FDOT

BASIC TRAFFIC SAFETY ACADEMY DESK REFERENCE

MAY 2024

TARGET ZERO
FATALITIES & SERIOUS INJURIES

Our Values

One FDOT.
We are one agency, one team.

Integrity.
We always do what is right.

Respect.
We value diversity, talent, and ideas.

Commitment.
We do what we say we are going to do.

Trust.
We are open and fair.

Customer Driven.
We listen to our customers.

Our Mission

The Department will provide a safe transportation system that ensures the mobility of people and goods, enhances economic prosperity, and preserves the quality of our environment and communities.

Our Vision

As one FDOT team, we serve the people of Florida by providing a transportation network that is well planned, supports economic growth, and has the goal of being congestion and fatality free.

Our Compass

INTRODUCTION TO THE SAFETY ACADEMY DESK REFERENCE

This guide was created by the Florida Department of Transportation (FDOT) to be used by all FDOT employees, especially those new to the department's Safe System Approach. The sections throughout this guidebook will help provide the initial startup for your projects that will align with processes to reduce serious injuries and fatalities, especially for vulnerable road users. The following areas are addressed through the guidebook:

- **The principles and elements of the Safe System Approach**
- **Steps for conducting a Safety Field Review**
- **Crash data processes and resources**
- **How to select Countermeasures**
- **Additional resources such as other guidebooks and manuals utilized by FDOT to help improve consistency with vital decision-making processes toward implementing roadway projects**

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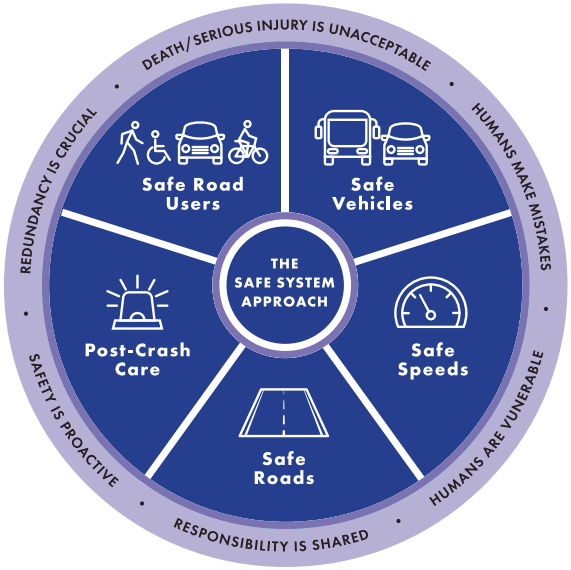
THE SAFE SYSTEM APPROACH

Imagine a world where nobody dies from vehicle crashes.

The Safe System Approach aims to eliminate fatal and serious injuries for all road users through a holistic view of the road system that anticipates human mistakes and keeps impact energy on the human body at tolerable levels. Safety is an ethical imperative of the designers and owners of the transportation system.



SAFE SYSTEM PRINCIPLES

Death and serious injury is unacceptable.

While no crashes are desirable, the Safe System Approach prioritizes crashes that result in death and serious injuries.

Humans make mistakes.

Transportation systems can be designed and operated to accommodate human errors and injury tolerances, as well as avoid death and serious injuries.

Humans are vulnerable.

It is critical to design and operate a transportation system that is human-centric and accommodates human vulnerabilities.

Responsibility is shared.

All stakeholders (transportation system users and managers, vehicle manufacturers, etc.) must ensure that crashes do not lead to death or serious injuries.

Safety is proactive.

Use proactive tools to identify and mitigate latent risks in the transportation system, rather than waiting for crashes to occur and reacting afterwards.

Redundancy is crucial.

Reducing risks requires that all the parts of the transportation system are strengthened, so that if one part fails, the other parts still protect people.

FIVE ELEMENTS OF A SAFE SYSTEM

We are committed to zero deaths, and a Safe System Approach is how we will get there. It requires holistically addressing the following elements to promote safety across the entire transportation system:

1. Safe road users.

Address the safety of all road users, including those who walk, bicycle, drive, ride transit, and travel by other modes.

2. Safe vehicles.

Design and regulate vehicles to minimize the occurrence and severity of collisions using safety measures that incorporate the latest technology.

3. Safe speeds.

Reduce speed to accommodate human injury tolerances by reducing impact forces, improving visibility, and providing additional time for drivers to stop.

4. Safe roads.

Design roads to accommodate human mistakes and injury tolerances, including physically separating people traveling at different speeds, providing dedicated times for different users to move through a space, and alerting users to hazards and other road users.

5. Post-crash care.

Prioritize helping those injured in a collision with emergency first responders who can quickly locate, stabilize, and transport them to medical facilities, as well as forensic analysis at the crash site, traffic incident management, and other activities.

The differences between the Safe System Approach and traditional road safety practices are outlined in Table 1.

Table 1. The Safe System Approach vs. Traditional Road Safety Practices

Traditional	Safe System
Prevent crashes	**Prevent deaths and serious injuries**
Improve human behavior	**Design for human mistakes/limitations**
Control speeding	**Reduce system kinetic energy**
Individuals are responsible	**Share responsibility**
React based on crash history	**Proactively identify and address risks**

We all share a role in implementing the Safe System Approach. It requires shifting how we think about transportation safety and how we prioritize our transportation investments. Consider applying a Safe System lens to upcoming projects and plans in your community by putting safety at the forefront and designing to accommodate human mistakes and injury tolerances.

Visit *safety.fhwa.dot.gov/zerodeaths* to learn more.

SAFETY FIELD REVIEW

Safety Field Reviews seek to identify safety concerns before a final design or study is completed. They involve a mix of data analysis and fieldwork and are generally performed by the internal design team.

SAFETY FIELD REVIEW PROCESS

The typical steps in a Safety Field Review include:

STEP ONE: COLLECT DATA

Collect data for the location prior to the field visit, including existing land use data, future developments, and transit service data.

In this step, review the following:

- Information from FDOT's Safety needs list dashboard
- Relevant work program data for the last five years and for the next five years
- Context classification information
- Historical annual average daily traffic (AADT)
- Peak hour turning movement counts (if available)
- Pedestrian/bicycle volume data (if available)
- Timing plans for traffic signals if there are signalized intersections in the project area
- Supplemental crash data is needed if other priority safety initiatives exist within half a mile of the project location
- Investigate and include any studies performed in the field review area
- As-builts if they are relevant

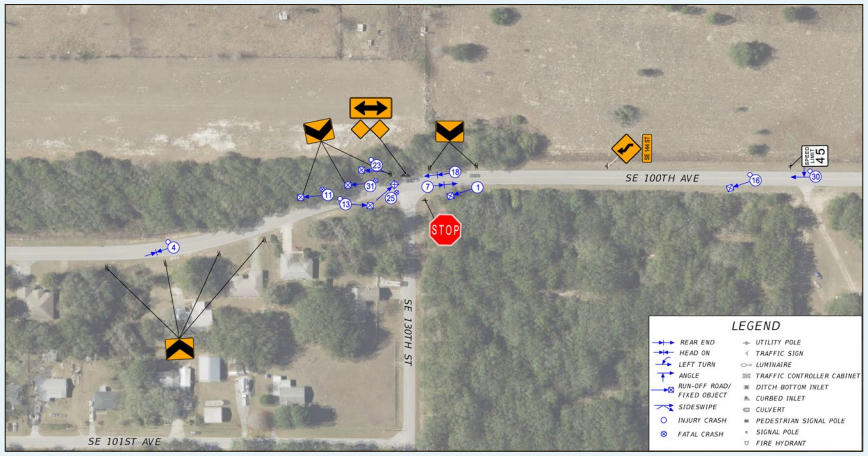
STEP TWO: CONDUCT A HISTORICAL CRASH ANALYSIS

For each crash, review the report and summarize key information such as:

- Location
- Time
- Severity
- Causes
- Weather conditions
- Specific crash type
- Lighting conditions
- Road surface conditions
- Day of the week
- Location and clusters of crashes

STEP THREE: PREPARE COLLISION DIAGRAM

Prepare a collision diagram of the crashes to identify crash problems and potential safety problems at the location. The collision diagram should be prepared consistent with guidance in the FDOT Manual on Uniform Traffic Studies (MUTS).



For more information on collision diagrams, see Chapter Two: Crash Data Systems Mapping of this handbook.

STEP FOUR: CONDUCT A FIELD REVIEW

At the minimum, observations should be taken during the a.m. peak hour, p.m. peak hour, time of peak crash frequency, and during one nighttime period. If any special periods exist, such as school arrival or dismissal, additional observations should occur.

See the Safety Field Review prompts section of this chapter for examples of specific items that you should note during your field review.

STEP FIVE: SUMMARIZE YOUR FIELD REVIEW FINDINGS

A report of your field review findings should include:

- Data collected
- Existing conditions information
- Key crash trends
- Safety concerns
- Suggested improvements
- Any pictures or measurements taken during observation

SAFETY FIELD REVIEW PROMPTS

These lists are intended to prompt designers to consider some commonly overlooked factors in design projects. It pushes you to think beyond "Did I do it by the design standards?" Instead, these prompts encourage you to ask, "Have I adequately provided a safe transportation experience for all road users?"

In recent years, with updates to the American Association of State Highway Transportation Officials' (AASHTO) *A Policy on Geometric Design of Highways and Streets, 7th Edition (Green Book)* and the release of the Highway Safety Manual (HSM), there has been a shift in thinking from striving to meet the standards to actively trying to reduce crashes, injuries, and fatalities.

While these lists are not all-inclusive of every issue that may be encountered, the hope is that you will consider the issues raised and make adjustments that provide more than a by-the-book design and create a safer transportation system project.

SIDEWALKS

- Are sidewalks provided?
- What conditions are the current sidewalks in?
- What is the width of the current sidewalks?
- Are the existing sidewalks accessible according to the Americans with Disabilities Act (ADA)?
- Will the proposed design safely accommodate pedestrians?
- Will the project provide continuity and safe lineages with existing or proposed pedestrian facilities?

DRIVEWAYS

- Are there driveways present in the study location?
- What is the density of any driveways present?
- Do all driveways have adequate sight distance?
- Do all driveways have adequate radii?
- How do the driveways interact with adjacent intersections and other driveways?
- Is the degree of access control consistent with the road's function and other sections of the road?
- Is the design speed compatible with the number and type of driveways?
- Have the possibilities of linking multiple access points into shared-use access been considered?

ROADWAYS

- In what condition is the pavement in the project area?
- Are there pavement markings present? If so, what condition are they in?
- Does the roadway geometry meet vertical and horizontal alignment design guidelines? Are the alignments consistent with the design speed?
- Is there on-street parking present?
- Are there medians or is there channelization present?
- Is there roadway lighting?
- Is the roadway design appropriate for the project location's volume and traffic mix?

STOP-CONTROLLED INTERSECTIONS

- Are there stop bars present? If so, what condition are they in?
- What other pavement markings are present at the intersection, and what are their conditions?
- What signage is present at the intersection and what condition is the signage in?
- Are there pedestrian crossings present? If so, are they ADA compliant? What markings and signage are being utilized at the crossing?
- How does the drainage operate at the intersection?
- Are there drains present? Is there evidence of poor drainage, such as sitting water?
- Is there lighting at the intersection?
- How is the intersection spaced in relation to other intersections?
- Is there adequate sight distance at the intersection?

