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SAFETY EVALUATION OF FLASHING YELLOW ARROWS FOR PROTECTED/PERMISSIVE LEFT-TURN CONTROL

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16. Abstract

In the spring of 2010, the Illinois Department of Transportation initiated an areawide implementation of the flashing yellow arrow (FYA) as the display for the left-turn permissive interval at more than 100 intersections operating with protected/permissive left-turn (PPLT) control in the Peoria, Illinois, area. Bradley University researchers evaluated the effectiveness of FYAs on safety at 86 intersections and 164 approaches where no other improvements were made. The effectiveness evaluation was performed using three years of "before FYA installation" crash data and three years of "after FYA installation" crash data using the naïve before and after and empirical Bayes methods for highway safety evaluation. In the "before" condition, the left-turn signals operated with a circular green ball for the permissive interval of PPLT control and a five-section signal head, while in the "after" condition, the FYA was displayed for the permissive interval of PPLT with a four-section signal head. Supplemental traffic signs with text "Left Turn Yield on Flashing Yellow Arrow" were mounted on the mast arm adjacent to the left-turn signal at over half of the FYA installations. This report presents the results of the comprehensive safety evaluation of FYA for PPLT control, focusing on the targeted crash types of left-turn-related crashes, and specifically, left-turn opposing through crashes. Analyses were also performed to assess the effects of the FYA supplemental signs and to assess the effects of the FYA overall on two subsets of drivers: older drivers (age 65+) and younger drivers (age 16 to 21 years). Crash modification factors for statistically significant crash reductions at the FYA approaches based on the empirical Bayes method are provided. The findings of this research, conducted on 164 FYA approaches in the Peoria area indicate that FYAs for PPLT control improve safety for left-turning vehicles. The results of the economic effectiveness of the FYAs yielded a benefit to cost ratio of 19.8 to 1.0. The results of this research may be used to make informed decisions on future installations of the FYA countermeasure to improve safety at signalized intersections.

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EXECUTIVE SUMMARY

Approximately 27% of all intersection crashes in the United States are associated with left turns, with over two-thirds occurring at signalized intersections. Various traffic signal control strategies have been implemented to balance concerns about both efficiency and safety of left turns. The *Manual on Uniform Traffic Control Devices (MUTCD)* lists four ways to control left-turning traffic at signalized intersections, which include permissive, protected, protected/permissive, and variable left-turn mode.

The National Committee on Uniform Traffic Control Devices (NCUTCD) expressed concern about the non-uniformity and number of different left-turn permissive indications used throughout the United States and therefore commissioned a study, published in the National Cooperative Highway Research Program Report 493, to evaluate and identify the best signal display for the permissive interval of protected/permissive left-turn (PPLT) control. The 2003 study found that the flashing yellow arrow (FYA) permissive indication is well understood by drivers and recommended its application for permissive left turns. In 2009, the FYA was adopted into the 2009 *MUTCD* after the Federal Highway Administration approved their installation through an interim approval. As of early 2010, 35 states throughout the United States were using FYAs for permissive left-turn control.

In the spring of 2010, the Illinois Department of Transportation (IDOT) initiated an areawide implementation to integrate the FYA as the display for the left-turn permissive interval at more than 100 intersections operating with PPLT control. Vertical four-section signal heads that included the FYA indication for the permissive interval of PPLT phasing replaced the vertically mounted five-section signal heads operating with the circular green (CG) indication for the permissive left-turn interval of PPLT phasing. At over half of the FYA installations, a supplemental sign was also installed with the text “Left Turn Yield on Flashing Yellow Arrow.”

Bradley University was retained to perform an effectiveness evaluation of the FYA at 86 FYA intersections and 164 FYA approaches where no other geometric or operational changes were made. The purpose of the overall research study was to evaluate the effectiveness of the FYAs on safety, driver comprehension, and operations. The research tasks for the overall evaluation study included performing comprehensive areawide traffic crash analyses, conducting field studies of traffic operations and traffic conflicts, and assessing driver comprehension of the new traffic control through a survey instrument.

To fulfill the research objectives, a comprehensive crash-based effectiveness evaluation was conducted to analyze the safety effects of the FYA, which is documented in this report. As a part of this research, two additional reports were previously published to document the findings of the field studies of traffic operations and conflicts and the driver comprehension survey, entitled *State-of-the-Art Literature Review on Permissive/Protected Left-Turn Control*, and *Driver Comprehension and Operations Evaluation of Flashing Yellow Arrows*.

Comprehensive traffic crash analyses based on 3 years of crash data before FYA installation, 3 years crash data after FYA installation, and 3 years of data at 100 comparison sites were conducted in order

to evaluate the safety effects of the use of FYAs for PPLT control. A total of 164 approaches located at 86 test intersections were included in the evaluation, focusing on the targeted crash types of left turn (LT)-related crashes, and specifically, left-turn opposing through (LTOT) crashes. Analyses were also performed to assess the effects of the FYA supplemental signs and to assess the effects of the FYA overall on two subsets of drivers: older drivers (age 65+) and younger drivers (age 16 to 21 years).

Two methods were used to evaluate the crash experience at the FYA locations: the naïve before and after, and the empirical Bayes (EB). To estimate safety effectiveness using the EB method, safety performance functions (SPFs) are needed. As a part of this research, eight SPF models were developed to predict crashes on an intersection basis and approach basis for four crash types: total crashes, injury crashes, LT-related crashes, and LTOT crashes. The crash history, traffic volumes, and operational features of a group of 100 comparison sites were compiled and analyzed using a statistical analysis software program. Assuming an underlying Poisson/negative binomial distribution, which is a common assumption in modeling traffic crashes per the *Highway Safety Manual* (HSM), SPF models were then developed to predict crashes using variables that were found to have a statistically significant influence on crashes observed at the comparison sites.

The observed crash reductions were calculated per the EB method procedure and then tested for statistical significance using the Poisson test at a 95% level of confidence (LOC). Crash modification factors (CMFs) were developed for statistically significant crash reductions at the FYA approaches based on the EB method and an unbiased index of effectiveness metric.

The statistically significant results, based on the EB method, in terms of crash reductions attributable to the FYAs are as follows:

- At the 164 FYA approaches evaluated, a 23.3% reduction in LT-related crashes and a 24.8% reduction in LTOT crashes were observed.

- When FYA supplemental signs were also installed, larger percent reductions were observed, which provides evidence that the FYA supplemental sign may improve safety at the study approaches in Peoria, Illinois, because the FYA is still a relatively new countermeasure. At the 90 FYA approaches with the supplemental sign, significant percent reductions of 31.9% and 30.9% were observed for LT-related crashes and LTOT crashes, respectively.

The findings from the older and younger driver analysis were based on the naïve before and after method because the necessary SPFs for the EB analysis are not available for those age categories.

- The evaluation results for older drivers indicates that the FYAs did not have an impact on the crash experience of this subset of drivers (no statistically significant changes were found).

- For the younger driver analysis, statistically significant reductions were observed for all the crash types on both an intersection level and FYA approach level. A comparison of the crash reductions for younger drivers versus all drivers reveals that relatively larger percent reductions in crashes were observed for the younger driver group. For example, the comparison at an approach basis for LTOT crashes for the naïve before and after method were 24.8% reduction for drivers of all ages versus a 36.1% reduction for drivers age 16 to 21 years.

This provides evidence that the FYA is especially helpful to younger drivers when making left-turn decisions at intersections operating with PPLT control.

Using the procedures outlined in the *HSM* and the *Guide to Developing Quality Crash Modification Factors*, CMFs were developed. Specifically, CMFs were determined for the targeted crash types on an approach basis that were found to be statically significant, per the EB method. The resulting CMFs, along with their confidence intervals for the targeted FYA crash types, are as follows:

- **LT-related crashes at FYA approach CMF = 0.617**, with a 95% confidence interval = 0.617 $\pm$ 0.012 = 0.605 to 0.629
- **LT-related crashes at FYA approach with supplemental sign CMF = 0.589**, with a 95% confidence interval = 0.589 $\pm$ 0.016 = 0.573 to 0.605
- **LTOT crashes at FYA approach CMF = 0.714**, with a 95% confidence interval = 0.714 $\pm$ 0.016 = 0.698 to 0.730
- **LTOT crashes at FYA approach with supplemental sign CMF = 0.711**, with 95% confidence interval = 0.711 $\pm$ 0.024 = 0.687 to 0.735

An analysis was conducted in order to determine the economic effectiveness of the installation of the FYAs at 86 test intersections in the Peoria area using the equivalent uniform annual benefit (EUAB) and equivalent uniform annual cost (EUAC) methods. Economic costs and benefits (in 2010 dollars) of the FYA were calculated and annualized in order to determine the benefit to cost ratio of the FYA implementation. The resulting benefit to cost ratio for the implementation of the FYAs at 86 intersections is 19.8 to 1.0, which indicates that the accrued benefits in dollar value exceeds the annualized cost of the FYA over a period of 15 years by a factor of nearly 20.

Based on the overall findings of this research, it is recommended that FYAs continue to be installed on state routes in Illinois because the FYAs were found to have significant safety impacts and reduce LT-related crashes at locations where installed. It is also recommended that supplemental signs be used when implementing the FYA in Illinois, especially while the FYA remains a new traffic control device. It should also be noted that in the Peoria area, especially on city roads, supplemental signs are commonly displayed at other left-turn signals in addition to the FYA. For example, at some city intersections still operating with the CG indications, supplemental signs with the text “Left Turn Yield on [CG symbol]”are displayed; at protected-only left-turn signals, signs with the text “No Turn on Red Arrow” or “Left Turn on Green Arrow Only” are often displayed. Additional research is needed to justify the long-term and continual use of the FYA supplemental sign, once more drivers become familiar with its meaning. It is also recommended that when FYAs are implemented, efforts be made to educate not only the driving public at large, but older drivers specifically to further improve safety for drivers making left turns at signalized intersections.

CONTENTS

LIST OF ACRONYMS

AASHTO	American Association of State Highway and Transportation Officials
ADT	average daily traffic
ASCE	American Society of Civil Engineers
CG	circular green
CMF	crash modification factor
EB	empirical Bayes
EUAB	equivalent uniform annual benefit
EUAC	equivalent uniform annual cost
FCR	flashing circular red
FCY	flashing circular yellow
FHWA	Federal Highway Administration
FRA	flashing red arrow
FYA	flashing yellow arrow
HSM	*Highway Safety Manual*
IDOT	Illinois Department of Transportation
INDOT	Indiana Department of Transportation
ITE	Institute of Transportation Engineers
LOC	level of confidence
LT	left turn
LTOT	left-turn opposing through
MUTCD	*Manual on Uniform Traffic Control Devices*
NCHRP	National Cooperative Highway Research Program
NCUTCD	National Committee on Uniform Traffic Control Devices
NTL	National Transportation Library
PDO	property damage only
PPLT	protected/permissive left-turn
RITA	Research and Innovative Technology Administration
RLR	red light running
SPF	safety performance function
SYA	solid yellow arrow

TRB	Transportation Research Board
USDOT	United States Department of Transportation
VPD	vehicles per day
YLR	yellow light running

CHAPTER 1: INTRODUCTION

Left turns at signalized intersections are widely recognized as being challenging and high-risk maneuvers for drivers. Approximately 27% of all intersection crashes in the United States are associated with left turns, with over two-thirds occurring at signalized intersections (O'Connor 2004). Three main sources of conflicts, which involve opposing through traffic, adjacent through traffic, and cross-street vehicular and pedestrian traffic, contribute to the complexity of a left turn. There are several efficiency and safety concerns related to left turns, making left-turn control an ongoing topic for discussion among traffic engineers. As a result, various traffic signal control strategies have been implemented to address issues that arise from left-turn movements. The *Manual on Uniform Traffic Control Devices (MUTCD*) lists four ways to control left-turning traffic at signalized intersections (Federal Highway Administration 2009):

- Permissive—Left-turn may be made after yielding to oncoming traffic and pedestrians.
- Protected—Left-turn may be made only when a green arrow signal is displayed.
- Protected/permissive—Left-turn movement is presented during both the protected and permissive phases during the same signal cycle.
- Variable left-turn mode—The operating mode changes between protected, permissive, and protected/permissive during different times of the day.

From a safety standpoint, protected-only left-turn phases are desirable because left-turn vehicles have exclusive right-of-way, thus minimizing conflicts with other traffic movements. Protected/permissive left-turn (PPLT) phasing represents a compromise between protected-only phasing and permissive-only phasing. Protected/permissive control has several advantages, "the most important being the reduction in delay for left-turning vehicles achieved by permitting left turns while the opposing through movement has a green indication" (Antonucci et al. 2004). Protected/ permissive left-turn control provides left-turning vehicles with a protected phase and a permissive phase, all within the same cycle. When applied appropriately, PPLT control has been shown to reduce delays and increase the overall efficiency of an intersection.

Historically, the *MUTCD* has provided limited guidance for PPLT control, particularly regarding the permissive left-turn signal indication (American Traffic Safety Services Association/Institute of Transportation Engineers 2001). Several signal indications for the permissive phase of PPLT-controlled intersections are currently being used across the United States, including the circular green (CG), flashing circular red (FCR), flashing circular yellow (FCY), flashing red arrow (FRA), and flashing yellow arrow (FYA). Uniformity of traffic control devices, including traffic signals, is critical in eliciting an appropriate driver action because it allows drivers more easily to recognize and understand the message. The National Committee on Uniform Traffic Control Devices (NCUTCD) expressed concern about the non-uniformity and number of different left-turn permissive indications used throughout the United States and therefore commissioned a study, published in the National Cooperative Highway Research Program (NCHRP) Report 493 (Brehmer et al. 2003), to evaluate and identify the best signal display for the permissive interval of PPLT control. The 2003 study found that the FYA-

permissive indication is well understood by drivers and recommended its application for permissive left turns.

In March 2006, the Federal Highway Administration (FHWA) issued a memorandum with the details of the interim approval for new FYA signals. The Office of Transportation Operations reviewed research and considered the FYA to be successful. The memorandum further stated that the Office of Transportation Operations believes the FYA has a low risk of safety concerns and minimal operational concerns. Meetings of the NCUTCD also indicated a consensus in the practitioner community in support of optional use of the FYA. The memorandum also provided details for the design and operational requirements of the new FYA signal (Paniati 2006).The FYA was adopted into the 2009 *MUTCD* after the FHWA approved its installation through an interim approval. As of early 2010, 35 states throughout the United States were using FYAs for permissive left-turn control (Hartzell 2011).

In the spring of 2010, the Illinois Department of Transportation (IDOT) began installing vertical four-section signal heads that included the FYA indication for the permissive interval of PPLT phasing at signalized intersections on state routes in the Peoria, Illinois, area. Bradley University was retained to perform an effectiveness evaluation of the FYA at the approaches where they were implemented. The focus of this report is to present the methodologies and results of the traffic crash-based effectiveness evaluation of the FYAs on safety.

This report contains the following chapters:

Chapter 2—Literature Review

Chapter 3—Study Purpose and Methodology

Chapter 4—Site Description and FYA Implementation

Chapter 5—Data Collection and Analysis

Chapter 6—Traffic Crash Analysis

Chapter 7—Evaluation Results and Statistical Analysis

Chapter 8—Economic Analysis

Chapter 9—Conclusions and Recommendations

CHAPTER 2: LITERATURE REVIEW

A comprehensive literature review was conducted to assess the state-of-the-art of PPLT control and signal indications used for the permissive left-turn phase. These searches were conducted through web-based queries, as well as queries through specific search engines, such as those of the U.S. Department of Transportation (USDOT), FHWA, Research and Innovative Technology Administration (RITA), the National Transportation Library (NTL), the Transportation Research Board (TRB), the Institute of Transportation Engineers (ITE), and the American Society of Civil Engineers (ASCE).

The extensive literature review for documents published prior to 2012 is documented in a separate report entitled *State-of-the-Art Literature Review on Permissive/Protected Left-Turn Control*, published by the Illinois Center for Transportation (Schattler and Lund 2013). It includes details of each paper and research report on topics pertaining to PPLT control and FYA, such as definitions of various PPLT signal indications and types of left-turn control, NCHRP Report 493 and follow-up studies, driver comprehension surveys, traffic crash-based studies, and traffic operations-based studies. Section 2.1 of this report provides a summary of the findings from the previous literature review conducted and published (Schattler and Lund 2013) as a part of this research.

Additional literature searches were conducted as a part of this research to identify recent journal papers and research findings on FYAs documented from 2013 to 2015. The findings from these studies are summarized in Section 2.2 of this report.

2.1 SUMMARY OF PREVIOUS LITERATURE REVIEW DOCUMENT

This section provides a summary of the findings from the comprehensive literature review document published in 2013 as a part of this research (Schattler and Lund 2013). Details of these findings may be found in *State-of-the-Art Literature Review on Permissive/Protected Left-Turn Control*, published by the Illinois Center for Transportation (Schattler and Lund 2013).

The majority of research on FYAs was conducted by the authors of NCHRP Report 493 (Brehmer et al. 2003). Extensive research was conducted as part of that study to identify the most suitable traffic signal display for PPLT control. Several conclusions were drawn regarding the FYA-permissive indication in NCHRP Report 493 (Brehmer et al. 2003). The conflict study showed that few left-turn conflicts are associated with the PPLT display. The driver confirmation and static follow-up studies showed that the scenarios involving the FYA had a high level of understanding and significantly lower fail-critical rates than the scenarios involving the CG (Brehmer et al. 2003; Knodler et al. 2001; Knodler et al. 2005b). The field implementation study revealed that the change in PPLT display from CG to FYA did not affect driver conflicts or follow-up headway. Observations during the activation of the FYA showed no significant findings. Overall there was a positive reaction to the FYA from the implementing agencies, the public, and law enforcement (Brehmer et al. 2003). The research team's general recommendations related to the FYA included the following (Brehmer et al. 2003):

- The FYA display should be adopted into the *MUTCD* as an alternative PPLT control.
- The four-section, all-arrow display in an exclusive signal arrangement should be used for PPLT control with FYAs.
- The opposing through green indication should be tied to the FYA with optional delay at the start of the FYA.
- Further research should be conducted to gain a better understating of different PPLT displays.

The authors of NCHRP Report 493 (Brehmer et al. 2003) published several papers in transportation journals documenting their analysis and results from follow-up studies on the impacts of FYAs. Concerning five-section signal arrangements, the FYA and FCY indications were the best understood in a driving simulation and static follow-up evaluation study. The CG permissive indication had the most fail-critical responses (Noyce and Smith 2003). A retrofitted FYA/CG display was studied and deemed to be acceptable for an interim display (Knodler et al. 2005a). Driver recognition of their yield requirements to pedestrians was not negatively affected by the FYA (Knodler et al. 2006a). Flashing yellow arrows used at wide-median locations resulted in high driver comprehension for the FYA, but there was a high percentage of initial fail-critical responses on the first viewing of the FYA (Knodler et al. 2006b). There is little evidence to suggest that installations of the FYA will impact driver comprehension of the CG permissive indication (Knodler et al. 2007a). There is no evidence to suggest that the FYA-permissive indication would negatively affect the understanding of the solid yellow arrow (SYA) used in change intervals (Knodler and Fisher 2009; Knodler et al. 2007b).

Additional crash-based, operations-based, and driver understanding survey studies were identified in the literature. A summary of the authors' main conclusions follow. Sites operating with PPLT control before and after implementation of the FYA showed an improvement in safety, while sites that operated with protected-only phasing before the installation of the FYA and switched to PPLT control typically showed an increase in collisions. The authors concluded that the change in phasing from protected-only to PPLT control had a greater impact than the permissive indication change from CG to FYA (Noyce et al. 2007; Perez 2010; Pulugurtha et al. 2011; Srinivasan et al. 2011a, 2011b). A study evaluating driver understanding of the FYA in Creve Coeur, Missouri, concluded that area drivers understand the CG with supplemental sign better than the FYA without a sign (Henery and Geyer 2008). An operations-based study determined that 95% of vehicles observed that turned left during the FYA-permissive indication did so safely (Lin et al. 2008). Researchers that conducted a traffic conflict analysis in Texas found that some high volume intersections with an FYA and lead–lead phasing showed an increase in some kinds of traffic conflicts (Qi et al. 2011a). The same researchers also performed a survey-based study and concluded that the FYA indication was well understood by drivers and suggested that louvered signal heads to prevent the left-turn drivers from seeing the adjacent through signals would increase comprehension even more. They also surveyed traffic engineers and suggested that the three-section, dual-arrow signal head should be used with great caution (Qi et al. 2011a). A crash-based analysis in 2011 concluded that left-turn crash rates did not increase for 14 of 17 study intersections after implementing the FYA. They also commented that

lead–lag signal phasing is not recommended with installation of the FYA due to the "red trap" and "yellow sneakers" crash problems (Qi et al. 2011b).

2.2 RECENT FINDINGS IN THE LITERATURE (2013–2015)

This section provides a summary of the recent findings from the literature on FYAs published from 2013 through 2015.

A 2015 study investigated the effectiveness of the installation of four different types of FYA at 222 intersections in North Carolina (Simpson and Troy 2015). Four categories were created based on the signal phasing before and after the FYA was installed: permissive-only to FYA-PPLT, protected-only to FYA-PPLT, PPLT to FYA-PPLT (Category 3), and permissive-only to FYA-permissive only. Crash rates were compared between the before-FYA and after-FYA conditions based on 2 to 3 years of crash data.

For the 105 intersections and 193 approaches for Category 3 (five-section PPLT to FYA-PPLT), the analysis revealed a 7% reduction in total crashes, a 15% reduction in injury crashes, and a 22% reduction in targeted crashes (Simpson and Troy 2015). The authors defined the targeted crash type as left-turn same-roadway crashes at an approach with the FYA in operation. The predicted after-FYA crashes were determined using a ratio of the *HSM*'s safety performance functions (SPFs) to account for traffic volume increases from the before-FYA period to the after-FYA period. However, the empirical Bayes (EB) method was not used, which limits the accuracy of the comparison.

Research was conducted to assess the effectiveness of upgrading the CG permissive indication to FYAs at intersections operating with PPLT control on driver comprehension and traffic operations in Peoria (Schattler et al. 2013a, 2013b). In that research, driver comprehension of the new traffic control was assessed through a survey instrument, and field investigations were conducted before and after the FYAs were installed to assess changes in traffic operations and traffic conflicts.

A total of 363 drivers completed an online static survey that included seven left-turn scenarios that portrayed the protected and permissive indications of PPLT phasing, with the flashing modes being animated. The results of the survey indicated that drivers had a high comprehension of both the CG and FYA-permissive left-turn indications. However, the survey results provided evidence that some drivers misinterpreted the meaning of a permissive left turn with CG display, and incorrectly and unsafely interpreted the meaning as "go" under some circumstances. With supplemental traffic signs present, driver understanding of the correct action to take when confronted with a FYA significantly increased, and the percentage of incorrect "go" responses significantly decreased. When survey participants were asked, "If oncoming traffic has a green light and you wish to turn left permissively, what signal indication best informs you that you must yield to oncoming traffic before completing your turn?", the majority (66%) felt that the FYA presented the best message in a permissive left turn (Schattler et al. 2013a, 2013b).

A total of 128 hours of field data were collected at 16 study approaches, and before and after comparisons were made to assess the impacts of converting the CG permissive left-turn indication to the FYA on operations using the following variables: median gap size accepted, red light running

(RLR), yellow light running (YLR), and traffic conflicts. The results of the statistical analysis conducted for the study revealed the following (Schattler et al. 2013a, 2013b):

- No significant differences were observed in the median gap size accepted.
- Only one out of the nine study variables involving RLR and YLR experienced a significant increase (RLR on a per-hour basis following the permissive left-turn interval). When exposure variables were considered, the results for RLR were not significant. Overall, the results of this analysis suggest that RLR and YLR, following either the protected interval or the permissive interval of PPLT phasing, is minimally affected by the installation of the FYA, if at all.
- No significant differences in the traffic conflict experience were observed for any of the traffic conflict variables studied.

Overall, the authors suggest that drivers in the Peoria area have high comprehension and acceptance of the FYA message. Additionally, the FYA does not appear to have any negative impacts on traffic operations (Schattler et al. 2013a, 2013b).

A study was conducted in the Bloomington and Peoria areas to investigate driver comprehension and behavior at different types of PPLT signal control (Rietgraf and Schattler 2013). Three types were studied: CG, FYA, and FRA. Drivers were observed at each type of signal control: 192 observations at CG approaches, 344 at FYA approaches, and 427 at FRA approaches. The driver behavior was categorized as safe/unsafe, efficient/inefficient, or a combination of the two. The analyses showed that drivers made safer decisions at FRA (98%) than at CG (86%) and FYA (91%), but they also had the least efficient operation (80%), due to the possible confusion about the FRA message. The FYA indication was found to have the highest combined proportion of safe and efficient actions (82%) compared with FRA (79%) and CG (72%). The authors concluded that the FYA provides the driver with a quicker comprehension time while still maintaining a high level of safety (Rietgraf and Schattler 2013).

The Indiana Department of Transportation (INDOT) commissioned an evaluation study of the FYA installed at two intersections operating with PPLT control (Rescot et al. 2015). Prior to the FYA installations, the signals operated with protected-only left-turn phasing. Because of minimum vertical clearance issues, the FYA signal installation varied at the two intersections: one was mounted vertically and the other was mounted horizontally. Driver performance data (speed and time during turn/braking), traffic crash data, and driver surveys were used to compare the two types of FYA placement. The authors found that there were no significant differences in driver performance between the horizontally and vertically mounted FYA signals. The projected crash modification factors showed an increase in crashes due to the left-turn operations changing from protected only to PPLT control with FYA. Additionally, there were no significant differences found from the driver surveys related to FYA signal mounting configuration (Rescot et al. 2015).

Research was conducted on the safety and operational impacts of the optional FYA delay (Appiah and Cottrell 2014). The researchers stated that “the FYA delay is typically implemented as a steady red arrow display after the steady yellow arrow indication of the protected movement and before the

start of the permissive movement indicated with the FYA" (Appiah and Cottrell 2014). The effectiveness of the FYA delay is debated. The authors surveyed DOTs, practitioners, and members of the NUTCD's Signals Technical Committee and found that in most cases in which an FYA is installed, a delay is utilized. There is a concern that FYA delays of less than 2 seconds might confuse drivers. Overall, there was a consensus that the FYA delay helps drivers distinguish the difference between the protected and permissive phases.

To further examine the safety and operational impacts of an FYA delay, simulations were run using the VISSIM and SSAM software. The simulations varied by the left, right, and through-traffic volumes, as well as the length of delay (0, 2, 4, or 8 seconds). A reduction in traffic conflicts due to an FYA delay was observed for all scenarios except when there was low opposing through volumes. In addition, FYA delays of 2 and 4 seconds did not result in negative operational impacts, though a delay of 8 seconds did in the low opposing traffic volume scenario (Appiah and Cottrell 2014).

Variable-mode left-turn phasing with FYAs by time of day was studied in central Florida to determine critical thresholds that warrant permissive or protected phasing (Abou-Senna et al. 2014). Traffic data, crash data, signal timing/phasing data, intersection geometric data, and land usage was considered. The authors used field observations along with the collected data to generate a model to predict the number of left-turning vehicles during the permissive phase. Using that model and actual crash data, the researchers determined the threshold for choosing a protected phase over a permitted phase. The authors developed guidelines and an interactive decision support system to provide guidance to help engineers decide whether permissive phasing with the FYA should be recommended (Abou-Senna et al. 2014).

Driver performance at three-section and four-section signal displays operating with FYAs was studied using the Oregon State University Driving Simulator (Hurwitz et al. 2014). The study was conducted on 27 subjects at 24 intersections, with a total of 620 left-turn maneuvers observed. Driver performance was measured in two ways: average total eye-glance durations at areas of interest and the position of the pedestrian in the crosswalk when the driver initiated the left turn. It was found that there was no significant difference in either of these variables when comparing them at three-section and four-section FYA signal displays (Hurwitz et al. 2014).

Research was also conducted in central Florida to assess differences in operational efficiency for protected-only left-turn signals and FYA-PPLT signals with a consideration for time of day (Chalise et al. 2014). Because traffic demands and volumes fluctuate throughout the day, the authors felt that that the most efficient and safe left-turn operation is one that can change as the traffic demand changes. Four intersections that were to receive FYA treatment were studied via observation and then by simulation using Synchro/SimTraffic programs. Protected-only and PPLT were each simulated and the intersection delay was calculated. The results were compared on an hourly basis. The authors suggested that if the PPLT operation yielded an average delay equal to or less than the protected-only operation, then for safety reasons, the protected-only operation would be preferred. The intersections studied were found to be most efficient and safe with a variable left-turn phasing plan, based on the time of day (Chalise et al. 2014).

CHAPTER 3: STUDY PURPOSE AND METHODOLOGY

The Illinois Department of Transportation initiated a safety program in 2010 to install FYAs for PPLT control at intersections located on state routes. Vertical four-section signal heads that included the FYA indication for the permissive interval of PPLT phasing replaced the vertically mounted five-section signal heads operating with the CG indication for the permissive left-turn interval of PPLT phasing. The Bradley University research team performed an effectiveness evaluation of the FYA at the approaches where no other geometric or operational changes were made. The purpose of the overall research study was to evaluate the effectiveness of upgrading the CG permissive indication to the FYA indication on safety, driver comprehension, and operations. The research tasks for the overall evaluation study included performing comprehensive areawide traffic crash analyses, conducting field studies of traffic operations and traffic conflicts, and assessing driver comprehension of the new traffic control through a survey instrument.

To fulfill the research objectives, a comprehensive crash-based effectiveness evaluation was conducted to analyze the safety effects of the FYA, which is documented in this report. As a part of this research, two additional reports were previously published to document the findings, entitled *State-of-the-Art Literature Review on Permissive/Protected Left-Turn Control* (Schattler and Lund 2013) and *Driver Comprehension and Operations Evaluation of Flashing Yellow Arrows* (Schattler et al. 2013a).

Comprehensive traffic crash analyses based on 3 years of before-FYA crash data, 3 years of after-FYA crash data, and 3 years of data at 100 comparison sites were conducted in order to evaluate the safety effects of the use of FYAs for PPLT control. A total of 164 approaches located at 86 test intersections were included in the evaluation. Two methods were used to evaluate the crash experience at the FYA locations: the naïve before and after, and the EB. These two methods seek to determine the effectiveness, or percent reduction in crashes, that can be attributed to the countermeasure or improvement. In both methods, the actual after-FYA crash frequency is compared with an expected value. The expected value represents the crashes that would have occurred in the after-FYA period had the safety improvements not been made at the test site. This expected value will never be known with 100% certainty because the conditions at the test site changed due to the improvements. The difference in the two evaluation methods lies in the determination of the expected value of the crashes without treatment. The percent reductions and crash modification factors (CMFs) were then determined for each of the two methods. The observed crash reductions were tested for statistical significance using the Poisson test at a 95% level of confidence (LOC).

3.1 NAÏVE BEFORE AND AFTER

In the naïve before and after method, as shown in Figure 3.1, the expected crash frequency in the after-FYA period, had the improvements not been made, is assumed to be the before-FYA crash frequency. Because the only major change made to the intersection was the installation of the FYA for PPLT control, it can be assumed that any significant change observed in crash frequencies would be a result of the FYAs. Although this method fails to account for fluctuations common in crash frequencies over time, it still provides useful insight into the impact of the treatment.

