Illinois Department of Transportation
2300 South Dirksen Parkway / Springfield, Illinois / 62764

March 14, 2014

CIRCULAR LETTER 2014-01 (REVISED)

FY 2015 HIGHWAY SAFETY IMPROVEMENT PROGRAM

COUNTY ENGINEERS/SUPERINTENDENTS OF HIGHWAYS
METROPOLITAN PLANNING ORGANIZATIONS - DIRECTORS
MUNICIPAL ENGINEERS/PUBLIC WORKS DIRECTORS
CONSULTING ENGINEERS

*[This Circular Letter supersedes Circular Letter 2014-01, dated January 17, 2014. Due to the recent publication of the Illinois Local Roads Five Percent Report, the deadline for submitting applications for the FY 2015 HSIP has been extended to **May 30, 2014**. In addition, a copy of the Illinois Local Roads Five Percent Report is included with this revised circular letter.]*

The new Moving Ahead for Progress in the 21st Century (MAP-21) federal highway bill places increased emphasis on the reduction of fatalities and serious injuries on all public roads and requires states to develop performance measures and targets. The Illinois Strategic Highway Safety Plan (SHSP) works to achieve this and outlines a mission to develop, implement, and manage an integrated multi-stakeholder process to improve the attributes of roads, users, and vehicles to reduce traffic-related deaths and life-altering injuries. The Bureau of Safety Engineering is responsible for oversight and implementation of the SHSP through the Highway Safety Improvement Program (HSIP). As part of this plan, we are requesting candidate projects for the HSIP that will be initiated in FY 2015.

PROJECTS

The HSIP is a core federal-aid funding program with the goal of achieving a significant reduction in traffic fatalities and serious injuries on all public roads. Both fatalities and serious injuries on the local roadway system have increased. Increased emphasis is being placed to address these severe crashes occurring on local roadways. Highway safety improvement projects correct, or improve, a location or feature, or address a highway safety problem that is contributing to these severe crashes on the roadway. Specific site or system-wide improvements that reduce severe crashes are eligible for funding. Because HSIP funds are limited, low cost safety improvements are encouraged. Funds may be used to address safety issues independently without completely reconstructing entire roadway segments or intersections to all of the latest policies and standards. Local agencies should also evaluate potential projects that address curve deficiencies and guardrail upgrades throughout transportation corridors. Projects that address pedestrian safety and injury issues should also be included as potential candidates.

Data trees and emphasis area tables for each county were developed to help local agencies determine areas of focus, i.e. rural county roads and roadway departure, urban non-signalized intersections, etc. In addition, we have developed a statewide local roadways five percent Most Severe Safety Needs list of roadway segments and intersections that can be provided to a local agency. A listing of the top 35 counties with the highest number of fatalities and serious injuries on the local system is attached. These tools can assist the local agency to best select the location(s) and strategies with the most potential to reduce fatalities and serious injuries and to submit as candidates for HSIP funding.

FUNDING

The anticipated funding level for the local highway system is approximately $13.3 million for HSIP and will be available in July 2014. The new MAP-21 federal highway bill does not contain a separate funding set-aside for a High Risk Rural Roads Program (HRRRP). However, rural roadways and the reduction of fatalities and serious injuries are evaluated for performance and continue to be a priority.

The federal funding level is a maximum 90 percent of the total improvement cost for the project with the local agency responsible for the ten percent matching funds. All phases of a safety improvement project are eligible for this program, including preliminary engineering, land acquisition, construction and construction engineering. The required benefit/cost ratio calculation should include all phases for which HSIP funds are requested. The project should be ready to utilize funds in state fiscal year 2015, but multi-year requests will be considered. A proposed funding schedule, including all phases of the project with the anticipated funding year, must be included with the application. Any later phases of the project, for which funds are requested from future fiscal years, should be clearly indicated on the application. Information regarding local matching funds, or additional funds that will be used to fund each candidate, should also be provided in the application. This will allow the department to effectively program HSIP funds and maximize the selection of safety projects. If a project is selected for funding, the notification letter will indicate for which fiscal year each phase has been approved. Local agencies are expected to have these funds obligated within two years of the appropriate fiscal year.

APPLICATION PROCESS

Detailed guidelines for the HSIP can be found in the Program Planning and Selection of HSIP Candidate Projects section of the IDOT HSIP policy effective November 1, 2006. This document is not included with this letter, but can be found online at http://www.dot.il.gov/illinoisSHSP/hsip.html (by clicking on the HSIP Policy: Safety 1-06 link).

