Driver Alert System – Evaluation Project

Final Report

Presented
To the

Transportation & Infrastructure Committee

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Executive Summary

Circumstances requiring school buses to stop create a high-risk environment for schoolchildren, school buses, and motorists approaching stopping or stopped school buses. Daily 75,966 pass-bys occur nationally while 1,031 pass-bys occur every day in Michigan. In fifty percent of school bus crashes, the vehicles approached a school bus from the rear. It is apparent that many motorists are confused by the school bus's eight-light system. The most common hazardous action on the part of the *"other"* driver in a school bus crash is *unable to stop in the assured clear distance*. This was illustrated when a teenage brother and sister were fatally injured when they crashed into the back of a stopped school bus. Steps were taken to reduce the risk of motorists crashing into stopped school buses. Representative Holly Hughes introduced **HB-4046** requiring installing a driver alert lighting system on the back of all school buses. The Michigan Association of Pupil Transportation (MAPT) commissioned a study to determine the efficacy of the Model 7500 Driver Alert System (DAS) to reduce pass-bys of stopping or stopped school buses. Forty school bus drivers from ten districts throughout Michigan collected motorists' pass-by data pre- and post-installation of the DAS. Under all environmental and operating conditions studied, there were reductions in motorists' pass-bys pre- to post-DAS installation. In four conditions, Time of Day AM, Passing from Rear, Two (2) Lane Roadway all Speed Limits, and Three (3) or more Lanes Roadway with Speed Limits Greater than 45 mph, pass-by reductions were substantial enough to indicate the DAS changed motorists' actions approaching stopping or stopped school buses.

A school bus stop loading and unloading site is a high-risk environment. School bus drivers' surveys[1] indicated that ***78,518*** pass-bys happen nationally and in Michigan ***1,031*** vehicles, pass-by stopped school buses ***every day***. During a 175-day school year, that represents ***13.7 million*** national and ***180,425*** Michigan pass-bys. A study by the Michigan State Police[2] indicated in 50% of school bus crashes a motor vehicle approached from the bus's rear. A pass-by happens when an approaching motorist does not stop for a stopped school bus exhibiting its overhead alternately flashing red lights. In the same study by the Michigan State Police, 12.8%[3] of school bus crashes occur at a bus stop. Everywhere in the United States, a school bus exhibiting its overhead alternately flashing red lights requires approaching motorists to stop until a school bus driver deactivates those lights.

Three reasons account for motorists pass-bys. ***Ignorance*** – motorists indicate they do not know the school bus stop law. ***Distraction*** – motorists tell police "they did not see the school bus." ***"The most common hazardous action on the part of the 'other' driver in a school bus crash … is 'Unable to stop in the assured clear distance …"***[4] ***Design*** – School bus signaling system design and placement is not consistent with motorists information processing. Red and amber signaling lights can be as high as nine (9) feet off the ground. This is way above a motorist's line-of-sight. School buses are using 20th century analog technology to communicate with motorists processing 21st century digital information.

In 2012, there was a tragic illustration of the danger around a school bus stop. A teenage brother and sister were fatally injured when the car the brother was driving inexplicably crashed into the back of a stopped school bus. **(See Exhibit 1)** ***"On average, less than 5% of school bus crashes result in injuries to occupants of the school bus."***[5] The devastated parents and grandparents did not want this experience to befall another family. They solicited the assistance of Representative Holley Hughes, R Montague. What to do and where to go for help confronted Representative Hughes. Enter the Michigan Association for Pupil Transportation.

Exhibit 1

Paul Wegmeyer, MAPT Legislation Committee Chairperson, convened several meetings with the Michigan Departments of Education and State Police, transportation supervisors, and vendors to explore options and possible solutions. Two actions were taken to tackle the pass-by problem. First, Representative Hughes sponsored **HB-4046**. **(See Appendix A)** The bill requires

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[1] National Association of State Directors of Pupil Transportation Services, 2015 Survey on Illegal Passing of School Buses – Summary of Results, www.nasdpts.org

[2] ***"School Bus Crashes in Michigan"***, Sergeant Steven J. Spink, Michigan Department of State Police, Traffic Services Section, Field Support Unit, p13, April 2006, www.michigan.gov/documents/SCHOOL_BUS_CRASHES_IN_MICHIGAN_final_forpub_156865_7.pdf

[3] Ibid, page 11.

