MEMORANDUM

750 Shipyard Drive
Suite 350
Wilmington, DE 19801
Phone 302.468.4880
www.rkk.com

Date: June 9, 2026

To: Peter Haag, P.E., PTOE
DelDOT, Chief of Traffic Engineering

From: Nicole Lehnert, P.E., PTOE – RK&K
Stephanie Everett, PhD, P.E., PTOE – RK&K

CC: Sonya LaGrand, P.E. – DelDOT
Wendy Carpenter, P.E., PTOE – DelDOT
Jim Burnett, P.E., PTOE – RK&K

Re: Crash Trends at New All-Way Stop Control (AWSC) Locations – 2025 Crash Data Update

---

DelDOT and RK&K have been monitoring, evaluating, and documenting the impacts of converting intersections from Two-Way Stop Control (TWSC) to All-Way Stop Control (AWSC) since 2021. Each year, a report is published outlining before and after crash trends for recently converted intersections. The most recent update (based on 2024 data) included a total of 62 intersections converted to AWSC between 2017 and 2023. This 2026 memorandum serves as the next annual update to the 2021 – 2025 studies, including 14 additional intersections converted to AWSC in 2024, bringing the total up to 76 sites. The analyses summarized in this memorandum also includes additional 2025 "after" crash data, where applicable.

This memorandum summarizes crash analyses performed at 76 intersections that were recently converted to All-Way Stop Control (AWSC) in Delaware. Based on the latest before and after comparisons and the updated estimated crash modification factors (CMFs) documented in this memorandum, intersections with similar characteristics to the study intersections can be expected to experience crash reductions following AWSC conversion, including reductions in fatal and injury crashes. These findings are consistent with the goals in Delaware's Strategic Highway Safety Plan and FHWA's Safe System approach.

AWSC LOCATIONS

This memorandum summarizes crash analyses performed at 76 intersections that were converted to AWSC between 2017 and 2024. Intersections that were converted to AWSC in 2025 are not included; they will be included in future updates to this memo once there is at least one full year of "after" crash data available. Crash data for the three-year period prior to conversion were used to evaluate "before" crash trends. Because several of the 76 intersections have less than three years of "after" data, crash data were converted to annual frequencies for the before-and-after crash comparison. The 76 intersections evaluated in 2026 are summarized in **Table 1** and additional intersection characteristics are further detailed in **Appendix A**.

Table 1. Intersections Converted to AWSC in Delaware (2017-2024)

#	Major Road	Minor Road	Install Year	# of Legs	Major Road Information			Met AWSC Crash Criteria		
					Speed Limit	Functional Classification	Install Year AADT	2011 DE MUTCD	FHWA IA-19	MUTCD 11th Edition
1	K322 (Delaware Ave)	K9 (Woodland Beach Rd) / Beach Ave	2019	4	25	Minor Collector	572	No	No	No
2	K241 (Peach Basket Rd)	K240 (Turkey Point Rd)	2017	4	50	Local	2,873	No	Yes	Yes
3	K371 (Barratts Chapel Rd)	K381 (Fox Chase Rd)	2018	4	35	Major Collector	1,684	Yes	Yes	Yes
4	N53 (Thompson Station Rd)	N301 (Pleasant Hill Rd) / N302 (Hopkins Rd)	2019	4	35	Local	4,260	Yes	Yes	Yes
5	S326 (Bethesda Rd)	S86 (Avenue of Honor)	2019	4	50	Local	1,353	No	Yes	Yes
6	S326 (Bethesda Rd)	S432 (Governor Stockley Rd)	2017	4	50	Local	852	No	No	No
7	S38 (Clendaniel Pond Rd)	S224 (Fleatown Rd)	2019	4	50	Local	1,189	Yes	Yes	Yes
8	S46 (Old Furnace Rd)	S535 (Middleford Rd)	2018	4	35	Major Collector	6,031	No	No	No
9	S47 (Johnson Rd)	S290 (Hurdle Ditch Rd)	2018	4	45	Local	1,335	Yes	Yes	Yes
10	S62 (East Trap Pond Rd)	S329 (W. Piney Grove Rd / Whaleys Corner Rd)	2017	4	50	Local	1,726	Yes	Yes	Yes
11	S750 (Shockley Town Rd)	S920 (Gum Rd)	2019	4	50	Local	849	No	Yes	Yes
12	SR 30 (Gravel Hill Rd)	S47 (Springfield Rd / Johnson Rd)	2017	4	50	Major Collector	3,632	No	Yes	Yes
13	SR 30 (Whitesville Rd)	S66 (Pepperbox Rd)	2017	4	50	Major Collector	1,098	No	Yes	No
14	SR 30 (Whitesville Rd)	S68 (Old Stage Rd)	2018	4	50	Major Collector	1,819	No	No	No
15	SR 5 (Harbeson Rd)	S292 (Forest Rd) / Anderson Corner Rd	2017	4	50	Major Collector	4,372	Yes	Yes	Yes
16	K103 (Hourglass Rd)	K182 (Slaughter Station Rd)	2020	4	50	Local	934	Yes	Yes	Yes
17	N216 (Rockwood Rd)	N217 (Miller Rd)	2020	3	35	Minor Collector	3,225	No	No	No
18	N243 (Old Kennett Rd)	N246 (Center Mill Rd)	2020	4	40	Major Collector	2,623	Yes	Yes	Yes
19	S270A (Munchy Branch Rd)	Field Lane / Shady Ridge Dr	2020	4	35	Local	4,158	No	No	No
20	S48 (Zoar Rd)	S317 (Peterkins Rd)	2020	4	45	Major Collector	6,031	Yes	Yes	Yes
21	SR 5 (Indian Mission Rd)	S302 (Harmons Hill Rd / Phillips Branch Rd)	2021	4	50	Major Collector	6,859	No	No	No
22	SR 30 (Cedar Creek Rd)	S38 (Jefferson Rd / Sylvan Acres Rd)	2020	4	50	Major Collector	5,516	Yes	Yes	Yes
23	K388 (Canterbury Rd)	K404 (Church Hill Rd)	2021	4	50	Minor Arterial	7,251	Yes	Yes	Yes
24	SR 30 (Cedar Creek Rd)	S207 (Johnson Rd)	2021	4	40	Major Collector	6,187	Yes	Yes	Yes
25	S410 (Godwin School Rd)	S433 (Country Living Rd)	2021	4	45	Local	575	No	No	No
26	K49 (Hartly Rd / Main St)	K182 (Slaughter Station Rd)	2022	3	25	Minor Arterial	4,303	No	No	No
27	S431 (Shortly Rd)	S329 (Piney Grove Rd)	2022	4	50	Minor Collector	4,439	No	Yes	Yes
28	SR 14 (Milford Harrington Hwy)	K384 (Killens Pond Rd)	2022	4	50	Minor Arterial	7,277	Yes	Yes	Yes
29	S280 (Stockley Rd)	S290 (Cool Spring Rd)	2022	4	50	Local	2,011	Yes	Yes	Yes
30	S88 (Cave Neck Rd)	S258 (Hudson Rd)	2022	4	50	Minor Collector	5,268	Yes	Yes	Yes
31	S52 (Roxana Rd)	S370 (Daisey Rd)	2022	4	50	Major Collector	4,709	Yes	Yes	Yes
32	SR 30 (Gravel Hill Rd)	S319 (Sand Hill Rd)	2020	4	50	Major Collector	3,110	Yes	Yes	Yes
33	S46 (Old Furnace Rd)	S529 (Cokesbury Rd)	2021	3	50	Major Collector	4,937	No	No	No
34	US13A (Seaford Rd)	S485 (Oneals Rd)	2021	4	50	Major Collector	4,057	Yes	Yes	Yes
35	S546 (Conrail Rd)	S544 (Hearns Pond Rd)	2021	4	35	Local	1,014	No	Yes	No
36	SR 54 (Lighthouse Rd)	S387 (Hudson Rd)	2021	4	50	Major Collector	5,502	No	No	No
37	N25 (Caldwell Corner Rd)	N459 (Grears Corner Rd)	2022	4	50	Local	1,077	Yes	Yes	Yes
38	S386 (Polly Branch Rd)	Creekview Cir	2022	3	40	Local	1,050	No	No	No
39	SR 18 (Cannon Rd)	(Wesley Church Rd)	2023	4	50	Major Collector	3,225	Yes	Yes	Yes
40	SR 20 (Hardscrabble Rd)	S446 (Beaver Dam Branch Rd)	2023	4	50	Major Collector	6,458	Yes	Yes	Yes
41	N486 (Duck Creek Rd)	N47 (Vandyke Greenspring Rd)	2023	3	50	Major Collector	3,556	No	No	No
42	S299 (Bay Farm Rd)	S298 (School Ln)	2023	3	35	Local	5,268	No	No	No
43	SR 20 (Hardscrabble Rd)	S62 (E Trap Pond Rd)	2023	4	50	Major Collector	6,458	No	Yes	Yes

Table 1 (cont.). Intersections Converted to AWSC in Delaware (2017-2024)

#	Major Road	Minor Road	Install Year	# of Legs	Major Road Information			Met AWSC Crash Criteria		
					Speed Limit	Functional Classification	Install Year AADT	2011 DE MUTCD	FHWA IA-19	MUTCD 11th Edition
44	SR 20 (Hardscrabble Rd)	S431 (Conaway Rd / Shortly Rd)	2023	4	50	Major Collector	6,380	Yes	Yes	Yes
45	SR 20 (Hardscrabble Rd)	S432 (Gov Stockley Rd / Cross Key Rd)	2023	4	50	Major Collector	6,380	Yes	Yes	Yes
46	S48 (Zoar Rd)	S321 (Wood Branch Rd)	2023	4	40	Local	3,594	Yes	Yes	Yes
47	SR 17 (Roxana Rd)	S365 (Peppers Corner Rd / Powell Farm Rd)	2023	4	50	Major Collector	3,916	Yes	Yes	Yes
48	SR 17 (Roxana Rd)	S392 (Gum Rd)	2023	4	50	Major Collector	5,435	Yes	Yes	Yes
49	US13A (Seaford Rd)	S493 (Bethel Rd)	2023	4	50	Major Collector	3,767	Yes	Yes	Yes
50	S78 (Woodland Ferry Rd)	S493 (Bethel Rd)	2023	4	45	Minor Collector	2,142	Yes	Yes	Yes
51	K401 (Bowman Rd)	K404 (Church Hill Rd)	2023	4	45	Local	1,703	Yes	Yes	Yes
52	SR 10A (Henry Cowgill Rd)	K246 (Berrytown Rd)	2023	4	50	Minor Collector	2,920	No	No	No
53	SR 9 (Denny St)	K14 (2nd St)	2023	4	25	Major Collector	2,644	No	No	No
54	S61 (Lowes Crossing Rd)	S421 (Careys Camp Rd)	2023	4	50	Local	1,074	No	No	No
55	K59 (Whiteleysburg Rd)	K455 (Fox Hunters Rd)	2023	4	50	Minor Collector	1,923	No	Yes	No
56	S224 (Fleatown Rd)	S213 (Old State Rd)	2023	4	50	Minor Collector	2,334	Yes	Yes	Yes
57	S18 (Federalsburg Rd)	S30 (Atlanta Rd)	2023	4	50	Minor Arterial	3,931	Yes	Yes	Yes
58	S432 (Governor Stockley Rd)	S329 (Piney Grove Rd)	2023	4	50	Local	1,964	No	No	No
59	K193 (Old North Rd)	K53 (Caesar Rodney Ave)	2023	4	25	Minor Collector	3,443	No	No	No
60	S461 (Old Stage Rd)	S462 (Trussum Pond Rd)	2023	4	50	Local	1,305	No	No	No
61	S30 (Atlanta Rd)	S543 (Ross Station Rd)	2023	3	50	Major Collector	4,186	Yes	Yes	Yes
62	K096 (Downs Chapel Rd)	K093 (Pearsons Grove Rd)	2023	3	40	Local	729	No	No	No
63	S277 (Robinsonville Rd)	S283 (Cedar Grove Rd)	2024	3	45	Local	3,700	No	Yes	No
64	S285 (Beaver Dam Rd)	S261 (Dairy Farm Rd)	2024	3	45	Major Collector	3,912	Yes	Yes	Yes
65	SR 15 (Canterbury Rd)	K371 (Barratts Chapel Road / Plymouth Road)	2024	4	40	Minor Arterial	5,424	Yes	Yes	Yes
66	S46 (Old Furnace Rd)	S525 (Coverdale Road / King Rd)	2024	4	50	Major Collector	4,654	No	No	No
67	SR 9 (Main St)	K89 (Port Mahon Rd)	2024	3	25	Major Collector	2,387	No	No	No
68	K368 (Millchop Ln)	K369 (Autumn Moon Ln)	2024	4	50	Local	539	No	Yes	Yes
69	S365 (Powell Farm Rd)	S353 (Burbage Rd)	2024	4	40	Major Collector	2,366	No	Yes	Yes
70	SR 5 (Harbeson Rd)	Chestnut St / Shingle Point Rd	2024	4	35	Major Collector	6,417	No	No	No
71	S361 (Muddy Neck Rd / Kent Ave)	S363 (Double Bridges Rd)	2024	3	35	Major Collector	5,148	No	No	No
72	S363 (Double Bridges Rd)	S362 (Parker House Rd)	2024	4	45	Major Collector	3,315	No	No	No
73	N423 (Bayview Rd)	N37 (Vance Neck Rd)	2024	4	40	Local	1,091	No	Yes	Yes
74	K90 (Sunnyside Rd)	K147 (Hillyard Rd)	2024	4	50	Major Collector	3,210	No	Yes	Yes
75	S22 (Federal St)	S197 (Mulberry St) / S88 (Wharton St)	2024	4	25	Major Collector	6,029	No	No	No
76	S88 (Atlantic St / Wharton St)	Chestnut St	2024	4	25	Minor Collector	3,321	No	No	No

CRASH DATA TRENDS

Three (3) years of "before" crash data and between one (1) and three (3) years of "after" crash data were obtained for the 76 intersections that have recently been converted to AWSC, depending on installation year. Crash data summaries were used to calculate annual average total crashes, rear-end crashes, angle crashes, single vehicles crashes, fatal crashes, injury crashes, and property damage only (PDO) crashes during the "before" and "after" periods at each intersection. The crash data reports can be found in **Appendix B**.

Table 2 summarizes the annual crash frequencies for all 76 study intersections and **Table 3** summarizes the same data for each individual intersection.