This website also contains the appendices to the HSIP policy describing the process and requirements to apply for local HSIP funding. Appendix F contains the HSIP Candidate Form (BSE HS1) that is required for application submittals. The Benefit/Cost methodology (in an Excel spreadsheet format) is available under Safety Analysis Tools.

The following options are available to determine the optimal crash locations to target when applying for HSIP funds. Please contact your applicable IDOT District Local Roads office for further assistance with these options.

- County Data Trees and Heat Maps will help a local agency determine crash trends for their roadways. These color-coded maps showing locations where fatalities and severe injuries have occurred have been distributed to each IDOT District office. If you would like to review these maps and do not have them, please contact your applicable district office.

- Illinois Local Roads Five Percent Report.

- Local crash analysis with documented crash data, trends, problem identification and appropriate safety countermeasures.

- External Safety Data Mart: Contact IDOT's Division of Traffic Safety at 217/785-2575 or via e-mail at dot.Safetydata@illinois.gov for information regarding access.

- Coordinate with the appropriate district office for assistance.

EVALUATION

Local agencies are expected to cooperate with IDOT in evaluating the effectiveness of selected projects. It is anticipated that IDOT's Bureau of Safety Engineering will conduct the detailed evaluation and reporting for selected HSIP projects to the Federal Highway Administration. The local agency should not assume significant cost for evaluation of the project.

Questions should be directed to your District Local Roads Engineer. We require you to submit electronic copies of your applications (either via e-mail or on a CD) to your IDOT District Bureau of Local Roads and Streets office no later than April 18, 2014. Local agencies will be notified of their selection by the department.

Sincerely,

James K. Klein

James K. Klein, P. E., S.E.
Acting Engineer of Local Roads and Streets

Attachment

cc: Alan Ho, FHWA
Jeff South
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Illinois Department of Transportation

FEBRUARY 2014

ILLINOIS LOCAL ROADS FIVE PERCENT REPORT

Prepared for
Illinois Department of Transportation
Division of Highways
Bureau of Safety Engineering

Driving Zero Fatalities to a Reality
Partnering for Illinois

Illinois Local Roads FIVE PERCENT Report

Federal Highway Administration Highway Safety Improvement Program

Prepared for

Illinois Department of Transportation

Bureau of Safety Engineering

February 2014

Prepared by

CH2MHILL.

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Acronyms and Abbreviations

3R	resurfacing, restoration, and rehabilitation
4Es	engineering, education, enforcement, and emergency medical services
A-Type injury	incapacitating injury (As defined by Illinois Department of Transportation, any injury, other than fatal, that prevents the injured person from walking, driving, or normally continuing the activities he/she was capable of performing before the injury occurred. Inclusions: severe lacerations, broken/distorted limbs, skull injuries, chest injuries and abdominal injuries.)
AADT	average annual daily traffic
B-Type injury	non-incapacitating injury (As defined by Illinois Department of Transportation, any injury, other than a fatal or incapacitating injury, that is evident to observers at the scene of the crash. Inclusions: lumps on the head, abrasions, bruises, and minor lacerations.)
BSE	Bureau of Safety Engineering
C-Type injury	reported, not evident (As defined by Illinois Department of Transportation, any injury reported or claimed that is not listed above. Inclusions: momentary unconsciousness, claims of injuries not evident, limping, complaints of pain, nausea.)
EMS	emergency medical services
FC	functional classification
FHWA	Federal Highway Administration
GIS	geographical information system
HSIP	Highway Safety Improvement Program
IDOT	Illinois Department of Transportation
IRIS	Illinois Roadway Information System
ISP	Illinois State Police
ISHSP	Illinois Strategic Highway Safety Plan
K	fatal (As defined by Illinois Department of Transportation, a traffic crash involving a motor vehicle in which at least one person dies within 30 days of the crash.)
MOE	measure of effectiveness
NCHRP	National Cooperative Highway Research Program
RAWSC	rural all way stop control (type of intersection)
RMLSC	rural minor leg stop control (type of intersection)

RS	rural signalized (type of intersection)
RSA	road safety assessment
SHSP	Strategic Highway Safety Plan
SPF	safety performance function
TRB	Transportation Research Board
UMLSC	urban minor leg stop control (type of intersection)
US	urban signalized (type of intersection)
vpd	vehicles per day
vph	vehicles per hour

Purpose of the Study

In the state of Illinois, between 2007 and 2011, more than 50 percent of the fatal and serious-injury crashes occurred in the local system, which represent about 80 percent of the total statewide roadway mileage. Therefore, understanding the safety issues in the local system is critical to reducing the number of severe crashes to meet Illinois' Zero Fatality Goal.