[4] Ibid, page 19

[5] Ibid, page 16

enhanced lighting on the back of new school bus purchases. Second, MAPT sponsored a Driver Alert System – Evaluation Project (DAS-EP). The project would test the efficacy of a lighting system to reduce the number of school bus pass-bys by communicating to motorists approaching stopping or stopped school buses ***what*** to do, ***when*** to do it, and **why** do it. While **HB-4046** worked its way through the Legislature, MAPT developed and field-tested the DAS-EP.

> *"**Conspicuity Issues***
> *Nearly 13% of all school bus related crashes occur at a school bus stop. An additional 2.5% of school bus related crashes occur at highway/rail crossings.*
> *The school bus is stopping ON the roadway in a place where other drivers do not expect it to stop.*
> *It is apparent that many motorists are confused when it comes to the eight-light system.*
> *The other factor that must be considered is the number of crashes occurring at highway/rail crossings.*
> ***Recommendation #2***
> *Lighting on the rear of the school bus directly wired into the alternately flashing overhead lights that displays a message or signal consistent with the overhead light system.*
> *The purpose of this system would be to augment the overhead lighting system and warn drivers approaching from the rear that the school bus is stopped or about to stop."*[6]

The DAS-EP included ten (10) school bus fleets[7] and 40 school buses. The project's objective: A school bus enhanced lighting system reduces school bus pass-bys. The ten school bus fleets represent large, medium, and small, as well as urban, suburban, and rural school districts. School bus drivers collected pass-by data under four operating conditions: 1) Time of Day – AM, Mid-day, & PM; 2) Pass-by Direction – from front or rear of school bus; 3) Side of Bus pass-by – traffic or curb side; and 4) Roadway Design and Speed limit – 2 lanes all speed limits, 3 or more lanes speed limits equal to or less than 45 mph, and 3 or more lanes speed limits greater than 45 mph. **(See exhibits 2, 3, and 4)**

Exhibit 2

Exhibit 3

Exhibit 4

The project tests took place over five weeks during September and October 2015. During the first two weeks, school bus drivers collected pass-by data using the traditional eight-light system.

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[6] Ibid, page 36

[7] Participating School Bus Fleets: Dean Transportation-LSD, Forest Hills Public Schools, Mason Public Schools, Novi Community Schools, Ravenna Public Schools, Saginaw Township Community Schools, Traverse City Area Public Schools, Van Buren ISD, West Ottawa Public Schools, and Zeeland Public Schools

During week three, fleets installed and tested the Model 7500 Driver Alert Device[8]. **(See Exhibit 5)** During weeks four and five, the same school bus drivers operating on the same routes, collected pass-by data when using the eight-light system in combination with the Driver Alert System. Project data summaries, conclusions, and recommendations are listed below.

