MDOT Streamlined Systemic Safety Program

Finding Locations For Treatments

October 2018

“Solutions - looking for safety problem locations”

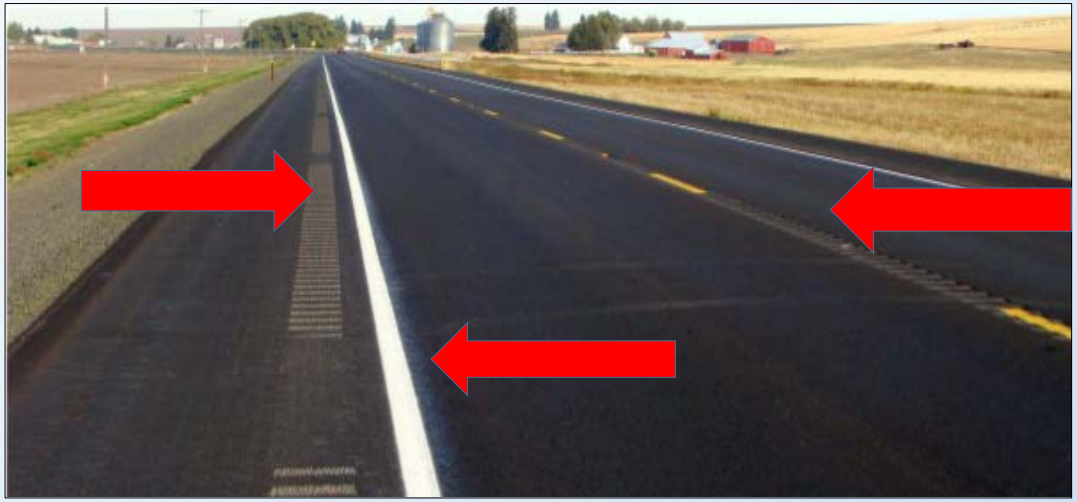
Turning the traditional approach—reactive spot analysis—around

Instead of:

Systemic – start with a countermeasure, find locations that can be helped with that treatment

Types of Eligible Projects

- Horizontal curve delineation
- Rumble strips
  - Shoulder
  - Center
- Edgeline pavement marking
- Stop-controlled intersections



Systemic Implementation

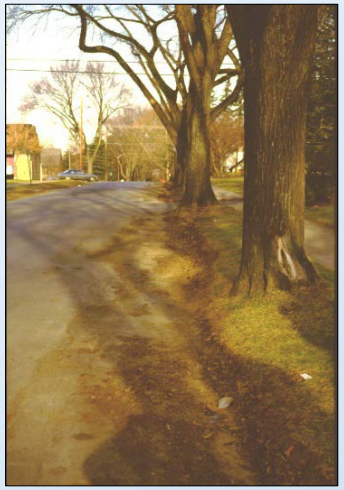
- This “family” of treatments is low-cost, they can be applied in a systemic approach
- Particularly applicable when crashes are widely scattered over many locations (e.g., in very rural areas)
- Rather than implement after a severe crash has occurred (reactive), a systemic approach implements based on the presence of certain risk factors (proactive)

Identification of Potential Project Locations

- Network screening
  - **Institutional knowledge/maintenance staff**
  - Public concerns/complaints
  - Law enforcement, EMS, wrecker services?
  - Network screening with crash data – frequency, crash mapping, and equivalent property damage only (Roadsoft)
  - Network screening with crash data and volumes – crash rates (RS)
  - Network screening utilizing software - Roadsoft
  - Network screening by systemic analysis

Reading the Road

Clues

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1)3-22-6
2)11-2-6
3)12-20-6
4)1-3-7
5)9-27-7
6)2-22-8
7)5-23-8
8)10-7-8
9)11-18-8-
10)12-5-8

