Infrastructure and Policy Needs for Personal Electric Mobility Devices in a Connected Vehicle World

Final Report

by

Judith L. Mwakalonge, South Carolina State University
Md Mahmud Hasan Mamun, South Carolina State University
Jae-Dong Hong, South Carolina State University
Mashrur Chowdhury, Clemson University

Contact information
Judith L. Mwakalonge, Ph.D.
134 Engineering and Computer Science Complex, SCSU
300 College Street NE, Orangeburg, SC 29117
Phone: (803) 536-8321; *E-mail:* jmwakalo@scsu.edu

November 2019

Center for Connected Multimodal Mobility (C^2M^2)

200 Lowry Hall, Clemson University
Clemson, SC 29634

DISCLAIMER

The contents of this report reflect the views of the authors, who are responsible for the facts and the accuracy of the information presented herein. This document is disseminated in the interest of information exchange. The report is funded, partially or entirely, by the Center for Connected Multimodal Mobility (C^2M^2) (Tier 1 University Transportation Center) Grant, which is headquartered at Clemson University, Clemson, South Carolina, USA, from the U.S. Department of Transportation's University Transportation Centers Program. However, the U.S. Government assumes no liability for the contents or use thereof.

ACKNOWLEDGMENT

The authors would like to thank the administration of the Transportation Program of the South Carolina State University (SCSU) for assisting in completing this study. They would also like to thank Dr. Mashrur "Ronnie" Chowdhury, Director of the Center for Connected Multimodal Mobility (C^2M^2), and his research team (Dr. Mizanur Rahman, Md. Mhafuzul Islam, and Md. Zadid Khan) for providing support for the field experiments at the Clemson University Connected Vehicle Testbed (CU-CVT).

Technical Report Documentation Page

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.

4. Title and Subtitle	5. Report Date
Infrastructure and Policy Needs for Personal Electric Mobility Devices in a Connected Vehicle World	November 2019
	6. Performing Organization Code

7. Author(s)	8. Performing Organization Report No.
Judith L. Mwakalonge, Ph.D.; ORCID: 0000-0002-7497-6829; Md Mahmud Hasan Mamun; ORCID: 0000-0003-4090-3661; Jae-Dong Hong, Ph.D.; ORCID: 0000-0003-1095-1195; and Mashrur Chowdhury, Ph.D.; ORCID: 0000-0002-3275-6983.	

9. Performing Organization Name and Address	10. Work Unit No.
South Carolina State University 300 College Street NE, Orangeburg, SC 29115	
	11. Contract or Grant No. 69A3551747117

12. Sponsoring Agency Name and Address	13. Type of Report and Period Covered
Center for Connected Multimodal Mobility (C2M2) Clemson University 200 Lowry Hall, Clemson Clemson, SC 29634	Final Report (September 2017 – November 2019)
	14. Sponsoring Agency Code

15. Supplementary Notes

16. Abstract

The Personal Electric Mobility Device (PEMD) is becoming a popular, accessible mode of transportation among the people who used to walk, bike, and drive cars. Although PEMDs have plenty of features, their safety and operational features while running on a walkway or roadway are less known. As these devices are too fast for a footpath and too slow for highways, they may need particular infrastructure and policy. This report provides the outcomes of an investigation on policy and infrastructure needs for PEMDs on walkways and in the connected world. This study analyzed the safety data from the National Electronic Injury Surveillance System (NEISS) to investigate the features of crashes related to PEMDs. Data was collected from the NEISS Query Builder website for four NEISS product codes (1329-Electric Powered Scooters, 1744-Electric Mobility Cart, 3215-Mopeds, and 5042-Electric Skateboards) from 2006 to 2017. It was found that there were 1,085,352 estimated injuries nationwide for these four products during that time. This study analyzed PEMD-related injuries by time (year, season, month, day, weekend, or workday), the demographics of the victims (gender, age, race), the location of the crashes, and affected body-part of victims. Following this analysis, an experiment was conducted to examine the effect of a hoverboard on pedestrians' walking speed in traditional operating conditions; it was found that pedestrian walking speed was reduced up to 10% when sharing the walkway with a hoverboard. Based on the experimental data, a simulated environment was created in VISSIM, a micro-simulation software, to measure any changes in operating characteristics of the pedestrian with and without PEMDs on a walkway. The simulation results concluded that PEMDs like a hoverboard or an electric scooter increased the delay time on the sidewalk; this magnitude is higher for a narrow path than a wider one. In a real-world test, the feasibility of a hoverboard was evaluated in a connected environment, and it was found that a connected vehicle could detect the hoverboard at a stopping-sight-distance at 40 mph. Finally, this report provides some recommendations for using PEMDs on walkways shared with pedestrians.

17. Keywords	18. Distribution Statement
Personal Electric Mobility Device; Safety Impact; Operational Impact; Delay Time; Walking Speed; NEISS; VISSIM; Connected Environment.	This report or any part of this report is restricted to publish until prior permission from the authors.

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	66	NA

TABLE OF CONTENTS

List of Tables

List of Figures

EXECUTIVE SUMMARY

Personal Electric Mobility Devices (PEMDs) were initially created for people with mobility, cardiac, breathing, and/or neural disabilities. However, in recent years, the use of PEMDs has expanded, and PEMDs are becoming more popular. Due to advances in technology, personal electric mobility devices can be utilized to bridge the first- and last-mile gap (thus increasing accessibility to public transportation), improve people's mobility, and reduce congestion and vehicle emissions by substituting for automobile travel. As more innovative mobility technologies are developed, they will provide more transportation options for people with mobility disabilities, public transport users, and those wanting to maintain an active lifestyle.

The current infrastructure in place for non-motorized traffic was designed for traditional transportation modes, e.g., pedestrians and bicyclists, and it is unclear how the existing infrastructure in place handles non-traditional non-motorized traffic (e.g., travelers on Segways, scooters, mopeds, hoverboards, and so on) and how infrastructure design and policy should be changed to accommodate PEMDs. Therefore, it is crucial for transport planners and public administrators to determine how non-motorized amenities (walkways, sidewalks, paths, and trails) should be maintained, including when/where specific vehicles and activities should be permitted, and how such legislation should be developed and implemented.

This study documents several types of PEMDs currently used on public transportation systems and explores the impact of PEMDs on walkways and the safety issues associated with these devices. Further, this study examines the operational effects of PEMDs in both traditional and connected environments.

To explore the hazards of PEMDs, this study has analyzed data on public safety from the National Electronic Injury Surveillance System (NEISS). This data was collected from the NEISS Query Builder website for four NEISS product codes (1329 Electric Powered Scooters, 1744 Electric Mobility Cart, 3215 Mopeds, and 5042 Electric Skateboards) from 2006 to 2017. It was found that there were an estimated 1,085,352 injuries nationwide, which involve these devices, during that time. This analysis was expanded to organize these incidents by time (year, season, month, day, weekend, or workday), the physical characteristics of victims (gender, age, race), the location of the incidents, and the body parts injured, looking for trends. This study found that most crashes occurred during summer months, on weekends, and to kids age 2-10 years old. It was also discovered that head injuries are prevalent among PEMDs riders.

Following the injury data analysis, the first experiment was conducted to investigate the effect of a hoverboard on pedestrians' walking speed in a traditional operating environment. This experiment was conducted at South Carolina State University in Orangeburg, South Carolina. The travel times for each pedestrian and hoverboard rider for each run were recorded during the experiment. From the travel distance and travel time, the walking speed and hoverboard running speed were calculated for each trial. It was found that the highest walking speed at the walkway near Engineering and Computer Science Complex (ECSC) building without the presence of a hoverboard is 3.12 mph, and with a hoverboard is 2.77 mph; for the sidewalk along Geathers Street, without PEMDs the maximum walking speed is 3.29 mph, and with PEMDs it is 2.74 mph. Thus, it was found that walking speed was reduced up to 10% when sharing a walkway with a hoverboard. Using the data collected in this experiment, a simulated environment was created in VISSIM, a micro-simulation software, to measure the delay time for pedestrians when PEMDs are present on a walkway. The simulation results showed that PEMDs like a hoverboard would increase the delay time on the sidewalk, and this magnitude is higher for a narrow path than a wider one.

The second experiment was carried out to explore the impact of the PEMDs on infrastructure utilizing the connected operating environment at the Clemson University Connected Vehicle Testbed (CU-CVT) in Clemson, South Carolina. Four different cases were defined, and twelve real-life scenarios were considered. For each situation, the travel time, speed, and the location of the pedestrian, hoverboard, and vehicle were recorded to determine the impact of hoverboard in the connected environment. From the experiment, it was observed that PEMD affects vehicle speed. The connected vehicle, when traveling at 40 mph, started reducing its speed at a distance of 250 ft. away from the pedestrian or hoverboard after receiving alert from the connected pedestrian or hoverboard.

In summary, this study recommends that riders must receive proper training before riding PEMDs on public infrastructure and should wear protective gear to reduce injury incidences and severity. It is also recommended that transportation planners and professionals should consider the impact of PEMDs on the width of the walkway. Since these non-traditional modes increase the delay time and reduce pedestrians' walking speed, an alternative lane could be created to divert PEMDs from sidewalks, and the use of these non-traditional vehicles on sidewalks or walkways could be restricted. Further, the widening of walkways may help to reduce the time delay for pedestrians.

CHAPTER 1

Introduction

1.1 Personal Electric Mobility Devices

This research project is funded by the Center for Connected Multimodal Mobility (C^2M^2), a United States Department of Transportation (USDOT) Tier 1 University Transportation Center (UTC). The Center's vision is to serve as an innovation center for transforming multimodal transportation through connectivity, data analytics, and automation. The Center addresses three USDOT priorities, namely, (i) promoting access to opportunities and equity, (ii) improving the mobility of people and goods, and (iii) optimizing passenger movement. This study examines the infrastructure and policy needs for Personal Electric Mobility Devices (PEMDs) in the connected vehicle world.

PEMDs were first launched to assist people with neural, cardiac, breathing, and/or mobility disabilities. The basic design attributes of PEMDs are that they are lightweight, easy to operate, and user-friendly (Miller, et al., 2010). PEMDs have become popular due to their multiple uses, and the fields of application have been expanded over time. For example, in the past, wheelchairs were only used as personal mobility devices if a person was physically disabled (Edwards & Mccluskey, 2010). In recent years, PEMDs are not only used to help people with mobility limitations but are also used as an alternative mode of transportation and as toys for kids. Figure 1 depicts some examples of PEMDs currently used in different regions of the world.

These modern PEMDs come with advanced technology and have the potential to increase transportation accessibility and mobility, which is why they are becoming a popular mode of transportation for people. By utilizing some of these PEMDs, for example, a Segway, people are able to travel up to a speed of 18 mph with a push of a button, where the human's walking speed is approximately about 3.1 mph (Carey, 2005) (TranSafety, 1997) (Segway, 1999). PEMDs offer a lot of attractive and beneficial features for transportation systems: for example, they can reduce the first- and last-mile gap for public transport, increase travel speed, decrease traffic congestion by replacing shorter vehicle trips, reduce air pollution emissions, decrease road and parking facility needs(Liu & Parthasarathy, 2003) (Hoenig, et al., 2007) (Miller, et al., 2010) (Dowling, et al., 2015). The use of PEMD has been growing, and they have the potential to become a part of an active day-to-day lifestyle.

As more advanced versions of PEMDs will be inevitably introduced in the future, their impact on the transportation system seems set to increase (Hoenig, et al., 2007). However, there are many challenges associated with them. PEMDs are comparatively faster than human walking speed but slower than the speed of an automobile. With their rise in popularity, there are plenty of safety concerns that have been raised regarding using these devices with pedestrians or motor vehicle facilities in mixed traffic. Since PEMDs like Segways, electric skateboards, or hoverboards are faster than most pedestrians, they can easily be involved in severe injury or fatal crashes due to differential speeds (Litman & Fitzroy, 2015) (Litman, 2006). For instance, a research study carried out in Australia found that between 2006 and 2008 about 713 patients were involved in motorized mobility scooter accidents, which was comparatively higher than 16% of all severe injuries reported in 2008 to 2009 (Clapperton & Cassell, 2011). Later, in Sydney in 2010, a survey was carried out among the injured patients at several hospitals; it concluded that about 31 patients out of 149 were hospitalized after being involved in PEMD accidents (Edwards & Mccluskey, 2010). The traditional transportation infrastructures are designed and constructed based on conventional motorized traffic like cars, buses, and trucks, and non-motorized transport such as pedestrians

and bicyclists. Therefore, there are gaps in our knowledge about how PEMDs will affect the infrastructure and traffic safety as they increase. It is crucial for transportation planners, professionals, and public officials to consider these non-traditional motorized modes along with pedestrians or bicyclists.

(i) Electric Unicycle

(ii) Egret (Kick Electric Scooter)

(iii) Electric Scooter

(iv) Three-wheeler Electric Scooter

(v) Electric Mobility Cart

(vi) Electric Bike

(vii) One-Wheeler Hoverboard

(viii) Electric Skateboard

(ix) Electric Solo-wheel

(x) Hoverboard

(xi) Segway

(xii) Electric Caster Board

Figure 1 Examples of Personal Electric Mobility Devices (Source: pngkey.com, imgbin.com & iotatrax.com)

1.2 Objectives of the Project

In this study, safety concerns associated with PEMDs have been examined, and their impact on pedestrian walking is discussed. First, raw safety data was queried from the National Electronic Injury Surveillance System (NEISS) from 2006 to 2017 for four product codes, which are 1329 (Electric Powered Scooters), 1744 (Electric Mobility Cart), 3215 (Mopeds), and 5042 (Electric Skateboards). Then two experiments were devised, one in a traditional operating environment and another in a connected environment. These experiments were conducted to investigate the influence of these devices on the walking of the pedestrians who share the sidewalk with PEMDs. In addition, the data from the traditional operating environment was input into micro-simulation software (VISSIM) for further study. Finally, the feasibility and impact of a hoverboard in a connected environment were examined by a real-world experiment.

CHAPTER 2

Literature Review

This section of the report reviews previous research on PEMDs. Scholarly articles and work in the traffic safety, injury prevention, and risk management fields were reviewed to illustrate the impacts of these non-traditional modes on roadway traffic operation and safety.

2.1 Studies on PEMD's Growth and Category

Freedonia Custom Research, an international industry market research association, estimated in 2006 that the demand for wheelchairs and PEMDs for the United States will rise 5% per year from 2010 and predicted that number to expand more in the next ten years (Freedonia, 2006)**.** Another study conducted by Transparency Market Research in 2006 states that the market value of PEMDs will expand at a rate of 7.2% from 2016 to 2024, which will eventually lead to $14.6 billion spent in 2024 (Research, 2016)**.** This report also concluded that the features of PEMDs like cost-effectiveness, innovative advanced technologies, and user-friendly interaction would attract users in the future. Besides future demand predictions, many researchers have conducted studies to classify PEMDs. A United Kingdom-based research institute, the Research Institute for Consumer Affairs (RICA), first ranked these non-traditional modes based on their running speed and overall weights. They categorized the PEMDs as Class 2, which were allowed on roadways upon registration, and Class 3, which were permitted to operate on footpaths with proper licenses and registration. Dowling et al. (2015) conducted a similar study within the controlled pedestrian environment at the Macquarie University campus. They evaluated the perception and acceptance of PEMDs among people where they grouped the non-traditional modes according to their operating maneuvers (Dowling, et al., 2015). They discussed three types of non-motorized non-traditional vehicles, which were one-wheel (electric unicycle, solo-wheel), two-wheel (electric scooter, skateboard, hoverboard, caster board, Egret), and three or more-wheels (Qugo, electric cart). Another research study showed that riders preferred the two-wheeled devices due to their comfortable maneuvering, while one-wheelers have a balance issue, which requires proper practice, and three or more-wheelers have problems traveling at high speed (Litman & Fitzroy, 2015). Some previous reviews have demonstrated that Canada, New Zealand, and the USA treat PEMDs as pedestrians and the Netherlands, Switzerland, Ireland, South Africa, and some other European and African countries consider them as road users (Bruneau & Maurice, 2012).

2.2 Studies on the Acceptability and Application of PEMDs

Gitelman et al. (2016) examined how electric scooters can enhance the mobility and standard of living of older people (Gitelman, et al., 2016). Another research study was jointly conducted by NRMA Motoring & Services, the Australian Competition and Consumer Commission (ACCC), CHOICE, Enable NSW, and Flinders University to investigate user preferences towards PEMDs in Australia (NRMA, 2012). They surveyed 2406 randomly selected people who did not use PEMDs and 515 scooter users. It was found that 50% of scooter riders were below 60 years old, and they were less vulnerable to accidents as they lived in a rural region. Moreover, the researchers concluded that while a scooter assists those who would be pedestrians during long-distance walks, they cannot be an alternative to a personal vehicle. It should be noted that this survey was based on people over 18 years old and ignored children, who are more susceptible to injury by PEMDs.

2.3 Research on the Safety Issues Regarding the PEMDs

The Canadian Council of Motor Transport Administrators conducted a real-world study in 2010, which included questionnaires for participants riding one, two and three-wheeled devices on footpaths and shared paths (Road Safety Canada Consulting, 2011). They observed that the average speed of PEMDs is 6 km/hr., which is too fast for walkways and too slow for roadways. In addition, they concluded that electric scooters and other PEMDs have a deleterious impact on pedestrians with impaired hearing or vision. Another study indicated that safety concerns were significantly higher for elderly or disabled people (Edwards & Mccluskey, 2010). Goodwin et al. (1998) learned that pedestrians and PEMD users have a propensity for more significant collision rates than drivers on a per-mile basis (Goodwin, et al., 1998). Further, the users of PEMDs are more vulnerable and exposed to a higher risk of being seriously injured compare to other road users, such as pedestrians (Löfqvist, et al., 2012). Powell et al. (2004) conducted a study to evaluate injuries involving scooters among the U.S. youth and compared them with inline skates and skateboards (Powell & Tanz, 2004). They estimated that of 190,878 casualties, and 90% of victims with injuries, were less than 15 years old. Results also indicated that the rate for scooter related-injuries peaked in 2001; further, forearm fractures were the most common injury type (56%) and accidents primarily involving children aged 5-12 years. Siracuse et al. (2017) explored hoverboard-related injuries with data extracted from the NEISS database from 2011 to 2015 (Siracuse, et al., 2017). This research showed that in 2015, there was a higher number of injuries with the most common type being a fracture (38.9%). At the end of the research period, there was substantial damage to various parts of the body, including arms (475% higher), legs (178% higher), heads and necks (187% higher), and over 4000% more wrist fractures than the previous four years.

2.4 Investigation of present Rules & Regulation Regarding PEMDs

Since PEMDs may have a significant impact on the health and safety of the user, some strategies have been proposed in various studies to handle mixing non-traditional traffic with regular pedestrians and automobiles (Hoenig, et al., 2007) (Litman, 2006). Currently, most governments have legislation to regulate PEMD use on footpaths such as helmet requirements (Zegeer, et al., 2002) (Liu & Parthasarathy, 2003). Many cities have introduced a code of conduct to promote safety with these non-traditional modes. For example, some major cities in China and Australia have restricted the use of PEMDs on roadways and limited them on public sidewalks, except for when used by physically disabled or elderly people (Rose & Richardson, 2009). Twaddell & Lynott, (2012) suggested incorporating safety education, outreach programs, and policy enforcement to provide necessary information to improve safety for these non-traditional modes (Edwards & Mccluskey, 2010) (Poncy, et al., 2011).

CHAPTER 3

Research Approach

The primary focus of this research was to investigate the traffic safety and operational impacts of PEMDs at the roadway network-level. The NEISS injury data were used to determine the effect of PEMDs on transportation safety. The injury data were collected from the NEISS database, which is obtained from the U.S. Consumer Product Safety Commission (CPSC) website (CPSC, 2019). This study extracted the data from 2006 to 2017 related to accidents involving scooters, skateboards, mopeds, and electric mobility carts to analyze and understand the safety implications of PEMDs.

After analyzing safety, the traffic operational impact of PEMDs was investigated in two different roadway environments, i) a traditional environment (i.e., a non-connected transportation system); and ii) a connected environment. To analyze the impact of PEMDs on traffic operations in a traditional environment, a real-world experiment was conducted at South Carolina State University in Orangeburg, South Carolina. The data collected from this experiment was then used to create simulations using micro-simulation software named VISSIM. Another real-world experiment was conducted in the Clemson University Connected Vehicle Testbed (CU-CVT) in Clemson, South Carolina, to determine the impact of PEMDs in a connected vehicle environment. Figure 2 shows the research approach, with the details described in the following sections.

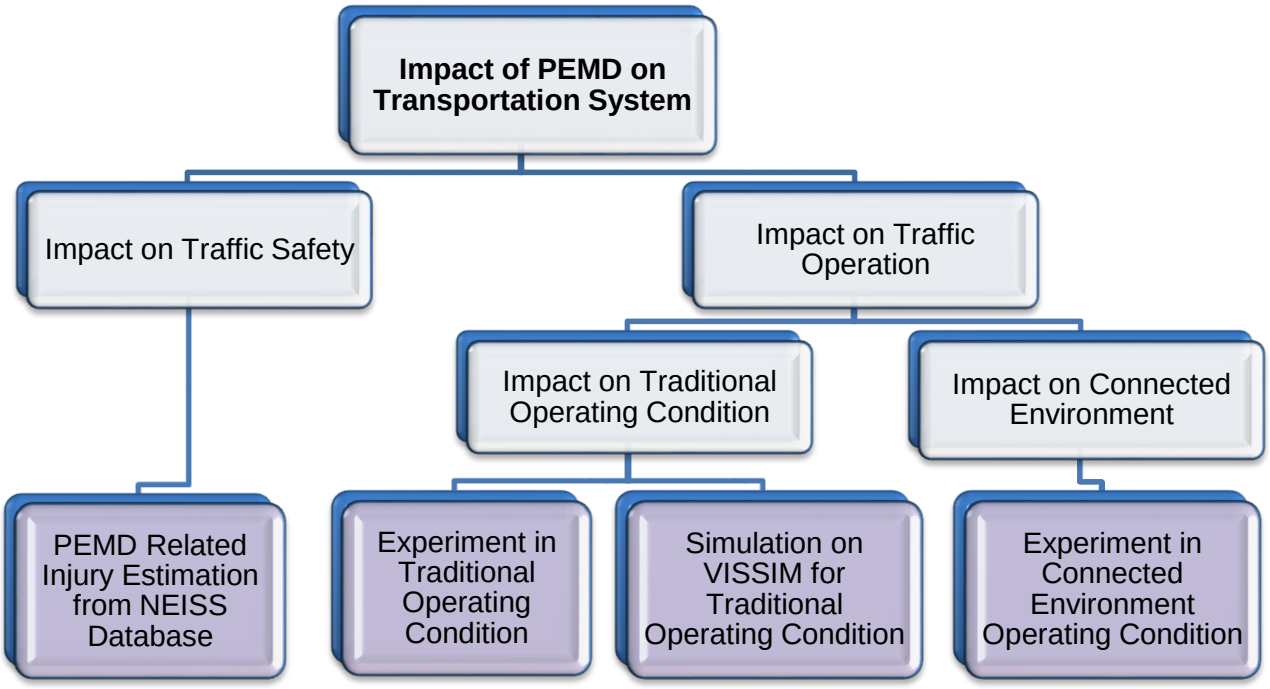


Figure 2 Flowchart of the Research Approach

3.1 PEMD-Related Injury Estimation from the NEISS Database

This section will provide a description of the NEISS data and the injury calculation procedure.

3.1.1 NEISS Database

The NEISS database is a national archive that gathers and stores different product-related injury information from hospitals across the U.S. NEISS follows the rules and regulations of the American Hospital Association Registration to collect and process data. The mandatory requirements for hospitals in terms of collecting, analyzing, and preserving data are that the hospital must have a minimum of six beds for patients and 24-hour service or an emergency room. According to the size, location, type, and the number of patients visiting annually, the hospitals are typically categorized into five groups, which are small, medium, large, very large, and children's hospitals. The reporting section of the emergency department of each hospital collects the data following the specific format and records the required patient information in the medical record book. Then the data is coded and transferred to the database according to the NEISS coding manual. Later, the CPSC updates the NEISS database, generates injury estimates nationally from the hospital data and maintains the computerized NEISS database (CPSC, 2019).

For this study, the NEISS coding manual was utilized to decode the information and extract data for injuries due to PEMDs. The devices used throughout the study were identified as scooters, skateboards, mopeds, and electric mobility carts, as derived from product codes 1329, 5042, 3215, and 1744, respectively. The decoding of the data also used patient data, including demographic characteristics such as age, gender, race, time (year, season, month, and day), body part affected, and location of the incident.

3.1.2 PEMD Related Injury Estimation

NEISS usually computes the weight of hospitals each year from the raw input and then calculates national estimates of injuries for specific product codes. According to the NEISS Design and Implementation Manual (Schroeder & Ault, 2001), the formula used by NEISS to calculate the weight of hospitals is as follows,

$$wtg_i = \frac{N_h * n'_h * R_h}{n_h * r_h}$$

where:

wtg_i = Weight of hospital *i* for a specific product code or injury type
N_h = Number of hospitals in the 1995 sampling frame for stratum *h*
n_h = Number of hospitals selected for the NEISS sample for stratum *h*
n'_h = Number of in-scope hospitals in the NEISS sample for stratum h
r_h = Number of NEISS hospitals participating in stratum *h* for the given month
R_h = Ratio adjustment for combined stratum *h*

However, in the extracted database used for this study, the weight of hospitals was calculated for each product code. Therefore, the national estimates of injury for specific product codes were calculated in this study by using an equation in the NEISS Design and Implementation Manual (Schroeder & Ault, 2001). The equation used for estimating national injury is:

$$E = \sum_{i}^{n} wtg_i * x_i$$

Where:

E = Injury estimation for hospital *i* (here, *i = 1, 2, 3, … … … n*)
wtg_i = Weight of hospital *i* for the month
x_i = Number of cases for a specified injury type reported by hospital *i* for the given month

By using the above equations, the total injuries during 2006-2017 caused by the four PEMDs were calculated from the NEISS raw data and analyzed to understand the damage resulting from the use of these four types of PEMDs.

3.2 PEMDs in a Traditional Operating Environment

A real-world experiment and a simulation on VISSIM were carried out to investigate the impact of PEMDs in a traditional operating environment.

3.2.1 Experiment in Traditional Operating Environment

An experiment was conducted on two different walkways at South Carolina State University, Orangeburg, SC, to examine the impact of PEMDs in a traditional pedestrian operation. The first walkway is away from the roadway and adjacent to the Engineering and Computer Science Complex (ECSC) building. The second walkway is along Geathers Street (as shown in Figure 3). The image was taken from Google Maps (Source: Map data © 2019 Google U.S.).

