CAMBRIDGE SYSTEMATICS

Study of School Zones with Traffic Signals

final

report

prepared for

Florida Department of Transportation Office of Traffic Operations

prepared by

Cambridge Systematics, Inc.

with

Kittelson and Associates, Inc.

FDOT Contract Number: C8L13

June 2009

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2457 Care Drive, Suite 101
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The opinions, findings, and conclusions expressed in this publication are those of the authors and not necessarily those of the State of Florida Department of Transportation.

SI* (MODERN METRIC) CONVERSION FACTORS

APPROXIMATE CONVERSIONS TO SI UNITS

Symbol	When You Know	Multiply By	To Find	Symbol
		LENGTH		
in	inches	25.4	millimeters	mm
ft	feet	0.305	meters	m
yd	yards	0.914	meters	m
mi	miles	1.61	kilometers	km
		AREA		
in^2	square inches	645.2	square millimeters	mm^2
ft^2	square feet	0.093	square meters	m^2
yd^2	square yard	0.836	square meters	m^2
ac	acres	0.405	hectares	ha
mi^2	square miles	2.59	square kilometers	km^2
		VOLUME		
fl oz	fluid ounces	29.57	milliliters	mL
gal	gallons	3.785	liters	L
ft^3	cubic feet	0.028	cubic meters	m^3
yd^3	cubic yards	0.765	cubic meters	m^3
	NOTE: volumes greater than 1000 L shall be shown in m^3			
		MASS		
oz	ounces	28.35	grams	g
lb	pounds	0.454	kilograms	kg
T	short tons (2000 lb)	0.907	megagrams (or "metric ton")	Mg (or "t")
		TEMPERATURE (exact degrees)		
°F	Fahrenheit	5 (F-32)/9 or (F-32)/1.8	Celsius	°C
		ILLUMINATION		
fc	foot-candles	10.76	lux	lx
fl	foot-Lamberts	3.426	$candela/m^2$	cd/m^2
		FORCE and PRESSURE or STRESS		
lbf	poundforce	4.45	newtons	N
lbf/in^2	poundforce per square inch	6.89	kilopascals	kPa

APPROXIMATE CONVERSIONS FROM SI UNITS

Symbol	When You Know	Multiply By	To Find	Symbol
		LENGTH		
mm	millimeters	0.039	inches	in
m	meters	3.28	feet	ft
m	meters	1.09	yards	yd
km	kilometers	0.621	miles	mi
		AREA		
mm^2	square millimeters	0.0016	square inches	in^2
m^2	square meters	10.764	square feet	ft^2
m^2	square meters	1.195	square yards	yd^2
ha	hectares	2.47	acres	ac
km^2	square kilometers	0.386	square miles	mi^2
		VOLUME		
mL	milliliters	0.034	fluid ounces	fl oz
L	liters	0.264	gallons	gal
m^3	cubic meters	35.314	cubic feet	ft^3
m^3	cubic meters	1.307	cubic yards	yd^3
		MASS		
g	grams	0.035	ounces	oz
kg	kilograms	2.202	pounds	lb
Mg (or "t")	megagrams (or "metric ton")	1.103	short tons (2000 lb)	T
		TEMPERATURE (exact degrees)		
°C	Celsius	1.8C+32	Fahrenheit	°F
		ILLUMINATION		
lx	lux	0.0929	foot-candles	fc
cd/m^2	$candela/m^2$	0.2919	foot-Lamberts	fl
		FORCE and PRESSURE or STRESS		
N	newtons	0.225	poundforce	lbf
kPa	kilopascals	0.145	poundforce per square inch	lbf/in^2

*SI is the symbol for the International System of Units. Appropriate rounding should be made to comply with Section 4 of ASTM E380.

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16. Abstract

One of the most pressing and controversial problems faced by parents, school administrators, law enforcement and transportation professionals throughout the country is the safety of children on their way to and from school. To proactively address this issue, the Florida Department of Transportation (FDOT) initiated this study to investigate the effectiveness of reduced speed school zones at marked crossing locations served by a traffic signal on a state highway, and whether the effectiveness is dependent on the grade level of students served, or other factors.

The study team conducted research tasks including a comprehensive literature review, an on-line survey and phone interviews of safety professionals, field reviews at 14 school sites, data collection, and data analysis.

The findings of this study emphasized the value of crossing guards and reduced speed zones in enhancing the safety of school crossings. The study team also observed that a reduced speed zone may encourage high school students to risk jaywalking by providing a lower speed environment. However, the speed and safety data analysis found no direct correlation between lower pedestrian/bicycle crash rates and reduced speed zones or pedestrian/bicycle volumes.

The study team recommended treatments that may improve safety at school crossings including: no right-turn on red, pedestrian lead phase, and all red pedestrian phase.

17. Key Word	18. Distribution Statement
School Zone, Reduced Speed Zone, Safety, School Crossings, Crossing Guards, Students, Signalized Intersections, Traffic Volumes, Traffic Speed, Crash Data	No restrictions.

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
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Executive Summary

One of the most pressing and controversial problems faced by parents, school administrators, law enforcement, and transportation professionals throughout the country is the safety of children on their way to and from school.

To proactively address this issue, the Florida Department of Transportation (FDOT) initiated this study to investigate the effectiveness of reduced speed school zones at marked crossing locations served by a traffic signal on a state highway, and whether the effectiveness is dependent on the grade level of students served, or other factors.

School zones – street segments near a school that are subject to a reduced speed limit during certain hours of the day – are intended to protect the safety of students. However, analysis has shown that at some locations, the traffic controls requested are unnecessary, costly, and tend to lessen respect for controls that are warranted. Regardless of the school location, safe and effective traffic control can best be obtained through uniform application of policies, practices, and standards developed through engineering studies.

Research indicated that many jurisdictions throughout the United States do not consider implementing reduced speed school zones for crossing locations served by traffic signals, instead relying on the safety provided by the signal. Several jurisdictions similarly do not consider high school sites as candidates for reduced speed school zone implementations.

The objective of this study was to review literature and policies, survey professionals, and evaluate conditions at fourteen school sites in Florida to provide guidance for the implementation of traffic control devices in proximity to schools on state highways. Detailed project tasks have included the following:

- A comprehensive literature review on international, national, and local guidance addressing the provision of school speed zones when there are signalized controls at pedestrian crossings on state highways.

- Two online surveys, collecting the input of school safety professionals on policies addressing the topic under study, and recommendations on school sites that could be studied for the purpose of this project. Both surveys were closed on Oct. 6th, 2008. Additional efforts were made to reach out to areas underrepresented in the responses. As a result, policy input was received from 20 states and eight Florida counties, and information was gathered on 112 candidate school sites around Florida.

- Site analysis and evaluation of transportation features relevant to this study conducted on all 112 school sites resulted in selection of 14 sites for field

review by the study team. School administration was contacted at each site and informed of the proposed study activity and schedule, and the study contacted the survey respondents who had identified each site to keep them informed of the project progress.

- The study team visited each of the 14 sites around the state while school was in session to observe pedestrian and traffic interactions during school opening and closing times. Activities included observations and documentation of state highway geometry conditions, control devices, traffic conditions, drivers and pedestrians' behavior, and conversations with crossing guards.

- Following the site reviews, but within the same week wherever possible, a traffic data team visited each site to collect traffic volume and speed survey data and conduct pedestrian counts at detailed locations identified by the study team during their site review visits. In addition to site traffic data, three-year crash records were obtained for each site.

- The study team conducted analysis for each site to identify trends in school-related crashes, speed reductions, and volumes of automobile and pedestrian traffic. Based on these analyses, the study team identified a series of findings and developed recommendations related to reduced speed school zone implementation in Florida on state highways served by a signalized crossing.

Findings

Benefit of Crossing Guards. Perhaps the clearest observation from the site visits and data analysis conducted for the 14 school sites throughout Florida was the great beneficial value of school crossing guards. An analysis of three years of crash data (2005 to 2007) indicated a small number of pedestrian and bicycle crashes, with no fatalities reported. A total of four crashes involved school students at all 14 schools. The students involved were all 15 years old or older. Among these four students was a special needs student hit at Site 5 (King High School) when she observed her mother driving by. Another pedestrian crash at Site 8 involved a crossing guard. Given the number of students attending these schools and the volumes of traffic on the state highways, this would appear to indicate safe conditions at most schools.

Benefit of Reduced Speed Zones. All the crossing guards interviewed indicated their belief that a reduced speed zone enhances safety at their crossing location. Most obviously, reduced speeds increase the reaction time available in the case of an incident. Several guards recounted experiences where children darted out into traffic unexpectedly, and the reaction provided by slower traffic speeds allowed them to protect the child. International research also indicates the relationship between vehicle speed and severity of pedestrian crashes, with a far

lower chance of serious or fatal injury to pedestrians when vehicles are traveling less than 30 mph.

High School Students. Another observation from the site evaluations was high school students repeatedly failing to adhere to crossing guard instructions and jaywalking across busy streets, whereas elementary and middle school children appeared much more prone to follow instructions and rules. Most jurisdictions in Florida do not provide crossing guards at high schools, so these observations were made at sites that also had an elementary or middle school nearby.

In most cases, it appeared that a reduced speed zone encouraged high school students to risk jaywalking and unsafe midblock crossing by providing a slower speed environment. For this reason, the recommendation based on study findings is that the FDOT not consider modifying its eligibility requirements for reduced speed school zones to include high schools unless justified by an engineering study.

Speed and Safety at School Sites. The following findings can be drawn from a quantitative analysis of traffic, speed and crash data for the study sites:

- A reduced speed zone did not correspond with a lower pedestrian/bicycle crash rate. Crashes were experienced at two sites (four pedestrians total of which one was a crossing guard) within speed zones and one (one pedestrian crash) where no speed zone exists.
- There is no apparent relationship between pedestrian/bicycle crash rates and the volume of pedestrians and bicyclists counted. Sites with high volumes (2, 7) experienced no crashes, while those experiencing crashes (4, 5, 8) had moderate volumes.
- Speeds were observed to drop at school sites with or without a speed zone, although the reduction was higher for reduced speed school zones.
- Miami-Dade and Broward counties were the only ones observed to standardize the reduced speed limit (15 mph).

Recommendations

Possible Pedestrian Safety Treatments

Several possible safety treatments have the potential to enhance safety for pedestrians and bicyclists at school crossings. These treatments may preclude the need for further pursuit of a speed zone for a high school.

No Right-Turn on Red (RTOR). Engineering observation at the site may determine that restricting right-turn on red movements may enhance safety for school students at a school crossing, consistent with FDOT Design Standards – School Signs and Markings, Index No. 17344, Sheet 1 of 6..

Pedestrian Lead-Phase. Several agencies around the country, including Pennsylvania DOT, have implemented a variety of low cost pedestrian safety treatments including time extensions for pedestrians at signalized intersections to give pedestrians a three-second head start when crossing. This "lead phase" for pedestrians allows them to walk into the intersection before the green phase for the parallel vehicle approach, to allow better visibility of the pedestrians.

All-Red Pedestrian Phase. Many agencies in the U.S. and abroad have implemented all-pedestrian phases at intersections with high crossing volumes. This allows all pedestrian movements to take place at once while a red signal is presented to all traffic approaches. This treatment was observed at the North Miami Senior High School site on NE 135th Street at NE 9th Avenue and appeared to work very effectively, providing safe crossing opportunities at this location which has no crossing guard.

Special Conditions for High Schools

Based on the analysis of traffic, geometric and safety conditions at the 14 sites in this study, a number of conditions have emerged that appear to provide justification for the implementation of a reduced speed zone for a high school pedestrian crossing on a state highway. These conditions include:

- Crash experience
- Pedestrian crossing volume
- Pedestrian crossing distance
- Sight-distance
- Traffic speed

Each of these conditions is discussed in further detail in the Recommendations section of this report.

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1.0 Introduction

1.1 BACKGROUND AND EXISTING CONDITIONS

A school zone is defined as "that portion of a street or highway located within a school area that is subject to a reduced speed limit at certain times of the day."[1] A school crossing is defined as an "official student crossing on an adopted school route plan of a school safety program. Any crossing not so officially designated is termed a 'pedestrian crossing'. " School zones and crossings are identified by traffic control devices – pavement markings, signs, and sometimes flashing lights – and are usually located adjacent to the school property, but are sometimes a block or two away.

