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Public Education and Enforcement Research Study—Macomb, Illinois, Analysis

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Safety of Highway-Railroad Grade Crossings

DOT/FRA/ORD-11/07

Final Report
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13. ABSTRACT (Maximum 200 words) The Public Education and Enforcement Research Study (PEERS) was a collaborative effort between the Federal Railroad Administration, the Illinois Commerce Commission, and local communities in the State of Illinois. This project was designed to promote safety at highway-rail grade crossings. The role of the John A. Volpe National Transportation Systems Center was to monitor and evaluate highway-rail grade crossings in Illinois communities using video data collection, while the communities conducted education and enforcement campaigns. The effectiveness of the programs was determined by counting the number of motorists and pedestrians that violated the crossing warning devices during three project phases. In 2006, results from one community, Arlington Heights, were published. This report focuses on the effectiveness of the PEERS programs in Macomb, IL, and compares the results to Arlington Heights. In Arlington Heights, overall violations were reduced nearly 31 percent, and the most risky pedestrian violations were reduced 76 percent. In Macomb, there were few pedestrian violations, but overall violations still increased slightly during the study. The variations in the effectiveness of the education and enforcement campaigns were accounted for by the differences in the communities and the way in which the program was implemented.			
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METRIC/ENGLISH CONVERSION FACTORS

ENGLISH TO METRIC

LENGTH (APPROXIMATE)

1 inch (in)	=	2.5 centimeters (cm)
1 foot (ft)	=	30 centimeters (cm)
1 yard (yd)	=	0.9 meter (m)
1 mile (mi)	=	1.6 kilometers (km)

AREA (APPROXIMATE)

1 square inch (sq in, in^2)	=	6.5 square centimeters (cm^2)
1 square foot (sq ft, ft^2)	=	0.09 square meter (m^2)
1 square yard (sq yd, yd^2)	=	0.8 square meter (m^2)
1 square mile (sq mi, mi^2)	=	2.6 square kilometers (km^2)
1 acre = 0.4 hectare (he)	=	4,000 square meters (m^2)

MASS - WEIGHT (APPROXIMATE)

1 ounce (oz)	=	28 grams (gm)
1 pound (lb)	=	0.45 kilogram (kg)
1 short ton = 2,000 pounds (lb)	=	0.9 tonne (t)

VOLUME (APPROXIMATE)

1 teaspoon (tsp)	=	5 milliliters (ml)
1 tablespoon (tbsp)	=	15 milliliters (ml)
1 fluid ounce (fl oz)	=	30 milliliters (ml)
1 cup (c)	=	0.24 liter (l)
1 pint (pt)	=	0.47 liter (l)
1 quart (qt)	=	0.96 liter (l)
1 gallon (gal)	=	3.8 liters (l)
1 cubic foot (cu ft, ft^3)	=	0.03 cubic meter (m^3)
1 cubic yard (cu yd, yd^3)	=	0.76 cubic meter (m^3)

TEMPERATURE (EXACT)

[(x-32)(5/9)] °F	=	y °C

METRIC TO ENGLISH

LENGTH (APPROXIMATE)

1 millimeter (mm)	=	0.04 inch (in)
1 centimeter (cm)	=	0.4 inch (in)
1 meter (m)	=	3.3 feet (ft)
1 meter (m)	=	1.1 yards (yd)
1 kilometer (km)	=	0.6 mile (mi)

AREA (APPROXIMATE)

1 square centimeter (cm^2)	=	0.16 square inch (sq in, in^2)
1 square meter (m^2)	=	1.2 square yards (sq yd, yd^2)
1 square kilometer (km^2)	=	0.4 square mile (sq mi, mi^2)
10,000 square meters (m^2)	=	1 hectare (ha) = 2.5 acres

MASS - WEIGHT (APPROXIMATE)

1 gram (gm)	=	0.036 ounce (oz)
1 kilogram (kg)	=	2.2 pounds (lb)
1 tonne (t)	=	1,000 kilograms (kg)
	=	1.1 short tons

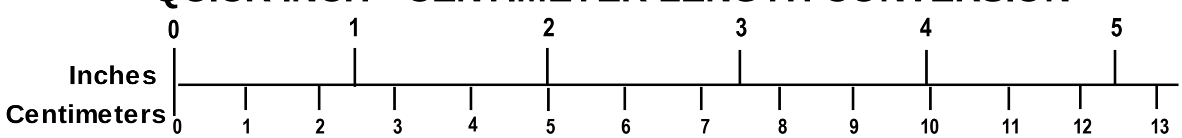
VOLUME (APPROXIMATE)

1 milliliter (ml)	=	0.03 fluid ounce (fl oz)
1 liter (l)	=	2.1 pints (pt)
1 liter (l)	=	1.06 quarts (qt)
1 liter (l)	=	0.26 gallon (gal)
1 cubic meter (m^3)	=	36 cubic feet (cu ft, ft^3)
1 cubic meter (m^3)	=	1.3 cubic yards (cu yd, yd^3)

TEMPERATURE (EXACT)

[(9/5) y + 32] °C	=	x °F

QUICK INCH - CENTIMETER LENGTH CONVERSION



QUICK FAHRENHEIT - CELSIUS TEMPERATURE CONVERSION

°F	-40°	-22°	-4°	14°	32°	50°	68°	86°	104°	122°	140°	158°	176°	194°	212°
°C	-40°	-30°	-20°	-10°	0°	10°	20°	30°	40°	50°	60°	70°	80°	90°	100°

For more exact and or other conversion factors, see NIST Miscellaneous Publication 286, Units of Weights and Measures. Price $2.50 SD Catalog No. C13 10286

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Executive Summary

The John A. Volpe National Transportation Systems Center (Volpe Center) was sponsored by the Federal Railroad Administration (FRA) to conduct a field operational test at highway-rail grade crossings in three communities in the State of Illinois. These three communities were Arlington Heights, Macomb, and Bartlett. The results from one community, the village of Arlington Heights, were detailed in the published report *Public Education and Enforcement Research Study* [1]. According to that study, the Public Education and Enforcement Research Study (PEERS) initiatives were successful in curbing overall violations and the most risky pedestrian violations.

The purpose of this report is to determine the effectiveness of the PEERS education and enforcement programs in another Illinois community, the city of Macomb, and compare those results to the ones from Arlington Heights. Highway-user behavior at the grade crossings in Macomb did not change for the safer during the study period. The different population demographics, characteristics of the crossings, and activities planned during the study likely contributed to the difference in results.

In 2004, the Secretary of the USDOT issued the action plan *Highway-Rail Grade Crossing Safety and Trespass Prevention* [2]. The action plan identified education and enforcement as key initiatives in reducing incidents, injuries, and fatalities at highway-rail grade crossings. To establish the effectiveness of education and enforcement as safety countermeasures, FRA conducted before-during-after field operational tests in three Illinois communities. These communities actively participated in grade crossing education and enforcement activities.

The effectiveness of the PEERS activities was measured by counting the number of motorists and pedestrians who violated the crossing warning devices. Significant reductions in violations indicate a change in behavior that can be attributed to the education and enforcement initiatives. The crossings were monitored for a period of 16 months. Two months of pretest data were collected before the programs began, followed by test data collection during the 12 months of the education and enforcement programs, and an additional 2 months of posttest data collection after the programs were completed. The violations were counted and standardized by the number of opportunities the highway user had to violate the crossing. This resulted in a violation rate. Those rates were compared by time period to identify any change.

The communities of Arlington Heights and Macomb have different demographics and traffic characteristics. The village of Arlington Heights is a more urban community. The rail line is a triple track that carriers approximately 70 trains per day, most of which are commuter trains. The city of Macomb is a rural community. Nearly one-half of the population is composed of students at the local university. The rail line through Macomb is a single track with approximately 20 freight trains per day. The reduction in violations that was witnessed at Arlington Heights did not occur in Macomb. Overall, violations in Arlington Heights were reduced by nearly 31 percent from the pretest to the posttest period. Violations in Macomb did not decrease from the pretest to the posttest period.

As with the previous study in Arlington Heights, the violation data was stratified by grade crossing, mode of transportation, and type of violation. The violations were categorized into three types, based on highway-user risk. Stratification of the Macomb data revealed that the focus of the analysis should be motorist violations. The investigation by crossing and by type of violation did not reveal any significant reductions in violations. Motorist behavior at the highway-rail grade crossings in Macomb was largely unchanged throughout the study period.

The violation data was further investigated for the difference in highway-user reactions to the PEERS programs in the two communities. A primary difference in the communities was the target audience of the PEERS programs. In Arlington Heights, the highway users that were most affected by the programs were pedestrians at the commuter rail station crossing. They used the crossing daily and received the safety messages on a regular basis. In Macomb, the primary users of the crossings were motorists, who may have used the crossings infrequently. Furthermore, because Macomb has seasonal population variations as a result of its large student population, the target audience was not exposed to crossing safety on a regular basis.

Another difference in the two communities is the amount of time the trains occupy the crossing. In Arlington Heights, the trains are primarily commuter trains. They are relatively short and usually operate at faster speeds. On average, the gates were down at the Arlington Heights' crossings for 2.1 minutes per train event. In Macomb, the trains are almost all freight trains. The freight trains tend to be longer and generally operate at slower speeds. On average, the gates were down at the crossings in Macomb approximately 3.7 minutes per train event. In the city of Macomb, motorists are delayed for a longer period when waiting for a train to pass. This may influence riskier behaviors.