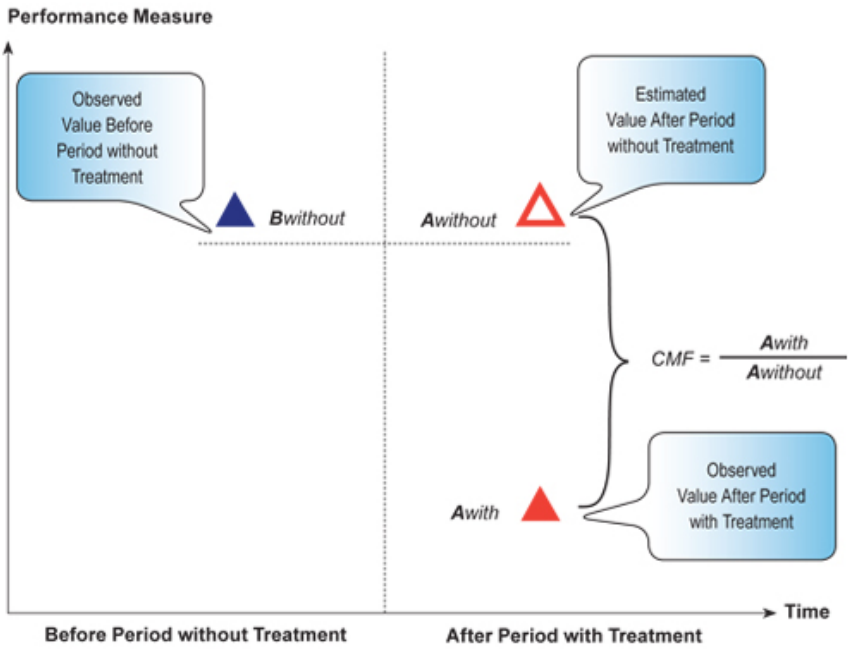


Figure 3.1 Naïve before and after method (Source: FHWA 2010).

3.2 EMPIRICAL BAYES (EB)

The random nature of crashes makes it impossible to truly predict the expected number of crashes in an after-treatment period, had the improvements not been made. Because of its ability to account for regression-to-the-mean bias, the EB method is commonly accepted as a more precise estimation of the expected crashes than any other method.

Regression-to-the-mean effects are typically observed at sites with very high values for crash frequencies and are defined as "the tendency of the response variable to fluctuate about the true mean value" (FHWA 1980). Thus, the decrease in the crash frequency during the after-treatment period cannot be completely attributed to the improvements made at the site unless proper care has been taken to guard against regression-to-the-mean effects. However, this phenomenon does not necessarily occur at all high crash locations. If the crash trend over a multi-year period shows a continuous increasing or decreasing trend with little fluctuation in the crash frequency, the chances of the crash frequency changing during the after-treatment period due to regression-to-the-mean effect are low. However, if there is a sudden drop in the crash frequency after some improvements were made at a treatment site, and the observed crash frequencies over a period of time continue to follow the after-period trend and differ from the multi-year trend observed during the before-improvement period, then this reduction **may not** be attributed to the regression-to-the-mean phenomenon. The regression-to-the-mean phenomenon is illustrated in Figure 3.2.

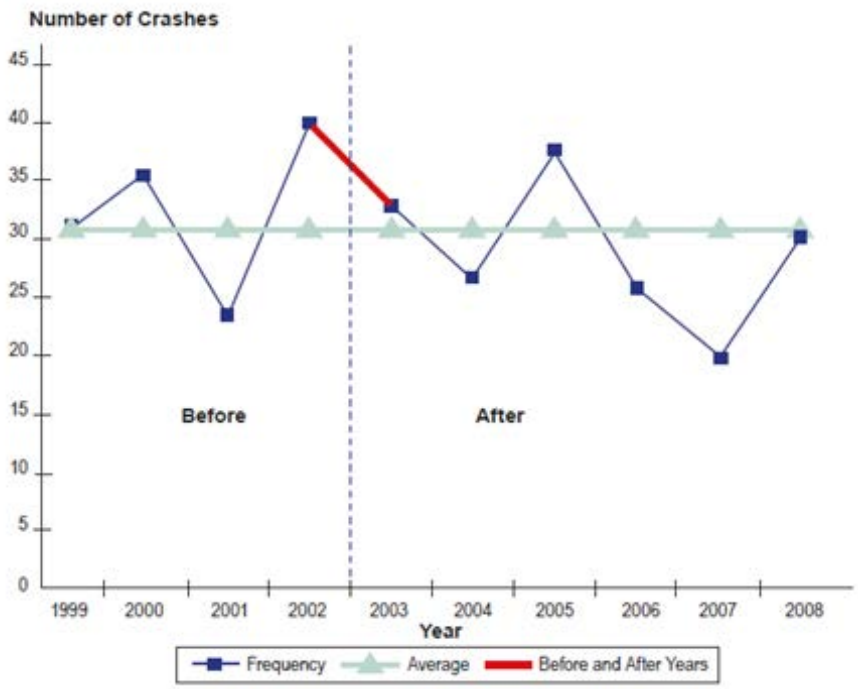


Figure 3.2 Regression-to-the-mean phenomenon (Source: FHWA 2010).

The EB method takes into account both the crash experience of the test sites and a crash prediction model, called a safety performance function (SPF), derived from the crash experience of numerous comparison sites (Figure 3.3). Once developed, this model is then weighted against the observed crash experience of the test site to more accurately predict the expected crashes.

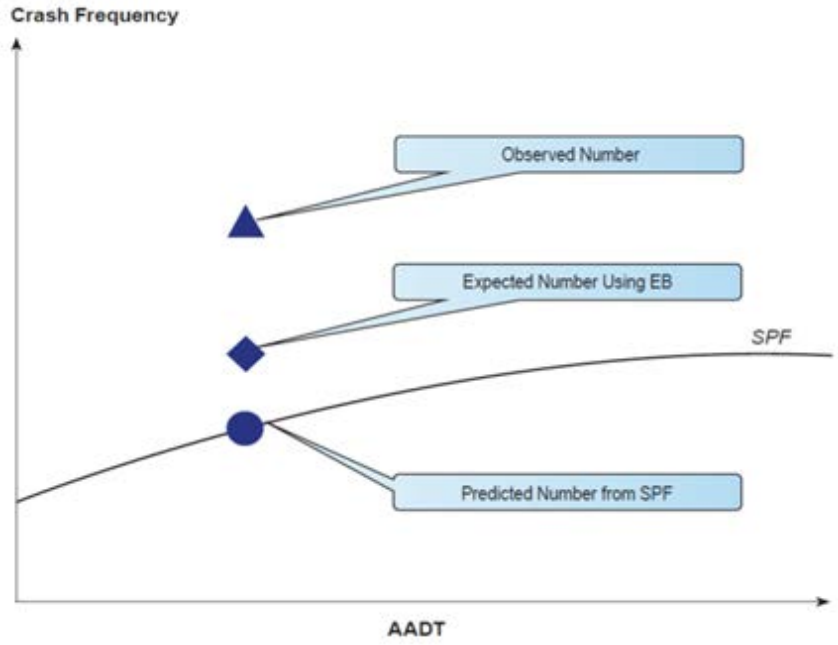


Figure 3.3 Empirical Bayes method (Source: FHWA 2010).

As a part of this research, eight SPF models were developed to predict crashes on an intersection basis and approach basis for the following four crash types:

- Total crashes
- Injury crashes
- Left turn (LT)-related crashes
- Left-turn opposing through (LTOT) crashes

The crash history, traffic volumes, and operational features of a group of 100 comparison sites were compiled and analyzed using the IBM SPSS statistical analysis software. Assuming an underlying Poisson/negative binomial distribution, which is a common assumption in modeling traffic crashes per the American Association of State Highway and Transportation Officials (AASHTO) *Highway Safety Manual* (Bonneson 2010), SPF models were then developed to predict crashes using variables that were found to have a statistically significant influence on crashes observed at the comparison sites.

The EB method accounts for potential regression-to-the-mean bias that may occur when safety treatments are installed at high crash locations. It should be noted that the FYAs were installed along state routes in the Peoria area and include a range of high, moderate, and low crash locations.

CHAPTER 4: SITE DESCRIPTION AND FYA IMPLEMENTATION

The FYA signal indication was installed at 112 intersections on state routes with PPLT phasing in the Peoria area. However, at 26 of these intersections, other safety improvements were also installed; thus, those intersections were excluded from the evaluation study because the impacts of the FYAs could not be isolated. Therefore, 86 intersections were eligible for inclusion in the evaluation where the FYA was installed at 164 study approaches. Figure 4.1 shows the geographical location of the 86 test sites throughout the greater Peoria area.

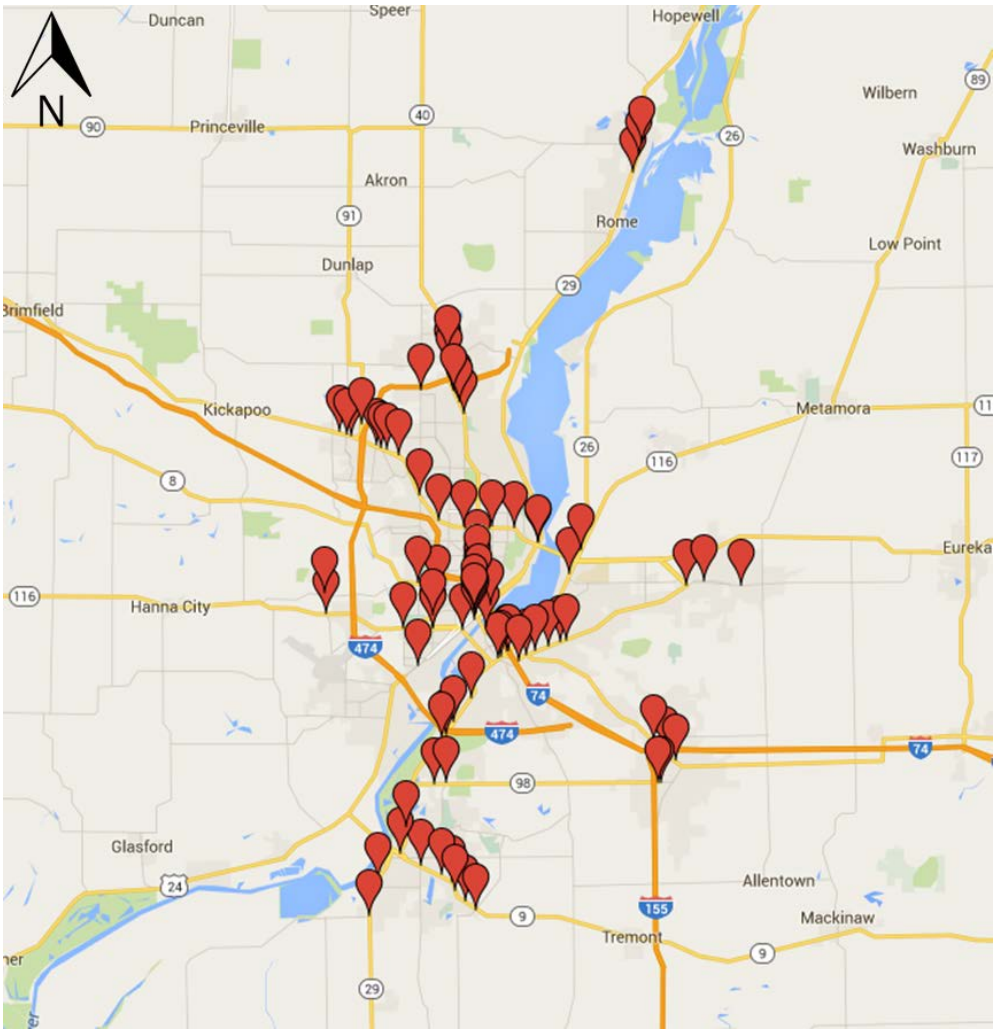


Figure 4.1 Location map of the FYA intersections in the Peoria area.

All 164 study approaches had dedicated left-turn lanes and are located on state routes under the jurisdiction of IDOT. In both the before and after conditions, the traffic signals operated with PPLT control with yellow and all-red intervals following the protected green arrow display to allow vehicles to clear the intersection prior to the permissive interval being displayed, which was the CG in the before condition and FYA in the after condition. Vertical four-section signal heads that included the FYA indication for the permissive interval of PPLT phasing replaced the vertically mounted five-

section signal heads operating with the CG indication for the permissive left-turn interval of PPLT phasing. At over half of the FYA installations, a supplemental sign was also installed with the text "Left Turn Yield on Flashing Yellow Arrow."

The initial cost of FYA installations was $6,000 per approach (2010 dollars) and included the cost of new four-section signal heads and controller cabinet rewiring. It should be noted that, due to IDOT's policy to have mast arms long enough to extend out to the left-turn lane and updated traffic controller equipment having recently been installed areawide, additional costs of mast arms and controller cabinets were not required at the FYA approaches.

Before the FYAs were installed, the permissive phase of the PPLT control operated with a CG indication, and on the state routes, supplemental signs with the text "Left Turn Yield on [CG symbol]" were generally not present, with the exception of five or six approaches. It should be noted, however, that on city maintained roads in Peoria (which are not included in this crash-based analysis), approaches operating with a CG indication for the permissive phase of PPLT control commonly have supplemental signs present to advise motorists to yield on the CG indication. The study approaches operated with PPLT phasing in both the "before" and the "after" periods.

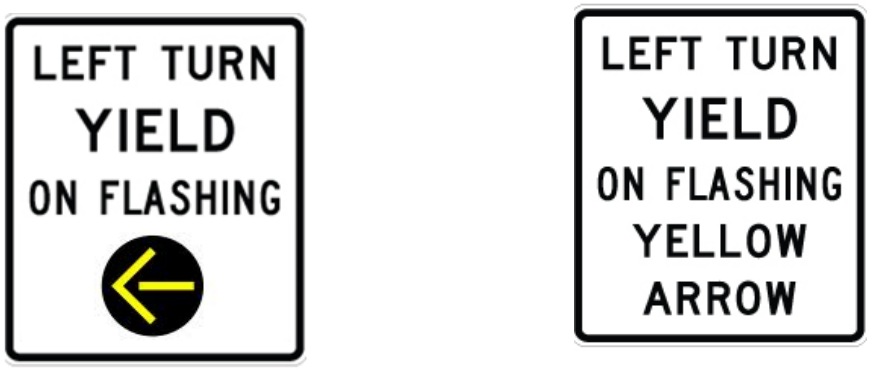
The new four-section vertical signal heads replaced the vertically mounted five-section signal heads operating with the CG indication for the permissive interval, as shown in Figure 4.2. At 90 of the FYA approaches, a supplemental sign with the text "Left Turn Yield on Flashing Yellow Arrow" was mounted on the mast arm adjacent to the FYA signal. At the remaining 74 FYA approaches, just the four-section signal head was installed, without the sign. The decision by IDOT to install the FYA supplemental sign at certain locations was subjective—not based on data analysis or crash trends. In general, the FYA supplemental signs were installed at locations geographically: at isolated intersection approaches and at every few approaches along corridors operating with the FYA. The rationale for not installing the supplemental sign at all approaches along corridors was that drivers were likely to have read the sign at the upstream intersections; therefore, it might not be necessary.

Vertical five-section signal head with CG-permissive indication

Vertical four-section signal head with FYA- permissive indication

Figure 4.2 Signal heads for CG and FYA operations.

The initial version of the sign installed at 10 to 15 FYA locations included text and a yellow arrow symbol, as shown in Figure 4.3a. Because it was determined that the yellow arrow symbol used was not an approved *MUTCD* symbol at that time, a sticker with the text "Yellow Arrow" was made and placed over the arrow symbol at these initial locations within a few months of operation. For all subsequent FYA installations with a supplemental sign, the sign shown in Figure 4.3b was installed. The supplemental sign used in the Peoria area, when present, is the sign with the text "Left Turn Yield on Flashing Yellow Arrow" (Figure 4.3b).



(a) Initial installation (b) Current installation

Figure 4.3 FYA left-turn supplemental signs used in installations.

The characteristics of the 86 intersections where the FYA signals were installed are shown in Table 4.1. The characteristics of the specific FYA approaches follow in Table 4.2. Sample photographs of the study FYA approaches are shown in Figure 4.4, following the tables.

Table 4.1 Study Intersection Characteristics
(asterisk in column 5 denotes divided highway)

No.	Intersection Name	City	Intersection Type	Intersection Geometry	Date FYA Installed	No. Approaches with FYA	No. Approaches with FYA Sign
1	Third & Walmart Entrance	Aledo	4-legged urban	3 lane x 3 lanes	10/22/2010	2	2
2	Third & College	Aledo	4-legged urban	3 lane x 3 lanes	10/27/2010	2	2
3	IL-29 (Fourth) & Cloverdale	Chillicothe	4-legged urban	5 lane x 3 lanes	5/20/2011	4	4
4	IL-29 (Fourth) & Walnut	Chillicothe	4-legged urban	5 lane x 3 lanes	5/17/2011	4	4
5	IL-29 (Fourth) & Truitt	Chillicothe	4-legged urban	5 lane x 3 lanes	5/17/2011	2	2
6	IL-29 (Main) & Highland/Rusche	Creve Coeur	4-legged urban	5 lane x 5 lanes*	6/23/2011	2	0

Table continues next page

No.	Intersection Name	City	Intersection Type	Intersection Geometry	Date FYA Installed	No. Approaches with FYA	No. Approaches with FYA Sign
7	IL-29 (Main) & I-474 Ramps A&D	Creve Coeur	Freeway ramp	5 lane x 3 lanes	6/23/2011	1	0
8	IL-29 (Main) & Fischer Rd.	Creve Coeur	4-legged urban	5 lane x 3 lanes	6/23/2011	2	2
9	US-150 (Meadows) & IL-8 (Washington)	East Peoria	4-legged urban	5 lane x 5 lanes	12/14/2010	1	1
10	US-150/IL-116 (Main) & I-74 EB Ramps	East Peoria	Freeway ramp	6 lane x 3 lanes	5/16/2011	1	0
11	US-150/IL-116 (Main) & I-74 WB Ramps	East Peoria	Freeway ramp	6 lane x 2 lanes	5/16/2011	1	1
12	US-150/IL-116 (Main) & Access Rd. 7 (Marina)	East Peoria	3-legged urban	5 lane x 3 lanes	9/30/2010	1	1
13	IL-8 (E. Washington) & Carver/Jay	East Peoria	4-legged urban	5 lane x 3 lanes	7/7/2011	2	2
14	IL-8 (E. Washington) & Dolans	East Peoria	3-legged urban	5 Lane x 3 lanes	7/6/2011	1	0
15	IL-8 (E. Washington) & Illini	East Peoria	4-legged urban	5 lane x 3 lanes	7/6/2011	2	2
16	IL-8 (E. Washington) & Rosedale/Putnam	East Peoria	4-legged urban	5 lane x 3 lanes	7/7/2011	1	1
17	IL-8/IL-116 (Main) & Springfield	East Peoria	4-legged urban	5 lane x 3 lanes	5/19/2011	2	2
18	IL-8/IL-116 (Main) & Washington	East Peoria	4-legged urban	5 lane x 4 lanes	6/7/2011	4	2
19	Washington & Veterans	East Peoria	4-legged urban	5 lane x 3 lanes	12/21/2010	1	1
20	W. Camp & Riverfront Dr. Ramps	East Peoria	Freeway ramp	5 lane x 3 lanes	7/6/2011	1	1
21	IL-29 & La Salle	Marquette Heights	3-legged urban	6 lane x 3 lanes*	5/9/2011	1	1
22	US-150 (Jackson) & Detroit	Morton	4-legged urban	3 lane x 3 lanes	5/24/2011	2	1
23	US-150 (Jackson) & Veterans	Morton	4-legged urban	3 lane x 3 lanes	5/24/2011	4	2
24	US-150 (Jackson) & Morton	Morton	4-legged urban	5 lane x 4 lanes*	12/21/2010	1	1
25	IL-98 (Birchwood) & Detroit	Morton	4-legged urban	5 lane x 4 lanes*	6/28/2011	4	2
26	IL-98 (Birchwood) & I-155 Ramps A&B	Morton	Freeway ramp	5 lane x 1 lane	6/28/2011	1	0
27	IL-98 & Main	North Pekin	3-legged urban	3 lane x 3 lanes	5/20/2011	1	1
28	IL-9 (Court) & Allentown	Pekin	3-legged urban	5 Lane x 3 lanes	6/16/2011	1	1
29	IL-9 (Court) & Barney	Pekin	4-legged urban	5 lane x 3 lanes*	6/16/2011	2	0
30	IL-9 (Court) & Fourteenth	Pekin	4-legged urban	5 lane x 3 lanes	6/9/2011	4	2
31	IL-9 (Court) & Parkway/Sunset	Pekin	4-legged urban	5 lane x 3 lanes*	6/15/2011	2	0
32	IL-9 (Court) & Valle Vista	Pekin	4-legged urban	5 lane x 3 lanes*	6/14/2011	4	2

Table continues next page

No.	Intersection Name	City	Intersection Type	Intersection Geometry	Date FYA Installed	No. Approaches with FYA	No. Approaches with FYA Sign
33	IL-9 (Court) & Veterans	Pekin	4-legged urban	5 lane x 5 lanes*	9/16/2010	4	4
34	IL-9 (Margaret) & Il29 (Fifth)	Pekin	4-legged urban	3 lane x 3 lanes	6/13/2011	1	1
35	IL-29 (Eighth) & Sheridan	Pekin	4-legged urban	5 lane x 3 lanes	6/29/2011	4	2
36	IL-29 (Second) & Derby	Pekin	3-legged urban	3 lane x 3 lanes	11/4/2010	1	0
37	IL-29 (Second) & Manito/Federal Prison	Pekin	4-legged urban	3 lane x 3 lanes	6/13/2011	2	2
38	IL-98 & Parkway	Pekin	4-legged urban	3 lane x 3 lanes*	5/25/2011	2	2
39	US-24 (Adams) & Griswold	Peoria	3-legged urban	7 lane x 3 lanes	12/23/2010	1	1
40	US-24/IL-29 (Washington) & WB Ramp G-4 Eaton	Peoria	Freeway ramp	5 lane x 4 lanes	5/11/2011	2	2
41	US-24/IL-29 (Washington) & Macarthur	Peoria	4-legged urban	5 lane x 4 lanes	3/2/2011	2	2
42	US-24/IL-29 (Washington) & State	Peoria	4-legged urban	5 lane x 3 lanes	3/2/2011	1	0
43	US-24/IL-29 (Adams) & Ramps B/C WB	Peoria	3-legged urban	5 lane x 3 lanes	6/22/2011	1	1
44	US-24/IL-29 (Adams) & Lorentz	Peoria	4-legged urban	5 lane x 3 lanes*	6/22/2011	1	0
45	War Memorial & Brandywine	Peoria	4-legged urban	5 lane x 3 lanes*	1/19/2011	4	0
46	War Memorial & Frostwood	Peoria	3-legged urban	5 Lane x 3 lanes	1/26/2011	1	0
47	War Memorial & Grand	Peoria	3-legged urban	5 Lane x 3 lanes	12/3/2010	1	0
48	War Memorial & Grand Prairie	Peoria	3-legged urban	7 lane x 3 lanes	12/28/2010	2	0
49	War Memorial & Mountello	Peoria	4-legged urban	5 lane x 3 lanes	12/3/2010	2	0
50	War Memorial & Northland	Peoria	3-legged urban	5 Lane x 3 lanes	1/19/2011	1	0
51	War Memorial & Mathis	Peoria	4-legged urban	3 lane x 3 lanes	1/4/2011	1	0
52	War Memorial & Orange Prairie	Peoria	4-legged urban	5 lane x 4 lanes	12/28/2010	4	2
53	IL-91 & American Prairie	Peoria	4-legged urban	3 lane x 3 lanes*	1/26/2011	1	0
54	War Memorial & Sheridan	Peoria	4-legged urban	5 lane x 5 lanes*	12/17/2010	2	2
55	War Memorial & Willow Knolls	Peoria	4-legged urban	5 lane x 3 lanes*	10/19/2010	4	2
56	War Memorial & Willow Knolls Ct.	Peoria	4-legged urban	5 lane x 3 lanes*	1/6/2011	2	0
57	War Memorial & Wisconsin	Peoria	4-legged urban	5 lane x 3 lanes	10/22/2010	3	0

Table continues next page

No.	Intersection Name	City	Intersection Type	Intersection Geometry	Date FYA Installed	No. Approaches with FYA	No. Approaches with FYA Sign
58	IL-6 NB Ramps & Allen	Peoria	Freeway ramp	5 lane x 1 lane	6/22/2011	1	0
59	IL-8 (Main) & Farmington	Peoria	3-legged urban	5 Lane x 3 lanes	6/14/2011	1	0
60	Knoxville & Alta	Peoria	4-legged urban	5 lane x 3 lanes	12/29/2010	2	0
61	Knoxville & Pennsylvania	Peoria	Freeway ramp	5 lane x 4 lane	1/10/2011	3	2
62	Knoxville & Bird/Frye	Peoria	4-legged urban	5 lane x 3 lanes	10/15/2010	1	0
63	Knoxville & Detweiller	Peoria	4-legged urban	5 lane x 3 lanes	10/15/2010	1	0
64	Knoxville & Glen Oak/Fayette	Peoria	4-legged urban	5 lane x 4 lanes	5/10/2011	1	0
65	Knoxville & McClure	Peoria	4-legged urban	5 lane x 4 lanes	12/9/2010	4	2
66	Knoxville & Richmar	Peoria	4-legged urban	5 lane x 3 lanes*	12/29/2010	2	0
67	Knoxville & Mossville	Peoria	4-legged urban	5 lane x 3 lanes	1/25/2011	4	2
68	Knoxville & Nebraska	Peoria	4-legged urban	5 lane x 3 lanes	11/30/2010	4	0
69	Knoxville & Northpoint	Peoria	4-legged urban	5 lane x 3 lanes	12/30/2010	1	0
70	IL-8/IL-116 (Howett) & IL-8 (Western)	Peoria	4-legged urban, one way	5 lane x 2 lanes	6/21/2011	1	1
71	IL-116 (Lincoln) & Laramie	Peoria	4-legged urban	5 lane x 3 lanes	10/7/2010	1	1
72	IL-116 (Lincoln) & IL-8 (Western)	Peoria	4-legged urban, one way	5 lane x 2 lanes	6/21/2011	1	1
73	Adams & IL-40 (Kumpf)	Peoria	4-legged urban	5 lane x 4 lanes	5/12/2011	1	0
74	Spaulding & Glen Oak/Knoxville	Peoria	Freeway ramp	5 lane x 4 lanes	5/9/2011	1	1
75	Jefferson & IL-40 (Kumpf)	Peoria	4-legged urban, one way	4 lane x 4 lanes	6/10/2011	1	1
76	IL-40 (Kumpf) & M.L. King	Peoria	4-legged urban	3 lane x 3 lanes	6/6/2011	1	0
77	IL-8 (Western) & M.L. King	Peoria	4-legged urban	5 lane x 3 lanes	6/21/2011	2	2
78	IL-8 (Farmington) & Sterling	Peoria	3-legged urban	3 lane x 3 lanes	7/5/2011	1	1
79	IL-116 & Maxwell	Peoria County	4-legged urban	3 lane x 3 lanes	10/13/2010	4	4
80	Farmington & Maxwell	Peoria County	3-legged urban	3 lane x 3 lanes	9/17/2010	1	1
81	IL-116 (Main) & Access Rd. 8	Tazewell County	3-legged urban	5 Lane x 3 lanes	10/6/2010	1	0
82	US-24 Bus & IL-8 (Washington)	Washington	3-legged urban	5 Lane x 3 lanes	5/18/2011	1	0
83	US-24 Bus. & Cummings	Washington	4-legged urban	5 lane x 3 lanes*	5/17/2011	2	2

Table continues next page

No.	Intersection Name	City	Intersection Type	Intersection Geometry	Date FYA Installed	No. Approaches with FYA	No. Approaches with FYA Sign
84	US-24 Bus. & Wilmor	Washington	4-legged urban	5 lane x 3 lanes*	7/5/2011	2	2
85	Knoxville & Lindbergh	Peoria	3-legged urban	5 lane x 4 lanes	12/30/2010	1	0
86	IL-40 (Kumpf) & John Gwynn	Peoria	4-legged urban	7 lane x 3 lanes	6/8/2011	3	1

TABLE 4.2 Average Daily Traffic Volumes at the Study Approaches

(ADT = Average Daily Traffic, VPD = Vehicles Per Day)

No.	Intersection	FYA App.	Supplemental FYA Sign	Approx. ADT (VPD)	Major Street ADT (VPD)	Minor Street ADT (VPD)	Intersection ADT (VPD)
1	Third & Walmart Entrance	EB	Yes	5,150	8,000	3,400	11,400
2	Third & Walmart Entrance	WB	Yes	2,850	8,000	3,400	11,400
3	Third & College	EB	Yes	3,400	8,300	3,600	11,900
4	Third & College	WB	Yes	5,100	8,300	3,600	11,900
5	IL-29 (Fourth) & Cloverdale	NB	Yes	7,550	15,600	3,000	18,600
6	IL-29 (Fourth) & Cloverdale	SB	Yes	8,050	15,600	3,000	18,600
7	IL-29 (Fourth) & Cloverdale	EB	Yes	2,275	15,600	3,000	18,600
8	IL-29 (Fourth) & Cloverdale	WB	Yes	900	15,600	3,000	18,600
9	IL-29 (Fourth) & Walnut	NB	Yes	8,050	14,150	1,650	15,800
10	IL-29 (Fourth) & Walnut	SB	Yes	6,100	14,150	1,650	15,800
11	IL-29 (Fourth) & Walnut	EB	Yes	900	14,150	1,650	15,800
12	IL-29 (Fourth) & Walnut	WB	Yes	750	14,150	1,650	15,800
13	IL-29 (Fourth) & Truitt	NB	Yes	6,100	10,850	2,075	12,925
14	IL-29 (Fourth) & Truitt	SB	Yes	4,750	10,850	2,075	12,925
15	IL-29 (Main) & Highland/Rusche	NB	No	12,350	24,400	5,175	29,575
16	IL-29 (Main) & Highland/Rusche	SB	No	12,250	24,400	5,175	29,575
17	IL-29 (Main) & I-474 Ramps A&D	SB	No	12,350	31,300	8,800	40,100
18	IL-29 (Main) Fischer Rd.	NB	Yes	12,350	24,700	3,100	27,800
19	IL-29 (Main) Fischer Rd.	SB	Yes	12,350	24,700	3,100	27,800
20	US-150 (Meadows) & IL-8 (Washington)	WB	Yes	11,200	23,700	6,800	30,500
21	US-150/IL-116 (Main) & I-74 EB Ramps	SB	No	15,350	29,500	6,300	35,800
22	US150/IL-116 (Main) & I-74 WB Ramps	NB	Yes	14,150	29,500	6,050	35,550
23	US-150/IL-116 (Main) & Access Rd. 7-Marina	NB	Yes	11,950	24,750	2,230	26,980
24	IL-8 (E. Washington) & Carver/Jay	EB	Yes	10,700	21,400	3,200	24,600
25	IL-8 (E. Washington) & Carver/Jay	WB	Yes	9,100	21,400	3,200	24,600
26	IL-8 (E. Washington) & Dolans	WB	No	10,700	21,400	600	22,000
27	IL-8 (E. Washington) & Illini	EB	Yes	9,100	16,750	5,200	21,950
28	IL-8 (E. Washington) & Illini	WB	Yes	7,650	16,750	5,200	21,950
29	IL-8 (E. Washington) & Rosedale/Putnam	EB	Yes	11,200	21,400	500	21,900
30	IL-8/IL-116 (Main) & Springfield	EB	Yes	14,250	28,400	3,250	31,650
31	IL-8/IL-116 (Main) & Springfield	WB	Yes	14,150	28,400	3,250	31,650
32	IL-8/IL-116 (Main) & Washington	NB	No	5,650	28,800	9,600	38,400
33	IL-8/IL-116 (Main) & Washington	SB	No	4,150	28,800	9,600	38,400
34	IL-8/IL-116 (Main) & Washington	EB	Yes	14,550	28,800	9,600	38,400
35	IL-8/IL-116 (Main) & Washington	WB	Yes	14,250	28,800	9,600	38,400
36	East Washington & Veterans	SB	Yes	4,850	10,200	3,925	14,125
37	W. Camp & Riverfront Dr. Ramps	EB	Yes	6,000	16,250	600	16,850