From the research conducted as part of this study, there is apparently some confusion regarding these terms amongst school safety and traffic professionals in Florida and around the country. The pavement markings placed in advance of school crossings (200 to 325 feet depending on speed) create a *segment* of roadway within these *school* markings that are regarded by many as a school zone, although by definition they are not if no reduced speed applies. Therefore, in this document, reference is made to a "reduced speed school zone" to clarify both conditions of a marked school zone that also has a reduced speed limit applied.

According to the Florida State Public and Private Schools database, updated in 2007, Florida has a total of 7,781 schools, many of which are located either directly adjacent to, on the state highway or within walking distance of state highways. Figure 1.1 shows the distribution of these schools in the State of Florida.

FDOT, pursuant to the authority granted under Section 316.0745, is required to apply a uniform system of traffic control devices and pedestrian control devices for use on the streets and highways in the state surrounding all schools, public and private. FDOT maintains school zones on state highways.

Current FDOT guidance on establishing reduced speed school zones and school crossings is provided by FDOT Topic No. 750-010-027. The procedure states that only public or private elementary and middle schools, or federally funded Headstart facilities providing a full-time educational program are eligible for the markings, signs, and other traffic control devices associated with a school zone. Upon a request from the local government, a reduced speed zone will be used at

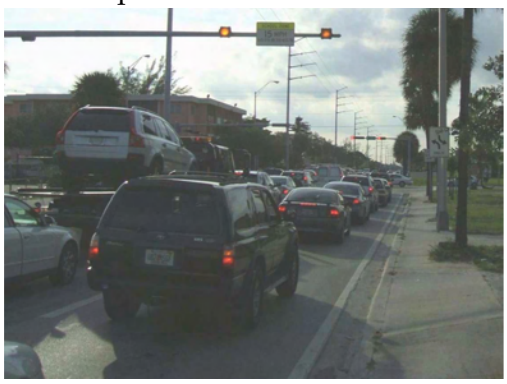
[1] FDOT Topic No. 750-010-027, page 2 of 5.

school crossings at signalized intersections at locations adjacent to or near school property if justified by an engineering study.

When special circumstances occur at a high school site, an engineering study may be used to justify a reduced speed school zone on a case-by-case basis. Such a study shall demonstrate that installation of a reduced speed school zone would enhance safety for pedestrians, bicyclists, and motorists.

Notwithstanding state law and FDOT procedure, school zone treatments vary throughout the state. Some have "regulatory reduced speed school zones" while others have "advisory reduced speed school zones." At some school sites, a signalized pedestrian crossing is provided with no accompanying reduced speed control. The regulatory and advisory reduced speed limits also vary statewide.

The current Manual on Uniform Traffic Control Devices (MUTCD) which covers uniform application of traffic control devices throughout the United States, and adopted for use in the State of Florida by Rule 14-15.010, Florida Administrative Code (F.A.C.) does not provide standards for the provision of school crossing signals for school zones. Different states have various practices for addressing reduced speed school zones.



In the context of national and statewide guidance and experience with school crossing treatments, the Florida DOT's District offices receive requests from time to time to install school zones at high schools located on or near state highways. Where a traffic signal is provided to address the student pedestrian crossing demand, the FDOT typically defers to the procedure which guides against such installation unless justified by a traffic engineering study.

1.2 PROJECT SCOPE AND OBJECTIVES

The objective of this project was to obtain additional data – from a literature review, survey of professionals and site evaluations – to evaluate the combined impact of reduced speed school zones and traffic signals on safety at school crossings. The results of the study are intended to be used by the FDOT in guidance for implementation of traffic control devices in proximity to schools on state highways.

The FDOT highly values the safety of all students as an overriding priority. At the same time, the FDOT is committed to addressing congestion on state highways and achieving adopted minimum level of service standards, particularly on Strategic Intermodal System (SIS) routes. The challenge is therefore to determine if providing a reduced speed school zone results in enhanced pedestrian safety for high school students at the possible cost of increased congestion and rear-end crashes caused by the speed reduction.

The research component of the study included a comprehensive literature review in search of any previous studies that are relevant to the establishment school zones on state highways, and the influence of traffic signals used in conjunction with reduced speed school zones. The research also included two online surveys of school safety and transportation professionals collecting the policies addressing this issue from school zone safety policy makers at different jurisdiction levels, as well as to collect local input on qualified school sites that could be selected for field data collection.

The traffic engineering study was conducted at 14 sites around the state and included the following:

- Twenty-four hour traffic volumes and speed study for primary directions of travel on the state highway in and out of the school zone
- Pedestrian counts and bicycle observations during school ingress and egress
- Examination of posted speed limits for school hours and for regular hours
- Evaluation of violations both with students and with drivers
- Examination of conditions adversely affecting pedestrian and bicycle safety (e.g., availability of sidewalks, bike lanes, horizontal and vertical sight distance, etc.)
- Examination of signal timing and pedestrian crossing time
- Examination of special control devices used to accommodate school zone activities (e.g., dedicated pedestrian crossing phase, no right-turn-on-red sign, pedestrian bridge, crossing guards, etc.)
- Examination of enforcement effort of the school zone speed limits;
- Interview crossing guards
- Crash history study

1.3 REPORT ORGANIZATION

The remainder of this report is organized as follows:

- **Section 2.0, Literature Review –** This section summarizes the literature review.

- **Section 3.0, Survey –** This section describes the on-line survey design and summarizes the survey findings.
- **Section 4.0, Field Studies –** This section describes the methodology of the field study and summarizes and analyses the data collected for 14 selected school sites.
- **Section 5.0, Findings and Recommendations –** This section summarizes the study findings and provides recommendations..

Figure 1-1 Florida Public and Private Schools

Source: Cambridge Systematics, Inc.; Florida State Public and Private Schools Database.

2.0 Literature Review

The research team conducted a comprehensive literature review to find and appraise any documents that have been produced related to designing or evaluating school zone traffic signal control devices and reduced speed limits. The survey also covered policies addressing provision of reduced speed school zones both nationwide and internationally. The findings from this research are included in this section. Further detail on the literature review task is provided in Appendix A.

Through the literature review task, the research team collected national policy (MUTCD), policies from 11 states (including Florida, Texas, Indiana, Minnesota, Utah, Washington, Nebraska, Oregon, Arizona, Idaho, Maryland), and three local level policies (Seattle, Washington; City of Billings, Montana; Ada County, Idaho) addressing provision of reduced speed school zones.

The findings from the literature review have been summarized in the following five areas due to their particular relevance to the research statement.

2.1 SCHOOL CROSSINGS AT SIGNALIZED INTERSECTIONS

The literature review uncovered just one state where reduced speed school zones are discouraged or require further justification for schools on state highways where signalized intersections are provided to facilitate pedestrian access:

- **Oregon –** "Reduced speed school zones need further justification when the crossing is at a signalized intersection or stop sign. Reduced speed school zones are discouraged in the following locations: a) where the posted speed is 45 mph or above; b) locations where students are not walking or biking to school; and c) should not be used alone on high-speed or high-volume roadways."[2]

2.2 SCHOOL CROSSINGS SERVING HIGH SCHOOLS

Idaho, Oregon, and Arizona have explicit policies stating that reduced speed school zones are not typically provided to serve high schools:

[2] From ODOT Website at: http://www.oregon.gov/ODOT/HWY/TRAFFIC-ROADWAY/docs/pdf/Guide_to_School_Area_Safety.pdf

- **Idaho (Ada County) –** "Reduced speed school zones are more or less standard for elementary and middle, but are not used for high schools."
- **Oregon –** "School speed zones need further justification when the school is a high school."
- **Arizona –** "School crossings shall not be established at signalized intersections on state highways. School crossings shall also not be established at stop-controlled intersections or within 600 feet of a signalized intersection. School crossings should not be established at high schools."

Following are the summarized policies at different jurisdiction levels addressing the provision of reduced speed school zones.

2.3 SECTION 316.1895, FLORIDA STATUTES (F.S.)

In Florida Section 316.1895, F.S. recognizes that automatic traffic control devices may be used instead of permanent or portable school zone signs. It does not prohibit the designation of a school zone where a traffic control device exists. In fact, FDOT's criteria and standards to be used in establishing school zones and school crossings state:

"School zones and signalized intersections should be independently justified control techniques, and the use of one neither requires nor precludes use of the other. When a school crossing is warranted, it should be located at a signalized intersection whenever possible."[3] (e.s.)

In addition, FDOT's Procedure further provides that "upon a request from the local government, a reduced speed school zone will be used at school crossings at signalized intersections at locations adjacent to or near school property if justified by an engineering study."[4] Clearly, the Department of Transportation's standards recognize that reduced speed school zones may be designated in conjunction with traffic signals.

2.4 NATIONAL GUIDANCE – MUTCD

Within the MUTCD, Section 4C.06 – Warrant 5, School Crossing (Traffic Control Signal Warrant) – addresses warrants for school zone traffic control. This section provides the standards for when a traffic signal is justified to be installed in a school zone to serve student crossing. It does address different treatment for a location served by existing traffic signals.

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[3] The 2002 Florida Statutes, Section 316.1895: Establishment of school speed zones, enforcement; designation.

[4] Department of Transportation Publication, Establishing School Zones and School Crossings, Procedure No. 750-010-027-h, Effective on May 3, 2006.

3.0 State and Local Agency Survey

Following the literature review, the project team conducted a survey of State Transportation Departments and Florida local transportation agencies to collect policies and practices regarding the placement of school crossings on state highways as well as local candidate school site information from professionals who specialize in school transportation safety.

These two surveys – a policy survey and school site survey – were conducted on-line to maximize the use of FDOT resources. The policy survey was designed to be distributed to different states across the country as well as Florida DOT Districts and County transportation departments to collect current policies and practices regarding provision of reduced speed school zones on the state highway system in Florida and other states.

The school site survey was designed to be distributed to different transportation agencies around the State of Florida to collect information on the school sites that fit this project purpose due to their existing conditions (reduced speed school zone and signal on a state highway) for evaluation by the study team and potential selection as candidate sites for field visits.

3.1 SURVEY RECIPIENTS

The email list for recipients assembled by the project team with assistance from Central Office consisted of agencies including the American Association of State Highway and Transportation Officials (AASHTO) Traffic Engineering Subcommittee Members, FDOT Pedestrian and Bicycle Programs Coordinators, FDOT Transportation Safety Engineers, etc. The project team assembled a total of 386 contacts in order to get a meaningful number of responses. These 386 contacts were then grouped into three parties, a group of 153 received the policy survey only, a group of 147 received the school site survey only, and a group 86 receive both surveys, as detailed in Table 3.1 which lists the professional groups and public agencies that were contacted.

The survey invitation was sent out through email on August 21, 2008. A second notice was sent out on September 4, 2008 to those who had not responded to the survey by that time. The online survey was closed on October 06, 2008.

After evaluation of the school site survey results, areas that reflected a low response rate were identified and the agencies in those areas were contacted again through telephone or email to try to obtain representation from a broad cross section of areas throughout the State of Florida.

Table 3.1 Public Agencies Contacted to Participate Onlne Surveys

Public Agencies	Number of People Contacted	Policy Survey	School Site Survey
AASHTO traffic engineering subcommittee	67	✔	
FHWA Field Safety Staff	86	✔	
FDOT Ped-Bicycle Program	74	✔	✔
FDOT Transportation Safety Engineer	12	✔	✔
FDOT Safe Route to School (SRTS)	15		✔
Community Traffic Safety Teams	65		✔
Office of Safe Schools	67		✔

Source: Cambridge Systematics, Inc.

3.2 EXAMPLE SURVEY FORM

The survey forms are duplicated below for reference.

Policy Survey

Contact Information:

- Name
- Title
- Affiliation
- Telephone
- Email
- Address

Survey Questions:

1. Do you have a policy that addresses the provision of school speed zones?
2. Does the policy address school speed zones where a traffic signal is provided for school crossing?
3. Please describe the policy or provide detailed source of such policy.
4. Have you received any requests for establishing a reduced speed school zone where a traffic signal exists, or vice versa? Please provide school names, locations, and contact information.
5. Do you have schools within your jurisdiction where both a reduced speed school zone and a traffic signal exist? If yes, you will be directed to another survey to provide detailed school information.