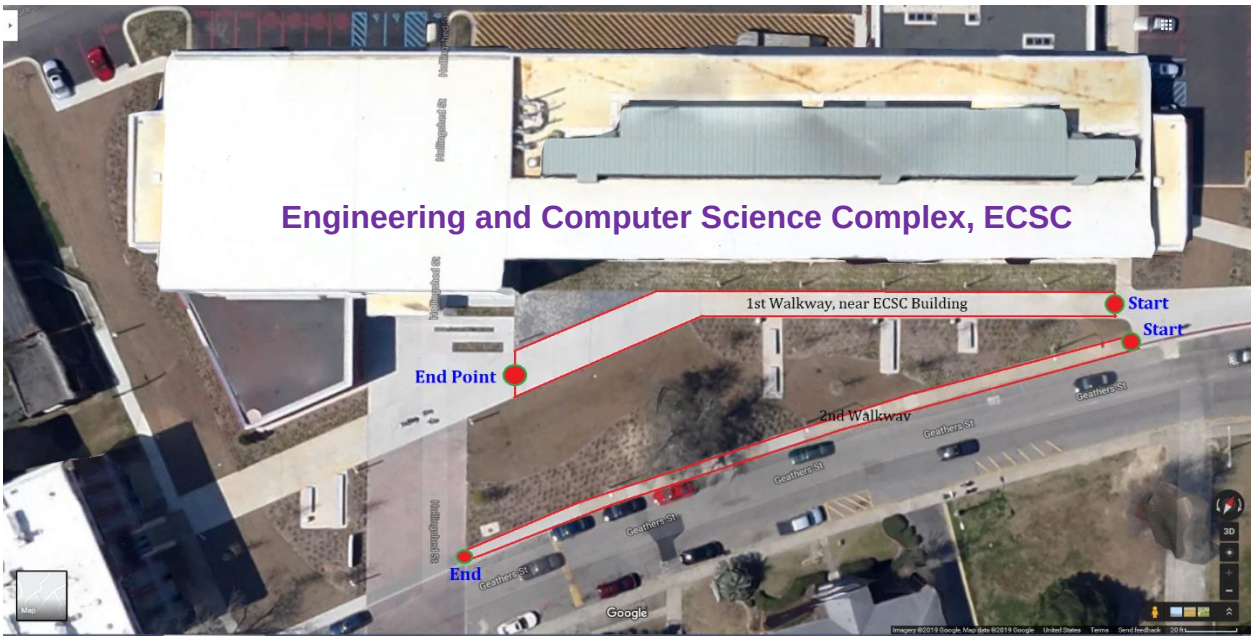


Figure 3 Walkways Used in the Experiment in a Traditional Operating Environment

The 1st walkway is comparatively wider than the second. The length of the 1st walkway is 239.5 ft., and the width is 10 ft. to 16 ft. The length of the 2nd walkway is 274.97 ft, and the width is 4.50 ft. During the experiment, two volunteers participated as regular pedestrians, and one trained volunteer participated as a hoverboard user for both walkways. The dimension of the hoverboard was 7.5 in × 23 in × 6.5 in.

3.2.2 Simulation of PEMD for Experiment in Traditional Operating Environment

A micro-simulation software, PTV VISSIM 7.00-02, was utilized to create a simulation model of the walkway, as shown in Figures 4 and 5. Given the travel time and distance, the walking speed of each volunteer and the running speed of the hoverboard user was calculated. These estimated walking speeds and hoverboard running speed were incorporated in the simulation model to

create a digital environment similar to the real-world experiment. For each scenario, ten simulation runs with a simulation duration of 600 seconds were performed in VISSIM, and the travel time, travel distance, delay time, and gain time were recorded. The 2-dimensional and 3-dimensional views of the model in VISSIM during the simulation run are shown in Figures 4 and 5. The green regions in these figures are the pedestrian areas where the pedestrian uses the grey-colored walkway to move from one location to another.

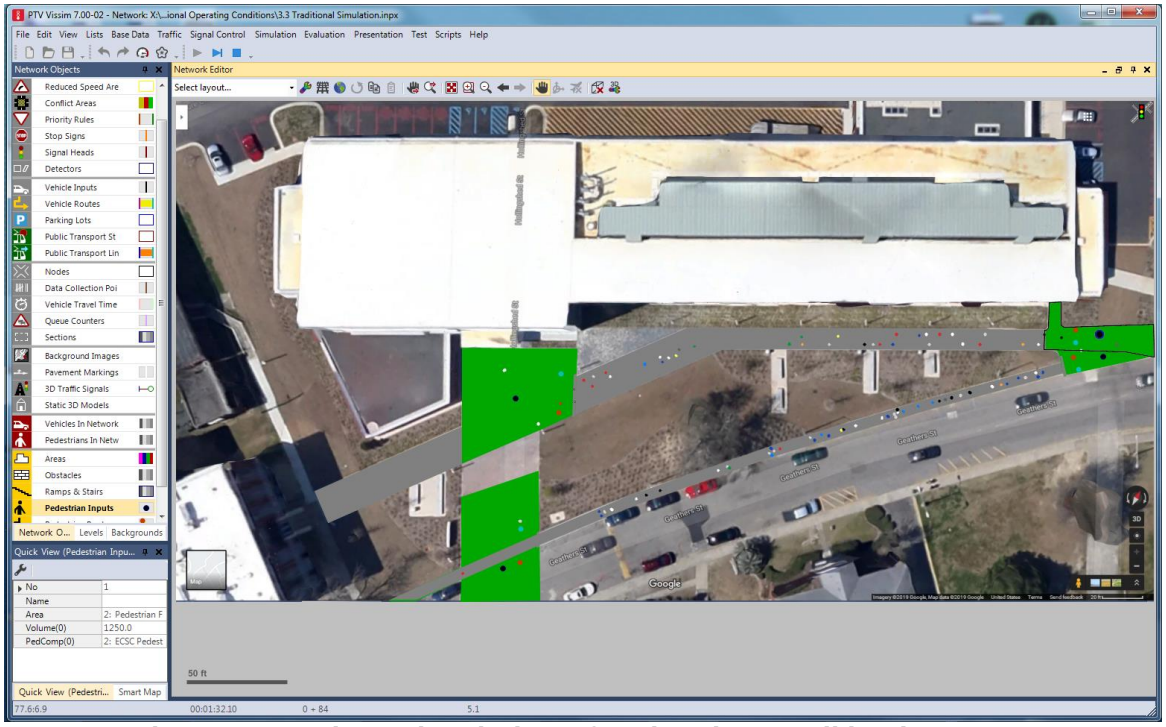


Figure 4 A 2-Dimensional View of Pedestrians Walking in VISSIM

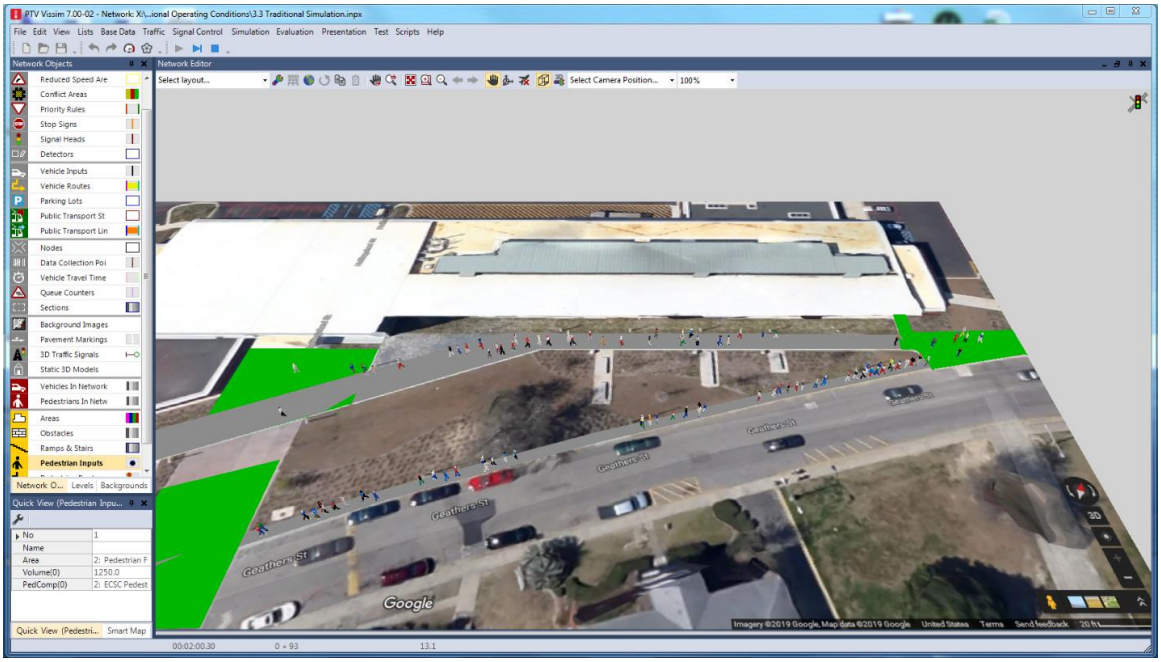


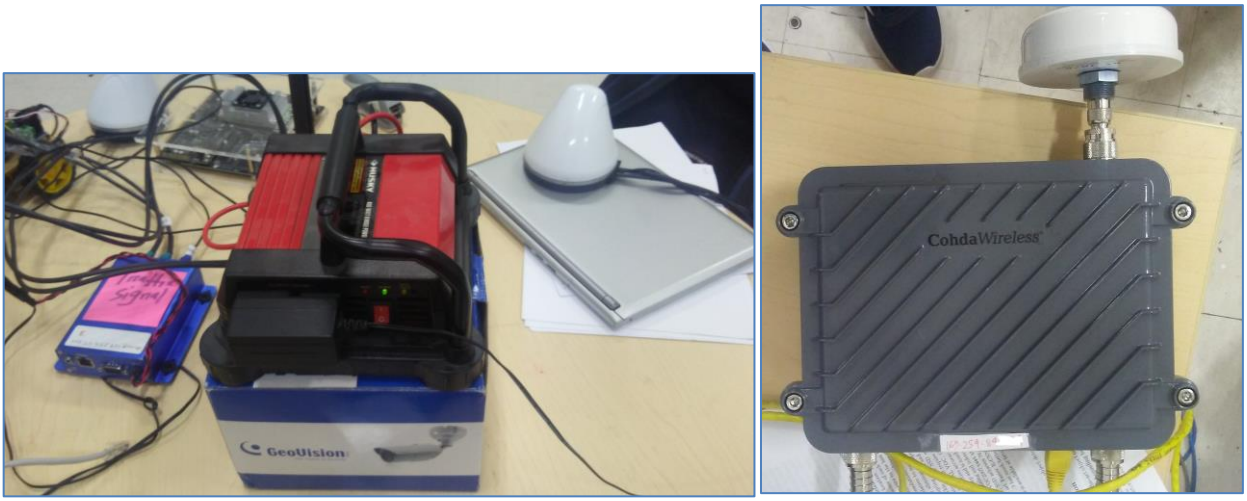
Figure 5 A 3-Dimensional View of Pedestrian Walking in the VISSIM

3.3 PEMDs in Connected Environment Operating Conditions

The impact of the PEMDs on infrastructure and travelers in a connected operating environment was assessed at Clemson University. Figure 6 shows the experiment area of the test, along with Perimeter Road in Clemson, SC (marked by the red line).

Figure 6 Study Area of PEMDs in a Connected Environment Operating Condition

In the experiment, three on-board-units (OBU) and one road-side-unit (RSU) were used to create a connected environment where each pedestrian, hoverboard, and vehicle was equipped with one OBU. A Cohda MK5 model with IEEE 802.11p radio-frequency devices were used as OBUs and the RSU. The Center for Connected Multimodal Mobility (C^2M^2) at Clemson University provided the OBU, RSU, and power supply units. Figure 7 shows the devices used in this experiment.



(i) Cohda MK5 On-board-unit (OBU) with power-supply (ii) Cohda MK5 Road-side-unit (RSU)

Figure 7 OBU and RSU Used to Create a Connected Environment

The OBUs transmitted the data, including the real-time travel time, speed, and latitude & longitude of its carrier (i.e., pedestrians, hoverboard, and car). The RSU received the transmitted data. The

data transmission and receiving mechanism were controlled by Python programming codes. The data collected by the RSU was processed and extracted in a JavaScript Object Notation (JSON) format for analysis. For this experiment, four different cases were defined, and twelve real-life scenarios were considered. For each situation, the travel time, speed, and location of pedestrians, the hoverboard, and the vehicle were recorded to determine the impact of a hoverboard in a connected environment. The connected environment and data collection setup are shown in Figures 8 and 9, respectively.

Figure 8 Setup of OBU and RSU to Create a Connected Environment

Figure 9 Checking of Connectivity Among Pedestrians, Hoverboard, and Car

CHAPTER 4

Data Analysis and Comparison

This chapter describes the analysis of the data from the NEISS database and field experiments. The analysis is divided into four segments, which are (i) safety data analysis of the NEISS database, (ii) data analysis for traditional operating conditions, (iii) analysis of the simulation data of VISSIM, and (iv)data analysis for the connected environment. Microsoft Excel and Stata (SE/12) software were used in data calculation and analysis.

4.1 NEISS Safety Data Analysis

As discussed above, the safety data was extracted from the NEISS database for 12 years (2006 to 2017) for four NEISS products (PEMDs).

Table 1 List of NEISS PEMDs Used in the Analysis

Product Code	Product Title	Notation in Analysis
1329	Scooters, unpowered	Scooters
1744	Electric mobility carts; motorized vehicles (three or more wheels);	Electric cart
3215	Mopeds or power-assisted cycles	Mopeds
5042	Scooters, skateboards, or hoverboards, powered	Skateboards

Using the equations from section 3.1.2 for raw NEISS data, it was derived that there were a total of 1,085,352 incidences for the four types of PEMDs. Scooters were involved in most of the accidents. The analysis also examined injuries by time (year, season, month, day, weekend, or workday), characteristics of victims (gender, age, race), location of incidences, and the injured body part of the victims.

4.1.1 National Injury Estimates for PEMDs from the NEISS Database by Time

First, the injury estimates were calculated and distributed in Stata by year. The analyzed data is presented in Table 2 and graphically displayed in Figures 10 and 11. It was found that most incidences occurred in 2017 (120k), which is almost double the estimated injuries in 2006 (66k). Electric Carts are less vulnerable to accidents (137k) compared to other PEMDs considered in this study. A probable reason for the safety of Electric Carts is that because they have more wheels than other PEMDs, and they provide a better balance. Since Scooters are frequently operated in both walkways and roadways, they have the highest injury estimate (635k).

Table 2 National Injury Estimates for All PEMDs by Year

Year	Scooters	(%)	Electric Cart	(%)	Mopeds	(%)	Skateboards	(%)	Total	(%)
2006	43924	6.91	5089	3.71	9569	6.03	7394	4.80	65976	6.08
2007	49525	7.79	5693	4.15	9820	6.19	7218	4.69	72256	6.66
2008	50850	8.00	5656	4.12	10717	6.75	8039	5.22	75262	6.93
2009	59311	9.34	8014	5.84	10515	6.62	7796	5.06	85636	7.89
2010	50247	7.91	9175	6.68	10346	6.52	9491	6.16	79259	7.30
2011	57180	9.00	12872	9.38	12446	7.84	9353	6.07	91851	8.46
2012	59654	9.39	11338	8.26	16269	10.25	9220	5.99	96481	8.89
2013	60752	9.56	13006	9.48	14670	9.24	7196	4.67	95625	8.81
2014	55802	8.78	14345	10.45	13716	8.64	5670	3.68	89533	8.25
2015	51797	8.15	16026	11.68	15581	9.82	15738	10.22	99143	9.13
2016	47785	7.52	15854	11.55	15603	9.83	34287	22.26	113529	10.46
2017	48521	7.64	20199	14.72	19465	12.26	32617	21.18	120802	11.13
Total	635348	100.00	137269	100.00	158716	100.00	154019	100.00	**1085352**	100.00

Figure 10 represents the overall injuries for the four PEMDs by year from 2006-2017. The injury estimate shows continuous growth except in 2010 and 2014. Since 2014, the total number of casualties has increased consistently.

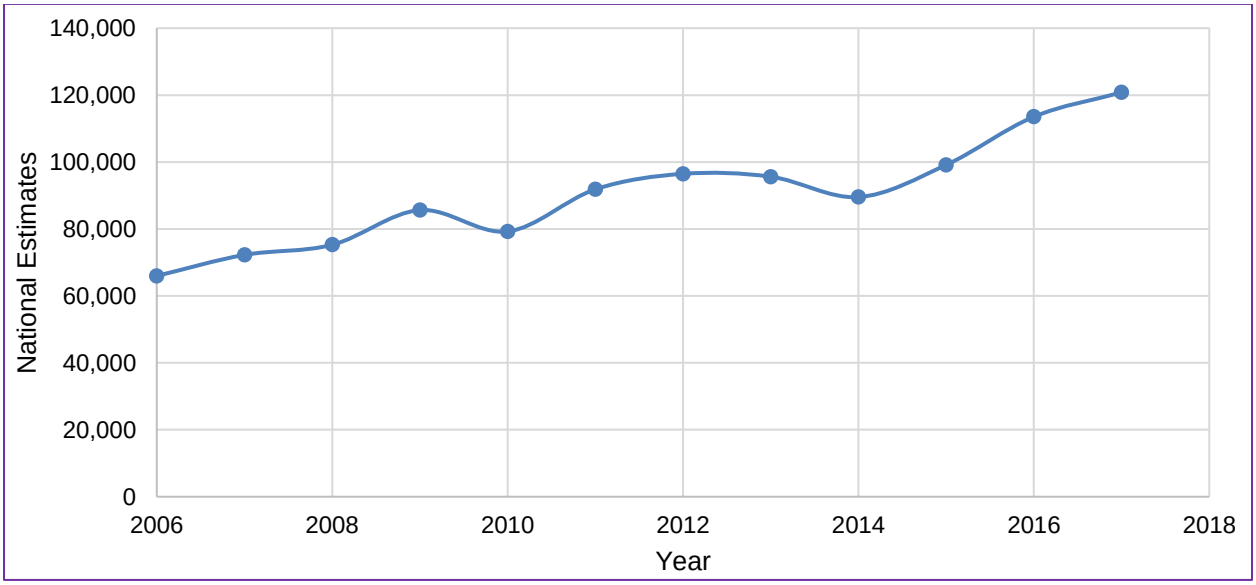


Figure 10 National Injury Estimates for All PEMDs by Year

The national injury estimate for each PEMD type by year is displayed in Figure 11. Injuries associated with Scooters fluctuated from 44k to 61k, with a peak in 2013 and then a gradual downward trend. The national estimates for Electric Carts and Mopeds were remarkably similar; both have a shallow uptrend. Safety concerns are raised for Skateboards, which had a relatively low rate of incidences until 2014 (5k) but with a sharp rise thereafter, jumping to 34k in 2016.

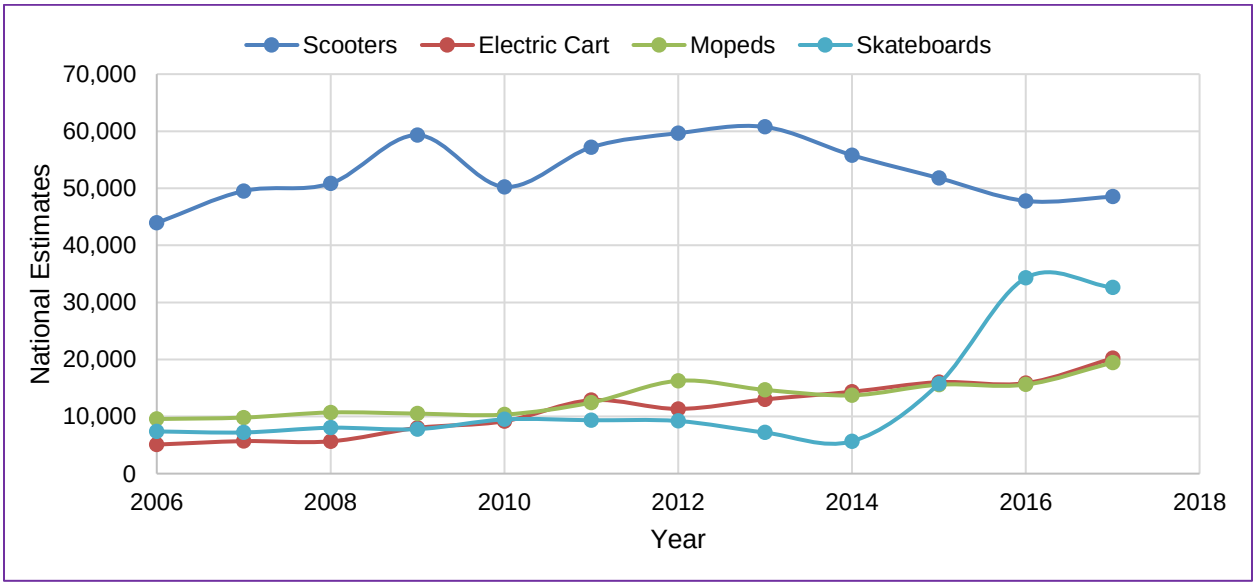


Figure 11 National Injury Estimates for Specific PEMD Types by Year

Additionally, national estimates were calculated by season, and it was observed that about 33.53% of total injuries occurred in summertime (June to August), while winter had the lowest rate

of collisions (15.27%), as shown in Table 3. The reason behind it could be that in winter, people usually do not travel by PEMDs due to weather conditions. These data are graphically presented in Figure 12.

Table 3 National Injury Estimates for All PEMDs by Season

Season	Scooters	(%)	Electric Cart	(%)	Mopeds	(%)	Skateboards	(%)	Total	(%)
Spring	198066	31.17	32322	23.55	39525	24.90	36807	23.90	306720	28.26
Summer	215369	33.90	42872	31.23	61102	38.50	44602	28.96	363946	33.53
Autumn	140516	22.12	34693	25.27	41024	25.85	32698	21.23	248932	22.94
Winter	81397	12.81	27382	19.95	17064	10.75	39912	25.91	165755	15.27
Total	635348	100.00	137269	100.00	158716	100.00	154019	100.00	1085352	100.00

From Figure 12, it is observed that Scooters, Electric Cart, and Mopeds had higher incident frequencies in the summer season. However, Skateboards show that more incidents in winter.

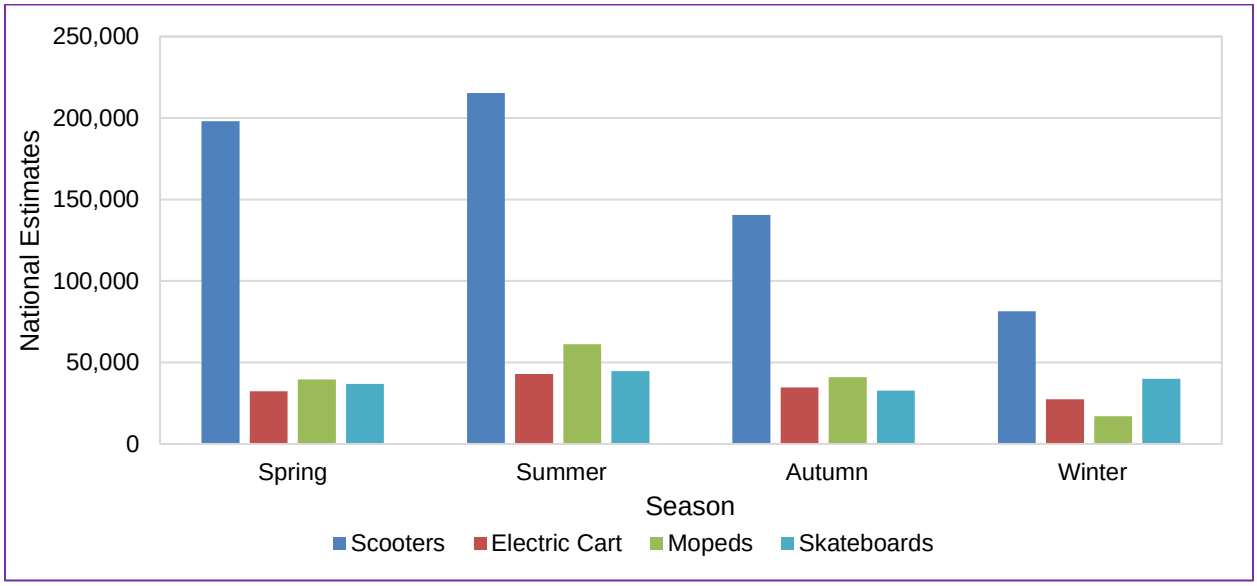


Figure 12 National Injury Estimates for Specific PEMD Types by Season

Disaggregating further, most incidents occurred in August (124k), with the fewest in February (48k) [Table 4].

Table 4 National Injury Estimates for Specific PEMD Types by Month

Month	Scooters	(%)	Electric Cart	(%)	Mopeds	(%)	Skateboards	(%)	Total	(%)
January	29060	4.57	7568	5.51	5045	3.18	11094	7.20	52768	4.86
February	25957	4.09	8929	6.50	5840	3.68	7929	5.15	48655	4.48
March	46326	7.29	10180	7.42	9966	6.28	10564	6.86	77037	7.10
April	71487	11.25	10074	7.34	14388	9.07	13850	8.99	109800	10.12
May	80252	12.63	12068	8.79	15171	9.56	12392	8.05	119883	11.05
June	71216	11.21	13459	9.81	19148	12.06	14220	9.23	118043	10.88
July	70114	11.04	13766	10.03	21217	13.37	16220	10.53	121317	11.18
August	74039	11.65	15646	11.40	20738	13.07	14162	9.19	124585	11.48
September	62325	9.81	13691	9.97	17296	10.90	13344	8.66	106656	9.83
October	46993	7.40	11191	8.15	13825	8.71	10809	7.02	82818	7.63
November	31198	4.91	9811	7.15	9903	6.24	8546	5.55	59457	5.48
December	26381	4.15	10885	7.93	6179	3.89	20888	13.56	64333	5.93
Total	635348	100.00	137269	100.00	158716	100.00	154019	100.00	**1085352**	100.00

Figure 13 shows the overall estimates of PEMDs accidents; fewer incidences happen in February with a linear increase until April. From April to September, the number of collisions is almost constant. They then start decreasing gradually until November.