Table continues next page

No.	Intersection	FYA App.	Supplemental FYA Sign	Approx. ADT (VPD)	Major Street ADT (VPD)	Minor Street ADT (VPD)	Intersection ADT (VPD)
38	IL-29 & La Salle	SB	Yes	14,300	31,300	4,250	35,550
39	US-150 (Jackson) & Detroit	SB	No	4,600	8,650	9,200	17,850
40	US-150 (Jackson) & Detroit	WB	Yes	5,000	8,650	9,200	17,850
41	US-150 (Jackson) & Veterans	NB	No	675	6,900	2,475	9,375
42	US-150 (Jackson) & Veterans	SB	No	1,800	6,900	2,475	9,375
43	US-150 (Jackson) & Veterans	EB	Yes	3,250	6,900	2,475	9,375
44	US-150 (Jackson) & Veterans	WB	Yes	3,650	6,900	2,475	9,375
45	US-150 (Jackson) & Morton	EB	Yes	4,400	11,150	8,550	19,700
46	IL-98 (Birchwood) & Detroit	NB	No	3,350	7,350	8,100	15,450
47	IL-98 (Birchwood) & Detroit	SB	No	4,750	7,350	8,100	15,450
48	IL-98 (Birchwood) & Detroit	EB	Yes	5,000	7,350	8,100	15,450
49	IL-98 (Birchwood) & Detroit	WB	Yes	2,350	7,350	8,100	15,450
50	IL-98 (Birchwood) & I-155 Ramps A&B	EB	No	3,900	9,550	1,200	10,750
51	IL-98 & Main	EB	Yes	1,925	6,725	4,500	11,225
52	IL-9 (Court) & Allentown	SB	Yes	12,100	24,050	750	24,800
53	IL-9 (Court) & Barney	EB	No	10,050	17,200	1,325	18,525
54	IL-9 (Court) & Barney	WB	No	7,150	17,200	1,325	18,525
55	IL-9 (Court) & Fourteenth	NB	No	3,850	18,750	8,250	27,000
56	IL-9 (Court) & Fourteenth	SB	No	4,400	18,750	8,250	27,000
57	IL-9 (Court) & Fourteenth	EB	Yes	8,400	18,750	8,250	27,000
58	IL-9 (Court) & Fourteenth	WB	Yes	10,400	18,750	8,250	27,000
59	IL-9 (Court) & Parkway/Sunset	EB	No	10,400	22,350	8,875	31,225
60	IL-9 (Court) & Parkway/Sunset	WB	No	11,950	22,350	8,875	31,225
61	IL-9 (Court) & Valle Vista	NB	Yes	10,050	21,150	3,650	24,800
62	IL-9 (Court) & Valle Vista	SB	Yes	12,100	21,150	3,650	24,800
63	IL-9 (Court) & Valle Vista	EB	No	2,200	21,150	3,650	24,800
64	IL-9 (Court) & Valle Vista	WB	No	1,450	21,150	3,650	24,800
65	IL-9 (Court) & Veterans	NB	Yes	5,250	10,400	7,900	18,300
66	IL-9 (Court) & Veterans	SB	Yes	2,650	10,400	7,900	18,300
67	IL-9 (Court) & Veterans	EB	Yes	7,150	10,400	7,900	18,300
68	IL-9 (Court) & Veterans	WB	Yes	3,250	10,400	7,900	18,300
69	IL-9 (Margaret) & IL-29 (Fifth)	SB	Yes	3,900	6,750	6,025	12,775
70	IL-29 (Eighth) & Sheridan	NB	Yes	9,100	20,850	5,075	25,925
71	IL-29 (Eighth) & Sheridan	SB	Yes	11,800	20,850	5,075	25,925
72	IL-29 (Eighth) & Sheridan	EB	No	2,175	20,850	5,075	25,925
73	IL-29 (Eighth) & Sheridan	WB	No	2,900	20,850	5,075	25,925
74	IL-29 (Second) & Derby	SB	No	6,500	12,850	1,975	14,825
75	IL-29 (Second) & Manito/Federal Prison	NB	Yes	3,150	8,750	2,850	11,600
76	IL-29 (Second) & Manito/Federal Prison	SB	Yes	5,600	4,650	3,725	11,600

Table continues next page

No.	Intersection	FYA App.	Supplemental FYA Sign	Approx. ADT (VPD)	Major Street ADT (VPD)	Minor Street ADT (VPD)	Intersection ADT (VPD)
77	IL-98 & Parkway	EB	Yes	4,800	6,900	5,000	11,900
78	IL-98 & Parkway	WB	Yes	2,100	6,900	5,000	11,900
79	US-24 (Adams) & Griswold	EB	Yes	11,350	20,600	1,025	21,625
80	US-24/IL-29 (Washington) & WB Ramp G-4	NB	Yes	4,450	7,700	3,225	10,925
81	US-24/IL-29 (Washington) & WB Ramp G-4	SB	Yes	3,250	7,700	3,225	10,925
82	US-24/IL-29 (Washington) & Macarthur	SB	Yes	4,600	10,400	8,450	18,850
83	US-24/IL-29 (Washington) & Macarthur	WB	Yes	5,050	10,400	8,450	18,850
84	US-24/IL-29 (Washington) & State	NB	No	4,600	9,100	3,500	12,600
85	US-24/IL-29 (Adams) & Ramps B/C WB	NB	Yes	8,950	17,900	7,300	25,200
86	US-24/IL-29 (Adams) & Lorentz	NB	No	8,950	17,900	200	18,100
87	US-150 (War Memorial) & Brandywine	NB	No	4,700	24,000	2,450	26,450
88	US-150 (War Memorial) & Brandywine	SB	No	1,225	24,000	2,450	26,450
89	US-150 (War Memorial) & Brandywine	EB	No	12,100	24,000	2,450	26,450
90	US-150 (War Memorial) & Brandywine	WB	No	12,100	24,000	2,450	26,450
91	US-150 (War Memorial) & Frostwood	WB	No	12,900	24,000	1,625	25,625
92	US-150 (War Memorial) & Grand	EB	No	16,000	32,000	500	32,500
93	US-150 (War Memorial) & Grand Prairie	EB	No	6,050	14,750	2,600	17,350
94	US-150 (War Memorial) & Grand Prairie	WB	No	8,700	14,750	2,600	17,350
95	US-150 (War Memorial) & Mountello	EB	No	10,350	20,850	2,400	23,250
96	US-150 (War Memorial) & Mountello	WB	No	12,050	20,850	2,400	23,250
97	US-150 (War Memorial) & Northland	EB	No	18,750	37,500	1,325	38,825
98	US-150 (War Memorial) & American TV	EB	No	5,050	10,100	500	10,600
99	US-150 (War Memorial) & Orange Prairie	NB	No	1,725	11,100	2,350	13,450
100	US-150 (War Memorial) & Orange Prairie	SB	No	625	11,100	2,350	13,450
101	US-150 (War Memorial) & Orange Prairie	EB	Yes	5,100	11,100	2,350	13,450
102	US-150 (War Memorial) & Orange Prairie	WB	Yes	6,050	11,100	2,350	13,450
103	IL-91 & American Prairie	NB	No	4,950	9,450	1,075	10,525
104	US-150 (War Memorial) & Sheridan	EB	Yes	12,700	26,000	14,700	40,700
105	US-150 (War Memorial) & Sheridan	WB	Yes	14,200	26,000	14,700	40,700
106	US-150 (War Memorial) & Willow Knolls	NB	No	3,650	20,250	9,250	29,500
107	US-150 (War Memorial) & Willow Knolls	SB	No	5,600	20,250	9,250	29,500
108	US-150 (War Memorial) & Willow Knolls	EB	Yes	12,000	20,250	9,250	29,500
109	US-150 (War Memorial) & Willow Knolls	WB	Yes	8,250	20,250	9,250	29,500
110	US-150 (War Memorial) & Willow Knolls Ct.	EB	No	8,250	18,600	1,300	19,900
111	US-150 (War Memorial) & Willow Knolls Ct.	WB	No	10,350	18,600	1,300	19,900
112	US-150 (War Memorial) & Wisconsin	NB	No	3,050	28,700	4,175	32,875
113	US-150 (War Memorial) & Wisconsin	EB	No	14,900	28,700	4,175	32,875
114	US-150 (War Memorial) & Wisconsin	WB	No	13,800	28,700	4,175	32,875
115	IL-6 NB Ramps & Allen	NB	No	10,300	20,600	5,600	26,200

Table continues next page

No.	Intersection	FYA App.	Supplemental FYA Sign	Approx. ADT (VPD)	Major Street ADT (VPD)	Minor Street ADT (VPD)	Intersection ADT (VPD)
116	IL-8 (Main) & Farmington	EB	No	10,200	22,250	5,500	27,750
117	IL-40 (Knoxville) & Alta	NB	No	9,300	17,500	2,375	19,875
118	IL-40 (Knoxville) & Alta	EB	No	2,375	17,500	2,375	19,875
119	IL-40 (Knoxville) & Pennsylvania	NB	No	5,150	24,650	4,050	28,700
120	IL-40 (Knoxville) & Pennsylvania	SB	Yes	13,200	24,650	4,050	28,700
121	IL-40 (Knoxville) & Pennsylvania	EB	Yes	1,300	24,650	4,050	28,700
122	IL-40 (Knoxville) & Bird/Frye	NB	No	11,900	22,850	1,275	24,125
123	IL-40 (Knoxville) & Detweiller	NB	No	12,850	25,700	2,900	28,600
124	Knoxville & Glen Oak/Fayette	WB	No	5,800	9,700	5,250	14,950
125	IL-40 (Knoxville) & McClure	NB	Yes	13,200	24,300	8,050	32,100
126	IL-40 (Knoxville) & McClure	SB	Yes	11,550	25,500	6,600	32,100
127	IL-40 (Knoxville) & McClure	EB	No	3,650	25,500	6,600	32,100
128	IL-40 (Knoxville) & McClure	WB	No	2,950	25,500	6,600	32,100
129	IL-40 (Knoxville) & Richmar	NB	No	9,300	18,600	1,850	20,450
130	IL-40 (Knoxville) & Richmar	SB	No	9,300	18,600	1,850	20,450
131	IL-40 (Knoxville) & Mossville	NB	Yes	8,200	14,550	2,700	17,250
132	IL-40 (Knoxville) & Mossville	SB	Yes	6,900	14,550	2,700	17,250
133	IL-40 (Knoxville) & Mossville	EB	No	1,475	14,550	2,700	17,250
134	IL-40 (Knoxville) & Mossville	WB	No	1,600	14,550	2,700	17,250
135	IL-40 (Knoxville) & Nebraska	NB	No	13,200	26,400	6,250	32,650
136	IL-40 (Knoxville) & Nebraska	SB	No	13,200	26,400	6,250	32,650
137	IL-40 (Knoxville) & Nebraska	EB	No	3,150	26,400	6,250	32,650
138	IL-40 (Knoxville) & Nebraska	WB	No	3,100	26,400	6,250	32,650
139	IL-40 (Knoxville) & Northpoint	NB	No	11,950	23,800	1,000	24,800
140	IL-8/IL-116 (Howett) & IL-8 (Western)	NB	Yes	6,900	13,800	3,525	17,325
141	IL-116 (Lincoln) & Laramie	WB	Yes	6,200	11,650	8,200	19,850
142	IL-8/IL-116 (Lincoln) & IL-8 (Western)	SB	Yes	6,900	12,700	4,300	17,000
143	Adams & IL-40 (Kumpf)	SB	No	7,800	18,000	8,450	26,450
144	Spaulding & Glen Oak/Knoxville	EB	Yes	2,900	11,800	5,800	17,600
145	Jefferson & IL-40 (Kumpf)	NB	Yes	7,800	14,700	9,500	24,200
146	IL-40 (Kumpf) & M.L. King	NB	No	2,650	5,300	3,600	8,900
147	IL-8 (Western) & M.L. King	SB	Yes	9,500	16,400	6,325	22,725
148	IL-8 (Western) & M.L. King	EB	Yes	2,325	13,600	8,200	22,725
149	IL-8 (Farmington) & Sterling	EB	Yes	7,850	7,350	7,150	21,800
150	IL-116 & Maxwell	NB	Yes	2,000	7,350	7,150	14,500
151	IL-116 & Maxwell	SB	Yes	5,150	7,350	7,150	14,500
152	IL-116 & Maxwell	EB	Yes	4,150	7,350	7,150	14,500
153	IL-116 & Maxwell	WB	Yes	3,200	7,350	7,150	14,500
154	Farmington & Maxwell	WB	Yes	3,000	5,700	2,750	8,450

Table continues next page

No.	Intersection	FYA App.	Supplemental FYA Sign	Approx. ADT (VPD)	Major Street ADT (VPD)	Minor Street ADT (VPD)	Intersection ADT (VPD)
155	IL-116(Main) & Access Rd. 8	NB	No	13,600	27,200	300	27,500
156	US-24 Bus. & IL-8 (Washington)	EB	No	6,450	16,350	6,100	22,450
157	US-24 Bus. & Cummings	EB	Yes	9,950	20,000	5,100	25,100
158	US-24 Bus. & Cummings	WB	Yes	10,050	20,000	5,100	25,100
159	US-24 Bus. & Wilmor	EB	Yes	8,950	15,700	3,925	19,625
160	US-24 Bus. & Wilmor	WB	Yes	6,750	15,700	3,925	19,625
161	IL-40 (Knoxville) & Lindbergh	NB	No	10,950	21,900	4,000	25,900
162	IL-40 (Kumpf) & John Gwynn	NB	Yes	6,950	13,800	2,550	16,350
163	IL-40 (Kumpf) & John Gwynn	SB	No	6,900	13,800	2,550	16,350
164	IL-40 (Kumpf) & John Gwynn	WB	No	2,550	13,800	2,550	16,350

(a) War Memorial and Frostwood (WB)

(b) US-24/IL-29 (Adams) and Lorentz (NB)

Figure 4.4 Sample FYA study approaches (continues next page).

(c) Farmington and Sterling (EB)

(d) Washington and Veterans (SB)

Figure 4.4 Sample FYA study approaches (continues next page).

(e) IL-29 and Fischer (SB)

Figure 4.4 Sample FYA study approaches.

CHAPTER 5: DATA COLLECTION AND ANALYSIS

The safety evaluation of the FYA was driven entirely by crash data. Safety effectiveness analyses were performed using crash data for periods both before and after the FYAs were installed. In order to sufficiently evaluate the safety effectiveness, a total of 6 years of crash data were needed for each of the 86 test intersections. For each test intersection, this 6-year period included the 3 years leading up to the installation of the FYA (3 years of before-FYA crash data), as well as 3 years of crash data after the FYA was installed (3 years of after-FYA crash data). Because the installation of the FYAs took only a few days per intersection, the after-FYA period began approximately 3 weeks after the FYA signals were installed. The 6-year study period varied from site to site based on the actual date the FYA signals were installed. In general, the period ranged from 2007 through 2013 for each FYA test site.

Crash data for all 86 FYA test sites were obtained from IDOT. Typically, the crash data were received in batches ranging from 6 months to 1 year of data, depending on data availability. Once the crash database files were received, the research team extracted the data for each intersection, downloaded the police traffic crash report forms, and then filed them for ease of use and organization. Because the police traffic crash reports were used in this evaluation study to determine accurate crash types, the research team extracted data from the forms one crash at a time.

All crash types were determined from the diagrams prepared by the police officers on the form and/or from the direction of movements of the involved drivers as noted in the crash report forms. The crash diagrams and narratives included on the crash report provided an accurate assessment of the type of crash that actually occurred, regardless of the crash type coded on the form. The narratives of the crash report forms were carefully analyzed to help minimize potential coding errors. For each test approach, crashes were collected within a 200-foot radius, and information was summarized for location details, crash details, and driver characteristics. Data extracted from crash report forms included the following:

- Date of crash
- Time of crash
- Day of week
- Weather conditions
- Road surface conditions
- Crash type
- Crash severity (K, A, B, C, PDO)
- Approach of intersection at which the crash occurred
- Driver(s) age and gender
- Primary contributory cause of crash

Identifying the specific crash type for each crash allowed for a more effective way of analyzing the data. Because the FYA is expected to have the greatest impact on left-turn movements, focus was placed on LT-related crashes categorized into one of the following nine types, as also shown in Figure 5.1:

- Left-turn rear-end
- Left-turn opposing through
- Left-turn opposing right-turn
- Left-turn pedestrian
- Left-turn sideswipe same
- Left-turn sideswipe opposite
- Left-turn angle near side
- Left-turn angle far side
- Left-turn single vehicle/other

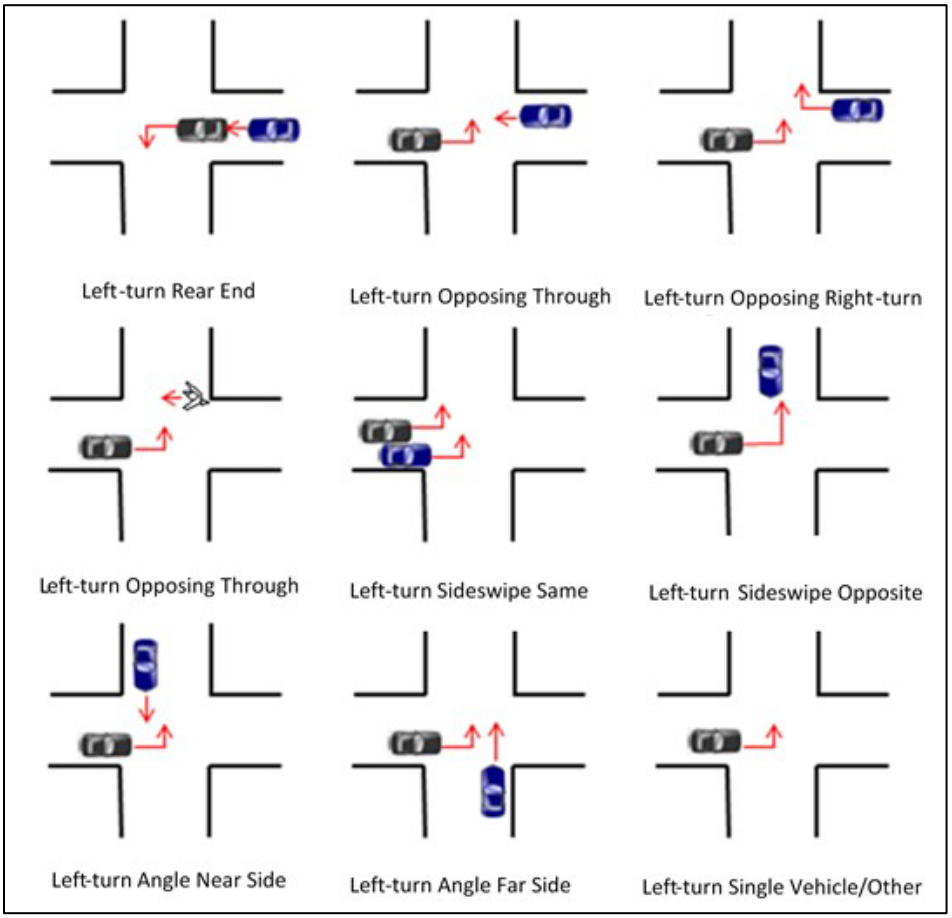


Figure 5.1 Left-turn-related crash types.

The traffic crash data were aggregated into four main categories for the analyses:

- Total crashes
- Injury crashes
- LT-related crashes
- LTOT crashes

These categories were chosen in order to gain a comprehensive understanding of the safety effects of the FYA. Left turn–related and LTOT crashes are considered to be the targeted crash types for the FYA because the FYAs were implemented to reduce these specific crash types.

Traffic volume data for the before and after periods for the test intersections were obtained from average daily traffic (ADT) counts on IDOT's website. The intersection characteristics (geometry, speed limit, PPLT control, and other characteristics) were obtained online from Google Earth and Google maps and were later verified in the field.

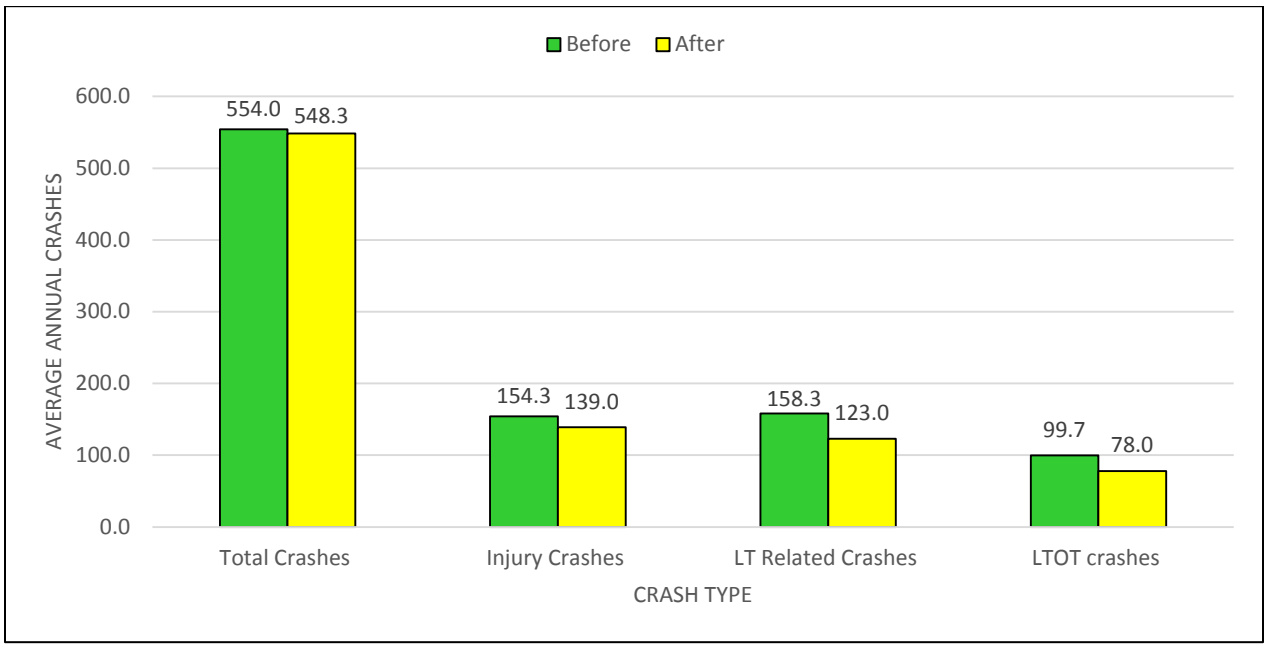
Once the traffic crash data had been extensively analyzed and summarized, crash comparisons were made to determine whether the FYA had statistically significant effects on crashes. The crash analysis was performed at all study approaches that had been converted from CG to FYA display.

A total of 3,307 traffic crashes occurred over a 6-year period at the 86 test intersections. Table 5.1 presents the overall crash frequencies for the before and after periods on an intersection basis and an FYA approach basis. Details of the crash frequencies by year, by crash type, and by intersection can be found in Appendix A; similar details for each FYA approach can be found in Appendix B.

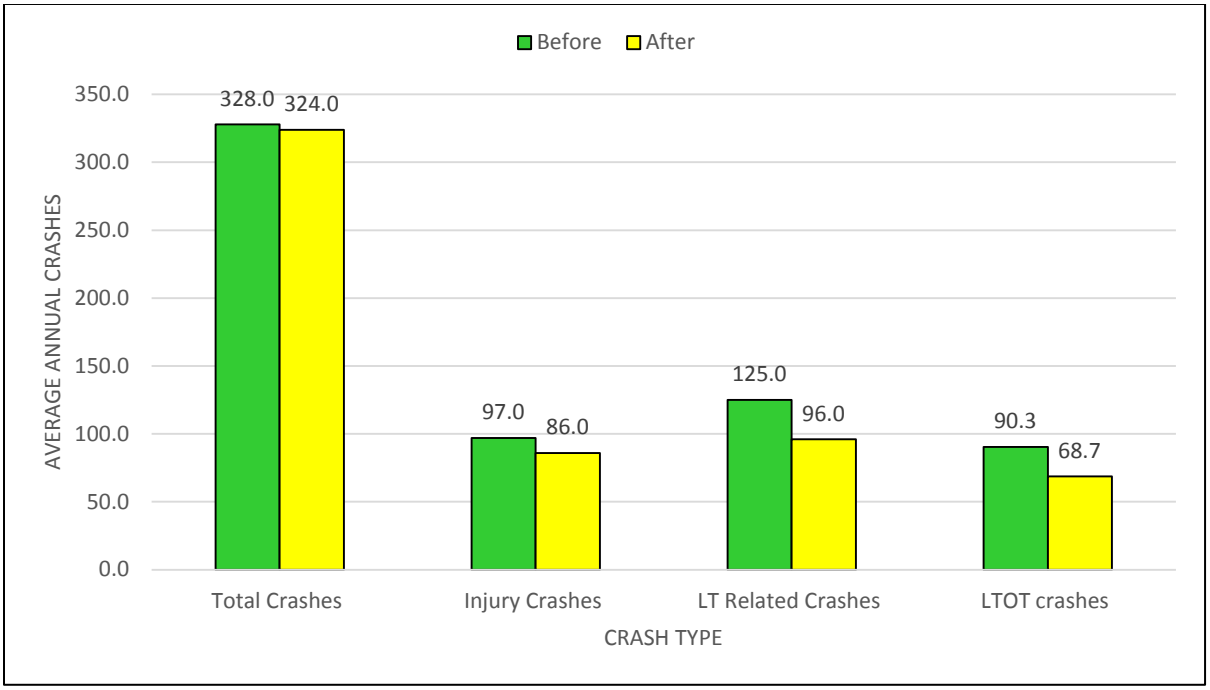
Table 5.1 Overall Crash Frequencies Before and After FYA Installation

		3-Year Crash Data Totals		Average Annual Crashes per Year	
	Crash Type	**Before**	**After**	**Before**	**After**
Intersection	Total Crashes	1,662	1,645	554.0	548.3
	Injury Crashes	463	417	154.3	139.0
	LT-Related Crashes	475	369	158.3	123.0
	LTOT Crashes	299	234	99.7	78.0
FYA Approaches	Total Crashes	984	972	328.0	324.0
	Injury Crashes	291	258	97.0	86.0
	LT-Related Crashes	375	288	125.0	96.0
	LTOT Crashes	271	206	90.3	68.7

Figure 5.2 provides graphical displays of the annual average crash comparisons on an (a) intersection basis and (b) FYA approach basis. The distribution of crashes by severity for the before and after periods for the 86 test intersections are shown in Figure 5.3.

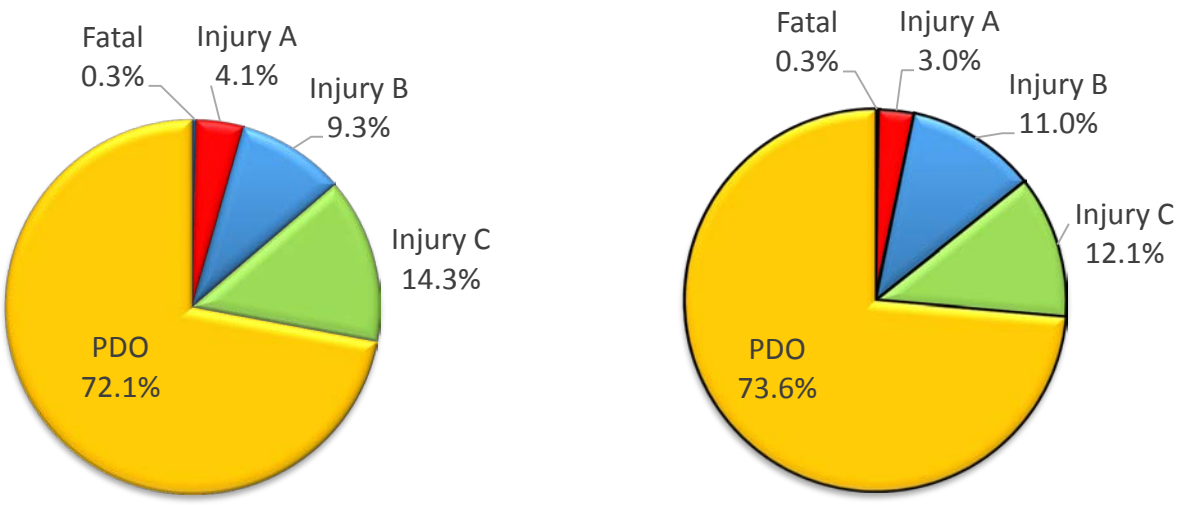


(a) 86 test intersections



(b) 164 FYA approaches

Figure 5.2 Comparison of before-FYA and after-FYA crashes.



(a) Before period (b) After period

Figure 5.3 Distribution of crashes by severity for the before and after periods.

The trends in Figure 5.2 indicate that crashes were reduced after the LT signals were converted from CG to FYA indications for PPLT control. It should be noted that FYAs were not installed at all approaches of the test intersections. Thus, the crash reductions on an intersection basis are not as great as the reductions on an approach basis. It can also be observed that the greatest reductions in crashes occurred for the targeted crash types (i.e., LT-related and LTOT crashes). The trends in Figure 5.3 show a decrease in the percentage of combined fatal (K) and injury A crashes from the before to after periods, from 4.4% to 3.3%. It should be noted that the observed reductions in crashes must be subjected to appropriate statistical testing before conclusions on the effectiveness of the FYAs can be made. The statistical testing for the safety evaluation is presented in the next two chapters.

CHAPTER 6: TRAFFIC CRASH ANALYSIS

Traffic crash analyses were performed for each of the 86 test intersections and 164 test approaches based on 3 years of before data and 3 years of after data. The analysis of traffic crashes and the effectiveness evaluations were based on the naïve before and after method and the EB method.

6.1 NAÏVE BEFORE AND AFTER METHOD

The naïve before and after method involves comparing the crash frequency before FYA implementation to the crash frequency after FYA implementation. The before-period crashes are considered to be the "expected" value, based on the assumption that the crashes would have remained the same over time had the FYAs not been implemented. The result of this comparison is a theoretical difference in crash frequency that can be attributed to implementation of the FYA, if the finding is found to be statistically significant at a 95% LOC. The naïve before and after analysis was performed at an intersection level as well as an approach level. The intersection-level analysis involved the evaluation of all crashes occurring at or within 200 feet of the 86 FYA test sites. The approach-level analysis focused on a smaller subset of the data, involving the evaluation of crashes occurring only at the 164 FYA approaches. Additionally, the approach-level analysis was further aggregated into "with" and "without" the supplemental FYA sign in order to determine the safety effects the supplemental sign.

The naïve before and after method was also used to perform more specific analyses. An older/younger driver analysis was performed in which crashes involving older drivers and younger drivers were analyzed to see the effects of the FYA for these age groups. Crashes that involved a driver of age 65 or older were considered older driver crashes. Crashes involving drivers 16 through 21 years of age were considered younger driver crashes. Please note that in this analysis, the fault of the crash was not assigned to the drivers. So, just because an older driver was involved in the crash, it does not mean that the older driver was at fault and the cause of the crash. The older/younger driver comparisons were performed at an intersection level as well as an approach level.

6.2 EMPIRICAL BAYES (EB) METHOD

The EB method of analysis accounts for regression-to-the-mean through the use of SPFs. In the EB method, a more complex approach is applied to determine the value of the "expected" after-FYA crashes without treatment. An SPF is an equation used to predict the crash frequency at a location as a function of traffic volume (and in some cases, roadway or intersection characteristics) and are developed based on trends at comparison sites. In the EB method conducted in this research, SPFs were developed by the research team in order to predict crash frequencies.

The development of SPFs involved locating and obtaining characteristics of 100 comparison sites. The comparison sites were intersections located throughout the central Illinois area that had geometric and traffic volume characteristics similar to the 86 FYA test sites. The comparison sites, much like the FYA test sites in the before period, operated with PPLT left-turn phasing, using a circular green ball

indication. Three years of crash data were obtained for the comparison sites from 2009 through 2011.

The geometric characteristics, crash history, and traffic volumes of the 100 comparison sites were compiled and analyzed using the IBM SPSS statistical analysis software. Details of the traffic volume, crash data, and other characteristics for the comparison sites can be found in Appendix C. Assuming an underlying Poisson/negative binomial distribution, which is a common assumption in modeling traffic crashes per the *HSM* (Bonneson 2010), SPF models were then developed to predict crashes using variables that were found to have a statistically significant influence on crashes. Equations 6.1, 6.2, 6.3, 6.4, and 6.5 show the form of the SPFs developed in this research, and Tables 6.1 and 6.2 show the coefficients, standard error, and overdispersion factors for the SPFs developed on an intersection level and approach level, respectively.