Exhibit 5: Model 7500 Driver Alert Device

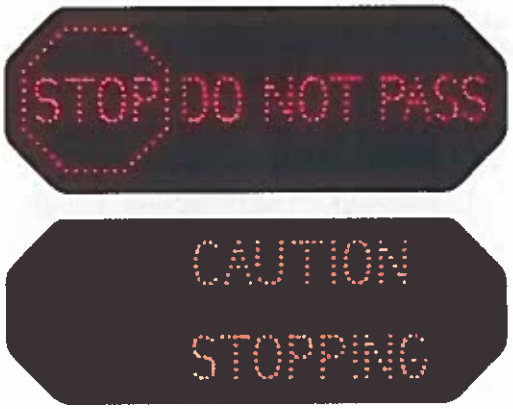
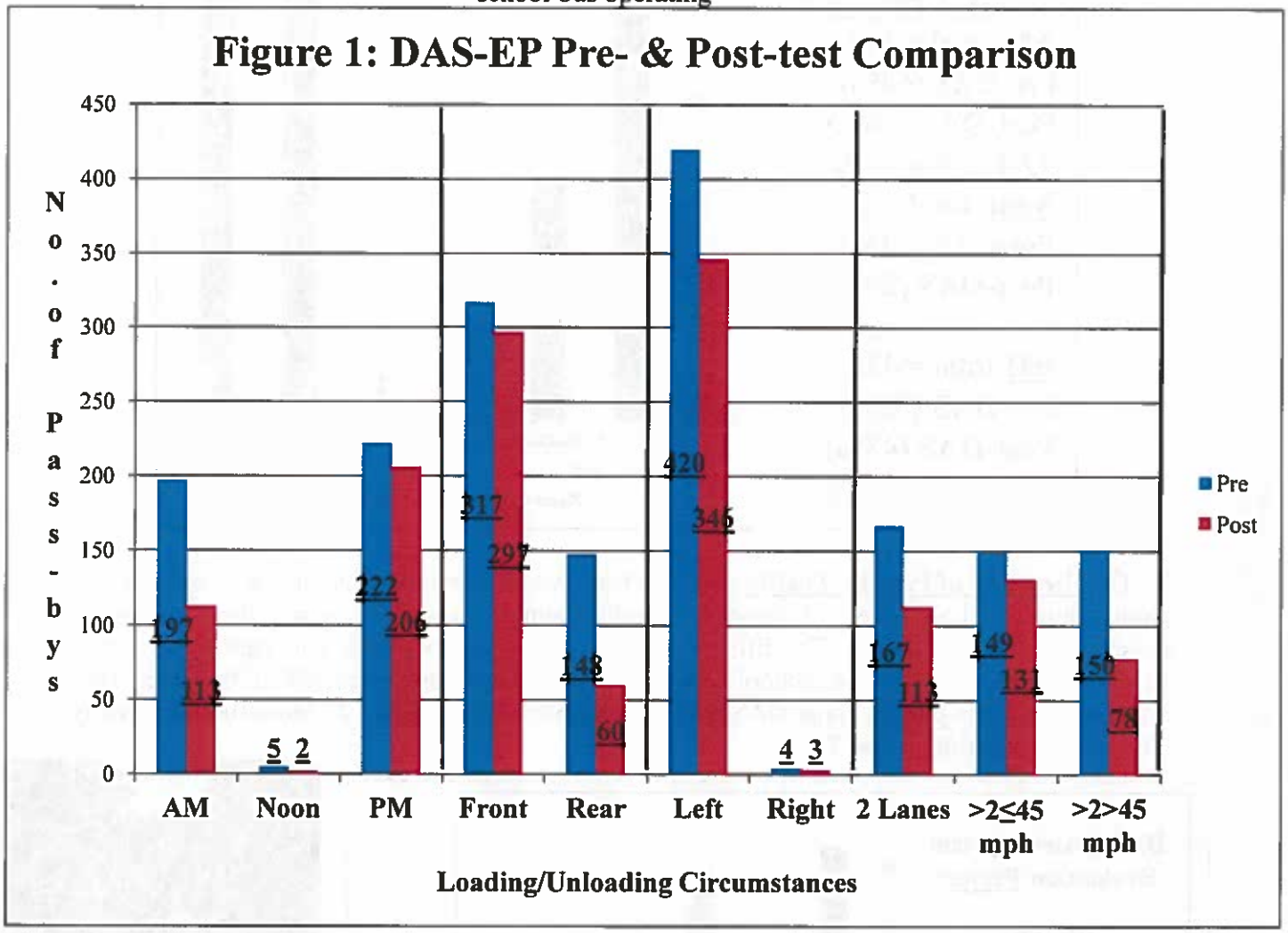


