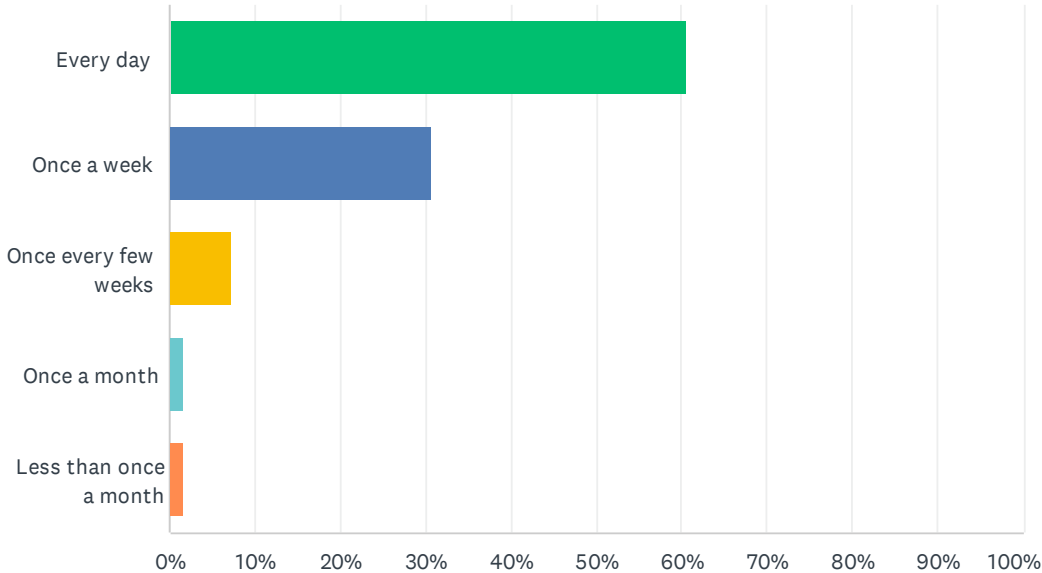


ANSWER CHOICES	RESPONSES	
Install bicycle lanes physically separated from cars	63.39%	71
Widen trails or shared use paths that do not meet industry-preferred width of 12'	45.54%	51
Install bicycle lanes separated from cars with a white stripe or two	28.57%	32
Install bicycle signals in urban, heavily ridden areas	27.68%	31
Update the statewide drivers manual with the meanings behind the various bike markings on the road	24.11%	27
Install more wayfinding signage so cyclists worry about traffic around them rather than their route	23.21%	26
Install sharrows to alert drivers that the road is also a marked bicycle route	19.64%	22
Install signage telling motorists to stay 3 feet away from bicyclists when passing	18.75%	21
Offer learn-to-ride program opportunities for children and adults	15.18%	17
Other (please specify)	13.39%	15
Reduce the speed limit on roads, particularly rural roads	11.61%	13
Total Respondents: 112		



Q11 How often do you travel in Downtown Noblesville?

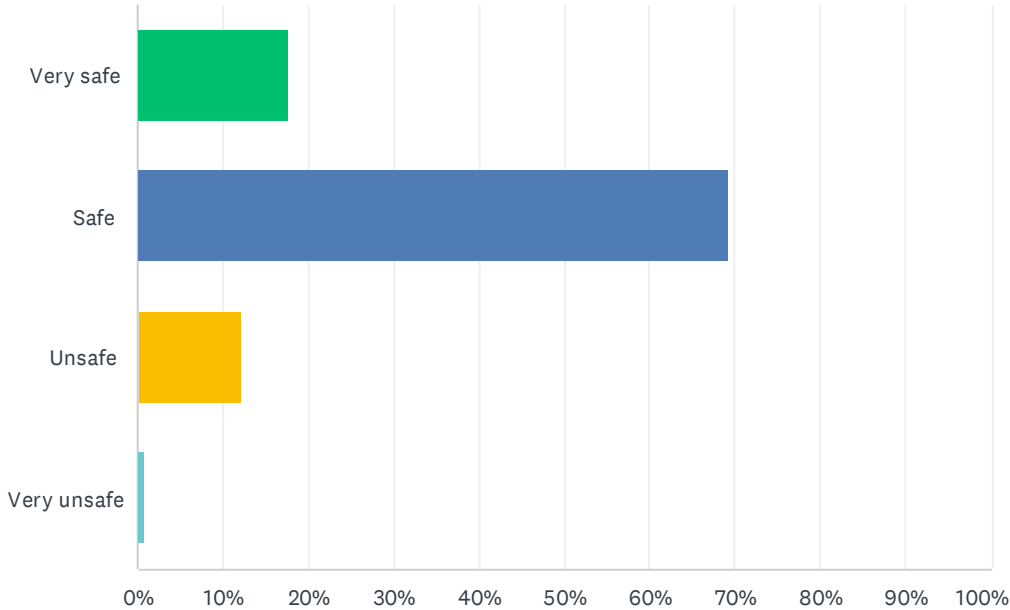
Answered: 124    Skipped: 13



ANSWER CHOICES	RESPONSES	
Every day	60.48%	75
Once a week	30.65%	38
Once every few weeks	7.26%	9
Once a month	1.61%	2
Less than once a month	1.61%	2
Total Respondents: 124		

Q12 How safe do you feel traveling in Downtown Noblesville?

Answered: 124    Skipped: 13

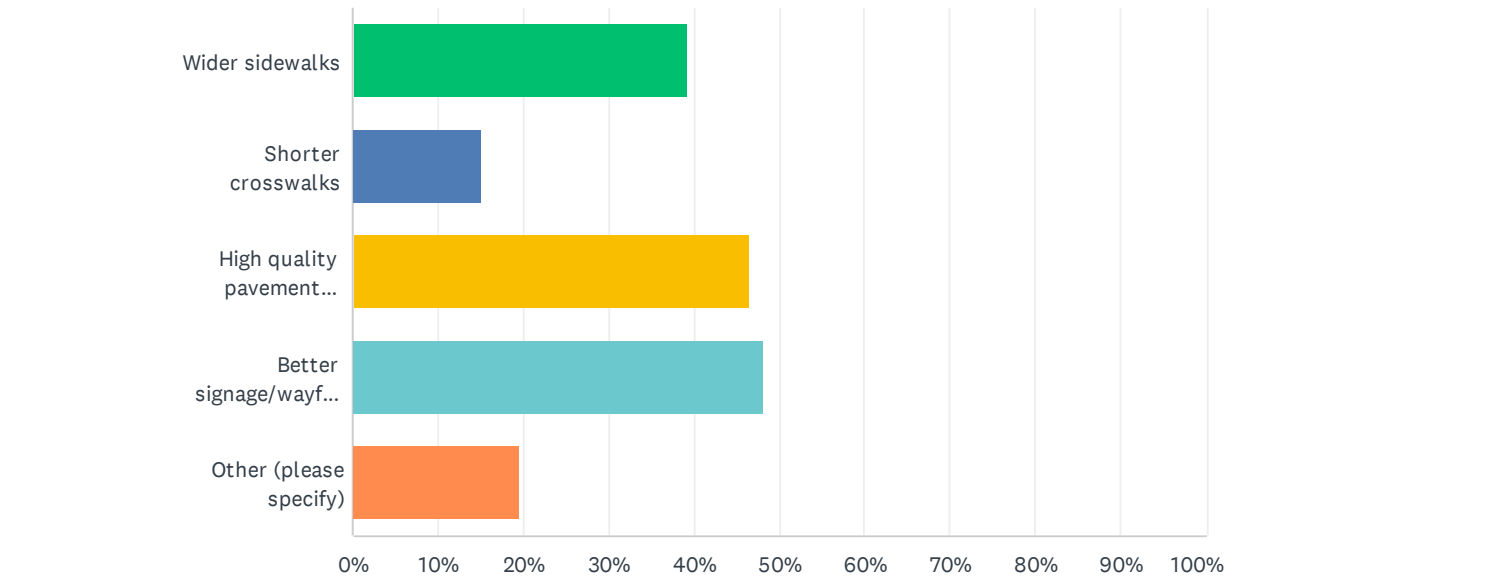


ANSWER CHOICES	RESPONSES	
Very safe	17.74%	22
Safe	69.35%	86
Unsafe	12.10%	15
Very unsafe	0.81%	1
TOTAL		124



Q13 Which of the following safety improvements would you support for Downtown Noblesville?

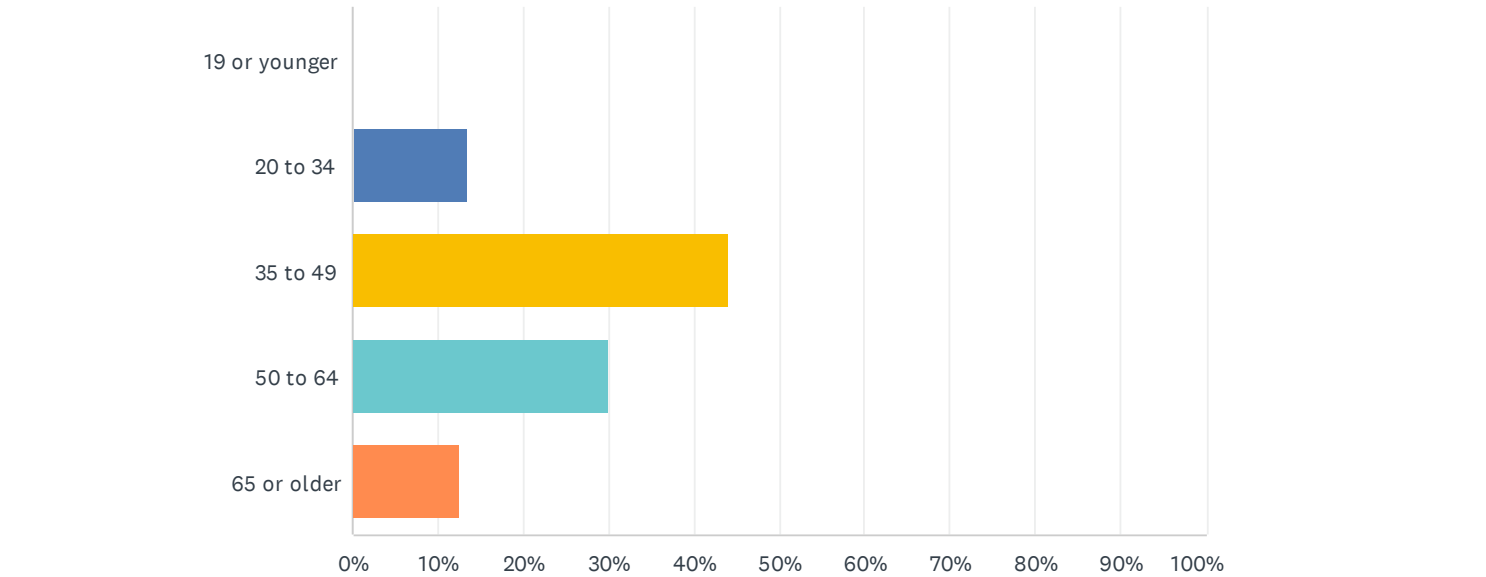
Answered: 112    Skipped: 25



ANSWER CHOICES	RESPONSES	
Wider sidewalks	39.29%	44
Shorter crosswalks	15.18%	17
High quality pavement striping	46.43%	52
Better signage/wayfinding	48.21%	54
Other (please specify)	19.64%	22
Total Respondents: 112		

Q14 How old are you?

Answered: 120    Skipped: 17

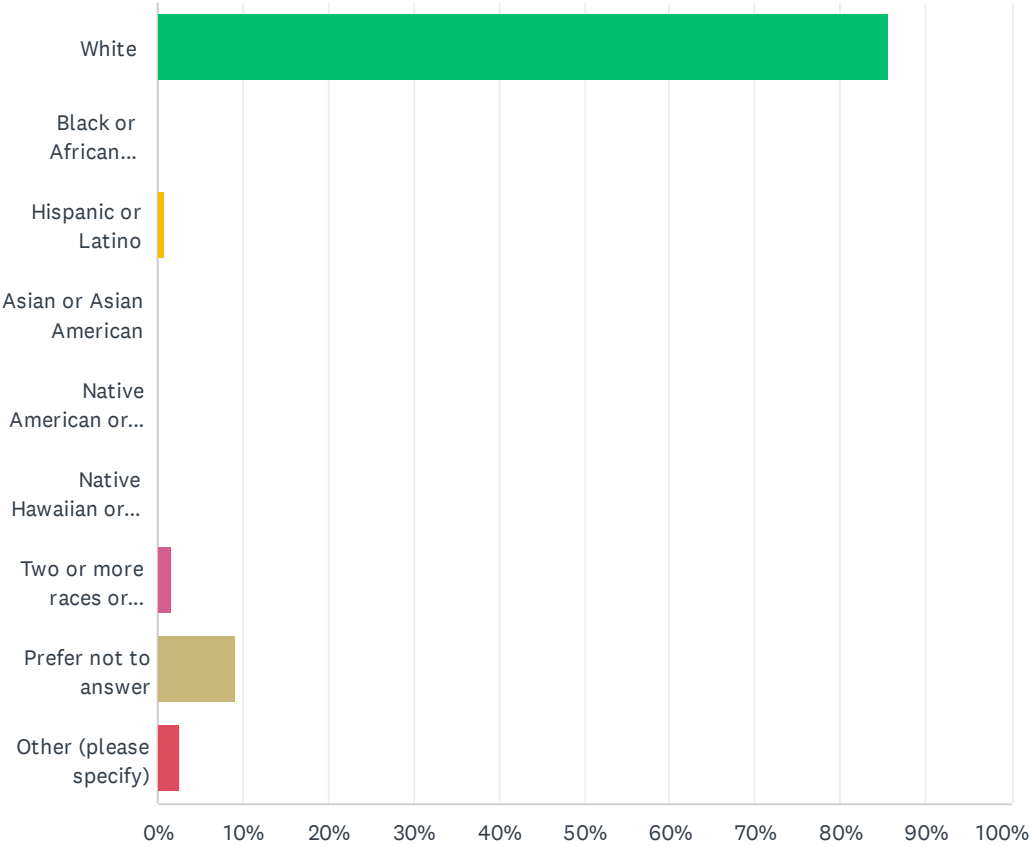


ANSWER CHOICES	RESPONSES	
19 or younger	0.00%	0
20 to 34	13.33%	16
35 to 49	44.17%	53
50 to 64	30.00%	36
65 or older	12.50%	15
TOTAL		120



Q15 What racial and ethnic identity best describes you?