Overall 86 Intersection Analysis

$$P = e^{\alpha} * e^{(TotalIntADT)\beta 1} \quad (6.1)$$

164 FYA Approach Analysis

Total Crashes:

$$P = e^{\alpha} * e^{(TotalIntADT)\beta 1} * e^{\left(Prop.\frac{App}{TotalADT}\right)\beta 2} * e^{(OppThruLanes)\beta 3} \quad (6.2)$$

Injury Crashes:

$$P = e^{\alpha} * e^{(TotalIntADT)\beta 1} * e^{(OppThruLanes)\beta 2} \quad (6.3)$$

LT-Related Crashes:

$$P = e^{\alpha} * e^{(ApproachADT)\beta 1} * e^{(OppThruLanes)\beta 2} \quad (6.4)$$

LTOT Crashes:

$$P = e^{\alpha} * e^{(TotalIntADT)\beta 1} * e^{(OppThruLanes)\beta 2} \quad (6.5)$$

where

P = average annual predicted crashes
TotalIntADT = total intersection ADT
ApproachADT = ADT on the specific approach
Prop. App/TotalADT = proportion of approach ADT to total intersection ADT
OppThruLanes = number of opposing through lanes for a specific approach
α, β_1, β_2, and β_3 = regression coefficients

Table 6.1 Intersection Analysis SPF Coefficients

	Regression Coefficients		
	Intercept α (St. Error)	Coefficient β_1 (St. Error)	Overdispersion Parameter (k)
Total Crashes	0.579 (0.14)	0.0000639 (5.13E-6)	0.07
Injury Crashes	–0.675 (0.21)	0.0000582 (6.96E-6)	0.013
Left-Turn-Related Crashes	–1.615 (0.32)	0.0000842 (1.12E-5)	0.265
LTOT Crashes	–2.073 (0.24)	0.0000603 (7.67E-6)	1.11E-07

Table 6.2 Approach Analysis SPF Coefficients

	Regression Coefficients				
	Intercept α (St. Error)	Coefficient β_1 (St. Error)	Coefficient β_2 (St. Error)	Coefficient β_3 (St. Error)	Overdispersion Parameter (k)
Total Crashes	–1.384 (0.20)	0.00005636 (4.99E-6)	0.228 (0.11)	1.726 (0.41)	7.86E-8
Injury Crashes	–1.695 (0.29)	0.00003531 (8.14E-6)	0.342 (0.18)	NA	7.36E-8
Left-Turn-Related Crashes	–1.419 (0.28)	0.00006329 (2.60E-5)	0.467 (0.18)	NA	4.71E-8
LTOT Crashes	–2.736 (0.39)	0.00004909 (8.90E-6)	0.555 (0.22)	NA	5.72E-15

The standard error of the coefficients helps measure the quality of an SPF and represents the ability of an SPF to predict crashes accurately. A small standard error indicates that the SPF predicts crashes accurately. As shown in Tables 6.1 and 6.2, the standard errors are very small, with values ranging from 0.000005 to 0.42.

The overdispersion parameters were derived from the negative binomial modeling process. Traffic crashes are typically assumed to follow a Poisson distribution, where the mean and variance are equal. If the mean and variance of the crashes are not equal, the negative binomial model should be used to account for this overdispersion. Using the predicted crashes per year, the overdispersion factor, and the weight factor, the expected number of after crashes without treatment can be predicted using the EB method, according to the specific steps listed below (Persaud et al. 2001).

1. "The annual number of crashes (*P*) that would be expected at intersections with traffic volumes and other characteristics similar to the one being analyzed" is estimated based on a regression model, called a safety performance function (Persaud et al. 2001).

2. "Traffic crash frequency at the test site in the 'before' period is combined with the estimate of (*P*) to determine the expected annual number of crashes (*m*) at the test site before treatment" (Persaud et al. 2001):

$$m = w_1(X) + w_2 (P) \quad (6.6)$$

where the weights w_1 and w_2 are "estimated from the mean and variance of the regression estimate as" (Persaud et al. 2001):

$$w_1 = P / (k + nP) \quad (6.7)$$

$$w_2 = k / (k + nP) \quad (6.8)$$

where

$$k = P^2 / Var (P) \quad (6.9)$$

and *k* is a "constant for a given model and is estimated from the regression calibration process" (Persaud et al. 2001).

Substituting the values of w_1 and w_2 into Equation 6.6 and dividing each term by *P*, gives:

$$m = (k + x) / (k / P + y) \quad (6.10)$$

3. To estimate *E*, adjustments are then made to account for volume changes between the "before" and "after" periods, as well as for the length of time the "after" data was accumulated. To adjust for volume changes, the expected annual number of crashes in the "before" period is multiplied by *R*, "the ratio of the annual regression predictions for the 'before' and 'after' periods" (Persaud et al. 2001).

$$m_a = R \times m_b \quad (6.11)$$

where

$$R = P_a/P_b \quad (6.12)$$

To estimate *E*, the number of crashes that would have occurred in the "after" period had the safety treatments not been implemented, m_a is multiplied by y_a, the length of the "after" period in years.

$$E = m_a \times (y_a) \quad (6.13)$$

The expected crash frequency (*E*) was then compared with the actual annual crash frequency observed in the after-FYA period and subjected to statistical testing in order to determine the crash reduction related to installation of the FYA.

CHAPTER 7: EVALUATION RESULTS AND STATISTICAL ANALYSIS

The results of the effectiveness of the FYAs are presented in this section for the analyses and evaluation methods listed, for four crash types (total crashes, injury crashes, LT-related crashes, and LTOT crashes). Please note that because the FYAs were installed to reduce these specific crash types, the targeted crash type for the FYA are LT-related and LTOT crashes.

Naïve Before and After, and EB Methods

- Intersection level (all approaches of 86 intersections)
- Approach level (164 approaches where the FYAs were installed)
  - Approach level with FYA supplemental sign (90 FYA approaches)
  - Approach level without FYA supplemental signs (74 FYA approaches)

Naïve Before and After Method

- Intersection level by driver age category (older drivers and younger drivers)
- Approach level by driver age category (older drivers and younger drivers)

The analyses by the driver age categories could be conducted using only the naïve before and after method because the SPFs needed for the EB method are not available in the literature, nor could the SPFs be developed as a part of this research owing to small sample sizes and the small subset of crashes that they represent.

7.1 SAFETY EVALUATION RESULTS OF FYA

The results of the traffic crash analysis and effectiveness evaluation of the FYAs are depicted in Table 7.1 for the two evaluation methods (naïve before and after, and EB) on an intersection and approach level for the four crash types. The crash data in Table 7.1 represent the average annual crash frequencies, aggregated for all test sites considered in the analysis (i.e., for all 86 test intersections, or all 164 test approaches). The average annual "after" crashes in both the naïve before and after and the EB methods represent the actual observed crash frequency that occurred after the FYAs were installed, on an aggregated basis. For the naïve before and after method, the average annual "before" crashes shown in Table 7.1 represent the aggregated actual "before" crash frequency. For the EB method, the expected annual crashes were calculated according to the EB steps shown in Section 6.2, using SPFs developed by the Bradley University research team. The percent reductions were calculated and subjected to statistical testing. The effectiveness of the FYA was statistically tested for significance to determine whether the observed reductions in traffic crashes occurred due to the FYA or other factors unrelated to the improvement. The null (H_o) and alternative (H_a) hypotheses used in the statistical analysis of the average/mean (μ) crash frequencies are as follows:

H_o: $\mu_{\text{after crashes}} = \mu_{\text{before crashes}}$

H_a: $\mu_{\text{after crashes}} < \mu_{\text{before crashes}}$

Given that traffic crash data are discrete and assumed to occur randomly, the Poisson test was used to test the significance of changes in crash frequencies. A one-tailed test was used at a 95% LOC and significance level (α) of 0.05 because it was hypothesized that traffic crash frequencies would reduce as a result of the FYAs implemented. The Poisson charts of significance were used to determine the significance and corresponding p-values. A p-value is defined as the lowest level of significance at which the calculated value of the test statistic is significant. Thus, for a one-tailed test, if the p-value is less than 0.05, then the null hypothesis is rejected and the finding is significant.

Table 7.1 FYA Safety Evaluation Results

(a) Intersection Basis (86 Test Intersections)

	Naïve Before and After				Empirical Bayes Method with SPFs Developed by Bradley University			
Crash Type	Avg. Annual Before Crashes	Avg. Annual After Crashes	% Reduction	Significant?* (p-value)	Expected Annual Crashes	Avg. Annual After Crashes	% Reduction	Significant?* (p-value)
Total crashes	554.0	548.3	1.0%	No (>0.20)	559.1	548.3	1.9%	No (>0.20)
Injury crashes	154.3	139.0	9.9%	No (0.09)	159.3	139.0	**12.7%**	**Yes (0.05)**
LT-related crashes	158.3	123.0	**22.3%**	**Yes (0.01)**	159.5	123.0	**22.9%**	**Yes (0.01)**
LTOT crashes	99.7	78.0	**21.7%**	**Yes (0.02)**	101.5	78.0	**23.2%**	**Yes (0.04)**

(b) Approach Basis (164 FYA Approaches)

	Naïve Before and After				Empirical Bayes Method with SPFs Developed by Bradley University			
Crash Type	Avg. Annual Before Crashes	Avg. Annual After Crashes	% Reduction	Significant?* (p-value)	Expected Annual Crashes	Avg. Annual After Crashes	% Reduction	Significant?* (p-value)
Total crashes	328.0	324.0	1.2%	No (>0.20)	327.7	324.0	1.1%	No (>0.20)
Injury crashes	97.0	86.0	11.3%	No (0.15)	97.2	86.0	11.6%	No (0.15)
LT-related crashes	125.0	96.0	**23.2%**	**Yes (0.01)**	125.2	96.0	**23.3%**	**Yes (0.01)**
LTOT crashes	90.3	68.7	**24.0%**	**Yes (0.02)**	91.3	68.7	**24.8%**	**Yes (0.01)**

* Based on Poisson test of crash frequencies at a 95% LOC and significance level $\alpha = 0.05$

Significant reductions, ranging from 21.7 to 24.8%, in the targeted crash types (LT-related crashes and LTOT crashes) were observed in all analyses due to the installation of FYAs. This provides evidence that the FYAs implemented in the Peoria area provide a significant improvement to safety. The

largest percent reduction (24.8% per EB method) was observed for LTOT crashes at the approaches where FYAs were installed.

Please note that the naïve before and after crash reductions are similar to EB results. This indicates that crashes at the test sites may not have experienced excessive fluctuations in crashes, or regression-to-the-mean effects. Please recall that regression-to-the-mean bias are generally observed when safety treatments are installed at high crash locations. However, in the Peoria area, the FYAs were installed at a mixture of high, moderate, and low crash locations, thus lessening the effects of possible regression-to-the-mean.

The results shown in Table 7.1b were further categorized into the following two groups: FYA approaches with the supplemental sign and FYA approaches with the signal only and no supplemental sign. The supplemental sign, when used, included the text "Left Turn Yield on Flashing Yellow Arrow." Of the 164 test approaches, 90 had supplemental signs, while the other 74 did not. The results are shown in Table 7.2.

Table 7.2 FYA Supplemental Sign Evaluation Results

(a) Naïve Before and After Method

	90 FYA Approaches With Sign				74 FYA Approaches Without Sign			
Crash Type	Avg. Annual Before Crashes	Avg. Annual After Crashes	% Reduction	Significant?* (p-value)	Avg. Annual Before Crashes	Avg. Annual After Crashes	% Reduction	Significant?* (p-value)
Total crashes	**182.0**	**165.0**	**9.3%**	**No (0.10)**	**146.7**	**159.0**	**–8.4%**	**No (>0.20)**
Injury crashes	55.3	46.0	16.8%	No (0.09)	41.7	40.0	4.0%	No (> 0.20)
LT-related crashes	72.3	49.3	**31.8%**	**Yes (0.01)**	52.7	46.7	11.4%	No (0.20)
LTOT crashes	49.7	34.7	**30.0%**	**Yes (0.03)**	40.7	34.0	16.4%	No (0.16)

(b) Empirical Bayes Method

	90 FYA Approaches With Sign				74 FYA Approaches Without Sign			
Crash Type	Expected Annual Crashes	Avg. Annual After Crashes	% Reduction	Significant?* (p-value)	Expected Annual Crashes	Avg. Annual After Crashes	% Reduction	Significant?* (p-value)
Total crashes	179.5	165.0	8.1%	No (0.11)	148.2	159.0	–7.3%	No (0.19)
Injury crashes	55.2	46.0	16.7%	No (0.09)	42.0	40.0	4.8%	No (>0.20)
LT-related crashes	72.5	49.3	**31.9%**	**Yes (0.01)**	52.7	46.7	11.5%	No (0.20)
LTOT crashes	50.2	34.7	**30.9%**	**Yes (0.02)**	41.2	34.0	17.4%	No (0.12)

*Based on Poisson test of crash frequencies at a 95% LOC and significance level $\alpha = 0.05$

As per the EB method results, FYA approaches with the supplemental sign experienced a significant reduction in LT-related and LTOT crashes of 31.9% and 30.9%, respectively. The addition of a supplemental FYA sign at an FYA approach has a notable impact on the safety performance of the FYA.

Table 7.3 and Table 7.4 depict the evaluation results of the older driver (age 65+ years) and younger driver (age 16 to 21 years) analyses, respectively. Similarly, this analysis was performed at an intersection level and at an approach level, but only for the naïve before and after method. The necessary age-specific SPFs for the EB method are not available in the literature nor could they be developed as a part of this research due to small sample sizes and the small subset of crashes that they represent.

Table 7.3 Older Driver Analysis Results

	Aggregated on an Intersection Level				Aggregated on an FYA Approach Level			
Crash Type	Avg. Annual Before Crashes	Avg. Annual After Crashes	% Reduction	Significant?* (p-value)	Avg. Annual Before Crashes	Avg. Annual After Crashes	% Reduction	Significant?* (p-value)
Total crashes	105.67	115.67	–9.5%	No (0.20)	68.67	74.67	–8.7%	No (>0.20)
Injury crashes	31.33	30.00	4.4%	No (>0.20)	20.67	21.00	–1.6%	No (>0.20)
LT-related crashes	34.67	35.33	–1.9%	No (>0.20)	27.33	28.67	–4.9%	No (>0.20)
LTOT crashes	20.67	24.33	–17.7%	No (>0.20)	18.00	22.67	–25.9%	No (0.15)

* Based on Poisson test of crash frequencies at a 95% LOC and significance level $\alpha = 0.05$

Table 7.4 Younger Driver Analysis Results

	Aggregated on an Intersection Level				Aggregated on an FYA Approach Level			
Crash Type	Avg. Annual Before Crashes	Avg. Annual After Crashes	% Reduction	Significant?* (p-value)	Avg. Annual Before Crashes	Avg. Annual After Crashes	% Reduction	Significant?* (p-value)
Total crashes	160.33	139.67	**12.9%**	**Yes (0.05)**	98.67	82.33	**16.6%**	**Yes (0.05)**
Injury crashes	43.33	28.67	**33.9%**	**Yes (0.02)**	31.00	18.00	**41.9%**	**Yes (0.01)**
LT-related crashes	52.00	34.33	**34.0%**	**Yes (0.01)**	43.33	26.67	**38.5%**	**Yes (0.01)**
LTOT crashes	35.33	25.00	**29.3%**	**Yes (0.05)**	32.33	20.67	**36.1%**	**Yes (0.03)**

* Based on Poisson test of crash frequencies at a 95% LOC and significance level $\alpha = 0.05$

The evaluation results for older drivers indicate that the FYAs did not have an impact on the crash experience of this subset of drivers because no statistically significant changes were found. However, based on the younger driver analysis, statistically significant reductions were observed for all the crash types for both an intersection level and FYA approach level. A comparison of the crash reductions for younger drivers (Table 7.4) versus all drivers (Table 7.1) reveals that a relatively larger percent reduction in crashes was observed for the younger driver group. For example, the comparison at an approach basis for LTOT crashes for the naïve before and after method was a 24.8% reduction for drivers of all ages versus a 36.1% reduction for drivers age 16 to 21 years. This provides evidence that the FYA is especially helpful to younger drivers when making left-turn decisions at intersections operating with PPLT control.

7.2 CRASH MODIFICATION FACTORS

The expected countermeasure effectiveness is commonly expressed as a crash modification factor (CMF). A CMF is a multiplicative factor used to compute the expected number of crashes after implementing a given countermeasure at a specific site.

Using the procedures outlined in the *HSM* (Bonneson 2010) and *A Guide to Developing Quality Crash Modification Factors* (Gross et al. 2010), CMFs were determined. Specifically, CMFs were determined for the targeted crash types on an approach basis that were found to be statically significant, per the empirical Bayes method. The procedure and equations used to calculate the unbiased index of effectiveness (θ), which is the CMF, as well as the variance, standard error, and confidence interval on the CMF, are as follows (please refer to Section 6.2 for definitions of variables):

- The empirical Bayes estimate, m_b, is calculated as $w \times P_b + (1-w) \times B$, where *B* is the sum of the before crashes at the FYA test approaches.
- The weighting factor, *w*, can be calculated as $\frac{1}{1+k \times \left(\sum P\right)}$, where *k* is the overdispersion factor
- The ratio of after-period SPF estimates to before-period estimates *(R*) is $R = P_a/P_b$
- The sum of the expected number of crashes in the after period in the test group that would have occurred without treatment (*E*) is $E = m_b \times R$
- The variance of *E* is estimated as $VAR(E) = E \times R \times (1 - w)$
- The unbiased estimate of effectiveness (θ), or the CMF, is $CMF = \theta = \frac{\frac{A}{E}}{1+\frac{VAR(E)}{E^2}}$, where *A* is the sum of the after-treatment crashes at the FYA approaches

- The variance of the CMF, or VAR(θ), is $\dfrac{\theta^2\left(\dfrac{1}{A}+\dfrac{VAR(E)}{E^2}\right)}{\left(1+\dfrac{VAR(E)}{E_2}\right)^2}$
- The square root of the variance is considered the standard error
- The 95% confidence interval is $\theta \pm Z_{\alpha/2}$ (standard error), where $Z_{\alpha/2}$ is the two-tailed Z statistic = 1.96

The weighting factors estimated from the SPFs and overdispersion factors were calculated to be 0.99. Table 7.5 provides the CMFs and standard errors, as well as the actual crash data at the test sites in the before and after periods, the SPF estimates for the before and after periods, and sample sizes.

Table 7.5 Crash Modification Factors for FYAs with PPLT Control on an Approach Basis

	Before FYA Installation		After FYA Installation				
Crash Type	Annualized Observed Crashes (B)	SPF Estimate Pb	Annualized Observed Crashes (A)	SPF Estimate Pa	CMF (θ)	VAR (θ)	Standard Error (θ)
LT-related crashes (n = 164)	125.0	156.5	96.0	155.7	0.617	0.0040	0.0630
LT-related crashes with supplemental sign (n = 90)	72.3	84.4	49.3	83.8	0.589	0.0070	0.0838
LTOT crashes (n = 164)	90.3	96.6	68.7	96.2	0.714	0.0074	0.0861
LTOT crashes with supplemental sign (n = 90)	49.7	49.4	34.7	48.8	0.711	0.0146	0.1207

In summary, the resulting CMFs, along with their confidence intervals for the targeted FYA crash types, are as follows:

- LT-related crashes at FYA approach CMF = 0.617
    - 95% confidence interval = 0.617 $\pm$ 0.012 = 0.605 to 0.629
- LT-related crashes at FYA approach with supplemental sign CMF = 0.589
    - 95% confidence interval = 0.589 $\pm$ 0.016 = 0.573 to 0.605

- LTOT crashes at FYA approach CMF = 0.714
    - 95% confidence interval = 0.714 $\pm$ 0.016 = 0.698 to 0.730
- LTOT crashes at FYA approach with supplemental sign CMF = 0.711
    - 95% confidence interval = 0.711 $\pm$ 0.024 = 0.687 to 0.735

CHAPTER 8: ECONOMIC ANALYSIS

An analysis was conducted to determine the economic effectiveness of the installation of FYAs at 86 test intersections in the Peoria area using the EUAB and EUAC method. Economic costs and benefits of the FYA were calculated and annualized to determine the benefit to cost ratio of the FYA implementation. The following assumptions were used in the economic analysis:

- Economic life = 15 years
- Discount rate of 3% per IDOT's approved rates (IDOT 2015; Holland 2012)
- Additional annual maintenance cost required for the FYA = $0
- Salvage value = $0

The initial cost of FYA installations was $6,000 per approach (2010 dollars) and included the cost of new four-section signal heads and controller cabinet rewiring. It should be noted that, due to IDOT's policy to have mast arms long enough to extend out to the left-turn lane and updated traffic controller equipment having recently been installed areawide, additional costs of mast arms and controller cabinets were not required at the FYA approaches. It is also important to note that installation of the FYAs does not add any new maintenance costs to any of the test sites; thus, the only cost associated with the FYA implementation was the initial cost.

The benefits of the FYA safety improvement were calculated by multiplying the reduction in crashes of a given severity (fatal; injury A, B, and C; and PDO) by the applicable societal crash costs. Societal crash costs include the monetary losses related to medical care, emergency services, property damage, lost productivity, etc. to society as a whole. The crash costs published in the *HSM* (Bonneson 2010) represent the costs in 2001 dollars, as shown in Table 8.1. These values were updated to 2010 dollars using the procedures described in the *HSM* and are shown in Table 8.1. The procedure for updating the crash costs to current year costs is outlined in Appendix A4 of the *HSM* and involves a two-step process using data from the U.S Bureau of Labor Statistics. In general, "the annual adjustment of crash costs utilizes federal economic indexes (such as the Consumer Price Index and Employment Cost Index) to account for the economic changes between the documented past year and the year of interest" (Bonneson 2010).

Comparing the difference in crash savings between the annual average of 3 years of before-FYA data with the average annual 3 years of after-FYA data resulted in an annual average crash savings by severity due to the FYAs. Table 8.2 displays the average crash frequencies by crash severity in the before and after periods at all 86 FYA test intersections.

Table 8.1 Societal Crash Costs by Crash Severity

Crash Severity Type	Comprehensive Societal Crash Cost (2001 dollars)	Comprehensive Societal Crash Costs (2010 dollars)
Fatal (K)	$4,008,900	$5,127,900
Injury A	$216,000	$273,200
Injury B	$79,000	$99,800
Injury C	$44,900	$56,400
PDO	$7,400	$9,200

Table 8.2 Annual Crash Frequencies by Severity

	Average Annual Crashes	
	Before Period	**After Period**
Fatal Crashes (K)	1.7	1.7
Injury A Crashes	22.3	16.0
Injury B Crashes	51.0	59.3
Injury C Crashes	78.3	65.0
PDO Crashes	395.3	396.7

The annualized monetary benefits due to crash savings can be calculated by finding the difference in average annual crash costs from the before to after periods for each severity class and then by multiplying this crash savings by the respective crash cost. The resulting value is the EUAB.

EUAB = (1.7 – 1.7) × $5,127,900 + (22.3 – 16.0) × $273,200 + (51.0 – 59.3) × $99,800 + (78.3 – 65.0) × $56,400 + (395.3 – 396.7) × $9,200

EUAB = $1,630,060 per year

The present worth of costs (in 2010 dollars) for the FYA installations is calculated as 164 approaches × $6,000 per FYA approach = $984,000. To annualize this present value, converting it to an EUAC value, it is multiplied by the capital recovery factor (A/P) for *i* =3% and *n* = 15 years, which is 0.0838. The resulting EUAC value is

EUAC = $984,000 x 0.0838 = $82,460

Table 8.3 displays the EUAB and EUAC of the FYA as well as the resulting benefit to cost ratio.

Table 8.3 Resulting Annual Benefits and Costs of FYA

FYA EUAB	**$1,630,060**
FYA EUAC	**$82,460**
Benefit to Cost Ratio	**19.8**

As shown in Table 8.3, the overall benefit to cost ratio for the implementation of the FYAs at 86 intersections is 19.8 to 1.0, which indicates that the accrued benefits in dollar value exceeds the annualized cost of the FYA over a period of 15 years by a factor of nearly 20. It should be noted that the economic analysis was performed on an intersection basis. It is expected that benefit to cost ratios calculated on an approach basis may even be higher because the crash reductions on an approach basis were greater.

CHAPTER 9: CONCLUSIONS AND RECOMMENDATIONS

In the spring of 2010, IDOT began installing vertical four-section signal heads that included the FYA indication for the permissive interval of PPLT phasing at more than 100 intersections on state routes in the Peoria area. The new signal heads replaced the vertically mounted five-section signal heads operating with the CG indication for the permissive left-turn interval of PPLT phasing. At over half of the FYA installations, a supplemental sign was also installed with the text "Left Turn Yield on Flashing Yellow Arrow." Bradley University researchers performed an effectiveness evaluation of the FYA at the approaches where no other geometric or operational changes were made.

Comprehensive traffic crash analyses based on 3 years of before-FYA crash data, 3 years of after-FYA crash data, and 3 years of data at 100 comparison sites were conducted in order to evaluate the safety effects of the use of FYAs for PPLT control. A total of 164 approaches located at 86 test intersections were included in the evaluation, focusing on the targeted crash types of LT-related crashes, and specifically, LTOT crashes. Analyses were also performed to assess the effects of the FYA supplemental signs and to assess the effects of the FYA overall on two subsets of drivers: older drivers (age 65+) and younger drivers (age 16 to 21 years). Two methods were used to evaluate the crash experience at the FYA locations: the naïve before and after, and the EB. The observed crash reductions were tested for statistical significance using the Poisson test at a 95% LOC. Crash modification factors were developed for statistically significant crash reductions at the FYA approaches based on the EB method and an unbiased index of effectiveness metric.

The statistically significant results, based on the EB method, in terms of crash reductions attributable to the FYAs are as follows:

- At the 164 FYA approaches evaluated, a 23.3% reduction in LT-related crashes and a 24.8% reduction in LTOT crashes were observed.

- When FYA supplemental signs were also installed, larger percent reductions were observed, which provides evidence that the FYA supplemental sign may improve safety at the study approaches in Peoria because the FYA is still a relatively new countermeasure. At the 90 FYA approaches with the supplemental sign, percent reductions of 31.9% and 30.9% were observed for LT-related crashes and LTOT crashes, respectively.

The findings from the older and younger driver analysis were based on the naïve before and after method because the necessary SPFs for the EB analysis are not available for these age categories.

- The evaluation results for older drivers indicate that the FYAs did not have an impact on the crash experience of this subset of drivers because no statistically significant changes were found.

- For the younger driver analysis, statistically significant reductions were observed for all the crash types on both an intersection level and FYA approach level. A comparison of the crash reductions for younger drivers versus all drivers reveals that relatively larger percent

reductions in crashes were observed for the younger driver group. For example, the comparison at an approach basis for LTOT crashes for the naïve before and after method were a 24.8% reduction for drivers of all ages versus a 36.1% reduction for drivers age 16 to 21 years. This provides evidence that the FYA is especially helpful to younger drivers when making left-turn decisions at intersections operating with PPLT control.

Using the procedures outlined in the *Highway Safety Manual* (Bonneson 2010) and the *Guide to Developing Quality Crash Modification Factors* (Gross et al. 2010), CMFs were developed. Specifically, CMFs were determined for the targeted crash types on an approach basis that were found to be statically significant, per the EB method. The resulting CMFs, along with their confidence intervals for the targeted FYA crash types, are as follows:

- **LT-related crashes at FYA approach CMF = 0.617**, with a 95% confidence interval = 0.617 $\pm$ 0.012 = 0.605 to 0.629
- **LT-related crashes at FYA approach with supplemental sign CMF = 0.589**, with a 95% confidence interval = 0.589 $\pm$ 0.016 = 0.573 to 0.605
- **LTOT crashes at FYA approach CMF = 0.714**, with a 95% confidence interval = 0.714 $\pm$ 0.016 = 0.698 to 0.730
- **LTOT crashes at FYA approach with supplemental sign CMF = 0.711**, with a 95% confidence interval = 0.711 $\pm$ 0.024 =0.687 to 0.735

An analysis was conducted in order to determine the economic effectiveness of the installation of the FYAs at 86 test intersections in the Peoria area using the EUAB and EUAC methods. Economic costs and benefits (in 2010 dollars) of the FYA were calculated and annualized in order to determine the benefit to cost ratio of the FYA implementation. The resulting benefit to cost ratio for the implementation of the FYAs at 86 intersections is 19.8 to 1.0, which indicates that the accrued benefits in dollar value exceeds the annualized cost of the FYA over a period of 15 years by a factor of nearly 20.

The initial cost of the FYA installations in the Peoria area was $6,000 per approach (2010 dollars) and included the cost of new four-section signal heads and controller cabinet rewiring. It should be noted that, due to IDOT's policy to have mast arms long enough to extend out to the left-turn lane and updated traffic controller equipment having recently been installed areawide, additional costs of mast arms and controller cabinets were not required at the FYA approaches.

Based on the overall findings of this research, it is recommended that FYAs continue to be installed on state routes in Illinois because the FYAs were found to have significant safety impacts and reduce LT-related crashes at locations where installed. It is also recommended that supplemental signs be used when implementing the FYA in Illinois, especially while the FYA remains a new traffic control device. It should also be noted that in the Peoria area, especially on city roads, supplemental signs are commonly displayed at other left-turn signals in addition to the FYA. For example, at some city

intersections still operating with the CG indications, supplemental signs with the text “Left Turn Yield on [CG symbol]”are displayed; at protected-only left-turn signals, signs with the text “No Turn on Red Arrow” or “Left Turn on Green Arrow Only” are often displayed. Additional research is needed to justify the long-term and continual use of the FYA supplemental sign, once more drivers become familiar with its meaning. It is also recommended that when FYAs are implemented, efforts be made to educate not only the driving public at large, but older drivers specifically to further improve safety for drivers making left turns at signalized intersections.