This study includes safety analysis on both state and local roadway and intersections. *The State FIVE PERCENT Report* is intended to assist the Illinois Department of Transportation (IDOT) to determine the nature and extent of safety problems, to provide guidance on where safety investments are needed, and to begin tracking the progress towards improving traffic safety in the state. This *Local FIVE PERCENT Report* expands this effort.

High-priority locations have been identified on the local road system in Illinois, including county roads, municipality roads, township roads, and intersections. The selected five percent locations included in the 2014 *Local FIVE PERCENT Report* were derived from different performance measures. Local intersections are defined as having all approaching routes defined as local routes. If one approaching route is a state route, the intersection would be defined as a state intersection. Typically, the local intersections with high KABC[1] weighted crash rate and KA weighted crash rate were selected as five percent locations. Due to the high number of small local roadway segments, crash-frequency-based performance measures were used to select the locations with more pressing safety needs.
High-priority locations are typically related to high-risk behaviors like speeding, alcohol-involved collisions, and serious crashes where drivers and/or passengers were unrestrained. These analyses help to identify the most cost-effective countermeasures by addressing needs in a multi-disciplinary approach as laid out in the Illinois Strategic Highway Safety Plan (ISHSP).

[1] IDOT classifies crash severity as follows:
K – fatal: A traffic crash involving a motor vehicle in which at least one person dies within 30 days of the crash.
A – incapacitating injury: Any injury, other than fatal, that prevents the injured person from walking, driving, or normally continuing the activities he/she was capable of performing before the injury occurred. Inclusions: severe lacerations, broken/distorted limbs, skull injuries, chest injuries and abdominal injuries.
B – non-incapacitating injury: Any injury, other than a fatal or incapacitating injury, that is evident to observers at the scene of the crash. Inclusions: lumps on the head, abrasions, bruises, and minor lacerations.
C – reported, not evident: Any injury reported or claimed that is not listed above. Inclusions: momentary unconsciousness, claims of injuries not evident, limping, complaints of pain, nausea.

Study Approach

Since safety performance functions (SPFs) were not developed for the local road system in Illinois, the following fundamental principles of highway safety were used in the analysis:

- Expected or typical safety performance is a function of roadway segment or intersection type. Rural two-lane roads have fundamentally different risk profiles than multilane urban arterials and, likewise, signalized intersections have different characteristics than unsignalized intersections.
- Expected safety performance is a function of traffic volume; but the relationship is complex, not linear, and varies with roadway type.
- Serious crashes are random events, and very rare on the local road system. Caution should be taken in identifying roadway segments and intersections that appear to be overrepresented in terms of serious crashes.
- Understanding types of crashes is important, not merely numbers or locations of crashes. For example, causes and treatments for single vehicle run-off-the-road crashes differ from those for rear-end or angle crashes.

In accordance with IDOT and Federal Highway Administration (FHWA) guidance, analysis should focus more on the most serious crashes: fatal (K) and incapacitating injury (A) crashes. In addition to crash frequency, a severity-weighting scheme was applied to the data.

Overview of Basic Data

The data necessary to complete a study of this nature include locations of crashes, details of crash characteristics, roadway geometry information, and traffic volume.

Statewide crash data (2007 to 2011) were used for this 2014 *Local FIVE PERCENT Report*. The crashes were assigned to roadway segments and intersections by IDOT using the Safety Analyst set of software tools. The database provided information on crashes that resulted in a fatality; an A, B, or C injury; and property damage only. In addition, the crash records contained information on the date and time of the crash, severity, environmental conditions, roadway and vehicle type, crash type, and citations.

The crash data, local roadway segments, and intersection layer were provided by IDOT. Only data readily available from IDOT's computer systems were used; no field data collection or verification was conducted to determine or analyze the local roadway and intersection Five Percent locations.

General Methodology

Five Percent Analysis of Local Roadway Segments

Local roads are defined based on the jurisdictional responsibility, which provides information related to the agency's jurisdictional responsibility of a highway. Toll roads are not included as part of the local road system.

Local roadway segments were categorized into 12 peer groups according to three criteria: setting type, number of lanes, and average annual daily traffic (AADT). Not all the local roads had enough information to be categorized under one of the peer groups (about 30 percent), so additional data cleaning and preparation was required. Details about this process are provided in Appendix A.

