SPEED VARIATION AND SAFETY IN WORK ZONES

Final Report

PROJECT SPR 822

RESEARCH

Oregon Department of Transportation

SPEED VARIATION AND SAFETY IN WORK ZONES

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by

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16. Abstract: In addition to lower speeds, the difference between vehicle speed and the average speed on the roadway has been identified as a factor in roadway crashes. For work zones, the potential for such speed variation from the average speed is magnified. The safety associated with speed variation in work zones affects both motorists driving through the work zone and the workers in the work zone. The overall goal of this research is to develop additional knowledge and practices that can be used to improve driver and worker safety in work zones and, as a result, mobility through work zones. The research focuses on high-speed roadways (e.g., highways and freeways) and typical mobile construction and maintenance operations that occur on such roadways (e.g., paving and re-striping). The research presented in this report involved a review of the archival literature germane to the topic of speed variation (with and without a work zone), the analysis results of speed variation and crash occurrence, and the impacts of selected traffic control interventions on speed variation in work zones in Oregon. The PCMS unit showing alternating messages "MAINTAIN CONSTANT SPEED" and "THRU WORK ZONE" in two phases and placed at the advance warning area was found to effectively reduce speed variation in the work zone. Based on the findings, the researchers recommend use of PCMS units that display custom messages to maintain constant speed for work zone operations on high-speed roadways.

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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	millimeters squared	mm^2
ft^2	square feet	0.093	meters squared	m^2
yd^2	square yards	0.836	meters squared	m^2
ac	acres	0.405	hectares	ha
mi^2	square miles	2.59	kilometers squared	km^2
		VOLUME		
fl oz	fluid ounces	29.57	milliliters	ml
gal	gallons	3.785	liters	L
ft^3	cubic feet	0.028	meters cubed	m^3
yd^3	cubic yards	0.765	meters cubed	m^3
		MASS		
oz	ounces	28.35	grams	g
lb	pounds	0.454	kilograms	kg
T	short tons (2000 lb)	0.907	megagrams	Mg
		TEMPERATURE (exact)		
°F	Fahrenheit	(F-32)/1.8	Celsius	°C

NOTE: Volumes greater than 1000 L shall be shown in m^3.

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	millimeters squared	0.0016	square inches	in^2
m^2	meters squared	10.764	square feet	ft^2
m^2	meters squared	1.196	square yards	yd^2
Ha	hectares	2.47	acres	ac
km^2	kilometers squared	0.386	square miles	mi^2
		VOLUME		
Ml	milliliters	0.034	fluid ounces	fl oz
L	liters	0.264	gallons	gal
m^3	meters cubed	35.315	cubic feet	ft^3
m^3	meters cubed	1.308	cubic yards	yd^3
		MASS		
G	grams	0.035	ounces	oz
Kg	kilograms	2.205	pounds	lb
Mg	megagrams	1.102	short tons (2000 lb)	T
		TEMPERATURE (exact)		
°C	Celsius	1.8C+32	Fahrenheit	°F

*SI is the symbol for the International System of Measurement

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DEDICATION

The research efforts and outcomes of this study are dedicated to those workers and motorists who have been injured or lost their lives in highway maintenance and construction work zones. Our work is dedicated to their lives and to preventing additional worker and motorist injuries and fatalities in the future.

DISCLAIMER

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EXECUTIVE SUMMARY

Roadway safety is a high priority. Past research conducted by ODOT and other agencies has focused on investigating ways to reduce vehicles speeds, as speed is one of the significant factors contributing to roadway crashes. Besides vehicle speed, another safety concern is speed differential among vehicles. Speed differential is often a contributing factor to roadway crashes, especially in work zones, where the speed limit may be considerably reduced from the normal speed limit and lane closures are implemented to accomodate construction needs.

The present study is designed to confirm the need to address vehicle speed variation in work zones, identify means to minimize speed variation, and recommend ways in which ODOT can minimize and mitigate the effects of speed variation. The overall goal of this investigation is to develop additional knowledge and practices that can be used to improve driver and worker safety in work zones and, as a result, mobility through work zones. The specific objectives for this research study are to:

1. Document the prevalence and magnitude of variation in vehicle speed from the average speed in work zones, and how this variation compares to variation in free flow conditions without a work zone present;

2. Determine work zone conditions and traffic control measures that can lead to greater variation in vehicle speed from the average speed;

3. Identify techniques within the traffic control plan and conduct of work operations for minimizing and mitigating variation in vehicle speed from the average speed in work zones;

4. Develop recommendations for both minimizing speed variation and mitigating the effects of speed variation in order to improve safety and mobility in work zones; and

5. Recommend a data collection plan for ODOT to study/monitor the speed variation in work zones and the corresponding impacts.

To achieve the research goal and meet the stated objectives, the study contains two overarching phases: Phase I to document and characterize speed variation in work zones and identify impacting factors, and Phase II to identify, develop, and communicate techniques that can be implemented by ODOT to minimize and mitigate speed variation to improve safety. Phase I is designed to address Objectives 1 and 2, and Phase II focuses on Objectives 3, 4, and 5.

In Phase I, a comprehensive review of literature on vehicle speed variation and crash risk on roadways, and the roadway features, traffic control measures, and work operations that potentially impact variation in vehicle speed in work zones was conducted. Moreover, this phase involves analysis of vehicle speed and crash databases to expose the extent to which vehicle speed varies on roadways, both with and without a work zone present, and the risk of crashes.

To investigate the prevalance and magnitude of variation in vehicle speed from the average speed in work zones, and how this variation compares to variation in free flow conditions without a work zone present, the study firstly utilized archived data collected from five past ODOT work zone projects (a total of 44 working days) to determine the relationships associated with speed variation prior to work zones and within the work zones. The speeds recorded at the road work ahead (RWA) sign location were viewed as representative speeds prior to the work zones. Two speed variation measurements, 5-min speed standard deviation (SD) and coefficient of variation (COV), at the locations prior to a work zone and within a work zone in the same 5-min window were compared. Additionally, existing Oregon roadway speed data at the locations of the selected case studies prior to and/or following the day/time when the work zone was present were solicited as representative vehicle speed without a work zone present. The speed variation assessments were conducted based on the comparisons of the condition before/after work zone operations relative to that during work zone operation in the same study periods.

The results of the study provide helpful insights into the prevalance and magnitude of speed variation in work zones on high-speed roadways. The extent of speed variation prevalance and magnitude of speed variation vary from one case study project to another depending on multiple factors including the methods used to calculate the speed variation (e.g., based on time mean speed or space mean speed, and based on across-lane speed or within-lane speed). Overall, the speed variation in a work zone was found to be generally greater than that prior to the work zone, and greater than that when the work zone was not present. The quantitative and descriptive analyses of the speed data using both archived data collected from the past ODOT work zone projects and roadway data without a work zone present from HERE Technologies reveal the following:

- With a work zone present, and for the past case study projects evaluated, between 10% and 28% of the examined work zone locations showed greater 5-min SD than that at the RWA sign location according to across-lane speed and within-lane speed at the same 5-min window. 5-min COVs showed more noticable speed variation difference than the 5-min SDs. Between 52% and 72% of the examined work zone locations showed greater 5-min COVs than at the RWA sign locations.

- With a work zone present, and for the past case study projects evaluated, between 30% and 62% of the examined days were associated with higher 5-min SD at one or more work zone locations than that at the RWA sign location in the same 5-min window. Additionally, the results from the analyses based on 5-min COV were more prominent. Between 77% and 95% of the days were associated with higher 5-min COVs at the work zone locations than at the RWA locations.

- Based on results from descriptive analyses of speed variations for the similar roadway segments with or without a work zone present, the average speed variations (5-min SD and COV) computed based on the data collected using portable traffic analyzers (sensors) from previous work zone projects were greater than those obtained using HERE Technologies when there was no work zone present. Even with the same data source (HERE), work zones were also associated with greater speed variations than at similar locations during normal (non-work zone) operations.

Due to limited availability of crash data on the investigated roadways with or without a work zone present, direct links could not be established between speed variation and the possibility of crash involvement. However, based on the findings from the analyses mentioned above, the speed variation was generally higher when there was a work zone present. With the increased risk associated with large variations in speed as described in the prior research, it is reasonable to assume that crash risk in work zones is high due to the prevalance of speed variation in work zones.

The outputs of Phase I were used to guide the direction and tasks of Phase II, which was planned to evaluate and develop potential technologies and strategies, as well as communicate recommendations, for minimizing and mitigating variation in vehicle speed in practice. With the input provided by the TAC and the findings from the literature review, four potential interventions were selected as promising speed variation interventions. They are:

1. A "pace car" continuously traveling at or slightly below the posted speed limit throughout the work zone;

2. A portable changeable message sign (PCMS) showing custom messages similar to "MAINTAIN CONSTANT SPEED / THRU WORKZONE" and placed at the advance warning area in the work zone;

3. The combination of a pace car and a PCMS (same message as in intervention #2); and

4. The combination of a PCMS unit (same message as in intervention #2), and flashing amber/white lights on paving equipment that were operating in the active work area.

The researchers then cooridnated with ODOT staff in order to examine the effectiveness of the identified potential speed variation interventions through field testing on case study projects. Three case study projects were selected:

- Case Study #1: I-84 Swanson Canyon to Arlington
- Case Study #2: I-205 Abernethy Bridge - SE 82nd Drive
- Case Study #3: I-5 Sutherlin – Garden Valley Blvd.

For each case study, at least one traffic control intervention was evaluated. Periods of testing were conducted for comparison, both without the traffic control intervention (control) and with selected traffic control intervention(s)/treatment(s). Portable traffic sensors were placed on the roadway pavement in the travel lanes at multiple locations throughout the planned work area to record the speeds of passing vehicles. The data were downloaded and analyzed with statistical methods. The quantitative analeyses of the speed data from the three case study projects included in this research study lead to the following findings:

- The pace car intervention did not show speed and speed reduction effects on vehicles throughout the work zone.

- The presence of PCMS intervention was effective at reducing speed variation in the work zone, especially for locations closer to the construction workers and equipment. Compared to the control case, the reductions in 1-min SD ranged from 1.29 mph to 2.05 mph; the reductions in 5-min SD ranged from 0.76 mph to 2.52 mph; the reductions in 1-min COV ranged from 0.015 to 0.060; and the reductions in 5-min COV ranged from 0.014 to 0.087. The differences listed above vary depending on the type of work being conducted, the length of the work zone, the location of the work zone, and type and amount of equipment present.

- The combination of the PCMS and pace car treatment was more effective in reducing speed variation than any single treatment alone in the active work area.

- The combination of a PCMS unit (same message as in intervention #2) and flashing amber/white lights on paving equipment that were present in the active work area was more effective than the PCMS unit only at the beginning of the active work area (where the paver with the amber/white lights was located) in reducing both speed (85^{th} percentile speed) and speed variation (SD and COV).

The findings of the study enable making recommendations for future practice. The use of a PCMS unit displaying custom alternating messages “MAINTAIN CONSTANT SPEED” and “THRU WORK ZONE” and placed in the advance warning area is recommended to help decrease speed variability through the work zone. Based on the results from the case study projects, speed variation in terms of SD and COV will be less with the presence of the PCMS unit located at the mid-point of the advance warning area (in-between the RWA sign location and the beginnging of taper location). Depending on the work zone length and the presence of roadway entrances and exits, including one or more PCMS units in the work zone, espeically at the advance warning area and at the transition area, is recommended to remind drivers to maintain constant speed relative to other vehicles.

In addition, further research to investigate and evaluate motorist reactions based on different traffic control interventions, and different messages on a PCMS board, is warranted. Standardized messages and locations of PCMS units should be determined in advance to ensure consistency across work zones and regions. Because limited data were collected for the cases that used the combination of the PCMS display and pace car, and the combination of the PCMS display and flashing amber/white lights on paving equipment, the effectiveness of these two and other potential combinations of treatments should be studied further.

Prior research indicates that without a work zone present, the percentage of trucks on a roadway affects speed variation amongst all vehicles. Further research is recommended to explore how truck percentage impacts speed variation specifically in work zones. The differential between the 85^{th} percentile and 15^{th} percentile speeds of all of the vehicles on the roadway should also be investigated as an impacting factor in work zones. The research should include consideration of both trucks passing through the work zone and construction and maintenance trucks, and how the work operation can be designed in order to limit or increase the number of trucks on the roadway to minimize speed variation. The research could also investigate whether truck percentage and the differential between 85^{th} and 15^{th} percentile speeds could be used as valid proxies for speed variation in addition to COV.

Lastly, additional research is recommended that will facilitate utilizing the speed variation knowledge gained from this study in practice. For example, information about speed variation could be used to support smart technologies that alert drivers of hazardous conditions. Further research to correlate the level of speed variation present to the level of risk to drivers would enable determining when speed variation rises to a dangerous level. Knowing these “trigger points” could then be programmed into smart technologies that are used to inform drivers of upcoming hazards in real-time. The technologies could connect to temporary or permanent variable message signs to alert the drivers to maintain constant speed relative to nearby vehicles. The correlations could also be utilized by traffic control designers to determine when the speed variation is expected to warrant the inclusion of additional or different traffic control measures in a traffic control plan.

1.0 INTRODUCTION

1.1 BACKGROUND

Vehicle speed is a significant factor that affects both motorist and worker safety, as well as mobility on roadways (National Highway Traffic Safety Administration (NHTSA), 2016, Aarts and Van Schagen, 2006, Monsere et al., 2004). The National Highway Traffic Safety Administration (NHTSA) found that in 2016, 18% of the drivers involved in fatal crashes were speeding at the time of the crash (NHTSA, 2018) . In work zones, the Federal Highway Administration (FHWA) reports that speeding was a contributing factor in 29% of crashes (Federal Highway Administration (FHWA), 2016). These crashes affect both drivers and workers on the roadway. In fact, the leading causes of death in the road and bridge construction sector are worker runovers, backovers, and falls (FHWA, 2016). The impact of work zone crashes on Oregon and other states goes beyond the social and emotional impact of the loss of life and injured citizens. The cost associated with each fatal crash can amount to millions of dollars (Blincoe et al., 2015). Additional losses to the public due to road closures, decreased mobility, and increased travel times as a result of crashes in work zones can have a negative impact on a state's economy (Blincoe et al., 2015).

Past research conducted by ODOT and its research partners has explored ways to lower vehicle speeds in maintenance and construction work zones (Gambatese et al., 2013, Gambatese and Zhang, 2014, Gambatese and Jafarnejad, 2018, Gambatese and Jafarnejad, 2015). As a result, ODOT has taken positive steps to lower vehicle speeds in work zones through added traffic control measures, and continues to search for ways to protect motorists and workers.

Another factor contributing to roadway crashes remains to be addressed specifically in work zones. In addition to lower speed, the difference in vehicle speed from the average speed has been identified as a factor in roadway crashes outside of work zones, including in Oregon (Monsere et al., 2004, Kloeden et al., 2002). The "Solomon curve" (Solomon, 1964) provides a representation of how variation in speed from the average speed on the roadway, both slower and faster than the average speed, increases the risk of crashes. The greater the variation, the greater the probability of a crash. Multiple subsequent, and more contemporary, research studies have corroborated the relationship between speed variation and crash risk on roadways (Johnson and Pawar, 2005, Kloeden et al., 2002, Fildes et al., 1991, West and Dunn, 1971, Cirillo, 1968). Consequently, drivers are often cautioned to "drive with the flow of traffic"(Cirillo, 2003).

Attention to the impacts of speed variation on crash risk has focused primarily outside of work zones. However, for work zones, the problem is potentially magnified. Within a work zone, there is a higher potential for differences in vehicle speed due to the presence of tapers, construction vehicles (e.g., asphalt trucks) entering/exiting the roadway, temporary speed reductions, and other unforeseen construction operational impacts. All of these issues, in conjunction with significant hazards related to distracted drivers and work zone distractions, place great importance on the need to address speed variation in work zones. The safety risk associated with this variation in speed affects both motorists driving through the work zone and the workers in the work zone. More information is needed to understand why speed differentials occur in general in work zones, and to update our understanding of speed variation based on current driving behavior, distractions, roadway conditions, and construction/maintenance operations.

Many past studies address the impacts of various temporary traffic control measures, such as the presence of law enforcement, yet focus primarily on speed reduction and only suggest corresponding reductions in speed variation. Limited research has been conducted that addresses specifically speed variation from the average speed on the roadway, and also specifically in work zones. Questions remain regarding how differences in vehicle speed impact the risk of crashes within work zones, and how common temporary traffic control measures can be used to minimize variation in speeds from the average speed within work zones. In addition, research is needed that addresses these issues for mobile and short-term (e.g., maintenance) work zones. Quantitative data on the amount of reduction in speed variation are also needed in order to strategically plan and design temporary traffic control measures and stage construction and maintenance operations. Prior research has identified the impacts that construction and maintenance activities, equipment, and staging can have on speed reduction. Further research is needed to develop strategies for reducing speed variation that are associated with conducting the work and the presence of work equipment. Lastly, analyses of data on Oregon roadways will provide ODOT with greater confidence in the results and recommended actions to implement throughout the state.

1.2 RESEARCH OBJECTIVES

The overall goal of this research is to develop additional knowledge and practices that can be used to improve driver and worker safety in work zones and, as a result, mobility through work zones. The research will focus on high-speed roadways (e.g., highways and freeways) and typical mobile construction and maintenance operations that occur on such roadways (e.g., paving and re-striping). To meet this goal, the proposed research focuses on variation in vehicle speed from the average speed in work zones. The research aims to confirm the need to address vehicle speed variation, identify means to minimize speed variation, and recommend ways in which ODOT can minimize and mitigate the effects of speed variation. Specifically, the objectives of the research are to:

1. Document the prevalence and magnitude of variation in vehicle speed from the average speed in work zones, and how this variation compares to variation in free flow conditions without a work zone present;

2. Determine work zone conditions and traffic control measures that can lead to greater variation in vehicle speed from the average speed;

3. Identify techniques within the traffic control plan and conduct of work operations for minimizing and mitigating variation in vehicle speed from the average speed in work zones;

4. Develop recommendations for both minimizing speed variation and mitigating the effects of speed variation in order to improve safety and mobility in work zones; and

5. Recommend a data collection plan for ODOT to study/monitor the speed variation in work zones and the corresponding impacts.

When developing recommended traffic control measures, special consideration is given to the potential use of new technologies such as smart work zone technologies that monitor the presence of slow-moving vehicles and queuing, and communicate these conditions to oncoming traffic. The potential integration of existing variable message signs (VMSs) and display messaging options are also considered in order to take advantage of existing roadway infrastructure. Additionally, the staging and implementation of construction and maintenance work operations and equipment are evaluated as possible means to minimize speed variation.

1.3 BENEFITS

The research will provide ODOT with quantitative information about vehicle speed variation in work zones, the impacts of this variation on the risk of crashes, and the work zone and driver conditions that both accentuate and moderate speed variation. Such information can be utilized to strategically plan and design work zone traffic control plans and construction and maintenance operations to minimize risk of injuries and fatalities. In addition, the recommended techniques for minimizing speed variation in work zones will help guide ODOT staff on what to implement in practice on future projects to proactively minimize speed variation and ultimately improve work zone safety.

Protecting the safety of both the traveling public and ODOT employees and other workers who build, operate, and maintain the state's transportation system is one of ODOT's core values. The proposed research will help ODOT fulfill its mission by further identifying the extent to which speed variation from the average speed exists in Oregon work zones and how speed variation impacts crash risk in work zones, and by providing ODOT personnel with proven techniques that minimize and mitigate the variation in speed in work zones.

Each work zone on Oregon roadways exposes drivers and workers to risk of injury. Oregon experiences approximately 500 crashes in work zones each year (ODOT 2017a; 2017b). Each crash has the potential to cause injury or death to a driver and/or worker. The proposed research directly relates to ODOT’s safety goal by focusing on reducing crashes through minimizing vehicle speed variation on roadways. The research also specifically addresses work zones, a driving environment that often creates additional risk to drivers and impacts mobility.

Safety and mobility affect the economic efficiency of both ODOT and the state’s economy. Each year, ODOT spends approximately $400 million on roadway construction (ODOT 2017a). At a national level, in 2010 the economic cost of the 13.6 million motor vehicle crashes that occurred on US roadways was estimated to be $242 billion, approximately $17,800 per crash (Blincoe et al., 2015). Specifically for crashes in work zones, the average direct cost (not including indirect costs) of motorist injuries has been estimated to be $3,687 per injury (in 2002; more recent values not found) (Mohan and Gautam, 2002). In addition to fulfilling moral and ethical obligations to hold human safety and health as top priority and be good stewards of our workforce, improving safety in construction and maintenance work zones also makes financial sense. It is estimated that for every $1 spent on accident prevention on construction sites, $3 is gained in benefit (Ikpe et al., 2012). Improving safety and mobility will lead to lower overall construction and maintenance costs and greater potential for ODOT to continue to support the state's economy and fulfill its mission.

1.4 IMPLEMENTATION

As indicated above, the study outputs consist of recommendations for minimizing and mitigating variation in vehicle speeds in work zones on high-speed roadways, and recommended practices for a data collection plan to continue studying/monitoring speed variation in work zones and the corresponding impacts. These outputs are communicated in the form of a research report submitted to ODOT that describes in detail the conduct and findings of the study along with recommendations for implementation in practice. In addition, the researchers will prepare and submit to ODOT a research note that summarizes the study findings, potential impact, and recommendations for implementation. The research report and research note will be submitted to ODOT for publication and distribution.

It is expected that the research outputs will be used by the ODOT Transportation Safety Division and the Region Traffic Control Plan Designers in each Region as they plan and design traffic control for work zones. In addition, the results are expected to be incorporated into the activities of the Statewide Construction Office and implemented through communication to and education of the Construction Project Managers statewide.

2.0 LITERATURE REVIEW

This chapter provides definitions of terms related to traffic engineering and safety, and especially speed statistics, that are used in the research study along with a comprehensive literature review of the current state-of-the-art findings related to the impacts of speed variation on roadway crashes and the identified countermeasures with and without a work zone present. The literature review is organized according to the following five topics related to speed variation and crashes:

- Key definitions and descriptions of traffic engineering, safety, and statistics terms that are used in the study
- Existing findings related to speed variation and crash involvement with and without a work zone present
- Identified factors that affect speed variation
- Identified measures to reduce speed variation with and without a work zone present
- Identified measures to control speed variation when large speed variation is observed

2.1 DEFINITIONS

Crash occurrence: the number and types of crashes that occur in terms of rates based on population or vehicle-miles traveled (Roess et al., 2011).

Crash involvement: the number and types of vehicles and drivers involved in crashes (Roess et al., 2011).

Crash probability: the long-term likelihood that a driver will be involved in a crash under a specified set of conditions (Transportation Research Board (TRB), 1998).

Crash severity: a term to describe the magnitude of crash consequences in terms of human health and suffering. The number of fatalities and fatality rates are often used as a measure of the seriousness of crashes (Roess et al., 2011). A fatal crash is a crash that results in one or more deaths within 30 days of the crash. A nonfatal injury crash is a crash in which in which at least one person is injured, but no injury results in death. A property-damage-only (PDO) crash is a collision that results in property damage, but in which no person is injured (TRB, 1998).

Case and control studies: observational studies that are used to identify causes of crashes on roadways by comparing case conditions (e.g., with crash) and control conditions (e.g., without crash) at similar locations. Such approaches can also be used to determine whether corrective measures are effective (Roess et al., 2011).

Coefficient of variation (COV): a standardized measure of data dispersion. COV is often measured as the ratio of the standard deviation to the mean of a data set (Ackaah et al., 2016).

Daily volume: a term used to describe rate of traffic flow. Four parameters are widely used to express daily volume (Roess et al., 2011):

- Average annual daily traffic (AADT): the average 24-hour volume at a given location over a full, 365-day year.
- Average annual weekday traffic (AAWT): the average 24-hour volume occurring on weekdays over a full, 365-day year.
- Average daily traffic (ADT): the average 24-hour volume at a given location over a defined time period less than one year.
- Average weekday traffic (AWT): the average 24-hour weekday volume at a given location over a defined time period less than one year.

A common means to estimate ADT or AWT is to measure monthly.

Density: the number of vehicles occupying a given length of highway or lane, generally expressed as vehicles per mile or vehicles per mile per lane (Roess et al., 2011).

Design speed: the maximum safe speed that can be maintained over a specified section of highway when conditions are so favorable that the design features of the highway govern (TRB, 1998).

Differential speed limit: prescribed different speed limits for different classes of vehicles (TRB, 1998). The motor vehicle codes in some states allow for differential speed limits.

Free flow: a free-flowing vehicle is one whose driver has the ability to choose a speed of travel without undue influence from other traffic, conspicuous police presence, or environmental factors (TRB, 1998).

Median speed (in spot speed studies): the speed that equally divides the distribution of spot speeds. 50% of observed speeds are higher than the median and the remaining 50% are lower than the median (Roess et al., 2011).

Occupancy: the proportion of time that a detector is “occupied”, or covered, by a vehicle in a defined time period (Roess et al., 2011).

Operating speed: the speed at which drivers of free-flowing vehicles choose to drive on a section of roadway (TRB, 1998).

Peak hour: the single hour of the day that has the highest hourly volume (Roess et al., 2011).

Posted speed limit: a speed limit determined by law or regulation and displayed on Speed Limit signs (FHWA 2009) .

Spacing: the distance between successive vehicles in a traffic lane (Roess et al., 2011).

Speed: a rate of motion measured in distance per unit time (Roess et al., 2011).

Speed distribution: a distribution of a statistical data set (or a population) is a listing or function showing all the possible values (or intervals) of the data and how often they occur. A speed distribution is a representation of the prevalence of different vehicle speeds within a specific location over a specified period of time. A common hypothesis is that speeds, particularly of free-flowing vehicles, are normally distributed (Fitzpatrick et al., 2000).

Space mean speed: the average speed of all vehicles occupying a given section of highway or lane over some specific time period (Roess et al., 2011).

Speed dispersion: a measure that can be quantified by the speed variance, the speed standard deviation, and sometimes by the speed range (Shinar, 1998). It describes the extent to which speed data spreads around the center of the distribution (Roess et al., 2011).

Speed harmonization: a traffic strategy framework that aims to reduce temporal and spatial variations of traffic speed with certain traffic control approaches (Ma et al., 2016). The objective of speed harmonization is often to control the distribution of speed and to reduce the speed variance among vehicles (Yelchuru et al., 2017).

Speed standard deviation (in spot speed studies): the average difference between observed speeds and the time mean speed during a study period. It is a measure of dispersion (Roess et al., 2011).

Speed variance (in spot speed studies): the square of the standard deviation, which is calculated by summing the squares of the differences between each measured speed and the average speed, and dividing the total by the sample size minus one (TRB, 1998).

Speed variation (speed variability, variation of traffic speeds): refers to individual vehicles traveling at different speeds in a roadway section (Lee et al., 2003). It could be a measure of the variability among the speeds about the mean speed (Fitzpatrick et al., 2000). The mean speed here is generally space mean speed.

It is worth noting that, as mentioned by Johnson and Pawar (2005) and Choudhary et al. (2018), previous studies have used multiple different definitions to express speed variation. The definitions are:

1. speed differences between individual speeds and average speed (Solomon (1964); Cirillo (1968); West and Dunn (1971); and Kloeden et al., 1997; 2001),

2. speed variance/standard deviation at road section level (Garber and Gadiraju (1988); Taylor et al. (2000); and Quddus (2013)),

3. speed difference between the 90th and the 50th percentile of speeds in each lane (Golob et al., 2004), and

4. speed differences between and across lanes (Kockelman and Ma (2010); Choudhary et al. (2018); and others.

Spot speed studies: studies that measure the speeds of individual vehicles at a given spot or location, and the result is a distribution of speeds that can be used for a range of applications, such as determining appropriate speed limits and exploring the relationship between speeds and crashes (Roess et al., 2011).

Time mean speed: the average speed of all vehicles passing a point on a highway or lane over some specified time period (Roess et al., 2011). According to Mathew and Rao (2017), time mean speed will always be greater than space mean speed. Time mean speed can be expressed as the summation of space mean speed and the standard deviation of the spot speed divided by the space mean speed.

Traffic volume: the number of vehicles passing a point on a roadway, or a given lane or direction of a roadway, during a specific time interval (Roess et al., 2011).

Travel time: the time taken to traverse a defined section of roadway. It is inversely related to speed (Roess et al., 2011).

85th percentile speed (in spot speed studies): the speed below which 85% of the vehicle travel (Roess et al., 2011).

2.2 SPEED VARIATION AND CRASH INVOLVEMENT

Studies related to traffic speed reveal that speed characteristics strongly correlate to safety concerns (Roess et al., 2011, Elvik et al., 2004, Quddus, 2013). According to Shinar (1998), at least two aspects of crashes can be considered as the result of speed: crash probability and crash severity (given a crash occurs). The relationship between speed and crash severity is consistent with the laws of physics. Crash severity, if expressed as the kinetic energy, is the energy released during a collision and is a function of speed ($E = \frac{1}{2} mv^2$) (Aarts and Van Schagen, 2006, Quddus, 2013, Elvik et al., 2004, Tanishita and Van Wee, 2017). In addition, traveling at a faster rate of speed results in less time available for drivers to react to potential hazards or for other motorists to react to the vehicle, as well as a larger required stopping distance and reduced maneuverability (Stuster et al., 1998, Aarts and Van Schagen, 2006). Conventional knowledge has emerged with the adage “speed kills” (Kweon and Kockelman, 2005). However, the impact of speed on crash occurrence is hard to quantify due to the nature of crashes, the variety of road designs, and traffic stream characteristics (Forbes, 2012, Aarts and Van Schagen, 2006).

A number of studies and research efforts have reported correlations between roadway crash frequencies and speed statistics, including average speed and speed variation. Compared to studies focusing on exploring relationships between average speed and crashes, the number of studies attempting to correlate crashes with speed variation are relatively low and their results vary (Choudhary et al., 2018). The dearth of studies may be because speed variation cannot be directly measured unless the traffic data are highly spatially and/or temporally aggregated (Choudhary et al., 2018). However, it is not hard to imagine that for vehicles that have big differences in speeds, the trailing vehicle needs to accelerate or decelerate frequently to maintain a desired and safe spacing from its heading vehicle, which might increase the potential for crashes (Wang et al., 2017).

The earliest documented study attempting to relate speed variations and crash occurrences appears to be conducted by Solomon (1964). The study was carried out using a case-control approach based on 10,000 crash cases, as well as speed data collected with 290,000 drivers on 600 miles of 2-lane and 4-lane rural highways (not including freeways) in the US (including 16 miles in Oregon). The average speed data were measured by test drives with free-flow traffic and were reviewed by state highway engineers. The travel speed of crash-involved drivers was estimated based on the information provided by police reports. The study found a benchmark skewed U-shaped curve showing the relationship between crash-involved vehicles' speed variation from average speed and crash involvement rates. The curve shows that the greater a driver's speed deviates from the average speed of all traffic, the higher the likelihood the driver will be involved in a crash. The findings show that the lowest crash involvement rate occurs when travelling at the average speed for nighttime driving, and approximately 6 mph above the average speed for daytime driving.

The existence of the U-shaped hypothesis has been subsequently confirmed by other studies that claimed "variance kills". The correlation was first identified by Lave (1985). The study explored the effects of average speed and speed variance, measured as the 85th percentile speed minus the average speed, on the fatality rates for high-speed roads based on highway statistics between 1981 and 1982 provided by the US DOT. By fitting the data in separate regression models on six different types of high-speed roads, Lave concluded, "there is no statistically discernable relationship between the fatality rate and average speed, though there is a strong relationship to speed variance." The finding reveals the importance of harmonizing the speed rather than limiting the absolute speed.

Over the years, there have been debates concerning the U-shaped curves and whether "variance kills" worldwide. The criticisms about the two studies are mainly on account of the data used and analyzed, and can be summarized as follows:

- The average speed data were computed based on a long section of roadway, which might not be representative to ensure the accuracy of the traffic speed statistic (Shinar, 1998, Monsere et al., 2004). The usage of such data may also result in a lack of consistency between the crash and the speed data (TRB, 1998).

- The crash data used were retrospective, either from police reports, driver self-reports, or third-party investigations, and the speeds of crash involved vehicles at the occurrences were estimated (Fildes et al., 1993; TRB, 1998; Monsere et al., 2004).

- In Solomon's study, turning vehicles contributed to the high crash involvement rate for vehicles traveling at speeds significantly from the average speed (TRB, 1998; Monsere et al., 2004). The occurrences of crashes related to turning vehicles might not have a direct relationship with speed variation.

- The relationship found by using the aggregated traffic and crash data does not provide enough evidence to conclude the same relationship at the individual level (Davis, 2002). Using such a method might lead to statistical deficiencies (Mensah and Hauer, 1998, Davis, 2002).

The existing studies reported inconsistent findings on the effect of speed variation on crash occurrence (Aarts and Van Schagen, 2006). To better understand the relationship between speed variation and crashes, studies pertaining to the topics are described in the following sections and are presented separately based on whether the study environment includes work zones.

2.2.1 Without a Work Zone Present

2.2.1.1 Research on Speed Variation and Crash Probability

2.2.1.1.1 Speed differences at individual vehicle level

One way to examine the relationship between speed variation and crash rate is to determine the crash rate of individual vehicles that drive at speeds that are different than the average travel speed (Aarts and Van Schagen, 2006). Because of the nature of crashes, the objective measure of the true speeds of crash-involved vehicles at the time of the occurrence of the crash is difficult to obtain. Thus, the studies reviewed in this section use some estimate of speed (TRB, 1998).

Using similar approaches as Solomon, Cirillo (1968) put an emphasis on rural and urban interstate systems instead of 2-lane and 4-lane main rural highways (excluding freeways). The study only analyzed crashes that occurred in the daytime which involved two or more vehicles traveling in the same direction, including rear-end, angle collisions and same-direction sideswipe crashes. The relationship between speed variation (measured as speed difference from mean speed) and the likelihood of crashes found in this study was similar to the U-shaped curve found by Solomon. An increase in the variation of speed among all vehicles resulted in a higher probability of crash involvement. For interstate highways, it was found that the speed at which crash risk was minimized occurred at approximately 12 mph above the average speed. Another finding worth mentioning is that interstate systems could accommodate larger speed variations on interstate highways, but not for vehicles traveling significantly slower than the average speed. In addition, in a 1971 study, Hauer provided a theoretical model to support the existence of the U-shaped curve by demonstrating that the probability of crash involvement is related to the rate of overtaking in traffic for vehicles traveling on rural roads between intersections.

To overcome the limitations due to the unrepresentative traffic data used in the previous studies, a study performed by the Research Triangle Institute (RTI) (West and Dunn, 1971) gathered traffic data by using magnetic loop detectors on a two-lane, two-way highway section in Indiana. The instrument-based study also found a U-shaped relationship between the speed deviating from the average speed and the crash involvement rate. The involvement rate was higher for vehicles traveling slow than for those vehicles traveling fast. However, after excluding the crashes related to turning vehicles, the result was less pronounced: the involvement rate was about the same for a vehicle that moved much faster and for a vehicle that moved much slower than the other surrounding traffic.

Moreover, the crash rates of vehicles at slow speeds were much lower than the findings of Solomon and Cirillo.

Harkey et al. (1990) aimed to assess the speed and crash data at 50 locations on urban and rural roadways over four states in a three-year study period. By using the speed data collected by traffic statistics recorders and inductive loops and the crash data on non-55 mph roadway sections (44 locations) from two states (North Carolina and Colorado), the researchers found a similar curve between variation from mean speed and crash involvement rate as that which Solomon and Cirillo concluded in their studies. In the study, Harkey et al. only included crashes that occurred on weekdays with non-alcohol and non-intersection involvement. It was also revealed that the lowest crash rate occurred near the 90th percentile of the travel speeds observed (approximately 7 mph above the mean speed).

On the contrary, the findings of a number of additional studies somewhat disagreed with the U-shaped relationship. In an Australian study (Fildes et al., 1991), a similar trend of increasing crash rate associated with higher speed deviations from the average speeds for faster travelers was found, but the researchers did not find such relationship for slower drivers. The studies were carried out on two rural highway sections where the posted speed limits were 62 mph (100 km/h), and two other urban 4-lane arterial sections with posted speed limits of (37 mph) 60 km/h. The speed measuring teams were responsible for collecting traffic data using a manual speed measurement technique, while the interview teams collected the crash data. As a result, the relationship found was a simple linear or curvilinear function between the speeds deviating from the average speed and the rates of crash involvement. The study showed that drivers who travel at speeds faster than the posted speed limit have a higher probability of being involved in crashes than those who travel slower.

The findings from another Australian study (Kloeden et al., 1997) which aimed at only casualty crashes supported those of Fildes et al. (1991). Using a case-control approach, the researchers computed the speed variations using the estimated speeds of crash-involved vehicles (non-alcohol related) which were determined by computer-aided crash reconstruction techniques and the average free-flow speeds of vehicles that were traveling in the same direction and at the same time of day, day of week, and time of year. The data were collected during the daytime on weekdays in a 37 mph (60 km/h) speed limit zone. Based on the analysis, the researchers concluded that for vehicles traveling below the posted speed limit, their associated casualty risks were not statistically different from those traveling at the posted speed limit. However, a steady increase was observed in casualty rate with increasing traveling speed for vehicles traveling faster than the posted speed limit.

2.2.1.1.2 Speed differences at road section level

Another predominant way to explore the relationship between speed variation and crash rate is to examine the influence of speed variance, or standard deviation, at a road section level (Aarts and Van Schagen, 2006). For such a study, speed variation or standard deviation is measured with the distribution of speeds in a traffic stream. Therefore, no estimation of pre-crash speed is needed (TRB, 1998).

A number of studies highlighted the importance of speed variation by showing that speed variation is a direct causal factor contributing to crash frequency, i.e., "variance kills". As mentioned previously, the relationship was initially introduced by Lave (1985). In the study, it was shown that greater speed variation (measured as the 85^{th} percentile speed minus the average speed), not the average speed, led to higher crash occurrence rates. Following the report of Lave's findings, Fowles and Loeb (1989), Levy and Asch (1989), and Synder (1989) challenged and re-examined Lave's study. The subsequent researchers pointed out potential deficiencies in Lave's work due to omitted variable bias, and suggested that besides speed variation, the average speed is also an important factor that correlates with crash occurrence rate. In addition, by distinguishing faster drivers from slower drivers, Synder (1989) did not find statistical evidence that speed variation correlates with fatality rates for drivers who travel at a slower rate of speed.

Responding to the follow-up studies (Fowles and Loeb, 1989, Levy and Asch, 1989, Synder, 1989), Lave (1989) replied that using aggregated data and combining dissimilar highway types in the subsequent studies was a major drawback in their studies and, therefore, resulted in different conclusions.

Similarly, a number of previous studies found a positive association of speed variation and crash rates, and no strong relationship between average speed and crash rates, which support the claim that "variance kills" rather than "speed kills". For example, Garber and Gadiraju (1988) confirmed that crash rates increased with an increase in speed variance, but did not find such a relationship between crash rates and average speed when examining a set of Virginia highways. The results were obtained based on ANOVA tests and regression analysis by using the traffic data from 24 hours of continuous recordings from traffic data recorders on weekdays and crash data from the Virginia DOT and the Virginia Department of Motor Vehicles (VDMOV).

Rodriguez (1990) found a slightly negative connection between the average speed and the fatality rate, and a significantly positive relationship between the variance of the speed distribution (measured as standard deviation) and the fatality rate. The study used aggregate speed and fatality data for each of the 50 US states that were obtained from the US Department of Transportation (DOT) Highway Statistics office between the years 1981 and 1985. It was also concluded that "variance kills" at the aggregate level is equivalent to "speed kills" at the individual level.

In addition, when considering two-lane highways in Virginia, Garber and Ehrhart (2000) found that the crash rate increases as the standard deviation increases for all flow rates, while the effect of the mean speed on crash rate was negligible. In this study, multiple linear regression and multivariate ratio of polynomials models were generated based on the traffic and crash data obtained from existing Virginia DOT data files.

A recent report (Day et al., 2019) conducted by researchers from Iowa State University also found that one of the primary factors affecting crash rate is speed variance. In the study, monthly average speed data including percentile speeds, average speeds, and the standard deviation and variance of speed for all interstate traffic management system (TMS) segments were obtained from 2013 to 2016. Nine years of crash data were obtained from the statewide crash database maintained by the Iowa DOT from 2008 to 2016. To examine the relationship between speed measures including speed variance and average speed, and crash frequencies, random effects negative binomial models were used. The analysis showed that a 1 mph increase in the speed standard deviation would lead to a 27.8% increase in the total number of crashes. In addition to the finding that speed variance is highly correlated with crash frequency, the study also found that the impacts of speed variance were most intense for the most severe crashes.

In research conducted outside the US, Quddus (Quddus, 2013) found that, after studying 298 road segments in London, UK, speed variation (measured as the standard deviation of speeds) is associated with crash rates. When controlling for other potential factors that might affect crash occurrence including such factors as road grade and curvature, the researcher found that average speed was not associated with crash rates. Similarly, using a car-following technique to collect traffic data on a selected expressway in Beijing, China, Qu et al. (2014) found a positive relationship between speed variance (measured as the standard deviation) and crash risk, and the relationship between average speed and crash risk was not significant.

Even though the above-mentioned studies did not find enough statistical evidence to support a positive relationship between mean speed and crash occurrence, there are a number of studies that have supported such a relationship, such as Finch et al. (1994), Nilsson (1982), Aljanahi et al. (1999), Aarts and Van Schagen (2006), Tanishita and Van Wee (2017), and Wang et al. (2018). Indeed, mean speed was proven as an influencing factor of speed variation in a few studies (see Section 2.3). It is not the objective of the present study to discuss whether average speed is a contributor to crash occurrence rates. The key point investigated in the present study is whether speed variation is dangerous. In addition to the aforementioned studies, a number of research studies found that speed variation correlates with the likelihood of crash occurrence; the studies are described below.

Taylor et al. (2000) suggested that speed variation, which is expressed as the spread of speed (measured as the coefficient of variation), correlates with crash occurrence. It was found that crash occurrence probability increases exponentially as the spread of speed increases when the mean speed remains constant. Analyzing speed variation at a road section level, the study was carried out based on speed and crash data collected on urban roads in the UK and on rural roads in the UK, Netherlands, Sweden, and Portugal.

Lee et al. (2003) proposed a log-linear model to predict crash occurrence based on traffic flow data collected by loop detectors and incident logs in a section of expressway in Toronto, Canada on weekdays over a 13-month study period. The researchers concluded that the speed variation (measured as the speed difference between upstream and downstream loop detectors) was significantly correlated with crash occurrence.

Abdel-Aty et al. (2004) developed a crash likelihood prediction logistic regression model using a matched case-control approach. Data from 670 crashes that occurred on a section of I-4 in Orlando, Florida were obtained from the Orlando Police Department and the corresponding traffic data were obtained from installed dual loop detectors. Analysis of the data revealed that the coefficient of variation was one of the parameters that significantly affected crash likelihood. Specifically, speed variation at a certain location in a 15-min period related to the likelihood of crash at the location and at the end of the time period, while speed variation at a certain location in a 5-min period related to the likelihood of crash at 0.5 miles downstream of the location and at the end of the time period. Later, in 2006, Abdel-Aty and Pemmanaboina examined more crashes that occurred on I-4 in Orlando, Florida and incorporated rain factors that might also have impact on the probability of crash occurrence. Using the same approach, the researchers found that larger coefficient of variation in speed near the location of the crash and 5 -10 minutes prior to the crash under a rainy condition resulted in greater probability of crash occurrence.

Zheng et al. (2010) reported the odds ratio of standard deviation of speed to crash occurrence by examining a 12-mile, 3-lane section in the northbound direction on I-5 in Portland, Oregon. The study was carried out to understand the relationship between traffic oscillations on freeway crash occurrences using a case-control approach. The traffic data were obtained by loop detectors installed while the crash data were obtained from two databases maintained by the Oregon DOT. Through conditional logistic regression, the researchers found that an additional unit increase in the speed variation increases the likelihood of (rear-end) crashes by about 8%.

After examining crashes on an urban freeway in Canada using a matched case-control approach, Islam et al. (2012) showed that freeway traffic collisions are highly related to the standard deviation of speed and coefficient of variation of speed. The study revealed significant differences in the coefficient of variation of speed between crash cases and non-crash cases before the time of collision.

Li et al. (2013) stated that the speed variation measures that correlate with collision likelihood depend on traffic states. To be specific, the standard deviation of speed as well as the coefficient of speed variation are effective measures in congested traffic and back of queue conditions, but may not be good measures for free flow and front of queue conditions. The study was conducted using a case-control approach to examine the data collected on a 6-mile section of I-880 in Oakland, California. Logistic regression models were generated to evaluate the impacts of speed variation.

With the wide use of traffic surveillance systems, instead of using documented traffic and crash data, researchers attempted to use high-resolution traffic and crash data to identify the relationship between traffic flow conditions and crash occurrences (Xu et al., 2016). The positive relationship between speed variation and crash likelihood was supported by some real-time crash prediction studies. For example, Yu and Abdel-Aty (2014) examined the crash and real-time traffic data on a mountainous freeway (I-70 in Colorado) and an urban expressway (State Road 408 in Florida) by using hierarchical Bayesian binary probit models with real-time data collected by Automatic Vehicle Detection (AVI) systems. The study revealed that large variations in speed 6 – 12 minutes prior to crash occurrence increase the possibility of severe crashes.

Shi et al. (2016) utilized speed data gathered from AVI systems, and crash data in the Central Florida area to explore crash mechanisms. Negative binomial models under the Bayesian inference framework were generated based on the collected data. The researchers identified that lower speed and larger variation of speed were significant risk factors contributing to the crashes.

After collecting and analyzing 508 crashes and the corresponding real-time traffic data prior to crashes on the I-880N freeway in California in 2009, Xu et al. (2016) found that crash risk increased with an increase in the speed variance at downstream stations and an increase in the speed difference between upstream and downstream stations. Similarly, when analyzing traffic and crash data of 247 expressways segments in Orlando, Florida, Wang et al. (2017) found that the average daily standard deviation of speed had a positive effect on crash frequency, while the average speed was negatively related to crash likelihood.

Moreover, Wang et al. (2018) utilized segmented traffic data collected by taxi-based high frequency GPS systems on urban arterials in downtown Shanghai, China to evaluate the relationship between mean speed, speed variation, and crashes. The study confirmed that speed variation has a significant positive effect on crashes; specifically, a 1% increase in speed variation was found to be related to a 0.74% higher crash frequency.

On the contrary, some studies did not find that speed variation was associated with crash occurrence. For example, Pei et al. (2012) used disaggregated crash and speed data collected by 480 taxis equipped with GPS systems from 112 road segments in Hong Kong, China. It was found that the standard deviation of speed was not significantly related to the likelihood of crash occurrence or crash severity. However, the researchers pointed out that the method used to calculate speed dispersion in the study is different from the traditional approach used in a mixed traffic stream with different types of vehicles.

2.2.1.1.3 Other related studies

As noted previously, other studies have quantified speed variation in different ways besides the speed difference at the individual vehicle level and at the road section level. For example, Kockelman and Ma (2010) estimated within-lane and across-lane speed variation (measured as standard deviation) and analyzed their effects on the likelihood of crash occurrence. The study utilized a subset of data from Golob and Recker (2003), which were collected on six Southern California freeways. No evidence was found that support speed variation influencing crash occurrence. However, the study found some factors that might have influence on speed variation. With respect to the factors affecting speed variation, the information can be found in Section 2.3 of this report. Likewise, Choudhary et al. (2018) also focused on the effects of between-lanes and within lane speed variations on crashes. The data were collected from a selected freeway in London, UK during a study period of three years. The findings showed that a large within lane speed variation at high volume conditions led to a high crash occurrence rate. High crash occurrence rate is also likely to occur due to large between-lane speed variation at high-speed conditions.

Additionally, Tanishita and Van Wee (2017) examined whether changes in mean speeds affect crash occurrence. The researchers generated Poisson models based on five-minute intervals of continuously monitored data from an expressway in Japan. It was found that both mean speed and speed changes in mean speeds affected the occurrence of crashes.

2.2.1.2 Other Studies related to Speed Variation and Crashes

Other than crash probability, studies have also shown that speed variations are associated with crash severity and crash type. Golob and Recker (2003) used the difference between the 90^{th} percentile and 50^{th} percentile of the traffic distribution of volume over occupancy to capture speed variation in each lane. Using the data collected from six major freeway routes in Orange County, California, the researchers found that collision type was related to median speed, and speed variations in "faster" lanes (left and interior lanes). Specifically, rear-end collisions were most likely to occur with traffic conditions where mean speed is relatively low and speed variation is high, which are common under heavily congested conditions and possibly in construction work zones that contain a temporary speed reduction and/or slow-moving equipment. Focusing on high-speed facilities (freeways and expressways), Yu and Abdel-Aty (2014) found that large speed variation prior to crash occurrence lead to severe crashes.

In the UK, Choudhary et al. (2018) analyzed the effects of between-lanes and within lane speed variations on crash severity and crash-involved vehicle types. The study found that within lane speed variance is a higher crash risk factor for passenger vehicles than heavy vehicles, while between-lane speed variance is a higher crash risk factor for heavy vehicles. In addition, the probability of being involved in a serious injury due to within lane speed variance is higher than that of a slight injury. However, in a study performed by Pei et al. (2012) using spatiotemporal speed data collected from 112 road segments in

Hong Kong, China by probe vehicles, the researchers did not find enough evidence to show that the standard deviation of speed correlated with crash severity.

Several studies have investigated the relationship between truck volume as a percentage of overall traffic volume, speed variation, and traffic safety. Dong et al. (2014) analyzed traffic data at urban signalized intersections in Tennessee, and found that as the truck percentage increased, the frequencies of truck-involved crashes and car-truck-involved crashes increased, but the frequency of car crashes decreased. Based on highway rear-end crash data on ten high-speed routes in Washington state, the study conducted by Lao et al. (2014) found that there was a non-monotonic relationship between crash frequency and truck percentage – as truck percentage increased, crash frequency increased initially and then decreased after a certain truck percentage threshold. However, the value of the threshold was not determined in the research study. In another study focused on crashes in highway work zones in Singapore, Weng et al. (2014) concluded that as the truck percentage increased, the occurrence likelihood of rear-end crashes also increased. The results of the study are of interest, yet differences between Singapore and the US in terms of driving laws, driving behavior, and vehicle volumes may limit the relevancy of the findings to practice in the US.

A China study (Chen et al., 2020) reported quantitative estimates of the relationship between truck percentage, speed variation, and traffic safety. Based on data collected from video recordings of freeways, the study concluded that when truck percentage ranged from 40% to 60%, the differential between the 85th percentile speed and the 15th percentile speed was above 26 mph (42 km/h), and the 15-min speed COV was above 0.223. The study revealed that the traffic flow tended to be more dangerous for truck percentages in this range than for both lower truck percentages and higher truck percentages. The study also showed that speed COV initially increased with an increase in truck percentage, then decreased as the truck percentage became high. The study findings suggest that there is greater speed variation, and more crashes, when the percentages of passenger cars and truck are close to the same values (i.e., both in the 40% - 60% range).

2.2.1.3 Summary

An extensive body of knowledge is available related to speed variations on roadways without a work zone present. Regarding the relationship between speed variation and crash occurrence, inconsistent conclusions were reached in the previous studies. For example, for research targeting speed differences at an individual vehicle level, Solomon (1964) and Cirillo (1968) both found that for vehicles traveling slower than average speed, the greater the speed deviated from the average speed, the higher the chance that the driver would be involved in a crash. However, when excluding crashes related to turning vehicles, West and Dunn (1971) found the crash occurrence rate for slow-speed vehicles was much lower than the findings of Solomon and Cirillo. In subsequent work (Fildes et al., 1991, Kloeden et al., 1997), researchers did not find that, for slower drivers, a greater difference between vehicle speed and average speed tends to increase the likelihood of crashes. Indeed, Kloeden et al. (1997) found no statistical difference in casualty risk between vehicles traveling below the posted speed limit and those traveling at the posted speed limit. No such doubts were found for vehicles traveling faster than average speed; all studies revealed that, for faster drivers, the speed difference from average speed increased the probability of crashes.

For research aimed at speed difference at a road section level, standard deviation, variance, and coefficient of variation can be measured based on aggregated traffic data on a given segment of roadway, and they are commonly-used speed variation measures. The majority of the studies, including Lave (1985), Garber and Gadiraju (1988), Taylor et al. (2000), Quddus (2013), and Shi et al. (2016), found a positive relationship between speed variation (measured as standard deviation, variance, or coefficient of variation) and crash occurrence. Although, when collecting traffic data with taxis equipped with GPS systems, Pei et al. (2012) did not find such a relationship.

The debate regarding the relationship between speed variation and the probability of crashes has lasted for several decades, and previous research studies have reached inconsistent conclusions. The possible reasons for inconsistent results are summarized in Table 2.1. In general, the reasons can be categorized based on the phases of data management: data collection, data pre-processing and data analysis.

Table 2.1: Reasons for Inconsistent Findings in the Studies related to Speed Variation and Crash Occurrence

Reasons		References
Data Collection	Differences in data quality (e.g., sample size)	Lord and Mannering (2010), Choudhary et al. (2018)
Data Pre-processing	Various definitions are used to express and compute speed variation	Johnson and Pawar (2005), Choudhary et al. (2018)
	Different data pre-processing methods related to speed and crash estimates	Kloeden et al. (1997), Aarts and Van Schagen (2006), Choudhary et al. (2018)
	Lack of temporal and/or spatial matches between vehicles examined in study periods and crash-involved vehicles	Aarts and Van Schagen (2006), Lord and Mannering (2010), Quddus (2013),
Data Analysis	Differences in modeling approaches	Lord and Mannering (2010), Quddus (2013), Choudhary et al. (2018)
	Bias due to omitted variables	Lord and Mannering (2010), Quddus (2013)

In the data collection phase, studies have utilized different approaches to retrieve traffic and crash data; thus, the data quality varied. For example, for traffic flow data, a traffic database (Choudhary et al., 2018, Cirillo, 1968), test-driving with the normal flow or probe vehicles (Solomon, 1964, Pei et al., 2012), and spot speed collection with traffic data recorders, laser guns, loop detectors, or other devices (Solomon, 1964, Garber and Gadiraju, 1988, Collins et al., 1999, Fitzpatrick et al., 2001, Golob and Recker, 2003, Medina and Tarko, 2005) were used in the studies. Whereas, for crash data, the majority of the studies used crash databases maintained by a police department or state DOT. Other approaches to collect crash data included individual interviews, used by Solomon (1964) and Fildes et al. (1991), and surveillance systems, such as in the study by Golob and Recker (2003). In addition, some studies only considered fatality incidents, such as Lave (1985) and Rodriguez (1990). Therefore, the data quality varied due to the sources of data.

Before constructing models to examine the relationship between speed variation and crash probability, the collected data must be pre-processed to estimate the required measures. As mentioned previously, studies used different definitions to express variation, as well as different ways to compute speed variation. In addition, the ways to determine average speed and vehicle speed at the time the crash occurred varied among studies. Especially for studies performed at an individual vehicle level, and because crashes are unpredictable, the exact vehicle speeds at the time the crashes occurred are difficult to obtain. Instead, researchers made estimates of the speeds of crash-involved vehicles by the crash investigator (West and Dunn,1971), through crash reconstruction techniques (Kloeden et al., 1997), or by other means. In this way, the estimated speeds might not be accurate and result in bias in the studies. Furthermore, if using aggregated data and control-case approaches, it is likely the data would lack temporal and/or spatial matches to better inform the relationship between speed variation and the likelihood of crashes.

During the data analysis phase, various statistical approaches were used by researchers to predict crashes due to speed variation. Multivariate regression, Poisson regression, log-normal regression, principal component analysis, nonlinear canonical correlation analysis, and Bayesian estimations are some of the approaches used. Details about the advantages and disadvantages of the commonly used crash-frequency models can be found in Lord and Mannering (2010). Additionally, when fitting models, studies may leave out important exploratory variables and, therefore, produce erroneous inferences.

Table 2.2 provides a summary description of the research related to speed variation and crash occurrence. In summary, even though the findings are inconsistent, it is not hard to conclude that speed variation is a contributing factor of crash occurrence. Moreover, speed variation also correlates with crash severity and crash type, as shown by Golob and Recker (2003) and Choudhary et al. (2018). Therefore, many studies (e.g., Lee et al., 2002 and Islam et al., 2012) suggest that measures of speed variation (speed standard deviation, variance, or coefficient of variation) could be used as crash precursors.

Table 2.2: Research on Speed Variation and Crash Involvement WITHOUT a Work Zone Present (adapted from TRB (1998))

Study	Study Area and Road Information	Speed Data	Crash Data	Research Objective and Methodology	Major Findings
Solomon (1964)	Main rural highways (2-lane and 4-lane) in 11 States (including Oregon)	Spot speed data were collected by concealed speed measuring devices during daytime and nighttime Average speed was determined by test-driving with the normal flow of traffic and selected by the state highway department engineers	Crash data were collected from the state authorities. Crash-involved vehicle speed was determined based on the estimated travel speed at which the driver was driving before the occurrence of the crash	Made comparisons between crash-involvement rates and variations in the speed of crash-involved vehicles from the average speed of traffic and plotted their relationship	A U-shaped curve showing the relationship between crash involvement and variation from average speed The lowest crash involvement rate occurred at about the average speed (nighttime) or at approximately 6 mph above the average speed (daytime)
Cirillo (1968)	Interstate highways in 20 states in both rural and urban areas	Data were collected only during daytime (between 9:00 am and 4:00 pm) Average speed was determined by weighted average of the average speed for each speed grouping	Crash data were collected by the state highway departments Crash types include: rear-end, angle collisions and same-direction, sideswipe Crash types exclude: head-on, single	Made comparisons between crash-involvement rates and variations in the speed of crash-involved vehicles from the average speed of traffic and plotted their relationship	A similar U-shape curve as Solomon The lowest crash involvement rate occurred at approximately 12 mph faster than the average speed

		The average speed for each speed group was retrieved from speed trend data	vehicle, and pedestrian crashes Only crashes involving two or more vehicles and vehicles traveling in the same direction were analyzed		
West and Dunn (1971)	State highways in Indiana with speed limits greater than or equal to 40 mph	Data were collected using an on-line digital computer and magnetic loop detectors in the pavement.	Crash data were provided by a crash investigation team by the Institute for Research in Public Safety at Indiana University The differences between the crash-involved vehicle speeds and average speeds were determined by the professional investigators.	Made comparisons between crash-involvement rates and variations in the speed of crash-involved vehicles from the average speed of traffic	A similar U-shape curve as Solomon After excluding the crashes involving turning vehicles, the crash rates found for slow speeds were much lower than what was found by Solomon and Cirillo
Lave (1985)	US highways in 50 states Six highway types: interstates, arterials, collectors, and freeways for both	Data were obtained from the US DOT (highway statistics)	Data were obtained from the US DOT (highway statistics)	Examined the relationship between speed distribution parameters (average speed and speed variance, which was measured by the 85th percentile speed minus	"Variance kills," speed variance correlated with fatality rates After controlling speed variance, average speed had very little or no

	rural and urban areas			the average speed) and two other parameters on fatality rates Regression analysis	effect on prevalence of fatalities
Garber and Gadiraju (1988)	Three types of highways in Virginia: interstates, arterials, and rural major collectors, where the posted speed limits were 55 mph	24-hour traffic data were collected on weekdays by Leupold and Stevens traffic data recorder	Crash data were retrieved from the Virginia Department of Transportation (VDOT) and the Virginia Department of Motor Vehicles (VDMOV)	Examined the relationship between the type of highway, average speed, speed variance, design speed, and crash rates at the road section level ANOVA tests and regression analysis	Crash rates increased with increases in speed variance (no U-shape reported) while the crash rates did not necessarily increase with increasing average speed The minimum speed variance was achieved when the posted speed limit was between 5 and 10 mph lower than the design speed
Fowles and Loeb (1989)	Same as Lave (1985)	Same as Lave (1985)	Same as Lave (1985)	Re-examined Lave (1985)'s findings, with considerations of more variables including motor vehicle inspection, and other policy-related variables on fatalities Regression analysis	Both average speed and speed variation had impacts on fatality rates
Levy and Asch (1989)	Similar datasets as Lave (1985)	Similar datasets as Lave (1985)	Similar datasets as Lave (1985)	Re-examined Lave (1985) findings	Both average speed and speed variation

				Regression analysis	had impacts on fatality rates
Synder (1989)	Similar datasets as Lave (1985) for main rural highways including interstates from 26 states (including Oregon)	Similar datasets as Lave (1985)	Similar datasets as Lave (1985)	Re-examined Lave (1985) findings, the study distinguished between fast and flow vehicles to measure speed dispersion: for faster drivers, the difference between 85th percentile and median speed; for slower drivers, the difference between median speed and 15th percentile speed Regression analysis	Average speed impacted fatalities Only speed variance for faster drivers had influence on fatality rates; no such a relationship was found for drivers traveling slower
Lave (1989)				Responded to Fowles and Loeb (1989), Levy and Asch (1989), and Synder (1989); mentioned issues related to aggregated data when combining dissimilar highway types Regression analysis	Speed variance correlated with fatality rates No statistical evidence was found to relate average speed and fatalities
Harkey et al. (1990)	Four states in the US for freeways, multi-lane and two-lane	Speed data were collected using International Road Dynamics 1040	Crash data were gathered by the examined states and only included	Examined the relationship between speed and crash involvement and	A similar U-shape curve as Solomon The lowest involvement rate

	roadways, where the posted speed limits ranged from 25 to 55 mph	Traffic Statistics Recorder (TSR) and inductive loops four times a year at each of these locations by the state transportation personnel	weekdays, non-alcohol, and non-intersection crashes	plotted their relationship	occurred at the 90th percentile of the travel speeds (approximately 7 mph above the mean speed)
Rodriguez (1990)	US highways for 50 states	Speed data (the average speed and the standard deviation of speeds) were obtained from the US DOT Highway Statistics	Crash data (fatality rate) were obtained from the US DOT Highway Statistics	Examined the relationship between average speed and standard deviation on fatalities Regression analysis	A positive and significant relationship between speed variation and fatality rate A negative connection between average speed and fatality rate
Fildes et al. (1991)	Two rural sites (highways with posted speed limits of 62 mph (100 km/h)); and two urban sites (4-lane, undivided arterial sections with posted speed limits of 37 mph (60 km/h))	A manual free speed measurement technique was used to obtain measurements of free-flow speeds during off-peak daylight and fine weather conditions	Crash data were gathered through individual interviews (self-reported crash histories)	Examined the relationship among drivers' attitudes, driving speeds, and their driving behaviors with free-flow speeds and self-report crash histories Multivariate analysis	The relationship between the speed deviated from the average speed and crash involvement was a simple linear or curvilinear function The crash risk was higher for drivers who travel faster than the posted speed limit than for those who travel slower than the posted speed limit.

Kloeden et al. (1997)	In 37 mph (60 km/h) speed limit zones in metropolitan areas	Speed data were collected using laser speed meters during daytime weekdays.	Crash data were collected based on the reported crash data (police crash report and ambulance radio frequency) Crash-involved speeds were estimated using crash reconstruction techniques	Examined the relationship between speed and the risk of involvement in a casualty crash, which involved a fatality Computation of relative risks	In a 37 mph (60 km/h) speed limit zone, traveling speeds below the posted speed limit was not statistically different from those traveling at the posted speed limit For vehicles traveling above the posted speed limits, there was a steady increase in casualty crash involvement with increasing traveling speed
Taylor et al. (2000)	Urban roads with speed limits of 30 or 40 mph in the UK Rural main roads with speed limits of 50 or 60 mph in the UK, Netherlands, Sweden, and Portugal	Traffic data were gathered from local authorities from the UK, Institute of Road Safety Research (SWOV) of the Netherlands, the Swedish Road and Transport Research Institute (VTI) and the Instituto Superior Tecnico (TRANS-POR) of Portugal.	Crash data were obtained from a national crash database and those reported by drivers themselves	Examined the effects of speed distribution parameters on crash rates Multivariate regression	Crash probability increased exponentially with the increase in the spread of speed

Garber and Ehrhart (2000)	Two-lane highways in Virginia	Traffic data were obtained from Virginia DOT data files	Crash data were obtained from Virginia DOT data files	Examined the effects of average speed, the standard deviation of speed, flow per lane, lane width, and shoulder width on crash rates Multiple linear regression and multivariate ratio of polynomials	An increase in the speed standard deviation increased the crash rate The effects of the average speed, lane width, and shoulder width on crashes were negligible
Golob and Recker (2003)	Six major freeway routes in Southern California	Traffic data were obtained from inductance loop detectors. The database used in this study contained traffic data for each 30-second interval.	Crash data were obtained from the Traffic Accident Surveillance and Analysis System (TASAS), mainly from police and insurance reports	Examined the relationship between the type of crashes and traffic characteristics with considerations of weather and lighting conditions Principal component analysis (PCA) and nonlinear (nonparametric) canonical correlation analysis (NLCCA)	Median speed and variations in speed for vehicles traveling in faster lanes were related to collision type Rear-end collision often occurred with low-speed high-variation flows ("stop-and-go" traffic).
Lee et al. (2003)	A 6.21-mile (10 km) expressway in Toronto	Traffic data were obtained from 38 loop detector stations for over a 13-month period	Data on 234 crashes were obtained and confirmed by the traffic control center on the examined section	Identified crash precursors with the consideration of exposure (identified as the product of daily traffic volume and the	The difference between the speed at the upstream detector and that at the downstream detector was significantly

				length of each road section) Log-linear model	higher when crashes occurred
Abdel-Aty et al. (2004)	A 13.25-mile interstate segment in Orlando, Florida	Traffic data including average speed, volume, and occupancy rate were obtained from installed dual loop detectors	337 crashes were obtained from the local police department.	Examined the relationship between speed parameters and daytime freeway crashes through a case-control approach Generalized estimating equations (GEE) technique with a probit link function	High speed variation at a certain location over a 15-min period increased the likelihood of crash at the location and at the end of the period High speed variation at a certain location over a 5-min period increased the likelihood of crash at 0.5 miles downstream of the location and at the end of the period
Abdel-Aty and Pemmanaboina (2006)	A 36.25-mile interstate segment in Orlando, Florida	Traffic data were obtained through dual loop detectors installed on the roadway, which included average speed, volume, and average occupancy for every 30 seconds, 24 hours a day, and 365 days a year	Crash data were obtained from the Florida DOT crash database	Developed a crash-likelihood prediction model with consideration of rain information using a matched case-control approach Logistic regression	The coefficient of variation in speed (in a 5-min interval) at the station closest to the crash location during 5-10 minutes prior to the crash occurrence with the rain index significantly affected crash occurrence

Zheng et al. (2010)	A 12-mile interstate segment in Portland, Oregon	Traffic data were obtained from loop detectors	Crash data were obtained from two databases maintained by ODOT: the statewide Crash Data System (CDS), and the incident database in the Portland Metropolitan area which was logged by the Traffic Management and Operations Center (TMOC)	Examined traffic and crash data under traffic oscillations through a case-control design Conditional logistic regression analysis	The standard deviation in speed was a significant contributor to crash occurrence under traffic oscillations on freeways The likelihood of a (rear-end) crash increased by 8% with an additional unit increase in the speed standard deviation
Kockelman and Ma (2010)	Same as Golob and Recker (2003)	See Golob and Recker (2003)	See Golob and Recker (2003)	Examined the relationship between speed and crash occurrence with the consideration of within-lane speed variation and across-lane variation Ordinary least squares (OLS), weighted least squares (WLS), and binomial regression models	There was insufficient evidence to show that average speed and speed variation (both within-lane and across-lane) triggered crashes
Islam et al. (2012)	A 5.72-mile (9.2 km) urban freeway segment in Edmonton, Canada	Traffic data were obtained from dual loop detectors through the database	Collision data were obtained from the City of Edmonton's collision database (Motor Vehicle	Examined the relationship between speed and other traffic characteristics on crash occurrence through a	Average speed, standard deviation of speed, coefficient of variation in speed, and average

		maintained by the Traffic Operation Group of the City of Edmonton	Collision Information System)	matched case-control approach Paired t-test	occupancy of the traffic stream at the location of collision all correlated with crash occurrence
Pei et al. (2012)	112 roadway segments in Hong Kong, China	Traffic flow data were obtained from the annual traffic census (ATC) system in Hong Kong, and spot speed data were obtained from taxi-based GPS systems	Crash data were obtained from the Traffic Information System maintained by the local Transport Department (a total 347 crashes were examined)	Evaluated the relationship between speed and crash risk with the considerations of distance and time exposure Joint probability models with Bayesian inference approach	Standard deviation of speed was not significantly related to the likelihood of crash occurrence or crash severity
Li et al. (2013)	A 6-mile interstate segment in Oakland, California	Traffic data were obtained from loop detectors which recorded average speed, occupancy, and traffic volume every 30 seconds	Crash data were obtained from the Statewide Integrated Traffic Records System maintained by the California Highway Patrol (a total of 446 crashes were examined)	Evaluated the relationship between speed variation and crash probability through a case-control approach Logistic regression	Impacts of speed variation on crash occurrence varied in different traffic conditions The speed standard deviation and coefficient of speed variation had significant impacts on crash occurrence for congested traffic and back of queue conditions, while the relationship was not significant in free flow and front of queue conditions

Quddus (2013)	266 road segments around London, UK	Traffic data were obtained from the UK Highway Agency	Crash data were obtained from the STATS19 National Road Accident Database	Examined the relationship between speed, speed variation, and crash frequencies Poisson regression	Average speed was not related to crash rates after controlling factors such as grade, curvature, etc. Speed variation correlated with crash rates (a 1% increase in speed variation resulted in a 0.3% increase in crash rates)
Qu et al. (2014)	An expressway section with a posted speed limit of 49.7 mph (80 km/h) in Beijing, China	Traffic data were obtained from the local traffic management systems	Crash data were represented by two parameters: time to collision (TTC) and deceleration rate to avoid crash (DRAC)	Examined the relationship between speed, speed dispersion, and volume on crash occurrence Regression analysis	Standard deviation in speed provided the best prediction of potential crash risks, and there was a positive relationship between them
Yu and Abdel-Aty (2014)	A 15-mile mountainous freeway segment in Colorado and an urban expressway segment in Florida	Traffic data were obtained from AVI detectors	Crash data were obtained from AVI detectors	Examined crash injury severity with real-time traffic and weather data Binary probit models with both the maximum likelihood estimation and Bayesian inference approach	Large variations in speeds 6-12 minutes prior to the crash occurrence increased the probability of severe crashes
Shi et al. (2016)	A 21-mile urban expressway segment in the	Traffic data were obtained from AVI detectors	Crash data were obtained from AVI detectors	Examined the relationship between traffic flow, roadway	Both lower speed and higher speed variation

	Central Florida area			geometric characteristics, and crash occurrence with real-time data Multi-level random parameters models, and negative binomial models	significantly increased the likelihood of crashes
Xu et al. (2016)	A 17-mile interstate segment in California	Traffic data were obtained from the Highway Performance Measurement System (PeMS)	Crash data were obtained from the Statewide Integrated Traffic Records System (SWITRS) which was maintained by the California DOT (Caltrans) (a total of 508 crashes examined)	Examined the predictability of crash risk models and the likelihood of crashes with real-time traffic data Bayesian inference approach	An increase in the occupancy at upstream stations, the speed variance at downstream stations, and the speed difference between upstream and downstream stations increased the crash occurrence
Wang et al. (2017)	247 segments from three expressways in Orlando, Florida	Traffic data were obtained from the Microwave Vehicle Detection System (MVDS), which was operated by the Central Florida Expressway Authority (CFX)	Crash data were obtained from the Signal Four Analytics (S4A) database (a total of 2228 crashes were examined)	Examined the relationship between traffic flow and crash frequency with roadway geometric data with real-time data Bayesian inference approach	The average daily standard deviation of speed was a positive contributing factor to crash occurrence
Tanishita and Van Wee (2017)	An expressway segment in Japan	Traffic data were gathered by double	Crash data were obtained from the	Examined the relationship between the mean speed and the	Both mean speed and change in mean

		vehicle detection loops	Central Nippon Expressway Co. Ltd.	change in the mean speed on crash occurrence Poisson regression with two additional dimensions	speed affected crash occurrence
Choudhary et al. (2018), UK	A 108.74-mile (175 km) three-lane freeway segment in London, UK	Traffic data were obtained from the Motorway Incident Detection and Automatic Signaling database of Highways England through inductive loop detectors installed in the study area	Crash data were obtained from the National Road Accident Database of the UK for three years	Explored the relationship between crash (occurrence and severity) and traffic measurements (speed and volume) Multivariate Poisson lognormal regression	Crash rate increased with an increase in the within-lane speed variance at higher volume conditions The crash rate also increased with an increase in the between-lane speed variance at high-speed conditions The within-lane speed variance imposed a higher risk for passenger vehicles or vans than heavy vehicles, while the between-lane speed variance created a higher risk for heavy vehicles than passenger cars. Within-lane speed variance contributes to a higher chance of fatality or seriously

					injures than minor injuries.
Wang et al. (2018)	Segments of eight urban arterials with a total length of 47.59 miles (76.59 km) in Shanghai, China	Traffic data were obtained using the floating car data (FCD) method from taxi-based GPS	Crash data were obtained from the local police department	Examined the relationship between speed, speed variation, and crash occurrence with taxi-based high frequency GPS data Hierarchical Poisson log-normal analysis	A 1% increase in speed variation was related to a 0.74% higher probability of a crash
Day et al. (2019)	Interstate roadway segments in Iowa	Traffic data were obtained through probe vehicle technology (provided by INRIX) and from Automatic Traffic Recorder equipment from 2013 to 2016	Crash data were obtained from the statewide crash database maintained by the Iowa DOT from 2008 to 2016	Examined the relationship between speed measurements including speed variance and average speed, with crash frequency Random effects negative binomial analysis	A 1 mph increase in the standard deviation of speed resulted in a 27.8% increase in the total number of crashes

2.2.2 With a Work Zone Present

Crash rates on roadways with a work zone present are often higher than the rates at the same location during normal operations without construction or maintenance activities present. The higher occurrence rates may be due to a number of factors including large speed variance resulting from drivers' different reactions towards hazardous conditions in the work zones, such as the presence of workers, a lane closure, and narrow lanes (Hou et al., 2013). It has been shown that the safest work zones are those with the smallest increase in the upstream-to-work-zone speed variation (Migletz et al., 1999). Other studies have also shown that high speed variation is a contributing factor to crash occurrence in work zones. This section presents a summary of the related studies of speed variation and work zone crashes.

2.2.2.1 Research on Speed Variation and Crash Probability

A study carried out by Rouphail et al. (1988) examined the crashes that occurred in long-term and short-term work zones on urban freeways in Chicago, Illinois. Work zone crash data were extracted from the crash data from the Illinois DOT between 1980 and 1985. With the comparison among the crashes "before", "during" and "after" construction activities, it was found that for long-term sites, the proportion of rear-end crashes and multiple-vehicle crashes increased significantly with a work zone present and the high frequency correlated with the increased speed variation during work progress in transition areas. To understand the characteristics of traffic flows in work zones, speed data were collected using test vehicles traveling through 46 selected work zones. The researchers found that for sites with two-lane closures, speed variation (measured as the coefficient of variation) increased in the transition zones, but slightly decreased in the transition zones for sites with single-lane closures when compared to speed variation in the advance warning area and in areas that were along the closed portion of the work zone. Additionally, the magnitude of speed variation was higher in high volume conditions than in low volume conditions.

Garber and Woo (1990) examined crash characteristics at seven urban work zones in Virginia. Traffic data were collected by traffic data recorders for conditions before the installation of the work zone ("before data") and during the progress of the construction work ("during") for 24-hour intervals. As for crash data, the researchers manually recorded traffic conflicts, which were defined as an event that involves the interaction of two or more vehicles in which one or more drivers takes an emergency maneuver to avoid a collision, for 8-hour periods. The traffic conflicts were shown to be good surrogates of crashes. For comparison purposes, data were collected on the same weekdays and during the same time of day. Significant differences were found in average speed and speed variance in "before" and "during" conditions. Average speed tends to reduce while speed variance tends to increase during work zone operations. Through regression analysis, it was shown that the change in speed variance between the "before" and "during" periods has a positive relationship with the change in crash rates (traffic conflict rates in this study), while no relationship was found between the change in average speed and crash rate.

Similarly, subsequent research (Zhao and Garber, 2001, Garber and Zhao, 2002) also found that the crashes in work zones were mainly caused by speed variation when examining work zone crashes in Virginia that occurred between 1996 and 1999. Therefore, speed variation was suggested as an important predictor of crashes in work zones.

2.2.2.2 Reasons for differences between with work zone and without work zone conditions

Prior research reveals that the presence of a work zone tends to increase the crash rate, and the most predominant type of crash in work zones is rear-end crashes at each locations within the work zone on different road types (Yang et al., 2014, Zhao and Garber, 2001, Garber and Zhao, 2002). Rouphail et al. (1988) and Xie et al. (2018) pointed out that the presence of a work zone has a significant disproportionately high percentage of rear-end crashes. The occurrence of rear-end crashes are mainly caused by vehicles driving at different speeds and following too closely during congestion and stop-to-go traffic, which often result in high speed variation (Zhao and Garber, 2001, Xie et al., 2018).

In addition, in the study performed by Zhao and Garber (2001), the researchers found that the proportion of multiple vehicle crashes with a work zone present was significantly higher than that without a work zone. The finding was in line with that of Rouphail et al. (1988). It indicates a higher interaction of vehicles within work zones, which can also be attributed to higher speed variances in work zones (Zhao and Garber, 2001).

Therefore, due to the nature of work zones, temporary lane reductions/closures are required to facilitate the operations. Because the traffic capacity is reduced and drivers may react differently towards the traffic control devices present, such as merging strategies, traffic congestion and stop-to-go driving conditions occur frequently. These conditions may result in high traffic volume impacts, high interactions with multiple vehicles, and differential speeds among drivers, which increase speed variation. Hall (1974) found that speed variation primarily contributed to rear-end and lane change collisions, which are consistent with the findings from the above-mentioned research without a work zone present. Thus, speed variation in work zones tends to be greater than that in free-flow conditions, which is associated with a higher probability of crashes. Continued attention should be given to speed variation in work zone conditions to improve work zone safety.

2.3 FACTORS AFFECTING SPEED VARIATION

Investigation and identification of factors that affect speed variation will help to identify countermeasures that minimize speed variation and therefore improve roadway safety. Based on a thorough literature search, various factors that affect speed variation were identified. Four types of contributing factors that impact speed variation are summarized below and in Table 3.3.

2.3.1 Speed-Related Factors

Collins et al. (1999) found that design speed and posted speed limit have strong influences on speed variance (measured as standard deviations). The study was carried on rural two-lane highways, and one of the research objectives was to identify whether design speed can be used to predict speed distribution measures. The study revealed that higher design speed and posted speed limits generally contribute to higher standard deviations. Similarly, in a study performed by Kockelman and Ma (2010), the researchers examined the relationships among average speed, speed variation (measured as standard deviation), and crash involvement using the dataset from Golob and Recker (2003) for vehicles traveling on freeways. The result also showed that speed variation (measured as standard deviation) for conditions limited to within-lane speeds and conditions that consider both within-lane and section average speeds increased with design speed. It was estimated that the within-lane and total speed standard deviation increased 1.8 mph and 4.6 mph for every 10 mph increase in design speed, respectively.

Additionally, Garber and Gadiraju (1988) identified that the difference between the design speed of the highway and the posted speed limit has impact on speed variation. The minimum speed variance was observed when the posted speed limit was between 6 and 12 mph lower than the design speed. Beyond this range, an increase in the difference between the design speed and the posted speed limit increased speed variation.

The impact of increased posted speed limit and truck differential speed limit (DSL) on speed variation was addressed in several studies. For example, Garber and Gadiraju (1991) found that the implementation of a DSL tended to increase the speed variance. The study compared case and control sites operating under a DSL (65/55 mph) in Virginia and non-DSL (55/55 mph) conditions in West Virginia. The researchers found that the overall speed variance for all vehicles was higher for Virginia under the DSL conditions compared to that in West Virginia with the non-DSL conditions. The finding was in contrast to that of Pfefer et al. (1991), which did not find significant effects of DSL implementation on speed variance on 15 rural interstate highway segments in Illinois, where the posted speed limits were changed from 55/55 mph to 65/55 mph. No impact was observed on the speed variance of passenger cars and trucks. Likewise, Harkey and Mera (1994) found the speed variance was similar for segments of interstate highways with a DSL and without a DSL. With the inconsistent findings, a reason for the discrepancy provided by FHWA (2004) was "the effect of the DSL, if any, is not enough to be detected in the aggregate speed data."

A number of studies confirmed the association between average speed and speed variation. Garber and Gadiraju (1988) found that a negative relationship exists between speed variance and average speed for highways. As average speed increases, speed variance decreases. The relationship the researchers observed was not simply linear; it is a second-order function. Moreover, a UK study conducted by Taylor et al. (2000) found a similar trend that speed variation decreases as the average speed increases. Medina and Tarko (2005) also found that a lower average speed resulted in larger speed variation for vehicles traveling on two-lane rural highway segments with a posted speed limit of 55 mph.

The findings of the studies mentioned in the previous paragraph are in contrast with the conclusions from Kockelman and Ma (2010) and Wang et al. (2016), who found that higher mean speeds are often associated with greater speed variation. As identified by Wang et al. (2016), the inconsistency may be due to the location of highways (rural or urban areas), the number of lanes, the presence of posted speed limit signs and intersections, etc. In addition, the conclusion reached by Kockelman and Ma (2010), limited to vehicles traveling in the same lane on freeways, was: higher within-lane speed variation occurred when vehicles travelled at a higher within-lane average speed.

2.3.2 Road Design and Traffic Control Features

Even though the study carried out by Collins et al. (1999) showed that there were low correlations between roadway geometric features and speed variance for free-flow vehicles on rural two-lane highways, many studies have shown that various road characteristics impact speed variation.

A study performed by researchers at Purdue University Medina and Tarko, 2005) claimed that speed variation was influenced by the presence of an intersection in a tangent section by developing free-flow speed models on tangent segments and horizontal curves of two-lane rural highways. Specifically, the presence of an intersection located within 350 ft. from any location in a tangent section increased the speed variation. Moreover, a study of urban arterials in Shanghai, China (Wang et al., 2016) had a consistent finding with Medina and Tarko (2005) in regards to the presence of intersections. The researchers found that speed variation increased as the number of access points increased. Furthermore, the number of lanes, the presence of bus stops, and traffic signals were identified as being associated with speed variation. To be specific, an increase in the number of lanes and bus stops resulted in increased speed variation, while an increase in the coordination of traffic signals (timing of green lights) resulted in a decrease in speed variation.

With respect to the geometric design of the roadway, Medina and Tarko (2005) found that speed variation increased as roadway grade increased, and decreased with an increase in the degree of curvature. Furthermore, Collins et al. (1999) and Fitzpatrick et al. (2000) found that for vehicles traveling on rural two-lane highways, for horizontal curves, the standard deviation of speed varied from 3.73 mph to 7.46 mph (6 to 12 km/h). Low speed variation (measured as standard deviation) was observed on horizontal curves with radii values that were less than 328 ft. (100 m). The range of speed variation increased as the radii value increased. The researchers also found that speed standard deviation was affected by pavement width as follows: speed deviation decreased with increasing pavement width, by 0.25 mph (0.4 km/h) for every 3.28 ft. (1 m) increase in pavement width.

The presence of warning signs also influences driver speed choice. For example, when exploring factors that affect drivers' speeds along two-lane rural highway transition zones, Cruzado and Donnell (2010) found that with the presence of a Curve Ahead warning sign, the speed variance (66 mph^2) in transition zones was much higher than that (11 mph^2) without a Curve Ahead warning sign.

Importantly, a number of studies mentioned that the presence of work zones would result in higher speed variability. Besides the studies mentioned above (Garber and Woo, 1990, Rouphail et al., 1988) that generally found speed variation increased during work zone operations, especially in transition areas, an additional study conducted by Kockelman and Ma (2010) found that the presence of work zones increased within-lane speed variation as driver concerns about safety in such locations. Specifically, Richards et al. (1985) found that work zone site characteristics, such as short tapers, missing arrow boards, signs, or combinations of these factors contributed to higher speed variation in work zones as drivers were not well informed.

2.3.3 Environmental Conditions

With the consideration of weather and lighting conditions, Golob and Recker (2003) examined the relationships between the type of traffic crashes and traffic characteristics using the data collected on six major freeway routes in Southern California. The researchers claimed that weather and lighting conditions contributed to speed variation (measured as the difference between the 90^{th} percentile and the 50^{th} percentile of the speed distribution). To be specific, dry, dark conditions resulted in high variations in speed, while wet, daylight conditions resulted in low variations. For vehicles traveling at night, Kockelman and Ma (2010) found that both within-lane and total speed variation increased substantially under streetlight conditions compared to under no-streetlight conditions.

2.3.4 Other Factors

Besides the factors mentioned above, researchers have also identified many others that impact speed variation. For example, some studies pointed out that traffic density/volume is a key indicator of speed variation, such as Kockelman and Ma (2010). To quantify the relationship between the factors and speed variation, Wang et al. (2013) proposed a speed variance function and discovered a nonlinear and heterogeneous relationship between speed variance and traffic density based on empirical traffic data collected by virtual loop detectors on highways in Georgia. It was found that speed variance initially increases to a maximum point, then decreases as traffic density increases. Additionally, in a study performed by Wang et al. (2016) to examine speed variation during peak and off-peak hours on urban arterials in Shanghai, China, it was shown that higher traffic volume resulted in reduced speed variation (measured as standard deviation) in peak-hours. The crash occurrence related to congested traffic examined by Zheng et al. (2010), as mentioned previously, revealed that an increase in speed variation increases the chance of getting involved in a crash.

In addition, Kockelman and Ma (2010) found that higher speed variations were observed in the right-side (slow) lanes in comparison with those in the left-side (fast and passing) lanes. The greater speed variation may be because the slow lanes tend to have more slow vehicles and weaving maneuvers due to merging and diverging traffic.

Park and Ritchie (2004) attempted to quantify the relationship between speed variance, driver's lane changing behavior, and vehicle heterogeneity. The data collection was conducted using double inductive loop detectors (ILD) and cameras on two sites on a 7-lane freeway in Irvine, California. Through multivariate regression analysis, the researchers found that driver's lane changing behavior tended to increase speed variance on the 7-lane freeway. Specifically, when the changing pattern experienced a more than 4-lane difference, the speed variance was influenced greatly. The researchers also claimed that longer vehicles (primarily for vehicles having a length not less than 10 feet) had considerable impact on speed variation.

Table 2.3: Factors Affecting Speed Variation

Category	Subcategory	Source
Speed-related factors	Posted speed limit	Collins et al. (1999)
	Design speed	Collins et al. (1999), Kockelman and Ma (2010)
	Difference between the posted speed limit and the design speed	Garber and Gadiraju (1988)
	Truck Differential Speed Limit (DSL)	Garber and Gadiraju (1991), Pfefer et al. (1991), Harkey and Mera (1994), FHWA (2004)
	Average speed	Garber and Gadiraju (1988), Taylor et al. (2000), Medina and Tarko (2005), Kockelman and Ma (2010), Wang et al. (2016)
Road design and traffic control features	Presence of intersections and the number of access points	Medina and Tarko (2005), Wang et al. (2016)
	Number of lanes	Wang et al. (2016)
	Traffic signal	Wang et al. (2016)
	Presence of bus stops	Wang et al. (2016)
	Curvature	Collins et al. (1999), Medina and Tarko (2005)
	Pavement width	Collins et al. (1999)
	Signs	Cruzado and Donnell (2010)
	Presence of work zones	Rouphail et al. (1988), Garber and Woo (1990), Kockelman and Ma (2010)
Environmental conditions	Weather	Golob and Recker (2003)
	Lighting	Golob and Recker (2003), Kockelman and Ma (2010),
Other	Traffic density/volume	Kockelman and Ma (2010), Wang et al. (2015), Wang et al. (2016)
	Travel lane	Kockelman and Ma (2010)
	Lane changing behavior	Park and Ritchie (2004)
	Length of vehicle	Park and Ritchie (2004)

2.4 WAYS TO REDUCE SPEED VARIATION

Given the positive correlation between speed variation and crash occurrence, it is logical that one goal would be to reduce the amount of speed variation, both with and without a work zone present. Reducing the amount of speed variation is expected to result in fewer crashes. A question then arises regarding the possible means to reduce speed variation. With the identification of factors that have influence on speed variation, prior research studies have been conducted to identify measures that can be implemented to reduce speed variation. The following sections present the findings of the literature search with respect to means to reduce speed reduction. The contents are organized based on whether the study environments included work zones or not.

2.4.1 Without a Work Zone Present

2.4.1.1 Signage

Deploying different types of changeable message signs (CMSs) on roadways has been found to be effective for speed variation reduction by a number of researchers. According to the Manual on Uniform Traffic Control Devices (MUTCD) (FHWA, 2009), a CMS is a traffic control device that is used to display one or more alternating messages with respect to safety, for both transportation- and emergency-related concerns. During adverse weather conditions, some studies (Downey, 2015, Robinson, 2000, Perrin et al., 2002, Young et al., 2012) have shown that the use of CMS systems was effective in providing positive guidance to drivers and, as a result, reducing speeds and speed variation and decreasing the crash occurrence rate.

A CMS can also be used to display variable speed limits (VSLs) based on ambient or operational conditions for the purpose of ensuring a more efficient traffic flow (FHWA, 2009). Waller et al. (2009) found that the use of VSL tended to reduce speed variability on selected freeways in Texas. In an Australian study (Jiang et al., 2011), a large reduction was found in speed deviation (about 12%) in high flow conditions with a VSL present on an urban freeway in Queensland. After deploying a VSL system on a freeway in Beijing, China, Shao-long et al. (2013) found that a VSL can reduce the speed variance of unstable traffic flow and minimize the effects of traffic congestion.

In Germany, van Nes et al. (2010) not only assessed speed variability between subjects (measured as the speed standard deviation for all subjects on a road section), but also examined the homogeneity of individual speeds (measured as the speed standard deviation for an individual subject at a particular road section) with the use of a VSL in a driving simulator environment. It was found that in comparison with static speed limit systems, the deployment of a VSL improved the homogeneity of individual speeds, as the standard deviation for an individual driver decreased significantly. However, no significant reduction in speed variation was found between subjects. Similarly, another study in Germany (Ackaah et al., 2016) did not find statistically significant differences in speed variation between subjects with VSL systems “on” and “off” on a three-lane freeway.

Studies have also examined the effects of a VSL on within-lane and across-lane speed variation. The study performed by Lucky (2014) showed that the application of a VSL on a freeway in France, reduced the within-lane speed variation in comparison to the condition without a VSL for the entire shoulder, middle, and faster lanes. However, the use of a VSL was found to increase across-lane speed variation. In contrast, Strömgren and Lind (2016) found that with the VSL systems activated, both the within-lane and total speed variance (measured as the squared standard deviation) decreased on a freeway section in Stockholm, Sweden. The reduction in within-lane and total speed variance was in proportion to the speed reduction, which was based on real-time average speed, of 4.35 mph to 6.21 mph (7 kph to 10 kph).

Another type of CMS is a radar speed sign which can display to approaching drivers the speed at which the drivers are traveling so that they are aware when they are traveling above the posted speed limit. Jomaa (2014) examined one type of radar speed sign named "vehicle-activated signs" on drivers' speed choices. This system measures the speed of passing vehicles and displays a warning message with the posted speed limit when the speed exceeds a trigger speed. The researcher found that the presence of vehicle-activated signs lowered both average speed and standard deviation of speed. In addition, it was recommended to set the trigger speed near the 85th percentile speed to minimize the standard deviation.

Furthermore, in addition to displaying the maximum speed limits, West and Dunn (1971) suggest that providing both maximum and minimum speed limits could be an effective means to reduce the number of high and low speed differences. Hauer (1971) also pointed out the importance of displaying the minimum speed limit to the drivers. Hauer claimed that displaying the minimum speed limit could reduce the total number of overtakings by nearly 23%, which was more than twice as effective as displaying the maximum speed limit.

2.4.1.2 Law Enforcement Presence

One way to improve driver compliance with speed limits is through the use of law enforcement. Speed camera (i.e., photo radar) enforcement is one type of speed limit enforcement that may be used, and the safety effect of different types of camera enforcement has been examined. Pertaining to speed variation, Chen et al. (2002) found the use of photo radar enforcement on a four-lane divided highway segments in British Columbia, Canada, achieved a 0.31 mph (0.5 km/h) reduction in speed deviation, as well as a 1.74 mph (2.8 km/h) reduction in average speed.

Additionally, a review provided by Soole et al. (2013) showed that average speed enforcement, which is a traffic enforcement system to check if a vehicle's average speed between two camera sites exceeds the posted speed limits, was a promising approach to reduce speed variation. The researchers found that such an enforcement approach could reduce mean and 85th percentile vehicle speeds by up to a third, and is an effective countermeasure for addressing speeding behavior. In addition, the implementation of the average speed camera enforcement was cited to reduce the number of injury crashes up to 65%. A similar system (automated speed enforcement areas) was examined by Shim et al. (2015) on Korean expressways through cross-sectional and before-and-after comparisons. The study revealed that the presence of automated speed enforcement systems reduced speed differences across vehicle types and the overall crash occurrence dropped by 7.6% on average.

Reed (2001) examined various speed fine policies and the relationship between fine policies and driver behavior through simulations. The study compared four types of fine functions: (1) base fine function (based on the fine function and enforcement levels at the time of writing), (2) zero variance – zero revenue fine function, (3) revenue equivalent fine function, and (4) revenue maximizing fine function. The researchers concluded that if the objective of utilizing speed fine policies as a traffic control measure is speed variation minimization, the policies could reduce speed variance by 12-38%, but with a reduction in revenues by less than 9% compared to the base fine function.

2.4.1.3 Other Measures

Additional research has been conducted on other traffic control measures, and combinations of measures, to determine their impact on speed variation without a work zone present. For example, Waller et al. (2009) found that the use of a VSL in conjunction with shoulder use during peak-hours on freeways in Texas, the within-lane speed variability was reduced. However, due to additional lane changes to and from the shoulder, the across-lane speed variability increased.

Islam and El-Basyouny (2013) proposed an integrated speed management action plan, which consists of an engineering treatment, such as painting a centerline, educational activities, and enforcement activities. The before-after experiments found that the proposed plan can effectively reduce speed variation as well as vehicle speeds over both the short-term and long-term.

Yelchuru et al. (2017) evaluated the effectiveness of an intelligent transportation systems identified as a Connected Vehicle Dynamic Mobility Application (DMA). Such a system enables sharing transportation data through a wireless communication network. The study focused on speed harmonization and was conducted on freeways in Chicago, Illinois. The researchers observed that in a connected environment, the average speed increased and speed variation decreased.

2.4.2 With a Work Zone Present

While the majority of research efforts were undertaken without a work zone present, a few approaches including the use of traffic control devices, lane markings, law enforcement, and other means have been shown to be effective in lowering speed variation in work zone conditions. The findings of these studies are described below.

2.4.2.1 Standards, Guidance, and Policies

Pertaining to work zones and speed variation, Section 6C.01 of the MUTCD (FHWA, 2009) states:

> "Research has demonstrated that large reductions in the speed limit, such as a 30-mph reduction, increase speed variance and the potential for crashes. Smaller reductions in the speed limit of up to 10 mph cause smaller changes in speed variance and lessen the potential for increased crashes. A reduction in the regulatory speed limit of only up to 10 mph from the normal speed limit has been shown to be more effective."

Therefore, to minimize speed variation in a work zone, a speed limit reduction from the free-flow condition is suggested to be no more than 10 mph; otherwise, the reduction would increase speed variation.

The Oregon Temporary Traffic Control Handbook (ODOT, 2016) provides guidance on designing and implementing traffic control measures for temporary work operations like construction and maintenance. No guidelines, standards, or policies that relate to speed variation were found in the Oregon Temporary Traffic Control Handbook.

2.4.2.2 Signage

2.4.2.2.1 Speed limit signs

Hou et al. (2013) examined different speed limit scenarios on three Interstate 70 short-term work zones in rural areas in Missouri. The scenarios tested were: (1) no posted speed limit reduction (posted speed limit of 70 mph); (2) 10 mph posted speed limit reduction (posted speed limit of 60 mph); and (3) 20 mph posted speed limit reduction (posted speed limit of 50 mph). A significant difference was found in the speed standard deviation among all the scenarios, while the lowest standard deviation and the lowest average speed were found in the 20-mph speed limit reduction scenario. The result is different from the MUTCD recommendation that 10-mph reduction is most effective as stated above. The researchers claimed that the reduction of 20 mph might be effective in short-term rural interstate work zones with original speed limits of 70 mph but not as effective under other conditions.

In addition, Sharma et al. (2017) examined four different Iowa crash and project databases to understand the impacts of temporary work zone speed limit reductions on speed variation. Though the availability and quality of the data limit the results, and real-time (e.g., case study) data was not utilized, the researchers found that while the speed limit reductions did actually result in reduced vehicle speeds, speed variation might be impacted by other latent factors related to the sites that were not investigated. Additionally, traffic volume was found to be an impacting factor. The results reveal that speed variation may not be affected by changes in roadway vehicle occupancy when the occupancy is less than 20%.

2.4.2.2.2 Changeable message signs, including variable speed limits and radar speed signs

While deploying CMSs in work zones, some studies have evaluated their influences on drivers' behaviors and some research showed that the signs were effective in reducing speed variations among vehicles. For example, in a two-phase research study conducted by Garber and Patel (1994) and by Garber and Srinivasan (1998), the researchers examined the effectiveness of CMSs at seven work zones on interstate highways in Virginia. The studies revealed that the use of a CMS lowered speed variance, and contributed to safer work zone conditions. The researchers also claimed that displaying personalized messages, such as

"YOU ARE SPEEDING, SLOW DOWN," could significantly reduce speed variance. The recommended location for a CMS in work zones on interstate highways was prior to the beginning of the work area, and at a location without obstructions by other signs.

Focusing on another type of CMS, one which incorporates a radar system that is capable of warning a driver when the operating speed exceeds a predetermined speed threshold, Wang et al. (2003) carried out a study on a rural two-lane, two-way highway with adjacent work activity with uninterrupted traffic-flow conditions in Georgia. The study confirmed that placing a CMS with radar prior to the active work area lowered speed variances at both the CMS location and the region adjacent to the active work area.

King et al. (2004) also showed the effectiveness of a CMS on reductions in speed variation in a study performed in work zones on I-70 in Missouri. The posted speed limit was reduced from 70 mph to 55 mph in the work zone. The CMS units used in this study were programmed with different messages to notify drivers of the varying traffic conditions near the work zone, especially of conditions where the average speed in the work zone had a significant drop. Two CMSs were placed on the roadway, one 2 miles and the other 5 miles upstream from the work zone. The researchers found that both average speed and speed variance were reduced significantly for vehicles approaching the work zone.

As for VSLs, some studies did not find significant impacts of the implementation of VSLs on speed variation reductions in work zones. For example, using a calibrated simulation model of a work zone on I-95/I-495 in Washington, D.C., Fudala and Fontaine (2010) did not find apparent effects of VSLs on speed variation reduction during congested work zone periods for both four-to-one lane closure conditions and four-to-two lane closure conditions. However, the researchers found that the use of a VSL lowered speed variation during the free-flow periods, and helped delay the formation of congestion during work zone operations. The researchers also pointed out the importance of VSL sign location, indicating that, "signs must be positioned so that drivers will accelerate back to a reasonable speed once they pass through a bottleneck". In addition, a study (Lyles et al., 2004) in an 18-mile work zone on I-96 in Michigan found that with the deployment of a VSL in the work zone, no significant benefit was obtained to lower speed variance, but average speeds were increased by 1 to 3 mph.

Nevertheless, there are a few studies that have concluded that using VSLs in work zones is effective in lowering speed variation. In an analysis of simulation-based experiments under highway work zone conditions, Lin et al. (2004) found the speed variance under the VSL control was lower than those under the non-VSL control. Similarly, aiming to lower the speed of the upstream traffic approaching the work zone bottleneck, Kwon et al. (2007) evaluated the VSL systems on a work zone on I-494 in Minnesota. The results showed that the deployment of VSLs reduced the average 1-min maximum speed differences during morning peak periods (between 6:00 am and 8:00 am) by 25% to 35%, which improved the total throughput volume at the downstream work zone.

When comparing VSL signs and static speed limit signs, a study funded by the Utah DOT (Riffkin et al., 2008, McMurtry et al., 2009), was carried out at a six-mile long-term work zone on I-80 in Utah in which during operations only one lane was open to traffic. The speed limit for the examined segment was reduced from 75 mph to 65 mph. In the study, two VSL signs (one set at 65 mph 24 hours per day, 7 days per week, and another one set to 55 mph during the daytime and 65 mph at nighttime) were tested against the static speed limit signs (65 mph). The study revealed that placing VSL signs after tapering to one-lane (transition area) showed that the VSL was more effective in reducing speed variances near the entry to the activity area of the work zone in comparison with static speed limit signs.

For work zones with mobile operations, instead of placing traffic control devices at fixed locations, Jafarnejad et al. (2017) examined the impact of truck-mounted radar speed signs (RSSs) in two work zones in Oregon. The study found that less speed variation between adjacent vehicles was obtained with the RSS turned on.

2.4.2.2.3 STOP/SLOW paddles

STOP/SLOW paddles have also been investigated with respect to their impact on the variation in vehicle speeds in work zones. As part of the Strategic Highway Research Program (SHRP), Stout et al. (1993) deployed flashing STOP/SLOW paddles (FSSPs) on flagged-controlled two-lane, one-way work zones in Virginia and found that FSSPs can slow approaching vehicles at an advance location designated by the flagger and reduce speed variation when compared to the conditions of standard paddle usage. The researchers claimed that using FSSPs in work zones with short sight-distance approaches to flaggers enabled smooth slowing driving behaviors and therefore reduce the likelihood of rear-end crashes and high-speed vehicles entering the work zone.

2.4.2.3 Pavement Markings

A transverse rumble strip is a series of intermittent, narrow, transverse areas of rough-textured, slightly raised or depressed road surface that extend across the travel lane to alert road users to unusual traffic conditions. Rumble strips may also be located along the shoulder, along the roadway centerline, or within islands formed by pavement markings to alert road users that they are leaving the travel lanes (FHWA, 2009) . The effectiveness of rumble strips on controlling speeds in work zones has been investigated. Zech et al. (2005) evaluated the effectiveness of rumble strips and police presence in a four-lane divided rural freeway work zones with a posted speed limit of 45 mph on I-86 in New York. The study revealed that police presence in conjunction with rumble strips was proven to be the most effective speed variation control, as it reduced the speed variation by about 25%.

2.4.2.4 Law enforcement presence

Richards et al. (1985) examined different speed controls including flagging, law enforcement, CMSs, lane width reduction, rumble strips, and conventional regulatory and advisory speed signs, in six work zones in Texas. The research confirmed that using a stationary patrol car without lights or radar parked on the side of the road parallel to traffic generally reduced speed standard deviation by 1 to 2 mph; however, no such reduction effect was found for a circulating patrol car.

2.4.2.5 Other measures

Optical speed bars are transverse strips spaced at gradually decreasing distances (McGee, H. W. and Hanscom, F. R, 2011). Speed bars are often used to increase drivers' perception of speed, therefore motivating drivers to lower their speeds. A study conducted by Meyer (2004) described that using optical speed bars was effective for speed variation (measured as standard deviation) reduction in a highway work zone in Kansas.

A recent NCHRP report (Mallela et al. 2019) mentions that the connected vehicle concept, either having connection among vehicles (V2V) or between vehicles and the infrastructure (V2I), is promising in collision avoidance as it provides real-time upstream and downstream data, and enables device-to-device communication. It could also be a supplement to onboard automation features that further enhance dynamic speed harmonization.

2.5 MITIGATING THE IMPACTS OF SPEED VARIATION

In the previous section, ways to reduce speed variation are identified through a literature search. The approaches are mainly deployed by state DOT, police departments, or contractors to create work zone conditions that influence drivers' behaviors to reduce their speed variation. When speed variation occurs, efforts may be implemented to reduce the impact of the speed variation. However, a literature search revealed very little prior research on this topic. This section describes products that have been designed and tested to lessen the impact of speed variation when the variation occurs.

With the development of new technologies, ways to control speed variation in a proactive manner are feasible. One example is by using an in-car assistant system. An intelligent speed adaptation (ISA) system is an in-vehicle technology that continuously monitors whether a vehicle speed exceeds the posted speed limit, and provides in-vehicle feedback, such as informing the driver of the speed limit and giving visual or auditory warnings for drivers to avoid speeding, interupting the task of driving by giving a counterforce on the gas pedal, or limiting the maximum speed a vehicle can travel (Marchau et al., 2010). Based on a literature review, Marchau et al. (2010) concluded that generally, the use of an ISA system could reduce speed variation. The effectiveness was shown in a few studies with instrumented vehicle experiments, driving simulations, and field operational tests. However, large-scale deployment of ISAs has to overcome several technical, social, and political issues, such as the reliability of GPS in urban areas to form speed limit maps.

Rear window notification display (RWND) is another in-car assistant system that aims to improve a driver's safety performance, particularly for car-following conditions. The system is capable of controlling a vehicle with the gas and brake pedals and the steering wheel to maintain a safe distance from the lead vehicle. Saffarian et al. (2013) carried out a simulator-based case-control experiment to examine the performance of a RWND. The researchers found that a RWND reduced speed variation (measured by the average of the absolute difference between the speed of the participant's car and the speed of the lead car).

Nevertheless, no study that examined in-car assistant systems in work zone conditions was found. Therefore, the effectiveness of using such a system in work zones is unknown.

2.6 POINT OF DEPARTURE

Since the introduction of the "Solomon curve" along with Lave's finding regarding "variance kills," the debate with respect to the impacts of speed variation on crash occurrence has lasted for decades. As presented in Section 2.2.1 and summarized in Table 2.1, there are several reasons behind the related research why the findings are inconsistent. However, the importance of speed variation on roadway crashes cannot be ignored. The majority of the previous work confirms that the greater the variation, the greater the probability of a crash.

It is obvious that a majority of the research efforts to examine the relationship between speed variation and crash occurrence focused on roadways without a work zone present. However, the studies performed by Rouphail et al. (1988), Migletz et al. (1999), Garber and Woo (1990), Zhao and Garber (2001), Garber and Zhao (2002), and Hou et al. (2013) pointed out the importance of addressing speed variation in work zones. Due to the nature of work zones, lane reductions/closures are often required to facilitate construction/maintenance activities. Different temporary traffic control devices are placed to inform drivers about the presence of work zones and to provide guidance to ensure their safety. However, drivers may act differently with respect to temporary traffic control devices and, as a result, creating large speed variations which further increase the likelihood of crashes in work zones. Limited research has been conducted to understand the speed variation in work zones, such as the typical work zone areas that create the largest speed variation, and influencing factors that contribute to greater speed variation.

In addition, with the recognition of the influencing factors on speed variation on roadways, research has been conducted to identify means to reduce speed variation and ways to control speed variation. As stated in Sections 2.4 and 2.5, a majority of the efforts attempting to reduce speed variation were conducted on roadway segments without the presence of a work zone. Though many past studies examined the effectiveness of various temporary traffic control measures in work zones, the primary focus was on average speed reduction, not speed variation reduction. However, some of the previous research, such as Lave (1985), concluded that the best way to manage speed was to coordinate the traffic flow rather than limiting it. Therefore, more research needs to be conducted to identify measures and examine their effectiveness in reducing speed variation in work zones. For example, there is a need to determine whether the presence of construction/maintenance activities, equipment, and staging are effective in promoting reductions in speed variation.

In the present study, a comparison of speed variation between free flow conditions and work zones conditions were conducted to provide further knowledge about drivers' speed choices when traveling through work zones. Additionally, the impacts of traffic control measures on speed variation were investigated. Lastly, techniques to minimize and control speed variation were identified.

3.0 RESEARCH METHODOLOGY

The present research was conducted in two phases (as shown in Figure 3.1). Phase I emphasizes providing a comprehensive understanding about speed variation with and without a work zone present, and identifying work zone characteristics (e.g., work zone layouts) that impact speed variation. In Phase II, the study focused on identifying technologies and strategies to reduce and control speed variation in work zones. The following three chapters are developed to describe the detailed research methods and results in the two-phase study.

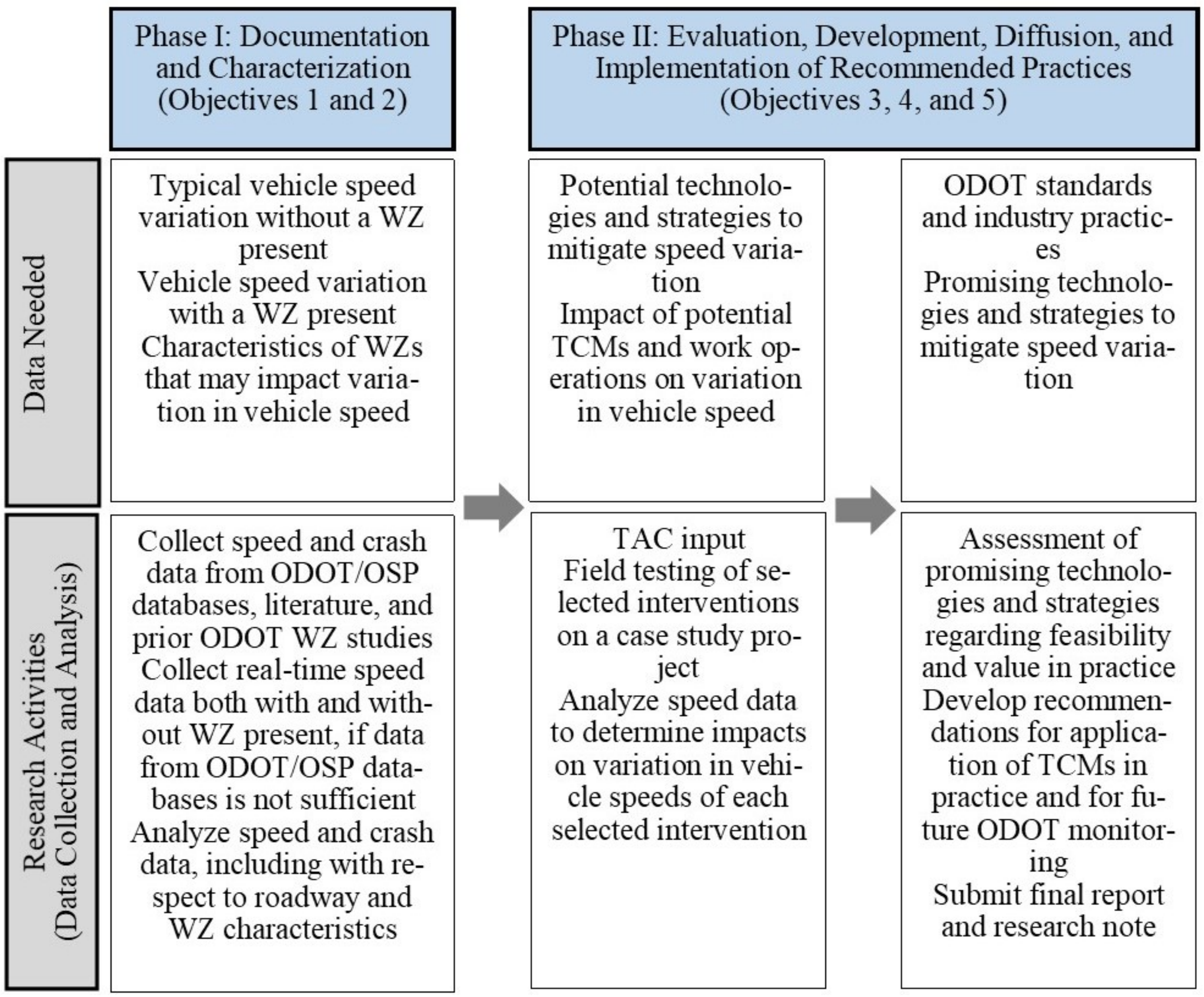


Figure 3.1: Plan for data collection and research activities

4.0 PHASE I – DOCUMENTATION AND CHARACTERIZATION

Phase I of the study aims to understand and document the prevalence and magnitude of variation in vehicle speed from the average speed in work zones, and how this variation compares to variation in free flow conditions without a work zone present. To do so, multiple sources of data are collected from previous ODOT research studies, and ODOT maintained databases. The following contents describe in detail the data collection, data analysis, and research findings for Phase I.