The final factor that was different among the two communities was the type of programs that were implemented as part of PEERS. In Arlington Heights, the town took a very active role. Throughout the life of the program, Arlington Heights continued to establish a police presence at the crossing to discourage unsafe behavior. The Macomb program relied on a passive approach to reach the community. The Macomb program did not specifically target the crossing users but was intended for the whole community. The results suggest that aggressive, persistent, and targeted education and enforcement programs are more likely to yield positive changes in behavior.

1. Introduction

1.1 Background

The Volpe Center provides technical support to FRA on most aspects of highway-rail grade crossing safety research. Under sponsorship of FRA, the Volpe Center participated in PEERS. The Volpe Center monitored eight highway-rail grade crossings located in three communities in Illinois to determine the effectiveness of education and enforcement programs.

In 2005, the Final Rule on the Use of Locomotive Horns at Highway-Rail Grade Crossings (Title 49 Code of Federal Regulations, Part 222) went into effect. Nonengineering alternative safety measures, including grade crossing education and enforcement, are permitted in the establishment of a quiet zone to lower the quiet zone risk index. The effectiveness of the alternative safety measures must be validated with a documented reduction in crossing violations.

In addition to safety measures for quiet zones, education and enforcement have been universally established as strategies to reducing incidents, injuries, and fatalities at highway-rail grade crossings. The *Secretary's Action Plan on Highway-Rail Grade Crossing Safety and Trespass Prevention* identifies expanding educational outreach and energizing enforcement as key elements in improving safety at grade crossings [2]. Also in support of these data, the revised second edition of the *Railroad-Highway Grade Crossing Handbook* states that motorist understanding and compliance with crossing warning devices is "mainly a function of education and enforcement" [3].

To explore the effectiveness of education and enforcement as safety measures, FRA and the Illinois Commerce Commission provided funds to support an analysis. Communities received grants to establish public education and enforcement programs that targeted highway-rail grade crossing safety. A field operational test was conducted in three communities by an objective third party, the Volpe Center. The final report, entitled *Public Education and Enforcement Research Study*, was published in 2006 and stated the findings on the effectiveness of education and enforcement programs in the community of Arlington Heights, IL [1]. The focus of this report is the analysis of three crossings in Macomb, IL, from July 1, 2003, through October 31, 2004, and a comparison to the results gathered from Arlington Heights.

1.2 Project Overview

The Volpe Center's role in the PEERS project was to observe motorist and pedestrian behavior at highway-rail grade crossings. The project was designed to analyze the effects of education and enforcement programs as crossing safety measures. Three communities in Illinois implemented well-defined education and enforcement activities targeted at reducing pedestrian and motorist violations at grade crossings. These three communities were Arlington Heights, Macomb, and Bartlett. The first study and report focused on Arlington Heights. This study and report focuses on the efforts in Macomb.

The communities enacted education and enforcement programs that targeted highway-rail grade crossing safety. Some of the program initiatives were direct mailings, poster campaigns, public service announcements, participation in Officer on the Train program, an increase in Operation Lifesaver presentations, and police enforcement blitzes. The effectiveness of the education and enforcement programs was evaluated by measuring the number of motor vehicle and pedestrian violations of the crossing warning devices. Violations were selected rather than incidents—or accidents—because violations occur at a much higher frequency. Accidents at the selected grade crossings over the study period would be too few to detect any performance differences. Violations represent a reasonable surrogate to incidents. The risk taken when committing a violation is a precursor to a grade crossing incident [4].

The study period for this project was 16 months. The lifespan of the project was divided into three phases: before, during, and after the communities implemented their PEERS programs. The pretest phase occurred before the education and enforcement programs began, from July 1, 2003, through August 31, 2003. The test phase was 12 months during which the communities conducted their education and enforcement initiatives, from September 1, 2003, through August 31, 2004. A posttest phase of data was also collected to measure any lasting effects of the programs from September 1, 2004, through October 31, 2004.

1.2.1 Project Objective

This second study on the PEERS programs had two objectives. The first objective was to determine whether the education and/or enforcement activities were successful in reducing the violation rate at highway-rail grade crossings in Macomb. Violation rate is the count of violations for a time period divided by the number of opportunities for violation to occur. The second objective was to compare the results of the study of Macomb to the results of the study of Arlington Heights.

1.2.2 Field Operational Test

The Volpe Center was responsible for monitoring the selected highway-rail grade crossings for violations of the crossing warning devices. This monitoring was achieved through a remote data collection system. The system in Macomb consisted of two computers and seven cameras (two at each of the three crossings in the study, and one at a nearby ungated crossing that was not included). The images from the cameras at the Lafayette Street crossing were transmitted to one computer and the images from the Jackson Street and Ward Street crossings to the other. At each crossing, a camera was positioned from opposite directions for a complete view. The images from one camera were analyzed, and the other camera served as backup. The city of Macomb allowed the cameras to be mounted on municipal light poles and be power by the electricity there.

The two remote data collection systems were housed in Burlington Northern Santa Fe Railroad (BNSF) bungalows at Lafayette Street and Jackson Street. The computers were loaded with video data collection software. High-speed cable access was available for Internet service. BNSF provided connections to the electrical power and the track circuitry traffic signal output module.

The video data collection software recorded continuously and distinguished between alarm and nonalarm files. An alarm file was created when the track circuitry indicated that the crossing warning devices had been activated. All other images were labeled as nonalarm files. Nonalarm files were deleted by the software first to preserve computer memory for the alarm files. The software allowed the alarm files to be separately designated and had the capability to remotely access the video database. The alarm files were downloaded to workstations at the Volpe Center.

Video data was collected and stored onsite in Macomb and then transmitted to the Volpe Center via the Internet. Computers with an in-house Internet connection were used to download the data to the Volpe Center. The Volpe Center workstations used structured query language calls to bring up the appropriate alarm data and upload the video and associated information from the remote systems. Data was stored on local hard disk drives and backed up on DVD media for processing and archiving.

1.3 Macomb

Macomb is located in McDonough County in Illinois. The population is just over 18,000. The rail line through Macomb is a single track owned and operated by BNSF. Amtrak passenger trains also use this line. The line carries, on average, 18 freight trains and 2 Amtrak trains per day.

The three crossings included in the PEERS study are Lafayette Street, Jackson Street, and Ward Street. Each crossing is equipped with flashing lights and gates. The track circuitry utilizes constant warning time at all three crossings and traffic signal preemption at the Lafayette Street crossing.

Site location surveys were conducted in Macomb on June 25, 2002, and September 25, 2002. These site surveys determined suitable locations for the cameras and field equipment. At each crossing, the team was accompanied by BNSF personnel. Figure 1 shows a schematic of the three crossings in Macomb. Details, schematic drawings, and photographs of each crossing are found in Appendix A.

The three crossings are less than 1 mile apart. There is an Amtrak station just west of the Lafayette Street crossing. Jackson Street is a five-lane road, and the railroad tracks cross the street at an angle. Both Lafayette and Jackson Streets are principal roads leading to the city center. Ward Street is a connector road off of Jackson Street.

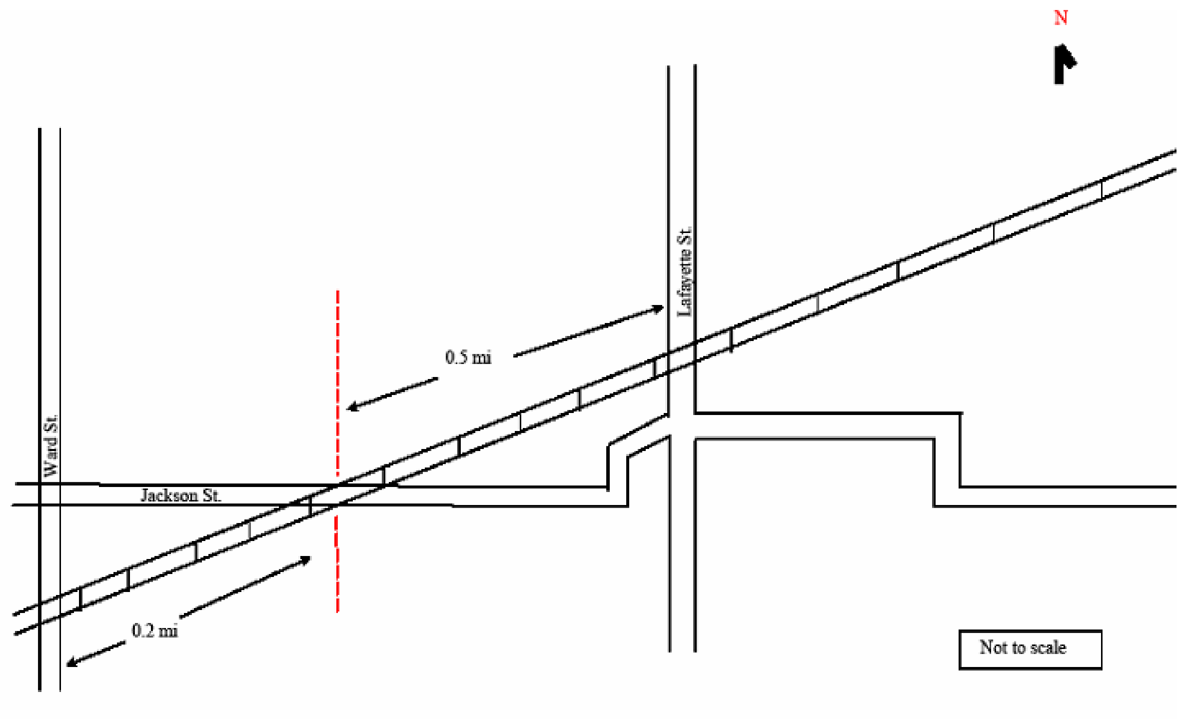

Figure 1. Macomb Crossings Schematic

1.3.1 Lafayette Street

The Lafayette Street crossing (DOT Crossing Number 072896B) consists of a single mainline track owned by BNSF and is located at milepost 202.36. Train speeds range anywhere from 1 to 79 miles per hour. The intersection has three directions of highway traffic that traverse the crossing. There are three reflective cross-buck signs, three red and white reflective gates, three sets of mast mounted flashing lights, three sets of cantilever mounted flashing lights, and one bell in place. There have been no major accidents at this crossing recently. On average, one gate per month is broken. The Annual Average Daily Traffic (AADT) was 12,400 in 2003. Although pedestrian activity is limited, this crossing is near the town commons and local businesses as well as the Amtrak station.