Table 1 summarizes the local roadway segments peer groups by total mileage and total number of crashes used in the analysis.

TABLE 1
Local Roadway Segments Peer Groups with Mileage and Total Number of Crashes

Peer Group	Setting Type	AADT	Number of Lanes	Peer Group	Total Mileage	Total Mileage (%)	Total Crashes	Total Crashes (%)
1	Rural	0-100	Two lanes	Rural AADT 0-100 / two lanes	33,341	31.0%	9,352	1.7%
2	Rural	100-250	Two lanes	Rural AADT 100-250 / two lanes	36,455	33.9%	21,781	4.1%
3	Rural	250-1,000	Two lanes	Rural AADT 250-1,000 / two lanes	14,972	13.3%	26,449	4.9%
4	Rural	1,000-2,500	Two lanes	Rural AADT 1,000-2,500 / two lanes	2,803	2.6%	14,087	2.6%
5	Rural	>2,500	Two lanes	Rural AADT >2,500 / two lanes	616	0.6%	5,724	1.1%
6	Rural	0 - >2,500	Multilane	Rural AADT 0 - >2,500 / multilane	20	0.0%	60	0.0%
7	Urban	0-250	Two lanes	Urban AADT 0-250 / two lanes	2,218	2.1%	3,855	0.7%
8	Urban	250-1,000	Two lanes	Urban AADT 250-1,000 / two lanes	12,996	12.1%	40,142	7.5%
9	Urban	1,000-2,500	Two lanes	Urban AADT 1,000-2,500 / two lanes	23,026	21.4%	194,480	36.4%
10	Urban	>2,500	Two lanes	Urban AADT >2,500 / two lanes	4,226	3.9%	123,811	23.2%
11	Urban	0-2,500	Multilane	Urban AADT 0-2,500 / multilane	146	0.1%	3,312	0.6%
12	Urban	>2,500	Multilane	Urban AADT >2,500 / two lanes	1,438	1.3%	91,603	17.1%
Total					**132,256**	**122.9%**	**534,656**	**100.0%**

To maximize the potential for safety improvement, property damage only crashes were removed from the analysis, and a weighting scheme for K, A, B, and C crashes was applied: 25, 10, 1, and 1, respectively. After applying the weighting factors, the KABC weighted crash rate was calculated for each local roadway segment. Additional performance measures used for the ranking criteria include KA crash frequency, KABC crash frequency, weighted KABC crashes, and weighted KABC per mile.

Sites were ranked using the different performance measures, and individual rankings were totaled for a total ranking score. The top five percent mileage was selected using a combination of the number of KA and KABC crashes and the ranking score. In addition, these locations were categorized into three groups called criteria, as follows:

- Criterion 1: Locations with one or more KA and three or more KABC
- Criterion 2: Locations with one or more KA and two or more KABC
- Criterion 3: Locations with one or more KABC

Table 2 shows the total ranking score for each of the 12 peer groups of local roadway segments.

TABLE 2
Total Ranking Score of Local Roadway Segments by Peer Group

Peer Group	Criterion 1	Criterion 2	Criterion 3	Total
1	11.9	62.3	1,592.3	1,666.5
2	34.5	145.1	1,642.3	1,821.9
3	181.6	280.9	286.6	749.0
4	107.8	32.1	0	139.9
5	30.3	0	0	30.3
6	1.0	0	1.5	2.5
7	2.0	5.8	102.1	109.9
8	21.8	28.0	599.7	649.5
9	73.1	84.7	993.4	1,151.2
10	178.5	32.7	0	211.3
11	3.1	1.5	2.7	7.3
12	66.6	5.2	0	71.8
Total	**712.4**	**678.2**	**5,220.6**	**6,611.2**

In addition, the hundred percent local roadway segments were divided into three tiers:

- Tier 1: All locations within Criteria 1 and 2
- Tier 2: All locations with at least one crash and Criterion 3
- Tier 3: All the remaining locations with zero crashes

Table 3 shows the total mileage for each of the three tiers of the hundred percent local roadway segments.

