

ADVANCING IMPLEMENTATION OF THE SAFE SYSTEM APPROACH

WEBINAR

MAY 8, 2024, 12:00 PM – 2:00 PM ET

ZERO IS OUR
GOAL
A SAFE SYSTEM IS HOW WE GET THERE



U.S. Department of Transportation
Federal Highway Administration

presented by

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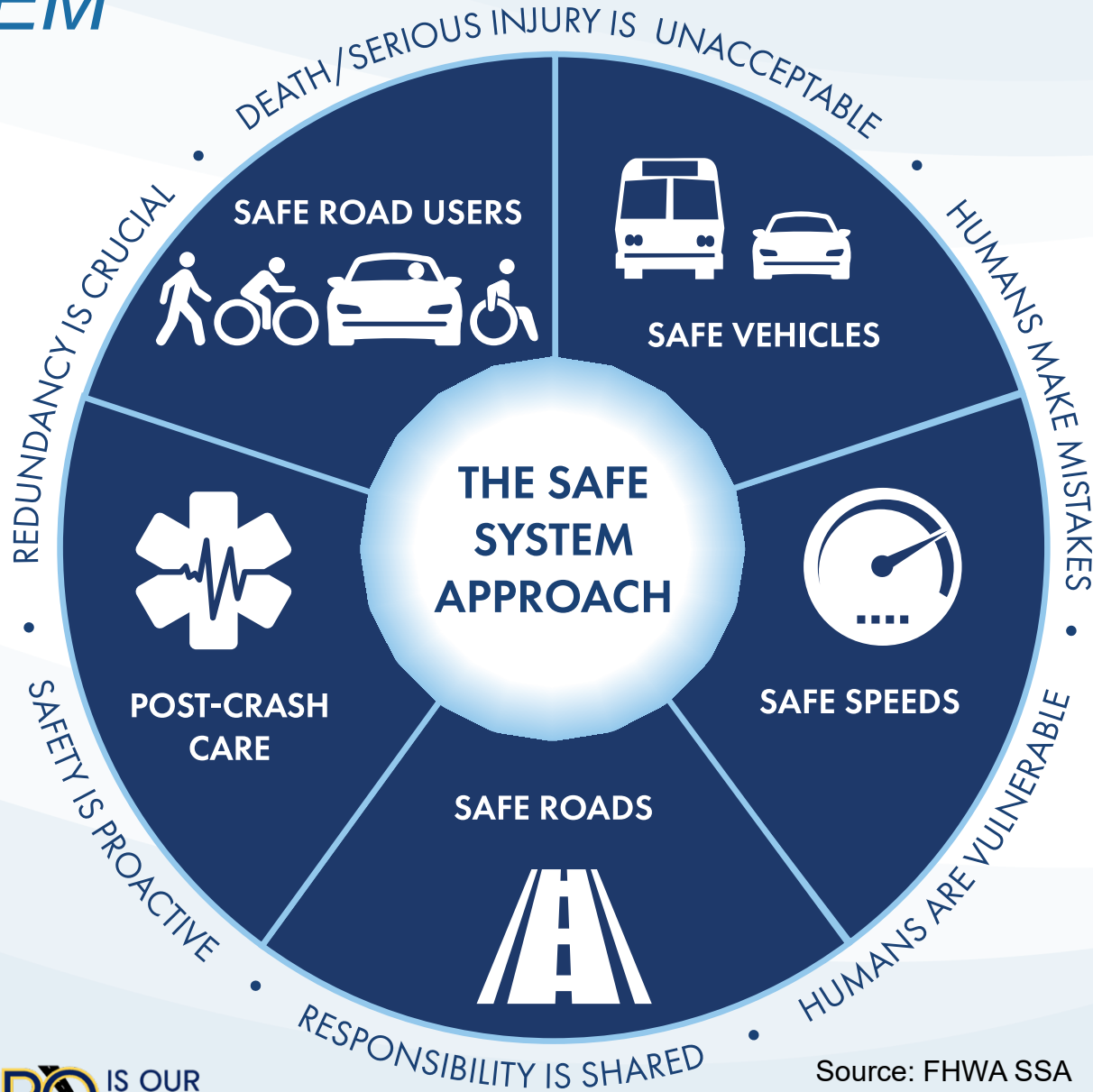
AGENDA



- Introduction
- Safe System Roadway Design Hierarchy
- Safe System Alignment Frameworks
- Other Safe System Assessment Tools
- Pilot Applications



SAFE SYSTEM APPROACH



Source: FHWA SSA



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SAFE SYSTEM APPROACH

Choose Your Own Pathway

“There is **no single pathway** for the adoption, establishment and implementation of a Safe System. Moving to a Safe System is a learning-by-doing process best described as a journey which presents opportunities, hazards and challenges along the way.”

Source: Zero Road Deaths and Serious Injuries: Leading a Paradigm Shift to a Safe System; OECD (2016)



INTEGRATING THE SSA INTO HSIP

- Research, prioritize, and fund engineering countermeasures that address Safe System elements and principles
- Assess crash severity risk using level of kinetic energy transfer and speed
- Identify opportunities to encourage local planning efforts that align with the Safe System Approach
- Establish Safe System working group and pilot projects



Source: FHWA



PROJECT PURPOSE

- The objective of this task order is to identify Safe System solutions (e.g. countermeasures or strategies) for highway safety improvement projects and conduct Safe System pilot projects.
- Safe System Solutions
 - » Conduct Literature Review
 - » Identify Safe System Solutions
 - » Develop Safe System Prioritization Framework
 - » Develop outreach materials
- Safe System Pilots
 - » Identify Pilot Locations
 - » Conduct Pilots



PILOT WORKSHOPS

- Assemble Review Team
- Develop Review Methodology
- Develop & Host Workshop
- Lead Project Review
- Prepare Recommendations Report
- Develop Pilot Application Summary

 U.S. Department of Transportation Federal Highway Administration	SAFE SYSTEM SOLUTIONS IN HIGHWAY SAFETY IMPROVEMENT PROJECTS Nevada DOT/Town of Nixon Workshop PROJECT OVERVIEW+ AGENDA <i>Friday, August 26, 2022</i>	 A SAFE SYSTEM IS HOW WE GET THERE
9:00-9:10 AM	Welcome	Karen Scurry
9:10-9:20 AM	Purpose, Ground Rules, and Logistics	Cory Hopwood
9:20-12:00 PM	Safe System Approach, Prioritization Framework, Examples, and Breakout Groups	Cory Hopwood/ Doug Cobb
<i>Safe System Approach + Potential Safe System Solutions (30 minutes) - Cory</i>		
<ul style="list-style-type: none">• Safe System Approach (20 minutes)<ul style="list-style-type: none">◦ Which one shows a Safe System?• Potential Safe System Solutions and Hierarchy of Effectiveness (10 minutes)		
<i>FHWA Intersection Framework + Austroads Alignment Matrix (20 minutes) - Cory</i>		
<ul style="list-style-type: none">• FHWA Intersection Framework (10 minutes)• Austroads Alignment Framework (10 minutes)		
<i>FHWA Safe System Alignment and Factors (50 minutes) - Doug</i>		
<ul style="list-style-type: none">• Factor 1: Exposure (10 minutes)• Factor 2: Crash Likelihood (10 minutes)• Factor 3: Crash Severity (10 minutes)• Safety Prompts (10 minutes)• Framework Scoring (10 minutes)		
<i>Break - (10 minutes)</i>		
<i>FHWA Framework Example (50 minutes) - Cory/Doug</i>		
<ul style="list-style-type: none">• Intersection Example		
12:00 - 1:00 PM	Lunch - (60 minutes)	
1:00 - 2:15 PM	Breakout Groups (75 minutes) - Cory/Doug	
<ul style="list-style-type: none">• Breakout Groups (Intersection Groups; Segment Groups)<ul style="list-style-type: none">◦ Introduction to the Scenario (5 minutes)◦ Identify Issues/Concerns (10 minutes)◦ Identify Contributing Factors (10 minutes)◦ Conduct Analysis on Existing Conditions (10 minutes)◦ Identify Potential Mitigations (10 minutes)◦ Conduct Framework Analysis w/ Mitigations (10 minutes)◦ Deliberation and Discussion (20 minutes)		

Source: FHWA

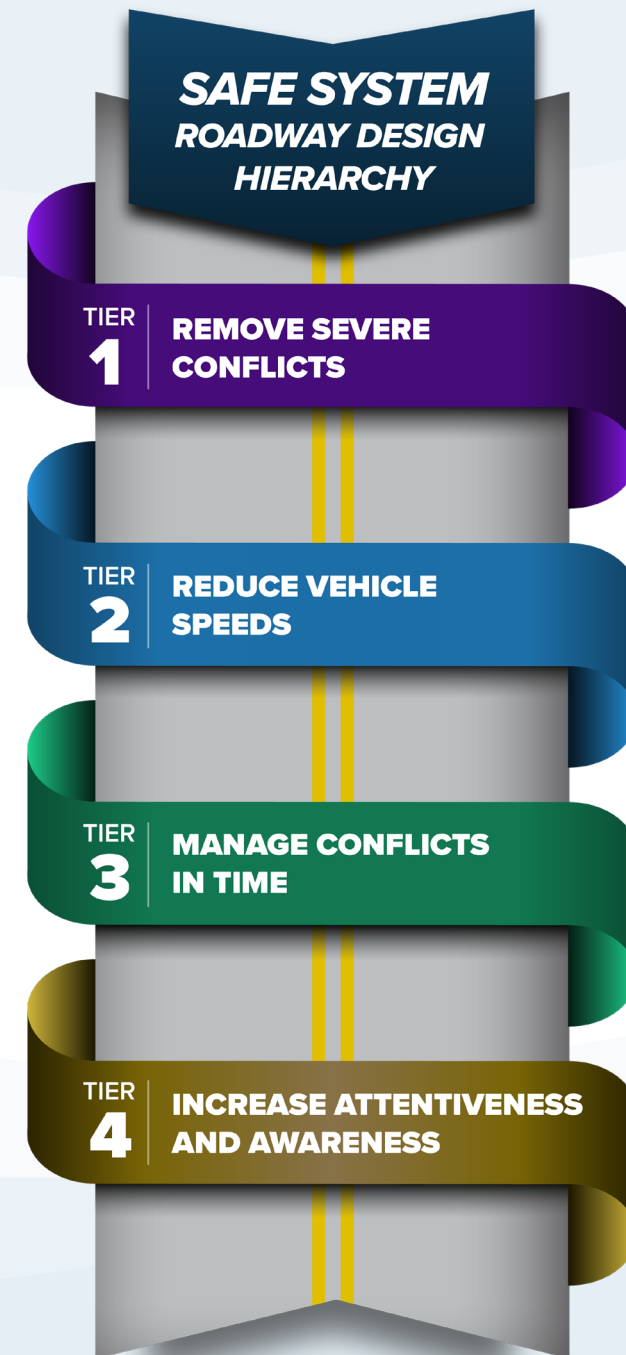
PILOT LOCATIONS

State/Organization	Project Description
MassDOT	RSA through Safe System Lens
Nevada DOT	Town of Nixon is access point for Burning Man music festival
Michigan DOT	Reviewing HSIP Manual and Integrating Safe System Lens into it
DRCOG	Corridor Study that is looking to improve crashes and make more multimodal
Broward MPO	Recently Updated their Off-Stem Road Safety Audit Process and looking to get feedback on Process and to help expedite design and construction for safety countermeasures
MAG	Recently approved their STSP and looking to evaluate the Safe System in Action Section of the document
Omaha	Support on identify safe system solutions along corridor to improve safety
Caltrans	Support on their ROR monitoring program to determine how well it fits within the Safe System Approach



OUTCOMES

- Safe System Roadway Design Hierarchy
- Safe System Alignment Frameworks
 - » Project-based
 - » Policy-based
- Promotional Materials
- Outreach Activities



Source: FHWA



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SAFE SYSTEM ROADWAY DESIGN HIERARCHY

PHIL BOBITZ

FHWA OFFICE OF SAFETY

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SAFE SYSTEM ROADWAY DESIGN HIERARCHY



SAFE SYSTEM ROADWAY DESIGN HIERARCHY

TIER
1

**REMOVE SEVERE
CONFLICTS**

TIER
2

**REDUCE VEHICLE
SPEEDS**

TIER
3

**MANAGE CONFLICTS
IN TIME**

TIER
4

**INCREASE ATTENTIVENESS
AND AWARENESS**



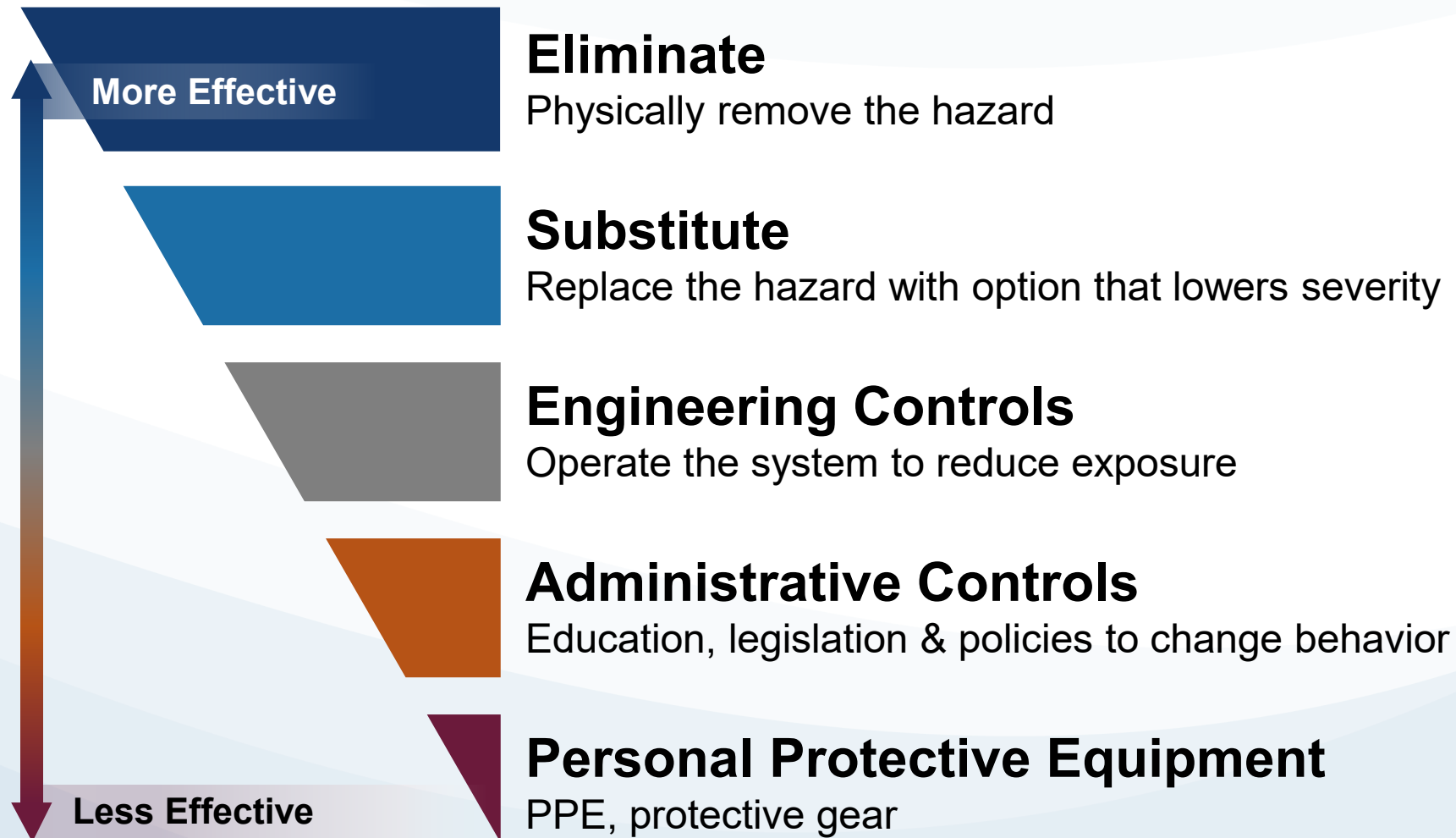
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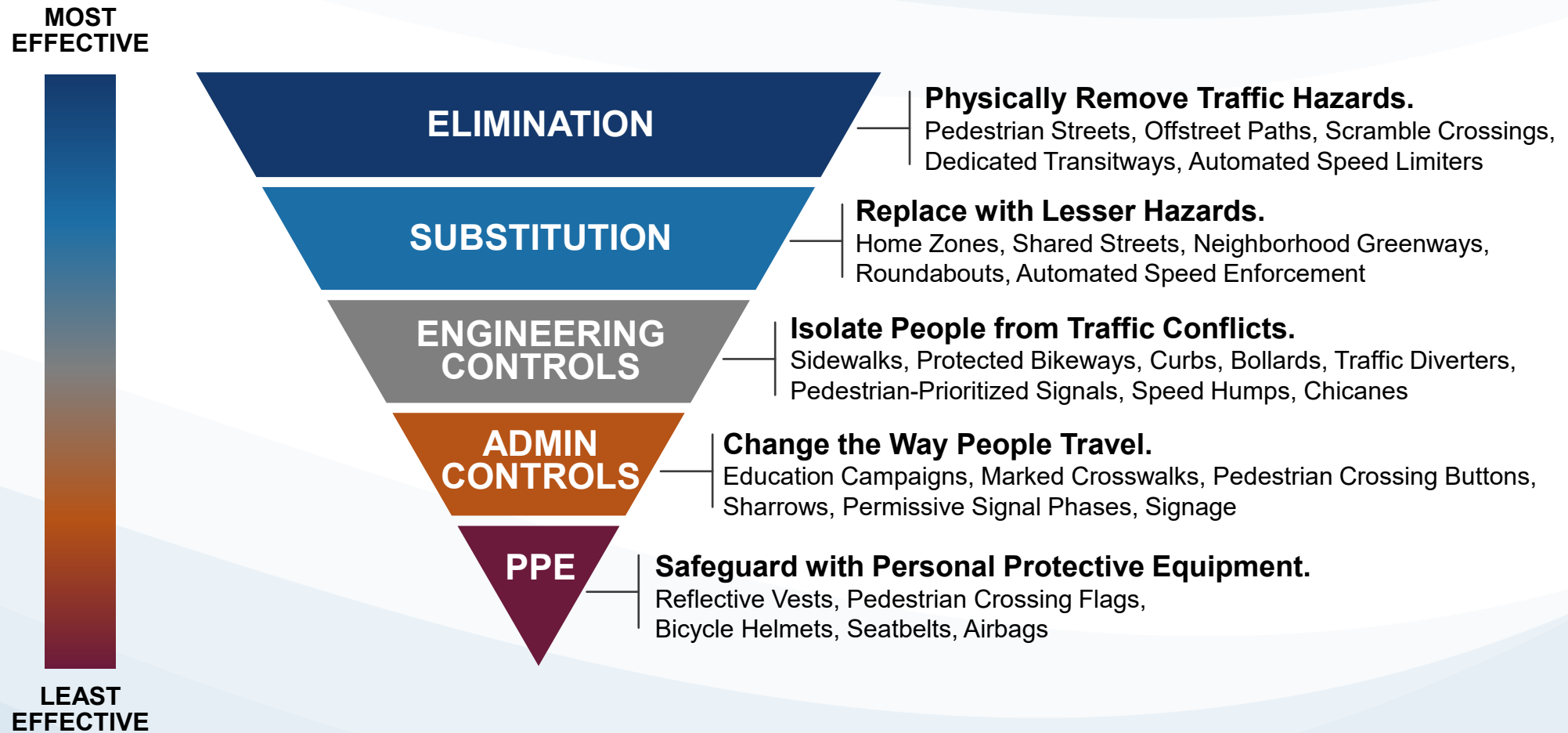
Source: FHWA.