1.3.2 Jackson Street

The Jackson Street crossing (DOT Crossing Number 072890K) is located at milepost 202.91. The road is a five-lane highway that crosses the tracks at a 22-degree angle. The gates are separated by approximately 300 feet, and within this span are driveways to four businesses. The crossing is equipped with two reflective cross-buck signs, two red and white reflective gates, four sets of mast-mounted flashing lights, two sets of cantilever-mounted flashing lights, and one bell in place. The gates do not block the turning center lane. There was one recent accident at the Jackson Street crossing. The engineer noticed the car and was able to slow the train to 10 miles per hour before impacting the car and there were no injuries or fatalities. The AADT at this crossing was 16,200 in 2003. There are sidewalks along the roadway, but pedestrian foot traffic appeared limited.

1.3.3 Ward Street

The Ward Street crossing (DOT Crossing Number 072906E) is located at milepost 203.11. There is one lane each north and south, and a road runs parallel to the tracks on the south. The area surrounding the crossing is commercial with an AADT of 8,100 in 2001. Both approaches to the crossing were equipped with two reflective cross-buck signs, two red and white reflective gates, two sets of mast-mounted flashing lights, and one bell in place. There have not been any accidents at the Ward Street crossing in the past 10 years.

2. Data Analysis

2.1 Data Analysis Plan

The data was collected and analyzed as a before-during-after study. The purpose of organizing the study in this manner was to compare the data from the three phases of the study. The before (pretest) data is useful in identifying the grade crossing environment at the start of the study, before any enhanced education and enforcement activities. The during (test) period data ascertains whether the education and enforcement activities have affected behavior at the crossings, either positively or negatively. The after (posttest) period data shows whether the test period behavioral changes lasted or reverted after the programs had ended. The test data was collected over a period greater than 1 year in an attempt to eliminate any seasonal affects on the data.

In Macomb, three crossings were monitored. There are approximately 20 trains per day through the city. Each time the crossing warning devices are activated at one of the crossings, it is considered a train event. The estimated numbers of train events collected were 2,600 events during the pretest and posttest periods and 21,000 during the test period.

2.1.1 Data Attributes

Data points extracted from the PEERS video images were chosen to aid the determination of the amount of risk a motorist or a pedestrian was taking at the crossing. Two similar studies, *Field Evaluation of Wayside Horn at Highway-Rail Grade Crossings* [5] and *Evaluation of the School Street Four-Quadrant Gate/In-Cab Signaling Grade Crossing System* [6], were used as references when selecting data attributes for this analysis. Table 1 is a list of elements that were collected from each viewed train event.

Table 1. Data Dictionary for Video Events

Data	**Description**
Date	Date event occurred
Crossing Name	Name of street crossing
Crossing Activation Time	Specific time when the track circuitry trigger activates the safety devices at the crossing
Gate Activation Time	Time when the gates begin to descend
Train Presence	Yes or no (false alarm)
Train Arrival Time	Time when train arrived at the grade crossings
Type of Train	Freight, passenger, track maintenance
Motor Vehicle Arrival Time	Time when the motor vehicle arrived at the grade crossing
Pedestrian Arrival Time	Time when the pedestrian arrived at the grade crossing
Violation: Type I	Number of violators that went through the crossing while lights were flashing but before gate descent
Violation: Type II	Number of violators that went through the crossing during gate descent
Violation: Type III	Number of violators that went through the grade crossing after gate descent
Violation after Train but before Gates Ascend	Yes or no
Violator Direction	The direction (N, S, E, W) from which the violator approached the crossing
Train Direction	The direction (N, S, E,W) from which the train approached the crossing
Track	The track that the train is on when it traverses the crossing (north side or south side, east side, or west side)
Second Train Event	Yes or no
End of Event Time	Time when the train has completely cleared the crossing and gates have retracted or the recording timed out

2.1.2 Violation Types

The evaluation of the effectiveness of the education and enforcement programs was based on the frequency with which motorists and pedestrians violated the warnings of approaching trains. In Macomb, the crossings were equipped with gates, flashing lights, and bells. The types of violations—during the train event—were based on when the violation occurred and how much risk the violator assumed. The violations were divided into three types:

- Type I is when a violator traverses the crossing while the lights are flashing, the bells are ringing, but before gate descent;
- Type II is when a violator traverses the crossing during gate descent or ascent with audible devices sounding; and
- Type III is when a violator traverses the grade crossing after the gates finish their descent and are fully deployed in a horizontal position.

Type III violations are the most risky and type I the least. The type I violation occurs at the first warning that a train is approaching. Type II violations occur both before and after the train arrival at the crossing. During a type III violation, the gate is in the horizontal position, and the motorist or pedestrian would have to go around the downed gate.

2.1.3 Performance Measures

The performance of the education and enforcement programs was measured by using the frequency of violations. For each phase of the project, the number of train events observed varied. Thus, it was necessary to use a rate of violations per train event. The violation frequency data can be separated into the three violation types, the three crossings, and the two modes of transportation used by the violator. Analyzing the violation rate at this level of detail enabled the researchers to establish trends in the data and determine how and where the PEERS programs were most effective.

2.2 Sampling Plan

To complete the PEERS evaluation of Arlington Heights, over 70,000 video data clips were viewed and recorded. This amount of data extended the project many months. To reduce the workload and the cost of including Macomb, a sampling of train events was used. Before the evaluation of Arlington Heights, pretest data from Macomb was viewed and recorded. All train events in the 2-month period were analyzed. The data collected from the pretest period was used to determine a statistically significant sample size at the 95 percent confidence level for the remaining 14 months of data. Table 2 contains the descriptive statistics of the Macomb pretest data.

Table 2. Macomb Pretest Descriptive Statistics

Macomb Violations by Train Event	
Mean	2.519612
Standard Error	0.043182
Median	2
Mode	2
Standard Deviation	2.234247
Sample Variance	4.991861
Kurtosis	1.505042
Skewness	1.162387
Range	14
Minimum	0
Maximum	14
Sum	6745
Count	2677

Using the formula

$$n = \left[\frac{\sigma z_{\alpha/2}}{\mathrm{E}} \right]^2$$

where

n is the sample size,

σ is the standard deviation,

$z_{\alpha/2}$ is the measure of the distance in standard deviations of a sample from the mean, with a confidence level α, and

E is the standard error.

The sample size for the 14 months of remaining data was determined to be 10,284 train events.

Once the sample size was determined, a method of sampling was chosen. Because variations in the data were expected both for each crossing and over time, a stratified random sample was chosen. A stratified random sample separates the items in the sample into unique groups. The data for the PEERS project was stratified by crossing and by month. It was assumed that the train events at each crossing and each month occur in equal proportion. Each stratified sample was composed of 245 train events per crossing per month.

The train events for each crossing and each month were selected randomly. All of the train events were assigned a number, and random numbers were selected using a random-number generator. Each random number generated corresponded to a train event that would be viewed for the study. Viewed video clips and database entries were selected randomly for quality checks. These quality checks ensured each viewer was collecting accurate information.

When the data was analyzed, it was discovered that during some months the data collection had been compromised. The video data from Jackson Street was lost from December 22 through March 8. The video data from Lafayette Street was lost from January 15 through February 20. The data loss was attributed to a variety of causes, including a lost connection with the cameras, a loss of electrical power, and errors transferring the images to DVD. The samples were determined before the discovery of the data loss, so adjusting the sample stratification was not an option. To collect more data from a particular street or during a particular month would skew the results. For months where less than 245 train events were available, all were viewed. The final sample size for the test and posttest periods was 9,297 train events. This data loss altered the confidence level to 93.7 percent for the Macomb results.

3. Arlington Heights PEERS Evaluation

3.1 Arlington Heights

The first evaluation of the PEERS program focused on the village of Arlington Heights, IL. The results from that evaluation are summarized herein and detailed in the published report *Public Education and Enforcement Research Study* [1].

Arlington Heights is a suburb of Chicago and has a population of over 76,000. The village has 10 public at-grade crossings, 2 pedestrian crossings, and 2 Northeastern Illinois Regional Commuter Rail (Metra) stations. The rail line through Arlington Heights is a triple track owned and operated by Union Pacific Corporation (UP). Metra commuter trains use this line. The line carries, on average, 63 Metra trains plus 12 UP freight trains each weekday.