Table 2. Annual Crashes at Intersections Converted to AWSC

Total Annual Crashes from All Study Intersections	Crash Type					Severity		
	Total	**Angle**	**Rear End**	**Single Vehicle**	**All Others**	**PDO**	**Injury**	**Fatal**
Before	340.00	195.33	37.67	67.67	39.33	214.00	122.33	3.67
After	164.17	57.83	37.83	46.00	22.50	136.00	27.83	0.33
% Change	-52%	-70%	0%	-32%	-43%	-36%	-77%	-91%

Table 3. Annual Crash Changes by Intersection Following Conversion to AWSC

#	Intersection	% Change after Conversion to AWSC							
		Crash Type					Severity		
		Total	Angle	Rear End	Single Vehicle	All Others	PDO	Injury	Fatal
1	Delaware Ave at Woodland Beach Rd / Beach Ave	-100%	--	-100%	-100%	--	-100%	-100%	--
2	Peach Basket Rd at Turkey Point Rd	-93%	-100%	-100%	--*	-100%	-89%	-100%	--
3	Barratts Chapel Rd at Fox Chase Rd	-89%	-92%	--	-100%	0%	-75%	-100%	-100%
4	Pleasant Hill Rd / Hopkins Rd at Thompson Station Rd	-72%	-80%	-100%	-38%	-88%	-53%	-93%	--
5	Bethesda Rd at Avenue of Honor	-80%	-100%	--*	-67%	--	-50%	-100%	-100%
6	Bethesda Rd at Governor Stockley Rd	-50%	-50%	-100%	--*	-100%	-50%	-50%	--
7	Clendaniel Pond Rd at Fleatown Rd	-100%	-100%	-100%	-100%	--	-100%	-100%	--
8	Old Furnace Rd at Middleford Rd	-21%	25%	-8%	-50%	-20%	-32%	13%	--
9	Johnson Rd at Hurdle Ditch Rd	-100%	-100%	-100%	--	-100%	-100%	-100%	--
10	East Trap Pond Rd at W. Piney Grove Rd / Whaleys Corner Rd	-63%	-77%	-100%	300%	-100%	-30%	-100%	--
11	Shockley Town Rd at Gum Rd	-73%	-100%	-50%	-50%	--*	-63%	-100%	--
12	Gravel Hill Rd at Springfield Rd / Johnson Rd	-9%	-56%	--*	100%	-100%	50%	-80%	--
13	Whitesville Rd at Pepperbox Rd	-86%	-100%	-100%	--	0%	-67%	-100%	--
14	Whitesville Rd at Old Stage Rd	-60%	-100%	--	0%	--	-50%	0%	-100%
15	Harbeson Rd at Forest Rd / Anderson Corner Rd	-83%	-88%	-100%	0%	-100%	-77%	-89%	-100%
16	Hourglass Rd at Slaughter Station Rd	-87%	-100%	--	-33%	-100%	-71%	-100%	--
17	Rockwood Rd at Miller Rd	-67%	--*	--	-100%	--	-50%	-100%	--
18	Old Kennett Rd at Center Mill Rd	-87%	-89%	--	--*	-100%	-71%	-100%	--
19	Munchy Branch Rd at Field Ln / Shady Ridge Dr	50%	-100%	--	--*	--	100%	0%	--
20	Zoar Rd at Peterkins Rd	-57%	-92%	-14%	-50%	0%	-31%	-90%	--
21	Indian Mission Rd at Harmons Hill Rd / Phillips Branch Rd	100%	160%	33%	--*	50%	140%	-33%	--
22	Cedar Creek Rd at Jefferson Rd / Sylvan Acres Rd	-55%	-50%	-100%	0%	-100%	-56%	-50%	--
23	Canterbury Rd at Church Hill Rd	-27%	-45%	0%	0%	-20%	25%	-90%	--
24	Cedar Creek Rd at Johnson Rd	-13%	-13%	-33%	100%	-33%	25%	-55%	--
25	Godwin School Rd at Country Living Rd	-75%	-100%	--	0%	--	-50%	-100%	--
26	Hartly Rd / Main St at Slaughter Station Rd	-60%	--	-100%	-50%	-50%	0%	-100%	--
27	Shortly Rd at Piney Grove Rd	-40%	-50%	--	-33%	0%	0%	-100%	--
28	Milford Harrington Hwy at Killens Pond Rd	0%	15%	400%	-67%	-50%	-6%	13%	--
29	Stockley Rd at Cool Spring Rd	-50%	-50%	--	0%	-100%	150%	-100%	-100%
30	Cave Neck Rd at Hudson Rd	-73%	-89%	20%	-100%	0%	-66%	-88%	--
31	Roxana Rd at Daisey Rd	-27%	-58%	--*	0%	100%	43%	-88%	--
32	Gravel Hill Rd at Sand Hill Rd	-43%	-75%	100%	-50%	33%	-24%	-73%	--
33	Old Furnace Rd at Cokesbury Rd	-53%	-75%	--*	-67%	0%	-46%	-75%	--
34	Seaford Rd at Oneals Rd	-45%	-80%	--*	-40%	-100%	10%	-92%	--
35	Conrail Rd at Hearns Pond Rd	-50%	-75%	0%	0%	-100%	-57%	-100%	--*
36	Lighthouse Rd at Hudson Rd	-40%	-40%	200%	-100%	--	-57%	50%	-100%
37	Caldwell Corner Rd at Grears Corner Rd	-85%	-89%	--	-100%	-50%	-100%	-50%	--
38	Polly Branch Rd at Creekview Cir	--	--	--	--	--	--	--	--
39	Cannon Rd at Wesley Church Rd	-42%	-100%	200%	200%	-25%	20%	-79%	-100%
40	Hardscrabble Rd at Beaver Dam Branch Rd	-19%	-50%	--*	--*	50%	125%	-83%	--
41	Duck Creek Rd at Vandyke Greenspring Rd	150%	--	50%	--*	50%	150%	--	--
42	Bay Farm Rd at School Ln	-75%	--	--	-75%	--	-75%	--	--
43	Hardscrabble Rd at E Trap Pond Rd	-46%	-83%	--*	-10%	--	7%	-100%	-100%
44	Hardscrabble Rd at Conaway Rd / Shortly Rd	-57%	-70%	200%	-40%	-100%	-47%	-73%	--
45	Hardscrabble Rd at Gov Stockley Rd / Cross Key Rd	-75%	-91%	-50%	200%	-100%	-63%	-88%	--
46	Zoar Rd at Wood Branch Rd	-82%	-88%	-25%	-50%	-100%	-84%	-75%	--

Table 3 (cont.) Annual Crash Changes by Intersection Following Conversion to AWSC

#	Intersection	% Change after Conversion to AWSC							
			Crash Type				Severity		
		Total	Angle	Rear End	Single Vehicle	All Others	PDO	Injury	Fatal
47	Roxana Rd at Peppers Corner Rd / Powell Farm Rd	-67%	-86%	-100%	50%	-100%	-40%	-100%	--
48	Roxana Rd at Gum Rd	-78%	-65%	-100%	-100%	--	-83%	-25%	--
49	Seaford Rd at Bethel Rd	-43%	-65%	-50%	50%	-25%	0%	-75%	--
50	Woodland Ferry Rd at Bethel Rd	-100%	-100%	-100%	--	-100%	-100%	-100%	--
51	Bowman Rd at Church Hill Rd	-63%	-70%	-100%	-100%	--*	-70%	50%	--
52	Henry Cowgill Rd at Berrytown Rd	-25%	-25%	-100%	-25%	--*	0%	-100%	--
53	Denny St at 2nd St	--*	--*	--	--*	--*	--*	--*	--
54	Lowes Crossing Rd at Careys Camp Rd	-75%	-100%	-100%	-67%	--	-57%	-100%	-100%
55	Whiteleysburg Rd at Fox Hunters Rd	-44%	-100%	--*	0%	--	-36%	-100%	--
56	Fleatown Rd at Old State Rd	-53%	-81%	-100%	0%	-100%	-6%	-100%	--
57	Federalsburg Rd at Atlanta Rd	-40%	-40%	-100%	50%	-25%	-14%	-57%	-100%
58	Governor Stockley Rd at Piney Grove Rd	-25%	-63%	-100%	50%	--*	-10%	-100%	--
59	Old North Rd at Caesar Rodney Ave	7%	-25%	50%	--*	-25%	-25%	200%	--
60	Old Stage Rd at Trussum Pond Rd	-36%	-50%	--	50%	-50%	13%	-100%	--
61	Atlanta Rd at Ross Station Rd	-44%	-100%	--	50%	--	-36%	-100%	--
62	Downs Chapel Rd at Pearsons Grove Rd	-100%	--	--	-100%	--	-100%	--	--
63	Robinsonville Rd at Cedar Grove Rd	-50%	-100%	-100%	200%	--	-40%	-100%	--
64	Beaver Dam Rd at Dairy Farm Rd	-60%	-63%	-50%	-63%	-100%	-67%	0%	--
65	Canterbury Rd at Barratts Chapel Road / Plymouth Road	-70%	-79%	-100%	-100%	50%	-60%	-100%	--
66	Old Furnace Rd at Coverdale Road / King Rd	110%	-40%	800%	50%	200%	150%	50%	--
67	Main St at Port Mahon Rd	500%	--	--*	200%	--	--*	-100%	--
68	Millchop Ln at K369 Autumn Moon Ln	-100%	-100%	--	-100%	-100%	-100%	-100%	--
69	Powell Farm Rd) at Burbage Rd	-100%	-100%	--	-100%	-100%	-100%	-100%	--
70	Harbeson Rd at Chestnut St / Shingle Point Rd	-77%	-100%	50%	-100%	-100%	-70%	-100%	--
71	Muddy Neck Rd / Kent Ave at Double Bridges Rd	-100%	--	-100%	-100%	-100%	-100%	--	--
72	Double Bridges Rd at Parker House Rd	-100%	-100%	-100%	--	-100%	-100%	-100%	--
73	Bayview Rd) at Vance Neck Rd	-54%	-57%	-100%	-100%	50%	-50%	-100%	--
74	Sunnyside Rd at Hillyard Rd	25%	13%	-100%	500%	-100%	140%	-57%	--
75	Federal St at Mulberry St / S88 Wharton St	800%	-100%	--*	--	--*	--*	-100%	--
76	Atlantic St / Wharton St at Chestnut St	-100%	-100%	-100%	-100%	--	-100%	--	--

--*: No reported crashes before AWSC implementation, and some number of crashes after implementation
-- : No reported crashes before and after AWSC implementation
xx% Reported crashes increased after AWSC implementation

The data from these 76 intersections show that, on average, all severities of crashes (PDO, injury, and fatal) decreased after conversion to AWSC. Similarly, all types of crashes decreased after conversion to AWSC, except for rear-end crashes. While other studies have shown an increase in rear-end crashes, Delaware's latest data indicates no changes to rear end crashes following conversion to AWSC[1].

There were eleven (11) fatal crashes across all 76 study intersections in the "before" period, and there was only one (1) fatal crash in the "after" period. This crash, at the intersection of Conrail Road and Hearns Pond Road, involved a single vehicle traveling at high speeds with impairment as a contributing factor.

While the data indicates that the number of crashes by crash types and severities decreased *on average* with the conversion to AWSC (with the exception of rear-end crashes which remained unchanged), there were multiple individual intersections that saw increases in specific types and/or severities of crashes. **Table 3** summarizes the changes in crash type and severity for all 76 intersections.

Nine (9) intersections experienced an increase in total crashes after AWSC implementation. **Table 4** outlines the annual average crashes for these nine intersections.

Table 4. Annual Crashes for Intersections with an Increase in Total Crashes After Conversion to AWSC

#	Intersection	Annual Crashes									
		Total Crashes		Rear End Crashes		Angle Crashes		PDO		Injury/Fatal	
		Before	After	Before	After	Before	After	Before	After	Before	After
19	Munchy Branch Rd at Field Ln / Shady Ridge Dr	0.67	1.00	--	--	0.67	--	0.33	0.67	0.33	0.33
21	Indian Mission Rd at Harmons Hill Rd / Phillips Branch Rd	4.33	8.67	2.00	2.67	1.67	4.33	3.33	8.00	1.00	0.67
41	Duck Creek Rd at Vandyke Greenspring Rd	1.00	2.50	0.67	1.00	--	--	1.00	2.50	--	--
53	Denny St at 2nd St	--	1.50	--	--	--	0.50	--	1.00	--	0.50
59	Old North Rd at Caesar Rodney Ave	2.33	2.50	0.33	0.50	0.67	0.50	2.00	1.50	0.33	1.00
66	Old Furnace Rd at Coverdale Road / King Rd	3.33	7.00	0.33	3.00	1.67	1.00	2.00	5.00	1.33	2.00
67	Main St at Port Mahon Rd	0.33	2.00	--	1.00	--	--	--	2.00	0.33	-
74	Sunnyside Rd at Hillyard Rd	4.00	5.00	0.33	--	2.67	3.00	1.67	4.00	2.33	1.00
75	Federal St at Mulberry St / S88 Wharton St	0.33	3.00	--	2.00	0.33	--	--	3.00	0.33	--

X.XX: Increase in annual crashes after AWSC implementation

- The intersection of *Munchy Branch Road at Field Lane / Shady Ridge Drive* is located on a curve, which may influence the increase in single vehicle crashes at the intersection. A project to install a shared use path along Munchy Branch Road was completed in June 2025.
- The intersection of *Indian Mission Road at Harmons Hill Road / Phillips Branch Road* saw increases in total crashes, rear end crashes, and angle crashes after conversion to AWSC. These increases could be due to the higher traffic volumes on the major roadway. A Long-term improvement project at this intersection is included in the Capital Transportation Program (CTP).
- The intersection of *Duck Creek Road at Vandyke Greenspring Road* saw an increase in total crashes, which included an increase in head on, single vehicle and "other" crashes. This was similar to the trends at the intersection when there was only one year of "after" data available.
- The intersection of *Denny Street at 2nd Street* included an increase in angle, head on, and single vehicle crashes, which was also similar to the trends at the intersection when there was only one year of "after" data available.
- The intersection of *Old North Road at Caesar Rodney Avenue* now includes an increase in head on and single vehicle crashes.
- The intersections of *Old Furnace Road at Coverdale Road / King Road*, *Main Street at Port Mahon Road*, *Sunnyside Road at Hillyard Road*, and *Federal Street at Mulberry Street* all saw an increase in total crashes, however, they all only have one year of after data available.

It is recommended that DelDOT monitor the seven (7) intersections described above that do not have long-term improvement projects planned to determine if crash trends change with additional time.

Similar to previous annual memoranda, the following sections summarize crash trends at new AWSC intersections by roadway functional classification, crash history prior to implementation, speed limit on the major road, and volume on the major road.

Roadway Functional Classification

On average, local roads, collector roads, and arterials all experienced reductions in annual crashes after converting to AWSC (see **Table 5** through **Table 7**). Arterial roads, which accounted for only five (5) study intersections, experienced the smallest reduction of total and angle crashes after conversion to AWSC. Intersections on collector roads experienced an increase in rear-end crashes. The increase in annual rear-end crashes along collector roads generally reflects an increase in PDO crashes and a decrease in injury crashes. The exceptions were at the intersections of Old North Road at Caesar Rodney Avenue and Old Furnace Road at Coverdale Road / King Road. These two intersections only have one year of "after" data, and it is recommended that DelDOT continue to review the crash trends at both of these intersections when additional data becomes available.

There were eleven fatal crashes amongst all 76 study intersections in the "before" data and one (1) fatal crash in the "after" data, which occurred on a local roadway. This equates to a 100% decrease in fatal crashes for both collector and arterial roadways and a 67% reduction on local roadways.

With the exception of fatal crashes and single vehicle crashes, local roads had the largest reduction in annual crashes for all other categories. Additional years of "after" data will continue to inform and strengthen these trends by making the sample size of the crash data even larger.

Table 5. Annual Crash Changes at Newly Converted AWSC Intersections – Local Roads

Crash Type	Annual Crashes by Type			Annual Crashes by Severity		
	Total	Angle	Rear End	PDO	Injury	Fatal
Before	94.67	57.67	6.67	63.00	30.67	1.00
After	25.50	8.67	1.50	22.50	2.67	0.33
% Change	-73%	-85%	-78%	-64%	-91%	-67%

Table 6. Annual Crash Changes at Newly Converted AWSC Intersections – Collector Roads

Crash Type	Annual Crashes by Type			Annual Crashes by Severity		
	Total	Angle	Rear End	PDO	Injury	Fatal
Before	216.67	121.67	28.33	133.67	80.67	2.33
After	119.67	39.17	33.67	98.83	20.83	0.00
% Change	-45%	-68%	19%	-26%	-74%	-100%

Table 7. Annual Crash Changes at Newly Converted AWSC Intersections – Arterial Roads

Crash Type	Annual Crashes by Type			Annual Crashes by Severity		
	Total	Angle	Rear End	PDO	Injury	Fatal
Before	28.67	16.00	2.67	17.33	11.00	0.33
After	19.00	10.00	2.67	14.67	4.33	0.00
% Change	-34%	-38%	0%	-15%	-61%	-100%

MUTCD AWSC Crash Warrants

The 2011 Delaware Manual of Uniform Traffic Control Devices (DE-MUTCD) includes guidance for implementing multi-way stop control, consistent with the 2009 FHWA MUTCD. One of the criteria is the number of crashes within a 12-month period. If an intersection has 5 or more reported crashes in a 12-month period that are susceptible to correction by a multi-way stop installation, the criteria for multi-way stop control is satisfied. Of the 76 study intersections, 34 intersections met the 2011 DE-MUTCD AWSC crash criteria, while the remaining 42 intersections did not.