SIGNALIZED INTERSECTIONS

- What pavement markings are present at the intersection and what condition are they in?
- What signage is present at the intersection and what condition is the signage in?
- Are there pedestrian crossings present? If so, are they ADA compliant? What markings and signage are being utilized at the crossing?
- If there are pedestrian crossings present, what signal heads are utilized? What condition are they in?
- Does the pedestrian signal timing seem adequate?
- What signal heads are present? What condition are they in?
- Are backplates present on the signal heads?
- Does the signal timing seem adequate for the movements at the intersection?
- How does the drainage operate at the intersection?
- Are there drains present? Is there evidence of poor drainage, such as sitting water?
- Is there lighting at the intersection?
- How is the intersection spaced in relation to other intersections? Are there any queues from other intersections spilling back into the intersection?
- Does the spacing of the signalized intersections allow for effective signal coordination?
- Is there adequate sight distance at the intersection?
- What are the vehicle speeds and driver behaviors that are noticed while drivers are traversing the intersection?

PEDESTRIANS

- Where are the pedestrians in the area walking to and from?
- How are they using the infrastructure?
- Do they obey the traffic control devices?
- Are pedestrians often conflicting with vehicles using the travel lane?
- Is it reasonable to expect pedestrians to walk to an intersection, cross, and turn back on the other side?
- Is there a population that may need more crossing time (i.e. school children, elderly) present in the project location?

BICYCLISTS

- Are bicycle facilities present in the project location?
- How are bicyclists navigating intersections?
- What bicyclist behaviors are present?
- How often are bicyclists in conflict with vehicles using the travel lane?
- How is the relationship between motorists and bicyclists? Do drivers seem to give bicyclists a “hard time”?

TRANSIT

- Is there a transit route present in or adjacent to the project location?
- Are there bus lanes present? If so, what is the frequency of bus stops?
- Are the bus stops accessible? Do they include shelter, benches, and/or landing pads?
- How are bus stops accessed by riders?

ADDITIONAL PROMPTS

- Are tire skid marks present in the project location?
- Is vehicle debris present?
- Are there any nearby utility poles or other objects that have been struck?
- Is there other evidence of crashes, such as an abundance of crushed glass or plastic?

SAFETY CRASH DATA GUIDANCE

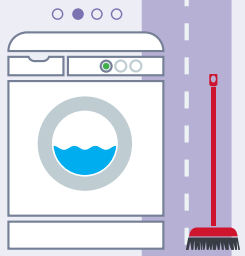
1 CLEAN DATA

When a safety analysis is needed on any project or location, transportation planners and engineers, including FDOT staff, partnering agencies, and consultants, can use this guide to obtain the most recent crash data available and perform accurate analysis. This is a requirement in many FDOT manuals for various types of safety analyses.

The following is covered in the guide:

- Detailed, step-by-step crash data process
- How to get started with the available data, including when to pull it, how to access it, and which source to use
- Processing and reporting timelines
- Different types of safety analysis methods and when to use each
- Information about traffic safety coalitions in Florida

DOWNLOAD DATA 2



3 SUMMARIZE DATA

4 SAFETY ANALYSIS

Use this QR code to access the guide.

GOLD STAR COUNTERMEASURES

Gold Star countermeasures are a set of measures and design features proven to effectively reduce or eliminate crash patterns. They are recommended for use in any projects with a risk of crashes. In locations that do not have a history of crashes, it is advisable to consider using Gold Star countermeasures when risk factors are present. The following lists the 66 Gold Star countermeasures that FDOT recommends.

BICYCLE/ PEDESTRIAN

1. Non-buffered bicycle lanes
2. Buffered bicycle lanes
3. Shared-use path
4. Advance warning signage and pavement markings for pedestrian crossings
5. Grade separated pedestrian crossings
6. Midblock pedestrian signal
7. Pedestrian crossing islands in urban and suburban areas
8. Pedestrian hybrid beacon
9. Midblock traffic control signal (traditional)
10. Rectangular rapid flashing beacon
11. Sidewalks
12. Median refuge islands
13. Raised crosswalk
14. Upgrade crosswalk markings to high visibility style

INTERSECTION

15. "STOP AHEAD" pavement markings
16. Leading pedestrian interval
17. Exclusive pedestrian phasing
18. Raised median
19. Two-way left-turn lane on two-land undivided road
20. Reduce driveway density
21. Replace two-way left-turn lane with raised median
22. High friction surface treatment
23. Bicycle boxes
24. Bicycle signals
25. Centerline hardening (without median refuge islands)
26. Change left-turn phasing from protected-permissive to protected-permissive flashing yellow arrow
27. Change right-turn lane geometry to increase line of sight (intersection level)
28. Conversion of stop-controlled intersection into single-lane roundabout
29. Convert intersection to median U-turn
30. Convert intersection to reduced collision U-turn
31. Convert standard diamond interchange to diverging diamond
32. Crosswalks on all approaches
33. Curb extensions (bulbs-out)
34. Intersection conflict warning system
35. Left-turn lane
36. Right-turn lane on one major road approach
37. Full access to right-in-right-out operations at stop-controlled intersections
38. Skewed intersections (less than 75 degrees) to a right angle
39. No turn on red
40. Protected intersection
41. Raised intersection
42. Retroreflective backplates on signals
43. Turning vehicles stop for pedestrians (R10-15a) signs

LANE DEPARTURE

44. Flatten side slope from 1V:3H to 1V:4H
45. Improved pavement friction (open graded friction course or high friction surface treatment)
46. Increased distance to roadside features from 16.7 feet to 30 feet
47. Centerline rumble strips on tangent sections
48. Guardrail
49. Median barrier
50. Safety edge treatment
51. Shoulder rumble strips
52. Transverse rumble strips as traffic calming devices
53. Widen shoulder

LANE DEPARTURE–CURVE

54. Flatten horizontal curve
55. Combined installation on chevron and curve warning signs and flashing beacons
56. Centerline rumble strips on horizontal curves
57. Sequential dynamic chevrons on horizontal curve

SPEED MANAGEMENT

58. Gateway treatment (R1-6)
59. Horizontal deflection to reduce travel speeds
60. Implement short blocks with marked crosswalks
61. Lane narrowing to reduce travel speeds
62. Lane repurposing
63. Set posted speed limit to target speed
64. Speed cameras
65. Speed feedback signs to reduce travel speed

CROSSCUTTING

66. Lighting

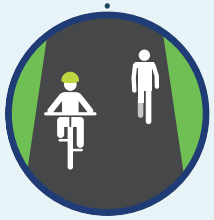
BICYCLE/PEDESTRIAN GOLD STAR COUNTERMEASURES

1. Non-buffered Bicycle Lanes

- Always located on both sides of the road on two-way streets.
- Should not be separated from other motor vehicle lanes by curbs, parking lanes, or other obstructions.
- Preferred bicycle facility on curbed roadways with a design speed of more than 45 miles per hour (mph).

2.Buffered Bicycle Lanes

- Pairs conventional bicycle lanes with a designated buffer space.
- Separates the bicycle lane from the adjacent motor vehicle travel lane and/or parking lane.



3. Shared-use Path

- Separates paved facilities from motorized vehicular traffic by an open space or barrier.
- Constructed either within the highway right-of-way or an independent right-of-way.
- Used by bicyclists, pedestrians, skaters, runners, and other non-motor vehicle users.

4. Advance Warning Signage and Pavement

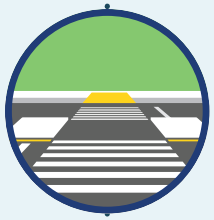
- Used where pedestrian crossings may not be expected by motorists.

5. Grade Separated Pedestrian Crossings

- Provides continuity of a bicycle/pedestrian facility over or under a barrier.
- The crossing structure may be either a bridge or an underpass.

6. Midblock Pedestrian Signal

- Operates similarly to a standard semi-actuated vehicular traffic control signal at a midblock crossing, except that it displays a flashing red indication in place of a solid red indication during the pedestrian clearance interval.
- Supports “complete streets,” a transportation policy and design approach that calls for roadways to be consistently designed and operated with users of all ages and abilities in mind.



7. Pedestrian Crossing Islands in Urban and Suburban Areas

- A raised island located between opposing traffic lanes at intersection or midblock locations to separate crossing pedestrians from motor vehicles.
- Also known as a refuge area.

8. Pedestrian Hybrid Beacon

- A traffic control device designed to help pedestrians safely cross higher-speed roadways at midblock crossings and uncontrolled intersections.
- Beacon head consists of two red lenses above a single yellow lens.
- Lenses remain “dark” until a pedestrian pushes the call button to activate the beacon, which then initiates a yellow to red lighting sequence consisting of flashing and steady lights.
- Directs motorists to slow and come to a stop, which provides the right-of-way to the pedestrian to safely cross the roadway before the lenses return to dark.

9. Midblock Traffic Control Signal (Traditional)

- Any highway traffic signal which alternately directs traffic to stop and permits pedestrians to proceed at midblock crosswalk.

10. Rectangular Rapid Flashing Beacon

- Pedestrian-actuated conspicuity enhancements used in combination with a pedestrian, school, or trail crossing warning sign.
- Improves safety at uncontrolled, marked crosswalks.
- Includes two rectangular yellow indications, each with an LED-array-based light source, that flash with high frequency when activated.

11. Sidewalks

- Separated from the roadway.
- Preferred accommodation for pedestrians with many benefits including safety, mobility, and healthier communities.

Roadways without sidewalks are more than 2x as likely to have pedestrian crashes as sites with sidewalks on both sides of the street.

12. Median Refuge Islands

- Medians can be defined by pavement markings, raised medians, or islands to separate motorized and non-motorized road users.
- Also known as a crossing area that is intended to help protect pedestrians crossing a road.

13. Raised Crosswalk

- Ramped speed tables spanning the entire width of the roadway that allow pedestrians to cross at-grade with the sidewalk.
- Often placed at midblock crossing locations to act as a traffic-calming measure.
- Demarcated with paint and/ or special paving materials.

14. High-Visibility Style Crosswalk Markings

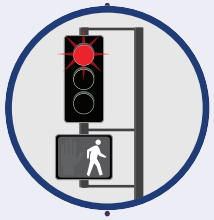
- Use patterns (i.e., bar pairs, continental, ladder) that are visible to drivers and pedestrians from farther away compared to traditional transverse line crosswalks.
- Should be considered at all midblock pedestrian crossings and uncontrolled intersections.
- Should use materials such as inlay or thermoplastic tape, instead of paint or brick.

INTERSECTION GOLD STAR COUNTERMEASURES

15. "STOP AHEAD" Pavement Markings

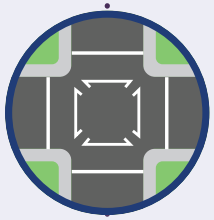
- Install "STOP AHEAD" pavement markings.

Expect a crash reduction of at least 15% with "STOP AHEAD" pavement markings.



16. Leading Pedestrian Interval

- Gives pedestrians the opportunity to enter the crosswalk at an intersection three to seven seconds before vehicles are given a green indication.
- Allows pedestrians to better establish their presence in the crosswalk.