Exhibit 5: Model 7500 Driver Alert Device

[8] Safe Fleet, Products: Warning Lights, Model 7500 Driver Alert Device, http://www.safefleetsolutions.com/products

Data

Figure 1 is a summary of school bus driver collected pre-DAS and post-DAS data across all four school bus operating



1. The **Time of Day** operating condition data resulted in the following outcomes. The morning (**AM**) condition showed a 43% reduction in motorists' pass-bys after installing and using the DAS. The **Noon** condition resulted in a 60% reduction in motorists' pass-bys after installing and using the DAS. The number of data points, 7-total, were too few to allow an appropriate evaluation. It is an indication of the substantial reduction in noon routes across Michigan. The (**PM**) condition showed a 7% reduction in motorists' pass-bys after installing and using the DAS. **(See Figure 1: Time of Day School Bus Pass-bys)**

Driver Alert System Evaluation Project

ToD Pass-bys

AM total = 310
Pre-DAS (64%)
Post-DAS (36%)
43% Δ Pre to Post

Noon total = 7
Pre-DAS (71%)
Post-DAS (29%)
60% Δ Pre to Post

PM total = 428
Pre-DAS (52%)
Post-DAS (48%)
7% Δ Pre to Post

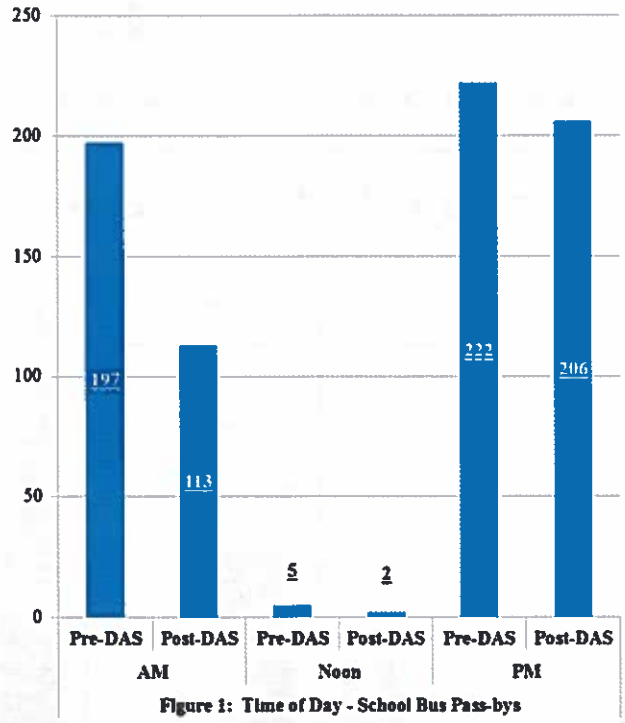


Figure 1: Time of Day - School Bus Pass-bys

2. The **Direction of Pass-by Traffic** indicates from which direction, front or rear, motorists passed stopped school buses. Motorists approaching stopped school buses from the front passed those buses 75% of the time. The difference between pre- and post-DAS front pass-bys was 6%. Motorists approaching stopped school buses from rear passed those buses 25% of the time. The difference between pre- and post-DAS pass-bys was 59%. **(See Figure 2: Direction of Pass-by Traffic and Exhibits 6 and 7)**