Collectively, both the intersections that met the 2011 DE-MUTCD AWSC crash criteria (see **Table 8**) and intersections that did not (see **Table 9**), saw a reduction in crashes for all types and all severities, with one exception: Intersections that did not meet the 2011 DE-MUTCD saw a slight increase in rear-end crashes.

Table 8. Annual Crash Changes at Newly Converted AWSC Intersections – Which Met 2011 DE-MUTCD Crash Criteria

Crash Type	Annual Crashes by Type			Annual Crashes by Severity		
	Total	Angle	Rear End	PDO	Injury	Fatal
Before	228.00	146.67	21.33	136.67	89.67	1.67
After	91.17	38.83	18.00	74.17	17.00	0.00
% Change	-60%	-74%	-16%	-46%	-81%	-100%

Table 9. Annual Crash Changes at Newly Converted AWSC Intersections – Which Did Not Meet 2011 DE-MUTCD Crash Criteria

Crash Type	Annual Crashes by Type			Annual Crashes by Severity		
	Total	Angle	Rear End	PDO	Injury	Fatal
Before	112.00	48.67	16.33	77.33	32.67	2.00
After	73.00	19.00	19.83	61.83	10.83	0.33
% Change	-35%	-61%	21%	-20%	-67%	-83%

In addition to the multi-way stop control guidance in the 2011 DE-MUTCD, DelDOT has previously used reduced crash thresholds to evaluate multi-way stop requests as part of engineering studies. The reduced thresholds were modeled after FHWA's Interim Approval for Optional Use of an Alternative Warrant 7 – Crash Experience for traffic control signal studies. These reduced thresholds are shown in **Appendix C**. Similar to the intersections that met the crash guidance in the 2011 DE-MUTCD, intersections that met the reduced thresholds (see **Table 10**) saw a higher reduction in crashes for all crash types and severities compared to the overall pool of intersections that did not meet the crash warrants (**Table 9**).

Table 10. Annual Crash Changes at Newly Converted AWSC Intersections – Which Met DelDOT's Reduced Thresholds

Crash Type	Annual Crashes by Type			Annual Crashes by Severity		
	Total	Angle	Rear End	PDO	Injury	Fatal
Before	276.67	177.33	25.33	168.33	106.00	2.33
After	112.17	46.00	21.33	93.50	18.33	0.33
% Change	-59%	-74%	-16%	-44%	-83%	-86%

In December 2023, FHWA released the 11th edition of the MUTCD. The 11th edition now includes crash warrants for AWSC that differ slightly from both the guidance in the 2009 version of the MUTCD and the reduced thresholds from FHWA's *Interim Approval for Optional Use of an Alternative Warrant 7 – Crash Experience.* Pending approval, the 2026 version of the DE-MUTCD will include the new AWSC crash warrants in the FHWA 11th edition. Per the 11th edition of the MUTCD, for a four-leg intersection, the AWSC crash warrant is met if there are at least five crashes in a 12-month period or at least six crashes in a 3-year period that are susceptible to correction by AWSC. For a three-leg intersection, the AWSC crash warrant is met if there are at least four crashes in a 12-month period or at least five crashes in a 3-year period that are susceptible to correction by AWSC. Intersections that met the AWSC crash warrants outlined in the 11th edition of the MUTCD (see **Table 11**) have very similar trends as the intersections that met DelDOT's reduced thresholds (see **Table 10**). It should be noted that there were four intersections which met the reduced thresholds in FHWA's Interim Approval but did not meet the AWSC warrants outlined in the 11th edition of the MUTCD (Whitesville Road at Pepperbox Road, Conrail Road at Hearns Pond Road, Whiteleysburg Road at Fox Hunters Road, and Robinsonville Road at Cedar Grove Road).

Table 11. Annual Crash Changes at Newly Converted AWSC Intersections – Which Met MUTCD 11th Edition Crash Warrants

Crash Type	Annual Crashes by Type			Annual Crashes by Severity		
	Total	Angle	Rear End	PDO	Injury	Fatal
Before	267.00	171.33	24.33	161.00	103.67	2.33
After	108.00	45.67	20.50	89.67	18.33	0.00
% Change	-60%	-73%	-16%	-44%	-82%	-100%

Table 8 through **Table 11** indicate that in general, there was a reduction in crashes of all types and severities after the implementation of AWSC regardless of whether or not the intersection met the 2011 DE-MUTCD AWSC crash criteria, the reduced crash thresholds from FHWA's Interim Approval, or the 11th edition of the FHWA MUTCD.

Speed Limit

Changes in the annual number of crashes for roadways with different speed limits were also compared. **Table 12** through **Table 14** show the total number of crashes before and after conversion to AWSC for roadways with speed limits between 25 and 35 mph, speed limits between 40 and 45 mph, and speed limits of 50 mph.

Table 12. Annual Crash Changes at Newly Converted AWSC Intersections – 25 to 35 MPH

Crash Type	Annual Crashes by Type			Annual Crashes by Severity		
	Total	Angle	Rear End	PDO	Injury	Fatal
Before	46.67	15.00	7.33	31.33	15.00	0.33
After	26.17	4.67	8.50	20.67	5.17	0.33
% Change	-44%	-69%	16%	-34%	-66%	0%

Table 13. Annual Crash Changes at Newly Converted AWSC Intersections – 40 to 45 MPH

Crash Type	Annual Crashes by Type			Annual Crashes by Severity		
	Total	Angle	Rear End	PDO	Injury	Fatal
Before	77.00	45.67	11.00	55.67	21.33	0.00
After	24.00	10.33	5.17	20.00	4.00	0.00
% Change	-69%	-77%	-53%	-64%	-81%	--

Table 14. Annual Crash Changes at Newly Converted AWSC Intersections – 50 MPH

Crash Type	Annual Crashes by Type			Annual Crashes by Severity		
	Total	Angle	Rear End	PDO	Injury	Fatal
Before	216.33	134.67	19.33	127.00	86.00	3.33
After	114.00	42.83	24.17	95.33	18.67	0.00
% Change	-47%	-68%	25%	-25%	-78%	-100%

In general, there was a reduction in crashes of all types and severities after the implementation of AWSC regardless of speed limit, with the exception of rear-end crashes, which increased by 16% at intersections on roadways with posted speed limits between 25 and 35 MPH and increased by 25% at intersections on roadways with a posted speed limit of 50 mph. While not explicitly outlined in **Table 12** and **Table 14**, individual intersections that experienced an increase in rear-end crashes generally saw an increase in PDO crashes and a decrease in injury crashes. The exceptions were the intersections of Milford Harrington Highway at Killens Pond Road, Old North Road at Caesar Rodney Avenue, and Old Furnace Road at Coverdale Road / King Road. The first intersection has a planned long-term improvement project included in the CTP, and the other two only have one year of "after" data. Intersections with posted speed limits of 40 or 45 mph had the largest reduction for all crash types and severities.

Average Daily Traffic (ADT)

Annual changes in the number of crashes for roadways with different Average Daily Traffic (ADT) were also compared. Implementation year ADT was obtained from DelDOT's Gateway portal and was used for this analysis. **Table 15** through **Table 17** show the total numbers of crashes before and after conversion to AWSC for roadways with low ADT (0-2,000 veh/day), medium ADT (2,001 – 4,000 veh/day), and higher ADT (>4,000 veh/day).

Table 15. Annual Crash Changes at Newly Converted AWSC Intersections – LOW ADT (0 – 2,000)

Crash Type	Annual Crashes by Type			Annual Crashes by Severity		
	Total	Angle	Rear End	PDO	Injury	Fatal
Before	56.00	34.33	3.67	34.00	20.67	1.33
After	13.83	3.33	1.17	12.83	0.67	0.33
% Change	-75%	-90%	-68%	-62%	-97%	-75%

Table 16. Annual Crash Changes at Newly Converted AWSC Intersections – MEDIUM ADT (2,001 – 4,000)

Crash Type	Annual Crashes by Type			Annual Crashes by Severity		
	Total	Angle	Rear End	PDO	Injury	Fatal
Before	114.00	66.67	14.33	72.67	40.00	1.33
After	52.50	18.33	10.17	43.50	9.00	0.00
% Change	-54%	-73%	-29%	-40%	-78%	-100%

Table 17. Annual Crash Changes at Newly Converted AWSC Intersections – HIGHER ADT (>4,000)

Crash Type	Annual Crashes by Type			Annual Crashes by Severity		
	Total	Angle	Rear End	PDO	Injury	Fatal
Before	170.00	94.33	19.67	107.33	61.67	1.00
After	97.83	36.17	26.50	79.67	18.17	0.00
% Change	-42%	-62%	35%	-26%	-71%	-100%

There were reductions in all crash types after conversion to ASWC, regardless of ADT, with the exception of rear-end crashes, which increased by 35% on roadways with higher ADT (>4,000 vehicles per day). The increase in rear-end crashes on roadways with higher ADT (>4,000 vehicles per day) included increases in injury crashes at the intersections of Milford Harrington Highway at Killens Pond Road, Lighthouse Road at Hudson Road, and Old Furnace Road at Coverdale Road / King Road. Intersections with low ADT (0 – 2,000 veh/day) had the greatest reduction in all crash types and severities, with the exception of fatal crashes.

Intersection Angle

The intersection angle, as it is referenced in this memorandum, is defined as the minimum angle between the major and minor roadways of the intersection. The intersection angle can range between 0 and 90 degrees, with a 90 degree angle representing the minor street being exactly perpendicular to the major street. When the intersection angle is less than 90 degrees, the intersection becomes skewed, with potentially limited sight distance and longer pedestrian crossings. Intersection angles were measured at each intersection and crash trends were compared.

Table 18 and **Table 19** show the total numbers of crashes before and after conversion to AWSC for intersections with large intersection angles of 80 to 90 degrees, medium intersection angles (60 to 79 degrees), and small intersection angles (<60 degrees). The closer the intersection angle is to 90 degrees, generally the better sight distance there is for all approaches.

Table 18. Annual Crash Changes at Newly Converted AWSC Intersections – Intersection Angle 80-90 degrees

Crash Type	Annual Crashes by Type			Annual Crashes by Severity		
	Total	Angle	Rear End	PDO	Injury	Fatal
Before	141.33	81.67	15.00	86.00	54.00	1.33
After	77.67	31.33	17.33	61.17	16.17	0.33
% Change	-45%	-62%	16%	-29%	-70%	-75%

Table 19. Annual Crash Changes at Newly Converted AWSC Intersections – Intersection Angle 60-79 degrees

Crash Type	Annual Crashes by Type			Annual Crashes by Severity		
	Total	Angle	Rear End	PDO	Injury	Fatal
Before	129.33	74.33	17.67	78.33	49.00	2.00
After	61.33	19.17	13.00	52.67	8.67	0.00
% Change	-53%	-74%	-26%	-33%	-82%	-100%

Table 20. Annual Crash Changes at Newly Converted AWSC Intersections – Intersection Angle <60 degrees

Crash Type	Annual Crashes by Type			Annual Crashes by Severity		
	Total	Angle	Rear End	PDO	Injury	Fatal
Before	69.33	39.33	5.00	49.67	19.33	0.33
After	25.17	7.33	7.50	22.17	3.00	0.00
% Change	-64%	-81%	50%	-55%	-84%	-100%

There were reductions in all crash types after conversion to ASWC, regardless of intersection angle, with the exception of rear-end crashes, which increased by 16% at intersections on roadways with intersection angles greater than 80 degrees and increased by 50% at locations with intersection angles less than 60 degrees. Intersections with intersection angles less than 60 degrees had the largest reduction in all crash types and severities, with the exception of rear-end crashes. Intersection angles between 60 degrees and 79 degrees had the largest reduction in rear end crashes.

Safest Feasible Intersection Design (SaFID)

The North Carolina Department of Transportation (NCDOT) recently published a document that aids in selecting optimum intersection configurations[2], which they termed the safest feasible intersection design (SaFID). In the NCDOT document, the following criteria are outlined for two-way stop control (TWSC) and All-Way Stop Control (AWSC):

- "Two-way stop control (TWSC) is feasible at intersections with up to about 14,000 vehicles per day on major streets with one through lane in each direction."
- "All-way stop control (AWSC) is feasible on two-lane roads with total entering demands of less than 15,000 vehicles per day."
- "AWSC is feasible when the minor street demand is greater than 500 vehicles per day."

Figure 1, which was taken from the NCDOT document, outlines what NCDOT indicates is the safest feasible intersection design based on minor street and major street volume combinations. Each of the 76 study intersections were plotted on the NCDOT figure and classified as having an optimum intersection control of TWSC or AWSC based on the major street AADT and minor street AADT, as shown in **Figure 2.** The SaFID methodology assumes the minor street has lower volumes, while the major street has higher volumes. There were a few intersections in Delaware's dataset where the major street (the roadway that was uncontrolled prior to AWSC conversion) had lower volumes than the minor street (the roadway that was stop-controlled prior to AWSC conversion). For the purpose of comparing the study intersections to the SaFID, **Figure 2** plots all intersections with the higher volumes as the major street, and the lower volumes as the minor street.

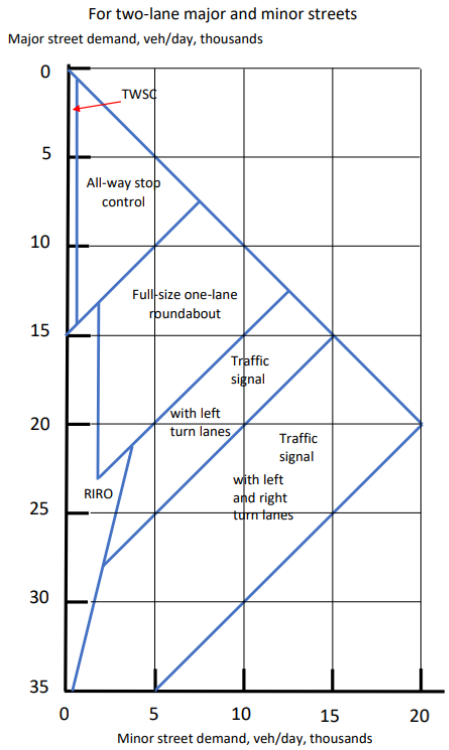


Figure 1. Optimum Intersection Configuration

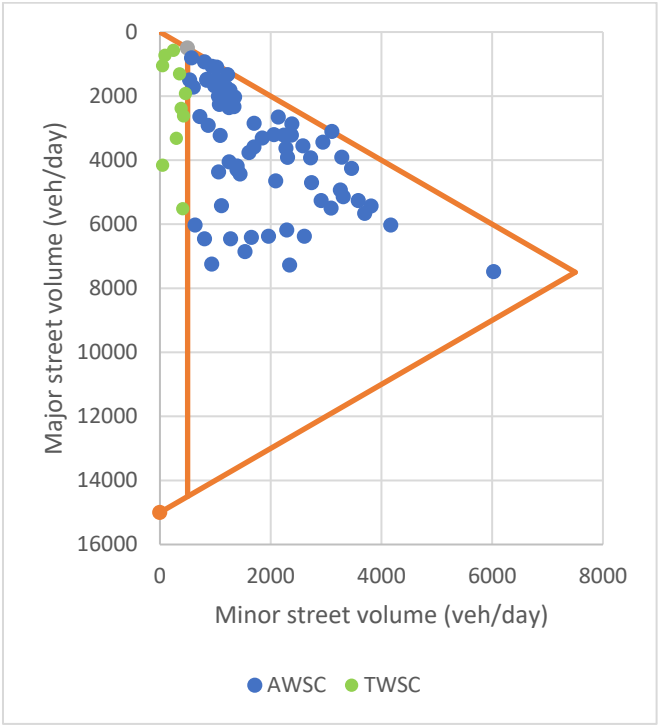


Figure 2. Study Intersections Compared with Optimum Intersection Configuration

Table 21 and **Table 22** show the total numbers of crashes before and after conversion to AWSC for roadways with an optimum configuration of TWSC and AWSC, respectively, per the NCDOT SaFID methodology.