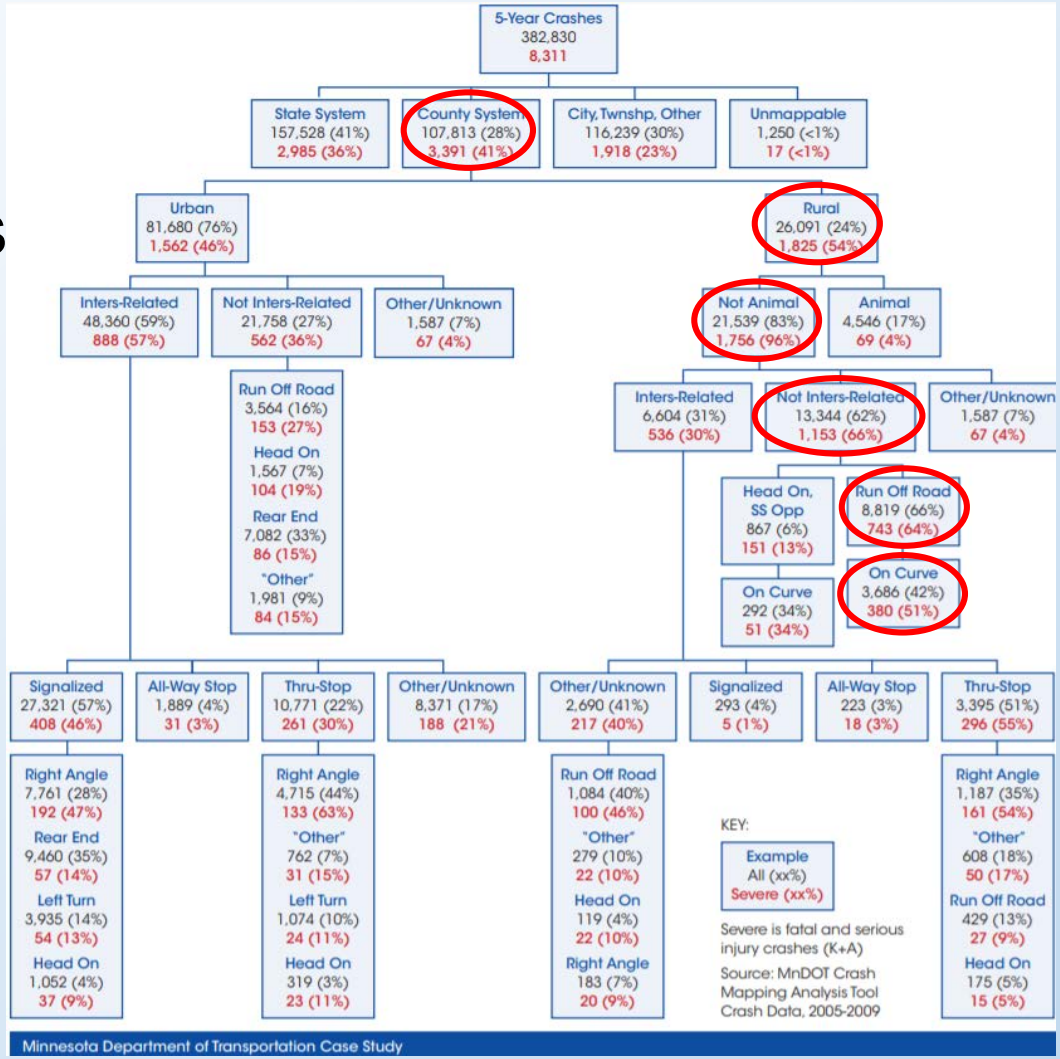
Finding Locations using Systemic Safety

- Identify locations for improvement by reviewing crash risk factors and scoring them
- Risks: geometrics, crash experience, roadway characteristics
- Limited risk data
- Crash performance is one measure of risk

Prioritization Strategies

- By road class, i.e.,
- Ranking by risks (s
- Functional class
- Corridor

Ranking by risks (systemic)