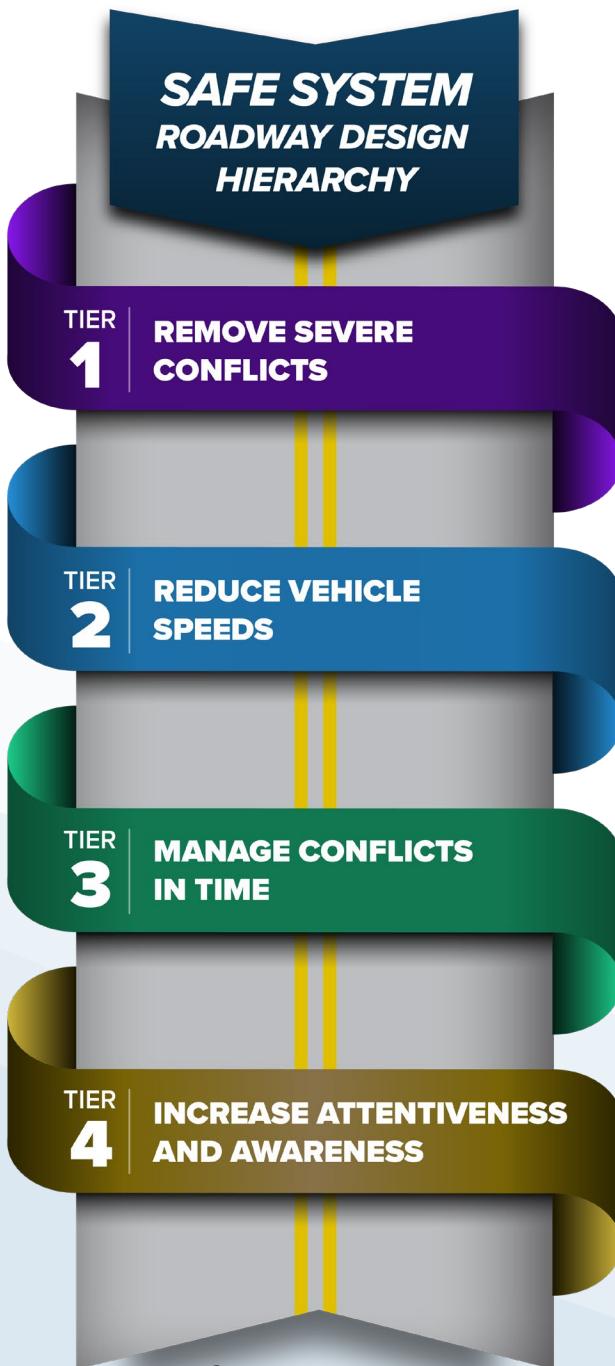
PREVENTION THROUGH DESIGN (PTD)

HIERARCHY OF CONTROL



HIERARCHY OF STREET SAFETY CONTROLS

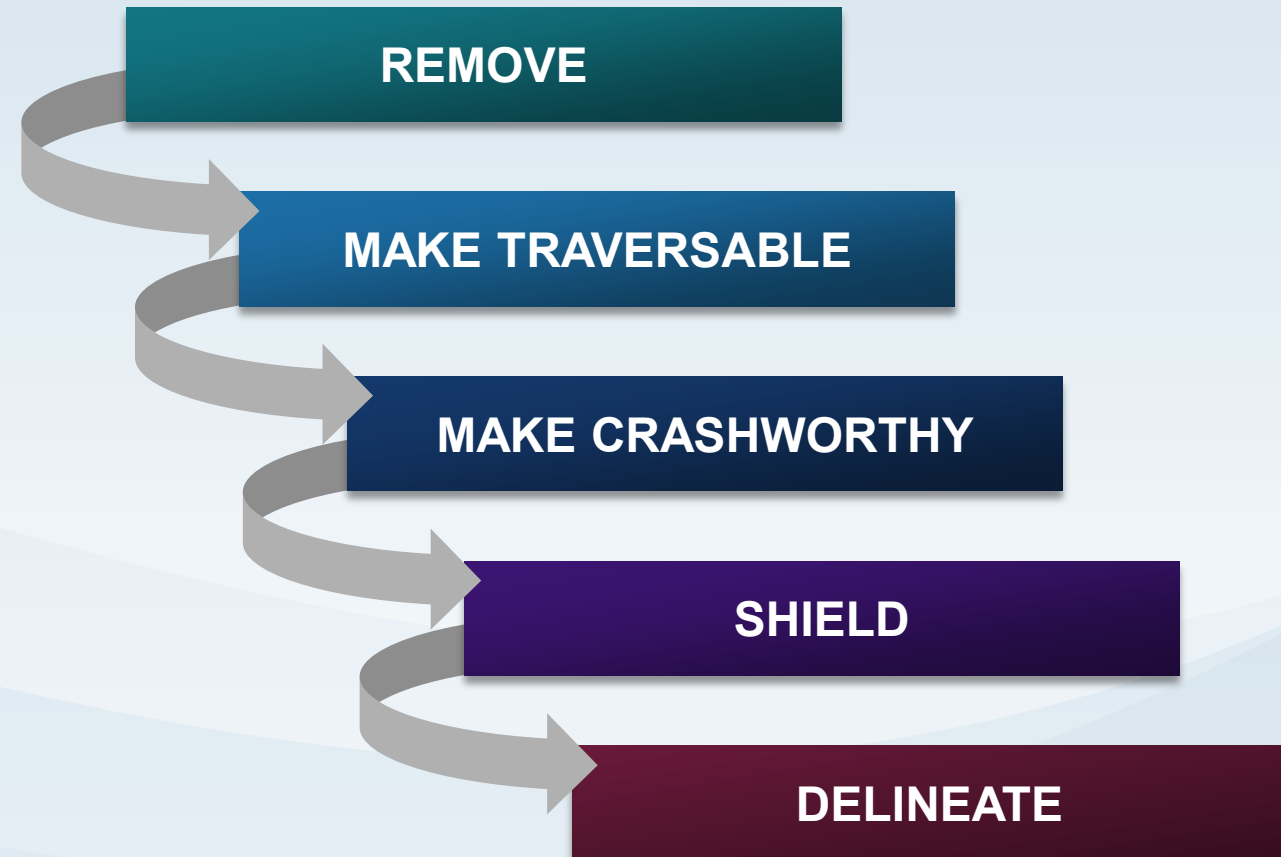




Source: FHWA.

WHAT'S OLD IS NEW

Hierarchy to address hazards within the roadside clear zone



Derived from AASHTO Roadside Design Guide.

REMOVE SEVERE CONFLICTS

- Supports the *Safe Roads* and *Safe Road Users* elements of the SSA
- Removing severe conflicts reduces risk by **eliminating potential roadway safety hazards**, providing **physical separation by space** to protect all roadway users, and **manages kinetic energy**

Proven Safety Countermeasures



Bicycle Lanes



Medians and
Pedestrian
Refuge Islands



Road Diets



Walkways



Median Barriers



Roadside Design
Improvements
at Curves



SafetyEdgeSM



Roundabouts



Corridor
Access
Management



Dedicated Left and Right
Turns at Intersections



Reduced Left Turn
Conflict Intersections



Local Road Safety Plans



Pavement Friction
Management



Road Safety Audits



REMOVE SEVERE CONFLICTS

NSC

New or Novel Safety Countermeasures

PSC

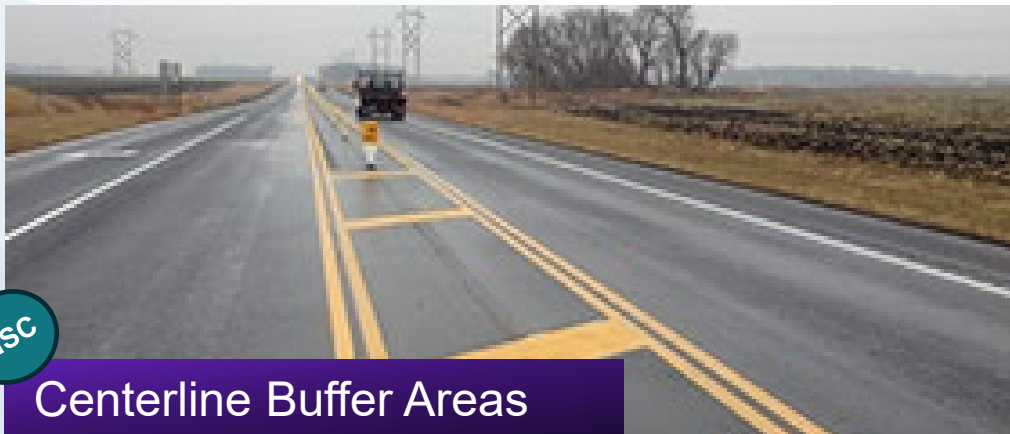
Proven Safety Countermeasures



NSC

Cable Median Barriers

Source: Oregon Highway US-26 – <https://www.semanticscholar.org/paper/Performance-Evaluation-of-a-Cable-Median-Barrier-on-Burns-Bell/3b556bdc0762981e9f88612a1247d0d9e91f5591>



NSC

Centerline Buffer Areas

Source: Centerline Buffer Area with yellow strips and centerline rumble strips on Highway 14, MnDOT: <https://www.mnltap.umn.edu/publications/exchange/2015/spring/us14.html>



PSC

Roundabouts

Source: McCormick Taylor, Frankford-Trenton-York Roundabout (Philadelphia, Pennsylvania) – <https://www.mccormicktaylor.com/our-work/frankford-trenton-york-roundabout>



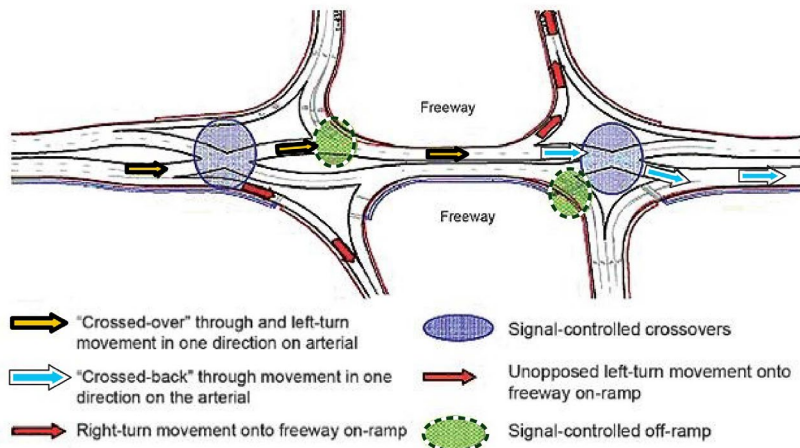
PSC

Separated Bike Lanes

Source: Making Safer Streets, New York City DOT – dot-making-safer-streets.pdf (nacto.org)

TIER 1

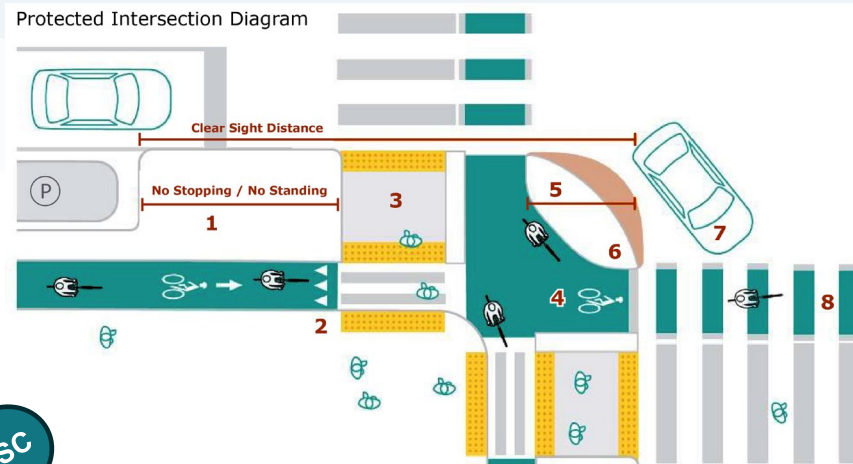
REMOVE SEVERE CONFLICTS



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Diverging Diamond Interchange

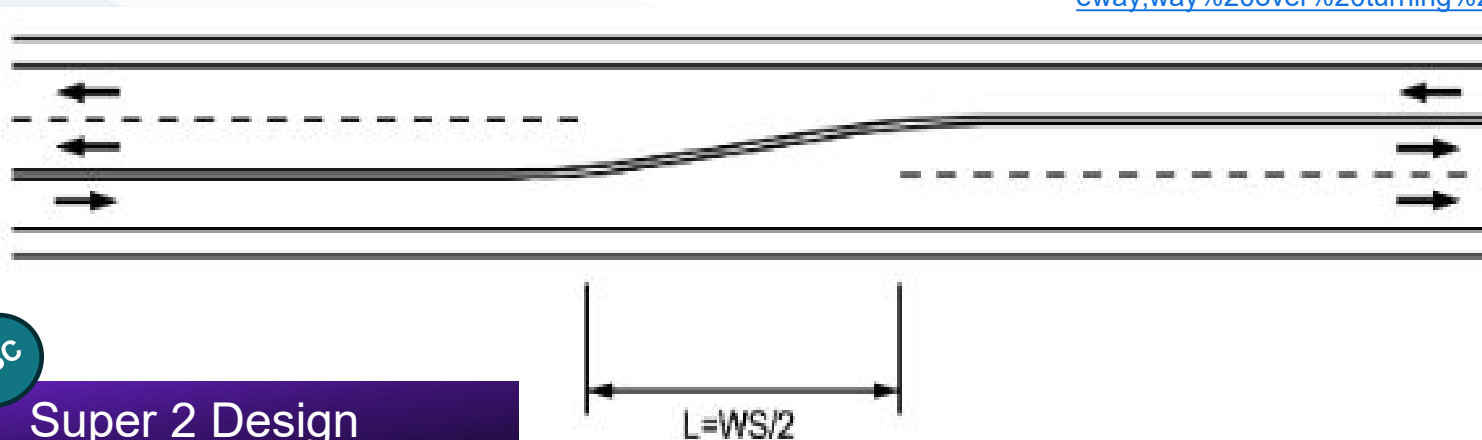
Source: FHWA, Diverging Diamond Interchange – <https://safety.fhwa.dot.gov/intersection/crossover/fhwasa14039.pdf>



NSC

Protected Intersection Features

Source: Protected Intersection Diagram, NACTO – <https://nacto.org/publication/dont-give-up-at-the-intersection/protected-intersections/#:~:text=At%20protected%20intersections%2C%20the%20bike%20way%20over%20turning%20motor%20vehicles.>



NSC

Super 2 Design

Source: Opening an Inside Passing Lane, TxDOT – http://onlinemanuals.txdot.gov/txdotmanuals/rdw/super_2_highways.htm#i1012456



Source: Super 2 Design, Texas A&M Institute 18

- Supports the *Safe Roads, Safe Speeds, and Safe Road Users* elements of the SSA
- Physical features to slow traffic supports the **management of kinetic crash energy to reduce impact forces on the human body**

