Roundabout Illumination and Safety

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Overview

Roundabouts have been shown to offer safety benefits over conventional designs under a wide range of circumstances in both urban and rural settings. At least 21 states in the US, including Georgia, have active roundabout programs. U.S. National guidelines for roundabout design recommend illuminating roundabouts in all environments. In rural areas, where the costs of providing lighting are proportionately higher, this illumination requirement may preclude the installation of a roundabout that is otherwise safer than a stop-controlled intersection. This study evaluates the link between roundabout illumination, safety, and cost.

Data Collection

Crash data was collected for all of Georgia and Minnesota. The GA data is from 2000 to 2010, lacks intersection illumination information, and covers all road types. The MN data was obtained for 2003 to 2010 from the Highway Safety Information System, includes multi-level illumination categories, but covers only state roads.

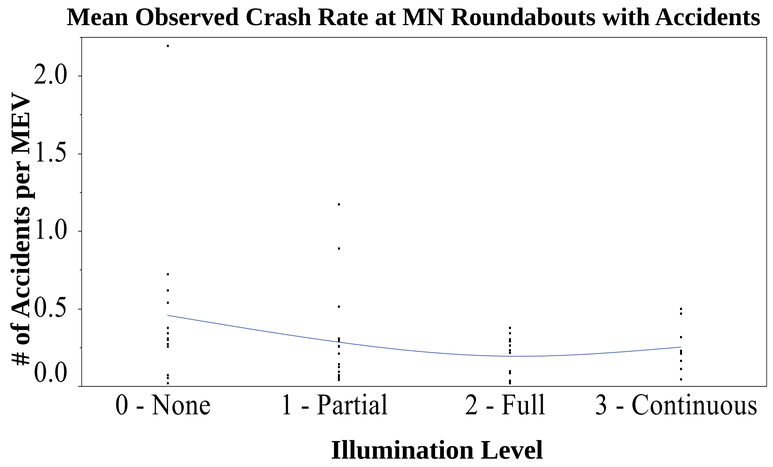
Methodology

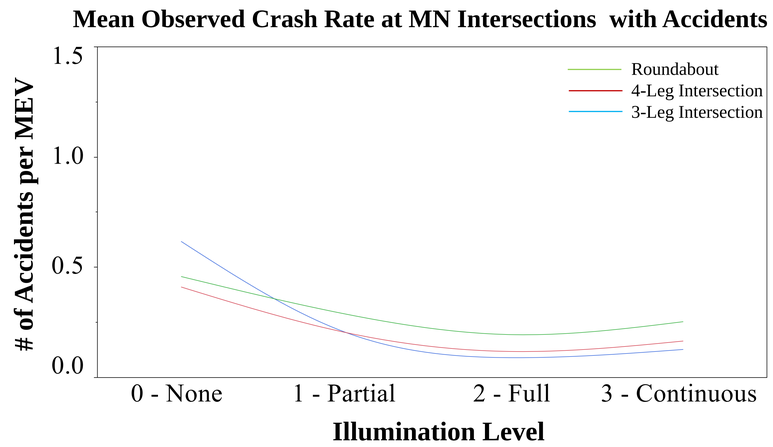
Analysis of the data from MN has been concluded and current efforts are focused on application of the results to GA. Synthesize of the information in the MN data files was done in three analysis steps. Step 1 involved using historical sunrise and sunset data to identify night and day crashes and matching crashes to intersections within a buffer radius of 325 ft. Historical.

In Step 2, the annual entering volume of each intersection was computed with an assumption of 50/50 split of AADT on bi-directional approaches. Each approach was also matched to the roadway file to determine those that are one-way in direction. One-way legs were assigned full AADT.

Step 3, calculated the observed crash rate for each intersection with an accident within a year. This rate was normalized by one million vehicles.

Results

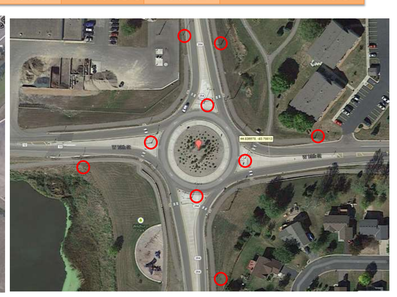




Observed Crash Rate at MN Roundabouts with Accidents

Illumination Level	None	Partial	Full	Continuous
# of Roundabout Intersections	14	17	12	9
# of Roundabout Crashes	37	62	41	95
Mean (Observed Crash Rate)	0.458	0.285	0.193	0.254
Std. Dev. (Observed Crash Rate)	0.540	0.311	0.131	0.152
Incremental % Reduction in Observed in Crash Rate		38%	32%	-32%
85th Percentile	0.698	0.628	0.346	0.486
50th Percentile	0.309	0.216	0.227	0.227
25th Percentile	0.212	0.070	0.053	0.139
15th Percentile	0.062	0.058	0.027	0.081

Typical Roundabout "Partial" Illumination Layout in MN



Typical Roundabout "Full" Illumination Layout in MN

Observed Crash Rate at MN 4-Leg Intersections with Accidents

Illumination Level	None	Partial	Full	Continuous
# of 4-Leg Intersections	1110	1088	1175	936
# of 4-Leg Intersection Crashes	1513	1642	1961	1727
Mean (Observed Crash Rate)	0.411	0.202	0.118	0.166
Std. Dev. (Observed Crash Rate)	0.584	0.242	0.104	0.148
Incremental % Reduction in Observed in Crash Rate		51%	41%	-40%
85th Percentile	0.687	0.317	0.205	0.300
50th Percentile	0.232	0.137	0.089	0.133
25th Percentile	0.129	0.078	0.053	0.056
15th Percentile	0.054	0.054	0.039	0.031

Observed Crash Rate at MN 3-Leg Intersections with Accidents

Illumination Level	None	Partial	Full	Continuous
# of 3-Leg Intersections	768	381	376	314
# of 3-Leg Intersection Crashes	841	427	427	370
Mean (Observed Crash Rate)	0.618	0.200	0.090	0.127
Std. Dev. (Observed Crash Rate)	0.813	0.240	0.084	0.214
Incremental % Reduction in Observed in Crash Rate		68%	55%	-42%
85th Percentile	1.215	0.332	0.159	0.226
50th Percentile	0.305	0.132	0.066	0.072
25th Percentile	0.163	0.066	0.029	0.025
15th Percentile	0.124	0.039	0.022	0.019

Summary

We have analyzed roundabout crash and illumination experience in MN, a state with a longer established roundabout program. We are currently working to apply findings to Georgia.

At this stage, the study finds that there is a safety benefit to providing illumination at roundabouts. About half of this benefit can be realized by "Partial" illuminating unlit roundabouts. The other half of the safety benefits can be obtained by providing "Full" illumination to previously "Partial" illuminated roundabouts.

Even more significantly, the study finds that the there is no incremental safety benefit by providing "Continuous" illumination to previously "Full" illuminated roundabouts.

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