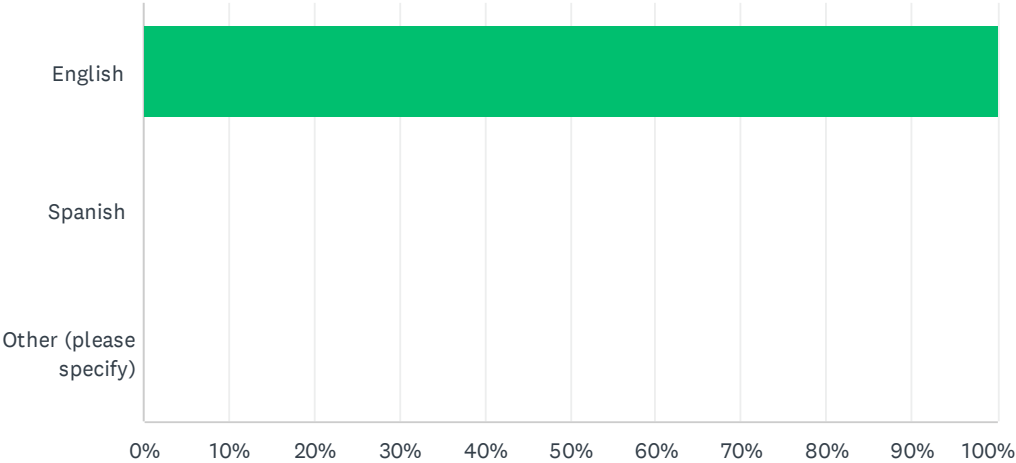
Answered: 119    Skipped: 18



ANSWER CHOICES	RESPONSES	
White	85.71%	102
Black or African American	0.00%	0
Hispanic or Latino	0.84%	1
Asian or Asian American	0.00%	0
Native American or Alaska Native	0.00%	0
Native Hawaiian or other Pacific Islander	0.00%	0
Two or more races or ethnicities	1.68%	2
Prefer not to answer	9.24%	11
Other (please specify)	2.52%	3
TOTAL		119

Q16 What is the primary language spoken in your home?

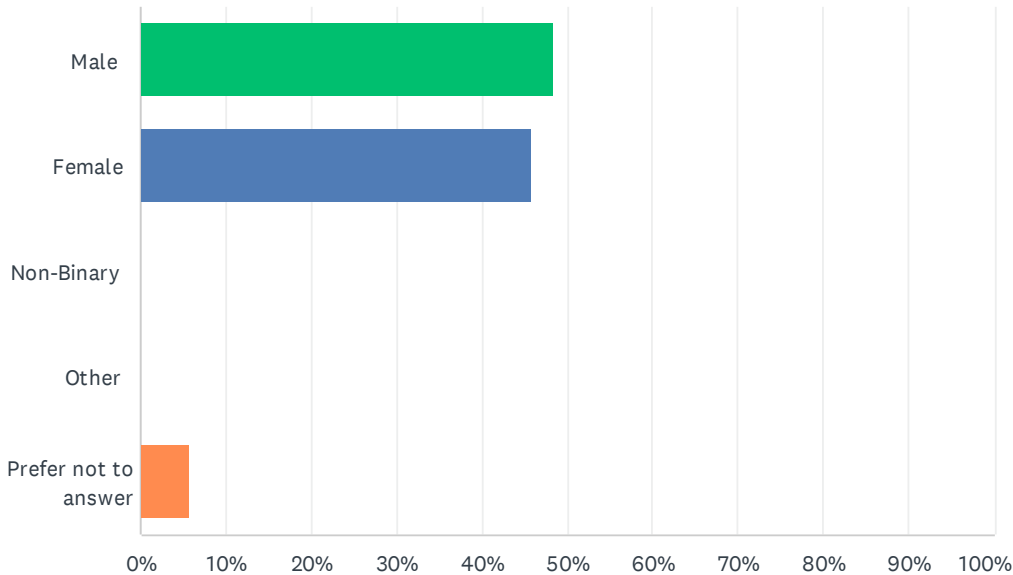
Answered: 120    Skipped: 17



ANSWER CHOICES	RESPONSES	
English	100.00%	120
Spanish	0.00%	0
Other (please specify)	0.00%	0
TOTAL		120

Q17 What is your gender identity?

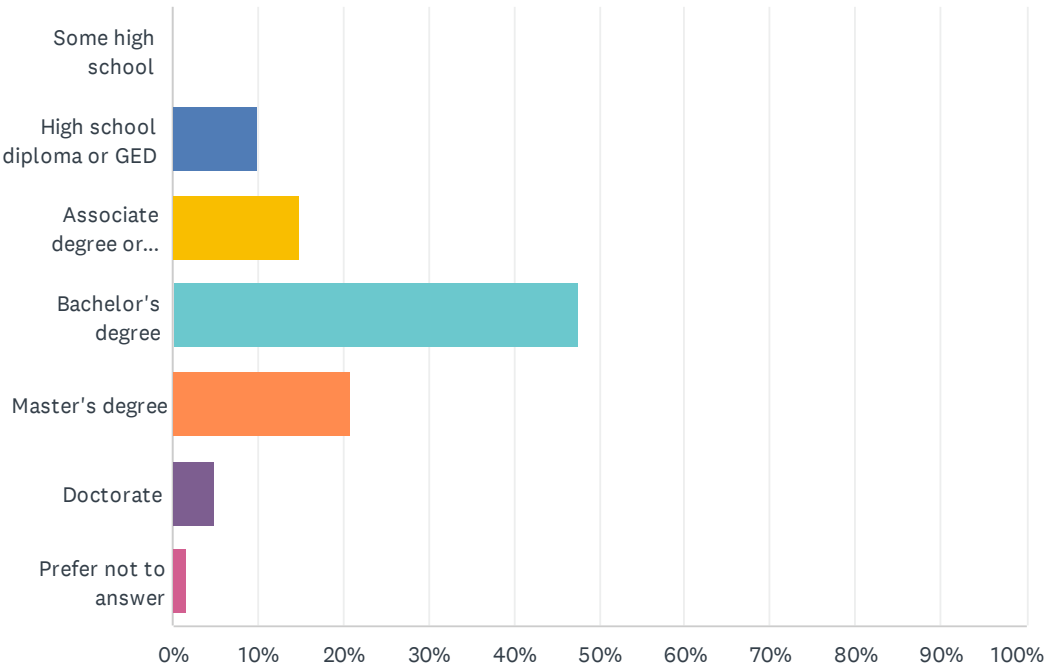
Answered: 120    Skipped: 17



ANSWER CHOICES	RESPONSES	
Male	48.33%	58
Female	45.83%	55
Non-Binary	0.00%	0
Other	0.00%	0
Prefer not to answer	5.83%	7
TOTAL		120

Q18 What is the last grade or level of education that you completed?

Answered: 120    Skipped: 17

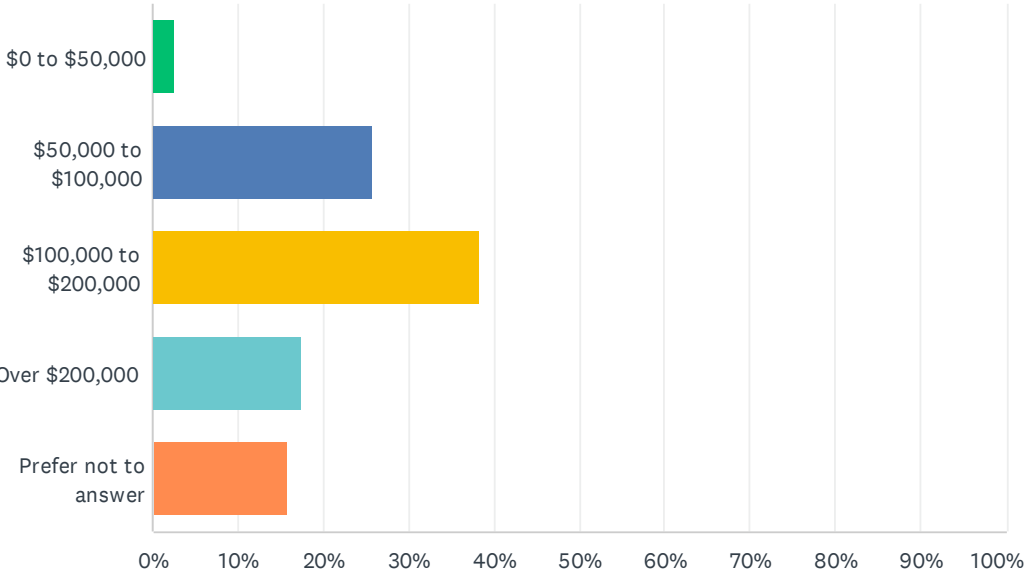


ANSWER CHOICES	RESPONSES	
Some high school	0.00%	0
High school diploma or GED	10.00%	12
Associate degree or training certificate	15.00%	18
Bachelor's degree	47.50%	57
Master's degree	20.83%	25
Doctorate	5.00%	6
Prefer not to answer	1.67%	2
TOTAL		120



Q19 What is your average annual household income (including all income earners in your household)?

Answered: 120   Skipped: 17



ANSWER CHOICES	RESPONSES	
\$0 to \$50,000	2.50%	3
\$50,000 to \$100,000	25.83%	31
\$100,000 to \$200,000	38.33%	46
Over \$200,000	17.50%	21
Prefer not to answer	15.83%	19
TOTAL		120

Q20 How many people age 16 or older live in your household?

Answered: 114   Skipped: 23

Q21 Who is filling out this survey? (Optional)

Answered: 60   Skipped: 77

ANSWER CHOICES	RESPONSES	
Name	66.67%	40
Company/Agency (if applicable)	3.33%	2
Resident of Noblesville (yes or no)	100.00%	60

Q22 Please provide your email address if you'd like to receive updates on plan progress and future events.

Answered: 33   Skipped: 104

Q23 Please use the space below to provide any additional comments to the project team.

Answered: 33   Skipped: 104





## Noblesville Safety Action Plan

### January 2024 Stakeholder Interview Summary

Compass Outreach Solutions and Lochmueller Group and hosted four stakeholder interviews to collect public input for the Noblesville Safety Action Plan (SAP). The short Microsoft Teams virtual meetings were scheduled Jan. 10-12, 2024, and used to help promote the public Open House the following week.

The participants listed below included members of and recommendations from the City of Noblesville Traffic Committee, which were selected to ensure that a wide range of roadway and transportation users were represented. A standard set of seven questions, shown in bold below, were used as discussion prompts to identify safety problems and explore potential improvements. A summary of responses is provided in bullet points below each question.

#### Participants

- Denise Aschleman, Principal Planner with the Noblesville Planning and Development Department
- Eric Cunningham, Deputy Chief of the Patrol Division with the Noblesville Police Department
- Lauren Guynn, Executive Director with the Shepherd's Center of Hamilton County
- Robert Herrington, Press Secretary for the Noblesville Mayor's Office
- Yolanda Kincaid, President/CEO of Janus Developmental Services
- Jason LeMaster, Hamilton County Health Department Administrator
- James Macky, Division Chief of Emergency Medical Services with the Noblesville Fire Department
- James Neal, Hamilton County Highway Engineer
- Sargeant Marley Pagel, Community Outreach with the Noblesville Police Department

#### How safe are the roadways in Noblesville for your agency/service/customers?

- Many interview participants separately said they felt roadways in Noblesville were generally safe. The Health Department and representatives of the city's mobility challenged users (Janus and Shepherd's Center) gave lower ratings for safety.
- Both police and fire departments were concerned with higher speed roads, such as State Road 37, 146<sup>th</sup> Street and more rural, open roads.
- The city planner and representatives of mobility challenged users noted pedestrian concerns crossing roundabouts. There was discussion of education and engineering solutions, including flashing lights when pedestrians are crossing.

#### How do your users feel about transportation safety?

- With a growing community, emergency responders and the Hamilton County Highway Engineer felt there are increasing congestion-related traffic problems.
- The Hamilton County Highway Engineer and the Shepherd's Center President/CEO said that downtown Noblesville is walkable, but there are less connected sidewalks and trails out of the central core.
- The Mayor's Press Secretary noted a safety conflict with non-motorized trail users and people wanting to use trails for motorized bikes and carts.

