February
2026

TRANSPORTATION SAFETY ACTION PLAN

Systemic Countermeasures Report

DUTCHESS COUNTY
TRANSPORTATION COUNCIL
Better ways from here to there

Transportation Safety Action Plan

Systemic Countermeasures Report

prepared for

DUTCHESS COUNTY TRANSPORTATION COUNCIL

Better ways from here to there

prepared by

CAMBRIDGE SYSTEMATICS

date

February 2026

Disclaimer

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1.0 Introduction

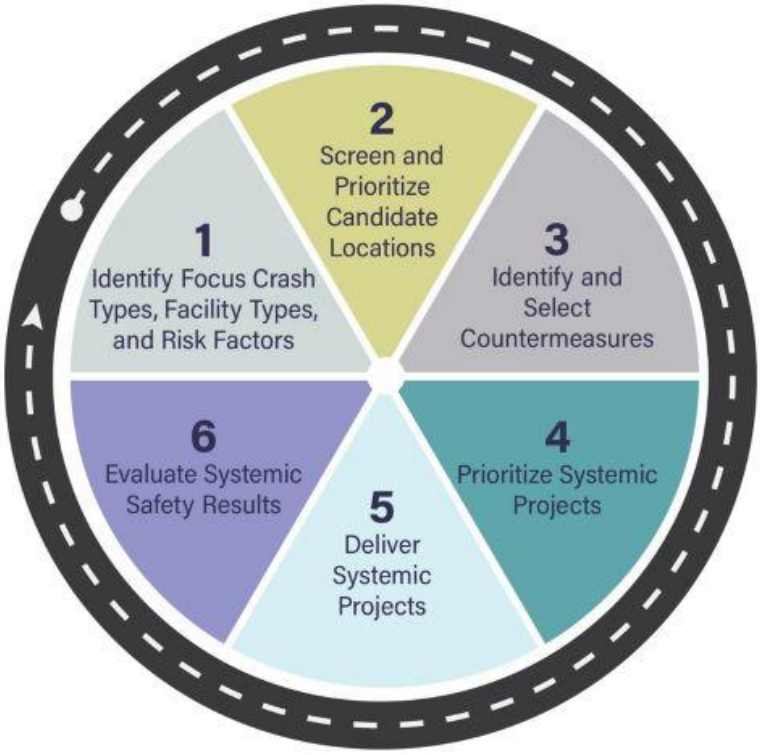
The Safe System Approach calls for a systemic approach to traffic safety. This means that we should not just be asking, how can we improve safety in locations where most crashes occur? But also, how can we improve the safety of the overall road system for the future?

The hotspot screening carried out for the Safety Action Plan examined locations with a compelling crash history and identified a range of safety improvement projects for road owners to consider at specific intersections and road segments. However, severe crashes are relatively rare and identifying prior crashes does not fully distinguish all locations with significant safety concerns or opportunities for improvement.

We can complement the traditional, reactive crash-based approach with a systemic approach that leads to a broader, proactive plan of action. Under the systemic screening method, we can isolate risk factors associated with the most common severe crash types, such as road types, traffic volumes, and speed limits.

Using these risk factors, we can evaluate the entire roadway network to identify locations where severe crashes are more likely to occur. The application of the systemic approach to safety analysis generally follows a six-step process, as outlined by the Federal Highway Administration (FHWA) in its Systemic Safety User Guide. This systemic approach and the traditional crash-based analysis together form a comprehensive approach to safety management.

As part of the systemic safety framework, we developed a set of **systemic treatment packages** that can be applied to high-risk locations. These systemic treatment packages provide a menu of proven low- to moderate-cost countermeasures designed to address key risk factors contributing to severe crashes.

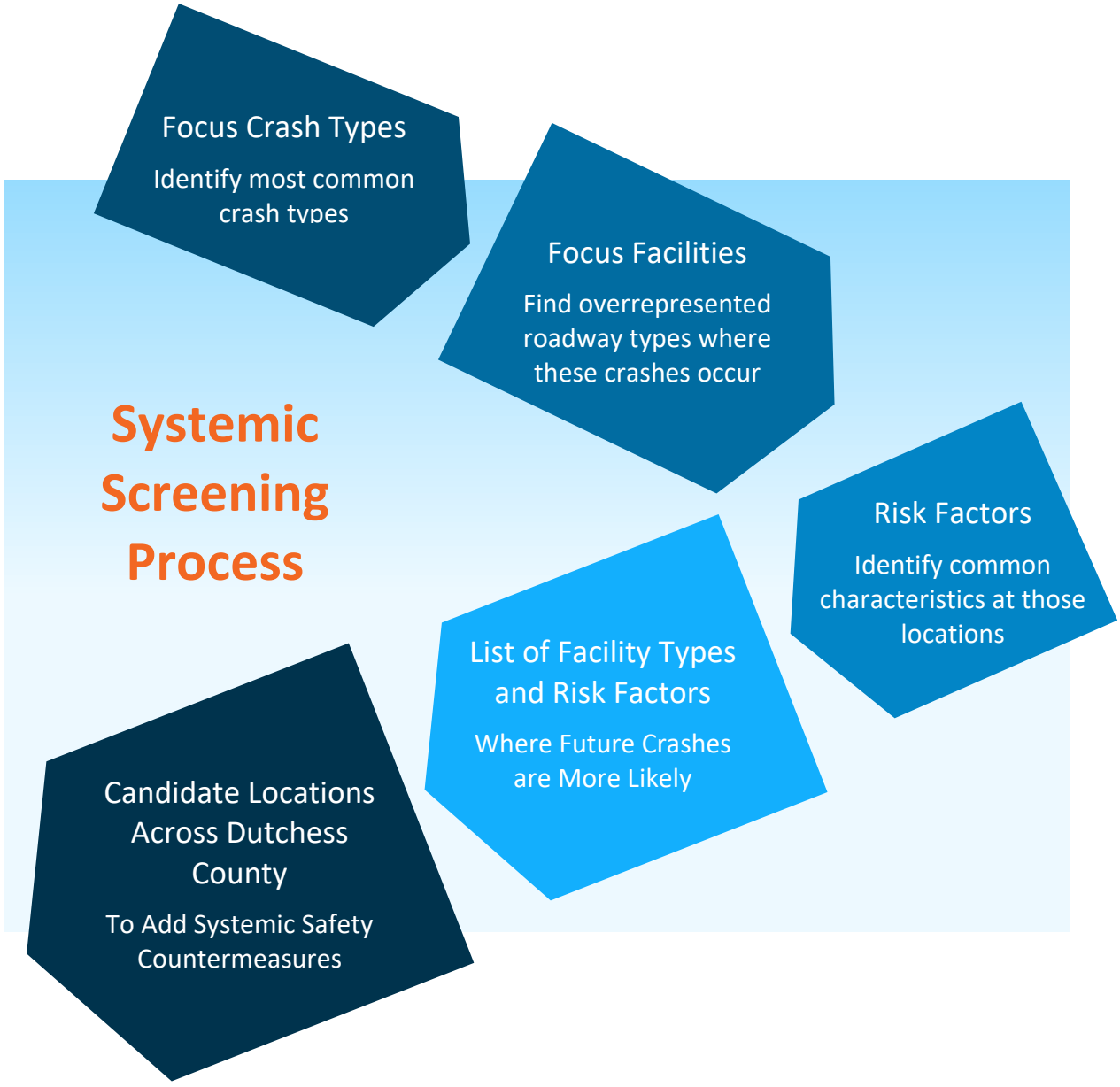


Steps of the Systemic Safety User Guide, 2024 (FHWA)

1.1 Systemic Screening Analysis and Findings

The systemic treatment packages presented in this toolkit are intended as a resource for road owners and decision makers to identify, prioritize, and implement proactive safety projects across Dutchess County. They were selected based on findings from the systemic screening analysis conducted for the county, using national and state guidance. This screening was conducted to identify and prioritize locations with the highest risk of crash types that often result in fatalities or serious injuries. Figure 1.1 shows how the systemic screening analysis was conducted. See Data Report Part 2 for additional details on the systemic screening.