Proven Safety Countermeasures



Appropriate
Speed Limits for
All Road Users



Road Diets



Roundabouts



Speed Safety
Cameras



Local Road
Safety Plans



Variable Speed
Limits



Pavement Friction
Management

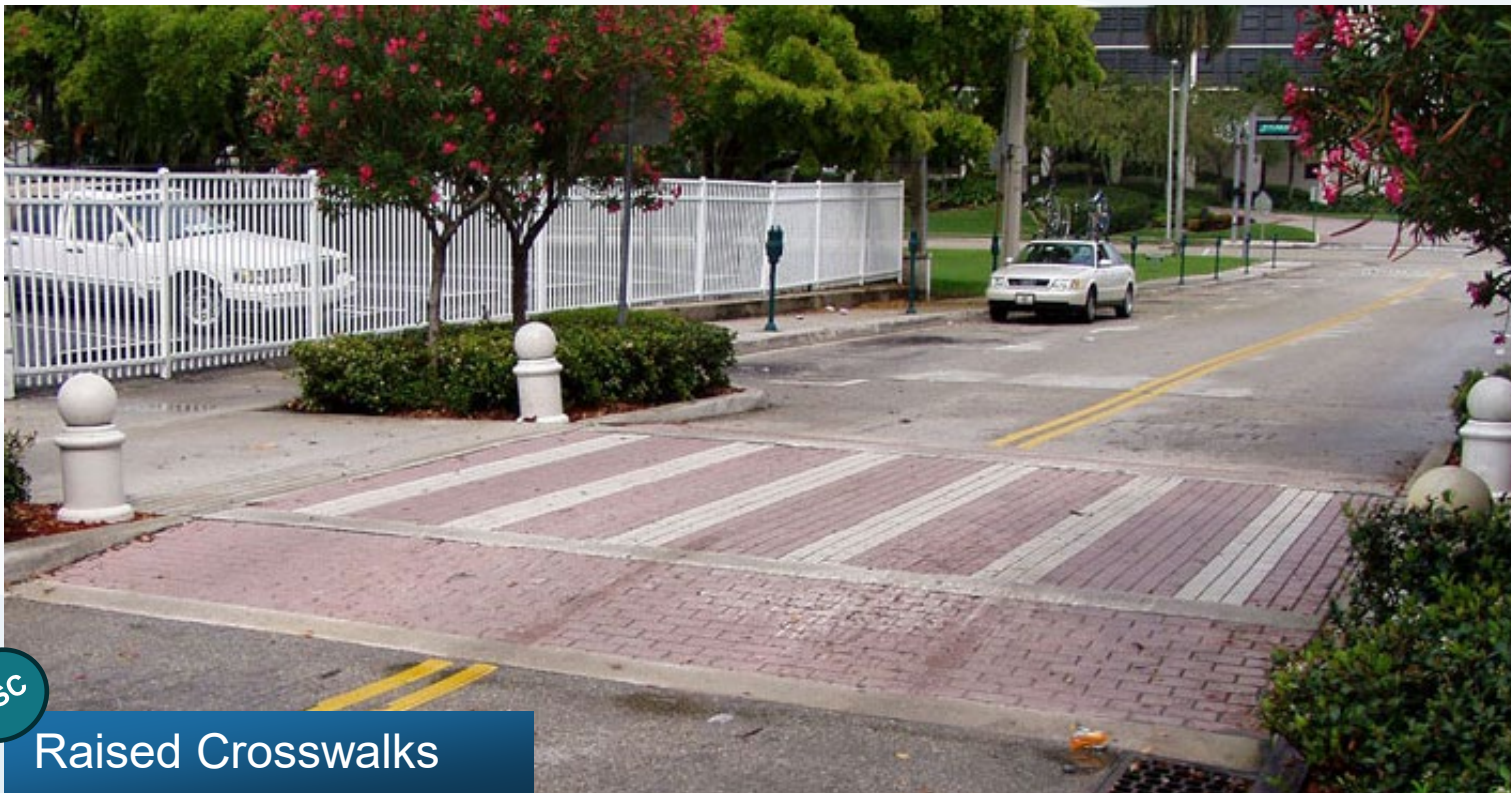


Medians and
Pedestrian
Refuge Islands



Road Safety Audit





NSC

Raised Crosswalks

Source: PedBikeImages – <https://www.pedbikeimages.org/details.php?picid=1301>.



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Self-Enforcing Roads

Source: Dan Hartman, City of Golden, CO – <https://highways.dot.gov/safety/speed-management/noteworthy-practice-booklet-speed-management/case-study-2-noteworthy-speed>.





NSC

Gateways

Source: Overhead reduced speed reduction sign leading up to the Village of Chatham gateway sign (Village of Chatham, Pennsylvania), Google Street View.



NSC

Speed Bump/Hump

Source: Speed Bump in Glendale Arizona, photo credit – Mike Cynecki:
<https://www.pedbikeimages.org/details.php?picid=435>.

TIER

2

REDUCE VEHICLE SPEEDS



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- Supports the *Safe Roads, Safe Speeds, and Safe Road Users* elements of the SSA
- Reduces traffic collisions by **separating users in time**
- Managing conflicts in time supports **safe roadway navigation, comfort, and convenience** for all users

Proven Safety Countermeasures



Leading Pedestrian Interval



Pedestrian Hybrid Beacons



Yellow Change Intervals

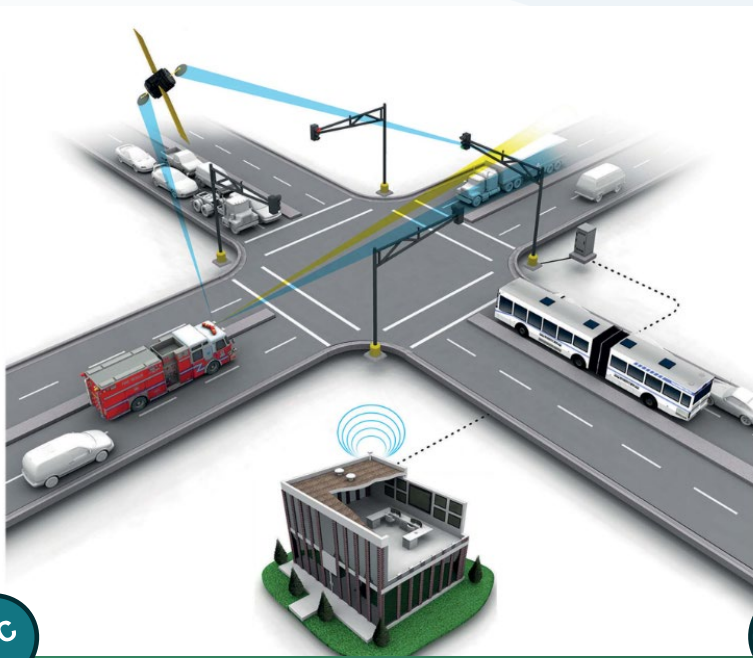


Local Road Safety Plans



Road Safety Audit





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Emergency Vehicle Preemption

Source: ITS International –
<https://www.itsinternational.com/its8/feature/priority-management-saves-time-money-and-lives>



NSC

Coordinated Signal Timing

Source: Urban Street Design Guide, NACTO.



NSC

Pedestrian Scramble

Source: Kamala Parks:
<https://www.pedbikeimages.org/details.php?picid=2580>

TIER
3

MANAGE CONFLICTS IN TIME



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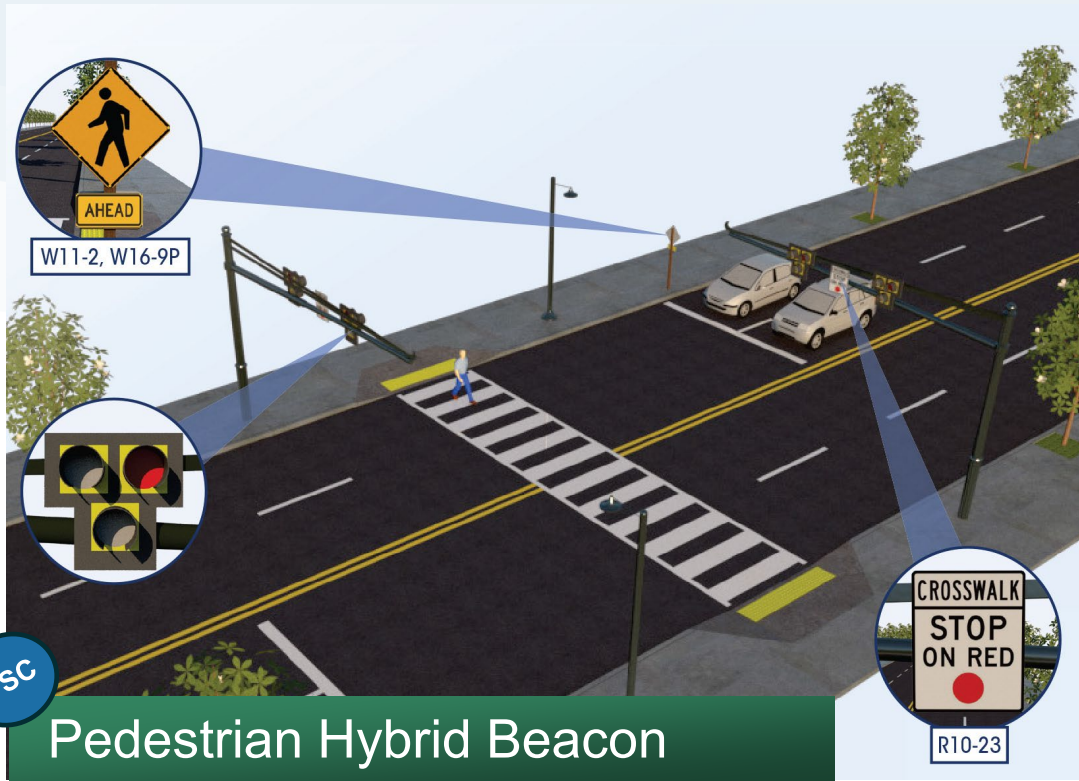
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Left-Turn Phasing

Source: FHWA.



PSC

Pedestrian Hybrid Beacon

Source: Pedestrian Hybrid Beacon (PHB), FHWA.

TIER
3

MANAGE CONFLICTS IN TIME

- Supports the *Safe Roads, Safe Speeds, and Safe Road Users* elements of the SSA
- Reinforces the Safe System principle that **responsibility is shared among all road users**
- Countermeasures that increase attentiveness and awareness **help drivers avoid potential crashes**

Proven Safety Countermeasures



Variable Speed Limits



Wide Edge Lines



Crosswalk Visibility Enhancements



Backplates with Reflective Borders



Rectangular Rapid Flashing Beacons (RRFB)



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



Enhanced Delineation for Horizontal Curves



Lighting



Longitudinal Rumble Strips and Stripes

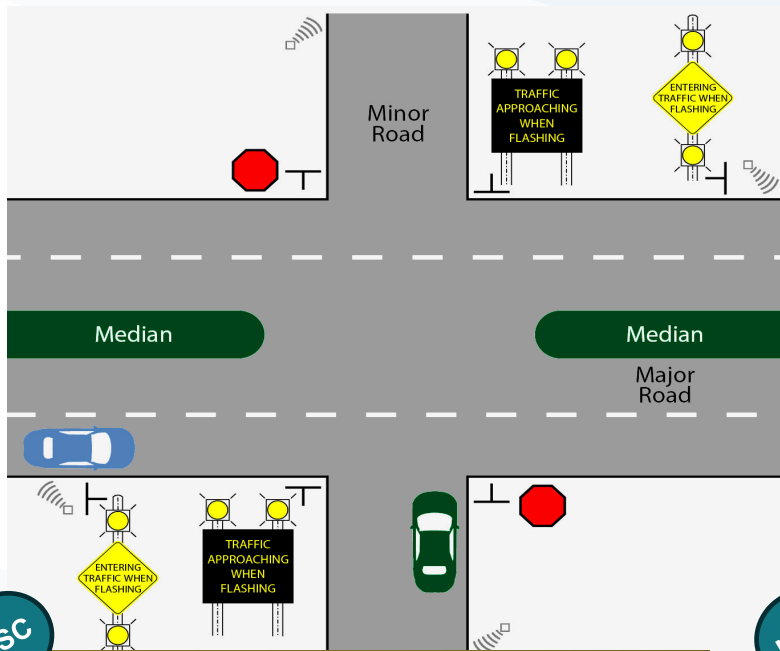


Local Road Safety Plans



Road Safety Audit





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Conflict Warning Systems

Source: ICWS highway roadway diagram and signage, Indiana Department of Transportation:
<https://www.in.gov/indot/traffic-engineering/intersection-conflict-warning-systems/>



NSC

Bicycle Treatments

Source: FHWA, Green Colored Paint: Improving Intersections for Pedestrians and Bicyclists: Informational Guide (dot.gov)



NSC

Transverse Rumble Strips

Source: Getty Images.

TIER

4

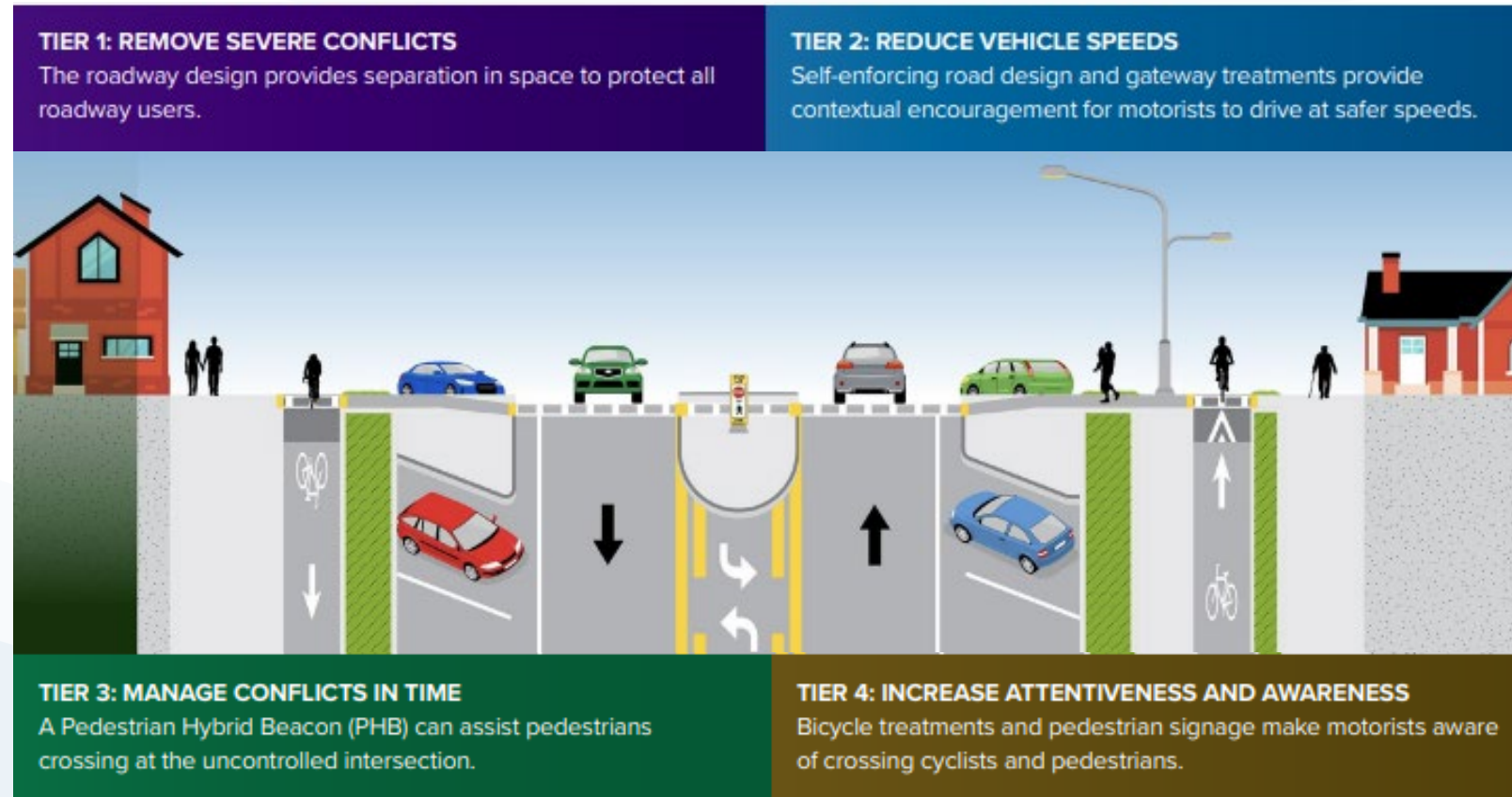
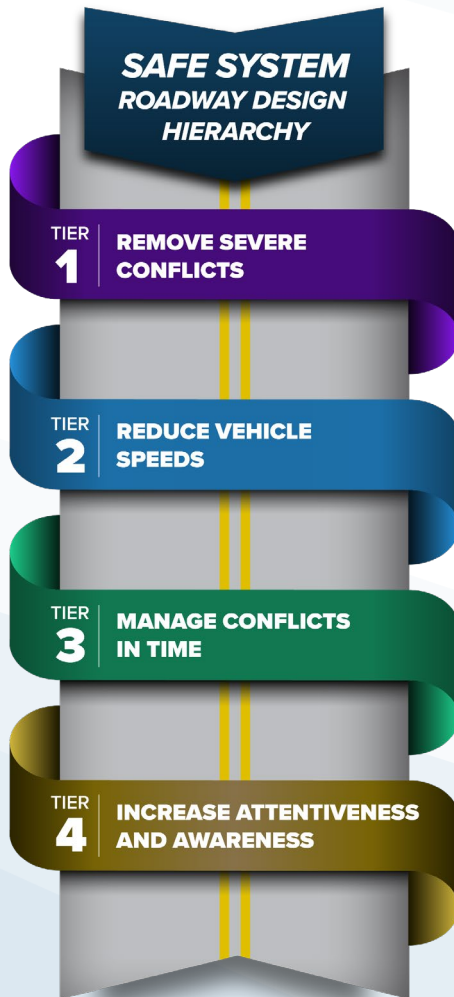
INCREASE ATTENTIVENESS AND AWARENESS



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HOW TO USE THE HIERARCHY



SAFE SYSTEM PROJECT-BASED ALIGNMENT FRAMEWORK

CORY HOPWOOD
CAMBRIDGE SYSTEMATICS

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PROJECT-BASED ALIGNMENT FRAMEWORK

Project-Based Alignment Framework Factors

Safe Speeds, Safe Roadways (Quantitative)

- Crash Exposure
- Crash Likelihood
- Crash Severity

Safe Users, Safe Vehicles, Post-Crash Care (Qualitative)

- Prompts and Questionnaires



Source: FHWA.