17. Exclusive Pedestrian Phasing

- Stops all vehicular movement and allows pedestrians to cross in any direction at the intersection, including diagonally.
- Clears the intersection of pedestrians during the vehicular phase.
- Allows better movement of vehicles and permits pedestrians to cross without vehicle interference.

18. Raised Median

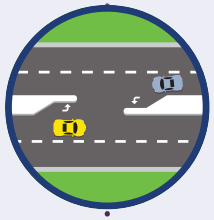
- Raised barriers in the center portion of the street or roadway are appropriate in some locations and not appropriate in others.
- Benefits pedestrians because they can serve as a place of refuge for pedestrians who cross a street midblock or at intersections.
- Provides a space for street trees and other landscaping, which can help reduce speeds by changing the character of a street.
- Benefits motorists by improving safety when they replace center turn lanes.
- Needs to provide desired turning movements so that motorists are not forced to travel on inappropriate routes, and an unsafe U-turn condition is not created.

19. Two-way Left-turn Lane on Two-lane Undivided Road

- Provides a center lane exclusively for left-turning vehicles coming from either direction.
- Removes vehicles from the primary travel lane while drivers wait for an acceptable gap to turn.
- Two-way left-turn lanes (TWLTL) may reduce crashes related to turning maneuvers that conflict with the opposing traffic.
- Used to reduce head-on collisions by providing a buffer between opposing directions of travel.

20. Reduce Driveway Density

- Design, approve, and permit property access points within the context of the number of driveways on both sides of the street in the vicinity of the proposed access points.
- Should not be considered in isolation.
- Possible strategies to reduce the number of driveways over time include the use of shared access to serve more than one property, the planning and development of additional roadways to provide connectivity and complementary mixed uses to minimize the need for multiple parking areas, and multiple driveways.



21. Replace TWLTL with Raised Median

- A lack of access management can lead to TWLTLs being responsible for more head-on collisions and an increase in angle crashes.
- Significantly reduce these types of crashes with a well-planned median.

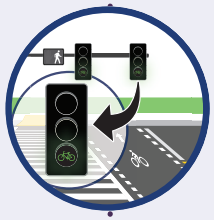
22. High Friction Surface Treatment

- Apply a very high-quality aggregate to the pavement using a polymer binder to restore and/or maintain pavement friction at existing or potentially high crash areas.
- Helps motorists maintain better control in both dry and wet driving conditions.

Can **reduce injury crashes up to 63% at ramps** and 48% at horizontal curves.

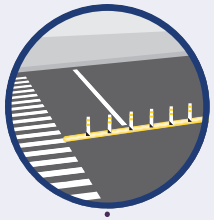
23.Bicycle Boxes

- Designated area at the head of a traffic lane at a signalized intersection.
- Provides bicyclists with a safe and visible way to get ahead of queuing traffic during the red signal phase.



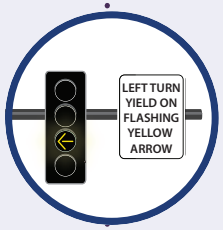
24. Bicycle Signals

- Traditional three lens signal heads with green, yellow, and red bicycle stenciled lenses.
- Can be employed at standard signalized intersections and hybrid signal crossings.
- Utilizes flashing amber warning beacons at unsignalized intersection crossings.
- May use push buttons, signage, and pavement markings to highlight these facilities for both bicyclists and motorists.



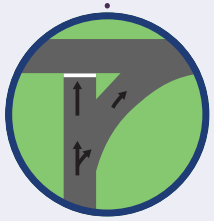
25. Centerline Hardening (without median refuge islands)

- Creates physical separation between travel directions, guides motorists, and reduces their turning speed.
- May be accomplished with rubber curbs or bollards installed on the yellow center line near an intersection and continued past the crosswalk.



26. Change Left-turn Phasing from Protected-permissive to Protected-permissive Flashing Yellow Arrow

- Indicates that left turns are permitted, but drivers must first yield to oncoming traffic and pedestrians and then proceed with caution.
- Does not replace the solid yellow arrow and its meaning.



27. Change Right-turn Lane Geometry to Increase Line of Sight

- Can include sharpening the flat approach angle typical in the traditional design, reducing the radius, adjusting the stop/yield bar position, and/or modifying the corner island to improve safety by increasing the line of sight of approaching through traffic.

28. Convert Stop-controlled Intersection into Single-lane Roundabout

- Considered a modern roundabout, which is an intersection with a circular configuration that safely and efficiently moves traffic.
- Features 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.
- Lower speeds and reduced conflicts result in reduction of crashes that cause injury or fatality.

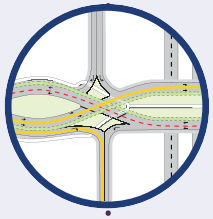
Converting to a roundabout reduces severe crashes by 82% at a former two-way stop-controlled intersection and 78% at former signalized intersections.

29. Convert Intersection to Median U-turn

- Reroutes both major street and minor street left-turning vehicles through one-way median openings located several hundred feet from the main intersection.
- Increases capacity and safety by eliminating all left turns from the main intersection and reducing conflict points.
- Allows two-phase signal controls at the intersection and the signalized U-turn crossovers.

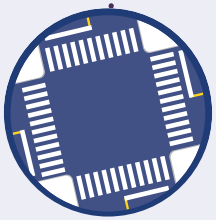
30. Convert Intersection to Reduced Collision U-turn

- Modifies the direct left-turn and through movements that drivers make from cross-street approaches.
- Directs cross-street vehicles to make a right turn followed by a U-turn at a designated location before continuing in the desired direction.



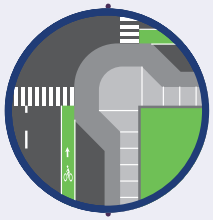
31. Convert Standard Diamond Interchange to Diverging Diamond

- Resembles a conventional diamond interchange where drivers make right turns.
- Differentiator is the crossover intersections which gently transition—or diverge—traffic from the right side of the road to the left side of the road and then back again.
- All left turns occur without having to cross opposing traffic.
- The road geometry, signs, and pavement markings all work together to make this very simple.



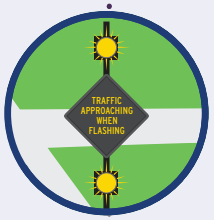
32. Crosswalks on All Approaches

- Occurs at all intersections (whether marked or not) and on any portion of a roadway distinctly indicated for pedestrian crossing.
- Helps drivers better identify the intersection and guides pedestrians to the best crossing location.



33. Curb Extensions (bulbs-out)

- Shorten the crossing distance.
- Provide additional space at intersections, allowing pedestrians to see and be seen before entering a crosswalk.
- Must take into consideration the needs of transit vehicles, drainage, and bicyclists during design process.



34. Intersection Conflict Warning System

- Warns motorists approaching an intersection of potential conflicts with other approaching vehicles.
- Is a type of Intelligent Transportation System technology that uses systems such as detection of vehicles on the major road, minor road, or both.

35. Exclusive Left-turn Lane

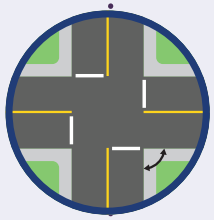
- Should be considered at any location serving the public, especially on curves and where speeds are greater than 45 mph.

36. Right-turn Lane on One Major Road Approach

- Effective for reducing traffic delays and the number of conflicts between vehicles at signalized intersections.
- Drivers entering the right-turn lane can easily see pedestrians crossing or about to cross and have enough space to stop completely once a pedestrian is spotted.

37. Full Access to Right-in-right-out Operations at Stop-controlled Intersections

- Can provide guidance to drivers on roadways with medians for right-in-right-out movements.
- Reduces the number of conflict points between vehicles which generally improves road-traffic safety and efficiency.
- Considered an important tool of access management.
- Combining access management with signalized intersections designed to permit U-turns, can accommodate high volumes of traffic with low delay and high safety.



38. Modify Skewed Intersections (less than 75 degrees) to a Right Angle

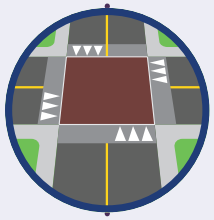
- Modify any intersection angles less than 75 degrees to a right angle.
- The intersection angle between two roadways significantly influences the safety and operation of an intersection.
- Intersection angles must be as close to 90 degrees as is practical.

39. No Turn on Red

- Prohibits right turns at red traffic signals using static, static conditional, and/or electronic signs.
- Consider “No Turn On Red” sign to enhance leading pedestrian interval implementation.

40. Protected Intersection

- Keeps bicycles physically separate from motor vehicles up until the intersection.
- Provides a high degree of comfort and safety for people of all ages and abilities.



41. Raised Intersection

- Reinforces slow speeds and encourages motorists to yield to pedestrians at the crosswalk, similar to speed humps and other vertical control elements.
- Creates a safe, slow-speed crossing and public space at minor intersections.

42. Retroreflective Backplates on Signals

- Improves the visibility of the illuminated face of the signal in both daytime and nighttime conditions by introducing a controlled-contrast background.
- Framing backplate with a 1- to 3-inch yellow retroreflective border improves visibility even more.

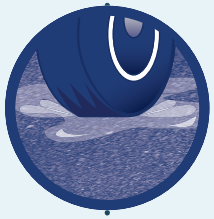
43. "Turning Vehicles Stop for Pedestrians" (R10-15a) Signs

- Emphasis to drivers turning where potential pedestrian conflicts might not be readily apparent.
- Should be used at signalized intersections.

LANE DEPARTURE GOLD COUNTERMEASURES

44. Flatten Side Slope from 1V:3H to 1V:4H

- Reduce the steepness of the side slope to increase drivers' ability to keep the vehicle stable, regain control of the vehicle, and avoid obstacles.
- Slopes of 1V:4H or flatter are considered recoverable (i.e., drivers can retain control of a vehicle by slowing or stopping).
- Slopes between 1V:3H and 1V:4H are generally considered traversable, but nonrecoverable (i.e., an errant vehicle will continue to the bottom of the slope).

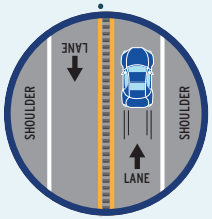


45. Improve Pavement with Open Graded Friction Course

- Constructed with high quality, polish-resistant aggregate.
- Has an outstanding capacity for providing and maintaining good frictional characteristics over the operating range of speeds on high-speed highways.
- Facilitates drainage of water from the tire/pavement interface, which improves tire contact with the pavement and reduces the potential for hydroplaning.

46. Increase Distance to Roadside Features from 16.7 Feet to 30 Feet

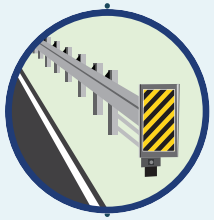
- Create a larger Clear Zone, which is an unobstructed, traversable area beyond the edge of the through traveled way for the recovery of errant vehicles.
- Should be free of rigid, fixed objects such as trees, utility cabinets, or poles.



47. Centerline Rumble Strips on Tangent Sections

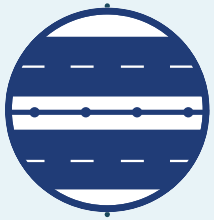
- Install rumble strip at or near the center line of a paved roadway.
- Made of a series of milled or raised elements intended to alert inattentive drivers through vibration and sound that their vehicles have left the travel lane.
- Often, the center line pavement marking is placed over the rumble strip, which is sometimes referred to as a centerline rumble stripe.