TABLE 3
Total Mileage of Hundred Percent Local Roadway Segments by Tier

Peer Group	Tier 1	Tier 2	Tier 3	Total Mileage
1	74.2	1,696.6	31,570.2	33,341.0
2	179.6	2,275.5	33,999.9	36,455.0
3	462.5	2,665.8	11,843.6	14,971.9
4	294.3	844.3	1,664.8	2,803.4
5	121.3	211.2	283.0	615.5
6	1.0	3.5	15.3	19.8
7	7.7	106.7	2,103.9	2,218.3
8	49.8	676.6	12,269.0	2,218.3
9	157.8	1,936.8	20,931.0	23,025.6
10	279.1	1,258.6	2,688.0	4,225.7
11	4.6	34.0	107.7	146.3
12	159.5	556.0	722.0	1,437.5
Total	**1,791.4**	**12,265.7**	**118,198.4**	**132,255.6**

Table 4 summarizes the crash information of selected local roadway segments (FIVE PERCENT locations).

TABLE 4
Summary of Number of Crashes of Selected Local Roadway Segments (FIVE PERCENT)

Peer Group	Fatal Crash	Fatal and A Crash	Total Crash (KABC)
1	97	691	2,239
2	163	1,241	3,770
3	239	1,420	2,007
4	49	319	603
5	15	102	195
6	2	4	10
7	10	125	510
8	78	954	4,602
9	230	3,119	14,143
10	155	1,688	5,256
11	6	58	119
12	78	863	3,193
Total	**1,122**	**10,584**	**36,647**

Five Percent Analysis of Local Intersections

A local intersection is defined as a location where all the intersecting approaches are local roads. In the database provided by IDOT, local intersections are pre-defined by the "Jurisdiction Type" field. Statewide, 100,059 local four-leg intersections were included in the analysis. These intersections were categorized into six peer groups according to two criteria: Urban/Rural Type, and Traffic Control Type. There are an additional 218,168 local intersections with three legs. During the analysis, a significant amount of data cleanup was required for the three-leg intersections. Hence, the focus of this analysis was only on the local four-leg intersections.

After the crash rates were calculated, the four-leg intersections were categorized into peer groups and ranked from high to low, first by the KABC weighted crash rate and then by the KA weighted crash rate. For each peer group, the intersections were divided into three tiers: The top five percent locations were classified as Tier 1 locations, which have a high priority to be reviewed by IDOT. The intersections with KABC weighted crash rate higher than the group average KABC weighted crash rate (excluding the Tier 1 locations) were classified as Tier 2 locations. The remaining intersections were classified as Tier 3 locations. Table 5 summarizes the three tiers for local four-leg intersections.

TABLE 5
Number of Local Intersections by Tier and Type

Tier	Rural Signalized (RS)	Rural Minor Leg Stop Control (RMLSC)	Rural All Way Stop Control (RAWSC)	Urban Signalized (US)	Urban Minor Leg Stop Control (UMLSC)	Urban All Way Stop Control (UAWSC)
Tier 1	4	1,648	52	261	2,854	159
Tier 2	8	107	3	1,178	6,826	446
Tier 3	189	31,264	1,019	4,019	47,316	2,706
Total	**201**	**33,019**	**1,074**	**5,458**	**56,996**	**3,311**

After performing the three-tier analysis, there were 4,978 local four-leg intersections included in the Tier 1 result. To prioritize the Tier 1 locations further, these 4,978 intersections were divided into three criteria for each peer group: Criterion 1 are the approximately top 0.5 percent of the statewide local four-leg intersections. This percentage is consistent with the state intersection analysis. Criterion 2 are the intersections with KABC weighted crash rate higher than Tier 1 average KABC weighted crash rate (excluding the Criterion 1 locations). The remaining Tier 1 intersections were included in Criterion 3. Table 6 summarizes the three criteria for local four-leg intersections.

TABLE 6
Number of Tier 1 Intersections by Criterion and Type

Criterion	Rural Signalized (RS)	Rural Minor Leg Stop Control (RMLSC)	Rural All Way Stop Control (RAWSC)	Urban Signalized (US)	Urban Minor Leg Stop Control (UMLSC)	Urban All Way Stop Control (UAWSC)
Criterion 1	2	158	7	28	271	14
Criterion 2	0	17	3	82	863	52
Criterion 3	2	1,473	42	151	1,270	93
Total	**4**	**1,648**	**52**	**261**	**2,854**	**159**

Table 7 summarizes the crash information of selected local four-leg intersections (FIVE PERCENT locations).