Sample of Priority Group (PG) Qualifiers

Intersections	Segments	Curves
PG1: Any locations with 3 or more stars	PG1: Any locations with 4 or more stars	PG1: Any locations with 2 or more stars
PG2: Any 2-star locations	PG2: Any 3-star location with	PG2: Any 1-star location with at least 5 all severity crashes
PG3: Any 1-star location with at least 1 severe crash	PG3: Any 2-star location with at least 1 severe crash	

Stop-controlled Intersection Upgrades

- What types of treatments
- How to find locations
- Policy/strategy
- Crash types addressed
  - Right angle

Stop Sign Treatments

Target crash types at stop-controlled intersections

- **Right angle crashes** – stop-related crashes fall into two types:
  - Driver does not stop at stop sign (disregard TCD)
  - Driver stops but makes poor choice of gaps (failed to yield).

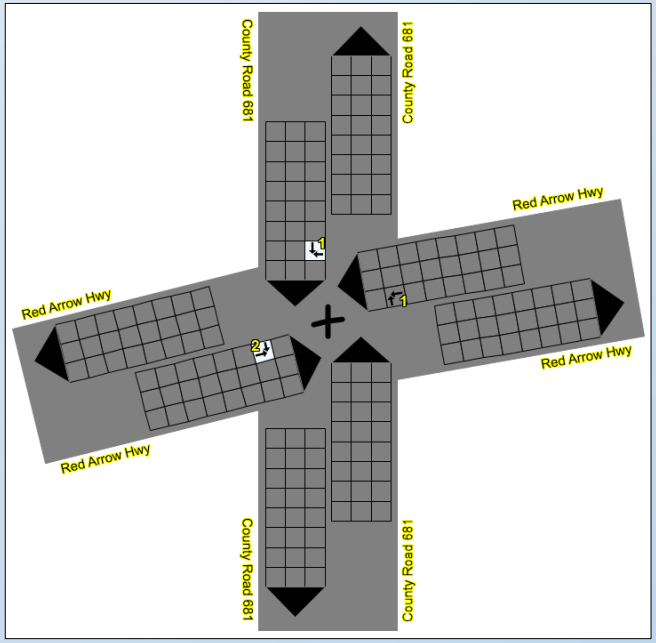
- Distinguishing between these crash conditions may require review of UD-10 crash reports

Locate Stop-controlled Intersections with Safety Issues

Software - **network screening** w/Roadsoft

- Review Roadsoft maps
- Run intersection ranking report
- Select a manageable number of locations
- Review Roadsoft collision diagram
- Make brief field visit

Systemic approach



Summary: Find Stop-controlled Project Locations

- Review local knowledge of system
- Review Roadsoft maps
- Run Roadsoft intersection ranking report
- Select a manageable number of locations
- Review Roadsoft collision diagram
- Make brief field visits

Roadway Departure Crashes

- Strategies
  - Keep vehicles on roadway
  - Provide safe recovery
  - Reduce crash severity

Lane departure crashes defined in Michigan data

- Four treatments addressing lane departure crashes:
  - Horizontal curve signing
  - Centerline rumble strips
  - Shoulder rumble strips/stripes
  - Edgeline pavement markings

Shoulder Rumble Strips

13 - 51%

Reduction

Crash types/factors addressed:

- Single vehicle, run-off-road fatal and injury crashes

Centerline Rumble Strips

44 - 64%

Reduction

Crash types/factors addressed:

- Head-on, sideswipe opposite-direction, and fatal and injury crashes

Rumble Stripes

Rumble stripes daytime (left) and at night in the rain (right). Note the brightness of the rumble stripe at night, as compared to the normal pavement marking to the left of the rumble line. The double edge line is shown only for the purpose of comparing the two types. Michigan DOT (by permission)

Edgeline Markings

- Finding locations
- Crash types/factors addressed
  - Night wet crashes
  - All crash types & severities

Local agency safety funding is only available for striping edgline pavement markings on roadways where these markings do not currently exist. Safety funding is not available for re-striping of pavement markings.