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DiroPby

Front total = 614
(75%)
Pre-DAS (52%)
Post-DAS (48%)
6% Δ Pre to Post

Rear total = 208
(25%)
Pre-DAS (71%)
Post-DAS (29%)
59% Δ Pre to Post

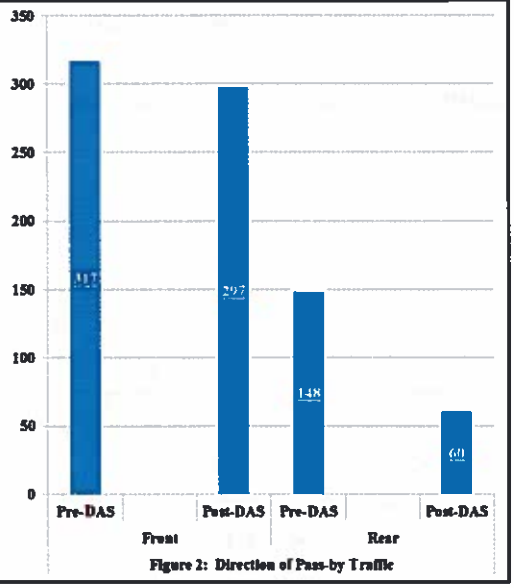

Figure 2: Direction of Pass-by Traffic

Exhibits 6 and 7

3. The **Side of School Bus Pass-by** indicated on which side of the school bus, traffic or curbside, motorists passed stopped school buses. Motorists passed stopped school buses 99% of the time on the traffic side of the bus. At only 1%, curbside pass-bys illustrates a motorist's panic (survival) response to losing vehicle control or a complete disregard for the welfare of children boarding or getting off a school bus. Neither the traffic side nor curbside post-DAS reductions were substantially different from the pre-DAS data. **(See Figure 3: Side of School Bus Pass-by)**