3502 Woodview Trace, Suite 150  
Indianapolis, Indiana 46268

PHONE: 317.222.3880 • TOLL FREE: 888.830.6977

## Small Group Stakeholder Interviews Summary





**How do underserved communities/disabled groups/senior groups feel about transportation safety?**

- The Hamilton County Highway Engineer observed mobility challenges for these groups outside of downtown Noblesville.
- Emergency responders agreed on the need to balance road improvements for vehicles with the needs of pedestrians.
- Both emergency responders and the city's planner suggested mid-block crossings as a way to address challenges in crossing roundabouts.
- The city planner said the grant funding did improve the narrow sidewalks for lower income and disabled residents of Noble Manor Apartments, north of SR 32/38 on Cumberland Road, but that drivers are parking on the new sidewalks.
- The Janus President/CEO supports clearing trees and bushes for sidewalk clearance, particularly low branches that would not be detected by blind users, and addressing uneven sidewalks for users who shuffle their feet. Signal timings should also be longer for pedestrians who move slower or have assistive devices.
- She also said there's a need to educate others about the space needed for accessible vans with lifts and to provide high-contrast signs, including replacement of sun-damaged signs.
- The Shepherd's Center Executive Director supports more consistency of roundabout design and signage, such as the advanced signage at the Southeastern Pkwy./136<sup>th</sup> Street/Olio Rd. signage showing elderly driver where each roundabout leg goes.

**Is speeding a safety issue for your service (customers or employees)?**

- Many interview participants separately agreed that redesigning the road with narrower lanes, etc. is effective in controlling speed although it is not low-cost.
- The public may submit speeding complaints through the police public input form or directly to the city's Traffic Committee, on which emergency response leaders serve. Complaints are reviewed and additional data collected as needed.
- Members of the Committee said that many speeding complaints are perception and not supported by speed data or observation.
- The Hamilton County Highway Engineer is concerned about artificially low speed limits, which he said breed a disrespect for all speed limits and create potential hazards with vehicles moving at different speeds.
- The Shepherd's Center Executive Director said that traffic enforcement is more visible and that speed limits seem more consistent across the line in Carmel. The Janus President/CEO agreed and advocated for more consistent speed limits in Noblesville.
- The Deputy Police Chief and Mayor's Press Secretary said that road projects increase safety on main roads when completed, but the construction creates ripple effects with complaints increase about drivers speeding through residential neighborhoods as an alternate route.

**How do safety concerns limit the way you use transportation?**

- Three participants said they avoid Campus Parkway near Hamilton Town Center. The Hamilton County Highway Department representative said it was due to out-of-town drivers and sudden lane changes. The Mayor's Press Secretary and city planner avoid the double-crossover diamond interchange at I-69.
- The Deputy Police Chief has witnessed crashes and uses extra caution when clearing South 10<sup>th</sup> Street intersections at Maple Avenue, Cherry Street and Hannibal Street. The city planner said she avoids turning from Maple Avenue onto 10<sup>th</sup> Street at certain times of day.
- The fire department is concerned about sideswiping cars on older, narrow streets during emergency runs.
- Emergency responders and the city planner said they avoid certain routes due to traffic flow more so than safety. The Mayor's Press Secretary said that Noblesville has enough alternate routes and back roads to assist with traffic flow.
- The Hamilton County Highway Engineer observed that it's hard to get drivers to change familiar routes, using the Keystone Ave. ramp to 146<sup>th</sup> Street as an example.

**What safety improvements would you support?**

- The Hamilton County Highway Department Engineer supports pedestrian improvements, including connecting lower-income housing to jobs, and observes Cumberland Pointe Apartment residents walking Cumberland Road to jobs near Lowe's.
- He and the Janus President/CEO identified a problem with pedestrians wearing dark clothing at dusk and night.
- The city planner supported closing gaps in the sidewalk and trail network and creating ways for pedestrians to cross SR 37.
- The Janus President/CEO supports the addition of passing "blisters" where left-turning traffic is waiting for a gap on two-lane roads.
- The EMS Division Chief is in favor of traffic signal preemption for emergency runs but says the systems are not fully reliable.
- Two interview participants noted an increase in school bus stop arm violations. The Community Outreach Sergeant suggested education of vehicle and school bus drivers.
- The Shepherd's Center Executive Director supports increased enforcement of speed limits and stop signs.

**Are there specific intersections or roadway segments that need safety improvements?**

- Government employees were aware of future improvements projects planned and felt that they would address the top safety concerns.
- The EMS Division Chief expressed visibility concerns at 8<sup>th</sup> Street and Maple Avenue and crash concerns with SR 37 at 186<sup>th</sup> Street outside the city limits. He also said that Pleasant Street drivers exiting recent roundabouts along 8<sup>th</sup> Street forget the stop sign at 9<sup>th</sup> Street.
- The Hamilton County Highway Engineer said that developing areas require ongoing monitoring. This includes areas near Promise Road north of SR 32, 166<sup>th</sup> Street and Boden Road, and 161<sup>st</sup> Street west of the White River. He said that routes for commercial vehicles is important, and is optimistic that Pleasant Street development will help.



- The Shepherd’s Center Executive Director supported interchanges with pedestrian crossings like those in Fishers, saying that low-income residents will run across SR 37 near the businesses.
- The Health Department Administrator said traffic moves fast on the access road that has no sidewalk behind Lowe’s and Best Buy, and the sidewalks for the new subdivision stop as their property line.
- The city planner supported improvements more for traffic than safety at SR 32 and Cumberland Road.
- Janus Developmental Services operates public transit service for the area and offered to have their professional drivers help flag safety concerns if authorities are interested following up on the reports.

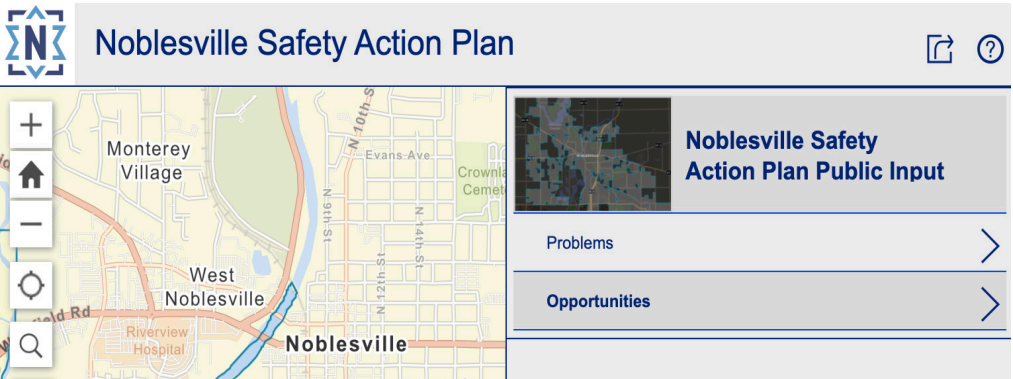


# SAFETY ACTION PLAN

## PUBLIC INPUT SURVEY AND ONLINE MAPPING TOOL

Noblesville was awarded a U.S. Department of Transportation Safe Streets and Roads For All (SS4A) grant in early 2023 to develop a Safety Action Plan.

This data-driven and community-involved plan will suggest projects and strategies to improve safety for all users of the City's transportation network. The Safety Action Plan will allow the City to apply for grants to help fund safety improvement projects.



The City of Noblesville is committed to reducing and eliminating traffic deaths and serious injuries.

Your valuable input will be heard by local leaders and used to develop the right strategies to improve roadway safety in Noblesville.



**SHARE YOUR THOUGHTS BY  
TAKING OUR SURVEY AND  
CONTRIBUTING TO THE  
PUBLIC INPUT ONLINE MAPPING TOOL**

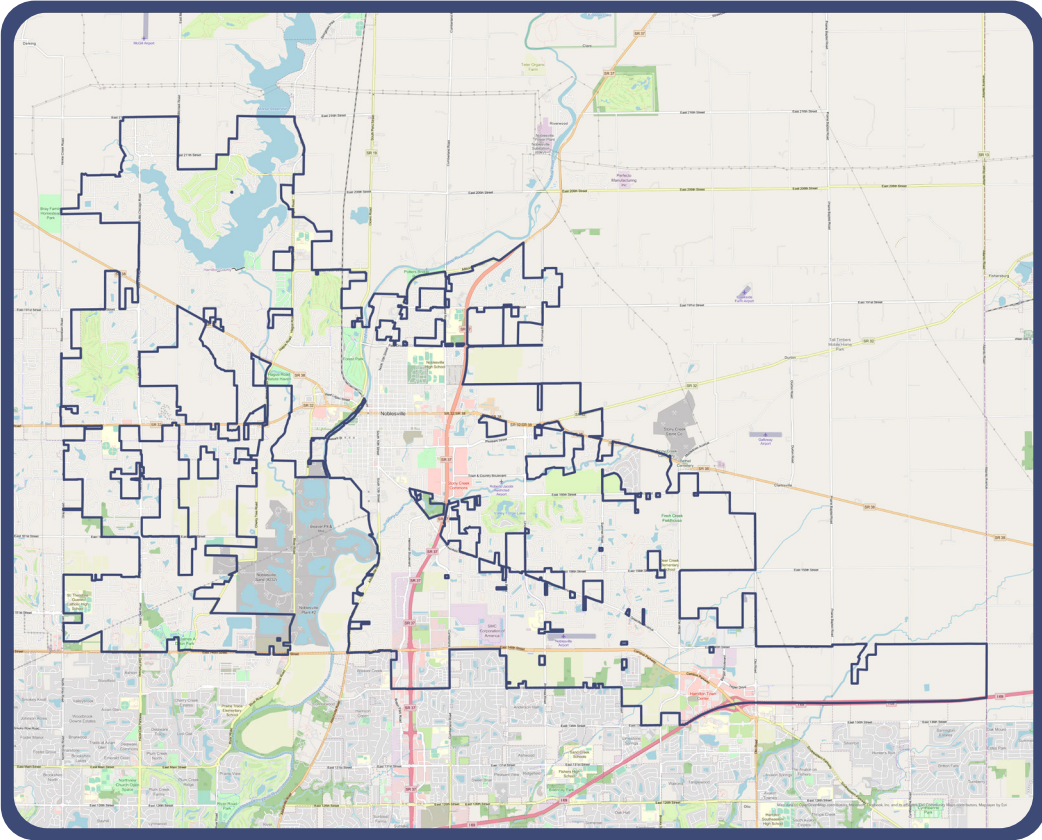
[WWW.SURVEYMONKEY.COM/R/YCSX67R](https://www.surveymonkey.com/r/YCSX67R)





Open House Poster Boards

SHARE YOUR THOUGHTS



Project Overview

The Safety Action Plan will be a comprehensive, data-informed, and community involved plan that will outline projects and strategies to improve safety within the City's multimodal transportation network. Noblesville is committed to reducing and eliminating traffic deaths and serious injuries and this plan will provide a framework for achieving this ambitious goal and allow the City to qualify for potential SS4A implementation grants to complete safety improvement projects.

What do we need to know?

Grab a sticky note and add your concerns you have or opportunities you see for roadway safety in Noblesville.

Please share your thoughts by taking our survey and contributing to the public input online mapping tool.



NOBLESVILLE SAFETY ACTION PLAN

The Project Team:  
The City of Noblesville selected a multidisciplinary consulting team led by Lochmueller Group to develop the Safety Action Plan.



# WELCOME!

### About The Project

The Noblesville Safety Action Plan is a comprehensive safety plan aimed at eliminating fatal and serious injury crashes. The Plan will combine an analysis of crash patterns with actionable strategies to make Noblesville streets safer, not just for motorists, but for all users including those who bike, walk, roll, or use public transportation. The Noblesville Safety Action Plan will meet all the requirements of the Safe Streets and Roads for All (SS4A) program and allow the City of apply for SS4A implementation grant funding for safety improvements.

### The Vision:

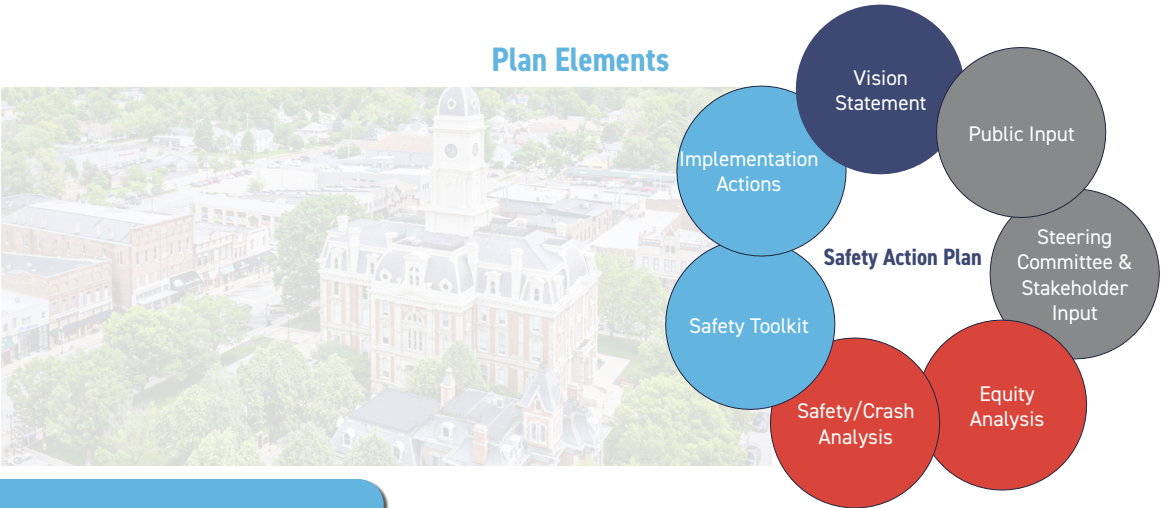
The City of Noblesville is home to residential neighborhoods of various sizes and characters as well as a thriving historic downtown including local restaurants, shopping, and art galleries. To ensure that Noblesville remains a great place to live, work, and play, every person must be safe as they travel in the City.