Table 21. Annual Crash Changes at Newly Converted AWSC Intersections – SaFID (TWSC)

Crash Type	Annual Crashes by Type			Annual Crashes by Severity		
	Total	Angle	Rear End	PDO	Injury	Fatal
Before	20.67	10.00	2.00	13.67	7.00	0.00
After	10.00	2.50	1.50	8.67	1.33	0.00
% Change	-52%	-75%	-25%	-37%	-81%	--

Table 22. Annual Crash Changes at Newly Converted AWSC Intersections – SaFID (AWSC)

Crash Type	Annual Crashes by Type			Annual Crashes by Severity		
	Total	Angle	Rear End	PDO	Injury	Fatal
Before	319.33	185.33	35.67	200.33	115.33	3.67
After	154.17	55.33	36.33	127.33	26.50	0.33
% Change	-52%	-70%	2%	-36%	-77%	-91%

In general, there was a reduction in crashes of all types and severities after the implementation of AWSC regardless of optimum intersection configuration (AWSC or TWSC), as outlined in NCDOT's publication, with the exception of a small 2% increase in rear-end crashes at intersections which the SaFID methodology indicated should've been converted to ASWC.

CRASH MODIFICATION FACTORS

Existing crash modification factors (CMFs) for the conversion of a two-way stop to AWSC are available through the FHWA CMF Clearinghouse. CMFs less than 1.0 indicate an expected reduction in crashes, while CMFs greater than 1.0 indicate an expected increase in crashes after implementing a countermeasure. The Clearinghouse includes a range of CMF values for angle crashes, rear-end crashes, and total crashes associated with conversion to AWSC. CMF reports can be found in **Appendix D**.

The before and after crash data for the 76 subject intersections were used to calculate "naïve" CMFs for total, angle, and rear-end crashes associated with the installation of All-Way Stop Control at intersections in Delaware. Mathematically, naïve CMFs

are equal to 1.0 minus the crash reduction (shown in **Table 2**) divided by 100. For example, if the conversion to AWSC results in a crash reduction of 52 percent, the corresponding naïve CMF is 1 – (52/100) = 0.48. The FHWA CMF Clearinghouse and this study's naïve CMFs can be found below in **Table 23**.

Table 23. CMF Comparison

Crash Type	Total	Angle	Rear End
Delaware Naïve Before-and-After CMFs	0.48	0.30	1.00
CMF Clearinghouse	0.319[3] – 0.690[1]	0.170[1] – 0.855[3]	1.03[1]

The table and statistics above indicate that the 76 intersections converted to AWSC in Delaware that were included in this study experienced approximately the same reductions in total and angle crashes as expected based on national experience summarized in the FHWA CMF Clearinghouse. However, instead of experiencing a slight increase (3%) in rear-end crashes as expected based on national experience summarized in the FHWA CMF Clearinghouse, there was no change (0%) in rear-end crashes in Delaware. Twenty-one (21) of the 76 (28%) study intersections in Delaware experienced an increase in rear-end crashes while the remaining 55 intersections experienced either no change or a decrease in rear-end crashes, as shown in **Table 3**. Based on the calculated and researched CMFs, it is reasonable to assume that converting an intersection to AWSC with similar characteristics to the study intersections can be expected to reduce the total number of crashes at an intersection, as well as the number of angle crashes, with the potential for either a slight increase or slight decrease in rear-end crashes.

EMPIRICAL BAYES

As noted above, the Delaware CMFs shown in **Table 23** are "naïve" estimates. These CMFs do not account for the regression-to-the-mean phenomenon in which a randomly large number of crashes during the "before" period is normally followed by a reduced number of crashes in the "after" period, even if no safety improvements had been made at the intersection. The empirical Bayes methodology more precisely estimates the number of crashes that would have occurred in the absence of AWSC at the 76 study intersections. Empirical Bayes correctly accounts for observed changes in crashes that may be due to the regression-to-the-mean phenomenon, and better accounts for time trends and changes in traffic volumes. The CMFs outlined below are presented using the 95% confidence interval, which is a likely range of the true CMF.

To estimate the 95% confidence intervals using the empirical Bayes method, the Highway Safety Manual (HSM) predictive method was used to calculate the number of predicted crashes ($N_{predicted}$) and the number of expected crashes ($N_{expected}$) both before and after implementation of AWSC at each intersection. Specifically, the AASHTO HSM spreadsheet tools were used to implement the formulas in the HSM for rural two-lane, two-way roads and urban and suburban arterials. The results of the HSM analysis were then used to calculate the 95% Confidence Interval for each CMF, using the equations below, adapted from the FHWA document *A Guide to Developing Quality Crash Modification Factors*. Results for each intersection can be found in **Appendix E**.

- $N_{expected\ T,A} = N_{expected\ T,B} * (N_{predicted\ T,A}/N_{predicted\ T,B})$
- $SPF\ weight = \frac{N_{expected\ T,B} - N_{observed\ T,B}}{N_{predicted\ T,B} - N_{observed\ T,B}}$
- $Var(N_{expected\ T,A}) = N_{expected\ T,A} * (\frac{N_{predicted\ T,A}}{N_{predicted\ T,B}}) * (1 - SPF\ Weight)$
- $CMF = \frac{N_{observed\ T,A}/N_{expected\ T,A}}{1+(Var(N_{expected\ T,A})/{N_{expected\ T,A}}^2)}$
- $Var(CMF) = \frac{CMF^2\left[\left(\frac{1}{N_{observed\ T,A}}\right)+\left(\frac{Var(N_{expected\ T,A})}{{N_{expected\ T,A}}^2}\right)\right]}{\left[1+\frac{Var(N_{expected\ T,A})}{{N_{expected\ T,A}}^2}\right]^2}$
- $Standard\ Error\ (SE) = \sqrt{Var(CMF)}$
- $95\%\ Confidence\ Interval = CMF \pm 1.96 * SE$

Where:

- $N_{expected\ T,A}$ = Expected number of crashes in the after period
- $N_{expected\ T,B}$ = Expected number of crashes in the before period
- $N_{predicted\ T,A}$ = Predicted number of crashes in the after period
- $N_{predicted\ T,B}$ = Predicted number of crashes in the before period
- $N_{observed\ T,A}$ = Observed number of crashes in the after period
- $N_{observed\ T,B}$ = Observed number of crashes in the before period
- $Var(N_{expected\ T,A})$ = Variance of expected number of crashes in the after period
- $Var(CMF)$ = Variance of the CMF estimate

The results of the empirical Bayes analyses indicate an expected reduction in total crashes between 21% and 44% with the implementation of AWSC, as shown in **Table 24**. Similarly, the empirical Bayes analyses indicate an expected reduction in fatal and injury crashes between 63% and 84% after AWSC implementation. The empirical Bayes analyses indicate a range of expected outcomes for PDO crashes, ranging between a 22% reduction and a 15% increase in crashes. This means that conversion to AWSC can be expected to result in a reduction in higher severity crashes, while PDO crashes may increase or decrease. Based on these results, AWSC is a tool that can be effective at reducing fatal and serious injury crashes, consistent with the goals of Delaware's Strategic Highway Safety Plan (SHSP) and FHWA's Safe System Approach.

Table 24. Empirical Bayes CMFs for All Intersections, by Crash Severity

Crash Type	CMF	95th % Confidence Interval
Total	0.67	0.56 – 0.79
Fatal and Injury	0.27	0.16– 0.37
PDO	0.97	0.78 – 1.15

Roadway Functional Classification

In addition to estimating the 95% confidence intervals for the CMFs for all intersections, the empirical Bayes methodology was also used to estimate separate CMFs for different roadway types. In general, the results in **Table 25** show that local roadways would be expected to see the largest reduction in crashes, as shown by lower CMF values. Where the 95% confidence interval range includes 1.00, the true CMF could be a number above or below 1.0 indicating crashes may increase or decrease. The 95% confidence intervals are below 1.00 for Fatal and Injury crashes for all functional classes, indicating AWSC is effective at reducing fatal and injury crashes for all of the roadway functional classifications studied.

Table 25. Empirical Bayes CMFs by Roadway Functional Classification

Crash Type	Local (25 intersections)		Collector (46 intersections)		Arterial (5 intersections)	
	CMF	95th % Confidence Interval	CMF	95th % Confidence Interval	CMF	95th % Confidence Interval
Total	0.46	0.27 – 0.65	0.72	0.57 – 0.87	0.78	0.37 – 1.18
Fatal and Injury	0.12	0.00 – 0.27	0.29	0.16 – 0.43	0.40	0.00 – 0.79
PDO	0.71	0.39 – 1.02	1.03	0.79 – 1.28	1.04	0.41 – 1.67

MUTCD AWSC Crash Warrants

The empirical Bayes methodology was also used to estimate separate CMFs depending on whether or not the intersection satisfies the guidance outlined in the MUTCD. As shown in **Table 26**, intersections that meet the AWSC crash criteria outlined in the 2011 DE-MUTCD would be expected to see a decrease in total and fatal/injury crashes. Intersections that did not meet the crash warrants outlined in the 2011 DE-MUTCD have the potential to see crash reductions or increases for total and PDO crashes. The 95% confidence intervals indicate that the true value of the CMF for PDO crashes could be either a decrease or an increase, regardless of whether the intersection met the 2011 DE-MUTCD AWSC crash criteria. However, the 95% confidence intervals for fatal and injury crashes indicate that AWSC is effective at reducing fatal and injury crashes regardless of whether the intersection met the 2011 DE-MUTCD AWSC criteria.

Intersections that met the reduced crash thresholds in FHWA's Interim Approval are also expected to see a reduction in total and fatal/injury crashes, as shown in **Table 27**. Intersections that did not meet the reduced crash thresholds are also expected to see a reduction in fatal/injury crashes. Regardless of whether or not the reduced crash thresholds were met, PDO crashes have the potential to increase or decrease after AWSC implementation.

Similar to intersections that met the reduced crash thresholds, intersections that met the crash warrants outlined in the 11th edition of the MUTCD are expected to see a reduction in crashes for both total and fatal/injury crashes, as shown in **Table 28**. Intersections that did not meet the crash warrants outlined in the 11th edition of the MUTCD have the potential to see crash reductions or increases for total and PDO crashes; however, the results indicate fatal and injury crashes would decrease following implementation of AWSC, regardless of whether the crash warrants in the 11th Edition of the MUTCD were met.

Table 26. Empirical Bayes CMFs – 2011 DE-MUTCD AWSC Crash Criteria

Crash Type	Met 2011 DE-MUTCD AWSC Crash Criteria (34 intersections)		Did Not Meet 2011 DE-MUTCD AWSC Crash Criteria (42 intersections)	
	CMF	95th % Confidence Interval	CMF	95th % Confidence Interval
Total	0.58	0.45 – 0.72	0.81	0.60 – 1.02
Fatal and Injury	0.25	0.13 – 0.38	0.29	0.10 – 0.47
PDO	0.83	0.61 – 1.05	1.19	0.85 – 1.52

Table 27. Empirical Bayes CMFs - DelDOT's Reduced AWSC Crash Thresholds

Crash Type	Met Reduced AWSC Crash Thresholds (48 intersections)		Did Not Meet Reduced AWSC Crash Thresholds (28 intersections)	
	CMF	95th % Confidence Interval	CMF	95th % Confidence Interval
Total	0.59	0.47 – 0.71	0.93	0.63 – 1.24
Fatal and Injury	0.23	0.12 – 0.34	0.35	0.04 – 0.66
PDO	0.86	0.66 – 1.06	1.31	0.85 – 1.77

Table 28. Empirical Bayes CMFs – 11th Edition of MUTCD Crash Warrants

Crash Type	Met 11th Edition of MUTCD AWSC Crash Warrants (44 intersections)		Did Not Meet 11th Edition of MUTCD AWSC Crash Warrants (32 intersections)	
	CMF	95th % Confidence Interval	CMF	95th % Confidence Interval
Total	0.59	0.46 – 0.71	0.90	0.63 – 1.18
Fatal and Injury	0.23	0.12 – 0.34	0.32	0.04 – 0.60
PDO	0.85	0.65 – 1.05	1.28	0.86 – 1.70

The CMF trends are similar whether the AWSC criteria in the 2011 DE-MUTCD, the reduced thresholds from FHWA's Interim Approval, or the AWSC warrants in the 11th edition of the FHWA MUTCD are used to evaluate the appropriateness of AWSC. As noted previously, the CMFs indicate that AWSC can be an effective tool to reduce fatal and serious injury crashes, consistent with Delaware's Strategic Highway Safety Plan (SHSP) and FHWA's Safe System Approach, regardless of which set of criteria are used to identify locations that may be appropriate for AWSC. The CMFs outlined above for fatal and injury crashes indicate that AWSC can be an effective tool even when none of the criteria are met.

Speed Limit

The empirical Bayes methodology was also used to estimate the CMFs for intersections along major roads with varying speed limits. The 95% confidence intervals shown in **Table 29** indicate that fatal and injury crashes would be expected to decrease after the implementation of AWSC, regardless of the speed limit. However, **Table 29** shows that for roadways with speed limits between 25 MPH and 35 MPH, both total and PDO crashes could be expected to either decrease or increase, the latter as indicated by the 95% confidence interval upper bound greater than 1.00. Similarly, PDO crashes could be expected to either decrease or increase for new AWSC intersections on roadways with speed limits of 50 mph.

Table 29. Empirical Bayes CMFs by Speed Limit

Crash Type	25 – 35 MPH (16 intersections)		40 – 45 MPH (16 intersections)		50 MPH (44 intersections)	
	CMF	95% Confidence Interval	CMF	95% Confidence Interval	CMF	95% Confidence Interval
Total	0.73	0.41 – 1.06	0.47	0.27 – 0.68	0.68	0.53 – 0.82
Fatal and Injury	0.36	0.03 – 0.68	0.18	0.00 – 0.37	0.24	0.12 – 0.36
PDO	0.99	0.50 – 1.48	0.68	0.36 – 1.00	1.00	0.76 – 1.24

Average Daily Traffic (ADT)

The empirical Bayes methodology was also used to estimate CMFs for intersections with varying ADTs. Intersections with Low (2,000 vehicles per day or less), Medium (2,001 to 4,000 vehicles per day), or Higher (greater than 4,000 vehicles per day) ADT would be expected to see a reduction in total and fatal/injury crashes after the implementation of AWSC, based on the 95% confidence intervals shown in **Table 30**. Regardless of ADT, intersections could potentially see either a decrease or increase in PDO crashes.

Table 30. Empirical Bayes CMFs by ADT

Crash Type	Low (19 intersections)		Medium (27 intersections)		Higher (30 intersections)	
	CMF	95th % Confidence Interval	CMF	95th % Confidence Interval	CMF	95th % Confidence Interval
Total	0.53	0.22 – 0.84	0.64	0.45 – 0.83	0.71	0.55 – 0.87
Fatal and Injury	0.06	0.00 – 0.22	0.26	0.08 – 0.43	0.31	0.15 – 0.46
PDO	0.88	0.35 – 1.41	0.92	0.61 – 1.23	1.00	0.74 – 1.26

Safest Feasible Intersection Design (SaFID)

The empirical Bayes methodology was also used to estimate CMFs for intersections in Delaware based on NCDOT's recommended intersection configuration, as outlined in the SaFID methodology. The 95% confidence intervals, shown in **Table 31**, indicate that there would be an expected reduction in fatal and injury crashes regardless of whether the recommended SaFID intersection configuration was TWSC or AWSC. This indicates that, in Delaware, there are safety benefits of converting intersections with volumes less than 15,000 vehicles per day to AWSC. This is true even if the minor street has a volume of less than 500 vehicles, which under the SaFID methodology would indicate TWSC as the optimum intersection configuration.

Table 31. Empirical Bayes CMFs by SaFID

Crash Type	TWSC (10 intersections)		AWSC (66 intersections)	
	CMF	95th % Confidence Interval	CMF	95th % Confidence Interval
Total	0.83	0.27 – 1.38	0.66	0.54 – 0.78
Fatal and Injury	0.25	0.00 – 0.65	0.27	0.16 – 0.38
PDO	1.23	0.34 – 2.12	0.95	0.76 – 1.14

Intersection Angle

Finally, the empirical Bayes methodology was used to estimate CMFs for intersections with varying minimum intersection angles. Intersections with intersection angles <60 degrees would be expected to see a reduction in total, fatal and injury, and PDO crashes, based on the 95% confidence intervals shown in **Table 32.** Intersections with intersection angles 60 degrees or above could see either an increase or decrease in PDO crashes.

