

Appendix A: Safety Treatment Toolkit

Introduction

The purpose of this toolkit is to provide a list of road safety countermeasures that can be applied to roads in the City of St. Louis Park. The toolkit is based on the Minnesota Department of Transportation's [District Safety Plan Road Safety Strategies](#), also known as the Big Book of Ideas, and modified to reflect countermeasures applicable within the city. Countermeasure can be selected based on the type of location needing improvement. The crash reduction factor (CRF)¹ of each countermeasure and estimated cost provided will also help aid decision making. Icons are shown next to a countermeasure if the countermeasure addresses pedestrians, bicyclists, or equity. In some cases, it also indicates what severe type the countermeasure is meant to address.

Countermeasure Icons:



The pedestrian icon indicates that the countermeasure addresses safety for people walking or using a wheelchair



The bicyclist icon indicates that the countermeasure addresses safety for people biking or using a scooter



This icon indicates that the countermeasure addresses Equity Safety

Severity Key

K = Fatal

A = Serious Injury

B = Minor Injury

C = Possible Injury

O = Property Damage Only (PDO)

Cost Estimate Thresholds (Per Mile)



Less than \$15,000
\$15,000 to \$50,000
\$50,000 to \$125,000
\$125,000 to \$400,000
\$400,000 or more

¹ Crash Reduction Factors (CRFs) are provided for each strategy (if available) to estimate the proportion of crashes that could be reduced if the strategy is implemented. The adjacent notes show what types of crashes the CRF applies to. Example: A CRF of 20% that applies to KABC (fatal or injury crashes) and single vehicle run off road (SVROR) crashes indicates that the total number of injury run off road crashes would be reduced by 20% if the associated strategy were implemented.

For more information on a specific strategy CRF and accompanying Crash Modification Factor (CMF), see the [Big Book of Ideas](#), or contact MnDOT's Office of Traffic Safety.

Segments Countermeasures

Strategies	Cost	CRF	Notes
1 SAFE SYSTEM ROAD DESIGN HIERARCHY TIER 1: Remove Severe Conflicts			
Access management 		44%	All crash severities & types
Bicycles 		—	
Shared use path 		—	
Side path 		—	
Separated bike lane (by parking, delineators, barriers, boulevard, sidewalk, or curb buffers)		—	
Bike lane		57%	All crash severities & types
Shared roadway		—	
Divided roadway 		39%	KABC crashes, all crash types
Median pedestrian improvements (flat median with pedestrian cut-throughs preferable)		9%	KABC crashes, all crash types
		86%	Fatal vehicle/bike and vehicle/ped crashes
Mid-block crosswalks *	—	—	
Ped refuge island / median island		9%	KABC crashes, all crash types
		86%	Fatal vehicle/bike and vehicle/ped crashes
Evaluate alternative crossing location		18%	All crash severities, vehicle/ped crashes
Grade-separated pedestrian underpass/overpass		—	
Pedestrian barriers to prevent mid-block crossing 		48%	KABC crashes, all crash types
Remove sightline obstructions / maintain vision triangles (vegetation, parking, other) 		—	
Road diet (3- & 5-Lane Conversions) 		47%	All crash severities & types
Sidewalks 		40%	All crash severities, vehicle/ped crashes
2 SAFE SYSTEM ROAD DESIGN HIERARCHY TIER 2: Reduce Vehicle Speeds			
Appropriate speed limits for all users 		17%	Fatal crashes, all crash types
Dynamic speed feedback sign 		—	
Mid-block crosswalks *	—	—	
Reduce crosswalk width / curb extension		—	
Speed safety cameras **		54%	All crash severities & types

 Strategies	 Cost	 CRF	Notes
Traffic calming design 	—	—	
Reduced lane width		Up to 43%	KABC crashes, all crash types
Horizontal chicanes		—	
Center median		39%	KABC crashes, all crash types
Urbanization (make it feel urban to encourage walking and reduce speeds through close peripheral building lines) 		—	
Variable advisory speed limits		29%	All crash severities & types
3 SAFE SYSTEM ROAD DESIGN HIERARCHY TIER 3: Manage Conflicts in Time			
Mid-block crosswalks 	—	—	
Ped hybrid beacon (PHB)		43%	All crash severities, vehicle/ped crashes
RRFB		69%	All crash severities, vehicle/ped crashes
Traffic signal (when warranted)		23%	KABC crashes, all crash types
4 SAFE SYSTEM ROAD DESIGN HIERARCHY TIER 4: Increase Attentiveness & Awareness			
Lighting 		23%	KABC crashes, all crash types
Mid-block crosswalks* 	—	—	
Lighting at crosswalks		23%	KABC crashes, all crash types
High visibility crosswalk markings		37%	All crash severities, vehicle/ped crashes
Parking restriction on crosswalk approach		20%	KABC crashes, all crash types
Raised crosswalk		45%	KABC crashes, vehicle/ped crashes
Advance “Yield Here” sign and stop bar		25%	All crash severities, vehicle/ped crashes
In-street ped crossing sign(s)		—	
Warning sign with edge mounted LED lights		—	
Pedestal-mounted flashing signal beacons		—	
Overhead warning signs		—	
Colored pavement / brick pavers		—	
Plowable centerline reflective markers		24%	All crash severities, nighttime crashes
Pedestrian safety zones at targeted locations 		—	