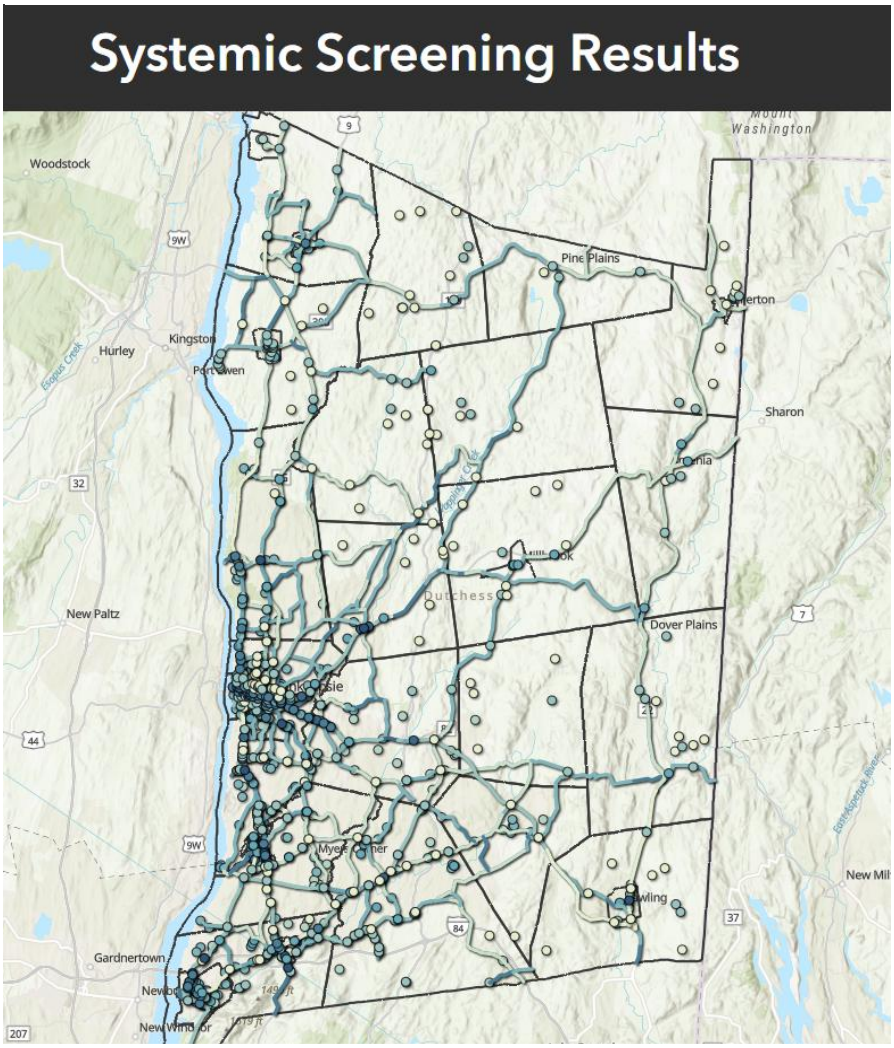
FIGURE 1.1. SYSTEMIC APPROACH TO ROADWAY SAFETY



For the systemic screening, four focus types were selected based on the NYSDOT 2023 Strategic Highway Safety Plan (SHSP) and Dutchess County's most recent five-year crash trends (2019-2023):

- Intersection-related crashes
- Pedestrian-related crashes
- Roadway departure crashes

FIGURE 1.2. SYSTEMIC SCREENING INTERACTIVE MAP



The systemic screening identified a significant number of systemic improvement opportunities through the county's road network, both in urban and rural areas. Every municipality in the county has multiple sites with systemic improvement potential.

- https://www.dutchessny.gov/Departments/Transportation-Council/Docs/DataAnalysisReportPART2_090525.pdfSpeed-related crashes

For each focus crash type, we identified the facility types where those crashes most often occur and the common risk factors associated with those crashes.

The Systemic Screening Results interactive map, Figure 1.2, shows

that dozens of intersections and segments are candidates for improvement based on just these four focus crash types.

To develop systemic treatment packages for these crash types, we consolidated the focus facility types for intersection-related and pedestrian-related crashes, since these crash types frequently overlap and share similar risks. Similarly, focus facility types for roadway departure and speed-related crashes were consolidated to develop their corresponding treatment packages.

This systemic screening and analysis rely in large part on NYSDOT data. However, the data is not complete for every road segment, so the scoring in some cases identifies intersections and segments as higher risk than expected. We encourage the analysis to be used to narrow down the road network to a list of potential improvement locations. Further investigation and engineering judgement will be needed to assess the actual risk at any given location, as well as to determine the most appropriate potential countermeasures.

1.2 Intersection- and Pedestrian-Related Focus Facilities

For each focus facility type, we identified intersections that have a greater-than-average number of risk factors. The focus facility types for intersection-related and pedestrian-related crashes are shown in Table 1. below. This table shows the distribution of such sites across the county.

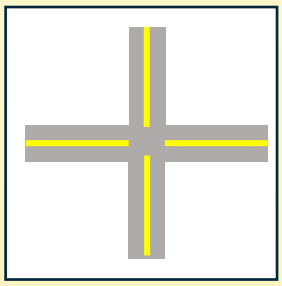
TABLE 1.1 INTERSECTION AND PEDESTRIAN FOCUS FACILITIES BY OWNER TYPE

Road Owner	Focus Facility Type*	Intersection-Related		Pedestrian-Related		
		Total Sites	Sites > Avg. # of Risk Factors	Total Sites	Sites > Avg. # of Risk Factors	Sites in VRU High-Risk Areas
NYSDOT	Urban Signalized Cross-Intersections and Intersections with Five or More Legs	94	52	-	-	-
	Urban Signalized Y-Intersections and T-Intersections	64	35	64	43	1
	Rural Stop-Controlled Cross-Intersections	58	41	-	-	-
	Urban Signalized Cross-Intersections	-	-	93	42	3
	Urban Stop-Controlled Cross-Intersections	-	-	66	32	0
County	Urban Signalized Cross-Intersections and Intersections with Five or More Legs	14	1	-	-	-
	Urban Signalized Y-Intersections and T-Intersections	16	3	16	6	0
	Rural Stop-Controlled Cross-Intersections	38	13	-	-	-
	Urban Signalized Cross-Intersections	-	-	13	3	0
	Urban Stop-Controlled Cross-Intersections	-	-	34	6	0
Local	Urban Signalized Cross-Intersections and Intersections with Five or More Legs	72	30	-	-	-
	Urban Signalized Y-Intersections and T-Intersections	19	4	19	15	3
	Rural Stop-Controlled Cross-Intersections	61	26	-	-	-
	Urban Signalized Cross-Intersections	-	-	72	54	18
	Urban Stop-Controlled Cross-Intersections	-	-	226	106	2

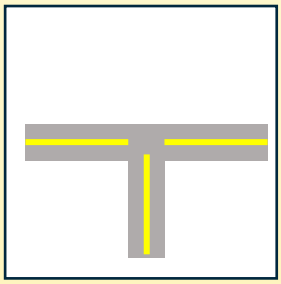
Source: CLEAR, Cambridge Systematics analysis **See below for an explanation of intersection types*

Additionally, several focus facilities for pedestrian-related crashes, located within NYSDOT's Vulnerable Road User (VRU) "High Risk Areas," were identified. For the purpose of developing its Vulnerable Road User Safety Assessment, NYSDOT identified VRU high-risk census tracts across the state. In Dutchess County, the City of Poughkeepsie was flagged for having at least one high-risk census tract.