4.1 DATA COLLECTION

For Phase I, data were collected to support answering the following questions related to conditions both with and without a work zone present:

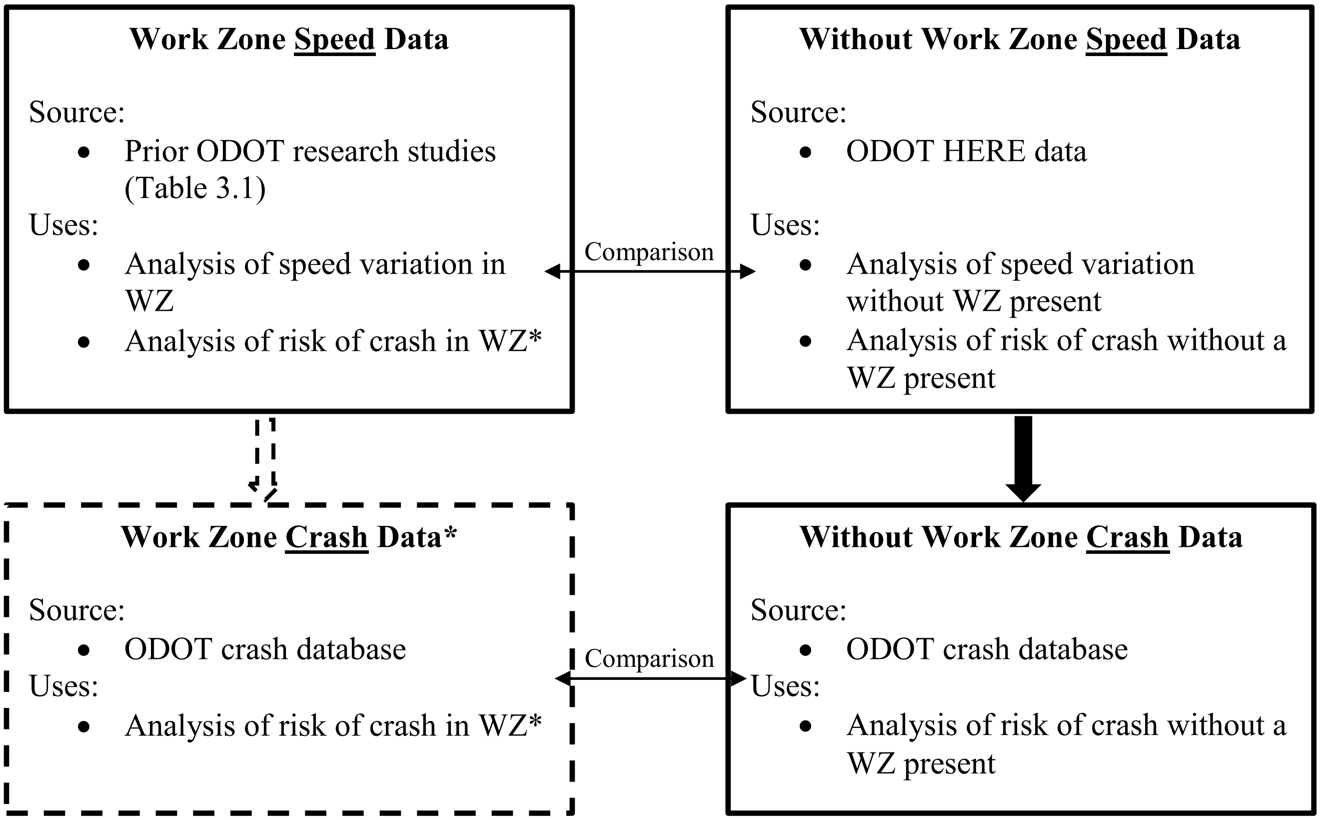
1. What is the nature of speed variation on high speed roadways in Oregon?

2. Is there a relationship between variation in vehicle speed from average roadway speed and the risk of crashes on Oregon roadways?

These questions target roadways both with and without a work zone present. To answer the questions when no work zone is present, existing Oregon roadway speed data (HERE data) and data in ODOT crash databases were targeted. Data needed from the databases includes: vehicle speed at time of crash, mean and standard deviation of speed on roadway prior to and at time of crash, geographic location of crash, direction of travel, and other vehicle information (e.g., size and type of vehicle) and roadway and driving conditions (e.g., the number of lane(s), weather) data that can be used to filter out confounding variables in the data.

The data collection in Phase I also focuses on roadways with a work zone present. Archived data collected from existing roadway infrastructure where work zones were present during previous ODOT work zone research studies were used to determine the relationships associated with variation in speed from average vehicle speed within work zones. Data similar to that for roadways without a work zone is collected, except that it was limited to speed data in the locations where a work zone was present.

Figure 4.1 depicts how the data was used in Phase I, where it came from, and how it was used and compared in the analyses. More detailed descriptions of the data and analyses are provided in the sections below.



(* = if work zone crash data in ODOT crash database is available, usable, and sufficient)

Figure 4.1: Phase I data sources, uses, and comparisons

4.1.1 Speed Data

4.1.1.1 Work Zone Speed Data

Field data has been collected from past ODOT research studies that is applicable to the present study and eliminates the need to collect additional speed data from the field. Vehicle speed data is available from a total of 11 case studies conducted as part of the past research studies (e.g., SPR 769, SPR 791, and ODOT Order No. 19-03) since 2013. The list of research projects and cases studies is provided in Table 4.1.

The past research primarily focused on mobile work zones on multi-lane, high-speed roadways (e.g., repaving projects and mobile maintenance operations). For each research project listed in Table 4.1, similar data collection processes and equipment were used. Portable traffic analyzers (sensors) which are capable to collect accurate traffic counts, speed, and classification with respect to vehicle length data were placed at different work zone locations, as shown in the typical work zone data collection setup in the Figure 4.2. For all the case study projects listed in the Table 4.1, either NC-200 portable traffic analyzers manufactured by Vaisala, or NC-350 analyzers manufactured by the M.H. Corbin were used. Table 4.2 shows the technical specifications of the traffic control analyzers used.

Table 4.1: Work Zone Data Collection on Past Research Projects

Project	Case Study	Year	Data Collection Dates	Roadway, Mileposts, and Travel Directions
1. High Speed Reduction Phase 2 (SPR 769)	I-5 Rock Point to Seven Oaks	2013	August 14, 18, 19, 20, 21, 26, 27, and 28 September 6	I-5 from MP 37 to 43 (both directions)
2. High Speed Reduction Phase 3	I-84 Arlington to Tower Road	2014	June 17, 18, 19, 23, 24, 26, 27, and 29	I-84 from MP147 to 159 (both directions)
3. Radar Speed Display Study	I-205 Relamping	2015	March 25 and 26	I-205 between Exit 6 and Exit 8 (southbound only)
	I-205 Sweeping	2015	March 30	I-205 between Exit 6 and Exit 8 (southbound only)
	I-84 (Banfield Expressway) Vactoring	2015	May 27 and 28	I-84 between Exit 2 and Exit 4 (westbound only)
	US-97 Spraying	2015	June 16	US-97 near Klamath Falls between Greensprings Drive and Nevada Street (northbound only)
4. Work Zone Lighting (SPR 791)	I-84 Jordan Road to Multnomah Falls	2016	August 16, 17, 18, 19, and 20	I-84 between Exit 18 and Exit 31 (eastbound only)
	I-5 South Medford to North Ashland	2016	August 30 and 31 September 1, 6, and 7	I-5 from MP 19 to MP27 (both directions)
5. Blue Lights Study (ODOT Order No. 19-03)	I-5 Hassalo	2018	August 1, 2, 8, and 9	I-5 between Exit 302 and Exit 306(A) (northbound only)
	I-5 Grants Pass 1	2018	August 12, 13, 14, and 15	I-5 between Exit 48 and Exit 52 (both directions)
	I-5 Grants Pass 2	2018	August 27, 28, 29, and 30	I-5 between Exit 48 and Exit 53 (both directions)

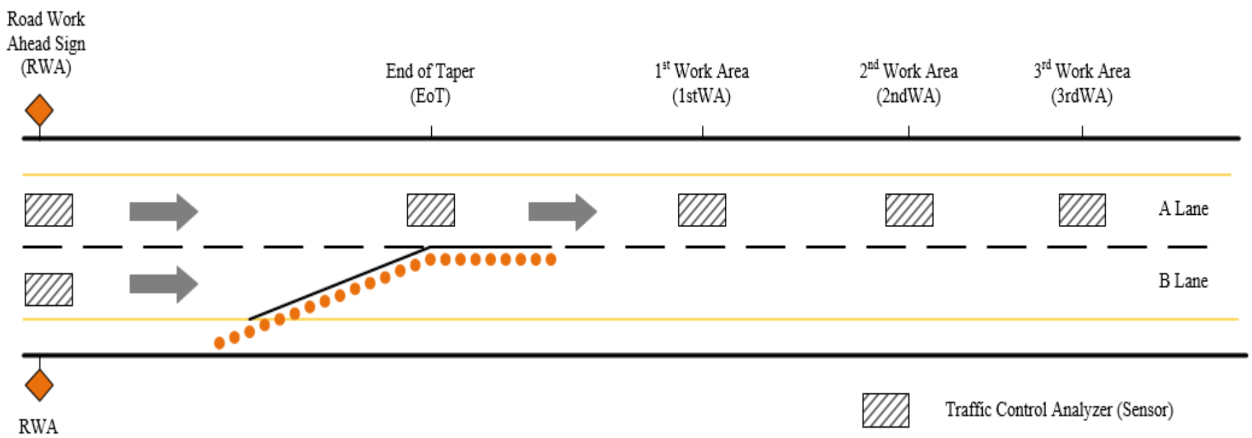


Figure 4.2: Typical placement of traffic control analyzers (sensors) in work zone

Table 4.2: Technical Specifications of Portable Traffic Control Analyzers Used in the Work Zone Field Data Collection (M.H. Corbin, 2015, Gambatese and Jafarnejad, 2018)

Criterion	Specification
Housing Material	Extruded/anodized aluminum
Ultimate Bearing Strength	88,000 psi (607Mpa)
Dimensions	181 × 118 × 12.7 mm / 7.125 × 4.625 × 0.5 in
Weight	0.59 Kg / 1.3 lb
Operating Temperature	-20 °C to + 60 °C / (-4 °F to +140 °F)
Sensor	GMR Magnetic chip for Vehicle Magnetic Imaging
Memory	Micro Serial Flash: 3MB
Battery	Lithium-ion rechargeable: Up to 21 days before recharge
Capacity	Up to 300,000 vehicles over 21 days per study, whichever occurs first
Vehicle Detection	Vehicles from 8 – 193 KPH / 5 – 120 MPH
Accuracy Length Classification	+/- 4ft, 90% of vehicles
Accuracy Speed Classification	+/- 4mph, 90% of vehicles
Accuracy Vehicle Count Determination	+/- 1%, 95% of vehicles

Data fields collected in the past ODOT research studies include work zone locations where traffic analyzers were placed, date and time, speed of vehicle, length of vehicle, and travel lane (if available).

4.1.1.2 Speed Data without a Work Zone Present

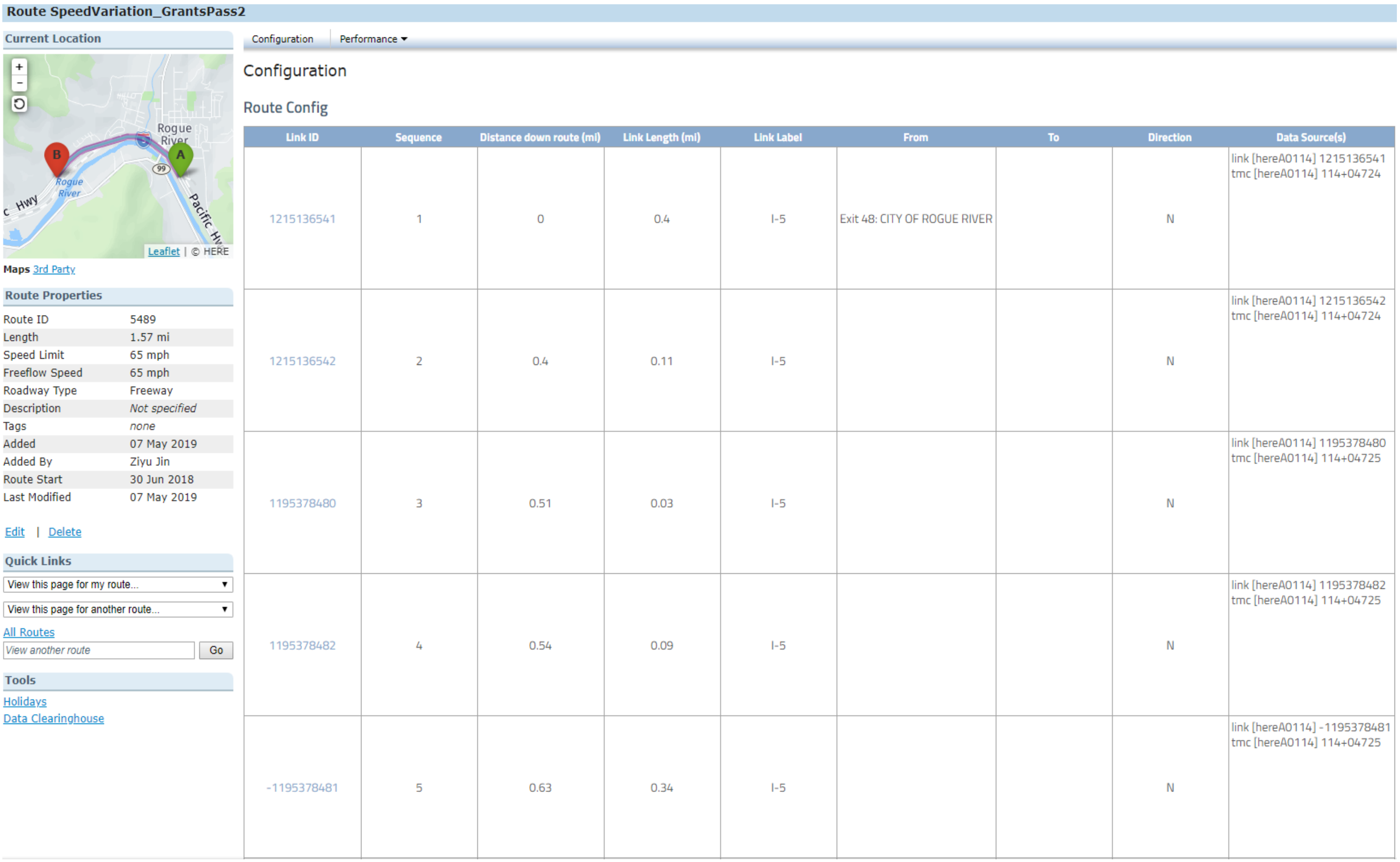
As mentioned above, existing Oregon roadway speed data were utilized for vehicle speeds without a work zone present. Data needed includes vehicle speed, date and time of recorded speed, geographic location, direction of travel, and other roadway design information (e.g., the number of lanes) that can be used to filter out confounding variables in the data.

Vehicle speed data used were collected by ODOT through its HERE program (https://www.here.com/) and accessed through ODOT's iPeMS interface (https://www.iteris.com/products/performance-analytics/ipems). Access to ODOT's iPeMS interface was requested so that the researchers could create specific routes to suit the needs for the present study. Granular speed data gathered utilizing probe data from HERE Technologies were then obtained and downloaded. Data used were that of vehicles travelling at the locations of the case studies included in selected prior ODOT work zone research studies (see Table 4.1). Speed data for vehicles travelling at the work zone location, prior to and/or following the day/time when the work zone was present, were used. In addition, given that the work in the work zones was conducted at night, speed data without the work zone present from vehicles travelling at night were used. The speed data and data fields of interest from HERE Technologies are shown in Table 4.3.

Table 4.3: Speed Data to be Collected and Analyzed from the ODOT HERE/iPeMS data

Data Fields Required to Analyze Free-Flow Speed Variation	HERE/iPeMS Data	Notes
Location	Approximate locations known by roadway segment in terms of links from iPeMS interface	The length of a link in iPeMS typically ranged from 0.01 and 0.09 miles
Date and Time	Date and time of data record	
Individual Vehicle Data / Aggregated Data in 5-min intervals (mean and SD) and Lane of Travel	Aggregated speed data (average speed) in 5-min intervals (combined lanes)	
Direction of Travel	Direction of travel of vehicle	
Vehicle Type		If available
Traffic Volume	Vehicle hours travelled	
Number of Lane(s)		May obtain based on location
Other factors: posted speed limit, presence of intersections, curvature, pavement width, signs, weather, lighting		May obtain based on location

To examine the speed data without a work zone present, 12 routes were created for the Blue Lights Study (ODOT Order No. 19-03) in the iPeMS and data requests were sent to ODOT's Transportation Planning Analysis Unit. Figure 4.3 shows a screenshot of the route created for the second day of data collection in the Grants Pass 1 case study based on the work zone location recorded. As can be observed from the figure, more than one link (roadway segments) may be included in a route.



Route SpeedVariation_GrantsPass2

Current Location

Maps 3rd Party

Route Properties

Route ID	5489
Length	1.57 mi
Speed Limit	65 mph
Freeflow Speed	65 mph
Roadway Type	Freeway
Description	*Not specified*
Tags	*none*
Added	07 May 2019
Added By	Ziyu Jin
Route Start	30 Jun 2018
Last Modified	07 May 2019

Edit | Delete

Quick Links

View this page for my route...

View this page for another route...

All Routes

View another route Go

Tools

Holidays

Data Clearinghouse

Configuration | Performance

Configuration

Route Config

Link ID	Sequence	Distance down route (mi)	Link Length (mi)	Link Label	From	To	Direction	Data Source(s)
1215136541	1	0	0.4	I-5	Exit 48: CITY OF ROGUE RIVER		N	link [hereA0114] 1215136541 tmc [hereA0114] 114+04724
1215136542	2	0.4	0.11	I-5			N	link [hereA0114] 1215136542 tmc [hereA0114] 114+04724
1195378480	3	0.51	0.03	I-5			N	link [hereA0114] 1195378480 tmc [hereA0114] 114+04725
1195378482	4	0.54	0.09	I-5			N	link [hereA0114] 1195378482 tmc [hereA0114] 114+04725
-1195378481	5	0.63	0.34	I-5			N	link [hereA0114] -1195378481 tmc [hereA0114] 114+04725

Figure 4.3: Example of a route in iPeMS

For each route, the researchers listed the possible date that the researchers requested and possible time periods. For example, as shown in Table 4.1, the field data collection for the I-5 Grants Pass 1 case study were conducted from August 12 to August 15, 2018 (Sunday to Wednesday) when the work zone was present. To compare the speed data without a work zone present, the dates requested were on the same weekday before/after paving. Since the paving started at July 29, 2018 and ended at September 28, 2018, for this case study, the dates requested before paving were July 8 – 11, July 15 – 18, and July 22 – 25 in 2018 (Sundays to Wednesdays), and those after paving included October 14 – 17, October 21 – 24, and October 28 – 31 (Sundays to Wednesdays). In addition, since night paving was performed for this case study and the typical data collection periods were from 10:00–04:00, the same time periods of data were requested.

As a result, the researchers received the data requested for the Blue Lights Study. The data fields in the dataset consist of the iPeMS link number, date-time, length of the link, mean speed (5-minute), standard deviation (5-minute), minimum speed (5-minute), maximum speed (5-minute), and several percentile speeds including the 85th percentile speed (5-minute).

4.1.2 Crash Data

No crashes in the work zones included in the prior research studies were recorded. Therefore, the data from past research studies mentioned above does not include data on work zone crashes. For crashes with/without a work zone present, the ODOT crash database maintained by the ODOT Crash Analysis and Reporting Unit was utilized to collect data related to crashes. Data were collected related to all crashes that occurred at the locations of the case studies from the previous ODOT research studies, if any. It is worth mentioning that, by the time in which the crash data was requested, the most recent completed crash data file year was 2017. Therefore, crash data (if any) related to the Blue Lights Study (ODOT Order No. 19-03) was not available.

The ODOT 2017 Motor Vehicle Traffic Crash Analysis and Code Manual provides (ODOT 2018) describes the crash database code fields. The crash data and data fields of interest for the analysis are as shown in Table 4.4.

Table 4.4: Crash Data Fields of Interest from ODOT Crash Database

Data Fields Required to Analyze Crashes	ODOT Crash Database		Notes
Crash Location	County	CRASH.CRASH_CNTY_ID	
	City	CRASH.CITY_SECT_ID	
	Urban Area	CRASH.URB_AREA_CD	
	Functional Classification	CRASH.FC_CD	Rural Interstate (Code 01), urban Interstate (Code 11), and urban other freeways and expressways (Code 12)
	NHS (whether a part of the National Highway System)	CRASH.NHS_FLG	
	Highway Number	CRASH.HWY_NO	
	Roadway Number	CRASH.RDWY_NO	
	Highway Number	CRASH.HWY_COMPNT_CD	Mainline state highway (Code 0)
	Mileage Type	CRASH.MLGE_TYPE_CD	
	Connection Number	CRASH.RD.CONN.NO	Blank: Not a ramp or connection on state highway system
Lane of Crash	Location of Impact	CRASH.IMPCT_LCT_CD	
Direction of Travel	Direction of Travel From/To	VHCL.CMPSS_DIR_FROM_CD, VHCL.CMPSS_DIR_TO_CD	
Date and Time of Occurrence	Crash Hour	CRASH.CRASH_HR_NO	Only know crash time at an hourly level
	Crash Date	CRASH.CRASH_DAY_NO	
	Crash Month	CRASH.CRASH_MO_NO	
	Crash Year	CRASH.CRASH_YR_NO	
Estimated Speed at Crash	Vehicle Speed Flag	VHCL.VHCL_SPEED_FLG	Only know if the vehicle was speeding or not

Work Zone Presence Indicator	Work Zone	CRASH.WRK_ZONE_IND	Not reported (blank), No (0), Yes (1), Unknown (9)
Number of Lanes	Number of Lanes	CRASH.LN_QTY	
Crash Severity	Crash Severity	CRASH.CRASH.SVRTY_CD	
	Injury Severity	PARTIC.INJ_SVRTY_CD	
Vehicle Type	Vehicle Type	VHCL.VHCL_TYP_CD	
Vehicle Movement	Vehicle Movement	VHCL.MVMNT_CD	Straight ahead (Code 1)
Crash Type (rear-end, sideswipe, angle collision, other) and Reason	Crash Type	CRASH.CRASH_TYP_CD	
	Collision Type	CRASH.COLLIS_TYP_CD	
	Crash Level Events	CRASH_CAUSE_EVNT.CRASH_EVNT_1_CD, CRASH_CAUSE_EVNT.CRASH_EVNT_2_CD, CRASH_CAUSE_EVNT.CRASH_EVNT_2_CD	
	Crash Level Cause	CRASH_CAUSE_EVNT.CRASH_CAUSE_1_CD, CRASH_CAUSE_EVNT.CRASH_CAUSE_2_CD, CRASH_CAUSE_EVNT.CRASH_CAUSE_3_CD	
Crash Confounding Factors: road geometry, speed limit, season, traffic condition, weather, etc.	Posted Speed	CRASH.POST_SPEED_LMT_VAL	
	Road Character (intersection, curve, grade, etc.)	CRASH.RD_CHAR_CD	
	Weather Condition	CRASH.WEATHR_COND_CD	
	Road Surface Condition	CRASH.RD_SURF_COND_CD	
	Light Condition	CRASH.LGT_COND_CD	
	Traffic Control Device	CRASH.TRAF_CNTL_DEVICE_CD	
	Traffic Control Device Functional	CRASH.TRAF_CNTL_DEVICE_CD	

In addition, the researchers also contacted ODOT staff to get access to TripCheck data that helps to confirm whether a crash occurred due to the presence of work zones, and whether a slowdown was the result of a crash. TripCheck (https://www.tripcheck.com/) is ODOT's travel information website that provides roadside camera images and detailed traffic information regarding Oregon road traffic congestion, incidents, weather conditions, etc.

If the requisite crash data in work zones were unreliable or insufficient, the researchers would initially compare the measured speed variation in work zones to the variation without a work zone present as shown in Figure 4.1. Given the driving and roadway conditions present in a work zone, and the literature review presented above regarding the impacts of speed variation on the risk of crash (Table 2.2), it was hypothesized that the prevalance and magnitude of speed variation in work zones would be greater than that without a work zone present. As a result, and based on the increased risk associated with large variations in speed as found in the prior research associated with the Solomon curve cited above, it was expected that the crash risk in work zones would also be high and the need for further study of speed variation in work zones would be confirmed.

4.2 DATA ANALYSIS

The Phase I analysis included assessment of the variation in vehicle speed both with and without a work zone present, and examination of the relationship between variation in vehicle speed from the average speed and the risk of crashes. Detailed analysis procedures of the two types of examinations are explained in detail in the following sub-sections.

4.2.1 Speed Variation Comparison

Two types of data sources were used for making speed variation comparisons between when a work zone is present and when there is no work zone present: data from field roadway work zone data collection in previous research studies and data from the ODOT iPeMS analytics platform utilizing HERE Technologies. Descriptions of the data collected from each of these sources are provided above in Section 4.1.1.1 and 4.1.1.2, respectively. The contents presented below aim to address research objective (1): document the prevalence and magnitude of variation in vehicle speed from the average speed in work zones, and how this variation compares to variation in free flow conditions without a work zone present.

4.2.1.1 Using Work Zone Data from Past ODOT Research Projects

This section describes the details regarding analyzing speed data that were collected from past ODOT research projects. One of the research questions posed is: "What is the nature of speed variation on high-speed roadways in Oregon?" To answer this question, initially two sub-questions are asked regarding the speed variation measurements selected [5-min standard deviation (SD) and 5-min coefficient of variation (COV)]:

1. Is the mean speed variation prior to a work zone lower than that in the work zone?

2. Are the mean differences in speed variation measurement statistically significant when comparing within the same 5-min intervals?

It should be noted that the analyses were intended to examine whether the mean speed variation in a work zone is generally greater than that prior to a work zone regardless of roadway geometrics, work zone layout, and sensor placement.

- Determination of Speed Variation Measurement

  As described in Sections 2.1 and 2.2, there are a variety of ways to express and calculate speed variation as presented in previous research. Based on the findings of the literature review, the speed variation measurements selected for the analysis in the present study are 5-min standard deviation (SD) and 5-min coefficient of variation (COV) with spot speeds. COV is the ratio of the standard deviation to the time mean speed. The reasons why these measurements are selected are listed as follows:

  1. SD and COV are suggested for use as crash precursors in many studies, and they correlate with crash occurrence (Taylor et al., 2000, Lee et al., 2003, Abdel-Aty and Abdalla, 2004, Islam et al., 2012).

  2. With respect to the time interval used to compute speed variation measurements, a 5-minute window is viewed as an appropriate interval for the present study. Due to the low traffic volume in some of the analyzed work zones, such as the work zone in the I-5 Rock Point to Seven Oaks case study project (Gambatese and Zhang, 2014), the 1-min interval used in the 2009 speed variation study (Lu and Chen, 2009) is not suitable. The 5-min interval is more suitable for the data collected and is supported by and used in many previous studies (Wang et al., 2013, Choudhary et al., 2018, Shim et al., 2015).

- Analysis of Work Zone Field Data from Prior Case Studies

  The processes used to prepare the work zone field data and conduct the analysis for speed data collected from previous work zone projects when a work zone is present are described below.

- Data Preparation

  Prior to starting the data analysis, a set of data preparation procedures is conducted to clean, filter, and transform the data so that it is ready to be used for descriptive and statistical analysis. Figure 4.4 depicts the data preparation process. After raw data is downloaded from the sensors, the speed data is calibrated to increase the data quality and accuracy. Detailed descriptions of the speed calibration processes and adjustment equations used can be found in the final reports from the previous research studies (Gambatese and Zhang, 2014, Gambatese and Jafarnejad, 2015, Gambatese and Jafarnejad, 2018).

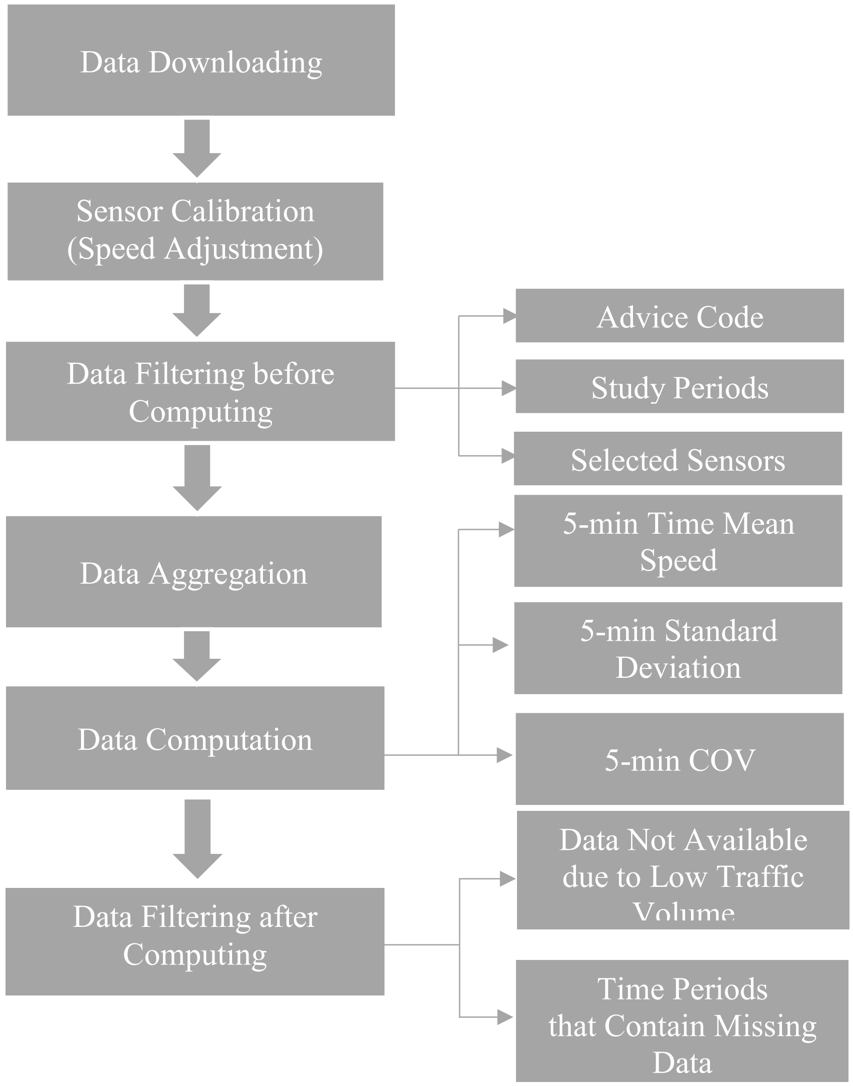


Figure 4.4: Data preparation process with work zone field data

Once the speed data is calibrated and before computing the speed variation measurements, the datasets are filtered based on three criteria. The first criterion is the advice code provided by the sensor that shows the degree of confidence in a particular observation. For example, an advice code of 128 indicates a bad recording of a passing vehicle. It suggests the recording may contain errors associated with the recorded vehicle length (either less than minimum length or exceeded maximum length) and/or the recorded vehicle speed (either too slow, extremely fast, or unable to record). Therefore, for an observation that has an advice code of 128 or other error codes, the observation is eliminated from the datasets.

The second criterion is based on the analyzed study periods to make the analyzed timeframes consistent across a case study project. For example, in the Grants Pass case studies in the Blue Lights research study (Gambatese et al., 2019), sensors were placed on the roadway at different times in the day and then also picked up at different times over the eight study days, which results in different start and end recordings. To standardize the data, only the data that were recorded during a specific time-frame (in common for all data collection days within a case project) were analyzed. For the Grants Pass case studies, data were only analyzed between the period from 23:00 and 05:00. The timeframes used for all of the case study projects were similar (i.e., nighttime work), but not exactly the same. For example, some timeframes extended from 22:00 to 04:00. Since the data from the different case studies is not combined, use of different timeframes is acceptable.

The third layer of filtering accounted for analyzed sensor locations. Even though the sensor placements in the previous work zone research studies are similar, there are some differences in terms of the number of sensors used due to availability and the sensor locations to accommodate the research needs and work zone operations. For example, in the SPR 769 study (Gambatese and Zhang, 2014), in addition to the placement locations shown in the Figure 4.2, traffic control analyzers were also placed before the Road Work Ahead (RWA) signs and at the start of the taper location (beginning of taper). In addition, in the I-5 South Medford project in the SPR 791 research study (Gambatese and Jafarnejad, 2018), additional sensors were placed before the end of taper locations, as well as at multiple locations in the work areas (more than three sensors placed in the active work areas). Also, on some data collection days, the length of work area planned by the contractor differed from that on other days, or stopped short of the planned end point due to time, equipment, material, weather, or other unplanned constraints. Therefore, in order to summarize the research findings and make uniform comparisons for all work zone case studies, the speed data used in the present study are limited to those collected from the sensors that were placed in common locations. These locations, as shown in the Figure 4.2, are: at the RWA sign (RWA), End of Taper (EoT), the 1^{st} Work Area (1stWA) sensor, the 2^{nd} Work Area (2ndWA) sensor, and the 3^{rd} Work Area (3rdWA) sensor.

After data are filtered based on the above-mentioned three criteria, the next step is to aggregate all of the qualified observations from the selected sensors into a single Excel file for individual data collection day on each case study. As an example, Table 4.5 shows a portion of the data on the fourth day of data collection on the I-84 Jordan Road to Multnomah Falls case study. The file contains seven variables as described below:

1. Time: the date and time of an observation (vehicle) recorded by an installed sensor;

2. Speed (mph): the calibrated passing speed of an observation;

3. Length (feet): the vehicle length of an observation;

4. Sensor: the location where the sensor is installed in a work zone in terms of work zone locations (e.g., RWA sign location, end of taper, 1^{st} WA, 2^{nd} WA, etc.);

5. Lane: the lane (C, O) in which the sensor was installed in a work zone in terms of work zone location and traffic lane (C means the sensor was placed in the to-be-

closed lane, and O means the sensor was placed in the open lane in the work area);

6. SensorNumber: the number of the sensor used; and

7. TimeRange: a 5-min time interval that is used for further analysis. As shown in Table 4.5, for example, observations recorded between 22:00 and 22:05 are associated with the TimeRange indicator of 0, those recorded between 22:05 and 22:10 are associated with the TimeRange indicator of 1, and so forth.

Table 4.5: Data Sample after Data Aggregation (I-84 Jordan Road to Multnomah Falls: Day 4)

Time	Speed	Length	Sensor	Lane	SensorNumber	TimeRange
8/18/2016 22:01	71.29	21	RWA	RWA(C)	305	0
8/18/2016 22:02	53.41	96	RWA	RWA(C)	305	0
8/18/2016 22:02	61.23	11	RWA	RWA(C)	305	0
8/18/2016 22:02	63.47	17	RWA	RWA(C)	305	0
8/18/2016 22:02	62.35	18	RWA	RWA(C)	305	0
8/18/2016 22:03	66.82	20	RWA	RWA(C)	305	0
8/18/2016 22:06	66.82	14	RWA	RWA(C)	305	1
8/18/2016 22:06	61.23	9	RWA	RWA(C)	305	1
8/18/2016 22:06	54.53	8	RWA	RWA(C)	305	1
8/18/2016 22:07	73.52	17	RWA	RWA(C)	305	1
8/18/2016 22:08	71.29	13	RWA	RWA(C)	305	1
8/18/2016 22:08	76.88	17	RWA	RWA(C)	305	1
8/18/2016 22:10	59.00	11	RWA	RWA(C)	305	2
8/18/2016 22:11	67.94	51	RWA	RWA(C)	305	2
8/18/2016 22:11	83.58	17	RWA	RWA(C)	305	2
8/18/2016 22:11	26.59	7	RWA	RWA(C)	305	2
8/18/2016 22:13	74.64	15	RWA	RWA(C)	305	2

Using the aggregated files and the statistical software R, the data are further aggregated to 5-min intervals, and speed variation measurements are then computed to develop the final datasets for data analysis. Two types of measurements are developed: within-lane speed variation and across-lane speed variation. To be specific, the following values are determined for each 5-min interval:

- Time mean speed (within lane): For each 5-min interval, mean speed within the lane is computed as the sum of all speeds divided by the number of observed speeds within the lane.

$$\textbf{Time mean speed (within lane)} = \frac{\sum_1^N s_i}{N}$$

(4-1)

Where:

s_i = vehicle speed of the i^{th} observation in the lane

N = total number of vehicles

- Time mean speed (across lanes): For each 5-min interval, mean speed across the lanes is computed as the sum of all speeds divided by the number of observed speeds for all lanes.

$$\textbf{Time mean speed (across lanes)} = \frac{\sum_1^N \sum_1^n s_{i,j}}{N} \tag{4-2}$$

Where:

$s_{i,j}$ = vehicle speed of the i^{th} observation in the j lane

N = total number of vehicles

n = total number of lanes in the road section

- Standard deviation (within lane): For each 5-min interval, standard deviation within lane is the average value of the difference between the individual observed speeds and the within-lane time mean speed.

$$\textbf{Standard deviation (within lane)} = \sqrt{\frac{\sum_i^N (s_i - \bar{x})^2}{N-1}} \tag{4-3}$$

Where:

s_i = vehicle speed of the i^{th} observation in the lane

N = total number of vehicles

$\bar{x}$ = time mean speed (within lane)

- Standard deviation (across lanes): For each 5-min interval, standard deviation across lanes is the average value of the difference between the individual observed speeds and the across-lane time mean speed.

$$\textbf{Standard deviation (across lanes)} = \sqrt{\frac{\sum_1^N \sum_1^n (s_{i,j} - \bar{x})^2}{N-1}} \tag{4-4}$$

Where:

$s_{i,j}$ = vehicle speed of the i^{th} observation in the j lane

N = total number of vehicles

n = total number of lanes of the road section

$\bar{x}$ = time mean speed (across lane)

- COV (within lane): For each 5-min interval, within-lane COV is computed as the within-lane standard deviation divided by the within-lane time mean speed.

COV (within lane) = Standard deviation (within lane) / Time mean speed (within lane)

(4-5)

- COV (across lanes): For each 5-min interval, across-lane COV is computed as the across-lane standard deviation divided by the across-lane time mean speed.

COV (across lanes) = Standard deviation (across lane) / Time mean speed (across lane)

(4-6)

Table 4.6 and Table 4.7 show a portion of the speed variation measurements after data computation, for a cross-lane and within-lane conditions, respectively. The data comes from Day 4 of the I-84 Jordan Road to Multnomah Falls case study.

Table 4.6: Data Sample of Speed Variation Measurements (across lane) (I-84 Jordan Road to Multnomah Falls: Day 4)

TimeRange	Lane	Count_Lane	Mean_Lane	SD_Lane	COV
0	RWA	23	62.80	8.31	0.13
1	RWA	26	66.83	7.71	0.12
2	RWA	29	66.14	10.88	0.16
3	RWA	30	67.41	6.95	0.10
4	RWA	28	69.13	7.89	0.11
5	RWA	23	69.02	6.18	0.09
6	RWA	25	68.05	9.86	0.14
7	RWA	27	66.06	7.84	0.12
8	RWA	25	63.68	8.19	0.13
9	RWA	24	68.15	9.90	0.15
10	RWA	18	68.15	8.69	0.13
11	RWA	19	68.41	11.24	0.16
12	RWA	31	66.76	5.58	0.08

Table 4.7: Data Sample of Speed Variation Measurements (within lane) (I-84 Jordan Road to Multnomah Falls: Day 4)

TimeRange	Lane	Count_Lane	Mean_Lane	SD_Lane	COV
0	RWA(C)	6	63.09	5.98	0.09
1	RWA(C)	6	67.38	8.32	0.12
2	RWA(C)	8	65.70	17.28	0.26
3	RWA(C)	11	69.46	5.64	0.08
4	RWA(C)	13	72.49	5.44	0.08
5	RWA(C)	7	67.14	3.52	0.05
6	RWA(C)	7	72.89	11.12	0.15
7	RWA(C)	9	71.29	8.42	0.12
8	RWA(C)	7	64.43	4.80	0.07
9	RWA(C)	6	72.59	14.88	0.20
10	RWA(C)	3	71.29	10.24	0.14
11	RWA(C)	6	78.55	8.32	0.11
12	RWA(C)	11	66.11	3.97	0.06

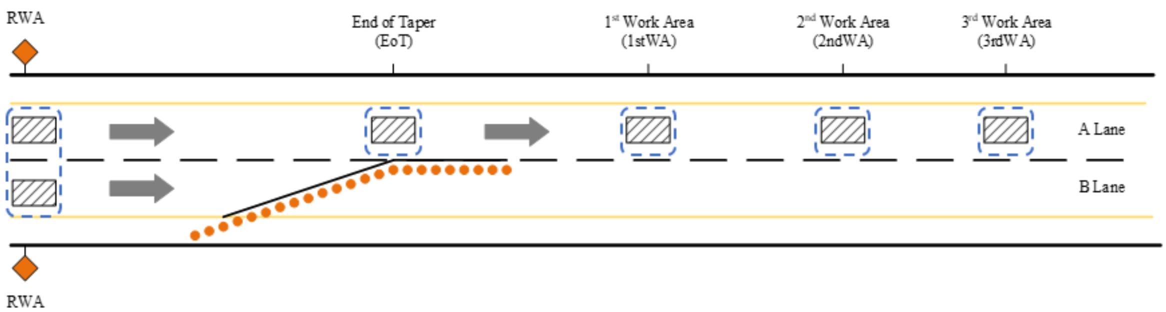
The last step before conducting the data analysis is to filter out data in which the SD or the COV values are not available or unreliable due to low traffic volume in a specific 5-min interval at a sensor placement location. Additionally, to make comparisons among speed variation measurements from multiple locations in a work zone, if there is data missing within a certain 5-min interval at one or more of the selected sensor locations (RWA, EoT, 1stWA, 2ndWA, 3rdWA, etc.) or the traveling lane, the data within that 5-min interval time period is eliminated from the analysis. These final filtering steps were performed, making the data ready for analysis.

Data Analysis

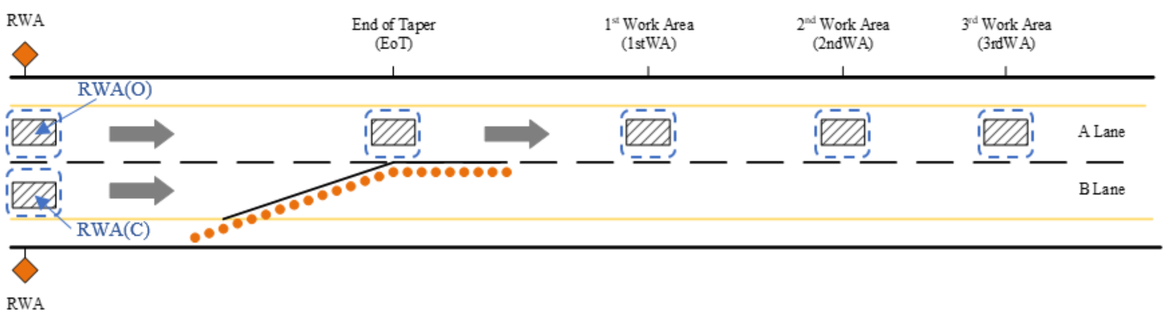
With the data collected from work zones in the prior studies, the speeds recorded at the RWA sign location are viewed as the representative speeds prior to a work zone for each case study project. Therefore, the computed speed variation measurement at the RWA sign location is compared with that of multiple work zone locations. Two types of analyses are conducted: 1) by work zone location, which is based on locations within the work zone; 2) by lane, which is based on locations within the work zone and travel lane.

For analysis by work zone location, the sensors included in the analysis are shown in Figure 4.5 (a). The across-lane speed measurements are computed from data collected by both sensors placed at the RWA sign location.

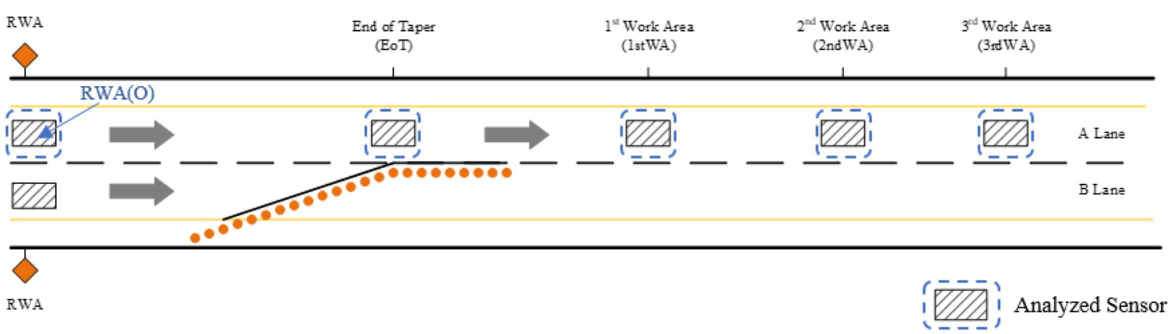
For analysis by lane using within-lane speed measurements, two analyses are conducted. Both analyses include the data from the sensor placed in the open lane [e.g., RWA(O)] at the RWA sign location. However, one analysis includes the data from the sensor placed at the RWA sign location in the to-be-closed lane [e.g., RWA(C)], as shown in Figure 4.5 (b). The other analysis excludes the to-be-closed lane sensor data, as shown in Figure 4.5 (c). The reason for the two different analyses is to account for the relatively low traffic volume in the to-be-closed lane which results in a large number of not available speed variation measurements in the 5-min intervals for some of the case study projects. Therefore, for different types of analyses (based on work zone locations or lanes), the number of 5-min intervals included are different.



a). Sensors Analyzed by Work Zone Location



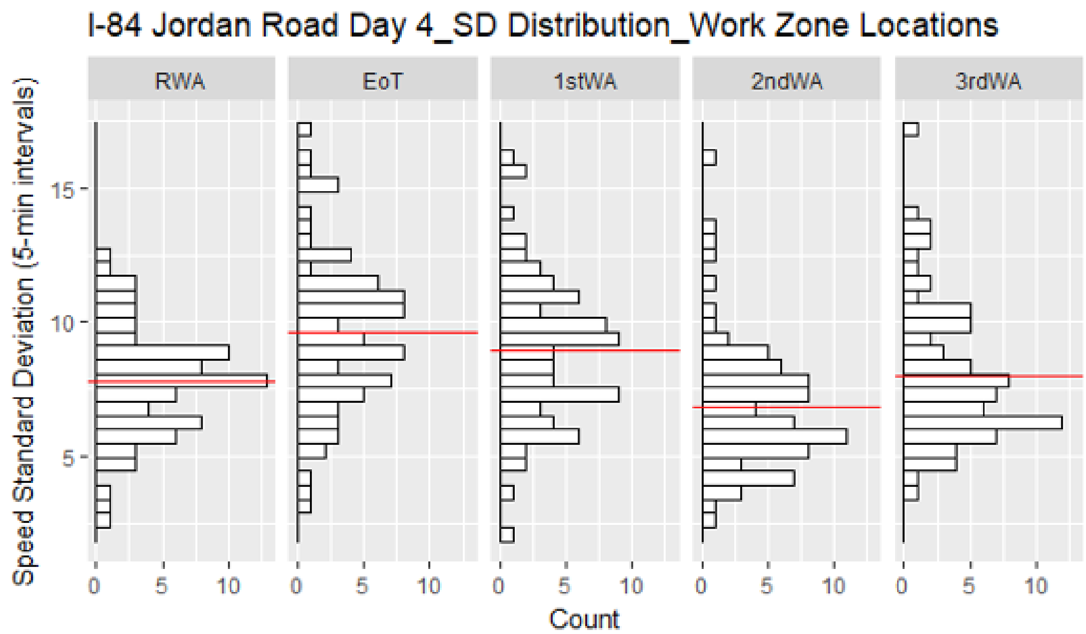
b). Sensors Analyzed by Lane (including RWA(C))



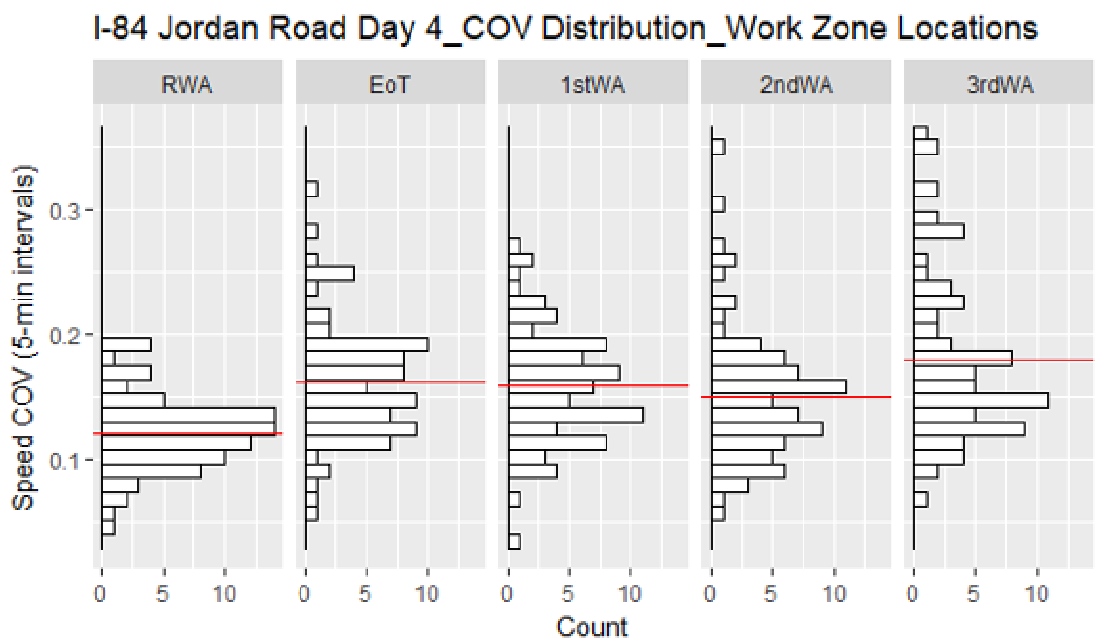
c). Sensors Analyzed by Lane (excluding RWA(C))

Figure 4.5: Sensors analyzed: (a) by work zone location; (b) by lane, including RWA(C); and (c) by lane, excluding RWA(C)

Using the statistical software R, graphs were plotted to visualize driver behavior based on the 5-min SD and 5-min COV among all analyzed work zone locations and lanes. As an example, Figure 4.6 shows the distribution of the two measurements (by work zone locations) on the 4th day of data collection on the I-84 Jordan Road to Multnomah Falls case study project.



a). 5-min SD Distribution



b). 5-min COV Distribution

Figure 4.6: Speed variation measurements distribution by work zone location sample (I-84 Jordan Road to Multnomah Falls: Day 4)

From the plots in Figure 4.6, it is easy to visualize whether the speed variation measurements at the RWA sign location are differ from those at the locations within the work zone. In addition, a Welch's ANOVA test is performed for both 5-min SD and 5-min COV for each case study project on each data collection day to test the hypothesis whether the mean values of all the compared samples are the same. If there is a difference in the means, a pairwise Welch's t-test is performed to check which pair has a statistical difference in the means. Welch's tests are used in this study due to unequal variances, which can be observed in Figure 4.6.

The reason why Welch's ANOVA and Welch's t-test were used than the traditional one-way ANOVA and student t-test is that the samples typically have unequal variances (as indicated in Figure 4.6 (a) and Figure 4.6 (b), in which the spreads of the distributions are unequal). In this case, Welch's tests are more suitable as Welch's analysis of variance is unaffected by unequal variances.

Furthermore, to confirm that the data of the present study does not violate the assumption of independence of either the ANOVA tests or t-tests, visual examination is performed as the data may suggest two types of dependence based on the data collection technique: serial (time) and spatial (location) dependence. As for the serial dependence, a vehicle might drive through multiple sensor locations in the work zone within the same 5-min interval, so that the recordings taken in the same 5-min interval from multiple locations might be from the same vehicle. For the spatial dependence, the sensors are placed in an order based on the direction of traffic in the work zones. As an example, Figure 4.7 shows a 5-min COV dot plot with connecting lines by 5-min intervals for the 4th day of data collection on the I-84 Jordan Road to Multnomah Falls case study project. Upon visual confirmation, there is no obvious trend across the work zone, which suggests a strong argument for independence.

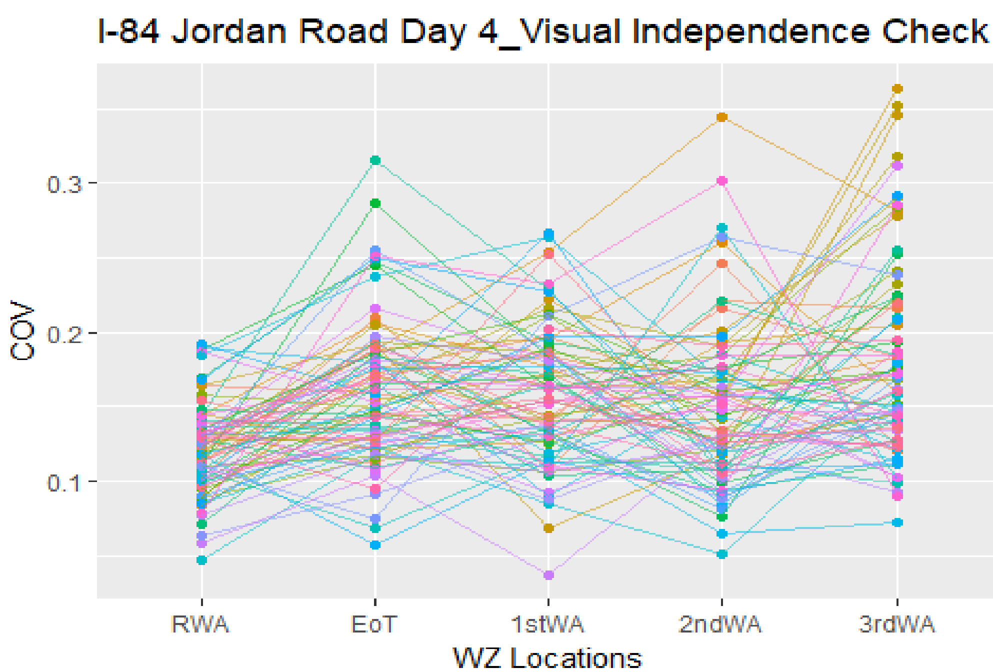


Figure 4.7: Example plot for independence check (I-84 Jordan Road to Multnomah Falls: Day 4)

4.2.1.2 Using Data Obtained from HERE Technologies

Besides determining speed variation with a work zone present, the analysis described below focused on speed variation without a work zone present. The processes are similar to what was done for the conditions with a work zone present; the primary difference is data source. The data used to obtain speed variation without a work zone present come from HERE Technologies as shown in Table 4.3.

Data Preparation

Preparation of the data was the first step. The data were initially filtered to include those data records (links as shown in Figure 4.3) that are as close as possible in terms of location to case studies with the work zone present. Secondly, the data were filtered to include only those data records that are on the same weekday before and after paving (as listed in Table 4.8), and are within the same study time periods used for the case studies with the work zone present (e.g., 22:00 - 04:00 for Grants Pass projects). After the data were prepared, the data were aggregated into a single Excel file based on each geographic location. A data sample is shown in Table 4.9. The data fields for each record include: link number, date-time, space mean speed (5-minute) (km/h), standard deviation (5-minute) (km/h), minimum speed (5-minute) (km/h), maximum speed (5-minute) (km/h), and several percentile speeds including the 85th percentile speed (5-minute) (km/h).

Table 4.8: HERE Data used for Comparisons

Case Study Project	Data collection Day/Date	HERE Data Day/Date	
		Before Paving	After Paving
I-5 Hassalo	Wed., 8/1/2018	Wed., 5/2/2018	Wed., 4/3/2019
		Wed., 5/9/2018	Wed., 4/10/2019
		Wed., 5/16/2018	Wed., 4/17/2019
		Wed., 5/23/2018	Wed., 4/24/2019
	Thurs., 8/2/2018	Thurs., 5/3/2018	Thurs., 4/4/2019
		Thurs., 5/10/2018	Thurs., 4/11/2019
		Thurs., 5/17/2018	Thurs., 4/18/2019
	Wed., 8/8/2018	Wed., 5/2/2018	Wed., 4/3/2019
		Wed., 5/9/2018	Wed., 4/10/2019
		Wed., 5/16/2018	Wed., 4/17/2019
		Wed., 5/23/2018	Wed., 4/24/2019
	Thurs., 8/9/2018	Thurs., 5/3/2018	Thurs., 4/4/2019
		Thurs., 5/10/2018	Thurs., 4/11/2019
		Thurs., 5/17/2018	Thurs., 4/18/2019
Grants Pass 1	Sun., 8/12/2018	Sun., 7/8/2018	Sun., 10/14/2018
		Sun., 7/15/2018	Sun., 10/21/2018
		Sun., 7/22/2018	Sun., 10/28/2018
		Sun., 7/29/2018	
	Mon., 8/13/2018	Mon., 7/9/2018	Mon., 10/15/2018
		Mon., 7/16/2018	Mon., 10/22/2018
		Mon., 7/23/2018	Mon., 10/29/2018
	Tues., 8/14/2018	Tues., 7/10/2018	Tues., 10/16/2018
		Tues., 7/17/2018	Tues., 10/23/2018
		Tues., 7/24/2018	Tues., 10/30/2018
	Wed., 8/15/2018	Wed., 7/11/2018	Wed., 10/17/2018
		Wed., 7/18/2018	Wed., 10/24/2018
		Wed., 7/25/2018	Wed., 10/31/2018
Grants Pass 2	Mon., 8/27/2018	Mon., 7/9/2018	Mon., 10/15/2018
		Mon., 7/16/2018	Mon., 10/22/2018
		Mon., 7/23/2018	Mon., 10/29/2018
	Tues., 8/28/2018	Tues., 7/10/2018	Tues., 10/16/2018
		Tues., 7/17/2018	Tues., 10/23/2018
		Tues., 7/24/2018	Tues., 10/30/2018
	Wed., 8/29/2018	Wed., 7/11/2018	Wed., 10/17/2018
		Wed., 7/18/2018	Wed., 10/24/2018
		Wed., 7/25/2018	
	Thur., 8/30/2018	Thurs., 7/12/2018	Thurs., 10/18/2018
		Thurs., 7/19/2018	Thurs., 10/25/2018
		Thurs., 7/26/2018	

Table 4.9: Data Sample from HERE after Filtering (I-5 Grants Pass 1: Day 1)

LINK DIR	Date Time	SPDLIMIT	MEAN	STDDEV	MIN	MAX	CONFIDENCE	PCT -5	PCT-10	PCT-85	PCT-90	PCT-95
767443148F	7/8/2018 22:00	105	101.3	0.6	101	102	30	101	101	102	102	102
767443148F	7/8/2018 22:30	105	121	4.6	116	125	30	116	116	125	125	125
767443148F	7/8/2018 22:35	105	105.4	4.4	102	113	40	102	102	113	113	113
767443148F	7/8/2018 22:40	105	103	0	103	103	10	103	103	103	103	103
767443148F	7/8/2018 22:45	105	108.3	4.2	105	113	30	105	105	113	113	113
767443148F	7/8/2018 23:10	105	110.4	4.7	99	116	40	99	100	114	115	116
767443148F	7/8/2018 23:20	105	112.6	7.3	102	122	40	102	102	122	122	122
767443148F	7/8/2018 23:25	105	111	0	111	111	30	111	111	111	111	111
767443148F	7/8/2018 23:55	105	99	2	97	101	30	97	97	101	101	101
767443148F	7/9/2018 0:25	105	103.3	1.2	102	104	30	102	102	104	104	104
767443148F	7/9/2018 0:30	105	105	0	105	105	10	105	105	105	105	105
767443148F	7/9/2018 1:00	105	102.8	3.8	100	108	30	100	100	108	108	108
767443148F	7/9/2018 1:05	105	100.8	2.5	98	105	40	98	98	105	105	105
767443148F	7/9/2018 1:10	105	103	0	103	103	30	103	103	103	103	103
767443148F	7/9/2018 1:30	105	93	1.4	92	94	30	92	92	94	94	94

767443148F	7/9/2018 1:35	105	96.7	1.2	96	98	30	96	96	98	98	98
767443148F	7/9/2018 1:55	105	102.8	1.5	101	104	30	101	101	104	104	104
767443148F	7/9/2018 2:00	105	103.2	1.5	101	104	30	101	101	104	104	104

The last step to prepare the data for analysis is to filter out those 5-min intervals in which the SD and COV values are not available or unreliable. The traffic volume may be too low in a specific 5-min interval. In such cases, the 5-min interval is eliminated from the dataset. A unit conversion was then performed to convert km/h to mph so that comparisons could be made in the subsequent steps.

Data Analysis

To compare the speed variation for roadway sections with a work zone present, and without a work zone present, both HERE data (without a work zone present) and data collected from past research projects (with a work zone present) were used in the analysis. However, the speed measurement computed above (see Section 4.2.1.1) with past research projects was based on time mean speed, whereas the granular speed measurement obtained from HERE were based on space mean speed. To make the comparison possible, a set of assumptions and computations was made to compute space mean speed using the work zone data collected from previous ODOT research projects. Typically, space mean speed (SMS) was determined by the equation below.

$$\boldsymbol{SMS = \frac{d}{(\sum_1^n t_i/n)}}$$

(4-7)

Where:

d = distance traversed,

n = number of observed vehicles,

t_i = time for vehicle "i" to traverse the section.

The following hypotheses were made to obtain the space mean speed for roadway sections between the first sensor and the third sensor placed in the work area in a work zone:

1. The 2^{nd}WA sensor was placed on the midpoint of the roadway section between the 1^{st}WA sensor and the 3^{rd}WA sensor;

2. When vehicles travelled through the roadway section between the 1^{st}WA sensor and the 3^{rd}WA sensor, the vehicles maintained the same speed as when they passed over the 2^{nd}WA sensor.

Assuming that the i^{th} vehicle travels at speed v_i when passing over the 2^{nd}WA sensor, the space-mean speed per 5-minutes (for roadway section between 1^{st}WA sensor and 3^{rd}WA sensor) can be obtained by:

$$SMS = \frac{d}{average\ travel\ time} = \frac{d}{\frac{\sum_1^n t_i}{n}} = \frac{nd}{\frac{d}{v_1} + \frac{d}{v_2} + \dots + \frac{d}{v_n}} = \frac{n}{\sum_1^n \frac{1}{v_i}}$$

(4-8)

Where:

d = the distance between the 1stWA sensor and the 3rdWA sensor;

t_i= the travel time for the ith vehicle that traveled between the 1stWA sensor and the 3rdWA sensor;

v_i = the speed when the ith vehicle passes over the 2ndWA sensor in a 5-minute period;

n = the number of vehicles passing the 2ndWA Sensor in a 5-minute period.

Descriptive analyses were then conducted to compare the speed variation measurements (SD and COV) with a work zone present to those without a work zone present at each location. Graphs were plotted to visualize driver behavior based on the 5-min SD and 5-min COV among all analyzed locations.

If data from the HERE database were sufficient, statistical analyses (same as Section 4.2.1.1) were performed using the statistical software R to compare the speed variation with a work zone present to the speed variation without a work zone present at each location.

4.2.2 Speed Variation and Crash Occurrence

This part of the analysis was designed to determine how the relationship between crashes and speed variation in work zones compares to the relationship between crashes and speed variation without a work zone present. To make this comparison, the relationship between crashes and speed variation in work zones was developed. First, followed by developing the relationship between crashes and speed variation without a work zone present. Then, once these relationships had been developed, they were compared.

4.2.2.1 With a Work Zone Present

As shown in Figure 4.1 and described in Section 4.1.2, the data source for crashes in a work zone would be the ODOT crash database maintained by the ODOT Crash Analysis and Reporting Unit. Those data records within the database which indicate a work zone was present at the crash location would be collected along with the accompanying details of the crash (see Table 4.4). The target locations are the locations of the case study projects in the prior research studies (see Table 4.1). If the crash database does not include crashes at the case study locations, crashes at nearby (upstream or downstream) locations are collected.

If sufficient crash data was received, descriptive relationships were planned to show the relationship between the speed variation and frequency of crashes, similar to the Solomon curves described above. For speed variation, values used in the comparison are the 5-min SD and 5-min COV, assuming that the ODOT HERE data provided sufficient detail on specific vehicle speeds to calculate SD and COV over 5-min intervals at the targeted locations. Plots of SD and COV versus frequency of crash were created to show how the frequency of crashes is affected by the magnitudes of SD and COV.

In addition to using SD and COV, other values that represent speed variation, and from which the HERE data can be used to calculate, are studied in terms of their relationship to the frequency of crashes. Examples of such values include: the difference between the speed of the vehicle in the crash and the regulatory speed; and the difference between the speed of the vehicle in the crash and the mean vehicle speed on the roadway.

4.2.2.2 Without a Work Zone Present

The process used to evaluate the relationship between speed variation and crashes without a work zone present was similar to that described above for cases with a work zone present. The data source for crashes was the ODOT crash database, and the data source for vehicle speeds was the ODOT HERE data. Crash and speed data are collected at locations in the vicinity of the case study projects, but without a work zone present. SD and COV at these locations were calculated. Descriptive relationships are then plotted, similar to that described above with a work zone present, to show the relationship between the speed variation and frequency of crashes. As depicted by the Solomon curve, it was assumed that as the speed variation increases (either positively or negatively) the frequency of crashes will also increase.

Lastly, a comparison between the crash and speed variation relationships (with and without a work zone present) is made. The plots of the relationships are visually compared to determine whether there is any difference in the relationships. As described above, it was expected that speed variation would be higher with a work zone present, and therefore the risk of crashes would be greater in a work zone.

4.3 RESULTS

4.3.1 Speed Variation Comparison

4.3.1.1 Using Work Zone Data from Past ODOT Research Projects

Using work zone data from past ODOT research projects, the researchers compared the speed variation measurements at the RWA sign location (which are viewed as free-flow speeds prior to entering a work zone) with those at multiple different sensor locations within the work zones (e.g., EoT, 1^{st}WA, 2^{nd}WA, and 3^{rd}WA). Two speed measurements were included in the analysis: 5-min SD and 5-min COV. As illustrated in Figure 4.5, two types of analyses were conducted: 1) by work zone location (the speed variation measurements were computed based on the data collected in both lanes at the RWA sign location), and 2) by lane. For the analysis by lane, two separate analyses were performed, one that included the data from the sensor placed at the RWA sign location in the to-be-closed lane [e.g., RWA(C)], and one that excludes the sensor data from the RWA(C) sensor.

Taking the data collected on the 4th day of the I-84 Jordan Road to Multnomah Falls case study project as an example, the summary statistics are provided in Table 4.10. The table reports the two speed variation measurements (5-min SD and COV) at the RWA sign location and other locations in the transition area and the active work area for all the three analyses (one by work zone location and two by lane). The sample size (n) shown in the table indicates how many 5-min intervals were included in the analysis. For this case study project, data collected from 22:00 to 05:00 (a window of 7 hours) was included in the analysis. A sample size of 84 should be included if sufficient traffic volume is guaranteed within all the 5-min intervals. In this case, only the analysis by lane when considering the sensor data obtained from the to-be-closed lane resulted in missing data due to low traffic volume. Hence, only 66 5-min intervals were included in the analysis by lane (including RWA(C)).

As observed from the table, regardless of the analysis type, the speed variation measurements recorded at the RWA sign location were generally smaller than those within the work zone. The results indicate that, in general, the speed variations in the work zones were typically greater than those prior to the work zone. However, some of the mean measurements were quite close to each other. For example, the mean 5-min SD at the 2ndWA sensor location by work zone location (6.94 mph) is smaller than that at the RWA sign location (7.75 mph).

Table 4.10: Summary Statistics of Speed Variation Measurements (I-84 Jordan Road to Multnomah Falls: Day 4)

By Work Zone Location (n = 84 time periods)		
Location	**Mean 5-min SD (mph)**	**Mean 5-min COV**
RWA	7.75	0.12
EoT	9.84	0.17
1stWA	8.99	0.16
2ndWA	6.94	0.15
3rdWA	8.10	0.18
By Lane (excluding RWA(C)) (n = 84 time periods)		
Lane	**Mean 5-min SD (mph)**	**Mean 5-min COV**
RWA(O)	7.45	0.12
EoT	9.84	0.17
1stWA	8.99	0.16
2ndWA	6.94	0.15
3rdWA	8.10	0.18
By Lane (including RWA(C)) (n = 66 time periods)		
Lane	**Mean 5-min SD (mph)**	**Mean 5-min COV**
RWA(C)	7.31	0.11
RWA(O)	7.30	0.11
EoT	9.75	0.16
1stWA	9.04	0.16
2ndWA	6.77	0.15
3rdWA	8.11	0.19

Welch’s ANOVA test was then adopted to examine the hypothesis: there is no statistical difference in the mean of all the compared samples (speed variation measurements at different sensor locations). If the computed p-value is more than 0.05, then the result suggests that the speed variation measurements taken at all sensor locations are the same. In other words, the result does not support that the speed variation measurements within work zones are greater than those prior to the work zones. If the computed p-value is less than 0.05, then statistical evidence was found to claim that there are some differences in the speed variation measurements for all selected sensor locations.

For example, for the data collected on the fourth day of the I-84 Jordan Road to Multnomah Falls project, reveals that for the by work zone location, the mean 5-min SD of speeds taken at all sensor locations are not the same (p-value = 9.02e-10). The mean 5-min COV of speeds taken at all sensor location are also not the same (p-value = 4.49e-15). In addition, for the analysis conducted by lane, the results also show that there is convincing evidence that the mean 5-min SD of speed, and the mean 5-min COV of speed taken at all sensor locations are not the same, with both p-values < 2.2e-16.

If the speed variation measurements for all the sensor locations were found to be not the same, to confirm whether the speed variation measurements at a specific place within a work zone are larger than those taken at the RWA sign location in the same 5-minute time window, pairwise Welch's t-tests were performed. The null hypothesis is that the mean speed variation measurements taken at the RWA sign location is smaller than or equal to that at multiple locations within work zones ($\mu_{prior\ to\ work\ zone} \leq \mu_{within\ work\ zone}$) in the same 5-minute time window.

Table 4.11 shows the pairwise Welch's t-test results, presented as p-values. The analysis by work zone location indicates that there is statistical evidence that, in comparison with the 5-min COV taken at the RWA sign location, the 5-min COVs taken at all of the selected work zone locations in the work zone are greater. Whereas, in terms of 5-min SD, the measurement at the RWA sign is greater than those taken at the EoT and 1stWA sensor locations, but not for those taken at the 2ndWA and 3$_{rd}$WA sensor locations. Similar results are reported for the analyses by lane.

Table 4.11: Welch's t-test Results (Reported as p-values) (I-84 Jordan Road to Multnomah Falls: Day 4)

By Work Zone Location (n = 84 time periods)		
Location	**5-min SD (mph)**	**5-min COV**
	RWA	**RWA**
EoT	1.0e-05*	7.7e-09*
1stWA	1.3e-02*	4.9e-07*
2ndWA	1	4.1e-05*
3rdWA	1	2.1e-10*

By Lane (excluding RWA(C)) (n = 84 time periods)				
Lane	**5-min SD (mph)**		**5-min COV**	
	RWA(C)	**RWA(O)**	**RWA(C)**	**RWA(O)**
EoT	-	3.4e-09*	-	9.5e-13*
1stWA	-	2.2e-05*	-	1.2e-11*
2ndWA	-	1	-	5.1e-06*
3rdWA	-	1.7e-01	-	9.5e-13*

By Lane (including RWA(C)) (n = 55 time periods)				
Lane	**5-min SD (mph)**		**5-min COV**	
	RWA(C)	**RWA(O)**	**RWA(C)**	**RWA(O)**
EoT	2.6e-02*	3.8e-07*	3.7e-04*	1.2e-09*
1stWA	1.5e-01	5.8e-04*	2.5e-04*	3.2e-08*
2ndWA	1	1	5.9e-03*	1.5e-04*
3rdWA	1	1.5e-01	1.8e-05*	7.2e-10*

Note: * means the result is statistically significant at a level of 0.05

The same statistical analyses were performed for all the case study projects listed in Table 4.1. To simply the presentation of the results, the following notations were used to report the meanings of the computed p-values, as shown in Table 4.12.

Table 4.12: Notation System for Results Presented in Table 4.13

Description	Notation
Speed variation measurement at RWA ≥ Speed variation measurement in WZ (p-value ≥ 0.1)	▲
Speed variation measurement at RWA < Speed variation measurement in WZ, and the statistical evidence in the difference (in the same 5-min window) is ***slightly*** (0.05 ≤ p-value < 0.1)	◔
Speed variation measurement at RWA < Speed variation measurement in WZ, and the statistical evidence in the difference (in the same 5-min window) is ***moderate*** (0.01 ≤ p-value < 0.05)	◐
Speed variation measurement at RWA < Speed variation measurement in WZ, and the statistical evidence in the difference (in the same 5-min window) is ***convincing*** (p-value < 0.01)	●

As a result, Table 4.13 and Table 4.15 present the analysis results by work zone locations for 5-min SD and 5-min COV, respectively. Table 4.17 and Table 4.19 display the results by lane including the data collected in the to-be-closed lane in the RWA sign location for 5-min SD and 5-min COV. Meanwhile, Table 4.21 and Table 4.23 present the results excluding the data in the to-be-closed lane at the RWA sign location for 5-min SD and 5-min COV.

The tables have similar formats with columns as described below:

1. Research Study No.: the index number of research study, as indicated in Table 4.1;
2. Case Study Project: the name of the case study project;
3. Day: the data collection day on a specific case study project;
4. EoT: the result displayed using the notation system (Table 4.12) regarding whether the speed variation measurement at the end of taper location (EoT) is greater than that prior to the work zone;
5. 1^{st}WA: the result displayed using the notation system (Table 4.12) regarding whether the speed variation measurement at the first sensor placed in the active work area (1^{st}WA) is greater than that prior to the work zone;
6. 2^{nd}WA: the result displayed using the notation system (Table 4.12) regarding whether the speed variation measurement at the second sensor placed in the active work area (2ndWA) is greater than that prior to the work zone;
7. 3^{rd}WA: the result displayed using the notation system (Table 4.12) regarding whether the speed variation measurement at the third sensor placed in the active work area (3rdWA) is greater than that prior to the work zone;

8. Number of Time Periods: the number of time periods (5-min intervals) included in the analysis;

9. Total Number of Time Periods: the total number of time periods (5-min intervals) included in the case study project.

The “#N/A” entry in the tables means that data were not available at a specific sensor location, and, therefore, the result of the comparison was not achievable. For example, in Table 4.13, the “#N/A” entries listed for the Research Study No. 3 I-84 Vactoring case study project mean that no sensor was placed at the EoT location on the two days of testing.

As observed from Table 4.13, when comparing the 5-min SD at the sensor locations within a work zone to that taken at the RWA sign location (computed based on data collected in both lanes), 17 out of 171 sensor locations showed greater 5-min SDs from the 44 days of testing. Data from 15 locations show convincing statistical evidence, and two show moderate evidence that the 5-min speed SD in the work zone was greater than the 5-min speed SD prior to the work zone. In addition, 15 out of 17 locations showed greater 5-min SD at the transition area and the beginning of the active work area. Out of the examined 44 days, 13 of the days had greater 5-min SDs from one or more sensor locations in the work zone than that at the RWA sign location.

Table 4.13: Summary Results for 5-min SD Analysis by Work Zone Location

Research Study No.	Case Study Project	Day	EoT	1st WA	2nd WA	3rd WA	Number of Time Periods	Total Number of Time Periods
1	I-5 Rock Point to Seven Oaks	1	▲	▲	▲	▲	71	72
		2	▲	▲	▲	▲	41	
		3	▲	▲	▲	▲	71	
		4	▲	▲	▲	▲	72	
		5	▲	▲	▲	▲	69	
		6	▲	▲	▲	▲	72	
		7	▲	▲	▲	▲	72	
		8	▲	▲	▲	▲	72	
2	I-84 Arlington to Tower Road	1	▲	▲	▲	▲	85	96
		2	▲	▲	▲	#N/A	88	
		3	▲	▲	▲	▲	86	
		4	▲	●	▲	▲	96	
		5	▲	●	▲	▲	96	
		6	▲	▲	▲	▲	93	
		7	▲	●	▲	▲	92	
		8	▲	▲	▲	▲	85	
3	I-205 Relamping	1	●	▲	▲	▲	52	60
		2	●	▲	▲	▲	42	
	I-205 Sweeping	1	▲	▲	▲	▲	25	36
	I-84 Vactoring	1	#N/A	▲	▲	▲	20	30
		2	#N/A	▲	▲	▲	24	
	US-97 Spraying	1	▲	▲	▲	▲	42	42
4	I-84 Jordan Road to Multnomah Falls	1	▲	▲	▲	▲	73	84
		2	▲	▲	▲	▲	81	
		3	▲	●	▲	▲	83	
		4	●	◐	▲	▲	84	

		5	●	●	▲	▲	82	
	I-5 South Medford to North Ashland	1	▲	▲	▲	▲	89	90
		2	#N/A	▲	▲	▲	88	
		3	●	▲	▲	▲	90	
		4	▲	▲	●	●	90	
		5	#N/A	▲	▲	▲	89	
5	I-5 Grants Pass 1	1	▲	▲	▲	▲	63	72
		2	●	▲	▲	▲	72	
		3	●	●	▲	▲	72	
		4	▲	▲	▲	▲	72	
	I-5 Grants Pass 2	1	◐	▲	▲	▲	61	72
		2	▲	▲	▲	▲	65	
		3	▲	▲	▲	▲	67	
		4	▲	▲	▲	▲	65	
	I-5 Hassalo	1	▲	▲	▲	▲	60	60
		2	▲	▲	▲	▲	60	
		3	▲	▲	▲	▲	60	
		4	▲	▲	▲	▲	59	

Table 4.14 lists the details about the 17 comparisons for which the 5-min SD at a work zone location is greater than that at the RWA sign. The differences in the mean 5-min SD vary from 1.02 mph to 3.60 mph. On average, the mean 5-min speed SD at a location in the transition area or in the active work area is 1.96 mph greater than that at the RWA sign location in the same 5-min window when considering data collected from both lanes at the RWA sign location.

Table 4.14: Case Study Days with Higher SDs in Work Zones from 5-min SD Analysis by Work Zone Location

Study No.	Case Study Project	Day	Mean 5-min SD (mph)			Mean SD Difference (WZ - RWA)
			RWA	WZ	Compared Work Zone Location	
2	I-84 Arlington to Tower Road	4	7.24	10.52	1stWA	3.28
		5	7.77	9.38	1stWA	1.61
		7	7.48	9.67	1stWA	2.19
3	I-205 Relamping	1	8.47	10.05	EoT	1.58
		2	8.45	10.37	EoT	1.92
4	I-84 Jordan Road to Multnomah Falls	3	8.10	9.71	1stWA	1.61
		4	7.75	9.84	EoT	2.09
			7.75	8.99	1stWA	1.24
		5	8.37	9.87	EoT	1.50
			8.37	9.67	1stWA	1.30
	I-5 South Medford to North Ashland	3	7.19	8.69	EoT	1.50
		4	7.56	9.71	2ndWA	2.15
			7.56	8.58	3rdWA	1.02
5	I-5 Grants Pass 1	2	11.49	13.97	EoT	2.48
		3	8.64	12.24	EoT	3.60
			8.64	11.04	1stWA	2.40
	I-5 Grants Pass 2	1	11.98	13.89	EoT	1.91
Average			**8.40**	**10.36**		**1.96**

In terms of 5-min COV, as shown in Table 4.15, 89 out of 171 sensor locations in work zones showed greater 5-min COVs than that was recorded at the RWA sign location in the same 5-min window (data from 81 locations show convincing statistical evidence, six show moderate evidence, and two show slight evidence). Thirty-four out of 44 days of testing showed greater 5-min COV at one or more sensor location in the work zone than that at the RWA sign location in the same 5-min window.

As summarized in Table 4.16, the differences in the mean 5-min COV between a location in the work zone and the RWA sign location ranged from 0.017 to 0.211. On average, the mean 5-min COV at a location in the transition area or in the active work area was 0.058 greater than that at the RWA sign location during the same 5-min window when considering data collected from both lanes at the RWA sign location.

Table 4.15: Summary Results for 5-min COV Analysis by Work Zone Location

Research Study No.	Case Study Project	Day	EoT	1st WA	2nd WA	3rd WA	Number of Time Periods	Total Number of Time Periods
1	I-5 Rock Point to Seven Oaks	1	●	●	●	●	71	72
		2	◐	●	▲	●	41	
		3	▲	▲	▲	●	71	
		4	◐	●	●	◐	72	
		5	▲	▲	▲	▲	69	
		6	▲	●	▲	▲	72	
		7	▲	●	●	●	72	
		8	▲	●	▲	▲	72	
2	I-84 Arlington to Tower Road	1	●	◐	●	●	85	96
		2	▲	●	●	#N/A	88	
		3	▲	●	●	●	86	
		4	▲	●	●	●	96	
		5	▲	●	●	●	96	
		6	●	●	▲	●	93	
		7	●	●	●	●	92	
		8	▲	●	●	●	85	
3	I-205 Relamping	1	●	▲	▲	▲	52	60
		2	●	▲	▲	▲	42	
	I-205 Sweeping	1	▲	▲	▲	▲	25	36
	I-84 Vactoring	1	#N/A	▲	▲	▲	20	30
		2	#N/A	▲	▲	▲	24	
	US-97 Spraying	1	▲	▲	▲	▲	42	42
4	I-84 Jordan Road to Multnomah Falls	1	▲	▲	▲	▲	73	84
		2	◐	●	●	●	81	
		3	●	●	▲	●	83	
		4	●	●	●	●	84	
		5	●	●	●	●	82	
	I-5 South Medford to North Ashland	1	▲	▲	▲	◐	89	90
		2	#N/A	▲	▲	▲	88	
		3	●	▲	▲	●	90	
		4	▲	▲	●	●	90	
		5	#N/A	▲	●	●	89	

5	I-5 Grants Pass 1	1	▲	▲	▲	●	63	72
		2	●	●	●	●	72	
		3	●	●	●	●	72	
		4	▲	▲	▲	▲	72	
	I-5 Grants Pass 2	1	●	●	●	●	61	72
		2	▲	◔	▲	▲	65	
		3	▲	●	●	●	67	
		4	▲	▲	◔	●	65	
	I-5 Hassalo	1	●	●	●	▲	60	60
		2	▲	▲	▲	▲	60	
		3	▲	▲	▲	▲	60	
		4	▲	●	▲	▲	59	

Table 4.16: Case Study Days with Higher COVs in Work Zones from 5-min COV Analysis by Work Zone Location

Study No.	Case Study Project	Day	Mean 5-min COV			Mean COV Difference (WZ - RWA)
			RWA	WZ	WZ Location	
1	I-5 Rock Point to Seven Oaks	1	0.143	0.186	EoT	0.042
			0.143	0.208	1stWA	0.065
			0.143	0.241	2ndWA	0.097
			0.143	0.171	3rdWA	0.028
		2	0.142	0.161	EoT	0.019
			0.142	0.221	1stWA	0.079
			0.142	0.184	3rdWA	0.042
		3	0.176	0.225	3rdWA	0.049
		4	0.143	0.162	EoT	0.019
			0.143	0.218	1stWA	0.075
			0.143	0.202	2ndWA	0.059
			0.143	0.165	3rdWA	0.022
		6	0.159	0.213	1stWA	0.054
		7	0.159	0.189	1stWA	0.030
			0.159	0.235	2ndWA	0.076
			0.159	0.211	3rdWA	0.052
		8	0.188	0.230	1stWA	0.041
2	I-84 Arlington to Tower Road	1	0.141	0.179	EoT	0.038
			0.141	0.168	1stWA	0.027
			0.141	0.197	2ndWA	0.057
			0.141	0.219	3rdWA	0.078
		2	0.131	0.185	1stWA	0.054
			0.131	0.199	2ndWA	0.068
		3	0.134	0.221	1stWA	0.088

			0.134	0.216	2ndWA	0.082
			0.134	0.205	3rdWA	0.071
		4	0.125	0.256	1stWA	0.131
			0.125	0.213	2ndWA	0.088
			0.125	0.206	3rdWA	0.081
		5	0.132	0.238	1stWA	0.106
			0.132	0.191	2ndWA	0.059
			0.132	0.196	3rdWA	0.064
		6	0.148	0.186	EoT	0.038
			0.148	0.258	1stWA	0.110
			0.148	0.190	3rdWA	0.042
		7	0.129	0.166	EoT	0.037
			0.129	0.237	1stWA	0.108
			0.129	0.210	2ndWA	0.081
			0.129	0.192	3rdWA	0.064
		8	0.151	0.221	1stWA	0.070
			0.151	0.199	2ndWA	0.047
			0.151	0.240	3rdWA	0.089
3	I-205 Relamping	1	0.148	0.177	EoT	0.028
		2	0.144	0.208	EoT	0.064
4	I-84 Jordan Road to Multnomah Falls	2	0.130	0.149	EoT	0.018
			0.130	0.152	1stWA	0.022
			0.130	0.168	2ndWA	0.037
			0.130	0.182	3rdWA	0.052
		3	0.127	0.144	EoT	0.017
			0.127	0.176	1stWA	0.049
			0.127	0.168	3rdWA	0.042
		4	0.121	0.165	EoT	0.044
			0.121	0.159	1stWA	0.038

			0.121	0.152	2ndWA	0.031
			0.121	0.182	3rdWA	0.061
		5	0.128	0.166	EoT	0.039
			0.128	0.171	1stWA	0.043
			0.128	0.170	2ndWA	0.042
			0.128	0.185	3rdWA	0.058
	I-5 South Medford to North Ashland	1	0.141	0.160	3rdWA	0.019
		3	0.119	0.156	EoT	0.037
			0.119	0.171	3rdWA	0.052
		4	0.125	0.207	2ndWA	0.082
			0.125	0.202	3rdWA	0.077
		5	0.131	0.178	2ndWA	0.047
			0.131	0.187	3rdWA	0.056
5	I-5 Grants Pass 1	1	0.162	0.215	3rdWA	0.054
		2	0.166	0.200	EoT	0.034
			0.166	0.236	1stWA	0.070
			0.166	0.219	2ndWA	0.053
			0.166	0.202	3rdWA	0.035
		3	0.119	0.221	EoT	0.102
			0.119	0.219	1stWA	0.100
			0.119	0.201	2ndWA	0.082
			0.119	0.149	3rdWA	0.030
	I-5 Grants Pass 2	1	0.156	0.216	EoT	0.059
			0.156	0.269	1stWA	0.112
			0.156	0.199	2ndWA	0.042
			0.156	0.214	3rdWA	0.057
		2	0.183	0.203	1stWA	0.019
		3	0.134	0.170	1stWA	0.036
			0.134	0.168	2ndWA	0.034

			0.134	0.174	3rdWA	0.040
		4	0.153	0.173	2ndWA	0.020
			0.153	0.182	3rdWA	0.030
	I-5 Hassalo	1	0.157	0.223	EoT	0.065
			0.157	0.369	1stWA	0.211
			0.157	0.222	2ndWA	0.065
		4	0.237	0.343	1stWA	0.106
Average			**0.141**	**0.199**		**0.058**

Table 4.17 and 4.19 present the results for 5-min SD and 5-min COV analyses when considering the two lanes at the RWA sign location separately. It can be observed that the number of time periods included in these two tables are lower than those shown in Table 4.13 and Table 4.15. The lower number of time periods is because at the RWA sign location, the sensor placed in the to-be-closed lane typically recorded fewer vehicles. If the number of vehicles recorded in a 5-min interval is less than two, calculating the speed SD is not possible. To perform pairwise comparisons between locations, data associated with one or multiple missing SD(s) in a 5-min interval were not included in the analyses.

Based on Table 4.17, when comparing to the 5-min SD recorded at the RWA sign in the to-be-closed lane, the data from 27 out of 165 sensor locations showed greater 5-min SDs in the same 5-min window (23 have convincing statistical evidence, 2 have moderate evidence, and 2 have slightly evidence). When comparing to the 5-min SD recorded at the RWA sign in the open lane, the data from 38 out of 165 sensor locations showed greater 5-min SDs in the same 5-min window (28 have convincing statistical evidence, 5 have moderate evidence, and 5 have slightly evidence). Among the 42 examined days, 24 of the days showed a greater 5-min SD in one or more sensor locations in the work zone than that recorded either in the open lane or in the to-be-closed lane at the RWA sign location.

Table 4.18 summarizes 65 comparisons associated with greater 5-min SD at the RWA sign location than that at a sensor location in the work zone. The differences in the mean 5-min SD between one lane at the RWA sign location and a sensor location in the work zone vary from 1.16 mph to 6.92 mph. On average, the 5-min SD at a location in the transition area or in the active work area is 2.78 mph greater than that at one of the lanes at the RWA sign location in the same 5-min window.

Table 4.17: Results for 5-min SD Analysis by Lane (including RWA(C))

Research Study No.	Case Study Project	Day	RWA(C)				RWA(O)				Number of Time Periods	Total Number of Time Periods
			EoT	1st WA	2nd WA	3rd WA	EoT	1st WA	2nd WA	3rd WA		
1	I-5 Rock Point to Seven Oaks	1	●	●	●	●	◔	▲	▲	▲	43	72
		2	▲	▲	▲	▲	▲	◐	▲	◔	34	
		3	▲	▲	▲	▲	▲	▲	▲	▲	47	
		4	▲	▲	▲	▲	◔	●	▲	◔	43	
		5	▲	▲	▲	▲	▲	▲	▲	▲	53	
		6	▲	◔	▲	▲	▲	●	▲	▲	47	
		7	▲	▲	▲	▲	▲	▲	▲	▲	50	
		8	▲	▲	▲	▲	▲	▲	▲	▲	55	
2	I-84 Arlington to Tower Road	1	▲	▲	▲	▲	▲	▲	▲	▲	46	96
		2	▲	▲	▲	#N/A	▲	▲	◔	#N/A	39	
		3	▲	▲	▲	▲	▲	▲	▲	▲	32	
		4	▲	▲	▲	▲	▲	▲	▲	▲	25	
		5	▲	▲	▲	▲	▲	▲	▲	▲	28	
		6	▲	▲	▲	▲	▲	▲	▲	▲	37	
		7	▲	▲	▲	▲	▲	▲	▲	▲	20	
		8	▲	▲	▲	▲	▲	▲	▲	▲	13	
3	I-205 Relamping	1	●	▲	▲	▲	●	▲	▲	▲	47	60
		2	●	▲	▲	▲	●	▲	▲	▲	42	
	I-205 Sweeping	1	▲	▲	▲	▲	▲	▲	▲	▲	24	36
	I-84 Banfield Expressway Vactoring	1	Lane Information Unavailable									
		2										

	US-97 Spraying	1	▲	▲	▲	▲	▲	▲	▲	▲	36	42
4	I-84 Jordan Road to Multnomah Falls	1	▲	▲	▲	▲	◐	◐	●	●	27	84
		2	▲	▲	▲	▲	▲	▲	▲	▲	48	
		3	▲	◔	▲	▲	◐	●	▲	▲	53	
		4	◐	▲	▲	▲	●	●	▲	▲	55	
		5	▲	▲	▲	▲	●	●	▲	▲	64	
	I-5 South Medford to North Ashland	1	▲	▲	▲	▲	●	▲	▲	▲	59	90
		2	#N/A	▲	▲	▲	#N/A	▲	▲	▲	68	
		3	●	▲	▲	▲	●	▲	▲	●	87	
		4	▲	▲	●	●	▲	▲	●	●	42	
		5	#N/A	▲	▲	▲	#N/A	▲	●	▲	64	
5	I-5 Grants Pass 1	1	▲	▲	▲	▲	▲	▲	▲	▲	54	72
		2	●	▲	●	◐	●	▲	●	▲	53	
		3	●	●	▲	▲	●	●	▲	▲	55	
		4	●	●	▲	▲	●	●	●	▲	64	
	I-5 Grants Pass 2	1	●	●	▲	▲	◐	▲	▲	▲	56	72
		2	▲	●	▲	▲	▲	▲	▲	▲	52	
		3	▲	▲	▲	▲	▲	▲	▲	▲	55	
		4	▲	▲	▲	▲	▲	▲	▲	▲	62	
	I-5 Hassalo	1	▲	●	●	▲	▲	●	▲	▲	60	60
		2	▲	▲	▲	▲	●	▲	▲	▲	60	
		3	▲	●	●	●	▲	▲	▲	▲	60	
		4	▲	▲	▲	▲	●	●	▲	▲	59	

Table 4.18: Case Study Days with Higher SDs in Work Zones from 5-min SD Analysis by Lane (including RWA(C))

Study No.	Case Study Project	Day	Mean 5-min SD (mph)				Mean SD Difference (WZ - RWA)
			RWA(C)	RWA(O)	WZ	WZ Location	
1	1-5 Rock Point to Seven Oaks	1	5.94		10.17	EoT	4.23
			5.94		8.98	1stWA	3.04
			5.94		9.50	2ndWA	3.56
			5.94		8.93	3rdWA	2.99
				8.61	10.17	EoT	1.57
		2		7.76	10.03	1stWA	2.27
				7.76	9.50	3rdWA	1.74
		4		6.11	8.07	EoT	1.97
				6.11	9.35	1stWA	3.24
				6.11	8.15	3rdWA	2.04
		6	8.66		10.81	1stWA	2.15
				8.46	10.81	1stWA	2.35
2	I-84 Arlington to Tower Road	2		7.28	8.48	2ndWA	1.20
3	I-205 Relamping	1	6.84		10.06	EoT	3.22
				7.85	10.06	EoT	2.21
		2	6.65		10.37	EoT	3.72
				6.65	10.37	EoT	3.73
4	I-84 Jordan Road to Multnomah Falls	1		4.40	5.86	EoT	1.47
				4.40	6.92	1stWA	2.52
				4.40	8.47	2ndWA	4.07
				4.40	9.55	3rdWA	5.15
		3	8.20		10.22	1stWA	2.02
				7.89	9.08	EoT	1.19
				7.89	10.22	1stWA	2.33
		4	7.31		9.75	EoT	2.44
				7.30	9.75	EoT	2.45

				7.30	9.04	1stWA	1.75
		5		7.97	10.08	EoT	2.11
				7.97	9.89	1stWA	1.92
	I-5 South Medford to North Ashland	1		7.80	9.18	EoT	1.38
		3	7.48		8.70	EoT	1.22
				6.56	8.70	EoT	2.14
				6.56	7.72	3rdWA	1.16
		4	7.10		10.38	2ndWA	3.28
			7.10		8.96	3rdWA	1.86
				7.21	10.38	2ndWA	3.18
				7.21	8.96	3rdWA	1.75
		5		7.16	8.63	2ndWA	1.47
5	I-5 Grants Pass 1	2	7.32		14.23	EoT	6.92
			7.32		11.18	2ndWA	3.86
			7.32		9.59	3rdWA	2.28
				8.61	14.23	EoT	5.62
				8.61	11.18	2ndWA	2.57
		3	7.46		12.37	EoT	4.91
			7.46		11.11	1stwA	3.65
				8.65	12.37	EoT	3.71
				8.65	11.11	1stwA	2.45
		4	9.24		13.16	EoT	3.92
			9.24		11.81	1stwA	2.57
				7.82	13.16	EoT	5.34
				7.82	11.81	1stwA	3.99
				7.82	9.52	2ndWA	1.70
	I-5 Grants Pass 2	1	10.65		14.00	EoT	3.36
			10.65		13.18	1stWA	2.53
				12.16	14.00	EoT	1.85
		2	7.27		9.61	1stWA	2.34
	I-5 Hassalo	1	8.62		11.50	1stWA	2.88
			8.62		10.40	2ndWA	1.78

				9.57	11.50	1stWA	1.92
		2		8.51	11.68	EoT	3.17
		3	7.70		8.96	1stWA	1.26
			7.70		11.32	2ndWA	3.61
			7.70		11.02	3rdWA	3.32
		4		8.56	11.52	EoT	2.96
				8.56	12.61	1stWA	4.04
Average			**7.68**	**7.48**	**10.34**		**2.78**

Table 4.19 shows the 5-min COV analysis when considering vehicle speeds recorded in the two lanes at the RWA sign location separately. Among the 165 sensor locations in the work zones, the data from 113 sensor locations showed a greater 5-min speed COV than that recorded at the RWA sign in the closed lane in the same 5-min window (96 locations have convincing statistical evidence, 8 have moderate evidence, and 9 have slightly evidence). When comparing to the 5-min speed COV recorded at the RWA sign in the open lane, the data from 112 sensor locations showed a greater value (90 locations have convincing statistical evidence, 17 have moderate evidence, and 5 have slightly evidence). Among the 42 examined days, 40 of them showed a greater 5-min COVs in one or more sensor locations in the work zone than that recorded either in the open lane or in the to-be-closed lane at the RWA sign location.

Table 4.19: Results for 5-min COV Analysis by Lane (including RWA(C))

Research Study No.	Case Study Project	Day	RWA(C)				RWA(O)				Number of Time Periods	Total Number of Time Periods
			EoT	1st WA	2nd WA	3rd WA	EoT	1st WA	2nd WA	3rd WA		
1	I-5 Rock Point to Seven Oaks	1	●	●	●	●	●	●	●	◔	43	72
		2	●	●	▲	●	●	●	▲	●	34	
		3	●	◐	●	●	▲	▲	▲	◐	47	
		4	◔	●	●	▲	●	●	●	●	43	
		5	▲	▲	▲	▲	◐	◐	◐	▲	53	
		6	▲	●	●	◔	▲	●	◔	▲	47	
		7	▲	●	●	●	▲	●	●	●	50	
		8	▲	●	▲	▲	▲	●	◔	▲	55	
2	I-84 Arlington to Tower Road	1	●	●	●	●	●	◐	●	●	46	96
		2	▲	◐	●	#N/A	▲	●	●	#N/A	39	
		3	▲	●	●	●	▲	●	●	●	32	
		4	▲	●	◐	●	▲	●	●	●	25	
		5	◔	●	◐	◔	▲	●	◐	◔	28	
		6	●	●	▲	●	◐	●	▲	▲	37	
		7	▲	●	◔	▲	●	●	●	◐	20	
		8	●	●	●	●	▲	◐	▲	▲	13	
3	I-205 Relamping	1	●	●	◐	●	●	▲	▲	▲	47	60
		2	●	●	●	●	●	●	◐	●	42	
	I-205 Sweeping	1	▲	▲	▲	▲	▲	▲	▲	▲	24	36
	I-84 Banfield Expressway	1	Lane Information Unavailable									
		2										

	US-97 Spraying	1	▲	▲	▲	▲	▲	▲	▲	▲	36	42
4	I-84 Jordan Road to Multnomah Falls	1	▲	◔	●	●	▲	▲	●	●	27	84
		2	▲	◔	●	●	●	●	●	●	48	
		3	◐	●	▲	●	●	●	▲	●	53	
		4	●	●	●	●	●	●	●	●	55	
		5	●	●	●	●	●	●	●	●	64	
	I-5 South Medford to North Ashland	1	▲	▲	▲	▲	●	◐	●	●	59	90
		2	#N/A	▲	▲	◐	#N/A	▲	▲	▲	68	
		3	●	▲	▲	●	●	◐	▲	●	87	
		4	▲	▲	●	●	▲	▲	●	●	42	
		5	#N/A	▲	●	●	#N/A	◐	●	●	64	
5	I-5 Grants Pass 1	1	◐	●	▲	●	▲	▲	▲	◐	54	72
		2	●	●	●	●	●	●	●	●	53	
		3	●	●	●	◔	●	●	●	◐	55	
		4	●	●	●	●	●	●	●	●	64	
	I-5 Granst Pass 2	1	●	●	●	●	●	●	●	●	56	72
		2	●	●	●	●	▲	◔	▲	▲	52	
		3	▲	●	●	●	◔	●	●	●	55	
		4	▲	▲	●	●	▲	▲	▲	▲	62	
	I-5 Hassalo	1	●	●	●	▲	●	●	●	◐	60	60
		2	▲	▲	▲	▲	●	●	▲	▲	60	
		3	●	●	●	▲	●	●	●	▲	60	
		4	▲	◔	▲	▲	●	●	●	▲	59	

Table 4.20 summarizes 225 comparisons associated with greater 5-min COV at the RWA sign location than that at a sensor location in the work zone. The differences in the mean 5-min COV between one lane at the RWA sign location and a sensor location in the work zone vary from 0.015 to 0.238. On average, the 5-min COV at a location in the transition area or in the active work area is 0.071 greater than that at one of the lanes at the RWA sign location in the same 5-min window.

Table 4.20: Case Study Days with Higher COVs in Work Zones from 5-min COV Analysis by Lane (including RWA(C))

Study No.	Case Study Project	Day	Mean 5-min COV				Mean COV Difference (WZ - RWA)
			RWA(C)	RWA(O)	WZ	WZ Location	
1	I-5 Rock Point to Seven Oaks	1	0.085		0.189	EoT	0.104
			0.085		0.218	1stWA	0.133
			0.085		0.250	2ndWA	0.164
			0.085		0.166	3rdWA	0.081
				0.141	0.189	EoT	0.048
				0.141	0.218	1stWA	0.077
				0.141	0.250	2ndWA	0.109
				0.141	0.165	3rdWA	0.024
		2	0.115		0.162	EoT	0.048
			0.115		0.220	1stWA	0.105
			0.115		0.175	3rdWA	0.061
				0.125	0.162	EoT	0.038
				0.125	0.220	1stWA	0.095
				0.125	0.175	3rdWA	0.051
		3	0.133		0.181	EoT	0.048
			0.133		0.175	1stWA	0.042
			0.133		0.196	2ndWA	0.063
			0.133		0.218	3rdWA	0.085
				0.172	0.218	3rdWA	0.046
		4	0.141		0.163	EoT	0.022
			0.141		0.223	1stWA	0.082
			0.141		0.182	2ndWA	0.041
				0.086	0.163	EoT	0.077
				0.086	0.223	1stWA	0.137
				0.086	0.182	2ndWA	0.096

				0.086	0.156	3rdWA	0.070
		5		0.153	0.198	EoT	0.045
				0.153	0.212	1stWA	0.059
				0.153	0.207	2ndWA	0.054
		6	0.139		0.223	1stWA	0.084
			0.139		0.182	2ndWA	0.043
			0.139		0.170	3rdWA	0.031
				0.148	0.223	1stWA	0.074
				0.148	0.182	2ndWA	0.033
		7	0.140		0.197	1stWA	0.058
			0.140		0.229	2ndWA	0.089
			0.140		0.214	3rdWA	0.075
				0.156	0.197	1stWA	0.042
				0.156	0.229	2ndWA	0.073
				0.156	0.214	3rdWA	0.059
		8	0.182		0.242	1stWA	0.060
				0.160	0.242	1stWA	0.082
				0.160	0.199	2ndWA	0.039
2	I-84 Arlington to Tower Road	1	0.128		0.188	EoT	0.060
			0.128		0.173	1stWA	0.045
			0.128		0.199	2ndWA	0.072
			0.128		0.235	3rdWA	0.107
				0.132	0.188	EoT	0.056
				0.132	0.173	1stWA	0.040
				0.132	0.199	2ndWA	0.067
				0.132	0.235	3rdWA	0.103
		2	0.128		0.164	1stWA	0.036
			0.128		0.175	2ndWA	0.046
				0.124	0.164	1stWA	0.040
				0.124	0.175	2ndWA	0.051

		3	0.121		0.234	1stWA	0.113
			0.121		0.218	2ndWA	0.097
			0.121		0.222	3rdWA	0.101
				0.133	0.234	1stWA	0.101
				0.133	0.218	2ndWA	0.085
				0.133	0.222	3rdWA	0.089
		4	0.106		0.281	1stWA	0.175
			0.106		0.187	2ndWA	0.081
			0.106		0.202	3rdWA	0.096
				0.135	0.281	1stWA	0.146
				0.135	0.187	2ndWA	0.052
				0.135	0.202	3rdWA	0.067
		5	0.125		0.160	EoT	0.036
			0.125		0.250	1stWA	0.126
			0.125		0.175	2ndWA	0.050
			0.125		0.180	3rdWA	0.056
				0.142	0.250	1stWA	0.109
				0.142	0.175	2ndWA	0.033
				0.142	0.180	3rdWA	0.038
		6	0.118		0.187	EoT	0.070
			0.118		0.246	1stWA	0.128
			0.118		0.177	3rdWA	0.059
				0.141	0.187	EoT	0.047
				0.141	0.246	1stWA	0.105
		7	0.131		0.261	1stWA	0.130
			0.131		0.229	2ndWA	0.098
				0.130	0.202	EoT	0.073
				0.130	0.261	1stWA	0.131
				0.130	0.229	2ndWA	0.100
				0.130	0.183	3rdWA	0.053

		8	0.077		0.126	EoT	0.049
			0.077		0.224	1stWA	0.147
			0.077		0.196	2ndWA	0.119
			0.077		0.178	3rdWA	0.101
				0.158	0.224	1stWA	0.066
3	I-205 Relamping	1	0.099		0.177	EoT	0.078
			0.099		0.138	1stWA	0.038
			0.099		0.129	2ndWA	0.030
			0.099		0.154	3rdWA	0.055
				0.139	0.177	EoT	0.038
		2	0.098		0.208	EoT	0.110
			0.098		0.151	1stWA	0.053
			0.098		0.148	2ndWA	0.050
			0.098		0.160	3rdWA	0.062
				0.113	0.208	EoT	0.095
				0.113	0.151	1stWA	0.038
				0.113	0.148	2ndWA	0.034
				0.113	0.160	3rdWA	0.046
4	I-84 Jordan Road to Multnomah Falls	1	0.117		0.172	1stWA	0.054
			0.117		0.208	2ndWA	0.091
			0.117		0.250	3rdWA	0.133
				0.134	0.208	2ndWA	0.074
				0.134	0.250	3rdWA	0.116
		2	0.120		0.154	1stWA	0.034
			0.120		0.167	2ndWA	0.047
			0.120		0.185	3rdWA	0.066
				0.123	0.152	EoT	0.029
				0.123	0.154	1stWA	0.031
				0.123	0.167	2ndWA	0.044
				0.123	0.185	3rdWA	0.062

		3	0.121		0.153	EoT	0.032
			0.121		0.183	1stWA	0.062
			0.121		0.178	3rdWA	0.056
				0.124	0.153	EoT	0.029
				0.124	0.183	1stWA	0.059
				0.124	0.178	3rdWA	0.053
		4	0.108		0.163	EoT	0.055
			0.108		0.159	1stWA	0.052
			0.108		0.151	2ndWA	0.043
			0.108		0.187	3rdWA	0.079
				0.114	0.163	EoT	0.049
				0.114	0.159	1stWA	0.045
				0.114	0.151	2ndWA	0.037
				0.114	0.187	3rdWA	0.073
		5	0.122		0.169	EoT	0.047
			0.122		0.175	1stWA	0.053
			0.122		0.171	2ndWA	0.049
			0.122		0.183	3rdWA	0.061
				0.123	0.169	EoT	0.046
				0.123	0.175	1stWA	0.052
				0.123	0.171	2ndWA	0.047
				0.123	0.183	3rdWA	0.059
	I-5 South Medford to North Ashland	1		0.128	0.151	EoT	0.024
				0.128	0.149	1stWA	0.021
				0.128	0.160	2ndWA	0.033
				0.128	0.157	3rdWA	0.029
		2	0.134		0.159	3rdWA	0.024
		3	0.119		0.156	EoT	0.038
			0.119		0.172	3rdWA	0.053
				0.111	0.156	EoT	0.045

				0.111	0.126	1stWA	0.015
				0.111	0.172	3rdWA	0.061
		4	0.112		0.222	2ndWA	0.110
			0.112		0.216	3rdWA	0.104
				0.122	0.222	2ndWA	0.100
				0.122	0.216	3rdWA	0.094
		5	0.136		0.185	2ndWA	0.050
			0.136		0.195	3rdWA	0.059
				0.117	0.138	1stWA	0.021
				0.117	0.185	2ndWA	0.068
				0.117	0.195	3rdWA	0.078
5	I-5 Grants Pass 1	1	0.121		0.165	EoT	0.044
			0.121		0.168	1stWA	0.047
			0.121		0.219	3rdWA	0.098
				0.167	0.219	3rdWA	0.052
		2	0.086		0.202	EoT	0.116
			0.086		0.230	1stWA	0.144
			0.086		0.209	2ndWA	0.123
			0.086		0.195	3rdWA	0.109
				0.132	0.202	EoT	0.070
				0.132	0.230	1stWA	0.098
				0.132	0.209	2ndWA	0.077
				0.132	0.195	3rdWA	0.062
		3	0.109		0.224	EoT	0.115
			0.109		0.225	1stWA	0.116
			0.109		0.206	2ndWA	0.097
			0.109		0.150	3rdWA	0.041
				0.119	0.224	EoT	0.104
				0.119	0.225	1stWA	0.106
				0.119	0.206	2ndWA	0.087

				0.119	0.150	3rdWA	0.031
		4	0.109		0.202	EoT	0.094
			0.109		0.213	1stWA	0.104
			0.109		0.202	2ndWA	0.094
			0.109		0.216	3rdWA	0.107
				0.139	0.202	EoT	0.064
				0.139	0.213	1stWA	0.074
				0.139	0.202	2ndWA	0.064
				0.139	0.216	3rdWA	0.077
	I-5 Grants Pass 2	1	0.138		0.220	EoT	0.082
			0.138		0.276	1stWA	0.138
			0.138		0.202	2ndWA	0.064
			0.138		0.213	3rdWA	0.074
				0.158	0.220	EoT	0.062
				0.158	0.276	1stWA	0.118
				0.158	0.202	2ndWA	0.044
				0.158	0.213	3rdWA	0.055
		2	0.110		0.141	EoT	0.031
			0.110		0.208	1stWA	0.097
			0.110		0.191	2ndWA	0.081
			0.110		0.169	3rdWA	0.059
				0.184	0.208	1stWA	0.023
		3	0.128		0.170	1stWA	0.042
			0.128		0.174	2ndWA	0.046
			0.128		0.179	3rdWA	0.051
				0.116	0.157	EoT	0.040
				0.116	0.170	1stWA	0.054
				0.116	0.174	2ndWA	0.058
				0.116	0.179	3rdWA	0.063
		4	0.136		0.171	2ndWA	0.035

			0.136		0.181	3rdWA	0.045
	I-5 Hassalo	1	0.138		0.223	EoT	0.085
			0.138		0.369	1stWA	0.231
			0.138		0.222	2ndWA	0.085
				0.130	0.223	EoT	0.092
				0.130	0.369	1stWA	0.238
				0.130	0.222	2ndWA	0.092
				0.130	0.153	3rdWA	0.022
		2		0.145	0.275	EoT	0.129
				0.145	0.193	1stWA	0.048
		3	0.145		0.196	EoT	0.051
			0.145		0.190	1stWA	0.045
			0.145		0.190	2ndWA	0.046
				0.157	0.196	EoT	0.038
				0.157	0.190	1stWA	0.032
				0.157	0.190	2ndWA	0.033
		4	0.271		0.343	1stWA	0.072
				0.139	0.278	EoT	0.139
				0.139	0.343	1stWA	0.203
				0.139	0.204	2ndWA	0.065
Average			***0.120***	***0.132***	***0.197***		***0.071***

Table 4.21 and Table 4.23 present the 5-min SD and COV analysis results when excluding the data collected in the to-be-closed lane at the RWA sign location. It can be observed from Table 4.21, when comparing to the 5-min SD at the RWA sign location, 46 out of 165 sensor locations showed a greater value in 5-min SD (the data from 34 sensor locations have convincing statistical evidence, 10 have moderate evidence, and 2 have slightly evidence). Among the 42 examined days, 26 days have at least one or more sensor locations in the transition area or in the active work area that showed a greater 5-min speed SD than that at the RWA sign location in the same 5-min window.

Similarly, Table 4.22 summarizes the 46 comparisons that have a greater SD in the work zone than that at the RWA sign location. The differences in the 5-min SD ranged from 0.80 mph to 5.42 mph. On average, the 5-min SD at a location in the transition area or in the active work area is 2.30 mph greater than that at the same (open) lane at the RWA sign location in the same 5-min window.

Table 4.21: Results for 5-min SD Analysis by Lane (excluding RWA(C))

Research Study No.	Case Study Project	Day	EoT	1st WA	2nd WA	3rd WA	Number of Time Periods	Total Number of Time Periods
1	I-5 Rock Point to Seven Oaks	1	◔	▲	▲	▲	71	72
		2	▲	◐	▲	◐	41	
		3	▲	▲	▲	▲	71	
		4	◐	●	▲	◐	44	
		5	▲	▲	▲	▲	53	
		6	▲	●	▲	▲	72	
		7	▲	▲	▲	▲	72	
		8	▲	▲	▲	▲	55	
2	I-84 Arlington to Tower Road	1	▲	▲	▲	▲	52	96
		2	▲	◐	●	#N/A	87	
		3	▲	▲	▲	▲	86	
		4	▲	●	▲	▲	96	
		5	▲	●	▲	▲	96	
		6	▲	▲	▲	▲	93	
		7	▲	●	◐	▲	92	
		8	▲	▲	▲	▲	84	
3	I-205 Relamping	1	●	▲	▲	▲	52	60
		2	●	▲	▲	▲	42	
	I-205 Sweeping	1	▲	▲	▲	▲	24	36
	I-84 Vactoring	1	Lane Information Unavailable					
		2						
	US-97 Spraying	1	▲	▲	▲	▲	42	42
4	I-84 Jordan Road to Multnomah Falls	1	▲	●	●	●	68	84
		2	◐	◐	▲	▲	79	
		3	◐	●	▲	▲	83	

		4	●	●	▲	▲	84	
		5	●	●	▲	▲	82	
		1	●	●	▲	▲	89	
		2	#N/A	▲	▲	▲	88	
	I-5 South Medford to North Ashland	3	●	▲	▲	●	90	90
		4	▲	▲	●	●	90	
		5	#N/A	▲	◐	▲	89	
		1	▲	▲	▲	▲	62	
	I-5 Grants Pass 1	2	●	▲	●	◔	72	72
		3	●	●	▲	▲	72	
		4	●	●	●	▲	72	
		1	●	▲	▲	▲	61	
5	I-5 Granst Pass 2	2	▲	▲	▲	▲	65	72
		3	▲	▲	▲	▲	55	
		4	▲	▲	▲	▲	62	
		1	▲	●	▲	▲	60	
	I-5 Hassalo	2	●	▲	▲	▲	60	60
		3	▲	▲	▲	▲	60	
		4	●	●	▲	▲	60	

Table 4.22: Case Study Days with Higher SDs in Work Zones from 5-min SD Analysis by Lane (excluding RWA(C))

Study No.	Case Study Project	Day	Mean 5-min SD (mph)			Mean SD Difference (WZ - RWA)
			RWA	WZ	WZ Location	
1	I-5 Rock Point to Seven Oaks	1	8.47	9.87	EoT	1.40
		2	8.03	10.00	1stWA	1.96
			8.03	9.80	3rdWA	1.76
		4	6.01	8.04	EoT	2.03
			6.01	9.27	1stWA	3.26
			6.01	8.32	3rdWA	2.31
		6	8.47	10.40	1stWA	1.93
2	I-84 Arlington to Tower Road	2	6.82	7.62	1stWA	0.80
			6.82	8.51	2ndWA	1.70
		4	7.16	10.52	1stWA	3.36
		5	7.47	9.38	1stWA	1.91
		7	7.15	9.67	1stWA	2.52
			7.15	8.46	2ndWA	1.30
3	I-205 Relamping	1	7.72	10.05	EoT	2.33
		2	6.65	10.37	EoT	3.73
4	I-84 Jordan Road to Multnomah Falls	1	5.07	6.87	1stWA	1.80
			5.07	8.31	2ndWA	3.24
			5.07	9.25	3rdWA	4.18
		2	7.53	8.76	EoT	1.22
			7.53	8.81	1stWA	1.28
		3	7.55	8.50	EoT	0.95
			7.55	9.71	1stWA	2.15
		4	7.45	9.84	EoT	2.39
			7.45	8.99	1stWA	1.54

		5	7.92	9.87	EoT	1.95
			7.92	9.67	1stWA	1.75
	I-5 South Medford to North Ashland	1	7.55	8.74	EoT	1.20
			7.55	8.58	1stWA	1.03
		3	6.57	8.69	EoT	2.12
			6.57	7.69	3rdWA	1.12
		4	7.04	9.71	2ndWA	2.67
			7.04	8.58	3rdWA	1.54
		5	7.38	8.49	2ndWA	1.11
5	I-5 Grants Pass 1	2	8.55	13.97	EoT	5.42
			8.55	11.33	2ndWA	2.78
			8.55	9.72	3rdWA	1.16
		3	8.63	12.24	EoT	3.61
			8.63	11.04	1stWA	2.41
		4	7.83	13.15	EoT	5.32
			7.83	12.00	1stWA	4.17
			7.83	9.38	2ndWA	1.55
	I-5 Grants Pass 2	1	11.93	13.89	EoT	1.97
	I-5 Hassalo	1	9.57	11.50	1stWA	1.92
		2	8.51	11.68	EoT	3.17
		4	8.56	11.52	EoT	2.96
			8.56	12.61	1stWA	4.04
Average			***7.55***	***9.86***		***2.30***

With respect to 5-min COV, Table 4.23 presents the analysis results conducted by lane excluding the vehicle speeds gathered in the to-be-closed lane at the RWA sign location. 119 out of 165 sensor locations showed a greater 5-min speed COV than that at the RWA sign location (the data from 103 locations have convincing statistical evidence, 12 have moderate evidence, and 4 have slightly evidence). Among the 42 examined days, 38 days had at least one or more sensor locations in the work zone associated with a greater 5-min COV than that the RWA sign location.