TABLE 7
Summary of Number of Crashes of Selected Local Four-leg Intersections (Tier 1)

Peer Group	Fatal Crash	Fatal and A Crash	Total Crash (KABC)
1	0	6	25
2	95	853	3,197
3	2	29	178
4	41	626	9,025
5	24	352	3,230
6	7	179	1,249
Total	**169**	**2,045**	**16,904**

Five Percent Selection Results

This section highlights the selected five percent locations by peer group for local roadway segments and intersections. The full list of Tier 1 intersections (including all three criteria locations) and Tier 1 roadway segments are shown in Appendix C. Maps of the local roadway five percent segments and intersections are shown in Appendixes D and E, respectively. (Note: For this report, the figures in the Appendixes C, D, and E have been reduced in size, but, if desired, they can be made available at 24 inches by 36 inches for optimum viewing.)

Treatments of Selected Locations

The local roadway five percent locations do not necessarily translate to actual prioritization of safety improvement projects within IDOT's limited budgets; therefore, these locations should be considered in a larger context. Applicable safety countermeasure treatments, the cost or ease of implementation of the treatments, and the resultant cost-effectiveness will vary widely across classes or volume ranges. Nevertheless, the list of sites can form a strong basis for identifying candidate safety projects for the full range of highways and highway types within Illinois.

Data limitations discussed previously preclude definitive judgments or decisions regarding what improvements should be made at each location. Further study is required to understand site conditions, such as pavement and shoulder condition, roadside characteristics, and right-of-way.

IDOT intends to collaborate with local roadway agencies to assist local agencies in their ability to determine the suitability of each indicated location for safety improvements in the following manner:

1. Confirm that each location has not been materially changed or improved since 2011 (the roadway database used for analysis). A review exhibits, tables, and underlying information by each agency is planned. Some locations may be removed from consideration if it is determined the location has been altered or reconstructed.
2. Perform field review of sites as necessary to confirm the accuracy of the data contained in state crash, traffic, and geometric databases to determine feasible engineering alternatives and to provide the necessary information to enable evaluation of appropriate safety countermeasures for each site. Additional effort is needed to understand the specifics of crash types (such as time of day and pavement or weather conditions).
3. Confirm whether sites continue to pose safety risks and to adjust lists or maps as updated crash information becomes available.
4. Determine logical project termini for the local roadway five percent locations, which were determined based on statewide analysis. Maps and other tools can be used to help identify logical termini to appropriately identify high-risk areas.
5. Consider low-cost safety improvements for each site that are consistent with countermeasures discussed in the National Cooperative Highway Research Program (NCHRP) *Report 500* series and other recent research. Effective safety countermeasures will address the specific crash types that are predominant or that can be expected at a site, given the type of roadway and level of traffic volume expected. Countermeasures have a cost both in dollars needed for implementation and other factors of varying importance, depending on the circumstances. The Illinois Countermeasure Tool may be implemented to assist with countermeasure selection on a systematic basis and the Benefit-Cost Tool may be used to assist with site-specific countermeasure selection.

Road safety assessments (RSAs) are being conducted throughout the state to identify high-risk locations and develop appropriate safety countermeasures. RSAs may be a good method for addressing the five percent locations.

Safety Countermeasures

Table 8 lists the safety countermeasures and their attributes, based on the NCHRP *Report 500* series, considered for the high-risk roadway segments and intersections, as well as possible impediments to implementation of each countermeasure. A similar list can be created for interstate roadways and interchanges.

Obtaining the maximum value for the effort and resources expended requires consideration of the cost-effectiveness of prioritizing a location and selecting an appropriate safety countermeasure. Prioritization does not necessarily mean that highest traffic volume or highest crash frequency locations are addressed first. Cost or difficulty of implementation at one site may make it less of a priority than a lower-volume site with fewer crashes for which a countermeasure can be readily implemented.

A simple "cost-per-crash-eliminated" metric is recommended as a means of prioritizing and ultimately implementing safety countermeasures. This approach is similar to that taken in development of Transportation Research Board (TRB) Special Report 214*, Designing Safer Roads, Practices for Resurfacing, Restoration and Rehabilitation* (1987). In the report, researchers asserted that measures with a cost-per-crash-eliminated of less than $10,000 are clearly appropriate on safety reasons alone. When cost-per-crash-eliminated is $10,000 to $50,000, cost-effectiveness may depend on other factors. Similarly, when cost-per-crash-eliminated exceeds $50,000, it generally would not be cost effective. Because the source of this data is from 1987 and does not represent current dollars, these values were recalculated in 2012 dollars using the Bureau of Labor Statistics inflation calculator. The range of cost-per-crash-eliminated in 2012 dollars is $20,000 to $100,000.