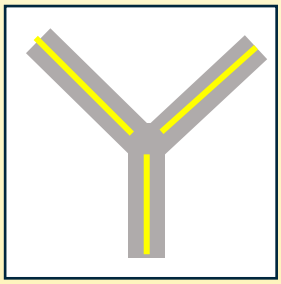
Intersection Types



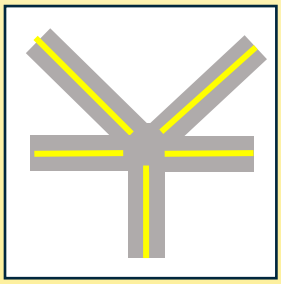
Cross Intersection (Four Leg Intersection)



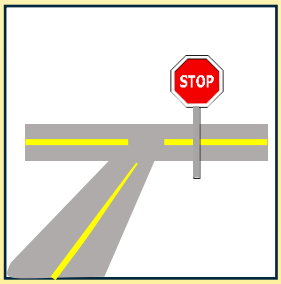
T Intersection (Three Leg Intersection)



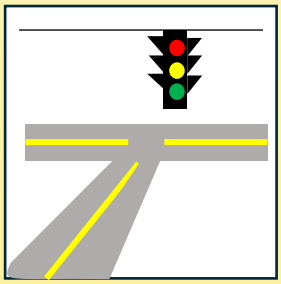
Y Intersection (Three Leg Intersection)



Intersections with Five or More Legs (Multi-Leg Intersection)



Stop-Controlled Intersection



Signalized Intersection

This complex urban intersection in Poughkeepsie has five legs that connect Main St., Church St., Fountain Pl, and further ahead, Corlies Ave.

1.3 Roadway Departure and Speed-Related Focus Facilities

The focus facility types identified for roadway departure and speed-related crashes, based on the systemic screening analysis, are shown in The roads below are classified by road owner and functional classification (see this guide for more information about functional classification). NYSDOT's Roadway Departure Safety Action Plan includes a risk factor map for Dutchess County in its Appendix D; NYSDOT also has a roadway departure crash density map in its HSIP Action Plan Viewer. These resources may also be helpful to prioritize roadway departure risk areas.

Table 1.2. For each focus facility type, we identified facilities that have a greater-than-average number of risk factors. The roads below are classified by road owner and functional classification (see this guide for more information about functional classification). NYSDOT's Roadway Departure Safety Action Plan includes a risk factor map for Dutchess County in its Appendix D; NYSDOT also has a roadway departure crash density map in its HSIP Action Plan Viewer. These resources may also be helpful to prioritize roadway departure risk areas.

TABLE 1.2 ROADWAY DEPARTURE AND SPEED MANAGEMENT FOCUS FACILITIES BY OWNER TYPE

Road Owner	Focus Facility Type	Roadway Departure		Speed-Related	
		Total Centerline Miles	Centerline Miles > Avg. # of Risk Factors	Total Centerline Miles	Centerline Miles > Avg. # of Risk Factors
NYSDOT	Urban Arterials (excluding freeways)	126	96	126	58
	Rural Arterials (excluding freeways)	90	25	90	62
	Urban Major Collectors	36	12	36	30
	Rural Major Collectors	60	46	60	18
County	Urban Arterials (excluding freeways)	16	15	16	0
	Rural Arterials (excluding freeways)	0	0	0	0
	Urban Major Collectors	103	55	103	85
	Rural Major Collectors	40	24	40	19
Local	Urban Arterials (excluding freeways)	16	9	16	0
	Rural Arterials (excluding freeways)	0	0	0	0
	Urban Major Collectors	65	56	65	21

	Rural Major Collectors	0	0	0	0

Source: CLEAR, Cambridge Systematics analysis.

1.4 How to Use the Systemic Treatment Packages

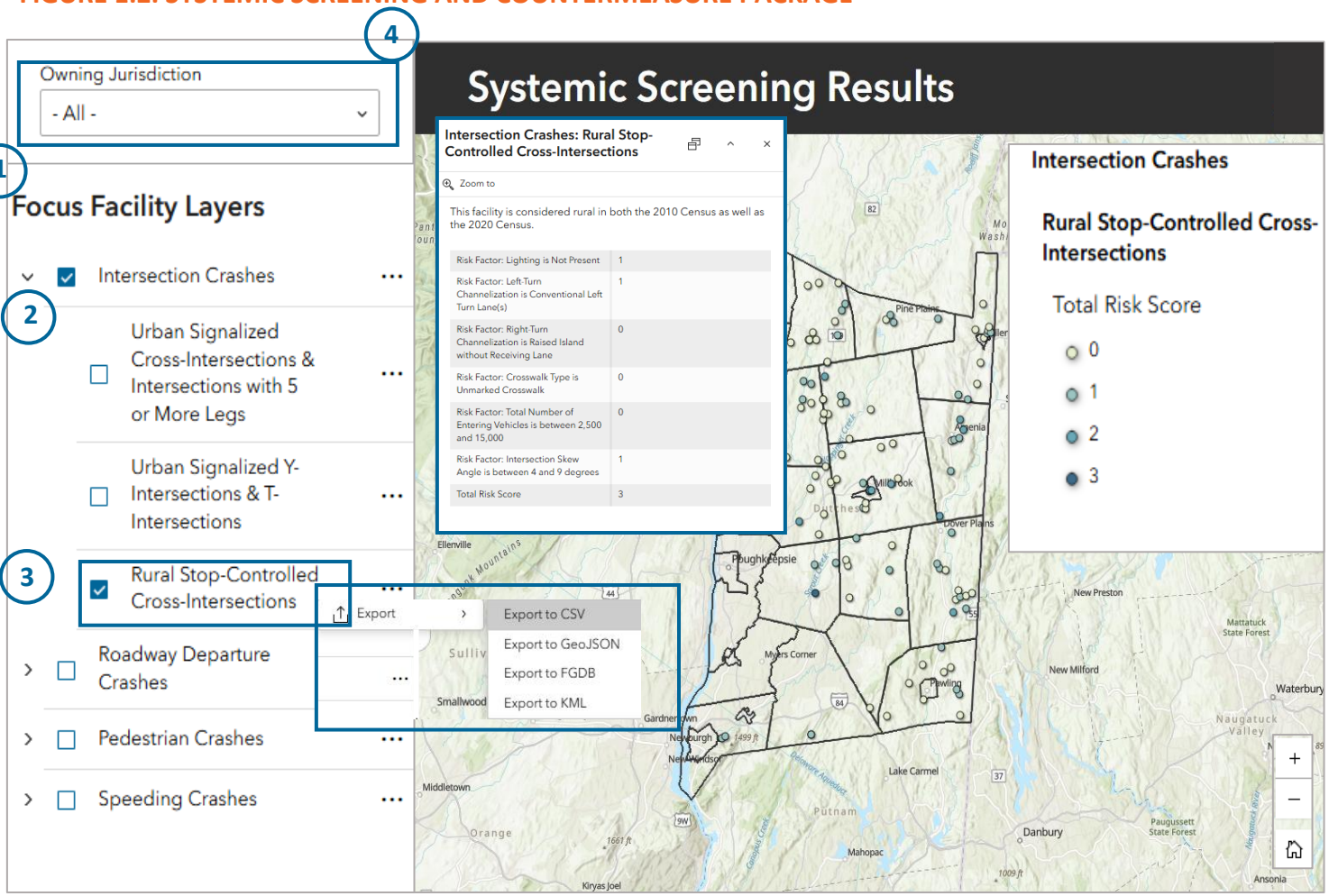
Combining the findings from the systemic analysis with the systemic countermeasure packages listed later in this report can lead to the development of potential roadway projects. However, determining what interventions to apply requires users to weigh multiple factors and exercise engineering judgement. Below is an example with step-by-step instructions for a typical analysis using these resources.