*Noblesville believes that traffic deaths are preventable and unacceptable and is committed to eliminating traffic deaths and serious injuries by 2050.* To make City streets safer for all, no matter age, ability, or community, Noblesville is dedicated to collaborating with all partners including residents, community stakeholders, local and regional governments, and state agencies. Zero is an ambitious goal, but together we can save lives and make Noblesville's streets safer for all.

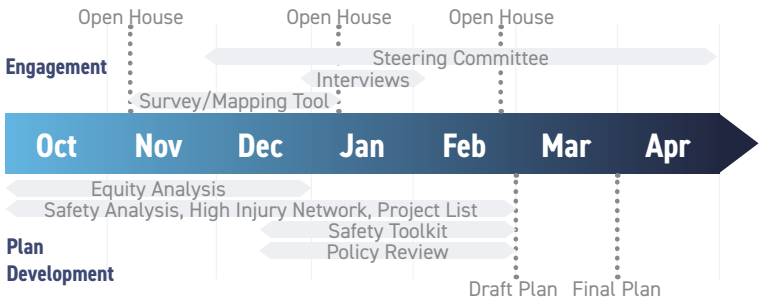


## NOBLESVILLE SAFETY ACTION PLAN

### Plan Elements



### Project Timeline



# SAFE STREETS & ROADS FOR ALL (SS4A)

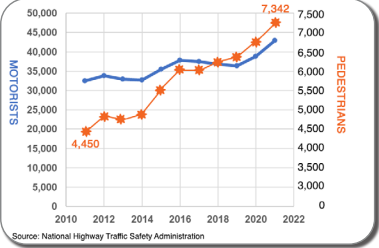
### Road Safety Trends

Traffic crashes are a leading cause of preventable death in the United States. According to the National Highway Traffic Safety Administration (NHTSA), 2021 saw nearly 43,000 traffic deaths across the nation, a 16-year high. Almost 43,000 people were again killed in traffic crashes in 2022. **Since 2020, notable increases include:**

- > **Fatalities on urban roads up 16%**
- > **Pedestrian fatalities up 13%**
- > **Bicycle fatalities up 5%**
- > **Speeding related fatalities up 5%**

In response to the alarming rise in traffic deaths, the Safe Streets and Roads for All (SS4A) grant program was established. The SS4A program has \$5 billion in appropriated funds over 5 years, 2022-2026, to fund initiatives to prevent roadway deaths and serious injuries.

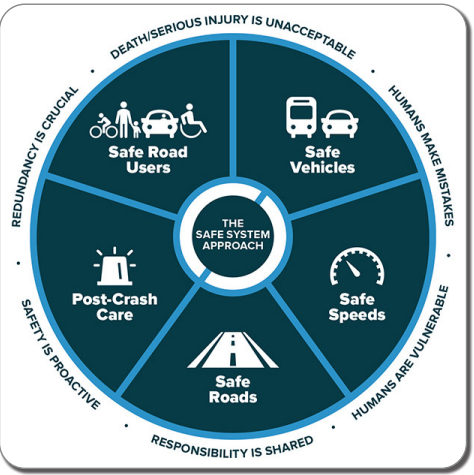
### Crash Fatalities by Year and Type



## NOBLESVILLE SAFETY ACTION PLAN

### Safe System Approach

In support of the U.S. Department of Transportation National Roadway Safety Strategy and the national goal of zero roadway deaths, a Safe System Approach has been adopted as the new guiding paradigm to address roadway safety. A Safe System Approach focuses on both human mistakes and human vulnerability and recommends a transportation system with redundancies built in to protect all users. A Safe System Approach is a holistic and human centered approach to roadway safety.



### Plan Requirements

- Commitment**
  - Public commitment to a goal of zero roadway fatalities and serious injuries
- Implementation**
  - Committee established to develop, implement, and monitor plan
- Analysis**
  - Existing and historic crash trends
  - Crash locations
  - Systemic and specific safety needs
  - Geospatial identification of higher risk locations
- Engagement**
  - Public and relevant stakeholders
  - Incorporation of information received
  - Inter- and intra-governmental cooperation and collaboration
- Equity**
  - Considerations of equity
  - Identification of underserved communities through data
  - Equity analysis of proposed projects and strategies
- Policy**
  - Assessment of current policies and plans
  - Implementation through adoption of revised or new policies, guidelines, and/or standards
- Comprehensive**
  - Comprehensive set of projects and strategies to address safety problems

- Accountability**
  - Measure progress over time
  - Plan posted publicly online



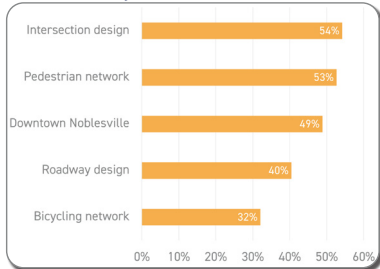
# ENGAGING THE COMMUNITY

## Public Outreach

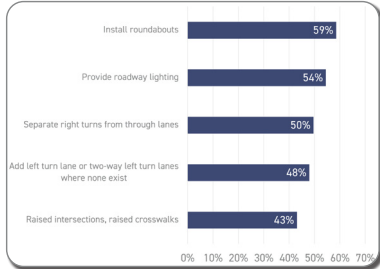
The goal of public outreach was to hear from residents about safety concerns, incorporate public input into the plan recommendations, and educate the public about effective safety improvement strategies. Public outreach efforts include open house events, a survey, and a public input mapping tool.

## Survey Results

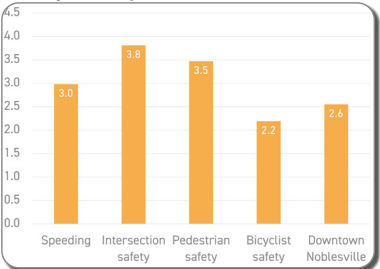
What topics would you like to see addressed in the Noblesville Safety Action Plan?



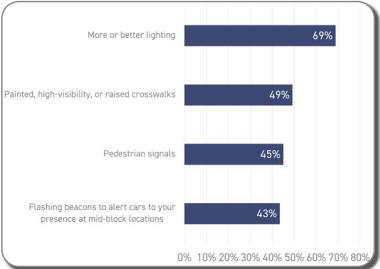
Which of the following safety improvements targeting drivers would you support in your community?



Rank the following safety issues in order of what's most important to you.



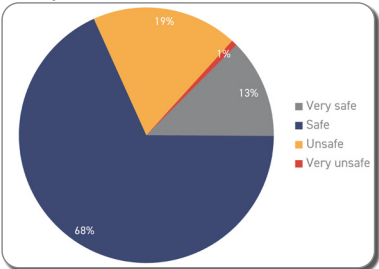
Which of the following safety improvements would you support for walking in your community?



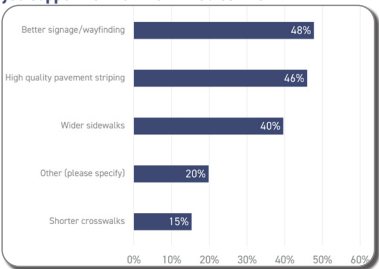
## Steering Committee

The Noblesville Safety Action Plan Steering Committee was established and tasked with assisting in the development, implementation, and monitoring of the plan in compliance with the SS4A Safety Action Plan requirements.

How safe do you feel traveling on or along the roadways in Noblesville?



Which of the following safety improvements would you support for Downtown Noblesville?



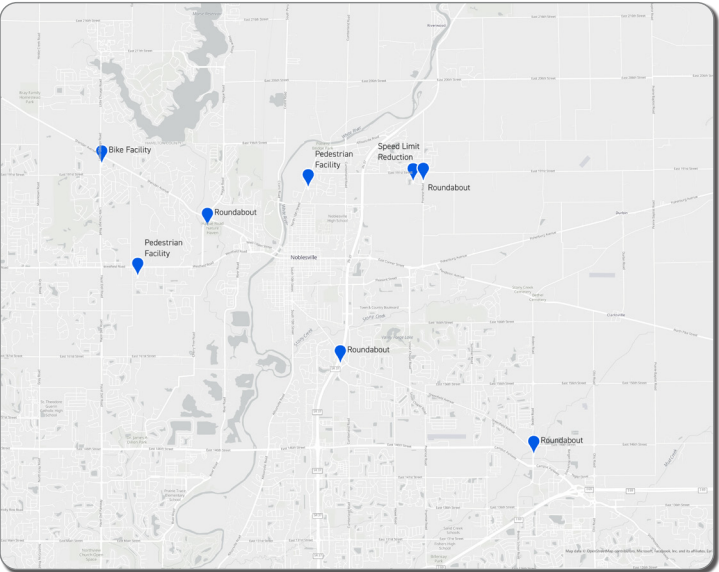
# ENGAGING THE COMMUNITY

## Public Input Mapping Tool

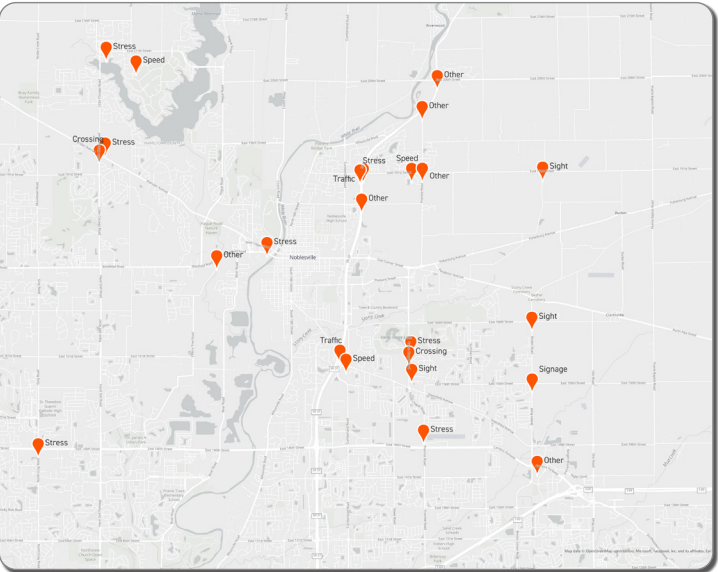
We asked for the public to provide locations on a map where they see any safety related problems or where they feel like there are opportunities to improve safety. Opportunities may include sidewalks, bike lanes, or roundabouts. Problems may include speeding, difficulty crossing the street, or uncomfortable conditions for pedestrians or bicyclists.

What do you think? Tell us if you have anything to add.

Public Input Map - Opportunities



Public Input Map - Problems



# NOBLESVILLE SAFETY ACTION PLAN



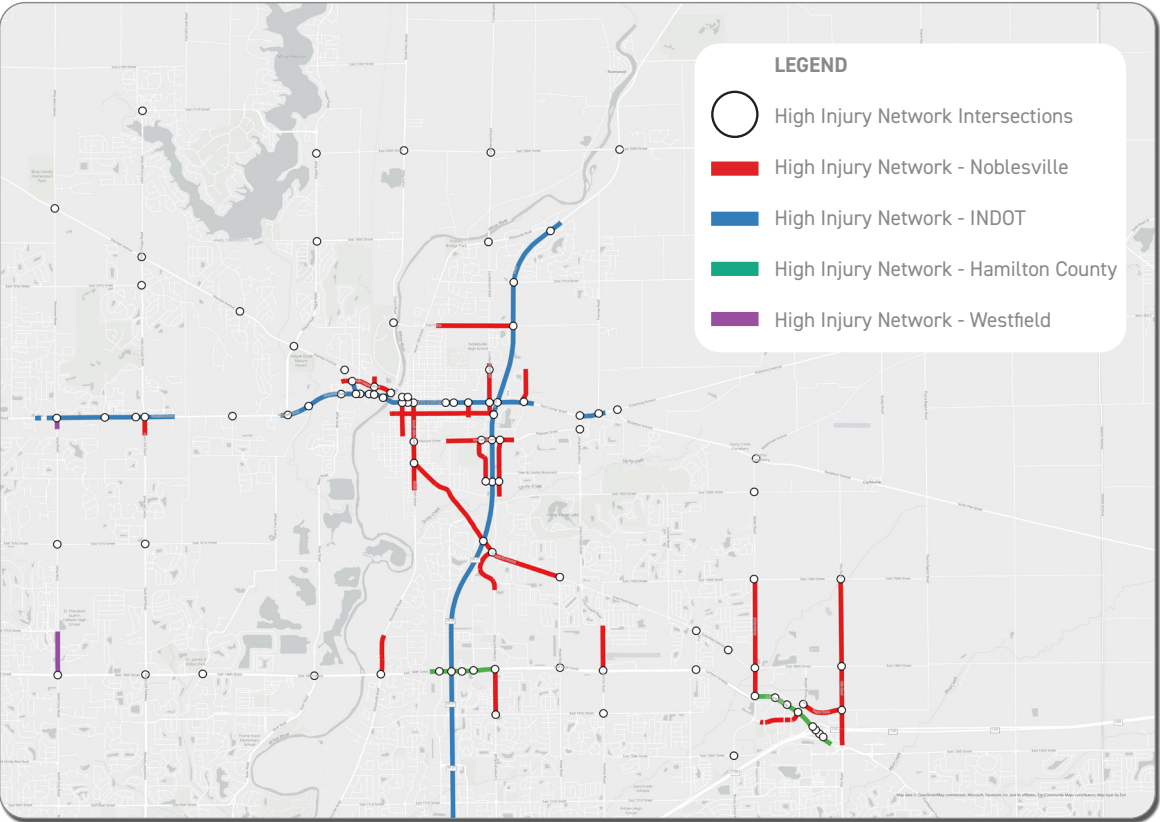
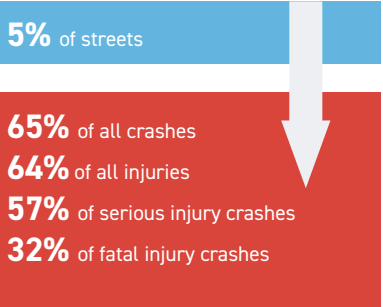
# NOBLESVILLE SAFETY ACTION PLAN

# HIGH INJURY NETWORK

A High Injury Network (HIN) represents the small number of roadways that experience the majority of fatal and serious injury crashes. The HIN will help decision makers prioritize safety improvements so that improvements can have the largest potential reduction of fatal and serious injury crashes.