EXPOSURE



Source: FHWA.

The volume and/or length (distance) various users are using a facility and could be involved in a potential crash



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Alignment Framework – Exposure Scoring Matrix

Project Location:

Category: *Exposure*

Vulnerable Road Users

Factor: Vulnerable Users Present (users per day)

Thresholds	Values
Less than 10	1
10 - 25	4
25 - 50	6
50 - 100	8
Greater than 100	10
User Input VRU Count	
Score	0

Factor: Crossing Distance (Max Number of Lanes)

Thresholds	Values
One Lane	1
Two Lanes	4
Three Lanes	6
Four Lanes	8
More than Four Lanes	10
User Input Distance	
Score	0
Exposure Score: Vulnerable Road Users Subtotal	0

Motor Vehicles

Factor: Motor Vehicle Volumes (AADT)

Thresholds	Values
Less than 1,000	1
1,000 - 5,000	4
5,000 - 10,000	6
10,000 - 15,000	8
Greater than 15,000	10
User Input AADT	
Score	0

Factor: Roadway Width (feet)

Thresholds	Values
Less than 30	1
30 - 35	4
36 - 41	6
42 - 47	8
48 or more	10
User Input Width	
Score	0
Exposure Score: Motor Vehicles Subtotal	0

Comments and Assumptions

Comments and Assumptions (Optional)

Source: FHWA.



LIKELIHOOD



Source: FHWA.

Elements and/or risks that impact the probability of a crash taking place by influencing the opportunity for conflict and/or user error rates



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Alignment Framework – Likelihood Scoring Matrix

Project Location:

Category: *Likelihood (Contributing Factors)*

Vulnerable Road Users

Factors: Risk Factor Evaluation

Thresholds	Values
Less than Two	1
Two	3
Three	6
Four	9
Five	12
Six	15
Seven	18
Eight	21
Nine	24
Ten	25
Eleven	26
Twelve	27
Thirteen	28
Fourteen	29
Fifteen	30
User Input Risk Factors	Identify and Weight Risk Factors - See Risk Factors (VRU) Tab
Score	Select Location Type
Select Intersection or Segment	
Likelihood Score: Vulnerable Road Users Subtotal	Select Location Type

Motor Vehicles

Factors: Risk Factor Evaluation

Thresholds	Values
Less than Two	1
Two	3
Three	6
Four	9
Five	12
Six	15
Seven	18
Eight	21
Nine	24
Ten	25
Eleven	26
Twelve	27
Thirteen	28
Fourteen	29
Fifteen	30
User Input Risk Factors	Identify and Weight Risk Factors - See Risk Factors (Motor Vehicle) Tab
Score	Select Location Type
Select Intersection or Segment	
Likelihood Score: Motor Vehicles Subtotal	Select Location Type

Source: FHWA.



Risk Factors (Motor Vehicle)

Roadside

Risk Factor: Lighting Conditions

Roadway Segments

Along Segment (Place "X" for condition that most closely applies)	Scaling Conditions for the Risk Factors	Scaling Conditions for the Risk Factors Description
	0	Lighting provided (substantial and meets illuminance standards)
	1.5	Lighting provided but not substantial
	3	No roadway lighting (does not include commercial lighting)
-	N/A	N/A

Intersections

Major Roadway Approaches Eastbound: Approach #1 (Place "X" for condition that most closely applies)	Major Roadway Approaches Westbound: Approach #2 (Place "X" for condition that most closely applies)	Minor Roadway Approaches Northbound: Approach #1 (Place "X" for condition that most closely applies)	Minor Roadway Approaches Southbound: Approach #2 (Place "X" for condition that most closely applies)	Scaling Conditions for the Risk Factors	Scaling Conditions for the Risk Factors Description
				0	Lighting provided (substantial and meets illuminance standards)
				1.5	Lighting provided but not substantial
				3	No intersection lighting (does not include commercial lighting)
-	-	-	-	N/A	N/A

Risk Factor: Fixed Objects

Roadway Segments

Along Segment (Place "X" for condition that most closely applies)	Scaling Conditions for the Risk Factors	Scaling Conditions for the Risk Factors Description
	0.00	No fixed objects within 30 feet (if operating speed exceeds 35 MPH)
	3.00	Fixed objects within 30 feet (if operating speed exceeds 35 MPH)
-	N/A	N/A

Risk Factors (VRU)

Roadside

Risk Factor: Pedestrian Space Separation

Roadway Segments

Along Segment (Place "X" for condition that most closely applies)	Scaling Conditions for the Risk Factors	Scaling Conditions for the Risk Factors Description
	0.00	Separated Shared Use Path
	0.75	Buffered (4 feet or more) sidewalk (width greater than 5 feet)
	1.50	Buffered (4 feet or more) sidewalk (width of 5 feet or less)
	2.25	Back-of-Curb Sidewalk (any width)
	3.00	Discontinuous or no sidewalk
-	N/A	N/A

Intersections

Major Roadway Approaches Eastbound: Approach #1 (Place "X" for condition that most closely applies)	Major Roadway Approaches Westbound: Approach #2 (Place "X" for condition that most closely applies)	Minor Roadway Approaches Northbound: Approach #1 (Place "X" for condition that most closely applies)	Minor Roadway Approaches Southbound: Approach #2 (Place "X" for condition that most closely applies)	Scaling Conditions for the Risk Factors	Scaling Conditions for the Risk Factors Description
				0.00	High Emphasis Raised Crosswalk on Approach or Grade Separated Crossing
				0.75	Crosswalk Marking (decorative or material) on Approach
				1.50	Crosswalk marking (high emphasis or ladder marking) on Approach
				2.25	Crosswalk marking (only lateral bars) on Approach
				3.00	No Crosswalk Marking on Approach
-	-	-	-	N/A	N/A

Risk Factor: Bike Space Separation

Roadway Segments

Along Segment (Place "X" for condition that most closely applies)	Scaling Conditions for the Risk Factors	Scaling Conditions for the Risk Factors Description
	0.00	Shared Use Path
	0.75	Buffered Bicycle Lane (protected) or Cycle Track
	1.50	Buffered Bicycle Lane (unprotected)
	2.25	On-Street Bicycle lane
	3.00	No designated facilities, "Shared the Road", or Sharrows
-	N/A	N/A

SEVERITY

**Factors that impact
the probability of a
serious or fatal
injury in the event
of a crash**



Source: FHWA.



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Alignment Framework – Severity Scoring Matrix

Project Location:

Category: Severity

Vulnerable Road Users

Risk Factor: Operating Speed (mph) or Speed Limit +7 mph

Thresholds	Values
0 - 20	1
21 - 25	5
26 - 30	10
31 - 35	15
Over 35	20
User Input Speed	
Score	0
For proposed conditions only: Do proposed improvements address factors impacting speed	
Vulnerable Road Users Subtotal	0
Comments and Assumptions (Discuss these improvements. Be sure to consider if these changes create new potential for severe conflict or speeding.) (Optional)	

Motor Vehicles

Risk Factor: Operating Speed (mph) or Speed Limit +7 mph

Thresholds	Values
0 - 25	1
26 - 30	3
31 - 35	6
36 - 40	9
41 - 45	12
46 - 50	15
51 - 55	18
Greater than 55	20
User Input Speed	
Score	0
For proposed conditions only: Do proposed improvements address factors impacting speed	
Motor Vehicles Subtotal	0
Comments and Assumptions (Discuss these improvements. Be sure to consider if these changes create new potential for severe conflict or speeding.) (Optional)	

Source: FHWA.



SUMMARY SCORING SHEET

Alignment Framework – Final Scoring Matrix

Project Location:

Category	Vulnerable Road Users (VRU)	VRU Score	Motor Vehicles	Motor Vehicles Score
Exposure Score:	Vulnerable Road Users Subtotal	0	Motor Vehicles Subtotal	0
Likelihood Score:	Vulnerable Road Users Subtotal	Select Location Type	Motor Vehicles Subtotal	Select Location Type
Severity Score:	Vulnerable Road Users Subtotal	0	Motor Vehicles Subtotal	0
Mode Subtotal:	Vulnerable Road Users	0	Motor Vehicles	0
<i>Total Score:</i>				
0				

Source: FHWA.



SAFE SYSTEM PROMPTS

Alignment Framework – Final Scoring Matrix

Project Location:

Safe System Elements	Prompts
Road User	<ol style="list-style-type: none"> 1. Are there design elements and built environment that impact user behaviors? Are there factors that might influence this? 2. What are the expected compliance and enforcement levels (alcohol/drugs, speed, road rules, and driving hours)? What is the likelihood of driver fatigue? Can enforcement of these issues be conducted safely? 3. Are there considerations for bicycle, micro-mobility, moped, scooter and motorcycle user separation and visibility. 4. Are there special user groups in the community that require additional consideration and treatments? For example, school access routes; zero-car or low income households; homelessness and substance abuse in area; aging population; physical and mental health facilities; etc.?
Vehicle	<ol style="list-style-type: none"> 1. What level of alignment is there with the ideal of safer vehicles? 2. Has vehicle breakdown been catered for? 3. Are there commercial vehicle enforcement possibilities in the area (e.g., shoulders, pull-offs, other private/commercial locations)? Can enforcement of these issues be conducted safely? 4. Are there considerations for heavy vehicle speeding issues; turning radii (driveways and intersections), acceleration and deceleration lane/ramp design and TCD for speed; roadside delivery/parking locations, required weaving or left turns from driveway/intersection access points (e.g., downstream U-turns or routing; traffic gaps at crossovers; one or two stage left turns)?

Safe System Elements	Prompts
Post-crash care	<ol style="list-style-type: none"> 1. Are there issues that might influence safe and efficient post-crash care in the event of a severe injury (e.g. congestion, access stopping space)? What are the expected response times the location? 2. Do emergency and medical services operate as efficiently and rapidly as possible? 3. Are other road users and emergency response teams protected during a crash event? Are drivers provided the correct information to address travelling speeds on the approach and adjacent to the incident? Is there reliable information available via radio, VMS etc. 4. Are incident management plans developed and available for the corridor/route? 5. Is the location covered by traffic control technology (signal and freeway ATM Systems) to manage incidents?
Equity	<ol style="list-style-type: none"> 1. Does the alternative consider all users? 2. Is access for vulnerable users impacted? If so, how? 3. Has the underrepresented community been involved in the project?

Source: FHWA.



PROJECT-BASED ALIGNMENT FRAMEWORK

PROJECT-BASED ALIGNMENT CAN BE USED TO

- ✓ **ASSESS EXISTING CONDITIONS** and supplement Road Safety Audits through a Safe System lens using quantitative (crash exposure, likelihood, severity) and qualitative (safety prompts) evaluations of the site.
- ✓ **EVALUATE AND COMPARE PROJECT ALTERNATIVES** that can help improve Safe System alignment (e.g., eliminating risks, reducing exposure, etc.) using the Safe System Roadway Design Hierarchy to determine the best (i.e., cost/benefit) solution for the site.



SAFE SYSTEM POLICY-BASED ALIGNMENT FRAMEWORK

KENDRA SCHENK
BURGESS & NIPLE

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POLICY-BASED ALIGNMENT FRAMEWORK

POLICY-BASED ALIGNMENT FRAMEWORK FACTORS



**Based on
FHWA HSIP
Self
Assessment
Criteria**

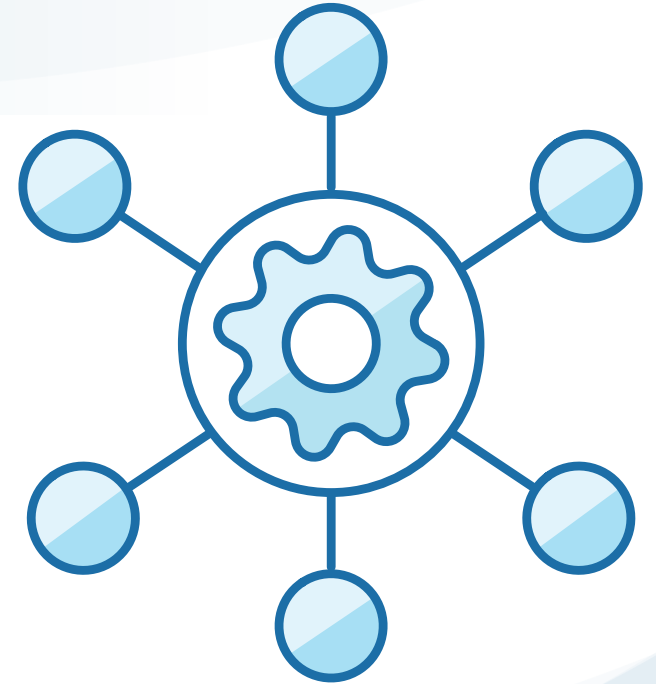
Source: FHWA

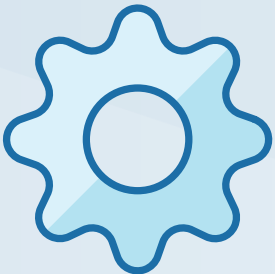


Phase	Scoring	Description	Example Situation	Example Scoring
Initiation	(0-3)	Agency has started to address the requirement described in the question. If the agency has not initiated any activities to address the requirement, record a response of "0".	The policy does not explicitly state a goal of zero fatal and serious injury crashes; however, the agency and management recently agreed that a goal should be developed.	<p>"1" Agency has begun initial discussion of the importance of planning around making zero fatal and serious injury crashes the documented goal.</p> <p>"2" Agency has identified ways to document that death and serious injury are unacceptable.</p> <p>"3" Agency has had advanced discussions on developing a plan to address the need to eliminate all fatal and serious injury crashes.</p>
Development	(4-6)	Agency has developed a plan or approach to address the requirement described in the question.	The policy does not explicitly state a goal of zero fatal and serious injury crashes; however, the agency and management recently committed future staff time and resources to the development of policy language explicitly stating fatal and serious injury crashes are unacceptable.	<p>"4" Agency has advanced the development of a plan (e.g., identified strategies, solutions, etc.) for addressing elimination of death and serious injury, but the plan has not been drafted yet.</p> <p>"5" Agency has advanced plan development, but plan is not finalized.</p> <p>"6" Agency has developed and finalized the plan to meet the requirement of addressing death and serious injury as unacceptable.</p>
Execution	(7-9)	Agency has executed an approach to meet the requirement described in the question.	The policy language has been edited to include the "elimination: of fatal or serious injury crashes, not just reducing crashes.	<p>"7" Agency has started drafting language into the policy about eliminating death and serious injury impacts to roadway improvement needs.</p> <p>"8" Agency has drafted language about addressing death and serious injury specifically and defined as a methodology.</p> <p>"9" Agency has finalized and adopted the approach and methodology to be integrated into the project delivery process.</p>
Evaluation	(10-12)	Agency has assessed the performance of the requirement described in the question after it has been executed for a period.	The agency has recently evaluated the adopted policy changes and developed a process to update the policy as needed.	<p>"10" Agency has the policy approved and has begun to set goals for the evaluation.</p> <p>"11" Agency has set goals for evaluation and evaluation approach focused on death and serious injury has been identified.</p> <p>"12" Agency has the goals set, initiated evaluation and has screened the policy to update based on results of evaluation.</p>
Integration	(13-15)	Agency has integrated the requirement described in the question into agency culture.	The agency has published policy updates following the assessment and uses it to guide several other agency practices.	<p>"13" Agency has adopted the policy changes supporting the notion that death and serious injury on the system is unacceptable.</p> <p>"14" Partners and agencies receiving support from or working with the Safety Program are required to support the principle.</p> <p>"15" All partner agencies and divisions are guided by the understanding mistakes on the roadway should not result in death and serious injury.</p>

POLICY-BASED ALIGNMENT FRAMEWORK

- Can be used to:
 - » Benchmark and track progress towards improving the Safe System Alignment of Agency Policies
 - » Raise the level of awareness of Safe System-related practices and strategies
 - » Identify gaps in existing policy and program efforts
 - » Generate strategies to improve Safe System Alignment in agency practices





FACTOR 1: *DEATH/SERIOUS INJURY IS UNACCEPTABLE*

Does the policy identify
the need to focus on
eliminating fatal and
serious injury crashes
versus all crashes?