Three crossings were monitored for 16 months. Two months of pretest data were collected from July 1, 2003, through August 31, 2003. Then, 12 months of test case data was collected from September 1, 2003, through August 31, 2004. Finally, 2 months of posttest data were collected from September 1, 2004, through October 31, 2004. The three crossings were Arlington Heights Road, Dunton Avenue, and Evergreen Avenue. Each crossing is equipped with flashing lights and motorist and pedestrian gates. The crossing at Dunton Avenue is adjacent to a Metra commuter rail station. The station produces considerable pedestrian activity at the crossing.

3.2 Results

The Arlington Heights PEERS data was analyzed for changes in motorist and pedestrian behavior at the three highway-rail grade crossings. The effectiveness of the PEERS programs was evaluated by using changes in the frequency of motorist and pedestrian violations during the pretest, test, and posttest periods. Violation counts were standardized over each project phase. The violation rate was calculated as the violation count for a given time period divided by the associated number of train events. The analysis was conducted for violations over the whole study period and then examined by type of violation, by mode of transportation, and by crossing. Once the data was stratified into distinct classes by mode of travel, grade crossing site location, and type of violation, more information on the PEERS program effectiveness became evident.

3.2.1 Overall Results

During the Arlington Heights study, train event and violation data was collected for 16 months. The overall program effectiveness was evaluated using all violations from all three crossings. The reduction in violations from the pretest to the posttest period was of the most interest. A reduction of 50 percent was considered a successful program. An analysis of least squared means was also conducted to check the statistical significance of the changes in violation rates. Table 3 shows the violation counts, train event counts, and violation rates for the three study periods.

Table 3. Arlington Heights Overall Violation Rates by Period

Overall Violation Rate			
	Period		
	Pretest	*Test*	*Posttest*
Violation Count	18,066	86,621	15,547
Train Events	6,963	45,305	8,674
Rate	2.59	1.91	1.79

The reduction in violation rate was measured from the pretest period to the posttest period, producing a 30.92 percent reduction. Data from all crossings and for all types of violations was tested and produced significant results. When the data was examined for differences by test period, significant findings were observed in all three possible scenarios. These findings suggest that overall highway-user behavior changed at the three Arlington Heights grade crossings examined. However, these summary counts and significance tests on the data, taken as a whole, do not provide much insight into the nature and frequency of the types of violations witnessed and effectiveness of the programs.

3.2.2 Stratified Violation Counts and Rates

Pedestrians and motorists behave differently at crossings. Furthermore, each crossing in this study has different demographic and traffic characteristics. Analyzing the Arlington Heights data by type of violation provided information on the types of behavior that were affected by the PEERS programs. The violation counts were affected by mode of travel, type of violation, and the specific grade crossing locations. Once the data was stratified into distinct classes, more information on the PEERS program was evident.

The violation data was broken down by mode of travel, violation type, and crossing. Arlington Heights Road carries primarily motor vehicle traffic and has a busy highway-highway intersection immediately to the north. Evergreen Avenue also carries primarily motor vehicle traffic, although not as heavy as Arlington Heights Road. Dunton Avenue has an adjacent commuter rail station and is, therefore, bustling with pedestrian activity. Table 4, Table 5, and Table 6 show the motorist and pedestrian violation rates at each crossing.

Table 4. Motorist and Pedestrian Violation Rates, Arlington Heights Road

Arlington Heights Road Motorist (M) and Pedestrian (P) Violation Rates by Violation Type/Period				
Violation Type	*Mode*	*Pretest*	*Test*	*Posttest*
Type I	M	1.09	1.17	1.21
	P	0.005	0.003	0.003
Type II	M	1.11	0.93	1.02
	P	0.08	0.03	0.02
Type III	M	0.004	0.004	0.001
	P	0.06	0.01	0.01

Table 5. Motorist and Pedestrian Violation Rates, Evergreen Avenue

Evergreen Avenue Motorist (M) and Pedestrian (P) Violation Rates by Violation Type/Period				
Violation Type	*Mode*	*Pretest*	*Test*	*Posttest*
Type I	M	0.10	0.06	0.10
	P	0.04	0.01	0.01
Type II	M	1.27	1.13	1.00
	P	0.26	0.21	0.23
Type III	M	0.01	0.005	0.001
	P	0.11	0.04	0.07

Table 6. Motorist and Pedestrian Violation Rates, Dunton Avenue

Dunton Avenue Motorist (M) and Pedestrian (P) Violation Rates by Violation Type/Period				
Violation Type	*Mode*	*Pretest*	*Test*	*Posttest*
Type I	M	0.13	0.13	0.11
	P	0.07	0.03	0.03
Type II	M	0.88	0.61	0.54
	P	0.43	0.33	0.39
Type III	M	0.0004	0.003	0.001
	P	2.20	0.96	0.52

The Arlington Heights Road crossing and the Evergreen Avenue crossing had similar motorist and pedestrian traffic patterns. They were used primarily by motorists. Most of the violations that occurred at these crossings were motorist type I and type II violations. The motorist violation rates for type I violations showed no difference between the pretest and posttest period. Motorist type II violations at Arlington Heights Road and Evergreen Avenue were reduced 21.2 and 8.1 percent from the pretest to the posttest period, respectively. The magnitudes of the estimated differences for pedestrian violations at Arlington Heights Road and Evergreen Avenue were so small relative to other violation differences that the results were insignificant.

Unlike both the Arlington Heights Road crossing and the Evergreen Avenue crossing, the Dunton Avenue crossing has an adjacent Metra commuter rail station stop and, as such, has extremely different motorist and pedestrian traffic patterns. Heavy pedestrian activity occurs at the crossing, and this crossing exhibits the highest number of type III violations. Eighty-three percent of all pedestrian violations occurred at the Dunton Avenue crossing.

Motorist violation rates at Dunton Avenue were reduced during PEERS. The type I motorist violation rate was reduced 12.4 percent, and the motorist type II violation rate was reduced 38.7 percent from the pretest period to the posttest period. The estimated differences in motorist type III violations at Dunton Avenue were too small to draw any meaningful conclusions.

Pedestrian violation rates experienced the greatest reductions. The magnitudes of the estimated differences for type I pedestrian violations at Dunton Avenue were too small to yield any positive results. The type II pedestrian violation rates decreased 11.4 percent from the pretest period to the posttest period. The type III pedestrian violation rates experienced a large reduction (76.3 percent) between the pretest and posttest periods. This reduction may be indicative of a behavioral change for pedestrians, most of whom are commuters, at the Dunton Avenue crossing.

The results showed the most significant reductions in pedestrian violations, especially the most risky type III violations. The pedestrians at the Dunton Avenue crossing were mostly commuters accessing the adjacent commuter rail stations. While waiting for trains to clear the highway-rail grade crossing, the commuters were a captive audience with time to listen and experience the education and enforcement programs regularly. The PEERS programs in Arlington Heights were effective in reducing the most dangerous pedestrian behaviors and were especially effective on commuters that were exposed to the crossing on a daily basis.

4. Macomb Results

The raw data on violations and train events in Macomb was organized by type of violation, mode of transport, and crossing. The analyses were standardized by train event. In addition, the data was segregated into three periods: the pretest period from July through August 2003, the test period from September 2003 through August 2004, and the posttest period from September through October 2004. The data was subsequently analyzed using Statistical Analysis System software.

Summary statistics were calculated to determine the spread and nature of the data. The total number of violations over the three test periods were stratified and analyzed. Each variable in the data set was examined separately.

4.1 Violation Counts and Rates

Violation counts were standardized over each test period. The violation rate was calculated as the violation count for a given time period divided by the associated number of train events. Overall violation counts and rates are given in Table 7. Over the whole study, violation rates increased in Macomb.

Table 7. Macomb Overall Violation Rates by Period

Overall Violation Rate			
	Period		
	Pretest	*Test*	*Posttest*
Violation Count	6,151	20,232	4,383
Train Events	2,453	7,832	1,471
Rate	2.51	2.58	2.98

Approximately one-half of the population in Macomb is made up of students at the local university. This results in a fluctuation in the number of citizens in the city based on the time of year. For this reason, the violation data was examined in 2-month time periods. Table 8 shows the counts of violations and train events and the violation rate in each 2-month time period. As mentioned in Section 2.2, a portion of data was lost during the January through February 2004 block, and this resulted in an outlier. The data in Table 7 and Table 8 shows an increase in violations in the posttest period. Every September, approximately 25 percent of the student population is new to Macomb. The posttest data likely includes students who were not present during the test period and, therefore, were not exposed to the PEERS programs. Although this cannot explain all the variation in the violation data, the population shift does affect the behavior during the study period. Breaking the data down by mode of transport, type of violation, and crossing will reveal additional information on any affects of the PEERS programs.

Table 8. Violation Counts and Rates by a 2-Month Period

		Violation Count	*Train Events*	*Rate*
Pretest	7/1/03–8/31/03	6,151	2,453	2.51
Test Case	9/1/03–10/31/03	2,906	1,260	2.31
	11/1/03–12/31/03	2,719	1,423	1.91
	1/1/04–2/29/04	1,069	770	1.39
	3/1/04–4/30/04	3,961	1,450	2.73
	5/1/04–6/30/04	5,172	1,461	3.54
	7/1/04–8/31/04	4,236	1,468	2.89
Posttest	9/1/04–10/31/04	4,323	1,463	2.95

In the Arlington Heights study, one of the major differences in violator behavior was between motorists and pedestrians. The Macomb violation data was stratified by mode of transportation. Table 9 and Table 10 show the pedestrian and motorist violation counts and rates for each crossing. At each of the three crossings in Macomb, the estimated differences in pedestrian violations were too small to draw any meaningful conclusions. Therefore, the focus of the remaining analyses is motorist violations.