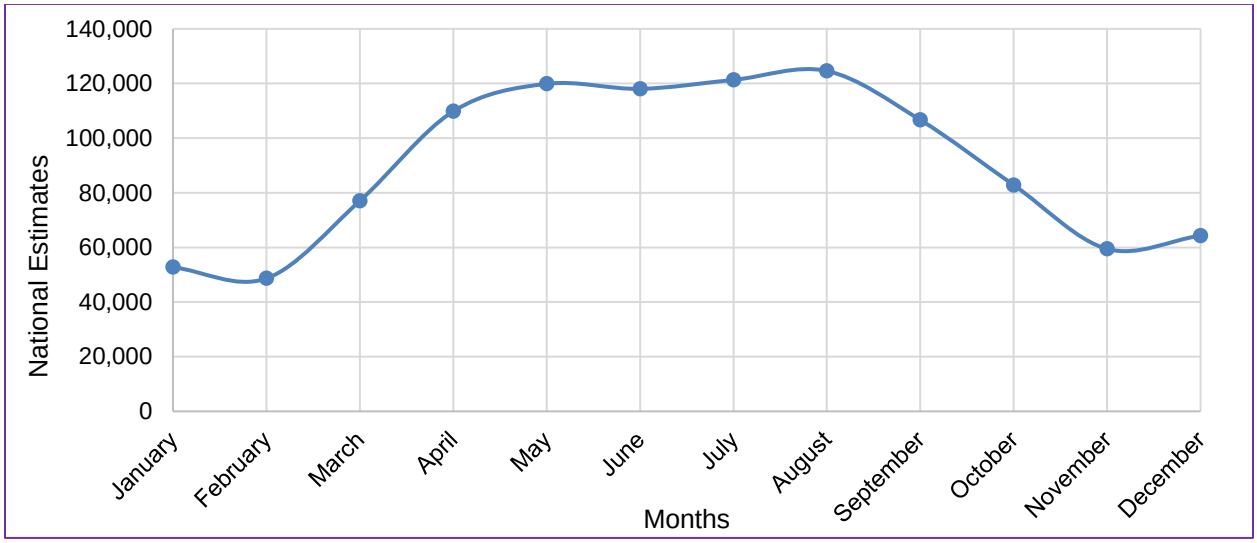


Figure 13 National Injury Estimates for All PEMDs by Month

In the injury distribution for specific PEMD type by month indicates that the estimated injury incidences were uniformly distributed throughout the entire year for each mode except for Scooters [Figure 14], which had a similar monthly injury distribution as the total estimates (higher for April to August).

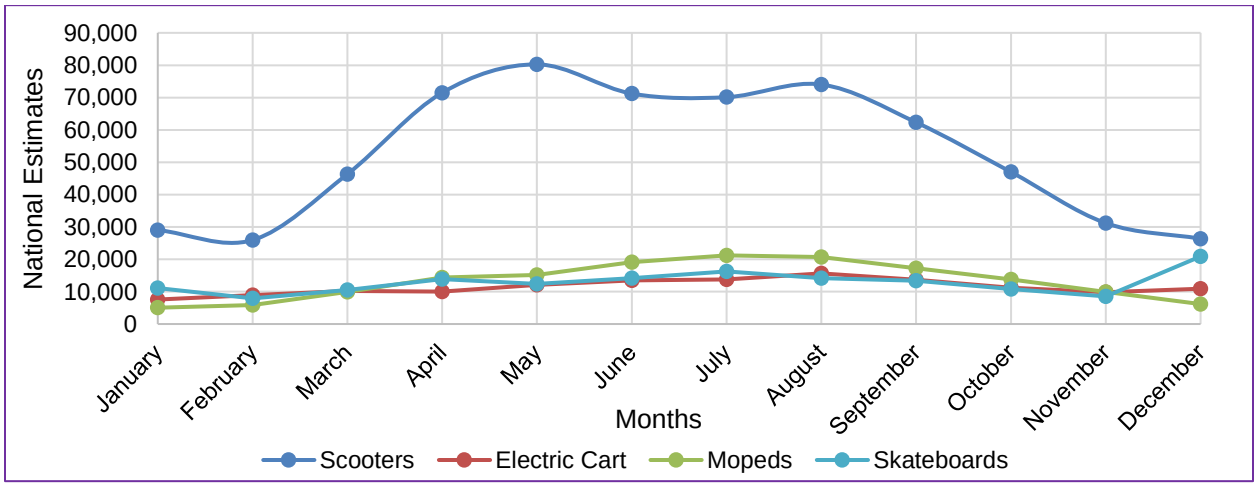


Figure 14 National Injury Estimates for Specific PEMD Types by Month

Table 5 presents the injury distribution by day of the week. The highest amount of injuries related to PEMDs occur on Sunday. Weekends are more prone to PEMDs accidents than workdays, with the number of injuries being relatively constant from Tuesday to Friday, then trending up on Sunday and down again on the next Tuesday [Figure 15]. This likely reflects the higher PEMD use on weekends.

Table 5 National Injury Estimates for Specific PEMD Types by Day

Day	Scooters	(%)	Electric Cart	(%)	Mopeds	(%)	Skateboards	(%)	Total	(%)
Monday	89476	14.08	20446	14.89	24546	15.47	23232	15.08	157700	14.53
Tuesday	80978	12.75	20531	14.96	20388	12.85	19278	12.52	141174	13.01
Wednesday	81332	12.80	19303	14.06	22195	13.98	18791	12.20	141621	13.05
Thursday	81832	12.88	19990	14.56	20559	12.95	17810	11.56	140191	12.92
Friday	81552	12.84	20415	14.87	21207	13.36	20757	13.48	143931	13.26
Saturday	102407	16.12	19207	13.99	25210	15.88	25862	16.79	172686	15.91
Sunday	117772	18.54	17376	12.66	24612	15.51	28288	18.37	188048	17.33
Total	635348	100.00	137269	100.00	158716	100.00	154019	100.00	**1085352**	100.00

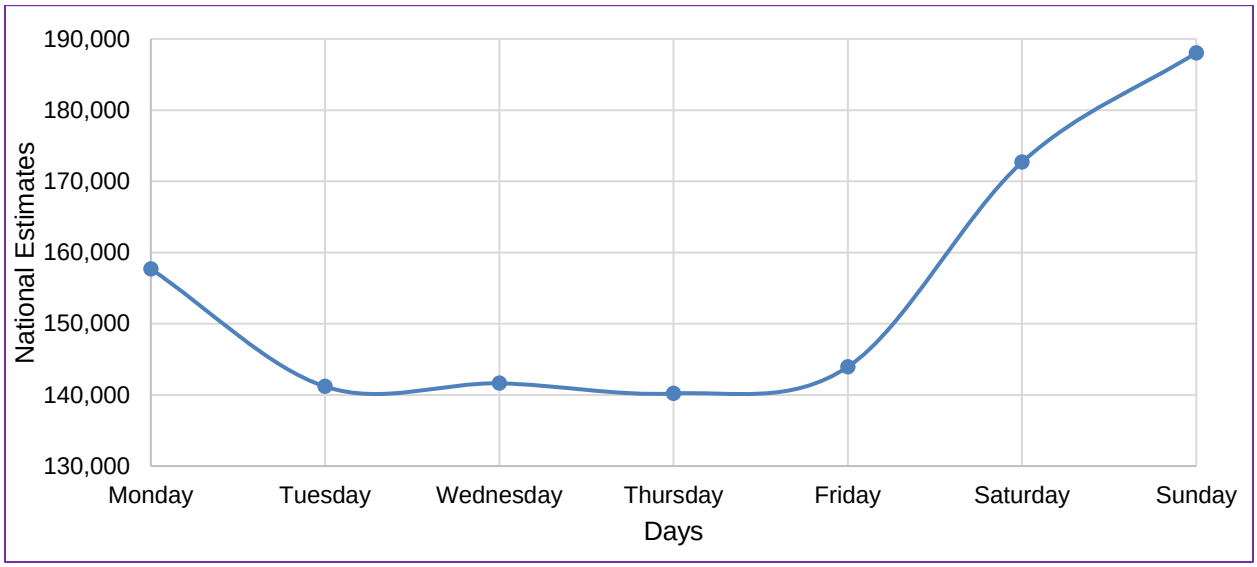


Figure 15 National Injury Estimates of All PEMDs by Day

Figure 16 represents the national estimate of injuries for the four-PEMD types each day. All four of the PEMDs have constant value on the workday and higher value on the weekend. Except for Scooters, the other PEMD types have relatively similar collision rates each day.

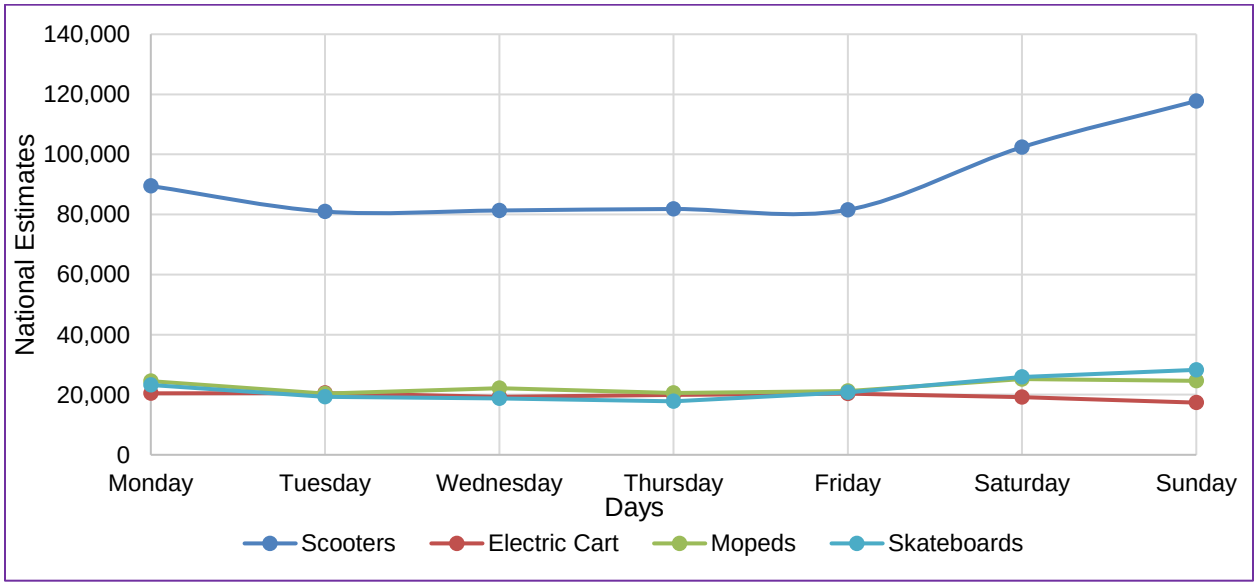


Figure 16 National Injury Estimates for Specific PEMD Types by Day

4.1.2 Estimates for PEMD Injuries by User Demographic

Based on the patient information from the NEISS database, an analysis was performed to understand the injury distribution by age groups, gender, and race. First, the national estimates are divided into 13 age categories for four specific PEMD types; this is presented in Table 6. It was found that children between the ages of 2-10 are most vulnerable to PEMD-related accidents — about 40.8% of the PEMD users who have been hospitalized fall into this age category. The distribution is shown in Figures 17 and 18. It was also found that Skateboard and Moped users between the ages of 11-20 are highly prone to collisions; for Electric Carts, the most vulnerable age group is 61-70, and for Scooters, those aged 2-10 are the most susceptible.

Table 6 National Injury Estimates for Specific PEMD Types by Age

Age (yr.)	Scooters	(%)	Electric Cart	(%)	Mopeds	(%)	Skateboards	(%)	Total	(%)
Unknown	0	0.00	7	0.00	32	0.02	0	0.00	39	0.00
< 2	6457	1.02	419	0.31	95	0.06	254	0.17	7226	0.67
2-10	396958	62.48	2109	1.54	4270	2.69	39221	25.46	442557	40.78
11-20	166191	26.16	2662	1.94	36969	23.29	45446	29.51	251269	23.15
21-30	19662	3.09	2276	1.66	35958	22.66	15204	9.87	73100	6.74
31-40	15915	2.50	5557	4.05	23567	14.85	13450	8.73	58490	5.39
41-50	11542	1.82	12899	9.40	24735	15.58	14127	9.17	63304	5.83
51-60	8822	1.39	21922	15.97	19722	12.43	11385	7.39	61852	5.70
61-70	5127	0.81	29615	21.57	9217	5.81	7245	4.70	51204	4.72
71-80	3235	0.51	28633	20.86	3321	2.09	4462	2.90	39651	3.65
81-90	1088	0.17	23890	17.40	812	0.51	2436	1.58	28226	2.60
> 91	350	0.06	7280	5.30	17	0.01	788	0.51	8435	0.78
Total	635348	100.00	137269	100.00	158716	100.00	154019	100.00	**1085352**	100.00

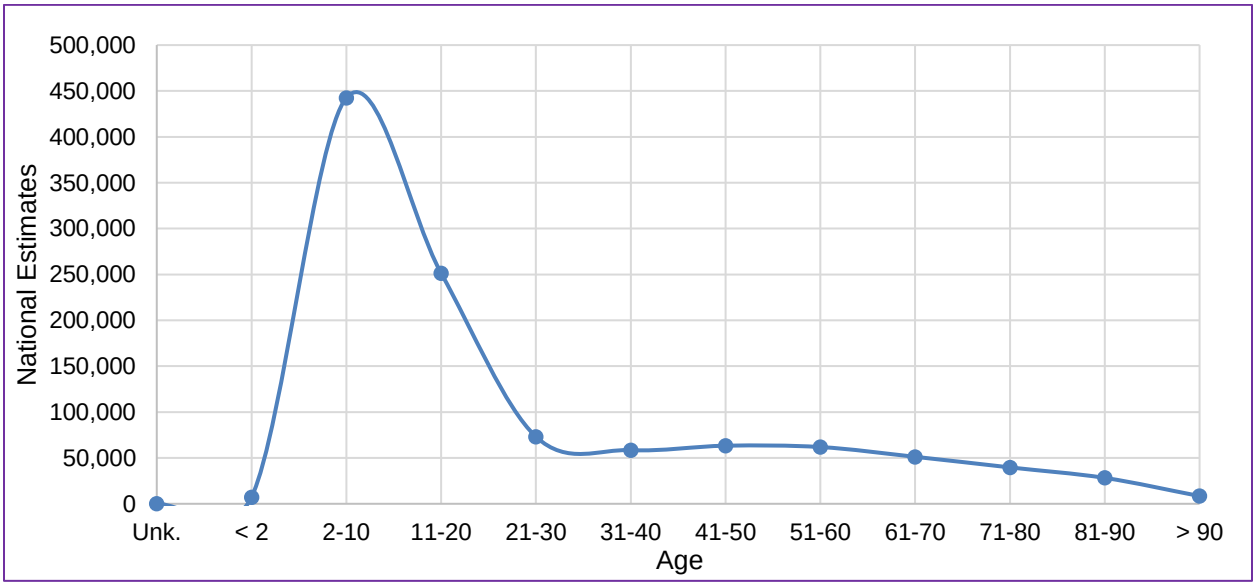


Figure 17 National Injury Estimates of for All PEMDs by Age

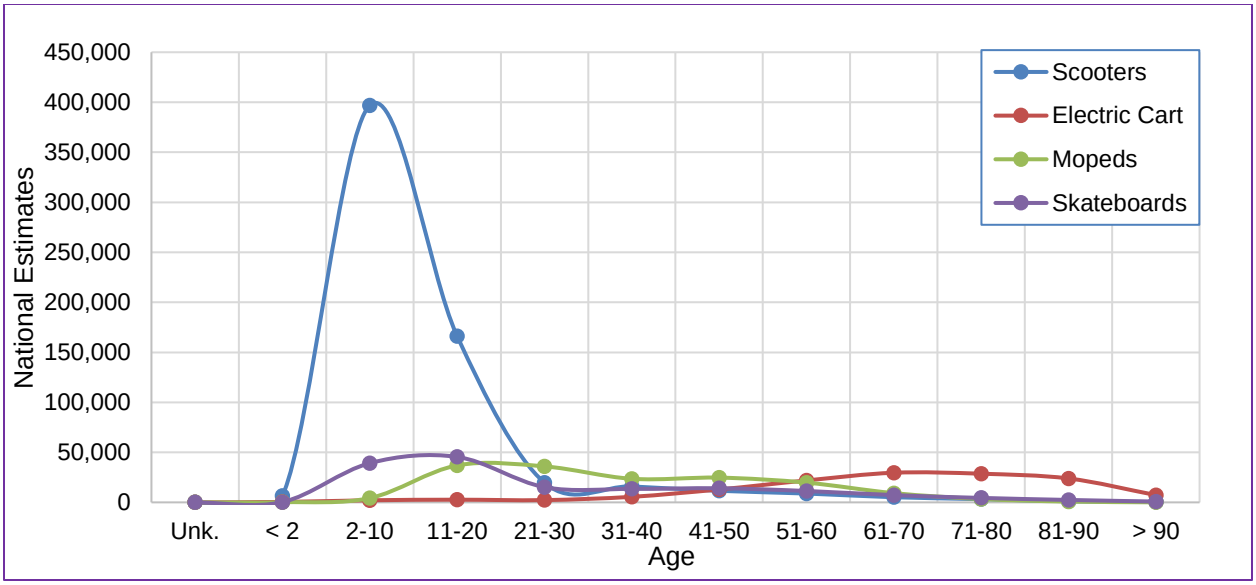


Figure 18 National Injury Estimates for Specific PEMD Types by Age

The PEMDs related injury incidence distribution based on gender is shown in Table 7, which indicates that males (59.42%) are more vulnerable to injury from these devices than females (40.47%). Only for Electric Carts, females have higher incidences than males. The analyzed data has been depicted in Figure 19.

Table 7 National Injury Estimates for Specific PEMD Types by Gender

Gender	Scooters	(%)	Electric Cart	(%)	Mopeds	(%)	Skateboards	(%)	Total	(%)
Unknown	60	0.01	279	0.20		0.00		0.00	339	0.03
Male	383619	60.38	62709	45.59	116806	73.59	82863	53.80	645997	59.52
Female	251669	39.61	74560	54.21	41910	26.41	71156	46.20	439295	40.47
Total	635348	100.00	137548	100.00	158716	100.00	154019	100.00	1085631	100.03

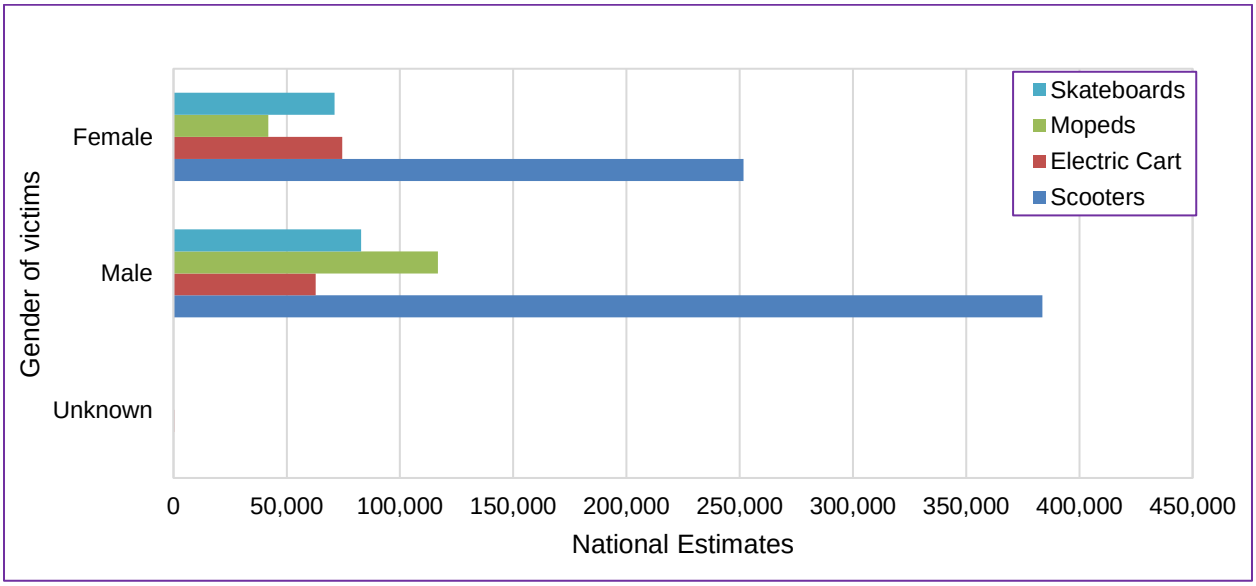


Figure 19 National Injury Estimates for Specific PEMD Types by Gender

Another analysis was conducted on the race of the patients hospitalized while using PEMDs. The findings are shown in Table 8 and Figure 20. White Americans are involved in most PEMD-related crashes, and they were engaged in about 564k crashes (52.0% of the total). Those of other races had very few PEMD-related injuries. However, about 30.4% of patients did not disclose their race in the hospital record book.

Table 8 National Injury Estimates for Specific PEMD Types by Race

Race	Scooters	(%)	Electric Cart	(%)	Mopeds	(%)	Skateboards	(%)	Total	(%)
Not Stated	173301	27.28	44732	32.59	56947	35.88	54651	35.48	329630	30.37
White	328996	51.78	78512	57.20	82463	51.96	74127	48.13	564098	51.97
Black / African American	66246	10.43	9595	6.99	13070	8.24	17599	11.43	106510	9.81
Other	59359	9.34	3770	2.75	5500	3.47	6061	3.94	74689	6.88
Asian	5553	0.87	239	0.17	327	0.21	850	0.55	6969	0.64
American Indian / Alaska Native	1595	0.25	390	0.28	409	0.26	447	0.29	2840	0.26
Native Hawaiian / Pacific Islander	299	0.05	32	0.02		0.00	284	0.18	615	0.06
Total	635348	100.00	137269	100.00	158716	100.00	154019	100.00	**1085352**	100.00

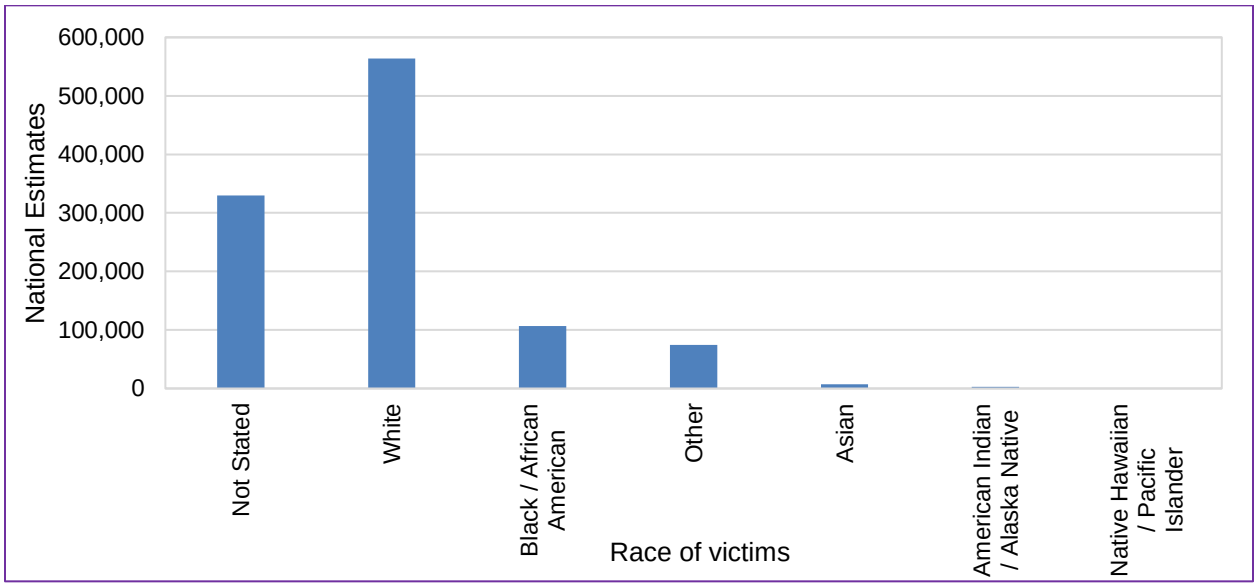


Figure 20 National Injury Estimates for All PEMDs by Race

4.1.3 National Injury Estimates by Location of Incidence and Body Part(s) of User

The final PEMD-related injury analyses were conducted based on the location where the incidence occurred and the affected body part(s) of the users. Table 9 shows results based on the location of the occurrence. Although the area of 34.9% of accidents is unknown, it is observed that home (27.79%) and apartment (24.6%) have many incidences of the eight listed locations. The street (7.7%) and school (3.6%) also have PEMD-related injuries. Figure 21 represents the national estimates by location for all PEMDs, and Figure 22 shows the injuries by location for each different type of PEMD. As explained above, Scooters-related injuries are the most common, with a higher number of collisions in all locations except apartment and street. In apartments, Scooters (105k) and Mopeds (106k) have almost equal incidences. In the street, Electric Carts have the highest number of injuries (36k).