Table 32. Empirical Bayes CMFs by Minimum Intersection Angle

Crash Type	80 - 90 degrees (33 intersections)		60 - 79 degrees (28 intersections)		< 60 degrees (15 intersections)	
	CMF	95% Confidence Interval	CMF	95% Confidence Interval	CMF	95% Confidence Interval
Total	0.77	0.58 – 0.96	0.70	0.50 – 0.89	0.44	0.25 – 0.63
Fatal and Injury	0.38	0.18 – 0.58	0.23	0.07 – 0.39	0.12	0.00 – 0.26
PDO	1.06	0.75 – 1.36	1.04	0.71 – 1.36	0.68	0.37 – 0.99

LONG TERM EFFECTIVENESS

As shown in **Table 1**, several of the study intersections were converted to AWSC almost a decade ago. Additional recent crash data was obtained for all intersections converted to AWSC prior to 2022 to determine whether there has been an increase in injury or fatal crashes in more recent years (after the 3-year "after" period). This recent crash data was used solely to identify any recent fatal or injury crashes and are not included in the analyses above regarding crashes for the 3 years prior to and 3 years following implementation of AWSC. There have only been two fatal crashes at intersections after conversion to AWSC. The first was a single vehicle crash that occurred at the intersection of Conrail Road at Hearns Pond Road in the second year after implementation. The second was a single vehicle crash with driver impairment that occurred at the intersection of Seaford Road at Oneals Road in the fourth year after implementation. In general, the average annual number of injury crashes at each of the 30 intersections that were implemented prior to 2022 remained similar to the average annual number of injury crashes in the "after" period used for before-and-after safety analysis presented above.

SUMMARY AND NEXT STEPS

An analysis of crash data from 76 intersections that were recently converted to All-Way Stop Control (AWSC), indicated positive safety benefits following conversion, including a 91% reduction in fatalities and a 77% reduction in injury crashes annually. Most intersections showed a reduction in the total number, type, and severity of crashes after AWSC implementation, regardless of the roadway classification (local, minor collector, and major collector), volumes (up to approximately 8,000 AADT), or speeds (25 to 50 mph). There was a reduction in injury and fatal crashes regardless of whether intersections met the 2011 DE-MUTCD crash criteria, the reduced crash thresholds in FHWA's Interim Approval, the MUTCD 11th Edition crash warrants, or even if they did not meet any AWSC crash criteria or warrants. While the magnitude of the crash reduction varied based on one or more of these factors, total crashes were still reduced, on average, following the implementation of AWSC. **Table 33** outlines the average changes in crashes for roadways with different functional classifications, speed limits, AADTs, and whether or not the intersection met the various crash warrants. While there were increases in rear-end and PDO crashes for some categories, on average, there was a reduction in all types and all severities of crashes, indicating potential safety benefits following AWSC conversion.

Table 33. Annual Crash Changes Summary (% Change)

Category	Group	Annual Crashes by Type			Annual Crashes by Severity		
		Total	Angle	Rear End	PDO	Injury	Fatal
Functional Classification	Local	-73%	-85%	-78%	-64%	-91%	-67%
	Collector	-45%	-68%	19%	-26%	-74%	-100%
	Arterial	-34%	-38%	0%	-15%	-61%	-100%
MUTCD Crash Warrants	Met 2011 DE-MUTCD Crash Criteria	-60%	-74%	-16%	-46%	-81%	-100%
	Met Reduced Threshold (IA-19)	-59%	-74%	-16%	-44%	-83%	-86%
	Met MUTCD 11th Edition Crash Warrants	-60%	-73%	-16%	-44%	-82%	-100%
Speed Limit	25 – 35 MPH	-44%	-69%	16%	-34%	-66%	0%
	40 – 45 MPH	-69%	-77%	-53%	-64%	-81%	--
	50 MPH	-47%	-68%	25%	-25%	-78%	-100%
AADT	Low (≤ 2,000 vpd)	-75%	-90%	-68%	-62%	-97%	-75%
	Medium (2,001 to 4,000 vpd)	-54%	-73%	-29%	-40%	-78%	-100%
	Higher (> 4,000 vpd)	-42%	-62%	35%	-26%	-71%	-100%
SaFID	TWSC	-52%	-75%	-25%	-37%	-81%	--
	AWSC	-52%	-70%	2%	-36%	-77%	-91%
Intersection Angle	<=10 degrees	-45%	-62%	16%	-29%	-70%	-75%
	>10 and <=30 degrees	-53%	-74%	-26%	-33%	-82%	-100%
	>30 degrees	-64%	-81%	50%	-53%	-79%	-100%

-- Zero fatal crashes before AND after implementation of AWSC

The data from these 76 intersections were also used to estimate crash modification factors (CMFs) for Delaware using the empirical Bayes method. Although the upper bound of the 95% confidence intervals indicated a potential increase in PDO crashes, the CMFs and confidence intervals all indicated that the number of fatal and injury crashes would be expected to decrease at intersections that are converted to AWSC. This data-driven analysis shows that AWSC can be an effective tool to reduce fatal and serious injury crashes, consistent with the goals of Delaware's Strategic Highway Safety Plan (SHSP) and FHWA's Safe System Approach.

It is recommended that DelDOT continue to update this study in the future to expand the data set used in the analyses. A larger sample size will continue to help confirm trends among various types of crashes as well as severities and may also help reduce the range of the 95% confidence intervals for one of more of the crash modification factors.

REFERENCES

[1]Deng, Z., S. Kyrychenko, T. Lee, and R. Retting. "Estimate of the Safety Effect of All-Way Stop Control Conversion in Washington, DC." Transportation Research Record No. 2674, Transportation Research Board of the National Academies of Science, Washington D.C., (2020).

[2]Hummer, Joseph E. "Selecting Optimum Intersection or Interchange Alternatives." North Carolina Department of Transportation. Jan. 2024.

[3]Simpson, C.L. and Hummer, J.E., "Evaluation of the Conversion from Two-Way Stop Sign Control to All-Way Stop Sign Control at 53 Locations in North Carolina." Transportation Safety and Security, Vol 2, No. 3, (2010) pp. 239-260

APPENDICES

Appendix A: Intersection Details
Appendix B: Crash Data – Full Reports*
Appendix C: Reduced Crash Thresholds
Appendix D: CMF Clearinghouse Reports
Appendix E: Empirical Bayes Summary

*Full reports can be found in the version under Part 2-Signs posted on the Delaware Manual on Uniform Traffic Control Devices at deldot.gov
https://deldot.gov/Publications/manuals/de_mutcd/index.shtml

Appendix A: Intersection Details

Crash Data Summary

#	Major Road	Intersecting Road	Rural/ Urban	Major Road Install Year AADT	Minor Road Install Year AADT	# of Legs	Major Road Speed Limit	Major Road Functional Class	Met Crash Criteria from 2011 DE-MUTCD?	Met Reduced Crash Thresholds from FHWA IA-19?	Met Crash Warrants from MUTCD 11th Edition?	SaFID Categorization (Install Year)	Intersection Angle	Years of Before Crash Data	Years of After Crash Data
1	K322 (Delaware Ave)	K9 (Woodland Beach Rd) / Beach Ave	Rural	572	246	4	25	Minor Collector	No	No	No	TWSC	90	3	3
2	K241 (Peach Basket Rd)	K240 (Turkey Point Rd)	Rural	2873	2387	4	50	Local	No	Yes	Yes	AWSC	79	3	3
3	K371 (Barratts Chapel Rd)	K381 (Fox Chase Rd)	Rural	1684	990	4	35	Major Collector	Yes	Yes	Yes	AWSC	79	3	3
4	N53 (Thompson Station Rd)	N301 (Pleasant Hill Rd) / N302 (Hopkins Rd)	Rural	4260	3464	4	35	Local	Yes	Yes	Yes	AWSC	77	3	3
5	S326 (Bethesda Rd)	S86 (Avenue of Honor)	Rural	1353	2035	4	50	Local	No	Yes	Yes	AWSC	73	3	3
6	S326 (Bethesda Rd)	S432 (Governor Stockley Rd)	Rural	852	1481	4	50	Local	No	No	No	AWSC	84	3	3
7	S38 (Clendaniel Pond Rd)	S224 (Fleatown Rd)	Rural	1189	1714	4	50	Local	Yes	Yes	Yes	AWSC	87	3	3
8	S46 (Old Furnace Rd)	S535 (Middleford Rd)	Rural	6031	7483	4	35	Major Collector	No	No	No	AWSC	90	3	3
9	S47 (Johnson Rd)	S290 (Hurdle Ditch Rd)	Rural	1335	1224	4	45	Local	Yes	Yes	Yes	AWSC	90	3	3
10	S62 (East Trap Pond Rd)	S329 (W. Piney Grove Rd / Whaleys Corner Rd)	Rural	1726	605	4	50	Local	Yes	Yes	Yes	AWSC	73	3	3
11	S750 (Shockley Town Rd)	S920 (Gum Rd)	Rural	849	1507	4	50	Local	No	Yes	Yes	AWSC	82	3	3
12	SR 30 (Gravel Hill Rd)	S47 (Springfield Rd / Johnson Rd)	Rural	3632	2278	4	50	Major Collector	No	Yes	Yes	AWSC	52	3	3
13	SR 30 (Whitesville Rd)	S66 (Pepperbox Rd)	Rural	1098	1028	4	50	Major Collector	No	Yes	No	AWSC	75	3	3
14	SR 30 (Whitesville Rd)	S68 (Old Stage Rd)	Rural	1819	1267	4	50	Major Collector	No	No	No	AWSC	76	3	3
15	SR 5 (Harbeson Rd)	S292 (Forest Rd) / Anderson Corner Rd	Rural	4372	1062	4	50	Major Collector	Yes	Yes	Yes	AWSC	69	3	3
16	K103 (Hourglass Rd)	K182 (Slaughter Station Rd)	Rural	934	808	4	50	Local	Yes	Yes	Yes	AWSC	81	3	3
17	N216 (Rockwood Rd)	N217 (Miller Rd)	Urban	3225	2243	3	35	Minor Collector	No	No	No	AWSC	90	3	3
18	N243 (Old Kennett Rd)	N246 (Center Mill Rd)	Rural	2623	429	4	40	Major Collector	Yes	Yes	Yes	TWSC	68	3	3
19	S270A (Munchy Branch Rd)	Field Lane / Shady Ridge Dr	Urban	4158	50	4	35	Local	No	No	No	TWSC	62	3	3
20	S48 (Zoar Rd)	S317 (Peterkins Rd)	Urban	6031	637	4	45	Major Collector	Yes	Yes	Yes	AWSC	62	3	3
21	SR 5 (Indian Mission Rd)	S302 (Harmons Hill Rd / Phillips Branch Rd)	Rural	6859	1540	4	50	Major Collector	No	No	No	AWSC	67	3	3
22	SR 30 (Cedar Creek Rd)	S38 (Jefferson Rd / Sylvan Acres Rd)	Rural	5516	413	4	50	Major Collector	Yes	Yes	Yes	TWSC	67	3	3
23	K388 (Canterbury Rd)	K404 (Church Hill Rd)	Rural	7251	938	4	50	Minor Arterial	Yes	Yes	Yes	AWSC	86	3	3
24	SR 30 (Cedar Creek Rd)	S207 (Johnson Rd)	Rural	6187	2294	4	40	Major Collector	Yes	Yes	Yes	AWSC	90	3	3
25	S410 (Godwin School Rd)	S433 (Country Living Rd)	Rural	575	808	4	45	Local	No	No	No	AWSC	90	3	3
26	K49 (Hartly Rd / Main St)	K182 (Slaughter Station Rd)	Rural	4303	1395	3	25	Minor Arterial	No	No	No	AWSC	90	3	3
27	S431 (Shortly Rd)	S329 (Piney Grove Rd)	Rural	4439	1449	4	50	Minor Collector	No	Yes	Yes	AWSC	90	3	3
28	SR 14 (Milford Harrington Hwy)	K384 (Killens Pond Rd)	Rural	7277	2346	4	50	Minor Arterial	Yes	Yes	Yes	AWSC	90	3	3
29	S280 (Stockley Rd)	S290 (Cool Spring Rd)	Rural	2011	1059	4	50	Local	Yes	Yes	Yes	AWSC	90	3	3
30	S88 (Cave Neck Rd)	S258 (Hudson Rd)	Rural	5268	2916	4	50	Minor Collector	Yes	Yes	Yes	AWSC	48	3	3
31	S52 (Roxana Rd)	S370 (Daisey Rd)	Rural	4709	2743	4	50	Major Collector	Yes	Yes	Yes	AWSC	90	3	3
32	SR 30 (Gravel Hill Rd)	S319 (Sand Hill Rd)	Rural	3110	3109	4	50	Major Collector	Yes	Yes	Yes	AWSC	90	3	3
33	S46 (Old Furnace Rd)	S529 (Cokesbury Rd)	Rural	4937	3261	3	50	Major Collector	No	No	No	AWSC	51	3	3
34	US13A (Seaford Rd)	S485 (Oneals Rd)	Rural	4057	1254	4	50	Major Collector	Yes	Yes	Yes	AWSC	65	3	3
35	S546 (Conrail Rd)	S544 (Hearns Pond Rd)	Rural	1014	1482	4	35	Local	No	Yes	No	AWSC	81	3	3
36	SR 54 (Lighthouse Rd)	S387 (Hudson Rd)	Rural	5502	3094	4	50	Major Collector	No	No	No	AWSC	81	3	3
37	N25 (Caldwell Corner Rd)	N459 (Grears Corner Rd)	Rural	1077	2266	4	50	Local	Yes	Yes	Yes	AWSC	46	3	3
38	S386 (Polly Branch Rd)	Creekview Cir	Rural	1050	50	3	40	Local	No	No	No	TWSC	77	3	2
39	SR 18 (Cannon Rd)	(Wesley Church Rd)	Rural	3225	2377	4	50	Major Collector	Yes	Yes	Yes	AWSC	78	3	2
40	SR 20 (Hardscrabble Rd)	S446 (Beaver Dam Branch Rd)	Rural	6458	810	4	50	Major Collector	Yes	Yes	Yes	AWSC	77	3	2
41	N486 (Duck Creek Rd)	N47 (Vandyke Greenspring Rd)	Rural	3556	2585	3	50	Major Collector	No	No	No	AWSC	73	3	2
42	S299 (Bay Farm Rd)	S298 (School Ln)	Urban	5268	3584	3	35	Local	No	No	No	AWSC	59	3	2
43	SR 20 (Hardscrabble Rd)	S62 (E Trap Pond Rd)	Rural	6458	1281	4	50	Major Collector	No	Yes	Yes	AWSC	90	3	2
44	SR 20 (Hardscrabble Rd)	S431 (Conaway Rd / Shortly Rd)	Rural	6380	2611	4	50	Major Collector	Yes	Yes	Yes	AWSC	90	3	2
45	SR 20 (Hardscrabble Rd)	S432 (Gov Stockley Rd / Cross Key Rd)	Rural	6380	1964	4	50	Major Collector	Yes	Yes	Yes	AWSC	85	3	2
46	S48 (Zoar Rd)	S321 (Wood Branch Rd)	Rural	3594	1701	4	40	Local	Yes	Yes	Yes	AWSC	49	3	2
47	SR 17 (Roxana Rd)	S365 (Peppers Corner Rd / Powell Farm Rd)	Rural	3916	2308	4	50	Major Collector	Yes	Yes	Yes	AWSC	63	3	2
48	SR 17 (Roxana Rd)	S392 (Gum Rd)	Rural	5435	3816	4	50	Major Collector	Yes	Yes	Yes	AWSC	52	3	2
49	US13A (Seaford Rd)	S493 (Bethel Rd)	Rural	3767	1613	4	50	Major Collector	Yes	Yes	Yes	AWSC	74	3	2
50	S78 (Woodland Ferry Rd)	S493 (Bethel Rd)	Rural	2142	2656	4	45	Minor Collector	Yes	Yes	Yes	AWSC	80	3	2
51	K401 (Bowman Rd)	K404 (Church Hill Rd)	Rural	1703	2853	4	45	Local	Yes	Yes	Yes	AWSC	76	3	2
52	SR 10A (Henry Cowgill Rd)	K246 (Berrytown Rd)	Rural	2920	874	4	50	Minor Collector	No	No	No	AWSC	78	3	2
53	SR 9 (Denny St)	K14 (2nd St)	Urban	2644	725	4	25	Major Collector	No	No	No	AWSC	76	3	2
54	S61 (Lowes Crossing Rd)	S421 (Careys Camp Rd)	Rural	1074	943	4	50	Local	No	No	No	AWSC	48	3	2
55	K59 (Whiteleysburg Rd)	K455 (Fox Hunters Rd)	Rural	1923	464	4	50	Minor Collector	No	Yes	No	TWSC	75	3	2
56	S224 (Fleatown Rd)	S213 (Old State Rd)	Rural	2334	1341	4	50	Minor Collector	Yes	Yes	Yes	AWSC	50	3	2
57	S18 (Federalsburg Rd)	S30 (Atlanta Rd)	Rural	3931	2723	4	50	Minor Arterial	Yes	Yes	Yes	AWSC	81	3	2
58	S432 (Governor Stockley Rd)	S329 (Piney Grove Rd)	Rural	1964	1221	4	50	Local	No	No	No	AWSC	51	3	2
59	K193 (Old North Rd)	K53 (Caesar Rodney Ave)	Urban	3443	2947	4	25	Minor Collector	No	No	No	AWSC	75	3	2
60	S461 (Old Stage Rd)	S462 (Trussum Pond Rd)	Rural	1305	355	4	50	Local	No	No	No	TWSC	52	3	2
61	S30 (Atlanta Rd)	S543 (Ross Station Rd)	Rural	4186	1397	3	50	Major Collector	Yes	Yes	Yes	AWSC	90	3	2
62	K096 (Downs Chapel Rd)	K093 (Pearsons Grove Rd)	Rural	729	93	3	40	Local	No	No	No	TWSC	30	3	2
63	S277 (Robinsonville Rd)	S283 (Cedar Grove Rd)	Rural	3700	5666	3	45	Local	No	Yes	No	AWSC	75	3	1