Table 9. Pedestrian Violation Counts and Rates

	Pretest	*Test*	*Posttest*
Ward	63 0.087	162 0.06	37 0.075
Jackson	76 0.098	174 0.072	61 0.124
Lafayette	160 0.168	314 0.115	68 0.139

Table 10. Motorist Violation Counts and Rates

	Pretest	*Test*	*Posttest*
Ward	1120 1.55	3399 1.26	749 1.53
Jackson	2960 3.82	10469 4.35	2504 5.11
Lafayette	1772 1.86	5714 2.1	964 1.97

In an effort to gain a better understanding of motorist behavior at the highway-rail grade crossings, the data was stratified by crossing. Each crossing has different demographics and traffic characteristics. The geography and layout of the crossing are also important. The Ward Street crossing has the lowest AADT of the three. The Jackson Street crossing has the highest AADT of the three and is skewed. The Lafayette Street crossing has an AADT similar to Jackson Street with three gates and two sets of traffic signals. There is more pedestrian traffic at Lafayette than the other two crossings. The highway traffic signals at Lafayette may be why there are considerably fewer violations at Lafayette than at Jackson. The crossing is equipped with simultaneous preemption to clear the tracks when a train is approaching. Therefore, a driver would have to run a red light before they could violate the grade crossing. Table 11, Table 12, and Table 13 show the motorist violation rates by type for each crossing.

Table 11. Motorist Violation Counts and Rates by Type, Ward Street

	Pretest	*Test*	*Posttest*
Type I	100 0.14	290 0.11	88 0.18
Type II	1011 1.40	3081 1.14	655 1.33
Type III	9 0.01	28 0.01	6 0.01

Table 12. Motorist Violation Counts and Rates by Type, Jackson Street

	Pre-test	*Test*	*Post-Test*
Type I	298 0.38	1093 0.45	294 0.60
Type II	2643 3.41	9313 3.87	2202 4.49
Type III	19 0.02	63 0.03	8 0.02

Table 13. Motorist Violation Counts and Rates by Type, Lafayette Street

	Pretest	*Test*	*Posttest*
Type I	561 0.59	1808 0.66	313 0.64
Type II	1190 1.25	3891 1.43	642 1.31
Type III	21 0.02	15 0.01	9 0.02

The examination of violations by type did not uncover any significant decreases in violation rates. The only violation rate reduction occurred at Ward Street for type II violations. This reduction, from 1.40 to 1.33, was 5 percent.

The stratification of violation by type did reveal that the majority of violations were type II violations. The motorists stopped at the crossings during a train event were frequently committing type II violations after the train had passed, and the gates were still ascending. This behavior may be perceived as less risky than a type II violation before the train arrives. The violation data was categorized by before and after the train. Table 14, Table 15, and Table 16 show the motorist violation rates and counts before the train for each crossing.

Table 14. Ward Street Motorist Violation Counts and Rates, before the Train

Violation Type	*Pretest*	*Test*	*Posttest*
Type I	97 0.13	284 0.11	85 0.17
Type II	63 0.09	253 0.09	74 0.15
Type III	8 0.01	21 0.01	3 0.01

Table 15. Jackson Street Motorist Violation Counts and Rates, before the Train

Violation Type	*Pretest*	*Test*	*Posttest*
Type I	297 0.38	1070 0.44	283 0.59
Type II	222 0.29	1083 0.45	111 0.23
Type III	13 0.02	32 0.01	3 0.01

Table 16. Lafayette Street Motorist Violation Counts and Rates, before the Train

Violation Type	*Pretest*	*Test*	*Posttest*
Type I	559 0.59	1774 0.65	308 0.63
Type II	135 0.14	523 0.19	75 0.15
Type III	20 0.02	11 0.00	8 0.02

The before-the-train-violation data does not indicate any change in behavior. Although the results were inconclusive, this data was examined because this behavior is more likely to result in a collision. If this behavior is altered, safety benefits will be realized. Future education and enforcement programs should include awareness of the risks of this behavior.

The counts of type II violations before the train show that the majority of type II violations, at all crossings, occur after the train has passed and the gates are ascending. Illinois law states that the drivers shall remain stationary until the gates are fully raised and the flashing lights are no longer illuminated. This part of the law, however, is largely disregarded in Macomb. In Macomb, the majority of the trains are longer, slower moving freight trains. On average, the crossing warning devices are active for 3.7 minutes during a train event. This delay time could influence the motorists' behavior after the train has traversed the crossing.

Another phenomenon that was noted by the data entry staff was platooning. Platooning—when one motorist commits a risky maneuver and others follow—leads to higher numbers of violations. The data entry staff indicated this behavior was especially prevalent for type II violations after the train. The first motorist's decision to violate the crossing warning device led to multiple violations by the motorists behind the first. This phenomenon contributed to the much higher after train violation counts compared with before training.

4.2 Arlington Heights Comparison

The results from the Macomb study are not similar to the results from Arlington Heights. The PEERS activities in each community did not yield the same changes in highway-user behavior. Figure 2 shows the violation rates of each community by 2-month time periods. In Arlington Heights, overall violations were reduced by nearly 31 percent from the pretest to the posttest period. In Macomb, there was an increase of 18.7 percent in overall violations from the pretest to the posttest period. The majority of the reduction in Arlington Heights was in pedestrian type III violations. The Macomb data contained too few pedestrian violations to analyze conclusively. The violations in Macomb were primarily motorist type II.

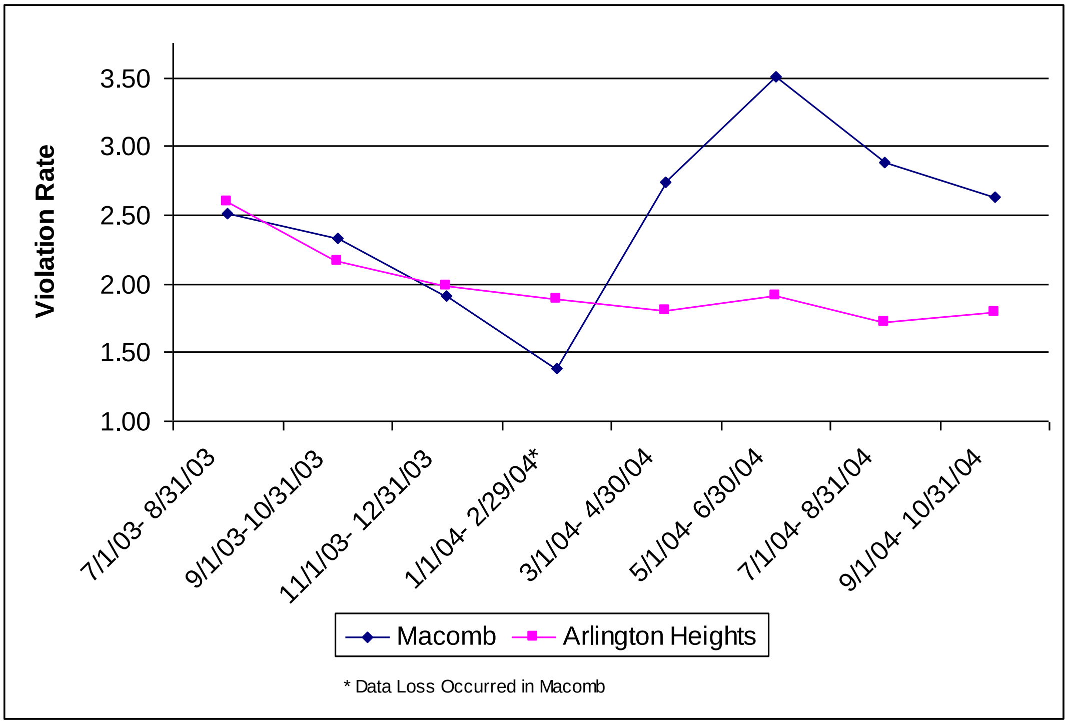

Figure 2. Violation Rates by a 2-Month Time Period, Macomb and Arlington Heights

The studies were conducted over the same period of time but yielded strikingly different results. The reasons for these differences could be attributed to the length of time crossing warning devices are active, the target audience, and the design of the PEERS programs.

In Arlington Heights, the trains through the community were primarily commuter rail trains. These trains tend to be shorter than freight trains and operate at faster speeds. In Macomb, almost all of the 20 trains per day were freight trains. Freight trains can be very long and generally operate at slower speeds. On average, in Arlington Heights, the crossing warning devices were active for 2.1 minutes per train event. In Macomb, the crossings warning devices were active for an average of 3.7 minutes per train event. On average, motorists and pedestrians in Macomb had to wait 76 percent longer at an activated crossing than in Arlington Heights. The motorists in Macomb were delayed for a longer time when the gates were deployed and therefore may have been more likely to disobey the crossing warning devices.

The audience of the PEERS activities could have contributed to the success of the PEERS programs in Arlington Heights and hindered the program effectiveness in Macomb. In Arlington

Heights, one of the monitored crossings was located adjacent to a commuter rail station. The pedestrians that used that crossing were mostly commuters. They used the crossing daily and were exposed to the crossing safety initiatives on a regular basis. The safety messages affected their daily routines. In Macomb, the crossing users were mostly motorists. These motorists may have been driving over the crossing infrequently and not exposed to the PEERS activities repeatedly. In addition, Macomb has a large student population. Because the students arrive and leave the community throughout the year, the population is continuously changing, and it may be more difficult to achieve the level of awareness needed for behavior modification.