With a centerline rumble strip on tangent sections, cross-over crashes were reduced by 67%.



48. Guardrail

- A semi-rigid barrier where a W-beam or box-beam is mounted on steel or timber posts.
- Deflects less than cable barriers and can be located closer to objects where space is limited.
- Functions as a system, which includes the guardrail itself, the posts, the soil that the posts are driven in, the connection of the guardrail to the posts, the end terminal, and the anchoring system at the end terminal. All these elements have a bearing on how the guardrail will function upon impact.
- Consists of two key functional components: the end terminal and the guardrail face.



49. Median Barrier

- Separates opposing traffic on a divided highway using a longitudinal barrier.
- Redirects vehicles striking either side of the barrier.
- Reduces the severity of cross-median crashes, which are attributed to the relatively high speeds that are typical on divided highways.
- AASHTO revised its Roadside Design Guide in 2006 to encourage consideration of barriers in medians up to 50 feet wide. The application of cable median barriers is a very cost-effective means of reducing the severity of median crossover crashes.
- Can be a cable, concrete, or beam guardrail.
- Should be used in locations with the highest instance of cross-median crashes.
- Consider implementing a systemic median barrier policy based on cross-median crash risk factors.

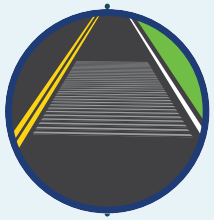
50. Safety Edge Treatment

- Allows drivers who drift off highways to return to the road safely.
- Shapes the edge of the pavement to 30 degrees, which research has shown to be the optimal angle to allow drivers to re-enter the roadway safely.
- Provides a strong, durable transition for all vehicles.

Safety Edge treatment reduces fatal and injury crashes by 11%, run-off road crashes by 21%, and head-on crashes by 19%.

51. Shoulder Rumble Strips

- Milled or raised elements on the pavement intended to alert drivers through vibration and sound that their vehicle has left the travel lane.



52. Transverse Rumble Strips as Traffic Calming Devices

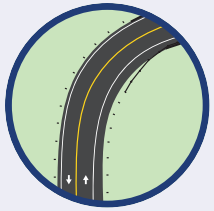
- Grooves cut into the pavement that act as a warning device.
- Creates noticeable sound and vibrations and may be used to slow down traffic when driven over.

53. Widen Shoulder

- Provides a stable surface for pedestrians to use when sidewalks cannot be provided.
- Offers numerous safety benefits for motorists and pedestrians.

Shoulder widening reduces head-on crashes by 15%-75%, sideswipe crashes by 15%-41%, fixed object crashes by 29%-49%, and pedestrian (walking along roadway) crashes by 71%.

LANE DEPARTURE - CURVE GOLD STAR COUNTERMEASURES



54. Flatten Horizontal Curve

- Reduces the steepness of the sideslope to increase drivers' ability to keep the vehicle stable, regain control of the vehicle, and avoid obstacles.

55. Combined Installation on Chevron and Curve Warning Signs and Flashing Beacons

- Add one or more of the other basic or enhanced treatments at a specific curve after an assessment at the system and corridor level.
- Warning signs call attention to unexpected conditions on or adjacent to a roadway.
- Horizontal Alignment signs give drivers advance warning of a horizontal curve.
- Chevron Alignment signs emphasize and guide drivers through a change in horizontal alignment.
- Using flashing beacons with a warning sign is another way to gain motorists' attention, typically used with one of the advance Horizontal Alignment signs for a horizontal curve.

56. Centerline Rumble Strips on Horizontal Curves

- Because motorists frequently cross over the centerline through curved sections, the centerline rumble strip is a candidate treatment for horizontal curve sections.

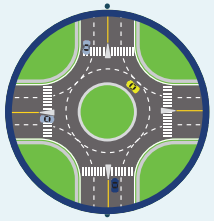
57. Sequential Dynamic Chevrons on Horizontal Curve

- Alert drivers to upcoming curves, the direction and sharpness of the curve, and appropriate operating speed through enhanced delineation treatments.

SPEED MANAGEMENT GOLD STAR COUNTERMEASURES

58. Gateway Treatment (R1-6) Signs

- Install at a crosswalk by placing signs on the edge of the road and on all lane lines.
- Should require all drivers to drive between two signs.
- Creates a perceived narrowing of the road to encourage lower speeds.

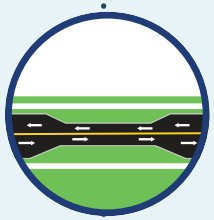


59. Horizontal Deflection to Reduce Travel Speeds

- Creates a horizontal shift in the roadway which hinders the ability of a motorist to drive in a straight line.
- Forces a motorist to slow the vehicle to comfortably navigate the roadway.
- Types of horizontal deflections include:
  - Speed cushions
  - Lateral shift
  - Chicane
  - Realigned intersection
  - Traffic circle
  - Small, modern roundabout and mini roundabout
  - Roundabout

60. Short Blocks with Marked Crosswalks

- Limits driver acceleration distance between intersections with short blocks of 500 feet or less.
- Can create engagement if used in conjunction with marked crosswalks.
- Accentuate the presence of the short blocks to reinforce low-speed and pedestrian-supportive contexts.



61. Lane Narrowing to Reduce Travel Speeds

- Reduce the width of a section of roadway in a gradual manner.
- Forces motorists to react with reduced speed because of a concern of a limited travel path.
- Discourages nonlocal traffic.

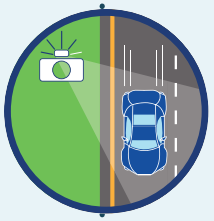
62. Lane Repurposing[1]

- Uses existing space within a roadway that has excess capacity or changing transportation demands.
- Can improve safety, calm traffic, provide better mobility and access for all road users, and enhance overall quality of life.
- Typically involves converting an existing four-lane undivided roadway to a three-lane roadway consisting of two through lanes and a center TWLTL.

63. Set Posted Speed Limit to Target Speed

- Conduct a network analysis of speeding-related crashes to identify locations to implement speed safety cameras (SSCs).
- Analysis can include scope, location types, roadway types, times of day, and road users most affected by speed-related crashes.

1 Lane Repurposing projects must follow the requriements found in Florida Statute 334.61



64. Speed Cameras

- Conduct a network analysis of speeding-related crashes to identify locations to implement SSCs.
- Analysis can include scope, location types, roadway types, times of day, and road users most affected by speed-related crashes.

65. Speed Feedback Signs to Reduce Travel Speed

- Include a speed-measuring device, which consists of loop detectors or radar, and a message sign that displays feedback to those drivers who exceed a predetermined speed threshold. Feedback can include displaying the driver's actual speed, showing a message such as "SLOW DOWN", or activating some warning device, such as beacons or a curve warning sign.

CROSSCUTTING GOLD STANDARD COUNTERMEASURE

66. Lighting

- Should be based on research recommending horizontal and vertical illuminance levels to provide safety benefits to all users of the roadway environment.
- Can also provide benefits in terms of personal security for pedestrians, wheelchair and other mobility device users, bicyclists, and transit users as they travel along and across roadways.

COUNTERMEASURE MATRICES

INTRODUCTION

The Crash Group/General Countermeasure Matrix identifies potential solutions for use by safety practitioners. This matrix is particularly helpful as a resource for potential engineering countermeasures, which may be implemented at a location to address a particular pedestrian crash type.

To develop the most suitable countermeasure, this matrix should be used in conjunction with local site data, including:

- The number of pedestrian crashes and types
- Traffic and pedestrian volumes
- Vehicle speeds
- Road width

Conscientious planning, effective education programs, and consistent safety and law enforcement also contribute to improving our communities for pedestrians.

The contents of the Crash Group/General Countermeasure Matrix do not constitute a standard, specification, or regulation.

BICYCLE AND PEDESTRIAN SAFETY STRATEGIES

Outlined in Table 2 are safety concerns associated with the high frequency of bicycle and pedestrian crashes, along with improvement strategies categorized by cost—ranging from low, to moderate, to high.

Table 2. Bicycle and Pedestrian Safety Concerns Improvement Strategies by Cost

Safety Concern	Low Cost	Moderate Cost	High Cost
Pedestrian visibility	A2, B1, B5, B8, B11, D8, D9, D11, D20, D22	B2, B3, B4, B7, B12, C3, D6, D10, D19, F7	D1, D5
Bike visibility	B1, E6	E1, E2, E3, E6	F7
Inadequate pedestrian facilities	A2, A3	A1, A4, A6, B3, B10, B13, C1, F10	D2, F4, F5
Inadequate bike facilities	E4, E6	A4, A6, E7, E8, E10	E5, E9, F4, F5
Crossing locations where traffic cannot be expected to stop for pedestrians (highway/rail facilities)	F3,	F9, E11, F6	B6, F10, F7
Driver compliance	A5, B1, D3, D4, D7, D8, D9, D11, D13, D14, D17, D18, D20, D22, D23, F1	D6, D10, D19, F2, F2, F3	D1, D2, D5
Excessive driver speed	A5, B8, B11, D23, F1	B2, B4, B9, E3, F2	F4, F5
Inadequate buffer	A2, E6	B7, E6, E7, E8, E10, E11	E5, E9, F5
Inadequate crossing time/excessive crossing distance	B8, D3, D21	B2, B3, B7, B12, D7	-
Inadequate pedestrian network connectivity	A3	A1, A4, C2, C3	-
Lane conflicts between cars and vulnerable users	D17, D18, D21, E4, E6	A6, E1, E2, E3, E6, E7, E8, E10	E5, E9, F4, F5
Pedestrian requiring special accommodations	-	B10, D12, D15, F6	-
Turning vehicle conflicts with simultaneous crossings	B1, B5, B8, B11, D3, D4, D8, D13, D14, D16, D21, F8	B2, B3, B4, B7, B9, D12, E2, E3	D2
Insufficient gaps	-	-	D1, D5

CATEGORY A: IMPROVEMENTS ALONG THE ROADWAY

A1 – Provide sidewalks, walkways, and paved shoulders

A2 – Provide street furniture and a secure walking environment

A3 – Fill sidewalk gaps

A4 – Add shared-use paths

A5 – Install speed limit pavement markings

A6 – Provide dedicated pedestrian/bicycle/transit-only lanes in dense urban areas

CATEGORY B: GEOMETRIC IMPROVEMENTS AT CROSSING LOCATIONS

B1 – Install marked crosswalks or enhance existing crosswalks

B2 – Provide bulb-out curbs

B3 – Provide crossing islands

B4 – Provide grade separated crossings for pedestrians and bicyclists

B5 – Restrict on-street parking near crossing locations

B6 – Install a pedestrian overpass or underpass

B7 – Extend median nose past crosswalk

B8 – Optimize crosswalk for pedestrian visibility and crossing distance

B9 – Reduce corner radii to encourage lower turning speeds

B10 – Modify curb corners to provide each crosswalk with its own ramp

B11 – Install a hardened centerline at intersections

B12 – Reduce width of driveways

B13 – Provide adequate crossing facilities at existing roundabout entries

CATEGORY C: TRANSIT-RELATED IMPROVEMENTS

C1 – Improve transit stops

C2 – Increase access to transit services

C3 – Relocate or locate bus stops near crossing locations

CATEGORY D: SIGN AND SIGNAL IMPROVEMENTS

D1 – Install traffic signals

D2 – Install or enhance pedestrian signals

D3 – Improve and prioritize pedestrians in signal timing

D4 – Restrict right-turns on red

D5 – Install a pedestrian hybrid beacon

D6 – Install rectangular rapid flashing beacons (RRFBs)