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APPENDIX A: BEFORE AND AFTER TRAFFIC CRASH DATA AT 86 TEST INTERSECTIONS

FYA NO.	INTERSECTION NAME	Total Intersection Crash Frequency								Injury Crash Frequency (K, A ,B , and C)							
		"Before" Period				"After" Period				"Before" Period				"After" Period			
		Year 1	Year 2	Year 3	Avg.	Year 1	Year 2	Year 3	Avg.	Year 1	Year 2	Year 3	Avg.	Year 1	Year 2	Year 3	Avg.
1	THIRD & WALMART ENTRANCE	3	0	2	1.67	0	7	4	3.67	0	0	2	0.67	0	2	4	2.00
2	THIRD & COLLEGE	3	2	1	2.00	3	0	1	1.33	0	0	0	0.00	1	0	0	0.33
3	IL29 (FOURTH) & CLOVERDALE	5	6	7	6.00	7	10	1	6.00	1	2	3	2.00	1	4	0	1.67
4	IL29 (FOURTH) & WALNUT	1	1	1	1.00	0	3	2	1.67	0	0	1	0.33	0	2	0	0.67
5	IL29 (FOURTH) & TRUITT	3	3	3	3.00	2	3	2	2.33	2	0	0	0.67	1	0	1	0.67
6	IL29 (MAIN) & HIGHLAND/RUSCHE	9	4	12	8.33	10	4	8	7.33	4	2	5	3.67	2	2	3	2.33
7	IL29 (MAIN) & I474 RAMPS A&D	21	12	11	14.67	12	16	8	12.00	3	4	3	3.33	4	3	2	3.00
8	IL29 (MAIN) FISCHER RD	9	2	6	5.67	9	3	4	5.33	6	2	1	3.00	1	0	1	0.67
9	US150 (MEADOWS) & IL8 (WASHINGTON)	11	8	6	8.33	7	7	7	7.00	1	2	3	2.00	2	4	2	2.67
10	US150/IL116 (MAIN) & I74 EB RAMPS	16	20	11	15.67	19	18	20	19.00	4	5	5	4.67	6	6	6	6.00
11	US150/IL116 (MAIN) & I74 WB RAMPS	10	7	27	14.67	17	7	10	11.33	5	3	10	6.00	5	1	3	3.00
12	US150/IL116 (MAIN) & ACCESS RD. 7 (MARINA)	4	1	5	3.33	10	2	3	5.00	2	0	1	1.00	4	1	1	2.00
13	IL8 (E. WASHINGTON) & CARVER/JAY	3	1	1	1.67	3	0	2	1.67	0	0	1	0.33	0	0	0	0.00
14	IL8 (E. WASHINGTON) & DOLANS	0	1	1	0.67	1	0	0	0.33	0	0	0	0.00	0	0	0	0.00
15	IL8 (E. WASHINGTON) & ILLINI	11	5	7	7.67	7	12	6	8.33	3	1	2	2.00	4	1	1	2.00
16	IL8 (E. WASHINGTON) & ROSEDALE/PUTNAM	6	2	11	6.33	6	1	4	3.67	2	1	3	2.00	1	0	1	0.67
17	IL8/IL116 (MAIN) & SPRINGFIELD	14	5	12	10.33	7	10	6	7.67	1	0	5	2.00	0	0	1	0.33
18	IL8/IL116 (MAIN) & WASHINGTON	15	13	8	12.00	11	10	9	10.00	3	4	2	3.00	0	3	1	1.33
19	WASHINGTON & VETERANS	10	6	4	6.67	6	7	6	6.33	1	0	0	0.33	0	3	2	1.67
20	W. CAMP & RIVERFRONT DR. RAMPS	1	0	1	0.67	3	1	2	2.00	0	0	1	0.33	0	0	0	0.00
21	IL29 & LA SALLE	6	5	9	6.67	4	7	3	4.67	1	1	2	1.33	3	2	1	2.00
22	US150 (JACKSON) & DETROIT	3	3	4	3.33	4	4	12	6.67	0	1	1	0.67	2	0	3	1.67
23	US150 (JACKSON) & VETERANS	2	0	1	1.00	4	2	4	3.33	1	0	1	0.67	1	0	2	1.00
24	US150 (JACKSON) & MORTON	7	3	5	5.00	4	7	7	6.00	3	2	1	2.00	0	2	1	1.00
25	IL98 (BIRCHWOOD) & DETROIT	4	3	3	3.33	7	4	5	5.33	1	1	2	1.33	3	0	1	1.33
26	IL98 (BIRCHWOOD) & I155 RAMPS A&B	2	0	1	1.00	2	0	0	0.67	1	0	0	0.33	0	0	0	0.00
27	IL98 & MAIN	2	4	3	3.00	4	1	0	1.67	1	2	2	1.67	2	0	0	0.67
28	IL9 (COURT) & ALLENTOWN	4	2	3	3.00	3	4	1	2.67	1	1	1	1.00	1	2	1	1.33
29	IL9 (COURT) & BARNEY	2	4	2	2.67	5	3	1	3.00	2	2	1	1.67	4	1	0	1.67
30	IL9 (COURT) & FOURTEENTH	16	7	7	10.00	6	8	7	7.00	3	4	1	2.67	3	2	3	2.67
31	IL9 (COURT) & PARKWAY/SUNSET	14	15	18	15.67	22	15	7	14.67	4	0	3	2.33	6	1	3	3.33
32	IL9 (COURT) & VALLE VISTA	16	7	9	10.67	4	12	13	9.67	4	0	3	2.33	0	1	1	0.67
33	IL9 (COURT) & VETERANS	12	18	11	13.67	12	11	10	11.00	2	6	4	4.00	3	3	4	3.33
34	IL9 (MARGARET) & IL29 (FIFTH)	7	3	7	5.67	10	10	7	9.00	0	2	3	1.67	5	1	2	2.67
35	IL29 (EIGHTH) & SHERIDAN	4	2	8	4.67	7	7	12	8.67	1	0	2	1.00	4	2	2	2.67
36	IL29 (SECOND) & DERBY	3	2	3	2.67	4	1	2	2.33	0	0	1	0.33	2	0	0	0.67
37	IL29 (SECOND) & MANITO/FEDERAL PRISON	4	0	2	2.00	5	5	4	4.67	1	0	1	0.67	3	2	0	1.67
38	IL98 & PARKWAY	2	2	3	2.33	5	6	4	5.00	0	1	1	0.67	1	2	0	1.00
39	US24 (ADAMS) & GRISWOLD	6	4	2	4.00	1	2	2	1.67	1	2	0	1.00	1	0	0	0.33
40	US24/IL29 (WASHINGTON) & WB RAMP G-4 EATON	3	1	1	1.67	4	2	3	3.00	0	0	0	0.00	2	0	0	0.67
41	US24/IL29 (WASHINGTON) & Macarthur	7	12	9	9.33	4	4	6	4.67	3	3	3	3.00	0	1	0	0.33
42	US24/IL29 (WASHINGTON) & State	3	0	5	2.67	2	1	1	1.33	1	0	1	0.67	0	0	0	0.00
43	US24/IL29 (ADAMS) & RAMPS B/C WB	3	2	7	4.00	6	4	9	6.33	1	0	2	1.00	1	1	2	1.33

FYA NO.	INTERSECTION NAME	LT-Related Crash Frequency								LTOT-Only Crash Frequency							
		"Before" Period				"After" Period				"Before" Period				"After" Period			
		Year 1	Year 2	Year 3	Avg.	Year 1	Year 2	Year 3	Avg.	Year 1	Year 2	Year 3	Avg.	Year 1	Year 2	Year 3	Avg.
1	THIRD & WALMART ENTRANCE	0	0	0	0.00	0	2	1	1.00	0	0	0	0.00	0	1	1	0.67
2	THIRD & COLLEGE	0	1	0	0.33	0	0	0	0.00	0	1	0	0.33	0	0	0	0.00
3	IL29 (FOURTH) & CLOVERDALE	1	4	2	2.33	1	5	0	2.00	1	3	1	1.67	1	5	0	2.00
4	IL29 (FOURTH) & WALNUT	0	0	1	0.33	0	1	1	0.67	0	0	0	0.00	0	0	1	0.33
5	IL29 (FOURTH) & TRUITT	1	1	1	1.00	1	2	0	1.00	0	1	0	0.33	1	1	0	0.67
6	IL29 (MAIN) & HIGHLAND/RUSCHE	1	3	4	2.67	4	0	3	2.33	1	3	2	2.00	4	0	3	2.33
7	IL29 (MAIN) & I474 RAMPS A&D	1	1	0	0.67	3	0	0	1.00	0	1	0	0.33	2	0	0	0.67
8	IL29 (MAIN) FISCHER RD	1	1	1	1.00	5	1	0	2.00	0	0	0	0.00	0	0	0	0.00
9	US150 (MEADOWS) & IL8 (WASHINGTON)	4	2	0	2.00	3	4	1	2.67	1	1	0	0.67	2	3	1	2.00
10	US150/IL116 (MAIN) & I74 EB RAMPS	11	8	5	8.00	9	6	5	6.67	10	7	5	7.33	5	5	5	5.00
11	US150/IL116 (MAIN) & I74 WB RAMPS	7	2	15	8.00	9	1	5	5.00	7	2	13	7.33	9	1	5	5.00
12	US150/IL116 (MAIN) & ACCESS RD. 7 (MARINA)	1	1	1	1.00	2	0	0	0.67	0	0	1	0.33	1	0	0	0.33
13	IL8 (E. WASHINGTON) & CARVER/JAY	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00
14	IL8 (E. WASHINGTON) & DOLANS	0	1	0	0.33	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00
15	IL8 (E. WASHINGTON) & ILLINI	5	2	4	3.67	1	0	0	0.33	3	2	3	2.67	1	0	0	0.33
16	IL8 (E. WASHINGTON) & ROSEDALE/PUTNAM	0	0	2	0.67	2	0	0	0.67	0	0	1	0.33	1	0	0	0.33
17	IL8/IL116 (MAIN) & SPRINGFIELD	2	1	1	1.33	2	0	0	0.67	1	0	1	0.67	2	0	0	0.67
18	IL8/IL116 (MAIN) & WASHINGTON	5	3	4	4.00	3	2	3	2.67	3	2	4	3.00	3	2	3	2.67
19	WASHINGTON & VETERANS	4	4	2	3.33	0	2	1	1.00	0	3	2	1.67	0	2	1	1.00
20	W. CAMP & RIVERFRONT DR. RAMPS	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00
21	IL29 & LA SALLE	1	2	3	2.00	1	0	1	0.67	1	2	3	2.00	1	0	1	0.67
22	US150 (JACKSON) & DETROIT	1	0	0	0.33	1	2	2	1.67	0	0	0	0.00	1	2	2	1.67
23	US150 (JACKSON) & VETERANS	0	0	0	0.00	1	0	0	0.33	0	0	0	0.00	0	0	0	0.00
24	US150 (JACKSON) & MORTON	2	0	1	1.00	2	2	2	2.00	0	0	0	0.00	1	1	2	1.33
25	IL98 (BIRCHWOOD) & DETROIT	2	1	2	1.67	2	1	2	1.67	2	1	2	1.67	1	1	2	1.33
26	IL98 (BIRCHWOOD) & I155 RAMPS A&B	2	0	0	0.67	0	0	0	0.00	1	0	0	0.33	0	0	0	0.00
27	IL98 & MAIN	1	2	1	1.33	3	1	0	1.33	1	2	1	1.33	1	1	0	0.67
28	IL9 (COURT) & ALLENTOWN	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00
29	IL9 (COURT) & BARNEY	1	0	0	0.33	0	0	0	0.00	1	0	0	0.33	0	0	0	0.00
30	IL9 (COURT) & FOURTEENTH	1	1	2	1.33	2	2	1	1.67	0	1	1	0.67	0	2	1	1.00
31	IL9 (COURT) & PARKWAY/SUNSET	5	5	5	5.00	6	2	0	2.67	2	3	4	3.00	6	2	0	2.67
32	IL9 (COURT) & VALLE VISTA	1	1	2	1.33	1	3	1	1.67	0	1	2	1.00	0	2	1	1.00
33	IL9 (COURT) & VETERANS	7	7	11	8.33	4	3	3	3.33	5	7	9	7.00	0	3	1	1.33
34	IL9 (MARGARET) & IL29 (FIFTH)	3	1	2	2.00	1	3	0	1.33	0	0	0	0.00	1	0	0	0.33
35	IL29 (EIGHTH) & SHERIDAN	1	0	2	1.00	3	1	3	2.33	1	0	2	1.00	3	1	2	2.00
36	IL29 (SECOND) & DERBY	1	1	2	1.33	1	0	0	0.33	1	0	0	0.33	0	0	0	0.00
37	IL29 (SECOND) & MANITO/FEDERAL PRISON	0	0	0	0.00	0	1	0	0.33	0	0	0	0.00	0	0	0	0.00
38	IL98 & PARKWAY	0	0	1	0.33	2	2	0	1.33	0	0	0	0.00	1	0	0	0.33
39	US24 (ADAMS) & GRISWOLD	3	2	0	1.67	1	1	0	0.67	3	2	0	1.67	1	1	0	0.67
40	US24/IL29 (WASHINGTON) & WB RAMP G-4 EATON	1	1	0	0.67	2	0	1	1.00	1	0	0	0.33	1	0	1	0.67
41	US24/IL29 (WASHINGTON) & Macarthur	0	2	0	0.67	0	0	1	0.33	0	2	0	0.67	0	0	1	0.33
42	US24/IL29 (WASHINGTON) & State	0	0	2	0.67	1	0	0	0.33	0	0	2	0.67	1	0	0	0.33
43	US24/IL29 (ADAMS) & RAMPS B/C WB	2	1	1	1.33	0	2	1	1.00	2	0	1	1.00	0	0	0	0.00

FYA NO.	INTERSECTION NAME	Total Intersection Crash Frequency								Injury Crash Frequency (K, A , B, and C)							
		"Before" Period				"After" Period				"Before" Period				"After" Period			
		Year 1	Year 2	Year 3	Avg.	Year 1	Year 2	Year 3	Avg.	Year 1	Year 2	Year 3	Avg.	Year 1	Year 2	Year 3	Avg.
44	UK24/IL29 (ADAMS) & LORENTZ	1	2	2	1.67	2	2	2	2.00	1	0	0	0.33	0	1	0	0.33
45	WAR MEMORIAL & BRANDYWINE	13	8	12	11.00	13	14	10	12.33	2	4	3	3.00	3	7	1	3.67
46	WAR MEMORIAL & FROSTWOOD	6	3	13	7.33	5	4	3	4.00	2	1	7	3.33	1	0	1	0.67
47	WAR MEMORIAL & GRAND	6	4	3	4.33	8	7	4	6.33	0	1	0	0.33	0	3	1	1.33
48	WAR MEMORIAL & GRAND PRAIRIE	7	3	8	6.00	4	5	1	3.33	1	2	1	1.33	1	0	0	0.33
49	WAR MEMORIAL & MOUNTELLO	3	3	6	4.00	4	3	0	2.33	1	0	0	0.33	0	0	0	0.00
50	WAR MEMORIAL & NORTHLAND	12	10	12	11.33	14	8	12	11.33	0	0	1	0.33	1	2	2	1.67
51	WAR MEMORIAL & MATHIS	3	0	2	1.67	2	2	1	1.67	0	0	1	0.33	0	1	0	0.33
52	WAR MEMORIAL & ORANGE PRAIRIE	7	7	5	6.33	4	6	4	4.67	2	2	0	1.33	2	0	0	0.67
53	IL91 & AMERICAN PRAIRIE	1	2	1	1.33	2	2	0	1.33	1	1	0	0.67	0	0	0	0.00
54	WAR MEMORIAL & SHERIDAN	21	23	21	21.67	16	19	15	16.67	3	5	5	4.33	3	4	3	3.33
55	WAR MEMORIAL & WILLOW KNOLLS	12	21	19	17.33	19	19	13	17.00	4	5	8	5.67	2	8	3	4.33
56	WAR MEMORIAL & WILLOW KNOLLS CT	6	8	8	7.33	6	7	4	5.67	1	1	2	1.33	2	1	0	1.00
57	WAR MEMORIAL & WISCONSIN	12	7	5	8.00	14	11	6	10.33	2	2	1	1.67	6	2	1	3.00
58	IL6 NB RAMPS & ALLEN	10	6	6	7.33	10	6	9	8.33	2	1	3	2.00	0	1	1	0.67
59	IL8 (MAIN) & FARMINGTON	11	11	16	12.67	10	7	7	8.00	2	7	2	3.67	3	1	3	2.33
60	KNOXVILLE & ALTA	2	2	4	2.67	6	2	2	3.33	1	0	1	0.67	1	1	0	0.67
61	KNOXVILLE & PENNSYLVANIA	14	11	9	11.33	10	7	12	9.67	1	4	2	2.33	1	2	1	1.33
62	KNOXVILLE & BIRD/FRYE	0	3	4	2.33	4	3	3	3.33	0	2	1	1.00	0	1	2	1.00
63	KNOXVILLE & DETWEILLER	5	9	2	5.33	9	8	4	7.00	2	4	1	2.33	4	3	1	2.67
64	KNOXVILLE & GLEN OAK/FAYETTE	10	2	8	6.67	11	7	9	9.00	7	0	3	3.33	2	0	0	0.67
65	KNOXVILLE & MCCLURE	10	8	12	10.00	16	16	11	14.33	3	2	4	3.00	5	6	4	5.00
66	KNOXVILLE & RICHMAR	1	1	3	1.67	6	5	5	5.33	1	0	2	1.00	3	3	2	2.67
67	KNOXVILLE & MOSSVILLE	6	3	5	4.67	4	5	7	5.33	0	0	2	0.67	2	1	2	1.67
68	KNOXVILLE & NEBRASKA	13	16	13	14.00	13	25	10	16.00	6	5	5	5.33	5	4	3	4.00
69	KNOXVILLE & NORTHPOINT	6	4	3	4.33	2	4	1	2.33	2	1	1	1.33	2	1	0	1.00
70	IL8/IL116 (HOWETT) & IL8 (WESTERN)	9	3	2	4.67	9	13	2	8.00	2	1	0	1.00	2	5	1	2.67
71	IL116 (LINCOLN) & LARAMIE	7	7	2	5.33	8	7	7	7.33	2	2	1	1.67	3	4	1	2.67
72	IL/IL116 (LINCOLN) & IL8 (WESTERN)	9	3	5	5.67	7	4	3	4.67	5	0	3	2.67	4	3	2	3.00
73	ADAMS & IL40 (KUMPF)	12	1	8	7.00	3	11	7	7.00	3	0	0	1.00	0	2	2	1.33
74	SPAULDING & GLEN OAK/KNOXVILLE	17	7	12	12.00	12	8	6	8.67	7	1	7	5.00	3	1	5	3.00
75	JEFFERSON & IL40 (KUMPF)	11	8	5	8.00	14	4	10	9.33	3	2	3	2.67	7	0	1	2.67
76	IL40 (KUMPF) & M.L.KING	2	2	5	3.00	2	2	2	2.00	0	1	2	1.00	0	1	2	1.00
77	IL8 (WESTERN) & M.L.KING	10	9	10	9.67	7	10	13	10.00	3	5	3	3.67	2	3	0	1.67
78	IL8 (FARMINGTON) & STERLING	15	10	17	14.00	12	16	8	12.00	1	3	5	3.00	2	0	1	1.00
79	IL116 & MAXWELL	11	5	6	7.33	2	3	7	4.00	2	2	1	1.67	1	2	1	1.33
80	FARMINGTON & MAXWELL	2	5	4	3.67	1	5	2	2.67	1	1	2	1.33	1	3	1	1.67
81	IL116 (MAIN) & ACCESS RD. 8	5	3	1	3.00	1	4	4	3.00	1	1	1	1.00	1	0	0	0.33
82	US24 BUS & IL8 (WASHINGTON)	11	6	7	8.00	6	12	7	8.33	5	2	1	2.67	1	5	1	2.33
83	US24 BUS & CUMMINGS	14	7	9	10.00	10	7	14	10.33	4	0	1	1.67	3	3	1	2.33
84	US24 BUS & WILMOR	9	5	8	7.33	9	10	5	8.00	5	2	1	2.67	3	2	2	2.33
85	KNOXVILLE & LINDBERGH	4	4	3	3.67	3	4	4	3.67	2	2	1	1.67	0	2	3	1.67
86	IL40 (KUMPF) & JOHN GWYNN	3	2	3	2.67	4	4	2	3.33	0	0	1	0.33	1	1	0	0.67

FYA NO.	INTERSECTION NAME	LT-Related Crash Frequency								LTOT-Only Crash Frequency							
		"Before" Period				"After" Period				"Before" Period				"After" Period			
		Year 1	Year 2	Year 3	Avg.	Year 1	Year 2	Year 3	Avg.	Year 1	Year 2	Yea r 3	Avg.	Year 1	Year 2	Year 3	Avg.
44	UK24/IL29 (ADAMS) & LORENTZ	1	0	0	0.33	0	0	0	0.00	1	0	0	0.33	0	0	0	0.00
45	WAR MEMORIAL & BRANDYWINE	5	4	7	5.33	6	5	1	4.00	5	2	6	4.33	6	2	1	3.00
46	WAR MEMORIAL & FROSTWOOD	1	0	2	1.00	0	1	1	0.67	1	0	2	1.00	0	0	1	0.33
47	WAR MEMORIAL & GRAND	0	1	1	0.67	3	1	0	1.33	0	1	0	0.33	0	0	0	0.00
48	WAR MEMORIAL & GRAND PRAIRIE	2	3	2	2.33	3	2	1	2.00	0	2	1	1.00	3	2	1	2.00
49	WAR MEMORIAL & MOUNTELLO	1	0	0	0.33	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00
50	WAR MEMORIAL & NORTHLAND	1	2	3	2.00	1	5	6	4.00	0	1	1	0.67	0	2	4	2.00
51	WAR MEMORIAL & MATHIS	0	0	0	0.00	0	1	0	0.33	0	0	0	0.00	0	1	0	0.33
52	WAR MEMORIAL & ORANGE PRAIRIE	1	0	1	0.67	1	2	1	1.33	1	0	0	0.33	0	1	0	0.33
53	IL91 & AMERICAN PRAIRIE	1	1	0	0.67	1	0	0	0.33	1	1	0	0.67	1	0	0	0.33
54	WAR MEMORIAL & SHERIDAN	4	4	5	4.33	3	1	7	3.67	3	1	4	2.67	3	1	4	2.67
55	WAR MEMORIAL & WILLOW KNOLLS	4	12	10	8.67	4	9	6	6.33	2	7	9	6.00	4	6	6	5.33
56	WAR MEMORIAL & WILLOW KNOLLS CT	2	2	3	2.33	1	1	1	1.00	2	0	1	1.00	1	0	1	0.67
57	WAR MEMORIAL & WISCONSIN	1	0	1	0.67	2	5	1	2.67	1	0	1	0.67	2	4	1	2.33
58	IL6 NB RAMPS & ALLEN	3	0	1	1.33	2	0	0	0.67	3	0	0	1.00	1	0	0	0.33
59	IL8 (MAIN) & FARMINGTON	1	5	5	3.67	2	2	2	2.00	1	2	2	1.67	1	2	2	1.67
60	KNOXVILLE & ALTA	1	1	0	0.67	3	1	0	1.33	1	0	0	0.33	1	1	0	0.67
61	KNOXVILLE & PENNSYLVANIA	5	1	3	3.00	2	1	2	1.67	2	1	2	1.67	1	1	2	1.33
62	KNOXVILLE & BIRD/FRYE	0	1	0	0.33	1	1	0	0.67	0	1	0	0.33	1	1	0	0.67
63	KNOXVILLE & DETWEILLER	2	3	1	2.00	3	2	1	2.00	1	2	1	1.33	1	0	1	0.67
64	KNOXVILLE & GLEN OAK/FAYETTE	4	1	4	3.00	1	0	1	0.67	2	1	2	1.67	0	0	0	0.00
65	KNOXVILLE & MCCLURE	2	1	2	1.67	6	2	1	3.00	1	0	1	0.67	3	0	1	1.33
66	KNOXVILLE & RICHMAR	0	0	0	0.00	4	2	1	2.33	0	0	0	0.00	2	1	1	1.33
67	KNOXVILLE & MOSSVILLE	2	2	1	1.67	3	1	3	2.33	1	1	1	1.00	2	1	3	2.00
68	KNOXVILLE & NEBRASKA	3	5	2	3.33	6	5	4	5.00	3	4	1	2.67	2	0	2	1.33
69	KNOXVILLE & NORTHPOINT	4	2	2	2.67	1	0	0	0.33	2	2	1	1.67	1	0	0	0.33
70	IL8/IL116 (HOWETT) & IL8 (WESTERN)	2	5	0	2.33	1	1	0	0.67	0	0	0	0.00	0	0	0	0.00
71	IL116 (LINCOLN) & LARAMIE	4	2	0	2.00	2	1	2	1.67	3	0	0	1.00	0	1	0	0.33
72	IL/IL116 (LINCOLN) & IL8 (WESTERN)	2	1	1	1.33	2	0	1	1.00	0	1	1	0.67	0	0	1	0.33
73	ADAMS & IL40 (KUMPF)	1	0	1	0.67	0	1	0	0.33	0	0	0	0.00	0	0	0	0.00
74	SPAULDING & GLEN OAK/KNOXVILLE	3	2	4	3.00	1	1	0	0.67	1	0	1	0.67	0	0	0	0.00
75	JEFFERSON & IL40 (KUMPF)	2	3	1	2.00	2	0	2	1.33	0	1	1	0.67	1	0	2	1.00
76	IL40 (KUMPF) & M.L.KING	1	2	3	2.00	0	0	0	0.00	1	2	3	2.00	0	0	0	0.00
77	IL8 (WESTERN) & M.L.KING	1	2	4	2.33	3	2	2	2.33	0	0	2	0.67	1	2	1	1.33
78	IL8 (FARMINGTON) & STERLING	1	0	1	0.67	1	2	0	1.00	0	0	1	0.33	1	2	0	1.00
79	IL116 & MAXWELL	1	2	2	1.67	0	0	2	0.67	1	2	0	1.00	0	0	0	0.00
80	FARMINGTON & MAXWELL	0	2	3	1.67	0	1	1	0.67	0	0	1	0.33	0	0	0	0.00
81	IL116 (MAIN) & ACCESS RD. 8	1	1	0	0.67	0	0	0	0.00	0	1	0	0.33	0	0	0	0.00
82	US24 BUS & IL8 (WASHINGTON)	5	1	3	3.00	2	1	0	1.00	4	1	3	2.67	0	1	0	0.33
83	US24 BUS & CUMMINGS	2	2	4	2.67	1	3	2	2.00	2	0	1	1.00	1	0	0	0.33
84	US24 BUS & WILMOR	3	4	4	3.67	2	1	2	1.67	1	4	1	2.00	0	0	2	0.67
85	KNOXVILLE & LINDBERGH	2	1	0	1.00	1	1	2	1.33	1	1	0	0.67	1	0	2	1.00
86	IL40 (KUMPF) & JOHN GWYNN	1	1	2	1.33	2	0	0	0.67	1	1	1	1.00	2	2	0	1.33

APPENDIX B: BEFORE AND AFTER TRAFFIC CRASH DATA AT 164 TEST APPROACHES

FYA NO.	INTERSECTION NAME	FYA Approach	Supplemental sign provided?	Total Crash Frequency								Injury Crash Frequency (K, A, B, & C)							
				"Before" Period				"After" Period				"Before" Period (d)				"After" Period			
				Year 1	Year 2	Year 3	Avg.	Year 1	Year 2	Year 3	Avg.	Year 1	Year 2	Year 3	Avg.	Year 1	Year 2	Year 3	Avg.
1	THIRD & WALMART ENTRANCE	EB	Yes	0	0	1	0.33	0	1	1	0.67	0	0	1	0.33	0	0	1	0.33
2		WB	Yes	1	0	0	0.33	0	1	2	1.00	0	0	0	0.00	0	0	2	0.67
3	THIRD & COLLEGE	EB	Yes	0	0	0	0.00	1	0	0	0.33	0	0	0	0.00	1	0	0	0.33
4		WB	Yes	2	0	0	0.67	0	0	1	0.33	0	0	0	0.00	0	0	0	0.00
5	IL29 (FOURTH) & CLOVERDALE	NB	Yes	3	2	2	2.33	2	4	0	2.00	1	1	1	1.00	0	2	0	0.67
6		SB	Yes	1	1	1	1.00	2	4	0	2.00	0	0	0	0.00	1	1	0	0.67
7		EB	Yes	1	3	4	2.67	2	2	0	1.33	0	1	2	1.00	0	1	0	0.33
8		WB	Yes	0	0	0	0.00	1	0	1	0.67	0	0	0	0.00	0	0	0	0.00
9	IL29 (FOURTH) & WALNUT	NB	Yes	0	1	0	0.33	0	1	0	0.33	0	0	0	0.00	0	1	0	0.33
10		SB	Yes	0	0	0	0.00	0	0	2	0.67	0	0	0	0.00	0	0	0	0.00
11		EB	Yes	1	0	0	0.33	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00
12		WB	Yes	0	0	1	0.33	0	2	0	0.67	0	0	1	0.33	0	1	0	0.33
13	IL29 (FOURTH) & TRUITT	NB	Yes	0	2	1	1.00	1	3	1	1.67	0	0	0	0.00	1	0	0	0.33
14		SB	Yes	0	0	0	0.00	1	0	1	0.67	0	0	0	0.00	0	0	1	0.33
15	IL29 (MAIN) & HIGHLAND/RUSCHE	NB	No	4	1	3	2.67	6	1	4	3.67	3	1	1	1.67	1	0	3	1.33
16		SB	No	3	0	5	2.67	2	2	4	2.67	1	0	2	1.00	1	1	0	0.67
17	IL29 (MAIN) & I474 RAMPS A&D	SB	No	3	2	3	2.67	3	2	4	3.00	1	1	1	1.00	2	2	2	2.00
18	IL29 (MAIN) FISCHER RD	NB	Yes	3	0	3	2.00	4	2	1	2.33	2	0	0	0.67	0	0	0	0.00
19		SB	Yes	6	1	2	3.00	4	1	2	2.33	4	1	0	1.67	0	0	1	0.33
20	US150(MEADOWS) & IL8(WASHINGTON)	WB	Yes	6	2	3	3.67	2	5	1	2.67	1	0	1	0.67	1	4	0	1.67
21	US150/IL116 (MAIN) & I74 EB RAMPS	SB	No	11	13	5	9.67	8	8	10	8.67	4	3	3	3.33	3	4	5	4.00
22	US150/IL116 (MAIN) & I74 WB RAMPS	NB	Yes	8	3	20	10.33	10	3	8	7.00	5	2	10	5.67	4	1	3	2.67
23	US150/IL116 (MAIN) & ACCESS RD 7 (MARINA)	NB	Yes	0	1	3	1.33	6	0	1	2.33	0	0	1	0.33	4	0	0	1.33
24	IL8 (E. WASHINGTON) & CARVER/JAY	EB	Yes	1	0	0	0.33	2	0	0	0.67	0	0	0	0.00	0	0	0	0.00
25		WB	Yes	0	0	1	0.33	0	0	2	0.67	0	0	1	0.33	0	0	0	0.00
26	IL8 (E. WASHINGTON) & DOLANS	WB	No	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00

FYA NO.	INTERSECTION NAME	FYA Approach	Supplemental sign provided?	LT-Related Crash Frequency								LTOT-Only Crash Frequency							
				"Before" Period				"After" Period				"Before" Period				"After" Period			
				Year 1	Year 2	Year 3	Avg.	Year 1	Year 2	Year 3	Avg.	Year 1	Year 2	Year 3	Avg.	Year 1	Year 2	Year 3	Avg.
1	THIRD & WALMART ENTRANCE	EB	Yes	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00
2		WB	Yes	0	0	0	0.00	0	1	1	0.67	0	0	0	0.00	0	1	1	0.67
3	THIRD & COLLEGE	EB	Yes	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00
4		WB	Yes	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00
5	IL29 (FOURTH) & CLOVERDALE	NB	Yes	1	2	1	1.33	0	3	0	1.00	1	2	1	1.33	0	3	0	1.00
6		SB	Yes	0	0	0	0.00	0	1	0	0.33	0	0	0	0.00	0	1	0	0.33
7		EB	Yes	0	2	1	1.00	1	1	0	0.67	0	1	0	0.33	1	1	0	0.67
8		WB	Yes	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00
9	IL29 (FOURTH) & WALNUT	NB	Yes	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00
10		SB	Yes	0	0	0	0.00	0	0	1	0.33	0	0	0	0.00	0	0	1	0.33
11		EB	Yes	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00
12		WB	Yes	0	0	1	0.33	0	1	0	0.33	0	0	0	0.00	0	0	0	0.00
13	IL29 (FOURTH) & TRUITT	NB	Yes	0	1	1	0.67	1	2	0	1.00	0	1	0	0.33	1	1	0	0.67
14		SB	Yes	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00
15	IL29 (MAIN) & HIGHLAND/RUSCHE	NB	No	1	1	0	0.67	2	0	2	1.33	1	1	0	0.67	2	0	2	1.33
16		SB	No	0	0	1	0.33	2	0	1	1.00	0	0	0	0.00	2	0	1	1.00
17	IL29 (MAIN) & I474 RAMPS A&D	SB	No	0	1	0	0.33	2	0	0	0.67	0	1	0	0.33	2	0	0	0.67
18	IL29 (MAIN) FISCHER RD	NB	Yes	0	0	0	0.00	2	1	0	1.00	0	0	0	0.00	0	0	0	0.00
19		SB	Yes	1	1	0	0.67	3	0	0	1.00	0	0	0	0.00	0	0	0	0.00
20	US150(MEADOWS) & IL8(WASHINGTON)	WB	Yes	1	1	0	0.67	1	3	0	1.33	1	1	0	0.67	1	2	0	1.00
21	US150/IL116 (MAIN) & I74 EB RAMPS	SB	No	10	7	5	7.33	7	5	4	5.33	10	7	5	7.33	4	5	4	4.33
22	US150/IL116 (MAIN) & I74 WB RAMPS	NB	Yes	7	1	15	7.67	9	1	5	5.00	7	1	13	7.00	9	1	5	5.00
23	US150/IL116 (MAIN) & ACCESS RD 7 (MARINA)	NB	Yes	7	4	1	4.00	1	0	0	0.33	0	0	1	0.33	1	0	0	0.33
24	IL8 (E. WASHINGTON) & CARVER/JAY	EB	Yes	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00
25		WB	Yes	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00
26	IL8 (E. WASHINGTON) & DOLANS	WB	No	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00