The Noblesville High Injury Network identifies the majority of all serious injuries and a third of all fatal injuries on just 5% of the total street network.

Notable streets on the HIN include SR37, SR32, SR38, 146th Street, 10th Street, Pleasant Street, Cumberland Road, Boden Road, and Olivo Road.



## NOBLESVILLE SAFETY ACTION PLAN

# SHARE YOUR THOUGHTS

### How Would You Spend Your Money

Just like parks, streets, and other public facilities, safety improvements and programs must compete for limited resources. Communities must choose how to best use limited funding and staff resources to support the safety of all road users.

In this exercise, please vote for up to **three (3)** improvements or programs you'd like to see Noblesville pursue through this plan and subsequent implementation efforts. You can vote for a single improvement or program more than once.

*Note, some improvements are very expensive while others are more affordable. Please consider this as you make your selections.*

Sidewalks  
\$\$\$\$

Place stickers here

Lighting  
\$\$\$\$

Place stickers here

Pedestrian HAWK  
\$\$\$\$

Place stickers here

Separated Bike Lanes  
\$\$\$\$

Place stickers here

Roundabouts  
\$\$\$\$

Place stickers here

Pedestrian Bridge  
\$\$\$\$

Place stickers here

High Visibility Crosswalks  
\$\$\$\$

Place stickers here

Signage  
\$\$\$\$

Place stickers here

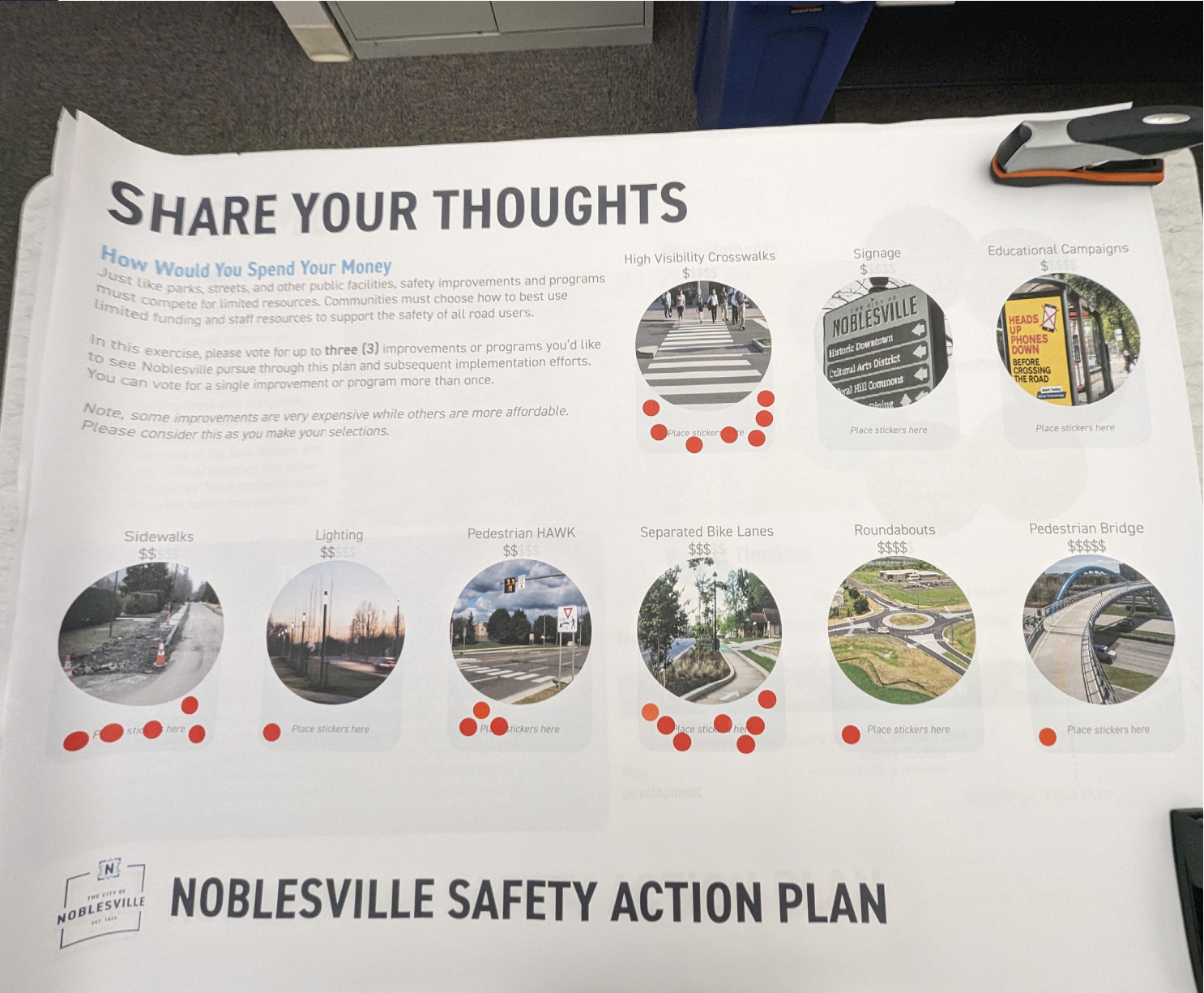
Educational Campaigns  
\$\$\$\$

Place stickers here



## NOBLESVILLE SAFETY ACTION PLAN





APPENDIX C  
Steering Committee



# Noblesville Safety Action Plan

Steering Committee Meeting #1  
December 8, 2023



## Agenda

- Introductions
- Safety Action Plan Background
- Steering Committee Roles & Responsibilities
- Plan Scope of Work
- Public engagement
- Recommendations



## The Team



Cheryl Sharp, PE, PTOE, AICP



Peter Williams, AICP, GISP



Erin Pipkin, APR



## Safety Oversight Committee (SOC)

- What does safety mean to you?
- What is a safe street?
- What modes of transportation do you use regularly? How safe do you feel?
  - Walking/running
  - Bicycle
  - Scooter

Organization Representative	Name
Engineering Department	Andrew Rodewald
Street Department	Patty Johnson
Police Department	Eric Cunningham
Police Department	Marley Pagel
Fire/EMS Department	James Macky
Fire/EMS Department	Uriah Eddingfield
IT; Public Safety	Jeff Hendricks
Mayor's Office	Robert Herrington
Planning Department	Denise Aschleman
Engineering Department	Sacha Lingerfeldt





# Safety Action Plan



# Comprehensive Safety Action

- 1. Are both of the following true?
  - Did a high-ranking official and/or governing body in the jurisdiction publicly commit to an eventual goal of zero roadway fatalities and serious injuries?
  - Did the commitment include either setting a target date to reach zero, OR setting one or more targets to achieve significant declines in roadway fatalities and serious injuries by a specific date?
- 2. To develop the Action Plan, was a committee, task force, implementation group, or similar body established and charged with the plan's development, implementation, and monitoring?
- 3. Does the Action Plan include all of the following?
  - Analysis of existing conditions and historical trends to baseline the level of crashes involving fatalities and serious injuries across a jurisdiction, locality, Tribe, or region;
  - Analysis of the location where there are crashes, the severity, as well as contributing factors and crash types;
  - Analysis of systemic and specific safety needs is also performed, as needed (e.g., high risk road features, specific safety needs of relevant road users, and;
  - A geospatial identification (geographic or locational data using maps) of higher risk locations.
- 4. Did the Action Plan development include all of the following activities?
  - Engagement with the public and relevant stakeholders, including the private sector and community groups;
  - Incorporation of information received from the engagement and collaboration into the plan; and
  - Coordination that included inter- and intra-governmental cooperation and collaboration, as appropriate.
- 5. Did the Action Plan development include all of the following?
  - Considerations of equity using inclusive and representative processes;
  - The identification of underserved communities through data; and
  - Equity analysis, in collaboration with appropriate partners, focused on initial equity impact assessments of the proposed projects and strategies, and population characteristics.
- 6. Are both of the following true?
  - The plan development included an assessment of current policies, plans, guidelines, and/or standards to identify opportunities to improve how processes prioritize safety; and
  - The plan discusses implementation through the adoption of revised or new policies, guidelines, and/or standards.
- 7. Does the plan identify a comprehensive set of projects and strategies to address the safety problems in the Action Plan, time ranges when projects and strategies will be deployed, and explain project prioritization criteria?
- 8. Does the plan include all of the following?
  - A description of how progress will be measured over time that includes, at a minimum, outcome data.
  - The plan is posted publicly online.
- 9. Was the plan finalized and/or last updated between 2018 and June 2023?



# Why Are We Here?

## Safe Streets and Roads for All (SS4A)

- Established in The Bipartisan Infrastructure Law (BIL)
- \$5 billion in appropriated funds over 5 years, 2022-2026
- Funds regional, local, and Tribal initiatives through grants to prevent roadway deaths and serious injuries

## Planning & Implementation

- Funds creation of safety action plans, or projects identified in qualifying safety action plans for implementation.

## SS4A Priorities

- Promote Safety
- Low-cost, high-impact strategies over wide geographic area
- Equitable investment, both urban and rural
- Evidence-based
- Demonstration public/private engagement
- Align with USDOT Strategic Goals (e.g. climate change, equity/Justice40)



# SOC Member Roles & Responsibilities

- 2. To develop the Action Plan, was a committee, task force, implementation group, or similar body established and charged with the plan's development, implementation, and monitoring?

## Expectations

- Participate in meetings and engaged discussion throughout the project
- Review materials
- Commit to membership and responsibilities

## Development

- Guidance
- Share knowledge
- Bring ideas
- Encourage others to get involved

## Implementation

- Leadership
- Action

## Monitoring

- Accountability
- Credibility
- Track progress and celebrate success



# Scope of Work



## Vision Statement

The City of Noblesville is home to a **thriving historic downtown** including local restaurants, shopping, and art galleries, as well as charming residential neighborhoods.

To ensure that Noblesville remains a great place to live, work, and play, every person must be safe as they travel in the City.