Table 9 National Injury Estimates for All PEMDs by Location

Location	Scooters	(%)	Electric Cart	(%)	Mopeds	(%)	Skateboards	(%)	Total	(%)
Unknown	247154	38.90	39965	29.11	33934	21.38	57609	37.40	378662	34.89
Home	206856	32.56	41080	29.93	10788	6.80	42937	27.88	301661	27.79
Farm	94	0.01		0.00	124	0.08	71	0.05	289	0.03
Apartment	105413	16.59	17722	12.91	106827	67.31	36719	23.84	266682	24.57
Street	29593	4.66	36650	26.70	5068	3.19	12203	7.92	83514	7.69
Public		0.00		0.00	40	0.03		0.00	40	0.00
Mobile		0.00		0.00		0.00		0.00	0	0.00
Industry	14798	2.33	446	0.33		0.00	386	0.25	15631	1.44
School	31439	4.95	1406	1.02	1935	1.22	4094	2.66	38873	3.58
Total	635348	100.00	137269	100.00	158716	100.00	154019	100.00	**1085352**	100.00

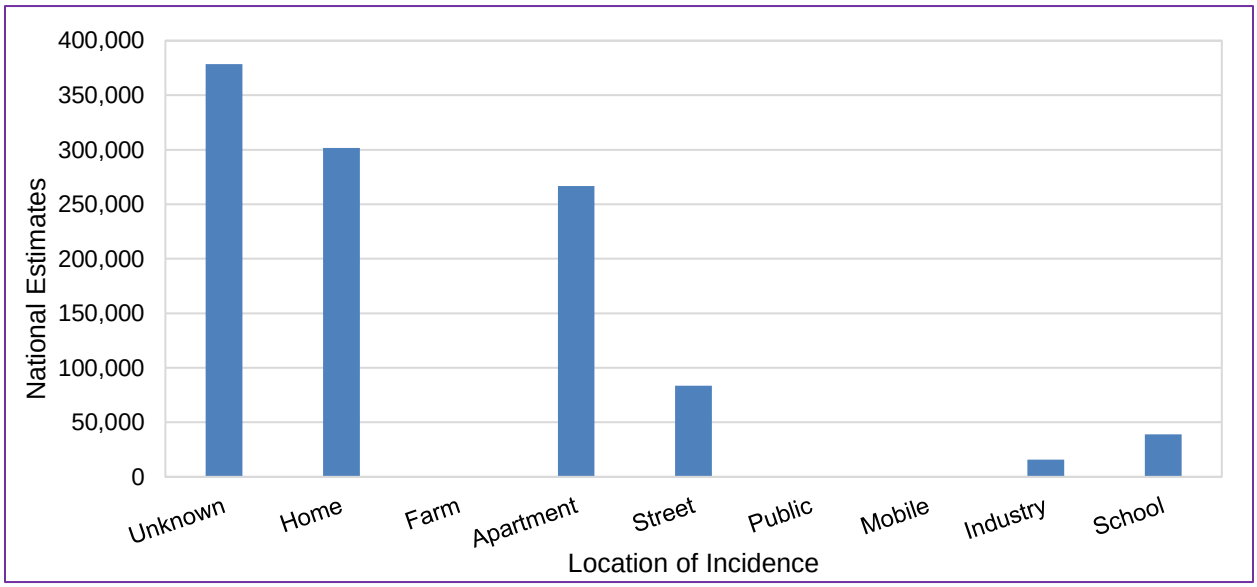


Figure 21 National Injury Estimates for All PEMDs by Location

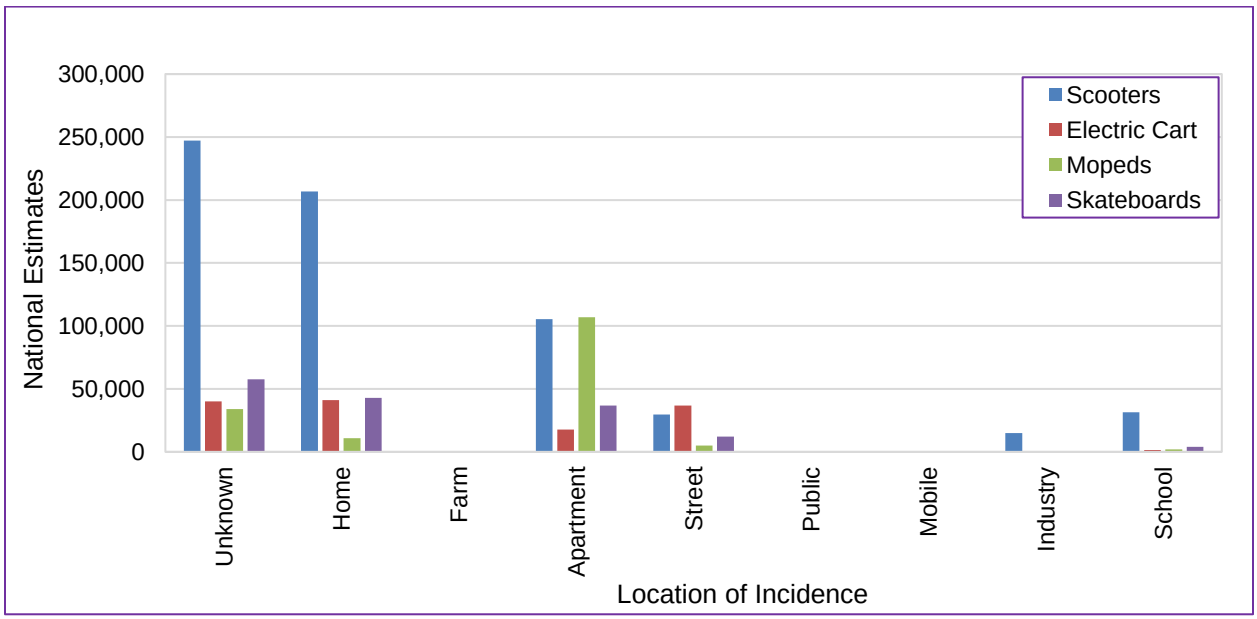


Figure 22 National Injury Estimates for Specific PEMD Types by Location

Table 10 and Figure 23 show the distribution of body parts injured while using PEMDS, in general, each specific PEMD type. Users' heads (13.3%) and faces (10.8%) are the most vulnerable body-parts, wrists (8.8%), lower arms (7.9%), and knees (7.2%) are also prone to be injured while using PEMDs. Figure 24 breaks down the injured body parts by different PEMD types. In the case of Scooters, the face (14.35%) is the most vulnerable body part where electric carts, mopeds, and skateboards, the head tends to be most injured.

Table 10 National Injury Estimates for Different Type of PEMDs by Body Part(s)

Body Part	Scooters	(%)	Electric Cart	(%)	Mopeds	(%)	Skateboards	(%)	Total	(%)
Internal	6	0.00		0.00		0.00		0.00	6	0.00
Shoulder	19840	3.12	7738	5.64	17163	10.81	7438	4.83	52179	4.81
Upper Trunk	11356	1.79	10072	7.34	11135	7.02	7310	4.75	39872	3.67
Elbow	35776	5.63	3712	2.70	6391	4.03	9144	5.94	55023	5.07
Lower Arm	62557	9.85	4179	3.04	5101	3.21	13865	9.00	85702	7.90
Wrist	68106	10.72	2789	2.03	6746	4.25	18004	11.69	95644	8.81
Knee	42239	6.65	9027	6.58	17367	10.94	9136	5.93	77769	7.17
Lower Leg	25659	4.04	13706	9.98	13798	8.69	9369	6.08	62532	5.76
Ankle	38081	5.99	7905	5.76	9376	5.91	10835	7.03	66196	6.10
Pubic Region	3533	0.56	22	0.02	16	0.01	374	0.24	3945	0.36
Head	78743	12.39	20292	14.78	23746	14.96	21232	13.79	144012	13.27
Face	91154	14.35	5944	4.33	9996	6.30	10044	6.52	117138	10.79
Eyeball	1614	0.25	173	0.13	353	0.22	214	0.14	2354	0.22
Upper Trunk (Old)	15757	2.48	21374	15.57	9929	6.26	8362	5.43	55421	5.11
Upper Arm	5438	0.86	1584	1.15	1801	1.13	1897	1.23	10721	0.99
Upper Leg	6766	1.06	2928	2.13	2845	1.79	1266	0.82	13806	1.27
Hand	17207	2.71	2247	1.64	5307	3.34	3216	2.09	27978	2.58
Foot	33094	5.21	11587	8.44	5410	3.41	9006	5.85	59097	5.44
25-50% of body	60	0.01		0.00	159	0.10	15	0.01	233	0.02
All Parts Body	510	0.08	1856	1.35	926	0.58	507	0.33	3799	0.35
Not Stated	2049	0.32	1429	1.04	1620	1.02	774	0.50	5873	0.54
Mouth	29228	4.60	64	0.05	1175	0.74	1633	1.06	32100	2.96
Neck	3106	0.49	3553	2.59	3694	2.33	2272	1.47	12624	1.16
Finger	28056	4.42	1708	1.24	3017	1.90	4347	2.82	37128	3.42
Toe	14073	2.22	3333	2.43	1564	0.99	3624	2.35	22594	2.08
Ear	1341	0.21	46	0.03	84	0.05	135	0.09	1606	0.15
Total	635348	100.00	137269	100.00	158716	100.00	154019	100.00	**1085352**	100.00

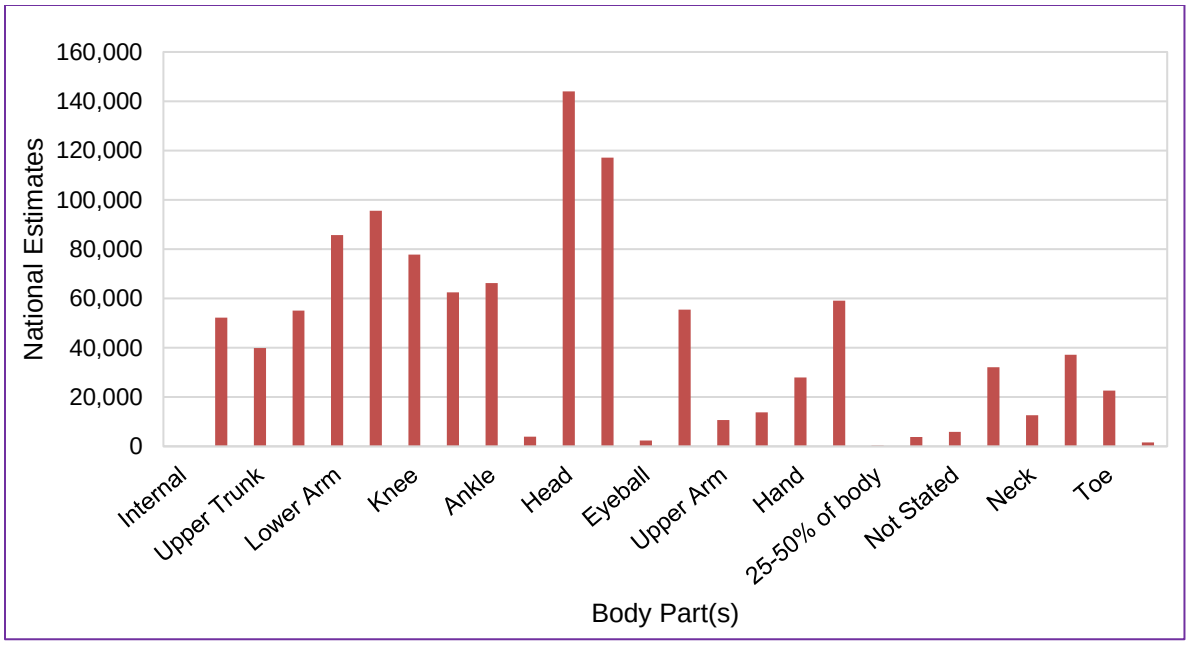


Figure 23 National Injury Estimates for All PEMDs by Body Part

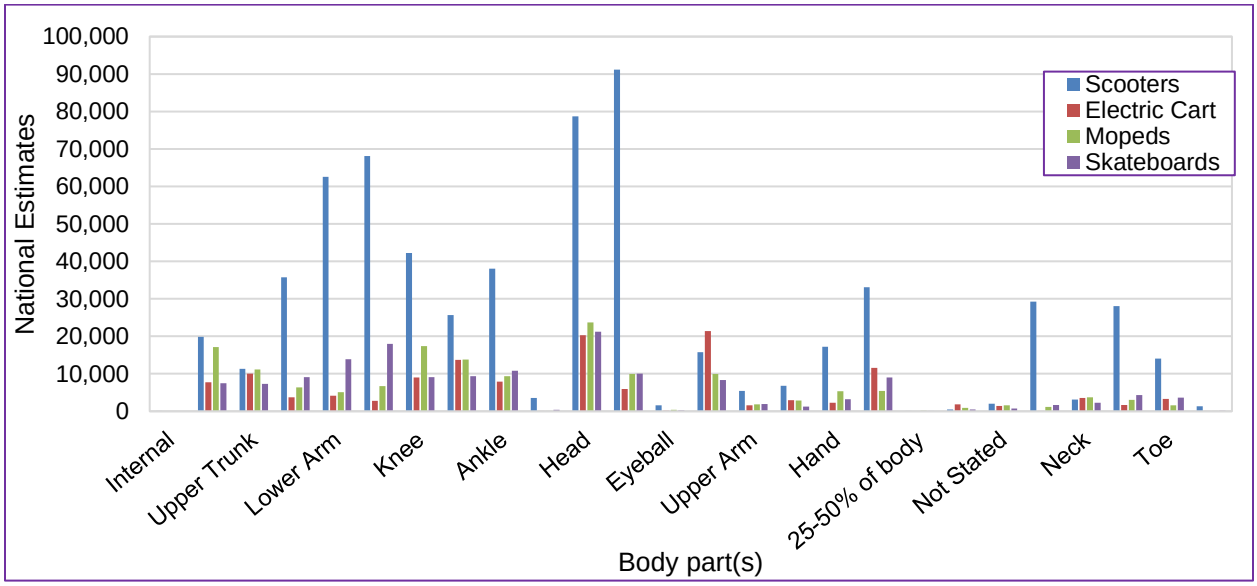


Figure 24 National Injury Estimates for a Specific PEMD by Body Part

Based on the analysis of the safety data obtained from the NEISS database, it can be concluded that PEMDs users are highly vulnerable to fall in collisions due to balance issues. The data also suggest that the manufacturers of PEMDs should be more concerned about safety issues and provide adequate protection measures like helmet or safety gear to reduce crash incidences.

4.2 Data Analysis for PEMDs in a Traditional Operating Environment

In the experiment involving PEMD use in traditional operating environments, four scenarios were defined for each route. Each volunteer performed 2 to 4 runs from the start-point to the end-point, and vice versa, for each scenario [Figure 3]. Details about the cases and scenarios are shown in

Table 11. The travel time and the travel distance were recorded for each volunteer during the experiment.

Table 11 Cases and Scenarios for the Experiment in Traditional Operating Condition

Cases*	Scenario No.	Scenario Details
A	1	Start to End - Single Pedestrian
A	2	End to Start - Single Pedestrian
B	1	Start to End - Multi Pedestrian - Opposite Direction
B	2	End to Start - Multi Pedestrian - Opposite Direction
B	3	Start to End - Multi Pedestrian - Same Direction
B	4	End to Start - Multi Pedestrian - Same Direction
C	1	Start to End - Single hoverboard Run
C	2	End to Start - Single hoverboard Run
D	1	Start to End - Mixed Traffic - Opposite Direction
D	2	End to Start - Mixed Traffic - Opposite Direction
D	3	Start to End - Mixed Traffic - Same Direction
D	4	End to Start - Mixed Traffic - Same Direction

*Case Details:

Case – A: Single Volunteer Walking
Case – B: Multiple Volunteers Walking
Case – C: Single Hoverboard Run
Case – D: Mixed Traffic, *i.e.,* Hoverboard Run and Volunteer Walking

From the travel distance and travel time, the walking and hoverboard running speeds were calculated for each run. Table 12 shows a summary of the walking speeds and hoverboard speeds for each volunteer for both walkways. It was found that the highest walking speed at the sidewalk near ECSC building without the presence of hoverboard was 3.12 mph, and with the hoverboard present, it dropped to 2.77 mph. For the walkway along Geathers Street, the walking speed without the presence of a PEMD was 3.29 mph, and with the PEMD, it was 2.74 mph. The hoverboard rider had speed ranging from roughly 4-5 mph.

Table 12 Travel Speeds of Pedestrians and a Hoverboard Rider in a Traditional Operating Environment

Walkway	Volunteers	Speed (mph)	Cases			
			A	B	C	D
Near ECSC Building	Pedestrian – 1	Max	3.12	2.93		
		Min	3.04	2.85		
		Average	3.08	2.89		
	Pedestrian – 2	Max	2.89	2.91		2.77
		Min	2.82	2.87		2.61
		Average	2.86	2.89		2.69
	All Pedestrians	Max	3.12	2.93		2.77
		Min	2.82	2.85		2.61
		Average	2.97	2.89		2.69
	Hoverboard Rider	Max			5.43	5.20
		Min			4.07	4.26
		Average			5.02	4.70
Along Geathers Street	Pedestrian – 1	Max	3.29	3.14		
		Min	3.24	2.86		
		Average	3.26	3.01		
	Pedestrian – 2	Max	2.76	2.89		2.74
		Min	2.72	2.83		2.57
		Average	2.74	2.85		2.68
	All Pedestrians	Max	3.29	3.14		2.74

Walkway	Volunteers	Speed (mph)	Cases			
			A	B	C	D
		Min	2.72	2.83		2.57
		Average	3.00	2.93		2.68
	Hoverboard Rider	Max			4.06	4.06
		Min			3.88	3.20
		Average			3.97	3.60

The presence of the hoverboard on the walkway negatively affects pedestrian walking speeds, as is shown in Table 13 and Figure 25. Pedestrians' walking speeds were comparatively higher in Case-A, i.e., a single pedestrian walking. The addition of one additional pedestrian to the walkway (Case-B, two pedestrians on the sidewalk), reduced walking speed by 2.5%. Adding the hoverboard (Case-D) reduced the walking speed of the pedestrian in both walkways (9.5% at ECSC Building and 10.8% at Geathers St.) for an average speed reduction of 10.1%. Thus, this analysis concludes that the use of PEMDs on walkways decreases pedestrian walking speed.

Table 13 Walking Speed Reduction with a Hoverboard Present on a Walkway

Case	Pedestrian Walking Speed (mph)			Speed Reduced due to hoverboard (%)		
	Near ECSC Building	Along Geathers Street	Average	Near ECSC Building	Along Geathers Street	Average
A	2.97	3.00	2.99	-	-	-
B	2.89	2.93	2.91	-2.64	-2.39	-2.52
D	2.69	2.68	2.68	-9.45	-10.81	-10.13

Figure 25 Impact of a Hoverboard on Pedestrian Walking Speed

4.3 Data Analysis of Travel Delay in a Simulated Environment

Based on the experimental data collected in traditional operating conditions, a simulation model was created using VISSIM software, and ten simulation runs were performed using a 10-minute duration for each scenario on both walkways. From the simulations, pedestrians' travel times, travel distances, and delay times were estimated, focusing on the impact of the presence of a Hoverboard. Four new 2D/3D pedestrian models and eight different speed conditions were created in VISSIM to mimic the experimental environment. Table 14 shows the 2D/3D model properties and speed criteria used in VISSIM.

Table 14 Travel Speed Data in a Traditional Environment from the Simulation Run in VISSIM

From Field Data	Speed for walkway near to ECSC Building (mph)		Speed for walkway along Geathers Street (mph)		Pedestrian characteristics			Pedestrian Type in VISSIM
	Max	Min	Max	Min	Width (in)	Length (in)	Height (in)	
Pedestrian-1	3.12	2.85	3.29	2.86	20	15	67	300
Pedestrian-2	2.91	2.61	2.89	2.57	23	20	73	400
Mixed Pedestrian	3.12	2.61	3.29	2.57	21.5	17.5	70	500
Hoverboard	5.43	4.07	4.06	3.20	24	19.5	72	600

Four pedestrian type was created in the VISSIM model based on real-world physical properties which are 300, 400, 500, and 600 representing Pedestrian-1, Pedestrian-2, Mixed Pedestrian, and hoverboard, respectively (as shown in Table 14). These simulation results were analyzed to examine the impact of PEMDs on the average delay on the walkway. Case B is more realistic than A, and Case C has no interaction between pedestrians and a hoverboard rider. Therefore, Case A and C were omitted in these simulations. For all simulations, it is observed that PEMDs create a time delay on the walkway (last row in Table 15), and it signifies that PEMDs have an adverse impact on walkers maneuvering the footpath. Since the sidewalk along ECSC building is comparatively wider (10-16 ft.) than the sidewalk along the Geathers Street, the delay time for pedestrians (1.70 sec) is shorter in the walkway along with ECSC building than the walkway along Geathers Street (9.01 sec). The hoverboard caused more delay (10.47 – 9.01 = 1.46 sec) in the narrow walkway than the wider one (1.11 sec).

Table 15 Travel Delay of Pedestrians and a Hoverboard Rider in VISSIM Simulation

Simulation Number	Pedestrian or hoverboard Code in VISSIM	Case B - Near ECSC Building		Case D - Near ECSC Building		Case B - Along Geathers Street		Case D - Along Geathers Street	
		Ped/hr	Mean Delay (s)	Ped/hr	Mean Delay (s)	Ped/hr	Mean Delay (s)	Ped/hr	Mean Delay (s)
1	300	73	1.95	51	1.24	90	9.13	68	7.86
1	400	48	1.06	52	1.16	94	7.38	66	7.73
1	500	53	1.57	34	1.34	79	8.06	72	7.53
1	600			32	5.98			57	17.79
2	300	71	1.91	52	1.47	96	9.63	71	7.93
2	400	62	1.42	54	1.18	85	7.39	73	6.69
2	500	46	1.82	40	2.17	84	8.33	55	7.70
2	600			26	5.28			69	16.18
3	300	67	1.96	51	1.74	85	9.84	67	8.59
3	400	72	1.44	50	1.22	90	8.19	69	8.07
3	500	53	1.81	50	2.07	101	8.52	63	7.95
3	600			38	6.75			78	17.18
4	300	70	1.76	51	1.66	83	10.05	71	8.21
4	400	66	1.39	54	1.22	91	8.12	62	7.14
4	500	57	1.42	46	2.08	103	9.63	67	7.70
4	600			42	6.45			85	18.08
5	300	66	1.89	52	1.76	90	9.89	72	8.44
5	400	74	1.51	54	1.22	94	8.24	63	7.20
5	500	68	1.98	50	1.49	108	9.05	69	8.21
5	600			46	7.29			88	16.69
6	300	63	1.46	56	0.98	92	10.04	67	8.99
6	400	63	1.49	42	1.35	94	7.87	67	8.18
6	500	67	1.87	45	1.54	81	9.25	68	8.23

Simulation Number	Pedestrian or hoverboard Code in VISSIM	Case B - Near ECSC Building		Case D - Near ECSC Building		Case B - Along Geathers Street		Case D - Along Geathers Street	
		Ped/hr	Mean Delay (s)	Ped/hr	Mean Delay (s)	Ped/hr	Mean Delay (s)	Ped/hr	Mean Delay (s)
6	600			46	5.63			64	18.80
7	300	72	2.19	58	1.51	78	9.28	61	8.32
7	400	60	1.08	41	1.06	104	7.90	75	7.61
7	500	79	1.93	49	1.66	76	9.74	69	8.36
7	600			59	9.25			56	19.05
8	300	65	1.92	49	1.52	81	10.11	62	8.98
8	400	70	1.52	48	1.23	97	8.21	72	7.28
8	500	59	1.83	51	2.04	91	10.07	65	8.51
8	600			41	7.39			70	17.87
9	300	61	2.18	47	1.46	78	9.71	56	8.57
9	400	76	1.16	58	1.16	101	8.07	79	7.56
9	500	50	2.11	44	1.60	106	9.40	69	8.95
9	600			33	6.40			81	18.18
10	300	59	2.25	46	1.85	87	10.78	65	9.41
10	400	73	1.23	59	1.36	87	8.13	68	7.05
10	500	63	1.97	45	1.71	114	10.36	72	8.38
10	600			43	7.04			86	17.86
For all Simulation	Walkway user		1.70		2.81		9.01		10.47

4.4 Data Analysis for Connected Environment

Twelve categories of tests were conducted to assess the impact of the PEMDs on travel behavior and infrastructure in a connected versus a non-connected environment. Table 16 indicates the details of the cases and the scenarios of the experiment conducted in the Clemson University Connected Vehicle Testbed (CU-CVT).

Table 16 Cases and Scenarios for the Experiment in a Connected Environment

Cases	Scenarios	Details of the Scenarios	No. of Trials
Case-A	Scenario-1	A pedestrian walking in the same direction of the vehicle in a non-connected environment	3
	Scenario-2	A pedestrian walking in the opposite direction of the vehicle in a non-connected environment	2
	Scenario-3	A pedestrian & a hoverboard traveling in the same direction of the vehicle in a non- connected environment	1
	Scenario-4	A pedestrian & a hoverboard traveling in the opposite direction of the vehicle in a non-connected environment	1
Case-B	Scenario-1	A pedestrian walking in the same direction of the vehicle in a connected environment	3
	Scenario-2	A pedestrian walking in the opposite direction of the vehicle in a connected environment	3
	Scenario-3	A pedestrian & a hoverboard traveling in the same direction of the vehicle in a connected environment	1
	Scenario-4	A pedestrian & a hoverboard traveling in the opposite direction of the vehicle in a connected environment	1
Case-C	Scenario-1	A pedestrian crossing the roadway in a non-connected environment	1
	Scenario-2	A pedestrian & a hoverboard crossing the roadway in a non-connected environment	2
Case-D	Scenario-1	A pedestrian crossing the roadway in a connected environment	1
	Scenario-2	A pedestrian & a hoverboard crossing the roadway in a connected environment	2
		Total Number of Trials =	***21***

Details about the data collected for Cases A, B, C, and D are attached in Appendices A, B, C, and D, respectively. Figure 26 represents the conditions of the experiment for Case-A and Case-B. Similarly, Figure 27 depicts the conditions for Case-C and Case-D.

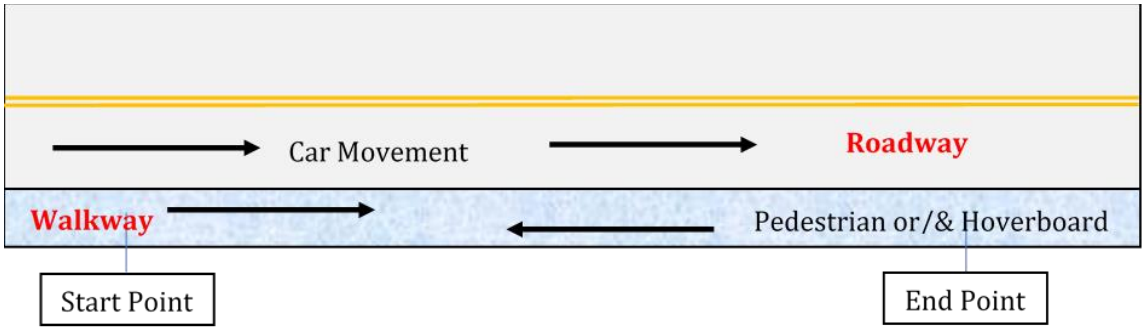


Figure 26 Pedestrian and Hoverboard Traveling Along the Roadway

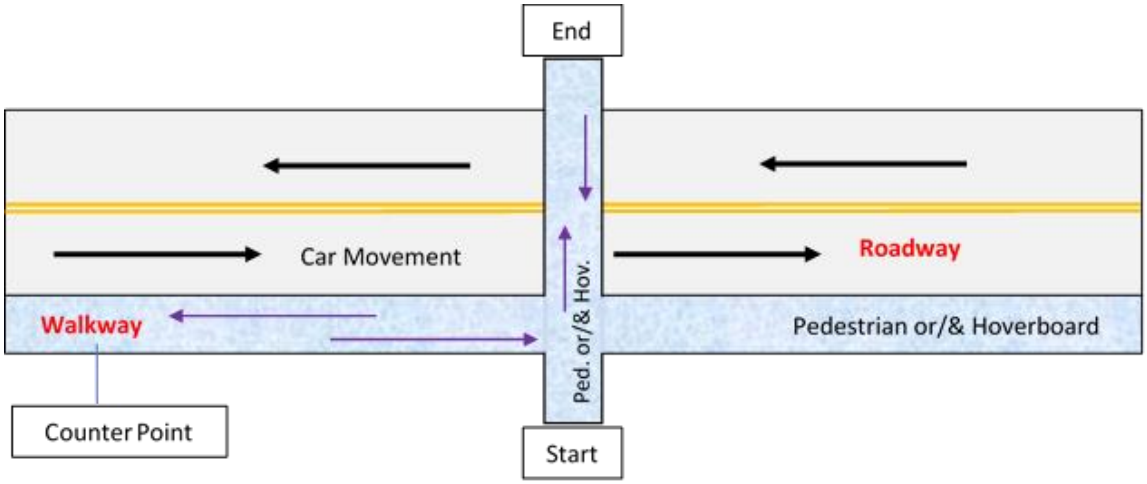


Figure 27 Pedestrian and Hoverboard Crossing the Roadway

4.4.1 Case-A - PEMDs Traveling Along the Roadway in a Non-Connected Environment

For Case-A Scenario-1, i.e., the pedestrian walking in the same direction of the vehicle in a non-connected environment, three trials were conducted. Figures 28 and 29 represent the speed and distance between the vehicle and pedestrian from those three trials, respectively. It was observed that the vehicle gradually reduces its speed as it approaches the pedestrian. The distance curves were similar for all types of trials.