School Site Survey

Contact Information:

- Name
- Title
- Affiliation
- Telephone
- Email
- Address

Survey Questions:

1. Name of school(s)?
2. Type of school?
3. School address and enforced reduced speed school zone times?
4. What type of area is the school located in?
5. Is the school located on a state highway?

   If your answer is "No" to question 5, please indicate number of blocks to state highway.
6. Does this school have reduced speed school zone and/or a signalize intersection?

   If there is a reduced speed school zone, please indicate the type of school flasher used.
7. What is the posted speed limit of the state highway?

   If there is a reduced speed school zone, what is the speed limit?
8. How many lanes on the state highway for both directions does a pedestrian have to cross?
9. Are marked crossing walks provided?

   At Signalized Intersection? (traffic signal) Yes or No; If your answer is "Yes," please indicate how many.

   At Pedestrian Signals? Yes or No; If your answer is "Yes," please indicate how many.

   At Unsignalized Intersection? Yes or No; If your answer is "Yes," please indicate how many.
10. Are crossing guards provided?

At Signalized Intersection? (traffic signal) Yes or No; If your answer is "Yes," please indicate how many.

At Pedestrian Signals? Yes or No; If your answer is "Yes," please indicate how many.

At Unsignalized Intersection? Yes or No; If your answer is "Yes," please indicate how many.

11. Is there a problem with students crossing at unmarked crossing locations?
12. Are sidewalks provided on state highways?
13. Are bicycle lanes provided on state highways?
14. Are you aware of pedestrian/bicycle crashes at this school? (If available, please provide crash information in the comments box below.)
15. Other comments?

3.3 SURVEY FEEDBACK SUMMARY

A total of 386 transportation professionals were contacted by email and provided email links to the online surveys. The policy survey was circulated to 239 people, and the school site survey to 233 people. In total, 35 responses were received on the policy survey and 44 responses received for the school site survey.

Responses from the policy survey covered 20 states. The school site survey received responses representing 17 Florida counties distributed amongst the seven DOT Districts. Figure 3.1 shows the distribution of the responses to each survey.

A number of people were also contacted via telephone and email and their input was used to supplement to the final school sites list. Overall, information on 114 schools distributed in 32 counties in the State of Florida were assembled through online survey and the telephone interview/emails.

Policy Survey

This summary includes the policy survey responses received as of October 6, 2008, representing 20 states. Detailed policy survey responses are presented in Appendix B.

In brief summary the survey responses indicated the following issues that are directly relevant to the research statement:

- **Florida; Broward County –** "Reduced speed school zones are provided on State or County roads for all schools including High Schools, regardless of signal provision."
- **Florida; Hillsborough County –** "We install School Speed Zones on County Roads in front of all Public and Private Schools, with or without a traffic signal."

- **Florida; Orange County –** "No reduced speed school zone is provided if the school crossing has a traffic signal – with limited exceptions."
- **Florida; Osceola County –** "No reduced speed school zone is provided if the school crossing is signalized."
- **Florida; Seminole County –** "No reduced speed school zone is provided if the school crossing is signalized."
- **Kansas –** "We do not allow reduced speed school zones when there is already a traffic signal providing gaps for students to cross."
- **Massachusetts –** "Speed zones provided only for schools with grades below 9; not when a signal is provided."
- **Mississippi –** "Speed zones can be established around a signal."
- **North Carolina –** "A signal may mitigate the need for a speed zone."
- **New York –** "Reduced speed school zone is not needed when signal provided." (Respondent opinion.)
- **Texas –** "Typically no reduced speed school zone is installed when signal provided." (Respondent opinion.)
- **Washington State –** "No reduced speed school zones are installed concurrent with traffic signals."

Two Florida counties reported they install reduced speed school zones for all schools regardless of the presence of a signalized school crossing. Three counties typically do not provide a reduced speed school zone if the crossing is signalized.

Four states indicated they do not provide a reduced speed zone if a signalized crossing serves school pedestrian access. One state indicates a signal may mitigate the need for a reduced speed zone, while another state specifies reduced speed zones for elementary and middle schools only. One state specifically indicates that reduced speed zones may be used in conjunction with a traffic signal.

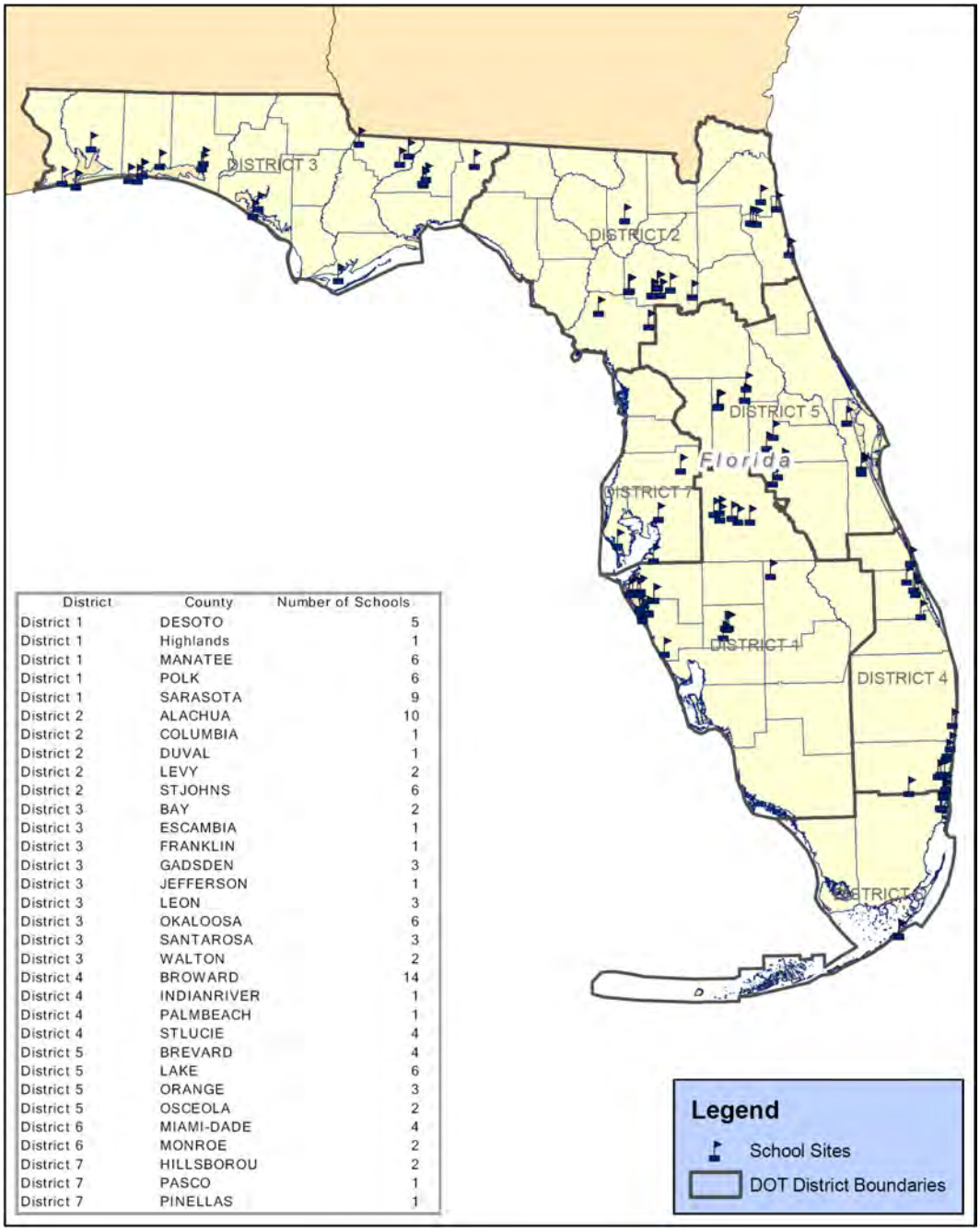
School Site Survey

This summary of school sites survey combines information from the online survey and the information collected via telephone and email follow ups with transportation safety staff. Overall, information was collected for 114 schools distributed in 32 counties in Florida. A more detailed summary of survey reponses can be found in Appendix C.

Figure 3.2 below shows the distribution of these schools throughout the state. The information collected from these school sites varies from county to county. For example:

- In Palm Beach County, no schools on state highways have both signals and speed zones.
- In Broward County, all the schools on state highways have reduced speed zones with or without signals.
- In Seminole County and Orange County, schools on state highways generally are not provided with reduced speed school zones when there are traffic signals.
- In Collier County, there are no schools on the state highways seved by any signals.

Figure 3-2 School Sites Distribution



District	County	Number of Schools
District 1	DESOTO	5
District 1	Highlands	1
District 1	MANATEE	6
District 1	POLK	6
District 1	SARASOTA	9
District 2	ALACHUA	10
District 2	COLUMBIA	1
District 2	DUVAL	1
District 2	LEVY	2
District 2	STJOHNS	6
District 3	BAY	2
District 3	ESCAMBIA	1
District 3	FRANKLIN	1
District 3	GADSDEN	3
District 3	JEFFERSON	1
District 3	LEON	3
District 3	OKALOOSA	6
District 3	SANTAROSA	3
District 3	WALTON	2
District 4	BROWARD	14
District 4	INDIANRIVER	1
District 4	PALMBEACH	1
District 4	STLUCIE	4
District 5	BREVARD	4
District 5	LAKE	6
District 5	ORANGE	3
District 5	OSCEOLA	2
District 6	MIAMI-DADE	4
District 6	MONROE	2
District 7	HILLSBOROU	2
District 7	PASCO	1
District 7	PINELLAS	1

Source: Cambridge Systematics, Inc.

3.4 SCHOOL SITE SELECTION

Field surveys at 14 school sites across Florida were a primary element from the outset of this study. To select the 14 school sites for the field reviews, the project team evaluated information for each school site collected from the online surveys as well as available map, traffic and school web-sites, and used it to prioritize the sites around the state.

Site Selection Methodology

To support the research statement, it was desired that the majority of school sites selected have signalized crosswalks within reduced speed school zones. However, a few locations with no reduced speed zone (but with a signalized school pedestrian access) were included for comparison purposes.

Besides traffic signals and reduced speed zones, a number of features were considered as the evaluation factors for evaluating the school sites. These features included:

- Proximity to the state road
- Posted speed limit on the state highway
- Number of lanes to cross on the state road
- Reported observations of jaywalkers, etc

Each feature of the school was given a score as shown in Table 3.2. The sum of all the scores achieved by each school site was then compared against each other to rank the sites. To ensure reasonable distribution of school sites throughout all FDOT Districts, the two school sites that gained the highest scores in each District were selected as the sites for field visit and review.

This scoring method was used to identify a primary list of 14 sites, and in addition, a secondary "alternate candidate sites" list was developed based on the next highest priority sites. In the case that a school from the primary list was removed based on refined information gathering and analysis, replacement would be found from this secondary list.

All the school sites selected for field visit were then carefully verified. Aerial photos of these school sites were reviewed and some of their features like existence of traffic signals and reduced speed zones on the state road, distance to the state road, number of lanes on the state highway, etc. were confirmed. If the data verification review indicated a conflict that rendered the site unsuitable for analysis for this study, a school site from the backup list would be selected to replace this one. The school and traffic data verification, the revised project site list was reviewed with FDOT project manager for approval prior to the final phase of individual site reviews.

Table 3.2 Scores Applied to School Features

Features	Score	Notes
Number of Blocks to State Road	5	5 minus number of blocks from the school to the state road (a school will get negative points if it is more than 5 blocks away from state road).
Speed Zone	1	1 point if there is a school speed zone.
Traffic Signal	1	1 point is there is a traffic signal.
State Road Speed Limit>=35	2	2 points if the posted state road speed is equal to or more than 35 mph.
State Road Speed Limit<35	1	1 point if the posted state road speed is less than 35.
Number of Lanes to Cross on State Road	1	1 point for each lane that the students need to cross on the state road.
Jaywalker	3	3 points if there are jaywalker problems.
Additional school	2	2 points for each additional school at a school site.