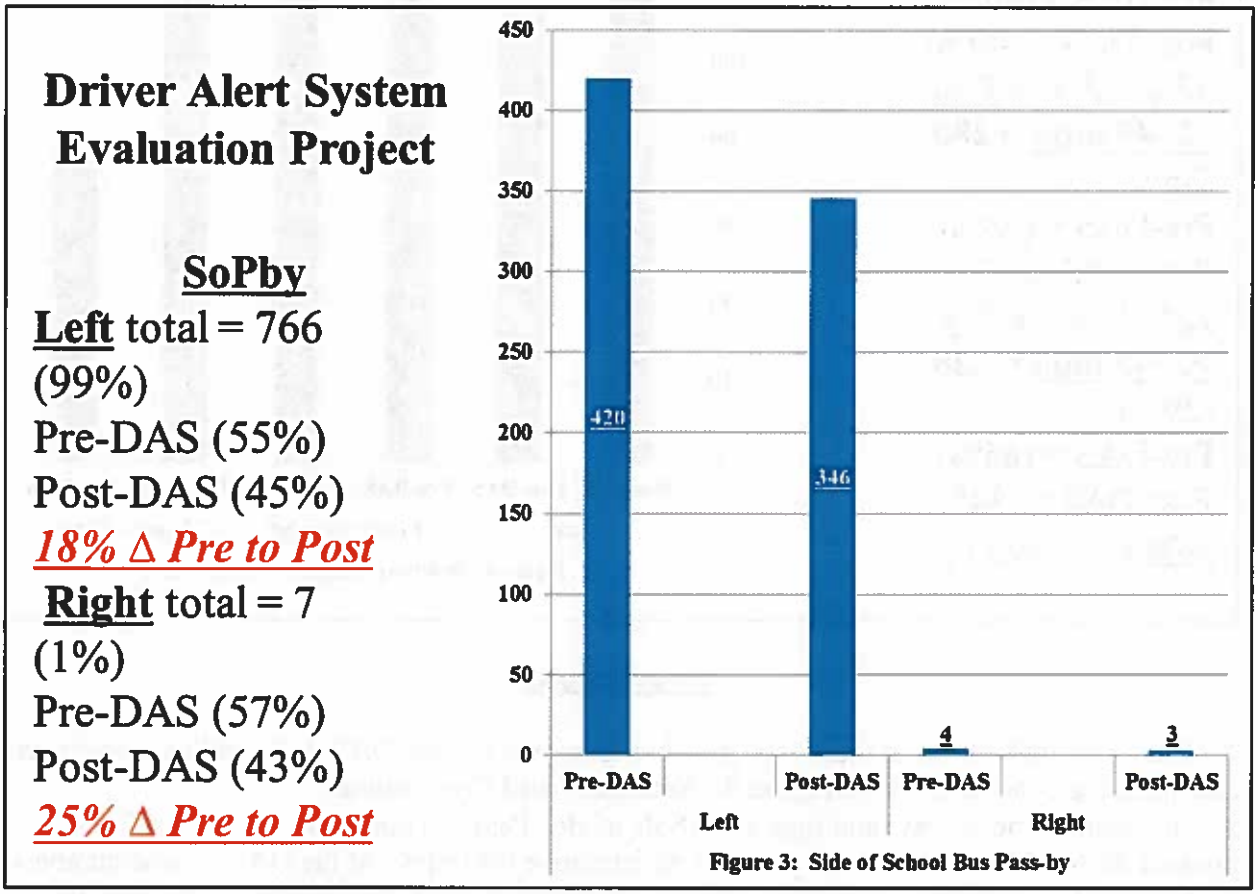

Figure 3: Side of School Bus Pass-by

4. **Roadway Design and Speed Limit** – 2 lanes all speed limits, ≥3 lanes and ≤45 mph, and ≥3 lanes and >45 mph – looked at the influence of roadway environment on motorists' pass-bys. The 2 lane all speeds condition produced a 32% reduction in pass-bys from pre- to post-DAS. The ≥3 lanes and ≤45 mph condition produced only a 12% reduction in pass-bys from pre- to post-DAS. The ≥3 lanes and >45 mph condition produced a 48% reduction in pass-bys from pre- to post-DAS. **(See Figure 4: Roadway Design and Speed Limit)**