As shown in Table 4.24, the differences in the 5-min COV between a location in the work zone and the RWA sign location ranged from 0.015 to 0.238. On average, the 5-min COV at a location in the transition area or in the active work area is 0.064 greater than that at the same (open) lane at the RWA sign location in the same 5-min window.

Table 4.23: Results for 5-min COV Analysis by Lane (excluding RWA(C))

Research Study No.	Case Study Project	Day	EoT	1st WA	2nd WA	3rd WA	Number of Time Periods	Total Number of Time Periods
1	I-5 Rock Point to Seven Oaks	1	●	●	●	●	71	72
		2	●	●	▲	●	41	
		3	▲	▲	◔	●	71	
		4	●	●	●	●	44	
		5	◐	◐	◐	▲	53	
		6	▲	●	◐	◐	72	
		7	▲	●	●	●	72	
		8	▲	●	◔	▲	55	
2	I-84 Arlington to Tower Road	1	●	◐	●	●	52	96
		2	◐	●	●	#N/A	87	
		3	▲	●	●	●	86	
		4	▲	●	●	●	96	
		5	▲	●	●	●	96	
		6	●	●	◐	●	93	
		7	●	●	●	●	92	
		8	▲	●	●	●	84	
3	I-205 Relamping	1	●	▲	▲	▲	52	60
		2	●	●	◐	●	42	
	I-205 Sweeping	1	▲	▲	▲	▲	24	36
	I-84 Vactoring	1	Lane Information Unavailable					
		2						

	US-97 Spraying	1	▲	▲	▲	▲	42	42
4	I-84 Jordan Road to Multnomah Falls	1	▲	▲	●	●	68	84
		2	●	●	●	●	79	
		3	●	●	▲	●	83	
		4	●	●	●	●	84	
		5	●	●	●	●	82	
	I-5 South Medford to North Ashland	1	●	●	●	●	89	90
		2	#N/A	▲	▲	▲	88	
		3	●	●	▲	●	90	
		4	▲	▲	●	●	90	
		5	#N/A	▲	●	●	89	
5	I-5 Grants Pass 1	1	▲	▲	▲	◐	62	72
		2	●	●	●	●	72	
		3	●	●	●	●	72	
		4	●	●	●	●	72	
	I-5 Granst Pass 2	1	●	●	●	●	61	72
		2	▲	◐	▲	▲	65	
		3	◔	●	●	●	55	
		4	▲	▲	▲	▲	62	
	I-5 Hassalo	1	●	●	●	◐	60	60
		2	●	●	◔	▲	60	
		3	●	●	●	▲	60	
		4	●	●	●	▲	60	

Table 4.24: Case Study Days with Higher COVs in Work Zones from 5-min COV Analysis by Lane (excluding RWA(C))

Study No.	Case Study Project	Day	Mean 5-min COV			Mean COV Difference (WZ - RWA)
			RWA	WZ	WZ Location	
1	I-5 Rock Point to Seven Oaks	1	0.140	0.186	EoT	0.046
			0.140	0.208	1stWA	0.069
			0.140	0.241	2ndWA	0.101
			0.140	0.171	3rdWA	0.031
		2	0.129	0.161	EoT	0.032
			0.129	0.221	1stWA	0.092
			0.129	0.184	3rdWA	0.055
		3	0.172	0.193	2ndWA	0.021
			0.172	0.225	3rdWA	0.053
		4	0.085	0.162	EoT	0.078
			0.085	0.221	1stWA	0.137
			0.085	0.185	2ndWA	0.100
			0.085	0.158	3rdWA	0.074
		5	0.153	0.198	EoT	0.045
			0.153	0.212	1stWA	0.059
			0.153	0.207	2ndWA	0.054
		6	0.149	0.213	1stWA	0.064
			0.149	0.175	2ndWA	0.026
			0.149	0.176	3rdWA	0.027
		7	0.154	0.189	1stWA	0.035
			0.154	0.235	2ndWA	0.081
			0.154	0.211	3rdWA	0.057
		8	0.160	0.242	1stWA	0.082
			0.160	0.199	2ndWA	0.039

2	I-84 Arlington to Tower Road	1	0.131	0.191	EoT	0.060
			0.131	0.173	1stWA	0.042
			0.131	0.195	2ndWA	0.064
			0.131	0.233	3rdWA	0.102
		2	0.117	0.132	EoT	0.015
			0.117	0.182	1stWA	0.064
			0.117	0.200	2ndWA	0.082
		3	0.128	0.221	1stWA	0.094
			0.128	0.216	2ndWA	0.088
			0.128	0.205	3rdWA	0.077
		4	0.124	0.256	1stWA	0.132
			0.124	0.213	2ndWA	0.089
			0.124	0.206	3rdWA	0.082
		5	0.128	0.238	1stWA	0.110
			0.128	0.191	2ndWA	0.063
			0.128	0.196	3rdWA	0.067
		6	0.139	0.186	EoT	0.047
			0.139	0.258	1stWA	0.119
			0.139	0.163	2ndWA	0.024
			0.139	0.190	3rdWA	0.051
		7	0.123	0.166	EoT	0.043
			0.123	0.237	1stWA	0.114
			0.123	0.210	2ndWA	0.087
			0.123	0.192	3rdWA	0.069
		8	0.151	0.222	1stWA	0.071
			0.151	0.199	2ndWA	0.048
			0.151	0.241	3rdWA	0.090
3	I-205 Relamping	1	0.137	0.177	EoT	0.039
		2	0.113	0.208	EoT	0.095

			0.113	0.151	1stWA	0.038
			0.113	0.148	2ndWA	0.034
			0.113	0.160	3rdWA	0.046
4	I-84 Jordan Road to Multnomah Falls	1	0.153	0.200	2ndWA	0.047
			0.153	0.233	3rdWA	0.080
		2	0.121	0.149	EoT	0.028
			0.121	0.153	1stWA	0.032
			0.121	0.168	2ndWA	0.047
			0.121	0.183	3rdWA	0.062
		3	0.120	0.144	EoT	0.025
			0.120	0.176	1stWA	0.057
			0.120	0.168	3rdWA	0.049
		4	0.118	0.165	EoT	0.048
			0.118	0.159	1stWA	0.042
			0.118	0.152	2ndWA	0.035
			0.118	0.182	3rdWA	0.065
		5	0.123	0.166	EoT	0.044
			0.123	0.171	1stWA	0.048
			0.123	0.170	2ndWA	0.047
			0.123	0.185	3rdWA	0.063
	I-5 South Medford to North Ashland	1	0.125	0.146	EoT	0.021
			0.125	0.149	1stWA	0.024
			0.125	0.151	2ndWA	0.026
			0.125	0.160	3rdWA	0.035
		3	0.111	0.156	EoT	0.045
			0.111	0.126	1stWA	0.015
			0.111	0.171	3rdWA	0.060
		4	0.119	0.207	2ndWA	0.088
			0.119	0.202	3rdWA	0.083

		5	0.120	0.178	2ndWA	0.057
			0.120	0.187	3rdWA	0.066
5	I-5 Grants Pass 1	1	0.167	0.216	3rdWA	0.049
		2	0.132	0.200	EoT	0.069
			0.132	0.236	1stWA	0.105
			0.132	0.219	2ndWA	0.088
			0.132	0.202	3rdWA	0.070
		3	0.118	0.221	EoT	0.103
			0.118	0.219	1stWA	0.101
			0.118	0.201	2ndWA	0.083
			0.118	0.149	3rdWA	0.031
		4	0.139	0.203	EoT	0.064
			0.139	0.213	1stWA	0.074
			0.139	0.198	2ndWA	0.058
			0.139	0.214	3rdWA	0.075
	I-5 Grants Pass 2	1	0.155	0.216	EoT	0.061
			0.155	0.269	1stWA	0.114
			0.155	0.199	2ndWA	0.044
			0.155	0.214	3rdWA	0.059
		2	0.181	0.203	1stWA	0.021
		3	0.116	0.157	EoT	0.040
			0.116	0.170	1stWA	0.054
			0.116	0.174	2ndWA	0.058
			0.116	0.179	3rdWA	0.063
	I-5 Hassalo	1	0.130	0.223	EoT	0.092
			0.130	0.369	1stWA	0.238
			0.130	0.222	2ndWA	0.092
			0.130	0.153	3rdWA	0.022
		2	0.145	0.275	EoT	0.129

			0.145	0.193	1stWA	0.048
			0.145	0.167	2ndWA	0.022
		3	0.157	0.196	EoT	0.038
			0.157	0.190	1stWA	0.032
			0.157	0.190	2ndWA	0.033
		4	0.139	0.278	EoT	0.139
			0.139	0.343	1stWA	0.203
			0.139	0.204	2ndWA	0.065
Average			***0.132***	***0.196***		***0.064***

4.3.1.2 With Data Obtained from HERE Technologies

A total of 12 days of data collection were conducted in the prior Blue Light study. The data gathered were viewed as representative data for conditions with a work zone. As listed in Table 4.8, corresponding data for each day (same weekday before and after paving) at similar locations were included for conditions without work zones. For each day, 5-min SD and COV were computed/summarized based on the procedures described in Section 4.2.1.2.

Table 4.25 lists the days and dates, and the number of 5-min intervals included on each day for the I-5 Hassalo project. The data from each day of data collection during paving are typically compared to six or eight days of data before or after paving from the HERE data. Due to the availability of the data from the HERE data, the number of 5-min intervals varies. The lowest number of data points available for this case study project is seven, which is insufficient for statistical analysis. Instead, descriptive analyses were performed for both 5-min SD and COV to show the differences in the data with or without work zones.

Table 4.25: Days, Dates, and Available Sample Size for Comparisons (I-5 Hassalo Project)

Day	Data Collection		Before Paving		After Paving	
	Day/Date	n	Day/Date	n	Day/Date	n
1	Wed., 8/1/2018	60	Wed., 5/2/2018	26	Wed., 4/3/2019	23
			Wed., 5/9/2018	18	Wed., 4/10/2019	33
			Wed., 5/16/2018	18	Wed., 4/17/2019	36
			Wed., 5/23/2018	34	Wed., 4/24/2019	17
2	Thurs., 8/2/2018	60	Thurs., 5/3/2018	26	Thurs., 4/4/2019	39
			Thurs., 5/10/2018	29	Thurs., 4/11/2019	27
			Thurs., 5/17/2018	34	Thurs., 4/18/2019	50
3	Wed., 8/8/2018	60	Wed., 5/2/2018	16	Wed., 4/3/2019	7
			Wed., 5/9/2018	17	Wed., 4/10/2019	21
			Wed., 5/16/2018	15	Wed., 4/17/2019	22
			Wed., 5/23/2018	17	Wed., 4/24/2019	9
4	Thurs., 8/9/2018	60	Thurs., 5/3/2018	22	Thurs., 4/4/2019	32
			Thurs., 5/10/2018	8	Thurs., 4/11/2019	32
			Thurs., 5/17/2018	17	Thurs., 4/18/2019	52

Figure 4.8 presents the results for the comparisons based on SD using box plots. Box plots are beneficial for visualizing the distribution of data. For each box plot, the plot displays five summary statistics: the minimum, first quartile, median, third quantile, and maximum 5-min speed SD on a specific day. In addition, a red X (x) marks the average value. It can be observed from Figure 4.8 that compared to the data from the HERE data without a work zone present, the average 5-min speed SDs with a work zone present are greater on all four days. The average 5-min speed SD without a work zone present ranged from 0.53 mph to 5.75 mph, whereas the average 5-min speed SD with a work zone present ranged from 7.16 mph to 11.05 mph. When examining the variability of the distribution (e.g., comparing the range between the minimum and the maximum,

comparing the range between the first and third quantiles), the data without a work zone present typically show lower variability.

Similar observations could be found with respect to 5-min speed COV in Figure 4.9. The data with a work zone present are more frequently associated with higher values in the 5-min speed COV. The average 5-min COVs with a work zone present vary from 0.178 to 0.245, while that without a work zone present vary from 0.021 to 0.111. Compared to the data distribution before or after paving, the ranges are typically broader with data recorded during paving operations, which show higher variability in the data with a work zone present.

The same descriptive analyses were conducted for the case study project I-5 Grants Pass 1. Similar to the previous case study project, on many days, the number of 5-min intervals from the HERE data is less than 10 (Table 4.26), which is not enough for statistical analyses. Therefore, boxplots for 5-min SD (Figure 4.10) and 5-min COV (Figure 4.11) are plotted to show the distribution of data with or without work zones. Additionally, the data the researchers received from HERE Technologies contain those recorded at the same time during the data collection for the Grants Pass case study projects. Although the available sample sizes for those days were not large (as shown in Table 4.26), the data are also displayed in the figures to provide additional reference points to compare the speed variance measurements with or without a work zone present.

Table 4.26: Days, Dates, and Available Sample Size for Comparisons (I-5 Grants Pass 1)

Day	Data Collection			Before Paving			After Paving		
	Day/Date	n	n (from HERE)	Day #	Day/Date	n	Day #	Day/Date	n
1	Sun., 8/12/2018	67	8	1	Sun., 7/8/2018	18	1	Sun., 10/14/2018	12
				2	Sun., 7/15/2018	17	2	Sun., 10/21/2018	9
				3	Sun., 7/22/2018	11	3	Sun., 10/28/2018	11
				4	Sun., 7/29/2018	15	4		
2	Mon., 8/13/2018	72	13	1	Mon., 7/9/2018	12	1	Mon., 10/15/2018	13
				2	Mon., 7/16/2018	9	2	Mon., 10/22/2018	5
				3	Mon., 7/23/2018	8	3	Mon., 10/29/2018	6
3	Tues., 8/14/2018	72	3	1	Tues., 7/10/2018	23	1	Tues., 10/16/2018	18
				2	Tues., 7/17/2018	17	2	Tues., 10/23/2018	13
				3	Tues., 7/24/2018	18	3	Tues., 10/30/2018	15
4	Wed., 8/15/2018	72	11	1	Wed., 7/11/2018	16	1	Wed., 10/17/2018	14
				2	Wed., 7/18/2018	18	2	Wed., 10/24/2018	7
				3	Wed., 7/25/2018	20	3	Wed., 10/31/2018	5

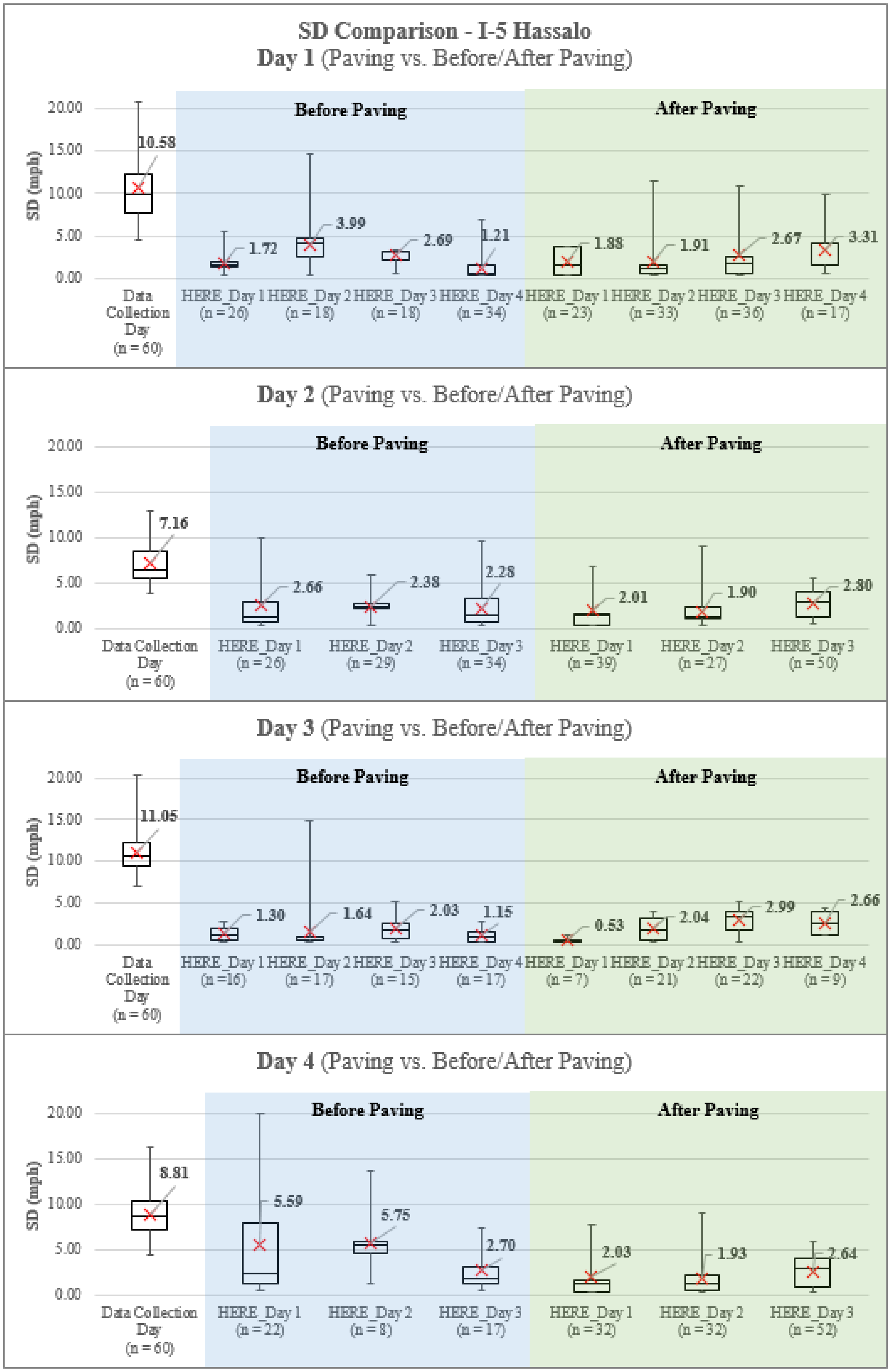


Figure 4.8: 5-min SD comparison (I-5 Hassalo)

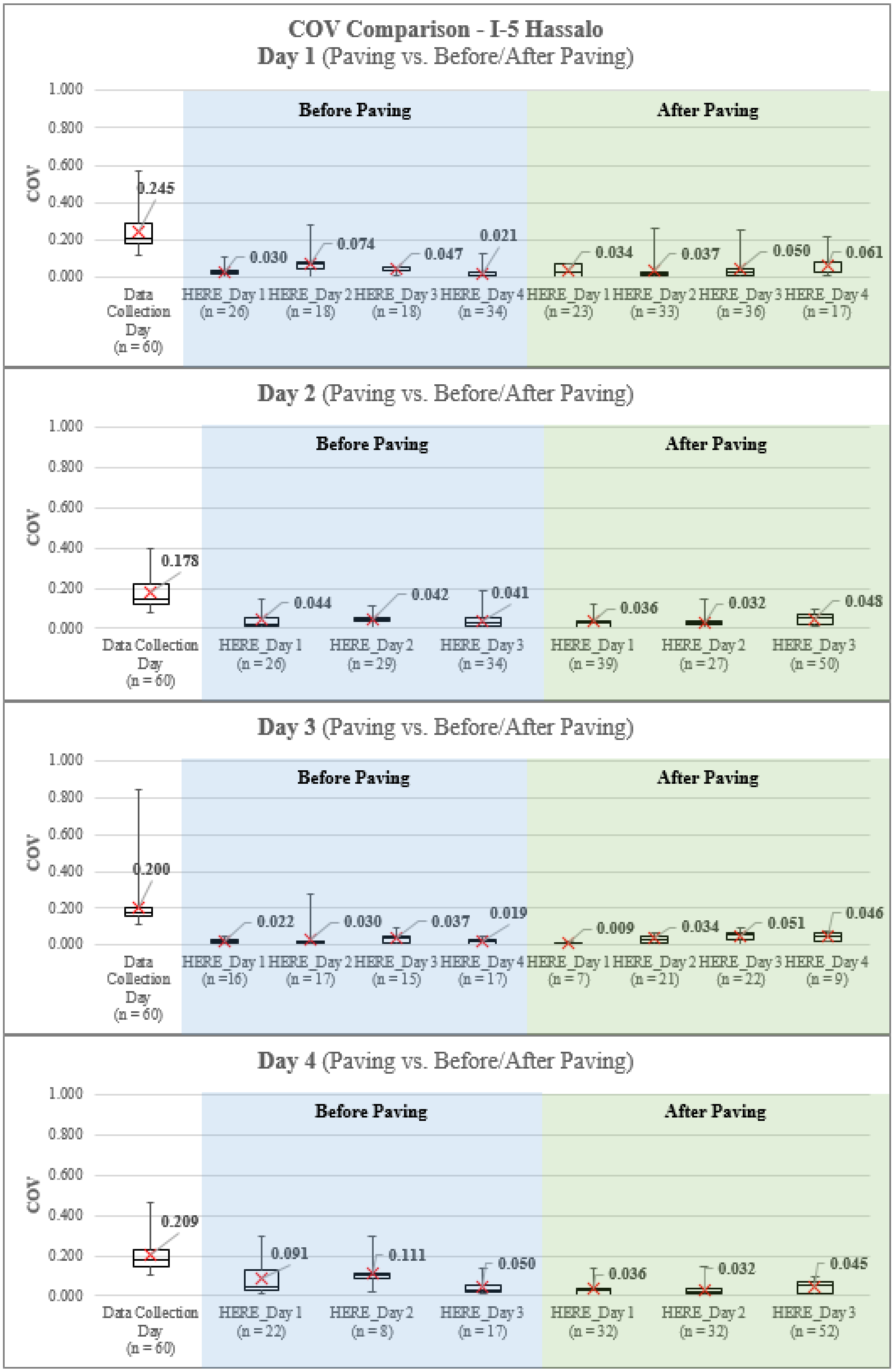


Figure 4.9: 5-min COV comparison (I-5 Hassalo)

Figure 4.10: 5-min SD comparison (I-5 Grants Pass 1)

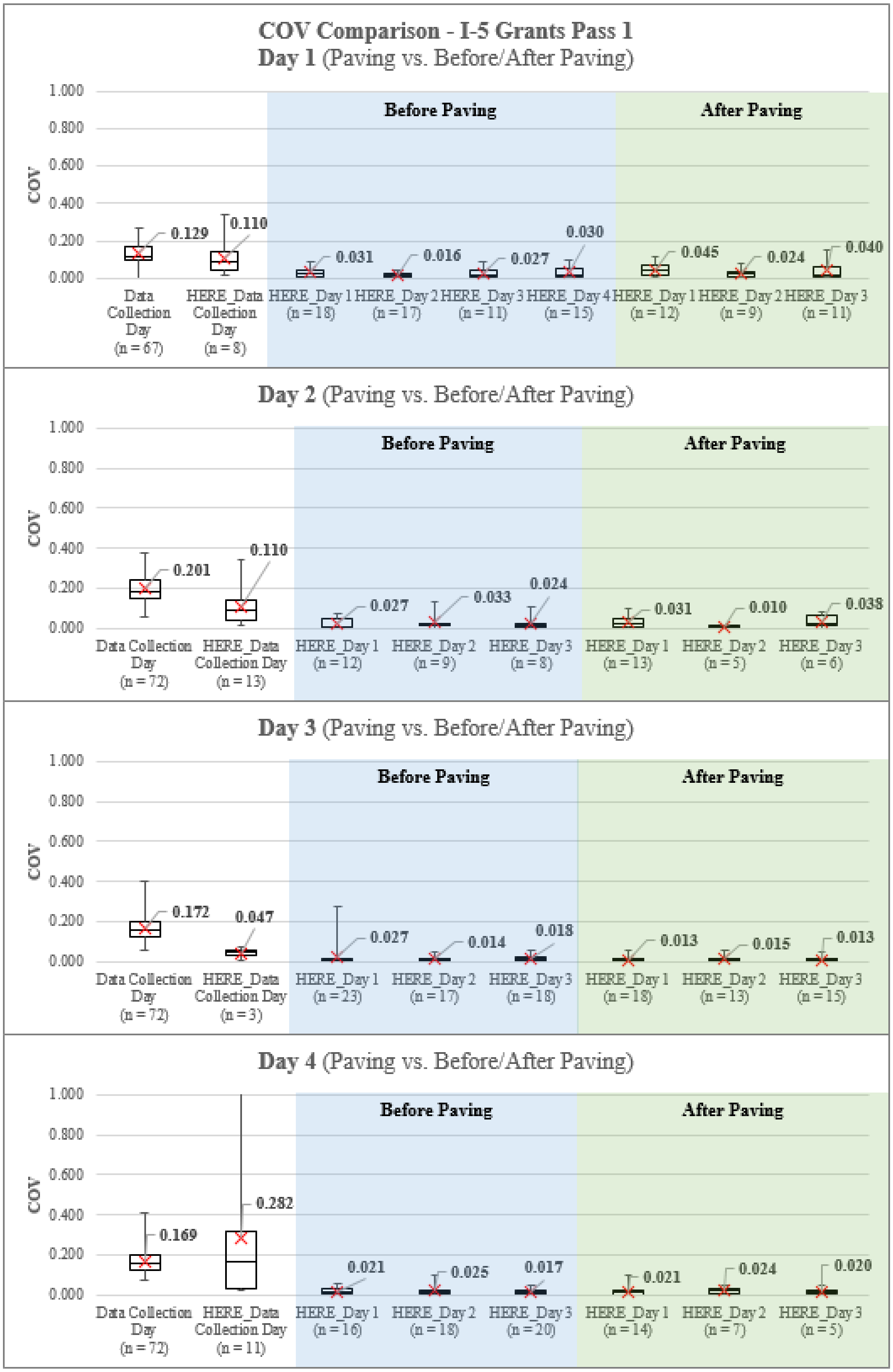


Figure 4.11: 5-min COV comparison (I-5 Grants Pass 1)

As shown in Figure 4.10, for all of the four data collection days with a work zone present, the average 5-min speed SDs computed based on the data collection from the previous case study are greater than those obtained from HERE Technologies on the same weekdays before or after paving. The average 5-min speed SDs on days without a work zone vary from 0.62 mph to 2.23 mph, and the average 5-min speed SDs on days with a work zone vary from 6.60 mph to 9.74 mph.

Figure 4.11 presents the boxplots based on 5-min speed COV for the I-5 Grants Pass 1 project. The average 5-min speed COVs computed based on the data collection from the previous case study during paving vary between 0.129 and 0.201. For data gathered from HERE Technologies on days before or after paving, the average 5-min speed COVs ranged from 0.010 and 0.045. Obviously, the ranges between the minimum and the maximum values and between the first and third quartiles with the days during paving are broader than those with the days before and after paving.

From data obtained using HERE Technologies, in general, the average 5-min speed SDs and COVs obtained during paving are also greater than those obtained before or after paving. However, the differences in the average 5-min speed SDs and COVs were different from those when using the data collected from the previous case study. One possible reason to the differences is because how the traffic data were collected from the two sources. The traffic data from HERE Technologies are collected utilizing probe data, while those from the previous case study were obtained using portable traffic analyzers. Another possible reason is due to the differences in the numbers of available 5-min intervals included.

For the I-5 Grants Pass 2 case study project, Table 4.27 lists the days, dates, and number of 5-min intervals included in the comparisons. It can be noticed in the table that, similar to the previous two case studies, the number of available data points for all of the days from the HERE database is lower than 30, which is insufficient for statistical analyses.

Table 4.27: Days, Dates and Available Sample Size for Comparisons (I-5 Grants Pass 2)

Day	Data Collection			Before Paving			After Paving		
	Day/Date	n	n (from HERE)	Day #	Day/Date	n	Day #	Day/Date	n
1	Mon., 8/27/2018	60	9	1	Mon., 7/9/2018	22	1	Mon., 10/15/2018	15
				2	Mon., 7/16/2018	19	2	Mon., 10/22/2018	17
				3	Mon., 7/23/2018	19	3	Mon., 10/29/2018	16
2	Tues., 8/28/2018	60	12	1	Tues., 7/10/2018	12	1	Tues., 10/16/2018	8
				2	Tues., 7/17/2018	7	2	Tues., 10/23/2018	3
				3	Tues., 7/24/2018	5	3	Tues., 10/30/2018	8
3	Wed., 8/29/2018	60	15	1	Wed., 7/11/2018	7	1	Wed., 10/17/2018	9
				2	Wed., 7/18/2018	9	2	Wed., 10/24/2018	7
				3	Wed., 7/25/2018	6			
4	Thur., 8/30/2018	60	27	1	Thurs., 7/12/2018	21	1	Thurs., 10/18/2018	24
				2	Thurs., 7/19/2018	12	2	Thurs., 10/25/2018	14
				3	Thurs., 7/26/2018	11			

Figure 4.12 shows the boxplots based on 5-min speed SD to present the distributions of data during, before, and after paving. Using the data collected in the case study project, the average 5-min SDs with a work zone present are at least 2.33 mph greater than those without a work zone present on the same weekdays and from similar roadway sections using HERE Technologies data. The average 5-min SDs without work zones ranged from 0.98 mph to 3.73 mph, and those with a work zone ranged from 5.57 mph to 8.66 mph. In general, the data distributions show higher variabilities from the data with work zones than those without work zones.

In terms of 5-min COV, Figure 4.13 presents the summary statistics in boxplots. It can be found, when comparing to the data on the same weekdays before or after paving, the data collected during the paving operation are associated with higher values in 5-min speed COV. The average 5-min speed COVs (with work zones) ranged from 0.144 to 0.185, and the average 5-min speed COVs (without work zones) ranged from 0.016 to 0.057. Similar to the boxplots based on 5-min SD, the data distributions based on 5-min COV show higher variabilities from the data with work zones than those without work zones.

Even though there are some differences in the traffic data when using the data gathered from the previous case study project and when using HERE Technologies data, it is obvious that, with the same data source from HERE Technologies, on most days, the average 5-min SDs and COVs obtained on the days with paving operations are also greater than those obtained on the days before or after paving.

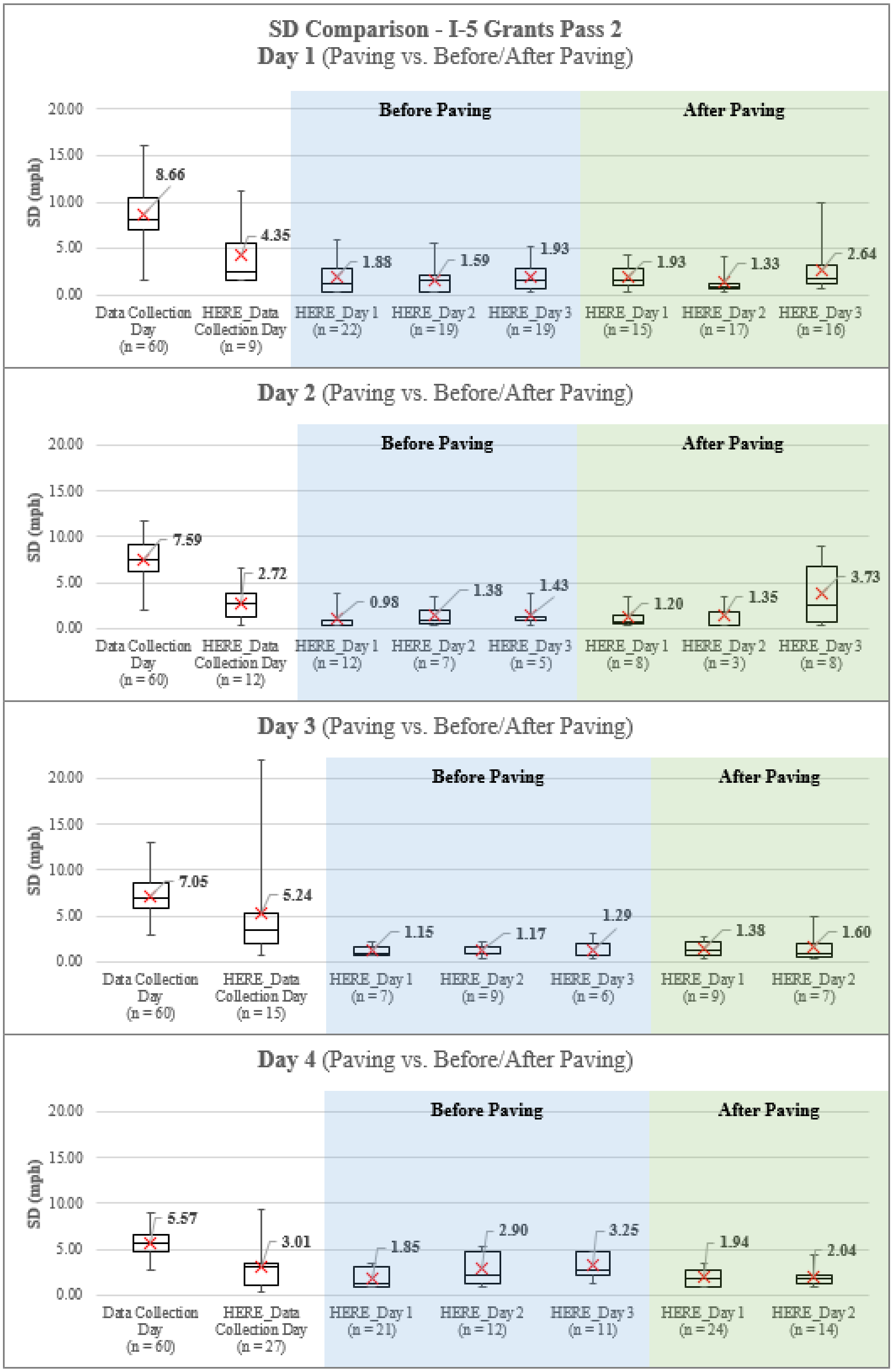


Figure 4.12: 5-min SD comparison (I-5 Grants Pass 2)

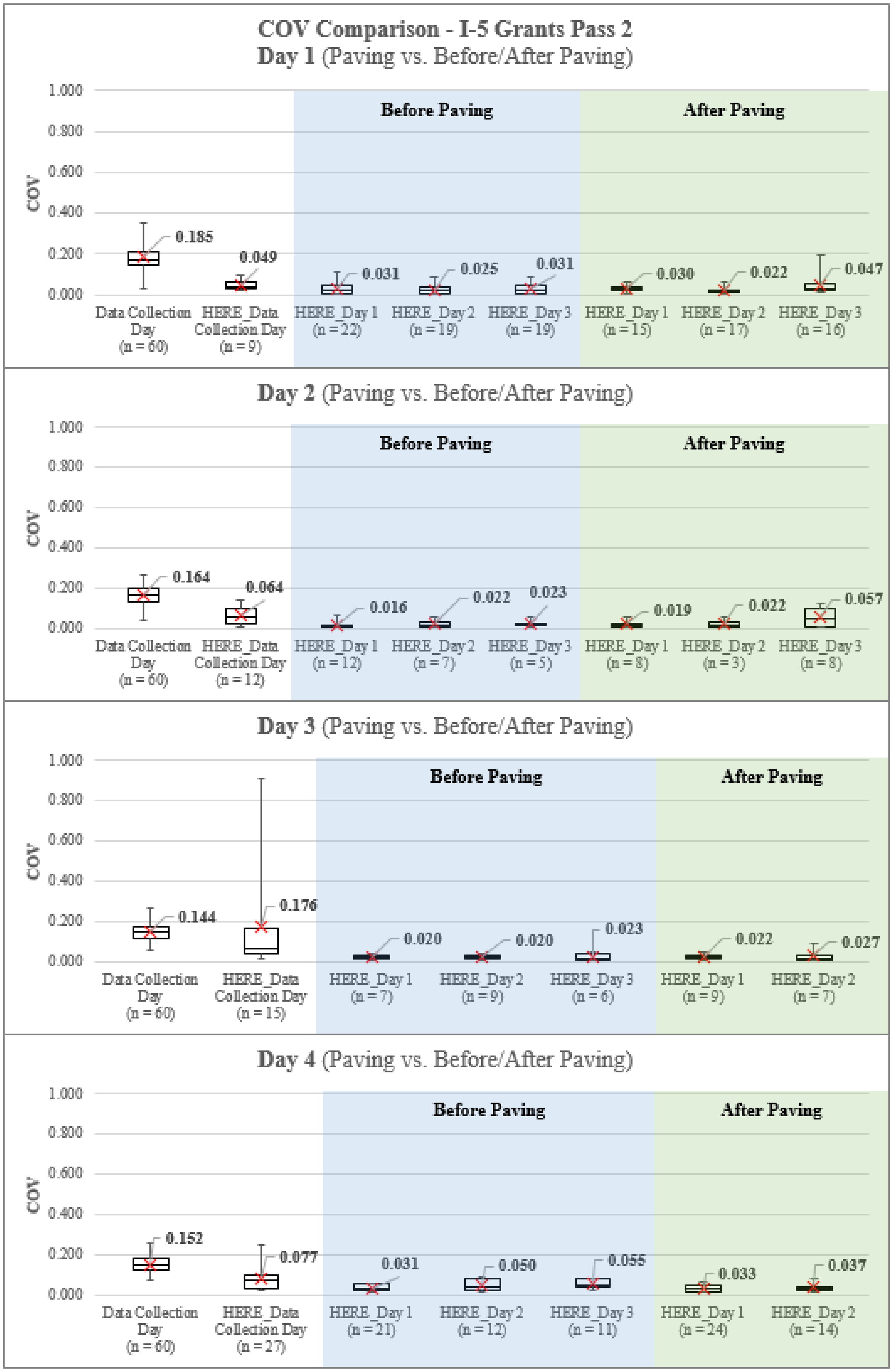


Figure 4.13: 5-min COV comparison (I-5 Grants Pass 2)

4.3.1.3 Summary of the Results

The speed variation comparisons conducted in the study used data from two sources: traffic data from prior ODOT research studies and ODOT HERE Technologies data. Two types of analyses were conducted to compare two speed variation measurements (5-min speed SD and 5-min speed COV) with and without a work zone present. The results from the two analyses show a prevalence of speed variation in work zones in Oregon. The results also provide estimates on the magnitude of the variations in terms of 5-min speed SD and COV by comparing speed variations with and without a work zone present. The findings regarding the prevalence and magnitude of speed variation in work zones are summarized below.

The first analyses used the data from prior ODOT research studies. Traffic data collected at the beginning of a work zone (at the RWA sign location) were viewed as traffic data without the work zone present. The data collected at the transition and active work area were viewed as representative traffic data with a work zone present.

Table 4.28 summarizes the results of the analyses based on across-lane time mean speed and within-lane time mean speed. The table shows the percentage of work zone locations associated with greater speed variations, and the percentage of days that have at least one work zone location associated with greater speed variations. In addition, the table also provides the magnitude of average differences in speed variation between locations in the transition or active work area and the RWA sign when the location in the transition or active work area showed a greater value in the same 5-min interval.

Table 4.28: Summary Results Using Data Collected from Past ODOT Work Zone Projects

	5-min SD			5-min COV		
	Work Zone Locations [1]	Days [2]	Average Differences in 5-min SD (mph) [3]	Work Zone Locations [1]	Days [2]	Average Differences in 5-min COV [4]
Across-lane (by work zone location)	10.0%	29.5%	1.96	52.0%	77.3%	0.058
Within-lane (by lane, and including RWA(C))	RWA(C): 16.3% RWA(O): 23.0%	57.1%	2.78	RWA(C): 68.5% RWA(O): 67.9%	95.2%	0.071
Within-lane (by lane, and excluding RWA(C))	27.9%	61.9%	2.30	72.1%	90.5%	0.064

Note:
1. The percentage of work zone locations that are associated with higher speed variations in the same 5-min interval.
2. The percentage of days that are associated with higher speed variations at one or more work zone locations in the same 5-min interval.
3. The average 5-min speed SD difference between a work zone location and the RWA sign location when the work zone location shown greater 5-min SD in the same 5-min interval.
4. The average 5-min speed COV difference between a work zone location and the RWA sign location when the work zone location shown greater 5-min COV in the same 5-min interval.

For the 5-min SD, between 10% and 28% of the examined work zone locations showed greater speed variation than at the RWA sign location. It should be noted that the number of vehicles recorded by the sensor placed in the to-be-closed lane at the RWA sign location (RWA(C)) was fewer than that placed in the other lane (RWA(O)), and vehicles typically traveled with higher speed in the other lane (RWA(O)). As a result, within-lane speed variations in the other lane (RWA(O)) are typically greater than in the to-be-closed lane (RWA(C)). Therefore, compared to the percentage of work zone locations that had greater 5-min SD than that recorded in the to-be-closed lane (RWA(C)), the percentage in the other lane (RWA(O)) was fewer, as well as the percentage when considering traffic in both lanes. The finding also applies to the percentage of days that have at least one work zone location(s) showing higher speed variability. When only comparing to the within-lane speed variation recorded by the RWA(O) sensor, the percentage of days are at its highest. Nearly 62% of days showed greater SD in the work zone.

On average, the 5-min SD at a location in the transition or active work area was 1.96 mph greater than that at the RWA sign location when considering traffic in both lanes. If only the traffic recorded by RWA(O) sensor is taken into consideration, the 5-min SD at a location in the transition or active work area was 2.30 greater than that at the RWA sign location when the work zone location shown had 5-min SD in the same 5-min interval.

Compared to 5-min SDs, the results based on 5-min COV are clearer that work zones were associated with higher speed variations. The COV is a dimensionless value describing the shape of the speed distribution, which enables speed variation comparisons regardless of the average speeds. More than half of the examined work zone locations were associated with greater 5-min COV regardless of the types of analyses. When considering traffic recorded in both lanes at the RWA sign location, around 78% of days showed greater 5-min COV in the work zone in the same 5-min interval. On average, the 5-min COV at a location in a work zone was 0.058 greater than that at the RWA sign location. When only considering traffic recorded by the RWA(O) sensor, more than 90% of days showed greater 5-min COV in the work zone, and the average difference was 0.064.

The second analyses mainly used the data obtained from the HERE Technologies data to obtain the summary traffic statistics for days without a work zone present. Due to the limited available data, statistical analyses were infeasible. Only descriptive results were reported. Table 4.29 summarizes the minimum and maximum average 5-min SD and COV values from the two mentioned data resources.

Table 4.29: Summary Results Using Data Collected from Past ODOT Work Zone Projects and HERE

	Data Source	Average 5-min SD (mph)		Average 5-min COV	
		min	max	min	max
With Work Zones (During Paving)	Previous work zone projects	5.57	11.05	0.129	0.245
With Work Zones (During Paving)	HERE Technologies	1.67	6.04	0.047	0.282
Without Work Zones (Before/After Paving)	HERE Technologies	0.53	5.75	0.009	0.111

It can be found that, the average speed variations (5-min SD and COV) computed based on the data collected using portable traffic analyzers (sensors) from previous work zone projects (5-min SD ranged from 5.57 mph to 11.05 mph, and 5-min COV ranged from 0.129 to 0.245) were greater than those obtained using HERE Technologies data when there was no work zone present (5-min SD ranged from 0.53 mph to 5.75 mph, and 5-min COV ranged from 0.009 to 0.111). Even with the same data source (HERE), work zones were also associated with greater speed variations (5-min SD ranged from 1.67 mph to 6.04 mph, and 5-min COV ranged from 0.047 to 0.282) than those at similar locations during normal operations.

4.3.2 Speed Variation and Crash Occurrence

To construct the relationship between speed variation and crash occurrence, sufficient and reliable crash data should be collected. However, consistent with the conversations with ODOT staff regarding the current availability of crash data in work zones, the crash data received by the researchers were limited and/or inconsistent. Corresponding data from TripCheck were also examined to confirm whether there was a work zone present when a crash occurred. Table 4.30 provides a summary of the crash data received for this study. Information on a total of 30 crashes were received, of which 5 occurred with a work zone present, 16 occurred without a work zone present, and the work zone status for the remaining 9 crashes was unknown.

Table 4.30: Summary of the Crash Data Received

Research Study	Case Study Project	Crash	Crash in WZ		
			Yes	No	Unknown
1. High Speed Reduction Phase 2 (SPR 769)	I-5 Rock Point to Seven Oaks	1		×	
		2	×		
		3			×
2. High Speed Reduction Phase 3	I-84 Arlington to Tower Road	1		×	
		2		×	
		3	×		
		4			×
		5		×	
		6		×	
		7		×	
3. Radar Speed Display Study	I-205 Relamping and Sweeping	1		×	
		2			×
		3		×	
		4			×
	I-84 (Banfield Expressway) Vactoring	1			×
	US 97 Spraying	1		×	
		2			×
		3		×	
		4		×	
4.Work Zone Lighting (SPR 791)	I-84 Jordan Road to Multnomah Falls	1		×	
		2			×
		3			×
	I-5 South Medford to North Ashland	1		×	
		2	×		
		3		×	
		4	×		
		5	×		
		6		×	
		7		×	
		8			×
	Total	**30**	**5/30**	**16/30**	**9/30**

In addition, none of the data resources (the ODOT crash database maintained by the ODOT Crash Analysis and Reporting Unit, and data from TripCheck) recorded actual/estimated vehicle speeds when vehicles were involved in crashes with or without a work zone present. In addition, none of the data resources provided accurate crash occurrence times. Thus, it was impossible to perform the analyses described in Section 4.2.2.2.

However, with the help of previous literature on the topic of speed variation and safety on highways, and the results of the speed variance analyses conducted in the present study (Section 4.3.1), the researchers were able to provide some estimates on the risk of crashes on Oregon high-speed roadways with or without a work zone present.

For example, based on the finding from Rodriguez (1990), taking speed SD as an independent variable, a 1 mph increase in speed SD would lead to a 0.0888 to 0.1850 increase in fatality rate (the number of highway fatalities per 100 million miles traveled). Based on the analyses results using the traffic data from previous ODOT work zone research projects, the within-lane 5-min SD at a location in the transition area or in the active work area was, on average, 2.30 mph greater than that prior to the work zone. Therefore, it could be assumed that the fatality rate on a highway section with a work zone present is between 0.2042 and 0.4255 higher than that without a work zone present. However, there are some deviations between the two studies. The study conducted by Rodriguez (1990) used aggregate speed data for each of the 50 U.S. states for the years 1981 through 1985. The present study used data only in the state of Oregon, and the aggregation level to compute speed SD is 5 minutes.

In addition, Zheng et al. (2010) found that with an additional unit increase in the speed SD, the likelihood of a (rear-end) crash increased by an average of 8.4%. It could be assumed that, if the average difference in the SD is 2.30 mph with or without a work zone present, it is 1.20 ($(1+0.084)^{2.30} = 1.20$) times more likely to have a crash when there is a work zone present than that without a work zone present. Nevertheless, it is worth mentioning that the study conducted by Zheng et al. (2010) used the 20-s aggregated traffic data collected by inductive loop detectors from a 12-mile freeway segment in Portland, OR, which is different from the present study.

Taylor et al. (2000) found that if the mean speed remains the same, the crash occurrence on urban classified roads in the UK rises exponentially with the speed COV. The model could be expressed as $AF = K \times V^{2.252} \times e^{5.893C_v}$, where AF is the crash frequency (the number of crashes that occurred per roadway segment per year), K is a site-specific constant which takes vehicle flows, pedestrian activity, road layout into account, V is the mean traffic speed (mph), and CV is the COV of the speed distribution. It could be assumed that, the average crash frequency increased by 1.49 ($= e^{5.893 \times 0.064}$) more on the roadway section with a work zone present than the normal operations condition – providing the mean speed remains constant and the average difference in within-lane COV with or without a work zone present is 0.064. However, the study utilized the data obtained from roadways in the UK, and the model was derived based on data collected from classified roads (speed limit 30 mph or 40 mph).

A large volume of previous research has been dedicated to establish the relationship between speed, speed variation, and crash occurrence. Speed variation was recognized to be positively associated with crash occurrence in many research studies (Lave, 1985, Garber and Gadiraju, 1988, Rodriguez, 1990, Garber and Ehrhart, 2000, Day et al., 2019). The present study shows the prevalence and the extent to which vehicle speed varies on roadways, both with and without a work zone present. These results were determined by comparing the traffic data at the RWA sign location and in the transition or active work area in work zones, and by comparing traffic data with or without a work zone present. The prevalence and magnitude of speed variation (expressed as SD and COV) in work zones are generally greater than that without a work zone present on a high-speed roadway segment in Oregon.

Due to the reliability and availability of crash data, the researchers were unable to establish a direct relationship between speed variation and crash occurrence in the study. By referring to the findings from previous speed variation and crash studies, the present study provides some estimates on the difference in crash occurrences for high-speed roadways in Oregon with a work zone present and under normal operations. The crash risk in work zones were higher than that without work zones due to the findings of greater speed variation in work zones. Despite the fact that there are some deviations in terms of methods of data collection and aggregation, locations, and work zone conditions among the previous studies and the present study, the results provide implications about the risk of crashes on roadways in Oregon with or without a work zone present. As a result, further study of ways to reduce speed variation in work zones is needed.

5.0 PHASE II – METHODS AND CASE STUDY PROJECTS

As shown in Phase I of the present study, speed variation in terms of SD and COV in work zones is generally greater than that without work zones, which poses an issue of concern with respect to high rates of crashes in work zones on high-speed roadways in Oregon. In Phase II, the objectives are to determine how to reduce the amount of speed variation in work zones and identify how to mitigate the impacts of speed variation in work zones.

5.1 DATA COLLECTION

Phase II consists of identifying possible traffic control measures (interventions) that are potentially highly beneficial to minimizing and mitigating variation in speed within a work zone, and implementing identified interventions in work zones to investigate their impacts on speed variation. The identification of case study projects on which to apply the interventions and the selection of specific traffic control treatments to apply were based on discussions with the TAC members.

Speed data were collected from selected field sites with a work zone present (case studies). Selected interventions were placed in the work zone to test the impact that the interventions have on speed variation. Speed data were then collected to compare the impact with the interventions (treatment) present with the condition in which no intervention is present (control). The data collection effort is similar in scope to that of previous work zone studies in which traffic analyzers (sensors) are placed in the roadway at multiple locations (similar to that shown in Figure 4.2) to collect vehicle speed, length, and timing data. The details of equipment used, case study projects examined, and traffic control interventions implemented are presented in the subsequent sections below.

5.2 EQUIPMENT

Various types of data were collected to understand the impact of the implemented speed variation treatments on high-speed roadway work zones. The data collected included various characteristics of passing vehicles (e.g., vehicle type, speed, and length, time of day, etc.), characteristics of the work zone (e.g., locations of construction equipment, locations of work zone signage, etc.), and general observations of the work zone and work operations made by the researchers during the case studies. To collect the data, several pieces of equipment, tools, and resources were used by the researchers, including traffic control analyzers (sensors), a video camera, iTrail GPS trackers, and handheld GPS units.

5.2.1 Traffic Control Analyzer

NC-200 portable traffic analyzers (older model) manufactured by Vaisala, and NC-350 traffic analyzers (newer model) manufactured by the M.H. Corbin were used to collect vehicle data on the roadway. The traffic control analyzers utilize Vehicle Magnetic Imaging (VMI) technology to collect traffic measurements of passing vehicles including vehicle count, speed, and length.

The analyzers can be placed directly in the traffic lane. To place traffic analyzers (sensors) on the roadway securely and to protect the analyzers from damage due to the road surface and the impacts from passing vehicles, reusable molded rubber covers were used during placement (Figure 5.1). On top of the reusable molded rubber covers, adhesive taper was used to adhere the covers to the roadway surface to hold the covers and sensors firmly in place.

Figure 5.1: Portable traffic analyzer components: Cover (left) and analyzer (right)

5.2.1.1 Sensor Calibration

Similar to previous studies, before conducting field data collection on case study projects, the traffic control analyzers are calibrated to ensure the accuracy of the analyzers. For the calibration test, all of the sensors were examined under controlled roadway conditions near the Corvallis Airport. During the test, the sensors were placed directly on the roadway and were programmed to start recording vehicle speeds at a predetermined time. Figure 5.2 shows the placement of the portable traffic analyzers in the calibration test. Since the present study contains work zone data that were collected in two separate years, two calibration tests were conducted. In 2019, the researchers calibrated all of the sensors at predetermined speeds from 30 to 60 mph (30, 35, 40, 45, 50, 55, and 60 mph). Three test vehicles were driven over the sensors, two times at each aforementioned speed. In 2020, four vehicles were used and the predetermined speeds ranged from 25 to 55 mph (23, 30, 35, 40, 45, 50, and 55 mph).

Figure 5.2: Placement of portable traffic analyzers in calibration test

After data were downloaded from the sensors, linear regression analysis was performed to calibrate the portable traffic analyzers that were used in the present study. In the analysis, the control speed was treated as an independent variable while the observed speed (sensor-recorded speed) was considered as a dependent variable. Figure 5.3 shows an example of the linear regression analysis of Sensor #101 in the calibration test conducted in 2019. To obtain the actual speed based on the recorded speed from the traffic analyzers, in the calibration equations for the sensors, the independent variable x represents the speed recorded by the sensor, while the dependent variable y represents the actual speed of the passing vehicle. Table 5.1 shows the calibration equations for all the traffic analyzers that were tested in the calibration tests in 2019 and 2020. As noted in the table, some sensors were not working properly during the calibration test(s); the malfunctioning sensors were eliminated from the actual field data collection.

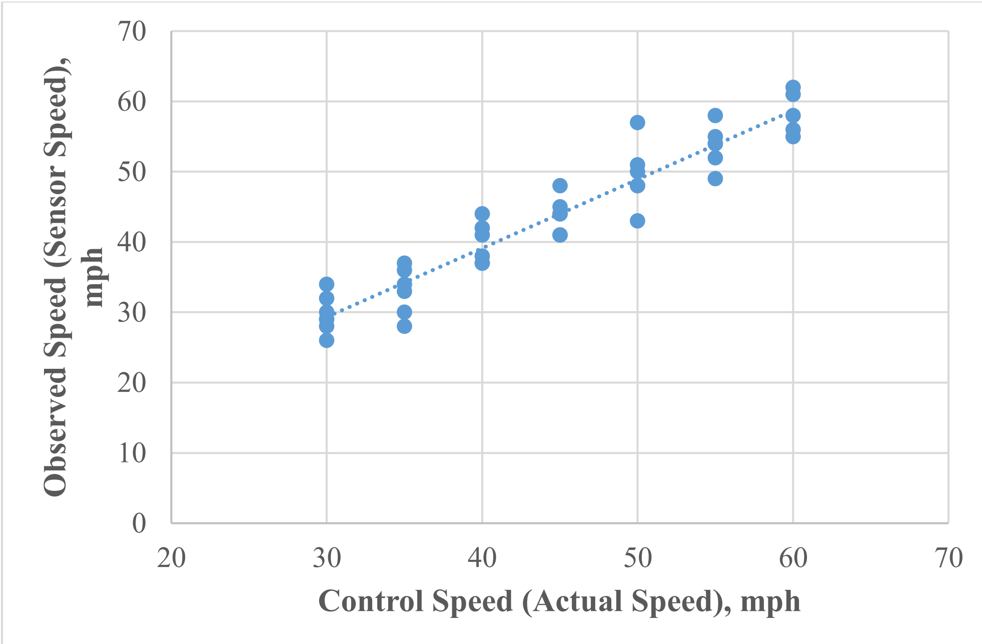


Figure 5.3: Linear regression of traffic analyzer data for sensor #101 in 2019 calibration test

Table 5.1: Calibration Equations for Traffic Analyzers

Sensor ID	Adjustment Equation (2019)	Adjustment Equation (2020)
101	y = 0.9326x + 3.8967	y = 1.2933x - 9.4113
102	y = 0.7386x + 8.6235	y = 1.0275x - 9.2245
103	y = 1.107x + 1.580	Not working
104	Not working	Not working
105	y = 1.033x + 3.406	Not working
106	y = 1.033x + 1.935	y = 1.1789x - 3.6738
107	y = 0.7423x + 9.5232	y = 0.9379x - 5.6308
108	y = 0.9771x + 2.5860	y= 1.4775x - 13.4167
216	y = 0.8104x + 6.6595	Not working
305	y = 0.9694x + 2.6065	y = 1.0768x - 0.7949
317	y = 0.8098x + 4.7285	y = 0.9523x - 3.7075
318	y = 0.8485x + 3.5500	y = 0.9354x - 0.6793
325	y = 0.8941x + 2.7539	y = 0.8371x - 4.8208
379	Not working	Not working
541	y = 0.7741x + 7.1688	y = 0.9046x - 2.9321
687	Not working	Not working
748	y = 0.942x + 3.060	y = 1.1452x - 4.6524
774	y = 0.9468x + 3.5972	y = 1.3053x - 9.3586
816	Not working	Not working

5.2.1.2 Sensor Preparation

A formal procedure was required to make sure the sensors were ready for data collection before field installation. The sensors were first fully charged, which takes several hours, before programming them. MH Corbin's Highway Data Management (HDM) software (version 9.3) was used to set up the sensors so that they gathered traffic data for a particular span of time.

5.2.1.3 Sensor Placement and Removal

On each case study project, sensors were typically placed on the roadway at the following locations: near the Road Work Ahead sign (RWA), beginning of the taper (BoT), end of the taper (EoT), and at multiple places in the work area, as well as at key locations for the examined implements, such as near the PCMS with custom messages. Figure 5.4 presents a simple representation of the sensor placement in a typical work zone configuration.

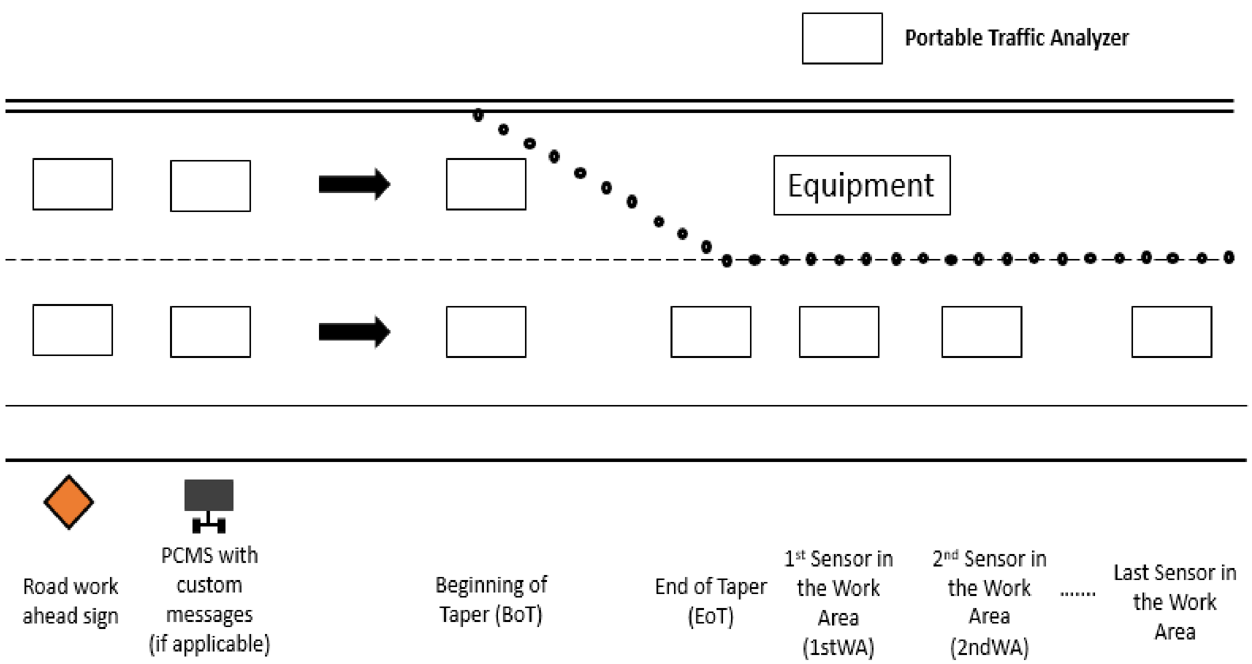


Figure 5.4: Typical sensor placement in work zone

After the data collection on each day was complete, a utility knife was used to cut the edges of the adhesive tape to remove both the cover and sensor from the road surface. Figure 5.5 (left) shows an example on how the researchers placed a sensor on the roadway, and Figure 5.6 (left) shows how the sensor looks after it is placed on the road surface. Figure 5.5 (right) presents how the researchers remove a sensor using a utility knife, and Figure 5.6 (right) shows the remaining adhesive tape on the road surface after a sensor is taken off. When a high volume of traffic was present, a rolling slowdown was used to ensure that there is no oncoming traffic during placement and removal of the sensors. If the traffic volume was low, the researchers waited for a large gap in the traffic and then placed/removed the sensors.

a). Sensor Installation b). Sensor Removal

Figure 5.5: Example of researchers installing and removing sensor

a). After sensor placement b). After sensor removal

Figure 5.6: Example of placed traffic sensor and remaining adhesive tape after sensor removal

5.2.1.4 Data Downloading

After all of the sensors were collected from the field, the traffic data were downloaded using HDM software for further analysis. To ease the data analysis process, sequential time stamped data were exported in .csv format. Figure 5.7 shows a screenshot of raw data exported from the HDM software.

	A	B	C	D	E	F	G	H	I
1	DateTime	AdviceCode	Speed	Length	StopTime	RoadTem	OCCFacto	Gap	Headway
2	8/19/2019 10:00	2	72	34	0	32	1	0	0
3	8/19/2019 10:00	128	254	16	0	32	0	1	373
4	8/19/2019 10:00	4	76	20	0	32	0	3	334
5	8/19/2019 10:00	4	75	13	0	32	0	2	220
6	8/19/2019 10:00	2	99	23	0	32	0	6	871
7	8/19/2019 10:00	4	66	75	0	32	2	2	194
8	8/19/2019 10:00	2	87	76	0	32	1	10	1276
9	8/19/2019 10:00	2	77	22	0	32	0	8	903
10	8/19/2019 10:00	2	67	19	0	32	0	5	491
11	8/19/2019 10:00	2	88	22	0	32	0	5	645
12	8/19/2019 10:00	2	87	24	0	32	0	13	1659
13	8/19/2019 10:01	2	93	22	0	32	0	16	2182
14	8/19/2019 10:01	2	80	56	0	32	1	6	704
15	8/19/2019 10:01	2	76	14	0	32	0	17	1895

Figure 5.7: Example of raw data from HDM software

5.2.2 GPS units

Similar to previous ODOT studies (e.g., ODOT 19-03), during the data collection periods, two types of GPS units were used: Handheld GPS and GPS Tracker. On each day, handheld GPS units were used to record the longitude and latitude of the placed traffic analyzer on the road. The values were then used to provide a location of the sensors for the analysis. In addition, GPS trackers (approximately 1.5” x 1.5” units) were placed on the main construction equipment used on the day of testing (e.g., pavers for paving operations) to record the trajectory of the equipment during the work operation. The data obtained from the GPS trackers were then used to determine the proximity of the equipment to the traffic sensor locations. Before each data collection period, GPS trackers were placed on the equipment, and then removed after the data collection period. Figure 5.8 shows two GPS trackers that were placed to the metal light bar on top of a paver to acquire satisfied satellite GPS signals without interfering with, or being obstructed by, the construction operation. After the GPS trackers were removed from the equipment, time stamped GPS data were downloaded using iTrail software for analysis.

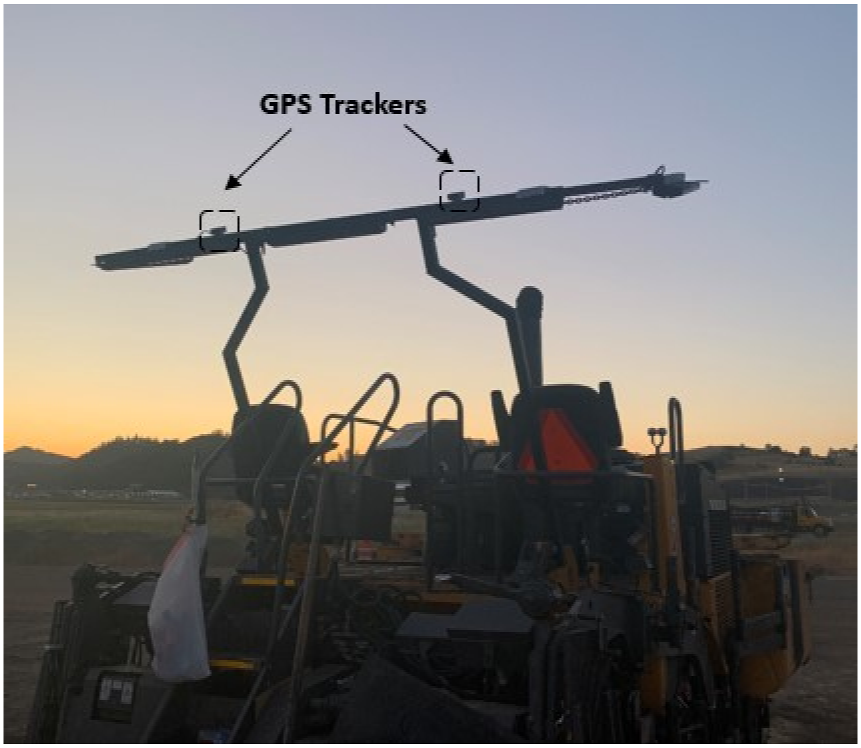


Figure 5.8: GPS trackers placed on a paver

5.3 TRAFFIC CONTROL INTERVENTIONS

Based on the literature review and discussions with the TAC, four types of interventions were identified as potential interventions, and were examined the field case study projects. The interventions were:

1. A "pace car" continuously traveling at or slightly below the posted speed limit throughout the work zone;

2. A PCMS unit showing custom messages similar to "MAINTAIN CONSTANT SPEED / THRU WORKZONE" placed at the advance warning area of the work zone;

3. The combination of a "pace car" and a PCMS (same message as in intervention #2); and

4. The combination of a PCMS unit (same message as in intervention #2), and flashing amber/white lights on paving equipment that were under operations in the active work area.

Details about how the four potential interventions were examined on the different case study projects can be found in the section below (Section 5.4).

5.4 CASE STUDY PROJECTS

5.4.1 Case Study #1: I-84 Swanson Canyon to Arlington Project

The first data collection was conducted on the I-84 Swanson Canyon to Arlington project (Case Study #1). The project was located in Gilliam County near the City of Arlington. At the time of data collection, a single lane (A-lane) was closed in the eastbound direction to accommodate the need for median barrier removal and reinstallation, and for median paving work. Figure 5.9 shows workers conducting the work on the site for this project. The construction work and data collection were conducted in the daytime. For this case study, the data collection was conducted over three days of eastbound active work between MP 125.5 and MP 129 (Figure 5.10). No speed reduction was implemented in the work zone; the posted speed limit is 70 for cars and 65 mph for trucks on this segment of I-84 (Figure 5.11).

Because the traffic volume at this segment of I-84 is relatively low during the sensor placement and removal times, no rolling slow down operation was sought from the contractor to place the sensors on the roadway. The research team waited on the shoulder until a large gap between passing vehicles appeared, in order to place the sensors on the pavement safely. The sensors were then removed from the roadway at the end of the work shift, and data were downloaded from the sensors. The sensors were then charged and reprogrammed for use the following day.

For this case study, three traffic control interventions were used. The first one was a “pace car” (an ODOT vehicle) driven multiple times over an extended period through the work zone at the speed that is equal to the speed limit or slightly lower than the speed limit. The pace car had its flashing amber lights on (Figure 5.12) in the right lane while travelling through the work zone. The second treatment was a PCMS showing the custom alternative messages “MAINTAIN CONSTANT SPEED” and “THRU WORK ZONE” in two phases (Figure 5.13). Each phase was programmed to display for 2 seconds. The combination of the two interventions (pace care and PCMS) was also examined.

Figure 5.9: Workers on the site (Case study #1)

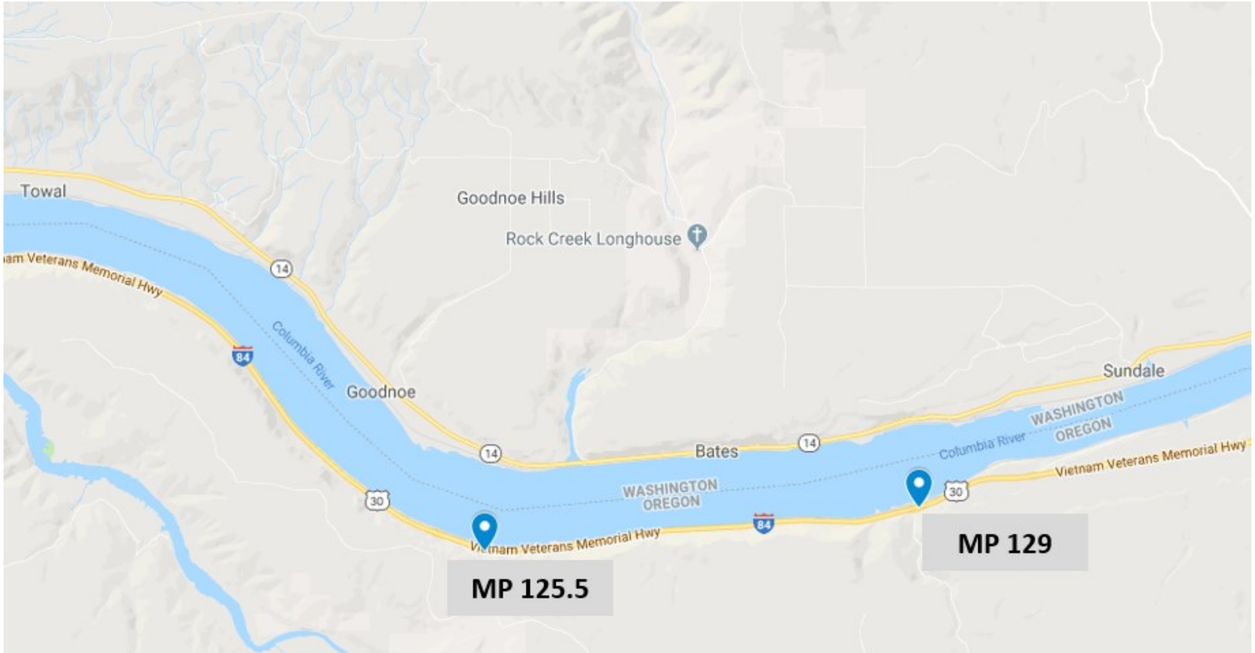


Figure 5.10: Location of case study #1 (Source: Google maps)

Figure 5.11: Posted speed limit sign and RWA sign on case study #1

Figure 5.12: Pace car with flashing lights on used in case study #1

Figure 5.13: PCMS used in case study #1 showing custom messages: "MAINTAIN CONSTANT SPEED" (left) and "THRU WORK ZONE" (right)

Table 5.2 summarizes the details of the data collection for Case Study #1. On the first day of data collection, the pace car was continuously driven through the work zone, one hour in the morning and more than two hours in the afternoon. A total of 15 trips were made by the pace car through the work zone. On the second day, the PCMS (Figure 5.13) was turned on the entire data collection period (09:00 – 17:30). To examine the combined effect of the two implemented treatments, on Day 3, both treatments were active in the morning, whereas only the PCMS was active in the afternoon. A total of 10 trips were made by the pace car in the morning.

Table 5.2: Description of Case Study #1 (I-84 Swanson Canyon to Arlington Project)

Details					Treatment		
Data Collection Day	**Day/Date**	**Time Frame**	**Lane Closure**	**Travel Direction**	**Pace Car**	**PCMS with a Custom Message**	**Treatment Effective Periods (approximately)**
1	Mon., 8/19/2019	10:00 to 16:00	A (fast) lane	Eastbound	X		Between 11:00 and 12:00; Between 13:30 and 16:00
2	Tue., 8/20/2019	09:00 to 17:30	A (fast) lane	Eastbound		X	The entire data collection period
3	Wed., 8/21/2019	09:00 to 17:00	A (fast) lane	Eastbound	X	X	Pace car was only effective between 09:30 and 12:00; PCMS was effective during the entire data collection period

Figure 5.14 illustrates the sensor placement configuration for Case Study #1. Two sets of RWA signs were placed at different locations in the advance warning area. At each RWA location, two sensors were placed on the roadway, one in the A-lane and one in the B-lane. For the treatment when an additional PCMS unit was placed in - between the locations of the second RWA sign and the BoT, two sensors were placed in each lane at the PCMS location. After the EoT location, sensors were placed in the active work area at intervals ranging from 0.1 to 0.4 miles. For the three days of data collection, sensors were placed in similar locations. However, after downloading the data from the sensors, the researchers found that several sensors were not working properly at the time of the recordings and the data collected contained many errors, such as the sensor placed near the EoT location on Day 1, as shown in Table 5.3. Therefore, those faulty data were not included in further data analysis. Because sensors were placed and/or removed at different times on the three days of data collection, to make the data consistent over the three days, only data that were gathered between 10:00 and 16:00, a window of 6 hours, were included in the analysis.

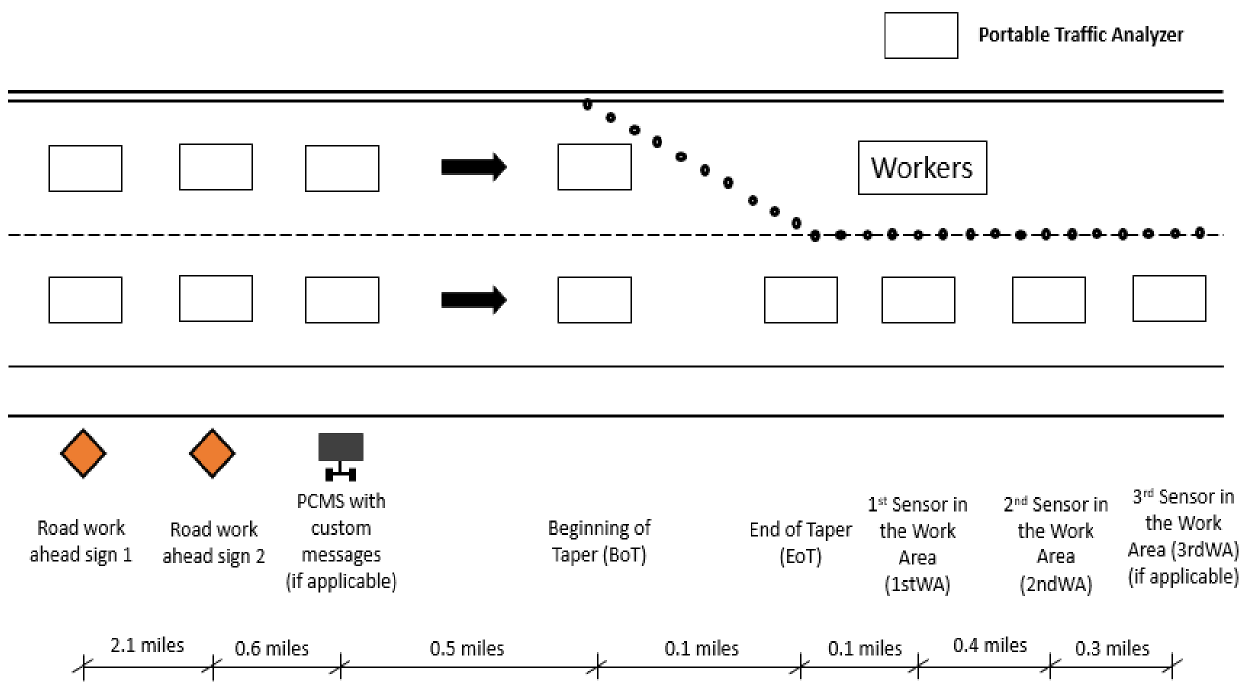


Figure 5.14: Traffic analyzer placement for case study #1

Table 5.3: Traffic Analyzer Information for Case Study #1

Sensor Location	Day1	Day2	Day3
RWA1	●	○	●
RWA2	●	●	●
PCMS (special)		●	●
BoT	●	●	○
EoT	○	●	●
1stWA	●	●	●
2ndWA	●	●	●
3rdWA		●	●

Notes:
● Sensor placed and recordings are good
○ Sensor placed and recordings are not good
Blank = no sensor placed on roadway

5.4.2 Case Study #2: I-205 Abernethy Bridge - SE 82nd Drive

Case Study #2 was a paving project on I-205, between Abernethy Bridge in Oregon City and SE 82nd Avenue. At the project location, the number of lanes in each direction varied from 2 to 4 lanes depending on the location within the work zone and direction of travel. Data collection was performed in the northbound direction on a segment where three lanes were present. Two lanes were closed at nighttime between 21:00 and 5:30 for the contractor to repave over 4 miles of I-205 and install rumble strips. Two days of field data collection were performed for this case study project, and only one treatment – PCMS showing custom alternative messages "MAINTAIN CONSTANT SPEED / THRU WORK ZONE" was examined (Figure 5.15). At the time of data collection, the contractor was working on paving the "C" lane of the northbound direction between approximately Exit 8 and Exit 13 (Figure 5.16). The posted speed limit on this section of roadway is 55 mph, and no speed reduction was put in place in the work zone during the time of data collection. Figure 5.17 shows an operating paver on this project.

Since this segment of I-205 is considered as high-volume freeway near dense neighborhoods, the researchers were not able to put down sensors without help from the contractor. For each data collection day, the research team coordinated with the contractor, and placed all the sensors at night while the contractor performed a rolling slow down to block oncoming traffic. The next morning, before the traffic volume became too heavy on this section of the roadway (at approximately 04:00), the researchers removed the sensors from the roadway. Data were then downloaded from the sensors, and the sensors were charged and reprogrammed for the following day of testing.

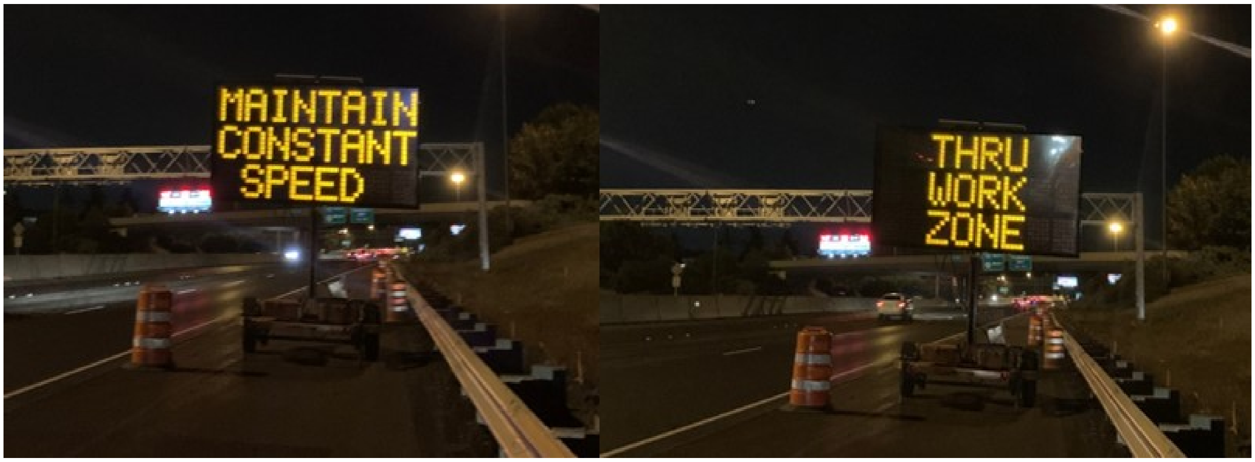


Figure 5.15: PCMS used in case study #2 showing custom messages: "MAINTAIN CONSTANT SPEED" (left) and "THRU WORK ZONE" (right)

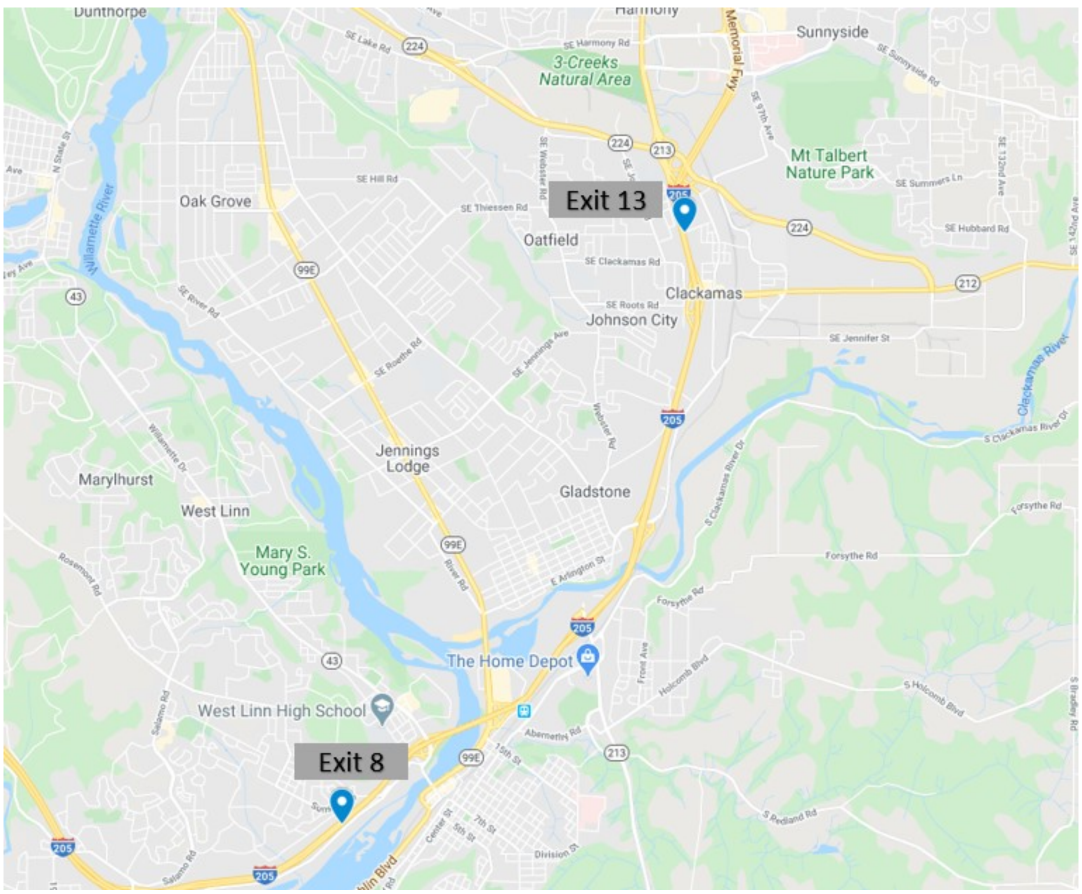


Figure 5.16: Location of case study #2 (Source: Google maps)

Figure 5.17: Paver performing work on the site (case study #2)

Table 5.4 summarizes the details of the three-day data collection period for this case study project. On Days 1 and 2, no treatment was placed in the work zone, and therefore are used as the control days. On Day 3, the PCMS, as shown in Figure 5.15, was placed on the freeway shoulder near the RWA location, and turned on for the entire data collection period. Since the sensors were placed and removed at different times on different days, data that were collected between 11:30 to 03:30, a window of 4 hours, were used in the data analysis to provide uniformity with respect to the time period when data were collected.

Table 5.4: Description of Case Study #2 (I-205 Abernethy Bridge – SE 82nd Drive)

Details					Treatment	
Day	**Day/Date**	**Time Frame**	**Lane Closure**	**Travel Direction**	**PCMS with a Custom Message**	**Treatment Effective Periods**
1	Mon., 7/27/2020	11:00 pm to 4:00 am	A and B lanes	Northbound		
2	Mon., 8/3/2020	11:15 pm to 4:00 am	A and B lanes	Northbound		
3	Wed., 8/5/2019	11:00 pm to 3:30 am	A and B lanes	Northbound	X	The entire data collection period

Figure 5.18 and Figure 5.19 show the locations where the traffic sensors were placed on Days 1 and 2, and on Day 3, respectively. Sensors were placed in the open lane(s) at key locations in the work zone including near the RWA sign, in the transition area, and at multiple locations in the active work area with typical intervals of 0.2 miles. It is worth mentioning that on Day 3, the PCMS was placed fairly close to the RWA sign. Therefore, no sensor was placed at the location adjacent to the PCMS unit. Instead, two additional sensors (one in the "A" lane and another in the "B" lane) were placed in the middle of the advance warning area (between the RWA sign location and the BoT location) to gather more data in the advance warning area. Table 5.5 lists the details of the traffic analyzer information for this case study. It should be noted that the sensor that was placed at the EoT location on Day 1 did not work properly; it contained limited useful data.

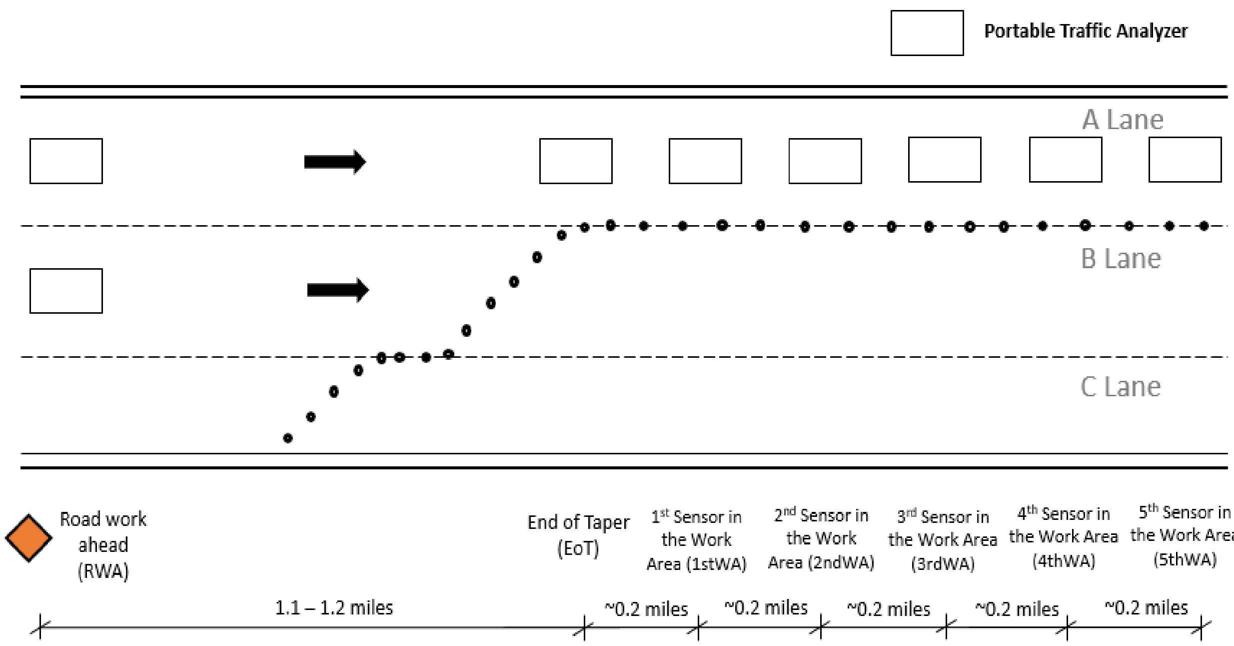


Figure 5.18: Traffic analyzer placement on days 1 and 2 (control) for case study #2

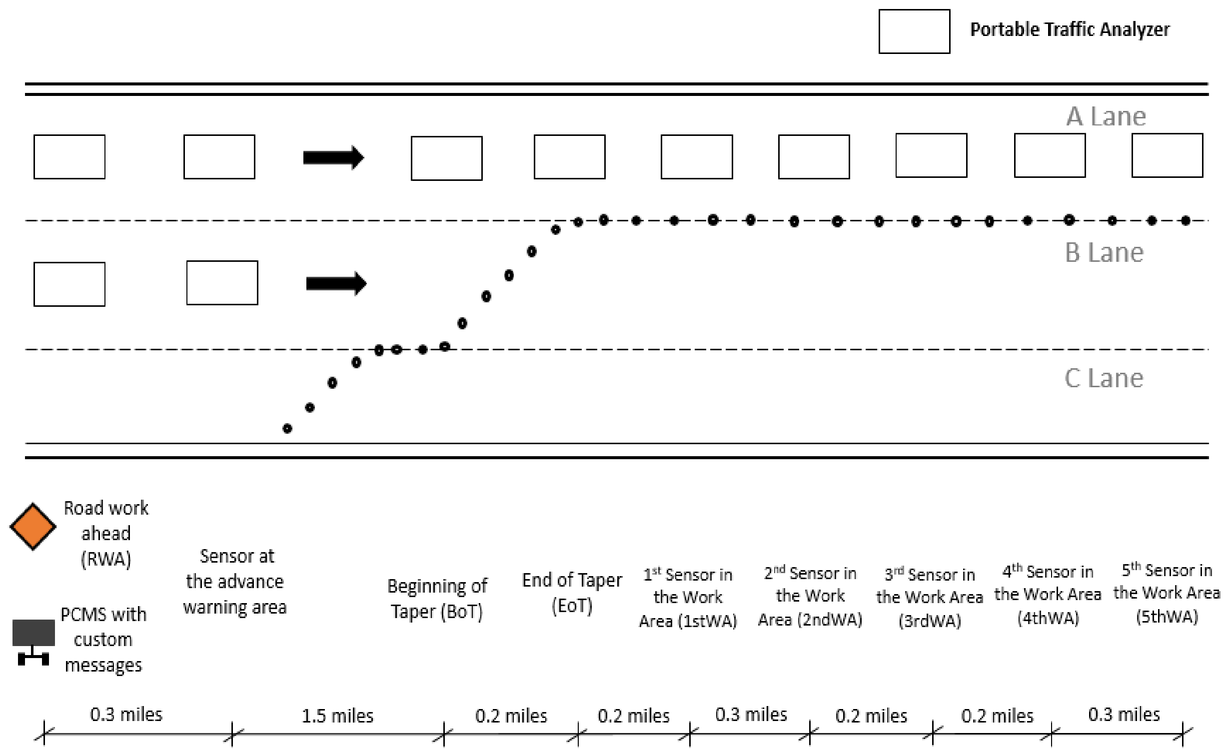


Figure 5.19: Traffic analyzer placement on day 3 for case study #2

Table 5.5: Traffic Analyzer Information for Case Study #2

Sensor Location	Day 1 - Control		Day 2 - Control		Day 3 - PCMS	
	A lane	B lane	A lane	B lane	A lane	B lane
RWA	●	●	●	●	●	●
At the advance warning area					●	●
BoT					●	
EoT	○		●		●	
1stWA	●		●		●	
2ndWA	●		●		●	
3rdWA	●		●		●	
4thWA	●		●		●	
5thWA	●		●		●	

Notes:
● Sensor placed and recordings are good
○ Sensor placed and recordings are not good
Blank = no sensor placed on roadway

The work zone locations on the three data collection days were not identical, and there are multiple freeway on-ramps and off-ramps in-between the sensor locations. Therefore, three detailed maps (Figure 5.20, Figure 5.21 and Figure 5.22) are developed to show the locations where the RWA, EoT and 5thWA (the last active work area sensor) sensors were placed, and the locations of freeway exits and entrances on this segment of I-205.

The work zone on Day 1 started at a location close to Exit 8 and ended at a location next to Exit 11 in the northbound direction of I-205 (Figure 5.20). There was one freeway exit and one entrance between the locations of the RWA sign and the EoT, and two exits and two entrances in-between the locations of the EoT and the 5thWA sensor. The number of passing vehicles recorded by the sensors may not be the same due to the presence of freeway entrances and exits along the roadway section.

The work zone on Day 2 was between Exit 8 and Exit 10 (Figure 5.21). There were two freeway exits and one entrance between the locations of the RWA sign and the EoT, and one freeway exit and one entrance between the locations of the EoT and the 5thWA sensor location, which would result in variations in the number of passing vehicles recorded by different sensors as well.

On Day 3, the sensors were placed between Exit 10 and Exit 13 (Figure 5.22). Based on the number of freeway exits and entrances in this segment of I-205 (one exit and two entrances between the location of RWA and EoT, and two exits and one entrance between the location of the EoT and 5thWA sensor locations), the traffic volumes recorded by different sensors could also differ.

It is worth mentioning that on Day 3, since the PCMS was placed close to the RWA sign, drivers who entered the work zone through freeway entrances downstream of the RWA sign would not see the message on the PCMS. Hence, not all of the drivers' behaviors, in terms of traveling speed recorded by the sensors that were placed downstream of the RWA sign, were under the influence of the PCMS unit.

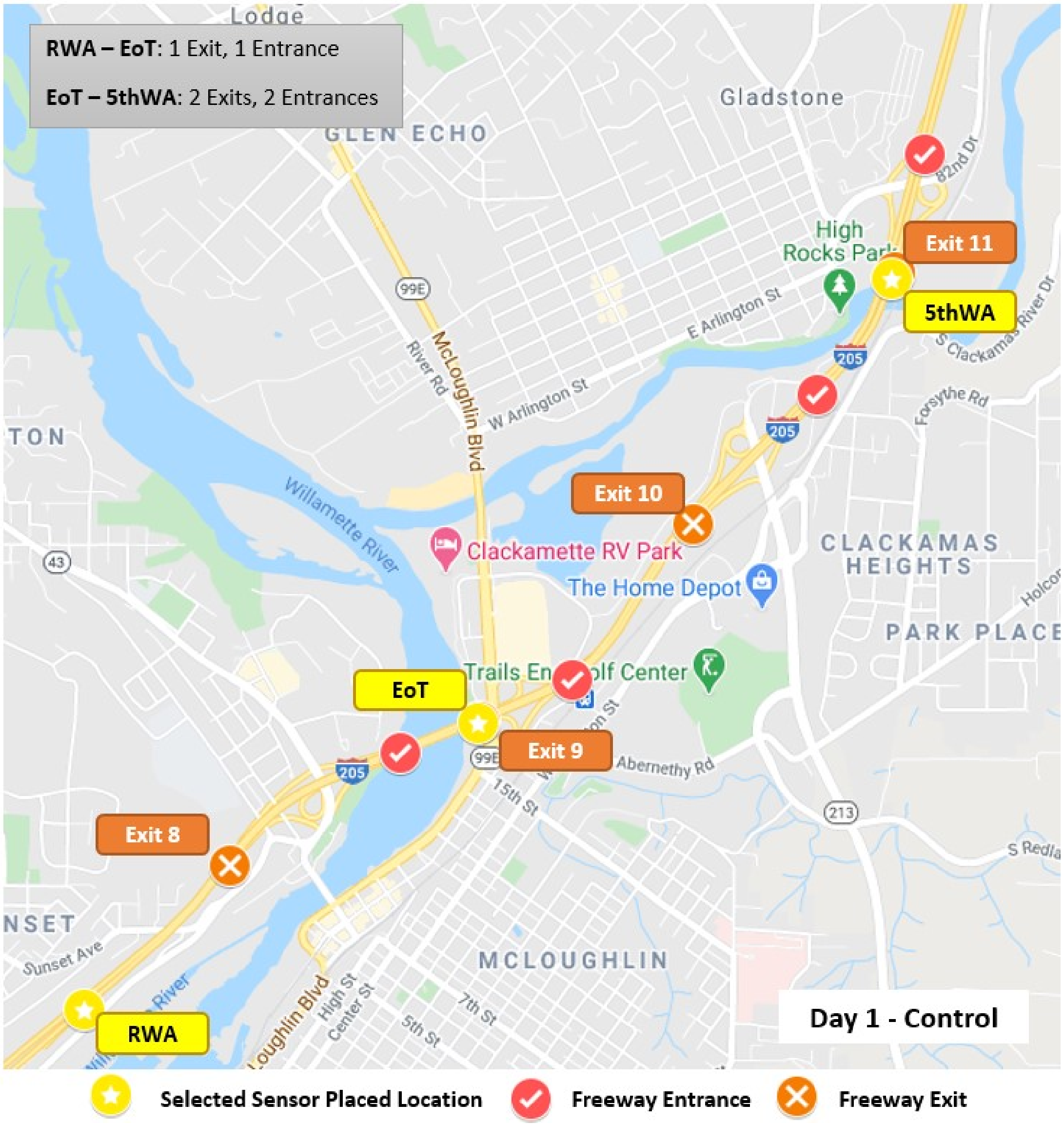


Figure 5.20: Location of case study #2 (day 1) (Source: Google maps)

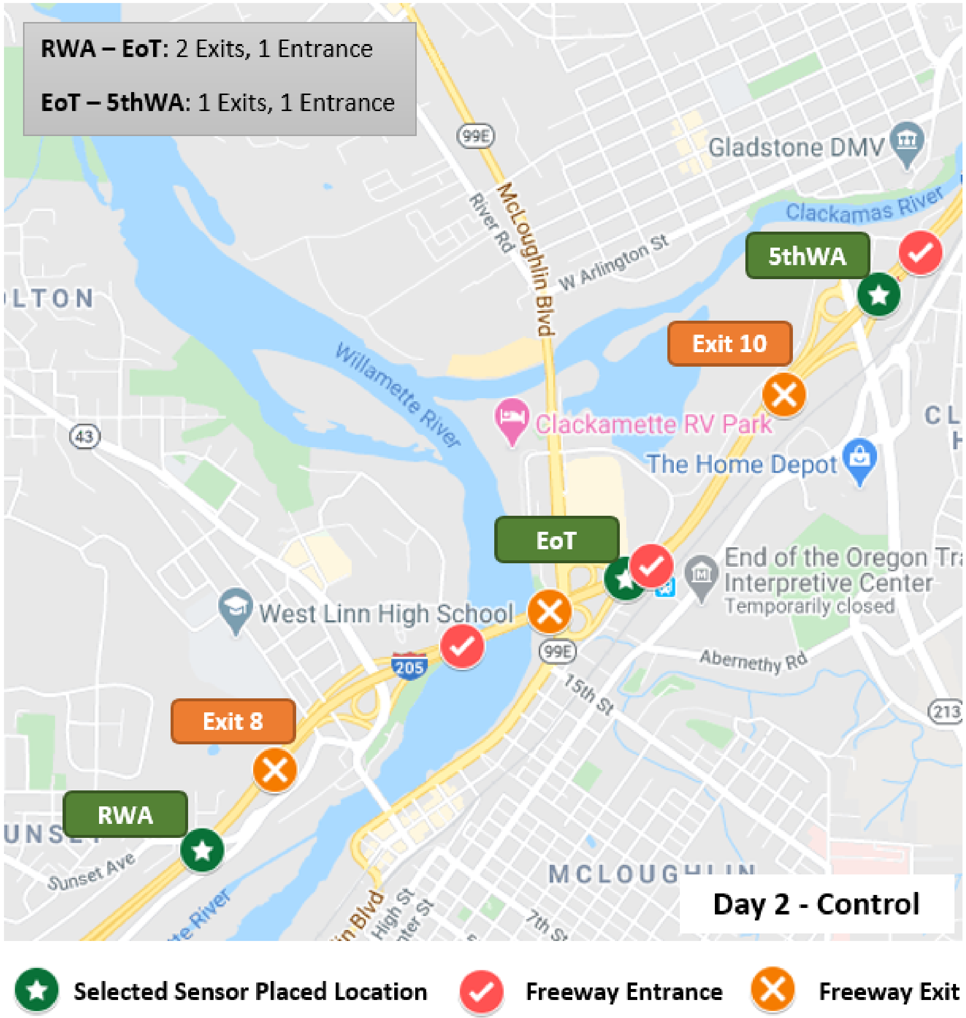


Figure 5.21: Location of case study #2 (day 2) (Source: Google maps)

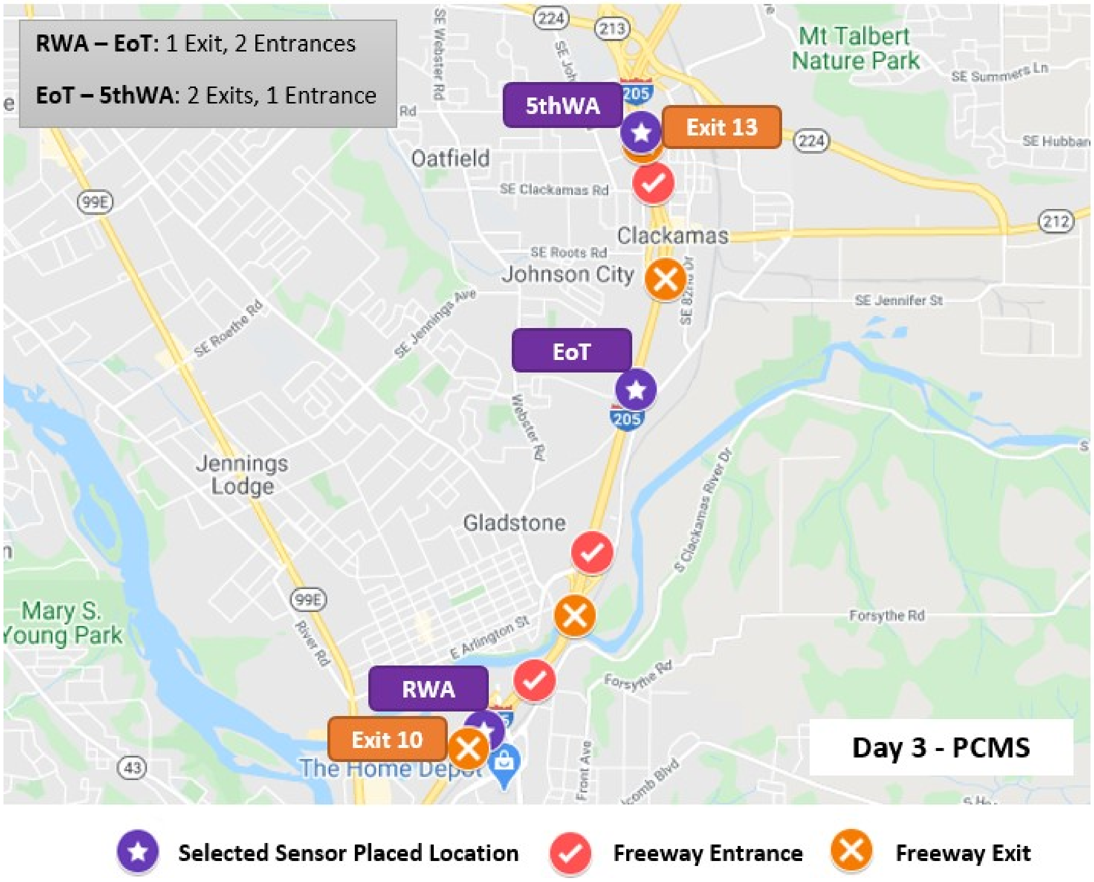


Figure 5.22: Location of case study #2 (day 3) (Source: Google maps)

5.4.3 Case Study #3: I-5 Sutherlin – Garden Valley Blvd.

The third case study project selected for this research was the I-5 Sutherlin – Garden Valley Blvd. project. The primary task of the project was to pave I-5 in the northbound and southbound directions from MP 125.38 – MP 136.69 with no work area from MP 129.12 – MP 129.97. Figure 5.23 shows the location of the project. The project contained many tasks, such as grinding 2.5" of the existing pavement and replacing it with 4" of asphalt, overlaying bridge decks within the paving limits, repairing culverts within the project limits, and removing and replacing barriers and guardrails.

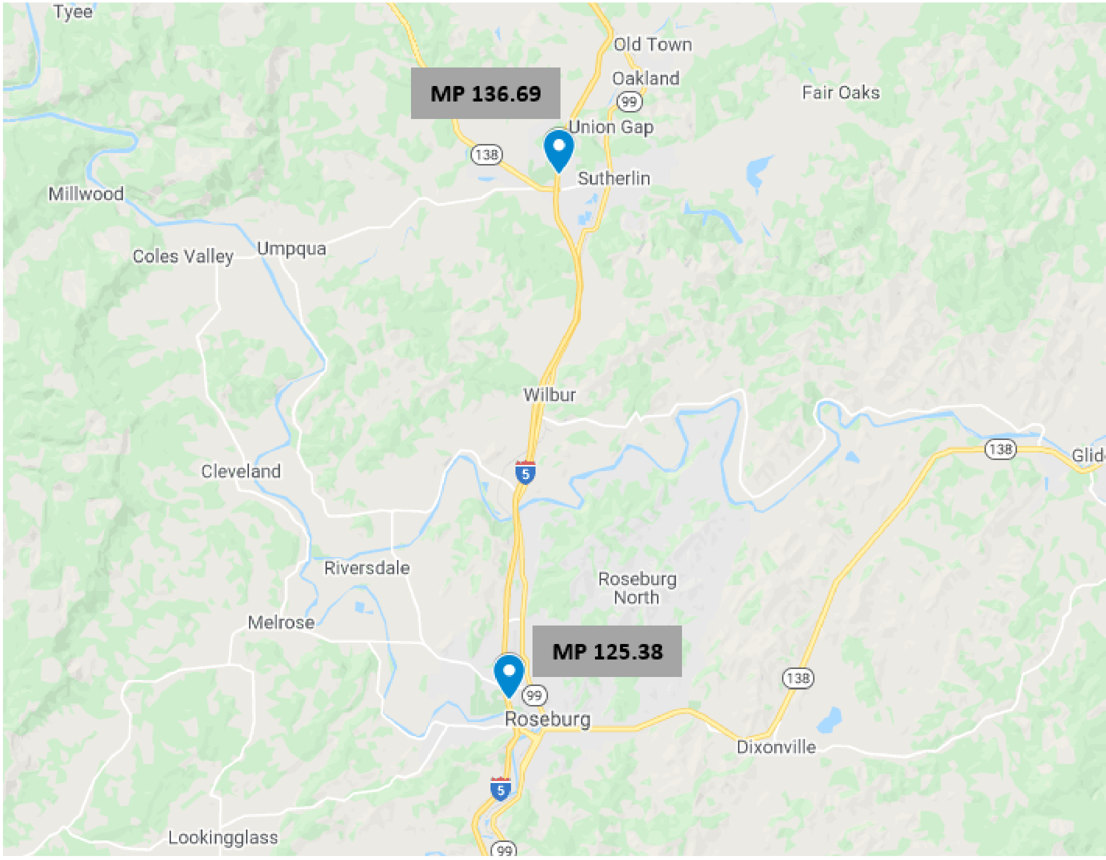


Figure 5.23: Location of I-5 Sutherlin – Garden Valley Blvd. project (case study #3) (Source: Google maps)

A total of seven nights of data collection were performed in this work zone, with two nights in the northbound direction (Case Study #3A), and five nights in the southbound direction (Case Study #3B). The details of the data collection for this case study are provided in Table 5.6. During the majority of the data collection periods, the contractor was conducting paving operations. During the work, the posted speed limit was 65 mph prior to the work zone, and the work zone speed limit was reduced to 50 mph. However, on the second day of data collection in the northbound direction (Case Study #3A Day 2), the contractor was removing and replacing median barrier, and the posted speed limit at that location was 60 mph with no speed reduction in the work zone.

The work operations typically started at 21:00 each day and ended at 07:00 the following day. To accommodate the paving operations, one or more lanes were closed between 20:00 and 08:00. To place the sensors on the roadway each night, the research team coordinated with the contractor. Since the highway was not fully closed, the contractor supported the research team by providing help in conducting a rolling slow down to ensure the research team has enough time to place all the sensors on the pavement. At the end of the work shift, before the traffic volume became too heavy at this section of the roadway (at approximately 05:00), the sensors were removed from the roadway. After picking up the sensors, the data were downloaded from each sensor, and the sensors were charged and reprogrammed for use the following night.

Considering each sensor needs time to turn on and calibrate itself to the local conditions, and the times when all sensors were placed varied between days given the varying daily construction schedule, only data that were gathered after 23:30 in the northbound direction and 21:30 in the southbound direction were included in the analysis.

Table 5.6: Data Collection Description of Case Study #3 (I-5 Sutherlin - Garden Valley Blvd.)

	Details					**Treatment**		
Day	**Case Study**	**Day/Date**	**Time Frame**	**Lane Closure**	**Travel Direction**	**PCMS with a Custom Message PCMS**	**PCMS and Flashing Amber/ White Lights**	**Treatment Effective Periods**
1	3A	Mon., 07/20/2020	23:30 – 04:30	A (fast) lane	Northbound			
2		Thurs., 07/23/2020	23:30 – 04:30	A (fast) lane	Northbound	X		Entire data collection period
1	3B	Wed., 08/26/2020	21:30 – 04:30	B, C (slow) lane	Southbound			
2		Mon., 08/31/2020	21:30 – 04:30	A (fast) lane	Southbound			
3		Tues., 09/01/2020	21:30 – 04:30	B (slow) lane	Southbound	X		Entire data collection period
4		Wed., 09/02/2020	21:30 – 04:30	A (fast) lane	Southbound	X		Entire data collection period
5		Tues., 09/08/2020	21:30 – 04:30	B (slow) lane	Southbound	X	X	Entire data collection period

As shown in Table 5.6, two treatments were examined in this case study project, a PCMS unit with custom messages and the combination of a PCMS unit and flashing amber lights on the paving equipment. Similar to the previous two case study projects, the alternating custom messages shown on the PCMS (Figure 5.24) were "MAINTAIN CONSTANT SPEED" and "THROUGH WORKZONE." In addition to the PCMS treatment alone, the combination of the

PCMS and flashing amber/white lights on the paver (Figure 5.25) was examined on the last night of data collection in the southbound direction (Case Study #3B Day 5).

Figure 5.24: PCMS used in case study #3 showing custom messages: "MAINTAIN CONSTANT SPEED" (left) and "THROUGH WORKZONE" (right)

Figure 5.25: Paver with flashing amber/white lights on (case study #3)

Similar to the Case Studies #1 and #2, the traffic sensors were placed in the open travel lane(s) upstream of and adjacent to the active work area at key locations (Figure 5.4). For this case study, on most of the testing days, only one lane was closed, except for Day 1 in the southbound direction (Case Study #3B Day 1) which involved a double lane closure (B and C lanes closed). Typically, two sensors were placed in each open lane at the location of the RWA sign. The distance from the RWA sign to the end of taper section varied from 1 to 3 miles based on the required speed reduction and roadway section design. Starting from the active work area, sensors were placed at approximately 0.2 to 0.3 mile intervals, and the number of sensors placed in the active work areas varied from 4 to 5, depending on the length of work zone on that work day. On treatment nights, the additional PCMS unit was put in place between the location of the RWA sign and the start of the transition area (the BoT location). Two sensors were placed in each open lane adjacent to the location of the PCMS unit. Table 5.7 and Table 5.8 present information regarding the traffic analyzers placed for Case Studies #3A and #3B. All sensors worked properly on this case study project.

Table 5.7: Traffic Analyzer Information for Case Study #3A

	Day 1		Day 2	
Sensor Location	**A lane**	**B lane**	**A lane**	**B lane**
RWA	X	X	X	X
PCMS			X	X
BoT				X
EoT		X		X
1stWA		X		X
2ndWA		X		X
3rdWA		X		X
4thWA		X		X

Note: X - sensor placed.

Table 5.8: Traffic Analyzer Information for Case Study #3B

	Day 1			Day 2		Day 3		Day 4		Day 5	
Sensor Location	**A lane**	**B lane**	**C lane**	**A lane**	**B lane**	**A lane**	**B lane**	**A lane**	**B lane**	**A lane**	**B lane**
RWA	X	X	X	X	X	X	X	X	X	X	X
PCMS						X	X	X	X	X	X
BoT	X				X	X			X	X	
EoT	X				X	X			X	X	
1stWA	X				X	X			X	X	
2ndWA	X				X	X			X	X	
3rdWA	X				X	X			X	X	
4thWA	X				X	X			X	X	
5thWA	X				X						

Note: X - sensor placed.

5.5 DATA PROCESSING AND ANALYSIS

Before the data could be used for analysis, a similar data processing procedure as that shown in Figure 4.4 was followed. Speed data were calibrated based on the results from the calibration tests, and then filtered using the same criteria (e.g., AdviceCode, analysis time periods, etc.). The types of vehicles were determined by the length of vehicle parameter recorded by the traffic sensors. Vehicles less than 25 ft. in length were counted as passenger cars and vehicles longer than 25 ft. in length were considered to be heavy vehicles (trucks).