FYA NO.	INTERSECTION NAME	FYA Approach	Supplemental sign provided?	Total Crash Frequency								Injury Crash Frequency (K, A, B, and C)							
				"Before" Period				"After" Period				"Before" Period				"After" Period			
				Year 1	Year 2	Year 3	Avg.	Year 1	Year 2	Year 3	Avg.	Year 1	Year 2	Year 3	Avg.	Year 1	Year 2	Year 3	Avg.
27	IL8 (E. WASHINGTON) & ILLINI	EB	Yes	3	2	3	2.67	1	2	1	1.33	0	1	2	1.00	1	1	0	0.67
28		WB	Yes	1	2	1	1.33	1	4	1	2.00	1	0	0	0.33	0	0	0	0.00
29	IL8 (E. WASHINGTON) & ROSEDALE/PUTNAM	EB	Yes	2	0	4	2.00	0	0	1	0.33	1	0	3	1.33	0	0	0	0.00
30	IL8/IL116 (MAIN) & SPRINGFIELD	EB	Yes	5	2	6	4.33	1	2	0	1.00	1	0	1	0.67	0	0	0	0.00
31		WB	Yes	5	3	3	3.67	0	0	2	0.67	0	0	3	1.00	0	0	1	0.33
32	IL8/IL116 (MAIN) & WASHINGTON	NB	No	1	1	2	1.33	3	3	2	2.67	0	0	1	0.33	0	1	0	0.33
33		SB	No	3	4	1	2.67	5	4	6	5.00	0	1	0	0.33	0	2	1	1.00
34		EB	Yes	6	4	3	4.33	3	1	0	1.33	1	1	0	0.67	0	0	0	0.00
35		WB	Yes	4	4	2	3.33	0	2	1	1.00	2	2	1	1.67	0	0	0	0.00
36	EAST WASHINGTON & VETERANS	SB	Yes	2	2	1	1.67	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00
37	W. CAMP & RIVERFRONT DR. RAMPS	EB	Yes	0	0	0	0.00	2	0	2	1.33	0	0	0	0.00	0	0	0	0.00
38	IL29 & LA SALLE	SB	Yes	2	4	6	4.00	1	2	1	1.33	0	1	2	1.00	0	1	1	0.67
39	US150 (JACKSON) & DETROIT	SB	No	2	0	1	1.00	0	0	1	0.33	0	0	0	0.00	0	0	0	0.00
40		WB	Yes	0	1	1	0.67	1	1	3	1.67	0	0	0	0.00	1	0	0	0.33
41	US150 (JACKSON) & VETERANS	NB	No	0	0	0	0.00	1	0	0	0.33	0	0	0	0.00	0	0	0	0.00
42		SB	No	0	0	0	0.00	1	0	1	0.67	0	0	0	0.00	0	0	0	0.00
43		EB	Yes	2	0	0	0.67	1	1	0	0.67	1	0	0	0.33	0	0	0	0.00
44		WB	Yes	0	0	1	0.33	1	1	3	1.67	0	0	1	0.33	1	0	2	1.00
45	US150 (JACKSON) & MORTON	EB	Yes	0	0	1	0.33	0	4	3	2.33	0	0	0	0.00	0	1	0	0.33
46	IL98 (BIRCHWOOD) & DETROIT	NB	No	1	0	0	0.33	1	1	2	1.33	1	0	0	0.33	1	0	0	0.33
47		SB	No	1	1	1	1.00	3	1	2	2.00	0	1	1	0.67	1	0	0	0.33
48		EB	Yes	1	1	2	1.33	2	1	0	1.00	0	0	1	0.33	1	0	0	0.33
49		WB	Yes	1	1	0	0.67	0	1	1	0.67	0	0	0	0.00	0	0	1	0.33
50	IL98 (BIRCHWOOD) & I155 RAMPS A&B	EB	No	1	0	0	0.33	0	0	0	0.00	1	0	0	0.33	0	0	0	0.00
51	IL98 & MAIN	EB	Yes	1	3	1	1.67	1	1	0	0.67	1	2	1	1.33	1	0	0	0.33
52	IL9 (COURT) & ALLENTOWN	SB	Yes	2	1	0	1.00	0	1	0	0.33	1	1	0	0.67	0	0	0	0.00
53	IL9 (COURT) & BARNEY	EB	No	2	1	1	1.33	2	3	0	1.67	2	1	1	1.33	2	1	0	1.00
54		WB	No	0	2	1	1.00	2	0	1	1.00	0	0	0	0.00	1	0	0	0.33

FYA NO.	INTERSECTION NAME	FYA Approach	Supplemental sign provided?	LT-Related (c) Crash Frequency								LTOT-Only Crash Frequency							
				"Before" Period				"After" Period				"Before" Period (d)				"After" Period			
				Year 1	Year 2	Year 3	Avg.	Year 1	Year 2	Year 3	Avg.	Year 1	Year 2	Year 3	Avg.	Year 1	Year 2	Year 3	Avg.
27	IL8 (E. WASHINGTON) & ILLINI	EB	Yes	1	1	2	1.33	1	0	0	0.33	0	1	1	0.67	1	0	0	0.33
28		WB	Yes	1	0	0	0.33	0	0	0	0.00	1	0	0	0.33	0	0	0	0.00
29	IL8 (E. WASHINGTON) & ROSEDALE/PUTNAM	EB	Yes	0	0	2	0.67	0	0	0	0.00	0	0	1	0.33	0	0	0	0.00
30	IL8/IL116 (MAIN) & SPRINGFIELD	EB	Yes	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00
31		WB	Yes	1	1	0	0.67	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00
32	IL8/IL116 (MAIN) & WASHINGTON	NB	No	1	1	1	1.00	1	0	1	0.67	0	0	1	0.33	1	0	1	0.67
33		SB	No	1	1	0	0.67	1	1	2	1.33	0	1	0	0.33	1	1	2	1.33
34		EB	Yes	1	0	1	0.67	1	0	0	0.33	1	0	1	0.67	1	0	0	0.33
35		WB	Yes	2	1	2	1.67	0	1	0	0.33	2	1	2	1.67	0	1	0	0.33
36	EAST WASHINGTON & VETERANS	SB	Yes	2	2	1	1.67	0	0	0	0.00	0	1	1	0.67	0	0	0	0.00
37	W. CAMP & RIVERFRONT DR. RAMPS	EB	Yes	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00
38	IL29 & LA SALLE	SB	Yes	1	2	3	2.00	1	0	1	0.67	1	2	3	2.00	1	0	1	0.67
39	US150 (JACKSON) & DETROIT	SB	No	1	0	0	0.33	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00
40		WB	Yes	0	0	0	0.00	0	1	1	0.67	0	0	0	0.00	0	1	1	0.67
41	US150 (JACKSON) & VETERANS	NB	No	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00
42		SB	No	0	0	0	0.00	1	0	0	0.33	0	0	0	0.00	0	0	0	0.00
43		EB	Yes	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00
44		WB	Yes	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00
45	US150 (JACKSON) & MORTON	EB	Yes	0	0	1	0.33	0	2	2	1.33	0	0	0	0.00	0	1	2	1.00
46	IL98 (BIRCHWOOD) & DETROIT	NB	No	0	0	0	0.00	0	0	1	0.33	0	0	0	0.00	0	0	1	0.33
47		SB	No	0	1	1	0.67	1	0	0	0.33	0	1	1	0.67	0	0	0	0.00
48		EB	Yes	1	0	1	0.67	1	0	0	0.33	1	0	1	0.67	1	0	0	0.33
49		WB	Yes	1	0	0	0.33	0	1	1	0.67	1	0	0	0.33	0	1	1	0.67
50	IL98 (BIRCHWOOD) & I155 RAMPS A&B	EB	No	1	0	0	0.33	0	0	0	0.00	1	0	0	0.33	0	0	0	0.00
51	IL98 & MAIN	EB	Yes	1	2	1	1.33	1	1	0	0.67	1	2	1	1.33	1	1	0	0.67
52	IL9 (COURT) & ALLENTOWN	SB	Yes	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00
53	IL9 (COURT) & BARNEY	EB	No	1	0	0	0.33	0	0	0	0.00	1	0	0	0.33	0	0	0	0.00
54		WB	No	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00

FYA NO.	INTERSECTION NAME	FYA Approach	Supplemental sign provided?	Total Crash Frequency								Injury Crash Frequency (K, A, B, and C)							
				"Before" Period				"After" Period				"Before" Period				"After" Period			
				Year 1	Year 2	Year 3	Avg.	Year 1	Year 2	Year 3	Avg.	Year 1	Year 2	Year 3	Avg.	Year 1	Year 2	Year 3	Avg.
55	IL9 (COURT) & FOURTEENTH	NB	No	2	2	3	2.33	1	0	1	0.67	0	1	1	0.67	1	0	0	0.33
56		SB	No	4	1	2	2.33	2	2	2	2.00	0	0	0	0.00	0	2	1	1.00
57		EB	Yes	4	1	1	2.00	2	5	1	2.67	0	0	0	0.00	1	0	1	0.67
58		WB	Yes	5	3	1	3.00	1	1	3	1.67	2	3	0	1.67	1	0	1	0.67
59	IL9 (COURT) & PARKWAY/SUNSET	EB	No	5	6	9	6.67	9	1	3	4.33	1	0	2	1.00	3	1	1	1.67
60		WB	No	4	6	5	5.00	11	11	2	8.00	1	0	0	0.33	2	0	1	1.00
61	IL9 (COURT) & VALLE VISTA	NB	Yes	3	1	2	2.00	1	2	1	1.33	0	0	1	0.33	0	0	0	0.00
62		SB	Yes	5	0	3	2.67	0	1	0	0.33	1	0	1	0.67	0	0	0	0.00
63		EB	No	4	2	3	3.00	3	8	8	6.33	1	0	1	0.67	0	1	0	0.33
64		WB	No	1	2	0	1.00	0	1	4	1.67	1	0	0	0.33	0	0	1	0.33
65	IL9 (COURT) & VETERANS	NB	Yes	2	3	3	2.67	1	5	3	3.00	2	1	2	1.67	0	2	1	1.00
66		SB	Yes	1	5	2	2.67	8	3	1	4.00	0	1	1	0.67	1	1	0	0.67
67		EB	Yes	2	4	5	3.67	2	1	3	2.00	0	1	1	0.67	1	0	2	1.00
68		WB	Yes	5	5	1	3.67	1	2	3	2.00	0	3	0	1.00	1	0	1	0.67
69	IL9 (MARGARET) & IL29 (FIFTH)	SB	Yes	0	2	2	1.33	1	1	2	1.33	0	1	1	0.67	0	0	0	0.00
70	IL29 (EIGHTH) & SHERIDAN	NB	Yes	1	1	2	1.33	0	0	1	0.33	0	0	1	0.33	0	0	0	0.00
71		SB	Yes	3	1	3	2.33	3	5	7	5.00	1	0	1	0.67	2	2	1	1.67
72		EB	No	0	0	3	1.00	2	0	4	2.00	0	0	0	0.00	2	0	1	1.00
73		WB	No	0	0	0	0.00	1	1	0	0.67	0	0	0	0.00	0	0	0	0.00
74	IL29 (SECOND) & DERBY	SB	No	1	1	1	1.00	0	0	0	0.00	0	0	1	0.33	0	0	0	0.00
75	IL29 (SECOND) & MANITO/FEDERAL PRISON	NB	Yes	0	0	0	0.00	1	2	2	1.67	0	0	0	0.00	1	1	0	0.67
76		SB	Yes	2	0	2	1.33	0	2	1	1.00	1	0	1	0.67	0	1	0	0.33
77	IL98 & PARKWAY	EB	Yes	1	0	0	0.33	1	1	0	0.67	0	0	0	0.00	1	0	0	0.33
78		WB	Yes	0	1	2	1.00	2	3	0	1.67	0	0	1	0.33	0	2	0	0.67
79	US24 (ADAMS) & GRISWOLD	EB	Yes	4	4	0	2.67	1	1	0	0.67	1	2	0	1.00	1	0	0	0.33
80	US24/IL29 (WASHINGTON) & WB RAMP G-4 EATON	NB	Yes	3	1	1	1.67	3	0	2	1.67	0	0	0	0.00	1	0	0	0.33
81		SB	Yes	0	0	0	0.00	0	0	1	0.33	0	0	0	0.00	0	0	0	0.00

FYA NO.	INTERSECTION NAME	FYA Approach	Supplemental sign provided?	LT-Related Crash Frequency								LTOT-Only Crash Frequency							
				"Before" Period				"After" Period				"Before" Period				"After" Period			
				Year 1	Year 2	Year 3	Avg.	Year 1	Year 2	Year 3	Avg.	Year 1	Year 2	Year 3	Avg.	Year 1	Year 2	Year 3	Avg.
55	IL9 (COURT) & FOURTEENTH	NB	No	0	0	1	0.33	1	0	1	0.67	0	0	1	0.33	0	0	1	0.33
56		SB	No	1	0	0	0.33	1	0	0	0.33	0	0	0	0.00	0	0	0	0.00
57		EB	Yes	0	0	0	0.00	0	2	0	0.67	0	0	0	0.00	0	2	0	0.67
58		WB	Yes	0	1	1	0.67	0	0	0	0.00	0	1	0	0.33	0	0	0	0.00
59	IL9 (COURT) & PARKWAY/SUNSET	EB	No	3	4	4	3.67	5	1	0	2.00	2	3	4	3.00	5	1	0	2.00
60		WB	No	0	1	0	0.33	1	0	0	0.33	0	0	0	0.00	1	0	0	0.33
61	IL9 (COURT) & VALLE VISTA	NB	Yes	1	1	0	0.67	1	1	0	0.67	0	1	0	0.33	0	0	0	0.00
62		SB	Yes	0	0	1	0.33	0	0	0	0.00	0	0	1	0.33	0	0	0	0.00
63		EB	No	0	0	1	0.33	0	2	1	1.00	0	0	1	0.33	0	2	1	1.00
64		WB	No	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00
65	IL9 (COURT) & VETERANS	NB	Yes	2	1	3	2.00	1	2	2	1.67	2	1	2	1.67	0	2	1	1.00
66		SB	Yes	0	2	2	1.33	2	0	1	1.00	0	2	1	1.00	0	0	0	0.00
67		EB	Yes	2	2	5	3.00	0	0	0	0.00	0	2	5	2.33	0	0	0	0.00
68		WB	Yes	3	2	1	2.00	1	1	0	0.67	3	2	1	2.00	0	1	0	0.33
69	IL9 (MARGARET) & IL29 (FIFTH)	SB	Yes	0	1	0	0.33	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00
70	IL29 (EIGHTH) & SHERIDAN	NB	Yes	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00
71		SB	Yes	1	0	0	0.33	1	1	1	1.00	1	0	0	0.33	1	1	0	0.67
72		EB	No	0	0	2	0.67	1	0	2	1.00	0	0	2	0.67	1	0	2	1.00
73		WB	No	0	0	0	0.00	1	0	0	0.33	0	0	0	0.00	1	0	0	0.33
74	IL29 (SECOND) & DERBY	SB	No	1	1	1	1.00	0	0	0	0.00	1	0	0	0.33	0	0	0	0.00
75	IL29 (SECOND) & MANITO/FEDERAL PRISON	NB	Yes	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00
76		SB	Yes	0	0	0	0.00	0	1	0	0.33	0	0	0	0.00	0	0	0	0.00
77	IL98 & PARKWAY	EB	Yes	0	0	0	0.00	1	0	0	0.33	0	0	0	0.00	0	0	0	0.00
78		WB	Yes	0	0	0	0.00	1	0	0	0.33	0	0	0	0.00	1	0	0	0.33
79	US24 (ADAMS) & GRISWOLD	EB	Yes	3	2	0	1.67	1	1	0	0.67	3	2	0	1.67	1	1	0	0.67
80	US24/IL29 (WASHINGTON) & WB RAMP G-4 EATON	NB	Yes	1	1	0	0.67	2	0	1	1.00	1	0	0	0.33	1	0	1	0.67
81		SB	Yes	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00

FYA NO.	INTERSECTION NAME	FYA Approach	Supplemental sign provided?	Total Crash Frequency								Injury Crash Frequency (K, A, B, and C)							
				"Before" Period				"After" Period				"Before" Period				"After" Period			
				Year 1	Year 2	Year 3	Avg.	Year 1	Year 2	Year 3	Avg.	Year 1	Year 2	Year 3	Avg.	Year 1	Year 2	Year 3	Avg.
82	US24/IL29 (WASHINGTON) & MACARTHUR	SB	Yes	1	4	3	2.67	1	1	3	1.67	1	1	0	0.67	0	1	0	0.33
83		WB	Yes	1	0	1	0.67	0	0	1	0.33	0	0	0	0.00	0	0	0	0.00
84	US24/IL29 (WASHINGTON) & STATE	NB	No	0	0	2	0.67	0	1	0	0.33	0	0	1	0.33	0	0	0	0.00
85	US24/IL29 (ADAMS) & RAMPS B/C WB	NB	Yes	2	0	1	1.00	1	0	1	0.67	0	0	0	0.00	1	0	0	0.33
86	UK24/IL29 (ADAMS) & LORENTZ	NB	No	0	1	0	0.33	2	1	0	1.00	0	0	0	0.00	0	1	0	0.33
87	US150 (WAR MEMORIAL) & BRANDYWINE	NB	No	0	1	0	0.33	1	2	1	1.33	0	0	0	0.00	1	0	0	0.33
88		SB	No	2	1	2	1.67	1	0	2	1.00	0	1	0	0.33	0	0	0	0.00
89		EB	No	8	4	6	6.00	5	5	5	5.00	2	2	2	2.00	2	3	1	2.00
90		WB	No	3	2	3	2.67	5	7	2	4.67	0	1	1	0.67	0	4	0	1.33
91	US150 (WAR MEMORIAL) & FROSTWOOD	WB	No	2	0	6	2.67	1	1	2	1.33	0	0	3	1.00	0	0	1	0.33
92	US150 (WAR MEMORIAL) & GRAND	EB	No	0	1	0	0.33	3	3	0	2.00	0	1	0	0.33	0	0	0	0.00
93	US150 (WAR MEMORIAL) & GRAND PRAIRIE	EB	No	2	2	1	1.67	4	3	1	2.67	0	2	0	0.67	1	0	0	0.33
94		WB	No	3	0	3	2.00	0	2	0	0.67	0	0	1	0.33	0	0	0	0.00
95	US150 (WAR MEMORIAL) & MOUNTELLO	EB	No	2	2	4	2.67	1	1	0	0.67	0	0	0	0.00	0	0	0	0.00
96		WB	No	0	0	1	0.33	2	1	0	1.00	0	0	0	0.00	0	0	0	0.00
97	US150 (WAR MEMORIAL) & NORHTLAND	EB	No	6	6	6	6.00	8	5	9	7.33	0	0	0	0.00	0	2	2	1.33
98	US150 (WAR MEMORIAL) & AMERICAN TV (MATHIS)	EB	No	1	0	2	1.00	0	1	1	0.67	0	0	1	0.33	0	0	0	0.00
99	US150 (WAR MEMORIAL) & ORANGE PRAIRIE	NB	No	2	1	0	1.00	2	0	0	0.67	0	0	0	0.00	1	0	0	0.33
100		SB	No	1	1	0	0.67	0	1	1	0.67	1	0	0	0.33	0	0	0	0.00
101		EB	Yes	2	1	2	1.67	0	2	0	0.67	1	0	0	0.33	0	0	0	0.00
102		WB	Yes	2	1	3	2.00	2	3	3	2.67	0	0	0	0.00	1	0	0	0.33
103	IL91 & AMERICAN PRAIRIE	NB	No	0	0	1	0.33	1	1	0	0.67	0	0	0	0.00	0	0	0	0.00
104	US150 (WAR MEMORIAL) & SHERIDEN	EB	Yes	4	8	6	6.00	9	4	6	6.33	0	2	0	0.67	2	2	1	1.67
105		WB	Yes	7	7	8	7.33	4	10	8	7.33	1	1	4	2.00	1	1	2	1.33
106	US150 (WAR MEMORIAL) & WILLOW KNOLLS	NB	No	2	4	3	3.00	3	3	0	2.00	2	0	0	0.67	0	0	0	0.00
107		SB	No	4	1	6	3.67	3	3	1	2.33	0	0	3	1.00	1	1	0	0.67
108		EB	Yes	2	11	5	6.00	7	6	10	7.67	1	3	3	2.33	0	4	3	2.33
109		WB	Yes	4	4	5	4.33	6	6	2	4.67	1	2	2	1.67	1	2	0	1.00

FYA NO.	INTERSECTION NAME	FYA Approach	Supplemental sign provided?	LT-Related Crash Frequency								LTOT-Only Crash Frequency							
				"Before" Period				"After" Period				"Before" Period				"After" Period			
				Year 1	Year 2	Year 3	Avg.	Year 1	Year 2	Year 3	Avg.	Year 1	Year 2	Year 3	Avg.	Year 1	Year 2	Year 3	Avg.
82	US24/IL29 (WASHINGTON) & MACARTHUR	SB	Yes	0	2	0	0.67	0	0	1	0.33	0	2	0	0.67	0	0	1	0.33
83		WB	Yes	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00
84	US24/IL29 (WASHINGTON) & STATE	NB	No	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00
85	US24/IL29 (ADAMS) & RAMPS B/C WB	NB	Yes	2	0	1	1.00	0	0	0	0.00	2	0	1	1.00	0	0	0	0.00
86	UK24/IL29 (ADAMS) & LORENTZ	NB	No	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00
87	US150 (WAR MEMORIAL) & BRANDYWINE	NB	No	0	1	0	0.33	0	1	0	0.33	0	0	0	0.00	0	0	0	0.00
88		SB	No	0	1	1	0.67	1	0	0	0.33	0	0	0	0.00	1	0	0	0.33
89		EB	No	4	1	3	2.67	3	2	1	2.00	4	1	3	2.67	3	2	1	2.00
90		WB	No	1	1	3	1.67	2	2	0	1.33	1	1	3	1.67	2	0	0	0.67
91	US150 (WAR MEMORIAL) & FROSTWOOD	WB	No	1	0	2	1.00	0	0	1	0.33	1	0	2	1.00	0	0	1	0.33
92	US150 (WAR MEMORIAL) & GRAND	EB	No	0	1	0	0.33	0	0	0	0.00	0	1	0	0.33	0	0	0	0.00
93	US150 (WAR MEMORIAL) & GRAND PRAIRIE	EB	No	1	2	1	1.33	3	2	1	2.00	0	2	1	1.00	3	2	1	2.00
94		WB	No	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00
95	US150 (WAR MEMORIAL) & MOUNTELLO	EB	No	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00
96		WB	No	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00
97	US150 (WAR MEMORIAL) & NORHTLAND	EB	No	0	1	2	1.00	0	4	5	3.00	0	1	0	0.33	0	2	3	1.67
98	US150 (WAR MEMORIAL) & AMERICAN TV (MATHIS)	EB	No	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00
99	US150 (WAR MEMORIAL) & ORANGE PRAIRIE	NB	No	0	0	0	0.00	1	0	0	0.33	0	0	0	0.00	0	0	0	0.00
100		SB	No	0	0	0	0.00	0	1	1	0.67	0	0	0	0.00	0	1	0	0.33
101		EB	Yes	1	0	1	0.67	0	0	0	0.00	1	0	0	0.33	0	0	0	0.00
102		WB	Yes	0	0	0	0.00	0	1	0	0.33	0	0	0	0.00	0	0	0	0.00
103	IL91 & AMERICAN PRAIRIE	NB	No	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00
104	US150 (WAR MEMORIAL) & SHERIDEN	EB	Yes	0	3	4	2.33	2	0	6	2.67	0	1	4	1.67	2	0	3	1.67
105		WB	Yes	3	0	1	1.33	1	1	1	1.00	3	0	0	1.00	1	1	1	1.00
106	US150 (WAR MEMORIAL) & WILLOW KNOLLS	NB	No	1	2	1	1.33	0	1	0	0.33	0	1	1	0.67	0	0	0	0.00
107		SB	No	0	0	2	0.67	0	0	0	0.00	0	0	2	0.67	0	0	0	0.00
108		EB	Yes	2	8	4	4.67	2	5	6	4.33	1	5	3	3.00	2	5	6	4.33
109		WB	Yes	1	2	3	2.00	2	3	0	1.67	1	1	3	1.67	2	1	0	1.00

FYA NO.	INTERSECTION NAME	FYA Approach	Supplemental sign provided?	Total Crash Frequency								Injury Crash Frequency (K, A, B, and C)							
				"Before" Period				"After" Period				"Before" Period				"After" Period			
				Year 1	Year 2	Year 3	Avg.	Year 1	Year 2	Year 3	Avg.	Year 1	Year 2	Year 3	Avg.	Year 1	Year 2	Year 3	Avg.
110	US150 (WAR MEMORIAL) & WILLOW KNOLLS CT. (BARING TRACE)	EB	No	3	0	3	2.00	4	3	2	3.00	1	0	1	0.67	2	1	0	1.00
111		WB	No	1	3	2	2.00	1	1	1	1.00	0	0	1	0.33	0	0	0	0.00
112	US150 (WAR MEMORIAL) & WISCONSIN	NB	No	1	0	0	0.33	2	0	1	1.00	1	0	0	0.33	0	0	0	0.00
113		EB	No	5	4	1	3.33	3	8	2	4.33	0	1	0	0.33	0	2	0	0.67
114		WB	No	4	2	3	3.00	6	3	2	3.67	1	0	1	0.67	5	0	0	1.67
115	IL6 NB RAMPS & ALLEN	NB	No	5	3	2	3.33	5	3	4	4.00	1	0	2	1.00	0	0	1	0.33
116	IL8 (MAIN) & FARMINGTON	EB	No	2	4	5	3.67	6	4	4	4.67	1	3	1	1.67	2	0	1	1.00
117	IL40 (KNOXVILLE) & ALTA	NB	No	1	1	1	1.00	3	2	2	2.33	0	0	0	0.00	1	1	0	0.67
118		EB	No	1	1	1	1.00	1	0	0	0.33	1	0	0	0.33	0	0	0	0.00
119	IL40 (KNOXVILLE) &PENNSYLVANIA	NB	No	3	3	1	2.33	2	0	7	3.00	1	1	0	0.67	0	0	1	0.33
120		SB	Yes	5	4	5	4.67	5	5	4	4.67	0	2	1	1.00	0	1	0	0.33
121		EB	Yes	0	3	1	1.33	2	0	0	0.67	0	0	0	0.00	0	0	0	0.00
122	IL40 (KNOXVILLE) & BIRD/FRYE	NB	No	0	2	2	1.33	2	1	1	1.33	0	2	1	1.00	0	1	1	0.67
123	IL40 (KNOXVILLE) & DETWEILLER	NB	No	0	1	0	0.33	3	0	1	1.33	0	1	0	0.33	1	0	0	0.33
124	KNOXVILLE & GLEN OAK/FAYETTE	WB	No	2	1	2	1.67	2	1	3	2.00	1	0	1	0.67	1	0	0	0.33
125	IL40 (KNOXVILLE) & MCCLURE	NB	Yes	4	0	1	1.67	5	5	1	3.67	2	0	1	1.00	2	2	1	1.67
126		SB	Yes	1	3	3	2.33	4	6	6	5.33	1	2	0	1.00	2	2	2	2.00
127		EB	No	3	3	5	3.67	2	3	1	2.00	0	0	1	0.33	0	1	1	0.67
128		WB	No	0	2	2	1.33	5	1	3	3.00	0	0	2	0.67	1	0	0	0.33
129	IL40 (KNOXVILLE) & RICHMAR	NB	No	1	0	0	0.33	4	3	2	3.00	1	0	0	0.33	1	1	2	1.33
130		SB	No	0	1	2	1.00	2	1	0	1.00	0	0	1	0.33	2	1	0	1.00
131	IL40 (KNOXVILLE) & MOSSVILLE	NB	Yes	3	1	1	1.67	1	0	1	0.67	0	0	0	0.00	1	0	1	0.67
132		SB	Yes	2	2	1	1.67	2	4	2	2.67	0	0	1	0.33	0	1	1	0.67
133		EB	No	0	0	0	0.00	0	1	1	0.67	0	0	0	0.00	0	0	0	0.00
134		WB	No	0	0	3	1.00	1	0	3	1.33	0	0	1	0.33	1	0	0	0.33
135	IL40 (KNOXVILLE) & NEBRASKA	NB	No	4	3	1	2.67	3	6	0	3.00	2	1	0	1.00	1	1	0	0.67
136		SB	No	1	3	3	2.33	6	14	6	8.67	1	1	0	0.67	3	3	3	3.00
137		EB	No	6	6	3	5.00	1	2	4	2.33	3	1	2	2.00	0	0	0	0.00
138		WB	No	0	4	4	2.67	1	1	0	0.67	0	2	1	1.00	0	0	0	0.00

FYA NO.	INTERSECTION NAME	FYA Approach	Supplemental sign provided?	LT-Related Crash Frequency								LTOT-Only Crash Frequency							
				"Before" Period				"After" Period				"Before" Period				"After" Period			
				Year 1	Year 2	Year 3	Avg.	Year 1	Year 2	Year 3	Avg.	Year 1	Year 2	Year 3	Avg.	Year 1	Year 2	Year 3	Avg.
110	US150 (WAR MEMORIAL) & WILLOW KNOLLS CT. (BARING TRACE)	EB	No	2	0	2	1.33	1	0	1	0.67	2	0	1	1.00	1	0	1	0.67
111		WB	No	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00
112	US150 (WAR MEMORIAL) & WISCONSIN	NB	No	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00
113		EB	No	0	0	1	0.33	0	4	0	1.33	0	0	1	0.33	0	3	0	1.00
114		WB	No	1	0	0	0.33	1	1	0	0.67	1	0	0	0.33	1	1	0	0.67
115	IL6 NB RAMPS & ALLEN	NB	No	3	0	0	1.00	2	0	0	0.67	3	0	0	1.00	1	0	0	0.33
116	IL8 (MAIN) & FARMINGTON	EB	No	1	3	4	2.67	2	2	2	2.00	1	2	2	1.67	1	2	2	1.67
117	IL40 (KNOXVILLE) & ALTA	NB	No	1	1	0	0.67	1	1	0	0.67	1	0	0	0.33	0	1	0	0.33
118		EB	No	0	0	0	0.00	1	0	0	0.33	0	0	0	0.00	0	0	0	0.00
119	IL40 (KNOXVILLE) &PENNSYLVANIA	NB	No	2	0	0	0.67	0	0	2	0.67	1	0	0	0.33	0	0	2	0.67
120		SB	Yes	3	1	1	1.67	2	1	0	1.00	1	1	1	1.00	1	1	0	0.67
121		EB	Yes	0	0	1	0.33	0	0	0	0.00	0	0	1	0.33	0	0	0	0.00
122	IL40 (KNOXVILLE) & BIRD/FRYE	NB	No	0	1	0	0.33	1	1	0	0.67	0	1	0	0.33	1	1	0	0.67
123	IL40 (KNOXVILLE) & DETWEILLER	NB	No	0	1	0	0.33	0	0	1	0.33	0	1	0	0.33	0	0	1	0.33
124	KNOXVILLE & GLEN OAK/FAYETTE	WB	No	2	1	2	1.67	1	0	0	0.33	2	1	2	1.67	0	0	0	0.00
125	IL40 (KNOXVILLE) & MCCLURE	NB	Yes	1	0	0	0.33	2	1	0	1.00	1	0	0	0.33	2	0	0	0.67
126		SB	Yes	0	0	1	0.33	1	1	0	0.67	0	0	1	0.33	1	0	0	0.33
127		EB	No	1	1	1	1.00	2	0	1	1.00	0	0	0	0.00	0	0	1	0.33
128		WB	No	0	0	0	0.00	1	0	0	0.33	0	0	0	0.00	0	0	0	0.00
129	IL40 (KNOXVILLE) & RICHMAR	NB	No	0	0	0	0.00	4	1	0	1.67	0	0	0	0.00	2	1	0	1.00
130		SB	No	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00
131	IL40 (KNOXVILLE) & MOSSVILLE	NB	Yes	2	1	1	1.33	0	0	0	0.00	1	0	1	0.67	0	0	0	0.00
132		SB	Yes	0	1	0	0.33	2	1	1	1.33	0	1	0	0.33	1	1	1	1.00
133		EB	No	0	0	0	0.00	0	0	1	0.33	0	0	0	0.00	0	0	1	0.33
134		WB	No	0	0	0	0.00	1	0	1	0.67	0	0	0	0.00	1	0	1	0.67
135	IL40 (KNOXVILLE) & NEBRASKA	NB	No	0	0	0	0.00	1	0	0	0.33	0	0	0	0.00	1	0	0	0.33
136		SB	No	1	2	2	1.67	4	4	3	3.67	1	2	1	1.33	1	0	2	1.00
137		EB	No	2	3	0	1.67	1	0	1	0.67	2	2	0	1.33	0	0	0	0.00
138		WB	No	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00