Driver Alert System Evaluation Project

Rdwy Ds&Sl

2 Lane = 280
(36%)
Pre-DAS = (60%)
Post-DAS = (40%)
32% Δ Pre to Post

>2≤45 mph = 280
(36%)
Pre-DAS = (53%)
Post-DAS=(47%)
12% Δ Pre to Post

>2>45 mph = 228
(29%)
Pre-DAS = (66%)
Post-DAS = (34%)
48% Δ Pre to Post

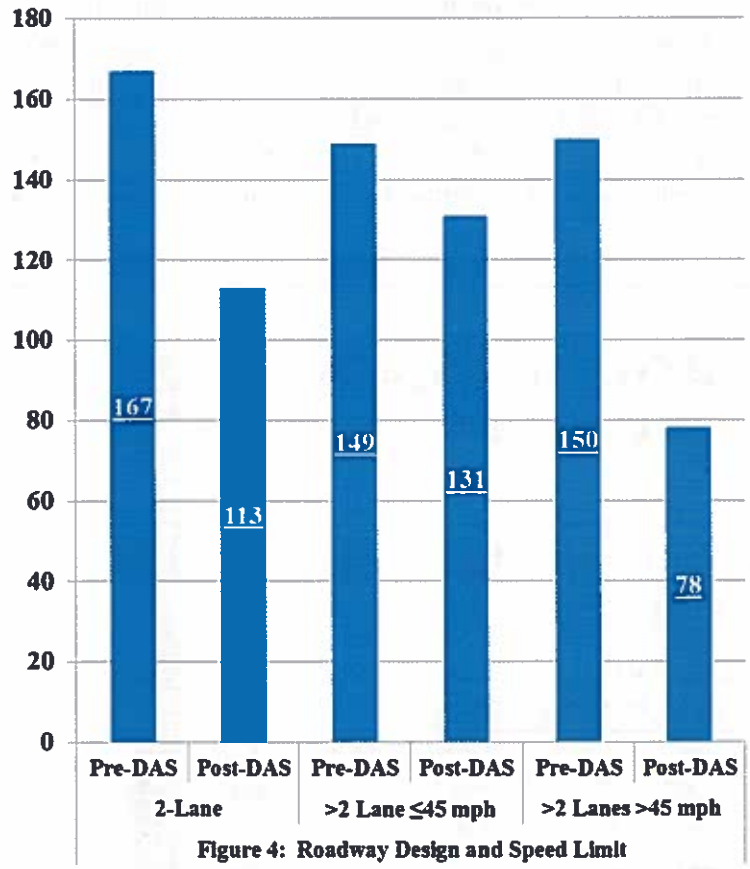

Figure 4: Roadway Design and Speed Limit

Conclusions

1. There were reductions in motorists' pass-bys from pre- to post-DAS during all environmental and operating conditions. **(See Figure 5: Summary and Conclusions)**
2. The noon (Time of Day) and right side (Side of Bus Pass-by) operating conditions did not produce the sufficient numbers of pass-bys to determine the impact of the DAS. These numbers are the result of substantial reductions in noon kindergarten bus routes and the highly unusual nature of a right-side passing maneuver.
3. Time of Day (AM) post-DAS numbers indicated that the DAS had a direct and positive impact upon reducing motorists' pass-bys of stopped school buses.
4. Time of Day (PM) post-DAS numbers indicated that the DAS had no impact upon reducing the number of motorists' school bus pass-bys.
5. The Direction of Pass-by Traffic overwhelmingly indicated that motorists pass stopped school buses while approaching from the front. School buses were not equipped with forward facing DAS.
6. Post-DAS data indicated that the DAS directly and positively reduced the number of pass-bys when motorists approached school buses from the rear.
7. Anecdotal information from project school bus drivers indicated that the DAS has a "calming" effect on motorists approaching a stopped school bus from both front and rear.

8. Data from Side of the School Bus Pass-by operating condition did not indicate a substantial difference between pre- and post-DAS pass-bys.
9. Roadway design and speed limit data from the **2 lane all speed limits** operating condition indicated a direct and positive reduction in motorists' pass-bys from pre- to post-DAS.
10. Roadway design and speed limit data from the **≥3 lanes and ≤45 mph speed limits** operating condition indicated no substantial change in motorists' pass-bys from pre- to post-DAS.
11. Roadway design and speed limit data from the **≥3 lanes and >45 mph speed limits** operating condition indicated a direct and positive reduction in motorists' pass-bys from pre- to post-DAS. **(See Figure 5: Summary and Conclusions)**