3. MAG REGIONAL SAFETY

Most of Arizona's crashes occur in the MAG region and unfortunately, 4,470 people have died during the past 10 years (2009 through 2018). While fatal crashes have significantly increased during the past 10 years, pedestrian fatalities have nearly tripled, with most of these occurring during non-day-light hours.



MAG REGION 2009-2018



829,498 crashes



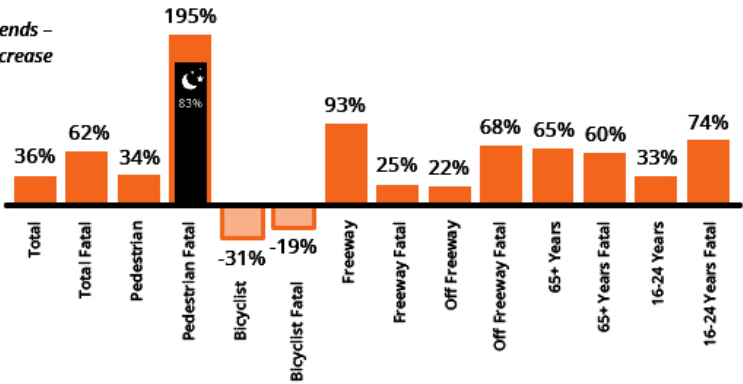
Nearly 4,500
people died



Nearly 380,000
people injured

- 65% of population
- 67% of vehicle miles traveled
- 71% of traffic deaths and injuries
- 73% of all crashes

MAG region crash trends –
percent increase/decrease
from 2009 to 2018

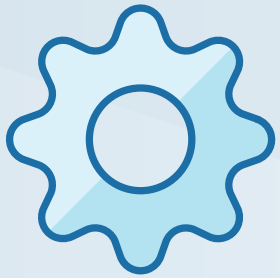


Source: MAG STSP 2021



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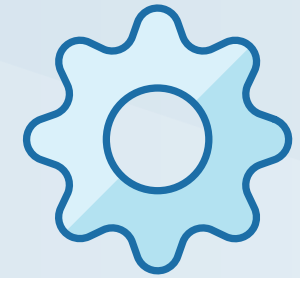


FACTOR 1:

DEATH/SERIOUS INJURY IS UNACCEPTABLE

All partner agencies and divisions are guided by the understanding that mistakes on the roadway should not result in death and serious injury.





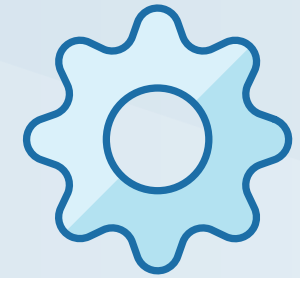
FACTOR 2: *HUMANS MAKE MISTAKES*

**Does the policy
address human error
in fatal and serious
injury crashes?
(i.e., does it evaluate
the human factors
related to the
crashes)**



Source: Bing Streetside, FHWA Rumble Strips and Rumble Stripes Decision Support Guide.

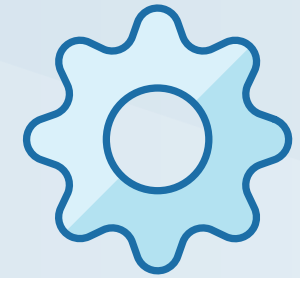




FACTOR 2: *HUMANS MAKE MISTAKES*

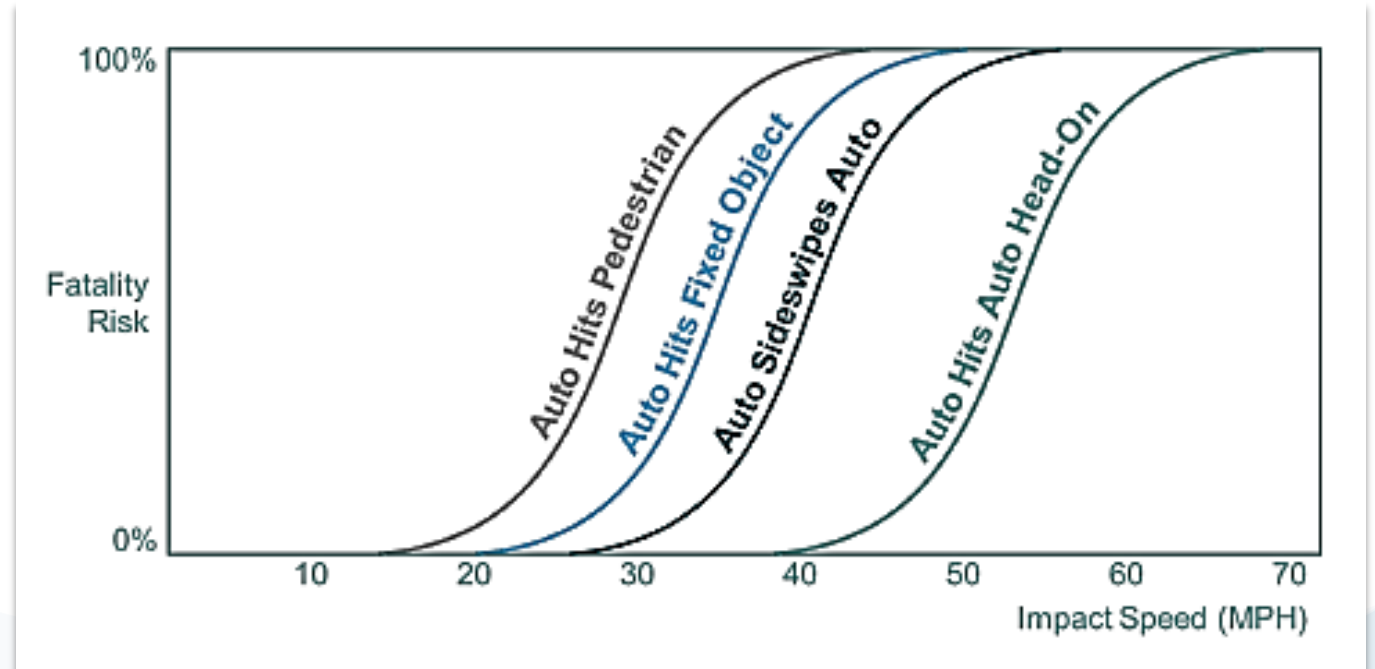
All partner agencies and divisions address human error and their practices are guided by the understanding that mistakes on the roadway should not result in serious injury or death.





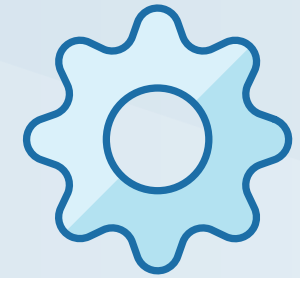
FACTOR 3: *HUMANS ARE VULNERABLE*

**Does the policy
account for crashes
that have a higher
likelihood of fatal or
serious injury due to
mode, speed, or angle
of collision?**



Source: FHWA

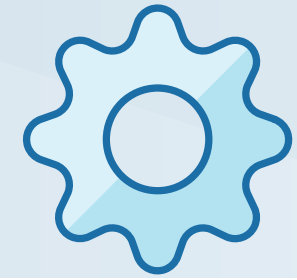




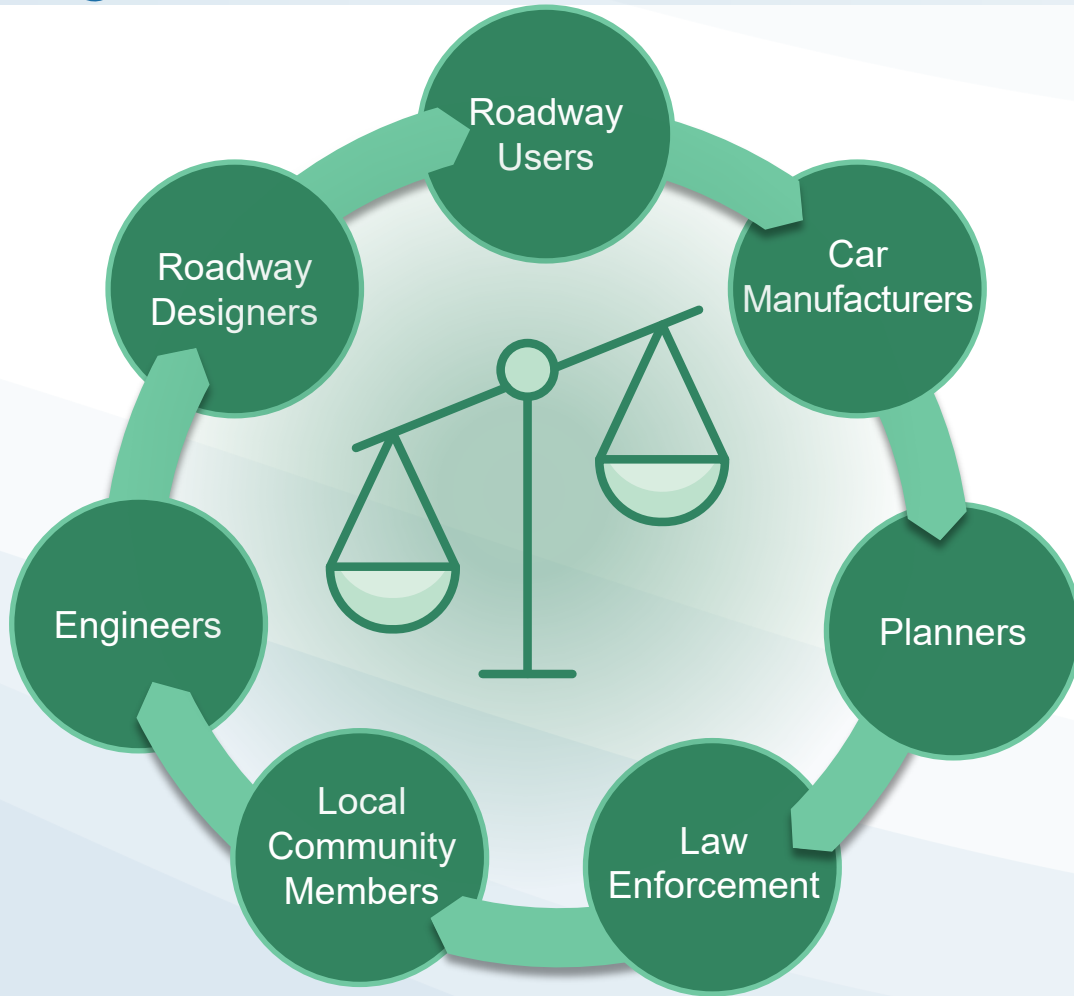
FACTOR 3: *HUMANS ARE VULNERABLE*

All partner agencies and divisions address human vulnerability, and their practices are guided by the understanding that the human body is susceptible to serious injury or death in conflicts involving motor vehicles.



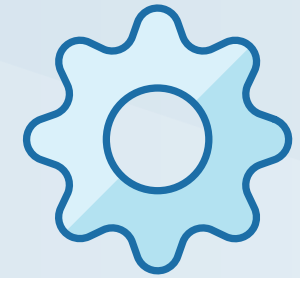


FACTOR 4: *RESPONSIBILITY IS SHARED*



Does the policy embrace a multi-disciplinary and multi-jurisdictional team, implying that responsibility is shared and that prioritization is not only focused on one roadway type or only infrastructure improvements?

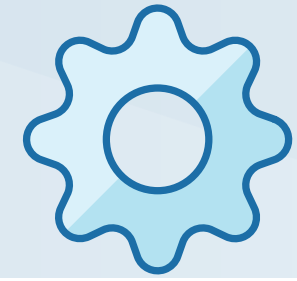




FACTOR 4: *RESPONSIBILITY IS SHARED*

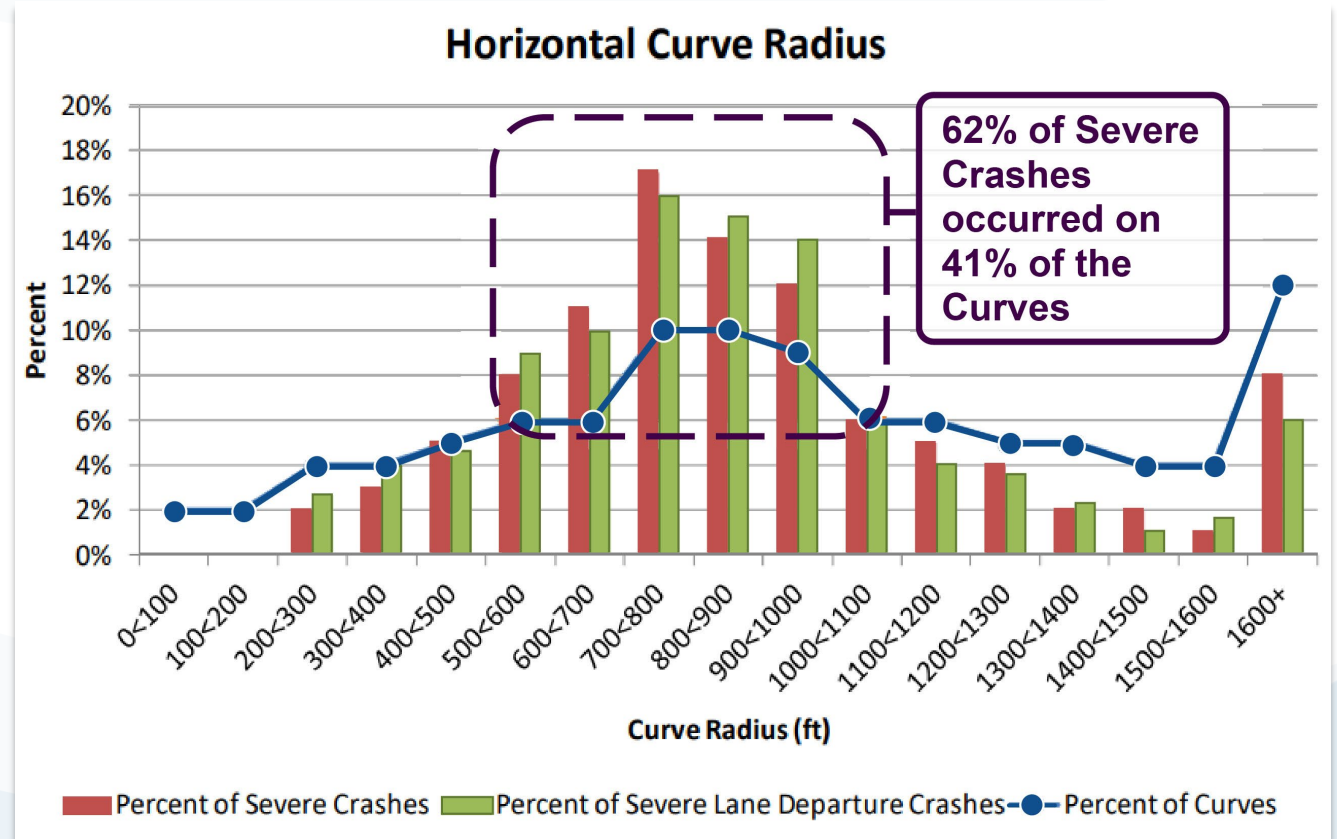
The agency has adopted the policy as a requirement and is guiding other agencies in cross discipline collaboration.