FYA NO.	INTERSECTION NAME	FYA Approach	Supplemental sign provided?	Total Crash Frequency								Injury Crash Frequency (K, A, B, and C)							
				"Before" Period				"After" Period				"Before" Period				"After" Period			
				Year 1	Year 2	Year 3	Avg.	Year 1	Year 2	Year 3	Avg.	Year 1	Year 2	Year 3	Avg.	Year 1	Year 2	Year 3	Avg.
139	IL40 (KNOXVILLE) & NORTHPOINT	NB	No	5	2	2	3.00	1	1	0	0.67	2	0	1	1.00	1	1	0	0.67
140	IL8/IL116 (HOWETT) & IL8 (WESTERN)	NB	Yes	1	2	0	1.00	1	4	0	1.67	0	1	0	0.33	1	1	0	0.67
141	IL116 (LINCOLN) & LARAMIE	WB	Yes	2	1	0	1.00	4	3	2	3.00	2	0	0	0.67	2	1	0	1.00
142	IL/IL116 (LINCOLN) & IL8 (WESTERN)	SB	Yes	5	1	3	3.00	2	1	1	1.33	3	0	1	1.33	1	1	0	0.67
143	ADAMS & IL40 (KUMPF)	SB	No	6	0	2	2.67	3	1	0	1.33	1	0	0	0.33	0	0	0	0.00
144	SPAULDING & GLEN OAK/KNOXVILLE	EB	Yes	4	2	2	2.67	1	0	0	0.33	1	0	1	0.67	0	0	0	0.00
145	JEFFERSON & IL40 (KUMPF)	NB	Yes	5	2	3	3.33	1	0	4	1.67	2	1	2	1.67	1	0	1	0.67
146	IL40 (KUMPF) & M.L.KING	NB	No	2	2	3	2.33	0	0	0	0.00	0	1	2	1.00	0	0	0	0.00
147	IL8 (WESTERN) & M.L.KING	SB	Yes	4	3	2	3.00	1	5	8	4.67	1	2	1	1.33	0	2	0	0.67
148		EB	Yes	2	1	4	2.33	1	0	1	0.67	1	0	2	1.00	1	0	0	0.33
149	IL8 (FARMINGTON) & STERLING	EB	Yes	1	0	3	1.33	3	3	2	2.67	0	0	1	0.33	0	0	1	0.33
150	IL116 & MAXWELL	NB	Yes	2	2	1	1.67	1	0	0	0.33	1	0	0	0.33	0	0	0	0.00
151		SB	Yes	6	2	4	4.00	0	0	3	1.00	1	1	1	1.00	0	0	0	0.00
152		EB	Yes	2	0	1	1.00	0	2	2	1.33	0	0	0	0.00	0	2	1	1.00
153		WB	Yes	1	1	0	0.67	0	0	2	0.67	0	1	0	0.33	0	0	0	0.00
154	FARMINGTON & MAXWELL	WB	Yes	0	2	1	1.00	0	2	1	1.00	0	0	1	0.33	0	1	0	0.33
155	IL116 (MAIN) & ACCESS RD. 8	NB	No	2	2	0	1.33	0	0	0	0.00	0	1	0	0.33	0	0	0	0.00
156	US24 BUS & IL8 (WASHINGTON)	EB	No	4	1	4	3.00	2	2	3	2.33	2	0	1	1.00	0	1	0	0.33
157	US24 BUS & CUMMINGS	EB	Yes	5	4	3	4.00	2	4	3	3.00	2	0	1	1.00	2	1	0	1.00
158		WB	Yes	5	0	1	2.00	2	2	7	3.67	0	0	0	0.00	0	2	1	1.00
159	US24 BUS & WILMOR	EB	Yes	4	3	6	4.33	6	3	3	4.00	2	1	0	1.00	3	0	1	1.33
160		WB	Yes	0	0	0	0.00	0	4	0	1.33	0	0	0	0.00	0	2	0	0.67
161	IL40 (KNOXVILLE) & LINDBERGH	NB	No	3	3	1	2.33	1	1	2	1.33	2	1	1	1.33	0	0	1	0.33
162	IL40 (KUMPF) & JOHN GWYNN	NB	Yes	1	2	1	1.33	4	1	1	2.00	0	0	0	0.00	0	0	0	0.00
163		SB	No	1	0	0	0.33	0	2	1	1.00	0	0	0	0.00	0	1	0	0.33
164		WB	No	0	0	1	0.33	0	0	0	0.00	0	0	1	0.33	0	0	0	0.00

FYA NO.	INTERSECTION NAME	FYA Approach	Supplemental sign provided?	Total Crash Frequency								Injury Crash Frequency (K, A, B, and C)							
				"Before" Period				"After" Period				"Before" Period				"After" Period			
				Year 1	Year 2	Year 3	Avg.	Year 1	Year 2	Year 3	Avg.	Year 1	Year 2	Year 3	Avg.	Year 1	Year 2	Year 3	Avg.
139	IL40 (KNOXVILLE) & NORTHPOINT	NB	No	4	2	2	2.67	1	0	0	0.33	2	2	1	1.67	1	0	0	0.33
140	IL8/IL116 (HOWETT) & IL8 (WESTERN)	NB	Yes	0	1	0	0.33	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00
141	IL116 (LINCOLN) & LARAMIE	WB	Yes	2	1	0	1.00	1	1	0	0.67	2	0	0	0.67	0	1	0	0.33
142	IL/IL116 (LINCOLN) & IL8 (WESTERN)	SB	Yes	1	1	1	1.00	1	0	1	0.67	0	1	1	0.67	0	0	1	0.33
143	ADAMS & IL40 (KUMPF)	SB	No	1	0	0	0.33	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00
144	SPAULDING & GLEN OAK/KNOXVILLE	EB	Yes	1	2	1	1.33	0	0	0	0.00	1	0	1	0.67	0	0	0	0.00
145	JEFFERSON & IL40 (KUMPF)	NB	Yes	1	1	1	1.00	0	0	1	0.33	0	1	1	0.67	0	0	1	0.33
146	IL40 (KUMPF) & M.L.KING	NB	No	1	2	3	2.00	0	0	0	0.00	1	2	3	2.00	0	0	0	0.00
147	IL8 (WESTERN) & M.L.KING	SB	Yes	0	1	1	0.67	1	1	0	0.67	0	0	0	0.00	1	1	0	0.67
148		EB	Yes	0	1	2	1.00	1	0	1	0.67	0	0	2	0.67	0	0	0	0.00
149	IL8 (FARMINGTON) & STERLING	EB	Yes	0	0	1	0.33	1	2	0	1.00	0	0	1	0.33	1	2	0	1.00
150	IL116 & MAXWELL	NB	Yes	0	0	1	0.33	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00
151		SB	Yes	0	1	1	0.67	0	0	1	0.33	0	1	0	0.33	0	0	0	0.00
152		EB	Yes	1	0	0	0.33	0	0	1	0.33	1	0	0	0.33	0	0	0	0.00
153		WB	Yes	0	1	0	0.33	0	0	0	0.00	0	1	0	0.33	0	0	0	0.00
154	FARMINGTON & MAXWELL	WB	Yes	0	2	1	1.00	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00
155	IL116 (MAIN) & ACCESS RD. 8	NB	No	0	1	0	0.33	0	0	0	0.00	0	1	0	0.33	0	0	0	0.00
156	US24 BUS & IL8 (WASHINGTON)	EB	No	4	1	3	2.67	0	1	0	0.33	4	1	3	2.67	0	1	0	0.33
157	US24 BUS & CUMMINGS	EB	Yes	2	1	1	1.33	0	2	1	1.00	2	0	1	1.00	0	0	0	0.00
158		WB	Yes	0	0	0	0.00	1	0	1	0.67	0	0	0	0.00	1	0	0	0.33
159	US24 BUS & WILMOR	EB	Yes	1	3	4	2.67	2	0	1	1.00	1	3	1	1.67	0	0	1	0.33
160		WB	Yes	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00
161	IL40 (KNOXVILLE) & LINDBERGH	NB	No	2	1	0	1.00	1	0	2	1.00	1	1	0	0.67	1	0	2	1.00
162	IL40 (KUMPF) & JOHN GWYNN	NB	Yes	1	1	1	1.00	2	1	0	1.00	1	1	1	1.00	2	1	0	1.00
163		SB	No	0	0	0	0.00	0	1	0	0.33	0	0	0	0.00	0	1	0	0.33
164		WB	No	0	0	1	0.33	0	0	0	0.00	0	0	0	0.00	0	0	0	0.00

APPENDIX C: TRAFFIC VOLUME, CRASH DATA, AND OTHER CHARACTERISTICS FOR 100 COMPARISON SITES

Int No.	City	Site Name	Approach	# Opposing Thru Lanes	Speed Limit (mph)	Approach ADT	Total Int ADT	ADT of Major Street	ADT of Minor Street	Prop. of Minor to Total ADT	Prop. of Minor to Major ADT	Prop. Of App to Total ADT
1	Springfield	IL 4 (Veterans Pkwy) & I-55 Blvd (Color Plant)	NB	1	35	3,300	21,050	14,450	6,600	0.31	0.46	0.16
			SB	1	40	500	21,050	14,450	6,600	0.31	0.46	0.02
2	Springfield	Sangamon Ave & I-55 Blvd (N Peoria)	NB	2	35	5,850	24,125	14,450	9,675	0.40	0.67	0.24
			SB	2	35	3,825	24,125	14,450	9,675	0.40	0.67	0.16
			EB	2	35	4,500	24,125	14,450	9,675	0.40	0.67	0.19
			WB	2	30	8,600	24,125	14,450	9,675	0.40	0.67	0.36
3	Springfield	I-55 Blvd (N 9th St) & E Converse St	NB	2	30	6,500	14,450	12,250	2,200	0.15	0.18	0.45
			SB	2	30	5,750	14,450	12,250	2,200	0.15	0.18	0.40
4	Springfield	I-55 Blvd (N 9th St) & N Grand Ave	NB	2	30	6,050	25,300	12,550	12,750	0.50	1.02	0.24
			SB	2	30	6,500	25,300	12,550	12,750	0.50	1.02	0.26
			EB	2	30	7,050	25,300	12,550	12,750	0.50	1.02	0.28
			WB	2	30	6,150	25,300	12,550	12,750	0.50	1.02	0.24
5	Springfield	I-55 Blvd (N 9th St) & E Carpenter St	NB	2	30	5,250	20,150	11,300	8,850	0.44	0.78	0.26
			SB	2	30	6,050	20,150	11,300	8,850	0.44	0.78	0.30
			EB	2	30	5,050	20,150	11,300	8,850	0.44	0.78	0.25
			WB	2	30	3,050	20,150	11,300	8,850	0.44	0.78	0.15
6	Springfield	IL 4 (Veterans Pkwy) & IL 97 (W Jefferson St)	EB	2	45	6,850	33,950	18,600	15,350	0.45	0.83	0.20
			WB	2	45	8,500	33,950	18,600	15,350	0.45	0.83	0.25
7	Springfield	IL 4 (Veterans Pkwy) &W Washington St	EB	2	40	3,800	33,900	24,900	9,000	0.27	0.36	0.11
			WB	2	40	4,300	33,900	24,900	9,000	0.27	0.36	0.13
8	Springfield	IL 4 (Veterans Pkwy) & W Browning Rd	NB	2	55	7,600	18,725	13,750	4,975	0.27	0.36	0.41
			SB	2	55	6,150	18,725	13,750	4,975	0.27	0.36	0.33
9	Springfield	I-55 Blvd (N Peoria) & N Dirksen Pkwy	SB	2	45	7,600	28,400	15,900	12,500	0.44	0.79	0.27
10	Springfield	I-55 Blvd (S Sherman Blvd) & IL 124 (E Andrew Rd)	NB	2	45	4,775	13,375	9,125	4,250	0.32	0.47	0.36
			SB	2	45	4,350	13,375	9,125	4,250	0.32	0.47	0.33
			EB	1	35	1,875	13,375	9,125	4,250	0.32	0.47	0.14
			WB	1	35	2,425	13,375	9,125	4,250	0.32	0.47	0.18
11	Springfield	IL 54 (E Sangamon Ave) & N Dirksen Pkwy	NB	2	40	8,900	38,950	20,800	18,150	0.47	0.87	0.23
			SB	2	40	11,450	38,950	20,800	18,150	0.47	0.87	0.29
			EB	2	45	9,950	38,950	20,800	18,150	0.47	0.87	0.26
			WB	2	45	9,800	38,950	20,800	18,150	0.47	0.87	0.25
12	Springfield	IL 97 (E Madison St) & I-55 Blvd (N 9th St)	SB	2	30	5,250	22,100	11,600	10,500	0.48	0.91	0.24
13	Springfield	IL 97 (E Jefferson St) & I-55 Blvd (N 9th St)	NB	2	30	5,300	21,950	11,450	10,500	0.48	0.92	0.24
14	Springfield	IL 54 (S Grand Ave) & I-55 Blvd (N 9th St)	NB	2	30	1,650	20,325	14,800	5,525	0.27	0.37	0.08
			SB	2	30	3,875	20,325	14,800	5,525	0.27	0.37	0.19
			EB	2	30	7,450	20,325	14,800	5,525	0.27	0.37	0.37
15	Springfield	IL 54 (S Grand Ave) & S 6th St	EB	2	30	8,450	28,850	16,250	12,600	0.44	0.78	0.29
16	Decatur	IL 121/IL 48 (E Pershing Rd) & N MLK Jr Dr	NB	2	40	4,000	30,850	23,450	7,400	0.24	0.32	0.13
			SB	2	40	3,400	30,850	23,450	7,400	0.24	0.32	0.11
17	Decatur	US 51 (Bloomington Rd) & Ash Ave	NB	2	45	11,150	30,900	24,700	6,200	0.20	0.25	0.36
			EB	1	30	2,500	30,900	24,700	6,200	0.20	0.25	0.08
18	Decatur	IL 121 (N 22nd St) & IL 105 (E Eldorado St)	SB	2	30	11,900	31,875	22,300	9,575	0.30	0.43	0.37
			EB	2	35	3,975	31,875	22,300	9,575	0.30	0.43	0.12
			WB	2	35	5,600	31,875	22,300	9,575	0.30	0.43	0.18
19	Decatur	US 36/IL 121 & S Airport Rd	EB	2	50	8,350	23,850	12,450	11,400	0.48	0.92	0.35
			WB	2	50	4,100	23,850	12,450	11,400	0.48	0.92	0.17

Int No.	City	Site Name	Avg. Annual 2009-2011 Intersection Crashes				Avg. Annual 2009-2011 Approach Crashes			
			Total	Injury	LT Related	LTOT	Total	Injury	LT Related	LTOT
1	Springfield	IL 4 (Veterans Pkwy) & I-55 Blvd (Color Plant)	5.67	0.67	0.33	2.33	1.67	0.67	0.33	0.33
							1.67	0.33	0.33	0.00
2	Springfield	Sangamon Ave & I-55 Blvd (N Peoria)	9.67	3.67	2.67	3.00	2.00	0.67	0.00	0.00
							3.00	0.67	1.00	0.33
							0.33	0.00	0.00	0.00
							5.00	1.67	2.67	2.33
3	Springfield	I-55 Blvd (N 9th St) & E Converse St	5.67	1.33	0.67	2.33	3.33	0.67	0.67	0.67
							1.33	0.67	0.67	0.00
4	Springfield	I-55 Blvd (N 9th St) & N Grand Ave	18.33	2.67	1.33	6.67	3.33	2.00	1.33	0.33
							3.33	1.33	0.00	0.00
							6.33	2.00	0.67	0.33
							4.33	1.00	0.67	0.67
5	Springfield	I-55 Blvd (N 9th St) & E Carpenter St	9.33	2.67	1.00	3.67	3.00	1.67	1.33	0.67
							2.00	0.67	0.33	0.00
							2.33	1.33	1.00	0.33
							1.67	0.00	0.00	0.00
6	Springfield	IL 4 (Veterans Pkwy) & IL 97 (W Jefferson St)	15.67	1.33	0.67	3.00	3.33	0.33	0.67	0.67
							1.67	0.33	0.67	0.00
7	Springfield	IL 4 (Veterans Pkwy) &W Washington St	17.67	3.00	2.67	6.33	3.33	1.00	1.33	1.00
							3.00	1.33	1.67	1.67
8	Springfield	IL 4 (Veterans Pkwy) & W Browning Rd	8.00	0.33	0.00	2.33	1.67	0.33	0.33	0.00
							1.00	0.33	0.00	0.00
9	Springfield	I-55 Blvd (N Peoria) & N Dirksen Pkwy	11.67	6.67	5.67	2.33	7.67	0.67	6.67	5.67
10	Springfield	I-55 Blvd (S Sherman Blvd) & IL 124 (E Andrew Rd)	4.67	0.33	0.33	1.00	3.00	0.33	0.33	0.33
							0.67	0.00	0.00	0.00
							0.67	0.00	0.00	0.00
							0.67	0.00	0.00	0.00
11	Springfield	IL 54 (E Sangamon Ave) & N Dirksen Pkwy	48.33	15.67	9.67	14.00	12.33	4.67	4.00	3.00
							11.00	4.00	4.00	1.33
							11.00	4.00	4.67	3.67
							12.00	1.00	3.00	1.67
12	Springfield	IL 97 (E Madison St) & I-55 Blvd (N 9th St)	11.67	0.00	0.00	2.67	0.67	0.00	0.00	0.00
13	Springfield	IL 97 (E Jefferson St) & I-55 Blvd (N 9th St)	6.67	0.00	0.00	3.00	0.33	0.33	0.00	0.00
14	Springfield	IL 54 (S Grand Ave) & I-55 Blvd (N 9th St)	9.00	3.00	2.33	4.00	0.00	0.33	0.00	0.00
							1.33	1.33	0.67	1.00
							3.33	2.67	2.33	1.33
15	Springfield	IL 54 (S Grand Ave) & S 6th St	15.00	0.33	0.33	4.67	2.33	0.67	0.33	0.33
16	Decatur	IL 121/IL 48 (E Pershing Rd) & N MLK Jr Dr	12.33	0.33	0.00	3.00	0.67	0.00	0.00	0.00
							1.67	0.33	0.33	0.00
17	Decatur	US 51 (Bloomington Rd) & Ash Ave	12.00	0.67	0.67	4.33	4.00	2.67	0.67	0.67
							0.67	0.33	0.00	0.00
18	Decatur	IL 121 (N 22nd St) & IL 105 (E Eldorado St)	14.67	2.00	1.33	4.67	5.67	1.67	0.33	0.00
							2.00	0.33	1.33	1.00
							3.00	1.00	0.33	0.33
19	Decatur	US 36/IL 121 & S Airport Rd	6.67	2.67	1.67	2.33	3.67	1.67	1.67	1.33
							2.33	0.67	1.00	0.33

Int No.	City	Site Name	Approach	# Opposing Thru Lanes	Speed Limit (mph)	Approach ADT	Total Int ADT	ADT of Major Street	ADT of Minor Street	Prop. of Minor to Total ADT	Prop. of Minor to Major ADT	Prop. Of App to Total ADT
20	Bloomington	US 51 (S Main St) & W Hamilton Rd	EB	2	40	2,600	22,400	16,100	6,300	0.28	0.39	0.12
			WB	2	35	3,800	22,400	16,100	6,300	0.28	0.39	0.17
21	Bloomington	N Towanda Barnes Rd & IL 9 (Couty Rd 1400 N)	NB	2	30	6,150	20,875	9,575	11,300	0.54	1.18	0.29
			SB	2	35	5,150	20,875	9,575	11,300	0.54	1.18	0.25
			EB	0	35	7,700	20,875	9,575	11,300	0.54	1.18	0.37
			WB	0	30	1,875	20,875	9,575	11,300	0.54	1.18	0.09
22	Bloomington	IL 9 (E Empire St) & Airport Rd	EB	2	45	8,850	26,150	16,550	9,600	0.37	0.58	0.34
23	Bloomington	IL 9 (E Empire St) & N Hershey Rd	NB	2	30	9,000	39,100	24,050	15,050	0.38	0.63	0.23
			SB	2	35	6,050	39,100	24,050	15,050	0.38	0.63	0.15
			EB	2	45	10,800	39,100	24,050	15,050	0.38	0.63	0.28
			WB	2	45	13,250	39,100	24,050	15,050	0.38	0.63	0.34
24	Bloomington	US 150/IL 9 (W Market St) & Brown St	WB	2	40	7,600	20,800	15,200	5,600	0.27	0.37	0.37
25	Bloomington	US 150/IL 9 (W Market St) & N Hinshaw Ave	NB	1	30	275	16,200	13,400	2,800	0.17	0.21	0.02
			SB	1	30	2,575	16,200	13,400	2,800	0.17	0.21	0.16
			EB	1	30	7,150	16,200	13,400	2,800	0.17	0.21	0.44
			WB	1	30	6,250	16,200	13,400	2,800	0.17	0.21	0.39
26	Bloomington	IL 9 (W Market St) & US 150 (N Mitsubishi Mtwy)	EB	2	45	3,675	9,800	7,650	2,150	0.22	0.28	0.38
27	Bloomington	I-55 Blvd (S Veterans Pkwy) & Fox Creek/W Hamilton	EB	2	45	5,000	18,600	11,800	6,800	0.37	0.58	0.27
			WB	2	45	4,750	18,600	11,800	6,800	0.37	0.58	0.26
28	Bloomington	I-55 Blvd (S Veterans Pkwy) & S Mercer Ave	NB	2	30	2,175	32,725	27,950	4,775	0.15	0.17	0.07
			SB	2	30	2,600	32,725	27,950	4,775	0.15	0.17	0.08
29	Bloomington	I-55 Blvd (S Veterans Pkwy) & E Oakland Ave	EB	2	35	7,500	53,150	36,100	17,050	0.32	0.47	0.14
			WB	2	30	9,550	53,150	36,100	17,050	0.32	0.47	0.18
30	Bloomington	I-55 Blvd (S Veterans Pkwy) & Eastland Dr	EB	2	30	3,600	51,400	42,950	8,450	0.16	0.20	0.07
			WB	2	30	4,850	51,400	42,950	8,450	0.16	0.20	0.09
31	Bloomington	W Raab Rd & US 51 (N Main St)	NB	2	45	8,150	31,050	16,000	15,050	0.48	0.94	0.26
			SB	2	40	6,900	31,050	16,000	15,050	0.48	0.94	0.22
32	Bloomington	US 51 (N Main St) & E Emerson St	EB	2	30	4,150	23,450	14,450	9,000	0.38	0.62	0.18
33	Bloomington	US 51 (N Center St) & W Emerson St	WB	2	30	3,600	21,000	13,250	7,750	0.37	0.58	0.17
34	Bloomington	US 51 (S Main St) & E Wood St	EB	1	30	2,350	14,900	11,900	3,000	0.20	0.25	0.16
35	Bloomington	IL 9 (E Empire St) & Fairway Dr	NB	2	30	5,050	18,911	9,661	9,250	0.49	0.96	0.27
			SB	2	30	4,550	18,911	9,661	9,250	0.49	0.96	0.24
36	Bloomington	US150 (S Clinton St) & E Grove St	NB	1	30	4,400	11,600	8,800	2,800	0.24	0.32	0.38
			SB	1	30	4,400	11,600	8,800	2,800	0.24	0.32	0.38
37	Bloomington	US150 (S Clinton St) & E Oakland Ave	EB	1	30	6,100	22,250	13,450	8,800	0.40	0.65	0.27
38	Bloomington	US150 (Oakland) & Hannah St	WB	2	30	6,350	21,350	13,700	7,650	0.36	0.56	0.30
39	Bloomington	IL9 (W Market St) & Caroline St	EB	2	30	9,250	20,250	16,850	3,400	0.17	0.20	0.46
			WB	2	40	7,600	20,250	16,850	3,400	0.17	0.20	0.38
40	Bloomington	E Washington St & US 150 (N Clinton St)	NB	1	30	4,400	20,125	10,650	9,475	0.47	0.89	0.22
			SB	1	30	5,075	20,125	10,650	9,475	0.47	0.89	0.25
			EB	2	30	5,700	20,125	10,650	9,475	0.47	0.89	0.28
			WB	2	30	4,950	20,125	10,650	9,475	0.47	0.89	0.25
41	Bloomington	US 150 (Morrissey Dr) & E Lincoln St	NB	1	35	4,400	11,150	8,225	2,925	0.26	0.36	0.39
			SB	1	35	3,825	11,150	8,225	2,925	0.26	0.36	0.34
			EB	1	30	2,750	11,150	8,225	2,925	0.26	0.36	0.25
			WB	1	30	2,025	11,150	8,225	2,925	0.26	0.36	0.18

Int No.	City	Site Name	Avg. Annual 2009-2011 Intersection Crashes				Avg. Annual 2009-2011 Approach Crashes			
			Total	Injury	LT Related	LTOT	Total	Injury	LT Related	LTOT
20	Bloomington	US 51 (S Main St) & W Hamilton Rd	8.67	0.33	0.00	2.67	0.33	0.33	0.00	0.00
							0.67	0.33	0.33	0.00
21	Bloomington	N Towanda Barnes Rd & IL 9 (Couty Rd 1400 N)	7.33	2.67	1.33	2.00	2.67	0.33	2.00	1.00
							0.67	0.33	0.00	0.00
							3.33	1.00	0.33	0.33
							0.67	0.33	0.33	0.00
22	Bloomington	IL 9 (E Empire St) & Airport Rd	7.33	2.00	1.67	2.00	2.67	1.00	2.00	1.67
23	Bloomington	IL 9 (E Empire St) & N Hershey Rd	28.00	6.67	5.00	5.00	11.33	1.33	1.67	1.33
							3.00	1.33	0.33	0.00
							8.33	2.00	2.67	1.67
							6.33	0.67	2.00	2.00
24	Bloomington	US 150/IL 9 (W Market St) & Brown St	4.67	0.00	0.00	1.00	0.33	0.00	0.00	0.00
25	Bloomington	US 150/IL 9 (W Market St) & N Hinshaw Ave	5.67	1.67	1.33	2.00	0.67	0.67	0.33	0.33
							0.67	0.33	0.00	0.00
							3.00	0.33	1.33	1.00
							1.67	0.33	0.00	0.00
26	Bloomington	IL 9 (W Market St) & US 150 (N Mitsubishi Mtwy)	3.00	1.00	1.00	1.33	2.00	1.33	1.00	1.00
27	Bloomington	I-55 Blvd (S Veterans Pkwy) & Fox Creek/W Hamilton	6.67	0.33	0.00	2.33	1.67	0.67	0.33	0.00
							0.67	0.33	0.00	0.00
28	Bloomington	I-55 Blvd (S Veterans Pkwy) & S Mercer Ave	6.33	0.00	0.00	2.67	1.33	0.33	0.00	0.00
							1.33	0.67	0.00	0.00
29	Bloomington	I-55 Blvd (S Veterans Pkwy) & E Oakland Ave	25.33	6.67	4.33	4.67	10.33	1.33	4.33	3.00
							6.67	1.67	2.33	1.33
30	Bloomington	I-55 Blvd (S Veterans Pkwy) & Eastland Dr	20.67	4.00	3.33	6.67	4.33	0.67	2.33	2.33
							4.33	1.67	1.67	1.00
31	Bloomington	W Raab Rd & US 51 (N Main St)	21.67	2.33	0.67	4.00	6.00	1.33	1.33	0.33
							4.33	1.00	1.00	0.33
32	Bloomington	US 51 (N Main St) & E Emerson St	7.67	0.00	0.00	1.00	0.67	0.00	0.00	0.00
33	Bloomington	US 51 (N Center St) & W Emerson St	7.67	2.33	2.00	1.00	3.33	1.00	2.33	2.00
34	Bloomington	US 51 (S Main St) & E Wood St	4.67	0.33	0.00	1.33	0.67	0.33	0.33	0.00
35	Bloomington	IL 9 (E Empire St) & Fairway Dr	10.67	1.33	0.33	1.33	1.67	0.33	0.67	0.00
							2.00	0.00	0.67	0.33
36	Bloomington	US150 (S Clinton St) & E Grove St	3.00	0.33	0.33	0.67	0.33	0.33	0.00	0.00
							1.67	0.33	0.33	0.33
37	Bloomington	US150 (S Clinton St) & E Oakland Ave	6.67	0.33	0.00	1.00	1.00	0.33	0.33	0.00
38	Bloomington	US150 (Oakland) & Hannah St	3.67	0.00	0.00	1.00	0.33	0.00	0.00	0.00
39	Bloomington	IL9 (W Market St) & Caroline St	6.33	0.67	0.67	1.33	1.00	0.00	0.00	0.00
							1.67	0.33	0.67	0.67
40	Bloomington	E Washington St & US 150 (N Clinton St)	6.33	0.33	0.33	1.33	0.33	0.00	0.00	0.00
							1.00	0.33	0.00	0.00
							1.67	0.00	0.00	0.00
							3.33	0.33	0.33	0.33
41	Bloomington	US 150 (Morrissey Dr) & E Lincoln St	3.00	0.33	0.00	1.00	1.67	0.33	0.00	0.00
							0.33	0.33	0.00	0.00
							0.33	0.00	0.00	0.00
							0.33	0.33	0.33	0.00