**Noblesville believes that traffic deaths are preventable and unacceptable and is committed to eliminating traffic deaths and serious injuries by 2040.**

To make City streets safer for all, no matter age, ability, or community, Noblesville is dedicated to collaborating with all partners including residents, community stakeholders, local and regional governments, and state agencies. **Zero is an ambitious goal, but together we can save lives and make Noblesville's streets safer for all.**



## Technical Work

### Crash Analysis

- Analyze the records to determine prevailing crash types, crash severity patterns, and other key determining factors influencing crash severity such as road users (motorists vs. pedestrians), urban vs. rural geography, and vehicle type.
- Crash Dashboard

### High Injury Network

- Prioritize locations for future safety improvements to achieve the largest impact and reduction in fatal and series injury crashes

### Equity

- Develop locally focused Equitable Target Areas (ETAs) and utilize USDOT's Equitable Transportation Community (ETC) Explorer Tool to explore insights of individual indicators of transportation disadvantage

### Safety Toolkit

- List and describe potential countermeasures (proven safety countermeasures)
- Typical applications
- General Costs
- Effectiveness (crash modification factors)



## Public Engagement

### Public Survey

- Assess current attitudes & opinions related to roadway safety for all users
- Review list of draft questions

### Public Input Mapping Tool

- Locations for safety problems and opportunities
- Help inform project list and potential safety countermeasures

### Stakeholder Interviews

- Emergency responders
- School transportation
- Street department
- Health department
- Mayor's office
- Bicycle/Pedestrian advocates
- Neighborhood groups
- Disabilities and elderly

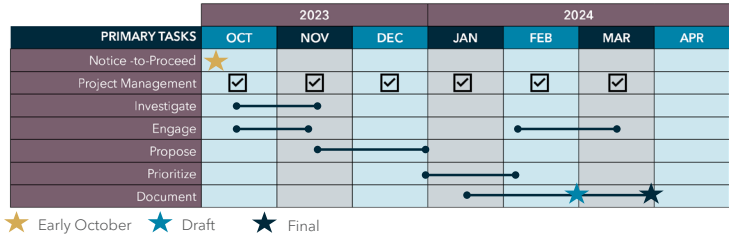
### Community Open Houses

- #1 in November (complete)
- Plan Information
- Input on key issues
- #2 in January
- Crash analysis & high injury network
- Input on policy/programmatic recommendations
- #3 in February
- Findings and recommendations

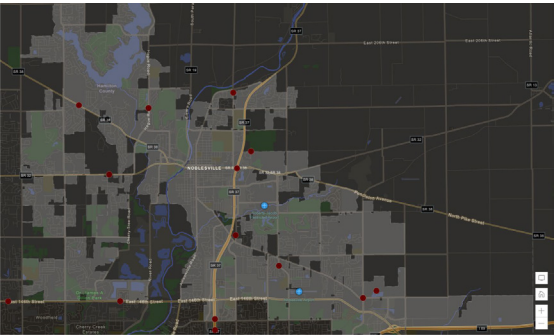




# Schedule



# Project Progress

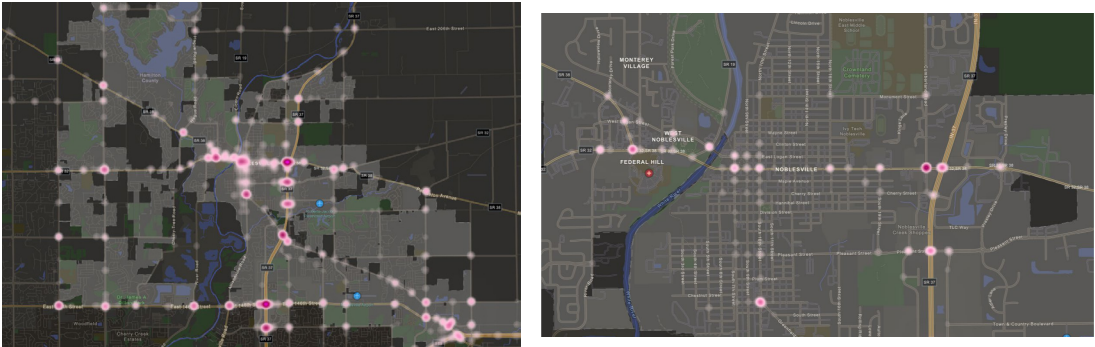


Fatal Crashes

2018-2022  
• 15 people killed



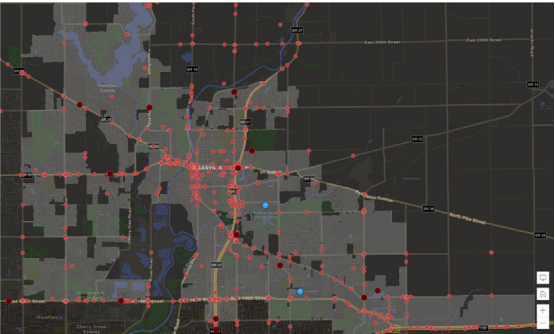
# Project Progress



Noblesville Crash Heatmaps



# Project Progress



KSI Crashes

2017-2022  
• 15 people killed  
• 647 KSI (killed or seriously injured) crashes



Project Progress



Crash Dashboard



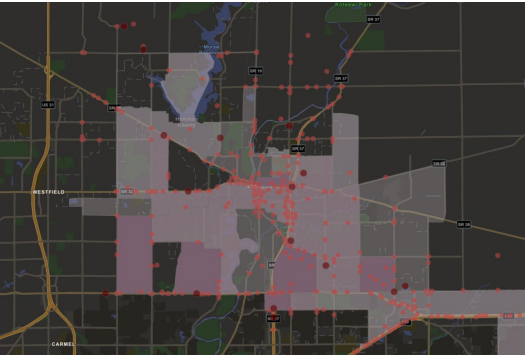
Plan Recommendations



Project Progress

Equitable Target Areas

- Income
- Race
- Limited English Proficiency



KSI Crashes & Equity



Plan Recommendations

- Comprehensive Safety Action Plan Goal
- Zero roadway fatalities and serious injuries



Comprehensive Project List

- Prioritized
- Proven safety countermeasures

List of Policies

- Complete Streets
- Fatal Crash Review
- Project selection

List of Programs

- Safety education/awareness
- Key marketing strategies
- Safety for all road users





# Next Steps

- Steering Committee Meetings
  - January
    - Next meeting (#2)
  - February/March
    - Meeting #3
- Open House #2
  - January
  - Engagement results
  - HIN
- Open House #3
  - February
  - Project list
  - Policies & programs
- Draft Plan
  - March



# Thank You

Feel free to reach out with any questions.



# Noblesville Safety Action Plan

Steering Committee Meeting #2  
January 11, 2023



# Agenda

- Vision Statement
- Public Engagement Results
- High Injury Network
- Open House
- Next Steps



# SOC Member Roles & Responsibilities

2 To develop the Action Plan, was a committee, task force, implementation group, or similar body established and charged with the plan's development, implementation, and monitoring?

- Expectations
- Participate in meetings and engaged discussion throughout the project
  - Review materials
  - Commit to membership and responsibilities

- Development
- Guidance
  - Share knowledge
  - Bring ideas
  - Encourage others to get involved
- Implementation
- Leadership
  - Action
- Monitoring
- Accountability
  - Credibility
  - Track progress and celebrate success



# Vision Statement

The City of Noblesville is home to **residential neighborhoods of various sizes and characters** as well as a thriving historic downtown including local restaurants, shopping, and art galleries.

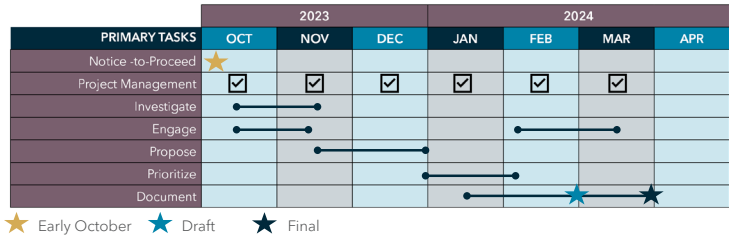
To ensure that Noblesville remains a great place to live, work, and play, every person must be safe as they travel in the City.

Noblesville believes that traffic deaths are preventable and unacceptable and is **committed to eliminating traffic deaths and serious injuries by 2050.**

To make City streets safer for all, no matter age, ability, or community, Noblesville is dedicated to collaborating with all partners including residents, community stakeholders, local and regional governments, and state agencies. Zero is an ambitious goal, but together we can save lives and make Noblesville’s streets safer for all.



# Schedule



# Public Engagement

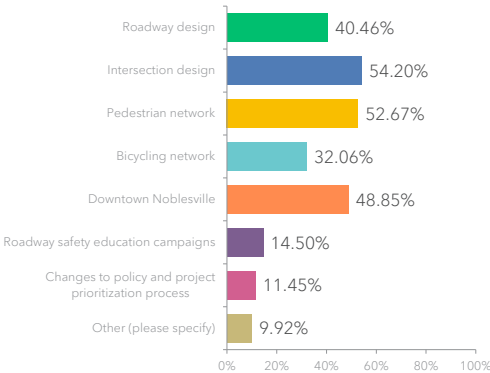
- Small group stakeholder interviews ongoing
- 136 survey responses
- 29 map entries
- Open house #2
  - January 18, 2024





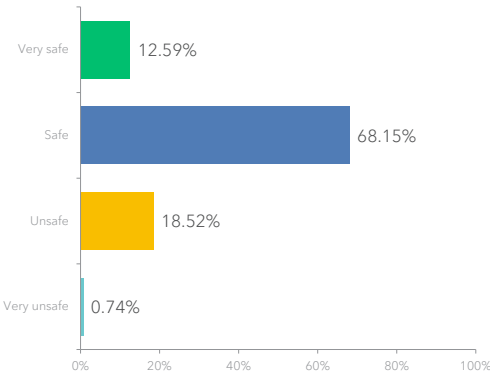
# Survey Results

What topics would you like to see addressed in the Noblesville Safety Action Plan?



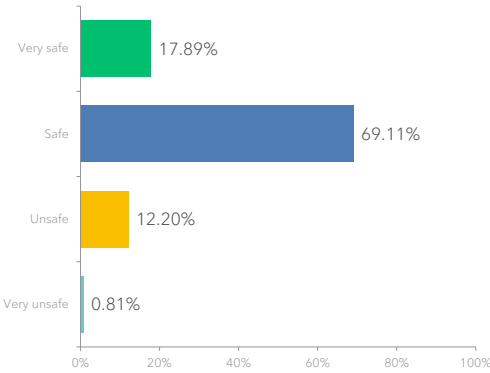
# Survey Results

How safe do you feel traveling on or along the roadways in Noblesville?



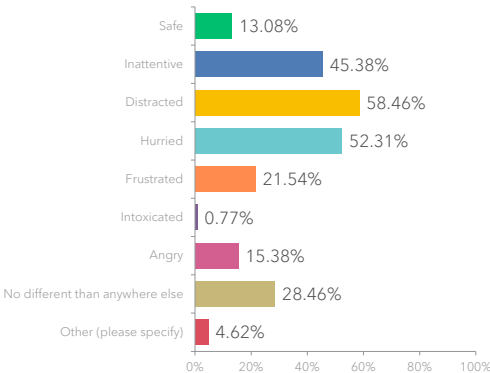
# Survey Results

How safe do you feel traveling in Downtown Noblesville?



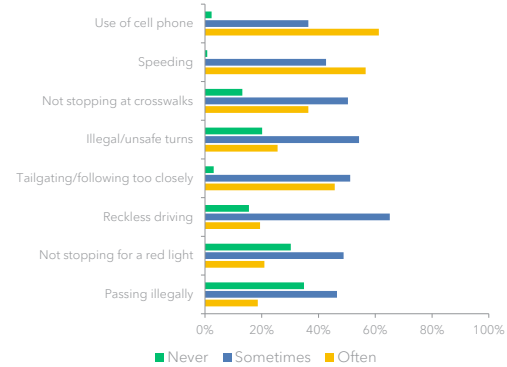
# Survey Results

What words best describe the behavior of drivers on streets in Noblesville?



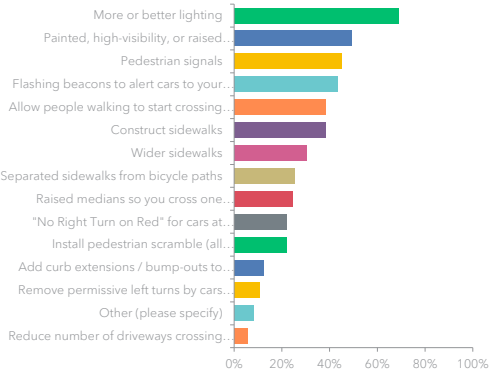
# Survey Results

How often do you observe the following?



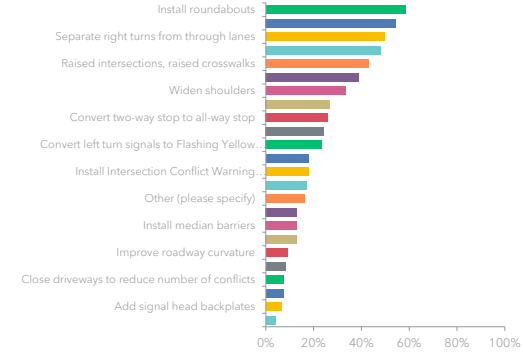
# Survey Results

Which of the following safety improvements would you support for walking in your community?



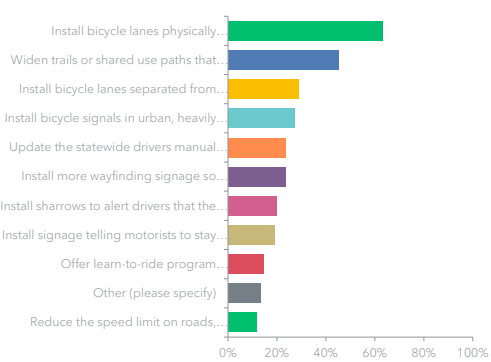
# Survey Results

Which of the following safety improvements targeting drivers would you support in your community?



# Survey Results

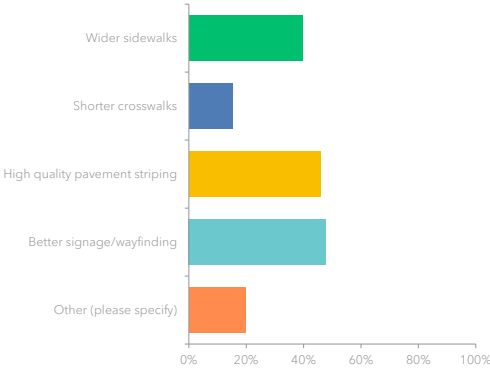
Which of the following safety improvements would you support for bicycling in your community?