Source: Cambridge Systematics, Inc.

Results

Selected School Sites

Table 3.3 lists the 14 recommended school sites (containing a total of 24 schools) selected from 112 sites throughout Florida identified through our web survey. They represent 13 counties from seven Districts. District 4 ended up with three school sites and District 7 with only one, due to the lack of suitable sites identifed in that region. Please note that the scores were calculated based on the input from the web survey. These scores were updated later in this study based on the observation from the field review.

All 14 school sites are located in urban or suburban areas; eight out of 24 are high schools; eight of them have signals and *regulatory* reduced speed zones; one has a signal and an *advisory* reduced speed zone. The summary of features from the list of primary sites is shown in Table 3.4.

Table 3.3 Recommended School Sites (14)

Selected School Sites	District	County	School Name	State Route	U/S/R	Number of Blocks to State Road	Reduced Speed Zone/Traffic Signal	SR Speed Limit	Number of Lanes to Cross	Jay-Walkers	Scores
1	District 4	Broward	McNicol MS	SR 824	U	0	Y/Y		5	Yes	18
	District 4	Broward	Hallandale HS	SR 824	U	2	Y/Y		5	Yes	16
2	District 4	Broward	Dillard ES	SR 838	U	1	Y/Y		8	Yes	20
	District 4	Broward	Dillard HS	SR 838	U	1	Y/Y		8	Yes	20
3	District 3	Santa Rosa	Gulf Breeze HS	SR 30	U	0	Y/Y	35	7		18
	District 3	Santa Rosa	Gulf Breeze MS	SR 30	U	0	Y/Y	35	7		18
4	District 6	Monroe	Coral Shores HS	SR 5	S	0	Y/Y	45	4	Yes	18
	District 6	Monroe	Plantation Key ES	SR 5	S	2	Y/Y	45	4	Yes	16
5	District 7	Hillsborough	King HS	SR 583	U/S	0	N/Y		7	Yes	17
6	District 5	Brevard	Golfview ES	SR 519	S	0	N/Y	45	5		17
	District 5	Brevard	Hans Christian Andersen ES	SR 519	S	0	N/Y	45	5		17
	District 5	Brevard	Kennedy MS	SR 519	S	0	N/Y	45	5		17
7	District 6	Miami-Dade	North Miami HS	SR 916	U	0	Y/Y		5		17
	District 6	Miami-Dade	Arch Creek ES	SR 916	U	0	Y/Y		5		17
	District 6	Miami-Dade	North Miami MS	SR 909	U	3	Y/Y		5		14
8	District 3	Okaloosa	W.C. Pryor MS	SR 188	S	0	Y/Y	40	6	No	17
	District 3	Okaloosa	Choctawhatchee HS	SR 188	S	0	Y/Y	40	6	No	17
9	District 2	St. Johns	Palm Valley ES	SR A1A	U	0	N/Y	45	6	No	15
10	District 1	Manatee	Orange Ridge ES	SR 55	U	2	N/Y	35	7	No	14
11	District 5	Lake	Leesburg ES	SR 44	U	0	Y/Y		5		15
	District 5	Lake	Oak Park MS	SR 44	U	0	Y/Y		5		15
12	District 4	St. Lucie	Morningside ES	SR 716	U	0	N/Y		7		14
13	District 1	Polk	Lake Region HS	SR 555	U/S	1	N/Y		7		13
14	District 2	Alachua	Westwood MS	SR 121	S	0	Y/Y	40	3	No	12

Source: Cambridge Systematics, Inc.

Note: U/S/R – Urban/Suburban/Rural; SR- State Road; ES – Elementary School; MS – Middle School; HS –High School
Site 6 has advisory reduced speed zone.
If no input is provided, the cells are left blank.

Table 3.4 Summary Table of School Sites Features

School Feature Classification	Number of Schools/Sites
High School (Junior High and Senior High)	8 schools
Elementary and Middle School	17 schools
Located in Urban/Suburban Area	14 sites
Located in Rural Area	0 sites
Speed Zone and Traffic Signal	8 sites
Signal Only	6 sites

Source: Cambridge Systematics, Inc.

The secondary list of school sites is presented in Table 3.5. These school sites are distributed across 14 counties from seven Districts. The summary of their features is shown in Table 3.6.

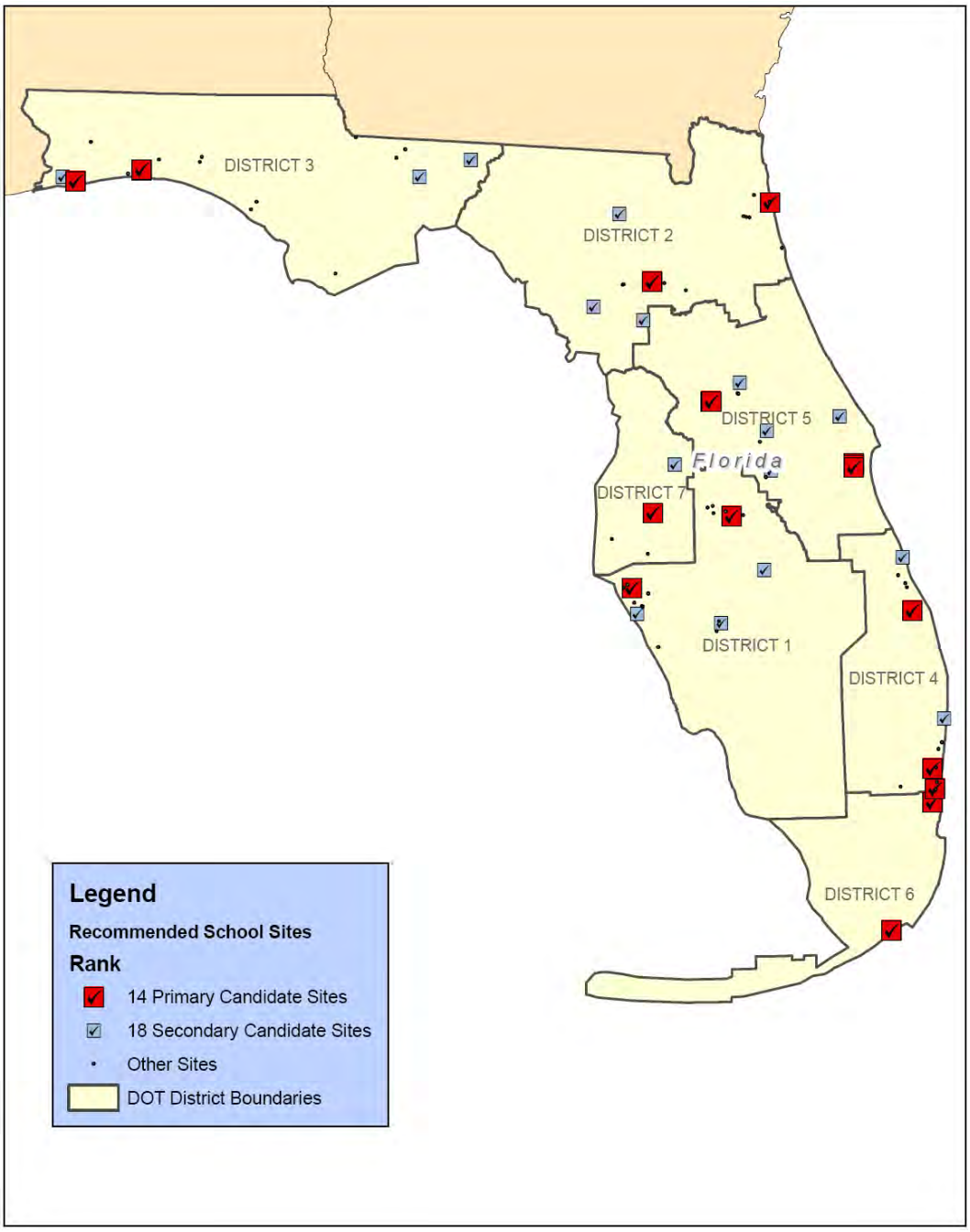
Table 3.6 Summary Table of Alternate School Sites Features

School Feature Classification	Number of Schools
High School (Junior High + Senior High)	8
Elementary + Middle School	17
Located in Urban/Suburban Area	14
Located in Rural Area	0
Speed Zone + Traffic Signal	9
Signal Only	5

Source: Cambridge Systematics, Inc.

Figure 3.3 shows a map of the locations of the 14 primary school sites and 15 alternate candidate sites. Most of the geographic information for these school sites was extracted from the Florida State Public and Private Schools GIS database (updated in 2007). However, there are a number of new schools that are not included in the database and were manually added to the map based on their street address.

Figure 3-3 Selected School Sites within Florida



Source: Cambridge Systematics, Inc.

4.0 Field Studies

Having finalized the selection of 14 school sites around the state, the study team prepared to visit each site to observe pedestrian conditions and collect related traffic data.

The field studies included detailing the site layout and observing on-site traffic patterns and parking and access patterns, identifying on-site safety and operational problems, recording off-site traffic control on adjacent streets, identifying safety and operational problems on the roadway, and collecting driveway count data.

The field studies were conducted for this project for several purposes:

- Obtain detailed geographic features pertinent to each school site.
- Obtain traffic control devices used at different school sites.
- Observe different driver's behavior and pedestrian/bicyclist's behavior.
- Observe intensity of speed limit enforcement and assistance from crossing guards.
- Review crash data occurred within 500 feet of the school site and identify crashes that appeared to be caused by existence or missing of reduced speed school zone.

The observations and findings from the field were used to provide support in identifying the critical factors that impact the safety of school crossings on the state highway.

4.1 Preparation for Field Reviews

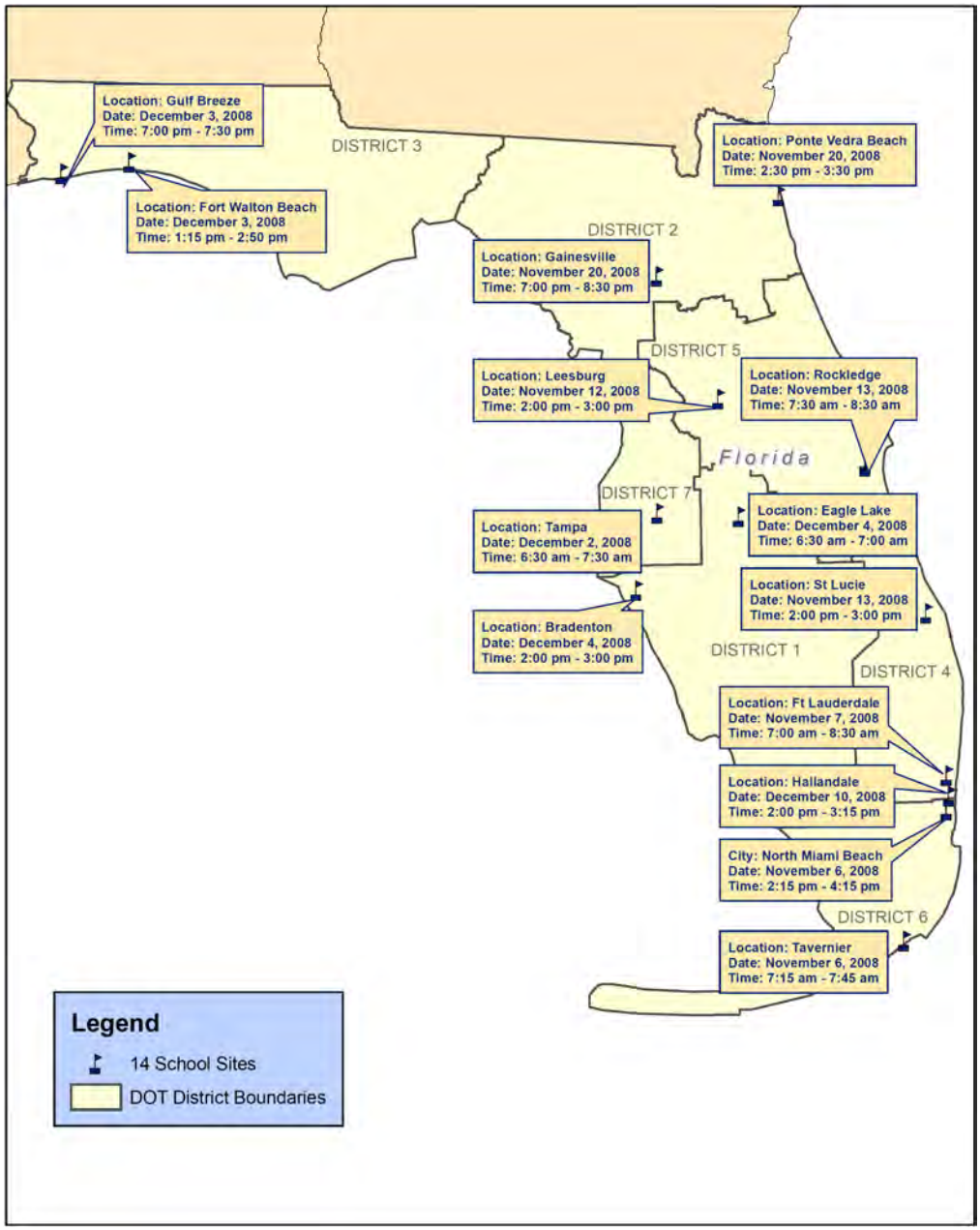
The study team made detailed preparations for the field review trips due to the distances involved. A few were conducted within a one-day trip, but the majority required coordinated overnight trips including flights to the Panhandle. Preparation included:

- Coordinate the date and time for the field reviews based on site locations and travel distances between sites.
- Contact the School Principal to advise school administration that this study was being conducted and the work activities and times.
- Contact local agency transportation engineering staff (where the school site was identified through such professionals).
- Prepare field data collection forms.

Coordinate Site Sequence, Date and Time

The field reviews were designed to finish in five consecutive weeks between November 6 and December 10, 2008, exclusive of Thanksgiving week. The project team arranged the field visit schedules in a way that the least amount of travel was required. Figure 4.1 shows how the field visit was organized. Detailed time and date of visit for each school can be found at Appendix E.

Figure 4-1 Field Visit Schedule



Source: Cambridge Systematics, Inc.

Following the field reviews of each school, data collection locations for volume and speed data inside and outside of school speed zone as well as count pedestrian counts location were determined and diagrams for these locations were drafted and delivered to the field data collection team.

Contact School Administration

After the field review schedules were made, all school Principals were contacted to advise school administration that this study is being conducted and the work activities and times. Some of the information obtained from the survey was verified with the school again, including:

- School's relative location to the state road
- Existence of signals at school crossings
- Existence of reduced speed school zone
- Amount of students walking to school, etc

If there was major inconsistency between survey records and school's input, the school was reevaluated and possibly replaced. Information like school opening, closing hours, and early release dates also were checked against the field review schedule.

Contact Local Transportation Agency

In addition to school officials, the study team contacted local County or District traffic engineering staff to make them aware of our visit schedules. In most cases, the sites were originally identified through the input of these professionals through our survey, so it was felt important to keep them informed of our work. In many cases, these agency staff provided additional local knowledge that was valuable in our preparation, and afterwards in data analysis.

Prepare Field Data Collection Forms

A set of field review forms was prepared for the field survey, consisting of all the relevant information desired to be collected from the school site. The field review forms were designed to document the following information:

- **Roadway Characteristics –** General site condition diagram; number of lanes and posted speed limit on state road; existence and type of sidewalks and/or bike lanes; existence of on street parking, transit stops; state road profile, alignment and sight distance; nearby pedestrian generators/attractors.
- **Reduced Speed School Zone Inventory –** reduced speed zone diagram; posted speed limit of the reduced speed zone and its extent; reduced speed sign type and time active; length of speed reduction zone; existence of crossing guard and times on duty; speeding vehicles or jaywalking pedestrians/bikes.

- **Pedestrian Signal Information** – Provision of pedestrian signals; duration of walk time and flash don't walk time; operations status; other observations.
- **Signal Timing and Phasing** – Control type; green time, yellow time and all red time; signal phasing.

4.2 CONDUCT FIELD REVIEWS AND COLLECT DATA

Field Reviews and Observations

The school site field reviews were conducted during school opening or closing times on typical school days to observe school attendees crossing the state highway while arriving and departing the school. Field review staff observed and documented school crossing features as well as traffic conditions and pedestrian behaviors in the school crossing school start and end times. Scanned copies of field review forms can be found in Appendix E. Table 4.1 presents the summarized observations from the field reviews.

The following seven major subjects that concern student safety at school crossings were summarized from the detailed observations recorded at each site.

Jaywalking

This is perhaps the greatest threat to students at these school crossings due to its frequency. Severe jay-walking problems were observed at North Miami Senior High School (Site 7), but it was observed to some extent at almost all locations. Comparing across the observations from 14 sites, high school students appeared to be less likely to adhere to the instructions from crossing guards and tend to take risks to cross the state road when gaps existed among traffic, or even when there was no gap but vehicle were traveling slowly in a queue. Elementary and middle school children appeared much more prone to follow instructions and rules.

Most jurisdictions in Florida do not provide crossing guards at high schools, so these observations were made at sites that also had an elementary or middle school nearby. It appeared that a reduced speed zone encouraged high school students to risk jaywalking and unsafe midblock crossing by providing the slower speed environment, providing support for the state's policy against providing reduced speed zones at high schools.

The one location where no jay-walking was observed – Site 3, Gulf Breeze – has the benefit of a pedestrian bridge across the state highway which is consistently used by all students and others at this location.

Red Light Runners

Red light running poses direct and extreme threat to the safety of the crossing students. Red light running was observed particularly at sites 7 (North Miami)

and site 9 (Ponte Vedra), and was noted by crossing guards at several of the school sites. Enforcement is the most effective means of addressing this problem.

Speeding Vehicles

Speeding is another prominent issue that threatens the safety of students trying to cross the road. Among the 14 school sites, the posted speed limit for the reduced speed zone varies from 15 mph to 30 mph; the posted speed limit for the state road varies from 35 mph to 55 mph.

Speeding was observed to be severe at Site 2 on SR 838 (Sunrise Boulevard) where Dillard High School and Dillard Elementary School are located. The reduced speed school zone on SR 838 starts at the foot of the I-95 interchange overpass. Westbound traffic speeds are excessive as a result of both the I-95 exit ramp and the down grade from the overpass. Observations also indicated that drivers tend to lose their patience when the reduced speed zone is excessively long, as it is on 135th Street in North Miami, with a zone length of approximately 0.5 mile. Clear warning signs and markings indicating the start and end of school speed zones are critical to effective speed reduction within these zones.

Speeding was also observed to be dependent on the level of police enforcement. On SR 519 in Brevard County (Site 6), police cars were parked in the median with their lights on during the times that the speed zone was in effect – which significantly affected vehicle speeds. At this location, the speed zone was not regulatory (only a warning sign was present) and the crossing guards identified that speeding was an issue when police were not present.

The type of signs and traffic control devices used and the limits of the speed zone may sometimes contribute to speeding as well.

Right-Turn-on-Red (RTOR)

Right turn on red is usually allowed in Florida unless prohibited by signs at individual intersections. RTOR is allowed at Site 7 where North Miami Senior High School, North Miami Middle School, and Arch Creek Elementary School are located. Vehicles were observed making right turns onto SR 916 (NE 135th Street) while there were students crossing the road. At Site 1 (Hallandale), there is a clear No RTOR sign next to the overhead signal at the intersection of South 27th Street and SR 824, however vehicles were still observed to make right turns on red.

At school crossings, RTOR should be consistently forbidden to provide a more protected right-of-way to the students crossing the state road.

Inconsistent Treatment and Placement of School markings

Signs and cross walk markings are the first steps to alerting drivers to the presence of children. According to FDOT Topic No. 750-010-027, "the design, application, and installation of traffic control devices in school areas, zones, and

crossings shall comply with the FDOT's Design Standards, Index 17344. The typical application of signs, markings, and signals contained therein must comply with the Chapter 7 of MUTCD."

Inconsistent school marking treatments can cause confusion among drivers. Based upon field observations, the equipment present at the site seems to play a role in driver recognition of the speed zone and their response to the speed zone. For example, whether the school speed zone is a warning or regulatory makes a difference on whether police can issue citations and their ability to enforce the speed reductions. Example of this can be found at Site 6, where Golfview Elementary School, Kennedy Middle School and Hans Christian Anderson Elementary School are located at. An advisory speed limit of 20 mph is used at all three school crossings. Police enforcement is available for each school crossing for 30 minutes. However, the police cannot issue citations to the drivers if they drive at a speed higher than 20 mph, which limits the level of enforcement at this site. In addition, the advisory speed limit also causes the driver's confusion at what speed is permitted within the school zone.

Consistent placement of school crossings also impacts motorists recognition of the school area. In some cases the placement of the crossing can lead to confusion and lack of motorist compliance. In particular, locations where a school zone is placed at an isolated crossing on the periphery of the campus, but not along the rest of the school frontage can create confusion with drivers. In this situation a driver may be traveling along the school frontage at a high rate of speed and then suddenly they have to slow down after they are nearly past the school. Similarly, a driver going the opposite direction goes through the reduced speed zone at the edge of a school campus and sees "end school" zone sign and speeds up to a high speed along the remainder of the school frontage. In either scenario, it is a confusing situation for drivers and could lead to safety problems.

An example of this can be found at the Site 11, where Leesburg Elementary School and Oak Park Middle School are located at. There is a signal controlling the main school entrance, so they didn't put in a reduced speed zone along the school frontage, but rather put in a reduced speed zone just at an isolated spot on the fringe of campus. If a reduced speed zone is going to be put in place – then the reduced speed zone should extend along the entire school frontage unless the length of the school frontage is excessively long (such as in Miami).

Pedestrian Actuated Signals

Pedestrian signal phase operation required manual activation by students or crossing guards at almost all sites visited. Without activating the pedestrian button, side street phases are allocated enough green time to clear only two or three vehicles, usually insufficient time for students to cross the state highway. This was observed during repeated signal cycles at Site 1 (Hallandale). At most of these sites, the crossing guards activated the pedestrian buttons for both crossings for every signal cycle.

All signals used by students to cross state highways should be programmed to automatically activate pedestrian phases for both intersecting streets during the morning and afternoon school ingress and egress hours. While it would be ideal if students were taught to always use the pedestrian crossing button, from a safety perspective it would be beneficial to ensure that adequate crossing time was provided at all such locations.

Relying on crossing guards to manually call the pedestrian phases adds an unnecessary burden to their responsibilities, and is an example of unnecessary risk. A guard may forget to activate the pedestrian signal due to a distraction, and falsely believe they're sending children across a crossing when they will have insufficient time to complete the crossing before highway traffic starts up again. A good example can be found at Palm Valley Elementary School (Site 9). The roadway cross-section was over 110 ft wide and only one crossing guard was present to help students cross the street. Since there was no button in the median to actuate the crossing, she would have to stand on one corner of the intersection to push the button and if a child was present on the opposite corner, she would have to sprint across the entire roadway to help the child across.

At Site 7 (North Miami) one of the three signals adjacent to the school (NE 135th Street at NE 9th Avenue) operated with an **all-red pedestrian phase.** This allows all pedestrian movements to take place at once while a red signal is presented to all traffic approaches. Many agencies in the U.S. and abroad have implemented all-pedestrian phases at intersections with high crossing volumes. This treatment was observed to work very effectively, providing safe crossing opportunities at this location which has no crossing guard. However, implementing this treatment at only one of three adjacent signals leads to a confusing environment for drivers and pedestrians.

At only one location – Sites 4 (Tavernier) were the signals controlled by the crossing guards through manual override (pickle).

Long Signal Cycle Length

Given the high volumes of traffic on many of the state highways at the study sites, signal cycle lengths tend to be high – in excess of 160 seconds in many cases. It was observed at several school sites that students tend to lose their patience and jaywalk if they are kept waiting for a long time before getting a green pedestrian crossing signal. For example, at Site 1 (Hallandale), the cycle length was 180 seconds for the intersection of SR 824 (Pembroke Road) and South 27th Avenue, which has the school crosswalk. Many students ended up jaywalking to cross the state road after losing their patience while waiting for the crossing signal.