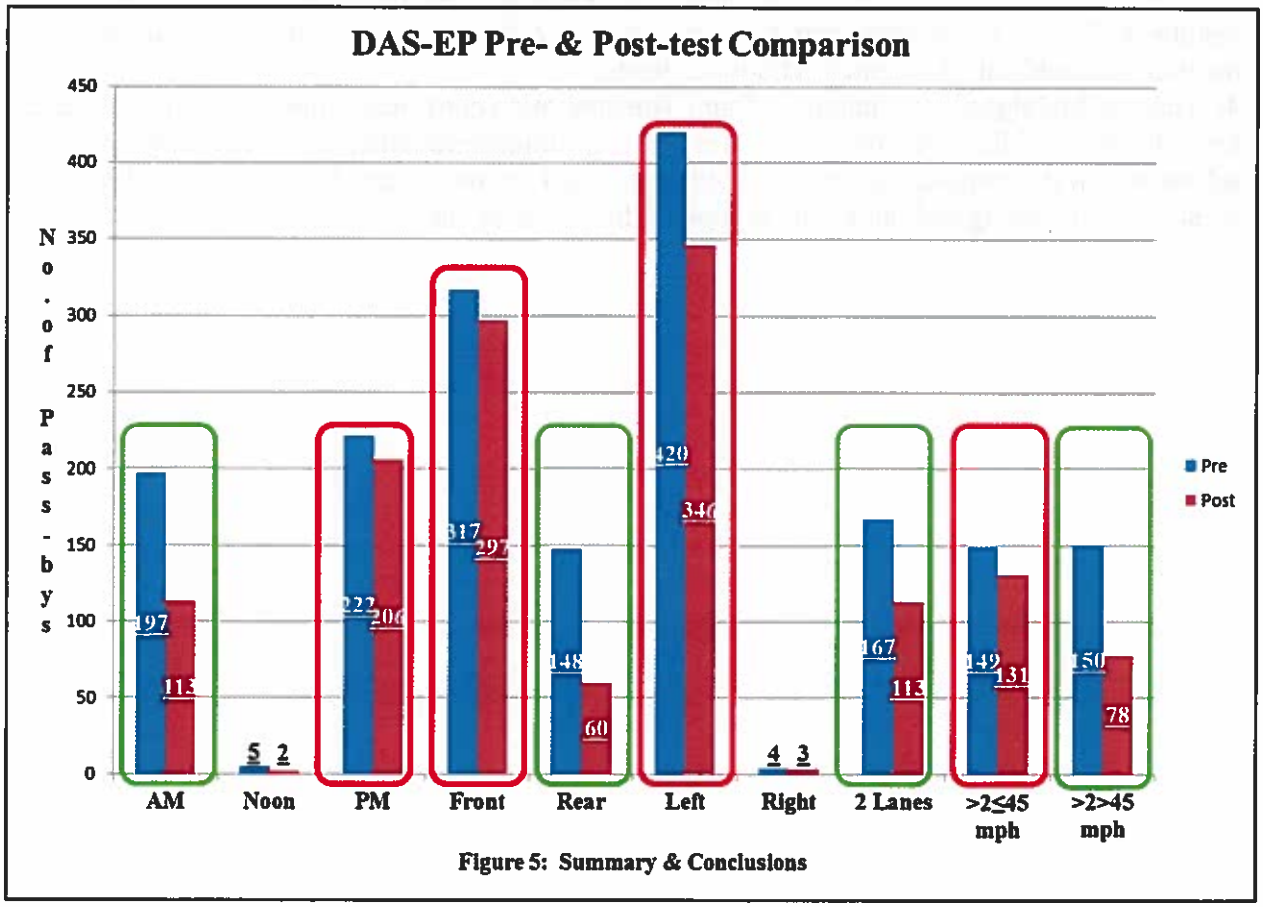

Figure 5: Summary & Conclusions

Recommendations

1. That the Michigan Association for Pupil Transportation work with Representative Hughes to revise HB-4046 to specifically describe an enhanced lighting system that communicates to motorists **what** to do, **when** to do it, and **why** do it when approaching a stopping or stopped school bus.
2. That the Michigan Association for Pupil Transportation works with the Michigan Departments of State Police to explore options to place driver alert system communication devices on the front of school buses.
3. That the Michigan Association for Pupil Transportation convenes a meeting of appropriate vendors to discuss the development and production of a driver alert communication device meeting the needs of Michigan's school bus fleets.
4. That the Michigan Association for Pupil Transportation convenes a meeting of the Michigan Departments of Education and State Police and pupil transportation supervisors to look into how school bus fleet administrators can best utilize all legal options when identifying school bus stop locations and loading and unloading schoolchildren at those sites.

Appendix A

HB-4046

Sponsor

Representative Holly Hughes

HOUSE BILL No. 4046

January 21, 2015, Introduced by Rep. Hughes and referred to the Committee on Transportation and Infrastructure.

A bill to amend 1990 PA 187, entitled

"The pupil transportation act,"

(MCL 257.1801 to 257.1877) by adding section 12.

THE PEOPLE OF THE STATE OF MICHIGAN ENACT:

SEC. 12. (1) THIS SECTION APPLIES TO SCHOOL BUSES MANUFACTURED AFTER THE EFFECTIVE DATE OF THE AMENDATORY ACT THAT ADDED THIS SECTION.

(2) A SCHOOL BUS SHALL BE EQUIPPED WITH ENHANCED REAR LIGHTING AT THE TOP AND BOTTOM OF THE REAR OF THE SCHOOL BUS THAT IS DESIGNED TO REDUCE THE NUMBER OF INJURIES AND FATALITIES RESULTING

FROM THE COLLISION OF MOTOR VEHICLES WITH THE REAR ENDS OF SCHOOL BUSES.

(3) THIS SECTION MAY BE REFERRED TO AS THE "PRIVACKY LAW".