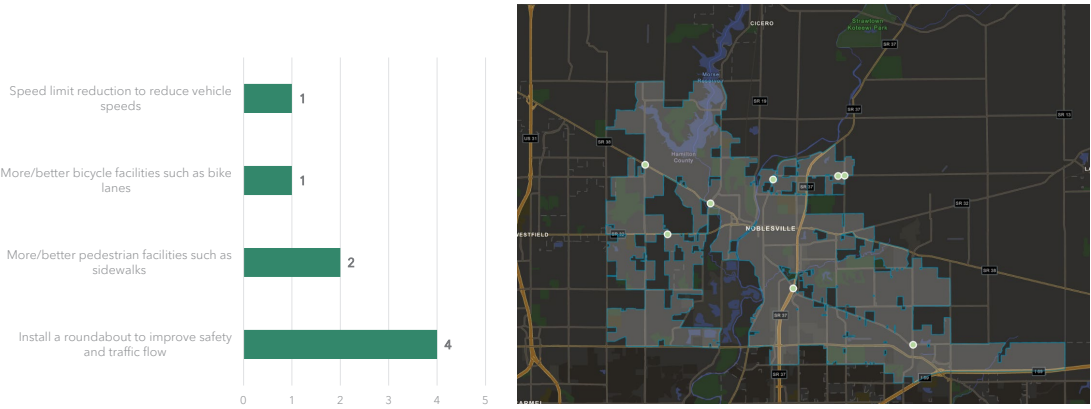


# Survey Results

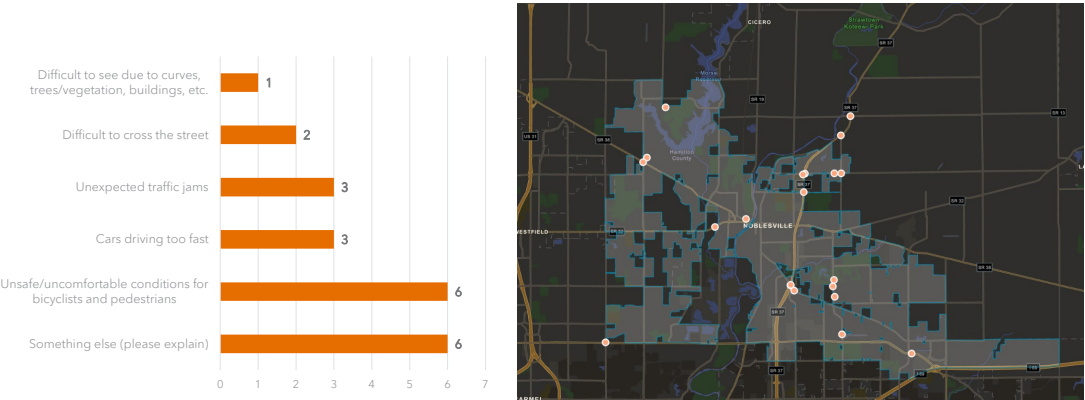
Which of the following safety improvements would you support for **Downtown Noblesville**?



# Public Input Mapping Tool Results

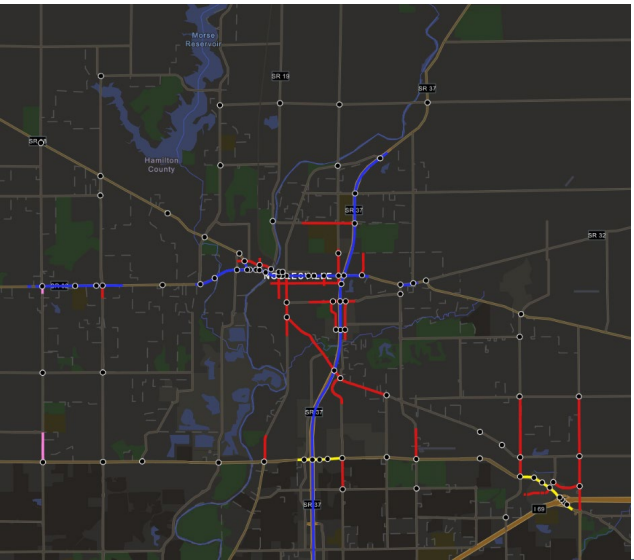


# Public Input Mapping Tool Results

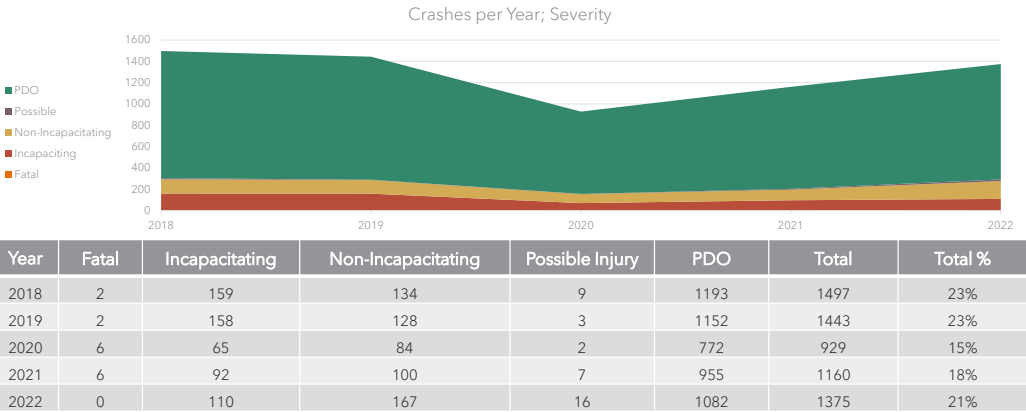


# High Injury Network

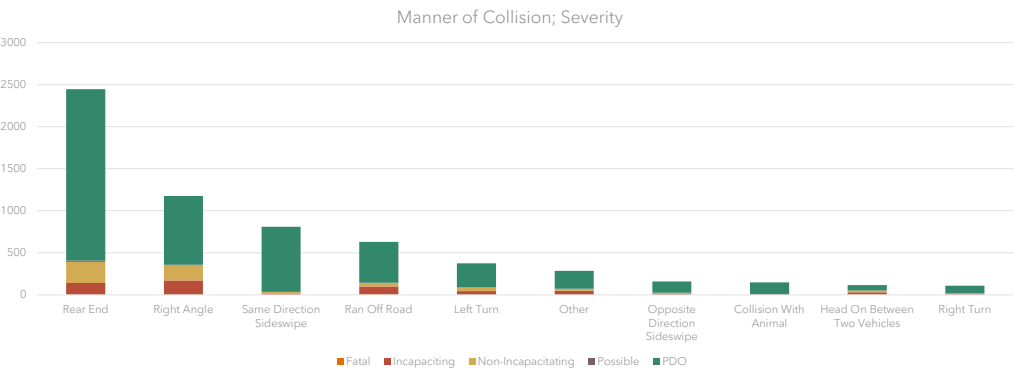
- 32 miles of roadway (5% of total roadway mileage)
- 97 intersections (3.5% of all intersections)
  - 65% of all crashes
  - 57% of incapacitating injury crashes
  - 64% of all people injured
  - 32% of fatal crashes



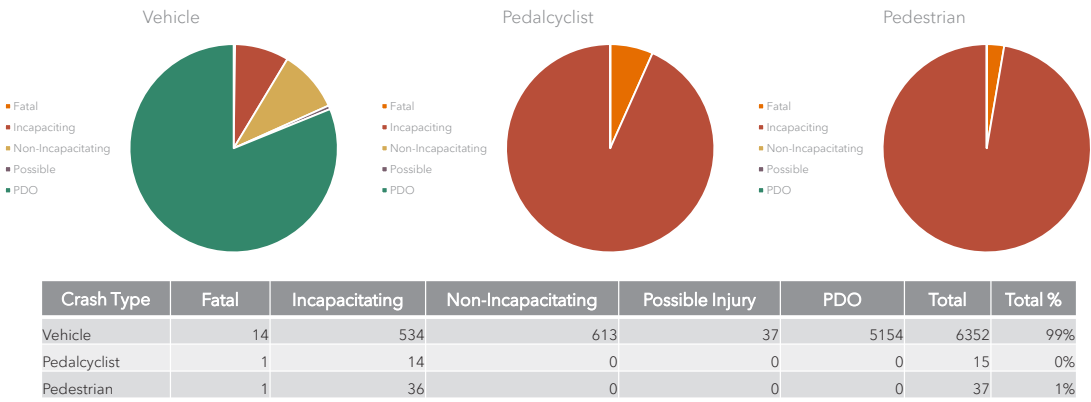
# Crash Analysis



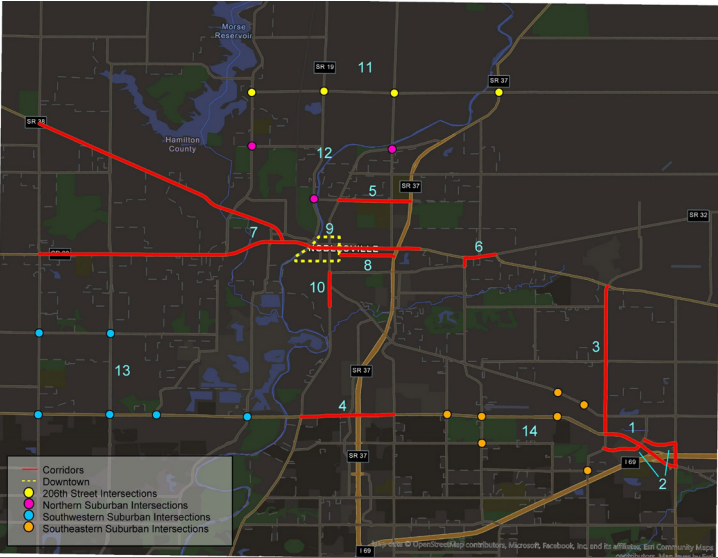
# Crash Analysis



# Crash Analysis

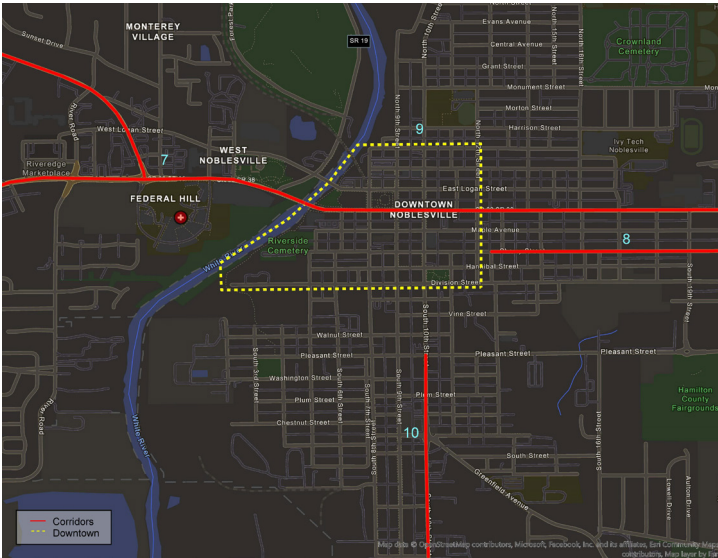


# High Injury Network Groupings





# High Injury Network Groupings



# Next Steps

- Steering Committee Meetings
  - February/March
    - Meeting #3
- Open House #3
  - February 28 or 29
  - Project list
  - Policies & programs
- Draft Plan
  - March



# Open House #2

When?

- January 18, 2024
- 5pm – 7:30pm

Where?

- Noblesville City Hall
- A213-214

• Materials

- SS4A background
- Project information
- Survey & Input Mapping Tool results
- High Injury Network
- Seeking input:
  - Types of safety improvements



# Thank You

Feel free to reach out with any questions.



# APPENDIX D

## Equity





## Equity Analysis

A safe and equitable transportation system expands access to opportunities for all Noblesville residents and helps to reduce the disparate economic, environmental, and health burdens experienced by disadvantaged and under-served communities. Historically disadvantaged populations such as people of color, people living in poverty, and people with limited English proficiency not only rely on alternative modes of transportation such as walking, biking, and transit, but may live in areas with limited or poor transportation infrastructure that contributes to unsafe travel conditions. Noblesville is committed to an equitable distribution of safety improvements so that all residents of all abilities can feel safe when traveling.

The local equity index is a composite index of demographic indicators where higher index values indicate higher concentrations of key equity demographics.

## Demographic Indicators

Three demographic indicators were used to identify disadvantaged populations and develop the equity index (shown in Table 1). For each demographic indicator, block group level data was used from the U.S. Census Bureau 2017-2021 American Community Survey (ACS) 5-year estimates.

**TABLE 1: DEMOGRAPHIC INDICATORS**

Demographic Indicator	Description	ACS Table ID
<i>People of Color</i>	Percent of total population reported as non-white.	ACSDT5Y2021.B02001
<i>Poverty</i>	Percent of households with income in the past 12 months below poverty level.	ACSDT5Y2021.B17017
<i>Limited English Proficiency</i>	Percent of households reported as limited English speaking.	ACSDT5Y2021.C16002

## Equity Index

The equity index is comprised of all three demographic indicators with equal weighting. The equity index is the sum of the three demographic indicators within each block group. While the demographic indicators capture the geographic distribution and concentration of individual groups, the equity index represents the general extent to which an area is comprised of disadvantaged groups of people.

## Climate and Economic Justice Screening Tool

To confront and address decades of underinvestment, the Justice40 Initiative, established by the Biden-Harris Administration, made it a goal that 40% of benefits of certain Federal investments flow to disadvantaged communities. The USDOT's SS4A program is covered by the Justice40 Initiative, and eligible safety action plans are required to consider the equity of projects and strategies. The Climate and Economic Justice Screening Tool (CEJST) is an interactive mapping tool that is used to identify disadvantaged communities. Disadvantaged communities are those that meet or exceed the threshold for one or more environmental, climate, or other burdens. The CEJST identifies one Census tract in Noblesville that is considered disadvantaged (18057110700).