How to Use the Systemic Countermeasure Packages

The first step is to use the Systemic Screening Map to determine what systemic issues you want to focus on. Open the online Systemic Screening map. The map is designed to narrow down locations by type of crash and type of facility.

1. In the left column, select a **Focus Crash Type**.
2. Then expand all associated **Focus Facility Type** layers.
3. Choose a **Focus Facility Type** from the expanded list. You can select multiple facility types.
4. You can also filter the selected facility layer by **Owning Jurisdiction** to identify locations that a specific municipality owns and operates.

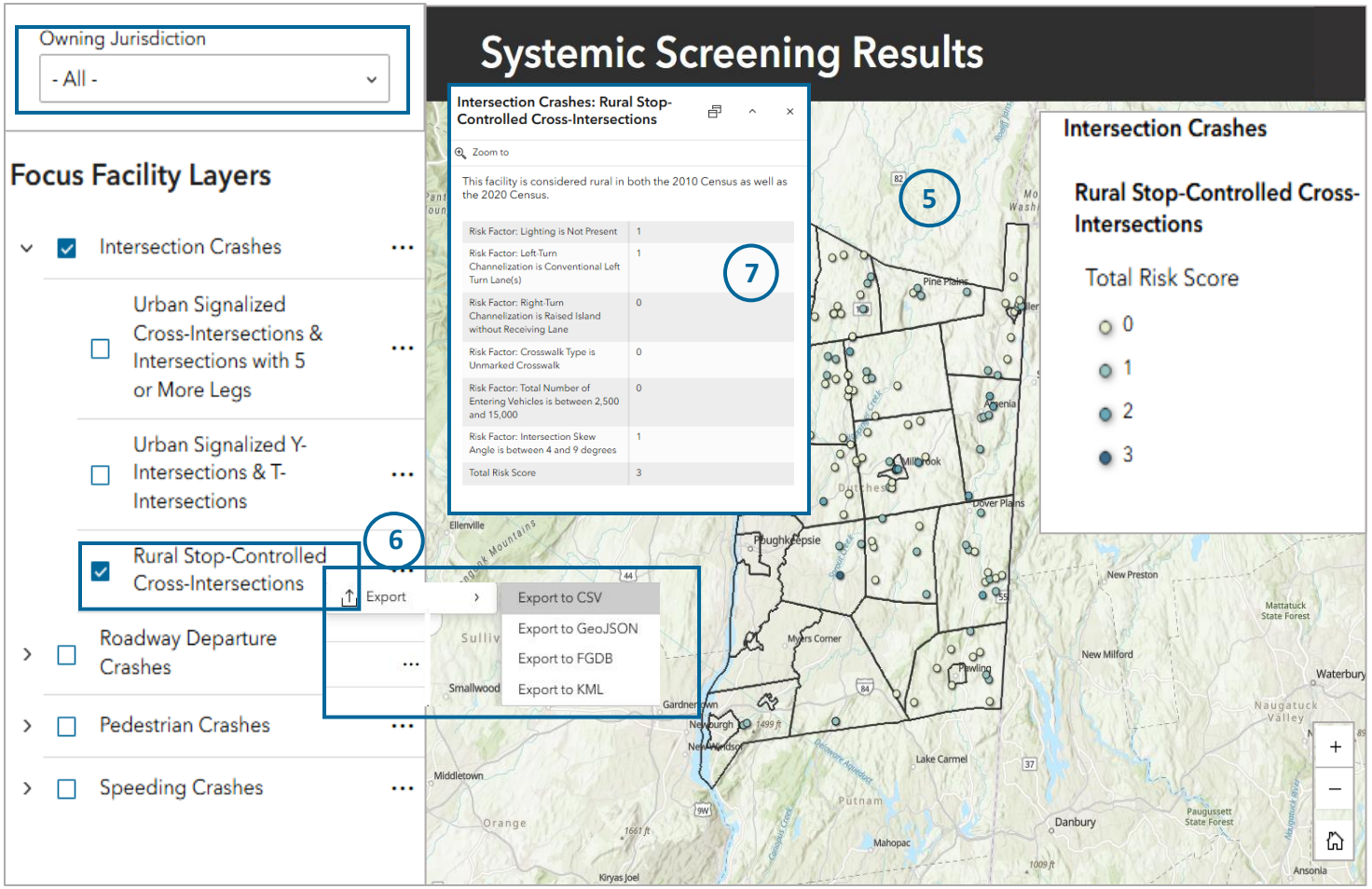
FIGURE 1.2. SYSTEMIC SCREENING AND COUNTERMEASURE PACKAGE



5. The resulting map will show the **High-Risk Sites** that meet the criteria used. The sites are colored by risk score as identified in the right-hand legend (darker colors indicate higher risk levels). These sites can be candidate locations for systemic treatment packages.

6. In the left column, you may also export the detailed focus facility site information by clicking the three-dot icon next to each layer and selecting your desired export format.

7. Finally, for any given High-Risk site, you can click on the point on the map to open a pop-up box showing the **Risk Factors** associated with that location.



The sample pop-up box shows a site with risk factors for crosswalks, traffic control type, entering vehicles, and intersection skew angle. This context will help select countermeasure packages.

8. Refer to the **Systemic Treatment Package Tables** in Section 2.0 below to select packages applicable to the selected Focus Crash Type, Focus Facility Type, and Risk Factors identified. In each table, you can use the '***Focus Facility Type(s)***' and '***Risk Factor(s)***' columns to match each High-Risk site with the appropriate countermeasure package.

9. Be sure to evaluate the applicability of each countermeasure included in the package based on the planning considerations and State guidelines listed in the '***Planning Considerations***' and '***NYSDOT Reference***' columns.