Another factor that could influence the effectiveness of the PEERS programs in the two communities is the type of program each implemented. Each community used the grant funds to design its own education and enforcement plans. The village of Arlington Heights created a very active program. Police presence at the crossing was a major part of the PEERS initiatives. The education and enforcement blitzes were conducted randomly but frequently throughout the study period. For example, from September 2003 through December 2003, Arlington Heights conducted 18 Operation Lifesaver presentations, 5 education blitzes, and 6 enforcement blitzes. By the end of the test period, Arlington Heights had expended all the available grant funds.

The city of Macomb adopted a less rigorous program. The primary means of program to pass along the safety message were direct mailings, newsletters, posters, and public service announcements. These initiatives reach a wide audience, but they do not specifically target the crossing users as the blitzes do. During the same time period as in Arlington Heights, from September 2003 through December 2003, Macomb conducted four Operation Lifesaver presentations, one education blitz, and one trooper on the train event. At the conclusion of the test period, Macomb had approximately one-third of the grant funds remaining.

The differences in results from the two communities indicate that a program that is more focused on the crossing users will reduce risky behavior. The active initiatives that targeted highway users for crossing safety outreach were more successful.

5. Conclusions and Recommendations

The analysis of highway-rail grade crossing violation data in Macomb was completed to determine whether the results from the first PEERS analysis in Arlington Heights were replicated in a community with different characteristics and demographics. The two communities had different population demographics, traffic makeup, and grade crossing characteristics. In Arlington Heights, overall grade crossing violations were reduced from the pre-test to the post-test period. In addition, when the data was stratified, it revealed that the most risky type of violation, type III, had over a 70 percent reduction. The majority of the reduction was attributed to pedestrians at the crossing adjacent to the commuter rail station.

In Macomb, overall grade crossing violations were not reduced from the pretest to the posttest period. The stratification of data did not reveal any behaviors that were affected by the PEERS programs. Grade crossing violations continued at the same rate, or increased, throughout the tenure of PEERS. The majority of violations in Macomb were committed by motorists. Pedestrian violations were too few to analyze conclusively.

The reasons for the different levels of PEERS program success in the two communities can be attributed to the variations in the study parameters. Limiting the amount of time highway users have to wait for a train to pass may reduce risky behavior. The extended delay time in Macomb may have resulted in more violations, especially after the train had traversed the crossing. Those motorists who are familiar with the crossings may also be more inclined to disobey the crossing warning devices before the train arrived in order to avoid a lengthy delay.

The target audience is extremely important in the success of the program. Citizens that use the crossing daily may be more likely to internalize the safety messages and adjust their behavior. The changing student population in Macomb introduced crossing users who were not exposed to the PEERS programs. The residents of Arlington Heights were continually subjected to the crossing awareness initiatives. The transient population in Macomb results in a turnover of students each year. These new students do not benefit from any past education and enforcement activities.

The design of the PEERS programs was very influential in the program success. The Arlington Heights program focused on activities at the crossings and was an aggressive and active program. The presence of officers and volunteers at the crossings to promote and enforce safety was particularly effective. The program in Macomb used more passive approaches to reach a wider portion of the community. However, the approach did not specifically target the members of the community who use the crossing regularly, and it did not result in a reduction in highway-rail grade crossing violations.

A guidance document is recommended as a next step in this area. On the basis of the first PEERS analysis and the analysis contained in this report, clearly, how the education and enforcement programs are implemented affects their effectiveness. A report on best practices and guidance would clarify the proper design of a successful crossing safety education and enforcement program.

6. References

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Abbreviations and Acronyms

AADT	Annual Average Daily Traffic
BNSF	Burlington Northern Santa Fe Railway
FRA	Federal Railroad Administration
Metra	Northeastern Illinois Regional Commuter Rail
PEERS	Public Education and Enforcement Research Study
UP	Union Pacific Corporation
USDOT	U.S. Department of Transportation
Volpe Center	John A. Volpe National Transportation Systems Center

Appendix A

Macomb Site Survey

Attachment 1-Site Survey List

U.S. Department of Transportation

Research and Special Programs Administration

John A. Volpe National Transportation Systems Center

Location: Macomb, IL

Date: June 25, 2002
September 25, 2002

Surveyor: VOLPE PEERS TEAM

Contact: Corzett, Dan – Signal Supervisor; BNSF
Golder, Dwight – Manager Signals; BNSF
BNSF Flag man

Notes:

On June 25, 2002 three Burlington Northern and Santa Fe Railway Company (BNSF) representatives provided the PEERS team with a safety briefing and then accompanied the PEERS team to all three crossings in the village of Macomb.

On September 25, 2002 two BNSF representatives accompanied the PEERS team at all three crossings in the village of Macomb. The railroad bungalows were opened and the PEERS team was permitted to view the inside. The positions of possible poles to mount cameras were recorded. The Ward Street crossing has streetlights on the north and south sides that would make reasonable choices. The railroad tracks cross Jackson Street, a five-lane highway, at an angle. In order to capture all crossing activity poles nearly 300 feet away will have to be used. The Lafayette Street crossing does not offer any options for pole mounts on the north side. It will be unconventionally monitored with both cameras on the south side. The PEERS team was met later that afternoon with an official of the Village of Macomb Department of Public Works to discuss electrical power in the selected poles.

General Information

* All three crossings are on the same section of BNSF track.

1	City:	Macomb
2	County:	McDonough
3	Track Owner:	BNSF
4	Number of Tracks:	One
5	Train Frequency:	20 / Day
6	Train Type:	2 Amtrak 18 Freight
7	Rail Road Personnel Assistance:	Yes
8	Rail Road Property Access:	Yes

Lafayette Street Crossing

1	DOT Crossing Number:	072896B

2	Bungalow Mile Post Number:	202.36
3	Type of Tracks:	Main
4	Type of Crossing:	Public At Grade
5	Speed Range:	1 to 79
6	Maximum Speed:	79
7	Warning Device: Signs:	3 Reflective Cross Bucks
8	Warning Device: Train Activated:	3 R/W Reflective Gates 3 Sets of Mast Mounted FL 3 Sets of Cantilever Mounted FL 1 Bell
9	Commercial Power Available:	Yes
10	Type of Development:	Commercial
11	Smallest Crossing Angle:	30 to 59 Degrees
12	Number of Traffic Lanes Crossing Tracks:	5
13	Pavement Crosshatch Markings:	Yes
14	Estimated AADT:	9100
15	Blue Print Availability:	Yes
16	Pole Locations:	See Lafayette Street Drawing

17 Recent Accident History:

No major accidents recently. On average one gate a month is broken off. There has been a maximum of four gates broken in one month.

18 Environment Description:

The area is commercial. There are businesses on either side of Lafayette street to the north of the grade crossing. There are businesses and the town common to the south side. The crossing is complex (See attached drawing and digital photographs.).

19 Gate Description:

There are gates from all approaches. Three gates total. No pedestrian gates. The gates are all train activated.

20 Pedestrian Description:

There did not appear to be much pedestrian activity, however the town common and businesses are on one side of the crossing with commercial and residential areas on the other.

Jackson Street Crossing

1	DOT Crossing Number:	072890K
2	Bungalow Mile Post Number:	202.91
3	Type of Tracks:	Main
4	Type of Crossing:	Public At Grade
5	Speed Range:	1 to 79
6	Maximum Speed:	79
7	Warning Device: Signs:	2 Reflective Cross Bucks
8	Warning Device: Train Activated:	2 R/W Reflective Gates 2 Sets of Cantilever Mounted FL 4 Sets of Mast Mounted FL 1 Bell
9	Commercial Power Available:	Yes
10	Type of Development:	Commercial
11	Smallest Crossing Angle:	30 to 59 Degrees
12	Number of Traffic Lanes Crossing Tracks:	5
13	Pavement Crosshatch Markings:	Yes
14	Estimated AADT:	12100
15	Blue Print Availability:	Yes
16	Pole Locations:	See Jackson Street Drawing

17 Recent Accident History:

There has been one recent accident. A car was pushed into the crossing by a tractor-trailer. The train did see the car and slowed to less than 10 mph. No one was hurt, everyone had evacuated from the vehicles.

18 Environment Description:
The area is commercial. The track crosses the road at an angle of approximately 22 degrees. There is over 300 feet between the gates. Within this span, there are entrance/exits to four businesses. Two of the businesses appear closed. Another is a car wash and the last is a business with an entrance/exit outside of the gates and crossing. The road is 5-lane highway with 2 lanes in both directions and a center turning lane. The gates do not block the turning lane. (See attached drawing and digital photographs.)

19 Gate Description:
There are gates on both approaches that are train activated. The gates cover 2 lanes of traffic each, leaving the center lane un-gated.