Crash Data Summary

#	Major Road	Intersecting Road	Rural/ Urban	Major Road Install Year AADT	Minor Road Install Year AADT	# of Legs	Major Road Speed Limit	Major Road Functional Class	Met Crash Criteria from 2011 DE-MUTCD?	Met Reduced Crash Thresholds from FHWA IA-19?	Met Crash Warrants from MUTCD 11th Edition?	SaFID Categorization (Install Year)	Intersection Angle	Years of Before Crash Data	Years of After Crash Data
64	S285 (Beaver Dam Rd)	S261 (Dairy Farm Rd)	Rural	3912	3288	3	45	Major Collector	Yes	Yes	Yes	AWSC	79	3	1
65	SR 15 (Canterbury Rd)	K371 (Barratts Chapel Road / Plymouth Road)	Rural	5424	1115	4	40	Minor Arterial	Yes	Yes	Yes	AWSC	74	3	1
66	S46 (Old Furnace Rd)	S525 (Coverdale Road / King Rd)	Rural	4654	2095	4	50	Major Collector	No	No	No	AWSC	90	3	1
67	SR 9 (Main St)	K89 (Port Mahon Rd)	Urban	2387	386	3	25	Major Collector	No	No	No	TWSC	90	3	1
68	K368 (Millchop Ln)	K369 (Autumn Moon Ln)	Rural	539	1501	4	50	Local	No	Yes	Yes	AWSC	90	3	1
69	S365 (Powell Farm Rd)	S353 (Burbage Rd)	Rural	2366	1252	4	40	Major Collector	No	Yes	Yes	AWSC	90	3	1
70	SR 5 (Harbeson Rd)	Chestnut St / Shingle Point Rd	Rural	6417	1654	4	35	Major Collector	No	No	No	AWSC	43	3	1
71	S361 (Muddy Neck Rd / Kent A	S363 (Double Bridges Rd)	Rural	5148	3315	3	35	Major Collector	No	No	No	AWSC	84	3	1
72	S363 (Double Bridges Rd)	S362 (Parker House Rd)	Urban	3315	1853	4	45	Major Collector	No	No	No	AWSC	21	3	1
73	N423 (Bayview Rd)	N37 (Vance Neck Rd)	Rural	1091	3234	4	40	Local	No	Yes	Yes	AWSC	90	3	1
74	K90 (Sunnyside Rd)	K147 (Hillyard Rd)	Rural	3210	2063	4	50	Major Collector	No	Yes	Yes	AWSC	83	3	1
75	S22 (Federal St)	S197 (Mulberry St) / S88 (Wharton St)	Urban	6029	4173	4	25	Major Collector	No	No	No	AWSC	49	3	1
76	S88 (Atlantic St / Wharton St)	Chestnut St	Urban	3321	1091	4	25	Minor Collector	No	No	No	AWSC	90	3	1

Appendix B: Crash Data – Full Reports

*Full reports can be found in the version under Part 2-Signs posted on the Delaware Manual on Uniform Traffic Control Devices at deldot.gov
https://deldot.gov/Publications/manuals/de_mutcd/index.shtml

Appendix C: Reduced Crash Thresholds

Interim Approval for Optional Use of an Alternative Warrant 7 – Crash Experience

The Federal Highway Administration also gave interim approval (IA-19) of an alternative crash warrant on February 24, 2017, for signals. Only one of the warrants below needs to be met in order to justify a traffic control device, according to the memorandum.

> *At least one of the following conditions applies to the reported crash history (where each reported crash considered is related to the intersection and apparently exceeds the applicable requirements for a reported crash):*
>
> 1. *The number of reported angle crashes and pedestrian crashes within a one-year period equals or exceeds the threshold number in Table IA-19-1 for total angle crashes and pedestrian crashes (all severities); or*
> 2. *The number of reported fatal-and-injury angle crashes and pedestrian crashes within a one-year period equals or exceeds the threshold number in Table IA-19-1 for total fatal-and-injury angle crashes and pedestrian crashes; or*
> 3. *The number of reported angle crashes and pedestrian crashes within a three-year period equals or exceeds the threshold number in Table IA-19-2 for total angle crashes and pedestrian crashes (all severities); or*
> 4. *The number of reported fatal-and-injury angle crashes and pedestrian crashes within a three-year period equals or exceeds the threshold number in Table IA-19-2 for fatal-and-injury angle crashes and pedestrian crashes.*

Table IA-19-1. Minimum Number of Reported Crashes in a One-Year Period

Number of through lanes on each approach		Total Angle and Pedestrian Crashes (all severities)		Total of Fatal-and-Injury Angle and Pedestrian Crashes	
Major Street	**Minor Street**	**Four Legs**	**Three Legs**	**Four Legs**	**Three Legs**
Urban Areas					
1	1	5	4	3	3
2 or more	1	5	4	3	3
2 or more	2 or more	5	4	3	3
1	2 or more	5	4	3	3
Rural Areas (major street speed >40 MPH or located in community with population < 10,000)					
1	1	4	3	3	3
2 or more	1	10	9	6	6
2 or more	2 or more	10	9	6	6
1	2 or more	4	3	3	3

Note: Angle crashes include all crashes that occur at an angle and involve one or more vehicles in the major street and one or more vehicles on the minor street.

Table IA-19-2. Minimum Number of Reported Crashes in a Three-Year Period

Number of through lanes on each approach		Total Angle and Pedestrian Crashes (all severities)		Total of Fatal-and-Injury Angle and Pedestrian Crashes	
Major Street	**Minor Street**	**Four Legs**	**Three Legs**	**Four Legs**	**Three Legs**
Urban					
1	1	6	6	4	4
2 or more	1	6	6	4	4
2 or more	2 or more	6	6	4	4
1	2 or more	6	6	4	4
Rural Areas (major street speed >40 MPH or located in community with population < 10,000)					
1	1	6	5	4	4
2 or more	1	16	13	9	9
2 or more	2 or more	16	13	9	9
1	2 or more	6	5	4	4

Note: Angle crashes include all crashes that occur at an angle and involve one or more vehicles in the major street and one or more vehicles on the minor street.

Appendix D: CMF Clearinghouse Reports

STUDY DETAILS

Study Title: Estimate of the Safety Effect of All-Way Stop Control Conversion in Washington, DC

Authors: Deng et al.

Publication Date: JUN, 2020

Abstract: This study evaluated safety effects associated with converting traditional stop control (TSC) to all-way stop control (AWSC) at 53 intersections in Washington, DC. Th utilized an observational treatment group and a randomly selected comparison group. Negative binomial regression modeling was used to estimate the effect of AWSC convers outcomes, control for confounding factors, and check its statistical significance. The study also examined potential covariates that could influence AWSC crash outcomes, such a of legs of the intersection and the functional classification of the intersecting roads. This study found an overall 36% reduction in all crashes and a 42% reduction in injury crashe with converting intersections from TSC to AWSC. In addition, the study revealed a statistically significant reduction in right-angle crashes along with a statistically significant in straight hit pedestrian crashes. For all the other collision types, including right turn, left turn, rear-end, sideswipes, and bicycle crashes, no statistically significant coefficients we With many "Vision Zero" cities considering increased use of AWSC to help achieve their safety goals, it is important to understand and communicate the safety effects of AWSC

Study Citation: Deng, Z., S. Kyrychenko, T. Lee, and R. Retting. "Estimate of the Safety Effect of All-Way Stop Control Conversion in Washington, DC". Transportation Research R 2674, Transportation Research Board of the National Academies of Science, Washington, D.C., (2020).

CMFS ASSOCIATED WITH THIS STUDY

CATEGORY: INTERSECTION TRAFFIC CONTROL

Countermeasure: Convert minor-road stop control to all-way stop control

CMF	CRF(%)	Quality	Crash Type	Crash Severity	Roadway Type	Area Type
0.64	36	★★★☆☆	All	All	Not specified	Not specified
0.58	42	★★★☆☆	All	K,A,B,C	Not specified	Not specified
1.1	-10	★★★☆☆	All	All	Not specified	Not specified
1.65	-65	★★★☆☆	All	K,A,B,C	Not specified	Not specified
0.57	43	★★★☆☆	All	All	Not specified	Not specified
0.46	54	★★★☆☆	All	K,A,B,C	Not specified	Not specified
1.08	-8	★★★☆☆	All	All	Major Collector	Not specified
1.99	-99	★★★☆☆	All	K,A,B,C	Major Collector	Not specified
0.78	22	★★★☆☆	All	All	Major Collector	Not specified
0.56	44	★★★☆☆	All	K,A,B,C	Major Collector	Not specified
0.4	60	★★★☆☆	All	All	Minor Arterial	Not specified
0.32	68	★★★☆☆	All	K,A,B,C	Minor Arterial	Not specified
0.43	57	★★★☆☆	All	All	Local	Not specified
0.4	60	★★★☆☆	All	K,A,B,C	Local	Not specified
0.81	19	★★★☆☆	All	All	Local	Not specified
0.86	14	★★★☆☆	All	K,A,B,C	Local	Not specified
0.7	30	★★★☆☆	All	All	All	Not specified
0.68	32	★★★☆☆	All	K,A,B,C	All	Not specified
0.36	64	★★★☆☆	All	All	All	Not specified
0.26	74	★★★☆☆	All	K,A,B,C	All	Not specified
1.46	-46	★★★☆☆	All	All	All	Not specified
1.68	-68	★★★☆☆	All	K,A,B,C	All	Not specified

0.51	49	★★★☆☆	All	All	All	Not specified
0.44	56	★★★☆☆	All	K,A,B,C	All	Not specified
0.22	78	★★★☆☆	All	All	All	Not specified
0.25	75	★★★☆☆	All	K,A,B,C	All	Not specified
0.69	31	★★★☆☆	All	All	All	Not specified
0.61	39	★★★☆☆	All	K,A,B,C	All	Not specified
0.17	83	★★★☆☆	Angle	All	Not specified	Not specified
1.25	-25	★★★☆☆	Right turn	All	Not specified	Not specified
0.78	22	★★★☆☆	Left turn	All	Not specified	Not specified
1.03	-3	★★★☆☆	Rear end	All	Not specified	Not specified
1.37	-37	★★★☆☆	Sideswipe	All	Not specified	Not specified
5.24	-424	★★★☆☆	Other	All	Not specified	Not specified
2.37	-137	★★★☆☆	Vehicle/pedestrian	All	Not specified	Not specified
1.29	-29	★★★☆☆	Vehicle/bicycle	All	Not specified	Not specified

This site is funded by the **U.S. Department of Transportation Federal Highway Administration** and maintained by the **University of North Carolina Highway Safety Research Center**

For more information, contact Karen Scurry at **karen.scurry@dot.gov**

The information contained in the Crash Modification Factors (CMF) Clearinghouse is disseminated under the sponsorship of the U.S. Department of Transportation in the interest of information exchange. The U.S. Government assumes no liability for the use of the information contained in the CMF Clearinghouse. The information contained in the CMF Clearinghouse does not constitute a standard, specification, or regulation, nor is it a substitute for sound engineering judgment.

STUDY DETAILS

Study Title: Evaluation of the Conversion from Two-Way Stop Sign Control to All-Way Stop Sign Control at 53 Locations in North Carolina

Authors: Simpson and Hummer

Publication Date: SEP, 2010

Abstract: Due to the perceived safety benefits, relative low cost, and ease of implementation of all-way stop control, there is growing interest in the conversion of intersections way to all-way stop control in North Carolina. However, there are few current, up-to-date studies quantifying their safety benefits, especially for higher speed rural locations or equipped with flashing beacons. The purpose of this project was to develop crash reduction factors for the conversion from two-way to all-way stop control at a diverse group o intersections that reflect North Carolina conditions and decision making. Other places with similar conditions might benefit from the findings as well. A total of 53 treatment sit urban, suburban, and rural areas were chosen for analysis in this project. The treatment locations were divided into three groups based upon presence of an overhead and/or sig flashing beacon. Group 1 consisted of 33 intersections without flashing beacons; Group 2 consisted of 8 intersections with flashing beacons in the before and after period; and G consisted of 8 intersections where the flashing beacon was installed with the all-way stop control. The results show a substantial decrease in total, injury, and frontal-impact cra after period when analyzing all locations and Groups 1, 2, and 3. The recommended crash reduction factors for conversion from two-way to all-way stop control are the factors c the empirical Bayes method with consideration for traffic increase. The recommended crash reduction factors from the overall group are a 68% reduction in total crashes, a 77% injury crashes, a 75% reduction in frontal-impact crashes, and a 15% reduction in "ran-stop-sign" crashes.

Study Citation: Simpson, C.L. and Hummer, J.E., "Evaluation of the Conversion from Two-Way Stop Sign Control to All-Way Stop Sign Control at 53 Locations in North Carolina." Transportation Safety and Security, Vol 2, No. 3, (2010) pp. 239-260.