5.5.1 Descriptive Statistics

After data were processed as described in the previous section, various descriptive statistics were produced to show the traffic volumes, truck percentages, and vehicle speeds during hourly ranges, and with hourly distribution statistics. Figure 5.26 shows an example of the hourly summary statistics from the sensors placed at the RWA sign location on Day 1 from Case Study #3A. The abbreviations in the figures are as follows: PC = passenger cars (<25 ft.), HV = heavy vehicles (>25 ft.), and Total = all vehicles.

	23:30 - 00:30			00:30 - 01:30			01:30 - 02:30			02:30 - 03:30			03:30 - 04:30		
Speed_Range	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total
<10	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	2.6%	1.5%
10-14	0.0%	0.0%	0.0%	3.6%	0.0%	1.4%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.9%	0.0%	0.8%
15-19	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
20-24	0.0%	0.0%	0.0%	0.0%	2.3%	1.4%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
25-29	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	2.8%	0.0%	1.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
30-34	0.0%	0.0%	0.0%	3.6%	0.0%	1.4%	2.8%	0.0%	1.1%	0.0%	1.4%	0.9%	0.0%	0.0%	0.0%
35-39	9.4%	5.1%	7.0%	3.6%	0.0%	1.4%	2.8%	1.7%	2.1%	0.0%	0.0%	0.0%	1.9%	0.0%	0.8%
40-44	15.6%	12.7%	14.0%	10.7%	7.0%	8.5%	2.8%	0.0%	1.1%	7.3%	8.1%	7.8%	5.6%	1.3%	3.1%
45-49	20.3%	22.8%	21.7%	25.0%	9.3%	15.5%	13.9%	12.1%	12.8%	12.2%	9.5%	10.4%	9.3%	13.2%	11.5%
50-54	20.3%	22.8%	21.7%	7.1%	27.9%	19.7%	22.2%	24.1%	23.4%	22.0%	21.6%	21.7%	13.0%	14.5%	13.8%
55-59	12.5%	20.3%	16.8%	14.3%	32.6%	25.4%	27.8%	19.0%	22.3%	17.1%	25.7%	22.6%	27.8%	26.3%	26.9%
60-64	12.5%	8.9%	10.5%	3.6%	7.0%	5.6%	5.6%	17.2%	12.8%	24.4%	16.2%	19.1%	14.8%	18.4%	16.9%
65-69	1.6%	1.3%	1.4%	3.6%	2.3%	2.8%	5.6%	3.4%	4.3%	2.4%	2.7%	2.6%	7.4%	2.6%	4.6%
70-74	3.1%	1.3%	2.1%	17.9%	2.3%	8.5%	2.8%	5.2%	4.3%	7.3%	4.1%	5.2%	7.4%	5.3%	6.2%
75 and above	4.7%	5.1%	4.9%	7.1%	9.3%	8.5%	11.1%	17.2%	14.9%	7.3%	10.8%	9.6%	11.1%	15.8%	13.8%
Total	64	79	143	28	43	71	36	58	94	41	74	115	54	76	130
85th Percentile	62.25	60.91	61.66	72.37	63.49	70.81	65.97	77.60	74.63	68.12	69.25	69.09	70.38	75.39	74.20
Average	52.66	53.37	53.05	55.16	57.83	56.78	57.55	62.20	60.42	58.59	59.27	59.03	59.49	60.71	60.20
Std Dev	10.62	11.10	10.85	16.10	14.55	15.12	15.71	14.20	14.89	11.17	13.17	12.45	14.24	16.41	15.50
Min	36.89	36.89	36.89	13.20	21.82	13.20	27.95	37.97	27.95	40.12	32.59	32.59	10.22	3.51	3.51
Max	86.43	105.81	105.81	90.73	99.35	99.35	109.04	106.89	109.04	96.12	106.89	106.89	98.27	102.58	102.58
Range	49.53	68.92	68.92	77.53	77.53	86.14	81.09	68.92	81.09	55.99	74.30	74.30	88.05	99.07	99.07
Speed limit compliance (%)	90.6%	92.4%	91.6%	71.4%	86.0%	80.3%	80.6%	74.1%	76.6%	82.9%	82.4%	82.6%	74.1%	76.3%	75.4%

Figure 5.26: Example of hourly summary of vehicle speeds recorded at RWA location (case study #3A day 1)

In Figure 5.26, vehicle volume in each speed range is shown as a percentage of the total volume during that hour. Descriptive statistics such as the 85th percentile speed, average speed, standard deviation, minimum speed, and maximum speed were determined based on the data collected at the sensor location. The data presented in Figure 5.26 consists of the combination of data from two sensors placed near the RWA sign in both the slow lane (B-lane) and the fast lane (A-lane).

For each of these figures, a "desired distribution of speeds," as described by Gambatese and Zhang (2014), should fulfill the following criteria:

1. The average speed would be below the posted, regulatory speed;
2. The highest speed recorded should also be below the posted, regulatory speed;
3. The distribution of speeds from the slowest speed to the fastest speed would be small (i.e., low standard deviation);
4. The distribution of speeds should hold true regardless of the volume of traffic, type of vehicle, and time of day.

It can be observed from the figure that the speeds on Day 1 from Case Study #3A would not be considered as a "desired distribution of speeds". The 1-hr average speed ranged from 52.66 mph to 62.60 mph, and the range is above the posted, regulatory speed (50 mph). The highest recorded speed (109.04 mph) is 59.04 mph above the posted, regulatory speed. In addition, the speed distribution varies from hour to hour; more drivers tended to drive faster in the late night/early morning hours (00:30 - 04:30). Furthermore, this figure provides the summary statistics with respect to the 1-hr standard deviation (SD). As shown in the figure, the 1-hr SD ranged from 10.62 mph (contributed by passenger cars passing between 23:30 and 00:30) to 16.41 mph (contributed by trucks passing between 03:30 and 04:30).

5.5.2 Statistical Analysis

Four traffic control treatments were examined in the three case studies as shown in Table 5.9. The analyses were only conducted within each case study due to the differences in work zone conditions, roadway geometries, and sensor placement, etc. For example, in Case Study #1, three treatments (pace car, PCMS, and the combination of pace car and PCMS) were examined. Comparisons were made between the pace car case and the control case (without any treatment), between the PCMS case and the control, and between the combination PCMS/pace car and the control, to confirm the effectiveness of the treatment at reducing the speed and speed variation measurements in the work zone compared to that without the treatment. In addition, for Case Study #1, to test the combined effects, comparisons were also made between the PCMS/pace car combination case and just the pace car case, and between the PCMS/pace car combination and the PCMS case.

Table 5.9: Treatments Examined in Each Case Study

Treatment	Case Study			
	#1	#2	#3A	#3B
Pace car	X			
PCMS	X	X	X	X
PCMS and pace car	X			
PCMS and flashing amber/white lights on paver				X

5.5.2.1 Determination of Speed Variation Time Aggregation Level

To examine the effectiveness of work zone treatments in the reduction of speed variation in work zones, it is essential to determine the time aggregation level. Based on a thorough literature search, the researchers did not find any relevant studies that examine the effectiveness of pace car treatments in reducing vehicle speed or speed variation in work zones. A similar approach that has been examined previously is called "circulating patrol car," which is a marked patrol car continuously driven through the work zone without lights or radar on. Benekohal et al. (1992) evaluated the impact of a marked police car circulating through two-lane, two-way rural interstate work zones in Illinois. The study found that such a treatment reduced the mean speeds of cars and trucks by about 4 and 5 mph, respectively. Meanwhile, the percentages of cars and trucks exceeding the speed limit through the work zone were reduced by 14 and 32 percent, respectively. The researchers also examined if there was a lasting impact on speeds after the patrol car left the project site, and found that one hour after the police car left the work zone, the mean speed of cars and trucks increased by about 2.5 and 0.5 mph, respectively.

Because there is no previous research that determines an appropriate aggregation level for the pace car treatment, the researchers analyzed three time aggregation levels (1-min, 5-min, and 30-min) for Case Study #1 for the following reasons.

The researchers firstly took into consideration of decision sight distance, which is defined as "the distance needed for a driver to detect an unexpected or otherwise difficult-to-perceive information source or condition in a roadway environment that may be visually cluttered, recognize the condition or its potential threat, select an appropriate speed and path, and initiate and complete complex maneuvers" by the American Association of State Highway and Transportation Officials (AASHTO) Green Book (AASHTO, 2018). The definition helps to determine an appropriate distance upstream of (behind) the pace car that drivers' maneuvers are reasonably impacted by the presence of the pace car. Table 5.10 shows the recommended decision sight distance provided by AASHTO (2018).

Table 5.10: Decision Sight Distance (adapted from AASHTO, 2018)

Design Speed (mph)	Decision Sight Distance (ft.)				
	Avoidance Maneuver				
	A	B	C	D	E
30	220	490	450	535	620
35	275	590	525	625	720
40	330	690	600	715	825
45	395	800	675	800	930
50	465	910	750	890	1030
55	535	1030	865	980	1135
60	610	1150	990	1125	1280
65	695	1275	1050	1220	1365
70	780	1410	1105	1275	1445
75	875	1545	1180	1365	1545
80	970	1685	1260	1455	1650
85	1070	1830	1340	1565	1785

Avoidance Maneuver A: Stop on road in a rural area
Avoidance Maneuver B: Stop on road in an urban area
Avoidance Maneuver C: Speed/path/direction change on rural road
Avoidance Maneuver D: Speed/path/direction change on suburban road or street
Avoidance Maneuver E: Speed/path/direction change on urban, urban core, or rural town road or street

Assuming the design speed of the roadway section in Case Study #1 is the same as the posted speed limit (70 mph), under avoidance maneuver D (speed/path/direction change on suburban road or street), the reasonable decision sight distance is 1,275 feet. Assuming vehicles behind the pace car were driven at the posted speed limit, only vehicles that were within approximately 13 seconds away from the pace car are impacted by the presence of the pace car. After considering the recordings taken during the drive-through with respect to the time when the pace car was passing over specific sensors, and examining the data collected in the present case study, the 13-sec aggregation level was found to be unreasonable for the speed variation analysis due to the low traffic volume in the examined roadway sections. For example, the maximum number of vehicles that could be included with a 13-sec aggregation level in the analysis was three vehicles, and with most extreme conditions, only one or no vehicle could be included (Note: Standard deviation and COV cannot be computed based on the observation of a single-vehicle). Therefore, a 13-sec aggregation level was found to not be realistic, and a 1-min level was used as the minimum time aggregation level in order to ensure a sufficient number of speed data points in the analysis.

In addition, a 5-min level was also used for several reasons. The approximate duration to drive from the start of the work zone to the end of work zone was nearly 5 minutes, and a 5-min aggregation level was adopted in several previous speed variation studies, such as Shim et al. (2015), Wang et al. (2015), and Choudhary et al. (2018). Furthermore, a 30-min level was also adopted, which helps to examine the effect of the pace car on speed measurements when it was continuously driven in work zones and when it was completely out of the work zone (e.g., returning for another pass through the work zone).

No pace car treatment was adopted in Case Studies #2 and #3, therefore only 1-min and 5-min analyses were performed for these two case study projects.

5.5.2.2 Statistical Analysis

After data were generated based on the time aggregation level, using the statistics software program R, the Wilcoxon signed-rank test was used to answer the following general research question: Does speed treatment A reduce the speed/speed variation of vehicles in a work zone more effectively than without using any treatment (the control case)/another treatment (treatment B)? The null and alternative hypotheses are shown below.

> H_0: The mean rank (median) of speed/speed variation measurement of vehicles of treatment A is greater than or equal to that of treatment B/control case. In the present study, this statement means that there is no statistical evidence that treatment A is more effective at reducing speed/speed variation than treatment B/control case.
>
> H_1: The mean rank (median) of speed/speed variation measurement of treatment A is smaller than or equal to that of treatment B/control case. In the present study, this statement means that there is statistical evidence that treatment A is more effective at reducing speed/speed variation than treatment B/control case.

Three speed and speed variations values were examined for each comparison; they are: the 85th percentile speed, SD, and COV. Wilcoxon signed-rank test is a non-parametric method and does not assume a normal distribution. The Wilcoxon signed-rank test is suitable for the analysis because after data aggregation, especially at the 30-min level, the sample size reduced to less than 30 data points (which cannot be viewed as a large sample that has a normal distribution).

A 95% confidence interval was selected to identify statistical significance in the speed and speed variation reduction between the case when there was a traffic control intervention put in place and the case when there was another intervention, or no intervention, in the work zone.

6.0 PHASE II – RESULTS, ANALYSIS, AND DISCUSSION

Following the research methods and data analysis procedures presented in the previous sections of the report, descriptive statistics including traffic volume, vehicle speeds, and speed variation were generated for each case study project. Statistical analyses were then conducted to confirm whether there was statistical evidence that the implemented traffic control interventions were effective in reducing vehicle speeds and speed variation. Given all of the traffic analyzers used and the multiple days of testing, a very large amount of data were gathered for this study, as well as for the generated summary statistics. In order to present the results neatly and efficiently, only representative tables and figures are provided in the body of the report. Additional details are provided in the Appendix.

Due to the differences in work zone site conditions, vehicle distribution, site layouts, and construction operations among the case study projects, analytical comparisons among different case studies were not made. The analyses were only conducted within each case study.

6.1 DESCRIPTIVE STATISTICS

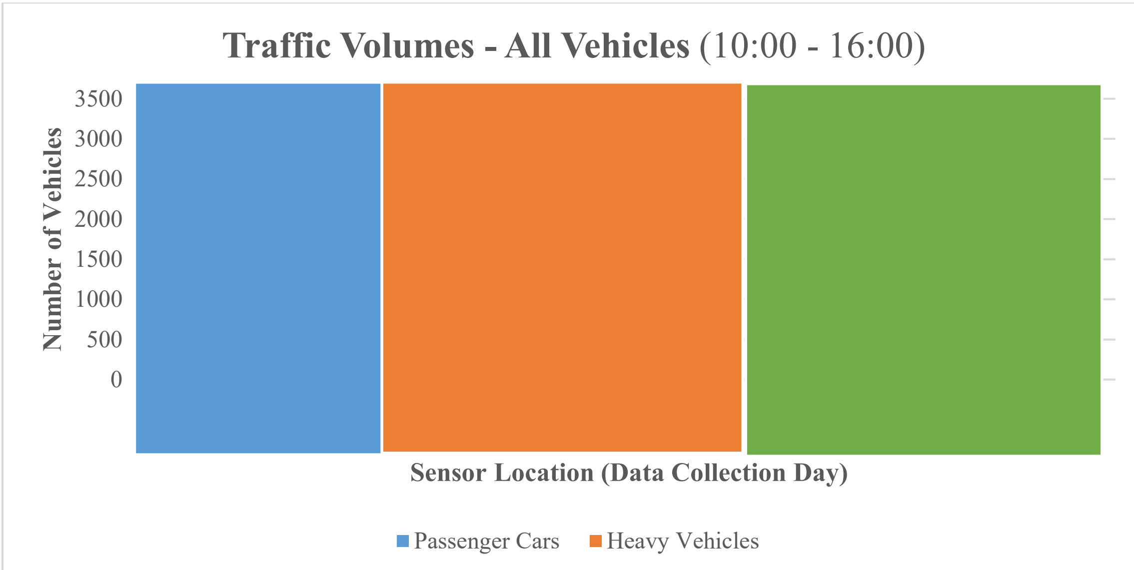
6.1.1 Case Study #1: I-84 Swanson Canyon to Arlington

6.1.1.1 Traffic Volume

Figure 6.1 (top) displays the number of different types of vehicles, based on vehicle length, recorded during common data collection periods (between 10:00 and 16:00) by the sensors that were placed in the active work area for the three data collection days during Case Study #1. The traffic volumes are inconsistent from day to day. Based on the data recorded by the 1stWA sensor, a high volume of vehicles passed through the work zone on Day 1, and a lower traffic volume was measured on Day 3. Regarding the percentage of heavy vehicles (trucks), as shown in Figure 6.1 (bottom), the truck percentage on Day 3 (38%) is greater than that on Day 1 (21%) and Day 2 (28%).

Since there was no on-ramp or off-ramp within the work zone, the total number of vehicles recorded by the different sensors in the work zone should be the same. One reason for the variations in the number of vehicles recorded could be, when passing vehicles traveled close to each other, the traffic sensors might consider them as one single vehicle. Another possible reason is that construction equipment or vehicles from the contractors may travel over the sensors in the middle of the shift, but they may not travel through the entire active work area.

Figure 6.2 shows the number of vehicles for each hour between 10:00 and 16:00 for all data collection days. The data displayed in this figure comes from the 1stWA sensor. The trend shows a similar pattern that the traffic volume slightly increases from 10:00 to 12:00 and then drops gradually from 13:00 to 16:00 on Days 1 and 2. Day 3 shows some differences in traffic volume from the other two days, and has a volume drop between 12:00 and 13:00 and a volume increase between 13:00 and 14:00.



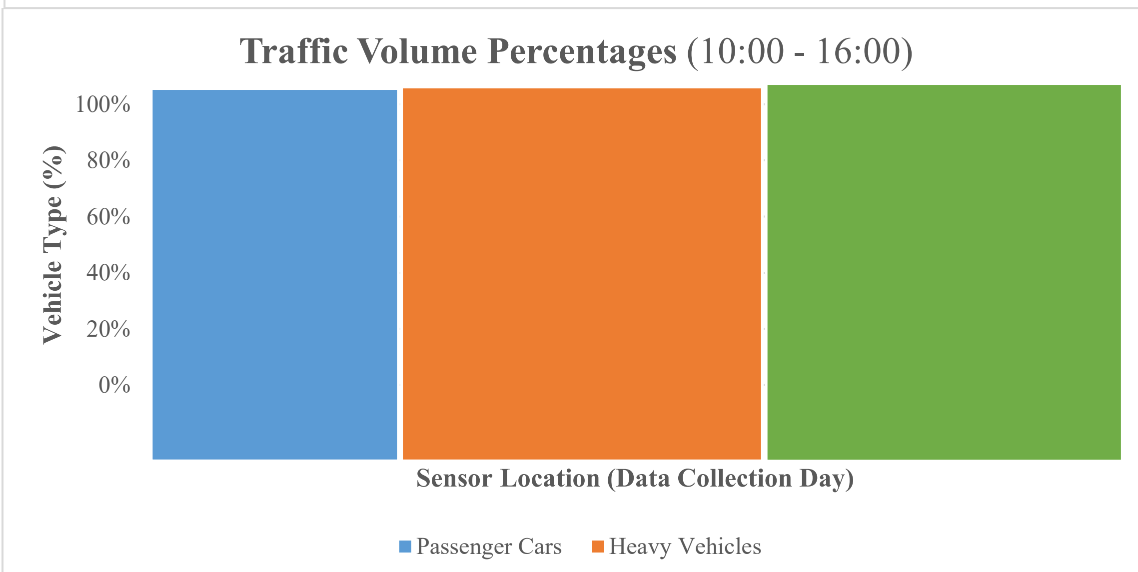


Figure 6.1: Traffic volumes at different sensor locations at active work area, total and by vehicle type (case study #1)

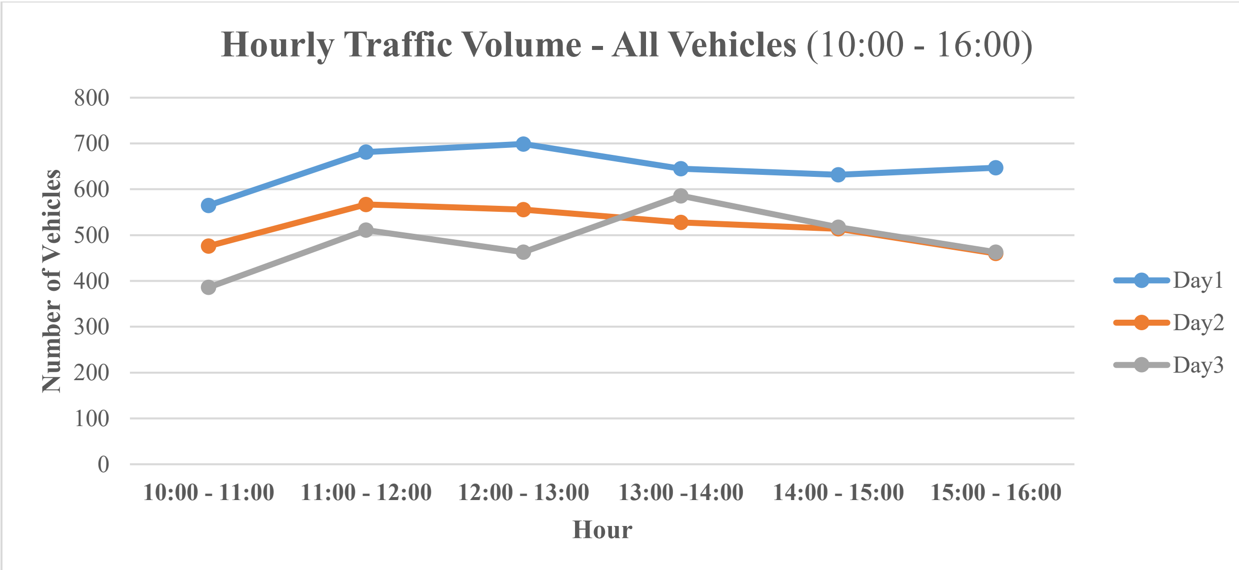


Figure 6.2: Hourly traffic volumes at 1stWA sensor location (case study #1)

As shown in Table 6.1, the truck percentage varied from 20% to 23% on Day 1, from 26% to 32% on Day 2, and from 34% to 40% on Day 3. On Days 2 and 3, the minimum truck percentage occurred from 11:00 to 12:00, while the maximum truck percentage occurred at different times on different days. The highest truck percentage (40%) was recorded between 12:00 and 13:00 on Day 3.

Table 6.1: Change in the Truck Percentage recorded by the 1stWA Sensor on Different Testing Days (Case Study #1)

	Truck Percentage		Related Time	
	Min	**Max**	**Min**	**Max**
Day 1	20%	23%	14:00 – 15:00	13:00 – 14:00
Day 2	26%	32%	11:00 – 12:00	15:00 – 16:00
Day 3	34%	40%	11:00 – 12:00	12:00 – 13:00

6.1.1.2 Vehicle Speed

Figure 6.3 shows the overall 85th percentile speed recorded at different sensor locations on the three days of data collection. It is worth noting that no sensor was placed at the location of the PCMS unit with custom messages on Day 1, and a few sensors did not work properly on different data collection days (Table 5.3). Thus, for those sensor locations that lack trustworthy speed data, estimated speeds were used to show the overall speed trend. The trend is quite similar for all data collection days. In Figure 6.3, it can be seen that drivers tended to increase their speeds between the locations of the first RWA sign (represented by the RWA1 sensor) and the second RWA sign (represented by the RWA2 sensor). This tendency may be because there was a relatively long distance (2.1 miles) between the two RWA signs. Shortly after passing the PCMS location, due to the presence of the lane reduction, drivers tended to decrease their speeds in the transition area (represented by the BoT and EoT sensors). While after passing the 1st sensor placed in the activity area (1stWA sensor), and where workers were working in the closed lane, drivers tended to speed up again.

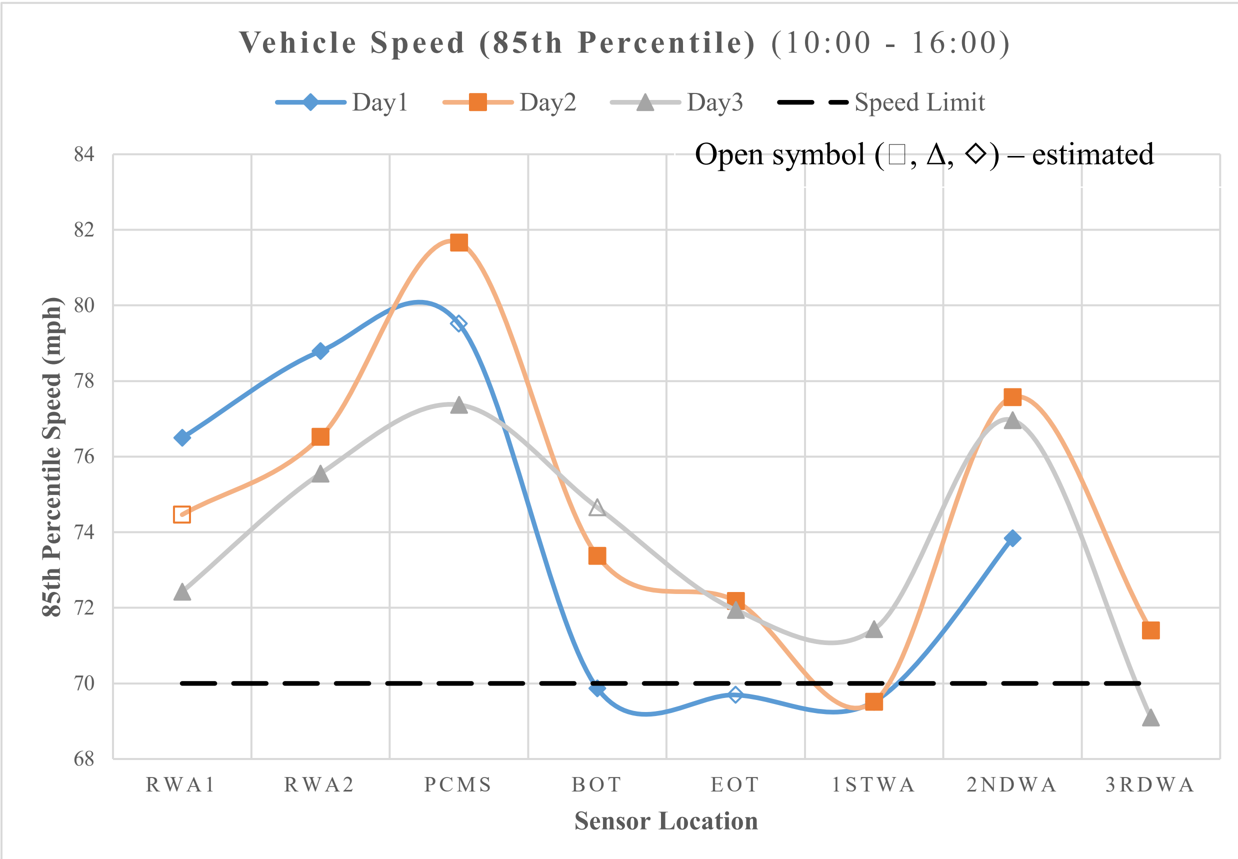


Figure 6.3: 85th Percentile speed at different sensor locations (case study #1)

Figure 6.4 shows the hourly vehicle speed (85^{th} percentile) record by the 1stWA sensor. The hourly speed pattern is similar for Day 1 and Day 3 with only a slight variation in the relative 85^{th} percentile speed (the hourly 85^{th} percentile speed on Day 3 was generally 2 mph higher than that on Day 2). The changes in the hourly 85^{th} percentile speeds between 10:00 and 15:00 were quite small on Day 2.

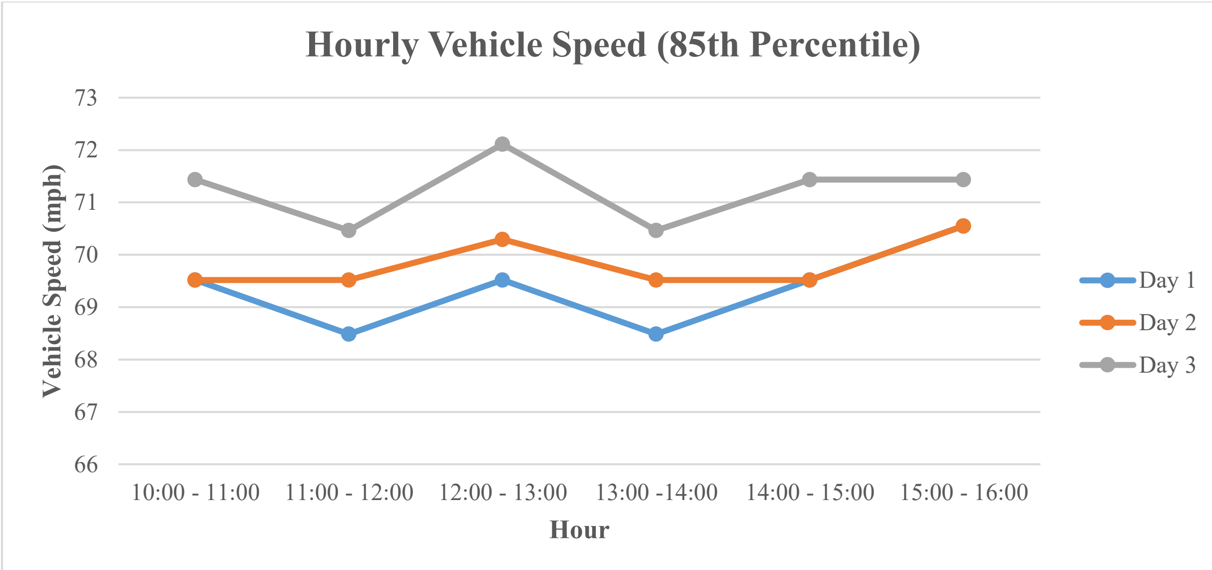


Figure 6.4: Hourly vehicle speed (85th percentile) at 1stWA sensor (case study #1)

Figure 6.5, Figure 6.6, and Figure 6.7 provide detailed speed and traffic volume information that was collected and summarized from the 1stWA sensor on the three days of data collection. The figures provide summary statistics in terms of speed distributions for passenger cars (PC), heavy vehicles (HV)/trucks, and both passenger cars and heavy vehicles combined (Total).

	10:00 - 11:00			11:00 - 12:00			12:00 - 13:00			13:00 - 14:00			14:00 - 15:00			15:00 - 16:00		
Speed_Range	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total
<10	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
10-14	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.2%	0.0%	0.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
15-19	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
20-24	0.0%	0.0%	0.0%	0.6%	0.0%	0.4%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
25-29	0.0%	0.0%	0.0%	1.1%	0.0%	0.9%	0.0%	0.0%	0.0%	0.0%	0.7%	0.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
30-34	0.0%	0.0%	0.0%	1.9%	2.6%	2.1%	0.0%	0.0%	0.0%	0.2%	0.0%	0.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
35-39	0.4%	0.8%	0.5%	2.5%	2.6%	2.5%	0.4%	0.7%	0.4%	0.6%	0.7%	0.6%	1.0%	0.0%	0.8%	0.2%	0.0%	0.2%
40-44	3.1%	1.7%	2.8%	5.5%	6.0%	5.6%	3.0%	1.4%	2.7%	3.4%	2.0%	3.1%	3.0%	2.4%	2.8%	2.6%	4.8%	3.1%
45-49	6.9%	14.4%	8.5%	11.9%	12.6%	12.0%	7.0%	12.1%	8.0%	7.3%	12.8%	8.5%	9.5%	17.6%	11.1%	9.0%	10.3%	9.3%
50-54	11.2%	22.0%	13.5%	12.8%	13.9%	13.1%	12.2%	20.0%	13.7%	11.5%	19.5%	13.3%	13.8%	8.8%	12.8%	10.4%	17.9%	12.1%
55-59	19.7%	26.3%	21.1%	18.5%	31.8%	21.4%	23.6%	27.1%	24.3%	23.2%	26.2%	23.9%	17.8%	32.0%	20.6%	21.5%	29.0%	23.2%
60-64	26.2%	16.9%	24.2%	19.8%	15.9%	18.9%	22.7%	21.4%	22.5%	23.4%	25.5%	23.9%	20.5%	26.4%	21.7%	22.7%	17.2%	21.5%
65-69	18.3%	10.2%	16.6%	12.6%	6.0%	11.2%	15.0%	10.7%	14.2%	15.5%	8.1%	13.8%	17.9%	8.0%	16.0%	17.1%	9.7%	15.5%
70-74	8.7%	3.4%	7.6%	7.9%	6.0%	7.5%	8.9%	2.1%	7.6%	7.9%	2.7%	6.7%	10.3%	3.2%	8.9%	9.2%	4.1%	8.0%
75 and above	5.4%	4.2%	5.1%	4.9%	2.6%	4.4%	7.2%	4.3%	6.6%	6.9%	2.0%	5.7%	6.3%	1.6%	5.4%	7.4%	6.9%	7.3%
Total	447	118	565	530	151	681	559	140	699	496	149	645	507	125	632	502	145	647
85th Percentile	69.52	65.39	69.52	68.49	64.35	68.49	70.55	65.39	69.52	69.52	64.35	68.49	70.55	64.35	69.52	70.55	66.83	70.55
Average	61.36	58.06	60.67	57.92	56.37	57.57	61.41	58.65	60.85	60.77	57.41	60.00	61.04	58.13	60.46	61.42	59.31	60.94
Std Dev	8.65	9.32	8.89	11.42	9.85	11.10	9.48	9.38	9.52	9.48	7.78	9.22	9.67	9.11	9.63	9.44	10.66	9.76
Min	36.46	38.53	36.46	23.03	30.26	23.03	38.53	38.53	38.53	10.64	26.13	10.64	36.46	41.63	36.46	35.43	40.59	35.43
Max	98.44	107.74	107.74	101.54	93.28	101.54	107.74	106.71	107.74	94.31	86.05	94.31	102.57	106.71	106.71	109.81	102.57	109.81
Range	61.98	69.21	71.28	78.51	63.01	78.51	69.21	68.18	69.21	83.67	59.91	83.67	66.11	65.08	70.24	74.38	61.98	74.38
Speed limit compliance (%)	85.9%	92.4%	87.3%	87.2%	91.4%	88.1%	83.9%	93.6%	85.8%	85.3%	95.3%	87.6%	83.4%	95.2%	85.8%	83.5%	89.0%	84.7%

Figure 6.5: Hourly summary of vehicle speed from the 1stWA sensor on day 1 (case study #1)

Examining the figures reveals that the computed average speeds at the 1stWA sensor location were all below the posted, regulatory speed (70 mph) regardless of the volume of traffic, type of vehicle, and time of day. Relatively, Day 3 shows higher average speeds than the other two days. As for the 85th percentile speeds, most of the time, those speeds for passenger cars exceeded the posted, regulatory speed. And, all of the 85th percentile speeds for trucks were below the posted, regulatory speed. Additionally, the speed distributions among different days and hours were quite similar, mainly ranging from 30 mph to 100 mph, with some extreme circumstances (e.g., passenger cars passing through the work zone between 15:00 and 16:00 on Day 1). As shown in the data, the 1-hr SD of speed varied from 7.78 mph to 11.42 mph on Day 1, from 7.29 mph to 9.79 mph on Day 2, and from 5.49 mph to 8.71 mph on Day 3. For the purpose of this study, a smaller standard deviation of speed is desired. The 1-hr standard deviations on Day 3 are smaller than those on Days 1 and 2. However, when comparing the speed limit compliance rate, fewer passenger cars were compliant with the posted speed limit on Day 3 than the other two days. In general, more than 90% of the trucks were driving slower than the posted speed limit.

	10:00 - 11:00			11:00 - 12:00			12:00 - 13:00			13:00 - 14:00			14:00 - 15:00			15:00 - 16:00		
Speed_Range	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total
<10	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
10-14	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
15-19	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
20-24	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
25-29	0.3%	0.0%	0.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
30-34	0.3%	0.0%	0.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.5%	0.7%	0.6%	0.0%	0.7%	0.2%	0.0%	0.0%	0.0%
35-39	0.9%	1.6%	1.1%	0.5%	0.0%	0.4%	0.2%	1.3%	0.5%	0.5%	0.7%	0.6%	0.0%	0.7%	0.2%	0.0%	1.4%	0.4%
40-44	1.7%	2.3%	1.9%	1.4%	4.8%	2.3%	2.7%	2.7%	2.7%	1.3%	2.8%	1.7%	1.6%	0.7%	1.4%	1.6%	3.4%	2.2%
45-49	7.2%	10.2%	8.0%	5.0%	11.6%	6.7%	5.4%	12.0%	7.2%	7.3%	6.9%	7.2%	5.3%	12.3%	7.2%	4.5%	10.2%	6.3%
50-54	12.1%	14.1%	12.6%	11.2%	17.1%	12.7%	8.6%	18.7%	11.3%	10.2%	13.9%	11.2%	11.2%	13.8%	11.9%	11.2%	17.0%	13.0%
55-59	18.7%	31.3%	22.1%	21.4%	29.5%	23.5%	21.7%	26.7%	23.0%	18.5%	38.9%	24.1%	20.5%	30.4%	23.2%	23.0%	25.9%	23.9%
60-64	25.0%	21.1%	23.9%	25.4%	24.7%	25.2%	28.3%	20.0%	26.1%	25.3%	20.8%	24.1%	24.5%	18.1%	22.8%	24.9%	25.2%	25.0%
65-69	18.7%	10.9%	16.6%	18.5%	8.2%	15.9%	16.5%	7.3%	14.0%	20.1%	8.3%	16.9%	20.2%	16.7%	19.3%	15.3%	8.2%	13.0%
70-74	9.8%	3.1%	8.0%	11.2%	2.7%	9.0%	10.3%	5.3%	9.0%	10.4%	4.2%	8.7%	9.0%	4.3%	7.8%	14.7%	3.4%	11.1%
75 and above	5.5%	5.5%	5.5%	5.5%	1.4%	4.4%	6.2%	6.0%	6.1%	6.0%	2.8%	5.1%	7.7%	2.2%	6.2%	4.8%	5.4%	5.0%
Total	348	128	476	421	146	567	406	150	556	384	144	528	376	138	514	313	147	460
85th Percentile	70.50	66.42	69.52	70.55	64.35	69.52	70.55	65.39	70.29	70.55	64.92	69.52	70.55	67.45	69.52	71.58	65.49	70.55
Average	61.34	59.16	60.75	62.22	57.62	61.04	61.83	58.50	60.93	62.08	58.46	61.10	62.67	59.04	61.69	62.31	58.96	61.24
Std Dev	8.97	9.31	9.11	8.86	7.29	8.71	8.43	9.09	8.73	9.45	7.50	9.09	9.07	9.10	9.21	8.61	9.79	9.13
Min	27.17	38.53	27.17	35.43	40.59	35.43	35.43	39.56	35.43	31.30	34.40	31.30	41.63	33.36	33.36	42.66	37.50	37.50
Max	90.18	99.48	99.48	99.48	85.01	99.48	91.21	88.11	91.21	105.67	82.95	105.67	102.57	105.67	105.67	100.51	106.71	106.71
Range	63.01	60.95	72.31	64.05	44.42	64.05	55.78	48.55	55.78	74.38	48.55	74.38	60.95	72.31	72.31	57.85	69.21	69.21
Speed limit compliance (%)	84.8%	91.4%	86.6%	83.4%	95.9%	86.6%	83.5%	88.7%	84.9%	83.6%	93.1%	86.2%	83.2%	93.5%	86.0%	80.5%	91.2%	83.9%

Figure 6.6: Hourly summary of vehicle speed from the 1stWA sensor on day 2 (case study #1)

	10:00 - 11:00			11:00 - 12:00			12:00 - 13:00			13:00 - 14:00			14:00 - 15:00			15:00 - 16:00		
Speed_Range	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total
<10	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
10-14	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
15-19	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
20-24	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
25-29	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
30-34	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
35-39	0.0%	0.0%	0.0%	0.3%	0.0%	0.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.7%	0.0%	0.4%
40-44	0.0%	1.3%	0.5%	0.0%	0.6%	0.2%	0.0%	0.5%	0.2%	0.0%	1.3%	0.5%	0.0%	0.5%	0.2%	0.7%	1.2%	0.9%
45-49	0.9%	2.6%	1.6%	0.9%	1.1%	1.0%	0.7%	0.0%	0.4%	4.0%	2.2%	3.2%	1.3%	2.5%	1.7%	2.7%	1.2%	2.2%
50-54	7.3%	13.2%	9.6%	7.1%	13.2%	9.2%	11.1%	12.5%	11.7%	13.0%	17.7%	14.8%	11.9%	12.2%	12.0%	4.5%	11.6%	7.1%
55-59	17.1%	28.9%	21.8%	14.8%	32.8%	20.9%	12.9%	31.0%	20.1%	15.0%	32.3%	21.8%	17.5%	25.9%	20.7%	16.8%	30.8%	22.0%
60-64	27.4%	30.3%	28.5%	32.0%	37.9%	34.1%	24.0%	33.7%	27.9%	28.0%	32.8%	29.9%	27.8%	35.5%	30.8%	25.8%	34.3%	28.9%
65-69	17.9%	13.8%	16.3%	20.8%	8.6%	16.6%	21.5%	14.7%	18.8%	17.2%	8.2%	13.7%	18.1%	13.7%	16.4%	21.6%	12.2%	18.1%
70-74	20.9%	6.6%	15.3%	15.7%	5.2%	12.1%	19.7%	5.4%	14.0%	16.4%	2.6%	10.9%	16.3%	5.6%	12.2%	18.2%	5.8%	13.6%
75 and above	8.5%	3.3%	6.5%	8.3%	0.6%	5.7%	10.0%	2.2%	6.9%	6.5%	3.0%	5.1%	7.2%	4.1%	6.0%	8.9%	2.9%	6.7%
Total	234	152	386	337	174	511	279	184	463	354	232	586	320	197	517	291	172	463
85th Percentile	72.40	67.56	71.43	72.40	64.65	70.46	73.37	67.56	72.11	71.43	64.65	70.46	72.40	67.56	71.43	72.40	67.56	71.43
Average	65.24	61.41	63.73	64.84	60.67	63.42	65.44	61.93	64.05	63.62	60.02	62.19	64.32	61.69	63.32	65.46	61.68	64.06
Std Dev	7.11	7.78	7.60	7.12	5.49	6.90	7.52	6.54	7.34	8.00	7.53	8.00	7.80	7.17	7.67	8.71	7.52	8.48
Min	46.23	41.38	41.38	38.47	44.29	38.47	46.23	44.29	44.29	45.26	41.38	41.38	45.26	41.38	41.38	37.50	41.38	37.50
Max	85.97	99.55	99.55	92.76	81.13	92.76	87.91	98.58	98.58	89.85	105.36	105.36	97.61	89.85	97.61	99.55	108.27	108.27
Range	39.75	58.16	58.16	54.29	36.84	54.29	41.68	54.29	54.29	44.59	63.98	63.98	52.35	48.47	56.23	62.04	66.89	70.77
Speed limit compliance (%)	70.5%	90.1%	78.2%	76.0%	94.3%	82.2%	70.3%	92.4%	79.0%	77.1%	94.4%	84.0%	76.6%	90.4%	81.8%	72.9%	91.3%	79.7%

Figure 6.7: Hourly summary of vehicle speed from the 1stWA sensor on day 3 (case study #1)

6.1.2 Case Study #2: I-205 Abernethy Bridge - SE 82nd Drive

In this case study, a total of three days of data were collected. The data that were collected from 23:30 until 03:30 the next morning on each night of testing were included in the analyses.

6.1.2.1 Traffic Volume

Figure 6.8 presents the number of vehicles recorded by the first three sensors placed in the active work area over a total of four hours each day on the three days of testing. It can be observed from the figure on top that the total traffic volumes varied from day to day. Day 3 appears to be the day with the most passing vehicles in this case study project. The segment of I-205 examined in this case study is near Oregon City, which has many freeway entrances and exits to connect dense neighborhoods. The numbers of passing vehicles recorded by different sensors in the active work area on the same day would be different if there were a freeway on-ramp or off-ramp present. For example, there is a freeway exit between the locations of the 2ndWA and the 3rdWA sensors on Day 1, and the presence of the exit contributed to the reductions in the recorded numbers of passenger cars and trucks by the two sensors. When comparing the truck percentage, the 1stWA sensor on Day 1 recorded the most trucks (30% of the passing vehicles were trucks).

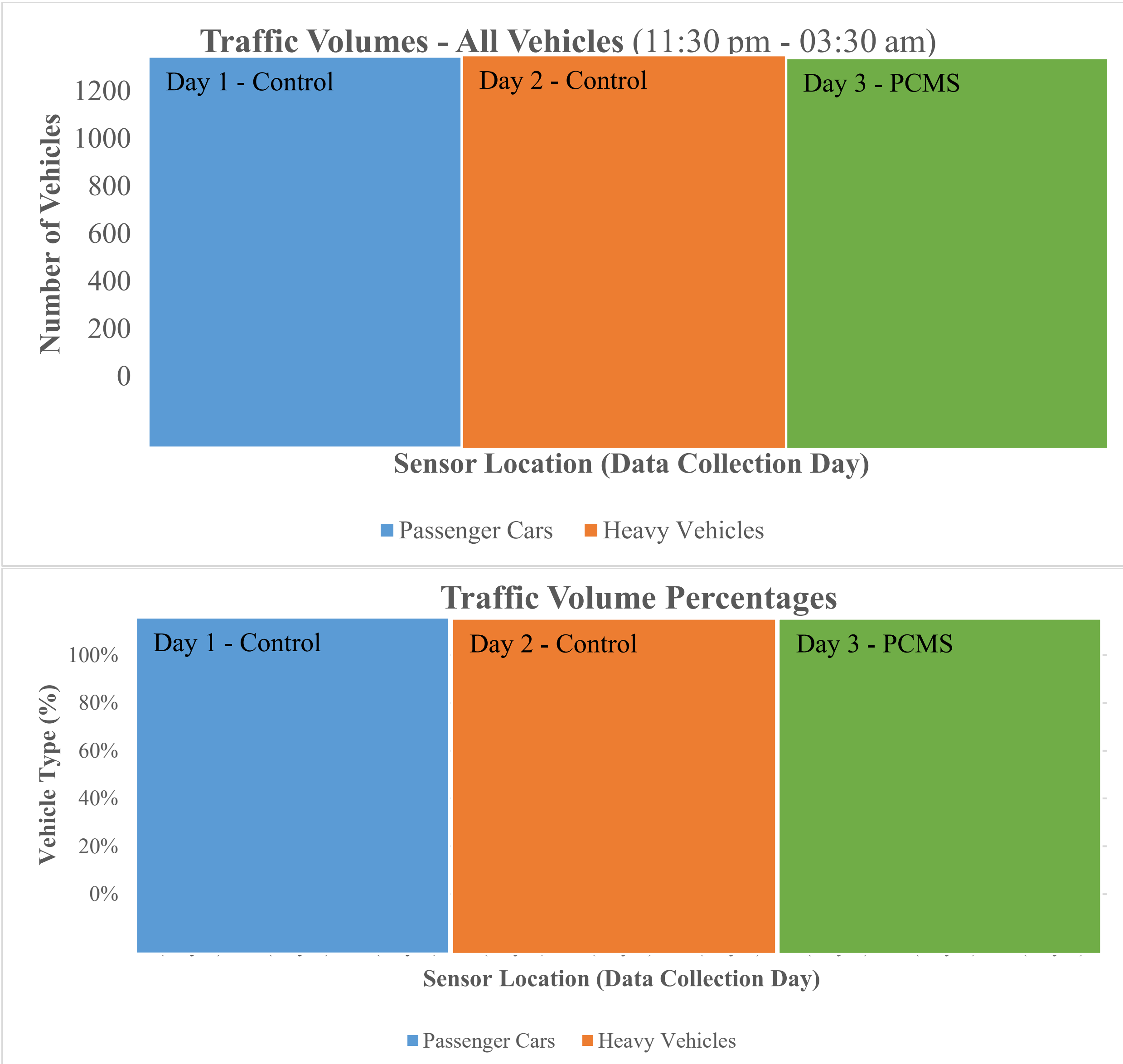


Figure 6.8: Traffic volumes at selected sensor locations in active work area, total and by vehicle type (case study #2)

To understand the hourly traffic pattern at this segment of I-205, hourly traffic volumes recorded by the 1stWA and 2ndWA sensors were plotted as shown in Figure 6.9. Though the number of vehicles recorded during each hour varied from day to day, the traffic volume pattern over time is similar. The highest number always occurred in the 1st hour on the night of testing (23:30 - 00:30). The number of vehicles continued to drop in the next two hours, and then increases in the last hour of recording (02:30 - 03:30).

Figure 6.10 provides a detailed breakdown of the number of passing vehicles by vehicle type recorded by the 1stWA sensor on Day 1. During the first hour of recording (23:30 – 00:30), 207 passenger cars and 69 trucks were recorded. In the second and third hours, the number of trucks dropped to 61 and 45, respectively. Compared to trucks, the reductions in the numbers of passing passenger cars are more obvious in the two-hour window. The number of passenger cars and trucks both increased during the last hour (02:30 – 03:30).

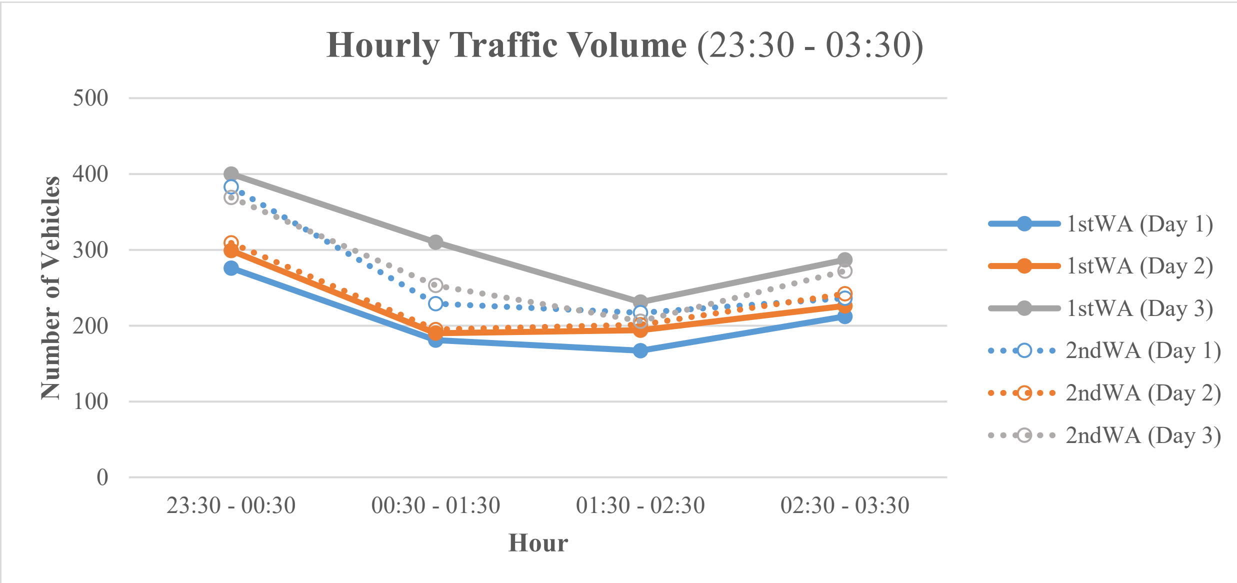


Figure 6.9: Hourly traffic volumes at 1stWA and 2ndWA sensor locations (case study #2)

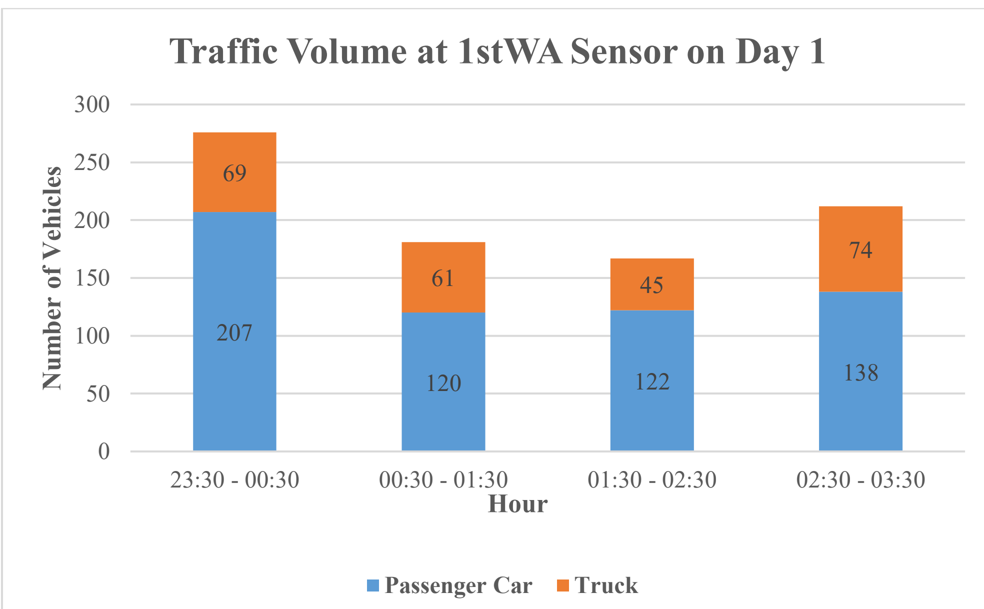


Figure 6.10: Hourly traffic volumes at 1stWA sensor on day 1, total and by vehicle type (case study #2)

As shown in Table 6.2, the ranges between the minimum and the maximum truck percentages recorded by the 1stWA sensors are different on all three data collection days (between 25% and 35% on Day 1, between 18% and 32% on Day 2, and between 15%

and 21% on Day 3). The data from Day 3 show the least truck percentage (15%) compared to the other two days. The periods when the minimum truck percentage occurred on all three days are identical (23:30 – 00:30). The maximum truck percentages occurred later in the nights (02:30 – 03:30 on Days 1 and 3, 01:30 - 02:30 on Day 2).

Table 6.2: Change in the Truck Percentage recorded by the 1stWA Sensor on Different Testing Days (Case Study #2)

	Truck Percentage		Related Time	
	Min	**Max**	**Min**	**Max**
Day 1	25%	35%	23:30 – 00:30	02:30 – 03:30
Day 2	18%	32%	23:30 – 00:30	01:30 – 02:30
Day 3	15%	21%	23:30 – 00:30	02:30 – 03:30

6.1.2.2 Vehicle Speed

The overall 85th percentile speeds at different sensor locations on the three days of testing are plotted in Figure 6.11. It should be noted that no sensor was put in place at the beginning of the taper location (represented by the BoT sensor) and in the middle of the advance warning area (represented by the AdWarn sensor) on Days 1 and 2. The speeds at these two locations on Days 1 and 2 were estimated based on the speeds from the nearby sensors.

The 85th percentile speed pattern in the advance warning area and the transition area is similar for the three days. Drivers tended to slow their vehicles after they entered the work zone. There are some variations in the speeds observed in the active work area. The data from Day 1 could be considered as a normal speed pattern in the active work area, as drivers tend to decrease their speeds in the active work area when they are close to construction equipment. It should be noted that the 1stWA sensor was typically placed at or near the start of paving for the night. Construction equipment (e.g., pavers, grinders, etc.) were typically staged in preparation for paving operations at the beginning of the work shift. The construction equipment often remained at the first two sensor locations for a longer period of time. It can be found that the 85th percentile speeds on Day 1 at these two locations were below the posted speed limit (55 mph) (represented by the dotted line in the figure). When they traveled farther from the construction equipment in the work zone, they would pick up their speeds.

A similar pattern could be observed from the data on Day 2. However, the falls and rises in the 85th percentile speeds between sensors placed in the active work area were relatively small (±2.3 mph on average) on Day 2 compared to Day 1 (±5.58 mph on average). On Day 3, none of the 85th percentile speeds recorded by the sensors placed in the active work area were below the posted speed limit. There are some variations in the 85th percentile speed. Following the 85th percentile speed (61.90 mph) at the EoT sensor location, the 85th percentile speed increased to 64.89 mph at the 1stWA sensor location, dropped to 59.82 mph at the 2ndWA location, rose to 66.89 mph at the 3rdWA location, and then fell to 55 mph at the 4thWA sensor location.

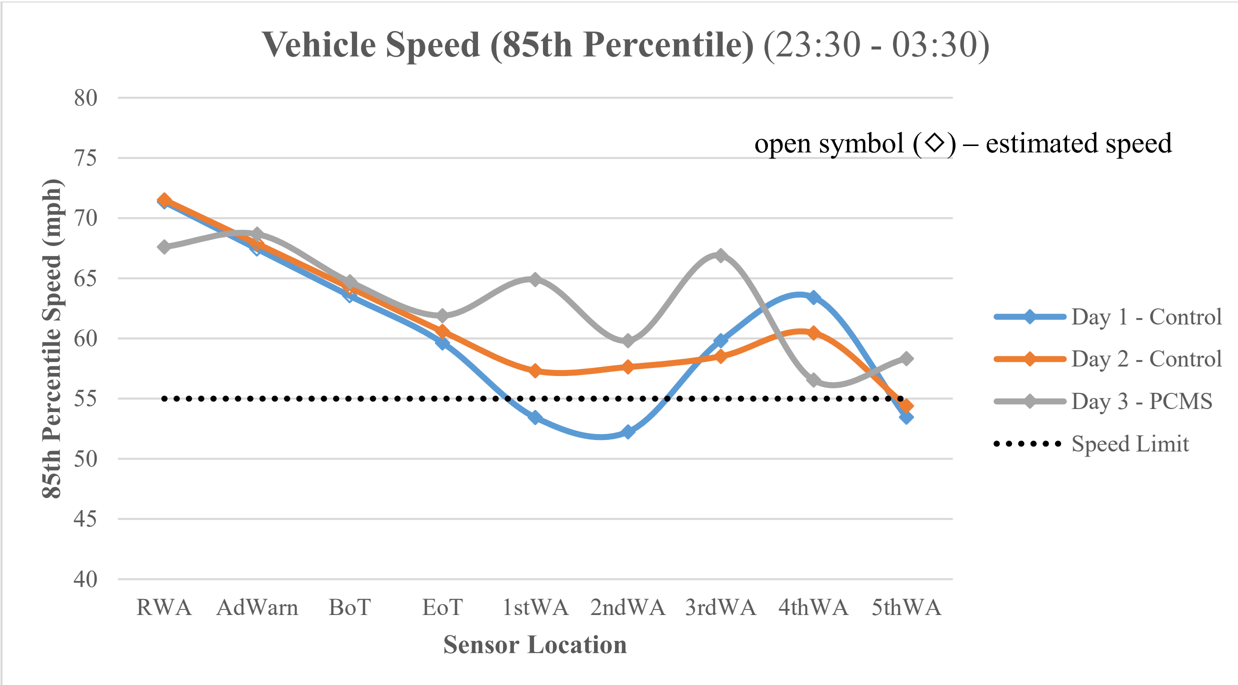


Figure 6.11: 85th percentile speed at different sensor locations (case study #2)

Examining the 85th percentile speed in detail, Figure 6.12 shows how the 85th percentile speed changed over the 4-hour window at the 1stWA and the 2ndWA sensor locations on the three days. It can be seen that typically, the 85th percentile speed is at its lowest point during the first hour of recording (23:30 – 00:30), it continued to rise in the following two hours, and then dropped during the last hour of recording (02:30 – 00:30). Also, in terms of different days, Day 3 was the day that showed the highest 85th percentile speeds in all hours, while Day 1 had the lowest 85th percentile speeds. The rises and falls shown on Day 3 are more dramatic than those on Days 1 and 2. Only the 85th percentile speeds computed from the two sensors on Day 1 are below the posted speed limit at all times. Furthermore, for most of the hours of testing, the 85th percentile speeds at the 1stWA sensor location were higher than those at the 2ndWA sensor location, except for a few hours on Day 2.

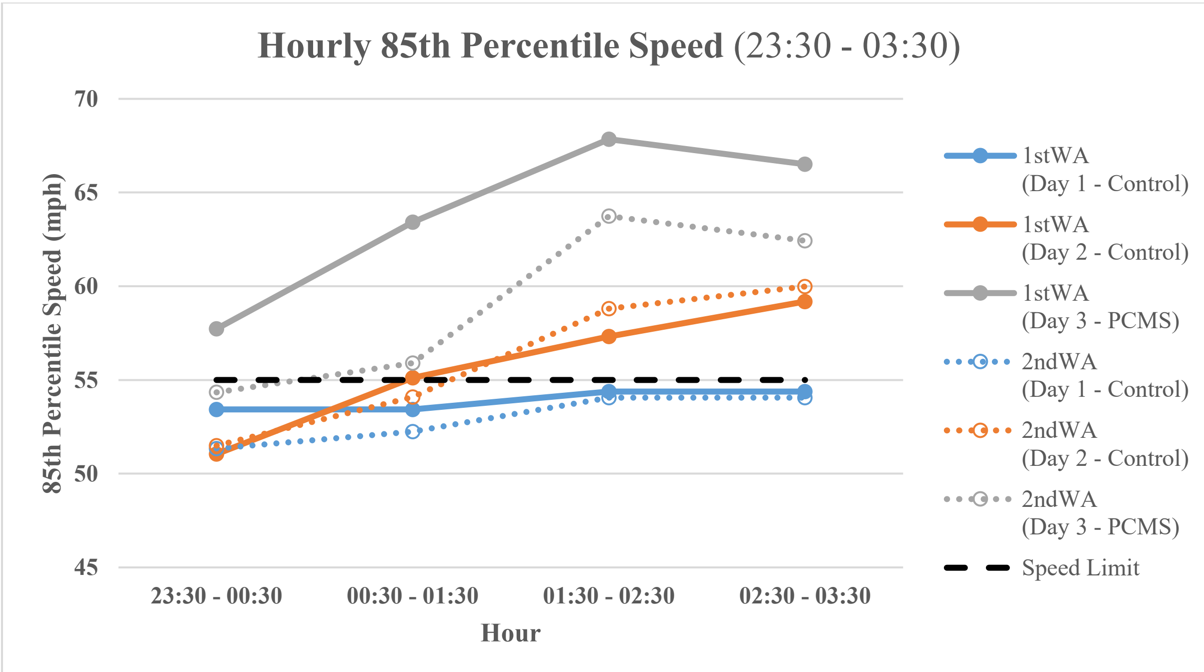


Figure 6.12: Hourly 85th percentile speed at the 1stWA and 2ndWA sensor locations (case study #2)

Figure 6.13, Figure 6.14, and Figure 6.15 show detailed summary data that were collected from the 1stWA sensors on all the data collection days. The speed distributions on Days 1 and 2 (two control nights) are quite similar, with the majority of the passenger cars traveling at speeds between 40 mph and 54 mph. However, the speeds on Day 2 are slightly higher than those on Day 1. On Day 1, the average speed ranged from 44.23 mph (contributed by passenger cars passing between 00:30 and 01:30) to 47.99 mph (contributed by trucks passing between 01:30 and 02:30), while on Day 2, the average speed ranged from 36.46 mph (contributed by trucks passing between 23:30 and 00:30) to 52.56 mph (contributed by passenger cars passing between 02:30 and 03:30). It should be noted that, on Day 2, more vehicles traveled faster at later hours (01:30 – 02:30 and 02:30 – 03:30) than earlier hours (23:30 – 00:30 and 00:30 – 01:30). The pattern is more prominent in the data collected on Day 3. On the contrary, no similar pattern was found on Day 1.

Compared to Days 1 and 2, the speeds are much higher on Day 3, with the average speed ranging from 42.07 mph (contributed by trucks passing between 23:30 and 00:30) to 57.54 mph (contributed by passenger cars passing between 02:30 and 03:30). With the same posted speed limit (55 mph), the speed compliance rates on Day 3 are much lower than on Days 1 and 2. In addition, the 1-hr standard deviation on Day 1 varies from 7.91 mph to 11.57 mph. Day 2 is similar to Day 1, with a minimum SD of 7.97 mph and a maximum SD of 11.52 mph. The 1-hr standard deviation on Day 3 ranged from 10.88 mph to 16.07 mph, which is much higher than those on Days 1 and 2. More drivers traveling at low-speeds (speeds lower than 24 mph) and high-speeds (speeds over 70 mph) on Day 3 is likely the reason why the higher standard deviation is found on Day 3.

	23:30 - 00:30			00:30 - 01:30			01:30 - 02:30			02:30 - 03:30		
Speed_Range	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total
<10	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
10-14	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
15-19	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
20-24	0.0%	1.4%	0.4%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
25-29	3.9%	2.9%	3.6%	1.7%	1.6%	1.7%	1.6%	0.0%	1.2%	2.9%	0.0%	1.9%
30-34	8.2%	11.6%	9.1%	7.5%	9.8%	8.3%	0.8%	6.7%	2.4%	8.7%	8.1%	8.5%
35-39	15.9%	14.5%	15.6%	21.7%	14.8%	19.3%	7.4%	15.6%	9.6%	7.2%	16.2%	10.4%
40-44	26.1%	26.1%	26.1%	31.7%	23.0%	28.7%	31.1%	20.0%	28.1%	31.9%	23.0%	28.8%
45-49	20.3%	18.8%	19.9%	12.5%	18.0%	14.4%	25.4%	22.2%	24.6%	21.7%	31.1%	25.0%
50-54	16.4%	10.1%	14.9%	15.0%	16.4%	15.5%	20.5%	17.8%	19.8%	13.8%	8.1%	11.8%
55-59	5.8%	2.9%	5.1%	7.5%	6.6%	7.2%	4.1%	8.9%	5.4%	8.0%	5.4%	7.1%
60-64	2.9%	2.9%	2.9%	0.8%	3.3%	1.7%	4.9%	2.2%	4.2%	2.2%	1.4%	1.9%
65-69	0.5%	2.9%	1.1%	1.7%	4.9%	2.8%	1.6%	2.2%	1.8%	1.4%	2.7%	1.9%
70-74	0.0%	2.9%	0.7%	0.0%	0.0%	0.0%	0.8%	2.2%	1.2%	1.4%	2.7%	1.9%
75 and above	0.0%	2.9%	0.7%	0.0%	1.6%	0.6%	1.6%	2.2%	1.8%	0.7%	1.4%	0.9%
Total	207	69	276	120	61	181	122	45	167	138	74	212
85th Percentile	53.43	54.00	53.43	53.43	55.34	53.43	54.24	55.34	54.38	54.38	54.38	54.38
Average	44.69	45.74	44.95	44.23	46.75	45.08	47.80	47.99	47.85	46.05	46.17	46.09
Std Dev	8.10	11.57	9.08	7.91	11.29	9.23	8.46	10.41	8.99	9.07	10.55	9.59
Min	26.77	22.96	22.96	28.67	29.62	28.67	25.81	30.58	25.81	25.81	30.58	25.81
Max	66.76	82.00	82.00	68.67	98.19	98.19	79.14	84.86	84.86	77.24	95.33	95.33
Range	40.00	59.04	59.04	40.00	68.57	69.52	53.33	54.28	59.04	51.42	64.76	69.52
Speed Limit Compliance (%)	90.8%	85.5%	89.5%	90.0%	83.6%	87.8%	86.9%	82.2%	85.6%	86.2%	86.5%	86.3%

Figure 6.13: Hourly summary of vehicle speed from the 1stWA sensor on day 1 (case study #2)

	23:30 - 00:30			00:30 - 01:30			01:30 - 02:30			02:30 - 03:30		
Speed_Range	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total
<10	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
10-14	0.4%	1.9%	0.7%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
15-19	2.4%	9.3%	3.7%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
20-24	2.0%	3.7%	2.3%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
25-29	8.6%	7.4%	8.4%	0.7%	2.3%	1.1%	0.8%	0.0%	0.5%	0.0%	0.0%	0.0%
30-34	11.0%	24.1%	13.4%	11.6%	13.6%	12.1%	6.1%	17.7%	9.8%	1.2%	0.0%	0.9%
35-39	17.1%	22.2%	18.1%	16.4%	22.7%	17.9%	12.1%	14.5%	12.9%	3.7%	6.3%	4.4%
40-44	20.0%	7.4%	17.7%	20.5%	27.3%	22.1%	9.8%	14.5%	11.3%	10.4%	15.9%	11.9%
45-49	20.4%	11.1%	18.7%	20.5%	22.7%	21.1%	23.5%	25.8%	24.2%	26.4%	22.2%	25.2%
50-54	9.4%	7.4%	9.0%	13.0%	2.3%	10.5%	23.5%	17.7%	21.6%	22.1%	27.0%	23.5%
55-59	3.3%	1.9%	3.0%	8.2%	4.5%	7.4%	13.6%	1.6%	9.8%	20.9%	15.9%	19.5%
60-64	2.9%	3.7%	3.0%	5.5%	0.0%	4.2%	8.3%	3.2%	6.7%	9.8%	7.9%	9.3%
65-69	1.2%	0.0%	1.0%	2.7%	0.0%	2.1%	1.5%	0.0%	1.0%	3.1%	0.0%	2.2%
70-74	0.4%	0.0%	0.3%	0.7%	0.0%	0.5%	0.0%	1.6%	0.5%	1.8%	3.2%	2.2%
75 and above	0.8%	0.0%	0.7%	0.0%	4.5%	1.1%	0.8%	3.2%	1.5%	0.6%	1.6%	0.9%
Total	245	54	299	146	44	190	132	62	194	163	63	226
85th Percentile	51.70	48.01	51.05	55.68	49.83	55.12	58.58	52.50	57.32	59.84	59.19	59.19
Average	41.83	36.46	40.86	46.10	43.50	45.49	49.09	45.80	48.04	52.56	51.50	52.26
Std Dev	10.73	11.30	11.01	9.13	10.74	9.56	9.10	11.52	10.02	7.97	8.87	8.22
Min	14.29	10.55	10.55	29.25	29.25	29.25	28.32	30.19	28.32	33.00	35.80	33.00
Max	87.25	61.06	87.25	71.35	85.38	85.38	80.70	94.73	94.73	88.18	86.31	88.18
Range	72.96	50.51	76.70	42.09	56.12	56.12	52.38	64.54	66.41	55.19	50.51	55.19
Speed Limit Compliance (%)	91%	94%	92%	83%	91%	85%	76%	90%	80%	64%	71%	66%

Figure 6.14: Hourly summary of vehicle speed from the 1stWA sensor on day 2 (case study #2)

	23:30 - 00:30			00:30 - 01:30			01:30 - 02:30			02:30 - 03:30		
Speed_Range	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total
<10	2.4%	1.6%	2.3%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
10-14	3.5%	1.6%	3.3%	0.4%	0.0%	0.3%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
15-19	3.5%	1.6%	3.3%	0.4%	0.0%	0.3%	0.5%	0.0%	0.4%	0.0%	1.7%	0.3%
20-24	2.1%	6.6%	2.8%	2.0%	1.7%	1.9%	0.5%	0.0%	0.4%	0.0%	0.0%	0.0%
25-29	5.0%	4.9%	5.0%	2.4%	3.4%	2.6%	0.0%	0.0%	0.0%	0.9%	1.7%	1.0%
30-34	5.0%	6.6%	5.3%	4.8%	5.2%	4.8%	0.5%	4.3%	1.3%	1.8%	0.0%	1.4%
35-39	11.8%	19.7%	13.0%	7.1%	20.7%	9.7%	2.7%	10.6%	4.3%	4.4%	6.8%	4.9%
40-44	12.4%	19.7%	13.5%	14.7%	17.2%	15.2%	3.8%	8.5%	4.8%	4.8%	18.6%	7.7%
45-49	11.2%	14.8%	11.8%	15.9%	10.3%	14.8%	14.7%	12.8%	14.3%	9.2%	11.9%	9.8%
50-54	19.8%	13.1%	18.8%	20.6%	12.1%	19.0%	17.9%	12.8%	16.9%	22.4%	22.0%	22.3%
55-59	9.7%	4.9%	9.0%	11.9%	6.9%	11.0%	20.1%	14.9%	19.0%	13.6%	11.9%	13.2%
60-64	3.5%	0.0%	3.0%	9.9%	10.3%	10.0%	20.7%	10.6%	18.6%	22.4%	13.6%	20.6%
65-69	4.4%	3.3%	4.3%	4.4%	1.7%	3.9%	8.2%	8.5%	8.2%	8.3%	3.4%	7.3%
70-74	2.4%	0.0%	2.0%	2.0%	0.0%	1.6%	4.3%	4.3%	4.3%	6.1%	0.0%	4.9%
75 and above	3.2%	1.6%	3.0%	3.6%	10.3%	4.8%	6.0%	12.8%	7.4%	6.1%	8.5%	6.6%
Total	339	61	400	252	58	310	184	47	231	228	59	287
85th Percentile	58.98	53.07	57.72	62.45	64.08	63.41	67.85	70.95	67.85	67.85	63.41	66.52
Average	45.10	42.07	44.64	50.68	49.66	50.49	57.37	56.91	57.28	57.54	53.57	56.73
Std Dev	16.07	13.29	15.70	12.92	15.12	13.34	10.88	15.93	12.04	10.97	14.42	11.84
Min	2.84	5.79	2.84	10.22	23.52	10.22	16.13	33.86	16.13	27.95	19.09	19.09
Max	94.44	85.58	94.44	104.78	87.05	104.78	94.44	109.22	109.22	94.44	104.78	104.78
Range	91.61	79.79	91.61	94.56	63.53	94.56	78.31	75.35	93.08	66.49	85.70	85.70
Speed Limit Compliance (%)	76.7%	90.2%	78.8%	68.3%	70.7%	68.7%	40.8%	48.9%	42.4%	43.4%	62.7%	47.4%

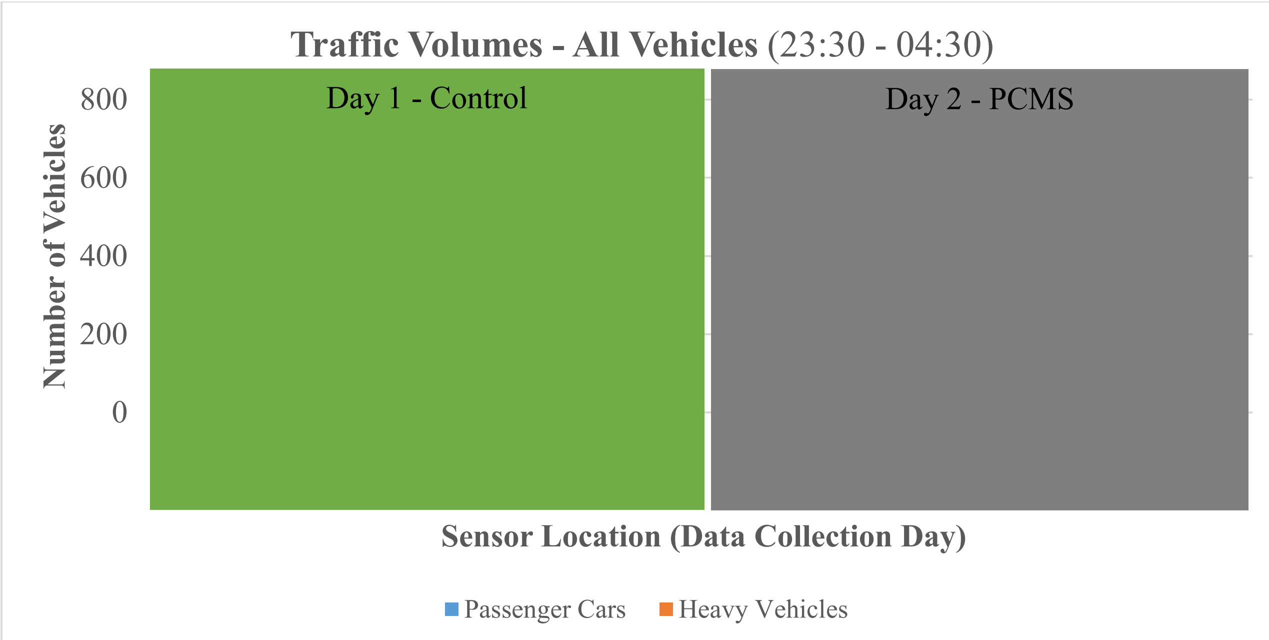
Figure 6.15: Hourly summary of vehicle speed from the 1stWA sensor on day 3 (case study #2)

6.1.3 Case Study #3: I-5 Sutherlin - Garden Valley Blvd.

As indicated in Table 5.6, Case Study #3 was separated based on the direction of travel on the days of data collection (Case Study #3A for northbound direction, and Case Study #3B for southbound direction). In the following subsections, the results from the northbound direction (Case Study #3A) are presented first, followed by those from the southbound direction (Case Study #3B).

6.1.3.1 Traffic Volume (Case Study #3A)

Figure 6.16 (top) shows the number of vehicles passing for Case Study #3A, from 23:30 to 04:30 the following day on the two days of testing in the northbound direction. The figure contains the data recorded by the four sensors placed in the active work area. There are some differences in the number of passing vehicles recorded by different sensors and different days. Apparently, on Day 2, a higher number of vehicles was recorded than on Day 1, especially for the number of passenger cars (vehicles < 25 feet in length).



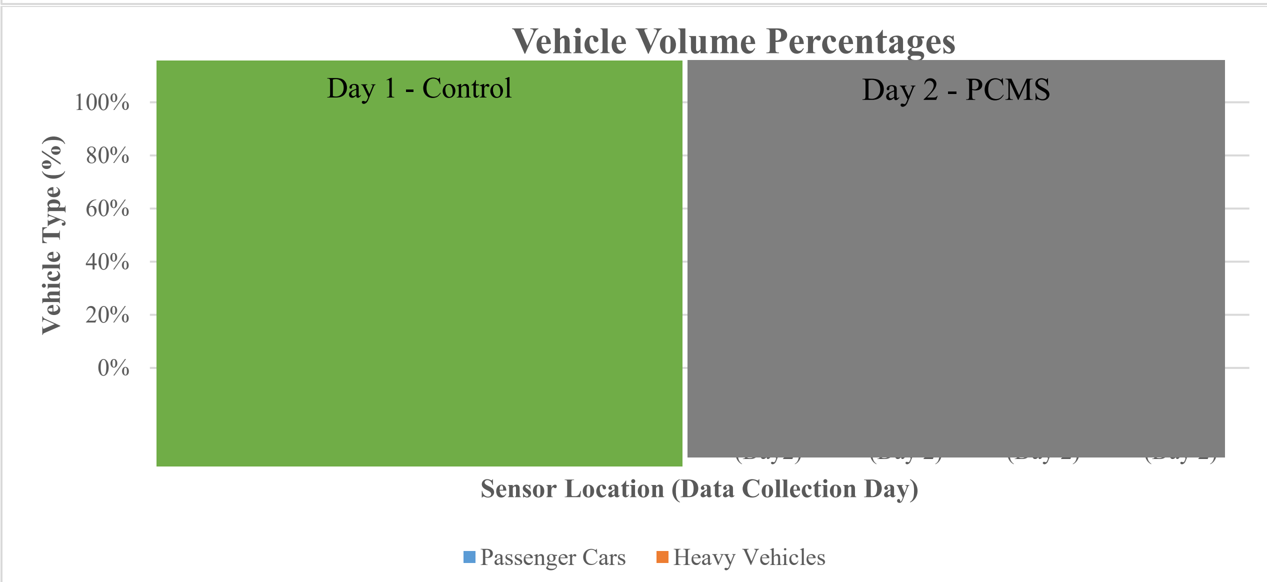


Figure 6.16: Traffic volumes at different sensor locations in active work area, total and by vehicle type (case study #3A)

As an example, for the 3rdWA sensor on Day 2, Figure 6.17 shows how the number of passing vehicles changed in the work zone throughout one night of testing. During the first hour of data recording (23:30 – 00:30), the total number of vehicles was 233, which included 154 passenger cars and 79 trucks. The total number of passenger cars and trucks decreased to 148 in the following hour (00:30 – 01:30). The lowest number of vehicles (147) occurred from 01:30 to 02:30. At 02:30, the number of vehicles started to increase. During the last hour of data recording (03:30 – 04:30), the total number of vehicles was approximately the same as that from 23:30 – 00:30 at the start of data recording.

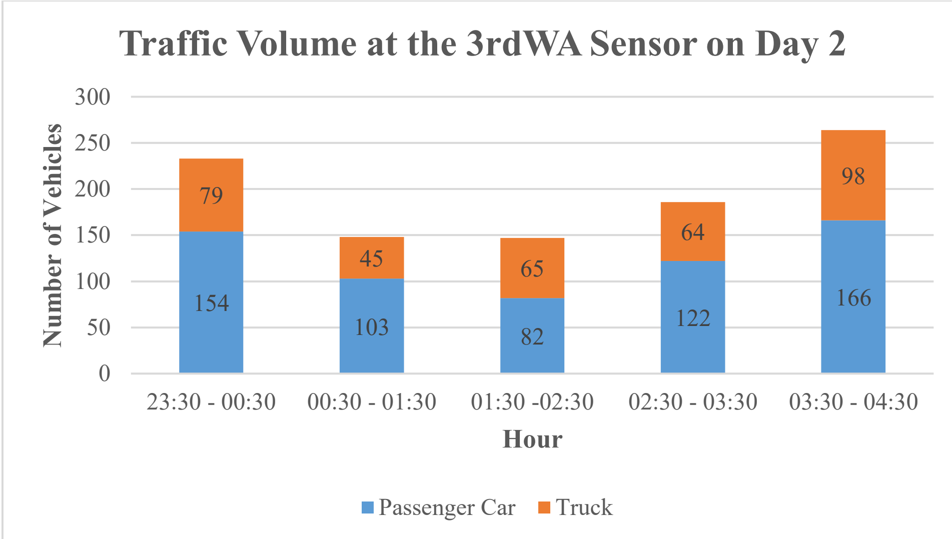


Figure 6.17: Hourly traffic volume at the 3rdWA sensor on day 2, total and by vehicle type (case study #3A)

As observed in Figure 6.16 (bottom), the total truck percentage varied from 36% (recorded by the 3rdWA sensor on Day 2) to 59% (recorded by the 3rdWA sensor on Day 1). Table 6.3 presents the minimum and maximum percentage of trucks and the related time to show the changes in truck percentage on each day. The truck percentage was at its lowest (30%) between 00:30 to 01:30 on Day 2. The highest truck percentage on both days occurred from 02:30 to 03:30, as the number of passenger cars was relatively low during that time period.

Table 6.3: Change in the Truck Percentage recorded by the 3rdWA Sensor on Different Testing Days (Case Study #3A)

	Truck Percentage		Related Time	
	Min	**Max**	**Min**	**Max**
Day 1	52%	65%	23:30 – 00:30	02:30 – 03:30
Day 2	30%	44%	00:30 – 01:30	02:30 – 03:30

Figure 6.16 (top) also shows that there are some variations in the number of vehicles recorded by the different sensors placed in the active work area. As shown in Figure 6.18, there is only one freeway entrance near the EoT location on Day 1, no other open on-ramp or off-ramp was located within the active work area. The total number of vehicles recorded by the different sensors in the work zone should be the same for each sensor on Day 1. Similarly, on Day 2, there was only one freeway exit (Exit 127) that was upstream of the last work area sensor placed that night (4thWA) (Figure 6.19). The total number of vehicles recorded by each of the first three sensors (1stWA, 2ndWA, and 3rdWA) should be the same too. Reasons why the variations in the number of vehicles recorded by the sensors are similar to what was explained in Section 6.1.1.1.

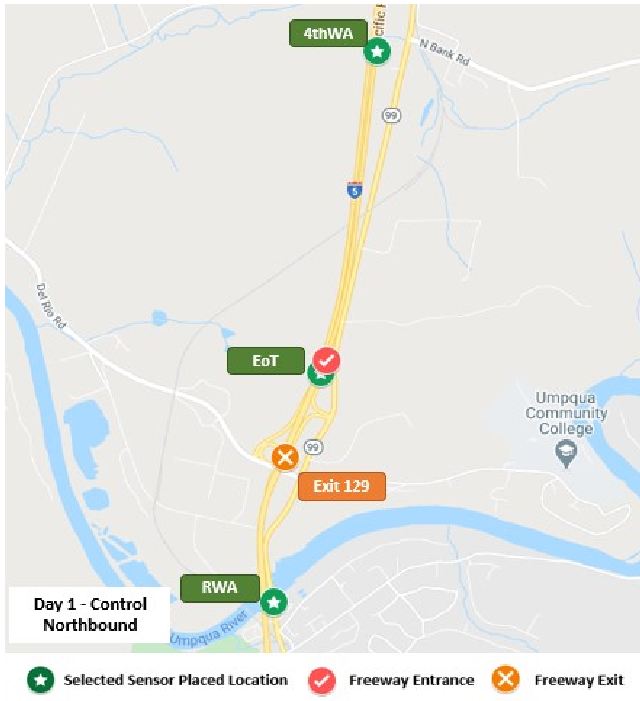


Figure 6.18: Locations of selected sensors and freeway entrances/exits on day 1 (case study #3A)

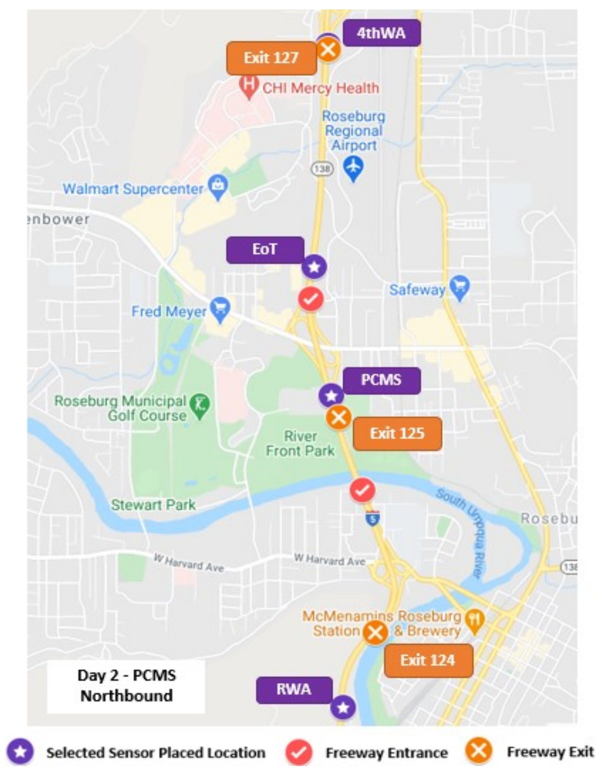


Figure 6.19: Locations of selected sensors and freeway entrances/exits on day 2 (case study #3A)

6.1.3.2 Vehicle Speed (Case Study #3A)

Figure 6.20 shows the 85th percentile speed at the different sensor locations to illustrate the overall speed trend for vehicles traveling through the work zone. It is worth mentioning that no sensor was placed at the PCMS and BoT locations on Day 1; estimated speeds (shown as open symbols) were used to plot speeds at these locations in the figure. In addition, the speed limits were different on Days 1 and 2. On Day 1, the posted regulatory speed limit prior to the work zone was 65 mph, which was reduced to 50 mph in the work zone. No speed reduction was implemented on Day 2, and the speed regulatory limit was 60 mph.

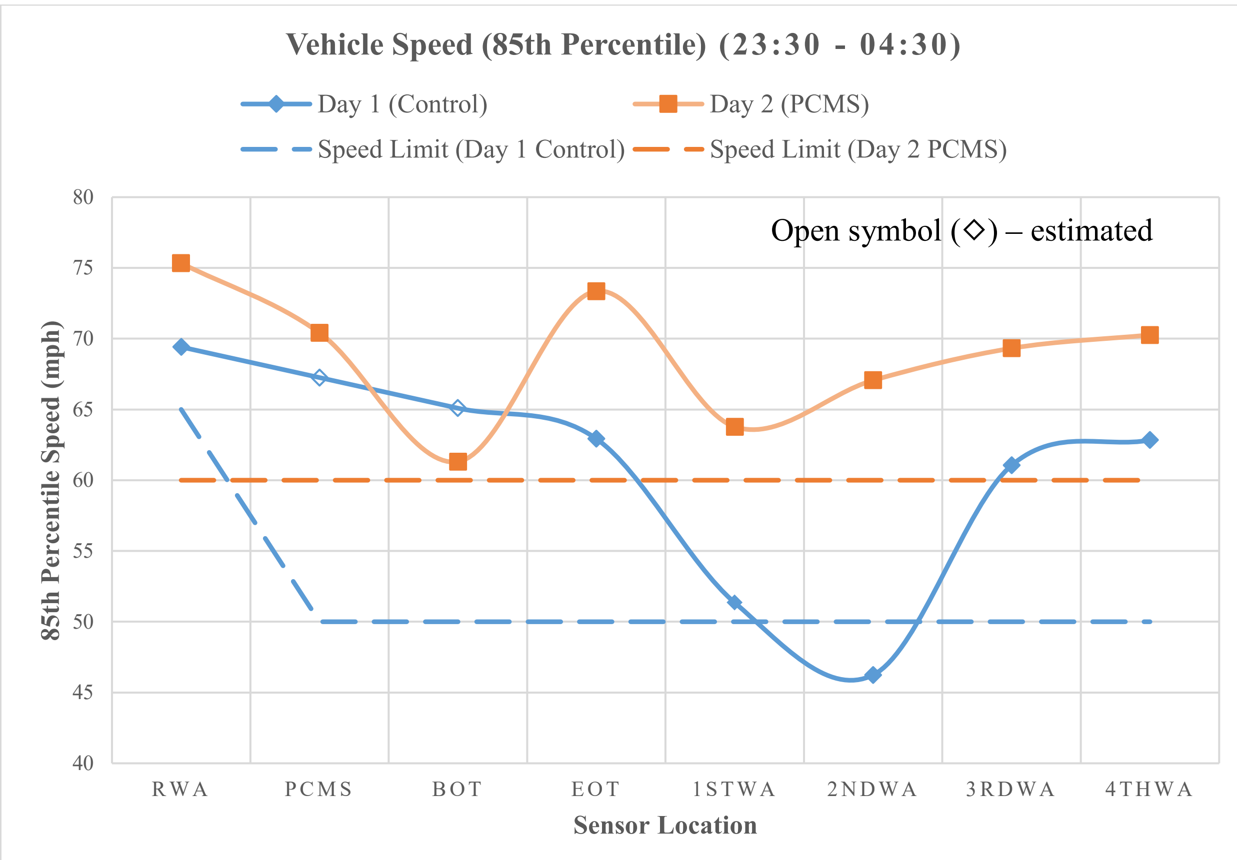


Figure 6.20: 85th percentile speed at different sensor locations on days 1 and 2 (case study #3A)

The speed trend is similar on both days at the advance warning area: after the RWA signs, drivers typically reduced their speeds. After passing through the 1stWA (on Day 2) or 2ndWA (on Day 1) sensor location, the drivers tend to gradually increase their speeds. As seen in the figure, in general, vehicle speeds in the active work area are higher than the posted speed limit (represented by the dashed line), except for the lowest 85th percentile speed of the passing vehicle recorded by the 2ndWA sensor on Day 1 (control) (46.24 mph) which was below the posted speed limit. The highest 85th percentile speed of the passing vehicles after the advance warning area was 73.36 mph. This speed, which was more than 10 mph above the posted speed limit, was recorded by the EoT sensor on Day 2 (PCMS). One possible reason for the higher speed is that, as shown in Figure 6.13, a freeway entrance is upstream to the EoT location on Day 2, and drivers may have traveled faster because they did not notice the posted speed limit and the presence of the work zone ahead.

On both days, the reductions in speeds between the EoT sensor location and the 1stWA sensor were quite similar (11.58 mph on Day 1 and 9.59 mph on Day 2). The differences in speed reduction between Day 1 and Day 2 may be a result of the different construction operations performed on these two days. Paving operations, which were performed on Day 1, require large equipment (e.g., paver, roller, and grinder) and drivers tend to drive slowly when they are close to large equipment. Barrier removal and replacement, which were performed on Day 2, typically do not require a large fleet of equipment compared to paving operations.

It is worth mentioning that the increases in speeds in the active work area on Day 2 (PCMS) occurred more gradually than those on Day 1 (control). The 85th percentile speed increase between the 2ndWA and the 4thWA sensor location on Day 2 was 3.2 mph, and that on Day 1 was 16.59 mph, which may suggest that the presence of the PCMS unit helps in calming vehicle speeds when drivers started to gain speeds in the active work area.

Figure 6.21 shows the change in the 85th percentile speed over the course of the work shift as recorded by the 1stWA and the 2ndWA sensors on Day 1 and Day 2. With regard to Day 1 (control), the 1stWA sensor shows a clear trend of reduction in speeds in the work zone from 23:00 to 02:30, and the same pattern could be observed for the 2ndWA sensor on the same day from 01:30 to 04:30. The progress of the paving activities may contribute to the speed reduction patterns in these two sensor locations as the staging of the equipment moved. The 85th percentile speeds recorded by the 2ndWA sensor were below the posted speed limit over the entire testing period, while those recorded by the 1stWA sensor were slightly above the posted speed limit, except for the time period between 01:30 and 02:30. On Day 2, the speed patterns recorded by the 1stWA and the 2ndWA sensors were quite similar with a slightly higher speed recorded by the 2ndWA sensor. In general, the 85th percentile speeds recorded on Day 2 were above the posted speed limit.

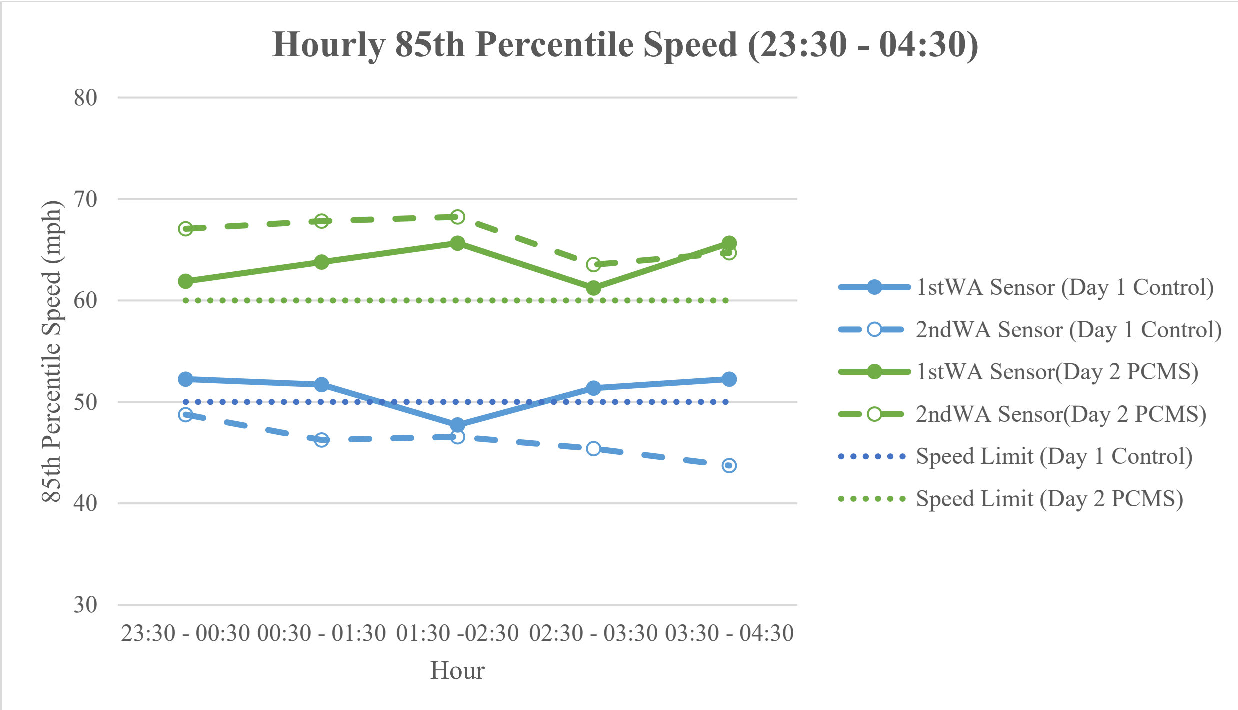


Figure 6.21: Hourly vehicle speed (85th percentile) at 1stWA and 2ndWA sensors on days 1 and 2 (case study #3A)

Figure 6.22 and Figure 6.23 present the hourly summary statistics of vehicle speeds recorded by the 1stWA sensor on Day 1 and Day 2, respectively. On Day 1 (control), the average speed varies from 37.59 mph for all heavy vehicles traveling from 01:30 – 02:30 to 45.11 mph for all heavy vehicles traveling from 23:30 – 00:30. The posted speed limit in the work zone was 50 mph, and the average speeds were below the posted speed limit at all the examined hours. The maximum 1-hr standard deviation was 10.81 mph, and the minimum was 6.77 mph. The maximum 85th percentile speed (52.38 mph) is 2.38 mph above the posted speed limit. There is no obvious change in the distributions of the speeds, except for some vehicles that traveled relatively slowly (< 24 mph) between 01:30 and 02:30.

	23:30 - 00:30			00:30 - 01:30			01:30 - 02:30			02:30 - 03:30			03:30 - 04:30		
Speed_Range	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total
<10	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
10-14	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.2%	0.6%	0.7%	0.0%	0.4%
15-19	0.0%	0.0%	0.0%	1.7%	0.0%	1.0%	0.0%	8.8%	4.7%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
20-24	0.0%	0.0%	0.0%	1.7%	2.2%	1.9%	5.1%	2.9%	3.9%	0.0%	1.2%	0.6%	2.1%	2.0%	2.1%
25-29	5.0%	1.4%	3.5%	5.1%	2.2%	3.8%	6.8%	11.8%	9.4%	1.2%	1.2%	1.2%	3.5%	7.9%	5.3%
30-34	11.0%	8.2%	9.8%	11.9%	13.3%	12.5%	8.5%	11.8%	10.2%	7.1%	11.6%	9.4%	7.0%	5.0%	6.2%
35-39	11.0%	19.2%	14.5%	28.8%	24.4%	26.9%	16.9%	19.1%	18.1%	13.1%	18.6%	15.9%	7.7%	10.9%	9.1%
40-44	20.0%	19.2%	19.7%	16.9%	22.2%	19.2%	22.0%	17.6%	19.7%	25.0%	14.0%	19.4%	26.1%	16.8%	22.2%
45-49	33.0%	26.0%	30.1%	11.9%	22.2%	16.3%	33.9%	20.6%	26.8%	33.3%	27.9%	30.6%	29.6%	32.7%	30.9%
50-54	14.0%	15.1%	14.5%	13.6%	11.1%	12.5%	3.4%	7.4%	5.5%	14.3%	20.9%	17.6%	12.0%	16.8%	14.0%
55-59	4.0%	6.8%	5.2%	3.4%	2.2%	2.9%	1.7%	0.0%	0.8%	3.6%	3.5%	3.5%	9.2%	1.0%	5.8%
60-64	2.0%	2.7%	2.3%	5.1%	0.0%	2.9%	1.7%	0.0%	0.8%	2.4%	0.0%	1.2%	1.4%	5.0%	2.9%
65-69	0.0%	1.4%	0.6%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.0%	0.4%
70-74	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
75 and above	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.7%	1.0%	0.8%
Total	100	73	173	60	45	105	59	68	127	84	87	171	142	101	243
85th Percentile	51.34	52.25	52.25	52.38	48.99	51.71	48.63	46.82	47.73	51.34	51.34	51.34	52.25	52.25	52.25
Average	44.20	45.11	44.58	42.43	42.16	42.32	41.52	37.59	39.41	44.71	43.89	44.29	44.85	44.64	44.76
Std Dev	8.12	8.15	8.12	10.81	7.22	9.40	8.18	9.98	9.36	6.77	8.97	7.95	8.82	9.24	8.98
Min	26.02	25.11	25.11	19.68	23.30	19.68	20.59	15.16	15.16	27.82	12.45	12.45	12.45	21.49	12.45
Max	64.91	69.44	69.44	83.00	56.77	83.00	62.20	54.06	62.20	62.20	78.48	78.48	70.34	72.15	72.15
Range	38.90	44.33	44.33	63.32	33.47	63.32	41.61	38.90	47.04	34.37	66.04	66.04	57.89	50.66	59.70
Speed limit compliance (%)	80.0%	74.0%	77.5%	78.0%	86.7%	81.7%	93.2%	92.6%	92.9%	79.8%	75.6%	77.6%	76.8%	75.2%	76.1%

Figure 6.22: Hourly summary of vehicle speed of 1stWA sensor for day 1 (case study #3A)

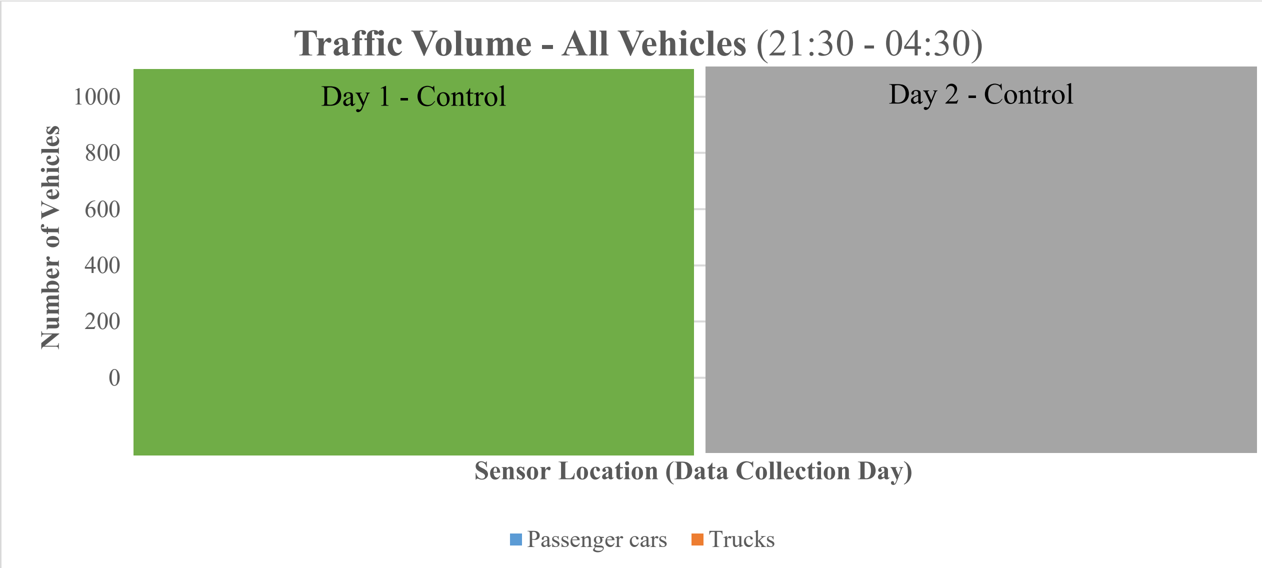
On Day 2 (Figure 6.23), the average speed recorded by the 1stWA sensor ranged from 48.24 mph for all passenger cars traveling from 23:30 - 00:30 to 55.15 mph for all heavy vehicles traveling from 03:30 – 04:30. Similar to Day 1, the average speeds were below the posted speed limit (60 mph) at all hours examined. However, the maximum 85th percentile speed recorded (69.40 mph) was 9.40 mph above the posted speed limit. The 1-hr standard deviation ranged from 10.79 mph to 15.14 mph, which is higher than that on Day 1 (control). It can also be noticed that the distributions of the speeds changed over the course of the data collection period. More vehicles tend to travel with higher speeds in the later hours (between 02:30 and 03:30, and between 03:30 and 04:40).

	23:30 - 00:30			00:30 - 01:30			01:30 - 02:30			02:30 - 03:30			03:30 - 04:30		
Speed_Range	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total
<10	0.8%	0.0%	0.5%	0.0%	0.0%	0.0%	1.6%	0.0%	0.7%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
10-14	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
15-19	1.6%	0.0%	0.9%	1.4%	0.0%	0.8%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
20-24	0.8%	0.0%	0.5%	2.9%	0.0%	1.6%	4.8%	0.0%	2.1%	0.0%	1.0%	0.6%	0.9%	0.0%	0.4%
25-29	2.4%	2.2%	2.3%	1.4%	1.7%	1.6%	0.0%	0.0%	0.0%	2.5%	0.0%	1.1%	0.9%	0.0%	0.4%
30-34	7.9%	1.1%	5.0%	7.1%	1.7%	4.7%	4.8%	0.0%	2.1%	4.9%	1.0%	2.8%	6.1%	2.4%	4.1%
35-39	5.5%	13.2%	8.7%	5.7%	5.1%	5.4%	11.3%	6.4%	8.6%	13.6%	6.1%	9.5%	6.1%	5.5%	5.8%
40-44	15.0%	9.9%	12.8%	10.0%	11.9%	10.9%	17.7%	5.1%	10.7%	21.0%	11.2%	15.6%	11.3%	16.5%	14.0%
45-49	28.3%	18.7%	24.3%	20.0%	23.7%	21.7%	11.3%	32.1%	22.9%	13.6%	28.6%	21.8%	20.0%	17.3%	18.6%
50-54	12.6%	14.3%	13.3%	11.4%	13.6%	12.4%	8.1%	20.5%	15.0%	14.8%	17.3%	16.2%	20.9%	15.7%	18.2%
55-59	11.8%	18.7%	14.7%	5.7%	20.3%	12.4%	19.4%	9.0%	13.6%	12.3%	13.3%	12.8%	9.6%	11.8%	10.7%
60-64	4.7%	7.7%	6.0%	15.7%	13.6%	14.7%	4.8%	11.5%	8.6%	9.9%	10.2%	10.1%	12.2%	11.0%	11.6%
65-69	3.9%	5.5%	4.6%	11.4%	0.0%	6.2%	4.8%	5.1%	5.0%	6.2%	3.1%	4.5%	6.1%	5.5%	5.8%
70-74	0.8%	1.1%	0.9%	4.3%	3.4%	3.9%	4.8%	3.8%	4.3%	0.0%	1.0%	0.6%	2.6%	3.9%	3.3%
75 and above	3.9%	7.7%	5.5%	2.9%	5.1%	3.9%	6.5%	6.4%	6.4%	1.2%	7.1%	4.5%	3.5%	10.2%	7.0%
Total	127	91	218	70	59	129	62	78	140	81	98	179	115	127	242
85th Percentile	59.08	62.84	61.90	66.59	60.30	63.77	66.96	64.62	65.65	60.96	62.84	61.24	63.77	69.40	65.65
Average	48.24	52.99	50.23	51.92	53.27	52.53	50.22	54.65	52.69	49.00	52.68	51.02	51.95	55.15	53.63
Std Dev	12.49	13.26	13.00	14.23	11.91	13.19	15.14	11.80	13.51	10.79	11.11	11.09	11.29	13.70	12.69
Min	7.50	26.26	7.50	19.69	29.07	19.69	3.75	37.51	3.75	26.26	22.51	22.51	24.38	30.01	24.38
Max	85.35	93.79	93.79	96.60	91.91	96.60	88.16	95.66	95.66	79.72	86.28	86.28	81.59	95.66	95.66
Range	77.85	67.53	86.29	76.91	62.84	76.91	84.41	58.15	91.91	53.46	63.78	63.78	57.21	65.65	71.28
Speed limit compliance (%)	86.6%	78.0%	83.0%	65.7%	78.0%	71.3%	79.0%	73.1%	75.7%	82.7%	78.6%	80.4%	75.7%	69.3%	72.3%

Figure 6.23: Hourly summary of vehicle speed of 1stWA sensor for day 2 (case study #3A)

6.1.3.3 Traffic Volume (Case Study #3B)

Figure 6.24 and Figure 6.25 present the number of vehicles recorded by the sensors that were placed in the active work zone on Days 1 and 2, on Days 3, 4, and 5 in the southbound direction, along with the truck percentages at different sensor locations. There are some variations in the number of vehicles on different days, and at different sensor locations. In general, the recorded passing vehicles on Days 1 and 2 are relatively fewer than that recorded on Days 3, 4, and 5.



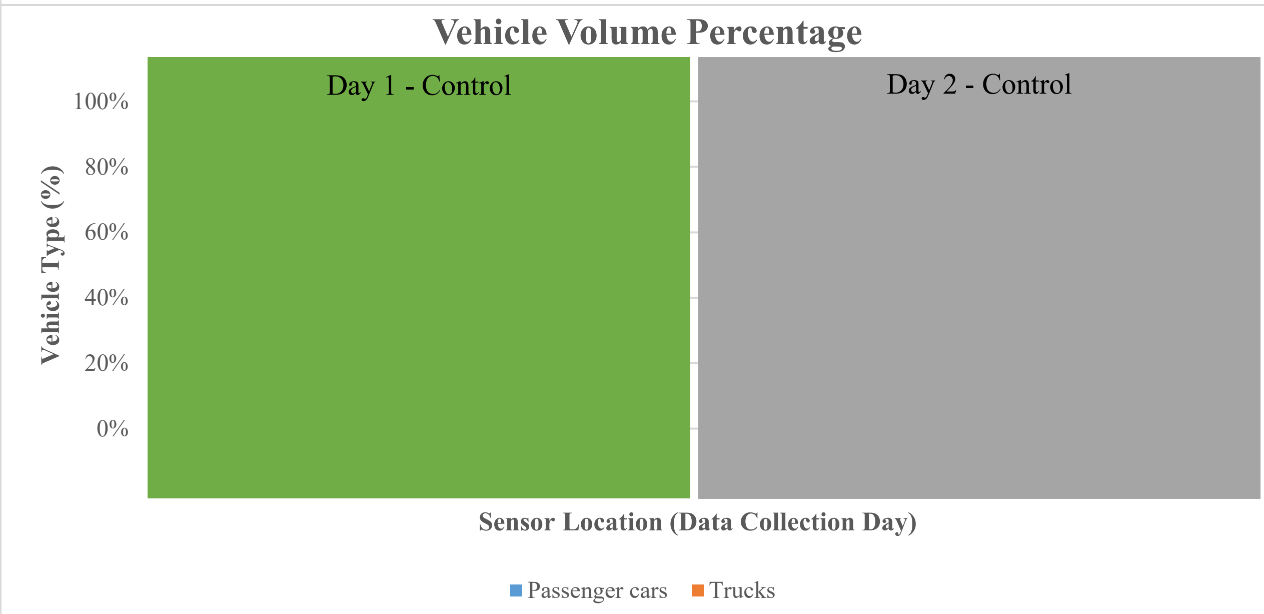


Figure 6.24: Traffic volumes at different sensor locations in active work area, total and by vehicle type on days 1 and 2(case study #3B)

After carefully examining the locations of the sensors placed on each day, it was found that there was no freeway entrance ramp or exit ramp between the 1stWA sensor location and the 4thWA sensor location on Days 3, 4, and 5. On the contrary, there are two exits and one entrance on the freeway section between the 1stWA sensor and the 5thWA sensor on Day 1 (Figure 6.26). The difference in the number of vehicles recorded by the 3rdWA sensor and the 4thWA sensor may be due to the presence of Exit 135. Similarly, on Day 2, the difference in the number of recorded passing vehicles between the 2ndWA and 3rdWA sensors may due to the presence of a freeway entrance (Figure 6.27).

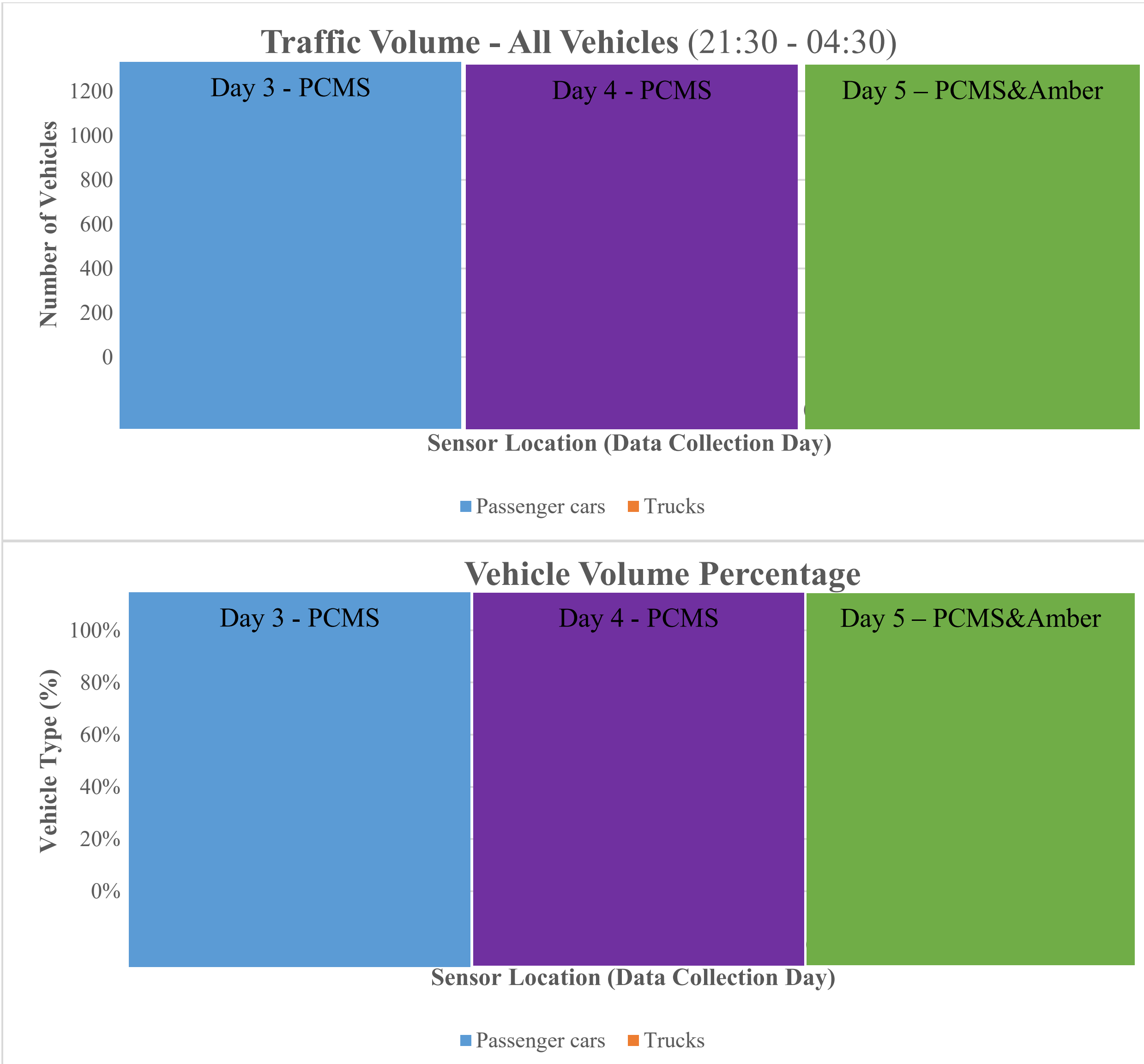


Figure 6.25: Traffic volumes at different sensor locations in active work area, total and by vehicle type on days 3, 4, and 5 (case study #3B)

Figure 6.26: Locations of selected sensors and freeway entrances/exits on day 1 (case study #3B)

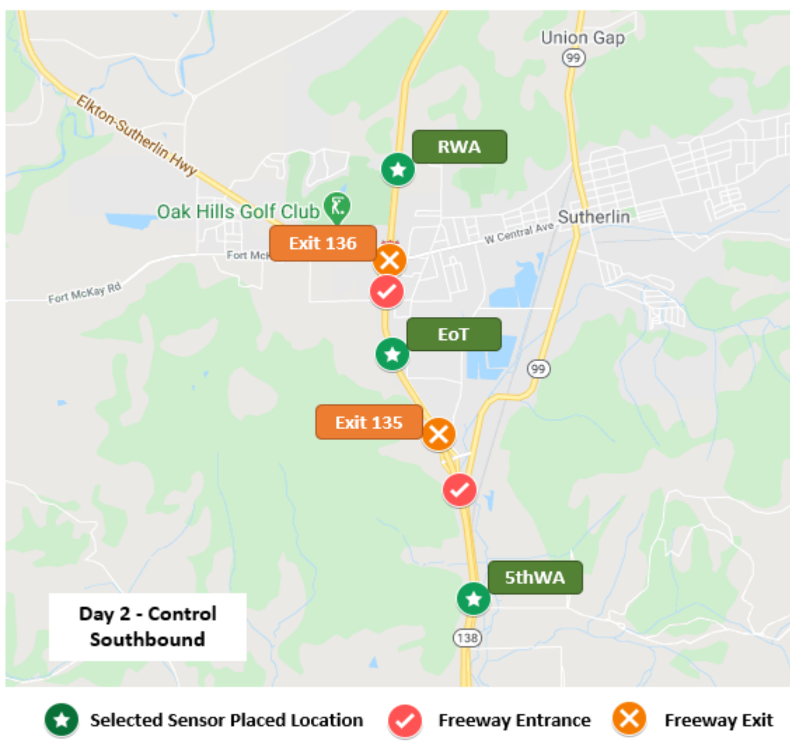


Figure 6.27: Locations of selected sensors and freeway entrances/exits on day 2 (case study #3B)

To observe how the number of passing vehicles changed over the course of the time on different days, Figure 6.28 was plotted to show the total number of the recorded vehicles at the 1stWA sensor location. It can be seen that the traffic volume pattern is similar. The highest number of vehicles always occurred during the first hour of recording (between 21:30 and 22:30), the number of vehicles decreased in the following hours, and then increased during the hours between 02:30 and 03:30, and between 03:30 and 04:30.