(*) When warranted by pedestrian volumes

(**) If programs become available state-wide

Intersection Countermeasures

Strategies	Cost	CRF	Notes
1 SAFE SYSTEM ROAD DESIGN HIERARCHY TIER 1: Remove Severe Conflicts			
Access management 		—	
Alternative Intersection	—	—	
Roundabout 		51%	Injury crashes, all crash types
Mini roundabout 		61%	KABC crashes, all crash types
Partial grade-separated intersection		—	
Center island medians and pedestrian refuge islands/median island 		9%	KABC crashes, all crash types
		86%	Fatal vehicle/bike and vehicle/ped crashes
Left turn calming / hardened centerlines		10%	All crash severities, left turn crashes
Remove sightline obstructions / maintain vision triangles (vegetation, parking, other)		—	
Turn lanes (offset, channelized)		34%	Angle crashes, all severities
		44%	All crash severities & types
¾ Intersection 		64%	All crashes, angle crashes
2 SAFE SYSTEM ROAD DESIGN HIERARCHY TIER 2: Reduce Vehicle Speeds			
Corridor signal timing to reduce high-speed flow		11%	Injury crashes, all crash types
Curb extensions / curb bump-outs		30%	All crash severities & types
Traffic calming design 		—	
Reduced lane width		Up to 43%	KABC crashes, all crash types
Urbanization (street trees, pedestrian-scaled lighting, boulevard, curb, curb extensions, narrow corner radii, and shoulders)		—	
3 SAFE SYSTEM ROAD DESIGN HIERARCHY TIER 3: Manage Conflicts in Time			
Appropriately timed yellow change intervals		Up to 36%	All crash severities, rear end crashes
Confirmation lights		71%	All crash severities, disobeyed signal crashes
Flashing yellow arrow (FYA)		37%	All crash severities, left turn crashes
High-intensity activated crosswalk beacon (HAWK) / pedestrian hybrid beacon (PHB) 		43%	All crash severities, vehicle/ped crashes
Leading pedestrian intervals 		59%	All crash severities, vehicle/ped crashes
Pedestrian countdown timers (visual and audible) 		9%	All crash severities, vehicle/ped crashes

Strategies	Cost	CRF	Notes
Pedestrian safety zones to apply pedestrian countermeasures at targeted locations of high-pedestrian traffic or equity concerns	 \$ \$	—	
Protected intersection	 \$ \$ \$ \$ to \$ \$ \$ \$ \$	—	
Rectangular rapid flashing beacon (RRFB)	 \$ \$	69%	All crash severities, vehicle/ped crashes
4 SAFE SYSTEM ROAD DESIGN HIERARCHY TIER 4: Increase Attentiveness & Awareness			
Crosswalk visibility enhancements	 —	—	
High-visibility crosswalk	\$ \$	37%	All crash severities, vehicle/ped crashes
Improved lighting	\$ \$	42%	All crash severities & types, nighttime crashes
Enhanced signing and pavement markings	\$	—	
Enhanced transit stops and bus transit	 \$ \$ \$ to \$ \$ \$ \$	45%	All crash severities & types
Intersection bicycle signing and markings	 —	—	
Green colored pavement	—	—	
Perpendicular bike lane crossings	—	—	
Bike lanes marked through the intersection (next to turn lane)	\$ \$	—	
Bike box (two-stage turn queue box)	—	—	
Bike related signs	—	—	
Raised crosswalks / raised intersections	 \$ \$ \$ to \$ \$ \$ \$ \$	45%	All crash severities, vehicle/pedestrian crashes
Reflective signal head backplate	\$	15%	All crash severities & types
Retroreflective strips on stop sign posts	\$	—	

(*) When warranted by pedestrian volumes

(**) If programs become available state-wide

Segment countermeasures descriptions and example photos



Access Management

Managing roadway access reduces potential conflict points by combining or limiting access locations.