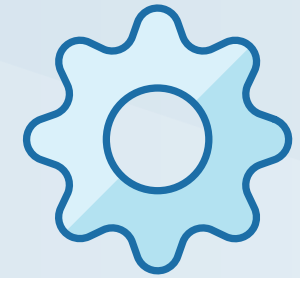
FACTOR 5: *SAFETY IS PROACTIVE*

**Does the policy
proactively account
for risks and
behaviors that could
lead to fatal and
serious injury
crashes?**



Source: FHWA, Resource Center, Safety and Design National Technical Service Team

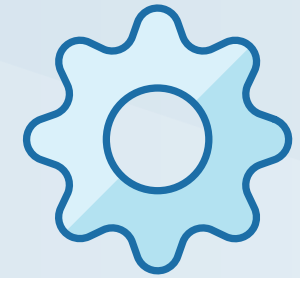




FACTOR 5: *SAFETY IS PROACTIVE*

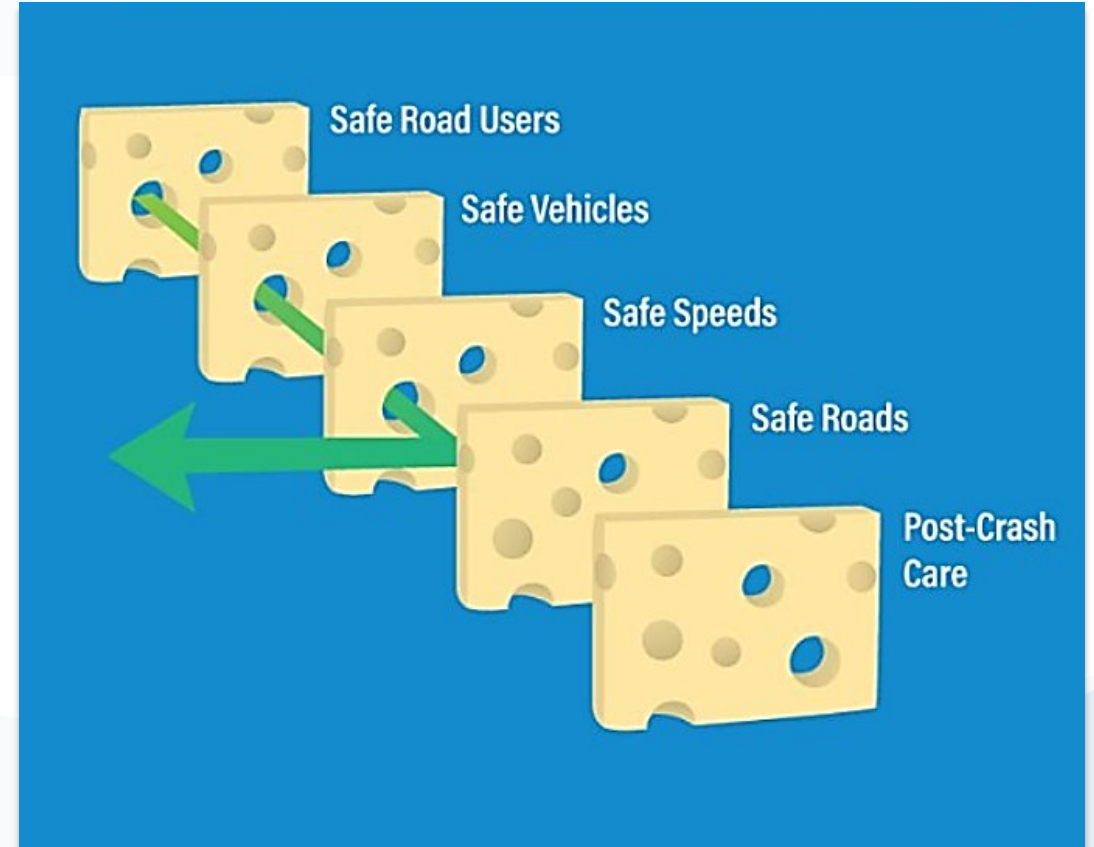
The agency has adopted the policy as a requirement and is guiding other agencies on how to integrate systemic and proactive safety approaches into their policies and guidance.





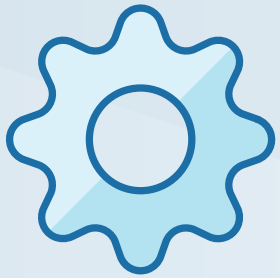
FACTOR 6: *REDUNDANCY IS CRUCIAL*

**Does the policy
integrate multi-faceted
approaches to safety to
ensure that if one
element fails, that
others support the
system?**



Source: GHSA

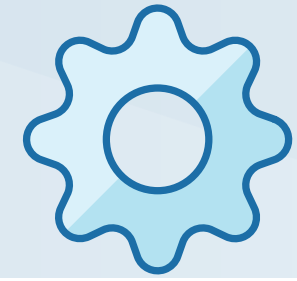




FACTOR 6: *REDUNDANCY IS CRUCIAL*

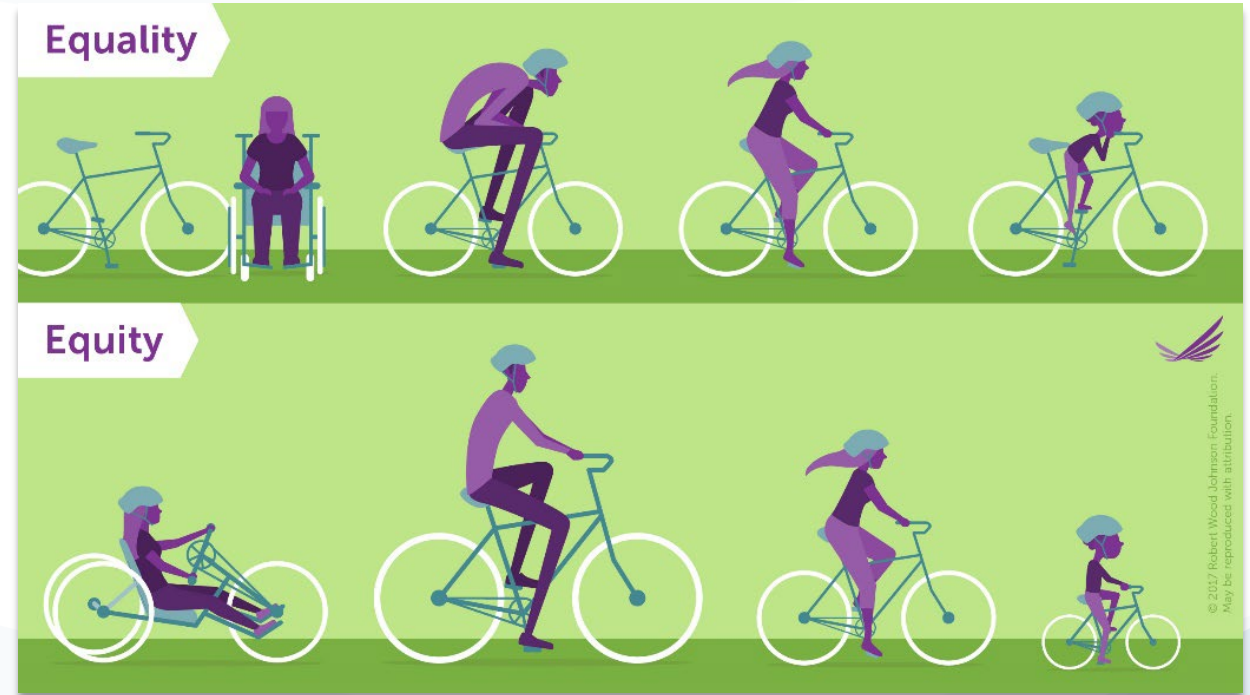
The agency has adopted a policy that supports redundant implementation to eliminate severe conflicts and is sharing the importance of redundancy to other agencies and partners in cross discipline collaboration.





FACTOR 7: *EQUITY*

**Does the policy
consider equity
(e.g., that all users are
provided the tools to
experience the
transportation system
equally)?**

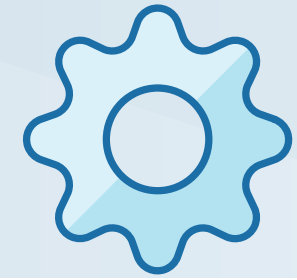


Source: Robert Wood Johnson Foundation



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FACTOR 7: *EQUITY*

The agency addresses equity as part of the policy, collaborates with community representatives and partners to identify equitable approaches, and integrates other transportation and safety partners into this conversation.



OTHER SAFE SYSTEM ASSESSMENT TOOLS

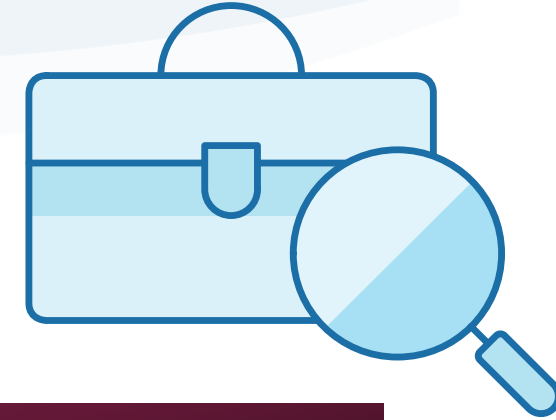
KAREN SCURRY
FHWA OFFICE OF SAFETY

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TOOLBOX OF SAFETY ANALYSIS TOOLS



Crash-Based Tools (e.g., HSM)

- Relies on crash data
- Regression-based models
- Sensitive to bias and RTM
- Context-based (rural/urban, functional class, segment/intersection, etc.)

SSA Alignment Framework

- Does not rely on crash data
- RSA-style, prompt-based series of questions
- Repeatable approach and framework but inherent subjectivity involved
- Results characterized in numeric terms intended for relative comparison

Safe System Intersection (SSI) Analytical Method

- Does not rely on crash data
- Uses kinetic energy management model (KEMM)
- Principles-based, not crash-based
- Inputs, methodology are objective, numeric



SAFE SYSTEM SOLUTIONS IN HSIP

PILOT APPLICATION

SUMMARY

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U.S. Department of Transportation
Federal Highway Administration

*PILOT
APPLICATIONS
AND
OUTCOMES*

**Sherry Ely-Mendez &
Lacey Tisler - Nixon**

Tribal Community Roadways

Mark Brown - Broward

MPO Policy

Jeff Sobczyk - Omaha

Urban corridor review





Advancing Implementation of the Safe System Approach

Mark R. Brown, AICP
Senior Planner
Broward MPO

Background



South Florida continues to be one of the most dangerous geographic regions for roadway fatalities, especially pedestrians.



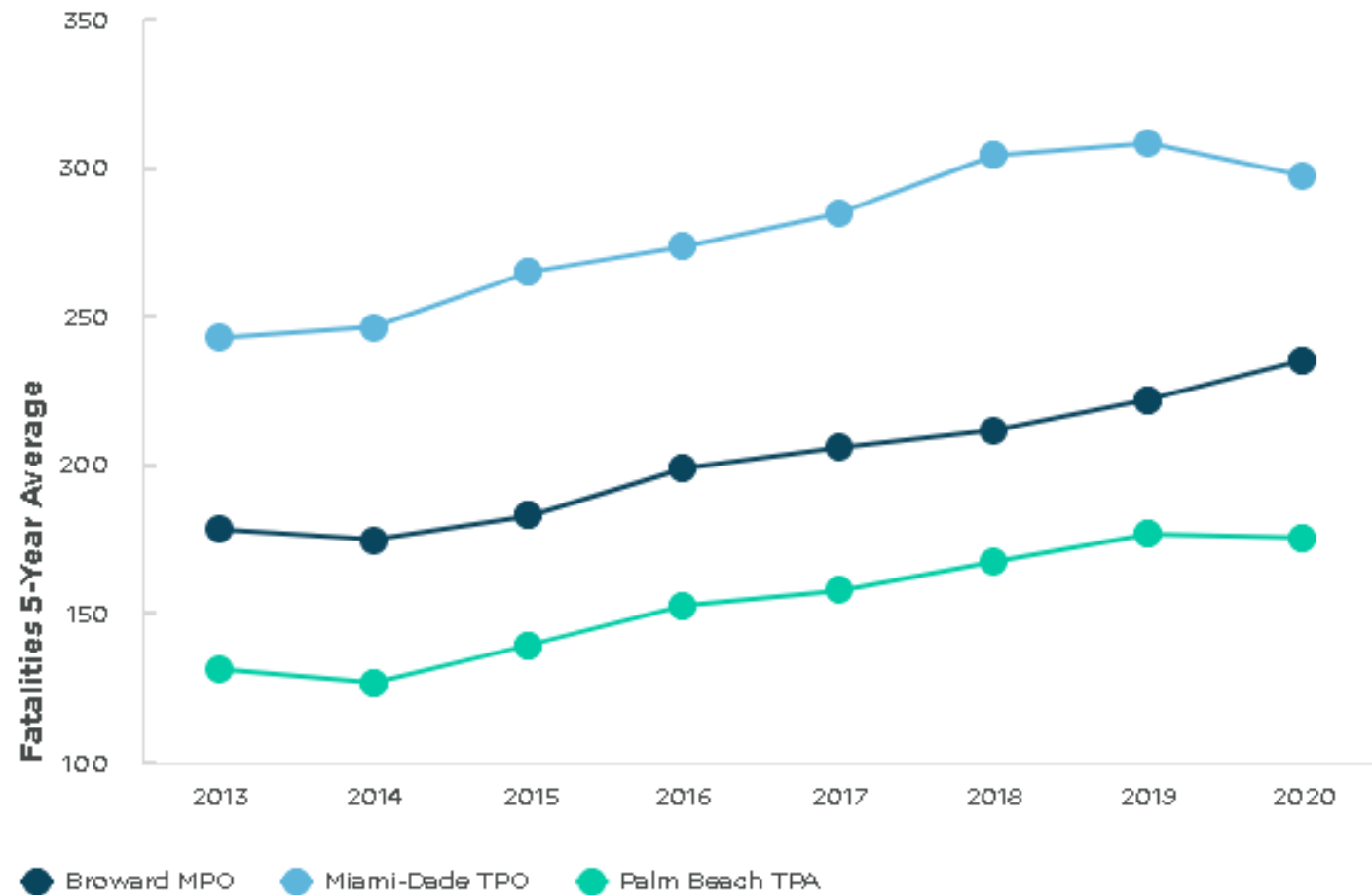
Dangerous by Design 2022 report ranked Florida as #2 most dangerous for pedestrians, with the Miami-Ft. Lauderdale-West Palm Beach area ranked #14 most dangerous metro area.



FDOT and FHWA have made safety a priority



Fatalities (5-Year Average)



Source: flhsmv.gov

Overarching Goals of Safety Program



To create an innovative, expedited, and equitable off-system safety study process where Broward MPO serves as a transparent point of contact and facilitator between FDOT and local municipalities.



To reduce severe injuries and fatalities. Getting projects into TIP that speak directly to safety is a high priority.



To create a consistent safety process with MTP, FHWA and FDOT policies.

Broward MPO Proposed Approach

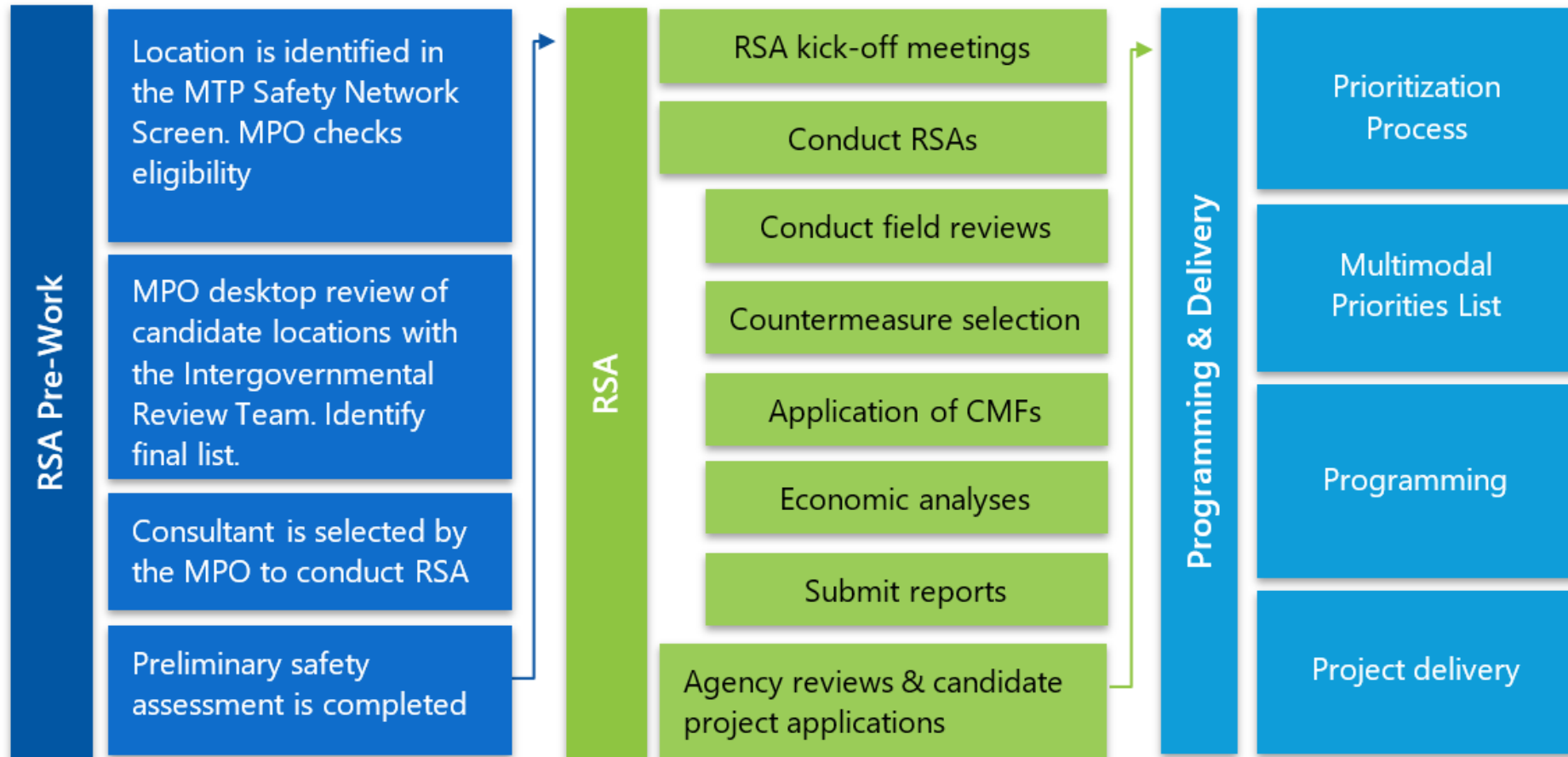


Project Sponsor	Funding Program Category	Costs/Revenues in Year of Expenditure				
		2025	2026/30	2031/35	2036/45	Total
System Management/Safety Program						
Broward MPO	Safety Project Studies – State Roads	\$295,000	\$1,625,000	\$1,900,000	\$4,875,000	\$8,695,000
Broward MPO	Safety Projects – State Roads	\$9,523,810	\$47,619,048	\$47,619,048	\$95,238,095	\$200,000,000
Broward MPO	Safety Project Studies – Non-State Roads	\$236,000	\$1,300,000	\$1,520,000	\$3,900,000	\$6,956,000
Broward MPO	Safety Projects – Non-State Roads	\$3,615,100	\$17,958,800	\$17,738,800	\$34,615,950	\$73,928,650
FDOT	Signal System Technologies	\$4,761,905	\$23,809,524	\$23,809,524	\$47,619,048	\$100,000,000
	TOTAL	\$18,431,814	\$92,312,371	\$92,587,371	\$186,248,093	\$389,579,650