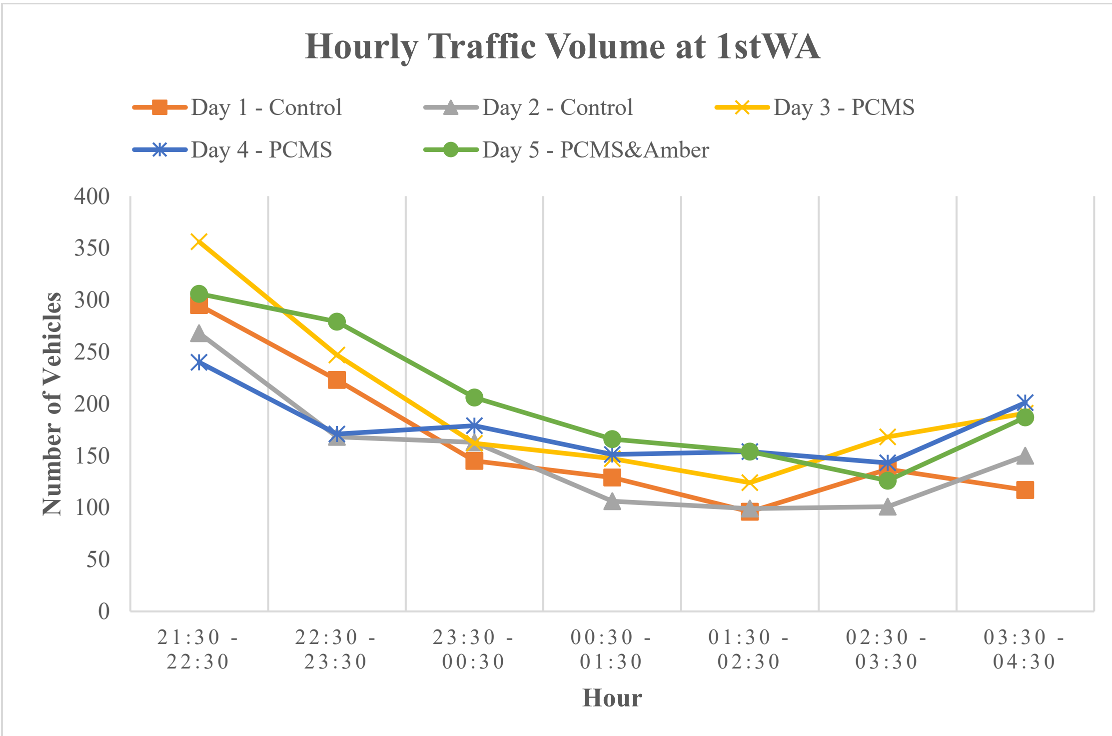


Figure 6.28: Hourly traffic volume at the 1stWA sensor location (case study #3B)

When comparing the truck percentage at the 1stWA sensor location, the percentage varied from 37% (Day 5) to 50% (Day 2), as shown in Figure 6.24 (bottom) and Figure 6.25 (bottom). Figure 6.29 provides a detailed hourly breakdown for the recorded vehicles on Day 2. It can be observed that during some hours (between 23:30 and 00:30, between 01:30 and 02:30, between 02:30 and 03:30, and between 03:30 and 04:30), the number of trucks was greater than the number of passenger cars recorded by the sensor.

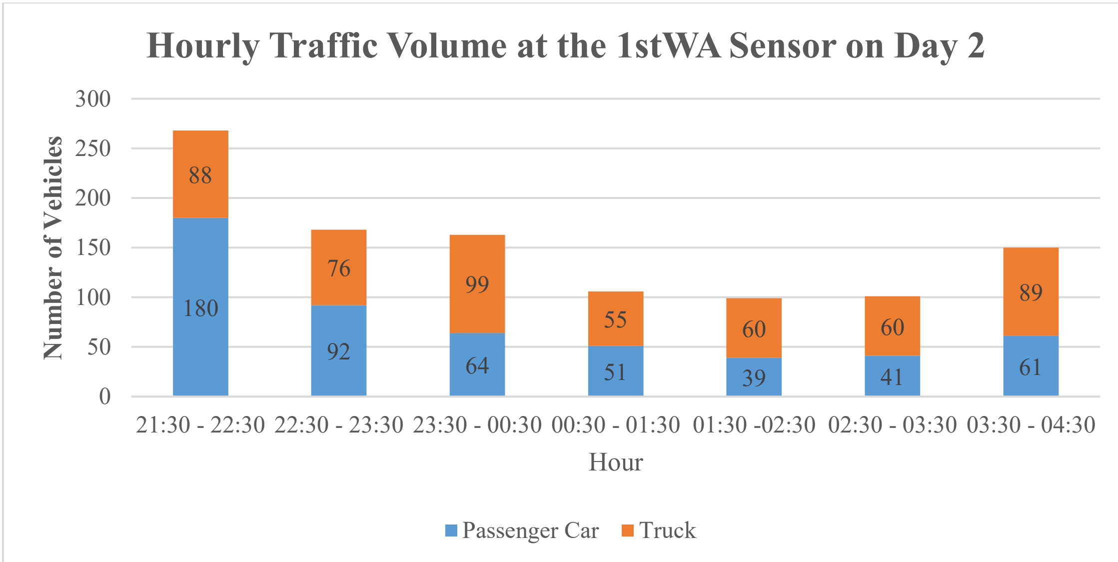


Figure 6.29: Hourly traffic volume at the 1stWA sensor on day 2, total and by vehicle type (case study #3B)

With respect to the changes in the hourly truck percentage, Table 6.4 shows that on all the testing days, the minimum truck percentages (which ranged from 26% to 41%) occurred during the first hour of recording (between 21:30 and 22:30). The hours in which the maximum truck percentages (which ranged from 51% to 67%) occurred varied. Most often, the maximum truck percentage occurred during the hours from 01:30 to 02:30, and from 02:30 to 03:30 in this case study.

Table 6.4: Change in Truck Percentage recorded by the 1stWA Sensor on Different Testing Days (Case Study #3B)

	Truck Percentage		Related Time	
	Min	**Max**	**Min**	**Max**
Day 1	29%	67%	21:30 – 22:30	01:30 – 02:30
Day 2	33%	61%	21:30 – 22:30	23:30 – 00:30
Day 3	34%	55%	21:30 – 22:30	02:30 – 03:30
Day 4	41%	51%	21:30 – 22:30	01:30 – 02:30
Day 5	26%	52%	21:30 – 22:30	02:30 – 03:30

6.1.3.4 Vehicle Speed (Case Study #3B)

Figure 6.30 presents the overall 85th percentile speed from all the sensor locations on the five days of testing. The dotted line shows that the speed limit was 65 mph at the RWA location, then reduced to 55 mph in the work zone.

In the advance warning and transition areas (between the RWA sign and the EoT sensor location), the 85th percentile speed drops occurred on most of the days, except on Day 4. On Day 4, the 85th percentile speed increased from 66.76 mph at the RWA location to 78.19 mph at the BoT location. Figure 6.30 also shows that the 85th percentile speed of traveling vehicles decreases, with a range between 1.8 mph and 8.7 mph decrease, from the EoT location to the 1stWA location on Days 1, 2, 4, and 5. However, on Day 3, the speed increased 8.0 mph from the EoT to the 1stWA sensor. On Days 1 and 4, the decreasing trend in the 85th percentile speed continued and after the 3rdWA sensor the speed started to increase. On Days 2, 3, and 5, the speed increased between the locations of the 1stWA sensor and the 2ndWA sensor and then decreased. The lowest 85th percentile speed in the active work zone occurred at the 1stWA sensor location on Days 2, 3, and 5, while for Days 1 and 4, the lowest 85th percentile speed occurred at the 3rdWA sensor location. All of the 85th percentile speeds in the work zone exceed the posted speed limit in the work zone.

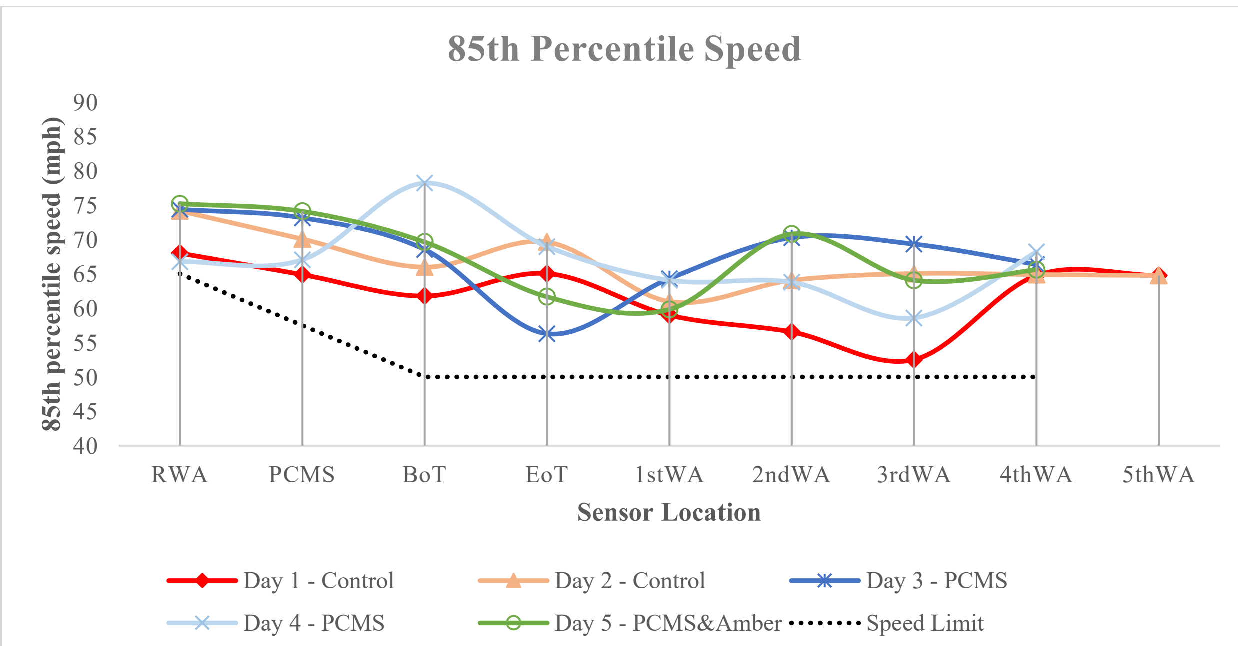


Figure 6.30: 85th percentile speed at different sensor locations (case study #3B)

Changes in the 85th percentile speeds at the 1stWA sensor location over the nights of data collection are presented in Figure 6.31. Even though there are some variations in the trends, it can be observed that on most of the days, the minimum hourly 85th percentile speed occurred during the 1st hour of recording (21:30 – 22:30), and the maximum occurred during later hours (02:30 – 03:30 and 03:30 – 04:30). When comparing the range between the maximum and minimum hourly 85th percentile speeds at night, the values varied from 6.30 mph (Day 4) to 17.73 mph (Day 1).

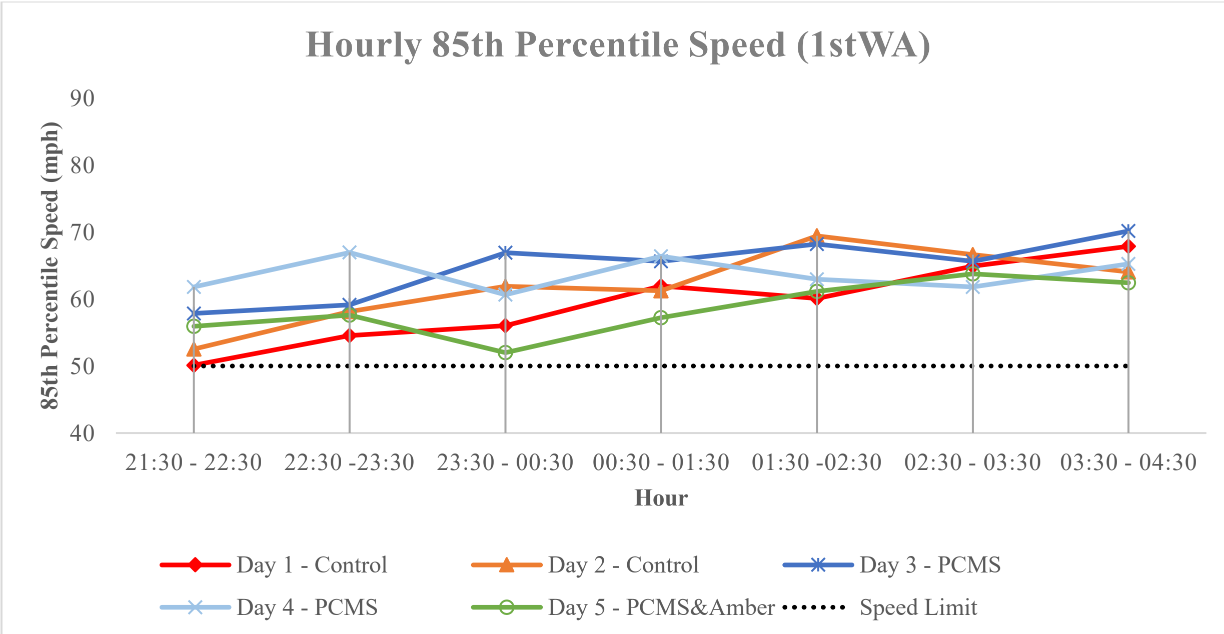


Figure 6.31: Hourly vehicle speed (85th percentile) at the 1stWA sensor location (case study #3B)

Figure 6.32, Figure 6.33, and Figure 6.34 present summaries of the vehicle speeds recorded for all vehicles at the 1stWA sensor location on Day 1 (Control), Day 3 (PCMS), and Day 5 (PCMS & Amber/White lights), respectively. The average speed values varied between 33.37 mph and 58.36 mph on Day 1, between 45.75 mph and 61.06 mph on Day 3, and between 42.41 mph and 57.21 mph on Day 5. The distributions of the speeds showed that on Days 1 and 3, the average speed increased from the hour between 23:30 and 00:30 and continued to increase to the end of testing at 04:30. On Day 5, the speed increased from one hour later – between 01:30 and 02:30.

The 1-hr SD on Day 1 varied from 7.51 mph (contributed by trucks passing between 01:30 and 02:30) to 15.16 mph (contributed by passenger cars passing between 02:30 and 03:30). On Days 3 and 5, the ranges of the SDs are similar. The SD on Day 3 varied from 8.13 mph (contributed by trucks passing between 01:30 and 02:30) to 15.29 mph (contributed by trucks passing between 21:30 and 22:30). The SD on Day 5 varied from 8.07 mph (contributed by passenger cars passing between 03:30 and 04:40) to 15.82 mph (contributed by trucks passing between 23:30 and 00:30). It can also be noticed from the figures that the speed limit compliance rates on Days 3 and 5 were low (below 20%), especially after 23:30 on Day 3, and after 03:30 on Day 5.

	21:30 - 22:30			22:30 - 23:30			23:30 - 00:30			00:30 - 01:30			01:30 - 02:30			02:30 - 03:30			03:30 - 04:30		
Speed_Range	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total
<10	2.4%	2.3%	2.4%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
10-14	4.3%	5.8%	4.7%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
15-19	6.7%	10.5%	7.8%	0.0%	0.0%	0.0%	1.2%	0.0%	0.7%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.4%	0.9%
20-24	5.3%	10.5%	6.8%	0.7%	1.3%	0.9%	2.5%	1.6%	2.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	3.3%	0.0%	1.5%	0.0%	0.0%	0.0%
25-29	3.8%	10.5%	5.8%	3.4%	3.8%	3.6%	3.7%	7.8%	5.5%	1.6%	0.0%	0.8%	0.0%	0.0%	0.0%	1.6%	0.0%	0.7%	2.2%	0.0%	0.9%
30-34	12.9%	14.0%	13.2%	4.1%	10.3%	6.3%	6.2%	6.3%	6.2%	4.9%	4.4%	4.7%	6.3%	1.6%	3.1%	9.8%	3.9%	6.6%	2.2%	1.4%	1.7%
35-39	15.8%	12.8%	14.9%	13.8%	14.1%	13.9%	9.9%	18.8%	13.8%	11.5%	17.6%	14.7%	6.3%	7.8%	7.3%	13.1%	9.2%	10.9%	4.4%	2.8%	3.4%
40-44	16.3%	16.3%	16.3%	20.7%	29.5%	23.8%	17.3%	9.4%	13.8%	11.5%	19.1%	15.5%	15.6%	14.1%	14.6%	8.2%	9.2%	8.8%	6.7%	4.2%	5.1%
45-49	13.9%	8.1%	12.2%	15.2%	17.9%	16.1%	17.3%	21.9%	19.3%	11.5%	16.2%	14.0%	21.9%	28.1%	26.0%	6.6%	18.4%	13.1%	8.9%	13.9%	12.0%
50-54	12.4%	7.0%	10.8%	27.6%	14.1%	22.9%	21.0%	25.0%	22.8%	24.6%	19.1%	21.7%	15.6%	23.4%	20.8%	16.4%	23.7%	20.4%	11.1%	23.6%	18.8%
55-59	2.9%	1.2%	2.4%	5.5%	2.6%	4.5%	8.6%	3.1%	6.2%	13.1%	7.4%	10.1%	15.6%	10.9%	12.5%	3.3%	15.8%	10.2%	17.8%	25.0%	22.2%
60-64	1.0%	1.2%	1.0%	4.1%	1.3%	3.1%	4.9%	3.1%	4.1%	11.5%	7.4%	9.3%	3.1%	10.9%	8.3%	18.0%	9.2%	13.1%	20.0%	15.3%	17.1%
65-69	1.0%	0.0%	0.7%	0.7%	3.8%	1.8%	2.5%	3.1%	2.8%	4.9%	5.9%	5.4%	6.3%	3.1%	4.2%	6.6%	3.9%	5.1%	8.9%	2.8%	5.1%
70-74	0.5%	0.0%	0.3%	0.7%	0.0%	0.4%	1.2%	0.0%	0.7%	0.0%	1.5%	0.8%	3.1%	0.0%	1.0%	6.6%	2.6%	4.4%	8.9%	2.8%	5.1%
75 and above	1.0%	0.0%	0.7%	3.4%	1.3%	2.7%	3.7%	0.0%	2.1%	4.9%	1.5%	3.1%	6.3%	0.0%	2.1%	6.6%	3.9%	5.1%	8.9%	6.9%	7.7%
Total	209	86	295	145	78	223	81	64	145	61	68	129	32	64	96	61	76	137	45	72	117
85th Percentile	51.59	47.16	50.12	54.55	51.59	54.55	57.50	53.88	56.03	61.94	60.38	61.94	65.41	58.98	60.09	66.37	63.04	64.89	71.39	63.93	67.85
Average	38.38	33.37	36.92	47.62	44.51	46.53	47.47	45.15	46.45	51.84	48.94	50.31	52.84	50.28	51.13	52.15	52.41	52.29	58.36	55.94	56.87
Std Dev	14.16	12.49	13.86	11.63	11.43	11.63	12.22	9.80	11.24	12.66	10.24	11.49	14.06	7.51	10.17	15.16	10.72	12.84	13.13	11.72	12.28
Min	5.79	7.27	5.79	20.57	22.04	20.57	16.13	25.00	16.13	26.48	32.39	26.48	30.91	32.39	30.91	20.57	30.91	20.57	26.48	19.09	19.09
Max	100.35	60.46	100.35	107.74	104.78	107.74	81.14	67.85	81.14	95.92	81.14	95.92	103.31	67.85	103.31	82.62	87.05	87.05	92.96	92.96	92.96
Range	94.56	53.19	94.56	87.17	82.74	87.17	65.01	42.85	65.01	69.44	48.76	69.44	72.40	35.46	72.40	62.06	56.15	66.49	66.49	73.88	73.88
Speed limit compliance (%)	81.3%	90.7%	84.1%	57.9%	76.9%	64.6%	58.0%	65.6%	61.4%	41.0%	57.4%	49.6%	50.0%	51.6%	51.0%	42.6%	40.8%	41.6%	24.4%	23.6%	23.9%

Figure 6.32: Hourly summary of vehicle speed recorded by the 1stWA sensor on day 1 (case study #3B)

	21:30 - 22:30			22:30 - 23:30			23:30 - 00:30			00:30 - 01:30			01:30 - 02:30			02:30 - 03:30			03:30 - 04:30		
Speed_Range	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total
<10	1.7%	0.8%	1.4%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
10-14	0.4%	2.5%	1.1%	0.7%	0.0%	0.4%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
15-19	1.3%	0.0%	0.8%	0.0%	1.1%	0.4%	1.1%	0.0%	0.6%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
20-24	3.4%	0.8%	2.5%	0.7%	0.0%	0.4%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
25-29	3.8%	5.8%	4.5%	3.3%	1.1%	2.4%	1.1%	1.4%	1.2%	1.3%	0.0%	0.7%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.0%	0.0%	0.5%
30-34	7.6%	10.8%	8.7%	7.8%	5.3%	6.9%	2.2%	0.0%	1.2%	1.3%	0.0%	0.7%	1.6%	1.6%	1.6%	0.0%	1.1%	0.6%	1.0%	1.1%	1.0%
35-39	12.3%	10.8%	11.8%	7.8%	10.6%	8.9%	3.4%	0.0%	1.9%	3.9%	2.9%	3.4%	0.0%	1.6%	0.8%	1.3%	1.1%	1.2%	3.0%	1.1%	2.1%
40-44	18.2%	12.5%	16.3%	10.5%	25.5%	16.2%	2.2%	6.8%	4.3%	5.2%	10.0%	7.5%	1.6%	3.2%	2.4%	9.3%	7.5%	8.3%	3.0%	1.1%	2.1%
45-49	10.6%	16.7%	12.6%	13.7%	17.0%	15.0%	4.5%	8.2%	6.2%	6.5%	8.6%	7.5%	6.6%	11.1%	8.9%	5.3%	14.0%	10.1%	3.0%	8.7%	5.8%
50-54	20.3%	11.7%	17.4%	20.3%	20.2%	20.2%	13.5%	32.9%	22.2%	22.1%	38.6%	29.9%	14.8%	23.8%	19.4%	22.7%	29.0%	26.2%	15.2%	19.6%	17.3%
55-59	9.7%	10.0%	9.8%	19.6%	10.6%	16.2%	32.6%	20.5%	27.2%	27.3%	20.0%	23.8%	29.5%	34.9%	32.3%	26.7%	23.7%	25.0%	26.3%	27.2%	26.7%
60-64	4.7%	6.7%	5.3%	9.8%	3.2%	7.3%	19.1%	13.7%	16.7%	9.1%	12.9%	10.9%	16.4%	9.5%	12.9%	16.0%	8.6%	11.9%	19.2%	22.8%	20.9%
65-69	2.5%	4.2%	3.1%	2.6%	1.1%	2.0%	9.0%	6.8%	8.0%	13.0%	2.9%	8.2%	13.1%	6.3%	9.7%	4.0%	8.6%	6.5%	8.1%	8.7%	8.4%
70-74	0.8%	0.8%	0.8%	0.7%	3.2%	1.6%	6.7%	0.0%	3.7%	3.9%	1.4%	2.7%	8.2%	6.3%	7.3%	10.7%	2.2%	6.0%	10.1%	4.3%	7.3%
75 and above	2.5%	5.8%	3.7%	2.6%	1.1%	2.0%	4.5%	9.6%	6.8%	6.5%	2.9%	4.8%	8.2%	1.6%	4.8%	4.0%	4.3%	4.2%	10.1%	5.4%	7.9%
Total	236	120	356	153	94	247	89	73	162	77	70	147	61	63	124	75	93	168	99	92	191
85th Percentile	56.55	60.62	57.84	60.43	55.32	59.13	68.19	65.86	66.89	68.19	60.43	65.60	70.77	64.31	68.19	67.93	62.50	65.60	73.36	65.60	70.13
Average	45.75	47.46	46.33	50.00	47.59	49.09	58.04	58.46	58.23	57.57	54.75	56.23	61.06	56.38	58.69	57.63	55.67	56.55	60.66	59.26	59.99
Std Dev	13.76	15.29	14.30	11.76	9.96	11.15	11.25	14.38	12.72	11.61	9.88	10.87	11.67	8.13	10.26	9.12	10.33	9.83	11.75	10.74	11.26
Min	3.52	7.40	3.52	13.87	19.04	13.87	19.04	28.09	19.04	26.80	37.15	26.80	34.56	34.56	34.56	39.73	31.97	31.97	26.80	34.56	26.80
Max	99.23	99.23	99.23	90.17	87.59	90.17	88.88	109.57	109.57	90.17	105.69	105.69	101.81	75.95	101.81	82.41	106.99	106.99	99.23	106.99	106.99
Range	95.70	91.82	95.70	76.30	68.54	76.30	69.84	81.48	90.53	63.37	68.54	78.89	67.25	41.39	67.25	42.68	75.01	75.01	72.42	72.42	80.18
Speed limit compliance (%)	59.3%	60.8%	59.8%	44.4%	60.6%	50.6%	14.6%	16.4%	15.4%	18.2%	21.4%	19.7%	9.8%	17.5%	13.7%	16.0%	23.7%	20.2%	11.1%	12.0%	11.5%

Figure 6.33: Hourly summary of vehicle speed recorded by the 1stWA sensor on day 3 (case study #3B)

	21:30 - 22:30			22:30 - 23:30			23:30 - 00:30			00:30 - 01:30			01:30 - 02:30			02:30 - 03:30			03:30 - 04:30		
Speed_Range	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total
<10	0.4%	0.0%	0.3%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.4%	0.6%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
10-14	0.4%	0.0%	0.3%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
15-19	1.3%	2.5%	1.6%	0.5%	0.0%	0.4%	1.6%	2.4%	1.9%	2.1%	0.0%	1.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.3%	0.5%
20-24	1.8%	1.2%	1.6%	0.5%	4.5%	1.8%	8.1%	7.3%	7.8%	3.1%	2.9%	3.0%	0.0%	1.4%	0.6%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
25-29	4.9%	3.7%	4.6%	3.7%	4.5%	3.9%	4.8%	7.3%	5.8%	2.1%	7.1%	4.2%	3.6%	0.0%	1.9%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
30-34	4.4%	4.9%	4.6%	3.7%	5.7%	4.3%	6.5%	6.1%	6.3%	6.3%	5.7%	6.0%	3.6%	1.4%	2.6%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
35-39	9.8%	13.6%	10.8%	11.5%	9.1%	10.8%	16.1%	22.0%	18.4%	7.3%	20.0%	12.7%	2.4%	5.7%	3.9%	1.6%	3.1%	2.4%	0.9%	1.3%	1.1%
40-44	17.3%	19.8%	18.0%	11.5%	20.5%	14.3%	16.9%	23.2%	19.4%	15.6%	14.3%	15.1%	15.5%	15.7%	15.6%	8.2%	4.6%	6.3%	7.1%	4.0%	5.9%
45-49	19.1%	21.0%	19.6%	24.1%	19.3%	22.6%	24.2%	12.2%	19.4%	18.8%	24.3%	21.1%	17.9%	20.0%	18.8%	16.4%	9.2%	12.7%	7.1%	10.7%	8.6%
50-54	22.2%	19.8%	21.6%	21.5%	17.0%	20.1%	12.1%	8.5%	10.7%	21.9%	11.4%	17.5%	21.4%	24.3%	22.7%	21.3%	36.9%	29.4%	22.3%	32.0%	26.2%
55-59	10.7%	9.9%	10.5%	14.1%	11.4%	13.3%	6.5%	4.9%	5.8%	16.7%	8.6%	13.3%	15.5%	17.1%	16.2%	24.6%	26.2%	25.4%	33.9%	25.3%	30.5%
60-64	3.6%	0.0%	2.6%	3.7%	3.4%	3.6%	0.8%	0.0%	0.5%	1.0%	2.9%	1.8%	10.7%	10.0%	10.4%	13.1%	9.2%	11.1%	14.3%	18.7%	16.0%
65-69	2.7%	0.0%	2.0%	3.1%	0.0%	2.2%	2.4%	1.2%	1.9%	0.0%	0.0%	0.0%	6.0%	1.4%	3.9%	8.2%	3.1%	5.6%	7.1%	4.0%	5.9%
70-74	0.9%	1.2%	1.0%	2.1%	2.3%	2.2%	0.0%	0.0%	0.0%	4.2%	1.4%	3.0%	2.4%	2.9%	2.6%	4.9%	4.6%	4.8%	2.7%	2.7%	2.7%
75 and above	0.4%	2.5%	1.0%	0.0%	2.3%	0.7%	0.0%	4.9%	1.9%	1.0%	0.0%	0.6%	1.2%	0.0%	0.6%	1.6%	3.1%	2.4%	4.5%	0.0%	2.7%
Total	225	81	306	191	88	279	124	82	206	96	70	166	84	70	154	61	65	126	112	75	187
85th Percentile	55.91	54.60	55.91	58.52	55.91	57.60	51.40	52.90	51.99	57.21	54.14	57.21	61.13	59.37	61.13	63.74	61.13	63.74	63.74	61.13	62.43
Average	46.29	45.96	46.21	48.30	46.84	47.84	42.46	42.31	42.40	47.57	43.51	45.86	51.54	51.11	51.35	55.93	55.81	55.86	57.21	55.05	56.35
Std Dev	11.13	11.82	11.30	10.11	12.17	10.80	10.79	15.82	12.99	11.59	10.90	11.45	10.25	9.27	9.79	8.46	9.52	8.99	8.07	8.16	8.15
Min	6.31	16.75	6.31	16.75	20.66	16.75	15.44	16.75	15.44	18.05	5.00	5.00	28.50	20.66	20.66	37.63	35.02	35.02	35.02	16.75	16.75
Max	80.71	92.45	92.45	74.18	95.07	95.07	66.35	109.42	109.42	82.01	70.26	82.01	82.01	74.18	82.01	78.10	100.29	100.29	79.40	71.57	79.40
Range	74.40	75.71	86.15	57.43	74.40	78.32	50.91	92.68	93.98	63.96	65.27	77.01	53.52	53.52	61.35	40.46	65.27	65.27	44.38	54.82	62.65
Speed limit compliance (%)	59.6%	66.7%	61.4%	55.5%	63.6%	58.1%	78.2%	80.5%	79.1%	55.2%	75.7%	63.9%	42.9%	44.3%	43.5%	26.2%	16.9%	21.4%	15.2%	17.3%	16.0%

Figure 6.34: Hourly summary of vehicle speed recorded by the 1stWA sensor on day 5 (case study #3B)

6.2 SPEED AND SPEED VARIATION ANALYSIS

Several statistical analysis tests were conducted to analyze the speed data that were collected from the three case studies. For each case study, the speed data gathered during the day/time periods with the traffic control intervention put in place in the work zone were compared to the speed data gathered without the traffic control intervention, or to another traffic control intervention that was active within the same case study.

6.2.1 Case Study #1: I-84 Swanson Canyon to Arlington

As indicated in Table 5.2, three traffic control interventions (pace car, PCMS, and the combination of pace car and PCMS) were examined in this case study projects. Since the sensors were placed at similar locations in this case study project, and assuming that driver behavior is likely to be similar when the drivers observe the pace car in the work zone regardless of the day of data collection, speed data from time periods on Day 1 and Day 3 when the pace car intervention was effective were merged together. Similarly, speed data related to the PCMS intervention from time periods on Day 2 and Day 3 were combined as well. Therefore, four datasets were prepared. They are:

1. Control data which contains the data recorded within the data analysis period (between 10:00 and 16:00) on Day 1 when the pace car treatment was not implemented (some time periods from 10:00 to 11:00, and from 12:00 to 13:30). A total of 16,110 data points are included.

2. Pace car data which contains the data recorded within the data analysis period (between 10:00 and 16:00) on Day 1 when the pace car treatment was implemented (some time periods from 11:00 to 12:00, and from 13:30 to 16:00). A total of 4,240 data points are included.

3. PCMS data which contains the data recorded within the data analysis period (between 10:00 and 16:00) on Day 2, and on Day 3 when the pace car treatment was not implemented (some time periods between 10:00 to 12:00, and from 12:00 to 16:00). A total of 39,096 data points are included.

4. The combination of PCMS and pace car data which contains the data recorded within the data analysis period (between 10:00 and 16:00) on Day 3 when the pace car treatment was implemented (from 10:00 to 12:00). A total of 2,101 data points are included.

As explained in Section 5.5.2.1, with the pace car treatment in the case study, three time aggregation levels were adopted (1-min, 5-min, and 30-min) in the analysis to compute the two speed variation measurements (SD and COV).

6.2.1.1 Impact of Pace Car on Speed and Speed Variation (Case Study #1)

To identify the statistical significance of the impact of the pace car, two datasets were used: the pace car dataset (dataset 2) and the control dataset (dataset 1). Speed data from the sensors which were placed at a similar location in the work zone were considered. Table 6.5 summarizes the results of the Wilcoxon signed-rank test performed on the two datasets, which tests whether the mean rank (median) of a speed measurement (the 85th percentile speed) or the speed variation measurement (SD/COV) of the pace car treatment is more effective at reducing speed/speed variation than the control case. The table firstly reports the median values of the speed/speed variation measurements for all the time aggregation levels (1-min, 5-min, and 30-min) for the control case and the pace car case for all of the analyzed sensor locations. The table also reports the difference in the median values of the compared measurement, and whether the difference is statistically significant at the level of 0.05 (p-value < 0.05).

For example, in Table 6.5, the first row shows the statistics generated based on a 1-min aggregation level for data collected at the first RWA sign location. For the control case, the median 1-min 85th percentile speed is 75 mph, the median 1-min SD is 7.93 mph, and the median 1-min COV is 0.116. For the pace car case, the median 1-min 85th percentile speed is 74.8 mph, the median 1-min SD is 8.12, and the median 1-min COV is 0.116. The median difference (pace car – control) between the two cases in the 85th percentile is -0.2 mph, which means that the median 1-min 85th percentile speed reduced 0.2 mph when the pace car was present in the work zone compared to the control case. However, the speed reduction is not statistically significant (p-value = 0.3424). No similar reduction effects were found in the median 1-min SD and COV.

Table 6.5: Result Summary for Pace Car vs. Control (Case Study #1)

	Statistics	Control			Pace Car			Comparison (Pace Car – Control)		
		85th Per. Speed	SD	COV	85th Per. Speed	SD	COV	85th Per. Speed	SD	COV
RWA1	1-min	75	7.93	0.116	74.8	8.12	0.116	-0.2	0.19	0
	5-min	75.7	8.08	0.119	75.8	8.55	0.123	0.1	0.47	0.004
	30-min	76.5	8.07	0.118	76.2	8.61	0.126	-0.3	0.54	0.008
RWA2	1-min	76.5	8.5	0.123	76.9	8.81	0.123	0.4	0.31	0
	5-min	78.2	9.02	0.128	78.2	8.98	0.129	0	-0.04	0.001
	30-min	79.1	8.74	0.126	78.2	9.34	0.135	-0.9	0.6	0.009
BoT	1-min	67.5	6.26	0.100	69.6	6.55	0.104	2.1	0.29	0.004
	5-min	68.9	6.66	0.105	69.9	7.36	0.117	1	0.7	0.012
	30-min	69.9	6.97	0.109	69.1	7.08	0.113	-0.8	0.11	0.004
1stWA	1-min	67.5	8.22	0.138	68.5	8.59	0.141	1	0.37	0.003
	5-min	68.5	8.79	0.145	69.5	9.87	0.168	1	1.08	0.023
	30-min	69.5	9.04	0.153	69.5	9.76	0.161	0	0.72	0.008
2ndWA	1-min	71.9	8.52	0.134	72	9.38	0.148	0.1	0.86	0.014
	5-min	72.9	9.59	0.148	72.9	10.1	0.161	0	0.51	0.013
	30-min	73.8	9.37	0.142	73.7	10.5	0.162	-0.1	1.13	0.02

Note: * represents the difference in median speed/speed variation measurement is statistically significant at the 0.05 level

In addition, it can be seen that for some sensor locations (e.g., RWA1, RWA2, BoT and 2ndWA), the median 85th percentile speed in time periods when the pace car intervention was present in the work zone was lower than that during the time periods without the intervention for the 30-min time aggregation level. However, none of the differences in the median values were found to be statistically significant. The pace car intervention did not show any statistically significant impact on reducing the speed variation in this analysis regardless of the time aggregation level.

6.2.1.2 Impact of PCMS on Speed and Speed Variation (Case Study #1)

Two datasets (datasets 1 and 3) were used to examine the impact of the PCMS unit on driver's behavior: the control dataset (part of the data collected on Day 1) and the PCMS dataset (data collected on Day 2 and part of the data collected on Day 3). Since the PCMS was put in place in-between the locations of the second RWA sign (RWA2) and the beginning of taper location (BoT) as shown in Figure 5.14, the PCMS unit may not have been visible to drivers at upstream locations. Therefore, the data from sensors (RWA1 and RWA2) that were placed upstream to the location of the PCMS unit were not included in the analysis. Only the data from the sensors that were placed downstream to the location of the PCMS unit were considered in the analysis. In addition, as indicated in Table 5.3, some sensors did not work properly during data collection at certain locations (e.g., the EoT sensor on Day 1 and the BoT sensor on Day 3), and no sensor was placed at the 3rdWA sensor location on Day 1; therefore, these sensor locations were not included in this analysis.

As shown in Table 6.6, regardless of the time aggregation level, at the 1stWA location (the sensor placed nearest to the construction workers), speed data collected within the time periods with the PCMS turned on showed lower median SD and COV than during those time periods in which the data was collected without any traffic control interventions. The median 1-min and 5-min SD reduced 1.29 mph and 0.76 mph, respectively. The differences in medians are all statistically significant. As for the 2ndWA, the presence of the PCMS unit only shows a speed variation reduction effect in COV at the 1-min level (0.005). No effect in reducing the 85th percentile speed could be found in this analysis for the PCMS unit.

Table 6.6: Result Summary for PCMS vs. Control (Case Study #1)

	Statistics	Control			PCMS			Comparison (PCMS – Control)		
		85th Per. Speed	SD	COV	85th Per. Speed	SD	COV	85th Per. Speed	SD	COV
1stWA	1-min	67.5	8.22	0.138	68.6	6.93	0.113	1.1	-1.29*	-0.025*
	5-min	68.5	8.79	0.145	69.9	8.03	0.131	1.4	-0.76*	-0.014*
	30-min	69.5	9.04	0.153	69.9	8.68	0.141	0.4	-0.36*	-0.012*
2ndWA	1-min	71.9	8.52	0.134	74.6	8.6	0.129	2.7	0.08	-0.005*
	5-min	72.9	9.59	0.148	77.1	10.1	0.149	4.2	0.51	0.001
	30-min	73.8	9.37	0.142	77.9	10.3	0.156	4.1	0.93	0.014

Note: * represents the difference in median speed/speed variation measurement is statistically significant at the 0.05 level

6.2.1.3 Impact of the combination of Pace Car and PCMS on Speed and Speed Variation (Case Study #1)

Three comparisons were made to test the impacts of the combination of the pace car and PCMS: 1) the combination and the control cases (datasets 1 and 4), 2) the combination and the pace car case (datasets 2 and 4), and 3) the combination and the PCMS case (datasets 3 and 4). Similar to the previous analyses, data collected from the sensor locations upstream of the location of the PCMS unit, and from sensors that did not collect data properly, were eliminated from the analysis.

Table 6.7 presents the results for the comparison between the combination and the control case. It can be observed that for both the 1stWA and 2ndWA sensor locations, the PCMS/pace car combination was effective in reducing the median in SD and COV for all the time aggregation levels analyzed. In addition, the speed variation reduction impact of the combination of the two traffic control interventions was more effective at the 1stWA sensor location than the 2ndWA sensor location. However, similar to the results from the previous two analyses (pace car vs. control, and PCMS vs. control), the combination also did not show any impact on reducing the 85th percentile speed.

Table 6.7: Result Summary for the Combination of Pace Car and PCMS vs. Control (Case Study #1)

	Statistics	Control			Combination			Comparison (Combination – Control)		
		85th Per. Speed	SD	COV	85th Per. Speed	SD	COV	85th Per. Speed	SD	COV
1stWA	1-min	67.5	8.22	0.138	69	5.94	0.091	1.5	-2.28*	-0.047*
	5-min	68.5	8.79	0.145	70.5	6.88	0.106	2	-1.91*	-0.039*
	30-min	69.5	9.04	0.153	71.4	7.18	0.112	1.9	-1.86*	-0.041*
2ndWA	1-min	71.9	8.52	0.134	74.4	8.07	0.110	2.5	-0.45*	-0.024*
	5-min	72.9	9.59	0.148	75.9	8.43	0.123	3	-1.16*	-0.025*
	30-min	73.8	9.37	0.142	76.1	8.44	0.122	2.3	-0.93*	-0.020*

Note: * represents the difference in median speed/speed variation measurement is statistically significant at the 0.05 level

Table 6.8 and Table 6.9 present the summary results when comparing the effect of the PCMS/pace car combination on speed and speed variation with that of the pace car only, and that of the PCMS only, respectively. It can be observed from the tables that, in the active work area (represented by the 1stWA and 2ndWA sensors), the combination of the two interventions was more effective in lowering SD and COV than one single intervention on its own. The reduction effects were found to be statistically significant at all three examined time aggregation levels in the analyses. However, in the transition area (represented by the EoT sensor location), no evidence was found that the combination introduced more speed or speed variation reduction effects than the PCMS intervention only.

Table 6.8: Result Summary for the Combination of Pace Car and PCMS vs. Pace Car (Case Study #1)

	Statistics	Pace Car			Combination			Comparison (Combination – Pace Car)		
		85th Per. Speed	SD	COV	85th Per. Speed	SD	COV	85th Per. Speed	SD	COV
1stWA	1-min	68.5	8.59	0.141	69	5.94	0.091	0.5	-2.65*	-0.050*
	5-min	69.5	9.87	0.168	70.5	6.88	0.106	1.0	-2.99*	-0.062*
	30-min	69.5	9.76	0.161	71.4	7.18	0.112	1.9	-2.58*	-0.049*
2ndWA	1-min	72.0	9.38	0.148	74.4	8.07	0.11	2.4	-1.31*	-0.038*
	5-min	72.9	10.1	0.161	75.9	8.43	0.123	3.0	-1.67*	-0.038*
	30-min	73.7	10.5	0.162	76.1	8.44	0.122	2.4	-2.06*	-0.040*

Note: * represents the difference in median speed/speed variation measurement is statistically significant at the 0.05 level

Table 6.9: Result Summary for the Combination of Pace Car and PCMS vs. PCMS (Case Study #1)

	Statistics	PCMS			Combination			Comparison (Combination – PCMS)		
		85th Per. Speed	SD	COV	85th Per. Speed	SD	COV	85th Per. Speed	SD	COV
EoT	1-min	70.3	6.16	0.095	71.1	6.22	0.095	0.8	0.06	0.0003
	5-min	71.8	6.92	0.107	71.9	7.57	0.115	0.1	0.65	0.008
	30-min	71.9	7.14	0.112	72.8	7.71	0.120	0.9	0.57	0.008
1stWA	1-min	68.6	6.93	0.113	69	5.94	0.091	0.4	-0.99*	-0.022*
	5-min	69.9	8.03	0.131	70.5	6.88	0.106	0.6	-1.15*	-0.025*
	30-min	69.9	8.68	0.141	71.4	7.18	0.112	1.5	-1.50*	-0.029*
2ndWA	1-min	74.6	8.6	0.129	74.4	8.07	0.110	-0.2	-0.53*	-0.019*
	5-min	77.1	10.1	0.149	75.9	8.43	0.123	-1.2	-1.67*	-0.026*
	30-min	77.9	10.3	0.156	76.1	8.44	0.122	-1.8	-1.86*	-0.034*

Note: * represents the difference in median speed/speed variation measurement is statistically significant at the 0.05 level

6.2.1.4 Observation notes for pace car intervention

When driving the pace car through the work zone, it was observed that in the advance warning area, most of the time, drivers behind (upstream of) the pace car spent some time observing and following the pace car ahead, and then eventually passed the pace car before entering the transition area. During the period of time observing the pace car, the driver maintained a speed similar to that of the pace car, i.e., the difference in speed was zero or very low. Meanwhile, there were circumstances when drivers behind the pace car did not care about the presence of the pace car, and passed the pace car with their original speeds. On a few occasions, vehicles stayed behind the pace car all the way through the transition area and active work area. In addition, the researchers observed that more heavy vehicles than passenger cars tended to choose to follow the pace car. While in the transition and activity areas, since the two-lane traffic was reduced to one lane, drivers had no choice but to stay behind and follow the pace car. Moreover, it was found that vehicles behind that chose to follow the pace car maintained a relatively long distance from the pace car when the flashing lights were on; however, when the flashing lights were turned off, the trailing vehicles moved closer to the pace car.

6.2.2 Case Study #2: I-205 Abernethy Bridge - SE 82nd Drive

In Case Study #2, only one traffic control intervention – a PCMS unit showing custom messages – was examined. As a first step, two datasets were generated to test the effectiveness of the PCMS unit in reducing speed and speed variation in the work zone on I-205. The datasets are:

1. Control data, which contains the data collected from 23:30 to 03:30 on Days 1 and 2. A total of 12,785 data points are included.

2. PCMS data, which contains the data collected from 23:30 to 03:30 on Day 3. A total of 9,218 data points are included.

Since the sensors were placed at a similar location during the paving operations on Days 1 and 2, and the traffic volumes and speeds (as shown in Section 6.1.2.1 and Section 6.1.2.2) were quite similar, the data from Days 1 and 2 (without PCMS) were combined as the control data.

Similar to the previous case study, the data were then aggregated based on appropriate time aggregation levels for the speed variation analysis. In this case study, 1-min and 5-min levels are used. A 30-min aggregation level was not used because no pace car treatment was adopted in this case study. After the data were processed, the Wilcoxon signed-rank test was used to determine whether there is statistical evidence that the PCMS unit has an effect on decreasing speed/speed variation in the work zone. The following section presents the analysis results for the 1-min and 5-min aggregation levels.

6.2.2.1 Impact of PCMS on Speed and Speed Variation (Case Study #2)

As explained in Section 5.4.2, different from other case study projects, instead of placing the PCMS unit in-between the locations of the RWA sign and the BoT, the PCMS unit was placed fairly close to the RWA sign at the beginning of the advance warning area on Day 3. There are several freeway entrances and exits along this segment of the I-205. Some drivers may have entered the freeway at a freeway entrance that was downstream of the RWA sign. As a result, their driving behavior in the work zone would not be impacted by the presence of the PCMS unit. Therefore, not all of the recorded speeds come from drivers influenced by the PCMS unit. In addition, the sensor placed at the EoT location on Day 1 did not record data properly. Therefore, the EoT sensor data were excluded from the analysis.

Table 6.10 presents the summary analysis result for this case study. It can be observed that at the RWA sign location when the PCMS unit was nearby, the 1-min and 5-min 85th percentile speeds have reductions of 5.4 mph and 5.8 mph, respectively. The effects on speed reduction are statistically significant at the 0.05 level. However, no similar effect was found in speed variation at the same location. With respect to locations within the active work area, at the first three sensor locations, no speed and speed variation reduction effects are observed when comparing the PCMS data to the control data.

At the 4thWA sensor location, compared to the control data, 1-min and 5-min 85th percentile speeds from the PCMS data reduced 5.7 mph and 5.8 mph, respectively. The 1-

min and 5-min SD reduced 0.2 mph and 0.3 mph. However, only the differences in the 85th percentile speeds are statistically significant.

Concerning the 5thWA sensor (the last sensor placed in the work zone), with the presence of the PCMS unit, the 1-min and 5-min SD reduced 2.05 mph and 2.52 mph, respectively, and the 1-min and 5-min COV reduced 0.060 and 0.087, respectively. There is statistical evidence that the 1-min and 5-min median SDs and COVs with the PCMS case are lower than those with the control case.

Table 6.10: Result Summary for PCMS vs. Control (Case Study #2)

	Statistics	Control			PCMS			Comparison (PCMS – Control)		
		85th Per. Speed	SD	COV	85th Per. Speed	SD	COV	85th Per. Speed	SD	COV
RWA	1-min	67.2	6.23	0.100	61.8	9.14	0.165	-5.4*	2.91	0.065
	5-min	70.3	8.1	0.127	64.5	10	0.183	-5.8*	1.90	0.056
1stWA	1-min	51.7	5.97	0.131	59.6	9.4	0.180	7.9	3.43	0.049
	5-min	53.5	8.69	0.186	63.1	11.9	0.224	9.6	3.21	0.038
2ndWA	1-min	51.3	5.68	0.125	54.1	8.49	0.190	2.8	2.81	0.065
	5-min	53.4	7.88	0.170	57	12.6	0.280	3.6	4.72	0.110
3rdWA	1-min	55.9	6.86	0.141	61.7	12.9	0.255	5.8	6.04	0.114
	5-min	58.9	10.4	0.211	65.3	15.7	0.291	6.4	5.30	0.080
4thWA	1-min	57.5	8.42	0.170	51.8	8.22	0.187	-5.7*	-0.20	0.017
	5-min	60.5	12	0.236	54.7	11.5	0.256	-5.8*	-0.50	0.020
5thWA	1-min	48.8	7.72	0.181	53.9	5.67	0.121	5.1	-2.05*	-0.060*
	5-min	51.9	10.6	0.256	57.4	8.08	0.169	5.5	-2.52*	-0.087*

Note: * represents the difference in median speed/speed variation measurement is statistically significant at the 0.05 level

6.2.3 Case Study #3: I-5 Sutherlin – Garden Valley Blvd

Similar to the descriptive statistics section, the analysis results of the Case Study #3 are also presented separately in two parts: Case Study #3A for data collected in the northbound direction, and Case Study #3B for data collected in the southbound direction.

6.2.3.1 Case Study #3A (Northbound)

In Case Study #3A, only one traffic control intervention was tested – a PCMS unit showing custom message placed in the advance warning area. Two datasets were prepared before conducting the statistical analysis:

1. Control data, which contains the data collected from 23:30 to 04:30 the following morning on Day 1 and includes a total of 4,505 data points.

2. PCMS data, which contains the data collected from 23:30 to 04:30 the following morning on Day 2, and includes a total of 7,193 data points.

The data were then aggregated to 1-min and 5-min levels to compute the speed variation measurements at each sensor location. Similar to Case Study #2, a 30-min aggregation level was not used because no pace car treatment was adopted in this case study project.

6.2.3.2 Impact of PCMS on Speed and Speed Variation (Case Study #3A)

Comparisons were made between common sensor locations on the two days, including EoT, 1stWA, 2ndWA, 3rdWA, and 4thWA sensors. The data at the RWA sign location were excluded because it was felt that driver behavior at this location would not be influenced by the presence of the PCMS unit, which was placed 1.3 miles downstream of the RWA sign. Several Wilcoxon signed-rank tests were run to check if the speed/speed variation measurements at a work zone location with the presence of the PCMS unit were lower than those in the same location without the presence of the PCMS. Table 6.11 presents the median speed and speed variation measurements at the 1-min and 5-min aggregation levels for all the analyzed sensor locations, and whether the differences in the medians are statistically significant at the 0.05 level.

Table 6.11: Result Summary for PCMS vs. Control (Case Study #3A)

	Statistics	Control			PCMS			Comparison (PCMS – Control)		
		85th Per. Speed	SD	COV	85th Per. Speed	SD	COV	85th Per. Speed	SD	COV
EoT	1-min	57.8	5.32	0.099	68.9	8.29	0.141	11.1	2.97	0.042
	5-min	61.6	8.02	0.145	71.7	10.3	0.166	10.1	2.28	0.021
1stWA	1-min	48.2	5.05	0.109	59.0	9.53	0.184	10.8	4.48	0.075
	5-min	50.4	7.59	0.171	62.3	12.1	0.228	11.9	4.51	0.057
2ndWA	1-min	42.6	4.66	0.115	62.2	7.25	0.124	19.6	2.59	0.009
	5-min	44.1	7.12	0.179	64.8	10.1	0.179	20.7	2.98	0.000
3rdWA	1-min	55.7	4.55	0.086	65.3	7.65	0.131	9.60	3.10	0.045
	5-min	58.4	6.62	0.127	68.3	10.3	0.178	9.90	3.68	0.051
4thWA	1-min	58.2	7.34	0.145	66.5	6.73	0.114	8.30	-0.61	-0.031*
	5-min	60.6	10.3	0.186	68.9	8.65	0.141	8.30	-1.65*	-0.045*

Note: * represents the difference in median speed/speed variation measurement is statistically significant at the 0.05 level

It should be noted that the posted speed limits for the two cases were different (50 mph for the control case, and 60 mph for the PCMS case). This difference could be one of the reasons why the differences in the median values of the 85th percentile are higher than those observed in other case studies. As for the SD and COV, and only at the 4thWA sensor location (toward the end of the work zone), the median values in the SD and COV from the PCMS case were lower than those from the control case. With the presence of the PCMS, the median 1-min SD reduced 0.61 mph, the 1-min COV reduced 0.031, the median 5-min SD reduced 1.65 mph, and the median 5-min COV reduced 0.045. Only the reduction in the 1-min SD is not statistically significant (p-value = 0.121).

6.2.3.3 Case Study #3B (Southbound)

For the data collected in the southbound direction of this case study, two traffic control interventions (PCMS and the combination of PCMS and amber/white lights on a paver) were tested on three days (PCMS on Days 3 and 4, and the combination on Day 5), as shown in Table 5.6. To compare the performance of the two interventions on speed and speed variation reductions in the work zone, three datasets were prepared before the analyses:

1. Control data, which contains the data collected from 21:30 to 04:30 on Days 1 and 2 when no traffic control interventions were put in place. A total of 16,771 data points were included.

2. PCMS data, which contains the data collected from 21:30 to 04:30 on Days 3 and 4 when only the PCMS unit (Figure 5.24) was placed in the advance warning area. A total of 19,435 data points were included.

3. The combination of PCMS and amber/white lights data, which contains the data collected from 21:30 to 04:30 on Day 5 when the PCMS unit was placed in the advance warning area and the amber/white lights on the paver (Figure 5.25) were turned on. A total of 9,557 data points were included.

The reasons for combining the data from different days are similar to what was explained in Case Study #1. The justification is based on the similarity in terms of the sensor placement in the work zone and the assumption that driver behavior resulting from the PCMS unit would be similar regardless of the day of data collection. After the datasets were prepared, the key summary statistics including the 85th percentile speed, SD and COV were calculated based on the two aggregation time levels (1-min and 5-min). Similar to Case Study #3A, a 30-min aggregation level was not used because no pace car treatment was tested in this case study project.

6.2.3.4 Impact of PCMS on Speed and Speed Variation (Case Study #3B)

The first comparison made in this case study was between the control case and the PCMS only case. Similar to the Case Study #3A, the RWA sensor location data were excluded from the analysis because of the RWA sensor location (a long distance upstream of the PCMS unit). All other sensor locations that were in common for both cases were included in the analysis.

In Case Study #3B, days with the presence of the PCMS unit showed slower recorded 85th percentile speeds at the end of the transition area (recorded by the EoT sensors) for both the 1-min and 5-min levels. The differences can be observed in Table 6.12, and they are both statistically significant. This result indicates that the speed when drivers entered the active work area decreased. At the EoT sensor location, the reduction in the median 5-min SD (0.65 mph) was also found to be statistically significant, but not the COV. At the 1stWA sensor location, it was found that both the 1-min COV and the 5-min COV have lower values when the PCMS unit was placed at the advance warning area to remind drivers to travel at a constant speed. Similar COV reduction effects could also be observed at the 3rdWA sensor location.

Table 6.12: Result Summary for PCMS vs. Control (Case Study #3B)

	Statistics	Control			PCMS			Comparison (PCMS – Control)		
		85th Per. Speed	SD	COV	85th Per. Speed	SD	COV	85th Per. Speed	SD	COV
BoT	1-min	58.9	5.33	0.099	66.7	9.39	0.154	7.8	4.06	0.055
	5-min	61.7	7.69	0.140	69.9	11.9	0.194	8.2	4.21	0.054
EoT	1-min	60.9	7.41	0.136	58.5	7.1	0.135	-2.4*	-0.31	-0.001
	5-min	64.3	9.73	0.173	60.4	9.08	0.172	-3.9*	-0.65*	-0.001
1stWA	1-min	53.4	8.11	0.171	58.8	8.22	0.156	5.4	0.11	-0.015*
	5-min	58.9	10.9	0.225	63	10.4	0.194	4.1	-0.50	-0.031*
2ndWA	1-min	54.7	7.36	0.158	61.8	8.95	0.168	7.1	1.59	0.010
	5-min	58.3	10.7	0.221	66	11.9	0.212	7.7	1.2	-0.009
3rdWA	1-min	53.5	7.64	0.168	58.6	7.67	0.146	5.1	0.03	-0.022*
	5-min	56.1	11.3	0.240	61.3	10.2	0.193	5.2	-1.10*	-0.047*
4thWA	1-min	58.3	8.06	0.157	61.4	8.59	0.155	3.1	0.53	-0.002
	5-min	62.8	11.5	0.218	64.9	11.7	0.207	2.1	0.20	-0.011

Note: * represents the difference in median speed/speed variation measurement is statistically significant at the 0.05 level

6.2.3.5 Impact of the combination of PCMS and Amber/White Lights on Paving Equipment (Case Study #3B)

The second comparison made in this case study was between the control case and the combination of the PCMS unit and amber/white lights on the paving equipment turned on case. Similar to the previous analysis, excluding the data collected from the sensors placed near the RWA sign, all sensor locations that were in common in both cases were included in the analysis.

It can be observed from Table 6.13, toward the end of the transition area (recorded by the EoT sensors), all three speed and speed variation measurements (the 85th percentile speed, SD, and COV) recorded lower values with the combination case. The median 1-min and 5-min 85th percentile speed reduced 3.3 mph and 4.8 mph, respectively. The median 1-min and 5-min SD reduced 1.70 mph and 1.47 mph, respectively. The median 1-min and 5-min COV reduced 0.025 and 0.012. All of the differences are statistically significant at the 0.05 level.

At the 1stWA sensor location, the same reduction effects were found, except for the 1-min 85th percentile speed comparison. The median 5-min 85th percentile speed decreased

1.7 mph when the combination of both traffic control interventions was present in the work zone. The 1-min and 5-min SD reduced 1.31 mph and 1.34 mph, respectively. The 1-min and 5-min COV reduced by 0.037 and 0.030, respectively. It can also be found from the table that toward the end of the active work area (represented by the 3rdWA and 4thWA sensor locations), the COVs were also less when the combination was implemented in the work zone.

Table 6.13: Result Summary for the Combination of PCMS and Amber/White Lights on Paving Equipment vs. Control (Case Study #3B)

	Statistics	Control			Combination			Comparison (Combination – Control)		
		85th Per. Speed	SD	COV	85th Per. Speed	SD	COV	85th Per. Speed	SD	COV
BoT	1-min	58.9	5.33	0.099	64.1	7.63	0.131	5.2	2.30	0.032
	5-min	61.7	7.69	0.140	67.0	10.4	0.177	5.3	2.71	0.037
EoT	1-min	60.9	7.41	0.136	57.6	5.71	0.111	-3.3*	-1.70*	-0.025*
	5-min	64.3	9.73	0.173	59.5	8.26	0.161	-4.8*	-1.47*	-0.012*
1stWA	1-min	53.4	8.11	0.171	55.4	6.80	0.134	2.0	-1.31*	-0.037*
	5-min	58.9	10.9	0.225	57.2	9.56	0.195	-1.7*	-1.34*	-0.030*
2ndWA	1-min	54.7	7.36	0.158	63.7	12.6	0.231	9.0	5.24	0.073
	5-min	58.3	10.7	0.221	66.8	16.4	0.298	8.5	5.70	0.077
3rdWA	1-min	53.5	7.64	0.168	57.6	7.82	0.152	4.1	0.18	-0.016*
	5-min	56.1	11.3	0.240	62.3	10.4	0.194	6.2	-0.90	-0.046*
4thWA	1-min	58.3	8.06	0.157	59.4	7.63	0.145	1.1	-0.43	-0.012
	5-min	62.8	11.5	0.218	61.7	11.0	0.201	-1.1	-0.50*	-0.017*

Note: * represents the difference in median speed/speed variation measurement is statistically significant at the 0.05 level

The third comparison was made between the combination case and the PCMS only case. Since the paver with the amber/white lights operated in the active work area, the presence of the paver would not have direct impact on driver behaviors when they were traveling in the advance warning area and the transition area. Therefore, only sensors that were placed in the active work area were included in the analysis.

Table 6.14 summarizes the outcome of the analysis. It can be seen that at the 1stWA sensor location, at a level of confidence of 95%, the median 1-min and 5-min 85th percentile speed reduced 3.4 mph and 5.8 mph, respectively, on days with the combination implemented compared to days with only the PCMS unit present. The 1-min and 5-min SD reduced 1.42 mph and 0.84 mph, respectively. The 1-min COV reduced 0.022. Toward the end of the active work area (recorded by the 4thWA sensor), similar speed and speed reduction effects were found in the 1-min and 5-min median 85th percentile speed and SD.

Table 6.14: Result Summary for the Combination of PCMS and Amber/White Lights on Paving Equipment vs. PCMS (Case Study #3B)

	Statistics	PCMS			Combination			Comparison (Combination – PCMS)		
		85th Per. Speed	SD	COV	85th Per. Speed	SD	COV	85th Per. Speed	SD	COV
1stWA	1-min	58.8	8.22	0.156	55.4	6.80	0.134	-3.4*	-1.42*	-0.022*
	5-min	63.0	10.4	0.194	57.2	9.56	0.195	-5.8*	-0.84*	0.001
2ndWA	1-min	61.8	8.95	0.168	63.7	12.6	0.231	1.9	3.65	0.063
	5-min	66.0	11.9	0.212	66.8	16.4	0.298	0.8	4.50	0.086
3rdWA	1-min	58.6	7.67	0.146	57.6	7.82	0.152	-1.0	0.15	0.006
	5-min	61.3	10.2	0.193	62.3	10.4	0.194	1.0	0.20	0.001
4thWA	1-min	61.4	8.59	0.155	59.4	7.63	0.145	-2.0*	-0.96*	-0.010
	5-min	64.9	11.7	0.207	61.7	11.0	0.201	-3.2*	-0.70*	-0.006

Note: * represents the difference in median speed/speed variation measurement is statistically significant at the 0.05 level

6.3 CASE STUDY ANALYSIS SUMMARY AND LIMITATIONS

As mentioned in the literature review, several traffic control interventions in work zones have been examined by other researchers. Some interventions were found to be effective in reducing speed and speed variance in work zones. For example, a stationary patrol car without lights flashing or radar parked on the side of the road parallel to traffic was found to be effective in reducing speed SD by 1 to 2 mph in work zones in Texas (Richards et al., 1985). The combination of the police presence and rumble strips helped in reducing speeds by 3 mph to 6 mph, and SD by 25% in work zones in New York (Zech et al., 2005).

The section below provides a summary of the analysis results for the four traffic control interventions examined in the three case studies in the present research. Because the analyses were only performed within each case study, the summary findings and limitations described below are separated for each case study.

6.3.1 Case Study #1: I-84 Swanson Canyon to Arlington

The quantitative analyses of the collected speed data from Case Study #1 provided evidence of the impacts of the three examined traffic control interventions – pace car, PCMS, and the combination of pace car and PCMS on vehicle speed and speed variation. The following is a summary of the findings that can be drawn from Case Study #1. The reported reductions are all statistically significant at a 0.05 level.

- The pace car intervention did not show that it has an effect on reducing vehicle speeds (85th percentile) and speed variation (SD and COV) at the advance warning area, at the transition area, and at the active work area.

- The presence of the PCMS intervention was effective at reducing speed variation in the active work area, especially for locations closer to the construction workers and equipment. The median 1-min SD was 1.29 mph lower, and COV was 0.025 lower, with the presence of the PCMS than without the presence of the PCMS. The reductions in 5-min SD and COV were 0.76 mph and 0.014, respectively.

- The combination of the PCMS and the pace car treatment was more effective in reducing speed variation (SD and COV) in the active work zone than without the treatment. At the location close to the construction workers and equipment, the reductions in 1-min SD and COV were 2.28 mph and 0.047, respectively, and in 5-min SD and COV the reductions were 1.91 mph and 0.039, respectively.

- In the transition area, the combination of the PCMS and the pace car treatment did not show it was more effective in reducing vehicle speed and speed variation than the PCMS alone.

- In the active work area, the combination of the PCMS and the pace car treatment showed greater reduction effects in speed variation (SD and COV) than the intervention with the PCMS alone. The combination was also more effective than the intervention with the just the pace car alone.

It should be noted that Case Study #1 is the only case study project that was performed in the daytime. Based on the data collected from the sensors, the 1-hr traffic volume in this roadway segment is the highest among all the case studies. The construction operation conducted on the site was median barrier removal and reinstallation at the time of data collection. Compared to other case study projects, no heavy construction equipment was operated in the active work zone. Because of the characteristics of the operation, the work operations did not move and sensors were placed at identical locations throughout the three-day data collection.

The posted regulatory speed limit at the Case Study #1 site (70/65 mph for cars/trucks) is the highest among the case study projects. No temporary speed reduction was implemented at this site. It was also the only case study project that had a differential speed limit for cars and trucks.

One limitation of this case study lies in the data collection process. As listed in Table 5.2, only limited data were collected without any traffic control interventions, with the pace car intervention, and for the case when the pace car and PCMS were both present in the work zone. In addition, only one pace car was implemented for the traffic control intervention. The effect of the pace car might be limited by the number of pace cars used in the work zone, as the presence of the pace car would only be visible to drivers who were close to the pace car when it was being driven in the direction of travel where the work operations were present (eastbound). Driver behavior would not be directly impacted by the presence of the pace car if the pace car is not present.

Another limitation is related to the data analysis. As mentioned in Section 5.5.2.1, based on the decision sight distance, only vehicles that were within 13 seconds away from the pace car are directly impacted by the presence of pace car according to the literature. However, due to the low traffic volume in the examined roadway segments, in order to have enough data points to conduct the analyses, the minimum time aggregation level used in the analyses was 1-min. As a result, the analyses may include some vehicles that were not impacted by the pace car directly. But the trailing vehicles could be indirectly impacted by the pace car because the speeds of the vehicles that were ahead and under the influence of the pace car may also have an effect on the trailing vehicles.

6.3.2 Case Study #2: I-205 Abernethy Bridge - SE 82nd Drive

In Case Study #2, only one traffic control intervention was tested, that is the PCMS with messages to remind drivers to travel at a constant speed through the work zone. It should be noted that, different from other case studies, the location of the PCMS in Case Study #2 was fairly close to the RWA sign. The findings are summarized below:

- At the posted speed limit of 55 mph, with the presence of the PCMS adjacent to the RWA sign, the median 1-min and 5-min 85th percentile speed at the RWA sign location reduced 5.4 mph and 5.8 mph, respectively. The reductions in the 85th percentile speed are statistically significant at the 0.05 level. No speed variation reduction was found at the same location.

- Speed and speed variation reductions with the presence of the PCMS were found toward the end of the work zone.

However, as displayed in the Figure 5.22, there were three freeway entrances between the locations of the RWA sign and the last sensor when the PCMS was placed close to the RWA sign. Hence, not all the vehicle speeds recorded by the sensors were under the influence of the presence of the PCMS unit in this case study. It could be one major limitation of this case study. In addition, compared to the data collected without any traffic control intervention (two days of control data), the data collected with the PCMS present (one day of PCMS data) were limited.

6.3.3 Case Study #3: I-5 Sutherlin – Garden Valley Blvd.

In Case Study #3A, two days of data collection was conducted, one day without any traffic control interventions, and another day with the PCMS unit placed in the middle of the advance warning area. From the analysis, it was found that the presence of the PCMS did not show any effects on reducing vehicle speed and speed variation in the transition area and in the active work area. Speed variation (COV) reduction was only found at the end of the work zone. Similar to Case Study #2, not all of the recorded vehicles speeds were under the influence of the presence of the PCMS as there was a freeway entrance located downstream of the location of the PCMS, as shown in Figure 6.19.

Other limitations associated with Case Study #3A lie in the differences in the construction operations, the posted speed limits, and the start and end points of the work zone on the two days of data collection. On Day 1 (control), paving operations were conducted with a posted speed limit of 65 mph prior to the work zone and a temporary reduction to 50 mph in the work zone. On Day 2 (PCMS), barrier removal and replacement work was conducted with a posted speed limit of 60 mph prior to and in the work zone. From Figure 6.18 and Figure 6.19, it can be observed that the work zone locations vary on the two different days, and there are some variations in the number of freeway entrances and exits throughout the work zone. These differences in the two days of data collection might impact driver behavior as well, which may have impacts when examining the speed and speed variation reduction effect of the PCMS unit.

As for the Case Study #3B, two traffic control interventions were examined – the PCMS unit placed in the middle of advance warning area, and the combination of the PCMS unit and amber/white lights on paving equipment turned on in the active work area. The findings regarding the effectiveness of the two interventions in the work zone with paving operations are summarized below:

- In the transition area, specifically at the end of the taper location, with the presence of the PCMS unit, the median 1-min and 5-min 85th percentile speed reduced 2.4 mph and 3.9 mph, respectively, compared to the control case. The 1-min SD and 5-min SD reduced 0.31 mph and 0.65 mph, respectively. The reductions in the 85th percentile speed and 5-min SD were found to be statistically significant.

- In the active work area, the presence of the PCMS unit was found to be effective in reducing COV at the beginning of the active work area where the construction equipment often remained for a longer period of time, compared to the control case. The 1-min and 5-min COV reductions were 0.015 and 0.031, respectively. The reductions are statistically significant at a level of 0.05.

- In the transition area, specifically at the end of the taper location, with the PCMS unit placed in the advance warning area and amber/white lights on the paving equipment turned on, the median 1-min and 5-min 85th percentile speed reduced 3.3 mph and 4.8 mph, respectively. The combination also reduced the median 1-min and 5-min SD by 1.70 mph and 1.47 mph, respectively. The reductions in 1-min and 5-min COV were 0.025 and 0.012, respectively. All reductions are statistically significant at the level of 0.05.

- In the active work area, specifically at the beginning of the active work area where the construction equipment often remained for a longer period of time, with the combination of the PCMS unit and amber/white lights on the paving equipment turned on, the median 1-min and 5-min SD reduced 1.31 mph and 1.34 mph, respectively, compared to the control case. The median 1-min and 5-min COV reduced by 0.037 and 0.030, respectively. The median 5-min 85th percentile speed reduced by 1.7 mph.

- The combination of the PCMS unit and amber/white lights on the paving equipment turned on shows greater reductions than the PCMS unit only at the beginning of the active work area with regards to the median 1-min and 5-min 85th percentile speeds, 1-min and 5-min SD, and 1-min COV.

It should be noted that the truck percentage in Case Study #3, which ranged from 26% to 67%, was the highest among all three case studies. It was found that at some periods of time, as shown in Figure 6.29, the number of trucks was greater than that of passenger cars, which makes Case Study #3 different from the other case studies. The difference in truck percentage may be because the Case Study #3 project was located on a highway segment with lower overall traffic volume and the data collection was conducted at night, which is consistent with the study by Ale Mohammadi (2014). Compared to the COVs in the control conditions of the other case study projects (as shown in Table 6.5, Table 6.6, and Table 6.7 for Case Study #1, and in Table 6.10 for Case Study #2), the COVs for Case Study #3 (as shown in Table 6.11 and Table 6.12) were relatively greater. The larger COVs for Case Study #3 may have been present because the truck percentage in this case study project fell into the range from 40% to 60%, which has been identified as a factor that contributes to higher COVs and relatively dangerous traffic conditions, as suggested in the study conducted by Chen (2020).

Additionally, on Day 5 of Case Study #3B, the air quality condition at the project site was unhealthy due to the wildfires in Oregon. This environmental condition may have some impact on the visibility of the PCMS unit and the amber/white lights.

Similar to Case Study #3A, one of the limitations of Case Study #3B is related to the different start and end locations of the work zone on different days. In addition, compared to the data collected without any traffic control intervention, and with the PCMS unit only, the data collected for the combination of the PCMS unit and amber/white lights on paving equipment turned on were limited.

7.0 CONCLUSIONS AND RECOMMENDATIONS

The results of the present research study provided an opportunity to assess the prevalence and magnitude of speed variation in high-speed roadway work zones in Oregon. The preliminary results of greater speed variation in work zones suggested that additional attention should be given to vehicle speed variability, in addition to average speed. Along with the analyses of vehicle speed, the study also examined the impacts of selected traffic control interventions on speed variation in case study projects.

The following conclusions are drawn from the literature review, the analyses of speed data collected with and without work zone present, as well as data (speed data, on-site observations, etc.) collected from the case study projects.

7.1 SPEED VARIATION IN OREGON WORK ZONES

Phase I of the study focused on investigating the prevalence and magnitude of variation in vehicle speed in work zones, and whether this variation is generally greater than speed variation under free flow conditions without a work zone present. To do so, the researchers analyzed archived speed data collected from past work zone projects, and Oregon roadway speed data captured with HERE Technologies at similar locations when there was no work zone present. Two speed variation measurements were assessed, 5-min speed SD and 5-min speed COV.

Based on vehicle speed data collected on case study projects in past ODOT research studies, the researchers compared the speed variation at the RWA sign location, which is viewed as containing free-flow speeds prior to entering a work zone, with those at multiple locations within work zones in the same 5-min window. Statistical analyses of vehicle speed variation (SD and COV) for the two groups reveal the following results:

- Between 10% and 28% of the examined locations within work zones are associated with higher SDs than those at the RWA locations;
- On between 30% and 62% of the data collection days, at least one work zone location showed a greater SD than that at the RWA location;
- Compared to SDs, COVs present more evident results that work zones are associated with greater speed variation;
- Between 52% and 72% of the examined locations within work zones are associated with higher COVs than those at the RWA locations; and
- On between 77% and 95% of the data collection days, at least one work zone location showed a greater COV than that at the RWA location.

Because of the limited availability of Oregon roadway speed data from HERE Technologies at the selected locations, only descriptive analyses were conducted to show the differences in speed variation with and without a work zone present. The analyses of vehicle speed comparing those days with the work zone present (from past work zone research studies) to the days without the work zone present (using HERE Technologies data) at similar locations reveal the following results:

- The average 5-min SDs with a work zone present using data collected with portable traffic analyzers (sensors), which ranged from 5.57 mph to 11.05 mph are greater than the average 5-min SDs during normal operations (without a work zone present) using HERE Technologies data at similar locations, which ranged from 0.53 mph to 5.75 mph.

- The average 5-min COVs with a work zone present using data collected with portable traffic analyzers (sensors), which ranged from 0.129 to 0.245, are greater than the average 5-min COVs during normal operations (without a work zone present) using HERE Technologies data at similar locations, which ranged from 0.009 to 0.111.

- With the same data source (HERE), traffic data with work zones are also associated with greater speed variations (5-min SD and COV) than those at similar locations during normal operations.

It should be noted that, in addition to the presence of work zones, multiple roadway design and traffic control features, along with environmental conditions, as listed in Table 2.3 and described in Section 2.3, may also impact vehicle speed and speed variation. This part of the analyses focuses on speed collected at different locations in work zones, and presents a preliminary assessment of speed variation in work zones on high-speed roadways in Oregon. The different types of work zones, the dynamic nature of work zone operations and traffic conditions, the percentage of trucks relative to the percentage of passenger vehicles, the weather conditions at the work zone locations, as well as variations in driver behaviors, limit the ability for researchers to eliminate these confounding factors when conducting the analyses. However, the results obtained from the analyses provide an initial and general assessment of the prevalence and magnitude of speed variation in work zones that can be used to confirm the need to address vehicle speed variation in work zones and guide future research.

In the present study, due to the limited availability of crash data on the investigated workdays, direct links between speed variation and the possibility of crash involvement could not be established. Nevertheless, based on the conclusions from the speed variation analyses mentioned above, and the findings from prior research that showed large variations in speed resulted in increased risk, it is reasonable to predict that crash risks in work zones would be high.

7.2 EFFECTIVENESS OF TRAFFIC CONTROL DEVICES ON SPEED VARIATION

The findings from Phase I reveal the need to address speed variation in work zones, and to investigate potential traffic control interventions to minimize variability in vehicle speed in order to improve work zone safety. Four potential traffic control treatments were identified as promising speed variation interventions. They are:

1. A “pace car” continuously traveling at or slightly below the posted speed limit throughout the work zone;

2. A PCMS unit showing custom, alternating messages similar to “MAINTAIN CONSTANT SPEED / THRU WORK ZONE” and placed in the advance warning area of the work zone;

3. The combination of a pace car and a PCMS (same message as in intervention #2); and

4. The combination of a PCMS unit (same message as in intervention #2), and flashing amber/white lights on paving equipment that were being operated in the active work area.

The researchers then examined the effectiveness of the identified treatments on three case study projects on high-speed roadway work zones in Oregon. Data collection was conducted to record passing vehicle data (speed, vehicle length, and time) at multiple locations within the work zones. For each case study, at least one traffic control treatment was examined. Each case study was analyzed independently. Comparisons were made between periods of testing with a selected traffic control intervention (treatment A), and those with another intervention (treatment B) or without any traffic control intervention (control). Similar to the speed variation analyses conducted in Phase I, two speed variation measurements, SD and COV, were assessed. Depending on whether the pace car treatment was implemented in the case study project, the time aggregation levels for speed variation vary. The primary time aggregation levels adopted were 1-min and 5-min.

The statistical analyses of the speed data from the three case study projects included in this research study reveal the following findings:

- The pace car intervention did not present statistically significant impact on reducing either speed or speed variation.

- The PCMS unit showing custom messages placed in the advance warning area of the work zone was found to be effective in reducing speed variation in work zones, especially for locations closer to the construction workers and equipment. The reductions in the median of 1-min SD ranged from 1.29 mph to 2.05 mph, and the reductions in 5-min SD ranged from 0.76 mph to 2.52 mph. As for COV, the reductions in 1-min COV ranged from 0.015 to 0.060, and in 5-min COV ranged from 0.014 to 0.087. The differences listed above vary depending on the type of work being conducted, the length of the work zone, the location of the work zone, and type and amount of equipment present.

- The PCMS and pace car combination treatment was more effective in reducing speed variation (SD and COV) in the active work zone than without the treatment.

Compared to the PCMS or the pace car alone condition, the combination also showed greater reduction effects in speed variation (SD and COV).

- The combination of the PCMS unit and amber/white lights on the paving equipment showed reductions in speed variation (SD and COV) in the transition and active work areas than without the treatment, especially for locations closer to the construction workers and equipment. Compared to the PCMS unit only treatment, the combination also showed greater reduction effects in speed and speed variation at the locations closer to construction workers and equipment.

Based on the findings, the PCMS unit showing custom messages "MAINTAIN CONSTANT SPEED / THRU WORK ZONE" and placed in the advance warning area of the work zone is the most promising traffic control intervention to reduce speed variation (SD and COV) in work zones, especially at locations closer to the construction workers and equipment.

In addition to the presence of traffic control interventions, it should be noted that the differences in work zone site conditions, vehicle distribution, site layouts, construction operations, data collection time and periods, and driver behaviors may also impact the results related to vehicle speed. The study was not completed in controlled experimental settings. Therefore, the abovementioned confounding factors cannot be avoided and removed. The presence of confounding factors, and the low number of case study projects limit the generalizability of the research findings. However, the results obtained from the case study projects present an assessment of the impact of the selected traffic control interventions on reducing speed variation in work zones. The findings can be used to make informed decisions on whether to adopt the examined traffic control devices in work zones.

The findings from the present study also enable making recommendations for future practice. It is recommended to place a PCMS unit showing custom messages "MAINTAIN CONSTANT SPEED / THRU WORK ZONE" in the advance warning area of high-speed roadway work zones. The PCMS could be placed at the midpoint between the RWA sign location and the beginning of the taper location. As observed in Case Study #2 (I-205 Abernethy Bridge - SE 82nd Drive), placing of the PCMS unit close to the RWA sign at the beginning of the advance warning area could be ineffective in reducing speed variation in the downstream work area because drivers who enter the work zone through freeway entrances downstream of the RWA sign would not see the message on the PCMS. Therefore, if available, depending on the length of the work zone, and the number of roadway entrances and exits throughout the work zone, it is recommended to place one or more PCMS units in the advance warning area and at the transition area to remind drivers to travel at a constant speed relative to surrounding vehicles in order to reduce speed variability.

It is worth mentioning that the placement of PCMS units should provide maximum legibility and time for public traffic to read, interpret, and respond appropriately to the message. When multiple PCMSs are used, it is recommended to place them on the same side of the roadway. For high-speed roadways (freeways and expressways), two adjacent units should be placed at least 1,000 feet apart. After the PCMS units are placed, visual inspection should be conducted to verify the units are unobstructed and the messages are readable (ODOT, 2018).

7.3 RECOMMENDATIONS FOR FUTURE RESEARCH

The present study also exposed the possibility for additional research to fully understand the prevalence and magnitude of speed variation in work zones, the relationship between speed variation and crash occurrence in work zones, the impacts of traffic control interventions on reducing speed variation, and the development of information and tools for application of the findings in practice.

With respect to speed variation in work zones, the analyses in the present study placed a focus on spot speed collected at multiple locations in work zones, and did not take into consideration roadway and work zone design factors that may also impact speed variation, such as road grade and curvature, the presence of other traffic control devices in work zones, etc. Future research is recommended to analyze more speed data, with and without work zones, considering factors that may relate to speed variation.

Because the limited availability of crash data in the selected roadway work zones analyzed, the present study could not establish a direct relationship between speed variation and crash occurrence in work zones. It is expected that with adequate detailed crash data (whether construction work zones were active when the crash occurred, the work zone location of the crash, the posted speed limit, whether construction workers and equipment were involved in the crash, crash type, the estimated average speed and crash-involved vehicle-speed, etc.), future research could quantify the relationship, similar to those listed in Table 2.2.

In the present study, the only alternating messages on the PCMS unit examined were "MAINTAIN CONSTANT SPEED / THRU WORK ZONE". Drivers may have different attitudes, perceptions, and responses toward the messages. Further research could be conducted to investigate and evaluate motorist reactions based on different messages and PCMS sign settings (e.g., matrix type, phases, etc.). Standardized messages and PCMS speed settings should be determined and used in order to ensure consistency throughout the state.

Research investigating optimal locations for showing the additional message to passing drivers should also be considered. For example, multiple PCMS units could be used, one after the RWA sign and additional units within the active work area. The PCMS signs located on top of the rollers could also show the additional message.

In addition to a PCMS unit, the use of a pace car, the combination of the PCMS display and pace car, and the combination of the PCMS display and flashing amber/white lights on paving equipment should be studied further. The present study provided limited opportunity for in-depth assessment of the three traffic control interventions. Even though the pace car intervention adopted - only one pace car continuously traveling throughout the work zone - did not show speed variation reduction effects in Case Study #1 (I-84 Swanson Canyon to Arlington Project), further study is recommended to examine whether multiple pace cars are effective in reducing speed variation, and determine the optimal number of pace cars. Additionally, the findings from Case Study #1 (I-84 Swanson Canyon to Arlington Project) and Case Study #3 (I-5 Sutherlin – Garden Valley Blvd.) suggest that the combination of the PCMS display and pace car, and the combination of the PCMS display and flashing amber/white lights on paving equipment are more effective in decreasing speed variation than a single treatment. However, the periods of testing with the combinations were limited. Further study is recommended to evaluate the impact of the combination treatment.

It is envisioned that many, if not all, future construction and maintenance work zones will incorporate smart technologies. Technologies are currently available and being developed that inform drivers of impending congestion and hazards, and the need to slow down, in real-time. These technologies commonly use observed vehicle speed to determine traffic conditions. Future technologies could be developed that utilize speed variation to identify and communicate hazardous driving conditions. That is, the technology could alert drivers to maintain constant speed relative to nearby vehicles when the amount of speed variation reaches a specified level. In order for the technology to do so, an understanding of what constitutes a dangerous level of speed variation (e.g., high level of SD and/or COV) is needed. With such an understanding, the technology could be programmed with "trigger points" to identify when to issue a real-time alert to drivers. The archival data and case study data collected in the present research does not provide the ability to determine the trigger points due to the inability to correlate crashes in work zones to speed variation in work zones as describe previously. Further research is recommended to correlate the level of crash risk associated with different levels of speed variation in order to identify dangerous driving conditions.

As described previously, the volume of trucks as a percentage of the overall traffic volume impacts speed variation. Prior research related to truck percentage focused on roadways without a work zone present. Future research is warranted to conduct an in-depth analysis of the impacts of truck percentage on speed variation when a work zone is present. This topic is especially of interest given that trucks used for the construction and maintenance operations taking place contribute to the truck percentage. Perhaps the number of construction/maintenance trucks used in the operation and allowed on the roadway at a specific time could be selected to minimize the impacts of truck percentage on speed variation. A related indicator that should also be investigated is the differential between the 85th percentile speed and the 15th percentile speed of all vehicles on the roadway.

Given the difficulties in quantifying speed variation in a way that accurately reflects the risk on the roadway, indicators of speed variation may be of interest for use in designing traffic control and communicating with drivers. For example, rather than calculating SD or COV amongst the vehicles on the roadway, truck percentage could be used as a proxy for speed variation. When designing traffic control measures for work zones, truck percentage could be used to indicate expected speed variation. Similarly, when alerting oncoming drivers of upcoming hazardous work zone conditions in real-time, the percentage of trucks on the roadway could be observed and used to identify a dangerous roadway condition. Future research is recommended to explore other valid means of measuring speed variation, such as truck percentage.

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APPENDIX A - SPEED DATA SUMMARY – CASE STUDY 1

Day 1 – RWA1

	10:00 - 11:00			11:00 - 12:00			12:00 - 13:00			13:00 - 14:00			14:00 - 15:00			15:00 - 16:00		
Speed_Range	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total
<10	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
10-14	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
15-19	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.2%	0.0%	0.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
20-24	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.2%	0.0%	0.2%	0.0%	0.0%	0.0%
25-29	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.6%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
30-34	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.2%	0.0%	0.1%	0.0%	0.0%	0.0%	0.2%	0.0%	0.2%	0.0%	0.0%	0.0%
35-39	0.0%	0.0%	0.0%	0.2%	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.6%	0.2%	0.2%	0.0%	0.2%
40-44	0.0%	0.0%	0.0%	0.0%	0.6%	0.1%	0.0%	1.2%	0.3%	0.0%	1.7%	0.5%	0.2%	0.6%	0.3%	0.0%	1.8%	0.5%
45-49	0.9%	0.0%	0.7%	0.6%	2.8%	1.1%	0.4%	2.4%	0.9%	0.6%	2.2%	1.1%	1.0%	3.8%	1.7%	0.8%	4.2%	1.7%
50-54	2.1%	8.1%	3.5%	1.7%	8.8%	3.6%	0.8%	8.9%	2.7%	1.7%	13.8%	5.0%	3.1%	9.4%	4.7%	2.1%	10.1%	4.2%
55-59	3.2%	25.2%	8.4%	2.7%	23.2%	8.0%	5.1%	17.2%	8.0%	4.8%	26.0%	10.6%	5.2%	23.8%	9.8%	4.2%	29.8%	10.8%
60-64	13.0%	35.6%	18.4%	13.1%	35.4%	18.8%	13.4%	38.5%	19.4%	14.4%	33.7%	19.7%	14.7%	36.3%	20.1%	15.0%	25.0%	17.6%
65-69	28.1%	20.7%	26.4%	28.0%	19.3%	25.8%	26.6%	23.7%	25.9%	27.3%	16.0%	24.2%	25.3%	11.3%	21.8%	25.1%	18.5%	23.3%
70-74	29.3%	6.7%	24.0%	29.8%	5.5%	23.5%	28.1%	3.6%	22.1%	28.1%	4.4%	21.6%	27.4%	9.4%	22.9%	30.5%	4.8%	23.8%
75 and above	23.3%	3.7%	18.7%	24.0%	4.4%	18.9%	25.6%	4.1%	20.4%	22.9%	2.2%	17.2%	22.6%	5.0%	18.2%	22.1%	6.0%	17.9%
Total	437	135	572	521	181	702	531	169	700	480	181	661	482	160	642	479	168	647
85th Percentile	77.48	68.05	76.50	76.54	67.98	75.59	77.45	67.81	76.54	76.54	66.17	75.59	76.54	69.88	75.59	77.45	67.98	76.50
Average	70.60	62.83	68.76	70.67	62.29	68.51	70.65	62.31	68.64	70.10	60.96	67.60	69.52	62.46	67.76	70.27	61.43	67.97
Std Dev	7.38	6.11	7.83	7.23	7.44	8.15	7.45	7.46	8.26	7.71	6.47	8.44	8.17	8.76	8.86	7.64	8.11	8.67
Min	46.20	51.88	46.20	39.58	44.31	39.58	32.00	28.21	28.21	17.19	44.31	17.19	20.64	39.58	20.64	39.58	42.42	39.58
Max	101.12	88.81	101.12	101.03	99.22	101.03	94.43	99.14	99.14	105.74	89.72	105.74	100.17	103.96	103.96	99.22	97.26	99.22
Range	54.91	36.93	54.91	61.45	54.91	61.45	62.43	70.93	70.93	88.55	45.41	88.55	79.53	64.38	83.32	59.65	54.84	59.65

Day 1 – RWA2

	10:00 - 11:00			11:00 - 12:00			12:00 - 13:00			13:00 - 14:00			14:00 - 15:00			15:00 - 16:00		
Speed_Range	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total
<10	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
10-14	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
15-19	0.0%	0.0%	0.0%	0.3%	0.0%	0.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.3%	0.0%	0.2%
20-24	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
25-29	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.6%	0.2%	0.0%	0.6%	0.2%	0.0%	0.0%	0.0%
30-34	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.3%	0.0%	0.2%	0.0%	0.0%	0.0%
35-39	0.3%	0.0%	0.2%	0.3%	0.0%	0.2%	0.0%	0.0%	0.0%	0.3%	0.0%	0.2%	0.3%	0.0%	0.2%	0.3%	0.0%	0.2%
40-44	0.0%	0.0%	0.0%	0.3%	0.0%	0.2%	0.0%	0.0%	0.0%	0.3%	0.6%	0.4%	0.3%	0.6%	0.4%	0.0%	0.0%	0.0%
45-49	0.3%	2.1%	0.9%	0.0%	2.7%	1.0%	1.0%	0.5%	0.9%	0.5%	0.0%	0.4%	1.1%	1.8%	1.3%	1.1%	2.0%	1.5%
50-54	1.3%	2.1%	1.5%	2.1%	5.5%	3.3%	1.6%	4.1%	2.4%	2.5%	6.9%	3.9%	2.5%	5.3%	3.4%	2.3%	5.6%	3.5%
55-59	2.8%	20.4%	8.2%	4.8%	20.2%	10.3%	6.2%	18.7%	10.3%	5.4%	24.0%	11.4%	6.6%	22.8%	11.7%	4.6%	16.2%	8.7%
60-64	17.6%	21.8%	18.9%	14.7%	26.8%	19.0%	19.4%	20.2%	19.7%	17.2%	21.7%	18.6%	13.9%	23.4%	16.9%	17.9%	23.2%	19.9%
65-69	22.6%	18.3%	21.3%	22.8%	12.0%	19.0%	22.7%	25.4%	23.6%	24.0%	15.4%	21.2%	23.8%	22.2%	23.3%	21.9%	16.2%	19.9%
70-74	25.1%	10.6%	20.6%	21.6%	14.2%	19.0%	20.4%	10.4%	17.1%	21.0%	12.0%	18.1%	24.9%	11.1%	20.5%	29.1%	10.6%	22.4%
75 and above	30.1%	24.6%	28.4%	33.0%	18.6%	27.9%	28.7%	20.7%	26.0%	28.9%	18.9%	25.6%	26.5%	12.3%	22.0%	22.5%	26.3%	23.9%
Total	319	142	461	333	183	516	387	193	580	367	175	542	366	171	537	351	198	549
85th Percentile	79.07	78.91	79.07	79.92	77.31	78.79	79.57	77.54	79.53	79.07	76.50	78.22	78.86	73.00	77.37	77.79	79.12	78.22
Average	71.49	67.70	70.32	71.05	66.21	69.33	70.67	67.73	69.69	70.67	65.88	69.12	70.31	65.01	68.63	70.08	67.60	69.19
Std Dev	7.83	9.57	8.58	8.88	9.50	9.38	8.70	9.33	9.01	8.66	10.05	9.40	9.11	9.25	9.47	8.79	10.03	9.32
Min	38.91	47.03	38.91	18.82	47.03	18.82	47.03	49.99	47.03	39.19	29.85	29.85	32.26	29.85	29.85	18.82	46.29	18.82
Max	91.79	94.34	94.34	91.79	96.04	96.04	94.34	94.34	94.34	95.19	94.34	95.19	96.04	96.04	96.04	96.04	95.19	96.04
Range	52.89	47.31	55.43	72.97	49.01	77.21	47.31	44.35	47.31	56.00	64.49	65.33	63.78	66.18	66.18	77.21	48.90	77.21

Day 1 – BoT

	10:00 - 11:00			11:00 - 12:00			12:00 - 13:00			13:00 - 14:00			14:00 - 15:00			15:00 - 16:00		
Speed_Range	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total
<10	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
10-14	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
15-19	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
20-24	0.0%	0.0%	0.0%	0.2%	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
25-29	0.0%	0.0%	0.0%	1.0%	1.0%	1.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
30-34	0.2%	0.0%	0.2%	1.6%	2.4%	1.8%	0.2%	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
35-39	0.2%	0.0%	0.2%	1.8%	1.5%	1.7%	0.0%	0.0%	0.0%	0.2%	0.0%	0.2%	0.2%	0.0%	0.2%	0.2%	0.0%	0.2%
40-44	0.2%	0.0%	0.2%	2.2%	2.9%	2.4%	0.0%	1.6%	0.4%	0.6%	1.0%	0.8%	1.3%	0.0%	0.9%	0.2%	1.1%	0.5%
45-49	2.3%	2.2%	2.3%	3.8%	6.3%	4.6%	2.4%	2.1%	2.3%	2.3%	0.5%	1.8%	5.5%	4.2%	5.1%	1.9%	1.7%	1.8%
50-54	4.7%	2.9%	4.2%	9.1%	9.7%	9.2%	7.7%	4.7%	6.9%	9.7%	11.3%	10.2%	6.1%	11.5%	7.5%	9.5%	7.4%	8.9%
55-59	16.7%	33.1%	20.7%	22.1%	26.7%	23.5%	23.4%	31.6%	25.6%	19.5%	34.5%	23.9%	20.5%	27.9%	22.4%	20.6%	32.0%	23.7%
60-64	29.1%	35.3%	30.6%	24.5%	34.0%	27.3%	25.9%	40.0%	29.8%	32.2%	35.6%	33.2%	27.7%	36.4%	29.9%	24.6%	32.6%	26.8%
65-69	29.5%	18.7%	26.9%	18.1%	11.7%	16.2%	23.8%	11.1%	20.3%	24.2%	12.4%	20.7%	23.3%	16.4%	21.5%	27.6%	18.9%	25.2%
70-74	12.8%	4.3%	10.7%	10.3%	2.4%	8.0%	9.8%	4.7%	8.4%	6.1%	2.1%	5.0%	11.5%	1.8%	9.0%	9.1%	2.9%	7.4%
75 and above	4.2%	3.6%	4.0%	5.2%	1.5%	4.1%	6.9%	4.2%	6.2%	5.1%	2.6%	4.4%	4.0%	1.8%	3.4%	6.3%	3.4%	5.5%
Total	430	139	569	497	206	703	509	190	699	472	194	666	477	165	642	475	175	650
85th Percentile	70.65	66.77	69.87	70.65	65.23	68.32	70.65	66.50	69.87	69.10	65.23	68.32	70.65	65.23	69.10	70.65	66.77	69.87
Average	64.20	62.19	63.71	60.77	58.44	60.09	63.40	61.66	62.93	62.68	60.70	62.10	62.72	60.38	62.12	63.55	61.44	62.98
Std Dev	6.82	5.84	6.64	9.79	8.81	9.57	7.27	6.46	7.09	6.92	5.91	6.70	7.52	5.93	7.22	7.26	6.05	7.01
Min	34.26	48.20	34.26	24.20	28.84	24.20	32.71	40.46	32.71	38.13	43.55	38.13	39.68	45.87	39.68	36.58	42.00	36.58
Max	83.80	82.26	83.80	82.26	83.80	83.80	84.58	82.26	84.58	84.58	83.80	84.58	82.26	80.71	82.26	84.58	80.71	84.58
Range	49.54	34.06	49.54	58.06	54.96	59.61	51.86	41.80	51.86	46.45	40.25	46.45	42.58	34.83	42.58	47.99	38.71	47.99

Day 1 – 1stWA

	10:00 - 11:00			11:00 - 12:00			12:00 - 13:00			13:00 - 14:00			14:00 - 15:00			15:00 - 16:00		
Speed_Range	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total
<10	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
10-14	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.2%	0.0%	0.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
15-19	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
20-24	0.0%	0.0%	0.0%	0.6%	0.0%	0.4%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
25-29	0.0%	0.0%	0.0%	1.1%	0.0%	0.9%	0.0%	0.0%	0.0%	0.0%	0.7%	0.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
30-34	0.0%	0.0%	0.0%	1.9%	2.6%	2.1%	0.0%	0.0%	0.0%	0.2%	0.0%	0.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
35-39	0.4%	0.8%	0.5%	2.5%	2.6%	2.5%	0.4%	0.7%	0.4%	0.6%	0.7%	0.6%	1.0%	0.0%	0.8%	0.2%	0.0%	0.2%
40-44	3.1%	1.7%	2.8%	5.5%	6.0%	5.6%	3.0%	1.4%	2.7%	3.4%	2.0%	3.1%	3.0%	2.4%	2.8%	2.6%	4.8%	3.1%
45-49	6.9%	14.4%	8.5%	11.9%	12.6%	12.0%	7.0%	12.1%	8.0%	7.3%	12.8%	8.5%	9.5%	17.6%	11.1%	9.0%	10.3%	9.3%
50-54	11.2%	22.0%	13.5%	12.8%	13.9%	13.1%	12.2%	20.0%	13.7%	11.5%	19.5%	13.3%	13.8%	8.8%	12.8%	10.4%	17.9%	12.1%
55-59	19.7%	26.3%	21.1%	18.5%	31.8%	21.4%	23.6%	27.1%	24.3%	23.2%	26.2%	23.9%	17.8%	32.0%	20.6%	21.5%	29.0%	23.2%
60-64	26.2%	16.9%	24.2%	19.8%	15.9%	18.9%	22.7%	21.4%	22.5%	23.4%	25.5%	23.9%	20.5%	26.4%	21.7%	22.7%	17.2%	21.5%
65-69	18.3%	10.2%	16.6%	12.6%	6.0%	11.2%	15.0%	10.7%	14.2%	15.5%	8.1%	13.8%	17.9%	8.0%	16.0%	17.1%	9.7%	15.5%
70-74	8.7%	3.4%	7.6%	7.9%	6.0%	7.5%	8.9%	2.1%	7.6%	7.9%	2.7%	6.7%	10.3%	3.2%	8.9%	9.2%	4.1%	8.0%
75 and above	5.4%	4.2%	5.1%	4.9%	2.6%	4.4%	7.2%	4.3%	6.6%	6.9%	2.0%	5.7%	6.3%	1.6%	5.4%	7.4%	6.9%	7.3%
Total	447	118	565	530	151	681	559	140	699	496	149	645	507	125	632	502	145	647
85th Percentile	69.52	65.39	69.52	68.49	64.35	68.49	70.55	65.39	69.52	69.52	64.35	68.49	70.55	64.35	69.52	70.55	66.83	70.55
Average	61.36	58.06	60.67	57.92	56.37	57.57	61.41	58.65	60.85	60.77	57.41	60.00	61.04	58.13	60.46	61.42	59.31	60.94
Std Dev	8.65	9.32	8.89	11.42	9.85	11.10	9.48	9.38	9.52	9.48	7.78	9.22	9.67	9.11	9.63	9.44	10.66	9.76
Min	36.46	38.53	36.46	23.03	30.26	23.03	38.53	38.53	38.53	10.64	26.13	10.64	36.46	41.63	36.46	35.43	40.59	35.43
Max	98.44	107.74	107.74	101.54	93.28	101.54	107.74	106.71	107.74	94.31	86.05	94.31	102.57	106.71	106.71	109.81	102.57	109.81
Range	61.98	69.21	71.28	78.51	63.01	78.51	69.21	68.18	69.21	83.67	59.91	83.67	66.11	65.08	70.24	74.38	61.98	74.38

Day 1 – 2ndWA

	10:00 - 11:00			11:00 - 12:00			12:00 - 13:00			13:00 - 14:00			14:00 - 15:00			15:00 - 16:00		
Speed_Range	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total
<10	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
10-14	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
15-19	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
20-24	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
25-29	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
30-34	0.2%	0.0%	0.2%	0.0%	0.0%	0.0%	0.2%	0.0%	0.1%	0.0%	0.6%	0.2%	0.2%	0.0%	0.2%	0.0%	0.7%	0.2%
35-39	0.0%	0.0%	0.0%	0.4%	0.0%	0.3%	0.6%	0.0%	0.4%	0.2%	0.0%	0.2%	0.0%	0.0%	0.0%	0.6%	0.0%	0.5%
40-44	0.5%	0.8%	0.5%	1.6%	4.0%	2.2%	1.1%	1.2%	1.2%	2.4%	1.2%	2.0%	1.5%	0.7%	1.3%	1.3%	2.0%	1.5%
45-49	0.7%	3.0%	1.3%	5.4%	6.3%	5.7%	2.7%	4.7%	3.2%	4.7%	4.8%	4.7%	6.1%	5.5%	6.0%	4.3%	8.2%	5.2%
50-54	5.2%	4.5%	5.0%	10.3%	16.0%	11.8%	7.5%	12.3%	8.7%	7.7%	15.6%	9.8%	10.1%	13.7%	11.0%	11.7%	10.2%	11.4%
55-59	15.5%	31.8%	19.3%	21.0%	27.4%	22.7%	22.0%	30.4%	24.1%	22.2%	34.7%	25.5%	16.2%	26.7%	18.8%	16.6%	29.3%	19.6%
60-64	19.9%	27.3%	21.6%	23.2%	24.0%	23.4%	22.2%	22.8%	22.4%	17.9%	22.8%	19.2%	19.7%	23.3%	20.6%	20.7%	20.4%	20.6%
65-69	20.6%	13.6%	19.0%	15.9%	9.7%	14.3%	17.8%	13.5%	16.7%	18.2%	7.8%	15.4%	18.2%	11.0%	16.4%	16.4%	10.2%	14.9%
70-74	24.1%	9.1%	20.6%	12.5%	6.3%	10.9%	13.0%	5.3%	11.1%	13.5%	4.8%	11.2%	16.7%	7.5%	14.5%	12.8%	8.2%	11.7%
75 and above	13.3%	9.8%	12.5%	9.7%	6.3%	8.8%	12.8%	9.9%	12.1%	13.2%	7.8%	11.8%	11.2%	11.6%	11.3%	15.6%	10.9%	14.4%
Total	427	132	559	496	175	671	522	171	693	468	167	635	456	146	602	469	147	616
85th Percentile	74.77	71.04	74.77	72.91	67.31	71.98	73.84	69.65	72.91	73.84	68.25	72.91	73.84	71.28	73.70	75.71	71.14	74.77
Average	66.96	64.19	66.30	63.06	60.26	62.33	64.23	62.58	63.82	64.33	61.27	63.53	63.93	62.78	63.65	64.77	62.04	64.12
Std Dev	8.50	10.56	9.09	9.39	9.24	9.42	9.26	10.59	9.62	10.36	10.59	10.50	9.63	10.58	9.87	10.88	11.70	11.13
Min	33.74	44.00	33.74	35.61	42.13	35.61	30.01	42.13	30.01	39.34	32.81	32.81	34.67	42.13	34.67	35.61	30.01	30.01
Max	99.95	104.62	104.62	94.36	99.02	99.02	97.16	101.82	101.82	104.62	103.68	104.62	99.95	101.82	101.82	104.62	101.82	104.62
Range	66.21	60.62	70.88	58.75	56.89	63.42	67.15	59.69	71.81	65.28	70.88	71.81	65.28	59.69	67.15	69.01	71.81	74.61

Day 2 – RWA2

	10:00 - 11:00			11:00 - 12:00			12:00 - 13:00			13:00 - 14:00			14:00 - 15:00			15:00 - 16:00		
Speed_Range	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total
<10	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
10-14	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
15-19	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
20-24	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
25-29	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
30-34	0.3%	0.0%	0.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.3%	0.0%	0.2%	0.0%	0.0%	0.0%	0.4%	0.0%	0.2%
35-39	0.3%	0.0%	0.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.3%	0.0%	0.2%	0.0%	0.0%	0.0%
40-44	0.3%	0.6%	0.4%	0.0%	0.6%	0.2%	0.0%	1.0%	0.4%	0.3%	0.0%	0.2%	0.6%	0.0%	0.4%	0.0%	0.0%	0.0%
45-49	0.0%	0.6%	0.2%	0.0%	2.4%	0.7%	0.9%	0.0%	0.5%	0.0%	1.7%	0.6%	0.6%	0.0%	0.4%	0.0%	1.2%	0.4%
50-54	2.3%	7.0%	4.0%	3.2%	9.6%	5.1%	1.7%	8.5%	4.2%	2.0%	10.5%	5.0%	2.4%	12.0%	5.8%	2.2%	13.9%	6.7%
55-59	5.4%	17.0%	9.6%	4.5%	26.3%	10.9%	9.2%	16.1%	11.7%	5.2%	23.8%	11.6%	6.4%	30.9%	14.9%	7.2%	27.2%	14.9%
60-64	14.7%	40.4%	24.0%	18.7%	28.1%	21.4%	18.2%	38.2%	25.5%	19.2%	31.5%	23.4%	21.3%	33.7%	25.6%	18.4%	33.5%	24.2%
65-69	22.1%	14.6%	19.4%	19.9%	13.8%	18.1%	17.3%	17.6%	17.4%	21.5%	15.5%	19.4%	18.0%	9.7%	15.1%	23.1%	12.7%	19.1%
70-74	31.8%	9.9%	23.8%	25.1%	10.2%	20.7%	28.8%	8.5%	21.4%	29.4%	7.2%	21.7%	25.0%	4.0%	17.7%	26.7%	5.8%	18.7%
75 and above	22.7%	9.9%	18.1%	28.6%	9.0%	22.8%	23.9%	10.1%	18.9%	22.1%	9.9%	17.9%	25.3%	9.7%	19.9%	22.0%	5.8%	15.8%
Total	299	171	470	402	167	569	347	199	546	344	181	525	328	175	503	277	173	450
85th Percentile	77.01	71.38	75.75	79.07	71.42	77.96	78.30	71.61	76.52	77.70	71.43	76.52	77.93	68.00	76.52	77.37	68.00	75.67
Average	70.11	64.55	68.09	70.80	63.38	68.63	70.07	64.52	68.05	69.99	63.41	67.72	69.79	62.75	67.34	70.26	62.09	67.12
Std Dev	8.43	8.10	8.73	8.63	9.28	9.44	8.67	8.36	8.96	8.14	8.46	8.82	8.98	8.63	9.46	8.99	7.73	9.40
Min	30.36	44.75	30.36	50.22	41.43	41.43	46.97	42.54	42.54	33.68	46.97	33.68	35.79	50.29	35.79	33.68	45.86	33.68
Max	91.25	94.34	94.34	105.64	103.42	105.64	101.21	95.19	101.21	100.10	95.68	100.10	95.19	100.10	100.10	105.64	94.34	105.64
Range	60.89	49.59	63.98	55.42	61.99	64.21	54.24	52.65	58.67	66.42	48.71	66.42	59.40	49.82	64.31	71.96	48.48	71.96

Day 2 – PCMS

	10:00 - 11:00			11:00 - 12:00			12:00 - 13:00			13:00 - 14:00			14:00 - 15:00			15:00 - 16:00		
Speed_Range	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total
<10	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
10-14	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.3%	0.0%	0.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
15-19	0.3%	0.0%	0.2%	0.0%	0.0%	0.0%	0.3%	0.0%	0.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
20-24	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
25-29	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.3%	0.5%	0.4%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
30-34	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.3%	0.0%	0.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
35-39	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.0%	0.4%	0.3%	0.0%	0.2%	0.0%	1.0%	0.4%	0.0%	0.0%	0.0%
40-44	1.4%	0.6%	1.1%	0.0%	1.1%	0.4%	1.2%	3.4%	2.0%	1.3%	1.5%	1.4%	0.0%	1.0%	0.4%	1.2%	1.6%	1.4%
45-49	3.1%	4.5%	3.6%	1.9%	3.4%	2.4%	2.0%	3.4%	2.5%	3.0%	2.5%	2.8%	1.5%	2.6%	2.0%	2.0%	2.2%	2.1%
50-54	2.0%	5.1%	3.2%	4.4%	10.2%	6.3%	6.9%	7.3%	7.1%	5.0%	9.0%	6.6%	4.1%	7.3%	5.5%	5.7%	7.6%	6.5%
55-59	10.6%	23.9%	15.6%	12.1%	19.9%	14.6%	11.0%	18.9%	13.9%	11.0%	15.4%	12.8%	9.8%	15.1%	12.0%	6.9%	9.8%	8.1%
60-64	19.1%	27.3%	22.2%	15.3%	25.0%	18.5%	14.5%	25.7%	18.7%	14.4%	23.9%	18.2%	11.3%	18.2%	14.2%	12.6%	18.5%	15.1%
65-69	19.5%	17.0%	18.6%	15.1%	16.5%	15.5%	18.5%	18.0%	18.3%	18.1%	16.4%	17.4%	15.0%	19.8%	17.0%	16.2%	22.3%	18.8%
70-74	20.1%	7.4%	15.4%	21.1%	10.2%	17.6%	15.9%	6.3%	12.3%	18.1%	10.0%	14.8%	13.9%	13.5%	13.8%	17.4%	14.7%	16.2%
75 and above	23.9%	14.2%	20.3%	30.1%	13.6%	24.8%	28.9%	15.5%	23.9%	28.8%	21.4%	25.8%	44.4%	21.4%	34.7%	38.1%	23.4%	31.8%
Total	293	176	469	365	176	541	346	206	552	299	201	500	266	192	458	247	184	431
85th Percentile	79.78	73.91	77.82	80.79	73.67	79.78	81.68	75.35	79.87	81.73	79.23	80.75	87.59	81.99	86.62	84.66	82.27	84.09
Average	68.51	64.97	67.18	69.94	64.59	68.20	68.66	63.90	66.88	69.49	66.45	68.27	73.71	67.64	71.17	72.16	69.09	70.85
Std Dev	10.83	11.30	11.13	10.88	11.23	11.27	12.93	11.39	12.58	11.96	11.81	11.98	13.08	12.84	13.31	12.83	13.49	13.18
Min	18.50	41.67	18.50	46.56	42.65	42.65	10.40	25.78	10.40	37.76	40.69	37.76	47.53	37.76	37.76	40.69	43.62	40.69
Max	105.18	105.18	105.18	105.18	105.18	105.18	102.25	104.20	104.20	105.18	106.16	106.16	109.09	106.16	109.09	107.14	108.11	108.11
Range	86.69	63.51	86.69	58.63	62.53	62.53	91.85	78.42	93.81	67.42	65.47	68.40	61.56	68.40	71.33	66.44	64.49	67.42