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TABLE 2.2 INTERSECTION SYSTEMIC TREATMENT PACKAGES

Package	Project Type(s)	Countermeasure(s)	Applicable Locations	Focus Facility Type(s)	Risk Factor(s)	Planning Considerations	NYSDOT Reference
Signalized	Signals, Beacons, Illumination 10	• Backplates with Retro-reflective Borders • Re-time signals for yellow and red light clearance intervals and improved coordination • Signal Ahead sign • Turning Vehicles Yield to Pedestrian sign • Advance Cross Street Name sign	Signalized intersections	• Urban signalized 3-leg intersections • Urban signalized cross-intersections • Urban signalized intersections with 5 or more legs	• Signalized intersections with pedestrian signals (push-button actuated) • Total entering vehicles greater than 15,000 • Intersection skew angle between 4 and 9 degrees	N/A 9	Pedestrian Safety Action Plan - Appendix B: Signalized Intersection Improvements

Some countermeasure examples:

Backplates with Retro-reflective Borders
(source: FHWA)


Signal Ahead Sign
(source: MUTCD)

Turning Vehicles Yield to Pedestrians Sign
(source: MUTCD)

Advance Cross Street Name Sign
(source: FHWA)

10. Use the '***Project Type(s)***' column to consider the potential project type (e.g., maintenance, signage, markings, etc.).

11. The Countermeasure Toolkit may be a useful reference for some of the systemic countermeasures.

12. Develop a list of potential projects based on the selected treatment packages and countermeasures.

13. Consider funding eligibility. For example, the countermeasures listed in this toolkit would typically be eligible for HSIP funding without requiring site-specific benefit-cost analyses. Municipalities in New York have been able to bundle similar systemic projects at multiple locations under a single application to NYSDOT for funding, enabling systemic solutions to be applied across the road network. However, depending on planning considerations and State guidelines, individual countermeasures may require field evaluation. Users may wish to coordinate with the DCTC to discuss funding sources and requirements.

The Treatment Package tables may also be used in other ways. If you know what kind of treatment package you are seeking, you can use the '**Package**' column. If you are seeking options for how to improve a specific type of site, you can use the '**Applicable Location**' column. If you have a specific countermeasure planned, you can see what other countermeasures might be combined into a package by scanning the '**Countermeasures**' column.

2.0 Systemic Treatment Packages

The systemic treatment packages contain groups of countermeasures that can be layered together to address the key risk factors associated with severe crash types at high-risk locations.

To create these packages, we reviewed national and state guidance, including NYSDOT Engineering Instruction bulletins. Additionally, NYSDOT approved several systemic treatments in its 2023 Strategic Highway Safety Plan (SHSP) and through the adoption of specific NYSDOT SHSP Emphasis Area plans, including:

- Pedestrian Safety Action Plan (2016)
- Vulnerable Road User Safety Assessment (2023)
- Roadway Departure Safety Action Plan (2024)

Each of these statewide plans includes individual countermeasures and countermeasure packages for specific focus facilities and other locations with identified risk factors.

This Safety Action Plan toolkit includes systemic treatment packages for intersection-, pedestrian-, roadway departure-, and speed-related crashes, as listed in Table 2.1 and described in greater detail below.

TABLE 2.1 SYSTEMIC TREATMENT PACKAGES

Intersection Treatment Packages	Pedestrian Treatment Packages	Roadway Departure Treatment Packages	Speed Treatment Packages
Signalized	Pedestrian Crossing	Curve Signage	Speed Feedback Signs
Signalized Enhanced	Pedestrian Crossing Enhanced	Curve Signage Enhanced	Lage Space Reallocation
Stop-Controlled	Crosswalks	Curve Corridors	Street Width Reduction
Stop-Controlled Enhanced	Crosswalks Enhanced	Friction Treatments	Vertical Deflection
Roundabout	VRU Countermeasures	Lighting	
	Transit Stop Crossing	CARDS	
	Transit Stop Lighting	SHARDS	
	Sidewalk Gap Completion		

Each treatment package is presented with the following information:

- **Typical project type:** The type of project, such as maintenance, signage, markings, delineators, illumination, or construction.
- **Included countermeasures:** The specific recommended improvements.
- **Applicable locations:** The locations where the project would typically be considered.
- **Addressed risk factors:** Specific conditions that indicate a higher level of risk, based on our systemic analysis.
- **Planning considerations:** Countermeasure recommendation sources/endorsements, limitations, and other considerations.

Some countermeasures packages, such as for signalized and stop-controlled intersections, pedestrian crossings, crosswalks, and curve signage, have both basic and "Enhanced" packages. The Enhanced packages include additional countermeasures and reflect "Enhanced treatments" identified in NYSDOT sources that may require additional site-by-site analysis, safety engineering evaluation, additional identification of community needs, and/or the consideration of additional NYSDOT guidance.

Each of these countermeasures are generally eligible for NYSDOT's Highway Safety Improvement Program (HSIP) without requiring site-specific benefit-cost analyses. However, some individual countermeasures may still require field evaluation and Enhanced packages may require additional analysis, as described above.

The countermeasures included in the treatment packages can be implemented in several ways:

- Bundling projects in a single contract across multiple focus facilities or jurisdictions;
- Integrating elements into capital projects; or
- Incorporating project elements into routine pavement, signage, and signal maintenance programs.

2.1 Intersection and Pedestrian-Related Crashes

Intersections are major points of conflict for vehicles, pedestrians, cyclists, and even trains (at on-street railroad crossings). Between 2019 and 2023, about half of pedestrian and bicyclist fatal and severe injury crashes in Dutchess County occurred at intersections. Proven countermeasures for intersections seek to reduce the severity of conflicts and increase pedestrian visibility while slowing down vehicles.

THE SYSTEMIC TREATMENT PACKAGES FOR INTERSECTION- AND PEDESTRIAN-RELATED CRASHES ARE SUMMARIZED IN TABLE 2. AND

Table 2..

TABLE 2.2 INTERSECTION SYSTEMIC TREATMENT PACKAGES

Package	Project Type(s)	Countermeasure(s)	Applicable Locations	Focus Facility Type(s)	Risk Factor(s)	Planning Considerations	NYSDOT Reference
Signalized	Signals, Beacons, Illumination	• Backplates with Retro-reflective Borders • Re-time signals for yellow and red light clearance intervals and improved coordination • Signal Ahead sign • Turning Vehicles Yield to Pedestrian sign • Advance Cross Street Name sign	Signalized intersections	• Urban signalized 3-leg intersections • Urban signalized cross-intersections • Urban signalized intersections with 5 or more legs	• Signalized intersections with pedestrian signals (push-button actuated) • Total entering vehicles greater than 15,000 • Intersection skew angle between 4 and 9 degrees	N/A	Pedestrian Safety Action Plan - Appendix B: Signalized Intersection Improvements

Some countermeasure examples:

Backplates with Retro-reflective Borders
(source: FHWA)

Signal Ahead Sign
(source: MUTCD)

Turning Vehicles Yield to Pedestrians Sign
(source: MUTCD)

Advance Cross Street Name Sign
(source: FHWA)

Package	Project Type(s)	Countermeasure(s)	Applicable Locations	Focus Facility Type(s)	Risk Factor(s)	Planning Considerations	NYSDOT Reference
Signalized *Enhanced*	Various	"Signalized" countermeasures (see above), plus: • Raised crosswalks • No Turn on Red sign (Overhead Blank-Out - which uses LED lights for better daytime visibility) • Restrict parking at intersections to improve visibility ("Daylighting") • Lighting • Dedicated left- and right-turn lanes	Signalized intersections	• Urban signalized 3-leg intersections • Urban signalized cross-intersections • Urban signalized intersections with 5 or more legs	• Marked crosswalks • Conventional left-turn lanes • Raised island with receiving lane for right turns • Lack of lighting • Total entering vehicles greater than 15,000	N/A	Pedestrian Safety Action Plan - Appendix B: Signalized Intersection Improvements

Some countermeasure examples:

Raised Crosswalks
(source: FHWA)