20 Pedestrian Description:
There did not appear to be much pedestrian foot traffic.

Ward Street Crossing

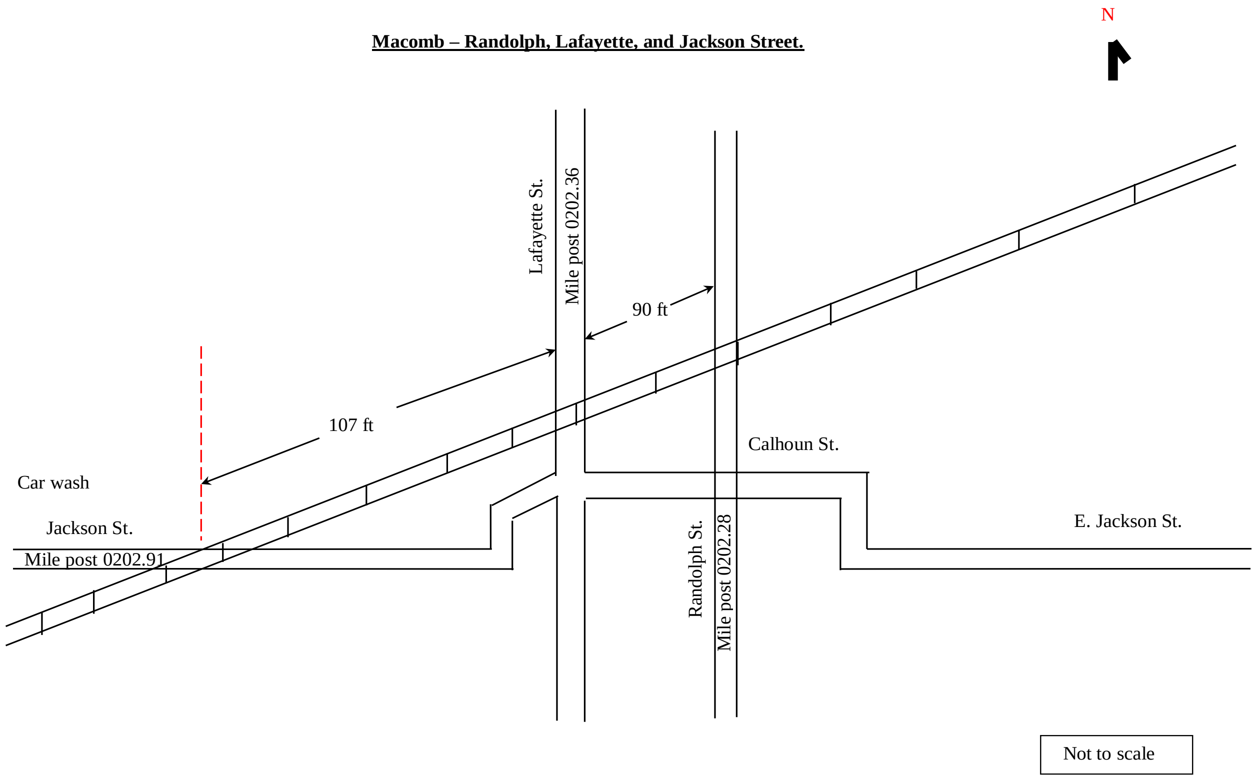
1	DOT Crossing Number:	072906E
2	Bungalow Mile Post Number:	203.11
3	Type of Tracks:	Main
4	Type of Crossing:	Public At Grade
5	Speed Range:	1 to 79
6	Maximum Speed:	79
7	Warning Device: Signs:	2 Reflective Cross Bucks
8	Warning Device: Train Activated:	2 R/W Reflective Gates 2 Sets of Mast Mounted FL 1 Bell
9	Commercial Power Available:	Yes
10	Type of Development:	Commercial
11	Smallest Crossing Angle:	30 to 59 Degrees
12	Number of Traffic Lanes Crossing Tracks:	2
13	Pavement Crosshatch Markings:	No
14	Estimated AADT:	8200
15	Blue Print Availability:	Yes
16	Pole Locations:	See Ward Street Drawing

17 Recent Accident History:
There have not been any accidents at the crossing within the past ten years.

18 Environment Description:
The area is commercial. There is steady motor vehicle traffic. There is a dirt road parallel to the tracks to the north; it accesses a Wendy's parking lot. There is a road parallel to the tracks to the south; it accesses a storage facility on the southwest corner and an auto body shop on the southeast corner. (See attached drawing and digital photographs.)

19 Gate Description:
There are gates on both approaches that are train activated. The gates are typical two-quadrant gates.

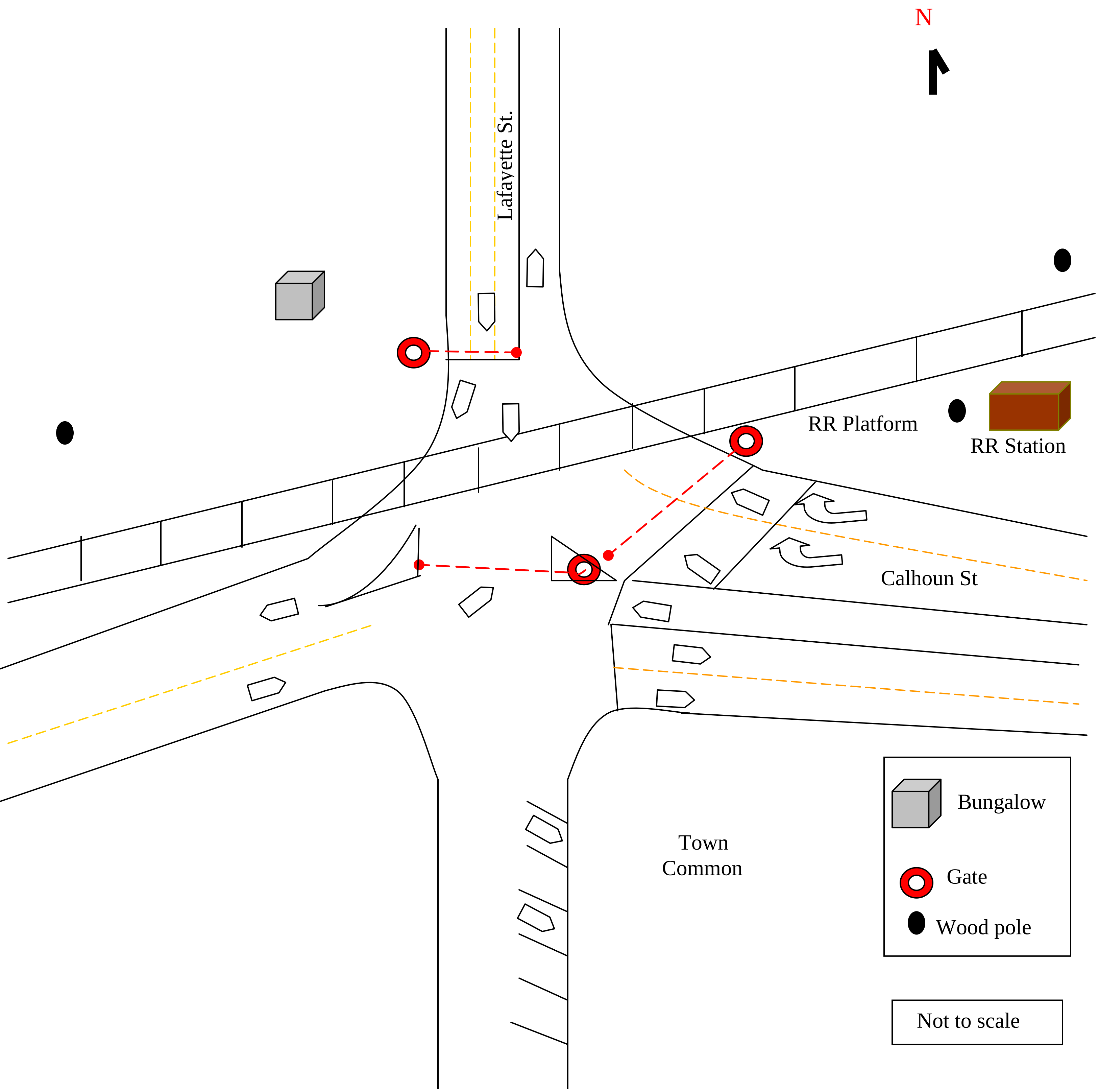
20 Pedestrian Description:
There did not appear to be much pedestrian foot traffic.



Macomb – Lafayette St., Jackson St., Block Diagram

Macomb – Lafayette Street Crossing # 072896B

Railroad Milepost: 0202.36



Lafayette Street Crossing

Macomb, IL

Figure 1. Southeast corner facing northwest.

Figure 2. Southwest corner facing north.

Figure 3. Northeast corner facing south.