Efforts should be made wherever possible to limit the cycle lengths at these locations, especially during the school ingress and egress times to minimize induced jaywalking.

Bicycles

Guidance suggests students dismount and walk their bicycle across school crossings. At many sites, students were observed to ride their bicycles across the crossings and at mid-blocks, even when there was heavy traffic present. These are considered dangerous behaviors and should be discouraged through training at the schools.

Table 4.2 School Site Traffic Speed Analysis

Site	School Name	School Ingress and Egress Time	State Route	Posted Speed on State Road	Posted Speed in Reduced Speed School Zone	Ingress		Egress	
						NB/EB	SB/WB	NB/EB	SB/WB
1	McNicol MS	6:30-7:30 a.m. and 1:45-2:45 p.m.	824	35	15	17	18	19	19
	Hallandale HS								
2	Dillard ES	7:15-8:15 a.m. and 1:30-2:30 p.m.	838	45	15	23	30	29	29
	Dillard HS								
3	Gulf Breeze HS	6:45-7:45 a.m. and 2:00-3:00 p.m.	30/U.S. 98	35	20	27	27	26	30
	Gulf Breeze MS								
4	Coral Shores HS	7:00-8:00 a.m. and 1:45-2:45 p.m.	U.S. 1	45	30	40	26	37	30
	Plantation Key ES								
5	King HS	6:30-7:30 a.m. and 2:15-3:15 p.m.	563	45	–	37	41	39	41
6	Golfview ES	7:15-8:15 a.m. and 2;00-3:00 p.m.	519	40	25	29	23	32	26
	Hans Christian Andersen ES								
	Kennedy MS								
7	North Miami HS	7:30-8:30 a.m. and 2:30-3:30 p.m.	915	40	15	16	17	16	17
	Arch Creek ES								
	North Miami MS								
8	W.C. Pryor MS	7:00-8:00 a.m. and 2:00-3:00 p.m.	168	40	20	20	20	19	19
	Choctawhatchee HS								
9	Palm Valley ES	7:45-8:45 a.m. and 2:30-3:30 p.m.	A1A	45	–	31	28	36	36
10	Orange Ridge ES	7:45-8:45 a.m. and 2:30-3:30 p.m.	U.S. 41	45	–	36	38	31	37
11	Leesburg ES	7:45-8:45 a.m. and 2:45-3:45 p.m.	44	40	20	20	21	26	27
	Oak Park MS								
12	Morningside ES	7:45-8:45 a.m. and 2:30-3:30 p.m.	716	45	–	32	40	36	41
13	Lake Region HS	6:15-7:15 a.m. and 2:30-3:30 p.m.	U.S. 17	45	–	36	43	39	41
14	Westwood MS	8:30-9:30 a.m. and 3:00-4:00 p.m.	121	35	20	20	24	19	22

Source: Kittelson and Associates, Inc./Cambridge Systematics, Inc.

The second highest volume was recorded at Site 12 (St. Lucie), which has a volume of approximately 0.9 million per year during school ingress and egress peak hours. This site does not have a school speed zone and was observed to have a low pedestrian crossing volume however a severe speeding problem (more than 50 percent of the vehicles speeding).

To calculate the annual traffic volume during school ingress and egress peak hours for the purposes of calculating crash rates, the approximate number days when schools are closed were calculated if the days fall into the following range:

- Weekends
- June and July: summer vacation
- Christmas Holidays: two weeks

Based on this assumption, the number of days that school open is estimated to be 208 days.

2007 yearly volumes were calculated based on the 2007 AADT, which was obtained from the 2007 Florida Traffic Information (FTI) CD.

Site 7 has the highest percentage (nine percent) compared to the other sites. This percentage indicates that nine percent of the vehicles traveling on SR 916 during school ingress and egress time were impacted by the reduced speed school zone annually.

Level of Service (LOS) Analysis

The purpose of capacity analysis is to identify the sites that have a failing LOS during school ingress and egress peak hours. The results of the analysis are presented in Table 4.4.

To determine the directional peak hour volume for LOS D and E for each state road, the Quality/Level of Service Handbook (FDOT 2007) was used as reference. For example, for SR 824 on Site 1, it is a state road with two-way traffic, has 4 lanes and its signal spacing at the section under study is 2 per mile. Referring to Table 4-7 in the Handbook, SR 824 is a Class II state road and the directional peak hour volume threshold for LOS D and E on SR 824 is 1,710 vph and 1,800 vph respectively.

From Table 4.3, the highest directional volume was selected from the school ingress and egress peak hour volumes. These peak hour volumes were used to compare with the LOS D and E volumes to identify any state road that has a failing LOS during school ingress and egress times. The result in Table 4.4 shows that the state road having the lowest LOS is U.S. 1 on Site 4, which has a peak hour volume of 781 vph, falling within a LOS D volume threshold of 860 vph. For the rest of the state roads, the LOS is well above LOS D.

Table 4.3 School Ingress and Egress Peak Hour Volume Analysis

Site	School Name	School Hour	School Ingress and Egress Time	Ingress (a.m.)		Egress (p.m.)		School Ingress/Egress Volume Yearly ((In/Out) PH x 208 days)	2007 Yearly Volume (365 days)	School Ingress/Egress Yearly Volume/2007 Yearly Volume
				School NB/EB Volume	School SB/WB Volumes	School NB/EB Volume	School SB/WB Volumes			
1	McNicol MS	7:15 a.m.-2:15 p.m.	6:30-7:30 a.m. and 1:45-2:45 p.m.	435	635	687	753	522,000	13,348,000	3.76%
	Hallandale HS	7:30 a.m.-2:35 p.m.								
2	Dillard ES	8:00 a.m.-2:00 p.m.	7:15-8:15 a.m. and 1:30-2:30 p.m.	1,104	798	920	992	793,000	18,734,000	4.06%
	Dillard HS	7:40 a.m.-2:40 p.m.								
3	Gulf Breeze HS	9:15 a.m.-3:51 p.m.	6:45-7:45 a.m. and 2:00-3:00 p.m.	1,041	1,494	1,431	1,328	1,101,000	1,916,000	5.44%
	Gulf Breeze MS	7:30 a.m. 2:25 p.m.								
4	Coral Shores HS	7:45 a.m.-2:30 p.m.	7:00-8:00 a.m. and 1:45-2:45 p.m.	557	740	781	649	567,000	6,694,000	7.81%
	Plantation Key (ES)	7:45 a.m.-2:15 p.m.								
5	King HS	7:20 a.m.-2:40 p.m.	6:30-7:30 a.m. and 2:15-3:15 p.m.	479	1,262	836	836	710,000	12,978,000	5.19%
6	Golfview ES	8:30 a.m.- 3:00 p.m.	7:15-8:15 a.m. and 2;00-3:00 p.m.	914	793	751	756	669,000	8,639,000	7.18%
	Hans Christian Andersen ES	8:00 a.m.- 2:30 p.m.								
	Kennedy MS	8:30/9:00 a.m.-4:00 p.m.								
7	North Miami SNR HS	7:30 a.m.- 2:30 p.m.	7:30-8:30 a.m. and 2:30-3:30 p.m.	935	1,019	1,080	1,081	856,000	8,999,000	8.69%
	Arch Creek ES	8:15 a.m.-3:00 p.m.*								
	North Miami MS	9:00 a.m.- 3:40 p.m.								
8	W.C. Pryor MS	7:45 a.m.- 2:20 p.m.	7:00-8:00 a.m. and 2:00-3:00 p.m.	856	810	981	1,052	769,000	9,998,000	7.15%
	Choctawhatchee SNR HS	7:00 a.m.- 2:00 p.m.								
9	Palm Valley ES	8:30 a.m.- 2:50 p.m.*	7:45-8:45 a.m. and 2:30-3:30 p.m.	680	850	883	1094	729,000	13,871,000	5.00%
10	Orange Ridge ES	8:30 a.m.-3:00 p.m.**	7:45-8:45 a.m. and 2:30-3:30 p.m.	867	948	870	886	743,000	12,397,000	5.65%
11	Leesburg ES	8:35 a.m.-3:05 p.m.*	7:45-8:45 a.m. and 2:45-3:45 p.m.	628	632	645	569	515,000	6,493,000	7.34%
	Oak Park MS	8:05 a.m.-3:58 p.m.*								
12	Morningside ES	8:30 a.m.- 3:00 p.m.	7:45-8:45 a.m. and 2:30-3:30 p.m.	1,302	548	1123	1273	883,000	15,542,000	5.38%
13	Lake Region HS	8:00 a.m.- 2:00 p.m.	6:15-7:15 a.m. and 2:30-3:30 p.m.	710	588	742	724	575,000	8,550,000	6.30%
14	Westwood MS	7:40 a.m.- 2:40 p.m.	8:30-9:30 a.m. and 3:00-4:00 p.m.	302	420	340	386	301,000	5,721,000	5.00%

Source: Kittelson and Associates, Inc./Cambridge Systematics, Inc.

* Schools with Wednesday early release (one hour before the normal release time).

* Schools with Wednesday early lease (two hours before the normal release time).

Table 4.4 Level of Service Analysis for State Road During School Ingress and Egress Peak Hour

Site	School Name	School Ingress and Egress Time	State Route	Though Lanes	Signal Spacing Class	Peak Hour – Peak Dir LOS D	Peak Hour – Peak Dir LOS E	Peak Directional Volume during School Hour
1	McNicol MS	6:30-7:30 a.m. and 1:45-2:45 p.m.	824	4	2	1,710	1,800	753
	Hallandale HS							
2	Dillard ES	7:15-8:15 a.m. and 1:30-2:30 p.m.	838	6	2	2,570	2,710	1,104
	Dillard HS							
3	Gulf Breeze HS	6:45-7:45 a.m. and 2:00-3:00 p.m.	30/U.S. 98	6	1	2,790	***	1,494
	Gulf Breeze MS							
4	Coral Shores HS	7:00-8:00 a.m. and 1:45-2:45 p.m.	US1	2	1	860	890	781
	Plantation Key (ES)							
5	King HS	6:30-7:30 a.m. and 2:15-3:15 p.m.	563	4	1	1,860	***	1,262
6	Golfview ES	7:15-8:15 a.m. and 2;00-3:00 p.m.	519	4	1	1,860	***	914
	Hans Christian Andersen ES							
	Kennedy MS							
7	North Miami SNR HS	7:30-8:30 a.m. and 2:30-3:30 p.m.	915	4	4U	1,501	1,577	1,081
	Arch Creek ES							
	North Miami MS							
8	W.C. Pryor MS	7:00-8:00 a.m. and 2:00-3:00 p.m.	168	4	2	1,710	1,800	1,052
	Choctawhatchee SNR HS							
9	Palm Valley ES	7:45-8:45 a.m. and 2:30-3:30 p.m.	A1A	4	2	1,710	1,800	1,094
10	Orange Ridge ES	7:45-8:45 a.m. and 2:30-3:30 p.m.	U.S. 41	6	1U	2,650.5	***	948
11	Leesburg ES	7:45-8:45 a.m. and 2:45-3:45 p.m.	44	4	1U	1,767	***	645
	Oak Park MS							
12	Morningside ES	7:45-8:45 a.m. and 2:30-3:30 p.m.	716	6	1	2,790	***	1,302
13	Lake Region HS	6:15-7:15 a.m. and 2:30-3:30 p.m.	U.S. 17	6	1	2,790	***	742
14	Westwood MS	8:30-9:30 a.m. and 3:00-4:00 p.m.	121	2	1	860	890	420

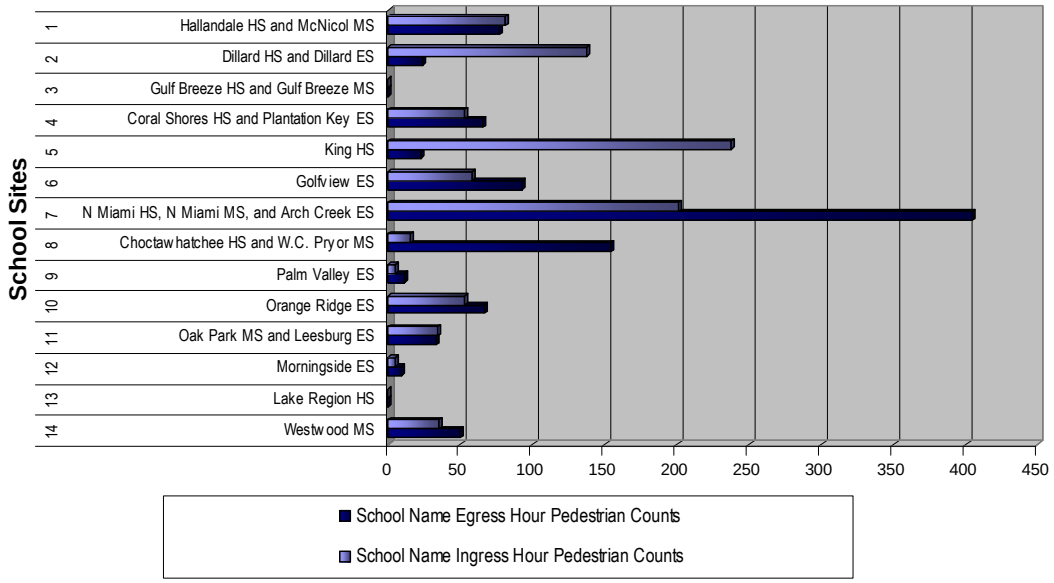
Source: Kittelson and Associates, Inc./Cambridge Systematics, Inc.