Int No.	City	Site Name	Approach	# Opposing Thru Lanes	Speed Limit (mph)	Approach ADT	Total Int ADT	ADT of Major Street	ADT of Minor Street	Prop. of Minor to Total ADT	Prop. of Minor to Major ADT	Prop. Of App to Total ADT
42	Champaign	US150 (Prospect Ave) & IL 10 (Springfield Ave)	NB	2	35	7,850	29,950	16,450	13,500	0.45	0.82	0.26
			SB	2	35	8,600	29,950	16,450	13,500	0.45	0.82	0.29
			EB	1	35	6,850	29,950	16,450	13,500	0.45	0.82	0.23
			WB	1	35	6,650	29,950	16,450	13,500	0.45	0.82	0.22
43	Champaign	US45 (Neil St) & US 150 (Springfield Ave)	NB	2	35	10,150	34,150	19,650	14,500	0.42	0.74	0.30
			SB	2	25	9,500	34,150	19,650	14,500	0.42	0.74	0.28
			EB	2	30	7,300	34,150	19,650	14,500	0.42	0.74	0.21
			WB	2	30	7,200	34,150	19,650	14,500	0.42	0.74	0.21
44	Champaign	US150 (University Ave) & IL 130 (High Cross Rd)	SB	1	40	1,625	15,450	8,225	7,225	0.47	0.88	0.11
			EB	1	45	5,700	15,450	8,225	7,225	0.47	0.88	0.37
			WB	1	45	2,525	15,450	8,225	7,225	0.47	0.88	0.16
45	Champaign	Mattis Ave & IL 10 (Springfield Ave)	NB	2	35	11,300	38,850	23,400	15,450	0.40	0.66	0.29
			SB	2	40	11,250	38,850	23,400	15,450	0.40	0.66	0.29
			EB	2	35	7,900	38,850	23,400	15,450	0.40	0.66	0.20
			WB	2	35	7,550	38,850	23,400	15,450	0.40	0.66	0.19
46	Champaign	US150 (Springfield Ave) & 1st St	NB	1	30	3,350	21,050	14,400	6,650	0.32	0.46	0.16
			SB	1	30	3,000	21,050	14,400	6,650	0.32	0.46	0.14
			EB	1	30	7,200	21,050	14,400	6,650	0.32	0.46	0.34
			WB	1	30	7,200	21,050	14,400	6,650	0.32	0.46	0.34
47	Champaign	US150 (Springfield Ave) & 4th St	NB	1	25	2,500	17,150	12,900	4,250	0.25	0.33	0.15
			SB	1	25	1,750	17,150	12,900	4,250	0.25	0.33	0.10
			EB	1	30	7,200	17,150	12,900	4,250	0.25	0.33	0.42
			WB	1	30	5,700	17,150	12,900	4,250	0.25	0.33	0.33
48	Champaign	US150 (Springfield Ave) & 6th St	WB	1	30	5,700	13,800	11,400	2,400	0.17	0.21	0.41
49	Champaign	US150 (Springfield Ave) & US 45 (Wright St)	NB	1	30	1,150	13,600	10,850	2,750	0.20	0.25	0.08
			SB	1	30	1,600	13,600	10,850	2,750	0.20	0.25	0.12
			EB	1	30	5,700	13,600	10,850	2,750	0.20	0.25	0.42
			WB	1	30	5,150	13,600	10,850	2,750	0.20	0.25	0.38
50	Champaign	US150 (Prospect Ave) & W Bradley Ave	NB	2	35	9,200	32,150	20,150	12,000	0.37	0.60	0.29
			SB	2	35	10,950	32,150	20,150	12,000	0.37	0.60	0.34
			EB	2	35	6,650	32,150	20,150	12,000	0.37	0.60	0.21
			WB	2	35	5,550	32,150	20,150	12,000	0.37	0.60	0.17
51	Champaign	N Prospect Ave & US 150 (Bloomington Rd)	NB	2	35	10,950	37,750	27,450	10,300	0.27	0.38	0.29
			SB	2	35	14,150	37,750	27,450	10,300	0.27	0.38	0.37
			WB	2	35	3,700	37,750	27,450	10,300	0.27	0.38	0.10
52	Champaign	US150 (University Ave) & US 45 (Wright St)	EB	2	35	10,150	23,050	20,650	2,400	0.10	0.12	0.44
			WB	2	35	10,050	23,050	20,650	2,400	0.10	0.12	0.44
53	Champaign	US150 (W University Ave) & N Lincoln Ave	NB	2	30	7,100	36,600	21,300	15,300	0.42	0.72	0.19
			SB	2	30	8,200	36,600	21,300	15,300	0.42	0.72	0.22
			EB	2	35	10,450	36,600	21,300	15,300	0.42	0.72	0.29
			WB	2	35	10,850	36,600	21,300	15,300	0.42	0.72	0.30
54	Champaign	US150 (W University Ave) & N Broadway Ave	EB	2	35	10,150	23,475	20,300	3,175	0.14	0.16	0.43
			WB	2	40	10,150	23,475	20,300	3,175	0.14	0.16	0.43
55	Champaign	US45 (N Cunningham Ave) & US150 (E University Ave)	NB	2	30	10,050	38,500	21,250	17,250	0.45	0.81	0.26
			SB	2	35	11,400	38,500	21,250	17,250	0.45	0.81	0.30

Int No.	City	Site Name	Avg. Annual 2009-2011 Intersection Crashes				Avg. Annual 2009-2011 Approach Crashes			
			Total	Injury	LT Related	LTOT	Total	Injury	LT Related	LTOT
42	Champaign	US150 (Prospect Ave) & IL 10 (Springfield Ave)	8.67	2.33	1.33	2.00	2.33	0.67	1.00	0.67
							2.00	0.67	0.00	0.00
							2.00	0.33	1.00	0.67
							2.33	0.67	0.33	0.00
43	Champaign	US45 (Neil St) & US 150 (Springfield Ave)	13.33	2.67	2.67	1.67	4.33	1.00	0.67	0.67
							4.00	0.67	0.67	0.67
							1.67	0.67	0.33	0.33
							2.67	0.00	1.00	1.00
44	Champaign	US150 (University Ave) & IL 130 (High Cross Rd)	3.33	2.00	1.33	1.00	0.67	0.33	0.00	0.00
							1.33	0.00	0.67	0.33
							1.33	0.67	1.33	1.00
45	Champaign	Mattis Ave & IL 10 (Springfield Ave)	14.33	5.33	3.00	3.00	3.00	0.00	0.67	0.33
							4.00	0.33	1.33	1.33
							4.33	0.67	2.33	1.00
							4.00	1.67	1.00	0.33
46	Champaign	US150 (Springfield Ave) & 1st St	8.00	0.67	0.67	1.33	1.67	0.33	0.33	0.33
							1.00	0.00	0.33	0.33
							3.00	1.00	0.00	0.00
							1.67	0.33	0.00	0.00
47	Champaign	US150 (Springfield Ave) & 4th St	7.33	2.33	2.00	2.67	0.67	0.33	0.00	0.00
							1.33	0.33	0.67	0.67
							2.33	0.33	0.00	0.00
							3.00	1.00	1.67	1.33
48	Champaign	US150 (Springfield Ave) & 6th St	2.33	0.00	0.00	0.67	1.00	0.00	0.00	0.00
49	Champaign	US150 (Springfield Ave) & US 45 (Wright St)	4.00	1.00	0.67	0.67	0.33	0.00	0.33	0.00
							0.33	0.33	0.00	0.00
							1.33	0.00	0.33	0.33
							2.33	0.00	0.33	0.33
50	Champaign	US150 (Prospect Ave) & W Bradley Ave	16.67	4.67	2.67	5.33	4.67	0.67	1.33	1.00
							4.67	0.67	0.33	0.00
							4.33	2.00	2.00	1.33
							3.33	1.33	1.00	0.33
51	Champaign	N Prospect Ave & US 150 (Bloomington Rd)	26.00	3.00	1.67	4.33	5.00	1.67	1.00	0.67
							6.33	1.33	1.67	1.00
							9.33	1.67	0.33	0.00
52	Champaign	US150 (University Ave) & US 45 (Wright St)	4.00	1.33	0.67	1.67	1.33	0.33	0.33	0.00
							2.00	0.33	1.00	0.67
53	Champaign	US150 (W University Ave) & N Lincoln Ave	22.00	10.00	6.00	4.00	4.00	0.67	2.67	2.33
							6.67	1.00	3.00	1.00
							5.00	1.67	3.00	2.33
							6.00	0.33	1.33	0.33
54	Champaign	US150 (W University Ave) & N Broadway Ave	5.00	1.67	1.33	1.00	3.00	0.33	1.67	1.33
							0.00	0.00	0.00	0.00
55	Champaign	US45 (N Cunningham Ave) & US150 (E University Ave)	20.00	6.00	4.67	5.00	5.67	1.33	1.67	1.00
							7.33	1.33	4.33	3.67

Int No.	City	Site Name	Approach	# Opposing Thru Lanes	Speed Limit (mph)	Approach ADT	Total Int ADT	ADT of Major Street	ADT of Minor Street	Prop. of Minor to Total ADT	Prop. of Minor to Major ADT	Prop. Of App to Total ADT
56	Champaign	US45 (N Cunningham Ave) & E Kerr Ave	NB	2	35	10,850	23,275	21,000	2,275	0.10	0.11	0.47
			SB	2	35	10,150	23,275	21,000	2,275	0.10	0.11	0.44
57	Champaign	US45 (N Cunningham Ave) & E Perkins Rd	NB	2	40	9,650	27,400	19,700	7,700	0.28	0.39	0.35
			SB	2	40	10,050	27,400	19,700	7,700	0.28	0.39	0.37
58	Champaign	US45 (N Cunningham Ave) & E Airport Rd	NB	2	50	6,250	13,800	11,450	2,350	0.17	0.21	0.45
			SB	2	50	5,200	13,800	11,450	2,350	0.17	0.21	0.38
59	Champaign	IL10 (W Springfield Ave) & S County Fair Dr	SB	1	30	7,500	27,100	16,800	10,300	0.38	0.61	0.28
			EB	2	35	8,900	27,100	16,800	10,300	0.38	0.61	0.33
			WB	2	35	7,900	27,100	16,800	10,300	0.38	0.61	0.29
60	Champaign	N Mattis Ave & US 150 (Bloomington Rd)	NB	2	40	9,700	26,975	18,150	8,825	0.33	0.49	0.36
			SB	2	40	8,000	26,975	18,150	8,825	0.33	0.49	0.30
			EB	1	40	4,050	26,975	18,150	8,825	0.33	0.49	0.15
61	Champaign	US45 (S Neil St) & W Green St	NB	2	35	11,300	30,450	21,450	9,000	0.30	0.42	0.37
			SB	2	35	10,150	30,450	21,450	9,000	0.30	0.42	0.33
			EB	1	30	3,750	30,450	21,450	9,000	0.30	0.42	0.12
			WB	1	30	5,250	30,450	21,450	9,000	0.30	0.42	0.17
62	Champaign	US45 (S Neil St) & W Kirby Ave	NB	2	35	10,650	37,400	21,850	15,550	0.42	0.71	0.28
			SB	2	35	11,200	37,400	21,850	15,550	0.42	0.71	0.30
			EB	2	35	7,400	37,400	21,850	15,550	0.42	0.71	0.20
			WB	2	35	8,600	37,400	21,850	15,550	0.42	0.71	0.23
63	Champaign	US45 (S Neil St) & Fox/St Marys	NB	2	40	10,650	24,450	21,300	3,150	0.13	0.15	0.44
			SB	2	40	10,650	24,450	21,300	3,150	0.13	0.15	0.44
			EB	1	30	1,050	24,450	21,300	3,150	0.13	0.15	0.04
			WB	1	30	2,100	24,450	21,300	3,150	0.13	0.15	0.09
64	Champaign	US45 (S Neil St) & W Windsor Rd	NB	2	45	10,650	33,200	20,150	13,050	0.39	0.65	0.32
			SB	2	40	10,000	33,200	20,150	13,050	0.39	0.65	0.30
			EB	2	35	6,850	33,200	20,150	13,050	0.39	0.65	0.21
			WB	2	45	7,350	33,200	20,150	13,050	0.39	0.65	0.22
65	Champaign	US45 (N Dunlap St) & Curtis Rd	NB	2	45	8,100	24,800	18,250	6,550	0.26	0.36	0.33
			SB	2	45	10,150	24,800	18,250	6,550	0.26	0.36	0.41
			EB	1	30	3,750	24,800	18,250	6,550	0.26	0.36	0.15
			WB	1	35	2,800	24,800	18,250	6,550	0.26	0.36	0.11
66	Champaign	IL10 (Springfield Ave) & S Duncan Rd	NB	1	30	4,950	21,675	12,125	9,550	0.44	0.79	0.23
			SB	1	35	4,600	21,675	12,125	9,550	0.44	0.79	0.21
			EB	1	35	4,725	21,675	12,125	9,550	0.44	0.79	0.22
			WB	1	35	7,400	21,675	12,125	9,550	0.44	0.79	0.34
67	Champaign	S Staley Rd & IL 10 (Springfield Ave)	NB	1	45	6,300	16,050	10,100	5,950	0.37	0.59	0.39
			SB	1	45	3,800	16,050	10,100	5,950	0.37	0.59	0.24
			EB	1	45	2,100	16,050	10,100	5,950	0.37	0.59	0.13
			WB	1	45	3,850	16,050	10,100	5,950	0.37	0.59	0.24
68	Champaign	US150 (W University Ave) & N Coler Ave	EB	2	35	10,850	24,475	21,700	2,775	0.11	0.13	0.44
			WB	2	35	10,850	24,475	21,700	2,775	0.11	0.13	0.44
69	Champaign	US150 (Springfield Ave) & S State St	WB	2	30	7,300	20,200	13,950	6,250	0.31	0.45	0.36
70	Champaign	US150 (Springfield Ave) & S Randolph St	EB	2	30	7,300	20,450	14,600	5,850	0.29	0.40	0.36
71	Champaign	US150 (E University Ave) & US 150 (Guardian)	EB	2	45	5,650	24,800	13,900	10,900	0.44	0.78	0.23
			WB	2	45	5,250	24,800	13,900	10,900	0.44	0.78	0.21

Int No.	City	Site Name	Avg. Annual 2009-2011 Intersection Crashes				Avg. Annual 2009-2011 Approach Crashes			
			Total	Injury	LT Related	LTOT	Total	Injury	LT Related	LTOT
56	Champaign	US45 (N Cunningham Ave) & E Kerr Ave	5.00	0.33	0.33	2.33	3.00	1.33	0.33	0.33
							2.33	0.67	0.00	0.00
57	Champaign	US45 (N Cunningham Ave) & E Perkins Rd	10.00	1.33	0.67	2.33	4.67	1.33	0.33	0.00
							4.00	0.00	1.00	0.67
58	Champaign	US45 (N Cunningham Ave) & E Airport Rd	2.00	0.33	0.00	0.00	1.00	0.00	0.00	0.00
							0.67	0.00	0.33	0.00
59	Champaign	IL10 (W Springfield Ave) & S County Fair Dr	8.00	1.67	1.33	2.67	1.67	1.33	0.67	0.67
							3.00	0.00	0.67	0.67
							3.33	1.00	0.33	0.00
60	Champaign	N Mattis Ave & US 150 (Bloomington Rd)	6.33	1.33	1.33	1.67	2.33	1.33	0.67	0.67
							1.00	0.00	0.00	0.00
							1.00	0.00	0.67	0.67
61	Champaign	US45 (S Neil St) & W Green St	13.00	4.67	3.00	2.67	4.67	1.33	1.00	0.67
							6.00	0.67	3.00	2.00
							2.00	0.33	0.33	0.00
							1.00	0.00	0.33	0.33
62	Champaign	US45 (S Neil St) & W Kirby Ave	18.00	5.33	2.67	5.00	6.00	2.00	1.00	0.33
							4.67	1.00	1.33	0.33
							2.67	1.33	1.67	1.33
							5.00	0.33	1.33	0.67
63	Champaign	US45 (S Neil St) & Fox/St Marys	4.33	0.67	0.67	1.67	1.67	0.33	0.00	0.00
							2.00	0.33	0.67	0.67
							1.00	0.33	0.00	0.00
							0.33	0.00	0.00	0.00
64	Champaign	US45 (S Neil St) & W Windsor Rd	10.00	3.33	3.33	4.33	2.33	0.67	0.33	0.33
							3.67	1.33	1.00	1.00
							1.33	0.67	0.33	0.33
							3.00	1.67	1.67	1.67
65	Champaign	US45 (N Dunlap St) & Curtis Rd	9.33	3.67	2.67	2.67	2.67	0.00	2.00	1.67
							4.33	1.33	1.00	1.00
							1.33	0.33	0.33	0.00
							1.00	0.33	0.33	0.00
66	Champaign	IL10 (Springfield Ave) & S Duncan Rd	7.33	2.00	0.67	0.33	1.33	0.00	0.33	0.00
							1.33	0.33	0.33	0.33
							2.00	0.00	0.33	0.00
							2.67	0.00	1.00	0.33
67	Champaign	S Staley Rd & IL 10 (Springfield Ave)	2.33	0.33	0.33	0.33	0.67	0.00	0.00	0.00
							1.00	0.00	0.00	0.00
							0.67	0.33	0.33	0.33
							0.00	0.00	0.00	0.00
68	Champaign	US150 (W University Ave) & N Coler Ave	3.67	0.33	0.00	0.33	1.00	0.00	0.00	0.00
							1.67	0.00	0.33	0.00
69	Champaign	US150 (Springfield Ave) & S State St	7.67	0.67	0.67	1.67	2.33	0.33	0.67	0.67
70	Champaign	US150 (Springfield Ave) & S Randolph St	7.33	0.67	0.33	3.33	3.33	1.00	0.67	0.33
71	Champaign	US150 (E University Ave) & US 150 (Guardian)	7.33	4.00	3.00	1.33	2.33	0.67	0.67	0.33
							3.67	0.33	3.33	2.67

Int No.	City	Site Name	Approach	# Opposing Thru Lanes	Speed Limit (mph)	Approach ADT	Total Int ADT	ADT of Major Street	ADT of Minor Street	Prop. of Minor to Total ADT	Prop. of Minor to Major ADT	Prop. Of App to Total ADT
72	LaSalle/Peru	IL251 & 38th St	EB	1	35	4,750	23,900	15,700	8,200	0.34	0.52	0.20
			WB	1	35	3,450	23,900	15,700	8,200	0.34	0.52	0.14
73	LaSalle/Peru	IL251 & N 29th Rd (Wenzel)	EB	1	35	2,150	19,850	14,400	5,450	0.27	0.38	0.11
			WB	1	35	3,300	19,850	14,400	5,450	0.27	0.38	0.17
74	LaSalle/Peru	IL251 & Shooting Park Rd	EB	2	35	6,200	25,350	12,750	12,600	0.50	0.99	0.24
			WB	2	35	6,400	25,350	12,750	12,600	0.50	0.99	0.25
75	LaSalle/Peru	US6 (4th St) & IL 56 (Peoria St)	NB	1	30	2,600	18,100	12,900	5,200	0.29	0.40	0.14
			SB	1	30	2,600	18,100	12,900	5,200	0.29	0.40	0.14
			EB	1	20	5,750	18,100	12,900	5,200	0.29	0.40	0.32
			WB	1	20	5,800	18,100	12,900	5,200	0.29	0.40	0.32
76	LaSalle/Peru	US6 (3rd St) & Creve Coeur St	EB	1	30	4,725	10,925	9,250	1,675	0.15	0.18	0.43
			WB	1	30	4,525	10,925	9,250	1,675	0.15	0.18	0.41
77	LaSalle/Peru	US6 (3rd St) & Bucklin St	NB	1	30	1,500	11,925	9,050	2,875	0.24	0.32	0.13
78	LaSalle/Peru	US6 (5th St) & IL 351 (Joliet St)	SB	1	30	4,050	16,125	8,400	7,725	0.48	0.92	0.25
79	LaSalle/Peru	IL351 (St Vincents Ave) & Civic Rd	NB	1	40	1,725	8,550	5,025	3,525	0.41	0.70	0.20
			SB	2	40	3,300	8,550	5,025	3,525	0.41	0.70	0.39
			EB	1	30	3,000	8,550	5,025	3,525	0.41	0.70	0.35
			WB	1	30	525	8,550	5,025	3,525	0.41	0.70	0.06
80	Galesburg	IL164 (W Main St) & IL 41 (N Linwood Rd)	NB	1	40	2,750	12,900	7,025	5,875	0.46	0.84	0.21
			SB	1	40	2,850	12,900	7,025	5,875	0.46	0.84	0.22
			EB	2	40	3,925	12,900	7,025	5,875	0.46	0.84	0.30
			WB	2	40	3,100	12,900	7,025	5,875	0.46	0.84	0.24
81	Galesburg	US150 (S Henderson St) & IL 164 (W Main St)	NB	2	35	3,050	18,200	9,850	8,350	0.46	0.85	0.17
			SB	2	35	7,500	18,200	9,850	8,350	0.46	0.85	0.41
			EB	2	35	3,900	18,200	9,850	8,350	0.46	0.85	0.21
			WB	2	35	4,700	18,200	9,850	8,350	0.46	0.85	0.26
82	Galesburg	US150 (S Henderson St) & W Losey Ave	NB	2	35	7,500	18,600	11,500	7,100	0.38	0.62	0.40
			SB	2	35	8,650	18,600	11,500	7,100	0.38	0.62	0.47
			EB	1	30	2,250	18,600	11,500	7,100	0.38	0.62	0.12
			WB	1	30	4,700	18,600	11,500	7,100	0.38	0.62	0.25
83	Galesburg	US150 (S Henderson St) & W Fremont St	NB	2	35	8,650	26,350	17,250	9,100	0.35	0.53	0.33
			SB	2	35	9,500	26,350	17,250	9,100	0.35	0.53	0.36
			EB	2	30	3,300	26,350	17,250	9,100	0.35	0.53	0.13
			WB	2	30	5,200	26,350	17,250	9,100	0.35	0.53	0.20
84	Galesburg	US150 (S Henderson St) & W Dayton St	NB	2	35	8,650	22,400	18,100	4,300	0.19	0.24	0.39
			SB	2	35	9,450	22,400	18,100	4,300	0.19	0.24	0.42
			EB	1	30	1,875	22,400	18,100	4,300	0.19	0.24	0.08
			WB	1	30	2,050	22,400	18,100	4,300	0.19	0.24	0.09
85	Galesburg	US150 (S Henderson St) & Home Blvd	NB	2	40	9,450	20,150	16,350	3,800	0.19	0.23	0.47
			SB	2	40	6,900	20,150	16,350	3,800	0.19	0.23	0.34
			EB	1	25	1,850	20,150	16,350	3,800	0.19	0.23	0.09
			WB	1	25	1,850	20,150	16,350	3,800	0.19	0.23	0.09
86	Galesburg	US150 (S Henderson St) & W Carl Sandburg Dr	EB	2	30	3,550	20,600	12,500	8,100	0.39	0.65	0.17
			WB	2	30	3,600	20,600	12,500	8,100	0.39	0.65	0.17

Int No.	City	Site Name	Avg. Annual 2009-2011 Intersection Crashes				Avg. Annual 2009-2011 Approach Crashes			
			Total	Injury	LT Related	LTOT	Total	Injury	LT Related	LTOT
72	LaSalle/Peru	IL251 & 38th St	14.33	1.67	1.00	2.67	3.67	1.00	0.67	0.00
							3.33	0.33	1.00	1.00
73	LaSalle/Peru	IL251 & N 29th Rd (Wenzel)	10.00	1.00	0.67	2.00	4.33	0.33	0.67	0.67
							1.33	0.00	0.33	0.00
74	LaSalle/Peru	IL251 & Shooting Park Rd	15.67	1.67	1.33	2.67	4.33	0.67	1.33	1.00
							3.33	0.33	0.33	0.33
75	LaSalle/Peru	US6 (4th St) & IL 56 (Peoria St)	4.33	0.33	0.00	0.00	0.00	0.00	0.00	0.00
							0.67	0.00	0.33	0.00
							2.00	0.00	0.00	0.00
							1.67	0.00	0.00	0.00
76	LaSalle/Peru	US6 (3rd St) & Creve Coeur St	4.33	1.00	0.00	0.33	2.33	0.00	1.00	0.00
							1.33	0.00	0.00	0.00
77	LaSalle/Peru	US6 (3rd St) & Bucklin St	2.67	0.00	0.00	1.00	0.33	0.33	0.00	0.00
78	LaSalle/Peru	US6 (5th St) & IL 351 (Joliet St)	3.67	0.33	0.33	1.00	0.33	0.00	0.33	0.33
79	LaSalle/Peru	IL351 (St Vincents Ave) & Civic Rd	1.00	0.00	0.00	0.00	0.33	0.00	0.00	0.00
							0.33	0.00	0.00	0.00
							0.33	0.00	0.00	0.00
							0.00	0.00	0.00	0.00
80	Galesburg	IL164 (W Main St) & IL 41 (N Linwood Rd)	2.33	0.00	0.00	0.67	0.33	0.00	0.00	0.00
							1.33	0.33	0.00	0.00
							0.67	0.00	0.00	0.00
							0.33	0.00	0.00	0.00
81	Galesburg	US150 (S Henderson St) & IL 164 (W Main St)	5.67	2.00	1.00	0.67	1.33	0.00	0.33	0.33
							1.67	0.00	1.00	0.67
							1.00	0.33	0.67	0.00
							1.33	0.33	0.00	0.00
82	Galesburg	US150 (S Henderson St) & W Losey Ave	10.33	1.67	0.33	2.33	4.33	0.67	0.00	0.00
							3.67	1.00	1.00	0.33
							1.67	0.00	0.67	0.00
							0.67	0.33	0.00	0.00
83	Galesburg	US150 (S Henderson St) & W Fremont St	12.00	2.67	1.33	3.00	5.67	1.33	1.33	0.67
							3.33	0.67	0.67	0.33
							2.67	1.33	0.67	0.33
							0.33	0.00	0.00	0.00
84	Galesburg	US150 (S Henderson St) & W Dayton St	6.00	1.00	0.33	1.33	1.67	0.00	0.00	0.00
							2.67	0.33	0.00	0.00
							1.00	0.33	0.67	0.33
							1.00	0.00	0.33	0.00
85	Galesburg	US150 (S Henderson St) & Home Blvd	4.33	2.00	1.67	0.67	1.33	0.00	0.00	0.00
							2.33	0.33	1.67	1.67
							0.00	0.00	0.00	0.00
							0.67	0.00	0.33	0.00
86	Galesburg	US150 (S Henderson St) & W Carl Sandburg Dr	8.67	1.33	0.33	3.00	2.67	1.00	0.67	0.33
							1.67	0.67	0.67	0.00

Int No.	City	Site Name	Approach	# Opposing Thru Lanes	Speed Limit (mph)	Approach ADT	Total Int ADT	ADT of Major Street	ADT of Minor Street	Prop. of Minor to Total ADT	Prop. of Minor to Major ADT	Prop. Of App to Total ADT
87	Galesburg	US150 (W Main St) & S Academy St	NB	1	30	2,325	11,825	8,400	3,425	0.29	0.41	0.20
			WB	1	25	3,950	11,825	8,400	3,425	0.29	0.41	0.33
88	Galesburg	US150 (W Main St) & Grand Ave	NB	1	35	1,975	13,550	9,600	3,950	0.29	0.41	0.15
			SB	1	30	1,000	13,550	9,600	3,950	0.29	0.41	0.07
89	Effingham	IL33 (N Keller Dr) & W Evergreen Ave	SB	2	40	1,600	28,575	24,750	3,825	0.13	0.15	0.06
			EB	1	55	14,250	28,575	24,750	3,825	0.13	0.15	0.50
90	Effingham	IL33 (N Keller Dr) & W Temple Ave	SB	2	40	10,950	26,150	20,350	5,800	0.22	0.29	0.42
91	Effingham	IL33 (S Henrietta St) & US 40 (W Fayette Ave)	NB	2	35	3,325	25,525	13,100	12,425	0.49	0.95	0.13
			SB	2	35	9,100	25,525	13,100	12,425	0.49	0.95	0.36
			EB	2	40	10,100	25,525	13,100	12,425	0.49	0.95	0.40
			WB	1	35	8,050	25,525	13,100	12,425	0.49	0.95	0.32
92	Effingham	US40 (W Fayette Ave) & IL 33 (S Willow St)	NB	1	35	8,500	16,000	9,725	6,275	0.39	0.65	0.53
			SB	1	30	2,025	16,000	9,725	6,275	0.39	0.65	0.13
			EB	1	30	5,500	16,000	9,725	6,275	0.39	0.65	0.34
			WB	1	35	4,225	16,000	9,725	6,275	0.39	0.65	0.26
93	Effingham	US45 (N 3rd St) & Technology Dr	SB	1	45	5,400	14,975	9,975	5,000	0.33	0.50	0.36
94	Effingham	US45 (N 3rd St) & E Evergreen St	NB	1	45	4,900	12,275	9,475	2,800	0.23	0.30	0.40
			SB	1	45	4,575	12,275	9,475	2,800	0.23	0.30	0.37
			EB	1	30	2,250	12,275	9,475	2,800	0.23	0.30	0.18
95	Effingham	US45 (N 3rd St) & E Temple Ave	NB	1	45	4,850	15,100	9,750	5,350	0.35	0.55	0.32
			SB	1	45	4,900	15,100	9,750	5,350	0.35	0.55	0.32
			EB	1	30	2,750	15,100	9,750	5,350	0.35	0.55	0.18
			WB	1	30	2,600	15,100	9,750	5,350	0.35	0.55	0.17
96	Effingham	US40 (E Fayette Ave) & US 45 (S 3rd St)	SB	1	30	3,675	16,500	12,050	4,450	0.27	0.37	0.22
			EB	2	30	6,550	16,500	12,050	4,450	0.27	0.37	0.40
97	Effingham	US40 (W Fayette Ave) & US 45 (S Banker St)	NB	1	35	8,450	27,300	17,050	10,250	0.38	0.60	0.31
			SB	1	35	1,800	27,300	17,050	10,250	0.38	0.60	0.07
			EB	2	35	10,200	27,300	17,050	10,250	0.38	0.60	0.37
			WB	2	35	6,850	27,300	17,050	10,250	0.38	0.60	0.25
98	Effingham	US45 (S Banker St) & W Wabash Ave	NB	2	35	9,750	22,775	19,050	3,725	0.16	0.20	0.43
			SB	2	35	9,300	22,775	19,050	3,725	0.16	0.20	0.41
			EB	1	35	875	22,775	19,050	3,725	0.16	0.20	0.04
			WB	1	35	2,850	22,775	19,050	3,725	0.16	0.20	0.13
99	Effingham	US40 (S Henrietta St) & W Grove Ave	NB	2	35	2,600	8,400	5,925	2,475	0.29	0.42	0.31
			SB	1	35	3,325	8,400	5,925	2,475	0.29	0.42	0.40
			EB	1	30	975	8,400	5,925	2,475	0.29	0.42	0.12
			WB	1	30	1,500	8,400	5,925	2,475	0.29	0.42	0.18
100	Effingham	US40 (W Fayette Ave) & S Maple St	NB	1	35	1,050	22,000	18,750	3,250	0.15	0.17	0.05
			SB	1	35	2,200	22,000	18,750	3,250	0.15	0.17	0.10

Int No.	City	Site Name	Avg. Annual 2009-2011 Intersection Crashes				Avg. Annual 2009-2011 Approach Crashes			
			Total	Injury	LT Related	LTOT	Total	Injury	LT Related	LTOT
87	Galesburg	US150 (W Main St) & S Academy St	1.33	0.00	0.00	0.33	0.67	0.00	0.00	0.00
							0.33	0.33	0.00	0.00
88	Galesburg	US150 (W Main St) & Grand Ave	2.67	0.67	0.00	0.00	1.33	0.00	0.67	0.00
							0.33	0.00	0.00	0.00
89	Effingham	IL33 (N Keller Dr) & W Evergreen Ave	17.33	0.67	0.00	2.67	7.33	1.00	0.67	0.00
							1.67	1.00	0.00	0.00
90	Effingham	IL33 (N Keller Dr) & W Temple Ave	3.00	0.67	0.00	0.33	2.00	0.33	0.67	0.00
91	Effingham	IL33 (S Henrietta St) & US 40 (W Fayette Ave)	11.00	1.33	1.00	2.67	3.33	1.33	0.67	0.67
							2.00	0.33	0.00	0.00
							3.67	1.00	0.33	0.00
							1.33	0.00	0.33	0.33
92	Effingham	US40 (W Fayette Ave) & IL 33 (S Willow St)	3.67	0.67	0.33	0.33	1.00	0.00	0.33	0.00
							0.67	0.33	0.00	0.00
							1.00	0.00	0.00	0.00
							0.67	0.00	0.33	0.33
93	Effingham	US45 (N 3rd St) & Technology Dr	2.67	0.00	0.00	0.33	0.33	0.00	0.00	0.00
94	Effingham	US45 (N 3rd St) & E Evergreen St	2.67	0.00	0.00	0.00	1.00	0.00	0.00	0.00
							1.00	0.00	0.00	0.00
							0.00	0.00	0.00	0.00
95	Effingham	US45 (N 3rd St) & E Temple Ave	2.00	0.67	0.33	0.33	1.67	0.33	0.67	0.33
							0.67	0.00	0.00	0.00
							0.00	0.00	0.00	0.00
							0.00	0.00	0.00	0.00
96	Effingham	US40 (E Fayette Ave) & US 45 (S 3rd St)	5.33	0.00	0.00	1.00	2.33	0.67	0.00	0.00
							2.00	0.33	0.00	0.00
97	Effingham	US40 (W Fayette Ave) & US 45 (S Banker St)	16.67	4.33	3.00	2.33	4.33	0.67	1.00	0.00
							1.33	0.00	0.00	0.00
							4.00	0.33	0.67	0.67
							4.67	1.00	2.67	2.33
98	Effingham	US45 (S Banker St) & W Wabash Ave	6.33	3.33	3.33	2.67	2.67	1.00	1.00	1.00
							2.67	1.33	1.33	1.33
							0.67	0.33	0.33	0.33
							1.00	0.00	0.67	0.67
99	Effingham	US40 (S Henrietta St) & W Grove Ave	2.00	0.00	0.00	0.67	0.00	0.00	0.00	0.00
							0.67	0.67	0.00	0.00
							1.00	0.00	0.00	0.00
							0.33	0.00	0.00	0.00
100	Effingham	US40 (W Fayette Ave) & S Maple St	8.33	0.00	0.00	1.67	0.00	0.00	0.00	0.00
							0.33	0.00	0.00	0.00


Illinois Department
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