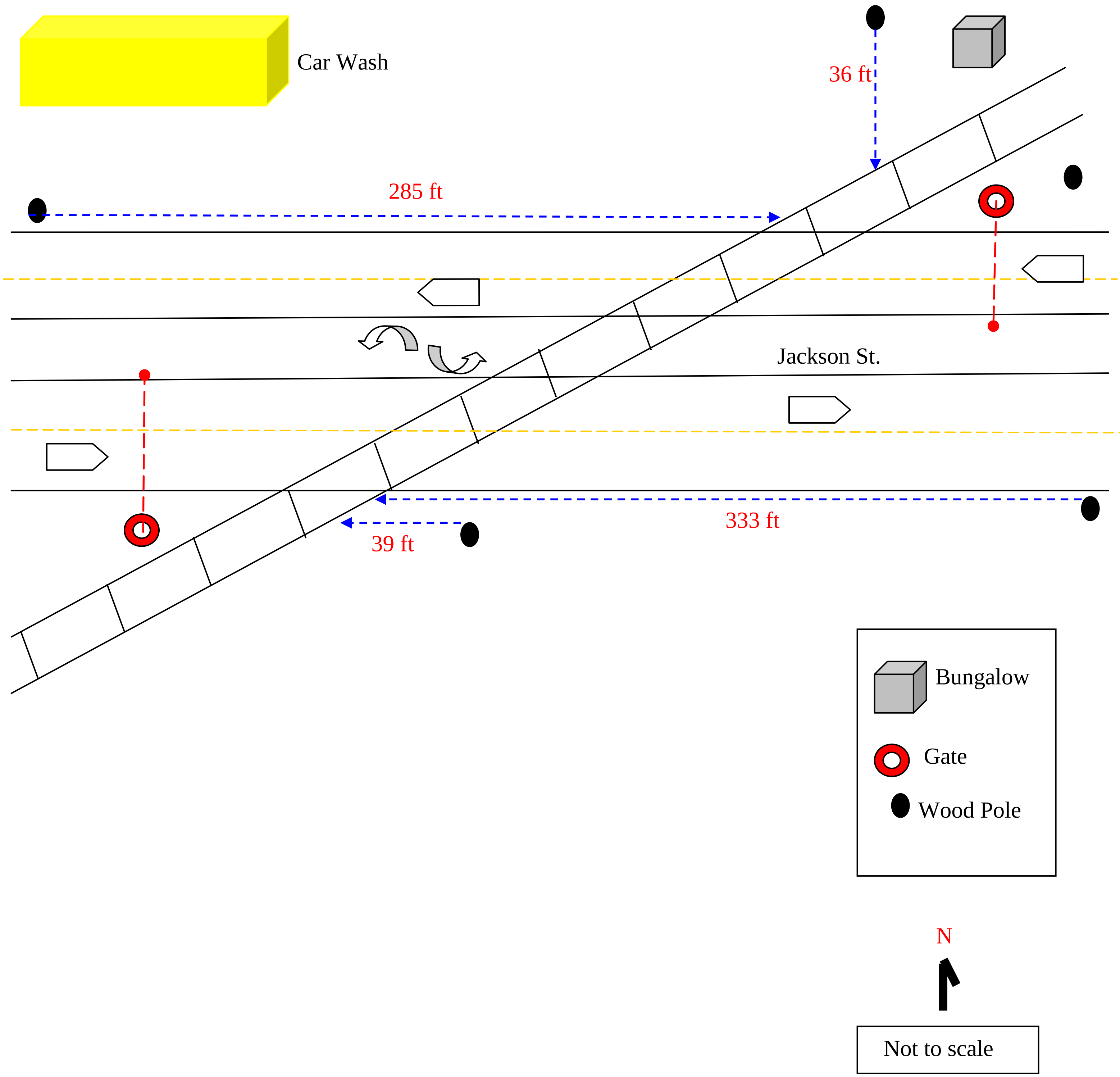
Figure 4. Northwest corner facing southeast.

Figure 6. Northwest corner facing southeast.

Figure 7. Northeast corner facing southwest.

Macomb – Jackson Street Crossing # 072890K

Railroad Milepost: 0202.91



Jackson Street Crossing

Macomb, IL

Figure 1. Northeast corner facing west.

Figure 2. Southwest corner facing west.

Figure 3. Southeast corner facing northeast.

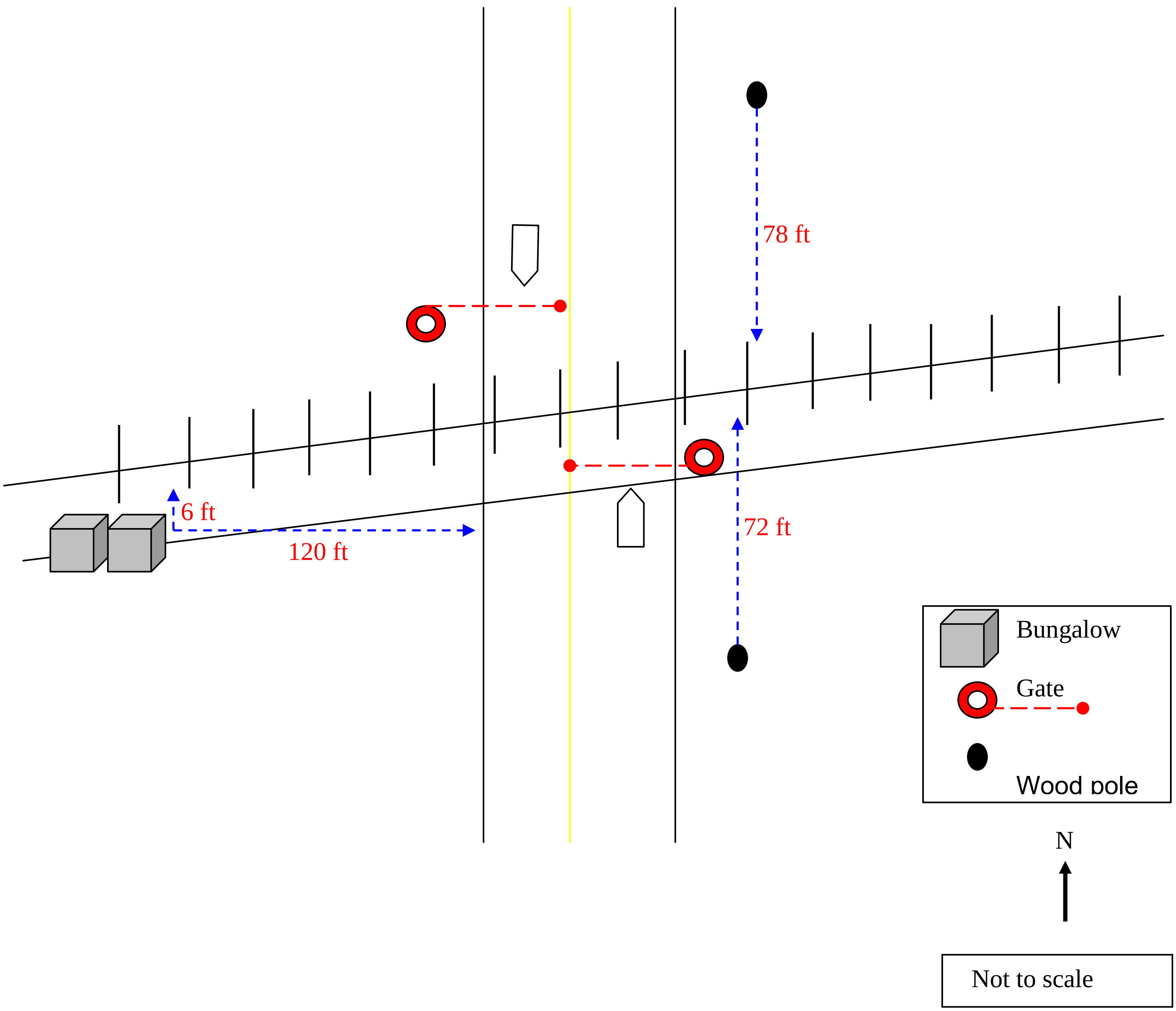
Figure 4. Northwest corner facing east.

Figure 5. Southeast corner facing northwest.

Figure 6. Southeast corner facing northeast.

Macomb-Ward Street Crossing # 072906E

Railroad Milepost: 0203.14



Ward Street Crossing

Macomb, IL

Figure 1. Northwest corner facing south.

Figure 2. Northeast corner facing west.

Figure 3. Southwest corner facing northeast.

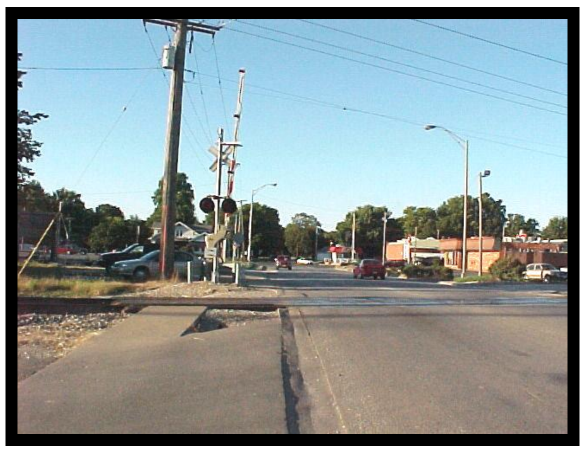


Figure 4. Southwest corner facing north.

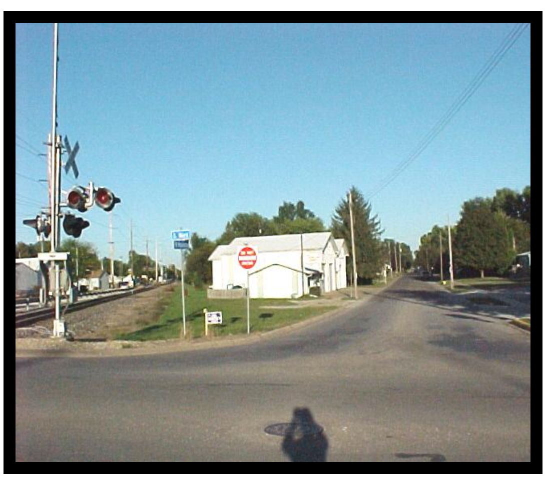


Figure 5. Southwest corner facing east.

Figure 6. Southeast corner facing northwest.