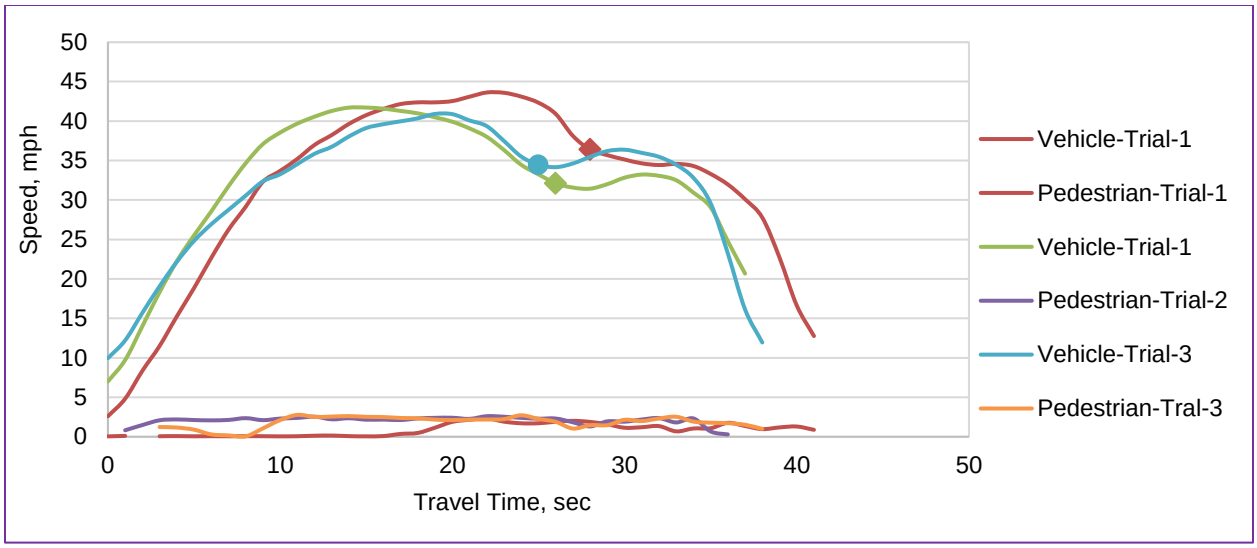


Figure 28 Speed Distributions of Pedestrian and Vehicle for Case-A Scenario-1

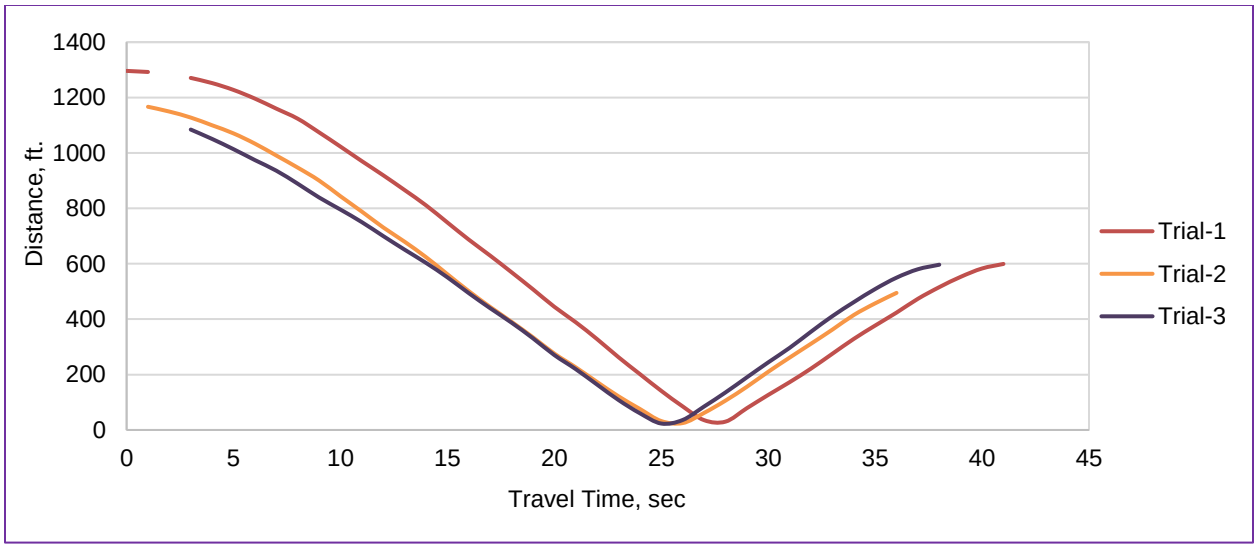


Figure 29 Distance between Vehicle and Pedestrian for Case-A Scenario-1

For Case-A Scenario-2, i.e., the pedestrian walking in the opposite direction of the vehicle in a non-connected environment, two trials were conducted. Figures 30 and 31 represent the speed and distance between the vehicle and pedestrian from those two trials, respectively. It was found that the vehicle gradually reduced its speed as it approached the pedestrian. The distance curves were similar for all types of trials. The diamond and bullet on the curves indicate the speed of the vehicle while passing the pedestrian.

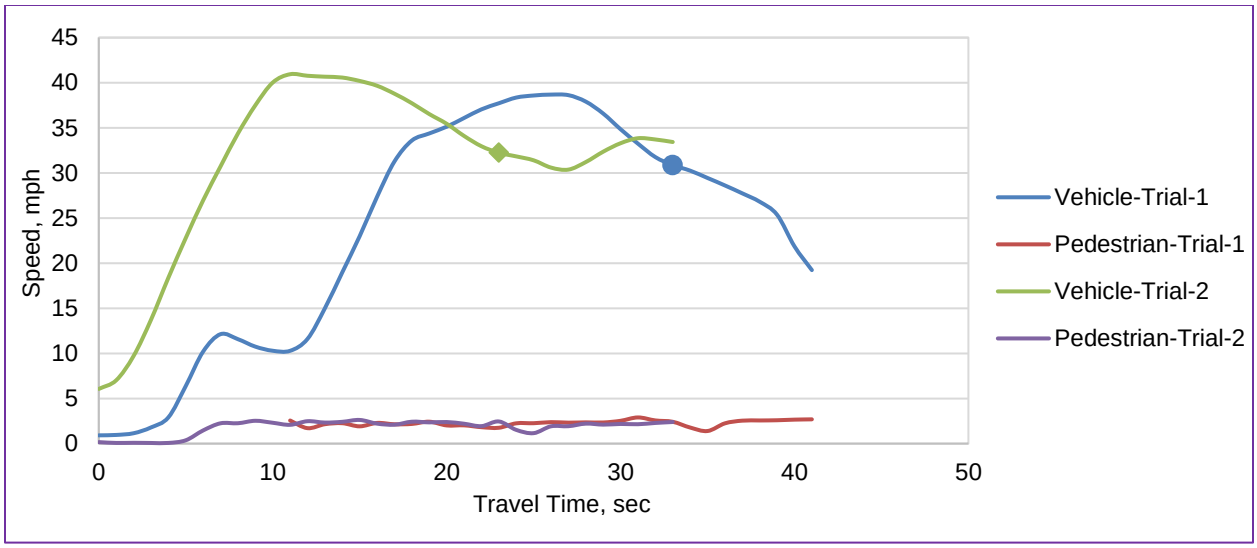


Figure 30 Speed Distributions of Pedestrian and Vehicle for Case-A Scenario-2

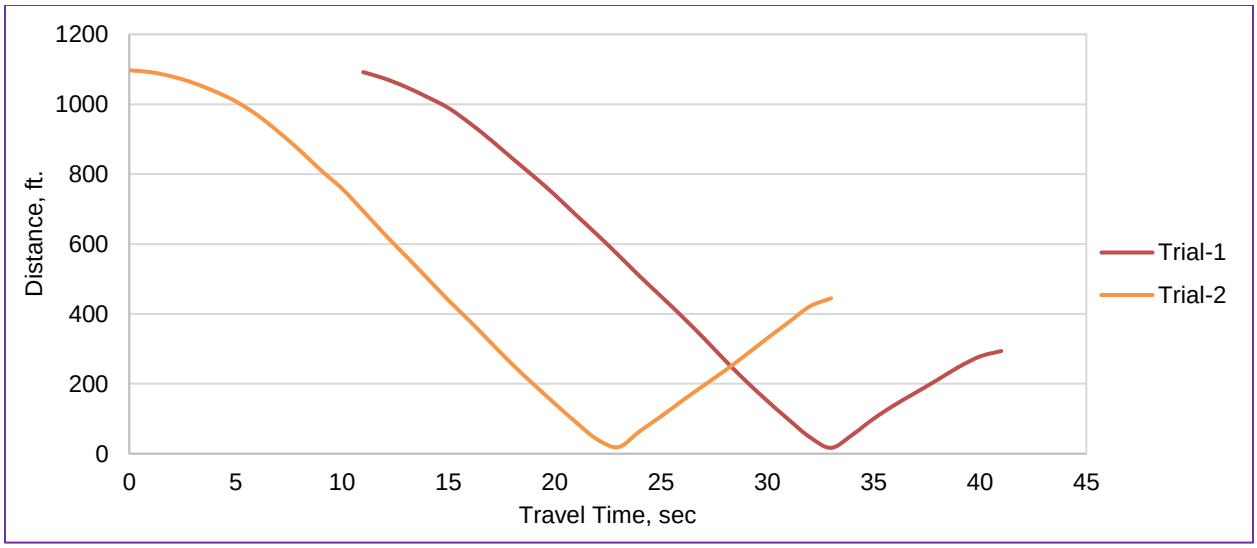


Figure 31 Distance between Vehicle and Pedestrian for Case-A Scenario-2

For Case-A Scenario-3, i.e., the pedestrian walking & hoverboard running in the same direction of the vehicle in a non-connected environment, one trial was conducted. Figures 32 and 33 represent the speeds of, and distances between the vehicle, the hoverboard, and the pedestrian, respectively. It was found that the vehicle maintained a relatively constant speed while passing the pedestrian and hoverboard. The distance curves for both the pedestrian and the hoverboard were similar. The diamond and bullet on the curve indicate the speed of the vehicle while passing the pedestrian. By comparing the speed between the pedestrian and hoverboard, it was found that the hoverboard maintained a relatively constant speed with a higher magnitude than the pedestrian, as observed in Figure 32.

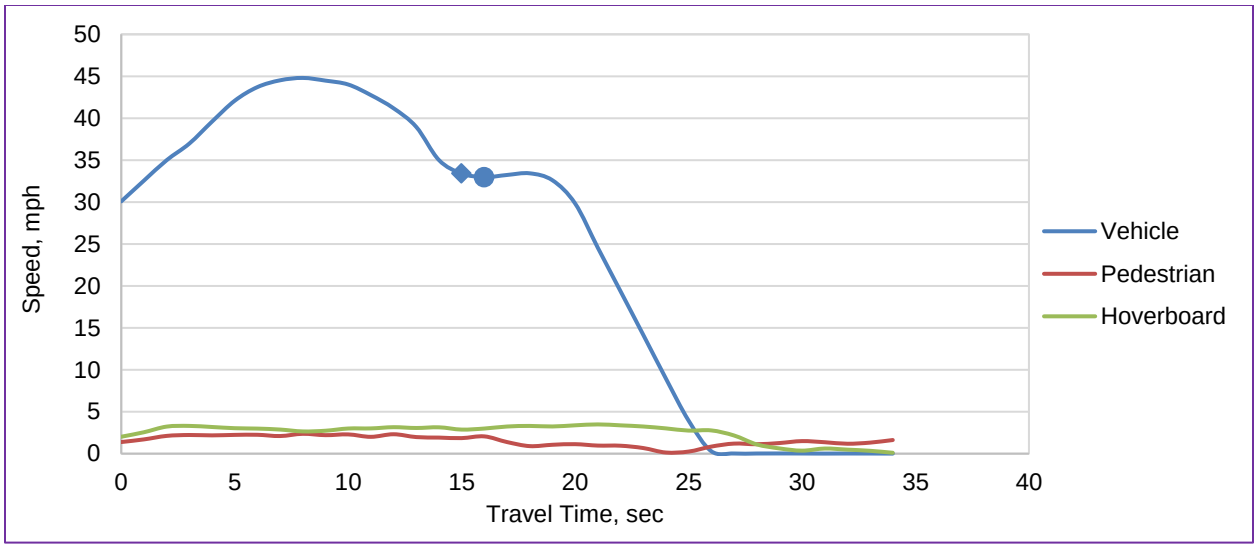


Figure 32 Speed Distribution for Case-A Scenario-3 at CU-CVT

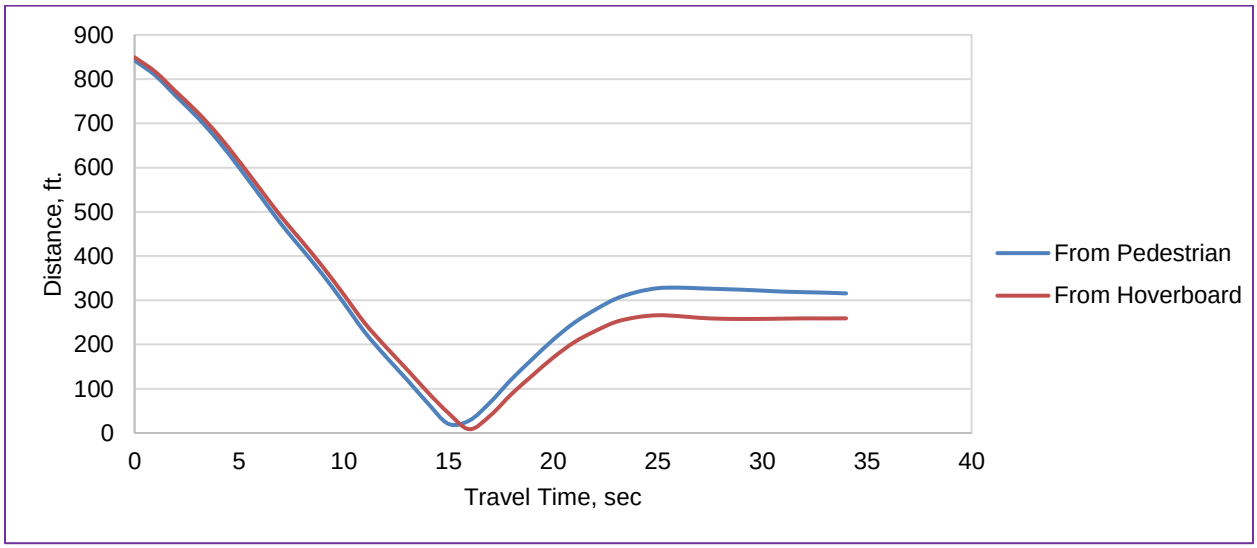


Figure 33 Distance Distribution of Vehicle, Pedestrian and Hoverboard for Case-A Scenario-3

For Case A-Scenario 4, i.e., a pedestrian walking and a hoverboard running in the opposite direction of the vehicle in a non-connected environment, one trial was conducted. Figures 34 and 35 represent the speed and distance among the vehicle, hoverboard, and pedestrian from that trial. It was found that the speed variation and distance variation is similar to the previous experiment where the pedestrian was passing in the same direction (Case-A Scenario-3).

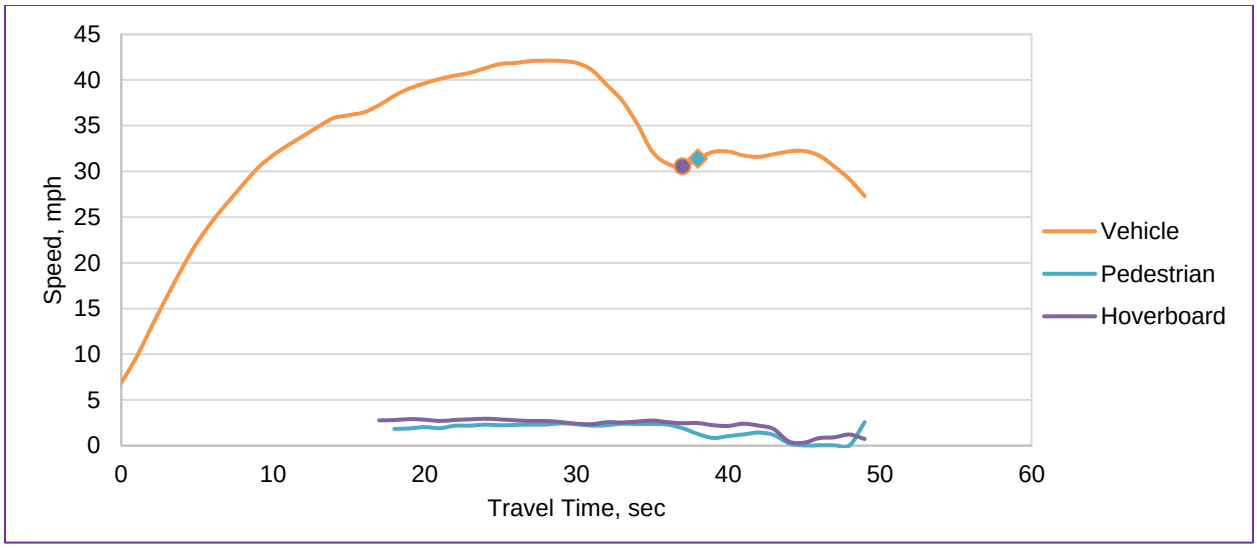


Figure 34 Speed Distribution for Case-A Scenario-4

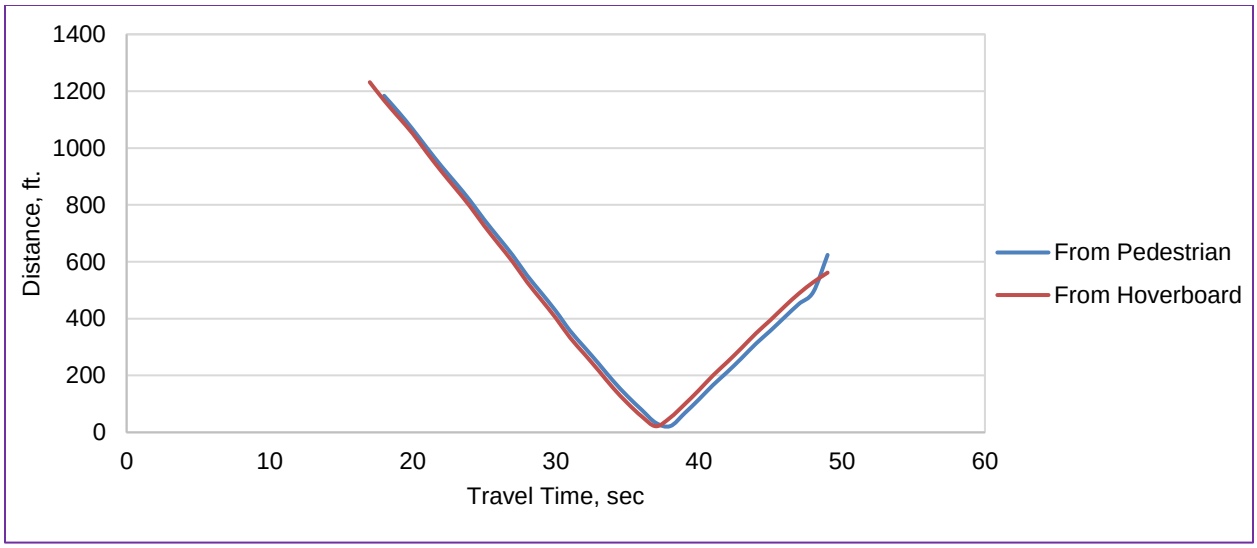


Figure 35 Distance Distribution of Vehicle for Case-A Scenario-4

4.4.2 Case-B - PEMDs Traveling along the Roadway in a Connected Environment

Three trials were conducted for Case-B Scenario-1, i.e., the pedestrian walking in the same direction as the vehicle in a connected environment. The speed distribution of vehicle and pedestrian and their distance from those three trials are shown in Figures 36 and 37, respectively. It was found that the vehicle gradually reduced its speed as it was approaching the pedestrian. The distance curves were similar for all types of trials. The square point with dotted lines indicates the position of the vehicle while the vehicle was 250 ft. away from the pedestrian. For 40 mph vehicle speed, the standard stopping sight distance is 250 ft.

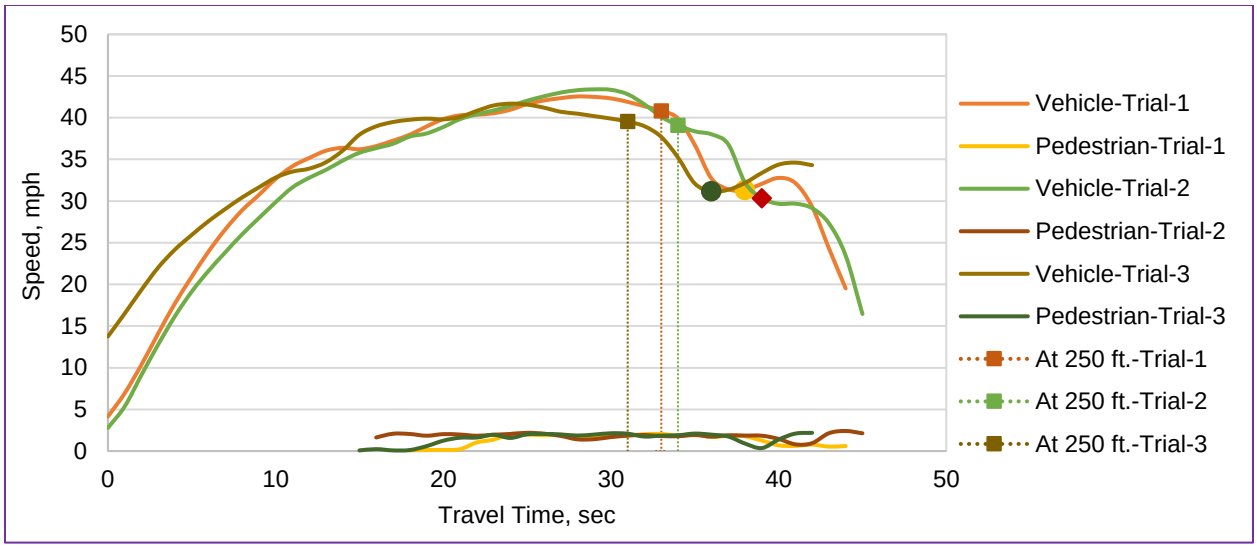


Figure 36 Speed Distribution for Case-B Scenario-1 at CU-CVT

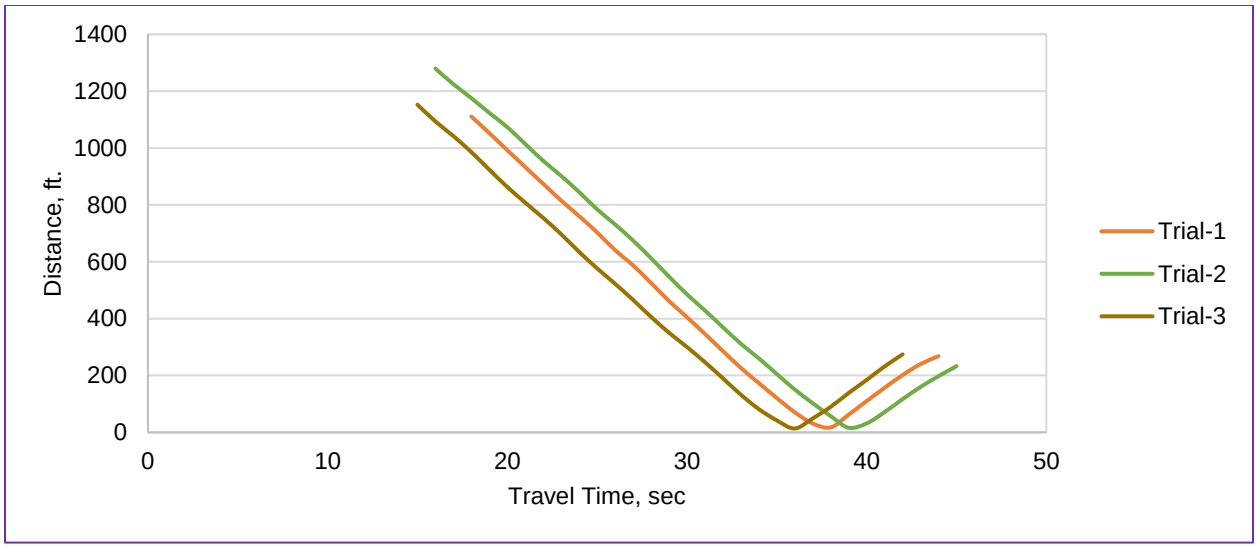


Figure 37 Distance between Vehicle and Pedestrian for Case-B Scenario-1

For Case-B Scenario-2, i.e., the pedestrian walking in the opposite direction of the vehicle in a connected environment, three trials were conducted. Figures 38 and 39 represent the speed and distance between the vehicle and pedestrian from those three trials, respectively. It was observed that the vehicle gradually reduced speed as it was approaching the pedestrian. The distance curves were similar for all types of trials. The square point with dotted lines indicates the position of the vehicle while the vehicle was 250 ft. away from the pedestrian. For 40 mph vehicle speed, the standard stopping sight distance is 250 ft. The diamond and bullet on the curves indicate the speed of the vehicle while passing a pedestrian.