Pedestrian Volume Analysis

Pedestrian peak hour volumes were also determined during this study. The peak hour was defined using the same method as the determination of traffic peak hour. The purpose of the pedestrian volume analysis is to examine the relationship between the pedestrian volume and crash frequency/rate. The Result of the analysis is presented in Figure 4.2.

From the data collected, it appears that Site 7 in North Miami (SR 916) has the highest pedestrian peak hour volume – 201 pedestrians crossing during ingress peak hour and 404 pedestrians crossing during egress peak hour. The second highest pedestrian volume occurred at Site 5 in Tampa, where 227 crossed SR 824 during the ingress peak hour.

Figure 4-2 School Site Pedestrian Counts



Crash Data Analysis

Crash analysis is used in this study to identify any sites that have had past pedestrian/bicycle crashes. The result of the analysis is presented in Table 4.5.

Before crash analysis, the crash records obtained from FDOT were screened to include only the crashes that occurred during the time when students were arriving at or leaving the school. Crash records were eliminated if they occurred during:

- Weekends
- June and July: summer vacation

- Christmas Holidays: two weeks
- More than 45 minutes before or more than 15 minutes after school opening
- More than 30 minutes before or more than 30 minutes after school closing

Location-wise, the crash data were eliminated if the crash happened more than 500 feet (0.1 mile) away from either side of the school crossing area. GIS software was used during the process of preliminary elimination of crashes outside the school crossing area. The hard copies of remaining crash records were obtained and checked to verify that the crash should be included in the analysis.

After the crash records were screened, they were then categorized into pedestrian/bicycle crashes, rear-end crashes, and all types of crashes. Calculation of the crash rate was based on the number of crashes divided by the vehicles passing through the intersection annually on the state roadway given in millions. For peak school hours, the number of vehicles was based on the counted vehicles in both directions multiplied by 208 days. For annual volume data, the number of vehicles was obtained from FDOT FTI CD for 2007.

Based on the crash analysis, the school site with the highest pedestrian/bicycle crash rate is Site 4, which had two crash records for the between 2005 and 2007 resulting in a crash rate of 3.53. Site 1 has the highest rear-end crash rate of 9.58 between 2005 and 2007. Both Site 1 and Site 4 have school speed reduction zones.

The result from crash analysis, together with the result from the speed analysis and pedestrian counts, indicated neither clear relationship between school speeding and crash rates, nor significant relationship between pedestrian or bicycle counts and crash rates. In fact, overall results indicated sites with no school speed zone had lower crash rates than those with speed zones. However, 14 schools sites out of 8,000 schools are not a good sample size to draw a statistical conclusion.

5.0 Findings and Recommendations

5.1 CURRENT GUIDANCE

Current FDOT guidance on establishing reduced speed school zones and school crossings is provided by FDOT's Establishing School Zones and School Crossings Topic No. 750-010-027. As stated in the procedure, only elementary and middle schools are eligible for the markings, signs or other traffic control devices associated with a reduced speed school zone. Where a signalized school crossing is provided, such a reduced speed zone may be justified by an engineering study.

When special circumstances occur at a high school site, an engineering study may be used to justify a reduced speed zone on a case-by-case basis. Such a study shall demonstrate that installation of a reduced speed school zone would enhance safety for pedestrians, bicyclists, and motorists.

5.2 SUMMARY OF FINDINGS

Based on the findings from work completed to date, which has included a literature review, a survey of national traffic safety professionals, and analysis of conditions at 14 school sites throughout Florida, there is no clear evidence to indicate the FDOT should consider modifying its current procedure regarding the application of a reduced speed zone at a high school served by a traffic signal.

5.3 LITERATURE REVIEW AND WEB SURVEY

An extensive national and international literature survey returned relatively little guidance on the subject of reduced speed school zone and school crossing treatments for high schools located on state highways. However, three western states – Arizona, Idaho, and Oregon – have guidance or policies similar to Florida's in that they generally do not provide reduced speed zones for high schools.

A web survey was developed to further research policy or guidance not uncovered in the literature review. The survey was emailed to 380 traffic engineering and safety professionals throughout Florida and the nation. Through this survey, feedback was received from 20 states. Of these, four states (Kansas, Massachusetts, North Carolina and Washington) have policies stating school speed zones are not used where a signalized pedestrian crossing is

provided and Massachusetts policy also provides reduced speed limits only for elementary and middle schools. Respondents from New York and Texas indicated similar guidance from their states, although no policy was referenced. Only Mississippi has a policy specifically indicating reduced speed zones can be established around a traffic signal.

Within Florida, five counties reported local policies relating to school crossings treatment. Broward and Hillsborough counties both have policies to provide reduced speed zones on county roadways for all schools. Three others – Orange, Osceola, and Seminole – indicated they typically do not provide a reduced speed zone if a signalized pedestrian crossing exists to serve the school.

5.4 SCHOOL SITES EVALUATION

Survey respondents provided details for 112 sites located throughout Florida where schools on or near state highways are served by a speed zone or traffic signal, or both. A qualitative ranking was established to compare these sites based on characteristics including number of lanes, speed, volume, proximity to state highway etc. Ultimately 14 sites were selected across the state for further detailed study.

Benefit of Crossing Guards

Perhaps the clearest observation from the site visits and data analysis conducted for the 14 school sites throughout Florida was the great beneficial value of school crossing guards.

Figure 5-1 - Crossing Guard

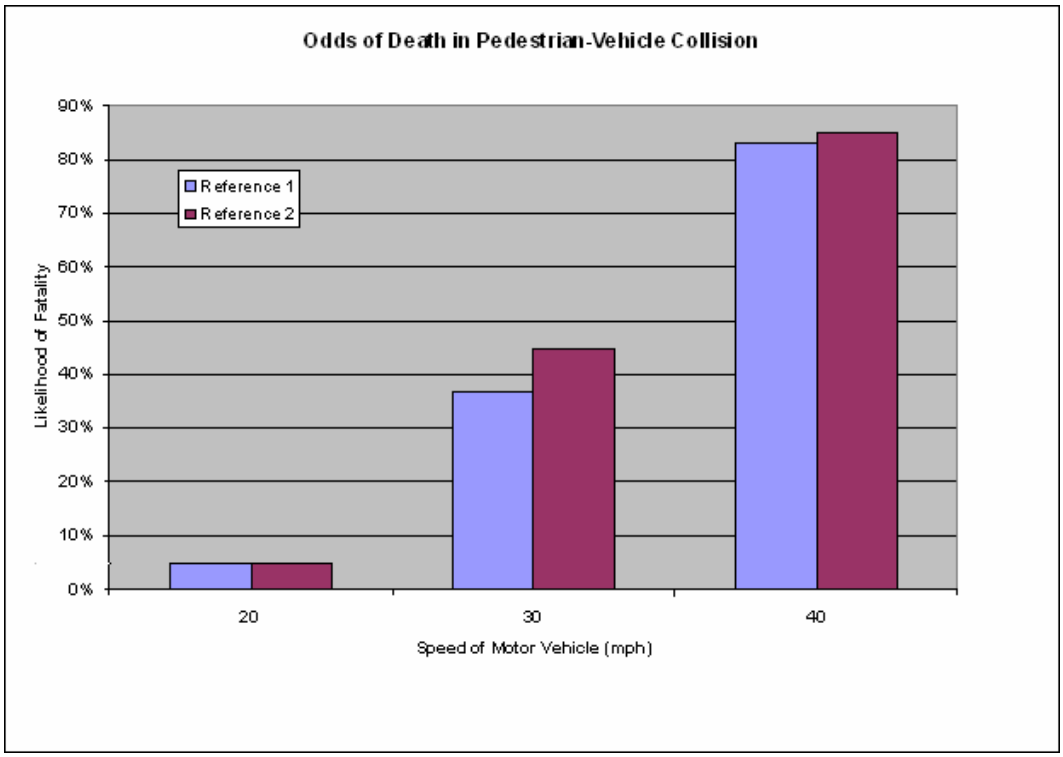
An analysis of three years of crash data (2005 to 2007) indicated a very small number of pedestrian and bicycle crashes, with no fatalities reported. A total of four crashes involved school students at all 14 schools. Among these four students was a special needs student hit at Site 5 (King High School). Another pedestrian crash at Site 8 involved a crossing guard. The students involved were all 15 years old or older. Given the number of students attending these schools and the volumes of traffic on the state highways, this would appear to indicate safe conditions at most schools.

Benefit of Reduced Speed Zones

All the crossing guards interviewed indicated their belief that a reduced speed zone enhances safety at their crossing location. Most obviously, reduced speeds

increase the reaction time available in the case of an incident. Several guards recounted experiences where children darted out into traffic unexpectedly, and the reaction provided by slower traffic speeds allowed them to protect the child. International research also clearly indicates the relationship between vehicle speed and severity of pedestrian crashes.

Figure 5-2 Pedestrian Crash Severity Relative to Travel Speed



1. U.K. Department of Transportation, *Killing Speed and Saving Lives*, London, 1987.

2. *Vehicle Speeds and the Incidence of Fatal Pedestrian Collisions* prepared by the Australian Federal Office of Road Safety, Report CR 146, October 1994, by McLean AJ, Anderson RW, Farmer MJB, Lee BH, Brooks CG.

High School Students

Another observation from the site evaluations was high school students repeatedly failing to adhere to crossing guard instructions and jaywalking across busy streets, whereas elementary and middle school children appeared much more prone to follow instructions and rules. Most jurisdictions in Florida do not provide crossing guards at high schools, so these observations were made at sites that also had an elementary or middle school nearby.

In most cases, it appeared that a reduced speed zone encouraged high school students to risk jaywalking and unsafe midblock crossing by providing the slower speed environment.

For this reason, the recommendation based on study findings is that the FDOT not consider modifying its procedure eligibility requirements for reduced speed school zones to include high schools unless justified by an engineering study.