The cost-per-crash-eliminated for the selected sites was prepared to determine the range of cost effectiveness. Values for expected countermeasure effectiveness were taken from the NCHRP *Report 500* series guides and from information in the Illinois Countermeasure Tool. Nominal implementation costs for lower-cost improvements were assigned. The FHWA *Lane Departure Strategic Action Plan* (March 2005) was referenced as well. The following general conclusions can help direct site-specific implementation:

- For lower-volume roadways (fewer than 2,500 vehicles per day [vpd]), strategies that cost less than $5,000 per mile are generally preferred to maximize total system effectiveness. Such strategies generally will include implementation of rumble strips, treatment for drop-off of pavement edge, enhanced delineation of objects or edges of pavement, placement of warning signs, and other treatments that do not require geometric changes, additional right-of-way, or other issues.

- For moderate- to higher-volume rural two-lane roads, additional strategies, such as removal of fixed objects, pavement of shoulders, and improved or enhanced guardrails that have a higher cost (approximately $10,000 per mile), will be effective. Of course, should less-costly treatments be determined as effective, those should be implemented first.

- For high-volume rural roadways and urban arterials, more-extensive treatments are generally required to reduce the types of crashes that occur. Rear-end crashes associated with driveway and other roadway access require widening for left-turn lanes, which in turn involves environmental, drainage, right-of-way, and other issues. The number of crashes

affected is greater, but so are the cost and difficulty of implementation. A planning-level threshold of $50,000 to $100,000 per mile is appropriate.

Site-specific analysis of implementation costs and expected long-term improvements should be conducted. Decisions should be made regarding prioritization and implementation of improvements as part of each district's or agency's safety program. Where reconstruction or resurfacing/3R (resurfacing, restoration, and rehabilitation) improvements are expected or programmed, selected safety improvements can and should be incorporated. Districts may wish to defer safety treatments at a high-risk site if it is programmed to be reconstructed in a few years. Coordination with other government agencies or departments, especially law enforcement, is recommended to obtain maximum value for the invested dollar.

TABLE 8
Potential Safety Countermeasures and Impediments to Implementation for Roadway Segments

Typical Predominant Crash Types	Potential Safety Countermeasure	Impediment to Implementation
Rural Two-Lane Roadway		
Low to Moderate Traffic Volume		
Run-off-the-road, fixed object, and overturned	Install shoulder/edge-line rumble strips	Requires paved shoulder in good condition
		More difficult snow removal
		Adverse effects on bicyclists
		Undesirable noise levels
		Additional shoulder maintenance requirements
	Improve or provide delineation	
	Remove/relocate roadside obstacles	Public reaction to tree cutting
		Coordination with environmental and public groups
	Install guardrail	Potential widening and attendant impacts
		Additional maintenance requirements
	Pave shoulder; implement “safety wedge”	Requires sufficient width of unpaved shoulder
	Flatten side slope; reshape, or regrade ditch	Potential additional right-of-way required
		Affect drainage patterns (culvert and other issues)
		Potential environmental issues, such as right-of-way
	Widen pavement/shoulder through curve	Potential right-of-way required
	Improve super-elevation transition	
	Provide advance curve warning (sign, rumble strips)	
	Reconstruct horizontal curve	Additional right-of-way required; more extensive impacts
		Generally cost-effective only for higher volumes
Rear-end and same direction sideswipe	Relocate or remove driveways/minor intersections	Property owner objections to changes in access
	Widen to provide left-turn lanes	Potential right-of-way and environmental issues
	Enforce speed limit	Requires shoulder or other locations for enforcement
		Diverts resources from other enforcement activities

TABLE 8
Potential Safety Countermeasures and Impediments to Implementation for Roadway Segments