- Our Metropolitan Transportation Plan (MTP) allocates funding to program safety studies and projects at locations with highest crash severity
- Broward MPO includes this program (and associated projects) as part of annual priorities list to FDOT

Off-System Road Safety Audit (RSA) Framework

RSA Process



- February 2023 – FHWA led a Safe System Workshop at the Broward MPO
- Explained FHWA's new process, proactive safety measures and assessment of Broward MPO's safety program



- FHWA's team provided comments on our safety framework document
- Comments involved:
 - Accommodating human errors
 - Clarifying the elimination of injuries and fatalities
 - More speed management and angle of collision discussion
 - Add redundancy concepts
 - Proactive identification high-risk corridors not reflected in crash data

Road Safety Analysis Framework



January 2022

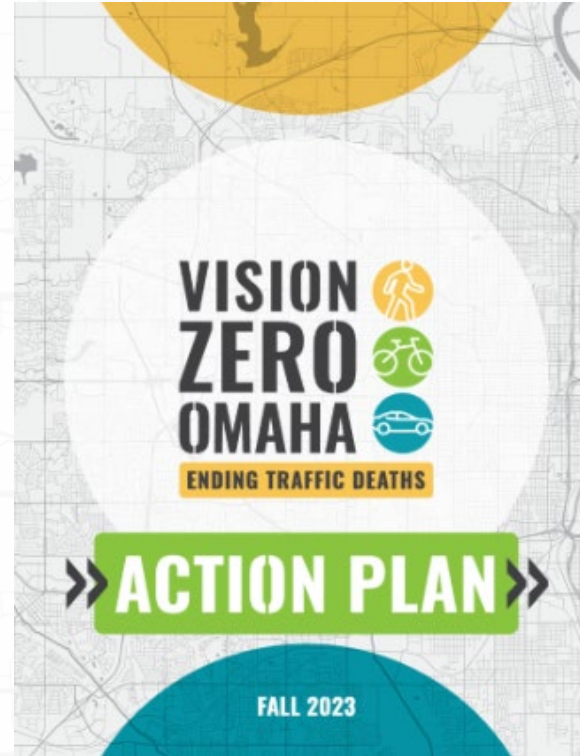
- BMPO incorporated FHWA's comments into our safety framework
- SS4A Action Plan currently in development and will incorporate Safe System Approach and what we learned from FHWA Workshop





Thank you!

BACKGROUND: SAFE SYSTEM SOLUTIONS HIERARCHY PILOT CITY OF OMAHA



EQUITY & HIGH INJURY AREAS

	MILES NOT IN EQUITY AREA	MILES IN EQUITY AREA	% IN EQUITY AREA
	23.8	22.8	49%
	55.3	33.6	38%
HIN TOTAL	79.1	56.4	42%
CITYWIDE	1,820.8	433	19%

2011-2020

EQUITY IN HIGH INJURY INTERSECTIONS

	INTERSECTIONS NOT IN EQUITY AREA	INTERSECTIONS IN EQUITY AREA	% IN EQUITY AREA
	15	10	40%
	32	12	27%
HII TOTAL	47	22	32%
CITYWIDE	12,426	2,905	19%

2011-2020

LEGEND

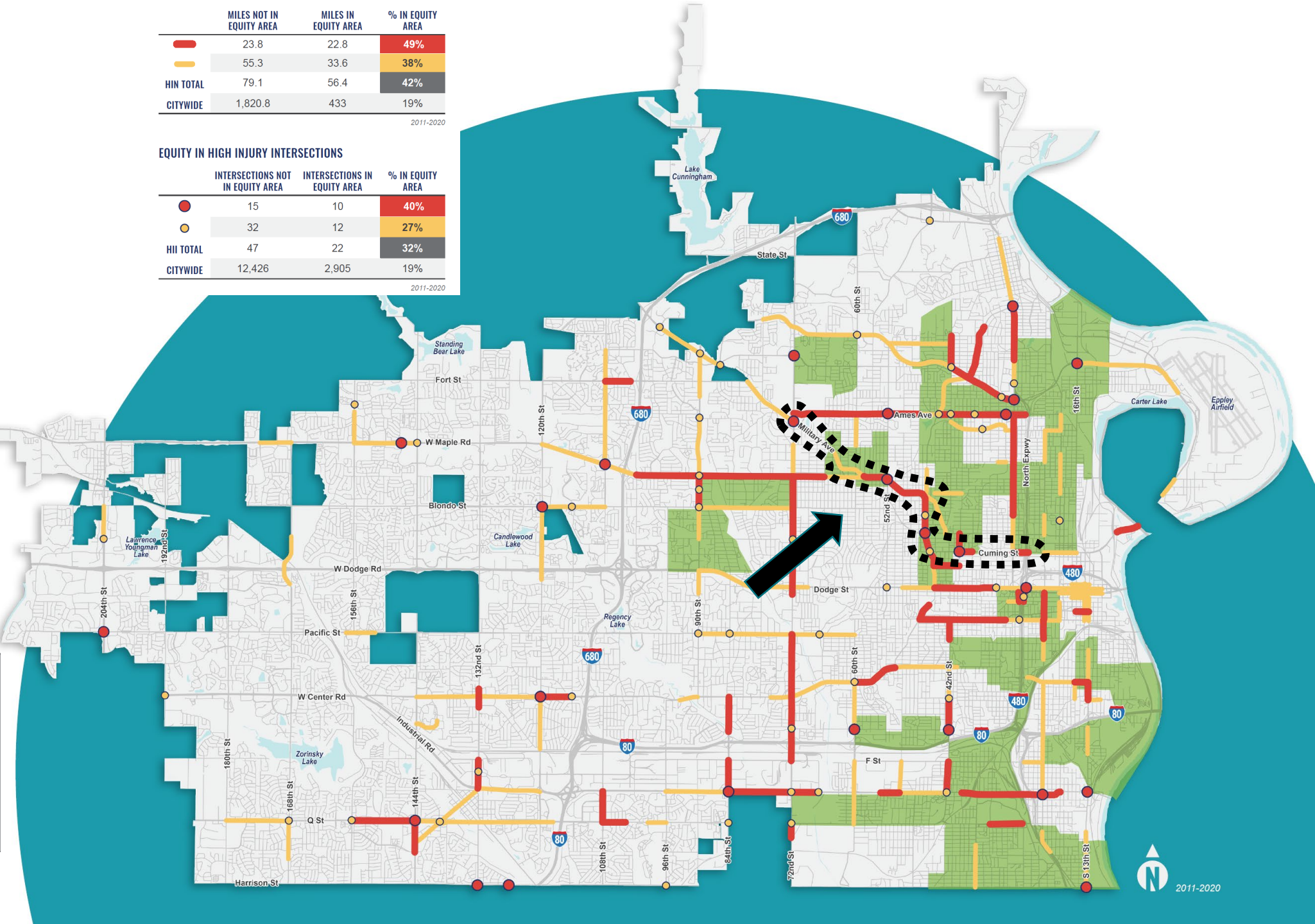
Priority HIN

HIN

Priority HII

HII

Historically Disadvantaged Census Tract (FHWA)



EQUITY & HIGH INJURY AREAS

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2011-2020

LEGEND

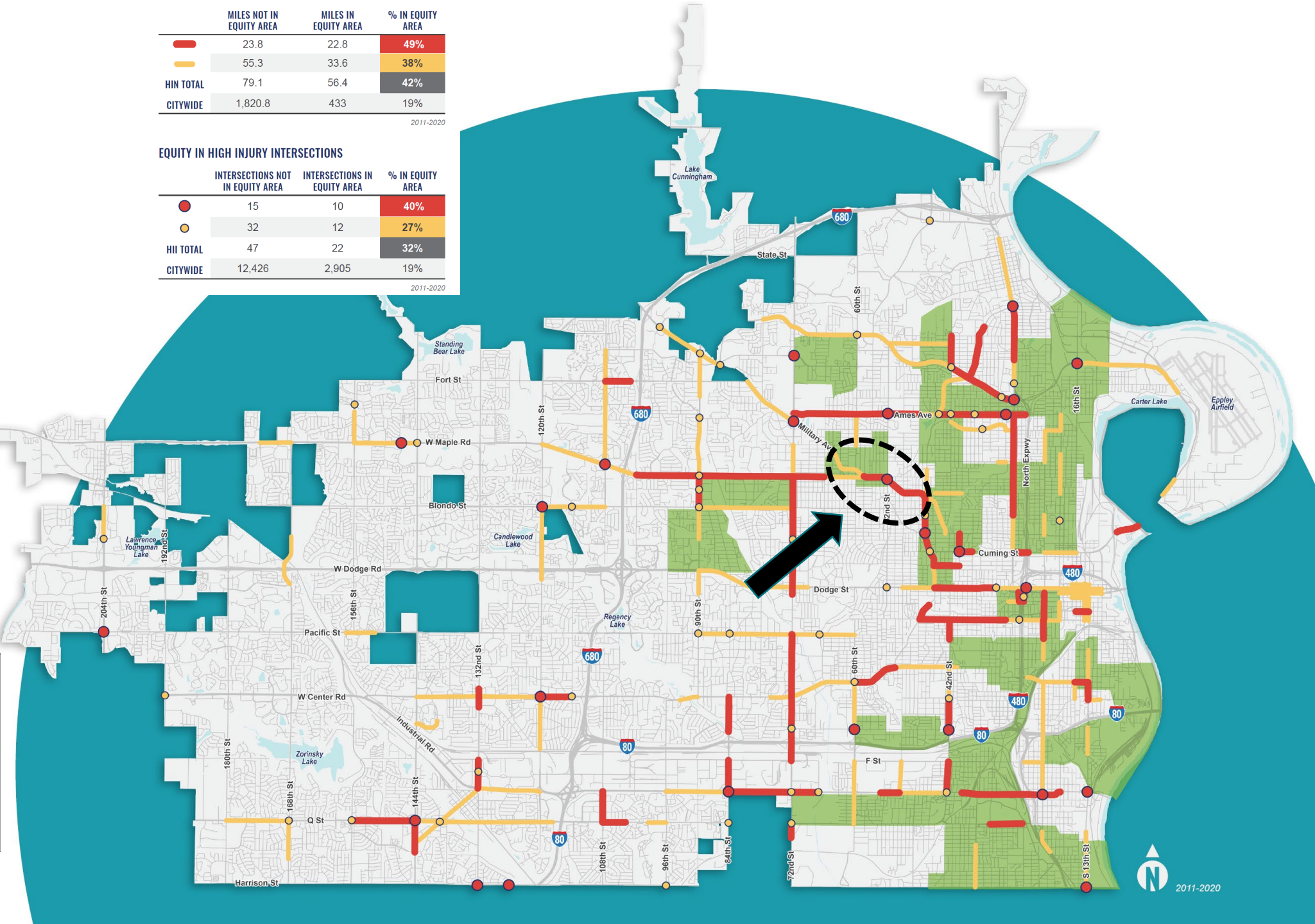
Priority HIN

HIN

Priority HII

HII

Historically Disadvantaged Census Tract (FHWA)





NORTH WEST RADIAL HIGHWAY MULTI-MODAL STUDY – OMAHA, NE



NW Radial Highway
Fontenelle Blvd to N 63rd St
(1.5mile)

2011-2022
28 KSI
3 Fatal



Table 1: Improvement Summary

Symbol	Countermeasure Name	Tier	Countermeasure Benefit
	Road Diet	1	A road diet effectively repurposes roadway space to accommodate infrastructure for other users along the roadway, including dedicated bicycle lanes to allow bicyclists to safely and easily travel within the roadway, dedicated bus lanes to provide space for transit uses, and dedicated on-street parking.
	Raised Median or Island with Directional Left-Turns	1/2	This countermeasure eliminates some of the potential crossing conflicts at an intersection and provides enclosure to improve driver behavior. Medians also narrow the roadway and promote slower vehicle speeds.
	Roundabout	1/2	Roundabouts are proven safety countermeasures that reduce fatal and serious injury collisions by lowering vehicle speeds, minimizing conflict points, and manipulating crash angles to reduce the kinetic energy of a crash. Additional pedestrian and bicycle countermeasures such as high visibility crosswalks, RRFBs, ADA curb ramps, and signage will be implemented at the crossing legs of the roundabout.
	Peanut Roundabout	1/2	Peanut roundabouts are a form of a roundabout that integrates a “peanut” like shape to accommodate multiple connection/streets that are in close proximity to each other at varying angles. Additional pedestrian and bicycle countermeasures such as high visibility crosswalks, RRFBs, ADA curb ramps, and signage will be implemented at the crossing legs of the peanut roundabout.
	No Right Turn on Red	1	No Right Turn on Red enhances both pedestrian and vehicle safety at intersections, especially when integrated with leading pedestrian intervals (LPIs).
	Pedestrian Refuge Island at Intersection	1/2	A pedestrian refuge island reduces the crossing distance for pedestrians and provides a location for pedestrians to stop while crossing through an intersection. Pedestrian refuge islands can also help to channelize vehicles at an intersection.
	Access Management Improvements	1/2	Access management helps to manage, improve and control the number of entrance and exit points along a corridor and can help reduce conflict points throughout a segment.
	Construct Near Perpendicular Right-Turn	2	Creating a near perpendicular right-turn lane will slow vehicles down and provide better visibility for vehicles and pedestrians in the crosswalk.
	Lane Narrowing	2	Lane narrowing not only helps to create a tighter driving scenario for motorists, which can lead to slower speeds, but it also can be used to repurpose space for other uses (e.g., road diets, expanded sidewalks, striped bicycle lanes, etc.)
	High Friction Surface	2	High friction surface can be used to restore or enhance friction and skid resistance and has shown to improve total crashes at intersections by 20% and improve injury crashes at horizontal curves by 48%.
	Curb Extensions	2/4	Curb extensions help to decrease speeds by narrowing the footprint of the roadway and increasing the visibility of pedestrians. Additionally, pedestrians will have a shorter crossing distance.