D7 – Install a pedestrian user-friendly intelligent intersection crossing

D8 – Install advance pedestrian warning signs

D9 – Install in-street pedestrian crossing signs

D10 – Install in-crosswalk lighting

D11 – Install LED flashing signs

D12 – Install automated pedestrian detection

D13 – Implement a leading pedestrian interval

D14 – Replace a five-section signal head with a four-section signal head and restrict vehicles turning during active pedestrian phase

D15 – Provide an accessible pedestrian signal

D16 – Install “Yield to Peds” or “Turning Vehicles Yield/Stop for Peds” signs

D17 – Install “Bikes May Use Full Lane” and fluorescent yellow-green ped/bike signs

D18 – Install “Begin Right Turn Lane Yield to Bikes” signs

D19 – Install RRFBs in advance of crossing RRFBs

D20 – Install advance yield or stop signs

D21 – Implement a Barnes Dance (pedestrian scramble)

D22 – Install “PED XING” pavement markings

D23 – Install speed feedback signs

CATEGORY E: BICYCLE FACILITIES—INTERSECTION IMPROVEMENTS

E1 – Install colored bicycle lanes at signalized intersections

E2 – Provide bicycle boxes at intersections

E3 – Implement a protected intersection

E4 – Implement keyhole bicycle lanes

E5 – Provide bicycle lanes, cycle track, or grade-separated bike path at roundabouts

CATEGORY E: BICYCLE FACILITIES—CORRIDOR IMPROVEMENTS

E6 – Install marked bicycle lanes or enhance existing bicycle lanes

E7 – Increase bicycle lane width

E8 – Pave shoulders

E9 – Provide separated bicycle facilities

E10 – Install in-road bicycle lanes

E11 – Install a barrier between bicycle lanes and the roadway

CATEGORY F: IMPROVE PEDESTRIAN AND BICYCLE SAFETY THROUGH OTHER MEASURES

F1 – Install or enhance school zone features

F2 – Enhance On-street parking through signage? or pavement markings?

F3 – Implement pedestrian and driver education programs

F4 – Implement a shared street

F5 – Provide pedestrian streets or malls

F6 – Enhance railroad crossing safety

F7 – Provide pedestrian scale lighting

F8 – Manage or restrict turning movements

F9 – Provide pedestrian fencing

F10 – Provide pedestrian railings

Refer to Table 1 in the *Guide for Improving Pedestrian Safety at Uncontrolled Crossing Locations* which provides guidance on application of the specific countermeasure relative to facility types (number of lanes, speed limits, etc.). You can access the PDF of the document using the following QR Code.

SIGNALIZED INTERSECTION SAFETY STRUCTURE

Outlined in Table 3 are safety concerns associated with high frequency crash types and overall safety issues at signalized intersections, along with improvement strategies categorized by cost—ranging from low, to moderate, to high.

Table 3. Signalized Intersection Safety Concerns Improvement Strategies by Cost

Safety Concern	Low Cost	Moderate Cost	High Cost
High frequency of right-angle crashes attributed to:			
Nearby driveways	B10	B4, F2	F1
Traffic from cross street	A2, A3	E2	B6, D11, D12
Skewed intersection	-	-	B9
Poor sight distance	A1, A12, C1, G5	C2, G4	B3
Drivers misjudging gaps	A1, A12	-	-
Not enough gaps for drivers	A1, A12	A4, B4	B6, G6
Driver unaware of intersection	D1, D2, D5, D6, D9	C2	B4
Nighttime conditions	A11, D1, D2, D5	G8	-
Right-turning vehicles hit from side	A3, C1	B1, G4	-
High frequency of rear-end crashes attributed to:			
Left-turning vehicles hit from behind	A1, A12	B1	B3, B7, G6
Left-opposing vehicles hit from behind	-	B1	B3
Right-turning vehicles hit from behind	A3	B1, B5	-
Standing water on roadway	-	G1, G7	-
Vehicles unable to stop safely (skidding)	-	G2, G7	-
Driver unaware of intersection	D1, D2, D3, D4, D5, D6, D9, D10	D8	D7
Nighttime conditions	A11, D1, D2, D5	G8	D7
Speed differentials of vehicles	E3	A4, E6	B7, B8
Sudden stops	A2, A3, D3, D10	A4	B7

Safety Concern	Low Cost	Moderate Cost	High Cost
High frequency of left-turn crashes attributed to:			
Left-turn vehicles hit by opposing traffic	A1, A3, A7, A12, C1	B1, B4	B3, G6
Nighttime conditions	A11, D1, D2, D5	G8	-
High frequency of sideswipe crashes attributed to:			
Left-turn vehicles hit by opposing traffic	A1, A12	B1	-
Nighttime conditions	D1, D2, D5, D10	-	-
High frequency of bicycle/pedestrian crashes:			
On school routes or near generators of bicycle/ pedestrian traffic	-	A8, A9, B2, E2	-
Vehicle/bicycle sideswipes on approaches	-	A9, G1	-
With turning vehicles	A1, A3, A12	A9, A8, G4, G5	A9, G8
Addresses overall safety issues			
Violation of traffic laws	E1, E2, E4	E5, E6	G9
Intersection near rail crossing	-	G3	-
Intersection near fire station	-	A5	-
Excessive delay	-	A6	B6
Intersection frequented by transit services	-	A10	-

CATEGORY A: REDUCE FREQUENCY AND SEVERITY OF INTERSECTION CONFLICTS THROUGH TRAFFIC CONTROL AND OPERATIONAL IMPROVEMENTS

A1 – Replace permissive left turns with protected left turns

A2 – Optimize change and clearance intervals

A3 – Restrict or eliminate turning maneuvers

A4 – Employ signal coordination

A5 – Employ emergency vehicle preemption

A6 – Remove unwarranted signal

A7 – Change green signal to flashing yellow arrow for permissive left turns

A8 – Install/implement pedestrian signal improvements

A9 – Install bicycle signal

A10 – Install transit signal priority technology

A11 – Modify night-time flash period (replace with steady operation)

A12 – Change left-turn phase permission (protected/permissive modification)

CATEGORY B: REDUCE INTERSECTION CONFLICTS THROUGH GEOMETRIC IMPROVEMENTS

B1 – Provide/improve turn lane channelization

B2 – Improve geometry of pedestrian and bicycle facilities

B3 – Utilize innovative intersection geometry

B4 – Corridor access management — implement median closures

B5 – Provide right-turn lanes at intersections

B6 – Convert T intersection to a continuous green T intersection

B7 – Install left-turn lane

B8 – Install acceleration/deceleration lanes

B9 – Change intersection skew angle

B10 - Reduce turning radii at intersection and/or nearby driveways

CATEGORY C: IMPROVE SIGHT DISTANCE AT SIGNALIZED INTERSECTIONS

C1 – Clear sight triangles

C2 – Increase positive turn lane offset

CATEGORY D: IMPROVE DRIVER AWARENESS OF INTERSECTIONS AND SIGNAL CONTROL

D1 – Improve visibility of intersections and signal control

D2 – Improve visibility of signals and signs at intersections

D3 – Install/add one signal head per lane

D4 – Install larger 12” signal heads

D5 – Install signal backplates/ retroreflective backplates

D6 – Install intersection warning devices

D7 – Convert pole mounted to overhead signals

D8 – Install supplemental pole-mounted signal on near-side approach

D9 – Install flashing beacons as advance warning

D10 – Advance street name signs

D11 – Convert signal from diagonal span wire to box span

D12 – Convert signal from span wire to mast arm

CATEGORY E: IMPROVE DRIVER COMPLIANCE WITH TRAFFIC CONTROL DEVICES

E1– Provide public information and education

E2 – Provide targeted conventional enforcement of traffic laws

E3 – Post reasonable, safe, and consistent speed limits on intersection approaches

E4 – Install red-light indicator lights

E5 – Install red-light cameras

E6 – Install an actuated advance warning dilemma zone protection system at high-speed signalized intersections

CATEGORY F: IMPROVE ACCESS MANAGEMENT NEAR SIGNALIZED INTERSECTIONS

F1 – Reduce driveway conflicts by eliminating driveways

F2 – Modify driveway access by either moving driveway further away from issue or restricting certain movements

CATEGORY G: IMPROVE SAFETY THROUGH OTHER INFRASTRUCTURE TREATMENTS

G1 – Improve drainage in intersection and on approaches

G2 – Provide high friction surface treatment in intersection and on approaches

G3 – Coordinate closely spaced signals near at-grade railroad crossings

G4 – Relocate signal hardware out of Clear Zone

G5 – Restrict or eliminate parking on intersection approaches

G6 – Convert a conventional signalized intersection to a signalized superstreet

G7 – Resurface pavement

G8 – Improve lighting

G9 – Perform an Intersection Control Evaluation (ICE) analysis to explore other options, such as median U-turns and restrict crossing U-turns

UNSIGNALIZED INTERSECTION SAFETY STRATEGIES

Outlined in Table 4 are safety concerns associated with high frequency crash types and overall safety issues at unsignalized intersections, along with improvement strategies categorized by cost—ranging from low, to moderate, to high.

Table 4. Unsignalized Intersection Safety Concerns Improvement Strategies by Cost

Safety Concern	Low Cost	Moderate Cost	High Cost
High frequency of right-angle crashes attributed to:			
Nearby driveways	C1, C3	A1, A2, B6, B8	-
Traffic from cross street	C1, C3, D2, E4, A1	B6, B8, D1	F3
Skewed intersection	-	-	B11, C2
Poor sight distance	C1, C3, H3	C4, D1	C2
Drivers misjudging gaps	H3, H6	A3, A4, D1	F2
Not enough gaps for drivers	D2, F1	A3, A4	B9,F2, F3
Driver unaware of intersection	E1, E4, E5, E6, E7, E8, E9, E10, E11, E12, E13, E14, E16, E17	E3	-
Nighttime conditions	E8	E2	-
Failure to yield at stop or yield sign	E1, E4, E6, E7, E8, E15, E20	G1	-
Possible signal location	-	-	F3
Speed differentials for vehicles	H3, H6	A3, A4, H1, H2	H8
High frequency of rear-end crashes attributed to:			
Left-turning vehicles hit from behind	A1	B3	B1, B2
Left-opposing vehicles hit from behind	-	-	B2
Trucks and RVs entering divided highway	A1, A3	-	B4
Speed differentials of entering vehicles	-	-	B4
Right-turning vehicles hit from behind	-	B5, B6	B4
Approaching vehicles hit from behind	-	-	B7