Day 2 – BoT

	10:00 - 11:00			11:00 - 12:00			12:00 - 13:00			13:00 - 14:00			14:00 - 15:00			15:00 - 16:00		
Speed_Range	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total
<10	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
10-14	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
15-19	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
20-24	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
25-29	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.4%	0.0%	0.2%	0.0%	0.0%	0.0%
30-34	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
35-39	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
40-44	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.0%	0.4%	0.0%	0.5%	0.2%	0.0%	0.5%	0.2%	0.0%	0.0%	0.0%
45-49	2.3%	0.5%	1.4%	0.7%	1.9%	1.2%	2.9%	1.5%	2.2%	1.2%	0.0%	0.6%	0.4%	0.5%	0.4%	0.6%	2.1%	1.5%
50-54	7.2%	8.9%	8.0%	5.4%	7.3%	6.2%	7.1%	4.9%	6.1%	4.4%	4.1%	4.2%	7.3%	10.6%	8.7%	7.9%	7.2%	7.5%
55-59	12.2%	23.4%	17.4%	14.5%	18.9%	16.3%	16.3%	22.0%	18.9%	13.5%	19.9%	16.5%	10.1%	13.6%	11.7%	13.6%	17.8%	16.0%
60-64	27.5%	35.9%	31.4%	20.9%	34.5%	26.5%	19.2%	36.6%	27.2%	17.9%	37.1%	26.9%	22.6%	37.4%	29.1%	25.4%	32.6%	29.5%
65-69	18.0%	17.7%	17.9%	22.3%	19.9%	21.3%	19.2%	16.6%	18.0%	25.1%	17.2%	21.4%	19.8%	19.2%	19.5%	16.9%	16.1%	16.5%
70-74	20.3%	7.8%	14.5%	21.3%	9.2%	16.3%	19.6%	11.2%	15.7%	21.1%	10.0%	15.9%	22.6%	8.6%	16.4%	19.2%	13.1%	15.7%
75 and above	12.6%	5.7%	9.4%	14.9%	8.3%	12.2%	15.8%	6.3%	11.5%	16.7%	11.3%	14.2%	16.9%	9.6%	13.7%	16.4%	11.0%	13.3%
Total	222	192	414	296	206	502	240	205	445	251	221	472	248	198	446	177	236	413
85th Percentile	74.20	69.50	72.40	74.34	70.46	74.20	75.31	70.46	73.37	75.31	72.40	74.34	75.31	70.90	74.34	75.31	73.13	74.34
Average	66.05	63.41	64.82	67.04	64.56	66.02	66.46	63.86	65.26	67.97	65.03	66.60	67.67	64.17	66.12	67.21	65.10	66.00
Std Dev	7.96	7.25	7.74	7.97	8.49	8.27	9.24	7.19	8.45	8.71	7.85	8.44	9.03	7.76	8.65	9.67	8.49	9.06
Min	45.26	49.14	45.26	47.20	45.26	45.26	45.26	42.35	42.35	46.23	42.35	42.35	27.81	41.38	27.81	49.14	46.23	46.23
Max	92.76	105.36	105.36	100.52	100.52	100.52	96.64	91.79	96.64	99.55	106.33	106.33	98.58	94.70	98.58	105.36	100.52	105.36
Range	47.50	56.23	60.10	53.32	55.26	55.26	51.38	49.44	54.29	53.32	63.98	63.98	70.77	53.32	70.77	56.23	54.29	59.13

Day 2 – EoT

	10:00 - 11:00			11:00 - 12:00			12:00 - 13:00			13:00 - 14:00			14:00 - 15:00			15:00 - 16:00		
Speed_Range	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total
<10	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
10-14	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
15-19	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
20-24	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
25-29	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.6%	0.2%	0.0%	0.0%	0.0%
30-34	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
35-39	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
40-44	0.3%	0.6%	0.4%	0.0%	0.0%	0.0%	0.5%	0.5%	0.5%	0.0%	0.6%	0.2%	0.0%	0.0%	0.0%	0.3%	0.0%	0.2%
45-49	1.8%	4.4%	2.7%	1.9%	2.5%	2.1%	1.8%	2.1%	1.9%	1.1%	0.0%	0.7%	0.3%	1.2%	0.6%	1.0%	1.8%	1.3%
50-54	5.2%	5.0%	5.1%	3.8%	8.1%	5.0%	6.4%	8.8%	7.2%	4.3%	5.5%	4.7%	3.9%	10.7%	6.0%	4.1%	5.9%	4.8%
55-59	11.3%	21.9%	14.8%	12.6%	33.5%	18.4%	10.5%	25.9%	15.6%	11.7%	37.0%	20.0%	13.3%	30.8%	18.9%	17.5%	32.5%	23.0%
60-64	23.0%	39.4%	28.4%	28.7%	39.1%	31.6%	26.7%	36.3%	29.8%	24.5%	40.9%	29.9%	22.4%	37.3%	27.2%	26.0%	32.5%	28.4%
65-69	27.6%	17.5%	24.3%	24.9%	11.2%	21.1%	26.9%	20.2%	24.7%	25.8%	12.2%	21.3%	24.9%	16.0%	22.1%	20.5%	23.1%	21.5%
70-74	15.6%	8.1%	13.2%	16.1%	3.7%	12.7%	15.9%	3.1%	11.7%	17.4%	1.7%	12.2%	23.0%	3.0%	16.6%	17.1%	2.4%	11.7%
75 and above	15.0%	3.1%	11.1%	12.1%	1.9%	9.3%	11.3%	3.1%	8.6%	15.2%	2.2%	10.9%	12.2%	0.6%	8.5%	13.4%	1.8%	9.1%
Total	326	160	486	422	161	583	390	193	583	368	181	549	361	169	530	292	169	461
85th Percentile	74.50	67.17	73.21	74.25	65.98	72.18	74.25	67.01	71.15	75.23	65.98	72.18	73.21	65.98	72.18	74.25	67.01	72.18
Average	66.47	62.32	65.10	66.01	61.10	64.65	65.69	61.98	64.46	66.83	61.43	65.05	66.87	60.97	64.99	66.14	61.95	64.60
Std Dev	7.50	6.43	7.42	6.83	5.42	6.83	7.49	6.85	7.48	7.11	5.28	7.03	6.72	5.49	6.92	7.55	5.42	7.13
Min	44.29	42.22	42.22	47.39	45.32	45.32	43.26	43.26	43.26	47.39	40.16	40.16	49.45	28.79	28.79	44.29	48.42	44.29
Max	88.71	89.74	89.74	83.54	77.34	83.54	104.20	108.33	108.33	88.71	85.61	88.71	88.71	78.38	88.71	99.04	88.71	99.04
Range	44.42	47.52	47.52	36.16	32.02	38.22	60.95	65.08	65.08	41.32	45.45	48.55	39.25	49.58	59.91	54.75	40.29	54.75

Day 2 – 1stWA

	10:00 - 11:00			11:00 - 12:00			12:00 - 13:00			13:00 - 14:00			14:00 - 15:00			15:00 - 16:00		
Speed_Range	**PC**	**HV**	**Total**	**PC**	**HV**	**Total**	**PC**	**HV**	**Total**	**PC**	**HV**	**Total**	**PC**	**HV**	**Total**	**PC**	**HV**	**Total**
<10	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
10-14	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
15-19	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
20-24	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
25-29	0.3%	0.0%	0.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
30-34	0.3%	0.0%	0.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.5%	0.7%	0.6%	0.0%	0.7%	0.2%	0.0%	0.0%	0.0%
35-39	0.9%	1.6%	1.1%	0.5%	0.0%	0.4%	0.2%	1.3%	0.5%	0.5%	0.7%	0.6%	0.0%	0.7%	0.2%	0.0%	1.4%	0.4%
40-44	1.7%	2.3%	1.9%	1.4%	4.8%	2.3%	2.7%	2.7%	2.7%	1.3%	2.8%	1.7%	1.6%	0.7%	1.4%	1.6%	3.4%	2.2%
45-49	7.2%	10.2%	8.0%	5.0%	11.6%	6.7%	5.4%	12.0%	7.2%	7.3%	6.9%	7.2%	5.3%	12.3%	7.2%	4.5%	10.2%	6.3%
50-54	12.1%	14.1%	12.6%	11.2%	17.1%	12.7%	8.6%	18.7%	11.3%	10.2%	13.9%	11.2%	11.2%	13.8%	11.9%	11.2%	17.0%	13.0%
55-59	18.7%	31.3%	22.1%	21.4%	29.5%	23.5%	21.7%	26.7%	23.0%	18.5%	38.9%	24.1%	20.5%	30.4%	23.2%	23.0%	25.9%	23.9%
60-64	25.0%	21.1%	23.9%	25.4%	24.7%	25.2%	28.3%	20.0%	26.1%	25.3%	20.8%	24.1%	24.5%	18.1%	22.8%	24.9%	25.2%	25.0%
65-69	18.7%	10.9%	16.6%	18.5%	8.2%	15.9%	16.5%	7.3%	14.0%	20.1%	8.3%	16.9%	20.2%	16.7%	19.3%	15.3%	8.2%	13.0%
70-74	9.8%	3.1%	8.0%	11.2%	2.7%	9.0%	10.3%	5.3%	9.0%	10.4%	4.2%	8.7%	9.0%	4.3%	7.8%	14.7%	3.4%	11.1%
75 and above	5.5%	5.5%	5.5%	5.5%	1.4%	4.4%	6.2%	6.0%	6.1%	6.0%	2.8%	5.1%	7.7%	2.2%	6.2%	4.8%	5.4%	5.0%
Total	348	128	476	421	146	567	406	150	556	384	144	528	376	138	514	313	147	460
85th Percentile	70.50	66.42	69.52	70.55	64.35	69.52	70.55	65.39	70.29	70.55	64.92	69.52	70.55	67.45	69.52	71.58	65.49	70.55
Average	61.34	59.16	60.75	62.22	57.62	61.04	61.83	58.50	60.93	62.08	58.46	61.10	62.67	59.04	61.69	62.31	58.96	61.24
Std Dev	8.97	9.31	9.11	8.86	7.29	8.71	8.43	9.09	8.73	9.45	7.50	9.09	9.07	9.10	9.21	8.61	9.79	9.13
Min	27.17	38.53	27.17	35.43	40.59	35.43	35.43	39.56	35.43	31.30	34.40	31.30	41.63	33.36	33.36	42.66	37.50	37.50
Max	90.18	99.48	99.48	99.48	85.01	99.48	91.21	88.11	91.21	105.67	82.95	105.67	102.57	105.67	105.67	100.51	106.71	106.71
Range	63.01	60.95	72.31	64.05	44.42	64.05	55.78	48.55	55.78	74.38	48.55	74.38	60.95	72.31	72.31	57.85	69.21	69.21

Day 2 – 2ndWA

	10:00 - 11:00			11:00 - 12:00			12:00 - 13:00			13:00 - 14:00			14:00 - 15:00			15:00 - 16:00		
Speed_Range	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total
<10	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
10-14	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
15-19	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
20-24	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
25-29	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
30-34	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.4%	0.0%	0.2%	0.0%	0.0%	0.0%
35-39	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.5%	0.2%	0.0%	0.6%	0.2%	0.7%	0.0%	0.4%	0.4%	0.0%	0.3%
40-44	0.3%	2.1%	0.9%	0.3%	0.6%	0.4%	1.5%	0.5%	1.1%	0.6%	0.6%	0.6%	1.8%	0.0%	1.1%	1.7%	0.6%	1.3%
45-49	2.9%	5.7%	3.8%	0.8%	5.4%	2.2%	1.8%	4.1%	2.6%	3.2%	1.7%	2.6%	3.2%	2.4%	2.9%	3.0%	2.5%	2.8%
50-54	5.9%	8.5%	6.7%	5.0%	12.0%	7.2%	4.7%	8.2%	6.0%	7.3%	6.2%	6.9%	4.9%	7.2%	5.8%	5.6%	7.5%	6.4%
55-59	15.3%	29.8%	19.9%	16.7%	22.9%	18.6%	13.9%	21.6%	16.7%	14.6%	20.9%	16.8%	12.0%	20.4%	15.1%	15.9%	19.9%	17.6%
60-64	19.5%	21.3%	20.1%	19.0%	18.7%	18.9%	19.2%	20.6%	19.7%	13.0%	29.4%	18.9%	15.5%	21.6%	17.8%	15.1%	19.9%	17.0%
65-69	17.6%	12.1%	15.8%	23.3%	17.5%	21.5%	17.7%	14.4%	16.5%	19.3%	18.6%	19.1%	17.3%	16.8%	17.1%	17.2%	19.3%	18.1%
70-74	18.9%	12.8%	17.0%	13.8%	12.0%	13.2%	20.4%	14.4%	18.2%	18.7%	8.5%	15.0%	16.3%	12.6%	14.9%	16.8%	13.7%	15.5%
75 and above	19.5%	7.8%	15.8%	21.2%	10.8%	18.0%	20.9%	15.5%	18.9%	23.4%	13.6%	19.9%	27.9%	19.2%	24.7%	24.1%	16.8%	21.1%
Total	307	141	448	378	166	544	339	194	533	316	177	493	283	167	450	232	161	393
85th Percentile	76.64	71.98	75.71	77.99	72.21	76.64	77.57	75.71	76.64	80.37	73.47	78.50	81.30	78.60	80.37	79.44	78.50	78.69
Average	67.30	62.44	65.77	67.58	63.71	66.40	68.11	65.60	67.20	68.38	65.37	67.30	69.02	66.78	68.19	67.84	66.81	67.42
Std Dev	10.41	9.31	10.32	9.73	10.81	10.22	10.69	11.50	11.05	11.13	10.59	11.02	12.46	10.74	11.89	11.43	12.41	11.84
Min	43.07	40.27	40.27	44.00	44.00	44.00	43.07	36.54	36.54	44.00	38.40	38.40	32.81	46.80	32.81	39.34	42.13	39.34
Max	105.55	93.43	105.55	97.16	103.68	103.68	99.95	105.55	105.55	99.95	102.75	102.75	103.68	100.89	103.68	104.62	104.62	104.62
Range	62.48	53.16	65.28	53.16	59.69	59.69	56.89	69.01	69.01	55.96	64.35	64.35	70.88	54.09	70.88	65.28	62.48	65.28

Day 2 – 3rdWA

	10:00 - 11:00			11:00 - 12:00			12:00 - 13:00			13:00 - 14:00			14:00 - 15:00			15:00 - 16:00		
Speed_Range	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total
<10	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
10-14	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
15-19	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
20-24	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
25-29	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
30-34	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
35-39	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
40-44	0.0%	0.7%	0.3%	0.0%	0.6%	0.2%	0.3%	0.0%	0.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.4%	0.0%	0.2%
45-49	1.6%	2.0%	1.8%	0.9%	0.6%	0.8%	2.0%	2.2%	2.0%	0.7%	1.1%	0.8%	1.1%	3.0%	1.8%	0.4%	0.6%	0.5%
50-54	2.8%	6.8%	4.3%	4.8%	9.3%	6.3%	8.2%	7.1%	7.8%	6.9%	8.1%	7.4%	5.4%	6.6%	5.9%	6.9%	12.6%	9.1%
55-59	16.3%	23.6%	19.0%	18.9%	23.6%	20.4%	22.0%	22.8%	22.3%	26.3%	35.5%	29.9%	16.9%	30.1%	21.8%	20.8%	33.3%	25.6%
60-64	26.8%	26.4%	26.6%	27.9%	25.5%	27.1%	28.2%	37.0%	31.5%	32.5%	29.0%	31.2%	32.7%	31.3%	32.2%	35.9%	28.9%	33.3%
65-69	21.5%	16.2%	19.5%	24.9%	20.5%	23.5%	19.3%	17.9%	18.8%	20.8%	16.1%	18.9%	25.5%	16.3%	22.1%	23.9%	15.7%	20.8%
70-74	15.9%	14.2%	15.2%	12.0%	8.7%	10.9%	10.8%	6.0%	9.0%	7.6%	5.4%	6.7%	11.2%	6.6%	9.5%	5.4%	3.8%	4.8%
75 and above	15.0%	10.1%	13.2%	10.5%	11.2%	10.7%	9.2%	7.1%	8.4%	5.2%	4.8%	5.1%	7.2%	6.0%	6.8%	6.2%	5.0%	5.7%
Total	246	148	394	333	161	494	305	184	489	289	186	475	278	166	444	259	159	418
85th Percentile	74.54	72.88	74.36	72.88	72.14	72.88	72.14	69.93	71.40	69.19	68.45	69.19	71.40	68.45	70.67	68.67	66.97	68.45
Average	66.42	64.18	65.58	65.37	64.27	65.01	63.90	63.06	63.59	63.14	61.91	62.66	64.56	62.58	63.82	63.33	62.02	62.83
Std Dev	7.90	8.06	8.03	7.25	8.22	7.59	7.60	7.35	7.51	6.45	6.40	6.45	6.72	7.58	7.11	6.69	7.49	7.02
Min	47.77	44.81	44.81	47.03	41.12	41.12	43.34	46.29	43.34	48.51	48.51	48.51	47.03	45.55	45.55	44.81	46.29	44.81
Max	88.39	88.39	88.39	86.18	89.13	89.13	86.92	89.13	89.13	86.92	84.70	86.92	83.96	89.13	89.13	88.39	89.13	89.13
Range	40.62	43.58	43.58	39.15	48.01	48.01	43.58	42.84	45.79	38.41	36.19	38.41	36.93	43.58	43.58	43.58	42.84	44.32

Day 3 – RWA1

	10:00 - 11:00			11:00 - 12:00			12:00 - 13:00			13:00 - 14:00			14:00 - 15:00			15:00 - 16:00		
Speed_Range	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total
<10	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
10-14	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
15-19	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
20-24	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.3%	0.0%	0.2%	0.0%	0.7%	0.2%
25-29	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
30-34	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
35-39	0.0%	0.7%	0.2%	0.0%	0.0%	0.0%	0.3%	0.0%	0.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
40-44	0.0%	0.7%	0.2%	0.2%	0.0%	0.2%	0.0%	1.2%	0.4%	0.0%	1.1%	0.3%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
45-49	1.4%	0.7%	1.2%	0.0%	4.2%	1.2%	0.3%	0.6%	0.4%	0.9%	2.8%	1.4%	1.0%	3.4%	1.7%	0.6%	2.1%	1.0%
50-54	2.4%	14.8%	5.9%	3.4%	12.6%	6.0%	2.1%	11.6%	4.9%	4.3%	10.2%	5.9%	1.8%	14.3%	5.2%	1.4%	15.1%	5.4%
55-59	11.1%	26.1%	15.3%	7.5%	26.9%	13.1%	8.9%	29.3%	15.0%	7.9%	35.0%	15.3%	8.2%	29.9%	14.2%	8.4%	28.1%	14.1%
60-64	19.2%	37.3%	24.3%	20.9%	35.9%	25.2%	24.3%	42.1%	29.6%	20.6%	36.7%	25.0%	19.8%	33.3%	23.5%	23.2%	36.3%	27.0%
65-69	27.1%	14.1%	23.5%	30.6%	12.6%	25.4%	26.9%	11.6%	22.3%	30.0%	10.7%	24.7%	34.2%	12.9%	28.4%	30.7%	11.6%	25.2%
70-74	27.4%	4.2%	20.9%	26.0%	3.0%	19.3%	27.7%	1.8%	19.9%	24.5%	2.3%	18.4%	23.9%	5.4%	18.8%	24.6%	4.1%	18.7%
75 and above	11.4%	1.4%	8.6%	11.4%	4.8%	9.5%	9.7%	1.8%	7.3%	11.9%	1.1%	9.0%	10.8%	0.7%	8.0%	11.2%	2.1%	8.5%
Total	369	142	511	412	167	579	383	164	547	470	177	647	389	147	536	358	146	504
85th Percentile	73.91	73.67	72.43	73.54	74.39	72.43	73.91	73.91	72.43	65.79	66.89	72.43	65.29	64.68	72.43	66.89	65.86	72.94
Average	67.36	67.70	65.51	67.45	67.43	65.85	67.47	67.67	65.47	60.68	61.28	65.40	60.83	60.00	65.62	60.74	60.45	65.58
Std Dev	7.01	6.66	7.56	6.96	7.38	7.51	6.96	6.82	7.43	6.79	7.57	7.62	6.37	5.28	7.37	6.08	7.53	7.75
Min	46.97	44.75	38.11	36.78	45.86	44.75	23.72	45.86	36.78	38.11	48.07	44.60	41.43	44.60	23.72	48.07	22.61	22.61
Max	91.25	92.35	100.10	94.43	102.32	99.32	92.35	99.00	105.18	100.10	99.32	102.32	105.18	76.86	93.46	93.46	99.00	99.00
Range	44.28	47.60	61.99	57.65	56.46	54.57	68.63	53.14	68.40	61.99	51.24	57.72	63.75	32.25	69.74	45.38	76.38	76.38

Day 3 – RWA2

	10:00 - 11:00			11:00 - 12:00			12:00 - 13:00			13:00 - 14:00			14:00 - 15:00			15:00 - 16:00		
Speed_Range	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total
<10	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
10-14	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
15-19	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
20-24	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
25-29	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
30-34	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
35-39	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.3%	0.0%	0.2%	0.0%	0.0%	0.0%	0.3%	0.0%	0.2%	0.0%	0.0%	0.0%
40-44	0.3%	0.6%	0.4%	0.0%	0.0%	0.0%	0.3%	0.0%	0.2%	0.2%	1.0%	0.5%	0.3%	0.0%	0.2%	0.0%	0.0%	0.0%
45-49	1.0%	2.9%	1.7%	0.3%	1.0%	0.5%	0.0%	1.7%	0.6%	1.0%	1.5%	1.1%	0.3%	1.8%	0.8%	0.0%	1.8%	0.6%
50-54	1.9%	4.1%	2.7%	1.7%	7.3%	3.7%	0.9%	3.3%	1.7%	2.7%	7.9%	4.4%	1.5%	5.5%	2.8%	2.1%	7.8%	4.1%
55-59	3.2%	16.9%	8.1%	3.4%	17.7%	8.4%	5.4%	15.6%	8.9%	4.7%	17.8%	9.0%	2.7%	23.6%	9.7%	6.4%	18.1%	10.4%
60-64	16.9%	36.0%	23.8%	17.2%	34.9%	23.4%	14.0%	39.4%	22.6%	17.2%	37.1%	23.8%	16.1%	32.1%	21.4%	14.4%	36.1%	21.7%
65-69	27.3%	19.8%	24.6%	31.4%	20.3%	27.5%	26.3%	27.8%	26.8%	27.0%	18.3%	24.1%	25.5%	22.4%	24.4%	22.7%	19.9%	21.7%
70-74	27.3%	12.2%	21.9%	26.0%	10.4%	20.5%	29.7%	7.8%	22.3%	23.6%	12.4%	19.9%	28.5%	7.9%	21.6%	30.1%	6.6%	22.2%
75 and above	22.1%	7.6%	16.9%	20.1%	8.3%	15.9%	23.1%	4.4%	16.8%	23.6%	4.0%	17.1%	24.8%	6.7%	18.8%	24.2%	9.6%	19.3%
Total	308	172	480	354	192	546	350	180	530	407	202	609	330	165	495	326	166	492
85th Percentile	76.50	71.53	75.55	75.84	71.77	75.55	76.50	69.29	75.74	77.45	70.82	75.55	76.50	69.87	75.81	76.57	71.06	75.84
Average	69.90	64.22	67.87	69.77	64.35	67.87	70.30	64.07	68.19	69.77	63.18	67.58	70.58	63.90	68.36	70.44	64.04	68.28
Std Dev	7.50	7.47	7.96	6.80	7.34	7.46	7.25	6.79	7.68	7.80	6.53	8.02	7.26	7.62	8.02	7.77	7.92	8.38
Min	41.86	42.42	41.86	46.29	46.20	46.20	36.74	47.15	36.74	44.31	44.31	44.31	35.95	47.15	35.95	51.88	45.26	45.26
Max	99.22	89.76	99.22	93.54	96.38	96.38	98.28	105.85	105.85	96.38	82.18	96.38	92.60	103.96	103.96	103.96	94.49	103.96
Range	57.36	47.34	57.36	47.25	50.18	50.18	61.54	58.70	69.12	52.07	37.87	52.07	56.64	56.81	68.01	52.07	49.23	58.70

Day 3 – PCMS

	10:00 - 11:00			11:00 - 12:00			12:00 - 13:00			13:00 - 14:00			14:00 - 15:00			15:00 - 16:00		
Speed_Range	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total
<10	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
10-14	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.6%	0.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
15-19	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
20-24	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
25-29	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
30-34	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
35-39	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.4%	0.0%	0.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
40-44	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.6%	0.2%	0.0%	0.6%	0.2%	0.0%	0.0%	0.0%
45-49	0.9%	0.7%	0.8%	0.0%	0.6%	0.2%	0.4%	0.0%	0.2%	0.0%	1.2%	0.4%	0.7%	1.2%	0.9%	0.4%	0.0%	0.2%
50-54	1.8%	4.6%	3.0%	2.3%	2.8%	2.5%	1.2%	3.8%	2.2%	2.3%	4.1%	2.9%	0.4%	5.5%	2.3%	1.6%	5.5%	3.1%
55-59	5.0%	11.3%	7.6%	4.6%	15.1%	8.4%	3.7%	12.5%	7.2%	9.8%	11.7%	10.5%	7.1%	13.3%	9.4%	8.0%	8.0%	8.0%
60-64	12.8%	25.8%	18.2%	14.3%	29.6%	20.0%	15.1%	25.6%	19.3%	14.4%	29.2%	19.7%	17.1%	26.7%	20.7%	12.0%	25.8%	17.4%
65-69	19.7%	27.8%	23.0%	20.8%	22.9%	21.6%	17.1%	23.1%	19.5%	19.6%	33.3%	24.5%	20.8%	21.2%	21.0%	22.4%	31.9%	26.2%
70-74	29.8%	17.2%	24.7%	30.6%	19.6%	26.5%	22.4%	22.5%	22.5%	30.7%	12.3%	24.1%	26.8%	17.0%	23.0%	27.2%	14.1%	22.0%
75 and above	29.8%	12.6%	22.8%	27.4%	9.5%	20.8%	39.6%	12.5%	28.9%	23.2%	7.0%	17.4%	27.1%	14.5%	22.4%	28.4%	14.7%	23.0%
Total	218	151	369	307	179	486	245	160	405	306	171	477	269	165	434	250	163	413
85th Percentile	78.22	73.21	77.34	79.07	73.98	77.37	80.13	74.82	78.65	77.37	71.43	76.44	78.22	74.82	77.37	78.22	74.82	77.37
Average	71.40	67.16	69.66	71.73	66.25	69.71	72.40	67.49	70.46	70.28	65.16	68.45	70.49	66.65	69.03	71.12	67.86	69.83
Std Dev	8.14	9.20	8.83	8.61	7.28	8.56	9.17	7.73	8.95	8.50	8.29	8.77	7.76	8.81	8.38	7.98	8.57	8.36
Min	46.82	45.13	45.13	50.22	46.82	46.82	36.02	51.91	36.02	50.49	11.19	11.19	48.52	40.04	40.04	48.42	50.22	48.42
Max	101.10	102.14	102.14	110.40	92.64	110.40	112.47	93.49	112.47	111.43	93.49	111.43	94.34	90.95	94.34	94.91	96.04	96.04
Range	54.28	57.01	57.01	60.18	45.82	63.58	76.44	41.58	76.44	60.95	82.30	100.25	45.82	50.91	54.30	46.49	45.82	47.62

Day 3 – EoT

	10:00 - 11:00			11:00 - 12:00			12:00 - 13:00			13:00 - 14:00			14:00 - 15:00			15:00 - 16:00		
Speed_Range	**PC**	**HV**	**Total**	**PC**	**HV**	**Total**	**PC**	**HV**	**Total**	**PC**	**HV**	**Total**	**PC**	**HV**	**Total**	**PC**	**HV**	**Total**
<10	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
10-14	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.5%	0.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
15-19	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
20-24	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
25-29	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
30-34	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
35-39	0.4%	0.0%	0.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.4%	0.0%	0.2%	0.4%	0.0%	0.2%
40-44	0.0%	0.0%	0.0%	0.0%	1.0%	0.4%	0.0%	0.0%	0.0%	0.6%	1.0%	0.8%	0.4%	0.0%	0.2%	0.0%	0.0%	0.0%
45-49	1.7%	2.3%	2.0%	1.0%	2.0%	1.4%	0.7%	0.9%	0.8%	3.0%	1.5%	2.4%	1.1%	2.1%	1.5%	1.1%	1.1%	1.1%
50-54	7.4%	9.3%	8.2%	8.2%	8.7%	8.4%	11.9%	8.5%	10.4%	12.2%	16.2%	13.7%	5.5%	6.9%	6.0%	5.6%	8.3%	6.7%
55-59	13.5%	23.3%	17.7%	15.7%	23.5%	18.8%	10.8%	25.5%	17.1%	14.0%	25.9%	18.4%	18.5%	21.7%	19.8%	10.4%	21.0%	14.6%
60-64	23.1%	32.6%	27.2%	20.8%	31.6%	25.2%	21.2%	30.7%	25.3%	23.8%	25.4%	24.4%	22.5%	32.8%	26.7%	21.9%	30.4%	25.3%
65-69	27.1%	15.7%	22.2%	28.0%	19.4%	24.5%	25.2%	17.5%	21.8%	24.7%	21.8%	23.6%	24.4%	21.7%	23.3%	32.6%	24.9%	29.5%
70-74	16.2%	8.7%	13.0%	13.3%	6.6%	10.6%	16.5%	9.9%	13.7%	11.9%	5.6%	9.6%	17.8%	6.3%	13.1%	14.1%	5.5%	10.6%
75 and above	10.5%	8.1%	9.5%	13.0%	7.1%	10.6%	13.7%	7.1%	10.8%	9.8%	2.0%	6.9%	9.5%	8.5%	9.1%	14.1%	8.8%	12.0%
Total	229	172	401	293	196	489	278	212	490	336	197	533	275	189	464	270	181	451
85th Percentile	73.40	70.32	72.75	72.75	69.51	71.94	73.93	70.32	72.75	71.94	67.89	70.32	72.75	69.51	71.94	74.37	68.70	72.75
Average	65.47	63.32	64.55	65.68	62.88	64.56	65.82	63.38	64.77	64.27	60.89	63.02	65.25	63.86	64.68	66.73	64.11	65.68
Std Dev	7.50	7.35	7.51	7.91	7.35	7.80	7.98	7.07	7.69	8.06	7.58	8.05	7.74	7.49	7.66	7.75	7.47	7.74
Min	38.74	46.03	38.74	49.27	40.36	40.36	47.65	47.65	47.65	43.60	11.21	11.21	37.93	46.03	37.93	37.93	47.65	37.93
Max	84.90	86.52	86.52	89.76	86.52	89.76	88.14	84.90	88.14	88.14	86.52	88.14	93.00	93.00	93.00	92.19	88.95	92.19
Range	46.16	40.49	47.78	40.49	46.16	49.40	40.49	37.25	40.49	44.54	75.31	76.93	55.07	46.97	55.07	54.26	41.30	54.26

Day 3 – 1stWA

	10:00 - 11:00			11:00 - 12:00			12:00 - 13:00			13:00 - 14:00			14:00 - 15:00			15:00 - 16:00		
Speed_Range	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total
<10	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
10-14	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
15-19	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
20-24	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
25-29	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
30-34	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
35-39	0.0%	0.0%	0.0%	0.3%	0.0%	0.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.7%	0.0%	0.4%
40-44	0.0%	1.3%	0.5%	0.0%	0.6%	0.2%	0.0%	0.5%	0.2%	0.0%	1.3%	0.5%	0.0%	0.5%	0.2%	0.7%	1.2%	0.9%
45-49	0.9%	2.6%	1.6%	0.9%	1.1%	1.0%	0.7%	0.0%	0.4%	4.0%	2.2%	3.2%	1.3%	2.5%	1.7%	2.7%	1.2%	2.2%
50-54	7.3%	13.2%	9.6%	7.1%	13.2%	9.2%	11.1%	12.5%	11.7%	13.0%	17.7%	14.8%	11.9%	12.2%	12.0%	4.5%	11.6%	7.1%
55-59	17.1%	28.9%	21.8%	14.8%	32.8%	20.9%	12.9%	31.0%	20.1%	15.0%	32.3%	21.8%	17.5%	25.9%	20.7%	16.8%	30.8%	22.0%
60-64	27.4%	30.3%	28.5%	32.0%	37.9%	34.1%	24.0%	33.7%	27.9%	28.0%	32.8%	29.9%	27.8%	35.5%	30.8%	25.8%	34.3%	28.9%
65-69	17.9%	13.8%	16.3%	20.8%	8.6%	16.6%	21.5%	14.7%	18.8%	17.2%	8.2%	13.7%	18.1%	13.7%	16.4%	21.6%	12.2%	18.1%
70-74	20.9%	6.6%	15.3%	15.7%	5.2%	12.1%	19.7%	5.4%	14.0%	16.4%	2.6%	10.9%	16.3%	5.6%	12.2%	18.2%	5.8%	13.6%
75 and above	8.5%	3.3%	6.5%	8.3%	0.6%	5.7%	10.0%	2.2%	6.9%	6.5%	3.0%	5.1%	7.2%	4.1%	6.0%	8.9%	2.9%	6.7%
Total	234	152	386	337	174	511	279	184	463	354	232	586	320	197	517	291	172	463
85th Percentile	72.40	67.56	71.43	72.40	64.65	70.46	73.37	67.56	72.11	71.43	64.65	70.46	72.40	67.56	71.43	72.40	67.56	71.43
Average	65.24	61.41	63.73	64.84	60.67	63.42	65.44	61.93	64.05	63.62	60.02	62.19	64.32	61.69	63.32	65.46	61.68	64.06
Std Dev	7.11	7.78	7.60	7.12	5.49	6.90	7.52	6.54	7.34	8.00	7.53	8.00	7.80	7.17	7.67	8.71	7.52	8.48
Min	46.23	41.38	41.38	38.47	44.29	38.47	46.23	44.29	44.29	45.26	41.38	41.38	45.26	41.38	41.38	37.50	41.38	37.50
Max	85.97	99.55	99.55	92.76	81.13	92.76	87.91	98.58	98.58	89.85	105.36	105.36	97.61	89.85	97.61	99.55	108.27	108.27
Range	39.75	58.16	58.16	54.29	36.84	54.29	41.68	54.29	54.29	44.59	63.98	63.98	52.35	48.47	56.23	62.04	66.89	70.77

Day 3 – 2ndWA

	10:00 - 11:00			11:00 - 12:00			12:00 - 13:00			13:00 - 14:00			14:00 - 15:00			15:00 - 16:00		
Speed_Range	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total
<10	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
10-14	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
15-19	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
20-24	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
25-29	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
30-34	0.0%	0.0%	0.0%	0.3%	0.0%	0.2%	0.0%	0.0%	0.0%	0.4%	0.0%	0.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
35-39	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
40-44	0.5%	0.0%	0.3%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.4%	0.0%	0.3%
45-49	0.5%	0.0%	0.3%	0.7%	0.6%	0.6%	0.9%	0.0%	0.5%	1.8%	0.0%	1.1%	1.5%	0.0%	0.9%	0.9%	0.0%	0.5%
50-54	2.9%	3.0%	2.9%	5.2%	2.2%	4.1%	6.0%	1.3%	4.1%	10.2%	2.2%	7.1%	7.2%	1.7%	5.0%	5.3%	4.3%	4.8%
55-59	15.7%	15.0%	15.5%	11.4%	8.4%	10.3%	12.8%	14.6%	13.6%	15.5%	21.2%	17.7%	11.7%	9.2%	10.7%	13.6%	12.8%	13.3%
60-64	12.9%	21.1%	16.0%	17.6%	21.8%	19.2%	15.6%	23.8%	19.0%	14.8%	21.7%	17.5%	9.1%	26.4%	15.9%	14.5%	19.5%	16.6%
65-69	25.7%	37.6%	30.3%	28.0%	33.5%	30.1%	24.3%	25.2%	24.7%	23.2%	26.1%	24.4%	23.0%	31.6%	26.4%	27.6%	29.3%	28.3%
70-74	18.1%	10.5%	15.2%	16.3%	20.1%	17.7%	18.3%	14.6%	16.8%	14.4%	14.7%	14.5%	21.9%	13.8%	18.7%	14.5%	12.8%	13.8%
75 and above	23.8%	12.8%	19.5%	20.4%	13.4%	17.7%	22.0%	20.5%	21.4%	19.7%	14.1%	17.5%	25.7%	17.2%	22.3%	23.2%	21.3%	22.4%
Total	210	133	343	289	179	468	218	151	369	284	184	468	265	174	439	228	164	392
85th Percentile	79.65	72.67	77.86	76.96	74.28	76.07	76.96	76.96	76.96	77.46	74.28	76.07	78.75	76.07	77.86	77.86	77.86	77.86
Average	69.11	66.95	68.28	68.17	68.17	68.17	68.29	68.51	68.38	66.78	67.45	67.04	69.39	68.38	68.99	68.56	68.64	68.59
Std Dev	9.09	7.40	8.53	8.76	7.48	8.29	9.03	8.82	8.93	9.87	9.08	9.56	9.98	8.42	9.40	9.48	9.06	9.30
Min	42.99	51.04	42.99	32.26	49.25	32.26	45.67	51.04	45.67	34.05	50.14	34.05	46.56	51.04	46.56	43.88	51.04	43.88
Max	95.74	89.48	95.74	96.63	93.06	96.63	93.06	100.21	100.21	99.32	99.32	99.32	100.21	95.74	100.21	98.42	94.85	98.42
Range	52.75	38.45	52.75	64.38	43.81	64.38	47.39	49.18	54.54	65.27	49.18	65.27	53.65	44.71	53.65	54.54	43.81	54.54

Day 3 – 3rdWA

	10:00 - 11:00			11:00 - 12:00			12:00 - 13:00			13:00 - 14:00			14:00 - 15:00			15:00 - 16:00		
Speed_Range	**PC**	**HV**	**Total**	**PC**	**HV**	**Total**	**PC**	**HV**	**Total**	**PC**	**HV**	**Total**	**PC**	**HV**	**Total**	**PC**	**HV**	**Total**
<10	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
10-14	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
15-19	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
20-24	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
25-29	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
30-34	0.3%	0.0%	0.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
35-39	0.0%	0.0%	0.0%	0.0%	0.6%	0.2%	0.0%	0.5%	0.2%	0.5%	0.0%	0.3%	0.0%	0.0%	0.0%	0.3%	0.0%	0.2%
40-44	0.0%	1.2%	0.4%	0.5%	0.0%	0.3%	0.0%	0.0%	0.0%	0.2%	0.0%	0.2%	0.0%	0.6%	0.2%	0.0%	0.6%	0.2%
45-49	0.6%	3.7%	1.6%	0.3%	0.6%	0.3%	3.3%	2.2%	2.9%	0.7%	1.5%	0.9%	2.5%	1.8%	2.2%	1.4%	0.0%	1.0%
50-54	4.3%	4.9%	4.5%	5.6%	3.3%	4.9%	6.3%	5.4%	6.0%	6.2%	6.5%	6.3%	7.7%	5.8%	7.1%	3.8%	3.9%	3.8%
55-59	15.5%	19.5%	16.8%	18.5%	23.3%	20.0%	20.9%	23.7%	21.9%	23.0%	26.5%	24.1%	18.6%	24.6%	20.5%	15.4%	27.9%	19.2%
60-64	28.9%	40.9%	32.9%	29.9%	41.1%	33.4%	25.6%	37.6%	29.7%	30.1%	46.5%	35.3%	29.9%	35.7%	31.7%	30.7%	42.9%	34.5%
65-69	31.9%	23.2%	29.0%	29.9%	24.4%	28.2%	29.5%	26.3%	28.4%	27.8%	15.5%	23.9%	23.6%	25.1%	24.1%	31.6%	16.9%	27.1%
70-74	11.9%	6.1%	9.9%	10.9%	3.9%	8.7%	9.6%	2.2%	7.1%	9.0%	2.5%	6.9%	12.1%	3.5%	9.3%	9.9%	4.5%	8.2%
75 and above	6.7%	0.6%	4.7%	4.3%	2.8%	3.8%	4.7%	2.2%	3.8%	2.5%	1.0%	2.0%	5.8%	2.9%	4.9%	7.0%	3.2%	5.8%
Total	329	164	493	394	180	574	363	186	549	435	200	635	365	171	536	345	154	499
85th Percentile	71.42	67.55	69.87	70.65	66.77	69.10	69.87	66.77	69.10	68.32	65.23	67.55	70.65	67.55	69.87	70.65	67.55	69.87
Average	64.89	62.36	64.05	64.07	62.68	63.63	63.60	62.18	63.12	63.06	61.47	62.56	63.68	62.37	63.26	64.75	62.56	64.07
Std Dev	6.43	5.98	6.39	6.05	5.43	5.90	6.84	5.64	6.49	6.17	4.78	5.81	6.86	5.79	6.56	6.54	5.52	6.32
Min	31.94	41.23	31.94	42.00	38.13	38.13	45.10	38.13	38.13	35.81	45.10	35.81	45.10	44.33	44.33	36.58	42.78	36.58
Max	83.03	77.61	83.03	83.03	79.93	83.03	83.03	81.48	83.03	81.48	79.93	81.48	84.58	83.80	84.58	84.58	83.80	84.58
Range	51.09	36.38	51.09	41.03	41.80	44.90	37.93	43.35	44.90	45.67	34.83	45.67	39.48	39.48	40.25	47.99	41.03	47.99

APPENDIX B - SPEED DATA SUMMARY – CASE STUDY 2

Day 1 – RWA

	23:15 - 00:15			00:15 - 01:15			01:15 - 02:15			02:15 - 03:15		
Speed_Range	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total
<10	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
10-14	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
15-19	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
20-24	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
25-29	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
30-34	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
35-39	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
40-44	0.9%	1.7%	1.1%	0.0%	0.0%	0.0%	0.9%	0.0%	0.6%	0.0%	0.0%	0.0%
45-49	1.9%	1.7%	1.8%	1.6%	0.0%	1.2%	1.7%	1.9%	1.8%	0.9%	4.5%	2.2%
50-54	6.0%	5.0%	5.8%	8.2%	9.8%	8.7%	6.0%	9.6%	7.1%	4.5%	4.5%	4.5%
55-59	21.9%	41.7%	26.2%	27.0%	41.2%	31.2%	23.9%	34.6%	27.2%	25.9%	47.0%	33.7%
60-64	34.9%	28.3%	33.5%	28.7%	25.5%	27.7%	31.6%	28.8%	30.8%	33.9%	33.3%	33.7%
65-69	15.3%	6.7%	13.5%	13.9%	15.7%	14.5%	12.8%	9.6%	11.8%	17.0%	3.0%	11.8%
70-74	6.5%	1.7%	5.5%	15.6%	2.0%	11.6%	9.4%	1.9%	7.1%	11.6%	3.0%	8.4%
75 and above	12.6%	13.3%	12.7%	4.9%	5.9%	5.2%	13.7%	13.5%	13.6%	6.3%	4.5%	5.6%
Total	215	60	275	122	51	173	117	52	169	112	66	178
85th Percentile	72.28	68.93	72.28	71.19	67.04	70.27	74.41	70.18	74.15	71.35	64.89	68.84
Average	64.18	63.80	64.10	63.03	61.86	62.68	64.65	62.38	63.95	63.43	60.65	62.40
Std Dev	8.48	12.50	9.48	7.04	8.55	7.51	9.54	8.12	9.16	6.52	7.60	7.05
Min	43.28	44.43	43.28	49.81	51.97	49.81	42.28	49.81	42.28	48.90	47.66	47.66
Max	100.34	105.81	105.81	82.12	101.50	101.50	97.54	86.31	97.54	84.44	88.58	88.58
Range	57.06	61.38	62.52	32.30	49.53	51.69	55.26	36.50	55.26	35.55	40.92	40.92

Day 1 – 1stWA

	23:15 - 00:15			00:15 - 01:15			01:15 - 02:15			02:15 - 03:15		
Speed_Range	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total
<10	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
10-14	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
15-19	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
20-24	0.0%	1.4%	0.4%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
25-29	3.9%	2.9%	3.6%	1.7%	1.6%	1.7%	1.6%	0.0%	1.2%	2.9%	0.0%	1.9%
30-34	8.2%	11.6%	9.1%	7.5%	9.8%	8.3%	0.8%	6.7%	2.4%	8.7%	8.1%	8.5%
35-39	15.9%	14.5%	15.6%	21.7%	14.8%	19.3%	7.4%	15.6%	9.6%	7.2%	16.2%	10.4%
40-44	26.1%	26.1%	26.1%	31.7%	23.0%	28.7%	31.1%	20.0%	28.1%	31.9%	23.0%	28.8%
45-49	20.3%	18.8%	19.9%	12.5%	18.0%	14.4%	25.4%	22.2%	24.6%	21.7%	31.1%	25.0%
50-54	16.4%	10.1%	14.9%	15.0%	16.4%	15.5%	20.5%	17.8%	19.8%	13.8%	8.1%	11.8%
55-59	5.8%	2.9%	5.1%	7.5%	6.6%	7.2%	4.1%	8.9%	5.4%	8.0%	5.4%	7.1%
60-64	2.9%	2.9%	2.9%	0.8%	3.3%	1.7%	4.9%	2.2%	4.2%	2.2%	1.4%	1.9%
65-69	0.5%	2.9%	1.1%	1.7%	4.9%	2.8%	1.6%	2.2%	1.8%	1.4%	2.7%	1.9%
70-74	0.0%	2.9%	0.7%	0.0%	0.0%	0.0%	0.8%	2.2%	1.2%	1.4%	2.7%	1.9%
75 and above	0.0%	2.9%	0.7%	0.0%	1.6%	0.6%	1.6%	2.2%	1.8%	0.7%	1.4%	0.9%
Total	207	69	276	120	61	181	122	45	167	138	74	212
85th Percentile	53.43	54.00	53.43	53.43	55.34	53.43	54.24	55.34	54.38	54.38	54.38	54.38
Average	44.69	45.74	44.95	44.23	46.75	45.08	47.80	47.99	47.85	46.05	46.17	46.09
Std Dev	8.10	11.57	9.08	7.91	11.29	9.23	8.46	10.41	8.99	9.07	10.55	9.59
Min	26.77	22.96	22.96	28.67	29.62	28.67	25.81	30.58	25.81	25.81	30.58	25.81
Max	66.76	82.00	82.00	68.67	98.19	98.19	79.14	84.86	84.86	77.24	95.33	95.33
Range	40.00	59.04	59.04	40.00	68.57	69.52	53.33	54.28	59.04	51.42	64.76	69.52

Day 1 – 2ndWA

	23:15 - 00:15			00:15 - 01:15			01:15 - 02:15			02:15 - 03:15		
Speed_Range	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total
<10	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
10-14	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
15-19	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
20-24	1.2%	0.0%	1.0%	0.5%	0.0%	0.4%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
25-29	5.5%	7.3%	5.7%	2.2%	4.7%	2.6%	0.0%	0.0%	0.0%	1.7%	0.0%	1.3%
30-34	8.8%	9.1%	8.9%	7.5%	9.3%	7.9%	3.5%	6.7%	4.1%	4.5%	1.7%	3.8%
35-39	14.6%	16.4%	14.9%	16.7%	16.3%	16.6%	6.4%	13.3%	7.8%	15.2%	13.8%	14.8%
40-44	23.5%	30.9%	24.5%	21.0%	30.2%	22.7%	21.5%	22.2%	21.7%	18.5%	39.7%	23.7%
45-49	25.0%	20.0%	24.3%	22.0%	34.9%	24.5%	35.5%	37.8%	35.9%	28.1%	27.6%	28.0%
50-54	15.5%	5.5%	14.1%	21.5%	4.7%	18.3%	22.7%	17.8%	21.7%	21.3%	10.3%	18.6%
55-59	4.3%	0.0%	3.7%	4.3%	0.0%	3.5%	7.6%	2.2%	6.5%	2.8%	3.4%	3.0%
60-64	0.3%	3.6%	0.8%	3.8%	0.0%	3.1%	2.3%	0.0%	1.8%	5.6%	0.0%	4.2%
65-69	0.3%	1.8%	0.5%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.6%	0.0%	0.4%
70-74	0.9%	0.0%	0.8%	0.5%	0.0%	0.4%	0.6%	0.0%	0.5%	0.6%	1.7%	0.8%
75 and above	0.0%	5.5%	0.8%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.1%	1.7%	1.3%
Total	328	55	383	186	43	229	172	45	217	178	58	236
85th Percentile	51.34	53.51	51.34	52.47	45.92	52.25	54.06	50.80	54.06	54.06	51.34	54.06
Average	43.51	44.49	43.65	45.27	41.58	44.58	47.36	45.05	46.88	46.85	45.84	46.60
Std Dev	8.41	11.78	8.96	7.97	5.89	7.75	6.54	5.76	6.44	8.80	8.00	8.60
Min	23.30	27.82	23.30	24.21	26.92	24.21	31.44	32.35	31.44	26.02	33.25	26.02
Max	74.86	81.20	81.20	70.34	52.25	70.34	72.15	55.87	72.15	86.62	83.00	86.62
Range	51.56	53.37	57.89	46.13	25.33	46.13	40.71	23.52	40.71	60.61	49.75	60.61

Day 1 – 3rdWA

	23:15 - 00:15			00:15 - 01:15			01:15 - 02:15			02:15 - 03:15		
Speed_Range	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total
<10	0.0%	2.7%	0.3%	0.6%	0.0%	0.5%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
10-14	0.0%	2.7%	0.3%	0.6%	0.0%	0.5%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
15-19	1.2%	2.7%	1.4%	3.7%	2.0%	3.3%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
20-24	0.8%	13.5%	2.4%	0.0%	2.0%	0.5%	0.0%	0.0%	0.0%	0.6%	0.0%	0.5%
25-29	5.8%	10.8%	6.4%	3.7%	4.1%	3.8%	0.6%	0.0%	0.5%	0.6%	0.0%	0.5%
30-34	5.0%	2.7%	4.7%	4.3%	2.0%	3.8%	1.9%	9.3%	3.5%	2.5%	3.6%	2.8%
35-39	14.3%	8.1%	13.6%	8.5%	18.4%	10.8%	3.9%	4.7%	4.0%	6.8%	3.6%	6.0%
40-44	20.5%	29.7%	21.7%	14.6%	26.5%	17.4%	7.7%	18.6%	10.1%	6.8%	21.4%	10.6%
45-49	19.0%	13.5%	18.3%	13.4%	16.3%	14.1%	12.9%	11.6%	12.6%	18.6%	25.0%	20.3%
50-54	14.3%	2.7%	12.9%	20.7%	12.2%	18.8%	22.6%	30.2%	24.2%	25.5%	23.2%	24.9%
55-59	14.0%	5.4%	12.9%	14.6%	4.1%	12.2%	23.2%	9.3%	20.2%	18.6%	12.5%	17.1%
60-64	1.2%	0.0%	1.0%	6.1%	0.0%	4.7%	11.6%	9.3%	11.1%	7.5%	1.8%	6.0%
65-69	1.6%	2.7%	1.7%	5.5%	6.1%	5.6%	7.1%	2.3%	6.1%	8.7%	1.8%	6.9%
70-74	0.4%	2.7%	0.7%	1.2%	2.0%	1.4%	3.9%	0.0%	3.0%	1.2%	0.0%	0.9%
75 and above	1.9%	0.0%	1.7%	2.4%	4.1%	2.8%	4.5%	4.7%	4.5%	2.5%	7.1%	3.7%
Total	258	37	295	164	49	213	155	43	198	161	56	217
85th Percentile	55.91	48.86	55.91	60.54	55.65	59.82	64.91	59.95	63.74	62.43	56.89	61.13
Average	45.81	38.34	44.88	48.97	45.65	48.20	55.48	50.84	54.47	52.97	52.01	52.72
Std Dev	10.79	14.01	11.48	14.72	12.73	14.33	10.73	11.74	11.09	10.55	13.28	11.29
Min	15.44	7.61	7.61	8.92	18.05	8.92	27.19	31.11	27.19	21.97	32.41	21.97
Max	87.23	71.57	87.23	105.51	78.10	105.51	91.15	95.07	95.07	89.84	102.90	102.90
Range	71.79	63.96	79.62	96.59	60.04	96.59	63.96	63.96	67.88	67.88	70.49	80.93

Day 1 – 4thWA

	23:15 - 00:15			00:15 - 01:15			01:15 - 02:15			02:15 - 03:15		
Speed_Range	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total
<10	0.0%	0.0%	0.0%	1.4%	2.7%	1.6%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
10-14	0.5%	0.0%	0.4%	1.4%	8.1%	2.7%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
15-19	0.0%	9.8%	1.6%	0.0%	2.7%	0.5%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
20-24	2.8%	4.9%	3.1%	2.7%	2.7%	2.7%	0.0%	2.4%	0.5%	1.2%	0.0%	0.9%
25-29	1.8%	7.3%	2.7%	3.4%	5.4%	3.8%	0.7%	0.0%	0.5%	0.6%	0.0%	0.5%
30-34	1.8%	0.0%	1.6%	4.1%	2.7%	3.8%	1.4%	2.4%	1.6%	1.2%	7.0%	2.7%
35-39	6.5%	14.6%	7.8%	11.0%	10.8%	10.9%	4.2%	11.9%	6.0%	4.8%	10.5%	6.3%
40-44	10.1%	9.8%	10.1%	12.3%	21.6%	14.2%	8.5%	9.5%	8.7%	4.2%	8.8%	5.4%
45-49	18.4%	7.3%	16.7%	14.4%	5.4%	12.6%	16.2%	11.9%	15.2%	14.5%	21.1%	16.2%
50-54	23.0%	17.1%	22.1%	13.7%	16.2%	14.2%	20.4%	23.8%	21.2%	17.6%	26.3%	19.8%
55-59	14.7%	0.0%	12.4%	12.3%	16.2%	13.1%	12.0%	19.0%	13.6%	23.6%	15.8%	21.6%
60-64	12.9%	9.8%	12.4%	8.9%	2.7%	7.7%	17.6%	9.5%	15.8%	14.5%	3.5%	11.7%
65-69	3.2%	2.4%	3.1%	4.1%	0.0%	3.3%	6.3%	0.0%	4.9%	7.9%	1.8%	6.3%
70-74	1.8%	7.3%	2.7%	2.7%	0.0%	2.2%	3.5%	0.0%	2.7%	4.8%	0.0%	3.6%
75 and above	2.3%	9.8%	3.5%	7.5%	2.7%	6.6%	9.2%	9.5%	9.2%	4.8%	5.3%	5.0%
Total	217	41	258	146	37	183	142	42	184	165	57	222
85th Percentile	61.94	70.80	61.94	64.89	56.03	63.41	67.85	61.94	67.18	66.96	58.39	64.89
Average	51.47	49.03	51.08	50.11	42.73	48.61	56.41	53.42	55.73	56.38	51.05	55.01
Std Dev	11.56	21.23	13.54	15.95	18.04	16.61	12.06	14.34	12.64	12.68	13.72	13.14
Min	13.18	16.13	13.18	8.75	8.75	8.75	26.48	23.52	23.52	23.52	32.39	23.52
Max	101.83	103.31	103.31	103.31	107.74	107.74	92.96	88.53	92.96	104.78	106.26	106.26
Range	88.65	87.17	90.13	94.56	98.99	98.99	66.49	65.01	69.44	81.26	73.88	82.74

Day 1 – 5thWA

	23:15 - 00:15			00:15 - 01:15			01:15 - 02:15			02:15 - 03:15		
Speed_Range	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total
<10	0.4%	1.7%	0.6%	0.0%	1.8%	0.4%	0.0%	1.8%	0.4%	1.1%	0.0%	0.8%
10-14	0.0%	1.7%	0.3%	0.5%	0.0%	0.4%	0.0%	3.6%	0.9%	0.0%	0.0%	0.0%
15-19	0.7%	1.7%	0.9%	1.1%	3.5%	1.6%	4.7%	3.6%	4.4%	1.7%	3.3%	2.1%
20-24	1.1%	3.4%	1.5%	5.4%	7.0%	5.8%	2.3%	7.1%	3.5%	7.8%	1.7%	6.3%
25-29	3.2%	0.0%	2.7%	5.4%	12.3%	7.0%	6.4%	3.6%	5.7%	9.5%	10.0%	9.6%
30-34	9.3%	8.5%	9.1%	16.7%	17.5%	16.9%	10.5%	5.4%	9.2%	17.3%	21.7%	18.4%
35-39	15.7%	11.9%	15.0%	17.2%	10.5%	15.6%	17.4%	12.5%	16.2%	17.3%	11.7%	15.9%
40-44	16.1%	18.6%	16.5%	18.8%	12.3%	17.3%	18.0%	19.6%	18.4%	18.4%	11.7%	16.7%
45-49	24.3%	18.6%	23.3%	21.5%	15.8%	20.2%	19.8%	10.7%	17.5%	14.0%	11.7%	13.4%
50-54	16.8%	6.8%	15.0%	5.4%	8.8%	6.2%	8.1%	17.9%	10.5%	4.5%	6.7%	5.0%
55-59	6.1%	5.1%	5.9%	4.3%	0.0%	3.3%	5.2%	3.6%	4.8%	5.0%	8.3%	5.9%
60-64	4.3%	5.1%	4.4%	2.7%	3.5%	2.9%	2.9%	5.4%	3.5%	2.8%	0.0%	2.1%
65-69	1.1%	8.5%	2.4%	1.1%	1.8%	1.2%	1.7%	0.0%	1.3%	0.0%	1.7%	0.4%
70-74	1.1%	1.7%	1.2%	0.0%	3.5%	0.8%	2.3%	1.8%	2.2%	0.6%	1.7%	0.8%
75 and above	0.0%	6.8%	1.2%	0.0%	1.8%	0.4%	0.6%	3.6%	1.3%	0.0%	10.0%	2.5%
Total	280	59	339	186	57	243	172	56	228	179	60	239
85th Percentile	54.39	65.93	54.68	49.71	52.14	49.71	54.39	54.16	54.39	49.05	58.15	51.58
Average	44.95	47.43	45.38	40.55	39.93	40.41	42.42	42.81	42.51	38.67	44.27	40.07
Std Dev	9.75	16.86	11.32	9.83	15.24	11.30	11.92	16.97	13.30	10.73	17.00	12.80
Min	6.56	8.44	6.56	13.13	4.69	4.69	15.00	3.75	3.75	8.44	16.88	8.44
Max	74.09	88.16	88.16	66.59	91.91	91.91	80.66	93.79	93.79	71.28	94.72	94.72
Range	67.53	79.72	81.60	53.46	87.22	87.22	65.65	90.04	90.04	62.84	77.85	86.29

Day 2 – RWA

	23:15 - 00:15			00:15 - 01:15			01:15 - 02:15			02:15 - 03:15		
Speed_Range	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total
<10	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
10-14	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
15-19	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
20-24	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
25-29	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
30-34	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.9%	0.0%	0.6%	0.0%	0.0%	0.0%
35-39	0.5%	0.0%	0.4%	0.0%	0.0%	0.0%	0.9%	0.0%	0.6%	0.0%	0.0%	0.0%
40-44	1.4%	1.7%	1.4%	0.0%	1.9%	0.5%	0.0%	0.0%	0.0%	3.2%	0.0%	2.0%
45-49	1.4%	1.7%	1.4%	4.3%	0.0%	3.1%	4.7%	1.4%	3.3%	2.4%	0.0%	1.5%
50-54	8.3%	8.5%	8.3%	10.7%	18.5%	12.9%	9.3%	20.5%	13.9%	8.8%	9.9%	9.2%
55-59	18.3%	18.6%	18.4%	21.4%	24.1%	22.2%	28.0%	12.3%	21.7%	23.2%	23.9%	23.5%
60-64	30.3%	18.6%	27.8%	27.1%	24.1%	26.3%	21.5%	28.8%	24.4%	27.2%	18.3%	24.0%
65-69	19.3%	22.0%	19.9%	23.6%	13.0%	20.6%	18.7%	13.7%	16.7%	20.0%	26.8%	22.4%
70-74	12.8%	13.6%	13.0%	5.0%	11.1%	6.7%	6.5%	12.3%	8.9%	6.4%	9.9%	7.7%
75 and above	7.8%	15.3%	9.4%	7.9%	7.4%	7.7%	9.3%	11.0%	10.0%	8.8%	11.3%	9.7%
Total	218	59	277	140	54	194	107	73	180	125	71	196
85th Percentile	71.52	75.52	71.52	69.62	71.57	69.68	71.52	71.52	71.52	70.42	72.00	71.52
Average	63.65	65.93	64.14	62.93	62.05	62.68	62.44	63.64	62.92	62.73	64.74	63.46
Std Dev	8.40	10.79	8.99	7.80	8.06	7.86	9.47	9.33	9.41	8.84	8.43	8.72
Min	37.03	44.57	37.03	46.24	42.96	42.96	33.69	46.76	33.69	40.38	50.57	40.38
Max	96.28	98.19	98.19	86.76	81.40	86.76	91.52	92.47	92.47	96.28	87.71	96.28
Range	59.25	53.62	61.15	40.52	38.45	43.81	57.84	45.71	58.79	55.90	37.14	55.90

Day 2 – EoT

	23:15 - 00:15			00:15 - 01:15			01:15 - 02:15			02:15 - 03:15		
Speed_Range	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total
<10	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
10-14	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
15-19	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
20-24	0.0%	1.9%	0.4%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.3%	0.0%	0.9%
25-29	0.5%	0.0%	0.4%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.3%	0.0%	0.9%
30-34	2.4%	13.0%	4.5%	3.2%	4.8%	3.6%	0.0%	1.7%	0.6%	0.0%	0.0%	0.0%
35-39	4.3%	5.6%	4.5%	5.6%	9.5%	6.6%	2.5%	8.6%	4.4%	0.6%	5.5%	2.2%
40-44	16.7%	29.6%	19.3%	11.3%	14.3%	12.0%	8.2%	12.1%	9.4%	6.4%	11.0%	7.8%
45-49	22.9%	11.1%	20.5%	23.4%	38.1%	27.1%	24.6%	43.1%	30.6%	17.2%	19.2%	17.8%
50-54	21.9%	16.7%	20.8%	21.8%	19.0%	21.1%	21.3%	15.5%	19.4%	26.8%	16.4%	23.5%
55-59	19.5%	14.8%	18.6%	18.5%	7.1%	15.7%	26.2%	10.3%	21.1%	22.3%	26.0%	23.5%
60-64	7.1%	5.6%	6.8%	9.7%	2.4%	7.8%	13.9%	3.4%	10.6%	17.8%	16.4%	17.4%
65-69	1.9%	1.9%	1.9%	4.0%	0.0%	3.0%	1.6%	1.7%	1.7%	3.2%	1.4%	2.6%
70-74	1.4%	0.0%	1.1%	0.8%	0.0%	0.6%	0.8%	1.7%	1.1%	2.5%	1.4%	2.2%
75 and above	1.4%	0.0%	1.1%	1.6%	4.8%	2.4%	0.8%	1.7%	1.1%	0.6%	2.7%	1.3%
Total	210	54	264	124	42	166	122	58	180	157	73	230
85th Percentile	58.43	57.35	58.43	60.58	53.05	59.51	60.58	55.20	59.51	62.74	61.66	62.74
Average	51.19	46.86	50.31	51.73	48.87	51.01	53.30	49.39	52.04	54.42	54.27	54.37
Std Dev	8.64	9.76	9.03	9.10	10.62	9.56	7.02	8.02	7.56	8.80	10.81	9.46
Min	27.20	20.74	20.74	31.51	33.66	31.51	35.82	33.66	33.66	20.74	36.89	20.74
Max	88.58	69.20	88.58	92.89	90.73	92.89	75.66	76.73	76.73	87.50	109.04	109.04
Range	61.38	48.46	67.84	61.38	57.07	61.38	39.84	43.07	43.07	66.76	72.15	88.30

Day 2 – 1stWA

	23:15 - 00:15			00:15 - 01:15			01:15 - 02:15			02:15 - 03:15		
Speed_Range	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total
<10	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
10-14	0.4%	1.9%	0.7%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
15-19	2.4%	9.3%	3.7%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
20-24	2.0%	3.7%	2.3%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
25-29	8.6%	7.4%	8.4%	0.7%	2.3%	1.1%	0.8%	0.0%	0.5%	0.0%	0.0%	0.0%
30-34	11.0%	24.1%	13.4%	11.6%	13.6%	12.1%	6.1%	17.7%	9.8%	1.2%	0.0%	0.9%
35-39	17.1%	22.2%	18.1%	16.4%	22.7%	17.9%	12.1%	14.5%	12.9%	3.7%	6.3%	4.4%
40-44	20.0%	7.4%	17.7%	20.5%	27.3%	22.1%	9.8%	14.5%	11.3%	10.4%	15.9%	11.9%
45-49	20.4%	11.1%	18.7%	20.5%	22.7%	21.1%	23.5%	25.8%	24.2%	26.4%	22.2%	25.2%
50-54	9.4%	7.4%	9.0%	13.0%	2.3%	10.5%	23.5%	17.7%	21.6%	22.1%	27.0%	23.5%
55-59	3.3%	1.9%	3.0%	8.2%	4.5%	7.4%	13.6%	1.6%	9.8%	20.9%	15.9%	19.5%
60-64	2.9%	3.7%	3.0%	5.5%	0.0%	4.2%	8.3%	3.2%	6.7%	9.8%	7.9%	9.3%
65-69	1.2%	0.0%	1.0%	2.7%	0.0%	2.1%	1.5%	0.0%	1.0%	3.1%	0.0%	2.2%
70-74	0.4%	0.0%	0.3%	0.7%	0.0%	0.5%	0.0%	1.6%	0.5%	1.8%	3.2%	2.2%
75 and above	0.8%	0.0%	0.7%	0.0%	4.5%	1.1%	0.8%	3.2%	1.5%	0.6%	1.6%	0.9%
Total	245	54	299	146	44	190	132	62	194	163	63	226
85th Percentile	51.70	48.01	51.05	55.68	49.83	55.12	58.58	52.50	57.32	59.84	59.19	59.19
Average	41.83	36.46	40.86	46.10	43.50	45.49	49.09	45.80	48.04	52.56	51.50	52.26
Std Dev	10.73	11.30	11.01	9.13	10.74	9.56	9.10	11.52	10.02	7.97	8.87	8.22
Min	14.29	10.55	10.55	29.25	29.25	29.25	28.32	30.19	28.32	33.00	35.80	33.00
Max	87.25	61.06	87.25	71.35	85.38	85.38	80.70	94.73	94.73	88.18	86.31	88.18
Range	72.96	50.51	76.70	42.09	56.12	56.12	52.38	64.54	66.41	55.19	50.51	55.19

Day 2 – 2ndWA

	23:15 - 00:15			00:15 - 01:15			01:15 - 02:15			02:15 - 03:15		
Speed_Range	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total
<10	1.1%	0.0%	1.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
10-14	1.9%	0.0%	1.6%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
15-19	2.6%	5.0%	2.9%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
20-24	4.1%	10.0%	4.9%	0.6%	3.2%	1.0%	1.3%	2.3%	1.5%	0.0%	0.0%	0.0%
25-29	8.9%	10.0%	9.1%	3.7%	0.0%	3.1%	3.8%	0.0%	3.0%	0.5%	0.0%	0.4%
30-34	10.4%	17.5%	11.3%	8.5%	16.1%	9.7%	6.4%	11.4%	7.5%	0.5%	2.1%	0.8%
35-39	19.3%	20.0%	19.4%	18.3%	25.8%	19.5%	10.2%	31.8%	14.9%	1.0%	8.5%	2.5%
40-44	17.5%	17.5%	17.5%	22.0%	16.1%	21.0%	14.0%	18.2%	14.9%	7.7%	10.6%	8.3%
45-49	14.1%	10.0%	13.6%	19.5%	19.4%	19.5%	10.8%	15.9%	11.9%	18.5%	23.4%	19.4%
50-54	9.3%	7.5%	9.1%	12.2%	16.1%	12.8%	16.6%	15.9%	16.4%	27.2%	31.9%	28.1%
55-59	7.1%	0.0%	6.1%	9.8%	0.0%	8.2%	22.9%	4.5%	18.9%	30.8%	19.1%	28.5%
60-64	2.2%	0.0%	1.9%	3.0%	0.0%	2.6%	10.2%	0.0%	8.0%	7.7%	2.1%	6.6%
65-69	0.7%	2.5%	1.0%	1.8%	0.0%	1.5%	3.2%	0.0%	2.5%	3.1%	0.0%	2.5%
70-74	0.4%	0.0%	0.3%	0.6%	0.0%	0.5%	0.6%	0.0%	0.5%	0.5%	2.1%	0.8%
75 and above	0.4%	0.0%	0.3%	0.0%	3.2%	0.5%	0.0%	0.0%	0.0%	2.6%	0.0%	2.1%
Total	269	40	309	164	31	195	157	44	201	195	47	242
85th Percentile	51.73	46.02	51.50	54.74	50.56	54.09	59.99	51.73	58.81	59.99	57.63	59.99
Average	40.39	36.67	39.91	45.34	43.18	44.99	49.40	42.73	47.94	54.00	50.10	53.24
Std Dev	12.05	10.56	11.92	9.32	13.13	10.01	10.85	7.40	10.54	7.98	7.22	7.97
Min	8.12	17.55	8.12	23.44	24.62	23.44	21.08	24.62	21.08	26.98	32.87	26.98
Max	82.39	69.42	82.39	74.13	102.43	102.43	70.60	57.63	70.60	89.46	70.60	89.46
Range	74.27	51.87	74.27	50.69	77.81	78.99	49.51	33.01	49.51	62.48	37.72	62.48

Day 2 – 3rdWA

	23:15 - 00:15			00:15 - 01:15			01:15 - 02:15			02:15 - 03:15		
Speed_Range	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total
<10	0.4%	0.0%	0.3%	0.0%	0.0%	0.0%	0.0%	4.5%	1.0%	0.0%	0.0%	0.0%
10-14	0.8%	5.4%	1.3%	0.0%	0.0%	0.0%	1.3%	6.8%	2.6%	0.0%	0.0%	0.0%
15-19	1.1%	2.7%	1.3%	0.0%	0.0%	0.0%	0.7%	2.3%	1.0%	0.0%	0.0%	0.0%
20-24	1.9%	0.0%	1.7%	0.0%	0.0%	0.0%	3.3%	6.8%	4.1%	0.5%	0.0%	0.4%
25-29	6.8%	8.1%	7.0%	4.8%	0.0%	4.2%	4.6%	0.0%	3.6%	2.1%	4.3%	2.5%
30-34	4.6%	10.8%	5.3%	7.9%	15.4%	8.9%	2.0%	6.8%	3.1%	1.6%	0.0%	1.3%
35-39	14.1%	27.0%	15.7%	12.7%	7.7%	12.0%	9.3%	6.8%	8.7%	4.7%	6.4%	5.0%
40-44	20.9%	16.2%	20.3%	18.2%	15.4%	17.8%	13.2%	22.7%	15.4%	10.5%	17.0%	11.8%
45-49	16.0%	21.6%	16.7%	20.0%	38.5%	22.5%	15.2%	18.2%	15.9%	19.4%	19.1%	19.3%
50-54	14.8%	0.0%	13.0%	15.2%	19.2%	15.7%	14.6%	9.1%	13.3%	20.4%	21.3%	20.6%
55-59	9.9%	8.1%	9.7%	9.7%	0.0%	8.4%	19.9%	11.4%	17.9%	23.0%	19.1%	22.3%
60-64	5.3%	0.0%	4.7%	6.1%	0.0%	5.2%	6.0%	2.3%	5.1%	11.0%	6.4%	10.1%
65-69	1.5%	0.0%	1.3%	3.0%	0.0%	2.6%	6.6%	2.3%	5.6%	4.7%	2.1%	4.2%
70-74	1.1%	0.0%	1.0%	1.2%	3.8%	1.6%	1.3%	0.0%	1.0%	1.6%	0.0%	1.3%
75 and above	0.8%	0.0%	0.7%	1.2%	0.0%	1.0%	2.0%	0.0%	1.5%	0.5%	4.3%	1.3%
Total	263	37	300	165	26	191	151	44	195	191	47	238
85th Percentile	57.21	47.55	55.91	57.73	51.01	57.21	61.13	54.14	59.82	61.13	59.82	61.13
Average	45.16	39.04	44.40	47.15	45.36	46.91	49.02	39.89	46.96	52.37	50.91	52.08
Std Dev	11.54	11.10	11.64	10.80	8.66	10.53	13.07	15.53	14.15	9.14	10.31	9.38
Min	8.92	11.53	8.92	25.88	31.11	25.88	10.22	5.00	5.00	24.58	29.80	24.58
Max	82.01	59.82	82.01	92.45	74.18	92.45	79.40	68.96	79.40	75.49	80.71	80.71
Range	73.10	48.30	73.10	66.57	43.07	66.57	69.18	63.96	74.40	50.91	50.91	56.13

Day 2 – 4thWA

	23:15 - 00:15			00:15 - 01:15			01:15 - 02:15			02:15 - 03:15		
Speed_Range	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total
<10	0.0%	0.0%	0.0%	1.8%	0.0%	1.5%	2.0%	0.0%	1.5%	0.0%	0.0%	0.0%
10-14	0.0%	0.0%	0.0%	0.6%	3.4%	1.0%	0.7%	7.0%	2.0%	0.0%	0.0%	0.0%
15-19	0.0%	5.6%	0.7%	2.4%	0.0%	2.1%	2.6%	0.0%	2.0%	0.0%	0.0%	0.0%
20-24	0.4%	2.8%	0.7%	1.2%	0.0%	1.0%	6.5%	9.3%	7.1%	0.0%	2.2%	0.4%
25-29	0.4%	0.0%	0.3%	3.6%	3.4%	3.6%	6.5%	11.6%	7.7%	0.0%	0.0%	0.0%
30-34	1.9%	5.6%	2.3%	4.2%	17.2%	6.2%	7.2%	7.0%	7.1%	2.1%	2.2%	2.1%
35-39	12.5%	16.7%	13.0%	15.7%	13.8%	15.4%	15.0%	16.3%	15.3%	11.4%	17.4%	12.6%
40-44	9.9%	11.1%	10.0%	14.5%	10.3%	13.8%	5.9%	16.3%	8.2%	9.8%	13.0%	10.5%
45-49	17.1%	19.4%	17.4%	15.7%	13.8%	15.4%	12.4%	11.6%	12.2%	15.5%	19.6%	16.3%
50-54	25.5%	27.8%	25.8%	16.3%	24.1%	17.4%	13.7%	9.3%	12.8%	25.9%	23.9%	25.5%
55-59	14.8%	2.8%	13.4%	12.7%	6.9%	11.8%	13.1%	4.7%	11.2%	13.0%	0.0%	10.5%
60-64	12.2%	2.8%	11.0%	7.8%	0.0%	6.7%	5.2%	0.0%	4.1%	13.5%	15.2%	13.8%
65-69	4.2%	0.0%	3.7%	1.8%	0.0%	1.5%	5.2%	2.3%	4.6%	3.6%	0.0%	2.9%
70-74	0.8%	5.6%	1.3%	1.2%	3.4%	1.5%	1.3%	0.0%	1.0%	3.1%	2.2%	2.9%
75 and above	0.4%	0.0%	0.3%	0.6%	3.4%	1.0%	2.6%	4.7%	3.1%	2.1%	4.3%	2.5%
Total	263	36	299	166	29	195	153	43	196	193	46	239
85th Percentile	60.46	54.18	60.46	57.50	54.25	57.50	58.98	51.15	57.50	61.94	62.31	61.94
Average	50.77	45.52	50.14	46.04	44.77	45.85	44.78	40.22	43.78	52.35	50.53	52.00
Std Dev	9.15	12.26	9.71	12.65	12.96	12.67	15.44	17.51	15.98	11.46	15.16	12.24
Min	23.52	16.13	16.13	2.84	13.18	2.84	5.79	10.22	5.79	30.91	20.57	20.57
Max	76.71	73.76	76.71	76.71	76.71	76.71	84.10	104.78	104.78	107.74	106.26	107.74
Range	53.19	57.62	60.58	73.88	63.53	73.88	78.31	94.56	98.99	76.83	85.70	87.17

Day 2 – 5thWA

	23:15 - 00:15			00:15 - 01:15			01:15 - 02:15			02:15 - 03:15		
Speed_Range	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total
<10	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.4%	0.0%	1.0%	0.0%	0.0%	0.0%
10-14	0.0%	0.0%	0.0%	0.0%	3.0%	0.5%	2.1%	4.3%	2.6%	0.0%	0.0%	0.0%
15-19	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	6.8%	4.3%	6.2%	1.7%	1.7%	1.7%
20-24	0.8%	7.4%	2.0%	2.6%	6.1%	3.2%	7.5%	10.6%	8.3%	1.7%	0.0%	1.3%
25-29	0.8%	7.4%	2.0%	6.5%	3.0%	5.9%	11.0%	8.5%	10.4%	3.9%	1.7%	3.4%
30-34	7.4%	7.4%	7.4%	14.2%	18.2%	14.9%	20.5%	10.6%	18.1%	11.2%	13.8%	11.9%
35-39	19.4%	9.3%	17.6%	16.8%	12.1%	16.0%	13.0%	17.0%	14.0%	18.5%	19.0%	18.6%
40-44	21.1%	16.7%	20.3%	18.7%	21.2%	19.1%	7.5%	14.9%	9.3%	19.1%	20.7%	19.5%
45-49	24.0%	16.7%	22.6%	18.7%	15.2%	18.1%	15.1%	14.9%	15.0%	25.3%	12.1%	22.0%
50-54	12.0%	13.0%	12.2%	9.7%	0.0%	8.0%	5.5%	10.6%	6.7%	9.6%	10.3%	9.7%
55-59	8.7%	3.7%	7.8%	5.8%	9.1%	6.4%	5.5%	0.0%	4.1%	3.9%	6.9%	4.7%
60-64	3.3%	7.4%	4.1%	3.2%	6.1%	3.7%	4.1%	2.1%	3.6%	2.8%	6.9%	3.8%
65-69	2.1%	5.6%	2.7%	1.9%	0.0%	1.6%	0.0%	2.1%	0.5%	0.0%	3.4%	0.8%
70-74	0.4%	1.9%	0.7%	1.9%	0.0%	1.6%	0.0%	0.0%	0.0%	1.7%	3.4%	2.1%
75 and above	0.0%	3.7%	0.7%	0.0%	6.1%	1.1%	0.0%	0.0%	0.0%	0.6%	0.0%	0.4%
Total	242	54	296	155	33	188	146	47	193	178	58	236
85th Percentile	54.39	61.01	56.04	53.46	56.65	54.39	49.94	47.27	49.89	52.52	59.08	52.52
Average	45.48	45.95	45.57	43.09	43.31	43.13	36.60	37.15	36.74	43.10	45.29	43.64
Std Dev	8.85	14.89	10.19	10.67	15.63	11.65	12.59	12.32	12.50	10.20	11.56	10.57
Min	20.63	20.63	20.63	20.63	10.31	10.31	7.50	13.13	7.50	15.94	19.69	15.94
Max	73.15	94.72	94.72	73.15	88.16	88.16	63.77	67.53	67.53	84.41	74.09	84.41
Range	52.52	74.09	74.09	52.52	77.85	77.85	56.27	54.40	60.03	68.47	54.40	68.47

Day 3 – RWA

	23:15 - 00:15			00:15 - 01:15			01:15 - 02:15			02:15 - 03:15		
Speed_Range	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total
<10	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	2.0%	0.7%
10-14	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
15-19	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
20-24	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
25-29	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.2%	0.0%	0.7%
30-34	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.1%	0.0%	0.7%	0.0%	0.0%	0.0%
35-39	1.9%	5.4%	2.8%	0.9%	0.0%	0.6%	4.6%	1.9%	3.5%	1.2%	2.0%	1.5%
40-44	5.7%	10.7%	7.0%	8.8%	16.0%	11.0%	3.4%	11.1%	6.4%	7.1%	11.8%	8.9%
45-49	15.7%	32.1%	20.0%	19.3%	24.0%	20.7%	16.1%	37.0%	24.1%	19.0%	47.1%	29.6%
50-54	20.8%	25.0%	21.9%	21.1%	32.0%	24.4%	18.4%	27.8%	22.0%	21.4%	21.6%	21.5%
55-59	14.5%	14.3%	14.4%	14.9%	12.0%	14.0%	17.2%	16.7%	17.0%	8.3%	9.8%	8.9%
60-64	10.1%	3.6%	8.4%	15.8%	6.0%	12.8%	17.2%	1.9%	11.3%	19.0%	2.0%	12.6%
65-69	15.7%	3.6%	12.6%	3.5%	0.0%	2.4%	9.2%	0.0%	5.7%	7.1%	2.0%	5.2%
70-74	6.9%	1.8%	5.6%	6.1%	0.0%	4.3%	4.6%	0.0%	2.8%	9.5%	2.0%	6.7%
75 and above	8.8%	3.6%	7.4%	9.6%	10.0%	9.8%	8.0%	3.7%	6.4%	6.0%	0.0%	3.7%
Total	159	56	215	114	50	164	87	54	141	84	51	135
85th Percentile	70.41	58.88	69.38	70.41	60.14	66.76	68.63	56.29	64.80	69.99	55.03	65.63
Average	58.77	52.08	57.03	57.77	53.81	56.56	57.77	51.49	55.37	57.31	49.25	54.26
Std Dev	10.99	10.42	11.22	11.84	11.05	11.72	10.92	8.77	10.57	10.62	9.03	10.76
Min	37.87	35.36	35.36	38.71	41.22	38.71	33.69	38.71	33.69	29.50	3.06	3.06
Max	97.54	99.41	99.41	101.28	85.59	101.28	86.31	96.60	96.60	80.70	71.35	80.70
Range	59.67	64.05	64.05	62.57	44.37	62.57	52.63	57.89	62.92	51.20	68.28	77.64

Day 3 – At the advance warning area

	23:15 - 00:15			00:15 - 01:15			01:15 - 02:15			02:15 - 03:15		
Speed_Range	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total
<10	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
10-14	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
15-19	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
20-24	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
25-29	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
30-34	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.1%	0.0%	0.7%
35-39	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
40-44	0.0%	3.1%	0.9%	0.8%	0.0%	0.6%	0.0%	1.9%	0.7%	1.1%	0.0%	0.7%
45-49	3.6%	9.4%	5.2%	5.1%	5.8%	5.3%	4.5%	0.0%	2.9%	1.1%	10.2%	4.3%
50-54	7.9%	10.9%	8.7%	11.0%	21.2%	14.1%	10.2%	19.2%	13.6%	10.1%	24.5%	15.2%
55-59	30.9%	34.4%	31.9%	25.4%	36.5%	28.8%	23.9%	51.9%	34.3%	24.7%	34.7%	28.3%
60-64	24.8%	17.2%	22.7%	27.1%	23.1%	25.9%	35.2%	17.3%	28.6%	29.2%	18.4%	25.4%
65-69	17.6%	9.4%	15.3%	16.9%	5.8%	13.5%	13.6%	7.7%	11.4%	16.9%	6.1%	13.0%
70-74	7.9%	4.7%	7.0%	7.6%	0.0%	5.3%	8.0%	1.9%	5.7%	9.0%	0.0%	5.8%
75 and above	7.3%	10.9%	8.3%	5.9%	7.7%	6.5%	4.5%	0.0%	2.9%	6.7%	6.1%	6.5%
Total	165	64	229	118	52	170	88	52	140	89	49	138
85th Percentile	70.00	69.99	70.38	69.39	64.89	68.48	67.72	63.11	66.76	70.14	63.60	67.90
Average	62.68	60.66	62.11	62.31	60.04	61.62	61.99	58.02	60.51	62.71	57.90	61.00
Std Dev	7.78	9.94	8.46	8.11	10.41	8.91	7.24	4.90	6.73	8.35	7.93	8.49
Min	45.51	41.20	41.20	43.35	47.66	43.35	47.66	44.43	44.43	30.43	45.51	30.43
Max	86.43	88.67	88.67	91.52	97.19	97.19	82.95	71.52	82.95	83.90	89.62	89.62
Range	40.92	47.47	47.47	48.17	49.53	53.84	35.29	27.09	38.52	53.47	44.11	59.19

Day 3 – BoT

	23:15 - 00:15			00:15 - 01:15			01:15 - 02:15			02:15 - 03:15		
Speed_Range	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total
<10	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
10-14	0.3%	0.0%	0.3%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
15-19	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
20-24	0.0%	0.0%	0.0%	0.5%	1.9%	0.8%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
25-29	0.0%	0.0%	0.0%	0.5%	0.0%	0.4%	0.0%	0.0%	0.0%	0.5%	0.0%	0.4%
30-34	1.3%	0.0%	1.1%	0.0%	1.9%	0.4%	0.6%	0.0%	0.5%	0.9%	2.9%	1.4%
35-39	4.9%	4.9%	4.9%	1.9%	5.8%	2.7%	2.4%	3.9%	2.8%	2.8%	7.4%	3.9%
40-44	6.2%	11.5%	7.1%	7.2%	7.7%	7.3%	4.9%	11.8%	6.5%	7.6%	7.4%	7.5%
45-49	13.0%	18.0%	13.9%	10.1%	17.3%	11.6%	11.6%	23.5%	14.4%	10.4%	26.5%	14.3%
50-54	16.6%	29.5%	18.8%	23.2%	26.9%	23.9%	17.1%	13.7%	16.3%	20.9%	20.6%	20.8%
55-59	26.7%	24.6%	26.4%	29.0%	28.8%	29.0%	32.9%	25.5%	31.2%	27.5%	19.1%	25.4%
60-64	16.3%	4.9%	14.4%	11.1%	3.8%	9.7%	14.0%	11.8%	13.5%	12.8%	10.3%	12.2%
65-69	6.8%	1.6%	6.0%	8.7%	0.0%	6.9%	7.9%	5.9%	7.4%	7.6%	0.0%	5.7%
70-74	4.6%	1.6%	4.1%	3.9%	0.0%	3.1%	3.7%	2.0%	3.3%	3.8%	0.0%	2.9%
75 and above	3.3%	3.3%	3.3%	3.9%	5.8%	4.2%	4.9%	2.0%	4.2%	5.2%	5.9%	5.4%
Total	307	61	368	207	52	259	164	51	215	211	68	279
85th Percentile	64.70	57.63	64.64	65.88	56.86	64.70	65.88	62.34	64.70	65.88	61.11	64.70
Average	56.02	53.44	55.59	56.68	52.87	55.91	57.54	54.67	56.86	56.82	53.38	55.99
Std Dev	10.04	12.11	10.44	9.62	12.53	10.36	10.09	10.82	10.31	10.55	13.41	11.39
Min	14.01	35.23	14.01	23.44	23.44	23.44	31.69	39.95	31.69	25.80	31.69	25.80
Max	88.28	108.32	108.32	100.07	101.25	101.25	105.96	108.32	108.32	102.43	103.61	103.61
Range	74.27	73.09	94.31	76.63	77.81	77.81	74.27	68.38	76.63	76.63	71.91	77.81

Day 3 – EoT

	23:15 - 00:15			00:15 - 01:15			01:15 - 02:15			02:15 - 03:15		
Speed_Range	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total
<10	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
10-14	0.3%	0.0%	0.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
15-19	0.3%	0.0%	0.2%	0.0%	0.0%	0.0%	0.6%	0.0%	0.4%	0.0%	0.0%	0.0%
20-24	6.9%	1.0%	5.5%	0.5%	0.0%	0.3%	1.8%	0.0%	1.3%	0.5%	1.1%	0.7%
25-29	5.9%	3.9%	5.5%	2.4%	1.1%	2.0%	3.0%	0.0%	2.2%	1.5%	0.0%	1.0%
30-34	14.1%	2.9%	11.4%	14.1%	7.9%	12.2%	3.6%	4.8%	3.9%	4.9%	6.7%	5.5%
35-39	12.2%	7.8%	11.1%	12.6%	4.5%	10.2%	9.7%	9.5%	9.6%	11.8%	11.1%	11.6%
40-44	18.1%	10.8%	16.4%	19.9%	11.2%	17.3%	21.8%	12.7%	19.3%	22.2%	8.9%	18.1%
45-49	18.4%	20.6%	19.0%	19.9%	21.3%	20.3%	20.0%	15.9%	18.9%	20.2%	20.0%	20.1%
50-54	8.1%	7.8%	8.1%	14.1%	13.5%	13.9%	11.5%	9.5%	11.0%	14.8%	13.3%	14.3%
55-59	7.8%	10.8%	8.5%	6.3%	4.5%	5.8%	11.5%	15.9%	12.7%	11.8%	10.0%	11.3%
60-64	4.4%	9.8%	5.7%	5.3%	3.4%	4.7%	6.1%	6.3%	6.1%	7.9%	5.6%	7.2%
65-69	2.2%	4.9%	2.8%	1.9%	9.0%	4.1%	3.0%	7.9%	4.4%	1.5%	6.7%	3.1%
70-74	0.6%	2.9%	1.2%	0.5%	9.0%	3.1%	3.6%	3.2%	3.5%	1.0%	3.3%	1.7%
75 and above	0.6%	16.7%	4.5%	2.4%	14.6%	6.1%	3.6%	14.3%	6.6%	2.0%	13.3%	5.5%
Total	320	102	422	206	89	295	165	63	228	203	90	293
85th Percentile	55.33	76.76	59.08	56.04	73.15	62.84	60.96	72.59	64.66	58.15	72.17	61.90
Average	42.76	55.66	45.88	45.87	55.63	48.81	48.72	55.33	50.54	48.20	53.94	49.96
Std Dev	11.69	17.53	14.42	11.32	16.15	13.70	12.19	15.19	13.38	10.36	15.84	12.56
Min	14.07	24.38	14.07	24.38	27.20	24.38	16.88	30.01	16.88	22.51	23.44	22.51
Max	83.47	96.60	96.60	90.97	95.66	95.66	92.85	94.72	94.72	96.60	96.60	96.60
Range	69.40	72.22	82.54	66.59	68.47	71.28	75.97	64.72	77.85	74.09	73.16	74.09

Day 3 – 1stWA

	23:15 - 00:15			00:15 - 01:15			01:15 - 02:15			02:15 - 03:15		
Speed_Range	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total
<10	2.4%	1.6%	2.3%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
10-14	3.5%	1.6%	3.3%	0.4%	0.0%	0.3%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
15-19	3.5%	1.6%	3.3%	0.4%	0.0%	0.3%	0.5%	0.0%	0.4%	0.0%	1.7%	0.3%
20-24	2.1%	6.6%	2.8%	2.0%	1.7%	1.9%	0.5%	0.0%	0.4%	0.0%	0.0%	0.0%
25-29	5.0%	4.9%	5.0%	2.4%	3.4%	2.6%	0.0%	0.0%	0.0%	0.9%	1.7%	1.0%
30-34	5.0%	6.6%	5.3%	4.8%	5.2%	4.8%	0.5%	4.3%	1.3%	1.8%	0.0%	1.4%
35-39	11.8%	19.7%	13.0%	7.1%	20.7%	9.7%	2.7%	10.6%	4.3%	4.4%	6.8%	4.9%
40-44	12.4%	19.7%	13.5%	14.7%	17.2%	15.2%	3.8%	8.5%	4.8%	4.8%	18.6%	7.7%
45-49	11.2%	14.8%	11.8%	15.9%	10.3%	14.8%	14.7%	12.8%	14.3%	9.2%	11.9%	9.8%
50-54	19.8%	13.1%	18.8%	20.6%	12.1%	19.0%	17.9%	12.8%	16.9%	22.4%	22.0%	22.3%
55-59	9.7%	4.9%	9.0%	11.9%	6.9%	11.0%	20.1%	14.9%	19.0%	13.6%	11.9%	13.2%
60-64	3.5%	0.0%	3.0%	9.9%	10.3%	10.0%	20.7%	10.6%	18.6%	22.4%	13.6%	20.6%
65-69	4.4%	3.3%	4.3%	4.4%	1.7%	3.9%	8.2%	8.5%	8.2%	8.3%	3.4%	7.3%
70-74	2.4%	0.0%	2.0%	2.0%	0.0%	1.6%	4.3%	4.3%	4.3%	6.1%	0.0%	4.9%
75 and above	3.2%	1.6%	3.0%	3.6%	10.3%	4.8%	6.0%	12.8%	7.4%	6.1%	8.5%	6.6%
Total	339	61	400	252	58	310	184	47	231	228	59	287
85th Percentile	58.98	53.07	57.72	62.45	64.08	63.41	67.85	70.95	67.85	67.85	63.41	66.52
Average	45.10	42.07	44.64	50.68	49.66	50.49	57.37	56.91	57.28	57.54	53.57	56.73
Std Dev	16.07	13.29	15.70	12.92	15.12	13.34	10.88	15.93	12.04	10.97	14.42	11.84
Min	2.84	5.79	2.84	10.22	23.52	10.22	16.13	33.86	16.13	27.95	19.09	19.09
Max	94.44	85.58	94.44	104.78	87.05	104.78	94.44	109.22	109.22	94.44	104.78	104.78
Range	91.61	79.79	91.61	94.56	63.53	94.56	78.31	75.35	93.08	66.49	85.70	85.70

Day 3 – 2ndWA

	23:15 - 00:15			00:15 - 01:15			01:15 - 02:15			02:15 - 03:15		
Speed_Range	**PC**	**HV**	**Total**	**PC**	**HV**	**Total**	**PC**	**HV**	**Total**	**PC**	**HV**	**Total**
<10	0.7%	0.0%	0.5%	0.5%	0.0%	0.4%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
10-14	3.0%	0.0%	2.4%	2.5%	7.1%	3.6%	1.9%	2.0%	1.9%	0.0%	0.0%	0.0%
15-19	6.3%	6.1%	6.2%	3.6%	0.0%	2.8%	1.3%	2.0%	1.5%	0.0%	0.0%	0.0%
20-24	5.3%	3.0%	4.9%	2.5%	5.4%	3.2%	1.3%	0.0%	1.0%	0.0%	0.0%	0.0%
25-29	8.6%	4.5%	7.9%	7.6%	5.4%	7.1%	3.8%	4.1%	3.9%	0.9%	0.0%	0.7%
30-34	9.9%	9.1%	9.8%	9.6%	14.3%	10.7%	5.1%	12.2%	6.8%	0.5%	3.5%	1.1%
35-39	16.2%	10.6%	15.2%	18.8%	14.3%	17.8%	7.6%	4.1%	6.8%	4.7%	12.3%	6.3%
40-44	16.5%	16.7%	16.5%	13.2%	16.1%	13.8%	12.1%	24.5%	15.0%	12.6%	17.5%	13.6%
45-49	12.5%	22.7%	14.4%	15.2%	12.5%	14.6%	17.8%	8.2%	15.5%	16.7%	22.8%	18.0%
50-54	7.6%	9.1%	7.9%	9.6%	10.7%	9.9%	17.2%	12.2%	16.0%	23.7%	24.6%	23.9%
55-59	6.3%	3.0%	5.7%	8.1%	3.6%	7.1%	11.5%	14.3%	12.1%	20.0%	8.8%	17.6%
60-64	1.0%	1.5%	1.1%	3.6%	1.8%	3.2%	8.3%	4.1%	7.3%	7.9%	1.8%	6.6%
65-69	3.6%	0.0%	3.0%	2.5%	0.0%	2.0%	7.6%	2.0%	6.3%	8.4%	3.5%	7.4%
70-74	0.3%	3.0%	0.8%	0.5%	1.8%	0.8%	3.2%	2.0%	2.9%	3.7%	0.0%	2.9%
75 and above	2.3%	10.6%	3.8%	2.0%	7.1%	3.2%	1.3%	8.2%	2.9%	0.9%	5.3%	1.8%
Total	303	66	369	197	56	253	157	49	206	215	57	272
85th Percentile	53.30	60.80	54.34	55.91	54.60	55.91	63.74	61.91	63.74	63.74	57.21	62.43
Average	40.20	46.71	41.36	42.44	42.13	42.37	49.44	49.43	49.44	53.54	50.07	52.81
Std Dev	15.33	18.32	16.08	14.61	18.29	15.46	13.45	18.63	14.80	9.34	12.43	10.14
Min	5.00	15.44	5.00	8.92	10.22	8.92	14.14	12.83	12.83	28.50	32.41	28.50
Max	102.90	100.29	102.90	98.98	102.90	102.90	98.98	108.12	108.12	83.32	101.59	101.59
Range	97.90	84.84	97.90	90.07	92.68	93.98	84.84	95.29	95.29	54.82	69.18	73.10

Day 3 – 3rdWA

	23:15 - 00:15			00:15 - 01:15			01:15 - 02:15			02:15 - 03:15		
Speed_Range	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total
<10	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
10-14	0.3%	0.0%	0.3%	0.9%	0.0%	0.7%	2.4%	0.0%	1.7%	0.0%	0.0%	0.0%
15-19	2.8%	1.4%	2.5%	0.9%	0.0%	0.7%	1.6%	0.0%	1.2%	0.6%	0.0%	0.4%
20-24	2.2%	1.4%	2.0%	4.4%	4.8%	4.5%	2.4%	4.3%	2.9%	0.0%	0.0%	0.0%
25-29	5.3%	4.1%	5.1%	9.7%	1.6%	8.0%	4.8%	6.4%	5.2%	1.2%	1.4%	1.3%
30-34	6.9%	8.2%	7.1%	4.9%	4.8%	4.8%	7.9%	10.6%	8.7%	2.4%	1.4%	2.1%
35-39	14.3%	19.2%	15.2%	14.2%	15.9%	14.5%	15.1%	17.0%	15.6%	4.1%	8.6%	5.4%
40-44	16.2%	15.1%	16.0%	11.9%	12.7%	12.1%	10.3%	14.9%	11.6%	9.5%	5.7%	8.4%
45-49	11.5%	11.0%	11.4%	9.3%	12.7%	10.0%	7.9%	2.1%	6.4%	6.5%	10.0%	7.5%
50-54	15.0%	6.8%	13.5%	15.9%	12.7%	15.2%	9.5%	6.4%	8.7%	15.4%	11.4%	14.2%
55-59	10.9%	4.1%	9.6%	8.4%	9.5%	8.7%	11.9%	6.4%	10.4%	12.4%	8.6%	11.3%
60-64	5.9%	4.1%	5.6%	7.1%	9.5%	7.6%	7.9%	8.5%	8.1%	14.8%	10.0%	13.4%
65-69	2.8%	4.1%	3.0%	4.9%	6.3%	5.2%	7.9%	6.4%	7.5%	15.4%	10.0%	13.8%
70-74	2.5%	6.8%	3.3%	4.0%	0.0%	3.1%	3.2%	4.3%	3.5%	7.1%	5.7%	6.7%
75 and above	3.4%	13.7%	5.3%	3.5%	9.5%	4.8%	7.1%	12.8%	8.7%	10.7%	27.1%	15.5%
Total	321	73	394	226	63	289	126	47	173	169	70	239
85th Percentile	59.13	74.65	61.72	63.01	66.12	63.01	68.19	71.03	68.19	72.07	82.41	75.95
Average	46.92	52.22	47.90	47.08	50.82	47.90	49.35	52.03	50.08	58.94	63.25	60.21
Std Dev	13.99	20.65	15.55	15.16	16.23	15.45	17.63	22.22	18.96	14.12	18.73	15.70
Min	13.87	15.16	13.87	11.28	20.33	11.28	11.28	21.63	11.28	17.75	28.09	17.75
Max	104.40	108.28	108.28	87.59	100.52	100.52	97.93	106.99	106.99	104.40	109.57	109.57
Range	90.53	93.12	94.41	76.30	80.18	89.24	86.65	85.36	95.70	86.65	81.48	91.82

Day 3 – 4thWA

	23:15 - 00:15			00:15 - 01:15			01:15 - 02:15			02:15 - 03:15		
Speed_Range	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total
<10	0.0%	0.0%	0.0%	1.3%	0.0%	1.0%	1.4%	0.0%	1.0%	0.0%	0.0%	0.0%
10-14	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
15-19	1.1%	0.0%	0.9%	1.3%	4.5%	2.0%	0.7%	6.0%	2.0%	0.5%	0.0%	0.4%
20-24	2.2%	1.3%	2.1%	1.7%	6.0%	2.7%	2.7%	6.0%	3.6%	2.0%	1.2%	1.8%
25-29	5.9%	0.0%	4.8%	4.8%	4.5%	4.7%	7.5%	2.0%	6.1%	5.1%	4.9%	5.0%
30-34	8.4%	6.6%	8.1%	10.0%	10.4%	10.1%	11.0%	14.0%	11.7%	4.6%	7.4%	5.4%
35-39	12.0%	15.8%	12.7%	24.7%	14.9%	22.5%	13.7%	14.0%	13.8%	10.2%	9.9%	10.1%
40-44	21.0%	26.3%	21.9%	20.3%	19.4%	20.1%	24.0%	12.0%	20.9%	18.3%	14.8%	17.3%
45-49	18.2%	15.8%	17.8%	17.7%	9.0%	15.8%	15.1%	10.0%	13.8%	22.8%	19.8%	21.9%
50-54	16.5%	9.2%	15.2%	10.0%	4.5%	8.7%	9.6%	8.0%	9.2%	14.2%	12.3%	13.7%
55-59	7.3%	5.3%	6.9%	3.5%	14.9%	6.0%	6.8%	8.0%	7.1%	12.7%	11.1%	12.2%
60-64	3.4%	3.9%	3.5%	1.3%	6.0%	2.3%	2.7%	4.0%	3.1%	3.6%	7.4%	4.7%
65-69	2.2%	6.6%	3.0%	0.4%	0.0%	0.3%	2.7%	2.0%	2.6%	3.0%	2.5%	2.9%
70-74	0.6%	2.6%	0.9%	0.9%	1.5%	1.0%	0.0%	2.0%	0.5%	1.5%	1.2%	1.4%
75 and above	1.1%	6.6%	2.1%	2.2%	4.5%	2.7%	2.1%	12.0%	4.6%	1.5%	7.4%	3.2%
Total	357	76	433	231	67	298	146	50	196	197	81	278
85th Percentile	54.48	65.01	55.71	51.40	59.62	53.45	53.45	66.35	56.54	58.59	60.65	58.59
Average	44.70	48.73	45.41	42.28	45.08	42.91	43.01	46.16	43.81	47.49	50.05	48.24
Std Dev	10.99	14.24	11.71	11.96	16.13	13.03	12.57	18.04	14.18	11.51	15.15	12.71
Min	15.44	23.66	15.44	0.02	17.49	0.02	8.24	17.49	8.24	19.55	24.68	19.55
Max	97.64	101.75	101.75	97.64	101.75	101.75	101.75	93.53	101.75	93.53	100.72	100.72
Range	82.20	78.09	86.31	97.61	84.26	101.72	93.50	76.04	93.50	73.98	76.04	81.17

Day 3 – 5thWA

	23:15 - 00:15			00:15 - 01:15			01:15 - 02:15			02:15 - 03:15		
Speed_Range	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total
<10	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.7%	0.4%
10-14	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
15-19	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.5%	0.0%	0.4%
20-24	0.6%	0.0%	0.5%	0.0%	0.0%	0.0%	0.0%	2.4%	0.5%	0.0%	0.0%	0.0%
25-29	0.0%	0.0%	0.0%	0.5%	2.6%	0.8%	2.0%	0.0%	1.6%	4.1%	3.4%	4.0%
30-34	1.1%	0.0%	1.0%	1.0%	7.7%	2.1%	2.7%	7.3%	3.7%	6.4%	8.6%	6.9%
35-39	2.3%	11.8%	3.1%	5.6%	5.1%	5.5%	13.5%	9.8%	12.7%	7.3%	12.1%	8.3%
40-44	14.1%	11.8%	13.9%	14.7%	30.8%	17.4%	27.0%	22.0%	25.9%	22.5%	25.9%	23.2%
45-49	14.7%	17.6%	14.9%	22.8%	20.5%	22.5%	22.3%	29.3%	23.8%	19.7%	19.0%	19.6%
50-54	25.4%	47.1%	27.3%	24.4%	23.1%	24.2%	16.2%	12.2%	15.3%	22.5%	12.1%	20.3%
55-59	15.3%	0.0%	13.9%	15.2%	10.3%	14.4%	8.8%	12.2%	9.5%	11.5%	5.2%	10.1%
60-64	9.6%	0.0%	8.8%	8.1%	0.0%	6.8%	5.4%	2.4%	4.8%	2.8%	1.7%	2.5%
65-69	11.3%	0.0%	10.3%	5.6%	0.0%	4.7%	1.4%	0.0%	1.1%	0.9%	1.7%	1.1%
70-74	1.7%	0.0%	1.5%	1.0%	0.0%	0.8%	0.0%	2.4%	0.5%	0.9%	0.0%	0.7%
75 and above	4.0%	11.8%	4.6%	1.0%	0.0%	0.8%	0.7%	0.0%	0.5%	0.9%	8.6%	2.5%
Total	177	17	194	197	39	236	148	41	189	218	58	276
85th Percentile	65.20	52.15	65.20	60.62	52.15	59.19	56.04	56.04	56.04	56.04	56.04	56.04
Average	54.56	51.80	54.31	51.56	46.32	50.69	46.85	46.04	46.68	47.35	48.26	47.55
Std Dev	10.12	13.53	10.45	8.69	7.42	8.70	8.35	9.16	8.52	9.75	17.94	11.91
Min	21.69	36.57	21.69	29.70	28.56	28.56	25.12	22.83	22.83	19.40	7.94	7.94
Max	86.96	88.11	88.11	82.38	59.48	82.38	76.66	70.93	76.66	94.98	104.14	104.14
Range	65.28	51.53	66.42	52.68	30.92	53.82	51.53	48.10	53.82	75.58	96.20	96.20

APPENDIX C - SPEED DATA SUMMARY – CASE STUDY 3A

Day 1 – RWA

	23:30 - 00:30			00:30 - 01:30			01:30 - 02:30			02:30 - 03:30			03:30 - 04:30		
Speed_Range	**PC**	**HV**	**Total**	**PC**	**HV**	**Total**	**PC**	**HV**	**Total**	**PC**	**HV**	**Total**	**PC**	**HV**	**Total**
<10	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	2.6%	1.5%
10-14	0.0%	0.0%	0.0%	3.6%	0.0%	1.4%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.9%	0.0%	0.8%
15-19	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
20-24	0.0%	0.0%	0.0%	0.0%	2.3%	1.4%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
25-29	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	2.8%	0.0%	1.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
30-34	0.0%	0.0%	0.0%	3.6%	0.0%	1.4%	2.8%	0.0%	1.1%	0.0%	1.4%	0.9%	0.0%	0.0%	0.0%
35-39	9.4%	5.1%	7.0%	3.6%	0.0%	1.4%	2.8%	1.7%	2.1%	0.0%	0.0%	0.0%	1.9%	0.0%	0.8%
40-44	15.6%	12.7%	14.0%	10.7%	7.0%	8.5%	2.8%	0.0%	1.1%	7.3%	8.1%	7.8%	5.6%	1.3%	3.1%
45-49	20.3%	22.8%	21.7%	25.0%	9.3%	15.5%	13.9%	12.1%	12.8%	12.2%	9.5%	10.4%	9.3%	13.2%	11.5%
50-54	20.3%	22.8%	21.7%	7.1%	27.9%	19.7%	22.2%	24.1%	23.4%	22.0%	21.6%	21.7%	13.0%	14.5%	13.8%
55-59	12.5%	20.3%	16.8%	14.3%	32.6%	25.4%	27.8%	19.0%	22.3%	17.1%	25.7%	22.6%	27.8%	26.3%	26.9%
60-64	12.5%	8.9%	10.5%	3.6%	7.0%	5.6%	5.6%	17.2%	12.8%	24.4%	16.2%	19.1%	14.8%	18.4%	16.9%
65-69	1.6%	1.3%	1.4%	3.6%	2.3%	2.8%	5.6%	3.4%	4.3%	2.4%	2.7%	2.6%	7.4%	2.6%	4.6%
70-74	3.1%	1.3%	2.1%	17.9%	2.3%	8.5%	2.8%	5.2%	4.3%	7.3%	4.1%	5.2%	7.4%	5.3%	6.2%
75 and above	4.7%	5.1%	4.9%	7.1%	9.3%	8.5%	11.1%	17.2%	14.9%	7.3%	10.8%	9.6%	11.1%	15.8%	13.8%
Total	64	79	143	28	43	71	36	58	94	41	74	115	54	76	130
85th Percentile	62.25	60.91	61.66	72.37	63.49	70.81	65.97	77.60	74.63	68.12	69.25	69.09	70.38	75.39	74.20
Average	52.66	53.37	53.05	55.16	57.83	56.78	57.55	62.20	60.42	58.59	59.27	59.03	59.49	60.71	60.20
Std Dev	10.62	11.10	10.85	16.10	14.55	15.12	15.71	14.20	14.89	11.17	13.17	12.45	14.24	16.41	15.50
Min	36.89	36.89	36.89	13.20	21.82	13.20	27.95	37.97	27.95	40.12	32.59	32.59	10.22	3.51	3.51
Max	86.43	105.81	105.81	90.73	99.35	99.35	109.04	106.89	109.04	96.12	106.89	106.89	98.27	102.58	102.58
Range	49.53	68.92	68.92	77.53	77.53	86.14	81.09	68.92	81.09	55.99	74.30	74.30	88.05	99.07	99.07

Day 1 – EoT

	23:30 - 00:30			00:30 - 01:30			01:30 - 02:30			02:30 - 03:30			03:30 - 04:30		
Speed_Range	**PC**	**HV**	**Total**	**PC**	**HV**	**Total**	**PC**	**HV**	**Total**	**PC**	**HV**	**Total**	**PC**	**HV**	**Total**
<10	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
10-14	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
15-19	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.4%	1.0%	1.2%
20-24	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.4%	0.0%	0.6%
25-29	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	2.2%	0.0%	0.8%	1.4%	1.0%	1.2%
30-34	0.0%	0.0%	0.0%	9.1%	2.3%	4.5%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.4%	0.0%	0.6%
35-39	3.0%	0.0%	1.3%	0.0%	2.3%	1.5%	0.0%	0.0%	0.0%	2.2%	1.3%	1.6%	1.4%	1.0%	1.2%
40-44	12.1%	0.0%	5.2%	0.0%	2.3%	1.5%	10.0%	0.0%	3.7%	15.6%	3.9%	8.2%	5.6%	2.0%	3.5%
45-49	9.1%	13.6%	11.7%	13.6%	31.8%	25.8%	33.3%	21.6%	25.9%	20.0%	27.3%	24.6%	26.4%	20.0%	22.7%
50-54	33.3%	22.7%	27.3%	27.3%	20.5%	22.7%	10.0%	37.3%	27.2%	33.3%	28.6%	30.3%	33.3%	36.0%	34.9%
55-59	18.2%	18.2%	18.2%	18.2%	13.6%	15.2%	10.0%	23.5%	18.5%	6.7%	24.7%	18.0%	11.1%	20.0%	16.3%
60-64	9.1%	22.7%	16.9%	9.1%	11.4%	10.6%	6.7%	11.8%	9.9%	13.3%	5.2%	8.2%	5.6%	11.0%	8.7%
65-69	12.1%	11.4%	11.7%	4.5%	11.4%	9.1%	20.0%	2.0%	8.6%	4.4%	5.2%	4.9%	4.2%	3.0%	3.5%
70-74	0.0%	4.5%	2.6%	13.6%	2.3%	6.1%	10.0%	3.9%	6.2%	2.2%	2.6%	2.5%	4.2%	3.0%	3.5%
75 and above	3.0%	6.8%	5.2%	4.5%	2.3%	3.0%	0.0%	0.0%	0.0%	0.0%	1.3%	0.8%	2.8%	2.0%	2.3%
Total	33	44	77	22	44	66	30	51	81	45	77	122	72	100	172
85th Percentile	64.24	67.18	66.67	69.99	64.47	66.20	66.67	61.06	64.80	60.87	59.19	60.12	60.78	61.20	61.38
Average	54.71	60.10	57.79	56.89	54.49	55.29	56.10	54.93	55.36	52.01	53.91	53.21	52.26	54.43	53.52
Std Dev	8.47	10.82	10.18	12.04	9.32	10.28	9.56	6.03	7.50	8.26	7.49	7.80	11.01	9.06	9.95
Min	37.67	47.96	37.67	34.87	33.93	33.93	43.28	45.16	43.28	28.32	37.67	28.32	15.22	15.22	15.22
Max	75.09	100.34	100.34	86.31	82.57	86.31	72.28	70.41	72.28	71.35	85.38	85.38	86.31	86.31	86.31
Range	37.42	52.38	62.67	51.45	48.64	52.38	29.00	25.26	29.00	43.03	47.71	57.06	71.09	71.09	71.09