Shared Use Path

Paths that accommodate both bicycles and pedestrians, separate from motor vehicle traffic.



Sidepath

A shared-use path located parallel to a roadway.



Separate Bike Lane

On-street bicycle lanes that are physically separated from vehicles by features such as curbs, bollards, parking lanes, or buffers.



Bike Lane

Dedicated lanes on a roadway reserved exclusively for bicycle use.



Shared Roadway

A roadway where bicycles and vehicles operate in the same travel space, effective on lower-speed streets.



Divided Roadway

A roadway where opposing directions of traffic are separated by a median, barrier, or open space.



Mid-Block Crosswalk

Pedestrian crossings located between intersections to provide access where demand is high but no nearby crosswalk exists.



Pedestrian Refuge Island/Median Island

Protected space in the middle of the roadway where pedestrians can stop before completing a crossing.



Pedestrian Barriers to Prevent Mid-Block Crossing

Fences or barriers that restrict mid-block pedestrian crossings at unmarked locations.



Remove Sightline Obstructions

Keeping intersections and roadways clear of visual obstructions (such as vegetation or parked vehicles) to improve driver visibility and recovery space.



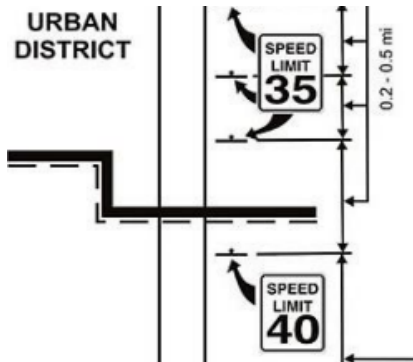
Road Diet (3 & 5 Lane Conversions)

Reconfiguring a multi-lane roadway, often converting a four-lane undivided street into three lanes with a center two-way left-turn lane, to calm traffic and improve safety.



Sidewalks

Paved pedestrian walkways that provide accessible travel, typically run parallel to roadways.



Appropriate Speed Limits for All Users

Speed limits are set considering land use context, pedestrian and bicycle activity, and driveway density, rather than relying only on roadway geometry.



Dynamic Speed Feedback Sign

Electronic signs that display a driver's real-time speed as they pass, encouraging compliance with posted limits.



Speed Safety Cameras

Cameras that detect and record speeding vehicles by capturing photo or video evidence above a set threshold.



Traffic Calming Design

Physical roadway design elements such as narrowed lanes, median installations, or gateway treatments that encourage lower vehicle speeds and improve safety.



Variable Advisory Speed Limits

Signs that provide adjusted advisory speeds in response to weather or roadway conditions.



Pedestrian Hybrid Beacon (PHB)

A signal system at unsignalized crossings that alerts drivers with flashing lights when activated by pedestrians.



RRFB (Rapids Rectangular Flashing Beacon)

Flashing light devices installed at unsignalized crossings to increase driver awareness of pedestrians, activated by button or detection.



Lighting

Corridor-wide or intersection-based lighting improves visibility and safety at night.



Plowable Centerline Reflective Markers

Centerline markers designed to withstand snowplow operations, improving visibility at night and in poor weather.



Pedestrian Safety Zones at Targeted Locations

Targeted locations with high pedestrian activity where enforcement strategies are focused on improving safety.

Intersection countermeasures descriptions and example photos



Before



Access Management

Consolidating entry points helps reduce the number of potential vehicle conflict areas.



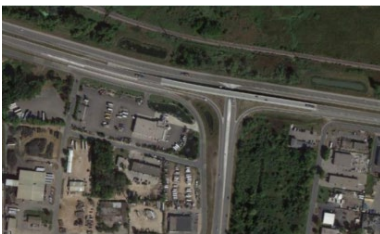
Roundabout

Circular intersection that naturally slows vehicles, decreasing the likelihood of severe crashes.



Mini Roundabout

A smaller-scale roundabout designed for constrained spaces. It provides similar safety benefits as a standard roundabout but requires less right-of-way.



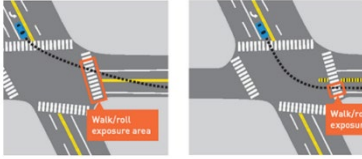
Partial Grade-Separated Intersection

Some turning movements are split onto different levels to reduce need for traffic signals.



Center Island Medians and Pedestrian Refuge Islands/Median Island

Space in the middle of a roadway where pedestrians have protection from vehicles.



Left Turn Calming/Hardened Centerlines

Concrete curbs or bollards along the centerline force drivers to take slower, wider left turns, protecting crosswalk users.