Safety Concern	Low Cost	Moderate Cost	High Cost
No left-turn lane and high opposing traffic	-	B8	-
Driver unaware of intersection	E1, E5, E6, E7, E8, E9, E10, E11, E12, E13, E14, E16, E17	E3	-
Nighttime conditions	-	E2	-
Speed differentials of vehicles	H3, H4, H5, H6	H1, H2	B7, B8
High frequency of left-turn crashes attributed to:			
Left-turn vehicles hit by opposing traffic	A1, E22, C1	-	B1, B10, C2, F2, F3
Trucks and/or RVs entering divided highway	-	-	B4
No left-turn lane and high opposing traffic	-	B8	F3
Nighttime conditions	E10	E2	C2
High frequency of sideswipe crashes attributed to:			
Speed differentials of entering vehicles	H6	B1	-
Vehicles within intersection	-	B12	-
Vehicles approaching intersection	E15	-	-
High frequency of run off road crashes:			
Approaching intersection	I4	B7	-
High frequency of pedestrian/bicycle crashes:			
With approaching vehicles	E18, E19, E20, E21, F4, G3, G4	B12, B13, H2, H7	F3, H8
Addresses overall safety issues			
Violation of traffic laws	F5	G1, G2	-

CATEGORY A: IMPROVE MANAGEMENT ACCESS (CORRIDOR)

A1 – Reduce driveway conflicts by eliminating driveways

A2 – Modify driveway access by either moving driveway further away from issue or restricting certain movements

A3 – Implement median closures

CATEGORY B: REDUCE CONFLICTS THROUGH GEOMETRIC DESIGN IMPROVEMENTS

B1 – Provide left-turn lanes at intersection

B2 – Provide zero or positive offset left-turn lanes at intersections

B3 – Provide left- or right-turn bypass lanes on shoulders at T-intersections

B4 – Provide left-turn acceleration lanes in median at divided highway high speed intersections

B5 – Provide right-turn lanes at intersections

B6 – Provide offset right-turn lanes at intersections

B7 – Provide full-width paved shoulders in intersection areas

B8 – Modify allowed turning maneuvers through geometric improvements

B9 – Convert four-legged intersections to offset T-intersections

B10 – Convert offset T-intersections to four-legged intersections

B11 – Realign intersection approaches to reduce or eliminate intersection skew

B12 – Reduce or extend curb radius

B13 – Install medians and pedestrian crossing islands

CATEGORY C: IMPROVE SIGHT DISTANCES

C1 – Clear sight triangles on stop- or yield-controlled approaches to intersections or in the medians of divided highways near intersections

C2 – Change horizontal and/or vertical alignment of approaches to provide more sight distance

C3 – Eliminate parking that restricts sight distance

C4 – Install fence instead of wall to provide clear sight distance

CATEGORY D: IMPROVE AVAILABILITY OF GAPS AND ASSIST DRIVERS IN JUDGING GAPS

D1 – Install an intersection conflict warning system

D2 – Re-time adjacent signals to create gaps at stop-controlled intersections

CATEGORY E: IMPROVE DRIVER AWARENESS—INTERSECTION IMPROVEMENTS

E1 – Improve visibility of intersections by providing enhanced signing and delineation

E2 – Improve visibility of the intersection by providing lighting

E3 – Install splitter islands on the minor-road approach to an intersection

E4 – Provide a stop line on minor-road approaches

E5 – Install transverse rumble strips on intersection approaches

E6 – Provide supplementary stop signs mounted over the roadway

E7 – Provide pavement markings with supplementary messages (i.e. STOP AHEAD)

E8 – Provide improved maintenance and retroreflectivity of stop signs

E9 – Install flashing beacons at stop-controlled intersections

E10 – Add a warning beacon to an existing regulatory or warning sign (provide flashing beacons at stop-controlled intersections)

E11 – Provide intersection warning signs

E12 – Provide Advance Traffic Control Warning signs (install advance warning signs—positive guidance)

E13 – Install post-mounted reflective delineators at the intersection

E14 – Install reflective strips on sign posts

E15 – Provide a yield line on yield-controlled approaches

E16 – Replace standard stop sign with flashing LED enhanced stop sign

E17 – Install red or orange flags with a regulatory or warning sign

E18 – Enhance pedestrian signing

E19 – Replace transverse crosswalk markings with high visibility markings

E20 – Provide advance yield line

E21 – Install crosswalk on one minor approach

E22 – Install object maker sign or keep right sign

CATEGORY F: CHOOSE APPROPRIATE INTERSECTION TRAFFIC CONTROL

F1 – Provide all-way stop-control at appropriate intersections

F2 – Convert a unsignalized intersection to an unsignalized restricted crossing U-turn (also known as a J-turn)

F3 – Install a traffic signal

F4 – Install high-emphasis crosswalks

F5 – Perform ICE Analysis

CATEGORY G: IMPROVE COMPLIANCE WITH TRAFFIC CONTROL DEVICES AND TRAFFIC LAWS

G1 – Provide targeted enforcement to reduce stop sign violations

G2 – Provide targeted public information and education on safety problems at specific intersections

G3 – Install pavement markings PED XING in advance of crossings

G4 – Install STATE LAW STOP FOR PEDS signs in advance of crossings

CATEGORY H: REDUCE OPERATING SPEEDS

H1 – Provide targeted speed enforcement

H2 – Provide traffic calming on intersection approaches through a combination of geometric and traffic control devices

H3 – Post reasonable, safe, and consistent speed limits on intersection approaches

H4 – Provide speed reduction pavement markings

H5 – Provide a dynamic speed feedback sign

H6 – Provide smooth lane narrowing

H7 – Raised bicycle crossings

H8 – Raised intersections

NOTE: The majority of the countermeasure information was obtained from FHWA's "Unsignalized Intersection Safety Strategies" website. This information was supplemented with additional countermeasure considerations from the FHWA's CMF Clearinghouse.

ROADWAY DEPARTURE SAFETY STRATEGIES

The Federal Highway Administration (FHWA) defines a roadway departure crash as one that occurs after a vehicle crosses an edgeline, centerline, or otherwise leaves the traveled way. From 2016 to 2018, an average of 19,158 fatalities resulted from roadway departures, which comprised 51% of all U.S. traffic fatalities. The current Strategic Approach Plan adopted by the FHWA involves keeping vehicles from departing the roadway, providing vehicles with safe recovery options following a roadway departure, and reducing crash severity if recovery from a roadway departure is not possible.

CATEGORY 1A: KEEP VEHICLES FROM DEPARTING THE ROADWAY—CURVE SAFETY

1A.i – **Add spiral transitions to curve**
Where to use – High speed curve locations where standard arc curves cause driver discomfort.

1A.ii – **Increase curve radius**
Where to use – Curve locations where curve radii are insufficient to safely or comfortably navigate the curve.

1A.iii – **In-lane curve warning pavement markings**
Where to use – Curve locations with curve warning signs in place continuing to experience lane departures.

1A.iv – **Static curve warning signs**
Where to use – Curve locations without adequate curve warning signs to warn drivers of upcoming curve conditions, including curve speed advisory speed signs.

1A.v – **Fluorescent curve warning signs**
Where to use – Curve locations where curve warning signs require increased daytime conspicuity against background environments.

1A.vi – **Changeable curve warning signs**
Where to use – Curve locations requiring additional supplemental messaging, such as vehicles traveling too fast for the upcoming curve or where hazardous road conditions regularly occur.

1A.vii – **Flashing curve warning signs**
Where to use – Curve locations with curve warning signs in place continuing to experience lane departures.

1A.viii – **Sequential flashing beacons**
Where to use – Curve locations requiring additional emphasis and guidance for the upcoming change in horizontal alignment, particularly at night.

1A.ix – **Standard chevron signs**
Where to use – Curve locations requiring additional emphasis and guidance for the upcoming change in horizontal alignment.

1A.x – **Oversized chevron signs**
Where to use – Curve locations requiring chevron signs with greater conspicuity or where lane departures continue to occur.

1A.xi – **Improve superelevation**
Where to use – Curve locations where the existing superelevation is insufficient or otherwise varies from the design superelevation.

1A.xii – **Install optical speed bars and/or chevrons (speed reduction markings)**
Where to use – Unexpected horizontal or vertical curves where drivers need to decelerate in advance. These markings should be used to supplement the appropriate warning signs and other necessary traffic devices.

CATEGORY 1B: KEEP VEHICLES FROM DEPARTING THE ROADWAY– PAVEMENT FRICTION

1B.i – **Resurfacing**
Where to use – Locations where pavement condition is poor. Consideration should be given to the proximity to future resurfacing projects.

1B.ii – **Friction course application**
Where to use – Locations, particularly curves or high-speed roads, where friction course application is preferable to geometric changes to the roadway. Friction course treatments include but are not limited to: permeable friction course; open graded friction course; chip seal; high-friction surface treatment; microsurfacing; slurry seal; thin hot-mix asphalt; and ultra-thin bonded wearing course.

1B.iii – **Pavement grinding patterns**
Where to use – Locations, particularly curves or high-speed roads, where pavement grinding is preferable to geometric changes to the roadway. Pavement grinding patterns include but are not limited to diamond grinding and grooving.

CATEGORY 1C: KEEP VEHICLES FROM DEPARTING THE ROADWAY– AUDIBLE PAVEMENT MARKINGS

1C.i – **Edgeline rumble stripes**
Where to use – Locations where vehicles are crossing the edgeline due to driver inattentiveness. Edgeline rumble strips provide greater nighttime visibility, particularly in wet-weather conditions, compared to shoulder rumble strips.

1C.ii – **Shoulder rumble strips**
Where to use – Locations where vehicles are crossing the edgeline due to driver inattentiveness. Shoulder rumble strips may be installed on existing shoulders without damaging existing edgeline pavement markings.

1C.iii – **Transverse rumble stripes**
Where to use – Locations where drivers need to be alerted to changing conditions not anticipated by an inattentive driver, such as the need to slow down approaching a curve.

1C.iv – **Profiled thermoplastic pavement markings**
Where to use – Locations where a low-cost alternative to rumble strips is desired. Profiled thermoplastic performs especially well at night and in wet-weather conditions compared to standard thermoplastic pavement markings.

1C.v – **Performed rumble strips**
Where to use – Locations where a low-cost alternative is preferred to traditional transverse rumble strips.

CATEGORY 1D: KEEP VEHICLES FROM DEPARTING THE ROADWAY– NIGHTTIME VISIBILITY

1D.i – **Increase pavement marking retroreflectivity**
Where to use – Locations where pavement markings require increased conspicuity at night or are worn and in need of refreshing.

1D.ii – **Install flashing beacons as advance warning**
Where to use – Locations where roadway conditions or features require greater driver attention due to nighttime visibility limitations.

1D.iii – **Provide new highway lighting**
Where to use – Locations without highway lighting which meet AASHTO and TAC requirements.

1D.iv – **Improve existing highway lighting**
Where to use – Locations where current lighting is insufficient for present road conditions.

1D.v – **Provide wider edgelines (8”)**
Where to use – Locations requiring greater edgeline conspicuity, such as at alignment changes.

1D.vi – **Post-mounted delineators**
Where to use – Short stretches featuring changes in horizontal alignment such as at curves or lane-reduction transitions. Can use in conjunction with oversized chevron signs.

1D.vii – **Improve sign retroreflectivity**
Where to use – Locations where existing signs are damaged, worn, or otherwise insufficiently retroreflective to provide adequate nighttime visibility.

1D.viii – **Install retroreflective strips on sign poles**
Where to use – Signs requiring additional conspicuity, particularly at night, especially curve warning signs, curve delineators, and "WRONG WAY" signs.