No Turn on Red Sign (Overhead Blank-Out –)
(source: CUTR)

Restrict Parking at Intersections (Daylighting)
(source: Countermeasure Toolkit)

Dedicated Right Turn Lane
(source: FHWA)

Package	Project Type(s)	Countermeasure(s)	Applicable Locations	Focus Facility Type(s)	Risk Factor(s)	Planning Considerations	NYSDOT Reference
Stop-Controlled	Maintenance; Signs, Markings, and Delineators	• Double oversized advance intersection warning signs (on through approach) • Double oversized advance "Stop Ahead" warning signs (on the stop approach) • Double (left and right) oversized Stop signs • Retroreflective sheeting on signs and signposts • Enhanced pavement markings • Painted stop bar • Removal of sight distance obstructions	Stop-controlled intersections	• Rural stop-controlled cross-intersections	• Raised island without receiving lane for right turns • Total entering vehicles between 2,500 and 15,000 • Intersection skew angle between 4 and 9 degrees • Lack of stop bar on stop approaches • Lack of lane edge lines	FHWA Proven Safety Countermeasures: Systemic Application of Multiple Low-Cost Countermeasures at Stop-Controlled Intersections	N/A

Some countermeasure examples:

Double (left and right) Oversized Stop Signs

(Source: Iowa State University CTRE)

Retroreflective Sheeting on Signs and Signposts

(Source: FWHA)

Enhanced Pavement Markings

(source: Countermeasure Toolkit)

Painted Stop Bar

(source: FHWA)

Package	Project Type(s)	Countermeasure(s)	Applicable Locations	Focus Facility Type(s)	Risk Factor(s)	Planning Considerations	NYSDOT Reference
Stop-Controlled *Enhanced*	Signals, Beacons, Illumination	"Stop Controlled" countermeasures (see above) plus: • Rectangular Rapid Flashing Beacons (RRFB) • Lighting	Stop-controlled intersections	• Rural stop-controlled cross-intersections	• Lack of lighting • Unmarked crosswalks	FHWA Proven Safety Countermeasures (see above)	N/A

Some countermeasure examples:

Rectangular Rapid Flashing Beacon (RRFB)
(source: FHWA)

Rural Intersection Lighting
(source: FHWA)

Package	Project Type(s)	Countermeasure(s)	Applicable Locations	Focus Facility Type(s)	Risk Factor(s)	Planning Considerations	NYSDOT Reference
Roundabout	Construction (2R/3R)	• Mini-Roundabouts (aka traffic circles) • Single-Lane Roundabouts • Multi-Lane Roundabouts	All intersections	• All intersections	• High approach speeds at intersections	NCHRP Guide for Roundabouts; NYSDOT Roundabout Design Guidance (Roundabout Software Manual)	N/A

Some countermeasure examples:

Mini-Roundabout (aka Traffic Circle)
(source: NACTO)

Single-Lane Roundabout
(source: FHWA)

Multi-Lane Roundabout
(source: FHWA)

TABLE 2.3 PEDESTRIAN SYSTEMIC TREATMENT PACKAGES

Package	Project Type(s)	Countermeasure(s)	Applicable Locations	Focus Facility Type(s)	Risk Factor(s)	Planning Considerations	NYSDOT Reference
Pedestrian Crossings	Maintenance; Signs, Markings, and Delineators	• High-visibility crosswalks • Restrict parking at intersections to improve visibility ("Daylighting") • Signal Ahead sign • No Turn on Red sign • Stop Here for Pedestrians sign	Signalized intersections	• Urban signalized 3-leg intersections, and cross-intersections	• Lack of lighting • No right-turn channelization • No left-turn lanes • Marked crosswalks • Signalized intersection with pedestrian signal	No Turn on Red signs should be prioritized near schools and other pedestrian generators	Pedestrian Safety Action Plan - Appendix B: Signalized Intersection Improvements

Some countermeasure examples:

High Visibility Crosswalk
(source: Countermeasure Toolkit)

Restrict Parking at Intersections (Daylighting)
(source: Countermeasure Toolkit)

No Turn on Red Sign
(source: MUTCD)

Stop Here for Pedestrian Sign
(source: MUTCD)

Package	Project Type(s)	Countermeasure(s)	Applicable Locations	Focus Facility Type(s)	Risk Factor(s)	Planning Considerations	NYSDOT Reference
Pedestrian Crossings *Enhanced*	Signals, Beacons, Illumination	"Pedestrian Crossings" countermeasures (see above) plus: • Leading Pedestrian Interval (LPI) • Pedestrian countdown timers • Evaluate left-turn phasing for pedestrian crossings • Accessible Pedestrian Signals (APS) • No Turn on Red sign (Overhead Blank-Out)	Signalized intersections	• Urban signalized 3-leg intersections, and cross-intersections	• Push-button actuated pedestrian signal • High daily pedestrian volumes • Located within a VRU high-risk area • Intersection skew angle between 4 and 9 degrees	N/A	Pedestrian Safety Action Plan - Appendix B: Signalized Intersection Improvements

Some countermeasure examples:

Leading Pedestrian Interval
(source: Countermeasure Toolkit)

Pedestrian Countdown Timer
(source: FHWA)

Accessible Pedestrian Signal (APS)
(source: NCHRP)

Package	Project Type(s)	Countermeasure(s)	Applicable Locations	Focus Facility Type(s)	Risk Factor(s)	Planning Considerations	NYSDOT Reference
Crosswalks	Maintenance; Signs, Markings, and Delineators	• High-visibility crosswalks • Pedestrian warning signs • Retroreflective signposts	Uncontrolled marked crosswalks	• Urban stop-controlled intersections	• Conventional left-turn lanes • Two-way stop-controlled intersection • Intersection skew angle between 7 and 9 degrees	See NYSDOT Pedestrian Safety Action Plan – Appendix C: PSAP/Highway Design Manual Exhibit 18-19 Cross Reference	NYSDOT Pedestrian Safety Action Plan – Appendix A: Crosswalks at Uncontrolled Locations
Crosswalks *Enhanced*	Signals, Beacons, Illumination	"Crosswalks" countermeasures (see above) plus: • Rectangular Rapid Flashing Beacons (RRFBs) • Raised pedestrian median refuge and/or corner island and/or curb extension • Pedestrian Hybrid Beacons	Uncontrolled marked crosswalks	• Urban stop-controlled intersections	• Marked crosswalks • Total entering vehicles between 7,000 and 15,000 • High daily pedestrian volumes	See NYSDOT Pedestrian Safety Action Plan – Appendix C: PSAP/Highway Design Manual Exhibit 18-19 Cross Reference	NYSDOT Pedestrian Safety Action Plan – Appendix A: Crosswalks at Uncontrolled Locations

Some countermeasure examples:

Rectangular Rapid Flashing Beacon (RRFB)
(source; FHWA)

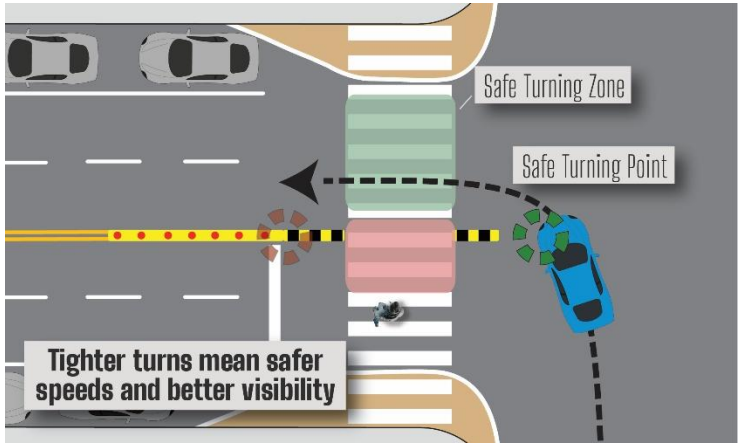
Raised Pedestrian Median Refuge
(source: FHWA)