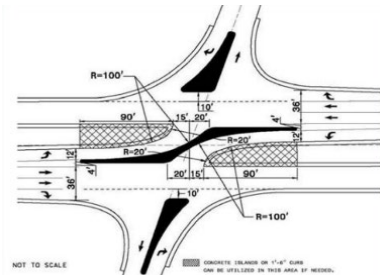
Remove Sightline Obstructions/Maintain Vision Triangles

Removing or managing obstructions such as vegetation or parked cars preserves drivers' ability to see pedestrians, cyclists, and other vehicles.



Turn Lanes

Dedicated lanes for left or right turns keep turning vehicles out of through lanes, improving traffic flow



3/4 intersection

Similar to a standard four-leg junction but restricts left turns from minor approaches, lowering conflict points.



Corridor Signal Timing

Signals can be adjusted to discourage speeding while still supporting efficient traffic progression along a corridor.



Curb Extensions and Curb Bump-Outs

Extending the curb into the roadway reduces pedestrian crossing distance and improves visibility.



Traffic Calming Design

Narrow lanes, medians, and similar features reduce driving speeds and improve safety in urban areas



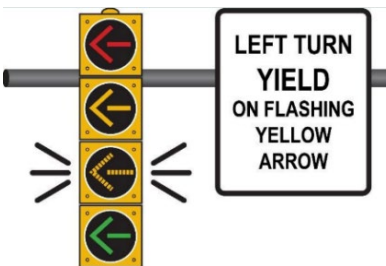
Yellow Change Intervals

The change interval between green and red needs to be carefully timed to ensure drivers clear the intersection safely before cross-traffic receives a green.



Confirmation Light

A blue light mounted on the back of a signal turns on with the red phase, helping police officers identify red-light violations.



Flashing Yellow Arrow (FYA)

This signal allows left turns after yielding to opposing traffic.



High-Intensity Activated Crosswalk Beacon (HAWK)/Pedestrian Hybrid Beacon (PHB)

Installed at unsignalized crossings, these pedestrian-activated beacons use flashing and solid lights to alert drivers to stop for crossing pedestrians.



Leading Pedestrian Interval (LPI)

Pedestrians start crossing before vehicles get a green light.



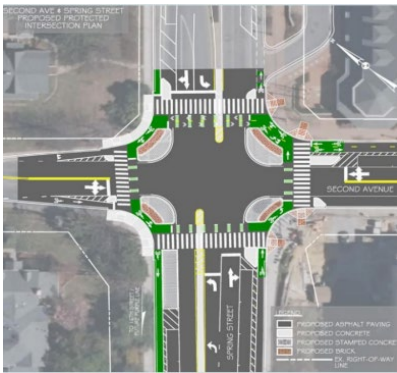
Pedestrian Countdown Timers

Visual and audible times that inform pedestrians how much crossing time remains.



Pedestrian Safety Zones

Apply pedestrian countermeasures at high-pedestrian or equity-priority locations.



Protected Intersection

Separates bicycles from vehicle paths by providing designated bike lanes and protected crossings.



Rapid Rectangular Flashing Beacon (RRFB)

Flashing lights activated by pedestrians pushing a button or permissive detection to draw driver attention to unsignalized crossings.



Crosswalk Visibility Enhancements

High visibility crosswalk, improved lighting, and enhanced signing and pavement marking.



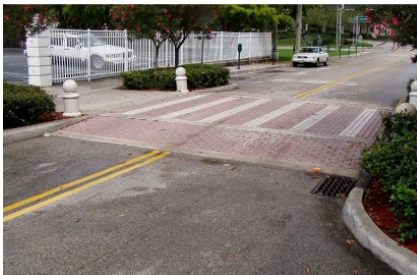
Enhanced Transit Stops and Bus Transit

Improved seating shelter, and heating at transit stops to improve comfort for users. Decreased headways, travel lanes, and signals to improve travel times and reliability.



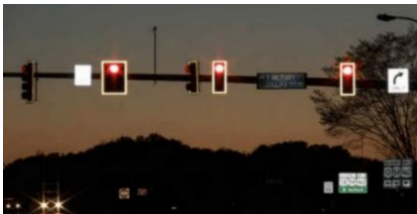
Intersection Bicycle Signing and Markings

Green colored pavement, perpendicular bike lane crossings, bike box, etc



Raised Crosswalks/Raised Intersections

Crosswalks elevated to sidewalk height slow vehicles and highlight pedestrian priority.



Reflective Signal Head Backplate

Adding reflective borders around traffic signals improves visibility.



Retroreflective Strips on Signposts

Retroreflective panels on signposts increase visibility at night.