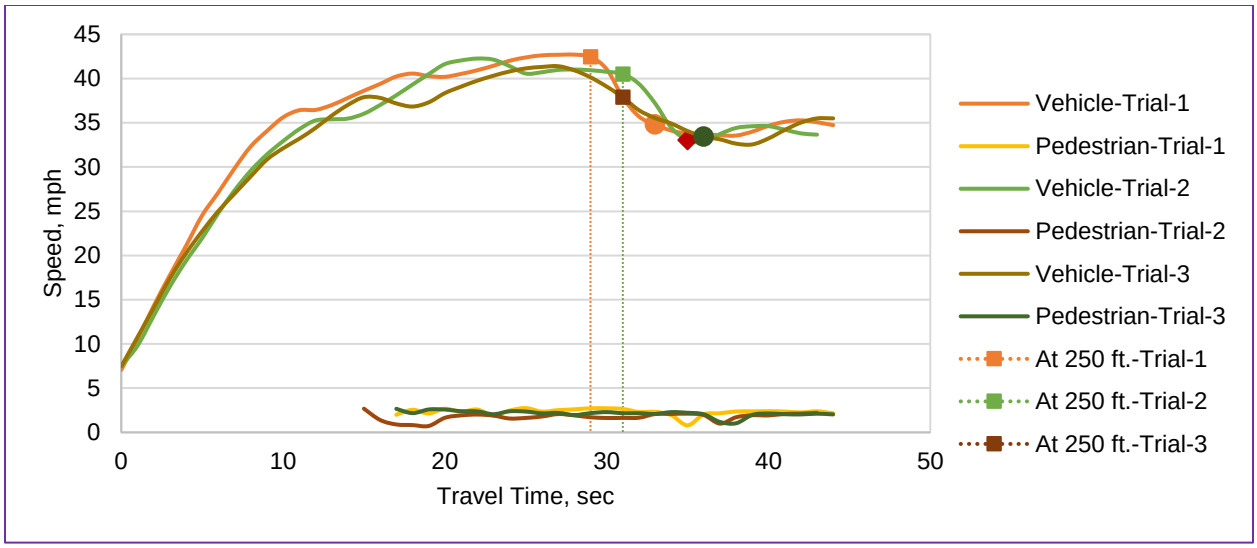


Figure 38 **Speed Distribution for Case-B Scenario-2**

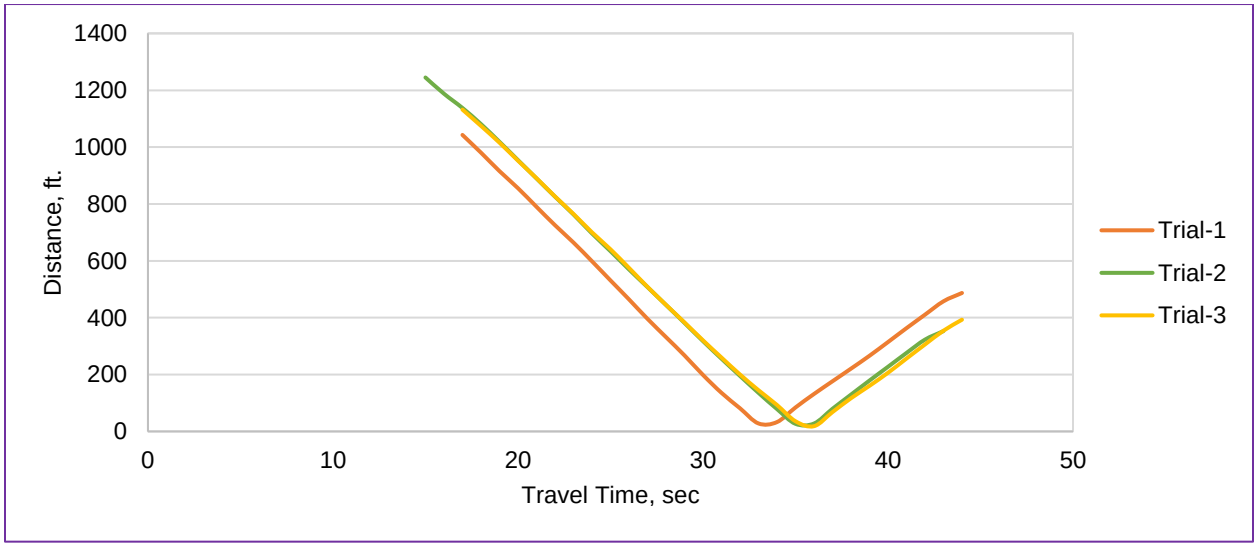


Figure 39 Distance between Vehicle and Pedestrian for Case-B Scenario-2

One trial was conducted for Case-B Scenario-3, i.e., the pedestrian walking and the hoverboard running in the same direction of the vehicle in a connected environment. Figures 40 and 41 depict the speed and distance between the vehicle, hoverboard, and pedestrian, respectively. It was shown that the distance curves for both the pedestrian and the hoverboard were similar. The diamond and bullet on the curves indicate the speed of the vehicle while passing the pedestrian. The hoverboard had a relatively constant speed and a higher speed than the pedestrian. The square point indicates the position of the vehicle while the vehicle was 250 ft. away from the pedestrian and hoverboard.

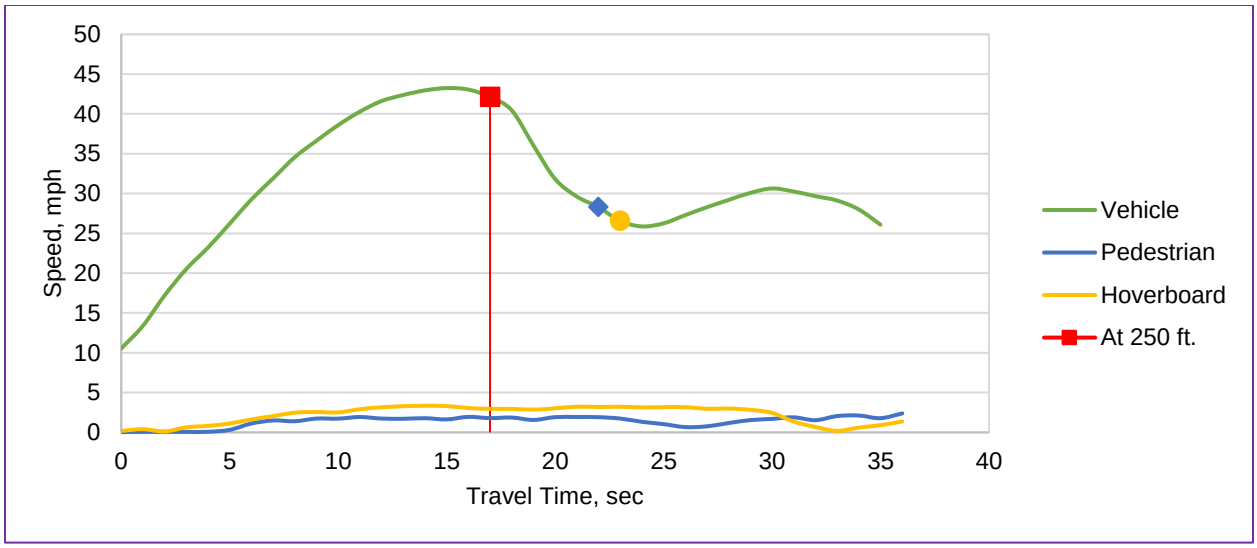


Figure 40 Speed Distribution for Case-B Scenario-3 at CU-CVT

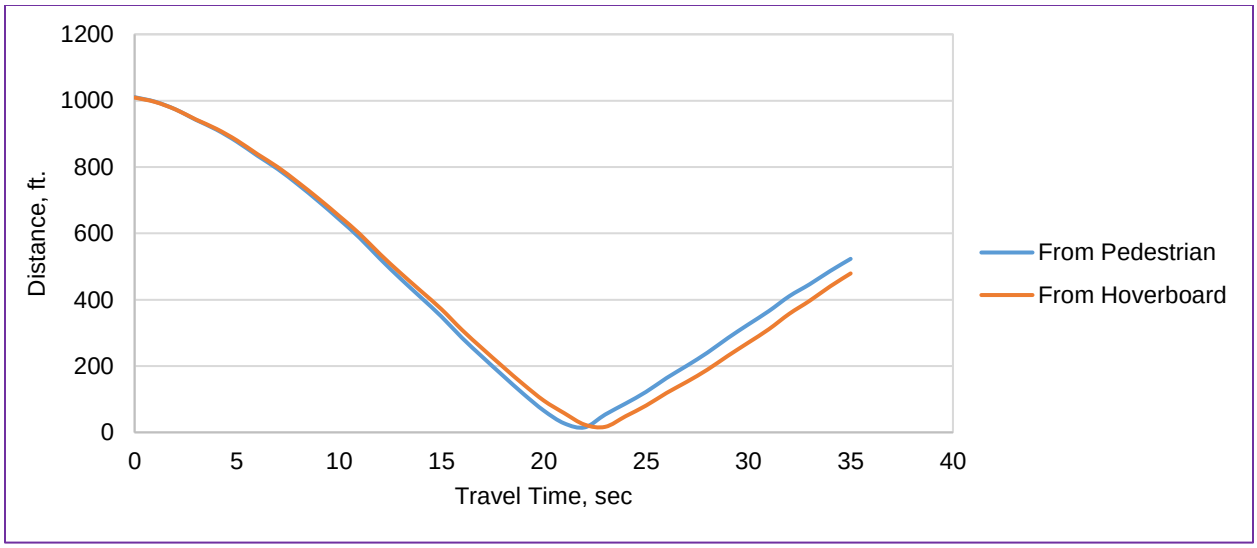


Figure 41 Distance between Vehicle, Hoverboard, and Pedestrian for Case-B Scenario-3

For Case-B-Scenario-4, i.e., pedestrian walking & hoverboard running in the opposite direction of the vehicle in a connected environment, one trial was conducted. Figures 42 and 43 show the speeds of, and distance between, the vehicle, hoverboard, and pedestrian. It was found that the speed variation and distance variation is similar to the previous trial of the passing in the same direction (case-B scenario-3). The square point with a dotted line indicates the position of the vehicle while the vehicle was 250 ft. away from the pedestrian and hoverboard.

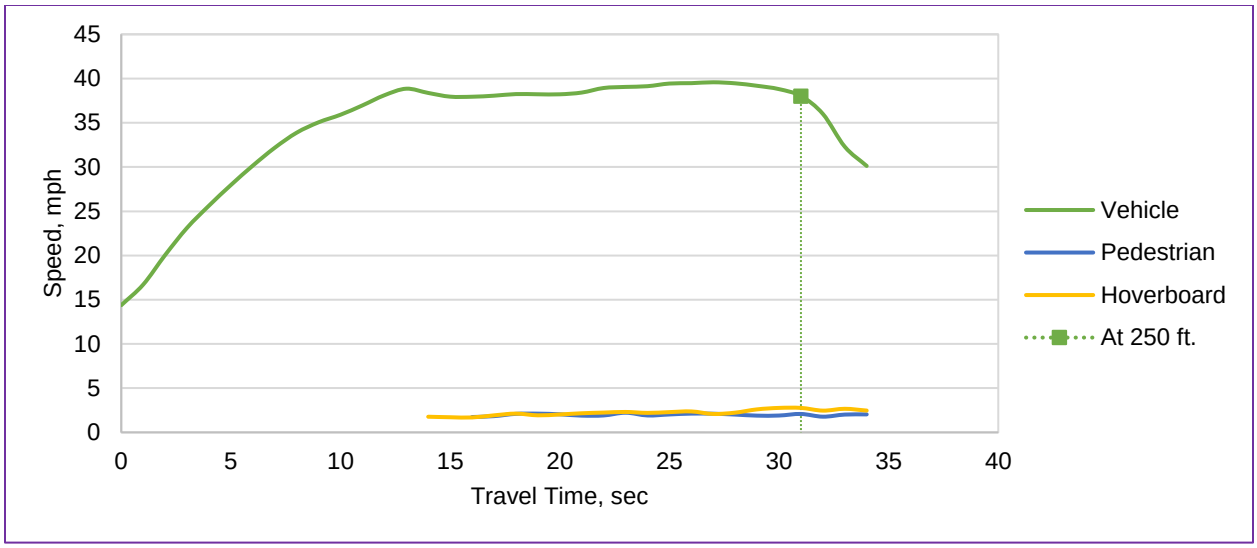


Figure 42 Speed Distribution for Case-B Scenario-4 at CU-CVT

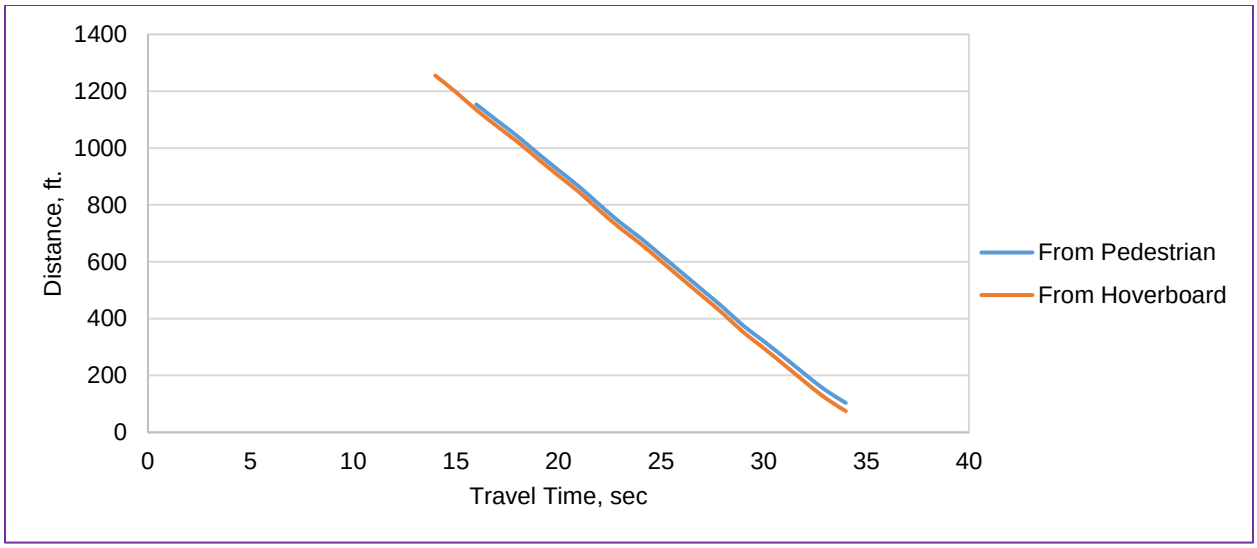


Figure 43 Distance Distribution of Vehicle from Pedestrian and Hoverboard for Case-B Scenario-4

4.4.3 Case-C - PEMDs Crossing the Roadway in Non-connected Environment

Two trials were conducted for Case-C Scenario-1, i.e., a pedestrian crossing the roadway of the vehicle in a non-connected operating environment. The speed distribution and distance between the vehicle and pedestrian from those two trials are shown in Figures 44 and 45, respectively. It was found that the vehicle gradually reduces its speed as it approaches the pedestrian. The distance curves were similar for all types of trials.

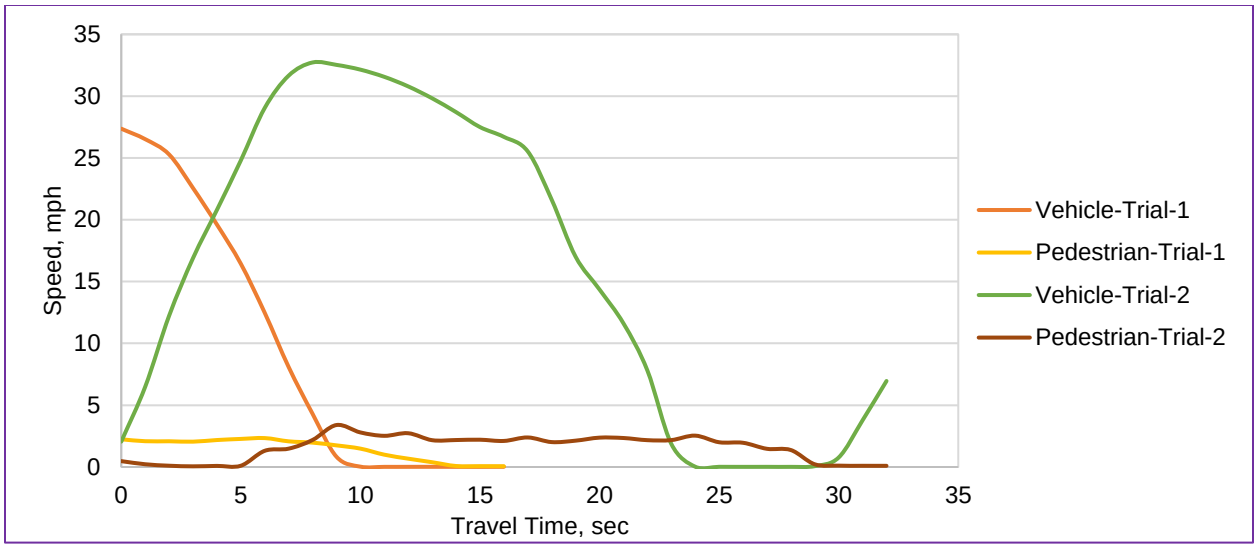


Figure 44 Speed Distribution for Case-C Scenario-1

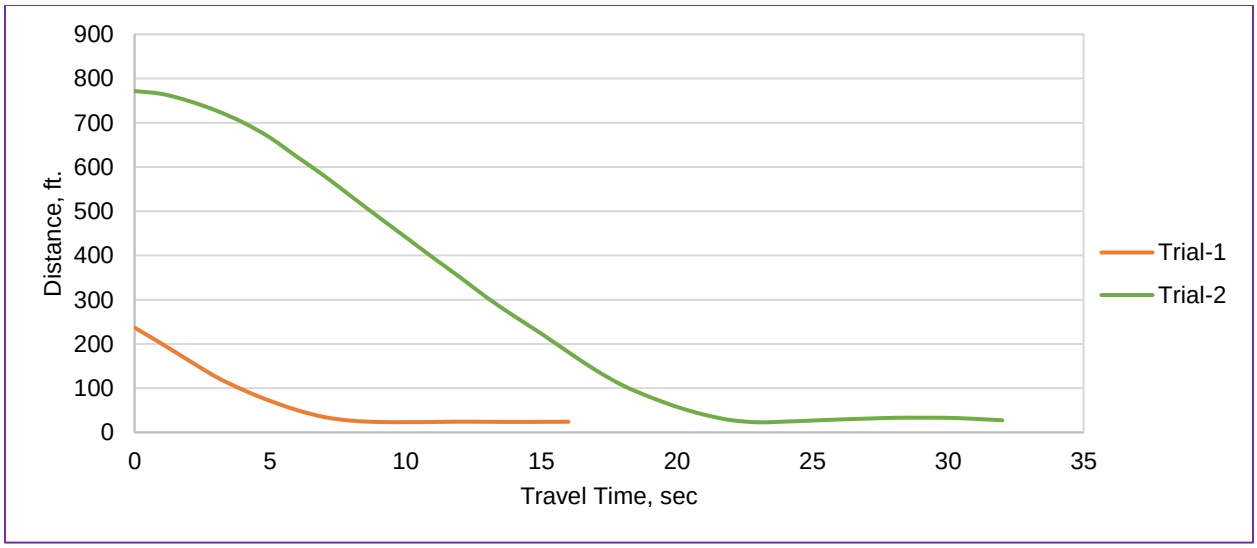


Figure 45 Distance between Vehicle and Pedestrian for Case-C Scenario-1

For Case-C Scenario-2, i.e., the pedestrian and hoverboard crossing the roadway in a non-connected operating environment, two trials were performed. The speed distribution and distance between the vehicle and pedestrian from those two trials are shown in Figures 46 and 47, respectively. It was observed that the vehicle gradually reduces its speed as it approaches the pedestrian and the hoverboard user. However, the speed of the pedestrian and the hoverboard were comparatively consistent. The distance curves were similar for both trials.

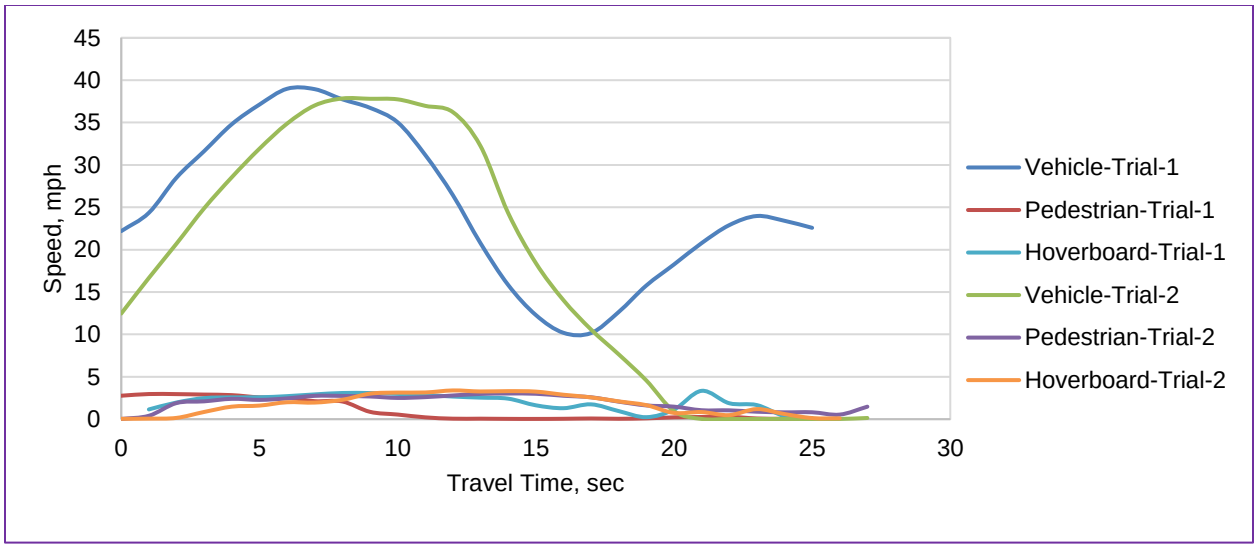


Figure 46 Speed Distribution for Case-C Scenario-2

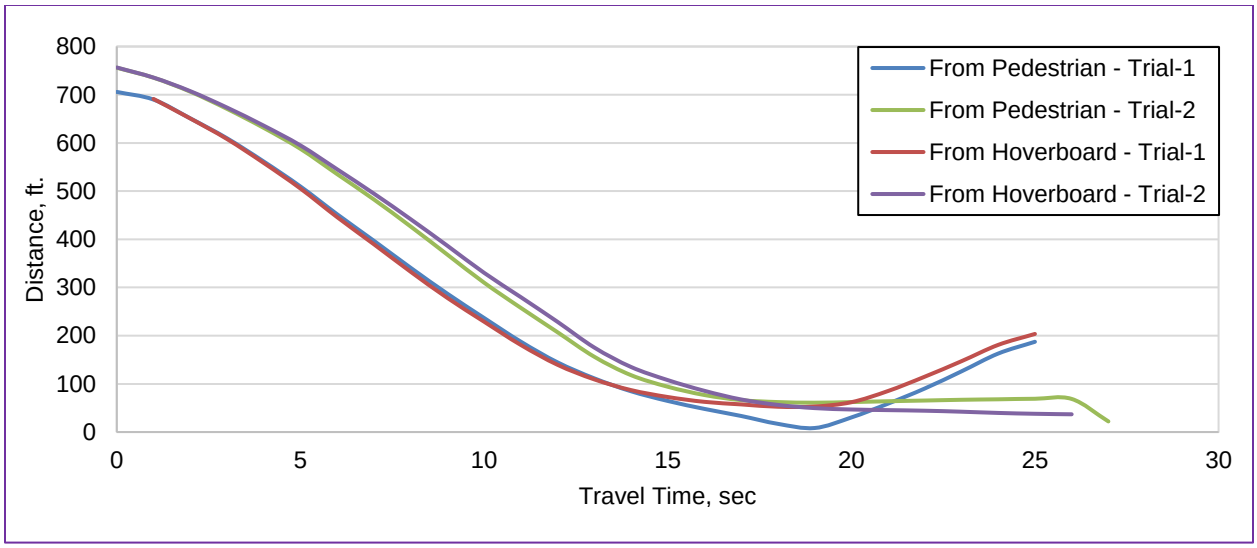


Figure 47 Distance Distribution between Vehicle, Pedestrian and Hoverboard for Case-C Scenario-2 at CU-CVT

4.4.4 Case-D - PEMDs Crossing the Roadway in Connected Environment

One trial was conducted for Case-D Scenario-1, i.e., the pedestrian crossing the roadway in a connected environment. The speed distribution and distance between the vehicle and the pedestrian from that trial are presented in Figures 48 and 49, respectively. The vehicle gradually reduced its speed as it approached the pedestrian. The distance curves were similar to the other trials. The square point with dotted lines indicates the position of the vehicle while the vehicle was 250 ft. away from the pedestrian. For 40 mph vehicle speed, the standard stopping sight distance is 250 ft.