Day 1 – 1stWA

	23:30 - 00:30			00:30 - 01:30			01:30 - 02:30			02:30 - 03:30			03:30 - 04:30		
Speed_Range	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total
<10	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
10-14	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.1%	0.6%	0.7%	0.0%	0.4%
15-19	0.0%	0.0%	0.0%	1.7%	0.0%	1.0%	0.0%	8.8%	4.7%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
20-24	0.0%	0.0%	0.0%	1.7%	2.2%	1.9%	5.1%	2.9%	3.9%	0.0%	1.1%	0.6%	2.1%	2.0%	2.1%
25-29	5.0%	1.4%	3.5%	5.0%	2.2%	3.8%	6.8%	11.8%	9.4%	1.2%	1.1%	1.2%	3.5%	7.9%	5.3%
30-34	11.0%	8.2%	9.8%	11.7%	13.3%	12.4%	8.5%	11.8%	10.2%	7.1%	11.5%	9.4%	7.0%	5.0%	6.2%
35-39	11.0%	19.2%	14.5%	28.3%	24.4%	26.7%	16.9%	19.1%	18.1%	13.1%	18.4%	15.8%	7.7%	10.9%	9.1%
40-44	20.0%	19.2%	19.7%	16.7%	22.2%	19.0%	22.0%	17.6%	19.7%	25.0%	13.8%	19.3%	26.1%	16.8%	22.2%
45-49	33.0%	26.0%	30.1%	11.7%	22.2%	16.2%	33.9%	20.6%	26.8%	33.3%	27.6%	30.4%	29.6%	32.7%	30.9%
50-54	14.0%	15.1%	14.5%	13.3%	11.1%	12.4%	3.4%	7.4%	5.5%	14.3%	20.7%	17.5%	12.0%	16.8%	14.0%
55-59	4.0%	6.8%	5.2%	3.3%	2.2%	2.9%	1.7%	0.0%	0.8%	3.6%	3.4%	3.5%	9.2%	1.0%	5.8%
60-64	2.0%	2.7%	2.3%	5.0%	0.0%	2.9%	1.7%	0.0%	0.8%	2.4%	0.0%	1.2%	1.4%	5.0%	2.9%
65-69	0.0%	1.4%	0.6%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.0%	0.4%
70-74	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.7%	1.0%	0.8%
75 and above	0.0%	0.0%	0.0%	1.7%	0.0%	1.0%	0.0%	0.0%	0.0%	0.0%	1.1%	0.6%	0.0%	0.0%	0.0%
Total	100	73	173	60	45	105	59	68	127	84	87	171	142	101	243
85th Percentile	51.34	52.25	52.25	52.38	48.99	51.71	48.63	46.82	47.73	51.34	51.34	51.34	52.25	52.25	52.25
Average	44.20	45.11	44.58	42.43	42.16	42.32	41.52	37.59	39.41	44.71	43.89	44.29	44.85	44.64	44.76
Std Dev	8.12	8.15	8.12	10.81	7.22	9.40	8.18	9.98	9.36	6.77	8.97	7.95	8.82	9.24	8.98
Min	26.02	25.11	25.11	19.68	23.30	19.68	20.59	15.16	15.16	27.82	12.45	12.45	12.45	21.49	12.45
Max	64.91	69.44	69.44	83.00	56.77	83.00	62.20	54.06	62.20	62.20	78.48	78.48	70.34	72.15	72.15
Range	38.90	44.33	44.33	63.32	33.47	63.32	41.61	38.90	47.04	34.37	66.04	66.04	57.89	50.66	59.70

Day 1 – 2ndWA

	23:30 - 00:30			00:30 - 01:30			01:30 - 02:30			02:30 - 03:30			03:30 - 04:30		
Speed_Range	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total
<10	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.4%	2.2%	1.9%
10-14	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	2.2%	0.0%	0.9%	1.4%	1.1%	1.2%
15-19	0.0%	0.0%	0.0%	3.0%	0.0%	1.3%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	2.8%	2.2%	2.5%
20-24	0.0%	0.0%	0.0%	3.0%	4.5%	3.9%	2.5%	1.5%	1.9%	0.0%	1.5%	0.9%	2.8%	4.4%	3.7%
25-29	0.0%	3.1%	1.6%	0.0%	4.5%	2.6%	2.5%	3.1%	2.9%	2.2%	15.4%	10.0%	12.7%	10.0%	11.2%
30-34	15.3%	18.5%	16.9%	27.3%	27.3%	27.3%	5.0%	21.5%	15.2%	22.2%	20.0%	20.9%	25.4%	21.1%	23.0%
35-39	22.0%	21.5%	21.8%	27.3%	27.3%	27.3%	45.0%	35.4%	39.0%	35.6%	21.5%	27.3%	26.8%	25.6%	26.1%
40-44	30.5%	26.2%	28.2%	21.2%	18.2%	19.5%	20.0%	20.0%	20.0%	17.8%	27.7%	23.6%	16.9%	15.6%	16.1%
45-49	20.3%	20.0%	20.2%	15.2%	6.8%	10.4%	15.0%	10.8%	12.4%	13.3%	9.2%	10.9%	8.5%	6.7%	7.5%
50-54	5.1%	3.1%	4.0%	0.0%	4.5%	2.6%	7.5%	3.1%	4.8%	2.2%	3.1%	2.7%	0.0%	5.6%	3.1%
55-59	3.4%	0.0%	1.6%	0.0%	2.3%	1.3%	0.0%	1.5%	1.0%	4.4%	0.0%	1.8%	1.4%	1.1%	1.2%
60-64	1.7%	1.5%	1.6%	0.0%	2.3%	1.3%	2.5%	1.5%	1.9%	0.0%	1.5%	0.9%	0.0%	3.3%	1.9%
65-69	1.7%	3.1%	2.4%	3.0%	0.0%	1.3%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
70-74	0.0%	1.5%	0.8%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
75 and above	0.0%	1.5%	0.8%	0.0%	2.3%	1.3%	0.0%	1.5%	1.0%	0.0%	0.0%	0.0%	0.0%	1.1%	0.6%
Total	59	65	124	33	44	77	40	65	105	45	65	110	71	90	161
85th Percentile	49.00	48.25	48.75	46.24	47.54	46.24	46.49	46.07	46.58	45.41	44.57	45.41	42.89	45.41	43.73
Average	43.11	42.21	42.64	38.00	39.24	38.71	40.91	39.85	40.26	39.04	37.55	38.16	35.05	37.16	36.23
Std Dev	7.71	9.68	8.77	8.23	10.20	9.37	6.95	9.01	8.27	7.69	7.24	7.43	8.39	11.92	10.53
Min	30.34	26.15	26.15	17.78	22.80	17.78	24.48	23.64	23.64	11.08	21.13	11.08	6.90	6.06	6.06
Max	68.84	75.54	75.54	65.50	79.73	79.73	62.98	86.42	86.42	57.12	60.47	60.47	56.29	85.59	85.59
Range	38.51	49.39	49.39	47.71	56.92	61.95	38.51	62.78	62.78	46.04	39.34	49.39	49.39	79.52	79.52

Day 1 – 3rdWA

	23:30 - 00:30			00:30 - 01:30			01:30 - 02:30			02:30 - 03:30			03:30 - 04:30		
Speed_Range	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total
<10	0.0%	1.6%	0.8%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
10-14	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
15-19	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
20-24	0.0%	0.0%	0.0%	2.7%	0.0%	1.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
25-29	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
30-34	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
35-39	1.7%	0.0%	0.8%	0.0%	2.2%	1.2%	0.0%	0.0%	0.0%	11.6%	0.0%	4.2%	4.8%	2.1%	3.2%
40-44	8.6%	1.6%	4.9%	8.1%	6.5%	7.2%	12.1%	18.0%	16.0%	9.3%	9.3%	9.3%	3.2%	11.6%	8.3%
45-49	17.2%	12.5%	14.8%	21.6%	28.3%	25.3%	27.3%	24.6%	25.5%	18.6%	21.3%	20.3%	21.0%	23.2%	22.3%
50-54	20.7%	37.5%	29.5%	27.0%	34.8%	31.3%	24.2%	21.3%	22.3%	25.6%	46.7%	39.0%	35.5%	24.2%	28.7%
55-59	19.0%	20.3%	19.7%	24.3%	15.2%	19.3%	18.2%	27.9%	24.5%	20.9%	8.0%	12.7%	19.4%	18.9%	19.1%
60-64	19.0%	17.2%	18.0%	8.1%	13.0%	10.8%	9.1%	4.9%	6.4%	9.3%	6.7%	7.6%	9.7%	7.4%	8.3%
65-69	3.4%	4.7%	4.1%	2.7%	0.0%	1.2%	3.0%	0.0%	1.1%	2.3%	2.7%	2.5%	4.8%	5.3%	5.1%
70-74	6.9%	1.6%	4.1%	0.0%	0.0%	0.0%	3.0%	0.0%	1.1%	2.3%	1.3%	1.7%	0.0%	1.1%	0.6%
75 and above	3.4%	3.1%	3.3%	5.4%	0.0%	2.4%	3.0%	3.3%	3.2%	0.0%	4.0%	2.5%	1.6%	6.3%	4.5%
Total	58	64	122	37	46	83	33	61	94	43	75	118	62	95	157
85th Percentile	64.33	62.52	63.76	60.67	58.43	58.86	60.67	58.19	59.14	59.14	59.14	59.14	59.67	63.91	62.57
Average	56.48	55.75	56.10	53.77	51.73	52.64	54.07	52.26	52.89	51.66	53.38	52.75	53.60	54.59	54.20
Std Dev	10.36	10.10	10.19	10.28	5.71	8.08	9.27	8.18	8.57	8.16	8.84	8.61	7.71	10.52	9.50
Min	37.24	2.96	2.96	22.00	35.34	22.00	42.96	41.05	41.05	36.29	40.10	36.29	37.24	38.19	37.24
Max	91.52	88.67	91.52	84.86	62.00	84.86	89.62	84.86	89.62	70.57	97.24	97.24	85.81	93.43	93.43
Range	54.28	85.71	88.56	62.85	26.66	62.85	46.66	43.81	48.57	34.28	57.14	60.95	48.57	55.23	56.19

Day 1 – 4thWA

	23:30 - 00:30			00:30 - 01:30			01:30 - 02:30			02:30 - 03:30			03:30 - 04:30		
Speed_Range	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total
<10	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
10-14	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
15-19	1.1%	0.0%	0.6%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.2%	0.0%	0.6%	0.0%	0.0%	0.0%
20-24	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
25-29	1.1%	0.0%	0.6%	2.0%	2.2%	2.1%	3.7%	1.4%	2.4%	0.0%	1.1%	0.6%	0.0%	0.0%	0.0%
30-34	4.4%	0.0%	2.3%	2.0%	0.0%	1.0%	1.9%	2.8%	2.4%	2.5%	2.2%	2.3%	0.9%	1.7%	1.3%
35-39	3.3%	4.9%	4.1%	6.0%	0.0%	3.1%	9.3%	9.7%	9.5%	7.4%	3.3%	5.3%	6.4%	2.5%	4.3%
40-44	15.6%	4.9%	10.5%	12.0%	17.4%	14.6%	18.5%	8.3%	12.7%	19.8%	20.0%	19.9%	13.6%	10.8%	12.2%
45-49	20.0%	11.0%	15.7%	22.0%	21.7%	21.9%	22.2%	38.9%	31.7%	32.1%	20.0%	25.7%	21.8%	11.7%	16.5%
50-54	11.1%	19.5%	15.1%	22.0%	17.4%	19.8%	20.4%	12.5%	15.9%	9.9%	18.9%	14.6%	21.8%	15.8%	18.7%
55-59	17.8%	20.7%	19.2%	10.0%	13.0%	11.5%	7.4%	9.7%	8.7%	16.0%	15.6%	15.8%	19.1%	19.2%	19.1%
60-64	12.2%	19.5%	15.7%	8.0%	15.2%	11.5%	11.1%	6.9%	8.7%	4.9%	7.8%	6.4%	10.0%	15.8%	13.0%
65-69	6.7%	6.1%	6.4%	8.0%	10.9%	9.4%	1.9%	2.8%	2.4%	2.5%	6.7%	4.7%	2.7%	6.7%	4.8%
70-74	3.3%	4.9%	4.1%	4.0%	0.0%	2.1%	3.7%	4.2%	4.0%	1.2%	3.3%	2.3%	2.7%	5.8%	4.3%
75 and above	3.3%	8.5%	5.8%	4.0%	2.2%	3.1%	0.0%	2.8%	1.6%	2.5%	1.1%	1.8%	0.9%	10.0%	5.7%
Total	90	82	172	50	46	96	54	72	126	81	90	171	110	120	230
85th Percentile	63.45	68.46	66.92	64.01	64.01	64.48	60.02	60.96	60.26	58.15	61.57	59.55	60.02	70.34	64.71
Average	52.73	57.67	55.08	52.59	53.33	52.95	48.96	50.42	49.79	49.54	51.73	50.69	51.91	57.69	54.92
Std Dev	12.24	10.71	11.76	11.38	9.41	10.44	9.69	11.31	10.63	10.63	9.77	10.21	8.45	12.41	11.06
Min	19.69	35.64	19.69	27.20	29.07	27.20	26.26	29.07	26.26	15.94	26.26	15.94	32.82	30.95	30.95
Max	90.97	87.22	90.97	80.66	76.90	80.66	71.28	93.79	93.79	94.72	76.90	94.72	79.72	95.66	95.66
Range	71.28	51.58	71.28	53.46	47.83	53.46	45.02	64.72	67.53	78.78	50.65	78.78	46.90	64.72	64.72

Day 2 – RWA

	23:30 - 00:30			00:30 - 01:30			01:30 - 02:30			02:30 - 03:30			03:30 - 04:30		
Speed_Range	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total
<10	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
10-14	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
15-19	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
20-24	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
25-29	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
30-34	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
35-39	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
40-44	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.9%	0.0%	0.9%	0.7%	0.8%	0.8%
45-49	1.7%	1.1%	1.4%	1.1%	1.6%	1.3%	1.5%	2.4%	2.0%	0.0%	0.0%	0.0%	2.8%	0.0%	1.5%
50-54	6.7%	7.9%	7.2%	8.5%	12.5%	10.1%	5.9%	8.2%	7.2%	2.9%	6.3%	4.7%	2.8%	3.4%	3.1%
55-59	11.7%	19.1%	14.8%	10.6%	26.6%	17.1%	11.8%	20.0%	16.3%	11.7%	21.6%	16.8%	5.0%	15.3%	9.7%
60-64	20.0%	39.3%	28.2%	21.3%	26.6%	23.4%	23.5%	29.4%	26.8%	25.2%	31.5%	28.5%	22.0%	36.4%	28.6%
65-69	24.2%	14.6%	20.1%	21.3%	15.6%	19.0%	26.5%	24.7%	25.5%	26.2%	18.0%	22.0%	15.6%	22.0%	18.5%
70-74	15.0%	10.1%	12.9%	22.3%	9.4%	17.1%	14.7%	7.1%	10.5%	19.4%	11.7%	15.4%	22.7%	5.9%	15.1%
75 and above	20.8%	7.9%	15.3%	14.9%	7.8%	12.0%	16.2%	8.2%	11.8%	12.6%	10.8%	11.7%	28.4%	16.1%	22.8%
Total	120	89	209	94	64	158	68	85	153	103	111	214	141	118	259
85th Percentile	77.38	70.34	75.24	74.45	70.57	73.43	78.90	69.91	73.43	74.38	71.52	73.46	79.14	75.76	78.19
Average	67.54	63.70	65.91	67.07	62.81	65.34	67.27	64.28	65.61	66.90	64.72	65.77	69.59	66.48	68.17
Std Dev	9.05	7.27	8.53	8.98	7.97	8.81	9.09	8.51	8.87	7.87	7.87	7.93	9.33	9.56	9.54
Min	46.76	48.67	46.76	45.92	49.62	45.92	45.92	46.76	45.92	43.20	51.53	43.20	42.00	42.00	42.00
Max	89.62	84.86	89.62	95.33	87.53	95.33	91.52	100.09	100.09	86.62	86.76	86.76	90.57	100.09	100.09
Range	42.85	36.19	42.85	49.42	37.91	49.42	45.61	53.33	54.18	43.42	35.24	43.56	48.57	58.09	58.09

Day 2 – PCMS

	23:30 - 00:30			00:30 - 01:30			01:30 - 02:30			02:30 - 03:30			03:30 - 04:30		
Speed_Range	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total
<10	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
10-14	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
15-19	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
20-24	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
25-29	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
30-34	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
35-39	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
40-44	1.1%	0.0%	0.6%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	2.5%	1.1%	0.0%	0.0%	0.0%
45-49	2.1%	2.5%	2.3%	0.0%	0.0%	0.0%	3.2%	2.5%	2.8%	1.0%	2.5%	1.7%	1.9%	1.9%	1.9%
50-54	6.3%	6.2%	6.3%	2.7%	14.8%	7.8%	6.5%	11.4%	9.2%	5.2%	13.8%	9.1%	5.6%	12.0%	8.8%
55-59	10.5%	45.7%	26.7%	16.2%	40.7%	26.6%	9.7%	44.3%	29.1%	25.0%	45.0%	34.1%	18.7%	27.8%	23.3%
60-64	38.9%	28.4%	34.1%	32.4%	31.5%	32.0%	35.5%	31.6%	33.3%	33.3%	27.5%	30.7%	32.7%	36.1%	34.4%
65-69	16.8%	13.6%	15.3%	17.6%	3.7%	11.7%	17.7%	3.8%	9.9%	12.5%	3.8%	8.5%	15.9%	12.0%	14.0%
70-74	14.7%	3.7%	9.7%	13.5%	3.7%	9.4%	16.1%	1.3%	7.8%	9.4%	2.5%	6.3%	15.0%	5.6%	10.2%
75 and above	9.5%	0.0%	5.1%	17.6%	5.6%	12.5%	11.3%	5.1%	7.8%	13.5%	2.5%	8.5%	10.3%	4.6%	7.4%
Total	95	81	176	74	54	128	62	79	141	96	80	176	107	108	215
85th Percentile	73.50	65.97	69.48	75.66	64.89	73.50	73.10	64.89	70.41	73.22	62.74	68.93	71.54	67.02	70.41
Average	64.97	60.19	62.77	66.71	59.98	63.87	65.94	60.26	62.75	64.47	58.93	61.95	64.82	61.51	63.16
Std Dev	7.82	5.20	7.14	7.63	6.43	7.86	8.80	6.95	8.28	8.07	6.12	7.74	7.55	7.21	7.55
Min	44.22	49.81	44.22	53.57	51.97	51.97	45.51	48.74	45.51	49.81	42.28	42.28	47.66	48.74	47.66
Max	92.86	73.50	92.86	90.99	78.89	90.99	98.47	92.86	98.47	89.12	82.57	89.12	84.27	90.99	90.99
Range	48.64	23.69	48.64	37.42	26.92	39.02	52.97	44.12	52.97	39.30	40.29	46.84	36.61	42.25	43.33

Day 2 – BoT

	23:30 - 00:30			00:30 - 01:30			01:30 - 02:30			02:30 - 03:30			03:30 - 04:30		
Speed_Range	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total
<10	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
10-14	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
15-19	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
20-24	1.8%	0.0%	0.9%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
25-29	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.4%	0.0%	0.6%
30-34	5.3%	0.0%	2.8%	4.0%	0.0%	2.0%	2.4%	0.0%	1.1%	1.5%	2.6%	2.1%	1.4%	2.3%	1.9%
35-39	3.5%	2.0%	2.8%	8.0%	2.1%	5.1%	0.0%	0.0%	0.0%	6.2%	1.3%	3.5%	2.8%	2.3%	2.5%
40-44	12.3%	7.8%	10.2%	10.0%	16.7%	13.3%	7.3%	7.4%	7.4%	12.3%	14.1%	13.3%	14.1%	12.6%	13.3%
45-49	24.6%	31.4%	27.8%	12.0%	16.7%	14.3%	26.8%	20.4%	23.2%	15.4%	25.6%	21.0%	25.4%	28.7%	27.2%
50-54	17.5%	19.6%	18.5%	28.0%	22.9%	25.5%	31.7%	29.6%	30.5%	29.2%	28.2%	28.7%	21.1%	24.1%	22.8%
55-59	12.3%	11.8%	12.0%	16.0%	18.8%	17.3%	22.0%	24.1%	23.2%	18.5%	16.7%	17.5%	19.7%	12.6%	15.8%
60-64	12.3%	15.7%	13.9%	10.0%	12.5%	11.2%	4.9%	9.3%	7.4%	13.8%	5.1%	9.1%	7.0%	10.3%	8.9%
65-69	5.3%	3.9%	4.6%	4.0%	2.1%	3.1%	4.9%	1.9%	3.2%	3.1%	2.6%	2.8%	1.4%	3.4%	2.5%
70-74	5.3%	3.9%	4.6%	6.0%	2.1%	4.1%	0.0%	3.7%	2.1%	0.0%	2.6%	1.4%	2.8%	1.1%	1.9%
75 and above	0.0%	3.9%	1.9%	2.0%	6.3%	4.1%	0.0%	3.7%	2.1%	0.0%	1.3%	0.7%	2.8%	2.3%	2.5%
Total	57	51	108	50	48	98	41	54	95	65	78	143	71	87	158
85th Percentile	63.15	64.24	63.82	62.98	62.94	62.98	57.96	62.23	59.55	60.47	57.96	59.64	59.22	61.31	60.85
Average	51.82	54.55	53.11	52.87	54.67	53.75	52.39	54.89	53.81	51.69	51.92	51.82	52.01	52.30	52.17
Std Dev	10.44	9.59	10.09	10.62	10.45	10.52	6.89	8.79	8.09	7.67	8.44	8.07	9.38	9.33	9.32
Min	24.48	36.20	24.48	31.17	39.55	31.17	34.52	40.38	34.52	31.17	30.34	30.34	27.83	31.17	27.83
Max	72.19	80.56	80.56	78.89	84.75	84.75	68.01	85.59	85.59	66.33	86.42	86.42	79.73	86.42	86.42
Range	47.71	44.37	56.09	47.71	45.20	53.57	33.48	45.20	51.06	35.16	56.09	56.09	51.90	55.25	58.60

Day 2 – EoT

	23:30 - 00:30			00:30 - 01:30			01:30 - 02:30			02:30 - 03:30			03:30 - 04:30		
Speed_Range	**PC**	**HV**	**Total**	**PC**	**HV**	**Total**	**PC**	**HV**	**Total**	**PC**	**HV**	**Total**	**PC**	**HV**	**Total**
<10	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
10-14	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
15-19	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
20-24	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
25-29	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.6%	0.0%	0.4%
30-34	1.3%	0.0%	0.9%	0.9%	0.0%	0.7%	1.1%	0.0%	0.7%	0.0%	0.0%	0.0%	0.6%	0.0%	0.4%
35-39	0.6%	2.7%	1.3%	3.7%	2.2%	3.3%	1.1%	0.0%	0.7%	1.6%	0.0%	1.1%	3.5%	1.0%	2.6%
40-44	4.4%	2.7%	3.9%	2.8%	4.4%	3.3%	5.7%	3.2%	4.7%	2.4%	9.4%	4.7%	5.8%	4.2%	5.2%
45-49	4.4%	6.7%	5.2%	6.5%	6.7%	6.5%	2.3%	6.5%	4.0%	5.6%	4.7%	5.3%	2.9%	6.3%	4.1%
50-54	11.4%	28.0%	16.7%	9.3%	15.6%	11.1%	16.1%	14.5%	15.4%	9.5%	25.0%	14.7%	8.7%	12.5%	10.1%
55-59	7.0%	18.7%	10.7%	10.2%	28.9%	15.7%	10.3%	25.8%	16.8%	16.7%	15.6%	16.3%	10.5%	14.6%	11.9%
60-64	25.9%	21.3%	24.5%	19.4%	22.2%	20.3%	13.8%	16.1%	14.8%	27.0%	25.0%	26.3%	16.9%	32.3%	22.4%
65-69	19.0%	14.7%	17.6%	15.7%	11.1%	14.4%	21.8%	17.7%	20.1%	18.3%	14.1%	16.8%	19.2%	16.7%	18.3%
70-74	13.3%	5.3%	10.7%	13.0%	4.4%	10.5%	14.9%	6.5%	11.4%	8.7%	4.7%	7.4%	19.2%	6.3%	14.6%
75 and above	12.7%	0.0%	8.6%	18.5%	4.4%	14.4%	12.6%	9.7%	11.4%	10.3%	1.6%	7.4%	12.2%	6.3%	10.1%
Total	158	75	233	108	45	153	87	62	149	126	64	190	172	96	268
85th Percentile	73.94	66.89	71.03	77.18	66.89	74.65	73.36	70.58	73.36	72.07	66.89	69.48	74.65	68.19	73.36
Average	63.26	57.86	61.52	64.03	58.79	62.49	63.25	62.14	62.79	62.81	58.22	61.26	63.65	61.02	62.71
Std Dev	10.98	8.02	10.41	13.07	8.43	12.11	11.45	11.33	11.37	10.35	8.56	10.00	12.13	9.18	11.22
Min	30.68	38.44	30.68	30.68	39.73	30.68	34.56	44.91	34.56	35.85	41.03	35.85	29.39	39.73	29.39
Max	96.64	74.65	96.64	101.81	79.83	101.81	88.88	104.40	104.40	96.64	79.83	96.64	99.23	87.59	99.23
Range	65.96	36.21	65.96	71.13	40.09	71.13	54.32	59.49	69.84	60.79	38.80	60.79	69.84	47.85	69.84

Day 2 – 1stWA

	23:30 - 00:30			00:30 - 01:30			01:30 - 02:30			02:30 - 03:30			03:30 - 04:30		
Speed_Range	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total
<10	0.8%	0.0%	0.5%	0.0%	0.0%	0.0%	1.6%	0.0%	0.7%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
10-14	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
15-19	1.6%	0.0%	0.9%	1.4%	0.0%	0.8%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
20-24	0.8%	0.0%	0.5%	2.9%	0.0%	1.6%	4.8%	0.0%	2.1%	0.0%	1.0%	0.6%	0.9%	0.0%	0.4%
25-29	2.4%	2.2%	2.3%	1.4%	1.7%	1.6%	0.0%	0.0%	0.0%	2.5%	0.0%	1.1%	0.9%	0.0%	0.4%
30-34	7.9%	1.1%	5.0%	7.1%	1.7%	4.7%	4.8%	0.0%	2.1%	4.9%	1.0%	2.8%	6.1%	2.4%	4.1%
35-39	5.5%	13.2%	8.7%	5.7%	5.1%	5.4%	11.3%	6.4%	8.6%	13.6%	6.1%	9.5%	6.1%	5.5%	5.8%
40-44	15.0%	9.9%	12.8%	10.0%	11.9%	10.9%	17.7%	5.1%	10.7%	21.0%	11.2%	15.6%	11.3%	16.5%	14.0%
45-49	28.3%	18.7%	24.3%	20.0%	23.7%	21.7%	11.3%	32.1%	22.9%	13.6%	28.6%	21.8%	20.0%	17.3%	18.6%
50-54	12.6%	14.3%	13.3%	11.4%	13.6%	12.4%	8.1%	20.5%	15.0%	14.8%	17.3%	16.2%	20.9%	15.7%	18.2%
55-59	11.8%	18.7%	14.7%	5.7%	20.3%	12.4%	19.4%	9.0%	13.6%	12.3%	13.3%	12.8%	9.6%	11.8%	10.7%
60-64	4.7%	7.7%	6.0%	15.7%	13.6%	14.7%	4.8%	11.5%	8.6%	9.9%	10.2%	10.1%	12.2%	11.0%	11.6%
65-69	3.9%	5.5%	4.6%	11.4%	0.0%	6.2%	4.8%	5.1%	5.0%	6.2%	3.1%	4.5%	6.1%	5.5%	5.8%
70-74	0.8%	1.1%	0.9%	4.3%	3.4%	3.9%	4.8%	3.8%	4.3%	0.0%	1.0%	0.6%	2.6%	3.9%	3.3%
75 and above	3.9%	7.7%	5.5%	2.9%	5.1%	3.9%	6.5%	6.4%	6.4%	1.2%	7.1%	4.5%	3.5%	10.2%	7.0%
Total	127	91	218	70	59	129	62	78	140	81	98	179	115	127	242
85th Percentile	59.08	62.84	61.90	66.59	60.30	63.77	66.96	64.62	65.65	60.96	62.84	61.24	63.77	69.40	65.65
Average	48.24	52.99	50.23	51.92	53.27	52.53	50.22	54.65	52.69	49.00	52.68	51.02	51.95	55.15	53.63
Std Dev	12.49	13.26	13.00	14.23	11.91	13.19	15.14	11.80	13.51	10.79	11.11	11.09	11.29	13.70	12.69
Min	7.50	26.26	7.50	19.69	29.07	19.69	3.75	37.51	3.75	26.26	22.51	22.51	24.38	30.01	24.38
Max	85.35	93.79	93.79	96.60	91.91	96.60	88.16	95.66	95.66	79.72	86.28	86.28	81.59	95.66	95.66
Range	77.85	67.53	86.29	76.91	62.84	76.91	84.41	58.15	91.91	53.46	63.78	63.78	57.21	65.65	71.28

Day 2 – 2ndWA

	23:30 - 00:30			00:30 - 01:30			01:30 - 02:30			02:30 - 03:30			03:30 - 04:30		
Speed_Range	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total
<10	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
10-14	0.0%	0.0%	0.0%	1.0%	0.0%	0.7%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
15-19	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
20-24	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.2%	0.0%	0.7%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
25-29	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.2%	0.0%	0.7%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
30-34	0.6%	0.0%	0.4%	0.0%	0.0%	0.0%	1.2%	1.4%	1.3%	2.7%	2.7%	2.7%	3.0%	0.0%	1.9%
35-39	1.9%	3.9%	2.6%	2.9%	0.0%	2.0%	0.0%	1.4%	0.7%	6.2%	4.1%	5.3%	1.8%	3.0%	2.2%
40-44	5.1%	7.8%	6.0%	5.8%	2.2%	4.7%	3.6%	2.9%	3.3%	1.8%	9.5%	4.8%	6.5%	5.0%	5.9%
45-49	9.6%	19.5%	12.9%	12.5%	21.7%	15.3%	12.0%	11.4%	11.8%	13.3%	14.9%	13.9%	11.9%	19.8%	14.9%
50-54	14.7%	26.0%	18.5%	14.4%	28.3%	18.7%	12.0%	18.6%	15.0%	17.7%	17.6%	17.6%	22.0%	23.8%	22.7%
55-59	25.0%	26.0%	25.3%	23.1%	28.3%	24.7%	19.3%	38.6%	28.1%	26.5%	35.1%	29.9%	25.6%	26.7%	26.0%
60-64	18.6%	5.2%	14.2%	18.3%	8.7%	15.3%	15.7%	17.1%	16.3%	14.2%	13.5%	13.9%	10.7%	13.9%	11.9%
65-69	10.3%	9.1%	9.9%	9.6%	2.2%	7.3%	18.1%	4.3%	11.8%	8.8%	1.4%	5.9%	7.7%	2.0%	5.6%
70-74	5.8%	1.3%	4.3%	8.7%	6.5%	8.0%	7.2%	1.4%	4.6%	4.4%	1.4%	3.2%	3.6%	0.0%	2.2%
75 and above	8.3%	1.3%	6.0%	3.8%	2.2%	3.3%	8.4%	2.9%	5.9%	4.4%	0.0%	2.7%	7.1%	5.9%	6.7%
Total	156	77	233	104	46	150	83	70	153	113	74	187	168	101	269
85th Percentile	69.42	61.87	67.06	68.89	63.52	67.83	70.24	64.70	68.24	66.12	61.17	63.52	67.06	62.34	64.70
Average	59.57	54.25	57.81	58.23	56.22	57.61	60.44	56.77	58.76	56.72	53.31	55.37	56.88	55.45	56.34
Std Dev	10.99	8.13	10.43	11.03	9.69	10.64	12.98	8.79	11.37	11.00	8.02	10.05	11.38	9.13	10.60
Min	31.69	38.77	31.69	12.83	41.12	12.83	22.26	31.69	22.26	31.69	31.69	31.69	30.51	37.59	30.51
Max	101.25	84.74	101.25	88.28	101.25	101.25	103.61	93.00	103.61	101.25	72.95	101.25	107.14	90.64	107.14
Range	69.56	45.98	69.56	75.45	60.12	88.42	81.34	61.30	81.34	69.56	41.26	69.56	76.63	53.05	76.63

Day 2 – 3rdWA

	23:30 - 00:30			00:30 - 01:30			01:30 - 02:30			02:30 - 03:30			03:30 - 04:30		
Speed_Range	**PC**	**HV**	**Total**	**PC**	**HV**	**Total**	**PC**	**HV**	**Total**	**PC**	**HV**	**Total**	**PC**	**HV**	**Total**
<10	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
10-14	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
15-19	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
20-24	0.6%	0.0%	0.4%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
25-29	0.6%	0.0%	0.4%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
30-34	0.0%	0.0%	0.0%	1.9%	2.2%	2.0%	0.0%	1.5%	0.7%	0.0%	1.6%	0.5%	0.0%	0.0%	0.0%
35-39	1.3%	0.0%	0.9%	2.9%	0.0%	2.0%	7.3%	3.1%	5.4%	3.3%	3.1%	3.2%	1.8%	2.0%	1.9%
40-44	0.6%	6.3%	2.6%	5.8%	2.2%	4.7%	2.4%	1.5%	2.0%	5.7%	7.8%	6.5%	3.6%	5.1%	4.2%
45-49	3.9%	8.9%	5.6%	6.8%	13.3%	8.8%	11.0%	6.2%	8.8%	6.6%	4.7%	5.9%	6.6%	10.2%	8.0%
50-54	23.4%	31.6%	26.2%	13.6%	22.2%	16.2%	20.7%	20.0%	20.4%	15.6%	23.4%	18.3%	16.3%	30.6%	21.6%
55-59	19.5%	16.5%	18.5%	22.3%	20.0%	21.6%	18.3%	20.0%	19.0%	18.0%	29.7%	22.0%	17.5%	22.4%	19.3%
60-64	14.3%	21.5%	16.7%	18.4%	22.2%	19.6%	12.2%	26.2%	18.4%	23.0%	17.2%	21.0%	25.3%	18.4%	22.7%
65-69	15.6%	11.4%	14.2%	10.7%	8.9%	10.1%	11.0%	9.2%	10.2%	13.9%	9.4%	12.4%	10.8%	5.1%	8.7%
70-74	8.4%	0.0%	5.6%	3.9%	4.4%	4.1%	7.3%	3.1%	5.4%	7.4%	0.0%	4.8%	9.0%	1.0%	6.1%
75 and above	11.7%	3.8%	9.0%	13.6%	4.4%	10.8%	9.8%	9.2%	9.5%	6.6%	3.1%	5.4%	9.0%	5.1%	7.6%
Total	154	79	233	103	45	148	82	65	147	122	64	186	166	98	264
85th Percentile	73.76	65.33	69.32	71.84	66.96	69.32	72.28	67.85	69.62	69.32	63.41	67.85	71.17	64.08	68.66
Average	62.00	57.35	60.43	60.53	57.67	59.66	59.63	59.16	59.42	59.77	56.44	58.62	61.44	56.43	59.58
Std Dev	12.04	9.57	11.46	12.74	9.14	11.81	13.81	9.98	12.23	10.21	9.21	9.98	11.30	8.61	10.64
Min	22.04	41.25	22.04	30.91	30.91	30.91	36.82	32.39	32.39	38.30	33.86	33.86	36.82	35.34	35.34
Max	104.78	106.26	106.26	94.44	76.71	94.44	101.83	88.53	101.83	85.58	90.01	90.01	103.31	81.14	103.31
Range	82.74	65.01	84.22	63.53	45.80	63.53	65.01	56.15	69.44	47.28	56.15	56.15	66.49	45.80	67.97

Day 2 – 4thWA

	23:30 - 00:30			00:30 - 01:30			01:30 - 02:30			02:30 - 03:30			03:30 - 04:30		
Speed_Range	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total
<10	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
10-14	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
15-19	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
20-24	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
25-29	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
30-34	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.0%	0.0%	0.6%	0.0%	0.0%	0.0%
35-39	1.4%	0.0%	1.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	2.0%	1.4%	1.7%	0.0%	0.0%	0.0%
40-44	4.3%	3.1%	3.9%	2.6%	2.1%	2.4%	1.3%	0.0%	0.7%	2.0%	5.5%	3.4%	2.0%	3.1%	2.4%
45-49	4.3%	13.8%	7.4%	6.4%	4.2%	5.6%	1.3%	6.0%	3.5%	6.9%	6.8%	6.9%	4.1%	3.1%	3.7%
50-54	18.1%	21.5%	19.2%	6.4%	25.0%	13.5%	14.7%	10.4%	12.7%	12.7%	16.4%	14.3%	11.5%	9.3%	10.6%
55-59	21.7%	40.0%	27.6%	24.4%	33.3%	27.8%	24.0%	46.3%	34.5%	26.5%	23.3%	25.1%	15.5%	40.2%	25.3%
60-64	10.9%	9.2%	10.3%	12.8%	12.5%	12.7%	12.0%	9.0%	10.6%	12.7%	27.4%	18.9%	24.3%	19.6%	22.4%
65-69	19.6%	9.2%	16.3%	20.5%	12.5%	17.5%	21.3%	14.9%	18.3%	22.5%	11.0%	17.7%	19.6%	16.5%	18.4%
70-74	10.1%	1.5%	7.4%	10.3%	4.2%	7.9%	18.7%	9.0%	14.1%	7.8%	1.4%	5.1%	10.1%	5.2%	8.2%
75 and above	9.4%	1.5%	6.9%	16.7%	6.3%	12.7%	6.7%	4.5%	5.6%	5.9%	6.8%	6.3%	12.8%	3.1%	9.0%
Total	138	65	203	78	48	126	75	67	142	102	73	175	148	97	245
85th Percentile	72.88	61.65	68.96	75.49	67.65	71.90	71.57	68.96	70.26	68.96	66.35	68.96	74.12	67.13	70.26
Average	61.31	57.11	59.96	65.06	59.85	63.08	63.55	61.38	62.52	61.35	59.46	60.56	63.86	60.74	62.62
Std Dev	9.76	8.51	9.56	11.98	9.23	11.27	8.22	10.01	9.14	10.57	9.85	10.29	9.81	8.88	9.56
Min	36.33	42.85	36.33	40.24	42.85	40.24	44.16	45.46	44.16	33.72	37.63	33.72	41.55	42.85	41.55
Max	84.62	104.20	104.20	100.29	89.84	100.29	80.71	105.51	105.51	106.81	97.68	106.81	92.45	108.12	108.12
Range	48.30	61.35	67.88	60.04	46.99	60.04	36.55	60.04	61.35	73.10	60.04	73.10	50.91	65.27	66.57

APPENDIX D - SPEED DATA SUMMARY – CASE STUDY 3B

Day 1 – RWA

	21:30 - 22:30			22:30 - 23:30			23:30 - 00:30			00:30 - 01:30			01:30 - 02:30			02:30 - 03:30			03:30 - 04:30		
Speed_Range	**PC**	**HV**	**Total**	**PC**	**HV**	**Total**	**PC**	**HV**	**Total**	**PC**	**HV**	**Total**	**PC**	**HV**	**Total**	**PC**	**HV**	**Total**	**PC**	**HV**	**Total**
<10	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	2.1%	0.0%	0.8%	0.0%	0.0%	0.0%
10-14	0.0%	0.9%	0.4%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.3%	0.8%	0.0%	0.0%	0.0%
15-19	0.0%	0.9%	0.4%	0.0%	1.1%	0.5%	0.0%	4.2%	2.2%	0.0%	3.9%	2.5%	0.0%	6.1%	3.9%	0.0%	2.6%	1.6%	0.0%	0.0%	0.0%
20-24	0.0%	5.3%	2.4%	0.0%	6.7%	3.2%	0.0%	12.7%	6.7%	0.0%	9.1%	5.9%	0.0%	16.7%	10.8%	0.0%	14.1%	8.7%	0.0%	2.7%	1.7%
25-29	0.0%	9.7%	4.3%	1.0%	13.5%	7.0%	0.0%	7.0%	3.7%	0.0%	13.0%	8.4%	0.0%	18.2%	11.8%	2.1%	10.3%	7.1%	0.0%	6.7%	4.3%
30-34	0.0%	9.7%	4.3%	0.0%	15.7%	7.5%	0.0%	19.7%	10.4%	0.0%	9.1%	5.9%	0.0%	7.6%	4.9%	2.1%	5.1%	4.0%	0.0%	21.3%	13.9%
35-39	0.7%	16.8%	7.9%	1.0%	11.2%	5.9%	0.0%	8.5%	4.5%	4.8%	11.7%	9.2%	0.0%	12.1%	7.8%	2.1%	7.7%	5.6%	0.0%	12.0%	7.8%
40-44	0.7%	9.7%	4.7%	2.1%	7.9%	4.8%	4.8%	9.9%	7.5%	9.5%	16.9%	14.3%	5.6%	13.6%	10.8%	0.0%	16.7%	10.3%	2.5%	14.7%	10.4%
45-49	6.4%	12.4%	9.1%	8.2%	4.5%	6.5%	9.5%	14.1%	11.9%	9.5%	5.2%	6.7%	16.7%	10.6%	12.7%	14.6%	15.4%	15.1%	12.5%	9.3%	10.4%
50-54	14.9%	8.0%	11.8%	8.2%	13.5%	10.8%	11.1%	7.0%	9.0%	4.8%	10.4%	8.4%	19.4%	9.1%	12.7%	18.8%	16.7%	17.5%	17.5%	6.7%	10.4%
55-59	15.6%	8.8%	12.6%	21.6%	11.2%	16.7%	22.2%	5.6%	13.4%	21.4%	9.1%	13.4%	5.6%	3.0%	3.9%	20.8%	5.1%	11.1%	20.0%	12.0%	14.8%
60-64	17.7%	5.3%	12.2%	21.6%	2.2%	12.4%	25.4%	2.8%	13.4%	19.0%	5.2%	10.1%	30.6%	1.5%	11.8%	12.5%	1.3%	5.6%	25.0%	6.7%	13.0%
65-69	14.9%	4.4%	10.2%	10.3%	4.5%	7.5%	11.1%	2.8%	6.7%	16.7%	2.6%	7.6%	11.1%	1.5%	4.9%	12.5%	1.3%	5.6%	12.5%	2.7%	6.1%
70-74	16.3%	3.5%	10.6%	9.3%	3.4%	6.5%	6.3%	0.0%	3.0%	7.1%	2.6%	4.2%	5.6%	0.0%	2.0%	8.3%	0.0%	3.2%	5.0%	1.3%	2.6%
75 and above	12.8%	4.4%	9.1%	16.5%	4.5%	10.8%	9.5%	5.6%	7.5%	7.1%	1.3%	3.4%	5.6%	0.0%	2.0%	4.2%	2.6%	3.2%	5.0%	4.0%	4.3%
Total	141	113	254	97	89	186	63	71	134	42	77	119	36	66	102	48	78	126	40	75	115
85th Percentile	74.15	61.48	72.28	75.09	59.19	71.36	70.60	56.81	67.17	69.65	57.32	65.08	67.60	49.86	62.98	69.44	53.57	62.03	67.25	59.18	62.85
Average	63.41	44.98	55.21	62.84	44.50	54.06	60.66	41.52	50.52	59.43	41.65	47.92	58.83	36.07	44.10	56.65	40.94	46.92	59.40	44.64	49.77
Std Dev	9.99	15.28	15.58	10.78	16.00	16.33	9.94	16.84	16.95	11.72	14.84	16.20	9.67	11.99	15.63	13.21	13.81	15.55	7.88	13.46	13.74
Min	38.71	13.43	13.43	29.62	19.15	19.15	40.38	15.34	15.34	38.71	15.34	15.34	41.22	16.29	16.29	4.93	14.39	4.93	43.28	22.00	22.00
Max	85.59	78.83	85.59	91.93	86.42	91.93	84.75	98.47	98.47	90.05	80.09	90.05	80.70	69.48	80.70	78.83	78.89	78.89	77.89	78.83	78.83
Range	46.88	65.40	72.15	62.30	67.28	72.78	44.37	83.13	83.13	51.35	64.76	74.72	39.48	53.18	64.41	73.90	64.50	73.96	34.61	56.83	56.83

Day 1 – BoT

	21:30 - 22:30			22:30 - 23:30			23:30 - 00:30			00:30 - 01:30			01:30 - 02:30			02:30 - 03:30			03:30 - 04:30		
Speed_Range	**PC**	**HV**	**Total**	**PC**	**HV**	**Total**	**PC**	**HV**	**Total**	**PC**	**HV**	**Total**	**PC**	**HV**	**Total**	**PC**	**HV**	**Total**	**PC**	**HV**	**Total**
<10	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
10-14	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
15-19	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
20-24	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
25-29	1.2%	1.8%	1.4%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
30-34	2.4%	2.7%	2.5%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
35-39	2.4%	4.5%	3.2%	0.0%	0.0%	0.0%	0.0%	1.3%	0.7%	0.0%	1.4%	0.9%	0.0%	1.5%	1.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
40-44	6.0%	15.3%	9.7%	0.0%	8.5%	3.9%	5.6%	14.7%	10.3%	2.1%	4.3%	3.4%	0.0%	4.5%	3.0%	2.0%	5.3%	4.0%	2.4%	0.0%	0.9%
45-49	19.3%	30.6%	23.8%	8.8%	27.7%	17.4%	9.9%	30.7%	20.5%	19.1%	28.6%	24.8%	12.5%	26.9%	22.2%	24.5%	32.9%	29.6%	12.2%	14.7%	13.8%
50-54	19.9%	27.0%	22.7%	27.4%	31.9%	29.5%	23.9%	30.7%	27.4%	29.8%	42.9%	37.6%	9.4%	32.8%	25.3%	16.3%	35.5%	28.0%	24.4%	34.7%	31.0%
55-59	18.1%	11.7%	15.5%	28.3%	21.3%	25.1%	28.2%	16.0%	21.9%	23.4%	12.9%	17.1%	28.1%	28.4%	28.3%	26.5%	14.5%	19.2%	31.7%	30.7%	31.0%
60-64	22.9%	3.6%	15.2%	15.0%	3.2%	9.7%	14.1%	5.3%	9.6%	14.9%	7.1%	10.3%	34.4%	6.0%	15.2%	14.3%	5.3%	8.8%	17.1%	13.3%	14.7%
65-69	3.0%	2.7%	2.9%	10.6%	3.2%	7.2%	8.5%	1.3%	4.8%	2.1%	0.0%	0.9%	6.3%	0.0%	2.0%	4.1%	0.0%	1.6%	2.4%	5.3%	4.3%
70-74	1.2%	0.0%	0.7%	4.4%	0.0%	2.4%	5.6%	0.0%	2.7%	2.1%	2.9%	2.6%	3.1%	0.0%	1.0%	10.2%	2.6%	5.6%	7.3%	0.0%	2.6%
75 and above	3.6%	0.0%	2.2%	5.3%	4.3%	4.8%	4.2%	0.0%	2.1%	6.4%	0.0%	2.6%	6.3%	0.0%	2.0%	2.0%	3.9%	3.2%	2.4%	1.3%	1.7%
Total	166	111	277	113	94	207	71	75	146	47	70	117	32	67	99	49	76	125	41	75	116
85th Percentile	63.01	55.20	61.66	65.97	58.43	64.89	65.97	56.17	63.01	62.74	57.35	60.58	64.57	58.43	61.66	67.26	56.28	62.09	63.81	61.66	62.74
Average	54.71	49.15	52.48	58.54	53.95	56.46	57.82	51.01	54.32	57.03	52.66	54.42	60.11	52.55	54.99	57.46	53.60	55.11	58.04	55.83	56.61
Std Dev	10.08	7.37	9.48	7.83	10.02	9.16	8.57	5.60	7.95	10.77	5.89	8.44	8.42	4.99	7.20	10.12	8.75	9.46	10.08	5.68	7.57
Min	28.28	28.28	28.28	45.51	40.12	40.12	41.20	39.05	39.05	41.20	39.05	39.05	45.51	39.05	39.05	43.35	41.20	41.20	44.43	46.58	44.43
Max	91.81	69.20	91.81	81.04	104.73	104.73	83.20	68.12	83.20	103.65	73.50	103.65	87.50	62.74	87.50	101.50	96.12	101.50	106.89	77.81	106.89
Range	63.53	40.92	63.53	35.53	64.61	64.61	42.00	29.07	44.15	62.45	34.46	64.61	42.00	23.69	48.46	58.15	54.92	60.30	62.45	31.23	62.45

Day 1 – EoT

	21:30 - 22:30			22:30 - 23:30			23:30 - 00:30			00:30 - 01:30			01:30 - 02:30			02:30 - 03:30			03:30 - 04:30		
Speed_Range	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total
<10	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
10-14	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
15-19	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
20-24	2.5%	2.1%	2.4%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	2.7%	0.0%	1.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
25-29	2.0%	3.2%	2.4%	0.0%	0.0%	0.0%	1.2%	0.0%	0.7%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.4%	0.8%	3.8%	0.0%	1.5%
30-34	3.9%	4.3%	4.0%	0.0%	1.2%	0.5%	2.5%	0.0%	1.3%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	3.8%	0.0%	1.5%
35-39	9.4%	20.2%	12.8%	0.8%	5.9%	2.8%	2.5%	4.2%	3.3%	6.3%	4.2%	5.2%	2.7%	0.0%	1.0%	1.7%	1.4%	1.5%	1.9%	0.0%	0.7%
40-44	14.8%	11.7%	13.8%	13.1%	9.4%	11.6%	8.6%	11.3%	9.9%	6.3%	2.8%	4.5%	2.7%	4.5%	3.8%	8.6%	5.4%	6.8%	1.9%	0.0%	0.7%
45-49	20.2%	22.3%	20.9%	23.8%	24.7%	24.2%	18.5%	25.4%	21.7%	9.5%	16.9%	13.4%	10.8%	14.9%	13.5%	13.8%	20.3%	17.4%	5.7%	14.8%	11.2%
50-54	21.7%	16.0%	19.9%	23.8%	31.8%	27.0%	19.8%	25.4%	22.4%	25.4%	35.2%	30.6%	16.2%	32.8%	26.9%	20.7%	23.0%	22.0%	11.3%	29.6%	22.4%
55-59	14.3%	9.6%	12.8%	13.8%	11.8%	13.0%	13.6%	18.3%	15.8%	20.6%	19.7%	20.1%	18.9%	22.4%	21.2%	19.0%	25.7%	22.7%	22.6%	25.9%	24.6%
60-64	3.9%	2.1%	3.4%	6.2%	10.6%	7.9%	13.6%	8.5%	11.2%	4.8%	4.2%	4.5%	16.2%	9.0%	11.5%	8.6%	8.1%	8.3%	15.1%	13.6%	14.2%
65-69	3.4%	2.1%	3.0%	11.5%	1.2%	7.4%	6.2%	1.4%	3.9%	9.5%	7.0%	8.2%	2.7%	7.5%	5.8%	15.5%	8.1%	11.4%	7.5%	3.7%	5.2%
70-74	2.0%	4.3%	2.7%	4.6%	2.4%	3.7%	9.9%	4.2%	7.2%	7.9%	2.8%	5.2%	21.6%	3.0%	9.6%	8.6%	2.7%	5.3%	13.2%	4.9%	8.2%
75 and above	2.0%	2.1%	2.0%	2.3%	1.2%	1.9%	3.7%	1.4%	2.6%	9.5%	7.0%	8.2%	5.4%	6.0%	5.8%	3.4%	4.1%	3.8%	13.2%	7.4%	9.7%
Total	203	94	297	130	85	215	81	71	152	63	71	134	37	67	104	58	74	132	53	81	134
85th Percentile	58.52	58.52	58.52	65.04	60.34	63.74	68.96	59.82	63.74	71.18	67.65	67.72	72.35	65.04	69.09	68.96	63.80	66.35	73.14	65.04	70.26
Average	49.34	48.03	48.93	54.76	51.88	53.62	55.44	52.30	53.97	57.46	55.76	56.56	59.33	56.82	57.71	57.35	55.45	56.28	61.25	58.36	59.50
Std Dev	11.84	13.53	12.39	9.99	8.21	9.41	11.68	8.13	10.27	11.95	10.39	11.14	11.98	9.24	10.31	10.03	9.22	9.60	16.14	9.26	12.47
Min	20.66	21.97	20.66	35.02	33.72	33.72	25.88	38.94	25.88	35.02	36.33	35.02	23.27	41.55	23.27	37.63	29.80	29.80	28.50	45.46	28.50
Max	108.12	109.42	109.42	97.68	83.32	97.68	84.62	76.79	84.62	87.23	96.37	96.37	85.93	89.84	89.84	80.71	84.62	84.62	104.20	89.84	104.20
Range	87.46	87.46	88.76	62.65	49.60	63.96	58.74	37.85	58.74	52.21	60.04	61.35	62.65	48.30	66.57	43.07	54.82	54.82	75.71	44.38	75.71

Day 1 – 1stWA

	21:30 - 22:30			22:30 - 23:30			23:30 - 00:30			00:30 - 01:30			01:30 - 02:30			02:30 - 03:30			03:30 - 04:30		
Speed_Range	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total
<10	2.4%	2.3%	2.4%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
10-14	4.3%	5.8%	4.7%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
15-19	6.7%	10.5%	7.8%	0.0%	0.0%	0.0%	1.2%	0.0%	0.7%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.4%	0.9%
20-24	5.3%	10.5%	6.8%	0.7%	1.3%	0.9%	2.5%	1.6%	2.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	3.3%	0.0%	1.5%	0.0%	0.0%	0.0%
25-29	3.8%	10.5%	5.8%	3.4%	3.8%	3.6%	3.7%	7.8%	5.5%	1.6%	0.0%	0.8%	0.0%	0.0%	0.0%	1.6%	0.0%	0.7%	2.2%	0.0%	0.9%
30-34	12.9%	14.0%	13.2%	4.1%	10.3%	6.3%	6.2%	6.3%	6.2%	4.9%	4.4%	4.7%	6.3%	1.6%	3.1%	9.8%	3.9%	6.6%	2.2%	1.4%	1.7%
35-39	15.8%	12.8%	14.9%	13.8%	14.1%	13.9%	9.9%	18.8%	13.8%	11.5%	17.6%	14.7%	6.3%	7.8%	7.3%	13.1%	9.2%	10.9%	4.4%	2.8%	3.4%
40-44	16.3%	16.3%	16.3%	20.7%	29.5%	23.8%	17.3%	9.4%	13.8%	11.5%	19.1%	15.5%	15.6%	14.1%	14.6%	8.2%	9.2%	8.8%	6.7%	4.2%	5.1%
45-49	13.9%	8.1%	12.2%	15.2%	17.9%	16.1%	17.3%	21.9%	19.3%	11.5%	16.2%	14.0%	21.9%	28.1%	26.0%	6.6%	18.4%	13.1%	8.9%	13.9%	12.0%
50-54	12.4%	7.0%	10.8%	27.6%	14.1%	22.9%	21.0%	25.0%	22.8%	24.6%	19.1%	21.7%	15.6%	23.4%	20.8%	16.4%	23.7%	20.4%	11.1%	23.6%	18.8%
55-59	2.9%	1.2%	2.4%	5.5%	2.6%	4.5%	8.6%	3.1%	6.2%	13.1%	7.4%	10.1%	15.6%	10.9%	12.5%	3.3%	15.8%	10.2%	17.8%	25.0%	22.2%
60-64	1.0%	1.2%	1.0%	4.1%	1.3%	3.1%	4.9%	3.1%	4.1%	11.5%	7.4%	9.3%	3.1%	10.9%	8.3%	18.0%	9.2%	13.1%	20.0%	15.3%	17.1%
65-69	1.0%	0.0%	0.7%	0.7%	3.8%	1.8%	2.5%	3.1%	2.8%	4.9%	5.9%	5.4%	6.3%	3.1%	4.2%	6.6%	3.9%	5.1%	8.9%	2.8%	5.1%
70-74	0.5%	0.0%	0.3%	0.7%	0.0%	0.4%	1.2%	0.0%	0.7%	0.0%	1.5%	0.8%	3.1%	0.0%	1.0%	6.6%	2.6%	4.4%	8.9%	2.8%	5.1%
75 and above	1.0%	0.0%	0.7%	3.4%	1.3%	2.7%	3.7%	0.0%	2.1%	4.9%	1.5%	3.1%	6.3%	0.0%	2.1%	6.6%	3.9%	5.1%	8.9%	6.9%	7.7%
Total	209	86	295	145	78	223	81	64	145	61	68	129	32	64	96	61	76	137	45	72	117
85th Percentile	51.59	47.16	50.12	54.55	51.59	54.55	57.50	53.88	56.03	61.94	60.38	61.94	65.41	58.98	60.09	66.37	63.04	64.89	71.39	63.93	67.85
Average	38.38	33.37	36.92	47.62	44.51	46.53	47.47	45.15	46.45	51.84	48.94	50.31	52.84	50.28	51.13	52.15	52.41	52.29	58.36	55.94	56.87
Std Dev	14.16	12.49	13.86	11.63	11.43	11.63	12.22	9.80	11.24	12.66	10.24	11.49	14.06	7.51	10.17	15.16	10.72	12.84	13.13	11.72	12.28
Min	5.79	7.27	5.79	20.57	22.04	20.57	16.13	25.00	16.13	26.48	32.39	26.48	30.91	32.39	30.91	20.57	30.91	20.57	26.48	19.09	19.09
Max	100.35	60.46	100.35	107.74	104.78	107.74	81.14	67.85	81.14	95.92	81.14	95.92	103.31	67.85	103.31	82.62	87.05	87.05	92.96	92.96	92.96
Range	94.56	53.19	94.56	87.17	82.74	87.17	65.01	42.85	65.01	69.44	48.76	69.44	72.40	35.46	72.40	62.06	56.15	66.49	66.49	73.88	73.88

Day 1 – 2ndWA

	21:30 - 22:30			22:30 - 23:30			23:30 - 00:30			00:30 - 01:30			01:30 - 02:30			02:30 - 03:30			03:30 - 04:30		
Speed_Range	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total
<10	0.0%	0.0%	0.0%	1.3%	0.0%	0.9%	1.1%	1.5%	1.3%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
10-14	0.0%	0.0%	0.0%	0.7%	0.0%	0.4%	4.3%	0.0%	2.5%	1.3%	0.0%	0.7%	0.0%	0.0%	0.0%	0.0%	1.4%	0.6%	0.0%	0.0%	0.0%
15-19	0.5%	2.4%	1.0%	3.9%	2.8%	3.6%	2.2%	4.5%	3.1%	0.0%	1.6%	0.7%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.2%	0.0%	0.6%
20-24	2.3%	0.0%	1.6%	4.6%	2.8%	4.0%	5.4%	12.1%	8.2%	2.7%	1.6%	2.2%	0.0%	0.0%	0.0%	5.3%	1.4%	3.6%	0.0%	0.0%	0.0%
25-29	3.7%	3.5%	3.6%	8.5%	12.5%	9.8%	12.9%	7.6%	10.7%	4.0%	1.6%	2.9%	2.4%	5.5%	4.2%	1.1%	5.6%	3.0%	0.0%	1.2%	0.6%
30-34	9.6%	12.9%	10.5%	20.9%	9.7%	17.3%	16.1%	9.1%	13.2%	10.7%	1.6%	6.6%	9.8%	5.5%	7.3%	10.6%	7.0%	9.1%	6.1%	6.1%	6.1%
35-39	14.2%	18.8%	15.5%	17.0%	20.8%	18.2%	11.8%	12.1%	11.9%	8.0%	26.2%	16.2%	9.8%	12.7%	11.5%	12.8%	12.7%	12.7%	13.4%	13.4%	13.4%
40-44	16.9%	21.2%	18.1%	10.5%	13.9%	11.6%	15.1%	13.6%	14.5%	20.0%	23.0%	21.3%	24.4%	18.2%	20.8%	9.6%	14.1%	11.5%	13.4%	7.3%	10.4%
45-49	12.8%	16.5%	13.8%	9.8%	11.1%	10.2%	10.8%	12.1%	11.3%	12.0%	13.1%	12.5%	19.5%	20.0%	19.8%	14.9%	22.5%	18.2%	7.3%	11.0%	9.1%
50-54	18.3%	12.9%	16.8%	13.1%	15.3%	13.8%	12.9%	10.6%	11.9%	17.3%	19.7%	18.4%	12.2%	21.8%	17.7%	16.0%	18.3%	17.0%	24.4%	22.0%	23.2%
55-59	12.3%	4.7%	10.2%	4.6%	8.3%	5.8%	5.4%	4.5%	5.0%	13.3%	6.6%	10.3%	14.6%	14.5%	14.6%	13.8%	7.0%	10.9%	9.8%	23.2%	16.5%
60-64	5.0%	2.4%	4.3%	3.9%	0.0%	2.7%	0.0%	3.0%	1.3%	5.3%	1.6%	3.7%	2.4%	1.8%	2.1%	7.4%	7.0%	7.3%	8.5%	8.5%	8.5%
65-69	2.7%	1.2%	2.3%	1.3%	1.4%	1.3%	2.2%	3.0%	2.5%	5.3%	3.3%	4.4%	2.4%	0.0%	1.0%	6.4%	2.8%	4.8%	3.7%	4.9%	4.3%
70-74	0.5%	1.2%	0.7%	0.0%	0.0%	0.0%	0.0%	1.5%	0.6%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	6.1%	1.2%	3.7%
75 and above	1.4%	2.4%	1.6%	0.0%	1.4%	0.4%	0.0%	4.5%	1.9%	0.0%	0.0%	0.0%	2.4%	0.0%	1.0%	2.1%	0.0%	1.2%	6.1%	1.2%	3.7%
Total	219	85	304	153	72	225	93	66	159	75	61	136	41	55	96	94	71	165	82	82	164
85th Percentile	57.84	51.89	56.55	52.67	52.67	52.67	51.37	55.58	52.67	56.55	52.67	55.25	57.84	55.12	56.55	60.43	55.90	57.84	66.51	60.23	61.72
Average	46.41	44.39	45.84	39.31	41.40	39.98	38.26	42.34	39.95	46.29	44.76	45.60	47.53	46.51	46.94	47.93	45.69	46.97	51.94	51.12	51.53
Std Dev	11.19	11.85	11.40	12.01	11.76	11.94	12.55	17.90	15.09	11.11	9.03	10.22	11.10	8.31	9.56	12.56	10.69	11.81	13.25	10.54	11.94
Min	17.75	16.45	16.45	4.82	15.16	4.82	6.11	9.99	6.11	13.87	17.75	13.87	29.39	26.80	26.80	21.63	12.57	12.57	19.04	25.51	19.04
Max	83.71	91.47	91.47	68.19	77.24	77.24	69.48	101.81	101.81	69.48	69.48	69.48	90.17	63.01	90.17	86.29	69.48	86.29	82.41	90.17	90.17
Range	65.96	75.01	75.01	63.37	62.08	72.42	63.37	91.82	95.70	55.61	51.73	55.61	60.79	36.21	63.37	64.67	56.91	73.72	63.37	64.67	71.13

Day 1 – 3rdWA

	21:30 - 22:30			22:30 - 23:30			23:30 - 00:30			00:30 - 01:30			01:30 - 02:30			02:30 - 03:30			03:30 - 04:30		
Speed_Range	**PC**	**HV**	**Total**	**PC**	**HV**	**Total**	**PC**	**HV**	**Total**	**PC**	**HV**	**Total**	**PC**	**HV**	**Total**	**PC**	**HV**	**Total**	**PC**	**HV**	**Total**
<10	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.6%	1.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
10-14	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.6%	1.0%	0.0%	0.0%	0.0%	1.4%	0.0%	0.6%
15-19	2.0%	0.9%	1.6%	0.8%	0.0%	0.5%	1.1%	0.0%	0.6%	3.2%	1.6%	2.4%	2.6%	1.6%	2.0%	5.8%	1.2%	3.6%	2.9%	1.1%	1.9%
20-24	4.0%	1.9%	3.3%	2.3%	3.7%	2.8%	1.1%	1.4%	1.2%	8.1%	1.6%	4.8%	7.7%	6.6%	7.0%	5.8%	6.1%	6.0%	8.6%	3.4%	5.7%
25-29	5.5%	3.7%	4.9%	6.1%	3.7%	5.2%	4.3%	4.3%	4.3%	8.1%	1.6%	4.8%	10.3%	3.3%	6.0%	16.3%	7.3%	11.9%	12.9%	4.5%	8.2%
30-34	15.0%	15.0%	15.0%	20.5%	14.8%	18.3%	14.9%	5.8%	11.0%	11.3%	14.1%	12.7%	25.6%	11.5%	17.0%	17.4%	23.2%	20.2%	15.7%	6.8%	10.8%
35-39	16.0%	19.6%	17.3%	22.7%	13.6%	19.2%	22.3%	18.8%	20.9%	16.1%	14.1%	15.1%	20.5%	14.8%	17.0%	22.1%	17.1%	19.6%	14.3%	13.6%	13.9%
40-44	17.0%	17.8%	17.3%	15.9%	21.0%	17.8%	20.2%	13.0%	17.2%	19.4%	17.2%	18.3%	17.9%	23.0%	21.0%	10.5%	15.9%	13.1%	12.9%	21.6%	17.7%
45-49	17.5%	16.8%	17.3%	12.9%	16.0%	14.1%	13.8%	23.2%	17.8%	24.2%	20.3%	22.2%	12.8%	16.4%	15.0%	12.8%	15.9%	14.3%	20.0%	23.9%	22.2%
50-54	13.5%	14.0%	13.7%	8.3%	11.1%	9.4%	10.6%	15.9%	12.9%	1.6%	4.7%	3.2%	2.6%	6.6%	5.0%	5.8%	6.1%	6.0%	8.6%	12.5%	10.8%
55-59	6.0%	2.8%	4.9%	5.3%	7.4%	6.1%	8.5%	4.3%	6.7%	4.8%	12.5%	8.7%	0.0%	1.6%	1.0%	2.3%	2.4%	2.4%	1.4%	4.5%	3.2%
60-64	0.5%	1.9%	1.0%	1.5%	6.2%	3.3%	2.1%	4.3%	3.1%	3.2%	6.3%	4.8%	0.0%	1.6%	1.0%	0.0%	0.0%	0.0%	0.0%	2.3%	1.3%
65-69	1.0%	0.9%	1.0%	2.3%	2.5%	2.3%	0.0%	4.3%	1.8%	0.0%	3.1%	1.6%	0.0%	1.6%	1.0%	0.0%	1.2%	0.6%	0.0%	2.3%	1.3%
70-74	0.5%	1.9%	1.0%	0.8%	0.0%	0.5%	1.1%	1.4%	1.2%	0.0%	0.0%	0.0%	0.0%	3.3%	2.0%	1.2%	0.0%	0.6%	1.4%	2.3%	1.9%
75 and above	1.5%	2.8%	2.0%	0.8%	0.0%	0.5%	0.0%	2.9%	1.2%	0.0%	3.1%	1.6%	0.0%	4.9%	3.0%	0.0%	3.7%	1.8%	0.0%	1.1%	0.6%
Total	200	107	307	132	81	213	94	69	163	62	64	126	39	61	100	86	82	168	70	88	158
85th Percentile	52.52	52.61	52.52	53.46	56.27	53.46	52.57	55.33	54.39	48.77	58.15	55.33	43.70	52.52	48.91	46.89	48.77	47.83	47.83	53.46	51.58
Average	42.09	43.77	42.68	41.64	43.71	42.43	42.59	47.01	44.46	39.55	45.81	42.73	35.68	42.85	40.05	36.45	40.13	38.25	37.54	44.90	41.64
Std Dev	11.32	12.22	11.65	10.80	10.61	10.75	9.61	12.51	11.11	10.46	11.94	11.62	8.19	15.43	13.51	10.43	11.96	11.32	11.00	11.61	11.89
Min	16.88	17.82	16.88	18.75	23.44	18.75	18.75	21.57	18.75	15.00	15.94	15.00	18.75	9.38	9.38	15.94	15.94	15.94	12.19	15.00	12.19
Max	91.91	91.91	91.91	84.41	69.40	84.41	74.09	93.79	93.79	60.96	77.84	77.84	50.64	90.97	90.97	72.21	82.53	82.53	72.21	92.85	92.85
Range	75.03	74.09	75.03	65.65	45.96	65.65	55.34	72.22	75.03	45.96	61.90	62.84	31.89	81.60	81.60	56.27	66.59	66.59	60.03	77.85	80.66

Day 1 – 4thWA

	21:30 - 22:30			22:30 - 23:30			23:30 - 00:30			00:30 - 01:30			01:30 - 02:30			02:30 - 03:30			03:30 - 04:30		
Speed_Range	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total
<10	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.5%	0.0%	0.6%	0.0%	0.0%	0.0%
10-14	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.5%	0.0%	0.6%	2.6%	1.2%	1.9%
15-19	0.0%	0.0%	0.0%	2.7%	0.0%	1.8%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	4.3%	1.7%	2.5%	2.9%	1.1%	1.9%	2.6%	0.0%	1.3%
20-24	0.0%	0.0%	0.0%	2.7%	0.0%	1.8%	4.2%	0.0%	2.0%	2.2%	0.0%	0.9%	4.3%	0.0%	1.2%	4.4%	0.0%	1.9%	3.9%	1.2%	2.5%
25-29	2.6%	0.0%	1.7%	2.7%	0.0%	1.8%	0.0%	0.0%	0.0%	0.0%	2.9%	1.8%	4.3%	0.0%	1.2%	7.4%	5.3%	6.2%	9.2%	6.2%	7.6%
30-34	2.6%	5.3%	3.4%	2.7%	11.1%	5.5%	0.0%	4.0%	2.0%	6.7%	5.8%	6.1%	26.1%	3.4%	9.9%	16.2%	12.8%	14.2%	9.2%	12.3%	10.8%
35-39	5.1%	5.3%	5.2%	5.4%	5.6%	5.5%	12.5%	4.0%	8.2%	8.9%	8.7%	8.8%	13.0%	3.4%	6.2%	11.8%	11.7%	11.7%	22.4%	8.6%	15.3%
40-44	12.8%	5.3%	10.3%	10.8%	16.7%	12.7%	16.7%	8.0%	12.2%	8.9%	14.5%	12.3%	17.4%	20.7%	19.8%	20.6%	19.1%	19.8%	21.1%	16.0%	18.5%
45-49	15.4%	15.8%	15.5%	16.2%	5.6%	12.7%	20.8%	16.0%	18.4%	24.4%	30.4%	28.1%	4.3%	25.9%	19.8%	11.8%	11.7%	11.7%	7.9%	19.8%	14.0%
50-54	20.5%	0.0%	13.8%	10.8%	0.0%	7.3%	8.3%	16.0%	12.2%	15.6%	10.1%	12.3%	8.7%	20.7%	17.3%	5.9%	14.9%	11.1%	6.6%	7.4%	7.0%
55-59	12.8%	5.3%	10.3%	10.8%	16.7%	12.7%	8.3%	16.0%	12.2%	8.9%	4.3%	6.1%	0.0%	15.5%	11.1%	7.4%	6.4%	6.8%	7.9%	9.9%	8.9%
60-64	5.1%	10.5%	6.9%	2.7%	16.7%	7.3%	12.5%	8.0%	10.2%	8.9%	4.3%	6.1%	4.3%	0.0%	1.2%	5.9%	7.4%	6.8%	2.6%	4.9%	3.8%
65-69	5.1%	0.0%	3.4%	5.4%	11.1%	7.3%	4.2%	0.0%	2.0%	6.7%	5.8%	6.1%	4.3%	1.7%	2.5%	0.0%	3.2%	1.9%	1.3%	2.5%	1.9%
70-74	7.7%	10.5%	8.6%	13.5%	0.0%	9.1%	0.0%	4.0%	2.0%	2.2%	0.0%	0.9%	8.7%	1.7%	3.7%	0.0%	1.1%	0.6%	0.0%	4.9%	2.5%
75 and above	10.3%	42.1%	20.7%	13.5%	16.7%	14.5%	12.5%	24.0%	18.4%	6.7%	13.0%	10.5%	0.0%	5.2%	3.7%	2.9%	5.3%	4.3%	2.6%	4.9%	3.8%
Total	39	19	58	37	18	55	24	25	49	45	69	114	23	58	81	68	94	162	76	81	157
85th Percentile	72.56	95.17	83.05	74.00	70.51	74.00	65.99	75.85	75.03	63.32	68.66	66.81	58.80	57.56	57.56	55.41	60.70	58.59	54.22	60.65	58.18
Average	54.90	68.76	59.44	55.04	57.39	55.81	53.75	58.51	56.18	51.51	51.93	51.77	42.95	50.26	48.19	41.12	47.35	44.74	41.00	47.05	44.12
Std Dev	14.49	22.09	18.36	17.60	17.93	17.58	17.26	14.15	15.77	13.68	15.79	14.93	15.33	11.20	12.85	13.55	14.04	14.14	13.09	14.06	13.89
Min	29.82	33.93	29.82	15.44	31.88	15.44	21.60	33.93	21.60	23.66	28.79	23.66	15.44	18.52	15.44	9.27	15.44	9.27	11.33	13.38	11.33
Max	88.39	101.75	101.75	94.55	99.69	99.69	98.66	87.36	98.66	89.42	101.75	101.75	74.00	87.36	87.36	81.20	100.72	100.72	81.20	80.17	81.20
Range	58.57	67.82	71.93	79.12	67.82	84.26	77.06	53.43	77.06	65.76	72.95	78.09	58.57	68.84	71.93	71.93	85.28	91.45	69.87	66.79	69.87

Day 1 – 5thWA

	21:30 - 22:30			22:30 - 23:30			23:30 - 00:30			00:30 - 01:30			01:30 - 02:30			02:30 - 03:30			03:30 - 04:30		
Speed_Range	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total
<10	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
10-14	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
15-19	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
20-24	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
25-29	1.9%	0.0%	1.4%	0.0%	0.0%	0.0%	2.9%	0.0%	2.2%	1.8%	1.6%	1.7%	0.0%	1.5%	1.0%	0.0%	0.0%	0.0%	1.4%	0.0%	0.6%
30-34	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.8%	0.0%	0.8%	10.0%	0.0%	3.1%	1.2%	1.2%	1.2%	0.0%	1.1%	0.6%
35-39	1.9%	0.0%	1.4%	2.9%	0.0%	2.4%	0.0%	0.0%	0.0%	0.0%	1.6%	0.8%	6.7%	7.4%	7.1%	6.2%	3.6%	4.9%	8.5%	4.5%	6.3%
40-44	5.6%	0.0%	4.3%	0.0%	0.0%	0.0%	0.0%	8.3%	2.2%	16.1%	19.0%	17.6%	13.3%	10.3%	11.2%	17.3%	28.9%	23.2%	25.4%	15.9%	20.1%
45-49	9.3%	12.5%	10.0%	0.0%	14.3%	2.4%	2.9%	16.7%	6.5%	21.4%	19.0%	20.2%	20.0%	20.6%	20.4%	27.2%	24.1%	25.6%	12.7%	28.4%	21.4%
50-54	13.0%	12.5%	12.9%	11.8%	0.0%	9.8%	5.9%	25.0%	10.9%	23.2%	31.7%	27.7%	33.3%	32.4%	32.7%	21.0%	28.9%	25.0%	26.8%	27.3%	27.0%
55-59	13.0%	12.5%	12.9%	20.6%	0.0%	17.1%	20.6%	8.3%	17.4%	21.4%	20.6%	21.0%	10.0%	20.6%	17.3%	16.0%	6.0%	11.0%	14.1%	12.5%	13.2%
60-64	7.4%	12.5%	8.6%	20.6%	14.3%	19.5%	20.6%	0.0%	15.2%	3.6%	3.2%	3.4%	6.7%	2.9%	4.1%	4.9%	4.8%	4.9%	4.2%	2.3%	3.1%
65-69	18.5%	18.8%	18.6%	5.9%	14.3%	7.3%	17.6%	8.3%	15.2%	3.6%	1.6%	2.5%	0.0%	0.0%	0.0%	3.7%	1.2%	2.4%	4.2%	4.5%	4.4%
70-74	14.8%	6.3%	12.9%	14.7%	28.6%	17.1%	5.9%	25.0%	10.9%	5.4%	0.0%	2.5%	0.0%	0.0%	0.0%	1.2%	1.2%	1.2%	1.4%	1.1%	1.3%
75 and above	14.8%	25.0%	17.1%	23.5%	28.6%	24.4%	23.5%	8.3%	19.6%	1.8%	1.6%	1.7%	0.0%	4.4%	3.1%	1.2%	0.0%	0.6%	1.4%	2.3%	1.9%
Total	54	16	70	34	7	41	34	12	46	56	63	119	30	68	98	81	83	164	71	88	159
85th Percentile	74.42	82.96	75.51	84.79	79.98	84.67	83.24	73.62	80.38	59.19	57.19	58.33	55.24	57.19	57.19	58.33	54.90	57.19	58.33	57.19	58.33
Average	62.58	67.71	63.75	67.02	70.44	67.61	68.40	59.67	66.13	52.32	51.28	51.77	48.18	51.77	50.67	50.80	48.73	49.75	50.28	51.19	50.79
Std Dev	14.32	16.75	14.94	13.85	12.84	13.59	18.31	12.72	17.33	9.57	7.91	8.71	7.96	10.65	10.00	8.33	7.05	7.76	9.51	9.17	9.30
Min	26.27	49.17	26.27	38.87	48.03	38.87	27.41	40.01	27.41	29.70	28.56	28.56	31.99	26.27	26.27	33.14	31.99	31.99	28.56	33.14	28.56
Max	107.58	104.14	107.58	98.42	89.25	98.42	107.58	80.09	107.58	78.95	84.67	84.67	64.06	100.71	100.71	78.95	74.37	78.95	84.67	92.69	92.69
Range	81.31	54.97	81.31	59.55	41.23	59.55	80.16	40.08	80.16	49.24	56.11	56.11	32.07	74.44	74.44	45.81	42.37	46.95	56.11	59.55	64.13

Day 2 – RWA

	21:30 - 22:30			22:30 - 23:30			23:30 - 00:30			00:30 - 01:30			01:30 - 02:30			02:30 - 03:30			03:30 - 04:30		
Speed_Range	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total
<10	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
10-14	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
15-19	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
20-24	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
25-29	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
30-34	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
35-39	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
40-44	0.7%	0.0%	0.5%	1.1%	0.0%	0.6%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.1%	0.8%
45-49	1.4%	0.0%	1.0%	2.3%	2.5%	2.4%	1.4%	1.2%	1.3%	0.0%	0.0%	0.0%	7.7%	1.8%	4.3%	6.5%	3.4%	4.5%	0.0%	0.0%	0.0%
50-54	6.5%	4.3%	5.8%	3.4%	2.5%	3.0%	5.6%	6.2%	5.9%	5.8%	10.2%	7.9%	5.1%	1.8%	3.2%	9.7%	10.3%	10.1%	2.9%	4.3%	3.9%
55-59	20.3%	18.6%	19.7%	13.8%	20.0%	16.8%	21.1%	17.3%	19.1%	21.2%	18.4%	19.8%	10.3%	18.2%	14.9%	6.5%	13.8%	11.2%	23.5%	20.4%	21.3%
60-64	17.4%	31.4%	22.1%	27.6%	25.0%	26.3%	23.9%	34.6%	29.6%	23.1%	46.9%	34.7%	17.9%	45.5%	34.0%	35.5%	32.8%	33.7%	23.5%	23.7%	23.6%
65-69	20.3%	18.6%	19.7%	18.4%	23.8%	21.0%	21.1%	16.0%	18.4%	17.3%	10.2%	13.9%	25.6%	16.4%	20.2%	16.1%	17.2%	16.9%	11.8%	24.7%	21.3%
70-74	14.5%	17.1%	15.4%	12.6%	15.0%	13.8%	12.7%	18.5%	15.8%	15.4%	6.1%	10.9%	7.7%	12.7%	10.6%	6.5%	17.2%	13.5%	14.7%	15.1%	15.0%
75 and above	18.8%	10.0%	15.9%	20.7%	11.3%	16.2%	14.1%	6.2%	9.9%	17.3%	8.2%	12.9%	25.6%	3.6%	12.8%	19.4%	5.2%	10.1%	23.5%	10.8%	14.2%
Total	138	70	208	87	80	167	71	81	152	52	49	101	39	55	94	31	58	89	34	93	127
85th Percentile	75.09	72.28	75.09	76.44	74.15	75.09	73.69	71.35	72.54	76.04	69.29	73.22	78.83	71.17	74.15	76.49	71.35	73.03	76.07	73.22	73.31
Average	66.17	65.90	66.08	66.62	65.39	66.03	65.29	64.32	64.77	66.36	63.01	64.73	66.43	63.63	64.79	65.49	63.71	64.33	66.97	65.31	65.75
Std Dev	8.82	8.82	8.80	8.90	7.99	8.48	7.83	6.69	7.24	8.41	7.63	8.18	9.31	6.10	7.68	9.78	6.95	8.04	8.15	7.24	7.49
Min	43.28	51.70	43.28	43.28	46.09	43.28	48.75	48.90	48.75	50.77	51.26	50.77	47.92	48.90	47.92	47.08	48.90	47.08	52.94	40.48	40.48
Max	89.12	98.47	98.47	89.12	96.60	96.60	86.31	80.70	86.31	85.59	92.86	92.86	80.70	78.83	80.70	86.31	79.77	86.31	79.77	85.38	85.38
Range	45.83	46.77	55.19	45.83	50.51	53.32	37.56	31.80	37.56	34.82	41.60	42.09	32.78	29.93	32.78	39.23	30.87	39.23	26.83	44.90	44.90

Day 2 – BoT

	21:30 - 22:30			22:30 - 23:30			23:30 - 00:30			00:30 - 01:30			01:30 - 02:30			02:30 - 03:30			03:30 - 04:30		
Speed_Range	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total
<10	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
10-14	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
15-19	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
20-24	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
25-29	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
30-34	0.0%	1.6%	0.6%	0.0%	0.0%	0.0%	0.0%	1.4%	0.8%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
35-39	2.2%	3.2%	2.6%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	5.1%	2.5%	5.6%	0.0%	2.4%	0.0%	1.8%	1.1%	1.7%	0.0%	0.7%
40-44	4.4%	3.2%	3.9%	0.0%	3.4%	1.6%	2.0%	4.3%	3.4%	7.1%	5.1%	6.2%	2.8%	0.0%	1.2%	5.3%	3.6%	4.3%	3.3%	2.5%	2.8%
45-49	7.7%	9.5%	8.4%	15.4%	10.2%	12.9%	6.1%	22.9%	16.0%	16.7%	15.4%	16.0%	5.6%	20.4%	14.1%	18.4%	18.2%	18.3%	6.7%	22.2%	15.6%
50-54	11.0%	33.3%	20.1%	18.5%	25.4%	21.8%	28.6%	30.0%	29.4%	19.0%	35.9%	27.2%	16.7%	32.7%	25.9%	28.9%	34.5%	32.3%	20.0%	32.1%	27.0%
55-59	26.4%	23.8%	25.3%	21.5%	40.7%	30.6%	14.3%	24.3%	20.2%	11.9%	17.9%	14.8%	33.3%	22.4%	27.1%	21.1%	18.2%	19.4%	30.0%	25.9%	27.7%
60-64	18.7%	11.1%	15.6%	15.4%	15.3%	15.3%	22.4%	10.0%	15.1%	21.4%	15.4%	18.5%	11.1%	12.2%	11.8%	13.2%	16.4%	15.1%	20.0%	14.8%	17.0%
65-69	13.2%	3.2%	9.1%	6.2%	1.7%	4.0%	6.1%	2.9%	4.2%	4.8%	2.6%	3.7%	13.9%	8.2%	10.6%	5.3%	1.8%	3.2%	8.3%	1.2%	4.3%
70-74	7.7%	3.2%	5.8%	13.8%	1.7%	8.1%	12.2%	1.4%	5.9%	7.1%	2.6%	4.9%	2.8%	2.0%	2.4%	2.6%	0.0%	1.1%	1.7%	0.0%	0.7%
75 and above	8.8%	7.9%	8.4%	9.2%	1.7%	5.6%	8.2%	2.9%	5.0%	11.9%	0.0%	6.2%	8.3%	2.0%	4.7%	5.3%	5.5%	5.4%	8.3%	1.2%	4.3%
Total	91	63	154	65	59	124	49	70	119	42	39	81	36	49	85	38	55	93	60	81	141
85th Percentile	71.89	64.57	69.20	72.86	60.91	65.97	70.27	60.58	65.21	73.34	60.58	64.89	68.66	63.81	65.97	61.66	62.63	61.87	66.13	61.66	63.81
Average	61.14	57.28	59.56	60.55	56.46	58.60	61.02	54.75	57.33	60.28	53.71	57.11	59.21	56.01	57.36	56.30	55.30	55.71	58.91	54.61	56.44
Std Dev	12.01	12.09	12.15	10.26	7.99	9.44	10.89	9.27	10.40	14.23	7.11	11.78	11.11	6.94	9.02	8.74	8.49	8.56	9.26	6.27	7.95
Min	36.89	32.59	32.59	45.51	41.20	41.20	41.20	33.66	33.66	40.12	35.82	35.82	36.89	45.51	36.89	43.35	36.89	36.89	35.82	41.20	35.82
Max	109.04	98.27	109.04	97.19	97.19	97.19	99.35	103.65	103.65	103.65	72.43	103.65	87.50	77.81	87.50	84.27	82.12	84.27	86.43	79.97	86.43
Range	72.15	65.68	76.45	51.69	55.99	55.99	58.15	69.99	69.99	63.53	36.61	67.84	50.61	32.30	50.61	40.92	45.23	47.38	50.61	38.76	50.61

Day 2 – EoT

	21:30 - 22:30			22:30 - 23:30			23:30 - 00:30			00:30 - 01:30			01:30 - 02:30			02:30 - 03:30			03:30 - 04:30		
Speed_Range	**PC**	**HV**	**Total**	**PC**	**HV**	**Total**	**PC**	**HV**	**Total**	**PC**	**HV**	**Total**	**PC**	**HV**	**Total**	**PC**	**HV**	**Total**	**PC**	**HV**	**Total**
<10	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
10-14	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	2.0%	1.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
15-19	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
20-24	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
25-29	1.0%	0.0%	0.6%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
30-34	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
35-39	2.1%	0.0%	1.2%	1.6%	1.6%	1.6%	0.0%	0.0%	0.0%	3.0%	0.0%	1.3%	0.0%	3.9%	2.4%	3.3%	3.5%	3.4%	2.1%	0.0%	0.8%
40-44	3.1%	4.3%	3.6%	8.1%	1.6%	4.8%	1.9%	6.2%	4.4%	6.1%	9.5%	8.0%	0.0%	2.0%	1.2%	0.0%	10.5%	6.9%	2.1%	3.7%	3.1%
45-49	18.8%	14.3%	16.9%	11.3%	9.7%	10.5%	16.7%	23.5%	20.7%	15.2%	14.3%	14.7%	9.1%	15.7%	13.1%	26.7%	17.5%	20.7%	10.6%	13.6%	12.5%
50-54	22.9%	32.9%	27.1%	17.7%	30.6%	24.2%	16.7%	29.6%	24.4%	21.2%	38.1%	30.7%	18.2%	25.5%	22.6%	20.0%	24.6%	23.0%	27.7%	37.0%	33.6%
55-59	10.4%	11.4%	10.8%	22.6%	24.2%	23.4%	13.0%	17.3%	15.6%	12.1%	16.7%	14.7%	15.2%	23.5%	20.2%	16.7%	15.8%	16.1%	21.3%	22.2%	21.9%
60-64	12.5%	15.7%	13.9%	11.3%	16.1%	13.7%	14.8%	8.6%	11.1%	15.2%	4.8%	9.3%	18.2%	17.6%	17.9%	6.7%	14.0%	11.5%	10.6%	11.1%	10.9%
65-69	9.4%	11.4%	10.2%	11.3%	9.7%	10.5%	20.4%	2.5%	9.6%	3.0%	7.1%	5.3%	18.2%	2.0%	8.3%	10.0%	1.8%	4.6%	12.8%	2.5%	6.3%
70-74	11.5%	2.9%	7.8%	8.1%	3.2%	5.6%	5.6%	2.5%	3.7%	9.1%	7.1%	8.0%	15.2%	2.0%	7.1%	16.7%	3.5%	8.0%	2.1%	3.7%	3.1%
75 and above	8.3%	7.1%	7.8%	8.1%	3.2%	5.6%	11.1%	9.9%	10.4%	15.2%	2.4%	8.0%	6.1%	5.9%	6.0%	0.0%	8.8%	5.7%	10.6%	6.2%	7.8%
Total	96	70	166	62	62	124	54	81	135	33	42	75	33	51	84	30	57	87	47	81	128
85th Percentile	71.29	68.95	70.57	71.24	65.52	69.19	70.57	64.86	68.67	72.48	65.38	70.48	70.57	63.91	68.24	69.91	62.57	68.67	66.86	62.95	66.72
Average	58.76	58.40	58.61	59.59	57.24	58.41	60.82	56.73	58.37	59.29	55.24	57.02	61.71	56.36	58.46	56.95	55.99	56.32	58.96	56.68	57.51
Std Dev	12.21	10.64	11.54	12.48	7.91	10.47	11.25	12.21	11.96	12.73	9.38	11.08	9.04	12.67	11.62	9.49	11.23	10.62	10.94	9.61	10.14
Min	26.77	41.05	26.77	37.24	39.15	37.24	42.00	40.10	40.10	38.19	42.00	38.19	45.81	11.53	11.53	38.19	38.19	38.19	39.15	44.86	39.15
Max	94.38	93.43	94.38	94.38	77.24	94.38	99.14	98.19	99.14	88.67	89.62	89.62	82.00	93.43	93.43	74.38	93.43	93.43	89.62	94.38	94.38
Range	67.61	52.38	67.61	57.14	38.09	57.14	57.14	58.09	59.04	50.47	47.62	51.42	36.19	81.90	81.90	36.19	55.23	55.23	50.47	49.52	55.23

Day 2 – 1stWA

	21:30 - 22:30			22:30 - 23:30			23:30 - 00:30			00:30 - 01:30			01:30 - 02:30			02:30 - 03:30			03:30 - 04:30		
Speed_Range	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total
<10	0.0%	0.0%	0.0%	0.0%	1.3%	0.6%	0.0%	0.0%	0.0%	0.0%	1.8%	0.9%	2.6%	0.0%	1.0%	2.4%	0.0%	1.0%	0.0%	0.0%	0.0%
10-14	0.0%	1.1%	0.4%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
15-19	0.6%	1.1%	0.7%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	2.6%	0.0%	1.0%	2.4%	0.0%	1.0%	1.6%	0.0%	0.7%
20-24	2.8%	2.3%	2.6%	0.0%	0.0%	0.0%	3.1%	0.0%	1.2%	0.0%	0.0%	0.0%	2.6%	0.0%	1.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
25-29	7.8%	5.7%	7.1%	2.2%	0.0%	1.2%	7.8%	2.0%	4.3%	0.0%	0.0%	0.0%	2.6%	3.3%	3.0%	2.4%	0.0%	1.0%	1.6%	1.1%	1.3%
30-34	15.6%	5.7%	12.3%	5.4%	2.6%	4.2%	7.8%	5.1%	6.1%	0.0%	1.8%	0.9%	7.7%	0.0%	3.0%	4.9%	3.3%	4.0%	6.6%	1.1%	3.3%
35-39	16.7%	12.5%	15.3%	13.0%	14.5%	13.7%	12.5%	9.1%	10.4%	7.8%	3.6%	5.7%	5.1%	1.7%	3.0%	9.8%	6.7%	7.9%	4.9%	5.6%	5.3%
40-44	22.2%	23.9%	22.8%	20.7%	17.1%	19.0%	14.1%	11.1%	12.3%	17.6%	10.9%	14.2%	12.8%	11.7%	12.1%	9.8%	5.0%	6.9%	14.8%	7.9%	10.7%
45-49	20.0%	23.9%	21.3%	22.8%	27.6%	25.0%	21.9%	31.3%	27.6%	25.5%	25.5%	25.5%	17.9%	13.3%	15.2%	22.0%	21.7%	21.8%	19.7%	32.6%	27.3%
50-54	7.2%	9.1%	7.8%	13.0%	19.7%	16.1%	10.9%	9.1%	9.8%	19.6%	20.0%	19.8%	10.3%	11.7%	11.1%	9.8%	18.3%	14.9%	14.8%	13.5%	14.0%
55-59	5.6%	8.0%	6.3%	5.4%	5.3%	5.4%	6.3%	11.1%	9.2%	15.7%	12.7%	14.2%	12.8%	15.0%	14.1%	14.6%	10.0%	11.9%	16.4%	16.9%	16.7%
60-64	0.6%	3.4%	1.5%	10.9%	2.6%	7.1%	9.4%	5.1%	6.7%	9.8%	7.3%	8.5%	12.8%	16.7%	15.2%	4.9%	18.3%	12.9%	6.6%	5.6%	6.0%
65-69	0.6%	0.0%	0.4%	2.2%	1.3%	1.8%	3.1%	2.0%	2.5%	2.0%	3.6%	2.8%	2.6%	8.3%	6.1%	2.4%	5.0%	4.0%	4.9%	4.5%	4.7%
70-74	0.6%	1.1%	0.7%	2.2%	5.3%	3.6%	3.1%	4.0%	3.7%	0.0%	1.8%	0.9%	0.0%	5.0%	3.0%	4.9%	5.0%	5.0%	1.6%	5.6%	4.0%
75 and above	0.0%	2.3%	0.7%	2.2%	2.6%	2.4%	0.0%	10.1%	6.1%	2.0%	10.9%	6.6%	7.7%	13.3%	11.1%	9.8%	6.7%	7.9%	6.6%	5.6%	6.0%
Total	180	88	268	92	76	168	64	99	163	51	55	106	39	60	99	41	60	101	61	89	150
85th Percentile	49.71	54.39	52.52	61.29	56.74	58.10	59.18	66.49	61.90	57.68	67.24	61.19	63.12	74.09	69.40	66.59	66.07	66.59	60.96	66.21	64.06
Average	41.04	44.92	42.31	48.39	48.32	48.36	46.04	52.41	49.91	50.44	53.83	52.20	48.96	58.37	54.66	49.75	55.36	53.09	51.58	53.37	52.64
Std Dev	9.30	12.50	10.59	11.20	11.34	11.23	11.78	14.68	13.93	9.23	14.42	12.26	15.71	13.81	15.23	15.93	12.42	14.15	13.68	11.67	12.51
Min	15.00	12.19	12.19	26.26	4.69	4.69	20.63	26.26	20.63	35.64	5.62	5.62	7.50	25.32	7.50	3.75	32.82	3.75	19.69	29.07	19.69
Max	74.09	96.60	96.60	83.47	83.47	83.47	73.15	94.72	94.72	86.28	90.97	90.97	82.53	94.72	94.72	81.59	94.72	94.72	91.91	95.66	95.66
Range	59.09	84.41	84.41	57.21	78.78	78.78	52.52	68.47	74.09	50.65	85.35	85.35	75.03	69.40	87.22	77.85	61.90	90.98	72.22	66.59	75.97

Day 2 – 2ndWA

	21:30 - 22:30			22:30 - 23:30			23:30 - 00:30			00:30 - 01:30			01:30 - 02:30			02:30 - 03:30			03:30 - 04:30		
Speed_Range	**PC**	**HV**	**Total**	**PC**	**HV**	**Total**	**PC**	**HV**	**Total**	**PC**	**HV**	**Total**	**PC**	**HV**	**Total**	**PC**	**HV**	**Total**	**PC**	**HV**	**Total**
<10	0.0%	1.4%	0.4%	0.0%	0.0%	0.0%	1.2%	1.2%	1.2%	0.0%	0.0%	0.0%	1.9%	0.0%	1.0%	2.0%	0.0%	0.9%	0.0%	0.0%	0.0%
10-14	1.3%	0.0%	0.9%	0.0%	2.8%	1.3%	0.0%	1.2%	0.6%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
15-19	0.0%	2.9%	0.9%	1.2%	0.0%	0.6%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	4.0%	0.0%	1.8%	0.0%	0.0%	0.0%
20-24	1.3%	2.9%	1.8%	1.2%	1.4%	1.3%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
25-29	1.9%	5.8%	3.1%	2.4%	0.0%	1.3%	1.2%	0.0%	0.6%	0.0%	0.0%	0.0%	3.8%	0.0%	1.9%	0.0%	0.0%	0.0%	1.4%	0.0%	0.6%
30-34	3.8%	2.9%	3.5%	1.2%	5.6%	3.2%	1.2%	4.9%	3.0%	3.3%	0.0%	1.9%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.4%	0.0%	0.6%
35-39	7.0%	10.1%	8.0%	7.3%	0.0%	3.9%	6.0%	2.5%	4.3%	0.0%	2.2%	0.9%	0.0%	0.0%	0.0%	0.0%	1.7%	0.9%	0.0%	1.2%	0.6%
40-44	19.1%	15.9%	18.1%	17.1%	11.1%	14.3%	14.5%	11.1%	12.8%	6.6%	2.2%	4.7%	5.7%	3.8%	4.8%	10.0%	1.7%	5.5%	11.1%	3.5%	7.0%
45-49	22.9%	15.9%	20.8%	15.9%	20.8%	18.2%	14.5%	21.0%	17.7%	13.1%	17.4%	15.0%	11.3%	15.4%	13.3%	14.0%	15.3%	14.7%	15.3%	8.2%	11.5%
50-54	22.3%	21.7%	22.1%	24.4%	25.0%	24.7%	24.1%	22.2%	23.2%	21.3%	32.6%	26.2%	17.0%	28.8%	22.9%	22.0%	28.8%	25.7%	20.8%	29.4%	25.5%
55-59	13.4%	7.2%	11.5%	11.0%	15.3%	13.0%	14.5%	14.8%	14.6%	27.9%	26.1%	27.1%	18.9%	21.2%	20.0%	16.0%	22.0%	19.3%	19.4%	22.4%	21.0%
60-64	2.5%	4.3%	3.1%	2.4%	11.1%	6.5%	10.8%	9.9%	10.4%	4.9%	6.5%	5.6%	13.2%	5.8%	9.5%	14.0%	10.2%	11.9%	16.7%	10.6%	13.4%
65-69	1.9%	2.9%	2.2%	8.5%	1.4%	5.2%	7.2%	3.7%	5.5%	8.2%	4.3%	6.5%	15.1%	7.7%	11.4%	10.0%	11.9%	11.0%	4.2%	10.6%	7.6%
70-74	0.6%	0.0%	0.4%	3.7%	1.4%	2.6%	2.4%	1.2%	1.8%	3.3%	4.3%	3.7%	1.9%	7.7%	4.8%	8.0%	3.4%	5.5%	1.4%	1.2%	1.3%
75 and above	1.9%	5.8%	3.1%	3.7%	4.2%	3.9%	2.4%	6.2%	4.3%	11.5%	4.3%	8.4%	11.3%	9.6%	10.5%	0.0%	5.1%	2.8%	8.3%	12.9%	10.8%
Total	157	69	226	82	72	154	83	81	164	61	46	107	53	52	105	50	59	109	72	85	157
85th Percentile	56.04	58.33	56.04	64.69	60.62	61.77	62.91	61.77	62.91	69.79	62.06	66.58	69.79	71.33	70.24	65.95	66.69	66.35	64.06	69.10	66.35
Average	48.14	47.15	47.83	50.86	51.86	51.33	52.33	52.73	52.53	58.24	56.09	57.32	58.53	59.19	58.86	53.94	57.25	55.73	56.57	59.73	58.28
Std Dev	11.32	16.21	12.98	12.66	13.82	13.18	11.35	14.06	12.72	13.11	10.76	12.15	16.12	12.76	14.49	13.42	8.82	11.23	13.22	11.15	12.20
Min	13.67	7.94	7.94	15.96	10.24	10.24	9.09	9.09	9.09	31.99	36.57	31.99	9.09	43.45	9.09	7.94	37.72	7.94	29.70	36.57	29.70
Max	108.72	108.72	108.72	90.40	105.29	105.29	86.96	100.71	100.71	96.13	106.43	106.43	107.58	103.00	107.58	73.22	78.95	78.95	107.58	100.71	107.58
Range	95.05	100.78	100.78	74.44	95.05	95.05	77.87	91.62	91.62	64.13	69.86	74.44	98.49	59.55	98.49	65.28	41.23	71.00	77.87	64.13	77.87

Day 2 – 3rdWA

	21:30 - 22:30			22:30 - 23:30			23:30 - 00:30			00:30 - 01:30			01:30 - 02:30			02:30 - 03:30			03:30 - 04:30		
Speed_Range	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total
<10	0.0%	0.0%	0.0%	0.8%	0.0%	0.5%	0.0%	1.0%	0.5%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.4%	0.0%	0.7%	0.0%	0.0%	0.0%
10-14	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.0%	0.5%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
15-19	0.0%	0.0%	0.0%	0.0%	2.4%	0.9%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.1%	0.0%	0.5%
20-24	0.4%	0.0%	0.3%	3.8%	1.2%	2.8%	4.7%	2.9%	3.7%	2.7%	0.0%	1.5%	1.4%	0.0%	0.7%	0.0%	0.0%	0.0%	1.1%	0.0%	0.5%
25-29	0.4%	0.0%	0.3%	1.5%	4.8%	2.8%	4.7%	4.9%	4.8%	0.0%	0.0%	0.0%	1.4%	2.9%	2.2%	1.4%	0.0%	0.7%	0.0%	0.0%	0.0%
30-34	1.3%	1.1%	1.3%	2.3%	3.6%	2.8%	7.1%	4.9%	5.9%	2.7%	1.8%	2.3%	2.9%	0.0%	1.5%	2.9%	1.4%	2.1%	2.1%	0.0%	1.1%
35-39	5.8%	10.1%	7.0%	6.8%	3.6%	5.6%	9.4%	11.7%	10.6%	9.6%	3.5%	6.9%	7.2%	2.9%	5.1%	2.9%	2.9%	2.9%	1.1%	0.0%	0.5%
40-44	10.7%	10.1%	10.5%	12.9%	14.5%	13.5%	15.3%	10.7%	12.8%	9.6%	12.3%	10.8%	11.6%	5.9%	8.8%	4.3%	5.7%	5.0%	6.3%	2.1%	4.2%
45-49	20.0%	27.0%	22.0%	16.7%	16.9%	16.7%	16.5%	21.4%	19.1%	19.2%	31.6%	24.6%	7.2%	25.0%	16.1%	11.4%	12.9%	12.1%	13.7%	17.9%	15.8%
50-54	23.6%	29.2%	25.2%	18.2%	24.1%	20.5%	11.8%	17.5%	14.9%	27.4%	22.8%	25.4%	23.2%	25.0%	24.1%	17.1%	20.0%	18.6%	14.7%	24.2%	19.5%
55-59	19.6%	6.7%	15.9%	18.2%	10.8%	15.3%	8.2%	10.7%	9.6%	9.6%	14.0%	11.5%	14.5%	16.2%	15.3%	20.0%	21.4%	20.7%	17.9%	31.6%	24.7%
60-64	8.4%	5.6%	7.6%	6.8%	8.4%	7.4%	8.2%	3.9%	5.9%	8.2%	5.3%	6.9%	7.2%	7.4%	7.3%	11.4%	7.1%	9.3%	11.6%	7.4%	9.5%
65-69	4.0%	2.2%	3.5%	5.3%	3.6%	4.7%	2.4%	1.9%	2.1%	4.1%	3.5%	3.8%	4.3%	1.5%	2.9%	10.0%	8.6%	9.3%	6.3%	7.4%	6.8%
70-74	1.8%	1.1%	1.6%	3.0%	3.6%	3.3%	1.2%	1.0%	1.1%	4.1%	1.8%	3.1%	5.8%	4.4%	5.1%	11.4%	7.1%	9.3%	6.3%	6.3%	6.3%
75 and above	4.0%	6.7%	4.8%	3.8%	2.4%	3.3%	10.6%	6.8%	8.5%	2.7%	3.5%	3.1%	13.0%	8.8%	10.9%	5.7%	12.9%	9.3%	17.9%	3.2%	10.5%
Total	225	89	314	132	83	215	85	103	188	73	57	130	69	68	137	70	70	140	95	95	190
85th Percentile	61.13	61.91	61.13	61.13	63.35	62.30	62.96	59.82	61.13	61.13	59.82	61.13	72.88	63.67	71.05	71.11	72.88	71.57	76.66	65.04	71.11
Average	53.01	52.99	53.00	51.27	49.95	50.76	49.72	48.54	49.07	51.08	51.83	51.41	56.63	55.73	56.18	57.38	59.95	58.67	60.12	57.46	58.79
Std Dev	10.75	13.48	11.57	13.35	13.18	13.27	16.54	15.53	15.97	11.53	10.44	11.03	16.24	14.58	15.39	14.54	14.98	14.77	15.18	9.82	12.82
Min	21.97	33.72	21.97	8.92	16.75	8.92	21.97	5.00	5.00	23.27	31.11	23.27	24.58	27.19	24.58	5.00	31.11	5.00	15.44	40.24	15.44
Max	104.20	105.51	105.51	93.76	91.15	93.76	97.68	101.59	101.59	88.54	93.76	93.76	106.81	104.20	106.81	108.12	102.90	108.12	102.90	101.59	102.90
Range	82.23	71.79	83.54	84.84	74.40	84.84	75.71	96.59	96.59	65.27	62.65	70.49	82.23	77.01	82.23	103.12	71.79	103.12	87.46	61.35	87.46

Day 2 – 4thWA

	21:30 - 22:30			22:30 - 23:30			23:30 - 00:30			00:30 - 01:30			01:30 - 02:30			02:30 - 03:30			03:30 - 04:30		
Speed_Range	**PC**	**HV**	**Total**	**PC**	**HV**	**Total**	**PC**	**HV**	**Total**	**PC**	**HV**	**Total**	**PC**	**HV**	**Total**	**PC**	**HV**	**Total**	**PC**	**HV**	**Total**
<10	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.9%	0.0%	0.5%	1.2%	1.8%	1.5%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.0%	0.0%	0.5%
10-14	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.2%	1.8%	1.5%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
15-19	0.0%	0.0%	0.0%	0.7%	0.0%	0.5%	0.0%	0.0%	0.0%	0.0%	1.8%	0.7%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
20-24	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.2%	5.5%	2.9%	0.0%	0.0%	0.0%	1.4%	0.0%	0.7%	1.0%	0.0%	0.5%
25-29	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.8%	0.0%	1.0%	1.2%	1.8%	1.5%	1.5%	1.6%	1.5%	1.4%	0.0%	0.7%	1.0%	0.0%	0.5%
30-34	0.9%	2.5%	1.3%	0.7%	0.0%	0.5%	1.8%	2.3%	2.0%	3.7%	3.6%	3.6%	1.5%	3.2%	2.3%	2.8%	0.0%	1.4%	0.0%	0.0%	0.0%
35-39	3.1%	1.3%	2.6%	2.8%	2.8%	2.8%	9.0%	6.9%	8.1%	13.4%	9.1%	11.7%	10.3%	8.1%	9.2%	2.8%	9.9%	6.3%	7.3%	0.0%	3.8%
40-44	3.6%	11.4%	5.6%	5.6%	7.0%	6.1%	10.8%	9.2%	10.1%	12.2%	9.1%	10.9%	5.9%	21.0%	13.1%	8.5%	5.6%	7.0%	5.2%	5.6%	5.4%
45-49	16.1%	17.7%	16.6%	9.8%	15.5%	11.7%	18.0%	24.1%	20.7%	12.2%	21.8%	16.1%	11.8%	24.2%	17.7%	11.3%	12.7%	12.0%	7.3%	18.0%	12.4%
50-54	27.8%	32.9%	29.1%	28.0%	28.2%	28.0%	22.5%	36.8%	28.8%	19.5%	23.6%	21.2%	17.6%	29.0%	23.1%	11.3%	22.5%	16.9%	15.6%	24.7%	20.0%
55-59	19.3%	16.5%	18.5%	21.0%	28.2%	23.4%	11.7%	6.9%	9.6%	12.2%	1.8%	8.0%	16.2%	6.5%	11.5%	11.3%	16.9%	14.1%	11.5%	19.1%	15.1%
60-64	16.1%	7.6%	13.9%	17.5%	7.0%	14.0%	11.7%	9.2%	10.6%	7.3%	7.3%	7.3%	11.8%	3.2%	7.7%	25.4%	19.7%	22.5%	19.8%	16.9%	18.4%
65-69	5.4%	2.5%	4.6%	5.6%	7.0%	6.1%	2.7%	1.1%	2.0%	2.4%	1.8%	2.2%	8.8%	1.6%	5.4%	8.5%	4.2%	6.3%	11.5%	4.5%	8.1%
70-74	5.8%	3.8%	5.3%	4.2%	1.4%	3.3%	3.6%	0.0%	2.0%	3.7%	1.8%	2.9%	5.9%	1.6%	3.8%	4.2%	0.0%	2.1%	9.4%	3.4%	6.5%
75 and above	1.8%	3.8%	2.3%	4.2%	2.8%	3.7%	5.4%	3.4%	4.5%	8.5%	7.3%	8.0%	8.8%	0.0%	4.6%	11.3%	8.5%	9.9%	9.4%	7.9%	8.6%
Total	223	79	302	143	71	214	111	87	198	82	55	137	68	62	130	71	71	142	96	89	185
85th Percentile	64.89	61.94	64.67	64.89	64.15	64.89	63.41	58.98	60.46	64.89	61.79	63.41	69.25	54.55	64.89	70.80	63.41	67.85	72.28	66.07	69.91
Average	55.73	53.95	55.27	56.34	55.19	55.96	52.33	51.36	51.90	51.38	47.75	49.92	56.89	48.07	52.68	58.71	55.73	57.22	58.18	57.75	57.97
Std Dev	9.40	11.08	9.88	9.81	9.53	9.71	12.88	8.95	11.30	15.03	16.28	15.58	14.91	7.91	12.83	15.25	12.58	14.01	13.97	11.87	12.97
Min	32.39	30.91	30.91	17.61	35.34	17.61	2.84	32.39	2.84	8.75	8.75	8.75	27.95	29.43	27.95	23.52	36.82	23.52	2.84	41.25	2.84
Max	97.40	100.35	100.35	81.14	95.92	95.92	98.87	85.58	98.87	95.92	90.01	95.92	106.26	70.80	106.26	103.31	104.78	104.78	97.40	107.74	107.74
Range	65.01	69.44	69.44	63.53	60.58	78.31	96.04	53.19	96.04	87.17	81.26	87.17	78.31	41.37	78.31	79.79	67.97	81.26	94.56	66.49	104.90

Day 2– 5thWA

	21:30 - 22:30			22:30 - 23:30			23:30 - 00:30			00:30 - 01:30			01:30 - 02:30			02:30 - 03:30			03:30 - 04:30		
Speed_Range	**PC**	**HV**	**Total**	**PC**	**HV**	**Total**	**PC**	**HV**	**Total**	**PC**	**HV**	**Total**	**PC**	**HV**	**Total**	**PC**	**HV**	**Total**	**PC**	**HV**	**Total**
<10	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.9%	0.5%	0.0%	0.0%	0.0%	2.2%	0.0%	0.9%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
10-14	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	4.3%	1.6%	2.8%	1.8%	0.0%	0.7%	0.0%	0.0%	0.0%
15-19	0.5%	1.0%	0.7%	0.0%	0.0%	0.0%	1.1%	0.0%	0.5%	0.0%	5.6%	2.5%	2.2%	6.3%	4.6%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
20-24	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	3.4%	0.0%	1.5%	1.5%	3.7%	2.5%	2.2%	4.8%	3.7%	5.5%	0.0%	2.1%	0.0%	0.0%	0.0%
25-29	3.1%	2.0%	2.7%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.5%	1.9%	1.7%	13.0%	6.3%	9.2%	1.8%	3.5%	2.9%	0.0%	0.0%	0.0%
30-34	5.2%	2.0%	4.1%	1.9%	0.0%	1.0%	0.0%	0.0%	0.0%	10.4%	7.4%	9.1%	6.5%	12.7%	10.1%	5.5%	7.1%	6.4%	3.3%	1.0%	2.1%
35-39	6.3%	5.0%	5.8%	8.3%	4.3%	6.4%	13.6%	8.5%	10.8%	13.4%	9.3%	11.6%	4.3%	6.3%	5.5%	5.5%	7.1%	6.4%	5.5%	5.1%	5.3%
40-44	11.0%	11.9%	11.3%	13.0%	10.6%	11.9%	17.0%	15.1%	16.0%	22.4%	29.6%	25.6%	15.2%	15.9%	15.6%	21.8%	9.4%	14.3%	16.5%	12.1%	14.2%
45-49	18.3%	16.8%	17.8%	18.5%	19.1%	18.8%	15.9%	23.6%	20.1%	20.9%	14.8%	18.2%	19.6%	20.6%	20.2%	10.9%	21.2%	17.1%	24.2%	24.2%	24.2%
50-54	19.9%	11.9%	17.1%	25.0%	11.7%	18.8%	17.0%	20.8%	19.1%	11.9%	5.6%	9.1%	15.2%	3.2%	8.3%	14.5%	21.2%	18.6%	15.4%	15.2%	15.3%
55-59	12.0%	19.8%	14.7%	13.9%	17.0%	15.3%	15.9%	15.1%	15.5%	7.5%	9.3%	8.3%	6.5%	11.1%	9.2%	10.9%	12.9%	12.1%	11.0%	10.1%	10.5%
60-64	7.9%	7.9%	7.9%	6.5%	12.8%	9.4%	3.4%	5.7%	4.6%	4.5%	0.0%	2.5%	6.5%	3.2%	4.6%	10.9%	8.2%	9.3%	9.9%	11.1%	10.5%
65-69	6.8%	8.9%	7.5%	4.6%	10.6%	7.4%	6.8%	1.9%	4.1%	1.5%	7.4%	4.1%	0.0%	1.6%	0.9%	5.5%	1.2%	2.9%	9.9%	8.1%	8.9%
70-74	4.2%	3.0%	3.8%	1.9%	4.3%	3.0%	1.1%	3.8%	2.6%	1.5%	3.7%	2.5%	2.2%	1.6%	1.8%	3.6%	3.5%	3.6%	3.3%	3.0%	3.2%
75 and above	4.7%	9.9%	6.5%	6.5%	9.6%	7.9%	4.5%	4.7%	4.6%	3.0%	1.9%	2.5%	0.0%	4.8%	2.8%	1.8%	4.7%	3.6%	1.1%	10.1%	5.8%
Total	191	101	292	108	94	202	88	106	194	67	54	121	46	63	109	55	85	140	91	99	190
85th Percentile	65.78	67.84	67.84	62.65	68.92	66.66	61.57	60.90	61.67	57.67	58.64	58.59	54.74	57.56	56.54	63.73	61.47	63.73	63.73	69.17	65.78
Average	52.21	55.49	53.34	52.94	57.71	55.16	50.38	51.71	51.11	46.61	45.92	46.30	41.55	43.28	42.55	48.60	51.05	50.08	52.17	55.66	53.99
Std Dev	12.84	15.23	13.78	10.89	13.42	12.33	13.17	12.36	12.72	11.52	14.94	13.10	14.46	15.06	14.77	13.55	12.77	13.09	10.16	13.37	12.03
Min	16.46	15.44	15.44	32.90	35.99	32.90	18.52	3.11	3.11	23.66	16.46	16.46	2.08	13.38	2.08	14.41	25.71	14.41	32.90	34.96	32.90
Max	95.58	97.64	97.64	84.28	96.61	96.61	98.66	102.77	102.77	83.25	97.64	97.64	72.98	80.17	80.17	76.06	96.61	96.61	83.25	97.64	97.64
Range	79.12	82.20	82.20	51.38	60.62	63.71	80.15	99.67	99.67	59.60	81.17	81.17	70.90	66.79	78.09	61.65	70.90	82.20	50.35	62.68	64.73