Typical Predominant Crash Types	Potential Safety Countermeasure	Impediment to Implementation
Rear-end and same direction sideswipe (continued)	Remove/relocate roadside sight obstructions	Public reaction to tree cutting
	Improve vertical geometry to enhance sight distance	Potential/probable additional right-of-way required
High Traffic Volume		
Rear-end and same direction sideswipe	Relocate or remove driveways/minor intersections	Property owner objections to changes in access
	Widen or place in median left-turn lanes	Potential right-of-way and environmental issues
	Enforce speed limit	Requires shoulder or other locations for enforcement
		Diverts resources from other enforcement activities
	Improve advance warning of signals, intersections	
Fixed object and overturned	Install shoulder/edge-line rumble strips	Requires paved shoulder in good condition
		More difficult snow removal
		Adverse effects on bicyclists
		Undesirable noise levels
		Additional shoulder maintenance requirements
	Remove/relocate roadside obstacles	Public reaction to tree cutting
		Coordination with environmental and public groups
	Install guardrail	Potential widening and attendant impacts
		Additional maintenance requirements
	Pave shoulder; implement ”safety wedge”	Requires sufficient width of unpaved shoulder
	Flatten side slope; reshape, or regrade ditch	Potential additional right-of-way required
		Affect drainage patterns (culvert and other issues)
		Potential environmental issues, such as right-of-way
		Adverse effects on bicyclists
		Undesirable noise levels
Multilane Rural Roadway		
Rear-end and same direction sideswipe	Enforce speed limit	Diverts resources from other enforcement activities
	Provide left-turn lanes	Potential right-of-way and environmental issues
		Affects median drainage

TABLE 8
Potential Safety Countermeasures and Impediments to Implementation for Roadway Segments

Typical Predominant Crash Types	Potential Safety Countermeasure	Impediment to Implementation
Rear-end and same direction sideswipe (continued)	Remove roadside sight obstructions	Public reaction to tree cutting
		Coordination with environmental and public groups
Fixed object and overturned	Install shoulder/edge-line rumble strips	More difficult snow removal
		Adverse effects on bicyclists
		Undesirable noise levels
		Additional shoulder maintenance requirements
	Remove/relocate roadside obstacles	Public reaction to tree cutting
		Coordination with environmental and public groups
Urban Arterials		
Rear-end and same direction sideswipe	Add left-turn lanes	Limited space may preclude or require additional right-of-way
		Proximity to major intersection may limit ability
	Implement median access control (raised)	Objections of adjacent property owners (access)
		Affect drainage patterns
		Increase maintenance requirements
	Relocate/close driveways	Objections of adjacent property owners (access)
	Improve or establish progression for signals	Conflicts with signal requirements of crossing roads
		Requires consensus of neighboring towns
	Restrict or prohibit left turns	Increases out of direction travel
		Objections of adjacent property owners (access)
Pedestrian	Add/improve signalization along arterial for pedestrians	May degrade operational quality
	Implement raised median	Objections of adjacent property owners (access)
		Affect drainage patterns
		Increase maintenance requirements
	Revise and enforce speed limits	Requires shoulder or other locations for enforcement
		Diverts resources from other enforcement activities

TABLE 8
Potential Safety Countermeasures and Impediments to Implementation for Roadway Segments

Typical Predominant Crash Types	Potential Safety Countermeasure	Impediment to Implementation
Angle and turning	Add left-turn lanes	Limited space may preclude or require additional right-of-way
		Proximity to major intersection may limit ability
	Implement median access control (raised)	Objections of adjacent property owners (access)
		Affect drainage patterns
		Increase maintenance requirements
	Relocate/close driveways	Objections of adjacent property owners (access)
	Restrict or prohibit left turns	Increases out of direction travel
		Objections of adjacent property owners (access)

Conclusions

The local roadway five percent locations are one approach that IDOT uses to identify and target safety dollars for improvements to the local road system. In conjunction with implementation of the state Strategic Highway Safety Plan (SHSP), IDOT has worked with the Illinois State Police (ISP) and emergency medical services (EMS) to develop programs and initiatives to reduce fatal and serious injury crashes. IDOT has developed a comprehensive 4Es (engineering, education, enforcement, and EMS) approach that has been effective in reducing fatal and serious injury crashes. IDOT is committed to the 4Es approach to reduce fatalities and serious injuries on all Illinois roadways and to provide continual safety improvement.

Federal regulations call for a description of the extent to which safety improvements funded under the Highway Safety Improvement Program (HSIP) contribute to the goals of reducing the number of roadway-related injuries and fatalities and the occurrences of roadway-related crashes. The effectiveness of the safety improvements, both individually and collectively by type of improvement, in reducing fatalities, injuries, and crashes needs to be considered. In the future, the number of crashes should be determined annually and accumulated for a period of 3 to 5 years and then compared with the "before" performance over a like number of years preceding the implementation of any safety improvements.

It is anticipated that IDOT districts, Illinois State Police, and local agencies use the 2014 *Local FIVE PERCENT Report* in conjunction with fatal and A-injury crash analysis as a basis to prepare HSIP project submittals, to implement operational safety improvements, to target enforcement areas, and to develop or enhance safety education programs.

Illinois Department of Transportation

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