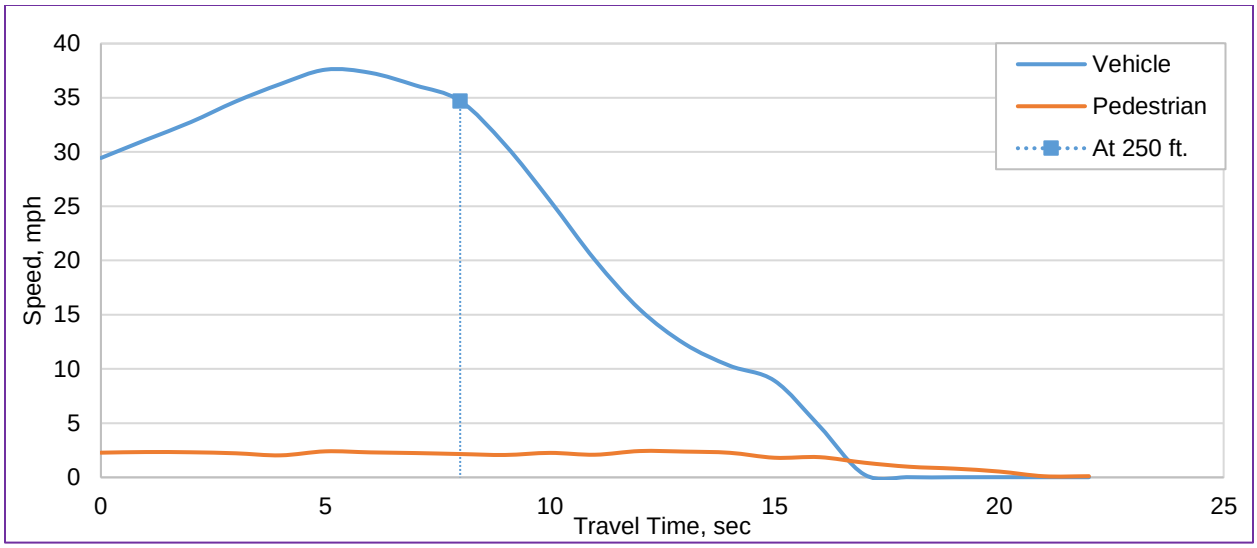


Figure 48 Speed Distribution for Case-D Scenario-1

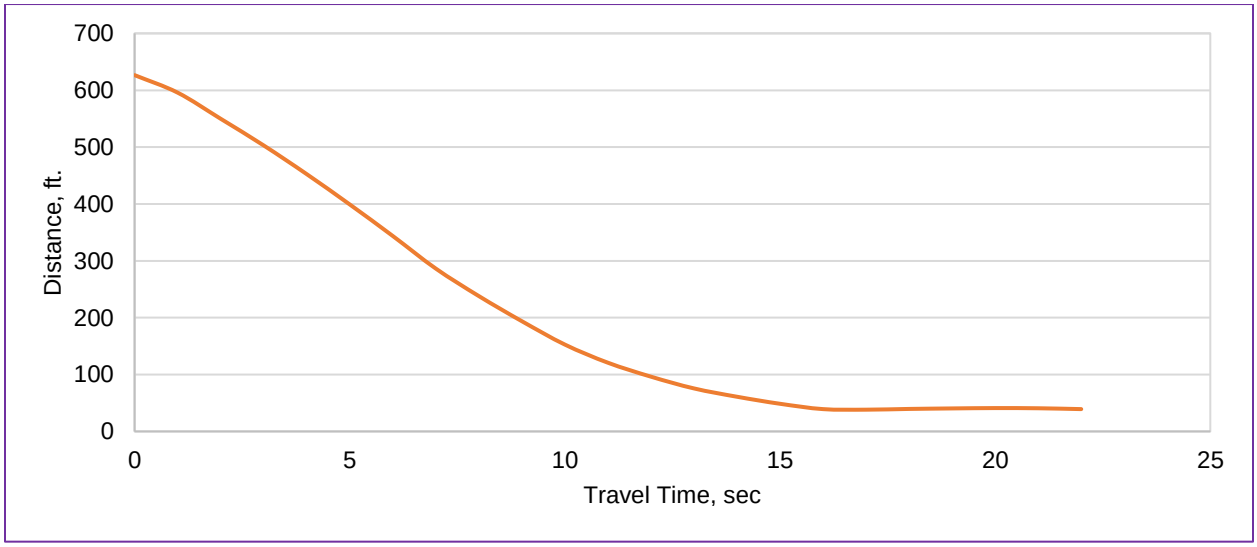


Figure 49 Distance between Vehicle and Pedestrian for Case-D Scenario-1

For Case-D Scenario-2, i.e., the pedestrian and hoverboard crossing the roadway in a connected operating environment, two trials were carried out. The speed distribution and distance between the vehicle and pedestrian from those two trials are shown in Figures 50 and 51, respectively. It was observed that the vehicle gradually reduced speed as it approached the pedestrian. The distance curves were similar for all trials. The square point with dotted lines indicates the position of the vehicle while the vehicle was 250 ft. away from the pedestrian. For 40 mph vehicle speed, the standard stopping sight distance is 250 ft.

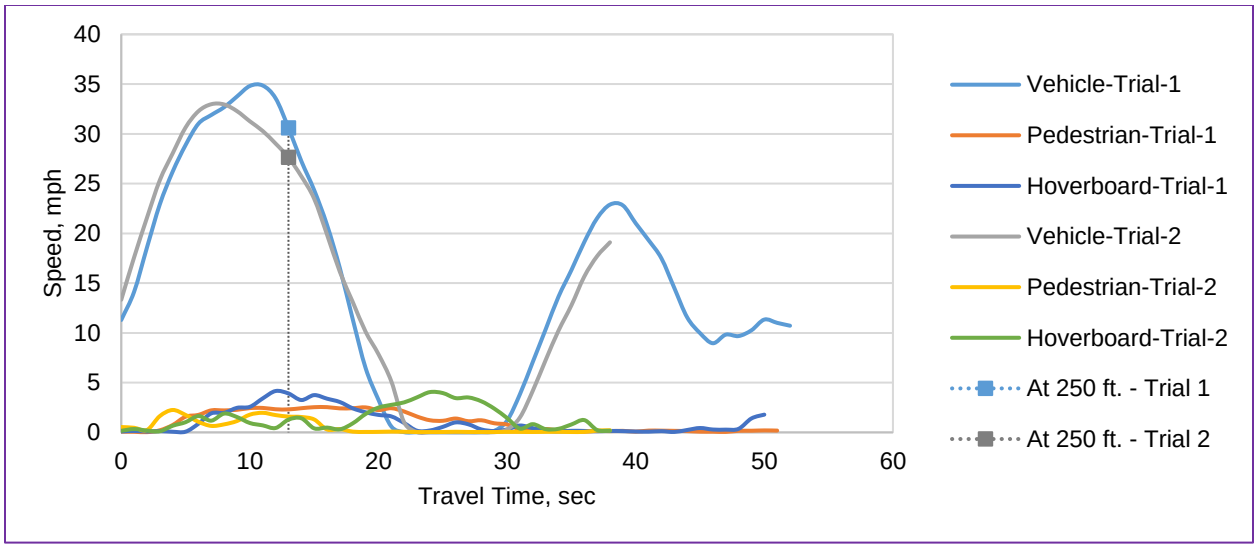


Figure 50 Speed Distribution for Case-D Scenario-2

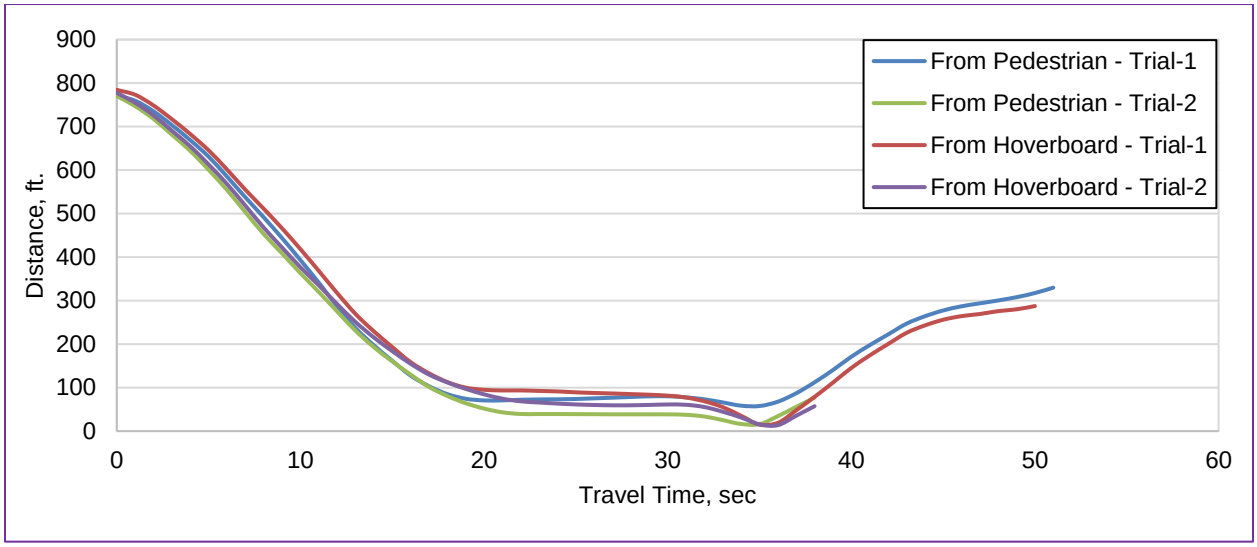


Figure 51 Distance Distribution of Vehicle from Pedestrian and Hoverboard for Case-D Scenario-2

CHAPTER 5

Conclusions and Recommendations

5.1 Conclusions

There is no consensus as to whether PEMDs should operate on roadways or walkways. For example, some major cities in China and Australia have restricted the use of PEMDs on roads and limited their use on public sidewalks except by the physically disabled or elderly people. In the US, several states prohibit PEMDs from congested non-motorized facilities, again except for people with disabilities. PEMDs are associated with high levels of injuries as they have balance issues, unlike pedestrians or automobiles. During the real-world experiments conducted in this research, the volunteer mentioned the issue of losing their balance, especially on the narrow walkway. From the safety data analysis of the NEISS database, the majority of injuries occur to children age 2-10 years, and most crashes occur at homes or apartments. Frequently, crashes occur in the summer, especially in August, with the majority of crashes happening on Sundays. This study found that PEMDs are faster than pedestrians and slower than cars, and similar findings are reported in a study by the Canadian Council of Motor Transport Administrators (CCMTA, 2010). From the experiment and corresponding VISSIM simulation for PEMDs in traditional operating environments, it was found that hoverboards on walkways reduce the walking speed of pedestrians (up to 10%) and create delays for both the hoverboard users and pedestrians. The delay time for the pedestrian is comparatively shorter on a broader walkway than on a narrower sidewalk. In a connected vehicle environment where vehicles and pedestrian/hoverboard are wirelessly connected, the vehicles usually started reducing their speed at a distance of 250 ft. away from the pedestrian or hoverboard while the vehicle was moving at 40 mph.

5.2 Recommendations

Based on this study, the following recommendations are made:

1. Based on this study of the hoverboard, it is recommended that PEMDs users should spend adequate time for training and must use protective gear while riding PEMD on public infrastructure (whenever allowable by law).

2. Transportation planners and professionals should consider the impact of PEMDs on the width of the walkway. Since these non-traditional modes increase the delay time and reduce pedestrians' walking speed, an alternative lane should be created to divert PEMDs from the walkway and restrict the use of these non-traditional vehicles on existing walkways. If PEMDs and pedestrians must share a walkway, the widening of walkways may help to reduce the delay time.

3. PEMDs are faster than pedestrians and slower than motorized vehicles. Therefore, more studies are required to observe the incorporation of PEMD into the existing and future transportation infrastructure.

4. PEMDs reduce pedestrians' walking speed at a higher rate compared to pedestrians in walkways without PEMDs. It is recommended that further analysis can be conducted to estimate infrastructure capacity reduction caused by operating PEMDs on walkways.

REFERENCES

Bruneau, J.-F. & Maurice, P., 2012. *A Legal Status for Personal Mobility Devices.* New Delhi, India, s.n.

Carey, N., 2005. *Establishing Pedestrian Walking Speeds.* [Online] Available at: https://www.westernite.org/datacollectionfund/2005/psu_ped_summary.pdf [Accessed 22 3 2019].

Clapperton, A. & Cassell, E., 2011. *A national review of rock fishing deaths and hospital-treated injury,* Melbourne, Australia: Monash University.

CPSC, 2019. *NEISS Frequently Asked Questions.* [Online] Available at: https://www.cpsc.gov/Research--Statistics/NEISS-Injury-Data/Neiss-Frequently-Asked-Questions [Accessed 21 March 2019].

CPSC, 2019. *NEISS Highlights, Data and Query Builder.* [Online] Available at: https://www.cpsc.gov/cgibin/NEISSQuery/home.aspx [Accessed 6 March 2019].

Dowling, R., Irwin, J. D., Faulks, I. J. & Howitt, R., 2015. *Use of personal mobility devices for first-and-last mile travel: The Macquarie-Ryde trial.* Gold Coast, Australia, s.n.

Edwards, K. & Mccluskey, A., 2010. A survey of adult power wheelchair and scooter users. *Disability and Rehabilitation: Assistive Technology,* 5(6), pp. 411-419.

Freedonia, 2006. *Wheelchairs & Other Personal Mobility Devices - US Industry Study with Forecasts to 2010 & 2015,* Cleveland, OH, USA: The Freedonia Group.

Gitelman, V., Pesahov, F., Carmel, R. & Chen, S., 2016. The Use of Mobility Scooters by the Elderly – A Feasibility Study in Israel. *Transportation Research Procedia,* Volume 14, pp. 2324-2333.

Goodwin, P., Hass-Klau, C. & Cairns, S., 1998. Evidence on the Effects of Road Capacity Reduction on Traffic Levels. *Traffic Engineering and Control,* 39(6), pp. 348-354.

Hoenig, H., Pieper, C., Branch, L. G. & Cohen, H. J., 2007. Effect of Motorized Scooters on Physical Performance and Mobility: A Randomized Clinical Trial. *Archives of Physical Medicine and Rehabilitation,* 88(3), pp. 279-286.

Litman, T., 2006. Managing Diverse Modes and Activities on Nonmotorized Facilities: Guidance for Practitioners. *ITE Journal,* 76(6), pp. 20-27.

Litman, T. & Fitzroy, S., 2015. *Safe Travels: Evaluating Mobility Management Traffic Safety Impacts,* Victoria, BC, Canada: Victoria Transport Policy Institute.

Liu, R. & Parthasarathy, R., 2003. *Urban Street: Is There Room for Segway Human Transporter (HT)?.* Anaheim, California, s.n.

Löfqvist, C., Pettersson, C., Iwarsson, S. & Brandt, A., 2012. Mobility and mobility-related participation outcomes of powered wheelchair and scooter interventions after 4-months and 1-year use. *Disability and Rehabilitation: Assistive Technology,* 7(3), pp. 211-218.

Miller, S. et al., 2010. *Operating Characteristics of the SegwayTM Human Transporter,* McLean, VA: U.S. Department of Transportation - Federal Highway Administration.

NRMA, 2012. *Mobility scooter usage and safety survey report,* Australia: A collaborative project involving the Australian Competition and Consumer Commission, NRMA Motoring & Services, CHOICE, EnableNSWand Flinders University.

Poncy, A. T., Twaddell, H. & Lynott, J., 2011. *Policy and Design Considerations for Accommodating Low-Speed Vehicles and Golf Carts in Community Transportation Networks,* Washington, DC: AARP Public Policy Institute.

Powell, E. C. & Tanz, R. R., 2004. Incidence and Description of Scooter-Related Injuries Among Children. *Ambulatory Pediatrics,* 4(6), pp. 495-499.

Research, T. M., 2016. *Personal Mobility Devices Market.* [Online] Available at: https://www.prnewswire.com/news-releases/personal-mobility-devices-market-to-touch-us-146-bn-by-2024-propelled-by-rising-preference-for-electric-wheelchairs-a-new-report-by-tmr-589847341.html [Accessed 28 March 2019].

Road Safety Canada Consulting, 2011. *Road Safety in Canada,* Ontario, Canada: Canadian Council of Motor Transport Administrators.

Rose, G. & Richardson, M., 2009. *Implications for road system management of emerging types of private passenger vehicles.* Auckland, New Zealand, s.n.

Schroeder, T. & Ault, K., 2001. *The NEISS Sample (Design and Implementation) 1997 to Present,* Bethesda, MD: U.S. Consumer Product Safety Commission.

Segway, 1999. *Segway: Personal Transportation That Simply Moves You.* [Online] Available at: http://www.segway.com/ [Accessed July 2017].

Siracuse, B., Ippolito, J. A., Gibson, P. & Beebe, K., 2017. Hoverboards: A new cause of pediatric morbidity. *Injury,* 48(6), pp. 1110-1114.

TranSafety, I., 1997. *Study Compares Older and Younger Pedestrian Walking Speeds.* [Online] Available at: http://www.usroads.com/journals/p/rej/9710/re971001.htm [Accessed July 2017].

Zegeer, C. V. et al., 2002. *Pedestrian Facilities Users Guide: Providing Safety and Mobility, Pedestrian and Bicycle Information Center,* McLean, VA: U.S. Department of Transportation - Federal Highway Administration.

APPENDICES

Appendix A - PEMDs along Roadway in a Non-connected Environment (Case-A)

Case A - Scenario 1 - Trial 1

Real Time	Travel Time (sec)	Vehicle-Trial-1			Pedestrian-Trial-1			Distance vehicle - Ped. (ft.)
		Speed	longitude	latitude	speed	longitude	latitude	
2019-05-22 11:52:28 AM	0	2.597903	-82.846040	34.676469	0.049214	-82.843403	34.673654	1296.1863
2019-05-22 11:52:29 AM	1	4.816261	-82.846029	34.676462	0.106817	-82.843402	34.673654	1292.3479
2019-05-22 11:52:30 AM	2	8.352958	-82.846002	34.676446				
2019-05-22 11:52:31 AM	3	11.505211	-82.845964	34.676425	0.064873	-82.843399	34.673653	1270.8393
2019-05-22 11:52:32 AM	4	15.247392	-82.845906	34.676392	0.085006	-82.843394	34.673651	1252.1961
2019-05-22 11:52:33 AM	5	18.833942	-82.845841	34.676347	0.055925	-82.843394	34.673651	1227.4415
2019-05-22 11:52:34 AM	6	22.656975	-82.845767	34.676285	0.073262	-82.843392	34.673651	1196.1787
2019-05-22 11:52:35 AM	7	26.225097	-82.845690	34.676208	0.058801	-82.843392	34.673651	1159.953
2019-05-22 11:52:36 AM	8	29.141079	-82.845618	34.676128	0.072223	-82.843391	34.673651	1123.6763
2019-05-22 11:52:37 AM	9	32.294930	-82.845522	34.676018	0.071584	-82.843391	34.673651	1074.3382
2019-05-22 11:52:38 AM	10	33.684746	-82.845422	34.675903	0.049587	-82.843391	34.673651	1022.8762
2019-05-22 11:52:39 AM	11	35.205533	-82.845321	34.675785	0.067430	-82.843391	34.673651	970.43664
2019-05-22 11:52:40 AM	12	36.980806	-82.845224	34.675670	0.131344	-82.843390	34.673651	919.40275
2019-05-22 11:52:41 AM	13	38.234058	-82.845122	34.675548	0.151743	-82.843389	34.673650	865.95298
2019-05-22 11:52:42 AM	14	39.646031	-82.845017	34.675423	0.077336	-82.843387	34.673650	810.91208
2019-05-22 11:52:43 AM	15	40.752388	-82.844897	34.675283	0.052410	-82.843385	34.673649	748.91989
2019-05-22 11:52:44 AM	16	41.542368	-82.844776	34.675144	0.087989	-82.843384	34.673648	687.11952
2019-05-22 11:52:45 AM	17	42.160366	-82.844663	34.675015	0.358559	-82.843383	34.673647	629.40921
2019-05-22 11:52:46 AM	18	42.373574	-82.844544	34.674881	0.484151	-82.843383	34.673647	569.27189
2019-05-22 11:52:47 AM	19	42.371337	-82.844421	34.674744	1.150937	-82.843380	34.673646	507.9215
2019-05-22 11:52:48 AM	20	42.535277	-82.844290	34.674599	1.888667	-82.843373	34.673642	444.6683
2019-05-22 11:52:49 AM	21	43.088348	-82.844172	34.674470	2.155190	-82.843364	34.673637	388.88339
2019-05-22 11:52:50 AM	22	43.623098	-82.844042	34.674331	2.331700	-82.843357	34.673631	327.91022
2019-05-22 11:52:51 AM	23	43.585388	-82.843900	34.674187	1.911357	-82.843350	34.673627	262.67222
2019-05-22 11:52:52 AM	24	43.101877	-82.843761	34.674055	1.706831	-82.843342	34.673623	201.72975
2019-05-22 11:52:53 AM	25	42.332349	-82.843620	34.673928	1.707950	-82.843338	34.673618	141.26005
2019-05-22 11:52:54 AM	26	40.912120	-82.843483	34.673811	1.902409	-82.843332	34.673613	85.098491
2019-05-22 11:52:55 AM	27	38.128067	-82.843350	34.673703	2.018733	-82.843324	34.673608	35.511396
2019-05-22 11:52:56 AM	28	36.395351	-82.843218	34.673601	1.882595	-82.843318	34.673603	29.993207
2019-05-22 11:52:57 AM	29	35.683665	-82.843081	34.673496	1.573730	-82.843312	34.673599	78.588632
2019-05-22 11:52:58 AM	30	35.130168	-82.842955	34.673404	1.142148	-82.843305	34.673598	126.37447
2019-05-22 11:52:59 AM	31	34.646283	-82.842829	34.673317	1.204145	-82.843294	34.673595	172.44812
2019-05-22 11:53:00 AM	32	34.428069	-82.842695	34.673231	1.347952	-82.843290	34.673590	221.53685
2019-05-22 11:53:01 AM	33	34.571237	-82.842552	34.673143	0.681539	-82.843292	34.673588	275.08684
2019-05-22 11:53:02 AM	34	34.308549	-82.842411	34.673060	1.047555	-82.843294	34.673593	328.60148
2019-05-22 11:53:03 AM	35	33.304829	-82.842277	34.672987	1.077595	-82.843292	34.673595	376.92023
2019-05-22 11:53:04 AM	36	31.968967	-82.842151	34.672921	1.761797	-82.843295	34.673602	423.63064
2019-05-22 11:53:05 AM	37	30.096278	-82.842014	34.672853	1.359723	-82.843298	34.673608	473.52898
2019-05-22 11:53:06 AM	38	27.775711	-82.841897	34.672795	0.967662	-82.843299	34.673613	515.55449
2019-05-22 11:53:07 AM	39	22.705550	-82.841796	34.672744	1.183053	-82.843302	34.673617	552.76597
2019-05-22 11:53:08 AM	40	16.640723	-82.841721	34.672697	1.297460	-82.843305	34.673622	582.99915
2019-05-22 11:53:09 AM	41	12.756865	-82.841688	34.672664	0.877650	-82.843308	34.673625	599.29379

Case A - Scenario 1 - Trial 2

Real Time	Travel Time (sec)	Vehicle-Trial-2			Pedestrian-Trial-2			Distance vehicle - Ped. (ft.)
		speed	longitude	latitude	speed	longitude	latitude	
2019-05-22 11:57:24 AM	0	7.005538	-82.845799	34.676176				
2019-05-22 11:57:25 AM	1	9.716889	-82.845771	34.676158	0.821352	-82.843348	34.673657	1166.7022
2019-05-22 11:57:26 AM	2	14.004579	-82.845721	34.676126	1.483877	-82.843344	34.673655	1149.4357
2019-05-22 11:57:27 AM	3	18.325184	-82.845657	34.676085	2.088612	-82.843336	34.673654	1127.748
2019-05-22 11:57:28 AM	4	22.241852	-82.845577	34.676032	2.192260	-82.843327	34.673651	1099.8346
2019-05-22 11:57:29 AM	5	25.510002	-82.845498	34.675971	2.117800	-82.843320	34.673647	1070.5269
2019-05-22 11:57:30 AM	6	28.548914	-82.845412	34.675887	2.077853	-82.843312	34.673641	1033.561
2019-05-22 11:57:31 AM	7	31.737597	-82.845322	34.675785	2.132234	-82.843304	34.673636	990.70044
2019-05-22 11:57:32 AM	8	34.659705	-82.845232	34.675678	2.354602	-82.843295	34.673627	947.15405
2019-05-22 11:57:33 AM	9	37.082110	-82.845137	34.675565	2.105390	-82.843288	34.673621	900.48832
2019-05-22 11:57:34 AM	10	38.537438	-82.845021	34.675430	2.301873	-82.843281	34.673613	843.68843
2019-05-22 11:57:35 AM	11	39.681504	-82.844906	34.675298	2.384642	-82.843273	34.673606	788.2256
2019-05-22 11:57:36 AM	12	40.558727	-82.844787	34.675164	2.544960	-82.843264	34.673599	731.14837

Real Time	Travel Time (sec)	Vehicle-Trial-2			Pedestrian-Trial-2			Distance vehicle - Ped. (ft.)
		speed	longitude	latitude	speed	longitude	latitude	
2019-05-22 11:57:37 AM	13	41.282717	-82.844679	34.675041	2.208878	-82.843257	34.673592	679.52078
2019-05-22 11:57:38 AM	14	41.708865	-82.844562	34.674910	2.344696	-82.843247	34.673585	623.91027
2019-05-22 11:57:39 AM	15	41.709504	-82.844433	34.674767	2.161315	-82.843240	34.673579	562.18896
2019-05-22 11:57:40 AM	16	41.570491	-82.844306	34.674625	2.174684	-82.843232	34.673572	501.06326
2019-05-22 11:57:41 AM	17	41.284474	-82.844186	34.674490	2.118119	-82.843224	34.673565	444.06902
2019-05-22 11:57:42 AM	18	40.976620	-82.844071	34.674366	2.317852	-82.843216	34.673558	390.48662
2019-05-22 11:57:43 AM	19	40.474361	-82.843948	34.674238	2.396200	-82.843208	34.673552	334.58368
2019-05-22 11:57:44 AM	20	39.920543	-82.843815	34.674107	2.408610	-82.843201	34.673544	275.6975
2019-05-22 11:57:45 AM	21	39.066968	-82.843698	34.673998	2.265708	-82.843193	34.673538	226.15845
2019-05-22 11:57:46 AM	22	38.005671	-82.843569	34.673885	2.602909	-82.843184	34.673531	173.20479
2019-05-22 11:57:47 AM	23	36.334632	-82.843435	34.673777	2.538356	-82.843175	34.673523	121.45157
2019-05-22 11:57:48 AM	24	34.457630	-82.843313	34.673683	2.393910	-82.843164	34.673515	75.895247
2019-05-22 11:57:49 AM	25	33.253644	-82.843191	34.673592	2.285096	-82.843156	34.673509	32.165714
2019-05-22 11:57:50 AM	26	32.117887	-82.843063	34.673496	2.309543	-82.843146	34.673502	24.899876
2019-05-22 11:57:51 AM	27	31.575255	-82.842958	34.673418	1.832742	-82.843141	34.673494	61.554052
2019-05-22 11:57:52 AM	28	31.434963	-82.842845	34.673337	1.310562	-82.843142	34.673493	105.84306
2019-05-22 11:57:53 AM	29	32.004120	-82.842721	34.673254	1.953647	-82.843147	34.673498	155.78982
2019-05-22 11:57:54 AM	30	32.826058	-82.842584	34.673168	1.906883	-82.843152	34.673504	209.95453
2019-05-22 11:57:55 AM	31	33.222965	-82.842453	34.673090	2.183312	-82.843158	34.673509	261.19723
2019-05-22 11:57:56 AM	32	33.065843	-82.842326	34.673018	2.368663	-82.843169	34.673516	311.26625
2019-05-22 11:57:57 AM	33	32.501053	-82.842193	34.672946	1.812716	-82.843177	34.673520	362.11204
2019-05-22 11:57:58 AM	34	30.936432	-82.842054	34.672875	2.319130	-82.843188	34.673526	414.89555
2019-05-22 11:57:59 AM	35	29.070561	-82.841940	34.672818	0.672059	-82.843194	34.673529	457.06954
2019-05-22 11:58:00 AM	36	24.776373	-82.841830	34.672765	0.294964	-82.843194	34.673529	494.8326
2019-05-22 11:58:01 AM	37	20.672117	-82.841772	34.672736				