Pedestrian Hybrid Beacon (PHB)
(source: FHWA)

Package	Project Type(s)	Countermeasure(s)	Applicable Locations	Focus Facility Type(s)	Risk Factor(s)	Planning Considerations	NYSDOT Reference
VRU Countermeasures	Various	• Curb extensions (on streets with parking) • Left turn calming infrastructure at intersections with problematic left turns	All road types, typically in urban areas and areas with pedestrian traffic, and to improve crosswalk visibility	• All intersections	• Conventional left-turn lanes • High vehicle speeds at intersections • Long pedestrian crossing distances	NYSDOT VRU "High-Risk" Areas (see pg. 6 above)	Vulnerable Road User Safety Assessment (Strategy 1)

Some countermeasure examples:

Curb extensions (on streets with parking)
(source: Iowa State University Institute for Transportation)



Left-Turn Calming Infrastructure
(source: City of Chicago)

Package	Project Type(s)	Countermeasure(s)	Applicable Locations	Focus Facility Type(s)	Risk Factor(s)	Planning Considerations	NYSDOT Reference
Transit Stop Crossings	Signs, Markings, and Delineators	• High-visibility crosswalks • Enhanced signing and pavement markings	All road types	• Transit Stops	• Unmarked crosswalks	Near public transit stops	Vulnerable Road User Safety Assessment (Strategy 1)
Transit Stop Lighting	Signals, Beacons, Illumination	• Lighting	All road types	• Transit Stops	• Lack of lighting	Near public transit stops	Vulnerable Road User Safety Assessment (Strategy 1)
Sidewalk Gap Completion	Minor Construction; Construction (1R); Construction (2R/3R)	• Construct new sidewalks, lighting, and warning signs	Typically local/collector roads, but could be anywhere sidewalks are needed	• Intersections	• Discontinuous or missing sidewalk	VRU "High-Risk" Areas	Vulnerable Road User Safety Assessment (Strategy 1)

2.2 Roadway Departures and Speed-Related Crashes

Roadway departures are among the deadliest crash types in New York State. NYSDOT's efforts to reduce roadway departure crashes are part of a strategic approach that involves countermeasures that: 1) keep vehicles on the roadway, 2) provide for safe recovery, and 3) reduce crash severity if vehicles do leave the roadway. Countermeasures that address any of these strategies should be considered for implementation. The treatment packages for roadway departure crashes are provided in Table 2..

Reducing speeds is also a critical component of systemic safety, as lower speeds reduce both the frequency and severity of crashes. In Dutchess County, unsafe speeds are a contributing factor in 41% of fatal and serious injury crashes involving roadway departures, so there are opportunities for layering countermeasures. Table 2. summarizes the systemic treatment packages for speed-related crashes.

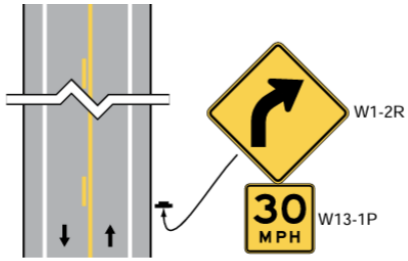
Pine Woods Rd in Hyde Park, which was a Field Investigation site and is a focus facility for Roadway Departure Crashes, is an example of where a roadway departure could lead a vehicle down a roadside slope.

TABLE 2.4 ROADWAY DEPARTURE SYSTEMIC TREATMENT PACKAGES

Package	Project Type(s)	Countermeasure(s)	Applicable Locations	Focus Facility Type(s)	Risk Factor(s)	Planning Considerations	NYSDOT Reference
Curve Signage	Maintenance; Signs, Markings, and Delineators	• Required horizontal alignment signs • Advisory speed plaques • Chevron signs • One Direction Large Arrow signs (may be used in place of or to supplement chevron signs)	Horizontal curves on Arterials and Collectors	• Urban and Rural Principal Arterials • Urban and Rural Minor Arterials • Urban and Rural Major Collectors	• Posted speed limit of 35 -40 MPH on urban arterials and rural major collectors or 45-50 MPH on rural arterials and urban major collectors • Shoulder width < 4 ft on urban arterials	Select countermeasures that are "Required" per Table 2C-4 in Section 2C-06 (MUTCD 11th Edition, 2023)	Roadway Departure Safety Action Plan – Level 1 Countermeasures (Table 19)

Some countermeasure examples:

Horizontal Alignment Sign
(source: MUTCD)



Advisory Speed Plaque
(source: MUTCD)

Chevron Sign
(source: FHWA)

One Direction Large Arrow Sign
(source: MUTCD)

Package	Project Type(s)	Countermeasure(s)	Applicable Locations	Focus Facility Type(s)	Risk Factor(s)	Planning Considerations	NYSDOT Reference
Curve Signage *Enhanced*	Maintenance; Signs, Markings, and Delineators	"Curve Signage" countermeasures (see above) plus: • Oversized horizontal alignment signs • "Recommended" and/or "Optional" horizontal alignment signs • Reflectorized sleeves on signposts • Post-mounted or barrier-mounted delineators • Breakaway sign supports	Horizontal curves on Arterials and Collectors	• Urban and Rural Principal Arterials • Urban and Rural Minor Arterials • Urban and Rural Major Collectors	• AADT > 10,000 on rural arterials or AADT < 2,000 on urban major collectors or AADT between 2,000 - 5,000 on rural major collectors	AADT > 1,000; KA Roadway departure crash history, at least 1 Risk Factor (as listed in Tables 5-6 of RwDSAP)	Roadway Departure Safety Action Plan – Level 2 Countermeasures (Table 19)

Some countermeasure examples:

Oversized Horizontal Alignment Sign
(source: FHWA)

Post-mounted Delineators
(source: Iowa State University Transportation Institute)

Breakaway Sign Supports
(source: FHWA)

Package	Project Type(s)	Countermeasure(s)	Applicable Locations	Focus Facility Type(s)	Risk Factor(s)	Planning Considerations	NYSDOT Reference
Curve Corridors	Various	• Wider edge lines • Curve warning pavement markings • Flashing beacons on warning signs • Shoulder widening (including SafetyEdge) • Clear zone improvements • Fill in roadside slopes to make more level • Roadside barriers	Horizontal curves	• Urban and Rural Principal Arterials • Urban and Rural Minor Arterials • Urban and Rural Major Collectors	• AADT > 10,000 on rural arterials, or AADT < 2,000 on urban major collectors, or AADT between 2,000 and 5,000 on rural major collectors • Shoulder width < 4 ft on urban arterials • Four through lanes on urban principal and minor arterials	At least 2 Risk Factors (as listed in Tables 5-6 of RwDSAP	Roadway Departure Safety Action Plan – Corridor Projects (Table 20); NYSDOT Engineering Bulletin 10-012

Some countermeasure examples:

Wider Edge Lines
(source: FHWA)

Curve Warning Pavement Markings
(source: Iowa Center for Transportation Research and Education)