## Equity Target Areas

To determine the equity target areas (ETAs) based on the equity index score, the equity index score was reclassified by quantile class. This method classified the equity index score by 20<sup>th</sup> percentile bins. The 80<sup>th</sup> percentile bin, top 20% of equity index scores, were combined with the CEJST disadvantaged communities to establish ETAs. ETAs are identified communities to target and prioritize safety improvements to improve equitable outcomes throughout the City.

Source: U.S. Census Bureau, 2017-2021 American Community Survey 5-Year Estimates [ACSDT5Y2021.B02001; ACSDT5Y2021.B17017; ACSDT5Y2021.C16002]									
Block Group ID	HH_total	HH_poverty	*Percent HH Poverty	Pop_total	Pop_nonwhite	*Percent Pop Nonwhite	LEP_total	*Percent HH LEP	Equity Index
180571107003	214	10	4.67%	444	17	3.83%	0	0.00%	8.50%
180571107002	488	49	10.04%	1333	106	7.95%	0	0.00%	17.99%
180571105092	571	43	7.53%	1323	65	4.91%	0	0.00%	12.44%
180571105111	807	54	6.69%	2512	159	6.33%	0	0.00%	13.02%
180571105091	574	0	0.00%	1561	182	11.66%	0	0.00%	11.66%
180571106002	523	120	22.94%	1184	98	8.28%	8	1.53%	32.75%
180571107001	474	54	11.39%	1144	200	17.48%	0	0.00%	28.87%
180571105112	574	8	1.39%	1632	23	1.41%	0	0.00%	2.80%
180571108183	717	0	0.00%	2114	305	14.43%	0	0.00%	14.43%
180571108143	1027	13	1.27%	2255	333	14.77%	0	0.00%	16.03%
180571105181	586	0	0.00%	1735	85	4.90%	0	0.00%	4.90%
180571105172	826	50	6.05%	2430	521	21.44%	0	0.00%	27.49%
180571105141	948	0	0.00%	2800	322	11.50%	0	0.00%	11.50%
180571105122	1141	59	5.17%	2567	41	1.60%	0	0.00%	6.77%
180571105093	403	31	7.69%	1183	112	9.47%	0	0.00%	17.16%
180571105113	497	0	0.00%	1373	0	0.00%	0	0.00%	0.00%
180571105142	604	0	0.00%	1502	96	6.39%	32	5.30%	11.69%
180571105054	1228	38	3.09%	3770	54	1.43%	0	0.00%	4.53%
180571105052	288	0	0.00%	1017	129	12.68%	0	0.00%	12.68%
180571105053	632	9	1.42%	2165	95	4.39%	2	0.32%	6.13%
180571105182	1088	28	2.57%	3076	461	14.99%	0	0.00%	17.56%
180571105162	996	85	8.53%	2618	150	5.73%	0	0.00%	14.26%
180571105133	1723	57	3.31%	4681	1238	26.45%	0	0.00%	29.76%
180571101013	890	0	0.00%	2664	182	6.83%	26	2.92%	9.75%
180571105173	916	0	0.00%	3071	209	6.81%	0	0.00%	6.81%
180571105161	1037	0	0.00%	2939	103	3.50%	39	3.76%	7.27%
180571101011	689	175	25.40%	1816	482	26.54%	0	0.00%	51.94%
180571101012	1404	147	10.47%	4161	931	22.37%	0	0.00%	32.84%
180571105151	682	98	14.37%	1618	501	30.96%	0	0.00%	45.33%
180571108171	599	0	0.00%	2084	672	32.25%	0	0.00%	32.25%
180571105094	452	8	1.77%	1169	0	0.00%	0	0.00%	1.77%
180571105171	649	156	24.04%	1841	89	4.83%	47	7.24%	36.11%
180571108202	712	13	1.83%	1395	596	42.72%	108	15.17%	59.72%
180571105131	1219	0	0.00%	3504	560	15.98%	158	12.96%	28.94%
180571105132	947	30	3.17%	2058	606	29.45%	213	22.49%	55.11%
180571106001	681	23	3.38%	1748	103	5.89%	0	0.00%	9.27%
180571106003	515	24	4.66%	1503	165	10.98%	2	0.39%	16.03%
180571105121	808	56	6.93%	2125	147	6.92%	0	0.00%	13.85%

APPENDIX E

High Injury Network





## High Injury Network

The identification of the high injury network (HIN) is a critical step in a successful safety action plan. The HIN represents those elements of the network (streets/roads and intersections), that are observed to have relatively high crash frequencies and/or higher rates of fatal and serious injury crashes. The HIN is used to identify and prioritize locations for safety improvements. This technical memorandum details the process by which the HIN was developed.

## Data

### Crash Records

Crashes from 2018 – 2022 were used in the analysis. Crash data was obtained from multiple sources:

- IMPO
- City of Noblesville
- ARIES

IMPO data included all fatal and incapacitating crashes and all bicycle and pedestrian crashes. IMPO staff cleaned and spatially located these crash records. City of Noblesville data included all crash reports taken by Noblesville Police Department. Noblesville staff cleaned and spatially located these crash records. For all remaining crash records, ARIES was used. ARIES data included crash reports taken by enforcement agencies other than Noblesville PD (i.e. Indiana State Police or Hamilton County Sheriff) with injury classifications other than fatal and incapacitating. Spatial and non-spatial methods were used to identify and remove duplicate crash records.

### Roadway Network

Roadway network data was sourced from INDOT. Roadway network layers for functional classification and lanes were dynamically segmented. The result of the dynamic segmentation was a roadway network layer segmented with a change in functional classification, number of lanes, lane width, or divided lanes.

### Intersections

Intersection data was sourced from Open Street Maps (OSM). The OSM intersections were filtered to remove segment endpoints. Noblesville intersection data was used to assign intersection type to all intersections (roundabout, signalized, unsignalized). Roundabout intersections were manually adjusted to the center of the roundabout.

## Safety Index

To develop the HIN, Lochmueller Group created a safety index score for each roadway segment and intersection. The safety index score evaluated each segment and intersection by the observed crash history. The safety index score represents a data-driven metric for overall roadway safety.

The safety index score relies on two input statistics:

1. **Crash Frequency:** the number of crashes per year (and per mile for segments) that occur along a segment or at an intersection.
2. **Equivalent Property Damage Only (EPDO) Weighted Frequency:** number of crashes per year (and per mile for segments) that occur along a segment or at an intersection where crashes are weighted according to their cost.

The input statistics captured both the number of crashes and the relative severity of crashes occurring at locations. Both input statistics were calculated by aggregating crashes along segments (within 100 feet) and at intersections (within 100 feet). Input statistics for intersections did not include length.

The formula for Crash Frequency is shown below:

$$\text{Crash Frequency} = \frac{\text{Total Number of Crashes}}{5 (\text{years}) \times \text{Length of Segment}}$$

To calculate EPDO Weighted Frequency, severity weight factors are required. Weight factors are based on the crash cost for each level of severity. The crash cost weights for the EPDO weighted frequency statistic were gathered from the FHWA Safety Program “Crash Costs for Highway Safety Analysis”. The monetary crash costs and the severity weight factors are shown in Table 1.

**TABLE 1: INDIANA CRASH COSTS AND SEVERITY WEIGHT FACTORS**

Crash Severity	Cost	Severity Weight Factor
(K) Fatal Injury	\$373,000	59.21
(A) Incapacitating Injury	\$373,000	59.21
(B) Non-incapacitating Injury	\$35,200	5.59
(C) Possible Injury	\$35,200	5.59
(O) No Injury/Property Damage Only	\$6,300	1.00

Using the severity weight factors, the formula for EPDO Weighted Frequency is shown below:

$$\text{EPDO Weighted Frequency} = \frac{(K \text{ crashes} \times K_s) + (A \text{ crashes} \times A_s) + (B \text{ crashes} \times B_s) + (C \text{ crashes} \times C_s) + (O \text{ crashes} \times O_s)}{5 (\text{years}) \times \text{Length of Segment}}$$

Where:

s = severity weight factor

Statistics for both segments and intersections were calculated by the same formula but with length being removed from the intersection calculations. Once both input statistics were generated, they were standardized. Standardization accomplished two main goals: it allows the data to be aggregated on a common scale and it mitigates the influence of outliers. For this analysis, the robust standardization

method was applied because of its effectiveness at mitigating the influence of outliers. After both input statistics were standardized, they were aggregated to create the safety index score. The safety index score should be used in comparison to other scores in the network where higher safety index scores mean more crashes, but it should not be interpreted on its own as a standalone value.

The formula for the safety index is shown below:

$$Safety\ Index = X_f + X_w$$

Where:

X = the standardized value

f = Crash Frequency

w = EPDO Weighted Frequency

To determine the HIN based on the safety index score, the safety index score was reclassified by quantile class. This method classified the safety index score by 20<sup>th</sup> percentile bins. The 80<sup>th</sup> percentile bin, top 20% of safety index scores, was identified as the HIN. The final HIN was cleaned to remove any remaining outliers or gaps.

# APPENDIX F

## Maps

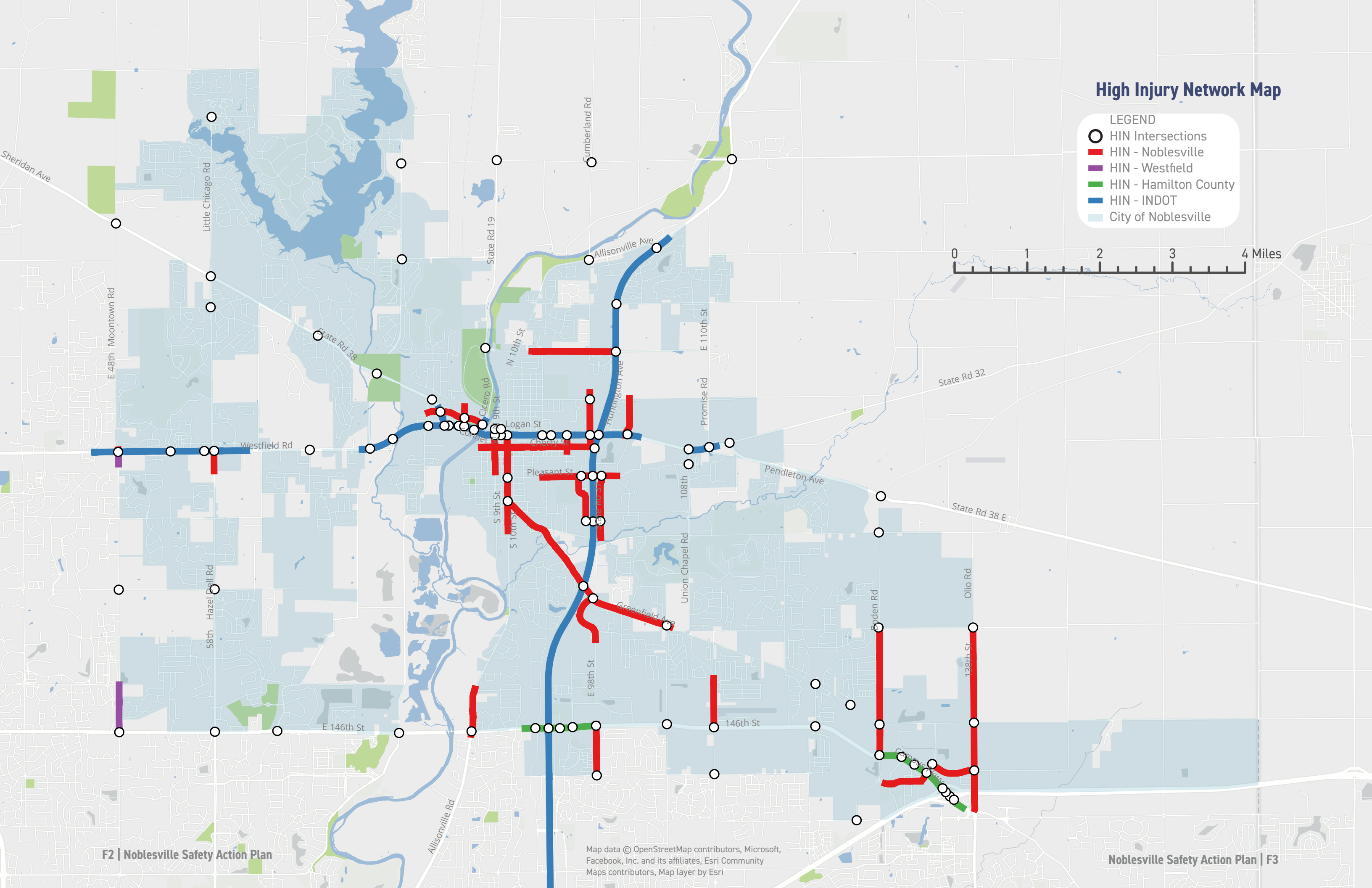




## High Injury Network Map

- LEGEND
- HIN Intersections
  - HIN - Noblesville
  - HIN - Westfield
  - HIN - Hamilton County
  - HIN - INDOT
  - City of Noblesville

0 1 2 3 4 Miles



CEJST Disadvantaged Community and Equity Index Map

LEGEND

- CEJST Disadvantaged Community
- Lower Equity Index
- Higher Equity Index