1D.ix – **Install or refurbish existing pavement edgelines and Reflective Pavement Markers**
Where to use – Locations where pavement edgelines or Reflective Pavement Markers are either missing or sufficiently worn as to negatively impact driver awareness and visibility of the pavement edge.

CATEGORY 1E: KEEP VEHICLES FROM DEPARTING THE ROADWAY—SPEED MANAGEMENT

1E.i – **Decrease speed limit**
Where to use – Locations exhibiting large numbers of speed-related run-off-the-road crashes.

1E.ii – **Install changeable speed warning signs**
Where to use – Locations exhibiting large numbers of speed-related run-off-the-road crashes where the speed limit is deemed appropriate. Improvements include dynamic speed feedback signs.

CATEGORY 1F: KEEP VEHICLES FROM DEPARTING THE ROADWAY—OTHER MEASURES

1F.i – **Increase lane width**
Where to use – Locations where narrow lanes are found to contribute to lane departure type crash trends.

1F.ii – **Add median or increase existing median width**
Where to use – Locations with a high frequency of head-on crashes caused by vehicles traversing the median, including a Two-Way Left Turn Lane. Medians taking the place of a Two-Way Left Turn Lane should include median openings where appropriate.

1F.iii – **Add shoulders or increase existing shoulder width**
Where to use – Locations where narrow shoulders are found to contribute to lane departure crash trends.

1F.iv – **Pave or upgrade shoulder**
Where to use – Locations where shoulders are nonexistent or comprised of grass, gravel or other composite material.

1F.v – **Install advance warning signs**
Where to use – Unexpected road features or conditions requiring driver action or awareness.

1F.vi – **Limited sight distance signs**
Where to use – In the vicinity of roadway alignment, foliage, or other structures that obstruct driver sight distance.

1F.vii – **Install "Lane Ends" signs**
Where to use – Locations where a reduction in the number of lanes is imminent and drivers must merge from the upcoming dropped lane.

1F.viii – **Install centerline pavement markings**
Where to use – Locations where centerline pavement markings are faded or otherwise missing.

1F.ix – **Install edgeline pavement markings**
Where to use – Locations where edgeline pavement markings are faded or otherwise missing.

CATEGORY 2A: PROVIDE A SAFE RECOVERY ONCE VEHICLES LEAVE THE ROADWAY—CLEAR ZONE MODIFICATIONS

2A.i – **Change Clear Zone width**
Where to use – Locations where Clear Zone widths do not meet *FDM* 215 criteria or are otherwise excessively narrow.

2A.ii – **Relocate fixed objects outside of Clear Zone**
Where to use – Locations where fixed objects, such as trees, signposts, and light posts, are located within the Clear Zone or otherwise do not meet roadside safety.

CATEGORY 2B: PROVIDE A SAFE RECOVERY ONCE VEHICLES LEAVE THE ROADWAY–VEHICULAR CONTROL

2B.i – **SafetyEdge^{SM}**
Where to use – Locations with narrow paved shoulders or grass shoulders where pavement-edge-related crashes occur. Additional testing may be needed to qualify the application of Safety Edge^{SM}.

2B.ii – **Flatten side slopes**
Where to use – Locations where Clear Zone side slopes do not meet *FDM* 215 criteria or are otherwise excessively tall.

CATEGORY 3A: REDUCE CRASH SEVERITY WHEN RECOVERY IS NOT POSSIBLE–LONGITUDINAL BARRIERS

3A.i – **Cable barrier**
Where to use – Locations where roadside barriers are desired to arrest vehicles departing the roadway, preventing them from deflecting back into traffic or from reaching oncoming traffic lanes or hazardous roadside conditions.

3A.ii – **Guardrail barrier**
Where to use – Locations where roadside barriers are desired to prevent vehicles from deflecting back into traffic or from reaching oncoming traffic lanes or hazardous roadside conditions.

3A.iii – **Concrete barrier**
Where to use – Locations where roadside barriers are desired to deflect vehicles onto the shoulder, or travel lanes where significant roadside hazards exist, such as at bridges.

3A.iv – **Concrete wall**
Where to use – Locations where roadside barriers are desired to deflect vehicles into the shoulder, or travel lanes where significant roadside hazards exist, such as at bridges. Concrete walls assist in noise reduction from roadside traffic to neighboring developments.

3A.v – **Crash cushions at fixed roadside features**
Where to use – Locations where roadside fixed objects, such as roadside barriers, cannot be relocated outside the roadway or Clear Zone.

CATEGORY 3B: PROVIDE A SAFE RECOVERY ONCE VEHICLES LEAVE THE ROADWAY–ROADSIDE FIXED OBJECTS

3B.i – **Increase lateral offset of utility poles**
Where to use – Locations where utility poles are located within the Clear Zone or otherwise do not meet roadside safety criteria in the *FDM* 215.

3B.ii – **Reduce longitudinal density of utility poles**
Where to use – Locations where the number or spacing of utility poles poses a greater risk to vehicles departing the roadway.

3B.iii – **Increase lateral clearance between the traveled way and objects within Clear Zone**
Where to use – Locations where objects are located within the Clear Zone but are unable to be relocated based on the *FDM* 215 criteria.

NOTE: The majority of the countermeasure information was obtained from FHWA's "Roadway Departure Safety" website. This information is supplemented with additional countermeasure considerations from the FHWA's CMF Clearinghouse.

FDM 202 SPEED MANAGEMENT STRATEGIES

Speed Management is a cross cutting measure that has an effect on all safety emphasis areas and is a pillar of the Safe System Approach. The *FDM* provides guidance regarding speed management strategies in different context areas. FDOT has pilot projects around the state using these principles and more, and guidance will evolve as our knowledge and experience matures. See Table 5 below for countermeasures to consider in speed management. Refer to *FDM* 202 for more information regarding each countermeasure.

Table 5. Strategies to Achieve Desired Operating Speed

Context Classification	Target Speed (mph)	Strategies																	
		Lane Repurposing	Roundabouts	On-street Parking	Chicanes	Lane Narrowing	Horizontal Deflections	Street Trees	Short Blocks	Speed Tables	Raised Intersections	Raised Crosswalks	Speed Feedback Sign	Pedestrian Refuge Islands	Bulb-Outs	RRFBs	PHBs	Terminated Vistas	Islands in Curved Sections
C2T	40-45		X			X	X						X				X		
	35	X	X	X		X	X	X	X				X	X	X	X	X	X	
	30	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	25	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
C3R, C3C	40-45		X			X	X						X				X		
	35	X	X			X	X						X	X	X	X	X	X	
C4	40-45		X			X	X						X				X		
	35	X	X	X		X	X	X	X				X	X	X	X	X	X	
	30	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	25	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
C5	35	X	X	X		X	X	X	X				X	X	X	X	X	X	
	30	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	25	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
C6	30	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	25	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

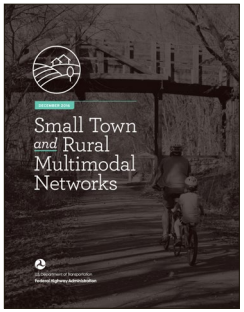
NOTES: 1. For C1 and C2 (55-70 mph): Speed Management Strategies are not used on high-speed roadways. See *FDM 202.4* for information on transitions from high-speed to low-speed facilities. 2. For C3R and C3C (50-55 mph): Project-specific, see *FDM 202.4*.

ADDITIONAL RESOURCES FOR PLANNING AND PRIORITIZATION

Guidebook for Developing Pedestrian and Bicycle Performance Measures

This guide presents a framework and performance measures for quantifying safety, operations, and comfort for people walking and bicycling on transportation facilities.

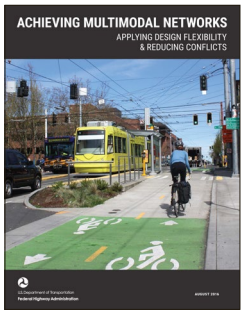
It is recommended to use this planning tool early in the process to help identify metrics that can be used to evaluate pedestrian and bicycle facilities.



Small Town and Rural Multimodal Networks

This is a design resource and idea book for rural and small communities seeking to achieve safe, comfortable, and active travel for people of all ages and abilities.

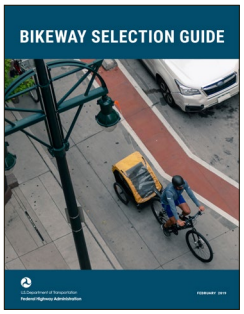
Since most of the guidance for high quality walking and bicycling infrastructure is centered around urban locations, this guide offers ideas and context-sensitive solutions for small towns and rural communities.



Achieving Multimodal Networks: Applying Design Flexibility and Reducing Conflicts

This guide highlights ways to apply design and flexibility while maintaining a focus on improving safety for people walking and bicycling.

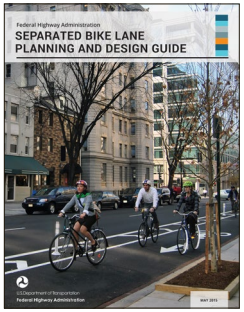
In the guide, planners, designers, and policy makers will find 24 design topics with 12 topics focused on applying flexibility in design treatments and 12 topics focused on reducing conflicts between modes of travel. This information offers options for improving safety and eliminating perceived barriers to implementation.



Bikeway Selection Guide

This resource helps transportation practitioners make informed trade-off decisions relating to the selection of bikeway types, including on-street, separated, and exclusive bicycling facilities.

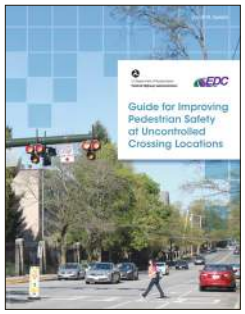
It is recommended to use this guide at the beginning of a design project to help determine the right type of facility and how to incorporate it into the planning and project prioritization process.



Separated Bikeway Planning and Design Guide

This guide spans the planning and design of separated bike lanes and provides use cases, design details, and implementation examples for different types of bicycling facilities. It walks practitioners through a four-step design process to establish directional and width criteria, select forms of separation, identify midblock design challenges and solutions, and develop the intersection design.

While the information is relevant in the planning stage, it is strongly recommended to use this guide during the design stage, too.



Safe Transportation for Every Pedestrian: Guide for Improving Pedestrian Safety at Uncontrolled Crossing Locations

This resource offers guidance on countermeasure selection using a broad, context-sensitive guide designed to reduce pedestrian fatalities and injuries at uncontrolled crossing locations.

The information in this guide is intended to help identify priority locations for implementing safety countermeasures, as well as what those countermeasures should be based on road conditions, crash causes, and pedestrian safety issues.

PedSafe Website

This website, commissioned by FHWA, provides general information on creating safe conditions for people who walk, along with a list of countermeasures and tools for selecting which countermeasures are appropriate for an intersection.

The information is intended to be used for the evaluation and selection of countermeasures.

BikeSafe Website

This website, commissioned by FHWA, provides general information on creating safe conditions for people who bike, along with a list of countermeasures and tools for selecting which countermeasures are appropriate for an intersection.

The information is intended to be used for the evaluation and selection of countermeasures.

Research Report 803: Pedestrian and Bicycle Transportation Along Existing Roads—ActiveTrans Priority Tool Guidebook

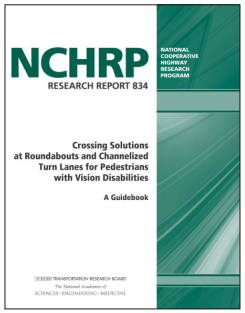
This guide is designed to assist planners and decision-makers through the project prioritization process for pedestrian and bicyclist projects.