Curve Treatments

- Horizontal curve signing
- Centerline rumble strips
- Shoulder rumble strips/stripes
- Centerline and shoulder rumble strips/stripes
- Edgeline pavement markings

Enhanced Curve Delineation

- Find locations
- Crash types addressed

SAFETY BENEFITS

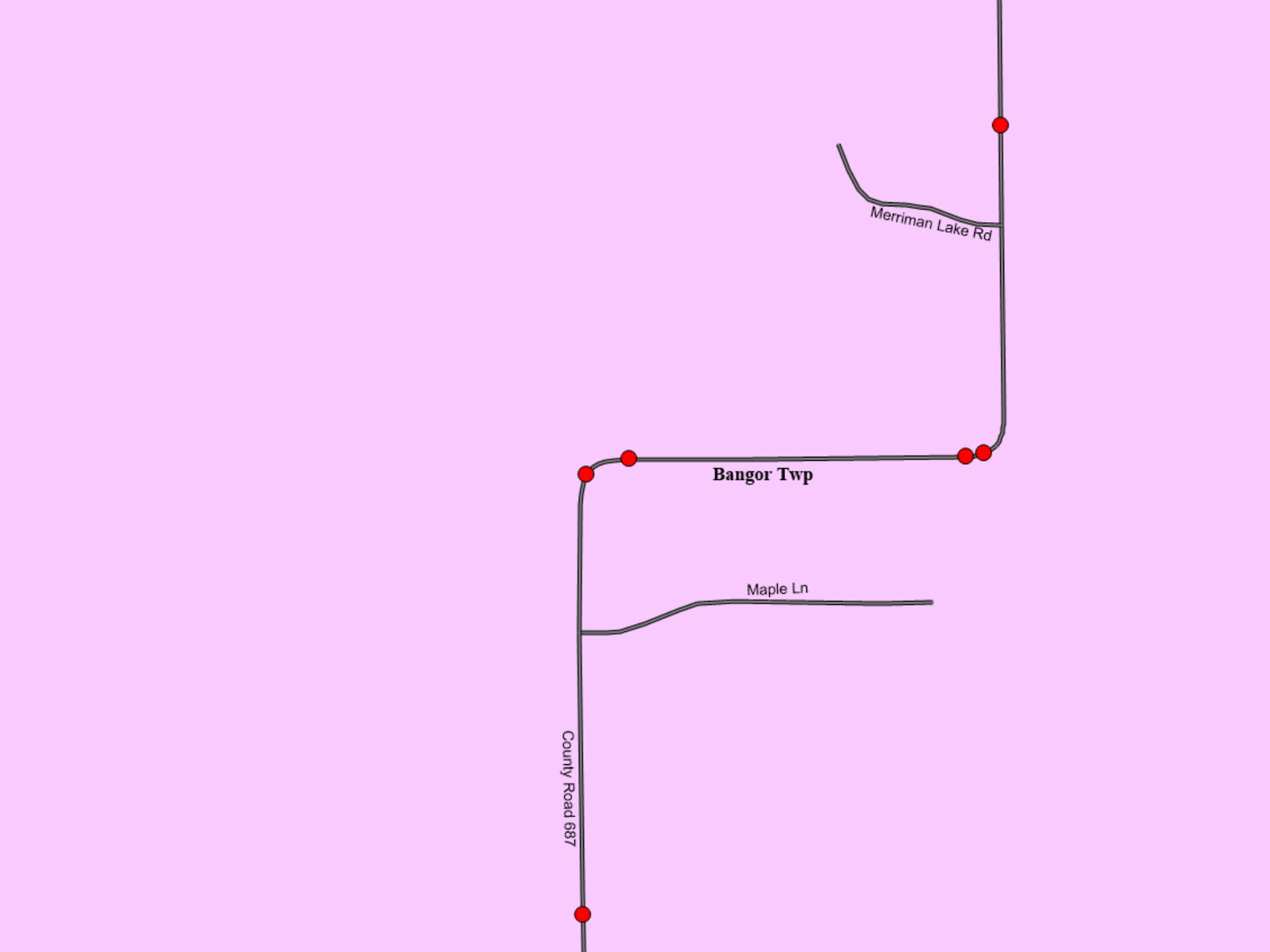
Chevron signs:

- 25% reduction in nighttime crashes
- 16% reduction in non-intersection fatal and injury crashes

Crash Types Associated with Curves

- Single vehicle
  - Fixed object
  - Overturn
- Multi-vehicle
  - Head-on
  - Sideswipe opposite

Night crashes


Merriman Lake Rd
Bangor Twp
Maple Ln
County Road 687

Crash Segment Ranking

Filter | Columns

Run Ranking

Limit List

Limit List to Top	100
Percent/Segments	(•) Percent ( ) Segments

Crash Dates

Start Date	1/1/2013
End Date	12/31/2017

Minimum Segment Length

Minimum Length (mi.)	0

Typical Crash Costs

TCFA (Fatal)	$2,600,000
TCIA (Injury)	$180,000

Advanced Filter:

Open Filter Builder

Filter:

Animal Crashes: Excluded
Start Date >= 1/1/2013
End Date <= 12/31/2017
Minimum Length = 0

Advanced Filter:

ROAD: Legal System = County Local or County Primary
Lane Departure = Single Vehicle
Area Code = Curved Road, Not Related to Others
Lighting = Dark, Unlighted or Dawn or Dusk

Trunkline Road

Segment Name	PR Number	PR BMP	PR EMP	From	To
County Road 665	579006	0.000	0.502	40th St	38th Ave
County Road 665	584007	3.013	3.564	40th St	40th St
County Road 665	584306	0.000	0.759	76th Ave	Amtrak
County Road 665	584306	0.759	1.182	Amtrak	72nd Ave
County Road 665	584602	0.000	0.605	47th Ave	Fisk Lake Rd
County Road 668	3140082	0.633	2.279	Valley Rd & County Road 669	City/Twp Line
County Road 669	3800031	0.000	1.275	92nd Ave & 38 1/2 St	88th Ave
County Road 669	3800031	3.895	4.210	79th Ave	City/Twp Line
County Road 669	3800031	4.710	5.364	33rd St	32nd St
County Road 681	587205	0.077	0.411	City/Twp Line	Camp Rd
County Road 681	587205	0.539	2.161	89th Ave	Territorial Rd
County Road 687	579309	14.971	15.369	34th Ave	Maple Ln
County Road 687	579309	15.369	15.465	Maple Ln	Name Change
County Road 687	579309	15.465	15.710	Name Change	Name Change
County Road 687	579309	15.843	16.202	Merriman Lake Rd	County Road 378
E Red Arrow Hwy	582007	8.960	9.479	33rd St	County Road 653
E Saint Joseph St	581305	9.544	9.614	City/Twp Line	W Red Arrow Hwy & Co
Fisk Lake Rd	584905	5.921	7.255	44th Ave & 40th St	37 1/2 St
Paulson Rd	584504	0.000	0.235	Wise Rd	31st St
Paw Paw Rd	580908	0.000	0.045	Paw Paw Rd	E Bayshore Dr
Paw Paw Rd	580908	2.065	2.436	38th St	60th Ave
Red Arrow Hwy	581305	7.044	7.539	56th St	55th St
Red Arrow Hwy	581305	7.539	7.860	55th St	Butcher Rd
Shaw Rd	602709	8.736	9.731	Lewis Dr	31st St
Shaw Rd	602709	11.506	12.270	27 1/2 St	County Road 652
Silver Lake Rd	586502	1.228	1.687	Lovers Ln & Oak St	51 1/2 St
Sister Lakes Rd	3140076	0.942	1.080	Marion Dr	Victory Shore Dr
Stapleton Rd	583009	0.000	1.197	School St & 44th St	46th St
Territorial Rd	3801075	0.000	0.191	County Road 215	County Road 352
W Red Arrow Hwy	582007	0.000	0.550	County Road 374 & E Saint Joseph St	50th St
W Red Arrow Hwy	582007	3.028	3.160	Lanphear Rd	N Shore Dr
W Red Arrow Hwy	582007	3.203	3.553	45th St	County Road 671