Flashing Beacons on Warning Signs
(source: FHWA)

Clear Zone Improvements
(source: KY Transportation Cabinet)

Roadside Barriers
(source: FHWA)

SafetyEdge[sm]

The SafetyEdge[SM] technology shapes the edge of the pavement at approximately 30 degrees from the pavement cross slope during the paving process. This safety practice reduces the vertical drop-off at the pavement edge. (Source: FHWA)

Package	Project Type(s)	Countermeasure(s)	Applicable Locations	Focus Facility Type(s)	Risk Factor(s)	Planning Considerations	NYSDOT Reference
Friction Treatments	Construction (1R)	• High Friction Surface Treatments, which help vehicles stay on the road in wet conditions	Horizontal curves and other locations at risk from wet roadways	• Urban and Rural Principal Arterials • Urban and Rural Minor Arterials • Urban and Rural Major Collectors	• Posted speed limit of 35 -40 MPH on urban arterials and rural major collectors, or 45-50 MPH on rural arterials and urban major collectors	Typically includes a crash analysis with a Benefit-Cost Ratio >= 1 for HSIP eligibility	Roadway Departure Safety Action Plan – Corridor Projects (Table 20)

A countermeasure example:

High Friction Surface Treatments

(source: FHWA)

Package	Project Type(s)	Countermeasure(s)	Applicable Locations	Focus Facility Type(s)	Risk Factor(s)	Planning Considerations	NYSDOT Reference
Lighting	Signals, Beacons, Illumination	• Street Lighting (see Countermeasure Toolkit for details)	Curves	• Rural Principal Arterials	• Lack of lighting	Consult NYSDOT's Policy on Highway Lighting	Policy on Highway Lighting, Warrant WAC-1
CARDS	Minor Construction; Construction (1R)	• Centerline audible roadway delineators (CARDs)	All road types; typically a corridor-wide application	• Rural Principal Arterials • Rural Minor Arterials	• AADT > 10,000 on rural arterials • Posted speed limit of 50 MPH on rural arterials • Positive median barrier on rural arterials	Consult NYSDOT Engineering Instruction 13-021 for a description of CARD-eligible roadways	NYSDOT Engineering Instruction 13-021

Centerline Audible Roadway Delineators (CARDs)

CARDS, or centerline rumble strips, create noise and vibration inside the vehicle if a driver crosses the centerline, thus alerting the driver to take corrective action. (Source: NYSDOT)

Package	Project Type(s)	Countermeasure(s)	Applicable Locations	Focus Facility Type(s)	Risk Factor(s)	Planning Considerations	NYSDOT Reference
SHARDS	Maintenance; Signs, Markings, and Delineators	• Secondary Highway Audible Roadway Delineators (SHARDs)	All road types; typically a corridor-wide application	• Rural Principal Arterials • Rural Minor Arterials	• AADT > 10,000 on rural arterials • Posted speed limit of 50 MPH on rural arterials	Consult NYSDOT Engineering Instruction 16-014 for a description of SHARD-eligible roadways	NYSDOT Engineering Instruction 16-014

Secondary Highway Audible Roadway Delineators (SHARDs)

SHARDS, or shoulder rumble strips, create noise and vibration inside the vehicle as a driver leaves the travel lane, thus altering the driver to take corrective action. (Source: NYSDOT)

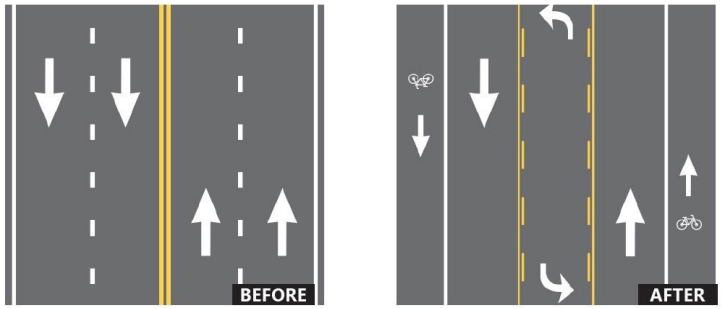
(source: FHWA)

TABLE 2.5 SPEED-RELATED SYSTEMIC TREATMENT PACKAGES

Package	Project Type(s)	Countermeasure(s)	Applicable Locations	Focus Facility Type(s)	Risk Factor(s)	Planning Considerations	NYSDOT Reference
Speed Feedback Signs	Maintenance; Signs, Markings, and Delineators	• Speed Radar/Feedback Signs	Advisory Speed Zones (School, Curve); Transition Zones between rural and populated areas	• Urban and Rural Principal Arterials • Urban and Rural Minor Arterials • Urban and Rural Major Collectors	• Posted speed limit of 55 - 60 MPH on all focus facilities, or 35 - 40 MPH on urban major collectors, or <35 MPH on rural major collectors	Highway Work Permit (PERM 33) is required for signs in NYSDOT right-of-way	N/A
Lane Space Reallocation	Signs, Markings, and Delineators; Construction (1R)	• Reallocate road space by reducing travel lanes to accommodate bicycle facilities and/or on-street parking	All road types, often in areas with bicycle traffic to connect bicycle routes or on commercial corridors to provide on-street parking	• Urban Principal Arterials • Urban Minor Arterials • Urban Major Collectors	• AADT between 2,000 and 10,000 on urban major collectors or AADT > 10,000 on urban arterials • Shoulder width between 5 and 12ft on urban arterials • 2 to 3 through lanes on urban arterials	AADT < 15,000; Consider during Initial Project Proposal (if State or Federal funding used)	N/A

A countermeasure example:

Lane space reallocation to make space for bicycle lanes (source: FHWA)



Package	Project Type(s)	Countermeasure(s)	Applicable Locations	Focus Facility Type(s)	Risk Factor(s)	Planning Considerations	NYSDOT Reference
Street Width Reduction	Minor Construction; Construction (1R)	• Choker • Median Island • On-Street Parking • Curb Extension	All road types; typically in urban areas and areas with excessive speeding	• Urban Principal Arterials • Urban Minor Arterials • Urban Major Collectors	• Divided road with curbed or unprotected median on urban arterials • Shoulder width between 5 and 12ft on urban arterials	FHWA Traffic Calming ePrimer (Table 3.1)	N/A

Some countermeasure examples:

Choker
(source: FHWA)

Median Island
(source: FHWA)

On-Street Parking
(source: FHWA)

Package	Project Type(s)	Countermeasure(s)	Applicable Locations	Focus Facility Type(s)	Risk Factor(s)	Planning Considerations	NYSDOT Reference
Vertical Deflection	Minor Construction; Construction (1R)	• Speed Hump • Speed Cushion • Speed Table • Offset Speed Table • Raised Crosswalk • Raised Intersection	Varies; typically installed on local streets or collector streets under 40mph speed limit; use on arterial streets is possible but requires review	• Urban Minor Arterials • Urban Major Collectors	• Posted speed limit of 35-40 MPH on urban major collectors • Divided road with curbed or unprotected median on urban arterials • AADT between 2,000 and 10,000 on urban major collectors	FHWA Traffic Calming ePrimer (Table 3.1).	N/A

Some countermeasure examples:

Speed Hump
(source: FHWA)

Speed Cushion
(source: FHWA)

Speed Table
(source: FHWA)

Offset Speed Table
(source: FHWA)

Raised Crosswalk
(source: FHWA)

Raised Intersection
(source: Caltrans)