A spreadsheet is included for agencies and communities to use to identify goals, develop weights, and prioritize projects according to goals and objectives.

Research Report 948: Guide for Pedestrian and Bicyclist Safety at Alternative and Other Intersections and Interchanges

This report offers guidance for improving non-motorized user safety at intersections, including alternative intersections and interchanges. It presents a quantitative analysis method built around 20 design flags, which highlight design characteristics that impact safety and quality of service for people walking and bicycling.

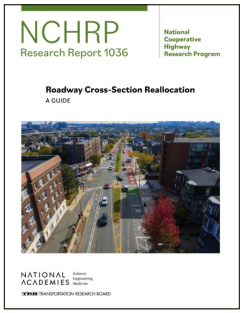
The primary intention is for this information to be applied in the preliminary design stage to ensure decisions do not negatively impact the integration of quality bicycle and pedestrian facilities. It can be a useful tool for comparing various intersection alternatives.



Research Report 834: Crossing Solutions at Roundabouts and Channelized Turn Lanes for Pedestrians with Vision Disabilities: A Guidebook

This report is an assessment tool specific to accessibility. It is a guide for how to evaluate and retrofit a roundabout or channelized turn lane (CTL) for pedestrians with vision disabilities, including both wayfinding tasks and pedestrian crossings.

It is suggested to refer to this guide early in the design process to ensure the needs of pedestrians of all abilities are considered.



Research Report 1036: Roadway Cross-Section Reallocation: A Guide

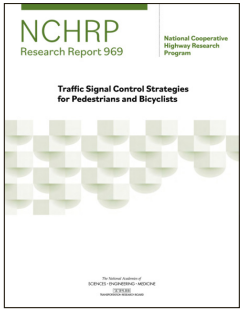
This report offers a six-step framework to help practitioners evaluate tradeoffs, considering outcomes related to transportation, livability, economic and environmental health, equity, and other concerns in cross-sectional reallocation project.

It is recommended to use the NCHRP 1036 throughout the project development process, but it should primarily be used in the design stage as a performance-based approach to reallocating cross-sections and daylighting the safety implications of design and cross-section decisions to all users.

Research Report 926: Guidance to Improve Pedestrian and Bicyclist Safety at Intersections

This report provides guidance on how to create safe crossings and select the best safety measures for intersections based on site conditions.

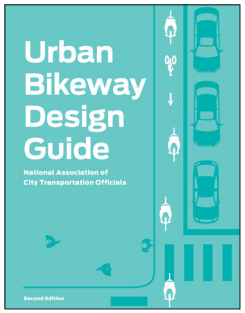
It is suggested to use this report when selecting countermeasures at intersections that have demonstrated safety issues. It can be used for systemic changes, not just specific sites.



Research Report 969: Traffic Signal Control Strategies for Pedestrians and Bicyclists

This report provides performance measures for considering pedestrian delays as part of an intersection analysis. It also includes 28 unique treatments to make intersections more pedestrian and bicyclist friendly.

It is recommended to use this report to analyze intersections already built and operating. While it is best to integrate pedestrians and bicyclists into the initial design, the guide offers treatments to improve safety and accessibility for people walking and bicycling.



Urban Bikeway Design Guide

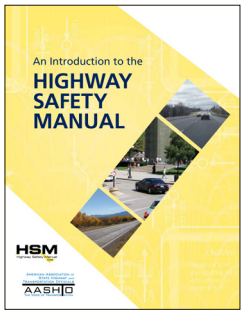
This guide serves as a primary resource for bikeway design in urban environments. Specifically, it is a resource for new or innovative designs that may not be covered in older guides.

This guide provides design guidance and contextual information for building bicycle facilities in urban environments, including photos and examples of built projects around the country.

Don't Give Up at the Intersection

This is an expansion of NACTO's *Urban Bikeway Design Guide* with additional detailed guidance on intersection design treatments that reduce vehicle-bicycle and vehicle-pedestrian conflicts. The guidance covers protected bike intersections, dedicated bike intersections, and minor street crossings, as well as signalization strategies to reduce conflicts and increase comfort and safety.

This is intended to be a resource for designing intersections that are safe and comfortable for pedestrians and bicyclists. A toolkit is included for intersection design strategies applicable to various contexts, construction types, and applications.

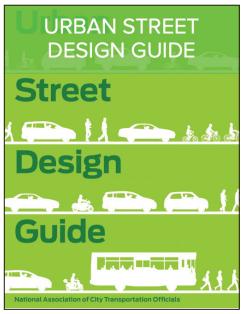


Highway Safety Manual

The premier guidance document for incorporating quantitative safety analysis in the highway transportation project planning and development processes.

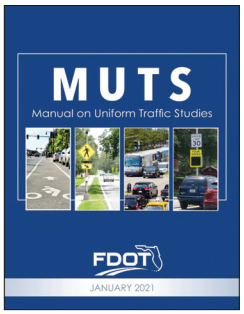
ITE Manual of Transportation Engineering Studies

A national guidance document for conducting various studies on public roadways using standardized study techniques and current technology.



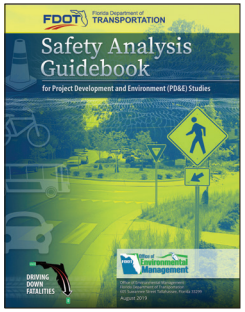
NACTO Urban Street Design Guide

A blueprint for designing 21st century streets, the guide unveils the toolbox and the tactics cities use to make streets safer, more livable, and more economically vibrant. The guide outlines both a clear vision for complete streets and a basic road map for how to bring them to fruition.



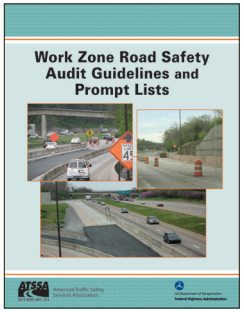
Manual on Uniform Traffic Studies

A Florida specific manual that expands on national reference and establishes minimum standards for conducting traffic engineering studies on the SHS.



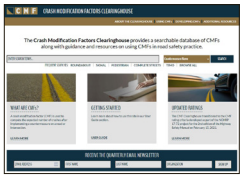
FDOT Safety Analysis Guidebook for PD&E Studies

The purpose of this guidance is to provide directions for integrating quantitative safety analysis into the PD&E process. It is commensurate with the project complexity and utilizes the best available data and methods, analysis examples demonstrating application of quantitative safety analysis and interpretation of results in the PD&E studies, and consistency and uniform format for completing safety analyses for PD&E studies throughout the state, thus expediting analysis, documentation, and review.



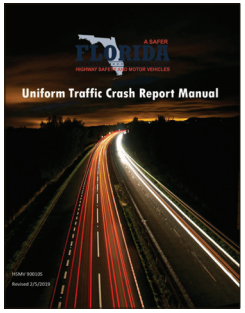
Work Zone Road Safety Audit Guidelines and Prompt Lists

Provides a process to individuals or agencies for performing formal work zone safety examinations to improve the safety of workers and all roadway users.



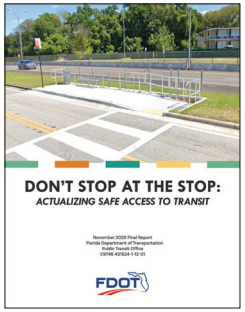
Crash Modification Factors Clearinghouse (CMF)

Provides a searchable database of CMFs along with guidance and resources on using CMFs in road safety practice.



Florida Uniform Traffic Crash Report Manual

Used by law enforcement officers in Florida to report traffic crashes to the DHSMV.

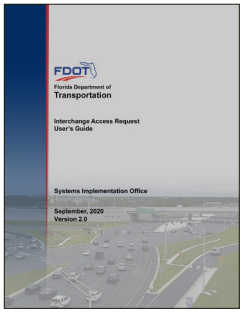


FDOT's Actualizing Safe Access to Transit

Provides guidance for implementing safe access to transit stops through the lens of improved coordination for bus stops, including safe, accessible crossings, sidewalks, and infrastructure.

FDOT Access Transit Design Handbook

Provides guidance to state and local governments and transit agencies for the design, location, and installation of transit facilities consistent with state and federal laws and regulations, including the American with Disabilities Act (ADA) and best practices.

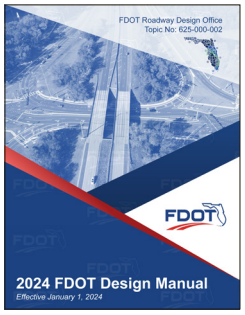


Quality Safety Analysis Section of Interchange Analysis Request User's Guide

The purpose of performing safety analyses in Interchange Access Requests (IARs) is to understand the impacts of the proposed modifications on safety and crash likelihood at an existing or proposed interchange.

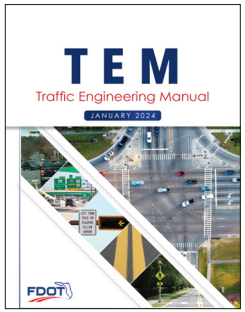
Florida Strategic Highway Safety Plan

A statewide safety plan developed by FDOT and its safety partners as a framework for eliminating fatalities and serious injuries on all public roads.



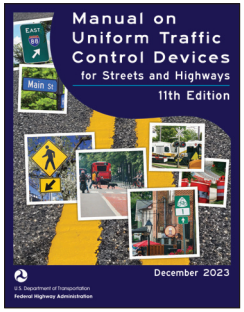
FDOT Design Manual

Florida specific manual that includes additions, deletions, or modifications to the AASHTO Greenbook to provide instructions and sample exhibits for preparing plans for roadway projects on the SHS.



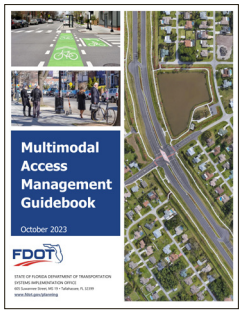
FDOT Traffic Engineering Manual

Florida specific reference that expands on national reference to provide traffic engineering standards and guidelines to be used on state roadways for signs, signals, markings, and operational topics for the SHS.



Manual on Uniform Traffic Control Devices

National reference manual that provides minimum standards for all traffic control devices—all road signs, highway markings, electronic traffic signals, railroad crossings, and roadway construction zone areas for public roadways.



FDOT Access Management Guidebook

Florida specific guide for coordinated planning, regulation, and design of access between roadways and land development by reducing conflicts on the roadway system and at its interface with other modes of travel for public roadways in Florida.

TRAFFIC SAFETY COALITIONS

The following traffic safety coalitions are resources to support the implementation of Florida's Strategic Highway Safety Plan and could also help in the reduction of identified crash types through different safety analyses.

Florida Occupant Protection Coalition

Motorcycle Safety Coalition

Florida Teen Safe Driving Coalition

Traffic Records Coordinating Committee

Florida Impaired Driving Coalition

Florida's Pedestrian and Bicycle Safety Coalition

Safe Mobility for Life Coalition

For up-to-date information and links, visit FDOT Safety Coalitions.

FDOT

TARGET ZERO

FATALITIES & SERIOUS INJURIES