Print Report | Export as File | Trend Analysis | View Crashes | Close

115 Segments Ranked

Systemic - Roadway Departures

Some curve risk factors

- Curve radius
- Speed differential (from tangent approach)
- Visual trap
- Intersection in a curve
- Traffic volume

Summary:
Finding Curve Treatment Sites

- Use your local knowledge of the network
- Review Roadsoft map for curve-related crashes
- Roadsoft – filter lane departure crashes
  - Segment Ranking Report
  - Curve Ranking Report
- Improve curve delineation
  - Signing
  - Rumble strips
  - Edgeline pavement markings

Lane Departure on Tangent Section

Crash types: lane departure crashes (‘run off road’ on right side)

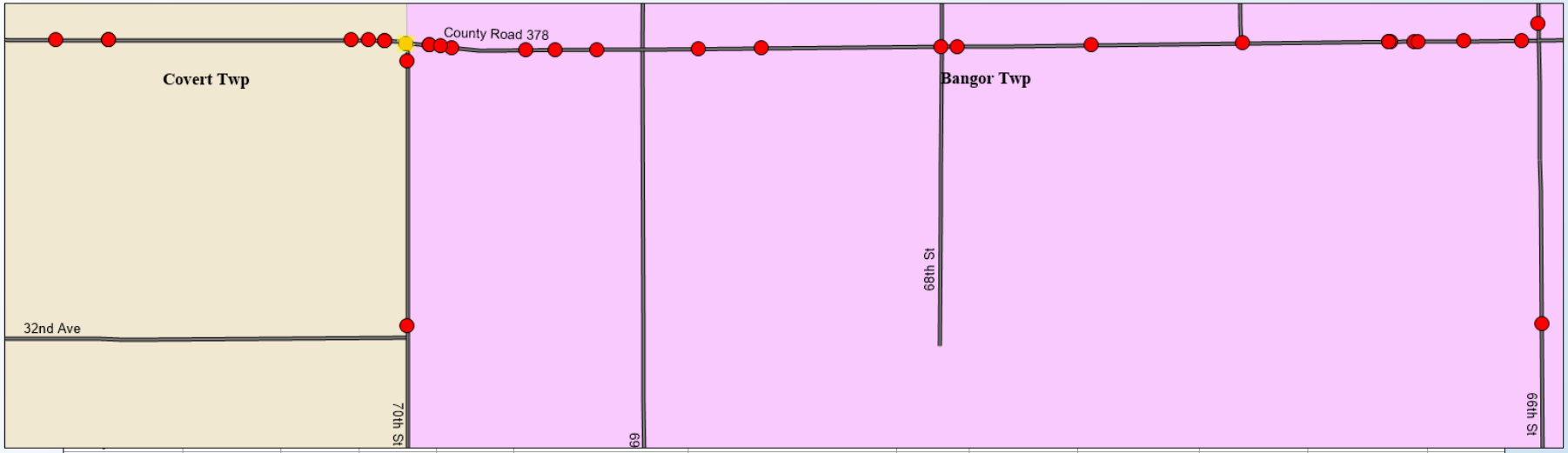
- Single vehicle

‘Run off road’ on left crossing centerline:

- Head on and sideswipe opposite

Corridor vs. spot treatment

Roadsoft Corridor Crash Map



County Road 376	577907	5.425	6.049	0.000	71st St	Van Buren State Park Trl & 70th St	0.624	1	0	0	0	1
County Road 376	582205	0.000	0.497	0.000	66th St	65th St	0.497	2	0	0	0	0
County Road 376	582205	0.497	0.996	0.000	65th St	County Road 687	0.499	2	0	0	0	1
County Road 376	582205	1.647	1.997	0.000	Wood St	62nd St	0.350	1	0	0	0	0
County Road 376	585008	0.245	0.492	0.000	60 1/2 St	60th St	0.247	1	0	0	0	1
County Road 376	585008	0.492	1.483	0.000	60th St	County Road 681	0.991	1	0	0	0	1
County Road 376	585207	0.000	0.511	0.000	68th St	Fire Lane 6	0.511	1	0	0	0	1
County Road 376	585207	0.511	1.006	0.000	Fire Lane 6	66th St	0.495	1	0	0	0	0
County Road 378	578004	1.487	2.235	0.000	77 1/2 St	76th St	0.748	2	0	0	0	2
County Road 378	578004	2.235	2.986	0.000	76th St	Orchard Dr	0.751	3	0	0	0	1
County Road 378	578005	2.106	3.112	0.000	M 140 & 30th Ave	72nd St	1.006	5	1	1	0	4
County Road 378	578005	3.112	4.100	0.000	72nd St	70th St	0.988	11	1	0	1	7
County Road 378	578005	4.100	4.494	0.000	70th St	69th St	0.394	7	0	0	0	5
County Road 378	578005	4.494	4.994	0.000	69th St	68th St	0.500	3	0	0	0	3
County Road 378	578005	4.994	5.494	0.000	68th St	67th St	0.500	2	0	0	0	2
County Road 378	578005	5.494	5.991	0.000	67th St	66th St	0.497	8	1	1	0	6
County Road 378	578005	5.991	7.231	0.000	66th St	County Road 687	1.240	11	0	0	0	7
County Road 378	578005	7.231	7.483	0.000	County Road 687	63rd St	0.252	1	0	0	0	1
County Road 378	578005	7.483	7.984	0.000	63rd St	62nd St & County Road 687	0.501	5	0	0	0	3
County Road 378	578005	7.984	8.608	0.000	62nd St & County Road 687	61st St	0.624	2	0	0	0	2
County Road 378	578005	8.608	8.979	0.000	61st St	60th St	0.371	2	0	0	0	1

Case Study 1 – Douglas County Georgia

- Developed a county curve action plan
- Lack of comprehensive data so relied on staff, enforcement, public
- Treatments: upgrade all curve signing, RPMs
- Added “Curve Ahead” markings with arrows – it worked!

Reduce speeds in horizontal curves				
FHWA-SA-11-09	Curve arrow and "50 mph" text	"Curve 55 mph" text	Transverse lines	"Curve Ahead" text

Case Study 2 – Minnesota

Purpose: identify where crash types most frequently occur

- Crash analysis of county road system in Minnesota
- More crashes on county system, majority rural road departure greater than 50% on curves
- Rural intersections – crashes primarily at through-stop-controlled intersections – right-angle crashes
- Urban – signalized intersections – most common: right angle

Case Study 3 – Minnesota DOT

- A star (*) indicates corresponding risk factor is present
- More stars identify locations as higher priority candidates for safety investment

Rank	Corridor	ADT Range	Road Departure Density	Access Density	Curve Critical Radius Density	Edge Risk	Totals
1	144.01	★	★	★	★	★	★★★★★
2	40.04	★	★	★	★	★	★★★★★
3	131.01		★	★	★	★	★★★★
4	9.02	★	★	★	★		★★★★
5	5.06	★	★	★	★		★★★★
6	31.02	★	★	★	★		★★★★
7	8.01	★	★			★	★★★
8	4.01		★	★		★	★★★
9	2.05			★	★	★	★★★
10	4.04			★	★	★	★★★
11	38.01			★	★	★	★★★
12	132.01			★	★	★	★★★
13	42.01			★	★	★	★★★
14	9.03		★	★	★		★★★
15	25.01		★	★	★		★★★

Summary

- You can get funding for **4 types** of simple safety projects with minimal time and effort
- Use your knowledge of your system to make good project choices
- Roadsoft can provide visual information as well as ranking reports to help identify locations
- Locations can be selected based on “risk’ in a “pro-active” fashion