CMFS ASSOCIATED WITH THIS STUDY

CATEGORY: INTERSECTION TRAFFIC CONTROL

Countermeasure: Convert minor-road stop control to all-way stop control

CMF	CRF(%)	Quality	Crash Type	Crash Severity	Roadway Type	Area Type
0.855	14.5	★★★☆☆	Angle	All	All	All
0.319	68.1	★★★☆☆	All	All	All	All
0.23	77	★★★☆☆	All	K,A,B,C	All	All
0.247	75.3	★★★☆☆	Angle,Head on,Left turn,Right turn	All	All	All

Countermeasure: Convert two-way (with flashing beacons) to all-way stop control (with flashing beacons)

CMF	CRF(%)	Quality	Crash Type	Crash Severity	Roadway Type	Area Type
0.667	33.3	★★☆☆☆	Angle	All	All	All
0.198	80.2	★★★☆☆	All	All	All	All
0.135	86.5	★★★☆☆	All	K,A,B,C	All	All
0.156	84.4	★★★☆☆	Angle,Head on,Left turn,Right turn	All	All	All

Countermeasure: Convert two-way (without flashing beacons) to all-way stop control (with flashing beacons)

CMF	CRF(%)	Quality	Crash Type	Crash Severity	Roadway Type	Area Type
0.601	39.9	★★★☆☆	Angle	All	All	All
0.183	81.7	★★★☆☆	All	All	All	All
0.134	86.6	★★★☆☆	All	K,A,B,C	All	All
0.143	85.7	★★★☆☆	Angle,Head on,Left turn,Right turn	All	All	All

Countermeasure: Convert two-way (without flashing beacons) to all-way stop control (without flashing beacons)

CMF	CRF(%)	Quality	Crash Type	Crash Severity	Roadway Type	Area Type
0.943	5.7	★★☆☆☆	Angle	All	All	All
0.393	60.7	★★★☆☆	All	All	All	All
0.276	72.4	★★★☆☆	All	K,A,B,C	All	All
0.299	70.1	★★★☆☆	Angle,Head on,Left turn,Right turn	All	All	All

This site is funded by the **U.S. Department of Transportation Federal Highway Administration** and maintained by the **University of North Carolina Highway Safety Research Center**

For more information, contact Karen Scurry at **karen.scurry@dot.gov**

The information contained in the Crash Modification Factors (CMF) Clearinghouse is disseminated under the sponsorship of the U.S. Department of Transportation in the interest of information exchange. The U.S. Government assumes no liability for the use of the information contained in the CMF Clearinghouse. The information contained in the CMF Clearinghouse does not constitute a standard, specification, or regulation, nor is it a substitute for sound engineering judgment.

Appendix E: Empirical Bayes Summary

Empirical Bayes Summary

Int #	Intersection	Before												
		$N_{expected\ T,B}$			$N_{predicted\ T,B}$			Crashes (Observed)						
								# of Crashes				Annual Crash Average ($N_{observed\ T,B}$)		
		Total	Fatal/Inj	PDO	Total	Fatal/Inj	PDO	# of years	Total	Fatal/Inj	PDO	Total	Fatal/Inj	PDO
1	K322 (Delaware Ave) and K9 (Woodland Beach Rd) / Beach Ave	0.390	0.168	0.222	0.365	0.157	0.208	3	2	1	1	0.667	0.333	0.333
2	K241 (Peach Basket Rd) and K240 (Turkey Point Rd)	3.104	1.338	1.766	2.258	0.973	1.285	3	14	5	9	4.667	1.667	3.000
3	K371 (Barratts Chapel Rd) and K381 (Fox Chase Rd)	2.162	0.932	1.230	1.125	0.485	0.640	3	18	10	8	6.000	3.333	2.667
4	N53 (Thompson Station Rd) and N301 (Pleasant Hill Rd) / N302 (Hopkins Rd)	7.351	3.168	4.183	4.093	1.764	2.329	3	32	15	17	10.667	5.000	5.667
5	S326 (Bethesda Rd) and S86 (Avenue of Honor)	1.685	0.726	0.959	1.207	0.520	0.687	3	10	6	4	3.333	2.000	1.333
6	S326 (Bethesda Rd) and S432 (Governor Stockley Rd)	1.007	0.434	0.573	0.813	0.350	0.463	3	6	2	4	2.000	0.667	1.333
7	S38 (Clendaniel Pond Rd) and S224 (Fleatown Rd)	1.896	0.817	1.079	1.259	0.543	0.717	3	12	4	8	4.000	1.333	2.667
8	S46 (Old Furnace Rd) and S535 (Middleford Rd)	7.834	3.251	4.583	2.891	1.200	1.691	3	33	8	25	11.000	2.667	8.333
9	S47 (Johnson Rd) and S290 (Hurdle Ditch Rd)	1.911	0.824	1.088	1.005	0.433	0.572	3	17	6	11	5.667	2.000	3.667
10	S62 (East Trap Pond Rd) and S329 (W. Piney Grove Rd / Whaleys Corner Rd)	1.711	0.737	0.973	0.811	0.350	0.461	3	19	9	10	6.333	3.000	3.333
11	S750 (Shockley Town Rd) and S920 (Gum Rd)	1.409	0.607	0.802	0.914	0.394	0.520	3	11	3	8	3.667	1.000	2.667
12	SR 30 (Gravel Hill Rd) and S47 (Springfield Rd / Johnson Rd)	3.420	1.474	1.946	3.229	1.392	1.837	3	11	5	6	3.667	1.667	2.000
13	SR 30 (Whitesville Rd) and S66 (Pepperbox Rd)	1.363	0.587	0.776	1.106	0.477	0.629	3	7	4	3	2.333	1.333	1.000
14	SR 30 (Whitesville Rd) and S68 (Old Stage Rd)	1.825	0.787	1.038	1.897	0.818	1.079	3	5	3	2	1.667	1.000	0.667
15	SR 5 (Harbeson Rd) and S292 (Forest Rd) / Anderson Corner Rd	3.888	1.676	2.212	2.039	0.879	1.160	3	23	10	13	7.667	3.333	4.333
16	K103 (Hourglass Rd) and K182 (Slaughter Station Rd)	1.643	0.708	0.935	0.910	0.392	0.518	3	15	8	7	5.000	2.667	2.333
17	N216 (Rockwood Rd) and N217 (Miller Rd)	0.711	0.259	0.452	0.587	0.202	0.385	3	3	1	2	1.000	0.333	0.667
18	N243 (Old Kennett Rd) and N246 (Center Mill Rd)	2.024	0.872	1.152	1.181	0.509	0.672	3	15	8	7	5.000	2.667	2.333
19	S270A (Munchy Branch Rd) and Field Lane / Shady Ridge Dr	0.793	0.284	0.510	0.766	0.254	0.512	3	2	1	1	0.667	0.333	0.333
20	S48 (Zoar Rd) and S317 (Peterkins Rd)	3.221	1.140	2.081	1.244	0.428	0.817	3	23	10	13	7.667	3.333	4.333
21	SR 5 (Indian Mission Rd) and S302 (Harmons Hill Rd / Phillips Branch Rd)	3.678	1.585	2.093	3.178	1.370	1.808	3	13	3	10	4.333	1.000	3.333
22	SR 30 (Cedar Creek Rd) and S38 (Jefferson Rd / Sylvan Acres Rd)	3.461	1.492	1.969	1.794	0.773	1.021	3	22	6	16	7.333	2.000	5.333
23	K388 (Canterbury Rd) and K404 (Church Hill Rd)	3.861	1.664	2.197	2.106	0.908	1.198	3	22	10	12	7.333	3.333	4.000
24	SR 30 (Cedar Creek Rd) and S207 (Johnson Rd)	5.655	2.437	3.217	3.813	1.643	2.170	3	23	11	12	7.667	3.667	4.000
25	S410 (Godwin School Rd) and S433 (Country Living Rd)	0.577	0.249	0.328	0.489	0.211	0.278	3	4	2	2	1.333	0.667	0.667
26	K49 (Hartly Rd / Main St) and K182 (Slaughter Station Rd)	1.168	0.485	0.683	0.920	0.382	0.538	3	5	3	2	1.667	1.000	0.667
27	S431 (Shortly Rd) and S329 (Piney Grove Rd)	2.297	0.990	1.307	1.839	0.793	1.047	3	10	4	6	3.333	1.333	2.000
28	SR 14 (Milford Harrington Hwy) and K384 (Killens Pond Rd)	5.447	2.348	3.099	3.378	1.456	1.922	3	24	8	16	8.000	2.667	5.333
29	S280 (Stockley Rd) and S290 (Cool Spring Rd)	0.689	0.297	0.392	0.421	0.182	0.240	3	10	8	2	3.333	2.667	0.667
30	S88 (Cave Neck Rd) and S258 (Hudson Rd)	6.903	2.975	3.928	2.345	1.011	1.334	3	45	16	29	15.000	5.333	9.667
31	S52 (Roxana Rd) and S370 (Daisey Rd)	3.831	1.651	2.180	2.992	1.289	1.702	3	15	8	7	5.000	2.667	2.333
32	SR 30 (Gravel Hill Rd) and S319 (Sand Hill Rd)	5.643	2.432	3.211	2.993	1.290	1.703	3	28	11	17	9.333	3.667	5.667
33	S46 (Old Furnace Rd) and S529 (Cokesbury Rd)	4.301	1.785	2.516	2.476	1.027	1.448	3	17	4	13	5.667	1.333	4.333
34	US13A (Seaford Rd) and S485 (Oneals Rd)	5.106	2.201	2.905	3.328	1.434	1.893	3	22	12	10	7.333	4.000	3.333
35	S546 (Conrail Rd) and S544 (Hearns Pond Rd)	1.245	0.537	0.708	0.928	0.400	0.528	3	8	1	7	2.667	0.333	2.333
36	SR 54 (Lighthouse Rd) and S387 (Hudson Rd)	3.541	1.526	2.015	3.727	1.606	2.121	3	10	3	7	3.333	1.000	2.333
37	N25 (Caldwell Corner Rd) and N459 (Grears Corner Rd)	1.967	0.848	1.119	1.255	0.541	0.714	3	13	4	9	4.333	1.333	3.000
38	S386 (Polly Branch Rd) and Creekview Cir	0.102	0.042	0.059	0.107	0.045	0.063	3	0	0	0	0.000	0.000	0.000
39	SR 18 (Cannon Rd) and (Wesley Church Rd)	2.735	1.179	1.556	1.977	0.852	1.125	3	13	8	5	4.333	2.667	1.667
40	SR 20 (Hardscrabble Rd) and S446 (Beaver Dam Branch Rd)	2.702	1.164	1.537	1.941	0.837	1.105	3	13	9	4	4.333	3.000	1.333
41	N486 (Duck Creek Rd) and N47 (Vandyke Greenspring Rd)	1.287	0.534	0.753	1.524	0.632	0.891	3	3	0	3	1.000	0.000	1.000
42	S299 (Bay Farm Rd) and S298 (School Ln)	1.611	0.669	0.943	1.332	0.553	0.779	3	6	0	6	2.000	0.000	2.000
43	SR 20 (Hardscrabble Rd) and S62 (E Trap Pond Rd)	3.239	1.396	1.843	2.412	1.040	1.373	3	14	7	7	4.667	2.333	2.333
44	SR 20 (Hardscrabble Rd) and S431 (Conaway Rd / Shortly Rd)	6.808	2.934	3.874	4.239	1.827	2.412	3	28	11	17	9.333	3.667	5.667
45	SR 20 (Hardscrabble Rd) and S432 (Gov Stockley Rd / Cross Key Rd)	5.497	2.369	3.128	3.435	1.480	1.954	3	24	12	12	8.000	4.000	4.000
46	S48 (Zoar Rd) and S321 (Wood Branch Rd)	6.111	2.634	3.477	2.712	1.169	1.543	3	34	6	28	11.333	2.000	9.333
47	SR 17 (Roxana Rd) and S365 (Peppers Corner Rd / Powell Farm Rd)	4.485	1.933	2.552	3.289	1.417	1.871	3	18	8	10	6.000	2.667	3.333
48	SR 17 (Roxana Rd) and S392 (Gum Rd)	5.114	2.204	2.910	3.726	1.606	2.120	3	20	2	18	6.667	0.667	6.000
49	US13A (Seaford Rd) and S493 (Bethel Rd)	3.955	1.705	2.251	2.285	0.985	1.300	3	21	12	9	7.000	4.000	3.000
50	S78 (Woodland Ferry Rd) and S493 (Bethel Rd)	2.364	1.019	1.345	1.918	0.827	1.092	3	10	6	4	3.333	2.000	1.333
51	K401 (Bowman Rd) and K404 (Church Hill Rd)	1.825	0.787	1.038	0.991	0.427	0.564	3	16	1	15	5.333	0.333	5.000
52	SR 10A (Henry Cowgill Rd) and K246 (Berrytown Rd)	1.657	0.714	0.943	1.334	0.575	0.759	3	8	2	6	2.667	0.667	2.000
53	SR 9 (Denny St) and K14 (2nd St)	0.449	0.154	0.294	0.484	0.152	0.331	3	0	0	0	0.000	0.000	0.000

Empirical Bayes Summary

Int #	Intersection	Before												
		$N_{expected\ T,B}$			$N_{predicted\ T,B}$			Crashes (Observed)						
								# of Crashes				Annual Crash Average ($N_{observed\ T,B}$)		
		Total	Fatal/Inj	PDO	Total	Fatal/Inj	PDO	# of years	Total	Fatal/Inj	PDO	Total	Fatal/Inj	PDO
54	S61 (Lowes Crossing Rd) and S421 (Careys Camp Rd)	1.539	0.663	0.876	0.968	0.417	0.551	3	12	5	7	4.000	1.667	2.333
55	K59 (Whiteleysburg Rd) and K455 (Fox Hunters Rd)	1.103	0.475	0.627	0.802	0.346	0.456	3	8	1	7	2.667	0.333	2.333
56	S224 (Fleatown Rd) and S213 (Old State Rd)	2.261	0.975	1.287	1.302	0.561	0.741	3	16	8	8	5.333	2.667	2.667
57	S18 (Federalsburg Rd) and S30 (Atlanta Rd)	4.262	1.837	2.425	3.621	1.561	2.060	3	15	8	7	5.000	2.667	2.333
58	S432 (Governor Stockley Rd) and S329 (Piney Grove Rd)	1.614	0.696	0.918	1.477	0.637	0.841	3	6	1	5	2.000	0.333	1.667
59	K193 (Old North Rd) and K53 (Caesar Rodney Ave)	1.537	0.550	0.987	1.131	0.383	0.749	3	7	1	6	2.333	0.333	2.000
60	S461 (Old Stage Rd) and S462 (Trussum Pond Rd)	1.485	0.640	0.845	1.234	0.532	0.702	3	7	3	4	2.333	1.000	1.333
61	S30 (Atlanta Rd) and S543 (Ross Station Rd)	3.711	1.600	2.112	4.953	2.135	2.818	3	8	1	7	2.667	0.333	2.333
62	K096 (Downs Chapel Rd) and K093 (Pearsons Grove Rd)	0.194	0.081	0.114	0.155	0.064	0.091	3	2	0	2	0.667	0.000	0.667
63	S277 (Robinsonville Rd) and S283 (Cedar Grove Rd)	2.338	0.970	1.368	2.861	1.187	1.673	3	6	1	5	2.000	0.333	1.667
64	S285 (Beaver Dam Rd) and S261 (Dairy Farm Rd)	7.101	2.947	4.154	2.768	1.149	1.619	3	30	3	27	10.000	1.000	9.000
65	SR 15 (Canterbury Rd) and K371 (Barratts Chapel Road / Plymouth Road)	4.317	1.861	2.456	2.760	1.190	1.571	3	20	5	15	6.667	1.667	5.000
66	S46 (Old Furnace Rd) and S525 (Coverdale Road / King Rd)	3.525	1.519	2.006	3.696	1.593	2.103	3	10	4	6	3.333	1.333	2.000
67	SR 9 (Main St) and K89 (Port Mahon Rd)	0.429	0.146	0.283	0.417	0.130	0.286	3	1	1	0	0.333	0.333	0.000
68	K368 (Millchop Ln) and K369 (Autumn Moon Ln)	1.046	0.451	0.595	0.712	0.307	0.405	3	9	3	6	3.000	1.000	2.000
69	S365 (Powell Farm Rd) and S353 (Burbage Rd)	2.333	1.006	1.328	1.576	0.679	0.897	3	13	3	10	4.333	1.000	3.333
70	SR 5 (Harbeson Rd) and Chestnut St / Shingle Point Rd	4.049	1.745	2.304	3.790	1.633	2.156	3	13	3	10	4.333	1.000	3.333
71	S361 (Muddy Neck Rd / Kent Ave) and S363 (Double Bridges Rd)	1.924	0.798	1.125	1.847	0.767	1.081	3	6	0	6	2.000	0.000	2.000
72	S363 (Double Bridges Rd) and S362 (Parker House Rd)	0.967	0.333	0.634	0.746	0.241	0.505	3	5	1	4	1.667	0.333	1.333
73	N423 (Bayview Rd) and N37 (Vance Neck Rd)	1.862	0.803	1.060	1.169	0.504	0.665	3	13	1	12	4.333	0.333	4.000
74	K90 (Sunnyside Rd) and K147 (Hillyard Rd)	3.318	1.430	1.888	2.236	0.964	1.272	3	12	7	5	4.000	2.333	1.667
75	S22 (Federal St) and S197 (Mulberry St) / S88 (Wharton St)	1.123	0.422	0.701	1.346	0.464	0.883	3	1	1	0	0.333	0.333	0.000
76	S88 (Atlantic St / Wharton St) and Chestnut St	0.666	0.234	0.432	0.689	0.222	0.466	3	3	0	3	1.000	0.000	1.000
	Total	**211.364**	**89.908**	**121.455**	**143.644**	**60.923**	**82.720**		**1020**	**378**	**642**	**340.000**	**126.000**	**214.000**