Day 3 – RWA

	21:30 - 22:30			22:30 - 23:30			23:30 - 00:30			00:30 - 01:30			01:30 - 02:30			02:30 - 03:30			03:30 - 04:30		
Speed_Range	**PC**	**HV**	**Total**	**PC**	**HV**	**Total**	**PC**	**HV**	**Total**	**PC**	**HV**	**Total**	**PC**	**HV**	**Total**	**PC**	**HV**	**Total**	**PC**	**HV**	**Total**
<10	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
10-14	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
15-19	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
20-24	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.3%	0.8%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
25-29	0.0%	0.0%	0.0%	0.0%	1.2%	0.6%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
30-34	0.8%	0.0%	0.4%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
35-39	0.0%	0.0%	0.0%	0.0%	1.2%	0.6%	1.6%	2.9%	2.3%	0.0%	0.0%	0.0%	0.0%	1.8%	1.1%	0.0%	2.7%	1.7%	0.0%	0.0%	0.0%
40-44	3.0%	4.0%	3.4%	0.0%	6.0%	2.9%	3.2%	4.3%	3.8%	2.1%	5.1%	4.0%	2.7%	7.1%	5.4%	2.4%	9.5%	7.0%	1.7%	3.2%	2.6%
45-49	2.3%	7.0%	4.3%	6.9%	9.6%	8.2%	1.6%	15.7%	9.0%	0.0%	13.9%	8.7%	5.4%	12.5%	9.7%	0.0%	4.1%	2.6%	3.4%	7.5%	5.9%
50-54	6.8%	15.0%	10.3%	5.7%	13.3%	9.4%	4.8%	10.0%	7.5%	8.5%	11.4%	10.3%	10.8%	10.7%	10.8%	7.3%	18.9%	14.8%	11.9%	5.4%	7.9%
55-59	8.3%	22.0%	14.2%	10.3%	26.5%	18.2%	6.3%	15.7%	11.3%	19.1%	12.7%	15.1%	13.5%	26.8%	21.5%	2.4%	16.2%	11.3%	6.8%	18.3%	13.8%
60-64	16.7%	26.0%	20.7%	14.9%	15.7%	15.3%	19.0%	18.6%	18.8%	14.9%	25.3%	21.4%	8.1%	16.1%	12.9%	17.1%	21.6%	20.0%	20.3%	25.8%	23.7%
65-69	26.5%	13.0%	20.7%	24.1%	16.9%	20.6%	19.0%	18.6%	18.8%	27.7%	19.0%	22.2%	13.5%	16.1%	15.1%	22.0%	20.3%	20.9%	23.7%	23.7%	23.7%
70-74	16.7%	5.0%	11.6%	16.1%	6.0%	11.2%	20.6%	1.4%	10.5%	10.6%	7.6%	8.7%	16.2%	3.6%	8.6%	17.1%	6.8%	10.4%	16.9%	5.4%	9.9%
75 and above	18.9%	8.0%	14.2%	21.8%	3.6%	12.9%	23.8%	12.9%	18.0%	17.0%	3.8%	8.7%	29.7%	5.4%	15.1%	31.7%	0.0%	11.3%	15.3%	10.8%	12.5%
Total	132	100	232	87	83	170	63	70	133	47	79	126	37	56	93	41	74	115	59	93	152
85th Percentile	77.44	69.62	73.81	76.79	68.67	74.07	77.24	68.67	75.40	75.62	68.95	71.52	82.57	69.38	74.57	77.24	68.67	72.48	74.81	70.76	73.46
Average	66.61	60.56	64.00	67.21	58.63	63.02	68.43	60.20	64.10	66.80	59.79	62.41	67.94	58.50	62.25	69.19	58.44	62.27	66.30	63.72	64.72
Std Dev	10.88	9.34	10.66	10.35	10.03	11.04	11.38	11.21	11.98	10.80	10.16	10.91	13.34	9.37	11.99	9.27	9.04	10.45	10.40	11.11	10.88
Min	34.38	40.10	34.38	45.81	28.67	28.67	39.15	39.15	39.15	42.00	23.91	23.91	40.10	38.19	38.19	42.00	36.29	36.29	42.00	42.00	42.00
Max	99.14	89.62	99.14	94.38	93.43	94.38	102.58	88.67	102.58	100.09	86.76	100.09	100.09	79.14	100.09	87.71	74.38	87.71	94.38	99.14	99.14
Range	64.76	49.52	64.76	48.57	64.76	65.71	63.43	49.52	63.43	58.09	62.85	76.18	59.99	40.95	61.90	45.71	38.09	51.42	52.38	57.14	57.14

Day 3 – PCMS

	21:30 - 22:30			22:30 - 23:30			23:30 - 00:30			00:30 - 01:30			01:30 - 02:30			02:30 - 03:30			03:30 - 04:30		
Speed_Range	**PC**	**HV**	**Total**	**PC**	**HV**	**Total**	**PC**	**HV**	**Total**	**PC**	**HV**	**Total**	**PC**	**HV**	**Total**	**PC**	**HV**	**Total**	**PC**	**HV**	**Total**
<10	0.5%	0.0%	0.3%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
10-14	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
15-19	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
20-24	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.3%	0.7%	0.0%	1.5%	0.9%	0.0%	0.0%	0.0%	1.3%	0.0%	0.6%
25-29	0.5%	0.7%	0.6%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
30-34	1.6%	0.0%	0.9%	0.8%	0.0%	0.4%	2.6%	1.3%	1.9%	1.7%	1.3%	1.4%	0.0%	1.5%	0.9%	0.0%	3.0%	1.9%	2.6%	1.0%	1.7%
35-39	2.2%	1.4%	1.9%	3.1%	2.9%	3.0%	0.0%	2.6%	1.3%	3.4%	5.0%	4.3%	1.9%	1.5%	1.7%	3.4%	2.0%	2.5%	2.6%	1.0%	1.7%
40-44	2.7%	4.3%	3.4%	3.8%	3.8%	3.8%	3.8%	1.3%	2.6%	3.4%	5.0%	4.3%	3.8%	6.2%	5.1%	6.9%	2.0%	3.8%	6.6%	3.1%	4.7%
45-49	6.6%	9.4%	7.8%	6.9%	9.6%	8.1%	7.7%	19.5%	13.5%	3.4%	7.5%	5.8%	9.6%	12.3%	11.1%	6.9%	12.1%	10.2%	6.6%	18.8%	13.4%
50-54	9.3%	16.7%	12.5%	5.3%	17.3%	10.6%	7.7%	10.4%	9.0%	12.1%	13.8%	13.0%	11.5%	26.2%	19.7%	10.3%	19.2%	15.9%	6.6%	10.4%	8.7%
55-59	13.7%	21.0%	16.9%	20.6%	20.2%	20.4%	15.4%	15.6%	15.5%	24.1%	17.5%	20.3%	21.2%	13.8%	17.1%	12.1%	17.2%	15.3%	13.2%	17.7%	15.7%
60-64	20.3%	15.2%	18.1%	24.4%	21.2%	23.0%	24.4%	10.4%	17.4%	20.7%	27.5%	24.6%	23.1%	20.0%	21.4%	19.0%	19.2%	19.1%	19.7%	11.5%	15.1%
65-69	13.7%	9.4%	11.9%	16.0%	8.7%	12.8%	14.1%	11.7%	12.9%	12.1%	7.5%	9.4%	5.8%	3.1%	4.3%	6.9%	8.1%	7.6%	22.4%	9.4%	15.1%
70-74	13.7%	6.5%	10.6%	6.9%	9.6%	8.1%	10.3%	9.1%	9.7%	10.3%	5.0%	7.2%	15.4%	7.7%	11.1%	15.5%	6.1%	9.6%	9.2%	15.6%	12.8%
75 and above	14.8%	15.2%	15.0%	12.2%	6.7%	9.8%	14.1%	18.2%	16.1%	8.6%	8.8%	8.7%	7.7%	6.2%	6.8%	19.0%	11.1%	14.0%	9.2%	11.5%	10.5%
Total	182	138	320	131	104	235	78	77	155	58	80	138	52	65	117	58	99	157	76	96	172
85th Percentile	74.86	74.94	74.89	73.15	70.34	71.15	72.59	78.41	75.03	72.64	69.40	70.34	71.28	65.65	71.26	76.39	71.28	74.09	71.27	72.92	72.51
Average	62.19	60.96	61.66	61.78	59.58	60.81	62.05	61.21	61.64	60.39	58.37	59.22	60.45	56.81	58.43	63.16	59.22	60.68	60.43	60.28	60.35
Std Dev	12.59	12.05	12.36	11.24	10.83	11.09	11.00	13.33	12.18	10.77	11.72	11.33	10.34	12.36	11.60	12.67	11.81	12.24	12.57	11.70	12.05
Min	8.44	29.07	8.44	33.76	37.51	33.76	30.95	33.76	30.95	31.89	24.38	24.38	38.45	20.63	20.63	36.57	32.82	32.82	24.38	30.01	24.38
Max	91.91	95.66	95.66	90.97	91.91	91.91	86.28	90.04	90.04	81.59	93.79	93.79	86.28	94.72	94.72	88.16	93.79	93.79	89.10	91.91	91.91
Range	83.47	66.59	87.22	57.21	54.40	58.15	55.34	56.27	59.09	49.71	69.40	69.40	47.83	74.09	74.09	51.58	60.96	60.96	64.72	61.90	67.53

Day 3 – BoT

	21:30 - 22:30			22:30 - 23:30			23:30 - 00:30			00:30 - 01:30			01:30 - 02:30			02:30 - 03:30			03:30 - 04:30		
Speed_Range	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total
<10	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.4%	0.9%	0.0%	0.0%	0.0%
10-14	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
15-19	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
20-24	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	2.6%	0.0%	1.0%	0.0%	0.0%	0.0%	2.4%	0.0%	0.9%	0.0%	0.0%	0.0%
25-29	0.8%	0.0%	0.4%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
30-34	0.8%	0.9%	0.8%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
35-39	0.0%	0.9%	0.4%	1.2%	0.0%	0.6%	0.0%	1.6%	0.9%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	2.4%	0.0%	0.9%	0.0%	0.0%	0.0%
40-44	3.0%	0.9%	2.1%	4.8%	3.4%	4.1%	1.9%	3.2%	2.6%	2.6%	1.7%	2.0%	0.0%	5.2%	3.1%	4.8%	6.8%	6.1%	0.0%	0.0%	0.0%
45-49	9.8%	13.6%	11.5%	12.0%	23.0%	17.6%	7.5%	17.5%	12.9%	10.3%	18.3%	15.2%	18.4%	10.3%	13.5%	14.3%	19.2%	17.4%	8.3%	8.8%	8.6%
50-54	16.5%	30.9%	23.0%	14.5%	31.0%	22.9%	20.8%	31.7%	26.7%	20.5%	30.0%	26.3%	23.7%	37.9%	32.3%	16.7%	27.4%	23.5%	21.7%	32.5%	27.9%
55-59	22.6%	22.7%	22.6%	22.9%	20.7%	21.8%	13.2%	23.8%	19.0%	23.1%	23.3%	23.2%	18.4%	15.5%	16.7%	26.2%	16.4%	20.0%	30.0%	25.0%	27.1%
60-64	13.5%	16.4%	14.8%	24.1%	11.5%	17.6%	22.6%	17.5%	19.8%	20.5%	16.7%	18.2%	15.8%	15.5%	15.6%	19.0%	15.1%	16.5%	11.7%	20.0%	16.4%
65-69	13.5%	4.5%	9.5%	8.4%	3.4%	5.9%	13.2%	0.0%	6.0%	7.7%	5.0%	6.1%	0.0%	6.9%	4.2%	4.8%	4.1%	4.3%	8.3%	5.0%	6.4%
70-74	11.3%	2.7%	7.4%	3.6%	0.0%	1.8%	9.4%	3.2%	6.0%	10.3%	0.0%	4.0%	10.5%	3.4%	6.3%	7.1%	4.1%	5.2%	10.0%	5.0%	7.1%
75 and above	8.3%	6.4%	7.4%	8.4%	6.9%	7.6%	11.3%	1.6%	6.0%	2.6%	5.0%	4.0%	13.2%	5.2%	8.3%	2.4%	5.5%	4.3%	10.0%	3.8%	6.4%
Total	133	110	243	83	87	170	53	63	116	39	60	99	38	58	96	42	73	115	60	80	140
85th Percentile	71.35	64.80	69.48	67.04	61.06	65.41	72.66	61.06	67.60	67.89	61.99	64.80	73.12	65.64	69.48	64.80	64.80	64.80	71.35	64.80	67.75
Average	60.68	57.38	59.19	59.21	55.69	57.41	61.69	54.73	57.91	58.18	56.77	57.32	59.85	57.01	58.13	56.47	55.82	56.05	60.46	58.04	59.08
Std Dev	10.36	9.82	10.23	10.43	9.18	9.94	9.70	6.88	8.95	9.71	8.98	9.25	10.81	9.61	10.14	10.45	10.69	10.56	9.68	7.95	8.78
Min	28.32	30.19	28.32	39.54	43.28	39.54	44.22	37.67	37.67	24.58	44.22	24.58	46.09	40.48	40.48	23.64	8.67	8.67	46.09	45.16	45.16
Max	87.25	93.80	93.80	92.86	90.05	92.86	82.57	78.83	82.57	80.70	92.86	92.86	94.73	94.73	94.73	83.51	91.93	91.93	90.05	90.99	90.99
Range	58.93	63.61	65.48	53.32	46.77	53.32	38.35	41.16	44.90	56.12	48.64	68.28	48.64	54.25	54.25	59.87	83.25	83.25	43.96	45.83	45.83

Day 3 – EoT

	21:30 - 22:30			22:30 - 23:30			23:30 - 00:30			00:30 - 01:30			01:30 - 02:30			02:30 - 03:30			03:30 - 04:30		
Speed_Range	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total
<10	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
10-14	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
15-19	0.0%	0.0%	0.0%	0.0%	1.2%	0.6%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
20-24	1.1%	1.0%	1.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
25-29	2.2%	0.0%	1.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	4.3%	0.0%	1.5%	0.0%	1.6%	1.1%	4.8%	0.0%	2.0%
30-34	5.4%	2.0%	3.6%	2.7%	3.6%	3.1%	2.2%	0.0%	1.1%	0.0%	0.0%	0.0%	4.3%	2.3%	3.0%	3.1%	1.6%	2.1%	4.8%	3.4%	4.0%
35-39	17.4%	17.0%	17.2%	21.3%	22.6%	22.0%	15.6%	17.0%	16.3%	24.0%	9.8%	15.2%	13.0%	4.5%	7.5%	18.8%	9.7%	12.8%	7.1%	6.9%	7.0%
40-44	22.8%	29.0%	26.0%	21.3%	31.0%	26.4%	20.0%	25.5%	22.8%	16.0%	36.6%	28.8%	26.1%	22.7%	23.9%	31.3%	45.2%	40.4%	31.0%	24.1%	27.0%
45-49	18.5%	17.0%	17.7%	14.7%	21.4%	18.2%	22.2%	29.8%	26.1%	28.0%	24.4%	25.8%	13.0%	34.1%	26.9%	18.8%	24.2%	22.3%	21.4%	20.7%	21.0%
50-54	14.1%	14.0%	14.1%	13.3%	4.8%	8.8%	17.8%	10.6%	14.1%	4.0%	12.2%	9.1%	30.4%	15.9%	20.9%	12.5%	11.3%	11.7%	14.3%	19.0%	17.0%
55-59	8.7%	8.0%	8.3%	16.0%	7.1%	11.3%	11.1%	6.4%	8.7%	16.0%	7.3%	10.6%	8.7%	13.6%	11.9%	6.3%	4.8%	5.3%	11.9%	13.8%	13.0%
60-64	3.3%	2.0%	2.6%	6.7%	2.4%	4.4%	6.7%	4.3%	5.4%	0.0%	2.4%	1.5%	0.0%	4.5%	3.0%	9.4%	0.0%	3.2%	2.4%	6.9%	5.0%
65-69	5.4%	3.0%	4.2%	1.3%	3.6%	2.5%	2.2%	2.1%	2.2%	8.0%	2.4%	4.5%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	5.2%	3.0%
70-74	0.0%	4.0%	2.1%	1.3%	0.0%	0.6%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.6%	1.1%	2.4%	0.0%	1.0%
75 and above	1.1%	3.0%	2.1%	1.3%	2.4%	1.9%	2.2%	4.3%	3.3%	4.0%	4.9%	4.5%	0.0%	2.3%	1.5%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Total	92	100	192	75	84	159	45	47	92	25	41	66	23	44	67	32	62	94	42	58	100
85th Percentile	56.29	58.09	57.42	57.12	53.94	57.12	58.30	56.37	57.42	57.12	55.45	55.66	53.27	55.91	55.45	54.70	51.14	52.10	55.32	58.80	58.09
Average	46.45	48.18	47.35	47.94	45.44	46.62	49.03	47.95	48.48	48.79	48.26	48.46	45.26	48.89	47.64	46.06	45.04	45.39	46.28	49.55	48.18
Std Dev	10.04	10.95	10.53	9.68	9.66	9.72	9.57	9.90	9.70	10.74	9.99	10.20	8.17	7.51	7.87	8.28	6.53	7.15	8.90	8.54	8.80
Min	22.80	21.13	21.13	33.69	19.46	19.46	34.52	35.36	34.52	35.36	36.20	35.36	26.15	34.52	26.15	33.69	28.66	28.66	26.15	32.85	26.15
Max	75.54	86.42	86.42	78.89	80.56	80.56	81.40	83.07	83.07	80.56	85.59	85.59	57.96	76.38	76.38	63.82	71.36	71.36	73.03	68.84	73.03
Range	52.74	65.29	65.29	45.20	61.11	61.11	46.88	47.71	48.55	45.20	49.39	50.23	31.81	41.86	50.23	30.14	42.69	42.69	46.88	36.00	46.88

Day 3 – 1stWA

	21:30 - 22:30			22:30 - 23:30			23:30 - 00:30			00:30 - 01:30			01:30 - 02:30			02:30 - 03:30			03:30 - 04:30		
Speed_Range	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total
<10	1.7%	0.8%	1.4%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
10-14	0.4%	2.5%	1.1%	0.7%	0.0%	0.4%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
15-19	1.3%	0.0%	0.8%	0.0%	1.1%	0.4%	1.1%	0.0%	0.6%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
20-24	3.4%	0.8%	2.5%	0.7%	0.0%	0.4%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
25-29	3.8%	5.8%	4.5%	3.3%	1.1%	2.4%	1.1%	1.4%	1.2%	1.3%	0.0%	0.7%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.0%	0.0%	0.5%
30-34	7.6%	10.8%	8.7%	7.8%	5.3%	6.9%	2.2%	0.0%	1.2%	1.3%	0.0%	0.7%	1.6%	1.6%	1.6%	0.0%	1.1%	0.6%	1.0%	1.1%	1.0%
35-39	12.3%	10.8%	11.8%	7.8%	10.6%	8.9%	3.4%	0.0%	1.9%	3.9%	2.9%	3.4%	0.0%	1.6%	0.8%	1.3%	1.1%	1.2%	3.0%	1.1%	2.1%
40-44	18.2%	12.5%	16.3%	10.5%	25.5%	16.2%	2.2%	6.8%	4.3%	5.2%	10.0%	7.5%	1.6%	3.2%	2.4%	9.3%	7.5%	8.3%	3.0%	1.1%	2.1%
45-49	10.6%	16.7%	12.6%	13.7%	17.0%	15.0%	4.5%	8.2%	6.2%	6.5%	8.6%	7.5%	6.6%	11.1%	8.9%	5.3%	14.0%	10.1%	3.0%	8.7%	5.8%
50-54	20.3%	11.7%	17.4%	20.3%	20.2%	20.2%	13.5%	32.9%	22.2%	22.1%	38.6%	29.9%	14.8%	23.8%	19.4%	22.7%	29.0%	26.2%	15.2%	19.6%	17.3%
55-59	9.7%	10.0%	9.8%	19.6%	10.6%	16.2%	32.6%	20.5%	27.2%	27.3%	20.0%	23.8%	29.5%	34.9%	32.3%	26.7%	23.7%	25.0%	26.3%	27.2%	26.7%
60-64	4.7%	6.7%	5.3%	9.8%	3.2%	7.3%	19.1%	13.7%	16.7%	9.1%	12.9%	10.9%	16.4%	9.5%	12.9%	16.0%	8.6%	11.9%	19.2%	22.8%	20.9%
65-69	2.5%	4.2%	3.1%	2.6%	1.1%	2.0%	9.0%	6.8%	8.0%	13.0%	2.9%	8.2%	13.1%	6.3%	9.7%	4.0%	8.6%	6.5%	8.1%	8.7%	8.4%
70-74	0.8%	0.8%	0.8%	0.7%	3.2%	1.6%	6.7%	0.0%	3.7%	3.9%	1.4%	2.7%	8.2%	6.3%	7.3%	10.7%	2.2%	6.0%	10.1%	4.3%	7.3%
75 and above	2.5%	5.8%	3.7%	2.6%	1.1%	2.0%	4.5%	9.6%	6.8%	6.5%	2.9%	4.8%	8.2%	1.6%	4.8%	4.0%	4.3%	4.2%	10.1%	5.4%	7.9%
Total	236	120	356	153	94	247	89	73	162	77	70	147	61	63	124	75	93	168	99	92	191
85th Percentile	56.55	60.62	57.84	60.43	55.32	59.13	68.19	65.86	66.89	68.19	60.43	65.60	70.77	64.31	68.19	67.93	62.50	65.60	73.36	65.60	70.13
Average	45.75	47.46	46.33	50.00	47.59	49.09	58.04	58.46	58.23	57.57	54.75	56.23	61.06	56.38	58.69	57.63	55.67	56.55	60.66	59.26	59.99
Std Dev	13.76	15.29	14.30	11.76	9.96	11.15	11.25	14.38	12.72	11.61	9.88	10.87	11.67	8.13	10.26	9.12	10.33	9.83	11.75	10.74	11.26
Min	3.52	7.40	3.52	13.87	19.04	13.87	19.04	28.09	19.04	26.80	37.15	26.80	34.56	34.56	34.56	39.73	31.97	31.97	26.80	34.56	26.80
Max	99.23	99.23	99.23	90.17	87.59	90.17	88.88	109.57	109.57	90.17	105.69	105.69	101.81	75.95	101.81	82.41	106.99	106.99	99.23	106.99	106.99
Range	95.70	91.82	95.70	76.30	68.54	76.30	69.84	81.48	90.53	63.37	68.54	78.89	67.25	41.39	67.25	42.68	75.01	75.01	72.42	72.42	80.18

Day 3 – 2ndWA

	21:30 - 22:30			22:30 - 23:30			23:30 - 00:30			00:30 - 01:30			01:30 - 02:30			02:30 - 03:30			03:30 - 04:30		
Speed_Range	**PC**	**HV**	**Total**	**PC**	**HV**	**Total**	**PC**	**HV**	**Total**	**PC**	**HV**	**Total**	**PC**	**HV**	**Total**	**PC**	**HV**	**Total**	**PC**	**HV**	**Total**
<10	0.0%	0.0%	0.0%	0.9%	1.9%	1.4%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
10-14	0.0%	0.0%	0.0%	0.9%	1.0%	0.9%	0.0%	0.0%	0.0%	1.4%	0.0%	0.7%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
15-19	1.2%	0.0%	0.7%	0.9%	1.9%	1.4%	1.4%	0.0%	0.7%	0.0%	1.4%	0.7%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
20-24	0.6%	0.0%	0.3%	1.7%	1.9%	1.8%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
25-29	2.3%	0.8%	1.7%	1.7%	8.7%	5.0%	1.4%	0.0%	0.7%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
30-34	1.7%	1.6%	1.7%	2.6%	8.7%	5.4%	0.0%	0.0%	0.0%	1.4%	0.0%	0.7%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
35-39	4.0%	3.3%	3.7%	11.1%	3.8%	7.7%	4.1%	1.3%	2.7%	2.8%	1.4%	2.1%	0.0%	1.6%	0.9%	0.0%	1.1%	0.6%	0.0%	1.1%	0.5%
40-44	12.1%	7.3%	10.1%	11.1%	10.6%	10.9%	5.5%	13.2%	9.4%	2.8%	6.8%	4.8%	3.8%	1.6%	2.6%	1.2%	2.3%	1.8%	3.0%	0.0%	1.6%
45-49	14.5%	9.8%	12.5%	12.0%	17.3%	14.5%	15.1%	7.9%	11.4%	9.9%	13.5%	11.7%	15.4%	6.3%	10.3%	14.8%	6.8%	10.7%	6.0%	10.1%	7.9%
50-54	16.2%	13.8%	15.2%	16.2%	17.3%	16.7%	11.0%	21.1%	16.1%	16.9%	20.3%	18.6%	11.5%	23.4%	18.1%	14.8%	23.9%	19.5%	18.0%	20.2%	19.0%
55-59	12.7%	16.3%	14.2%	14.5%	10.6%	12.7%	17.8%	25.0%	21.5%	25.4%	28.4%	26.9%	25.0%	29.7%	27.6%	23.5%	29.5%	26.6%	24.0%	27.0%	25.4%
60-64	15.0%	8.9%	12.5%	5.1%	4.8%	5.0%	13.7%	13.2%	13.4%	8.5%	9.5%	9.0%	3.8%	6.3%	5.2%	14.8%	14.8%	14.8%	18.0%	16.9%	17.5%
65-69	6.4%	17.9%	11.1%	6.0%	3.8%	5.0%	13.7%	3.9%	8.7%	11.3%	10.8%	11.0%	13.5%	15.6%	14.7%	9.9%	13.6%	11.8%	11.0%	13.5%	12.2%
70-74	4.6%	6.5%	5.4%	5.1%	1.0%	3.2%	5.5%	6.6%	6.0%	4.2%	6.8%	5.5%	15.4%	7.8%	11.2%	7.4%	1.1%	4.1%	12.0%	4.5%	8.5%
75 and above	8.7%	13.8%	10.8%	10.3%	6.7%	8.6%	11.0%	7.9%	9.4%	15.5%	1.4%	8.3%	11.5%	7.8%	9.5%	13.6%	6.8%	10.1%	8.0%	6.7%	7.4%
Total	173	123	296	117	104	221	73	76	149	71	74	145	52	64	116	81	88	169	100	89	189
85th Percentile	67.65	72.48	70.26	69.74	61.13	66.35	72.09	67.65	70.00	74.83	66.35	67.65	74.18	69.68	72.55	72.88	66.35	68.96	71.57	68.70	70.26
Average	55.67	60.44	57.65	53.16	47.46	50.48	58.61	57.86	58.23	60.36	56.35	58.31	62.11	60.52	61.23	61.61	59.67	60.60	61.30	60.19	60.78
Std Dev	15.73	13.97	15.18	16.97	16.36	16.89	13.69	13.20	13.40	15.21	9.66	12.80	11.97	11.17	11.51	11.45	10.63	11.04	9.74	10.00	9.85
Min	16.75	29.80	16.75	6.31	5.00	5.00	19.36	38.94	19.36	12.83	19.36	12.83	44.16	38.94	38.94	44.16	37.63	37.63	42.85	36.33	36.33
Max	108.12	101.59	108.12	108.12	93.76	108.12	88.54	106.81	106.81	109.42	85.93	109.42	89.84	105.51	105.51	98.98	106.81	106.81	98.98	102.90	102.90
Range	91.37	71.79	91.37	101.81	88.76	103.12	69.18	67.88	87.46	96.59	66.57	96.59	45.69	66.57	66.57	54.82	69.18	69.18	56.13	66.57	66.57

Day 3 – 3rdWA

	21:30 - 22:30			22:30 - 23:30			23:30 - 00:30			00:30 - 01:30			01:30 - 02:30			02:30 - 03:30			03:30 - 04:30		
Speed_Range	**PC**	**HV**	**Total**	**PC**	**HV**	**Total**	**PC**	**HV**	**Total**	**PC**	**HV**	**Total**	**PC**	**HV**	**Total**	**PC**	**HV**	**Total**	**PC**	**HV**	**Total**
<10	0.6%	0.0%	0.4%	0.9%	0.0%	0.5%	1.6%	0.0%	0.8%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
10-14	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	4.9%	1.5%	3.2%	6.9%	1.4%	3.9%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.1%	0.0%	0.5%
15-19	0.0%	0.0%	0.0%	1.7%	0.0%	1.0%	1.6%	0.0%	0.8%	1.7%	0.0%	0.8%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
20-24	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	3.3%	6.2%	4.8%	1.7%	0.0%	0.8%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.1%	0.0%	0.5%
25-29	1.3%	0.0%	0.8%	1.7%	1.1%	1.5%	1.6%	6.2%	4.0%	5.2%	4.3%	4.7%	1.9%	0.0%	0.9%	1.3%	1.1%	1.2%	0.0%	1.1%	0.5%
30-34	0.0%	0.9%	0.4%	3.5%	4.4%	3.9%	0.0%	3.1%	1.6%	0.0%	0.0%	0.0%	1.9%	0.0%	0.9%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
35-39	3.2%	0.0%	1.9%	9.6%	3.3%	6.8%	1.6%	4.6%	3.2%	6.9%	11.6%	9.4%	13.0%	1.6%	6.8%	5.3%	2.3%	3.7%	2.1%	1.1%	1.6%
40-44	9.1%	1.8%	6.0%	6.1%	9.9%	7.8%	9.8%	7.7%	8.7%	8.6%	4.3%	6.3%	7.4%	6.3%	6.8%	2.7%	5.7%	4.3%	6.3%	2.2%	4.3%
45-49	7.1%	5.4%	6.4%	13.9%	17.6%	15.5%	11.5%	12.3%	11.9%	12.1%	13.0%	12.6%	13.0%	20.6%	17.1%	13.3%	16.1%	14.8%	7.4%	9.9%	8.6%
50-54	21.4%	18.8%	20.3%	16.5%	18.7%	17.5%	16.4%	20.0%	18.3%	19.0%	26.1%	22.8%	18.5%	38.1%	29.1%	17.3%	24.1%	21.0%	16.8%	27.5%	22.0%
55-59	15.6%	18.8%	16.9%	10.4%	5.5%	8.3%	9.8%	13.8%	11.9%	13.8%	8.7%	11.0%	11.1%	4.8%	7.7%	18.7%	23.0%	21.0%	13.7%	23.1%	18.3%
60-64	16.2%	25.9%	20.3%	10.4%	12.1%	11.2%	16.4%	9.2%	12.7%	10.3%	5.8%	7.9%	11.1%	12.7%	12.0%	17.3%	16.1%	16.7%	23.2%	18.7%	21.0%
65-69	10.4%	9.8%	10.2%	6.1%	14.3%	9.7%	9.8%	6.2%	7.9%	1.7%	7.2%	4.7%	11.1%	7.9%	9.4%	6.7%	2.3%	4.3%	8.4%	6.6%	7.5%
70-74	5.2%	3.6%	4.5%	8.7%	3.3%	6.3%	4.9%	1.5%	3.2%	5.2%	5.8%	5.5%	5.6%	3.2%	4.3%	4.0%	4.6%	4.3%	9.5%	2.2%	5.9%
75 and above	9.7%	15.2%	12.0%	10.4%	9.9%	10.2%	6.6%	7.7%	7.1%	6.9%	11.6%	9.4%	5.6%	4.8%	5.1%	13.3%	4.6%	8.6%	10.5%	7.7%	9.1%
Total	154	112	266	115	91	206	61	65	126	58	69	127	54	63	117	75	87	162	95	91	186
85th Percentile	69.40	74.27	71.17	72.28	68.58	72.28	66.37	65.48	66.37	63.41	70.80	69.47	67.92	65.48	66.37	73.46	63.41	67.62	72.28	66.37	69.69
Average	58.85	62.61	60.43	54.82	56.69	55.65	52.42	50.68	51.52	50.80	55.53	53.37	54.74	55.11	54.94	59.18	55.72	57.32	59.90	58.27	59.10
Std Dev	14.68	12.90	14.06	15.46	14.42	15.01	17.43	16.14	16.73	18.83	16.74	17.81	14.23	9.14	11.72	13.66	10.64	12.21	13.49	10.87	12.27
Min	5.79	30.91	5.79	5.79	26.48	5.79	5.79	10.22	5.79	13.18	11.70	11.70	29.43	39.77	29.43	27.95	26.48	26.48	13.18	26.48	13.18
Max	109.22	107.74	109.22	103.31	103.31	103.31	87.05	90.01	90.01	106.26	104.78	106.26	106.26	79.67	106.26	101.83	103.31	103.31	97.40	101.83	101.83
Range	103.43	76.83	103.43	97.52	76.83	97.52	81.26	79.79	84.22	93.08	93.08	94.56	76.83	39.89	76.83	73.88	76.83	76.83	84.22	75.35	88.65

Day 3 – 4thWA

	21:30 - 22:30			22:30 - 23:30			23:30 - 00:30			00:30 - 01:30			01:30 - 02:30			02:30 - 03:30			03:30 - 04:30		
Speed_Range	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total
<10	0.0%	0.0%	0.0%	0.0%	0.9%	0.4%	0.0%	1.4%	0.7%	0.0%	1.3%	0.7%	0.0%	0.0%	0.0%	0.0%	1.0%	0.6%	0.0%	0.0%	0.0%
10-14	0.0%	0.8%	0.3%	0.0%	0.0%	0.0%	1.3%	1.4%	1.3%	0.0%	0.0%	0.0%	2.0%	0.0%	0.9%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
15-19	0.0%	0.0%	0.0%	0.0%	0.9%	0.4%	0.0%	0.0%	0.0%	1.7%	2.5%	2.1%	0.0%	1.5%	0.9%	1.4%	0.0%	0.6%	0.0%	0.0%	0.0%
20-24	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.3%	0.0%	0.7%	3.3%	0.0%	1.4%	0.0%	3.1%	1.8%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
25-29	1.2%	0.0%	0.7%	1.8%	0.0%	0.9%	3.8%	0.0%	2.0%	1.7%	7.5%	5.0%	6.1%	9.2%	7.9%	0.0%	1.0%	0.6%	0.0%	0.0%	0.0%
30-34	0.6%	0.0%	0.3%	2.6%	0.9%	1.8%	1.3%	0.0%	0.7%	5.0%	1.3%	2.9%	2.0%	7.7%	5.3%	2.9%	1.0%	1.8%	1.0%	0.0%	0.5%
35-39	0.0%	0.0%	0.0%	6.1%	0.9%	3.6%	5.0%	1.4%	3.3%	11.7%	6.3%	8.6%	18.4%	12.3%	14.9%	8.7%	1.0%	4.2%	1.0%	2.1%	1.6%
40-44	4.8%	0.0%	2.7%	11.4%	9.9%	10.7%	6.3%	9.6%	7.8%	11.7%	11.3%	11.4%	14.3%	12.3%	13.2%	14.5%	19.6%	17.5%	4.1%	6.4%	5.2%
45-49	7.7%	12.7%	9.9%	14.0%	20.7%	17.3%	11.3%	19.2%	15.0%	13.3%	10.0%	11.4%	14.3%	7.7%	10.5%	10.1%	29.9%	21.7%	14.4%	17.0%	15.7%
50-54	20.8%	19.8%	20.4%	14.0%	25.2%	19.6%	20.0%	23.3%	21.6%	20.0%	27.5%	24.3%	20.4%	16.9%	18.4%	17.4%	23.7%	21.1%	22.7%	46.8%	34.6%
55-59	16.1%	25.4%	20.1%	16.7%	15.3%	16.0%	25.0%	20.5%	22.9%	15.0%	15.0%	15.0%	8.2%	15.4%	12.3%	10.1%	8.2%	9.0%	26.8%	12.8%	19.9%
60-64	18.5%	15.9%	17.3%	11.4%	9.9%	10.7%	7.5%	4.1%	5.9%	3.3%	7.5%	5.7%	4.1%	7.7%	6.1%	10.1%	3.1%	6.0%	14.4%	7.4%	11.0%
65-69	8.9%	6.3%	7.8%	12.3%	4.5%	8.4%	3.8%	6.8%	5.2%	5.0%	2.5%	3.6%	4.1%	4.6%	4.4%	13.0%	4.1%	7.8%	11.3%	1.1%	6.3%
70-74	7.7%	4.8%	6.5%	3.5%	0.9%	2.2%	6.3%	2.7%	4.6%	5.0%	0.0%	2.1%	4.1%	0.0%	1.8%	7.2%	3.1%	4.8%	2.1%	0.0%	1.0%
75 and above	13.7%	14.3%	13.9%	6.1%	9.9%	8.0%	7.5%	9.6%	8.5%	3.3%	7.5%	5.7%	2.0%	1.5%	1.8%	4.3%	4.1%	4.2%	2.1%	6.4%	4.2%
Total	168	126	294	114	111	225	80	73	153	60	80	140	49	65	114	69	97	166	97	94	191
85th Percentile	74.31	73.51	74.37	67.50	64.63	66.81	66.69	66.58	66.58	60.80	60.62	60.62	58.10	59.48	59.48	68.64	59.02	66.35	64.75	59.54	62.91
Average	61.53	61.01	61.31	55.45	55.47	55.46	54.96	55.73	55.32	49.52	51.12	50.43	47.28	46.58	46.88	54.35	51.51	52.69	56.34	54.81	55.59
Std Dev	13.63	13.23	13.44	12.96	13.95	13.43	14.47	15.19	14.77	13.73	16.43	15.30	12.65	13.45	13.06	13.25	11.46	12.28	8.10	10.87	9.57
Min	26.27	10.24	10.24	26.27	9.09	9.09	11.38	7.94	7.94	18.25	7.94	7.94	12.53	15.96	12.53	17.11	9.09	9.09	33.14	37.72	33.14
Max	108.72	107.58	108.72	106.43	109.87	109.87	91.54	105.29	105.29	86.96	109.87	109.87	75.51	83.53	83.53	84.67	93.83	93.83	80.09	105.29	105.29
Range	82.45	97.34	98.49	80.16	100.78	100.78	80.16	97.34	97.34	68.71	101.92	101.92	62.99	67.57	71.00	67.57	84.74	84.74	46.95	67.57	72.15

Day 4 – RWA

	21:30 - 22:30			22:30 - 23:30			23:30 - 00:30			00:30 - 01:30			01:30 - 02:30			02:30 - 03:30			03:30 - 04:30		
Speed_Range	**PC**	**HV**	**Total**	**PC**	**HV**	**Total**	**PC**	**HV**	**Total**	**PC**	**HV**	**Total**	**PC**	**HV**	**Total**	**PC**	**HV**	**Total**	**PC**	**HV**	**Total**
<10	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.1%	0.0%	0.6%
10-14	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
15-19	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
20-24	0.0%	0.0%	0.0%	0.9%	0.0%	0.5%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.3%	0.6%
25-29	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.1%	3.8%	2.4%
30-34	0.0%	0.0%	0.0%	0.9%	0.0%	0.5%	0.0%	0.0%	0.0%	0.0%	1.3%	0.7%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.1%	2.5%	1.8%
35-39	0.5%	0.9%	0.6%	0.0%	1.2%	0.5%	0.0%	0.0%	0.0%	1.6%	2.6%	2.2%	1.7%	2.5%	2.2%	4.3%	3.8%	4.0%	4.4%	3.8%	4.1%
40-44	6.1%	12.5%	8.4%	6.4%	7.1%	6.7%	4.9%	7.6%	6.2%	4.8%	7.8%	6.5%	3.3%	10.1%	7.2%	6.4%	10.3%	8.8%	4.4%	6.3%	5.3%
45-49	10.7%	13.4%	11.7%	9.2%	19.0%	13.5%	7.3%	19.0%	13.0%	16.1%	14.3%	15.1%	13.3%	7.6%	10.1%	17.0%	23.1%	20.8%	13.3%	11.4%	12.4%
50-54	17.3%	18.8%	17.9%	14.7%	23.8%	18.7%	12.2%	20.3%	16.1%	24.2%	22.1%	23.0%	23.3%	22.8%	23.0%	25.5%	15.4%	19.2%	16.7%	25.3%	20.7%
55-59	19.9%	23.2%	21.1%	17.4%	17.9%	17.6%	19.5%	21.5%	20.5%	17.7%	26.0%	22.3%	20.0%	35.4%	28.8%	12.8%	25.6%	20.8%	12.2%	16.5%	14.2%
60-64	15.3%	17.9%	16.2%	19.3%	17.9%	18.7%	23.2%	21.5%	22.4%	9.7%	18.2%	14.4%	20.0%	10.1%	14.4%	19.1%	10.3%	13.6%	14.4%	24.1%	18.9%
65-69	14.3%	4.5%	10.7%	21.1%	6.0%	14.5%	15.9%	6.3%	11.2%	17.7%	3.9%	10.1%	8.3%	6.3%	7.2%	10.6%	5.1%	7.2%	18.9%	2.5%	11.2%
70-74	8.2%	1.8%	5.8%	6.4%	4.8%	5.7%	9.8%	1.3%	5.6%	6.5%	0.0%	2.9%	3.3%	2.5%	2.9%	4.3%	5.1%	4.8%	3.3%	0.0%	1.8%
75 and above	7.7%	7.1%	7.5%	3.7%	2.4%	3.1%	7.3%	2.5%	5.0%	1.6%	3.9%	2.9%	6.7%	2.5%	4.3%	0.0%	1.3%	0.8%	8.9%	2.5%	5.9%
Total	196	112	308	109	84	193	82	79	161	62	77	139	60	79	139	47	78	125	90	79	169
85th Percentile	70.57	64.24	69.57	69.43	64.86	67.72	70.57	63.24	67.72	67.72	62.95	65.81	66.91	63.24	64.86	64.95	62.43	64.29	68.67	62.95	66.57
Average	59.99	56.63	58.77	59.46	56.00	57.96	61.99	56.14	59.12	57.06	55.69	56.30	58.02	55.31	56.48	55.42	53.83	54.43	57.92	53.56	55.88
Std Dev	10.63	10.54	10.71	9.93	8.93	9.64	10.62	8.89	10.21	9.18	10.31	9.81	9.42	7.91	8.67	8.78	8.88	8.84	13.33	10.90	12.41
Min	38.19	36.29	36.29	24.86	35.34	24.86	40.10	42.00	40.10	36.29	34.38	34.38	35.34	39.15	35.34	38.19	35.34	35.34	3.06	21.77	3.06
Max	99.14	91.52	99.14	85.81	83.90	85.81	97.24	99.14	99.14	83.90	100.09	100.09	82.00	81.05	82.00	71.52	76.29	76.29	100.09	84.86	100.09
Range	60.95	55.23	62.85	60.95	48.57	60.95	57.14	57.14	59.04	47.62	65.71	65.71	46.66	41.90	46.66	33.33	40.95	40.95	97.03	63.09	97.03

Day 4 – PCMS

	21:30 - 22:30			22:30 - 23:30			23:30 - 00:30			00:30 - 01:30			01:30 - 02:30			02:30 - 03:30			03:30 - 04:30		
Speed_Range	**PC**	**HV**	**Total**	**PC**	**HV**	**Total**	**PC**	**HV**	**Total**	**PC**	**HV**	**Total**	**PC**	**HV**	**Total**	**PC**	**HV**	**Total**	**PC**	**HV**	**Total**
<10	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.0%	0.0%	0.5%
10-14	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
15-19	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
20-24	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
25-29	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
30-34	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
35-39	0.0%	0.0%	0.0%	0.7%	0.0%	0.4%	2.5%	0.0%	1.3%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
40-44	1.0%	2.5%	1.6%	2.2%	0.0%	1.3%	3.8%	2.5%	3.1%	1.4%	1.4%	1.4%	4.5%	1.2%	2.7%	1.6%	0.0%	0.7%	1.0%	1.1%	1.0%
45-49	5.7%	4.9%	5.4%	4.4%	6.4%	5.2%	3.8%	7.5%	5.6%	4.3%	11.0%	7.7%	10.6%	9.9%	10.2%	4.8%	2.7%	3.6%	2.9%	3.4%	3.1%
50-54	10.8%	25.4%	16.5%	11.1%	25.5%	17.0%	11.3%	27.5%	19.4%	15.9%	15.1%	15.5%	10.6%	18.5%	15.0%	15.9%	29.7%	23.4%	9.5%	15.9%	12.4%
55-59	27.3%	29.5%	28.2%	31.1%	35.1%	32.8%	28.8%	30.0%	29.4%	29.0%	34.2%	31.7%	30.3%	40.7%	36.1%	28.6%	24.3%	26.3%	24.8%	34.1%	29.0%
60-64	26.8%	22.1%	25.0%	28.1%	23.4%	26.2%	18.8%	20.0%	19.4%	29.0%	23.3%	26.1%	19.7%	16.0%	17.7%	20.6%	28.4%	24.8%	36.2%	28.4%	32.6%
65-69	14.4%	6.6%	11.4%	15.6%	2.1%	10.0%	12.5%	6.3%	9.4%	10.1%	9.6%	9.9%	6.1%	7.4%	6.8%	17.5%	9.5%	13.1%	9.5%	10.2%	9.8%
70-74	9.8%	2.5%	7.0%	4.4%	4.3%	4.4%	8.8%	1.3%	5.0%	2.9%	0.0%	1.4%	6.1%	3.7%	4.8%	9.5%	4.1%	6.6%	11.4%	4.5%	8.3%
75 and above	4.1%	6.6%	5.1%	2.2%	3.2%	2.6%	10.0%	5.0%	7.5%	7.2%	5.5%	6.3%	12.1%	2.5%	6.8%	1.6%	1.4%	1.5%	3.8%	2.3%	3.1%
Total	194	122	316	135	94	229	80	80	160	69	73	142	66	81	147	63	74	137	105	88	193
85th Percentile	69.20	65.81	68.12	67.04	63.81	65.97	71.35	64.89	68.12	67.14	65.11	65.97	72.97	64.89	67.04	68.63	63.92	66.76	69.63	65.97	68.12
Average	61.67	59.57	60.86	60.25	58.22	59.42	61.29	58.11	59.70	60.68	59.27	59.96	60.70	58.00	59.21	60.62	58.65	59.55	61.49	59.51	60.59
Std Dev	8.70	9.86	9.20	7.42	6.60	7.15	9.80	7.96	9.05	8.51	9.58	9.07	10.43	6.81	8.70	7.18	6.13	6.68	8.84	6.70	7.98
Min	41.20	41.22	41.20	39.05	45.51	39.05	37.87	42.28	37.87	42.28	42.28	42.28	43.35	44.43	43.35	44.43	45.51	44.43	5.22	43.35	5.22
Max	102.58	102.58	102.58	91.81	78.05	91.81	89.66	90.73	90.73	86.43	97.19	97.19	96.12	81.04	96.12	75.66	75.66	75.66	79.97	78.89	79.97
Range	61.38	61.36	61.38	52.76	32.54	52.76	51.79	48.46	52.86	44.15	54.92	54.92	52.76	36.61	52.76	31.23	30.15	31.23	74.74	35.53	74.74

Day 4 – BoT

	21:30 - 22:30			22:30 - 23:30			23:30 - 00:30			00:30 - 01:30			01:30 - 02:30			02:30 - 03:30			03:30 - 04:30		
Speed_Range	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total
<10	0.0%	0.0%	0.0%	0.0%	1.2%	0.5%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
10-14	0.0%	0.0%	0.0%	0.0%	1.2%	0.5%	0.0%	1.4%	0.7%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.2%	0.6%
15-19	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
20-24	0.5%	0.0%	0.3%	0.0%	2.4%	0.9%	1.3%	1.4%	1.4%	0.0%	0.0%	0.0%	0.0%	1.5%	0.7%	3.4%	0.0%	1.6%	0.0%	0.0%	0.0%
25-29	1.9%	0.0%	1.3%	0.8%	0.0%	0.5%	0.0%	0.0%	0.0%	1.6%	0.0%	0.8%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
30-34	0.5%	1.0%	0.6%	0.8%	0.0%	0.5%	0.0%	0.0%	0.0%	1.6%	0.0%	0.8%	1.4%	0.0%	0.7%	0.0%	0.0%	0.0%	3.3%	2.4%	2.9%
35-39	1.5%	1.0%	1.3%	3.8%	2.4%	3.3%	2.6%	2.9%	2.7%	3.1%	0.0%	1.6%	0.0%	3.0%	1.4%	0.0%	1.5%	0.8%	2.2%	6.0%	4.0%
40-44	3.9%	2.0%	3.2%	0.8%	2.4%	1.4%	5.1%	5.7%	5.4%	10.9%	8.2%	9.6%	6.9%	0.0%	3.6%	3.4%	4.4%	3.9%	6.7%	2.4%	4.6%
45-49	8.3%	11.8%	9.4%	7.6%	6.0%	7.0%	5.1%	10.0%	7.4%	3.1%	9.8%	6.4%	6.9%	10.4%	8.6%	8.5%	5.9%	7.1%	6.7%	12.0%	9.2%
50-54	16.5%	21.6%	18.2%	14.5%	16.7%	15.3%	15.4%	11.4%	13.5%	6.3%	14.8%	10.4%	13.9%	22.4%	18.0%	23.7%	13.2%	18.1%	13.3%	9.6%	11.6%
55-59	10.7%	17.6%	13.0%	16.8%	17.9%	17.2%	7.7%	14.3%	10.8%	15.6%	18.0%	16.8%	16.7%	17.9%	17.3%	10.2%	20.6%	15.7%	14.4%	16.9%	15.6%
60-64	17.5%	13.7%	16.2%	11.5%	13.1%	12.1%	16.7%	11.4%	14.2%	17.2%	11.5%	14.4%	13.9%	13.4%	13.7%	23.7%	25.0%	24.4%	8.9%	12.0%	10.4%
65-69	11.7%	9.8%	11.0%	16.0%	9.5%	13.5%	9.0%	21.4%	14.9%	18.8%	16.4%	17.6%	15.3%	13.4%	14.4%	11.9%	7.4%	9.4%	8.9%	10.8%	9.8%
70-74	7.8%	7.8%	7.8%	10.7%	10.7%	10.7%	3.8%	5.7%	4.7%	7.8%	3.3%	5.6%	5.6%	6.0%	5.8%	3.4%	1.5%	2.4%	5.6%	7.2%	6.4%
75 and above	19.4%	13.7%	17.5%	16.8%	16.7%	16.7%	33.3%	14.3%	24.3%	14.1%	18.0%	16.0%	19.4%	11.9%	15.8%	11.9%	20.6%	16.5%	30.0%	19.3%	24.9%
Total	206	102	308	131	84	215	78	70	148	64	61	125	72	67	139	59	68	127	90	83	173
85th Percentile	78.19	73.53	76.71	75.97	75.23	75.23	87.72	73.76	82.55	73.76	78.19	75.82	79.67	71.10	78.19	69.77	79.59	76.86	82.10	76.71	78.48
Average	62.55	61.34	62.15	62.88	60.95	62.13	66.75	60.88	63.97	61.47	62.40	61.92	64.17	60.99	62.64	60.08	64.07	62.22	64.04	61.79	62.96
Std Dev	14.93	13.28	14.39	13.78	16.60	14.94	17.37	14.77	16.40	14.01	14.10	14.01	15.93	14.19	15.15	13.79	14.87	14.46	16.40	17.60	16.97
Min	22.04	32.39	22.04	26.48	5.79	5.79	23.52	11.70	11.70	29.43	41.25	29.43	32.39	20.57	20.57	20.57	39.77	20.57	30.91	10.22	10.22
Max	106.26	104.78	106.26	101.83	101.83	101.83	109.22	95.92	109.22	98.87	103.31	103.31	107.74	107.74	107.74	100.35	104.78	104.78	101.83	109.22	109.22
Range	84.22	72.40	84.22	75.35	96.04	96.04	85.70	84.22	97.52	69.44	62.06	73.88	75.35	87.17	87.17	79.79	65.01	84.22	70.92	98.99	98.99

Day 4 – EoT

	21:30 - 22:30			22:30 - 23:30			23:30 - 00:30			00:30 - 01:30			01:30 - 02:30			02:30 - 03:30			03:30 - 04:30		
Speed_Range	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total
<10	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.7%	0.0%	0.8%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
10-14	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
15-19	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
20-24	0.9%	0.0%	0.6%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
25-29	0.0%	0.0%	0.0%	0.7%	0.0%	0.4%	1.1%	0.0%	0.6%	0.0%	0.0%	0.0%	1.7%	0.0%	0.8%	2.8%	0.0%	1.5%	0.0%	0.0%	0.0%
30-34	0.5%	0.0%	0.3%	0.7%	0.0%	0.4%	1.1%	0.0%	0.6%	4.7%	0.0%	2.4%	0.0%	0.0%	0.0%	1.4%	0.0%	0.7%	0.0%	0.0%	0.0%
35-39	3.3%	3.8%	3.5%	0.7%	3.1%	1.7%	3.3%	1.4%	2.5%	4.7%	0.0%	2.4%	0.0%	0.0%	0.0%	1.4%	1.5%	1.5%	1.0%	1.3%	1.1%
40-44	8.4%	10.6%	9.1%	2.9%	2.1%	2.5%	0.0%	0.0%	0.0%	3.1%	3.4%	3.3%	1.7%	0.0%	0.8%	2.8%	4.6%	3.7%	4.0%	5.0%	4.5%
45-49	17.3%	26.9%	20.4%	9.4%	15.5%	11.9%	8.9%	9.6%	9.2%	12.5%	8.5%	10.6%	3.3%	7.6%	5.6%	5.6%	7.7%	6.6%	8.1%	7.5%	7.8%
50-54	20.1%	24.0%	21.4%	17.3%	20.6%	18.6%	17.8%	42.5%	28.8%	26.6%	33.9%	30.1%	18.3%	37.9%	28.6%	26.8%	32.3%	29.4%	13.1%	33.8%	22.3%
55-59	22.4%	17.3%	20.8%	32.4%	33.0%	32.6%	21.1%	20.5%	20.9%	21.9%	20.3%	21.1%	28.3%	27.3%	27.8%	31.0%	27.7%	29.4%	23.2%	20.0%	21.8%
60-64	8.4%	3.8%	6.9%	12.9%	8.2%	11.0%	14.4%	11.0%	12.9%	1.6%	10.2%	5.7%	8.3%	9.1%	8.7%	12.7%	12.3%	12.5%	13.1%	16.3%	14.5%
65-69	6.5%	5.8%	6.3%	7.2%	10.3%	8.5%	13.3%	6.8%	10.4%	4.7%	6.8%	5.7%	15.0%	7.6%	11.1%	7.0%	10.8%	8.8%	12.1%	1.3%	7.3%
70-74	3.7%	6.7%	4.7%	6.5%	1.0%	4.2%	8.9%	2.7%	6.1%	10.9%	5.1%	8.1%	8.3%	4.5%	6.3%	4.2%	1.5%	2.9%	12.1%	7.5%	10.1%
75 and above	8.4%	1.0%	6.0%	9.4%	6.2%	8.1%	10.0%	5.5%	8.0%	9.4%	11.9%	10.6%	13.3%	6.1%	9.5%	4.2%	1.5%	2.9%	13.1%	7.5%	10.6%
Total	214	104	318	139	97	236	90	73	163	64	59	123	60	66	126	71	65	136	99	80	179
85th Percentile	66.41	63.74	65.63	70.26	65.83	68.96	71.11	62.96	68.57	71.57	70.66	71.57	70.46	65.37	70.26	64.39	62.96	63.74	72.88	68.05	71.57
Average	56.62	53.17	55.49	59.82	57.62	58.92	59.97	57.18	58.72	56.74	59.49	58.06	60.56	58.42	59.44	56.83	56.53	56.68	62.29	57.91	60.33
Std Dev	13.00	9.39	12.03	11.47	11.09	11.35	10.84	8.22	9.82	11.99	11.70	11.88	12.81	9.19	11.07	9.84	7.74	8.87	12.13	9.94	11.38
Min	21.97	35.02	21.97	29.80	35.02	29.80	27.19	38.94	27.19	32.41	44.16	32.41	5.00	48.07	5.00	28.50	35.02	28.50	36.33	38.94	36.33
Max	104.20	88.54	104.20	104.20	108.12	108.12	93.76	87.23	93.76	82.01	104.20	104.20	84.62	100.29	100.29	87.23	83.32	87.23	106.81	91.15	106.81
Range	82.23	53.52	82.23	74.40	73.10	78.32	66.57	48.30	66.57	49.60	60.04	71.79	79.62	52.21	95.29	58.74	48.30	58.74	70.49	52.21	70.49

Day 4 – 1stWA

	21:30 - 22:30			22:30 - 23:30			23:30 - 00:30			00:30 - 01:30			01:30 - 02:30			02:30 - 03:30			03:30 - 04:30		
Speed_Range	**PC**	**HV**	**Total**	**PC**	**HV**	**Total**	**PC**	**HV**	**Total**	**PC**	**HV**	**Total**	**PC**	**HV**	**Total**	**PC**	**HV**	**Total**	**PC**	**HV**	**Total**
<10	0.8%	0.0%	0.4%	0.0%	1.3%	0.6%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
10-14	0.0%	0.0%	0.0%	0.0%	1.3%	0.6%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.3%	0.6%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
15-19	2.3%	1.8%	2.1%	1.1%	2.6%	1.8%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
20-24	3.8%	0.9%	2.5%	2.1%	0.0%	1.2%	0.0%	0.0%	0.0%	0.0%	1.4%	0.7%	1.3%	0.0%	0.6%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
25-29	6.1%	3.7%	5.0%	5.3%	0.0%	2.9%	1.9%	0.0%	1.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
30-34	6.9%	8.3%	7.5%	7.4%	2.6%	5.3%	2.8%	0.0%	1.7%	0.0%	1.4%	0.7%	3.9%	0.0%	1.9%	0.0%	0.0%	0.0%	0.0%	1.2%	0.5%
35-39	13.0%	11.9%	12.5%	6.4%	7.8%	7.0%	9.4%	2.7%	6.7%	0.0%	2.8%	1.3%	2.6%	1.3%	1.9%	0.0%	0.0%	0.0%	0.0%	5.8%	2.5%
40-44	19.8%	24.8%	22.1%	26.6%	18.2%	22.8%	17.9%	20.5%	19.0%	7.6%	8.3%	7.9%	10.5%	11.5%	11.0%	11.1%	8.5%	9.8%	7.8%	5.8%	7.0%
45-49	9.9%	10.1%	10.0%	13.8%	9.1%	11.7%	16.0%	27.4%	20.7%	17.7%	15.3%	16.6%	17.1%	23.1%	20.1%	25.0%	18.3%	21.7%	13.0%	19.8%	15.9%
50-54	13.7%	13.8%	13.8%	13.8%	13.0%	13.5%	21.7%	21.9%	21.8%	17.7%	38.9%	27.8%	28.9%	30.8%	29.9%	34.7%	36.6%	35.7%	21.7%	29.1%	24.9%
55-59	9.2%	6.4%	7.9%	4.3%	19.5%	11.1%	11.3%	16.4%	13.4%	27.8%	13.9%	21.2%	18.4%	10.3%	14.3%	11.1%	16.9%	14.0%	29.6%	16.3%	23.9%
60-64	3.1%	7.3%	5.0%	4.3%	3.9%	4.1%	5.7%	4.1%	5.0%	8.9%	4.2%	6.6%	6.6%	9.0%	7.8%	5.6%	11.3%	8.4%	6.1%	9.3%	7.5%
65-69	6.9%	3.7%	5.4%	2.1%	6.5%	4.1%	8.5%	2.7%	6.1%	8.9%	5.6%	7.3%	5.3%	5.1%	5.2%	8.3%	2.8%	5.6%	11.3%	8.1%	10.0%
70-74	4.6%	1.8%	3.3%	1.1%	1.3%	1.2%	0.9%	0.0%	0.6%	2.5%	0.0%	1.3%	2.6%	1.3%	1.9%	1.4%	2.8%	2.1%	4.3%	1.2%	3.0%
75 and above	0.0%	5.5%	2.5%	11.7%	13.0%	12.3%	3.8%	4.1%	3.9%	8.9%	8.3%	8.6%	2.6%	6.4%	4.5%	2.8%	2.8%	2.8%	6.1%	3.5%	5.0%
Total	131	109	240	94	77	171	106	73	179	79	72	151	76	78	154	72	71	143	115	86	201
85th Percentile	58.91	62.91	61.77	63.09	68.87	66.92	62.06	58.56	60.62	66.69	62.57	66.35	62.63	62.91	62.91	62.57	61.20	61.77	66.35	63.20	65.20
Average	45.40	48.03	46.59	49.55	53.92	51.52	51.15	51.40	51.25	58.68	54.71	56.79	52.80	54.57	53.70	53.74	54.25	53.99	57.74	53.86	56.08
Std Dev	13.57	14.64	14.10	16.54	18.74	17.65	11.48	9.87	10.82	13.29	12.79	13.17	10.06	13.31	11.82	8.84	7.73	8.28	10.93	9.44	10.47
Min	9.09	18.25	9.09	19.40	7.94	7.94	26.27	37.72	26.27	40.01	22.83	22.83	21.69	13.67	13.67	41.16	42.30	41.16	40.01	34.28	34.28
Max	74.37	100.71	100.71	99.56	107.58	107.58	89.25	86.96	89.25	104.14	101.85	104.14	76.66	108.72	108.72	91.54	77.80	91.54	99.56	84.67	99.56
Range	65.28	82.45	91.62	80.16	99.63	99.63	62.99	49.24	62.99	64.13	79.02	81.31	54.97	95.05	95.05	50.39	35.50	50.39	59.55	50.39	65.28

Day 4 – 2ndWA

	21:30 - 22:30			22:30 - 23:30			23:30 - 00:30			00:30 - 01:30			01:30 - 02:30			02:30 - 03:30			03:30 - 04:30		
Speed_Range	**PC**	**HV**	**Total**	**PC**	**HV**	**Total**	**PC**	**HV**	**Total**	**PC**	**HV**	**Total**	**PC**	**HV**	**Total**	**PC**	**HV**	**Total**	**PC**	**HV**	**Total**
<10	0.0%	0.0%	0.0%	0.0%	1.3%	0.7%	1.6%	0.0%	0.8%	0.0%	0.0%	0.0%	1.5%	0.0%	0.7%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
10-14	0.5%	1.6%	0.9%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
15-19	0.0%	0.0%	0.0%	2.6%	0.0%	1.3%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
20-24	2.3%	1.6%	2.1%	2.6%	2.7%	2.6%	3.2%	0.0%	1.7%	0.0%	0.0%	0.0%	1.5%	0.0%	0.7%	0.0%	0.0%	0.0%	0.0%	1.0%	0.5%
25-29	2.7%	0.8%	2.1%	7.8%	6.7%	7.2%	3.2%	3.6%	3.4%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	3.3%	0.0%	1.4%	0.0%	0.0%	0.0%
30-34	8.2%	2.5%	6.2%	7.8%	8.0%	7.9%	11.3%	3.6%	7.6%	0.0%	1.3%	0.6%	0.0%	0.0%	0.0%	3.3%	0.0%	1.4%	1.9%	0.0%	1.0%
35-39	14.6%	13.1%	14.1%	14.3%	5.3%	9.9%	3.2%	5.4%	4.2%	6.7%	1.3%	3.9%	4.5%	2.4%	3.3%	11.5%	1.2%	5.6%	5.6%	1.0%	3.4%
40-44	18.7%	21.3%	19.6%	16.9%	13.3%	15.1%	21.0%	16.1%	18.6%	16.0%	15.2%	15.6%	9.1%	11.9%	10.7%	13.1%	12.2%	12.6%	13.9%	6.3%	10.3%
45-49	28.8%	22.1%	26.4%	18.2%	20.0%	19.1%	16.1%	14.3%	15.3%	25.3%	20.3%	22.7%	19.7%	25.0%	22.7%	18.0%	15.9%	16.8%	19.4%	16.7%	18.1%
50-54	13.2%	13.9%	13.5%	6.5%	6.7%	6.6%	16.1%	10.7%	13.6%	24.0%	21.5%	22.7%	21.2%	17.9%	19.3%	19.7%	14.6%	16.8%	13.0%	18.8%	15.7%
55-59	4.6%	6.6%	5.3%	6.5%	12.0%	9.2%	8.1%	10.7%	9.3%	5.3%	13.9%	9.7%	19.7%	10.7%	14.7%	14.8%	20.7%	18.2%	19.4%	24.0%	21.6%
60-64	3.2%	5.7%	4.1%	3.9%	5.3%	4.6%	6.5%	10.7%	8.5%	9.3%	8.9%	9.1%	16.7%	7.1%	11.3%	9.8%	18.3%	14.7%	10.2%	11.5%	10.8%
65-69	0.9%	4.1%	2.1%	2.6%	4.0%	3.3%	4.8%	7.1%	5.9%	5.3%	3.8%	4.5%	3.0%	9.5%	6.7%	0.0%	4.9%	2.8%	8.3%	9.4%	8.8%
70-74	1.8%	2.5%	2.1%	3.9%	8.0%	5.9%	3.2%	5.4%	4.2%	2.7%	7.6%	5.2%	3.0%	8.3%	6.0%	1.6%	6.1%	4.2%	2.8%	2.1%	2.5%
75 and above	0.5%	4.1%	1.8%	6.5%	6.7%	6.6%	1.6%	12.5%	6.8%	5.3%	6.3%	5.8%	0.0%	7.1%	4.0%	4.9%	6.1%	5.6%	5.6%	9.4%	7.4%
Total	219	122	341	77	75	152	62	56	118	75	79	154	66	84	150	61	82	143	108	96	204
85th Percentile	53.46	60.02	55.33	60.02	69.12	65.98	60.54	73.15	66.07	62.84	68.09	65.70	63.77	69.49	65.65	60.02	67.53	63.49	65.65	68.46	66.59
Average	44.91	48.90	46.34	46.28	50.41	48.32	46.66	55.32	50.77	52.44	54.98	53.74	52.52	56.02	54.48	50.46	56.69	54.03	54.26	57.45	55.76
Std Dev	9.83	13.17	11.28	15.62	17.08	16.44	13.34	15.83	15.14	10.57	11.86	11.29	10.77	11.84	11.48	11.41	11.13	11.63	11.23	11.69	11.53
Min	10.31	10.31	10.31	16.88	6.56	6.56	4.69	27.20	4.69	35.64	30.95	30.95	4.69	39.39	4.69	26.26	35.64	26.26	32.82	22.51	22.51
Max	76.90	90.97	90.97	95.66	96.60	96.60	75.97	90.97	90.97	82.53	95.66	95.66	72.21	87.22	87.22	81.59	93.79	93.79	90.04	93.79	93.79
Range	66.59	80.66	80.66	78.78	90.04	90.04	71.28	63.78	86.29	46.90	64.72	64.72	67.53	47.83	82.54	55.34	58.15	67.53	57.21	71.28	71.28

Day 4 – 3rdWA

	21:30 - 22:30			22:30 - 23:30			23:30 - 00:30			00:30 - 01:30			01:30 - 02:30			02:30 - 03:30			03:30 - 04:30		
Speed_Range	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total
<10	0.0%	0.0%	0.0%	0.7%	1.1%	0.8%	0.0%	0.0%	0.0%	1.4%	0.0%	0.8%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
10-14	0.0%	0.0%	0.0%	0.0%	1.1%	0.4%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
15-19	0.0%	0.0%	0.0%	0.7%	1.1%	0.8%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
20-24	0.4%	0.0%	0.3%	0.0%	3.2%	1.2%	1.8%	0.0%	0.8%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
25-29	1.3%	0.0%	0.9%	2.0%	2.1%	2.0%	3.5%	3.0%	3.3%	5.8%	3.2%	4.5%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
30-34	0.4%	0.9%	0.6%	4.7%	1.1%	3.3%	3.5%	0.0%	1.6%	4.3%	0.0%	2.3%	1.4%	0.0%	0.7%	0.0%	0.0%	0.0%	0.9%	1.3%	1.0%
35-39	7.6%	3.4%	6.3%	19.3%	17.0%	18.4%	15.8%	24.2%	20.3%	18.8%	4.8%	12.1%	6.8%	3.1%	5.1%	1.6%	0.0%	0.7%	6.0%	1.3%	4.1%
40-44	14.0%	18.1%	15.3%	21.3%	17.0%	19.7%	19.3%	18.2%	18.7%	10.1%	23.8%	16.7%	9.6%	7.8%	8.8%	10.9%	8.5%	9.6%	9.5%	6.3%	8.2%
45-49	31.4%	37.1%	33.2%	18.7%	26.6%	21.7%	19.3%	19.7%	19.5%	21.7%	34.9%	28.0%	19.2%	37.5%	27.7%	28.1%	28.2%	28.1%	17.2%	24.1%	20.0%
50-54	23.7%	28.4%	25.3%	17.3%	22.3%	19.3%	10.5%	9.1%	9.8%	23.2%	12.7%	18.2%	41.1%	29.7%	35.8%	25.0%	36.6%	31.1%	25.9%	35.4%	29.7%
55-59	9.3%	5.2%	8.0%	6.7%	2.1%	4.9%	17.5%	13.6%	15.4%	2.9%	11.1%	6.8%	9.6%	12.5%	10.9%	15.6%	15.5%	15.6%	19.0%	17.7%	18.5%
60-64	7.6%	5.2%	6.8%	6.0%	3.2%	4.9%	1.8%	3.0%	2.4%	1.4%	6.3%	3.8%	9.6%	7.8%	8.8%	7.8%	9.9%	8.9%	10.3%	10.1%	10.3%
65-69	1.7%	0.0%	1.1%	1.3%	1.1%	1.2%	3.5%	1.5%	2.4%	4.3%	0.0%	2.3%	1.4%	1.6%	1.5%	4.7%	0.0%	2.2%	7.8%	0.0%	4.6%
70-74	1.7%	0.0%	1.1%	0.7%	0.0%	0.4%	1.8%	0.0%	0.8%	1.4%	1.6%	1.5%	1.4%	0.0%	0.7%	3.1%	0.0%	1.5%	2.6%	1.3%	2.1%
75 and above	0.8%	1.7%	1.1%	0.7%	1.1%	0.8%	1.8%	7.6%	4.9%	4.3%	1.6%	3.0%	0.0%	0.0%	0.0%	3.1%	1.4%	2.2%	0.9%	2.5%	1.5%
Total	236	116	352	150	94	244	57	66	123	69	63	132	73	64	137	64	71	135	116	79	195
85th Percentile	57.68	53.83	56.77	55.55	53.15	54.06	58.58	57.90	58.58	54.96	56.77	56.18	56.95	56.36	56.77	62.29	56.77	59.39	62.20	59.49	61.29
Average	49.88	49.52	49.76	46.01	44.70	45.51	47.44	48.44	47.98	46.90	48.41	47.62	51.47	50.92	51.21	53.59	52.45	52.99	53.66	53.29	53.51
Std Dev	8.56	7.26	8.15	9.97	10.80	10.29	11.13	12.25	11.71	12.91	8.79	11.12	7.25	6.07	6.70	9.03	6.23	7.68	8.92	7.68	8.42
Min	23.30	34.16	23.30	8.83	9.73	8.83	24.21	26.02	24.21	8.83	26.92	8.83	33.25	36.87	33.25	36.87	43.20	36.87	33.25	34.16	33.25
Max	81.20	84.81	84.81	80.29	86.62	86.62	77.58	86.62	86.62	83.91	80.29	83.91	73.96	69.44	73.96	83.91	83.00	83.91	82.10	82.10	82.10
Range	57.89	50.66	61.51	71.46	76.89	77.80	53.37	60.61	62.42	75.08	53.37	75.08	40.71	32.57	40.71	47.04	39.80	47.04	48.85	47.94	48.85

Day 4 – 4thWA

	21:30 - 22:30			22:30 - 23:30			23:30 - 00:30			00:30 - 01:30			01:30 - 02:30			02:30 - 03:30			03:30 - 04:30		
Speed_Range	**PC**	**HV**	**Total**	**PC**	**HV**	**Total**	**PC**	**HV**	**Total**	**PC**	**HV**	**Total**	**PC**	**HV**	**Total**	**PC**	**HV**	**Total**	**PC**	**HV**	**Total**
<10	0.0%	0.9%	0.3%	0.6%	2.1%	1.2%	0.0%	2.8%	1.2%	1.8%	2.1%	1.9%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
10-14	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.4%	0.6%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
15-19	0.9%	0.0%	0.6%	0.6%	0.0%	0.4%	1.0%	1.4%	1.2%	0.0%	2.1%	1.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
20-24	0.5%	0.0%	0.3%	0.0%	0.0%	0.0%	0.0%	1.4%	0.6%	3.6%	2.1%	2.9%	1.8%	0.0%	0.9%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
25-29	0.0%	0.0%	0.0%	1.2%	0.0%	0.8%	1.0%	0.0%	0.6%	3.6%	0.0%	1.9%	0.0%	0.0%	0.0%	1.3%	0.0%	0.7%	0.0%	0.0%	0.0%
30-34	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	2.8%	1.2%	9.1%	2.1%	5.8%	1.8%	1.6%	1.7%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
35-39	0.9%	3.4%	1.8%	4.3%	3.1%	3.9%	8.0%	5.6%	7.0%	10.9%	2.1%	6.8%	9.1%	4.8%	6.8%	2.6%	0.0%	1.4%	2.7%	0.0%	1.5%
40-44	2.8%	6.8%	4.2%	4.3%	2.1%	3.5%	9.0%	4.2%	7.0%	14.5%	16.7%	15.5%	12.7%	8.1%	10.3%	6.6%	7.2%	6.9%	3.6%	4.7%	4.1%
45-49	7.8%	8.5%	8.1%	8.1%	3.1%	6.2%	9.0%	9.7%	9.3%	14.5%	10.4%	12.6%	9.1%	8.1%	8.5%	5.3%	5.8%	5.5%	2.7%	7.1%	4.6%
50-54	22.1%	20.5%	21.6%	23.0%	20.6%	22.1%	17.0%	27.8%	21.5%	12.7%	20.8%	16.5%	20.0%	22.6%	21.4%	17.1%	21.7%	19.3%	11.7%	16.5%	13.8%
55-59	20.3%	26.5%	22.5%	21.1%	27.8%	23.6%	18.0%	25.0%	20.9%	5.5%	18.8%	11.7%	16.4%	22.6%	19.7%	35.5%	36.2%	35.9%	19.8%	17.6%	18.9%
60-64	20.7%	18.8%	20.1%	18.6%	23.7%	20.5%	19.0%	5.6%	13.4%	9.1%	6.3%	7.8%	5.5%	11.3%	8.5%	17.1%	14.5%	15.9%	22.5%	24.7%	23.5%
65-69	9.2%	6.8%	8.4%	8.1%	6.2%	7.4%	9.0%	1.4%	5.8%	0.0%	6.3%	2.9%	5.5%	6.5%	6.0%	5.3%	8.7%	6.9%	17.1%	16.5%	16.8%
70-74	6.5%	1.7%	4.8%	4.3%	2.1%	3.5%	6.0%	2.8%	4.7%	0.0%	6.3%	2.9%	3.6%	6.5%	5.1%	3.9%	0.0%	2.1%	7.2%	4.7%	6.1%
75 and above	8.3%	6.0%	7.5%	5.6%	9.3%	7.0%	3.0%	8.3%	5.2%	14.5%	4.2%	9.7%	14.5%	8.1%	11.1%	5.3%	5.8%	5.5%	12.6%	8.2%	10.7%
Total	217	117	334	161	97	258	100	72	172	55	48	103	55	62	117	76	69	145	111	85	196
85th Percentile	69.48	64.31	68.19	66.89	66.38	66.89	68.38	60.88	66.05	64.31	66.70	66.12	74.52	66.89	71.55	64.31	63.01	64.31	74.01	69.48	70.77
Average	59.52	57.00	58.64	56.78	59.56	57.83	55.51	52.34	54.19	50.64	53.23	51.85	55.70	57.34	56.57	57.33	57.11	57.22	63.27	60.85	62.22
Std Dev	11.65	11.49	11.64	11.72	14.74	12.98	11.48	15.00	13.12	19.45	17.19	18.39	15.18	13.01	14.03	9.99	8.35	9.22	11.86	10.72	11.42
Min	19.04	6.11	6.11	7.40	7.40	7.40	19.04	8.69	8.69	6.11	8.69	6.11	20.33	34.56	20.33	25.51	43.61	25.51	37.15	41.03	37.15
Max	100.52	96.64	100.52	108.28	104.40	108.28	91.47	86.29	91.47	97.93	108.28	108.28	92.76	105.69	105.69	92.76	87.59	92.76	97.93	101.81	101.81
Range	81.48	90.53	94.41	100.88	97.00	100.88	72.42	77.60	82.77	91.82	99.58	102.17	72.42	71.13	85.36	67.25	43.97	67.25	60.79	60.79	64.67

Day 5 – RWA

	21:30 - 22:30			22:30 - 23:30			23:30 - 00:30			00:30 - 01:30			01:30 - 02:30			02:30 - 03:30			03:30 - 04:30		
Speed_Range	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total
<10	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.2%	0.7%
10-14	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
15-19	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
20-24	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
25-29	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	2.1%	0.0%	0.9%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
30-34	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
35-39	1.6%	0.0%	1.1%	2.7%	2.7%	2.7%	0.0%	0.0%	0.0%	3.4%	3.1%	3.3%	0.0%	2.9%	1.7%	2.8%	0.0%	1.0%	1.7%	2.5%	2.1%
40-44	5.7%	3.2%	4.9%	1.8%	2.7%	2.1%	5.3%	5.1%	5.2%	3.4%	7.7%	5.7%	2.1%	5.9%	4.3%	5.6%	1.5%	3.0%	6.7%	0.0%	2.8%
45-49	7.4%	23.8%	13.0%	6.3%	33.3%	17.1%	6.6%	25.6%	16.2%	8.6%	24.6%	17.1%	10.6%	27.9%	20.9%	8.3%	18.5%	14.9%	10.0%	17.3%	14.2%
50-54	16.4%	27.0%	20.0%	15.2%	34.7%	23.0%	17.1%	30.8%	24.0%	15.5%	21.5%	18.7%	17.0%	35.3%	27.8%	13.9%	36.9%	28.7%	13.3%	34.6%	25.5%
55-59	13.9%	23.8%	17.3%	17.0%	16.0%	16.6%	13.2%	11.5%	12.3%	10.3%	21.5%	16.3%	10.6%	14.7%	13.0%	13.9%	27.7%	22.8%	21.7%	25.9%	24.1%
60-64	13.1%	3.2%	9.7%	11.6%	1.3%	7.5%	13.2%	7.7%	10.4%	10.3%	7.7%	8.9%	12.8%	8.8%	10.4%	13.9%	6.2%	8.9%	11.7%	9.9%	10.6%
65-69	8.2%	4.8%	7.0%	8.0%	2.7%	5.9%	6.6%	7.7%	7.1%	10.3%	4.6%	7.3%	8.5%	1.5%	4.3%	11.1%	4.6%	6.9%	8.3%	4.9%	6.4%
70-74	10.7%	4.8%	8.6%	9.8%	1.3%	6.4%	10.5%	5.1%	7.8%	6.9%	0.0%	3.3%	10.6%	1.5%	5.2%	8.3%	4.6%	5.9%	3.3%	0.0%	1.4%
75 and above	23.0%	9.5%	18.4%	27.7%	5.3%	18.7%	27.6%	6.4%	16.9%	31.0%	9.2%	19.5%	25.5%	1.5%	11.3%	22.2%	0.0%	7.9%	23.3%	3.7%	12.1%
Total	122	63	185	112	75	187	76	78	154	58	65	123	47	68	115	36	65	101	60	81	141
85th Percentile	78.83	68.09	77.49	78.83	57.96	76.02	78.83	68.84	76.38	79.23	63.65	77.14	78.92	58.80	72.11	75.90	59.97	69.68	77.38	61.31	68.01
Average	63.65	57.40	61.52	64.88	53.81	60.44	64.57	56.39	60.43	64.78	55.55	59.90	63.85	52.70	57.26	63.04	55.05	57.89	61.67	54.96	57.81
Std Dev	13.86	11.42	13.38	13.83	9.61	13.43	12.48	10.05	12.00	14.69	11.05	13.65	13.90	7.15	11.76	13.24	6.48	10.15	13.10	9.80	11.76
Min	35.36	41.22	35.36	35.36	38.71	35.36	40.38	41.22	40.38	35.36	37.87	35.36	29.50	36.20	29.50	35.36	42.89	35.36	37.03	8.67	8.67
Max	96.60	93.80	96.60	101.28	90.05	101.28	89.12	87.25	89.12	97.54	98.47	98.47	90.05	78.83	90.05	93.80	73.22	93.80	89.12	99.41	99.41
Range	61.24	52.58	61.24	65.92	51.35	65.92	48.74	46.03	48.74	62.18	60.60	63.11	60.55	42.63	60.55	58.44	30.32	58.44	52.08	90.73	90.73

Day 5 – PCMS

	21:30 - 22:30			22:30 - 23:30			23:30 - 00:30			00:30 - 01:30			01:30 - 02:30			02:30 - 03:30			03:30 - 04:30		
Speed_Range	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total
<10	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
10-14	0.6%	0.0%	0.4%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	2.1%	0.0%	0.8%	2.4%	0.0%	0.9%	0.0%	0.0%	0.0%
15-19	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.0%	0.0%	0.5%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
20-24	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
25-29	1.3%	0.0%	0.8%	0.7%	0.0%	0.4%	0.0%	0.0%	0.0%	1.4%	0.0%	0.7%	0.0%	1.3%	0.8%	2.4%	0.0%	0.9%	0.0%	1.2%	0.6%
30-34	1.3%	0.0%	0.8%	1.4%	0.0%	0.9%	2.0%	0.0%	1.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	2.4%	0.0%	0.9%	2.6%	0.0%	1.3%
35-39	2.6%	0.9%	1.9%	1.4%	0.0%	0.9%	2.0%	0.0%	1.1%	2.7%	1.4%	2.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	2.6%	1.2%	1.9%
40-44	6.5%	5.7%	6.1%	3.6%	6.6%	4.8%	6.0%	4.8%	5.5%	6.8%	5.5%	6.2%	6.3%	5.1%	5.6%	9.5%	2.9%	5.4%	3.8%	4.9%	4.4%
45-49	13.5%	11.3%	12.6%	12.1%	12.1%	12.1%	7.0%	14.5%	10.4%	9.6%	20.5%	15.1%	12.5%	16.7%	15.1%	7.1%	11.6%	9.9%	14.1%	14.8%	14.5%
50-54	15.5%	12.3%	14.2%	12.9%	16.5%	14.3%	20.0%	20.5%	20.2%	9.6%	16.4%	13.0%	14.6%	14.1%	14.3%	11.9%	21.7%	18.0%	15.4%	18.5%	17.0%
55-59	14.2%	17.0%	15.3%	16.4%	23.1%	19.0%	10.0%	14.5%	12.0%	16.4%	11.0%	13.7%	25.0%	10.3%	15.9%	14.3%	17.4%	16.2%	16.7%	16.0%	16.4%
60-64	18.1%	17.0%	17.6%	17.1%	11.0%	14.7%	16.0%	12.0%	14.2%	15.1%	13.7%	14.4%	18.8%	11.5%	14.3%	19.0%	10.1%	13.5%	14.1%	18.5%	16.4%
65-69	7.7%	12.3%	9.6%	11.4%	2.2%	7.8%	13.0%	10.8%	12.0%	9.6%	9.6%	9.6%	12.5%	12.8%	12.7%	4.8%	10.1%	8.1%	9.0%	7.4%	8.2%
70-74	8.4%	7.5%	8.0%	9.3%	14.3%	11.3%	8.0%	6.0%	7.1%	13.7%	9.6%	11.6%	2.1%	5.1%	4.0%	9.5%	10.1%	9.9%	10.3%	4.9%	7.5%
75 and above	10.3%	16.0%	12.6%	13.6%	14.3%	13.9%	15.0%	16.9%	15.8%	15.1%	12.3%	13.7%	6.3%	23.1%	16.7%	16.7%	15.9%	16.2%	11.5%	12.3%	11.9%
Total	155	106	261	140	91	231	100	83	183	73	73	146	48	78	126	42	69	111	78	81	159
85th Percentile	71.28	75.26	72.21	74.09	74.09	74.09	74.89	75.97	75.55	74.90	72.21	73.39	66.72	78.02	75.26	74.89	74.65	75.03	73.96	71.28	73.39
Average	58.40	61.83	59.80	61.29	60.74	61.07	60.19	61.61	60.83	61.09	59.84	60.47	57.63	62.26	60.49	59.23	62.22	61.09	59.26	59.02	59.14
Std Dev	13.05	12.19	12.80	13.02	12.90	12.94	13.09	13.37	13.20	12.84	12.66	12.72	11.02	13.81	12.97	16.41	12.37	14.04	12.09	12.35	12.18
Min	13.13	38.45	13.13	27.20	40.33	27.20	15.94	42.20	15.94	29.07	39.39	29.07	14.07	29.07	14.07	11.25	43.14	11.25	30.01	29.07	29.07
Max	90.04	93.79	93.79	95.66	96.60	96.60	90.97	94.72	94.72	85.35	95.66	95.66	78.48	93.79	93.79	91.91	95.66	95.66	83.47	95.66	95.66
Range	76.91	55.34	80.66	68.47	56.27	69.40	75.03	52.52	78.78	56.27	56.27	66.59	64.42	64.72	79.72	80.66	52.52	84.41	53.46	66.59	66.59

Day 5 – BoT

	21:30 - 22:30			22:30 - 23:30			23:30 - 00:30			00:30 - 01:30			01:30 - 02:30			02:30 - 03:30			03:30 - 04:30		
Speed_Range	**PC**	**HV**	**Total**	**PC**	**HV**	**Total**	**PC**	**HV**	**Total**	**PC**	**HV**	**Total**	**PC**	**HV**	**Total**	**PC**	**HV**	**Total**	**PC**	**HV**	**Total**
<10	0.0%	2.0%	0.8%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	2.0%	1.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
10-14	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
15-19	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
20-24	1.4%	0.0%	0.8%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
25-29	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
30-34	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
35-39	0.0%	3.9%	1.6%	0.0%	0.0%	0.0%	0.0%	1.9%	0.9%	0.0%	2.0%	1.1%	5.9%	0.0%	2.4%	0.0%	0.0%	0.0%	0.0%	2.0%	1.0%
40-44	5.6%	3.9%	4.9%	4.8%	8.2%	6.2%	5.3%	1.9%	3.6%	11.4%	9.8%	10.5%	5.9%	2.0%	3.6%	9.7%	7.0%	8.0%	6.4%	4.0%	5.2%
45-49	18.1%	17.6%	17.9%	13.1%	31.1%	20.7%	14.0%	24.5%	19.1%	9.1%	25.5%	17.9%	14.7%	28.6%	22.9%	12.9%	8.8%	10.2%	12.8%	6.0%	9.3%
50-54	20.8%	13.7%	17.9%	15.5%	19.7%	17.2%	19.3%	28.3%	23.6%	18.2%	33.3%	26.3%	20.6%	16.3%	18.1%	19.4%	29.8%	26.1%	23.4%	22.0%	22.7%
55-59	13.9%	13.7%	13.8%	22.6%	8.2%	16.6%	8.8%	15.1%	11.8%	15.9%	9.8%	12.6%	14.7%	20.4%	18.1%	19.4%	21.1%	20.5%	14.9%	30.0%	22.7%
60-64	11.1%	9.8%	10.6%	15.5%	9.8%	13.1%	19.3%	13.2%	16.4%	18.2%	7.8%	12.6%	14.7%	14.3%	14.5%	6.5%	15.8%	12.5%	12.8%	12.0%	12.4%
65-69	8.3%	13.7%	10.6%	13.1%	8.2%	11.0%	15.8%	7.5%	11.8%	11.4%	3.9%	7.4%	8.8%	4.1%	6.0%	16.1%	7.0%	10.2%	17.0%	14.0%	15.5%
70-74	5.6%	5.9%	5.7%	4.8%	6.6%	5.5%	7.0%	1.9%	4.5%	4.5%	3.9%	4.2%	5.9%	4.1%	4.8%	3.2%	7.0%	5.7%	6.4%	2.0%	4.1%
75 and above	15.3%	15.7%	15.4%	10.7%	8.2%	9.7%	10.5%	5.7%	8.2%	11.4%	3.9%	7.4%	8.8%	8.2%	8.4%	12.9%	3.5%	6.8%	6.4%	8.0%	7.2%
Total	72	51	123	84	61	145	57	53	110	44	51	95	34	49	83	31	57	88	47	50	97
85th Percentile	74.71	73.90	75.05	70.67	69.62	70.38	72.10	64.48	69.62	69.81	60.10	67.62	69.67	66.76	69.33	71.05	66.38	68.62	68.76	67.38	68.29
Average	59.74	59.54	59.66	60.27	56.57	58.71	61.07	56.45	58.84	59.32	53.79	56.35	57.69	56.44	56.95	60.34	57.31	58.38	58.39	58.76	58.58
Std Dev	14.21	15.96	14.90	10.82	11.45	11.20	11.92	10.53	11.46	11.69	9.09	10.68	12.18	13.78	13.09	13.17	9.32	10.86	10.30	9.58	9.89
Min	20.10	3.91	3.91	42.00	40.10	40.10	44.86	38.19	38.19	40.10	38.19	38.19	37.24	2.96	2.96	41.05	41.05	41.05	41.05	38.19	38.19
Max	97.24	95.33	97.24	93.43	89.62	93.43	99.14	98.19	99.14	83.90	83.90	83.90	91.52	98.19	98.19	97.24	86.76	97.24	83.90	87.71	87.71
Range	77.14	91.42	93.33	51.42	49.52	53.33	54.28	59.99	60.95	43.81	45.71	45.71	54.28	95.23	95.23	56.19	45.71	56.19	42.85	49.52	49.52

Day 5 – EoT

	21:30 - 22:30			22:30 - 23:30			23:30 - 00:30			00:30 - 01:30			01:30 - 02:30			02:30 - 03:30			03:30 - 04:30		
Speed_Range	**PC**	**HV**	**Total**	**PC**	**HV**	**Total**	**PC**	**HV**	**Total**	**PC**	**HV**	**Total**	**PC**	**HV**	**Total**	**PC**	**HV**	**Total**	**PC**	**HV**	**Total**
<10	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
10-14	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
15-19	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
20-24	0.0%	0.0%	0.0%	0.0%	1.1%	0.4%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
25-29	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.0%	0.5%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
30-34	0.6%	0.0%	0.4%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.5%	0.8%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.3%	0.0%	0.7%
35-39	1.9%	9.3%	4.6%	2.1%	0.0%	1.3%	2.0%	2.1%	2.0%	0.0%	6.1%	3.3%	2.0%	2.7%	2.4%	0.0%	1.5%	0.9%	0.0%	0.0%	0.0%
40-44	5.6%	14.4%	8.9%	2.9%	11.8%	6.4%	8.0%	13.4%	10.7%	14.8%	15.2%	15.0%	9.8%	8.2%	8.9%	8.2%	3.0%	5.2%	2.7%	2.8%	2.7%
45-49	31.5%	22.7%	28.2%	20.0%	29.0%	23.6%	16.0%	26.8%	21.3%	25.9%	36.4%	31.7%	21.6%	43.8%	34.7%	26.5%	31.8%	29.6%	16.0%	32.4%	24.0%
50-54	22.8%	28.9%	25.1%	20.0%	21.5%	20.6%	24.0%	23.7%	23.9%	18.5%	25.8%	22.5%	17.6%	24.7%	21.8%	18.4%	43.9%	33.0%	28.0%	26.8%	27.4%
55-59	21.0%	13.4%	18.1%	22.9%	19.4%	21.5%	22.0%	20.6%	21.3%	18.5%	10.6%	14.2%	21.6%	13.7%	16.9%	20.4%	10.6%	14.8%	29.3%	19.7%	24.7%
60-64	9.3%	5.2%	7.7%	17.1%	8.6%	13.7%	13.0%	5.2%	9.1%	11.1%	1.5%	5.8%	19.6%	2.7%	9.7%	14.3%	4.5%	8.7%	9.3%	14.1%	11.6%
65-69	2.5%	0.0%	1.5%	7.1%	0.0%	4.3%	5.0%	2.1%	3.6%	5.6%	0.0%	2.5%	0.0%	0.0%	0.0%	4.1%	1.5%	2.6%	4.0%	1.4%	2.7%
70-74	1.9%	3.1%	2.3%	5.0%	0.0%	3.0%	4.0%	1.0%	2.5%	1.9%	1.5%	1.7%	0.0%	2.7%	1.6%	4.1%	0.0%	1.7%	5.3%	0.0%	2.7%
75 and above	3.1%	3.1%	3.1%	2.9%	8.6%	5.2%	6.0%	4.1%	5.1%	3.7%	1.5%	2.5%	7.8%	1.4%	4.0%	4.1%	3.0%	3.5%	4.0%	2.8%	3.4%
Total	162	97	259	140	93	233	100	97	197	54	66	120	51	73	124	49	66	115	75	71	146
85th Percentile	60.58	58.43	59.51	65.05	60.80	63.81	65.05	57.35	63.81	62.79	54.39	58.59	62.74	56.28	60.10	63.60	55.20	60.58	63.81	60.58	63.01
Average	53.82	51.90	53.10	56.57	54.64	55.80	56.46	52.52	54.52	54.24	49.95	51.88	56.21	51.14	53.23	55.99	52.44	53.95	56.55	54.71	55.66
Std Dev	8.83	11.26	9.84	8.84	13.31	10.86	10.17	9.10	9.83	8.73	9.40	9.32	13.26	7.22	10.41	11.13	7.02	9.13	8.90	9.00	8.96
Min	31.51	35.82	31.51	35.82	22.89	22.89	36.89	29.36	29.36	40.12	33.66	33.66	37.97	35.82	35.82	41.20	37.97	37.97	30.43	42.28	30.43
Max	98.27	109.04	109.04	91.81	104.73	104.73	98.27	92.89	98.27	78.89	104.73	104.73	104.73	82.12	104.73	101.50	83.20	101.50	89.66	101.50	101.50
Range	66.76	73.22	77.53	55.99	81.84	81.84	61.38	63.53	68.92	38.76	71.07	71.07	66.76	46.30	68.92	60.30	45.23	63.53	59.22	59.22	71.07

Day 5 – 1stWA

	21:30 - 22:30			22:30 - 23:30			23:30 - 00:30			00:30 - 01:30			01:30 - 02:30			02:30 - 03:30			03:30 - 04:30		
Speed_Range	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total
<10	0.4%	0.0%	0.3%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.4%	0.6%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
10-14	0.4%	0.0%	0.3%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
15-19	1.3%	2.5%	1.6%	0.5%	0.0%	0.4%	1.6%	2.4%	1.9%	2.1%	0.0%	1.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.3%	0.5%
20-24	1.8%	1.2%	1.6%	0.5%	4.5%	1.8%	8.1%	7.3%	7.8%	3.1%	2.9%	3.0%	0.0%	1.4%	0.6%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
25-29	4.9%	3.7%	4.6%	3.7%	4.5%	3.9%	4.8%	7.3%	5.8%	2.1%	7.1%	4.2%	3.6%	0.0%	1.9%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
30-34	4.4%	4.9%	4.6%	3.7%	5.7%	4.3%	6.5%	6.1%	6.3%	6.3%	5.7%	6.0%	3.6%	1.4%	2.6%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
35-39	9.8%	13.6%	10.8%	11.5%	9.1%	10.8%	16.1%	22.0%	18.4%	7.3%	20.0%	12.7%	2.4%	5.7%	3.9%	1.6%	3.1%	2.4%	0.9%	1.3%	1.1%
40-44	17.3%	19.8%	18.0%	11.5%	20.5%	14.3%	16.9%	23.2%	19.4%	15.6%	14.3%	15.1%	15.5%	15.7%	15.6%	8.2%	4.6%	6.3%	7.1%	4.0%	5.9%
45-49	19.1%	21.0%	19.6%	24.1%	19.3%	22.6%	24.2%	12.2%	19.4%	18.8%	24.3%	21.1%	17.9%	20.0%	18.8%	16.4%	9.2%	12.7%	7.1%	10.7%	8.6%
50-54	22.2%	19.8%	21.6%	21.5%	17.0%	20.1%	12.1%	8.5%	10.7%	21.9%	11.4%	17.5%	21.4%	24.3%	22.7%	21.3%	36.9%	29.4%	22.3%	32.0%	26.2%
55-59	10.7%	9.9%	10.5%	14.1%	11.4%	13.3%	6.5%	4.9%	5.8%	16.7%	8.6%	13.3%	15.5%	17.1%	16.2%	24.6%	26.2%	25.4%	33.9%	25.3%	30.5%
60-64	3.6%	0.0%	2.6%	3.7%	3.4%	3.6%	0.8%	0.0%	0.5%	1.0%	2.9%	1.8%	10.7%	10.0%	10.4%	13.1%	9.2%	11.1%	14.3%	18.7%	16.0%
65-69	2.7%	0.0%	2.0%	3.1%	0.0%	2.2%	2.4%	1.2%	1.9%	0.0%	0.0%	0.0%	6.0%	1.4%	3.9%	8.2%	3.1%	5.6%	7.1%	4.0%	5.9%
70-74	0.9%	1.2%	1.0%	2.1%	2.3%	2.2%	0.0%	0.0%	0.0%	4.2%	1.4%	3.0%	2.4%	2.9%	2.6%	4.9%	4.6%	4.8%	2.7%	2.7%	2.7%
75 and above	0.4%	2.5%	1.0%	0.0%	2.3%	0.7%	0.0%	4.9%	1.9%	1.0%	0.0%	0.6%	1.2%	0.0%	0.6%	1.6%	3.1%	2.4%	4.5%	0.0%	2.7%
Total	225	81	306	191	88	279	124	82	206	96	70	166	84	70	154	61	65	126	112	75	187
85th Percentile	55.91	54.60	55.91	58.52	55.91	57.60	51.40	52.90	51.99	57.21	54.14	57.21	61.13	59.37	61.13	63.74	61.13	63.74	63.74	61.13	62.43
Average	46.29	45.96	46.21	48.30	46.84	47.84	42.46	42.31	42.40	47.57	43.51	45.86	51.54	51.11	51.35	55.93	55.81	55.86	57.21	55.05	56.35
Std Dev	11.13	11.82	11.30	10.11	12.17	10.80	10.79	15.82	12.99	11.59	10.90	11.45	10.25	9.27	9.79	8.46	9.52	8.99	8.07	8.16	8.15
Min	6.31	16.75	6.31	16.75	20.66	16.75	15.44	16.75	15.44	18.05	5.00	5.00	28.50	20.66	20.66	37.63	35.02	35.02	35.02	16.75	16.75
Max	80.71	92.45	92.45	74.18	95.07	95.07	66.35	109.42	109.42	82.01	70.26	82.01	82.01	74.18	82.01	78.10	100.29	100.29	79.40	71.57	79.40
Range	74.40	75.71	86.15	57.43	74.40	78.32	50.91	92.68	93.98	63.96	65.27	77.01	53.52	53.52	61.35	40.46	65.27	65.27	44.38	54.82	62.65

Day 5 – 2ndWA

	21:30 - 22:30			22:30 - 23:30			23:30 - 00:30			00:30 - 01:30			01:30 - 02:30			02:30 - 03:30			03:30 - 04:30		
Speed_Range	**PC**	**HV**	**Total**	**PC**	**HV**	**Total**	**PC**	**HV**	**Total**	**PC**	**HV**	**Total**	**PC**	**HV**	**Total**	**PC**	**HV**	**Total**	**PC**	**HV**	**Total**
<10	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.0%	0.0%	0.6%	0.0%	4.5%	2.4%	0.0%	0.0%	0.0%	1.8%	0.0%	0.8%	0.0%	0.0%	0.0%
10-14	0.0%	0.0%	0.0%	0.7%	1.5%	1.0%	1.0%	1.4%	1.2%	5.2%	0.0%	2.4%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
15-19	0.0%	0.0%	0.0%	1.4%	0.0%	1.0%	1.0%	4.2%	2.4%	5.2%	1.5%	3.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
20-24	0.6%	0.0%	0.4%	2.1%	1.5%	1.9%	2.1%	4.2%	3.0%	3.4%	6.0%	4.8%	3.9%	1.5%	2.6%	1.8%	0.0%	0.8%	0.9%	1.2%	1.1%
25-29	2.5%	2.4%	2.5%	0.7%	1.5%	1.0%	9.3%	2.8%	6.5%	5.2%	6.0%	5.6%	5.9%	1.5%	3.4%	1.8%	0.0%	0.8%	0.9%	0.0%	0.5%
30-34	2.5%	1.2%	2.1%	2.8%	1.5%	2.4%	4.1%	5.6%	4.8%	10.3%	6.0%	8.0%	2.0%	1.5%	1.7%	5.4%	0.0%	2.5%	1.9%	0.0%	1.1%
35-39	4.5%	11.8%	7.0%	11.3%	7.4%	10.0%	7.2%	9.9%	8.3%	5.2%	19.4%	12.8%	21.6%	9.2%	14.7%	8.9%	3.2%	5.9%	6.5%	3.7%	5.3%
40-44	9.6%	8.2%	9.1%	11.3%	5.9%	9.5%	9.3%	8.5%	8.9%	13.8%	7.5%	10.4%	9.8%	7.7%	8.6%	8.9%	6.5%	7.6%	6.5%	2.5%	4.8%
45-49	12.1%	9.4%	11.2%	8.5%	11.8%	9.5%	15.5%	12.7%	14.3%	6.9%	7.5%	7.2%	13.7%	21.5%	18.1%	14.3%	24.2%	19.5%	12.1%	12.3%	12.2%
50-54	15.9%	20.0%	17.4%	16.2%	22.1%	18.1%	14.4%	15.5%	14.9%	17.2%	14.9%	16.0%	15.7%	23.1%	19.8%	7.1%	17.7%	12.7%	13.1%	23.5%	17.6%
55-59	12.7%	3.5%	9.5%	9.9%	2.9%	7.6%	7.2%	12.7%	9.5%	3.4%	6.0%	4.8%	7.8%	12.3%	10.3%	14.3%	17.7%	16.1%	12.1%	23.5%	17.0%
60-64	12.7%	14.1%	13.2%	8.5%	16.2%	11.0%	5.2%	8.5%	6.5%	6.9%	7.5%	7.2%	5.9%	9.2%	7.8%	10.7%	11.3%	11.0%	16.8%	11.1%	14.4%
65-69	8.9%	10.6%	9.5%	8.5%	11.8%	9.5%	3.1%	5.6%	4.2%	8.6%	1.5%	4.8%	2.0%	3.1%	2.6%	7.1%	1.6%	4.2%	14.0%	3.7%	9.6%
70-74	7.6%	4.7%	6.6%	6.3%	2.9%	5.2%	7.2%	1.4%	4.8%	0.0%	0.0%	0.0%	2.0%	0.0%	0.9%	5.4%	4.8%	5.1%	5.6%	4.9%	5.3%
75 and above	10.2%	14.1%	11.6%	12.0%	13.2%	12.4%	12.4%	7.0%	10.1%	8.6%	11.9%	10.4%	9.8%	9.2%	9.5%	12.5%	12.9%	12.7%	9.3%	13.6%	11.2%
Total	157	85	242	142	68	210	97	71	168	58	67	125	51	65	116	56	62	118	107	81	188
85th Percentile	72.28	72.87	72.28	72.28	72.13	72.28	73.16	64.89	69.32	66.37	64.89	65.48	61.20	61.94	61.94	73.02	73.76	73.76	69.47	73.76	70.80
Average	57.50	58.89	57.99	55.31	57.87	56.14	51.14	49.30	50.36	46.68	46.57	46.62	49.65	53.16	51.62	54.63	57.72	56.25	57.49	58.63	57.98
Std Dev	15.44	19.23	16.84	18.06	18.18	18.10	18.88	16.91	18.05	18.96	20.26	19.59	17.39	14.56	15.89	17.95	13.38	15.72	13.41	13.69	13.51
Min	20.57	26.48	20.57	10.22	10.22	10.22	2.84	14.66	2.84	10.22	1.36	1.36	20.57	20.57	20.57	5.79	36.82	5.79	23.52	20.57	20.57
Max	100.35	109.22	109.22	101.83	106.26	106.26	104.78	100.35	104.78	97.40	94.44	97.40	101.83	98.87	101.83	101.83	98.87	101.83	103.31	101.83	103.31
Range	79.79	82.74	88.65	91.61	96.04	96.04	101.95	85.70	101.95	87.17	93.08	96.04	81.26	78.31	81.26	96.04	62.06	96.04	79.79	81.26	82.74

Day 5 – 3rdWA

	21:30 - 22:30			22:30 - 23:30			23:30 - 00:30			00:30 - 01:30			01:30 - 02:30			02:30 - 03:30			03:30 - 04:30		
Speed_Range	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total
<10	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
10-14	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.0%	0.0%	0.6%
15-19	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.1%	0.0%	0.6%	0.0%	2.7%	1.4%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
20-24	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.4%	0.6%	1.4%	2.7%	2.0%	0.0%	0.0%	0.0%	2.0%	0.0%	1.1%
25-29	0.5%	0.0%	0.3%	0.0%	0.0%	0.0%	0.8%	0.0%	0.5%	2.2%	2.9%	2.5%	4.2%	2.7%	3.4%	1.7%	2.9%	2.3%	1.0%	2.6%	1.7%
30-34	2.4%	1.1%	2.0%	1.1%	0.0%	0.7%	0.8%	2.6%	1.5%	2.2%	5.7%	3.8%	6.9%	9.3%	8.2%	3.4%	2.9%	3.1%	4.1%	2.6%	3.4%
35-39	7.1%	4.4%	6.3%	1.6%	4.5%	2.6%	4.2%	6.4%	5.1%	8.9%	15.7%	11.9%	2.8%	6.7%	4.8%	3.4%	10.0%	7.0%	5.1%	3.9%	4.6%
40-44	5.2%	9.9%	6.6%	6.6%	12.4%	8.5%	11.0%	16.7%	13.3%	12.2%	24.3%	17.5%	8.3%	22.7%	15.6%	22.0%	18.6%	20.2%	12.2%	7.9%	10.3%
45-49	12.7%	22.0%	15.5%	14.2%	15.7%	14.7%	19.5%	23.1%	20.9%	22.2%	21.4%	21.9%	25.0%	18.7%	21.8%	13.6%	15.7%	14.7%	15.3%	17.1%	16.1%
50-54	22.2%	29.7%	24.4%	16.9%	30.3%	21.3%	23.7%	25.6%	24.5%	21.1%	21.4%	21.3%	25.0%	20.0%	22.4%	20.3%	18.6%	19.4%	23.5%	27.6%	25.3%
55-59	19.8%	9.9%	16.8%	23.0%	21.3%	22.4%	16.9%	12.8%	15.3%	16.7%	2.9%	10.6%	11.1%	9.3%	10.2%	22.0%	10.0%	15.5%	10.2%	13.2%	11.5%
60-64	9.4%	4.4%	7.9%	12.6%	9.0%	11.4%	8.5%	7.7%	8.2%	5.6%	1.4%	3.8%	6.9%	0.0%	3.4%	8.5%	4.3%	6.2%	10.2%	11.8%	10.9%
65-69	9.9%	9.9%	9.9%	14.2%	2.2%	10.3%	5.9%	2.6%	4.6%	4.4%	1.4%	3.1%	4.2%	1.3%	2.7%	1.7%	8.6%	5.4%	6.1%	5.3%	5.7%
70-74	2.8%	2.2%	2.6%	3.8%	1.1%	2.9%	2.5%	1.3%	2.0%	1.1%	0.0%	0.6%	0.0%	2.7%	1.4%	1.7%	1.4%	1.6%	5.1%	1.3%	3.4%
75 and above	8.0%	6.6%	7.6%	6.0%	3.4%	5.1%	5.9%	1.3%	4.1%	2.2%	1.4%	1.9%	4.2%	1.3%	2.7%	1.7%	7.1%	4.7%	4.1%	6.6%	5.2%
Total	212	91	303	183	89	272	118	78	196	90	70	160	72	75	147	59	70	129	98	76	174
85th Percentile	67.50	66.35	67.50	67.50	60.39	66.35	64.06	57.19	61.77	58.33	53.35	57.19	59.88	54.78	57.19	59.48	65.95	62.91	64.57	62.91	64.06
Average	56.17	54.89	55.78	57.85	53.48	56.42	54.74	50.85	53.19	50.62	45.25	48.27	50.62	45.81	48.17	50.90	52.08	51.54	52.54	54.51	53.40
Std Dev	11.88	12.84	12.17	10.35	8.73	10.04	12.97	9.45	11.82	10.56	9.25	10.33	12.80	11.78	12.48	9.98	14.49	12.59	12.96	13.04	12.99
Min	29.70	34.28	29.70	31.99	35.43	31.99	25.12	34.28	25.12	19.40	23.98	19.40	22.83	17.11	17.11	28.56	27.41	27.41	13.67	26.27	13.67
Max	92.69	106.43	106.43	89.25	82.38	89.25	109.87	98.42	109.87	83.53	82.38	83.53	105.29	88.11	105.29	83.53	100.71	100.71	86.96	105.29	105.29
Range	62.99	72.15	76.73	57.26	46.95	57.26	84.74	64.13	84.74	64.13	58.41	64.13	82.45	71.00	88.18	54.97	73.29	73.29	73.29	79.02	91.62

Day 5 – 4thWA

	21:30 - 22:30			22:30 - 23:30			23:30 - 00:30			00:30 - 01:30			01:30 - 02:30			02:30 - 03:30			03:30 - 04:30		
Speed_Range	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total	PC	HV	Total
<10	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
10-14	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
15-19	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.4%	0.7%	0.0%	3.3%	1.6%	0.0%	0.0%	0.0%
20-24	0.9%	1.1%	1.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.4%	0.6%	0.0%	0.0%	0.0%	3.1%	6.7%	4.8%	1.6%	3.7%	2.5%
25-29	0.5%	0.0%	0.3%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	3.8%	1.4%	2.7%	1.6%	1.7%	1.6%	2.5%	2.5%	2.5%
30-34	1.8%	1.1%	1.6%	0.5%	0.0%	0.4%	2.4%	1.2%	1.9%	3.2%	4.2%	3.7%	6.4%	6.9%	6.7%	14.1%	5.0%	9.7%	4.9%	3.7%	4.4%
35-39	6.9%	4.4%	6.1%	1.6%	2.4%	1.9%	4.7%	2.4%	3.8%	6.5%	4.2%	5.5%	11.5%	13.9%	12.7%	10.9%	16.7%	13.7%	4.9%	11.1%	7.4%
40-44	5.5%	9.9%	6.8%	7.7%	11.9%	9.0%	5.5%	8.4%	6.7%	11.8%	19.7%	15.2%	20.5%	19.4%	20.0%	14.1%	11.7%	12.9%	11.5%	13.6%	12.3%
45-49	12.8%	13.2%	12.9%	3.8%	2.4%	3.4%	5.5%	8.4%	6.7%	17.2%	22.5%	19.5%	10.3%	13.9%	12.0%	10.9%	8.3%	9.7%	15.6%	8.6%	12.8%
50-54	19.3%	31.9%	23.0%	15.3%	15.5%	15.4%	15.0%	19.3%	16.7%	19.4%	19.7%	19.5%	23.1%	23.6%	23.3%	17.2%	16.7%	16.9%	22.1%	30.9%	25.6%
55-59	17.9%	19.8%	18.4%	23.5%	27.4%	24.7%	24.4%	28.9%	26.2%	20.4%	15.5%	18.3%	11.5%	6.9%	9.3%	14.1%	18.3%	16.1%	19.7%	16.0%	18.2%
60-64	13.3%	8.8%	12.0%	15.3%	26.2%	18.7%	14.2%	20.5%	16.7%	7.5%	7.0%	7.3%	3.8%	5.6%	4.7%	10.9%	5.0%	8.1%	13.1%	2.5%	8.9%
65-69	8.7%	4.4%	7.4%	18.0%	6.0%	14.2%	15.0%	7.2%	11.9%	7.5%	2.8%	5.5%	5.1%	2.8%	4.0%	1.6%	3.3%	2.4%	1.6%	2.5%	2.0%
70-74	4.1%	0.0%	2.9%	7.7%	4.8%	6.7%	6.3%	0.0%	3.8%	3.2%	1.4%	2.4%	1.3%	1.4%	1.3%	1.6%	1.7%	1.6%	2.5%	1.2%	2.0%
75 and above	8.3%	5.5%	7.4%	6.6%	3.6%	5.6%	7.1%	3.6%	5.7%	3.2%	1.4%	2.4%	2.6%	2.8%	2.7%	0.0%	1.7%	0.8%	0.0%	3.7%	1.5%
Total	218	91	309	183	84	267	127	83	210	93	71	164	78	72	150	64	60	124	122	81	203
85th Percentile	68.77	61.72	66.89	69.48	64.31	69.48	69.48	63.01	66.89	63.01	58.49	61.72	57.84	57.00	57.84	59.13	58.03	59.13	60.43	56.55	59.13
Average	56.27	53.93	55.58	60.53	58.07	59.76	58.50	56.45	57.69	53.45	49.99	51.95	49.35	48.16	48.78	47.11	46.93	47.02	50.93	49.60	50.40
Std Dev	12.30	11.24	12.03	10.89	10.93	10.94	11.57	10.23	11.08	10.97	9.31	10.40	12.23	11.60	11.91	11.33	14.52	12.92	10.11	13.27	11.46
Min	22.92	21.63	21.63	34.56	37.15	34.56	30.68	34.56	30.68	30.68	21.63	21.63	28.09	16.45	16.45	21.63	19.04	19.04	22.92	20.33	20.33
Max	96.64	103.11	103.11	99.23	104.40	104.40	96.64	100.52	100.52	90.17	78.53	90.17	101.81	94.05	101.81	70.77	100.52	100.52	74.65	103.11	103.11
Range	73.72	81.48	81.48	64.67	67.25	69.84	65.96	65.96	69.84	59.49	56.91	68.54	73.72	77.60	85.36	49.15	81.48	81.48	51.73	82.77	82.77