SAFE SYSTEM ROADWAY DESIGN HIERARCHY

TIER
1 REMOVE SEVERE
CONFLICTS

TIER
2 REDUCE VEHICLE
SPEEDS

TIER
3 MANAGE CONFLICTS
IN TIME

TIER
4 INCREASE ATTENTIVENESS
AND AWARENESS

Project-Based Alignment Framework Factors

- Exposure
- Crash Likelihood
- Crash Severity
- Safety Prompts

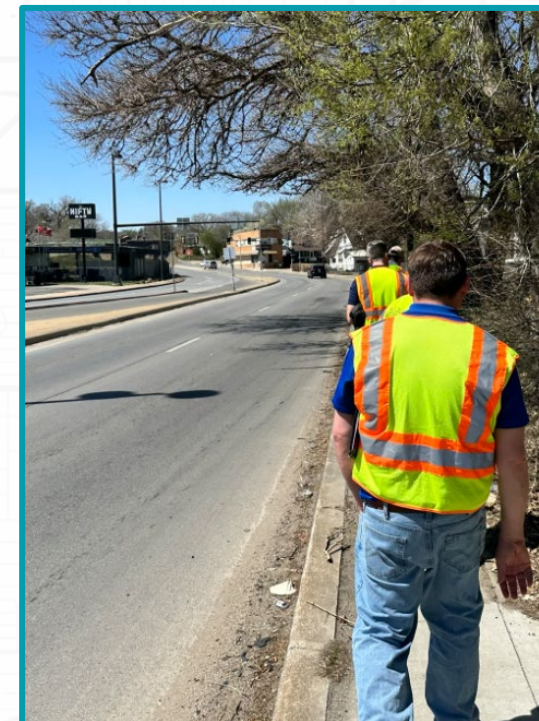
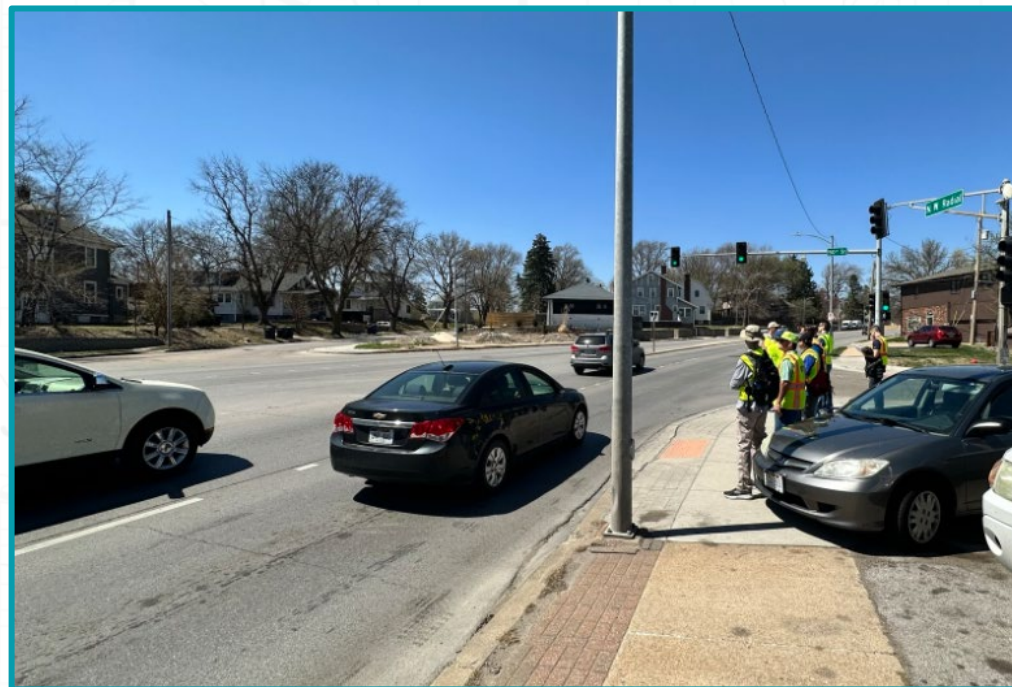
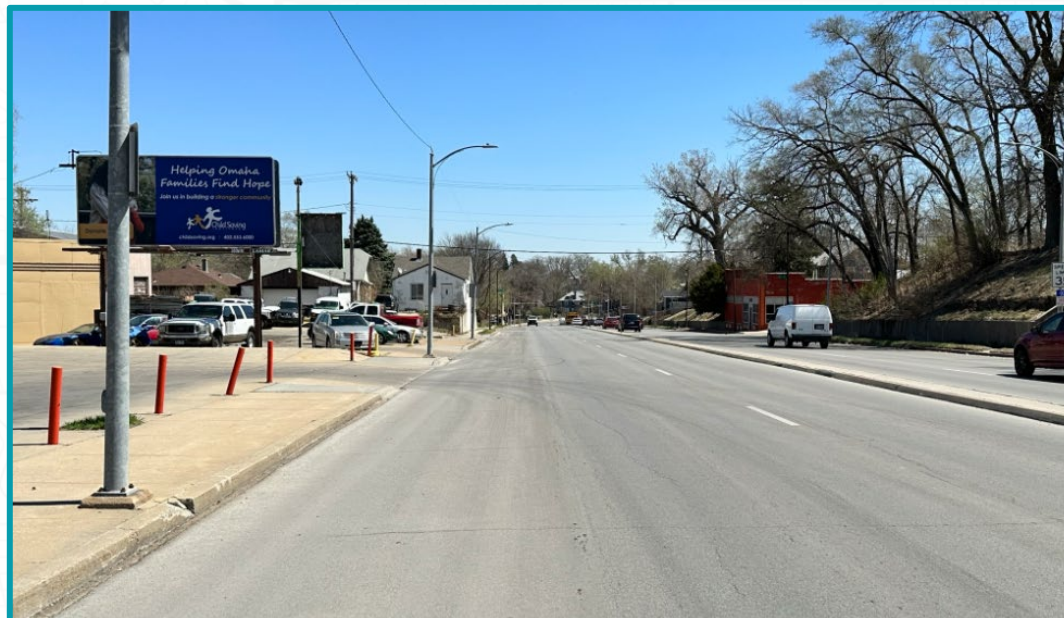
Safe Roads and Safe Speeds

PRIORITIZATION FRAMEWORK - SCORING MATRIX							Project Location:		Example		
Safe System Elements	Category	Factors	Vulnerable Road Users				Motor Vehicles				
			Thresholds	Values	Input	Score	Thresholds	Values	Input	Score	
Safe Roads and Safe Speeds	Exposure	Motor Vehicle Volumes (AADT)	No exposure values provided, as these rows are only applicable to motor vehicle exposure				Less than 1,000	1	51000	10	
		1,000 - 5,000					4				
		5,000 - 10,000					6				
		10,000 - 15,000					8				
		Greater 15,000					10				
		Roadway Width (feet)	No exposure values provided, as these rows are only applicable to motor vehicle exposure				Less than 30	1	62	10	
		30 - 35					4				
		36 - 41					6				
		42 - 47					8				
		48 or more					10				
		Vulnerable Users Present (users per day)	Less than 10	1	70	8	No exposure values provided, as these rows are only applicable to vulnerable user exposure				
			10 - 25	4							
			25 - 50	6							
			50 - 100	8							
			Greater than 100	10							
		Crossing Distance (Max Number of Lanes)	One Lane	1	5	10					
	Two Lanes		4								
	Three Lanes		6								
	Four Lanes		8								
	More than Four Lanes	10									
	Exposure Score:		Vulnerable Road Users Subtotal			18	Motor Vehicles Subtotal			20	
	Likelihood (Contributing Factors)	Number of Risk Factors	Less than Two	1	7	18	Less than Two	1	4	9	
			Two	3			Two	3			
			Three	6			Three	6			
			Four	9			Four	9			
			Five	12			Five	12			
			Six	15			Six	15			
			Seven	18			Seven	18			
			Eight	21			Eight	21			
			Nine	24			Nine	24			
			Ten	25			Ten	25			
			Eleven	26			Eleven	26			
			Twelve	27			Twelve	27			
			Thirteen	28			Thirteen	28			
			Fourteen	29			Fourteen	29			
			Fifteen	30			Fifteen	30			
		Discuss the Risk Factors attributed or addressed and how they impact the likelihood of a fatal or serious injury crash:	<div>- Proximity to Business Serving Alcohol</div> <div>- Proximity to Transit Stops</div> <div>- Proximity to a School</div> <div>- Separation in Time for Bikes (Major)</div> <div>- Separation in Time for Bikes (Minor)</div> <div>- Separation in Space for Bikes (Minor)</div> <div>- Driveways Near Intersection</div>				<div>- Crossing Conflict Intersection</div> <div>- Proximity to Business Serving Alcohol</div> <div>- Skewed Intersection</div> <div>- Driveways near Intersection</div>				
	Likelihood Score:		Vulnerable Road Users Subtotal			18	Motor Vehicles Subtotal			9	
Severity	Operating Speed (mph) or Speed Limit +7 mph	0 - 20	1	47	20	0 - 25	1	47	12		
		21 - 25	5			26 - 30	3				
		26 - 30	10			31 - 35	6				
		31 - 35	15			36 - 40	9				
		Over 35	20			41 - 45	12				
						46 - 50	15				
						51 - 55	18				
						Greater than 55	20				
		For proposed conditions only:									

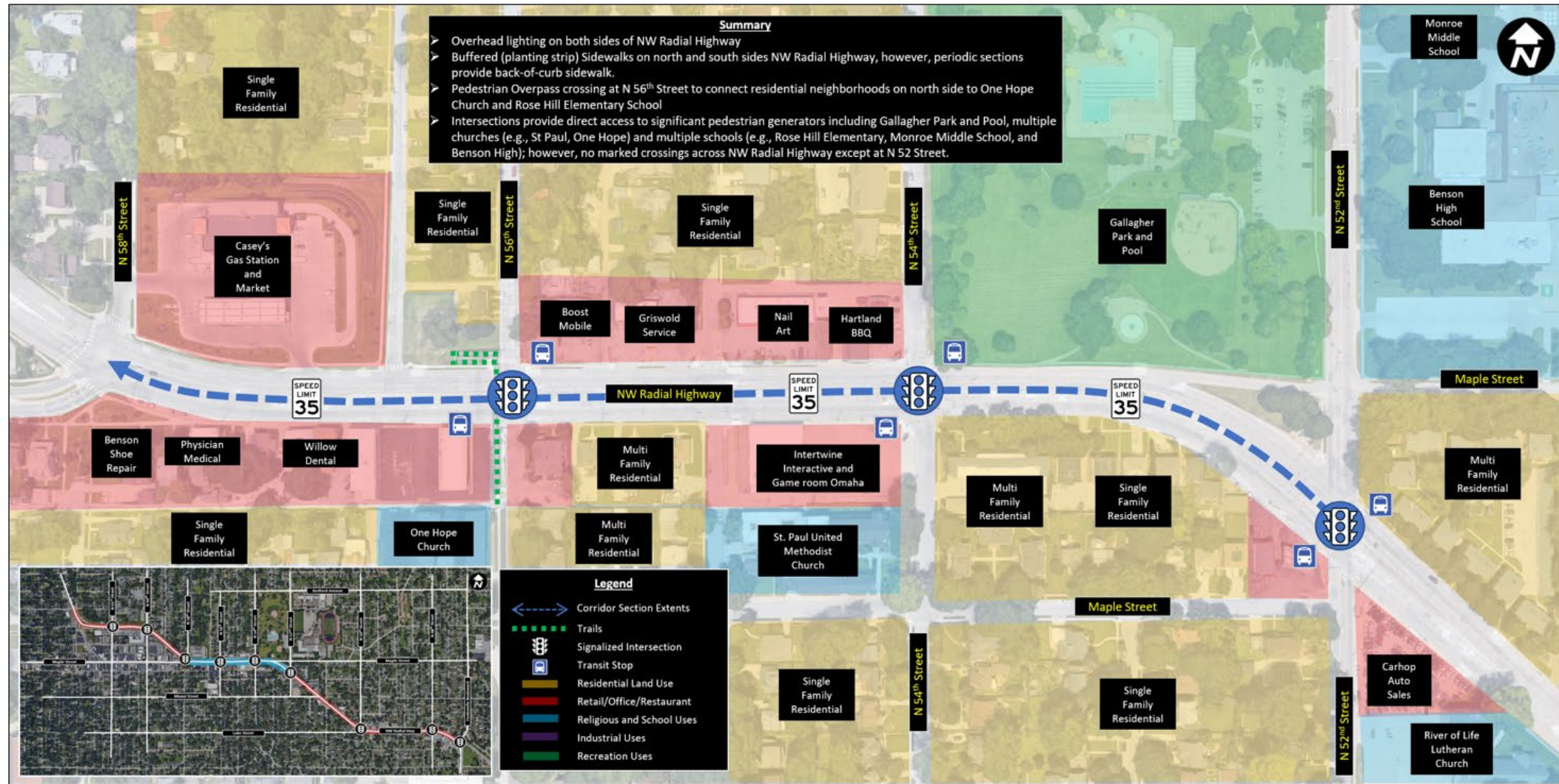




Field Review



Safe System Implementation Recommendations Report





Safe System Implementation Recommendations Report

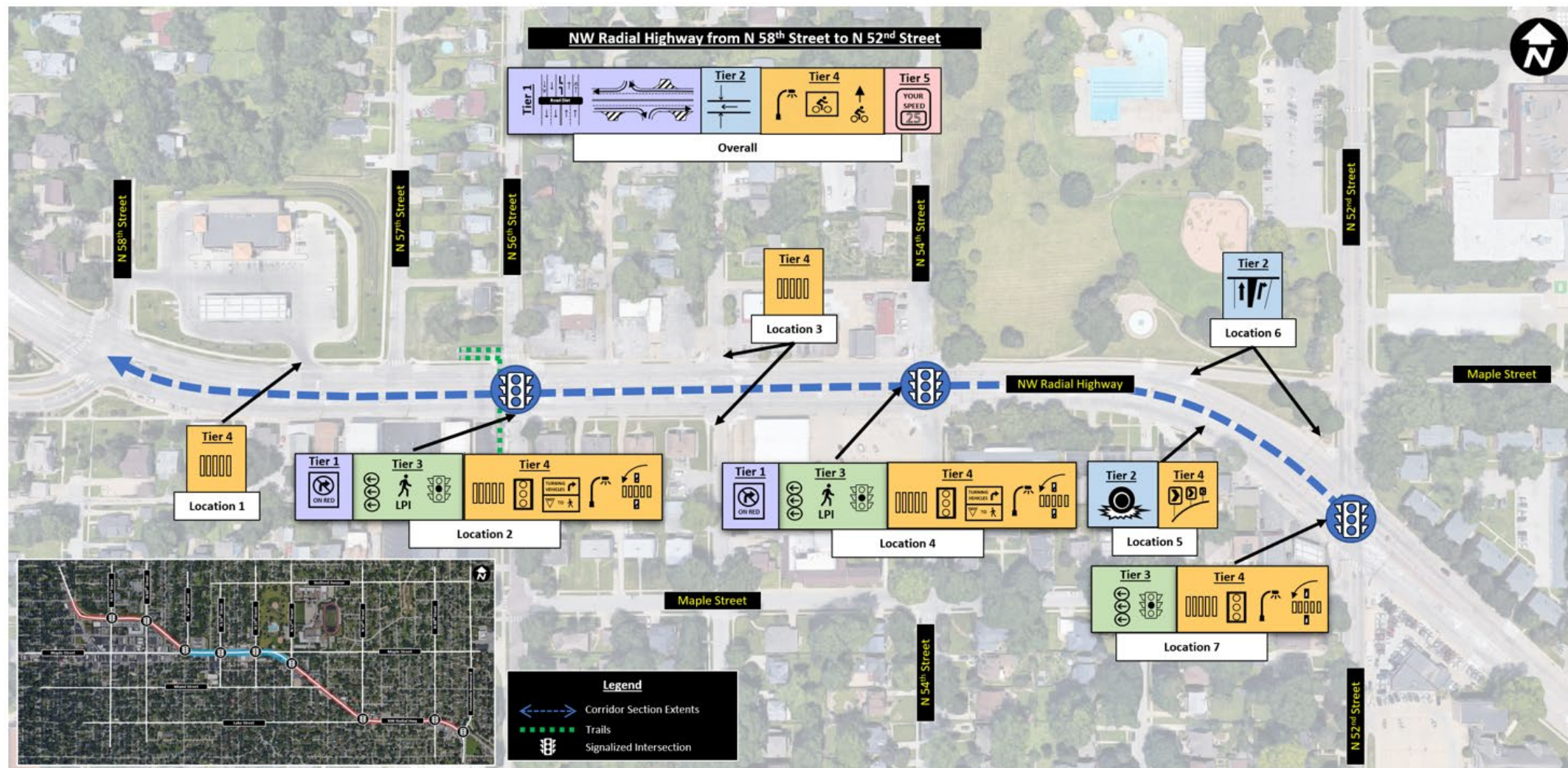
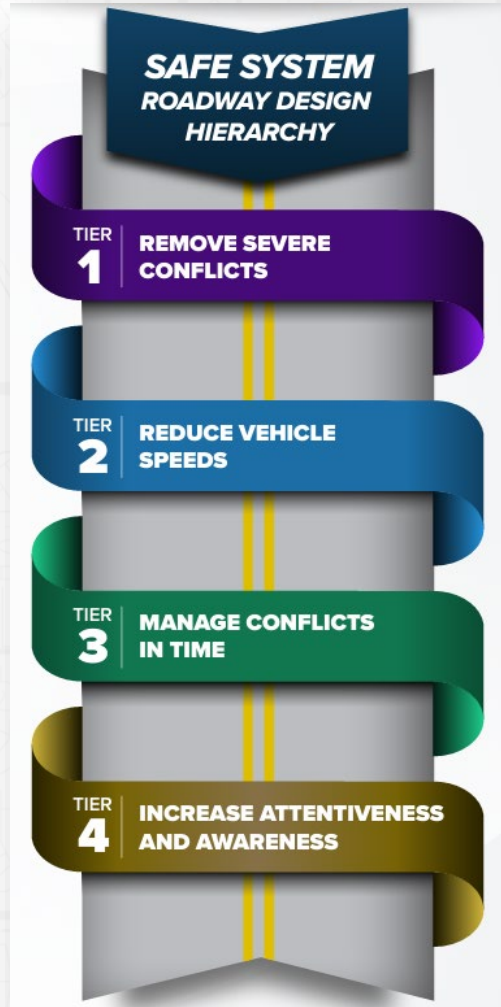


Figure 25: Hierarchy Analysis – NW Radial Highway from N 58th Street to N 52nd Street

OUTCOME OF PILOT:



- **Foundational Safety Tool**
 - Recommendations will be integrated larger NW Radial Study
- **Currently Used in Day to Day Safety Discussions**
 - Same Language, Same Lens
- **Change in Counter Measure Evaluation Process**
 - Less Rigid (warrants)
 - Embrace Systemic Approach
 - Context is Key
- **Integrating Hierarchy into Process and Policy**
 - Intersection Control Evaluation Policy (ICE)
 - *"If not roundabout, then what?"*
 - Updating Complete Street Policy
 - Updating Traffic Impact Studies

SAFE SYSTEM SOLUTIONS IN HSIP

WRAP-UP

ZERO IS OUR
GOAL
A SAFE SYSTEM IS HOW WE GET THERE



U.S. Department of Transportation
Federal Highway Administration

TRAINING WORKSHOPS

- **Conference Workshop**

- » A four-hour workshop held as part of a larger conference.

- **Project-based Workshop**

- » A multi-day workshop hosted by a State, regional, local, or tribal agency.

- **Policy-based Workshop**

- » A one-day workshop hosted by a State, regional, local, or tribal agency.

<https://highways.dot.gov/sites/fhwa.dot.gov/files/2024-04/Safe%20System%20Approach%20Workshop%20Description.pdf>



RESOURCES

- Safe System Roadway Design Hierarchy
- Overview of Safe System Alignment Frameworks Flyer
- Safe System Project-based Alignment Framework
- Safe System Policy-based Alignment Framework
- Pilot Application Summaries (coming soon)

<https://highways.dot.gov/safety/zero-deaths/resources>



THANK YOU!

ZERO  **IS OUR GOAL**
A SAFE SYSTEM IS HOW WE GET THERE



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