Empirical Bayes Summary

Int #	Intersection	After									CMF		
		$N_{predicted\ T,A}$			Crashes (Observed)								
					# of Crashes			Annual Crash Average ($N_{observed\ T,A}$)					
		Total	Fatal/Inj	PDO	# of Years	Total	Fatal/Inj	PDO	Total	Fatal/Inj	PDO	Total	Fatal/Inj	PDO
1	K322 (Delaware Ave) and K9 (Woodland Beach Rd) / Beach Ave	0.183	0.079	0.104	3	0	0	0	0.000	0.000	0.000	0.000	0.000	0.000
2	K241 (Peach Basket Rd) and K240 (Turkey Point Rd)	2.750	1.185	1.565	3	1	0	1	0.333	0.000	0.333	0.079	0.000	0.134
3	K371 (Barratts Chapel Rd) and K381 (Fox Chase Rd)	1.031	0.444	0.586	3	2	0	2	0.667	0.000	0.667	0.307	0.000	0.479
4	N53 (Thompson Station Rd) and N301 (Pleasant Hill Rd) / N302 (Hopkins Rd)	4.213	1.816	2.397	3	9	1	8	3.000	0.333	2.667	0.372	0.090	0.547
5	S326 (Bethesda Rd) and S86 (Avenue of Honor)	1.402	0.604	0.797	3	2	0	2	0.667	0.000	0.667	0.301	0.000	0.416
6	S326 (Bethesda Rd) and S432 (Governor Stockley Rd)	0.988	0.426	0.562	3	3	1	2	1.000	0.333	0.667	0.703	0.393	0.784
7	S38 (Clendaniel Pond Rd) and S224 (Fleatown Rd)	1.197	0.516	0.681	3	0	0	0	0.000	0.000	0.000	0.000	0.000	0.000
8	S46 (Old Furnace Rd) and S535 (Middleford Rd)	2.347	0.974	1.373	3	26	9	17	8.667	3.000	5.667	1.264	0.795	1.391
9	S47 (Johnson Rd) and S290 (Hurdle Ditch Rd)	0.999	0.431	0.569	3	0	0	0	0.000	0.000	0.000	0.000	0.000	0.000
10	S62 (East Trap Pond Rd) and S329 (W. Piney Grove Rd / Whaleys Corner Rd)	0.704	0.303	0.400	3	7	0	7	2.333	0.000	2.333	1.436	0.000	2.336
11	S750 (Shockley Town Rd) and S920 (Gum Rd)	0.836	0.360	0.475	3	3	0	3	1.000	0.000	1.000	0.688	0.000	1.172
12	SR 30 (Gravel Hill Rd) and S47 (Springfield Rd / Johnson Rd)	3.757	1.619	2.138	3	10	1	9	3.333	0.333	3.000	0.743	0.162	0.986
13	SR 30 (Whitesville Rd) and S66 (Pepperbox Rd)	1.101	0.475	0.627	3	1	0	1	0.333	0.000	0.333	0.213	0.000	0.286
14	SR 30 (Whitesville Rd) and S68 (Old Stage Rd)	1.954	0.842	1.112	3	2	1	1	0.667	0.333	0.333	0.303	0.525	0.284
15	SR 5 (Harbeson Rd) and S292 (Forest Rd) / Anderson Corner Rd	2.290	0.987	1.303	3	4	1	3	1.333	0.333	1.000	0.282	0.148	0.350
16	K103 (Hourglass Rd) and K182 (Slaughter Station Rd)	1.022	0.440	0.581	3	2	0	2	0.667	0.000	0.667	0.326	0.000	0.510
17	N216 (Rockwood Rd) and N217 (Miller Rd)	0.352	0.128	0.224	3	1	0	1	0.333	0.000	0.333	0.550	0.000	0.831
18	N243 (Old Kennett Rd) and N246 (Center Mill Rd)	1.521	0.655	0.865	3	2	0	2	0.667	0.000	0.667	0.231	0.000	0.359
19	S270A (Munchy Branch Rd) and Field Lane / Shady Ridge Dr	0.350	0.109	0.240	3	3	1	2	1.000	0.333	0.667	4.235	1.178	2.721
20	S48 (Zoar Rd) and S317 (Peterkins Rd)	1.141	0.388	0.753	3	10	1	9	3.333	0.333	3.000	1.031	0.266	1.333
21	SR 5 (Indian Mission Rd) and S302 (Harmons Hill Rd / Phillips Branch Rd)	5.309	2.288	3.021	3	26	2	24	8.667	0.667	8.000	1.262	0.398	2.101
22	SR 30 (Cedar Creek Rd) and S38 (Jefferson Rd / Sylvan Acres Rd)	3.721	1.604	2.117	3	10	3	7	3.333	1.000	2.333	0.427	0.232	0.514
23	K388 (Canterbury Rd) and K404 (Church Hill Rd)	5.191	2.237	2.954	3	16	1	15	5.333	0.333	5.000	0.516	0.068	0.794
24	SR 30 (Cedar Creek Rd) and S207 (Johnson Rd)	4.129	1.780	2.349	3	20	5	15	6.667	1.667	5.000	1.004	0.544	1.218
25	S410 (Godwin School Rd) and S433 (Country Living Rd)	1.011	0.436	0.575	3	1	0	1	0.333	0.000	0.333	0.236	0.000	0.352
26	K49 (Hartly Rd / Main St) and K182 (Slaughter Station Rd)	0.671	0.278	0.392	3	2	0	2	0.667	0.000	0.667	0.610	0.000	0.505
27	S431 (Shortly Rd) and S329 (Piney Grove Rd)	1.787	0.770	1.017	3	6	0	6	2.000	0.000	2.000	0.791	0.000	1.303
28	SR 14 (Milford Harrington Hwy) and K384 (Killens Pond Rd)	3.548	1.529	2.019	3	24	9	15	8.000	3.000	5.000	1.292	0.926	1.382
29	S280 (Stockley Rd) and S290 (Cool Spring Rd)	1.585	0.683	0.902	3	5	0	5	1.667	0.000	1.667	0.567	0.000	0.592
30	S88 (Cave Neck Rd) and S258 (Hudson Rd)	5.443	2.346	3.097	3	12	2	10	4.000	0.667	3.333	0.237	0.084	0.339
31	S52 (Roxana Rd) and S370 (Daisey Rd)	2.320	1.000	1.320	3	11	1	10	3.667	0.333	3.333	1.113	0.225	1.464
32	SR 30 (Gravel Hill Rd) and S319 (Sand Hill Rd)	2.971	1.281	1.691	3	16	3	13	5.333	1.000	4.333	0.886	0.346	1.215
33	S46 (Old Furnace Rd) and S529 (Cokesbury Rd)	2.357	0.978	1.379	3	8	1	7	2.667	0.333	2.333	0.575	0.082	0.849
34	US13A (Seaford Rd) and S485 (Oneals Rd)	2.421	1.043	1.377	3	12	1	11	4.000	0.333	3.667	0.991	0.183	1.397
35	S546 (Conrail Rd) and S544 (Hearns Pond Rd)	1.267	0.546	0.721	3	4	1	3	1.333	0.333	1.000	0.685	-0.162	0.907
36	SR 54 (Lighthouse Rd) and S387 (Hudson Rd)	4.380	1.888	2.492	3	6	3	3	2.000	1.000	1.000	0.424	0.513	0.561
37	N25 (Caldwell Corner Rd) and N459 (Grears Corner Rd)	1.583	0.682	0.901	3	2	2	0	0.667	0.667	0.000	0.240	0.428	0.000
38	S386 (Polly Branch Rd) and Creekview Cir	0.105	0.044	0.061	2	0	0	0	0.000	0.000	0.000	0.000	0.000	0.000
39	SR 18 (Cannon Rd) and (Wesley Church Rd)	2.370	1.022	1.349	2	5	1	4	2.500	0.500	2.000	0.682	0.307	0.709
40	SR 20 (Hardscrabble Rd) and S446 (Beaver Dam Branch Rd)	1.902	0.820	1.082	2	7	1	6	3.500	0.500	3.000	1.183	0.388	0.893
41	N486 (Duck Creek Rd) and N47 (Vandyke Greenspring Rd)	2.053	0.852	1.201	2	5	0	5	2.500	0.000	2.500	1.067	0.000	-3.560
42	S299 (Bay Farm Rd) and S298 (School Ln)	1.606	0.667	0.940	2	1	0	1	0.500	0.000	0.500	0.204	0.000	0.385
43	SR 20 (Hardscrabble Rd) and S62 (E Trap Pond Rd)	3.066	1.322	1.745	2	5	0	5	2.500	0.000	2.500	0.545	0.000	0.843
44	SR 20 (Hardscrabble Rd) and S431 (Conaway Rd / Shortly Rd)	3.393	1.462	1.931	2	8	2	6	4.000	1.000	3.000	0.683	0.353	0.867
45	SR 20 (Hardscrabble Rd) and S432 (Gov Stockley Rd / Cross Key Rd)	4.846	2.089	2.758	2	4	1	3	2.000	0.500	1.500	0.238	0.130	0.287
46	S48 (Zoar Rd) and S321 (Wood Branch Rd)	2.991	1.289	1.702	2	4	1	3	2.000	0.500	1.500	0.279	0.103	0.365
47	SR 17 (Roxana Rd) and S365 (Peppers Corner Rd / Powell Farm Rd)	2.990	1.288	1.701	2	4	0	4	2.000	0.000	2.000	0.447	0.000	0.729
48	SR 17 (Roxana Rd) and S392 (Gum Rd)	6.562	2.828	3.734	2	3	1	2	1.500	0.500	1.000	0.152	0.181	0.182
49	US13A (Seaford Rd) and S493 (Bethel Rd)	2.581	1.112	1.468	2	8	2	6	4.000	1.000	3.000	0.822	0.456	0.946
50	S78 (Woodland Ferry Rd) and S493 (Bethel Rd)	1.485	0.640	0.845	2	0	0	0	0.000	0.000	0.000	0.000	0.000	0.000
51	K401 (Bowman Rd) and K404 (Church Hill Rd)	2.307	0.994	1.313	2	4	1	3	2.000	0.500	1.500	0.426	-0.070	0.562
52	SR 10A (Henry Cowgill Rd) and K246 (Berrytown Rd)	1.128	0.486	0.642	2	4	0	4	2.000	0.000	2.000	1.245	0.000	2.167
53	SR 9 (Denny St) and K14 (2nd St)	0.526	0.167	0.359	2	3	1	2	1.500	0.500	1.000	2.649	3.262	2.270

Empirical Bayes Summary

Int #	Intersection	After									CMF		
		$N_{predicted\ T,A}$			Crashes (Observed)								
					# of Crashes			Annual Crash Average ($N_{observed\ T,A}$)					
		Total	Fatal/Inj	PDO	# of Years	Total	Fatal/Inj	PDO	Total	Fatal/Inj	PDO	Total	Fatal/Inj	PDO
54	S61 (Lowes Crossing Rd) and S421 (Careys Camp Rd)	1.187	0.512	0.675	2	2	0	2	1.000	0.000	1.000	0.472	0.000	0.770
55	K59 (Whiteleysburg Rd) and K455 (Fox Hunters Rd)	0.623	0.269	0.355	2	3	0	3	1.500	0.000	1.500	1.526	0.000	2.684
56	S224 (Fleatown Rd) and S213 (Old State Rd)	1.815	0.782	1.033	2	5	0	5	2.500	0.000	2.500	0.717	0.000	1.142
57	S18 (Federalsburg Rd) and S30 (Atlanta Rd)	3.975	1.713	2.262	2	6	2	4	3.000	1.000	2.000	0.578	0.437	0.484
58	S432 (Governor Stockley Rd) and S329 (Piney Grove Rd)	2.136	0.921	1.215	2	3	0	3	1.500	0.000	1.500	0.553	0.000	1.025
59	K193 (Old North Rd) and K53 (Caesar Rodney Ave)	0.915	0.301	0.614	2	5	2	3	2.500	1.000	1.500	1.649	-0.449	1.553
60	S461 (Old Stage Rd) and S462 (Trussum Pond Rd)	0.606	0.261	0.345	2	3	0	3	1.500	0.000	1.500	1.783	0.000	2.851
61	S30 (Atlanta Rd) and S543 (Ross Station Rd)	3.592	1.548	2.044	2	3	0	3	1.500	0.000	1.500	0.486	0.000	0.580
62	K096 (Downs Chapel Rd) and K093 (Pearsons Grove Rd)	0.075	0.031	0.044	2	0	0	0	0.000	0.000	0.000	0.000	0.000	0.000
63	S277 (Robinsonville Rd) and S283 (Cedar Grove Rd)	3.187	1.323	1.865	1	1	0	1	1.000	0.000	1.000	0.305	0.000	0.019
64	S285 (Beaver Dam Rd) and S261 (Dairy Farm Rd)	4.042	1.677	2.365	1	4	1	3	4.000	1.000	3.000	0.356	-0.075	0.457
65	SR 15 (Canterbury Rd) and K371 (Barratts Chapel Road / Plymouth Road)	2.675	1.153	1.522	1	2	0	2	2.000	0.000	2.000	0.438	0.000	0.760
66	S46 (Old Furnace Rd) and S525 (Coverdale Road / King Rd)	2.878	1.240	1.638	1	7	2	5	7.000	2.000	5.000	2.250	1.425	2.178
67	SR 9 (Main St) and K89 (Port Mahon Rd)	0.423	0.133	0.290	1	2	0	2	2.000	0.000	2.000	6.952	0.000	6.721
68	K368 (Millchop Ln) and K369 (Autumn Moon Ln)	0.689	0.297	0.392	1	0	0	0	0.000	0.000	0.000	0.000	0.000	0.000
69	S365 (Powell Farm Rd) and S353 (Burbage Rd)	1.569	0.676	0.893	1	0	0	0	0.000	0.000	0.000	0.000	0.000	0.000
70	SR 5 (Harbeson Rd) and Chestnut St / Shingle Point Rd	4.536	1.955	2.581	1	1	0	1	1.000	0.000	1.000	0.185	0.000	0.344
71	S361 (Muddy Neck Rd / Kent Ave) and S363 (Double Bridges Rd)	3.188	1.323	1.865	1	0	0	0	0.000	0.000	0.000	0.000	0.000	0.000
72	S363 (Double Bridges Rd) and S362 (Parker House Rd)	1.038	0.349	0.689	1	0	0	0	0.000	0.000	0.000	0.000	0.000	0.000
73	N423 (Bayview Rd) and N37 (Vance Neck Rd)	1.669	0.719	0.949	1	2	0	2	2.000	0.000	2.000	0.673	0.000	1.189
74	K90 (Sunnyside Rd) and K147 (Hillyard Rd)	3.242	1.397	1.845	1	5	1	4	5.000	1.000	4.000	0.877	0.390	0.800
75	S22 (Federal St) and S197 (Mulberry St) / S88 (Wharton St)	1.555	0.545	1.010	1	3	0	3	3.000	0.000	3.000	1.933	0.000	2.891
76	S88 (Atlantic St / Wharton St) and Chestnut St	0.750	0.245	0.505	1	0	0	0	0.000	0.000	0.000	0.000	0.000	0.000
	Total	**166.107**	**70.605**	**95.502**		**391**	**69**	**322**	**164.167**	**28.167**	**136.000**			