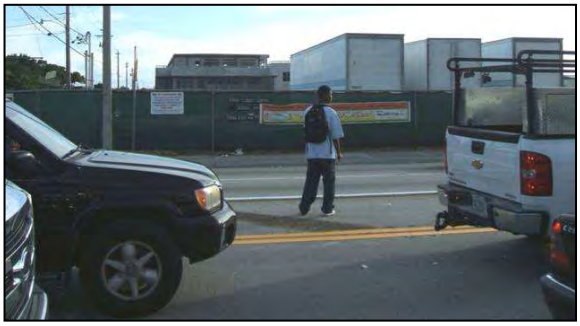


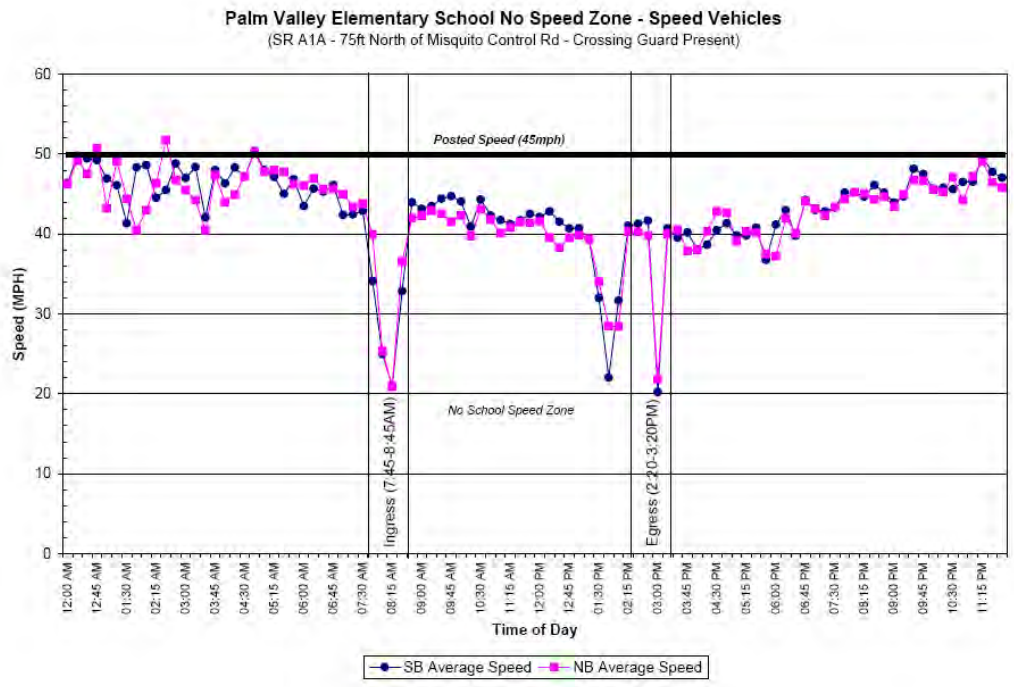
Figure 5-3 - Jaywalking

Speed and Safety at School Sites

Table 5.1 (provided at the end of this section) summarizes traffic speeds, pedestrian volumes, and three-year crash experience for the 14 study sites. The following findings can be drawn from an analysis of this data:

- A reduced speed zone did not correspond with a lower pedestrian/bicycle crash rate. Crashes were experienced at two sites (four pedestrians total of which one was a crossing guard) within speed zones and one (one pedestrian crash) with no zone.
- There is no apparent relationship between pedestrian/bicycle crash rates and the volume of pedestrians and bicyclists counted. Sites with high volumes (2, 7) experienced no crashes, while those experiencing crashes (4, 5, 8) had moderate volumes.
- Speeds were observed to drop at school sites with or without a speed zone, although the reduction was higher for reduced speed school zones.
- Miami-Dade and Broward counties are the only ones to standardize the reduced speed limit (15 mph).

Figure 5-4 Speed Throughout the Day



5.5 POSSIBLE PEDESTRIAN SAFETY TREATMENTS

Several possible safety treatments have the potential to enhance safety for pedestrians and bicyclists at school crossings. These treatments may preclude the need for further pursuit of a speed zone for a high school.

No Right-Turn-on-Red (RTOR). Engineering observation at the site may determine that restricting right-turn on red movements may enhance safety for school students at a school crossing. Example signs are shown below, including an illuminated/blankout sign which can be programmed to illuminate only during school ingress and egress times.

Figure 5-5 - Possible Safety Treatments

R10-11

Blankout Sign

Pedestrian Lead-Phase. Several agencies around the country, including Pennsylvania DOT, have implemented a variety of low cost pedestrian safety treatments including time extensions for pedestrians at signalized intersections to give pedestrians a three-second head start when crossing. This "lead phase" for pedestrians allows them to walk into the intersection before the green phase for the parallel vehicle approach, to allow better visibility of the pedestrians.

All-Red Pedestrian Phase. Many agencies in the U.S. and abroad have implemented all-pedestrian phases at intersections with high crossing volumes. This allows all pedestrian movements to take place at once while a red signal is presented to all traffic approaches. This treatment was observed at the North Miami Senior High School site on NE 135th Street at NE 9th Avenue and appeared to work very effectively, providing safe crossing opportunities at this location which has no crossing guard.

Figure 5-6 - All-Red Pedestrian Phase

5.6 SPECIAL CONDITIONS FOR HIGH SCHOOLS

Based on the analysis of traffic, geometric and safety conditions at the 14 sites in this study, a number of conditions have emerged that appear to provide justification for the implementation of a reduced speed zone for a high school pedestrian crossing on a state highway. These conditions include:

- Crash experience
- Pedestrian crossing volume
- Sight distance
- Traffic speed

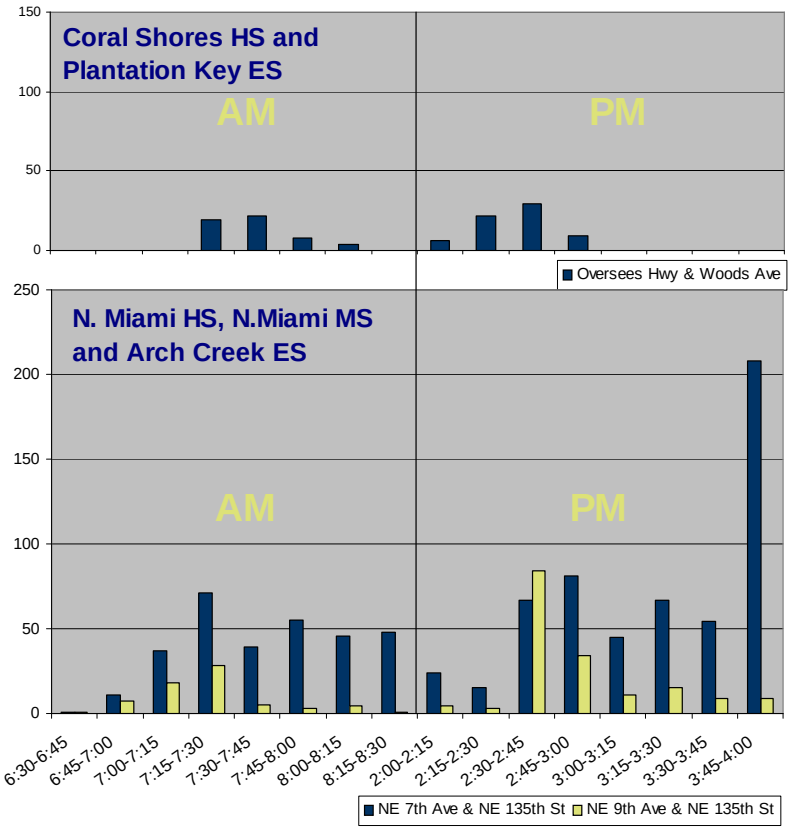
Crash Experience

The clearest justification for a speed zone treatment at a high school may be provided by repeated crash experience. Fortunately, Florida has very few examples of this in recent years. It should be noted though, that severe crashes involving pedestrians tend to be random events, and despite the trauma caused to those involved, one such crash should not generally be used to justify a reduced speed zone.

Pedestrian Crossing Volume

Although the analysis of crash records (Table 5.1) indicated no relationship between pedestrian or bicycle counts and crash rates, it is clear that exposure of these modes to traffic can be expected to be correlated with crashes. While our observations included seeing dozens of students crossing a state highway unaided and with no apparent safety concerns, common sense would seem to indicate that high crossing volumes could be used to justify a reduced speed school zone.

A review of warrants or guides around the country has not identified any widely accepted threshold for pedestrian crossing volumes, but the number of 20 crossing pedestrians per hour for both school opening and closing has appeared in a number of references. This volume matches that currently recommended in the mid-block crossing guidelines for FDOT. Further review is being conducted to validate this number.



Pedestrian Crossing Distance

Large crossing distances from wide road cross sections result in increased exposure to the pedestrian. It is recommended that an uninterrupted crossing distance that exceeds five lanes or 60 feet should qualify a site for a reduced speed zone.

Sight-Distance

Unsafe sight distances due to horizontal or vertical curvature, signs, structures, or other obstructions clearly present a case to consider a reduced speed zone treatment at a high school location.

Traffic Speed

Traffic speeds pose the greatest danger to crossing students. It is recommended that any arterial with a posted speed of 55 mph or higher should qualify for a speed zone. The same would apply to an arterial for which the 85th percentile speed measured outside of school opening and closing times meets or exceeds 55 mph.

Unsafe traffic speeds such as those observed at one school site resulting from a freeway off ramp and an overpass gradient present another example of a case where a reduced speed zone could be justified at a high school.

Table 5.1 Speed, Pedestrian Volume and Crash Rate Relationship

With Speed Zone																	
Site No.	School Name	State Road	Posted Speed MPH	Reduced Speed MPH	Ave. Speed				Observed Reduction				Ped Counts		Ped/Bike Crashes	Ped/Bike Crash Rate	Rear End Crash Rate	Total Crash Rate
					Ingress Hour		Egress Hour		Ingress Hour		Egress Hour		Ingress Hr	Egress Hr				
					NB/EB	SB/WB	NB/EB	SB/WB	NB/EB	SB/WB	NB/EB	SB/WB	Total	Total				
4	Coral Shores HS and Plantation Key ES	US1	45	30	40	26	37	30	5	19	8	15	53	66	2	3.53	7.05	14.10
2	Dillard HS and Dillard ES	838	45	15	23	30	29	29	22	15	16	16	138	24	0	0.00	6.30	16.39
6	Golfview ES	519	40	25	29	23	32	26	11	17	8	14	58	93	0	0.00	4.49	13.46
8	Choctawhatchee HS and W.C. Pryor MS	168	40	20	20	20	19	19	20	20	21	21	16	154	2	2.60	1.30	9.10
11	Oak Park MS and Leesburg ES	44	40	20	20	21	26	27	20	19	14	13	34	33	0	0.00	0.00	1.94
7	North Miami HS, North Miami MS, and Arch Creek ES	915	40	15	16	17	16	17	24	23	24	23	201	404	0	0.00	4.67	15.19
14	Westwood MS	121	35	20	20	24	19	22	15	11	16	13	35	50	0	0.00	3.32	6.64
3	Gulf Breeze HS and Gulf Breeze MS	30/US98	35	20	27	27	26	30	8	8	9	5	0	0	0	0.00	0.00	2.72
1	Hallandale HS and McNicol MS	824	35	15	17	18	19	19	18	17	16	16	81	77	0	0.00	9.58	13.41
								All	16						0.44	0.68	4.08	10.33
								15mph	19									

Without Speed Zone																	
Site No.	School Name	State Road	Posted Speed MPH	Reduced Speed MPH	Ave. Speed				Observed Reduction				Ped Counts		Ped/Bike Crashes	Ped/Bike Crash Rate	Rear End Crash Rate	Total Crash Rate
					Ingress Hour		Egress Hour		Ingress Hour		Egress Hour		Ingress Hr	Egress Hr				
					NB/EB	SB/WB	NB/EB	SB/WB	NB/EB	SB/WB	NB/EB	SB/WB	Total	Total				
5	King HS	563	45	45	37	41	39	41	8	4	6	4	237	23	1	1.41	4.23	14.09
9	Palm Valley ES	A1A	45	45	31	28	36	36	14	17	9	9	5	11	0	0.00	1.37	4.11
10	Orange Ridge ES	US 41	45	45	36	38	31	37	9	7	14	8	53	67	0	0.00	4.04	13.46
12	Morningside ES	716	45	45	32	40	36	41	13	5	9	4	5	9	0	0.00	4.53	7.93
13	Lake Region HS	US17	45	45	36	43	39	41	9	2	6	4	0	0	0	0.00	1.74	1.74
									8						0.20	0.28	3.18	8.27

* Site 6 Has Advisory Speed Reduction signs that are not enforsable. A police officer is frequently present during ingress and egress hours.