Case A - Scenario 1 - Trial 3

Real Time	Travel Time (sec)	Vehicle-Trial-3			Pedestrian-Trial-3			Distance vehicle - Ped. (ft.)
		Speed	longitude	latitude	speed	longitude	latitude	
2019-05-22 11:59:48 AM	0	9.955769	-82.845761	34.676160	2.836516	-82.843382	34.673697	1147.4005
2019-05-22 11:59:49 AM	1	12.206191	-82.845734	34.676139				
2019-05-22 11:59:50 AM	2	15.698627	-82.845682	34.676102				
2019-05-22 11:59:51 AM	3	19.059240	-82.845614	34.676054	1.231948	-82.843398	34.673706	1084.4051
2019-05-22 11:59:52 AM	4	22.163237	-82.845537	34.675995	1.167714	-82.843405	34.673711	1050.5108
2019-05-22 11:59:53 AM	5	24.820154	-82.845453	34.675924	0.897410	-82.843409	34.673712	1013.5978
2019-05-22 11:59:54 AM	6	26.926769	-82.845371	34.675839	0.295923	-82.843411	34.673710	974.22804
2019-05-22 11:59:55 AM	7	28.743586	-82.845299	34.675755	0.171503	-82.843412	34.673712	935.93425
2019-05-22 11:59:56 AM	8	30.555503	-82.845212	34.675653	0.051131	-82.843417	34.673715	888.9521
2019-05-22 11:59:57 AM	9	32.362679	-82.845118	34.675543	1.060338	-82.843417	34.673717	839.32066
2019-05-22 11:59:58 AM	10	33.256361	-82.845030	34.675440	2.110610	-82.843410	34.673714	795.65158
2019-05-22 11:59:59 AM	11	34.551743	-82.844935	34.675329	2.769406	-82.843398	34.673707	750.20689
2019-05-22 12:00:00 PM	12	35.861347	-82.844829	34.675206	2.514388	-82.843388	34.673697	699.9678
2019-05-22 12:00:01 PM	13	36.746560	-82.844725	34.675088	2.560247	-82.843380	34.673688	650.80243
2019-05-22 12:00:02 PM	14	38.055844	-82.844623	34.674972	2.617929	-82.843371	34.673679	603.13207
2019-05-22 12:00:03 PM	15	39.119697	-82.844511	34.674847	2.522058	-82.843362	34.673669	551.01968
2019-05-22 12:00:04 PM	16	39.605765	-82.844390	34.674712	2.492018	-82.843353	34.673661	493.94861
2019-05-22 12:00:05 PM	17	39.971036	-82.844273	34.674584	2.378890	-82.843343	34.673653	439.56334
2019-05-22 12:00:06 PM	18	40.351379	-82.844159	34.674463	2.340541	-82.843335	34.673646	387.33313
2019-05-22 12:00:07 PM	19	40.904504	-82.844037	34.674334	2.169570	-82.843329	34.673639	331.00602
2019-05-22 12:00:08 PM	20	40.875423	-82.843905	34.674199	2.112474	-82.843324	34.673632	270.45462
2019-05-22 12:00:09 PM	21	40.079956	-82.843788	34.674086	2.169570	-82.843316	34.673625	219.70231
2019-05-22 12:00:10 PM	22	39.362891	-82.843655	34.673963	2.184910	-82.843309	34.673616	163.70159
2019-05-22 12:00:11 PM	23	37.479657	-82.843517	34.673846	2.235882	-82.843302	34.673608	108.21334
2019-05-22 12:00:12 PM	24	35.506942	-82.843390	34.673744	2.720192	-82.843291	34.673601	60.333116
2019-05-22 12:00:13 PM	25	34.474780	-82.843276	34.673657	2.262353	-82.843282	34.673593	23.220525
2019-05-22 12:00:14 PM	26	34.160907	-82.843157	34.673565	1.895698	-82.843275	34.673586	35.995729
2019-05-22 12:00:15 PM	27	34.623647	-82.843026	34.673466	1.040844	-82.843269	34.673583	84.535752
2019-05-22 12:00:16 PM	28	35.473068	-82.842896	34.673374	1.466833	-82.843269	34.673582	135.31391
2019-05-22 12:00:17 PM	29	36.202330	-82.842755	34.673280	1.469709	-82.843269	34.673584	189.87874
2019-05-22 12:00:18 PM	30	36.373247	-82.842617	34.673193	2.147520	-82.843273	34.673588	243.97591
2019-05-22 12:00:19 PM	31	35.973197	-82.842483	34.673112	1.987415	-82.843280	34.673592	296.29223
2019-05-22 12:00:20 PM	32	35.471150	-82.842332	34.673026	2.312419	-82.843290	34.673595	354.61668
2019-05-22 12:00:21 PM	33	34.466418	-82.842185	34.672947	2.534521	-82.843300	34.673601	410.85223
2019-05-22 12:00:22 PM	34	32.811570	-82.842048	34.672878	1.919346	-82.843304	34.673608	461.25827
2019-05-22 12:00:23 PM	35	29.584325	-82.841918	34.672816	1.780332	-82.843307	34.673615	508.70628
2019-05-22 12:00:24 PM	36	23.226771	-82.841804	34.672763	1.718016	-82.843311	34.673621	549.8112

Real Time	Travel Time (sec)	Vehicle-Trial-3			Pedestrian-Trial-3			Distance vehicle - Ped. (ft.)
		Speed	longitude	latitude	speed	longitude	latitude	
2019-05-22 12:00:25 PM	37	16.133564	-82.841727	34.672718	1.515195	-82.843315	34.673626	580.20355
2019-05-22 12:00:26 PM	38	11.942597	-82.841692	34.672687	0.997702	-82.843318	34.673627	596.57602

Case A - Scenario 2 - Trial 1

Real Time	Travel Time (sec)	Vehicle-Trial-1			Pedestrian-Trial-1			Distance vehicle - Ped. (ft.)
		speed	longitude	latitude	speed	longitude	latitude	
2019-05-22 12:04:11 PM	0	0.914933	-82.845904	34.676297				
2019-05-22 12:04:12 PM	1	0.960951	-82.845902	34.676295				
2019-05-22 12:04:13 PM	2	1.148700	-82.845899	34.676292				
2019-05-22 12:04:14 PM	3	1.791517	-82.845894	34.676288				
2019-05-22 12:04:15 PM	4	2.903626	-82.845885	34.676281				
2019-05-22 12:04:16 PM	5	6.383759	-82.845867	34.676269				
2019-05-22 12:04:17 PM	6	10.205940	-82.845836	34.676249				
2019-05-22 12:04:18 PM	7	12.127736	-82.845795	34.676217				
2019-05-22 12:04:19 PM	8	11.572321	-82.845757	34.676178				
2019-05-22 12:04:20 PM	9	10.747507	-82.845724	34.676143				
2019-05-22 12:04:21 PM	10	10.290946	-82.845693	34.676111				
2019-05-22 12:04:22 PM	11	10.285726	-82.845662	34.676080	2.560247	-82.843421	34.673723	1091.6812
2019-05-22 12:04:23 PM	12	11.602041	-82.845627	34.676046	1.710559	-82.843425	34.673727	1073.5262
2019-05-22 12:04:24 PM	13	14.997487	-82.845581	34.676005	2.149757	-82.843433	34.673735	1049.5082
2019-05-22 12:04:25 PM	14	18.985419	-82.845522	34.675955	2.260329	-82.843441	34.673741	1020.7823
2019-05-22 12:04:26 PM	15	22.992632	-82.845453	34.675897	1.914872	-82.843446	34.673744	989.5556
2019-05-22 12:04:27 PM	16	27.356273	-82.845371	34.675819	2.292925	-82.843461	34.673755	946.28585
2019-05-22 12:04:28 PM	17	31.272301	-82.845276	34.675720	2.141368	-82.843467	34.673760	897.62714
2019-05-22 12:04:29 PM	18	33.589514	-82.845180	34.675614	2.179733	-82.843476	34.673767	845.51535
2019-05-22 12:04:30 PM	19	34.375606	-82.845088	34.675508	2.427592	-82.843485	34.673774	794.45041
2019-05-22 12:04:31 PM	20	35.123776	-82.844990	34.675393	2.014791	-82.843490	34.673779	741.14055
2019-05-22 12:04:32 PM	21	36.086006	-82.844882	34.675270	2.023207	-82.843495	34.673784	683.25972
2019-05-22 12:04:33 PM	22	37.043761	-82.844777	34.675150	1.820279	-82.843501	34.673790	626.87248
2019-05-22 12:04:34 PM	23	37.720614	-82.844666	34.675025	1.754447	-82.843507	34.673794	567.95964
2019-05-22 12:04:35 PM	24	38.353738	-82.844554	34.674899	2.249463	-82.843515	34.673800	507.93163
2019-05-22 12:04:36 PM	25	38.582178	-82.844448	34.674780	2.258997	-82.843525	34.673806	450.42716
2019-05-22 12:04:37 PM	26	38.681086	-82.844340	34.674663	2.377931	-82.843536	34.673814	392.31149
2019-05-22 12:04:38 PM	27	38.619248	-82.844226	34.674540	2.323497	-82.843547	34.673823	331.36441
2019-05-22 12:04:39 PM	28	37.905326	-82.844106	34.674411	2.354602	-82.843557	34.673830	268.0069
2019-05-22 12:04:40 PM	29	36.581981	-82.843989	34.674290	2.340541	-82.843568	34.673839	207.45257
2019-05-22 12:04:41 PM	30	34.843512	-82.843878	34.674182	2.526532	-82.843579	34.673849	151.1327
2019-05-22 12:04:42 PM	31	33.242779	-82.843770	34.674081	2.898406	-82.843591	34.673858	97.647925
2019-05-22 12:04:43 PM	32	31.757730	-82.843664	34.673986	2.567437	-82.843601	34.673866	47.34921
2019-05-22 12:04:44 PM	33	30.868736	-82.843564	34.673899	2.416919	-82.843612	34.673875	16.848061
2019-05-22 12:04:45 PM	34	30.252549	-82.843461	34.673811	1.780332	-82.843620	34.673881	54.22756
2019-05-22 12:04:46 PM	35	29.440837	-82.843354	34.673720	1.395142	-82.843623	34.673882	100.19964
2019-05-22 12:04:47 PM	36	28.613467	-82.843254	34.673638	2.244670	-82.843618	34.673878	140.03332
2019-05-22 12:04:48 PM	37	27.733953	-82.843159	34.673563	2.544108	-82.843610	34.673870	175.51354
2019-05-22 12:04:49 PM	38	26.805651	-82.843061	34.673491	2.563975	-82.843600	34.673863	211.22321
2019-05-22 12:04:50 PM	39	25.361828	-82.842958	34.673419	2.587889	-82.843592	34.673856	248.0723
2019-05-22 12:04:51 PM	40	21.855810	-82.842870	34.673358	2.656917	-82.843582	34.673847	278.23657
2019-05-22 12:04:52 PM	41	19.228134	-82.842822	34.673326	2.688128	-82.843576	34.673841	293.85042

Case A - Scenario 2 - Trial 2

Real Time	Travel Time (sec)	Vehicle-Trial-2			Pedestrian-Trial-2			Distance vehicle - Ped. (ft.)
		speed	longitude	latitude	speed	longitude	latitude	
2019-05-22 12:08:40 PM	0	6.057796	-82.845720	34.676087	0.163301	-82.843447	34.673732	1096.9091
2019-05-22 12:08:41 PM	1	7.017096	-82.845707	34.676078	0.072330	-82.843446	34.673732	1091.8757
2019-05-22 12:08:42 PM	2	9.709858	-82.845675	34.676055	0.088202	-82.843446	34.673732	1079.3233
2019-05-22 12:08:43 PM	3	13.716645	-82.845629	34.676023	0.070093	-82.843447	34.673733	1061.2364
2019-05-22 12:08:44 PM	4	18.377275	-82.845567	34.675981	0.072543	-82.843448	34.673734	1037.3509
2019-05-22 12:08:45 PM	5	22.786455	-82.845493	34.675929	0.369105	-82.843448	34.673735	1008.4058
2019-05-22 12:08:46 PM	6	26.967035	-82.845408	34.675856	1.460761	-82.843452	34.673739	969.86165
2019-05-22 12:08:47 PM	7	30.725834	-82.845311	34.675760	2.250102	-82.843457	34.673746	921.6885
2019-05-22 12:08:48 PM	8	34.367031	-82.845212	34.675651	2.256813	-82.843463	34.673752	869.04451
2019-05-22 12:08:49 PM	9	37.495476	-82.845106	34.675531	2.530047	-82.843471	34.673759	811.57428
2019-05-22 12:08:50 PM	10	40.015456	-82.845011	34.675419	2.310501	-82.843478	34.673765	758.65996
2019-05-22 12:08:51 PM	11	40.941574	-82.844894	34.675281	2.082647	-82.843483	34.673771	694.54492

Real Time	Travel Time (sec)	Vehicle-Trial-2			Pedestrian-Trial-2			Distance vehicle - Ped. (ft.)
		speed	longitude	latitude	speed	longitude	latitude	
2019-05-22 12:08:52 PM	12	40.768686	-82.844772	34.675139	2.481579	-82.843489	34.673778	628.34032
2019-05-22 12:08:53 PM	13	40.665784	-82.844655	34.675007	2.329676	-82.843497	34.673782	565.79822
2019-05-22 12:08:54 PM	14	40.570871	-82.844537	34.674876	2.412445	-82.843504	34.673789	503.09285
2019-05-22 12:08:55 PM	15	40.194789	-82.844417	34.674744	2.622137	-82.843514	34.673795	439.31133
2019-05-22 12:08:56 PM	16	39.661690	-82.844305	34.674621	2.212713	-82.843522	34.673801	380.26626
2019-05-22 12:08:57 PM	17	38.779673	-82.844187	34.674491	2.095430	-82.843530	34.673807	317.95358
2019-05-22 12:08:58 PM	18	37.726366	-82.844070	34.674366	2.426506	-82.843541	34.673814	256.31147
2019-05-22 12:08:59 PM	19	36.524618	-82.843958	34.674251	2.351087	-82.843550	34.673821	199.18537
2019-05-22 12:09:00 PM	20	35.449419	-82.843846	34.674143	2.389116	-82.843558	34.673827	143.8255
2019-05-22 12:09:01 PM	21	34.100508	-82.843733	34.674039	2.204084	-82.843566	34.673833	90.267028
2019-05-22 12:09:02 PM	22	32.961077	-82.843624	34.673943	1.933727	-82.843572	34.673839	41.071218
2019-05-22 12:09:03 PM	23	32.229418	-82.843517	34.673853	2.453243	-82.843579	34.673844	18.981639
2019-05-22 12:09:04 PM	24	31.833469	-82.843400	34.673757	1.519882	-82.843584	34.673847	64.198587
2019-05-22 12:09:05 PM	25	31.400769	-82.843300	34.673674	1.158766	-82.843586	34.673848	106.67069
2019-05-22 12:09:06 PM	26	30.591614	-82.843188	34.673585	1.917109	-82.843583	34.673845	151.5852
2019-05-22 12:09:07 PM	27	30.369192	-82.843076	34.673500	1.928614	-82.843579	34.673839	194.95354
2019-05-22 12:09:08 PM	28	31.204233	-82.842961	34.673419	2.211754	-82.843573	34.673832	237.39751
2019-05-22 12:09:09 PM	29	32.353731	-82.842837	34.673335	2.104271	-82.843567	34.673827	283.08577
2019-05-22 12:09:10 PM	30	33.292312	-82.842707	34.673250	2.178838	-82.843560	34.673822	330.35738
2019-05-22 12:09:11 PM	31	33.846183	-82.842578	34.673169	2.147840	-82.843553	34.673816	375.9542
2019-05-22 12:09:12 PM	32	33.707755	-82.842447	34.673089	2.289197	-82.843545	34.673811	421.53882
2019-05-22 12:09:13 PM	33	33.427491	-82.842378	34.673049	2.393590	-82.843539	34.673807	444.77039

Case A - Scenario 3

Real Time	Travel Time (sec)	Vehicle			Pedestrian			Distance vehicle - Ped. (ft.)	hoverboard			Distance vehicle - Hov. (ft.)
		Speed	longitude	latitude	speed	Longitude	latitude		speed	longitude	latitude	
2019-05-22 01:11:23 PM	0	30.082430	-82.845176	34.675582	1.386940	-82.843478	34.673744	842.04333	2.019265	-82.8434	34.67377	849.3687
2019-05-22 01:11:24 PM	1	32.556978	-82.845106	34.675502	1.702037	-82.843473	34.673741	807.97845	2.556252	-82.8434	34.67376	816.2432
2019-05-22 01:11:25 PM	2	34.990781	-82.845009	34.675390	2.119398	-82.843466	34.673737	760.4186	3.228311	-82.8434	34.67375	770.553
2019-05-22 01:11:26 PM	3	36.974095	-82.844912	34.675279	2.227413	-82.843458	34.673731	713.9049	3.312038	-82.8434	34.67374	725.4423
2019-05-22 01:11:27 PM	4	39.592343	-82.844803	34.675153	2.182673	-82.843450	34.673724	660.46525	3.181014	-82.8434	34.67373	673.5129
2019-05-22 01:11:28 PM	5	42.083083	-82.844679	34.675011	2.238491	-82.843443	34.673719	599.82855	3.037207	-82.8434	34.67373	613.9452
2019-05-22 01:11:29 PM	6	43.708743	-82.844546	34.674864	2.251700	-82.843435	34.673712	536.21719	2.989271	-82.8433	34.67372	551.6655
2019-05-22 01:11:30 PM	7	44.519176	-82.844413	34.674717	2.104644	-82.843427	34.673707	472.59467	2.875823	-82.8433	34.67371	489.2779
2019-05-22 01:11:31 PM	8	44.802636	-82.844293	34.674585	2.367066	-82.843420	34.673701	415.40194	2.652123	-82.8433	34.6737	433.0942
2019-05-22 01:11:32 PM	9	44.481786	-82.844169	34.674451	2.207599	-82.843411	34.673695	357.52022	2.736224	-82.8433	34.6737	375.2353
2019-05-22 01:11:33 PM	10	44.017129	-82.844032	34.674307	2.298145	-82.843404	34.673689	293.80387	3.001095	-82.8433	34.67369	312.7193
2019-05-22 01:11:34 PM	11	42.754183	-82.843885	34.674161	2.006909	-82.843396	34.673683	227.97082	3.0126	-82.8433	34.67368	248.3756
2019-05-22 01:11:35 PM	12	41.184661	-82.843759	34.674040	2.316573	-82.843388	34.673677	173.08405	3.158324	-82.8433	34.67367	195.018
2019-05-22 01:11:36 PM	13	38.962149	-82.843636	34.673929	1.979745	-82.843380	34.673671	121.45636	3.062453	-82.8433	34.67366	144.533
2019-05-22 01:11:37 PM	14	35.008411	-82.843506	34.673817	1.917855	-82.843373	34.673666	68.004852	3.144263	-82.8433	34.67366	92.60909
2019-05-22 01:11:38 PM	15	33.410554	-82.843381	34.673717	1.856710	-82.843366	34.673662	20.679192	2.873586	-82.8433	34.67365	44.97876
2019-05-22 01:11:39 PM	16	32.968533	-82.843269	34.673630	2.060597	-82.843358	34.673656	28.252697	2.99758	-82.8432	34.67364	8.575261
2019-05-22 01:11:40 PM	17	33.230955	-82.843158	34.673546	1.385981	-82.843351	34.673651	69.573786	3.238058	-82.8432	34.67363	39.55638
2019-05-22 01:11:41 PM	18	33.429728	-82.843027	34.673448	0.901191	-82.843348	34.673649	120.92243	3.308843	-82.8432	34.67363	87.48967
2019-05-22 01:11:42 PM	19	32.600920	-82.842909	34.673363	1.061457	-82.843345	34.673645	166.67907	3.24397	-82.8432	34.67362	129.694
2019-05-22 01:11:43 PM	20	29.837745	-82.842793	34.673283	1.133200	-82.843341	34.673643	210.75169	3.382344	-82.8432	34.67361	170.3127
2019-05-22 01:11:44 PM	21	24.564124	-82.842690	34.673215	0.966064	-82.843337	34.673641	248.91459	3.490093	-82.8432	34.6736	204.9291
2019-05-22 01:11:45 PM	22	19.380090	-82.842609	34.673164	0.949607	-82.843335	34.673640	278.39099	3.377231	-82.8432	34.67359	230.22
2019-05-22 01:11:46 PM	23	14.193126	-82.842540	34.673121	0.673017	-82.843332	34.673639	303.50684	3.242691	-82.8432	34.67358	251.1193
2019-05-22 01:11:47 PM	24	8.968506	-82.842498	34.673096	0.139014	-82.843331	34.673638	318.64909	3.014837	-82.8432	34.67357	261.7091
2019-05-22 01:11:48 PM	25	3.954377	-82.842475	34.673082	0.248307	-82.843332	34.673638	327.40022	2.753374	-82.8431	34.67356	266.2426
2019-05-22 01:11:49 PM	26	0.297201	-82.842469	34.673079	0.844947	-82.843329	34.673637	328.60503	2.774839	-82.8431	34.67355	264.2533
2019-05-22 01:11:50 PM	27	0.020133	-82.842470	34.673078	1.200310	-82.843325	34.673634	327.04268	2.173725	-82.8431	34.67355	260.3973
2019-05-22 01:11:51 PM	28	0.019813	-82.842470	34.673078	1.126330	-82.843320	34.673631	325.47074	1.111789	-82.8431	34.67354	258.3523
2019-05-22 01:11:52 PM	29	0.026205	-82.842469	34.673078	1.267740	-82.843316	34.673629	323.98836	0.629236	-82.8431	34.67354	257.8217
2019-05-22 01:11:53 PM	30	0.019760	-82.842469	34.673077	1.498790	-82.843309	34.673626	321.82705	0.361755	-82.8431	34.67354	257.9696
2019-05-22 01:11:54 PM	31	0.010865	-82.842469	34.673077	1.364890	-82.843304	34.673620	319.66524	0.61182	-82.8431	34.67354	258.5561
2019-05-22 01:11:55 PM	32	0.020453	-82.842468	34.673077	1.184971	-82.843304	34.673615	318.36537	0.480955	-82.8431	34.67353	259.1234
2019-05-22 01:11:56 PM	33	0.016405	-82.842468	34.673076	1.319457	-82.843303	34.673610	317.25914	0.342261	-82.8431	34.67353	258.9901
2019-05-22 01:11:57 PM	34	0.007830	-82.842468	34.673076	1.626858	-82.843299	34.673607	315.58316	0.106258	-82.8431	34.67353	259.2274

Case A - Scenario 4

Real Time	Travel Time (sec)	Vehicle			Pedestrian			Distance vehicle - Ped. (ft.)	hoverboard			Distance vehicle - Hov. (ft.)
		speed	longitude	latitude	speed	Longitude	latitude		speed	longitude	latitude	
2019-05-22 01:05:42 PM	0	6.857151	-82.847066	34.677648								
2019-05-22 01:05:43 PM	1	9.667994	-82.847036	34.677643								
2019-05-22 01:05:44 PM	2	13.035745	-82.846988	34.677624								
2019-05-22 01:05:45 PM	3	16.252444	-82.846938	34.677582								
2019-05-22 01:05:46 PM	4	19.379770	-82.846881	34.677521								
2019-05-22 01:05:47 PM	5	22.219801	-82.846816	34.677448								
2019-05-22 01:05:48 PM	6	24.554058	-82.846752	34.677374								
2019-05-22 01:05:49 PM	7	26.573643	-82.846683	34.677295								
2019-05-22 01:05:50 PM	8	28.519833	-82.846603	34.677205								
2019-05-22 01:05:51 PM	9	30.372069	-82.846514	34.677107								
2019-05-22 01:05:52 PM	10	31.764761	-82.846420	34.677003								
2019-05-22 01:05:53 PM	11	32.882622	-82.846323	34.676894								
2019-05-22 01:05:54 PM	12	33.887567	-82.846230	34.676788								
2019-05-22 01:05:55 PM	13	34.920209	-82.846135	34.676678								
2019-05-22 01:05:56 PM	14	35.838977	-82.846029	34.676555								
2019-05-22 01:05:57 PM	15	36.160785	-82.845923	34.676434								
2019-05-22 01:05:58 PM	16	36.470184	-82.845824	34.676321								
2019-05-22 01:05:59 PM	17	37.257555	-82.845721	34.676205					2.772985	-82.8432	34.67352	1231.557
2019-05-22 01:06:00 PM	18	38.276668	-82.845603	34.676071	1.836577	-82.843167	34.673519	1183.8035	2.80392	-82.8432	34.67353	1167.54
2019-05-22 01:06:01 PM	19	39.091575	-82.845498	34.675951	1.885045	-82.843174	34.673524	1126.9726	2.909059	-82.8432	34.67354	1109.215
2019-05-22 01:06:02 PM	20	39.641557	-82.845392	34.675830	2.035111	-82.843190	34.673537	1065.8376	2.845144	-82.8433	34.67355	1050.734
2019-05-22 01:06:03 PM	21	40.120595	-82.845269	34.675687	1.912262	-82.843195	34.673541	1000.1428	2.705279	-82.8433	34.67356	983.2032
2019-05-22 01:06:04 PM	22	40.494494	-82.845153	34.675551	2.184590	-82.843202	34.673546	936.49733	2.814146	-82.8433	34.67356	918.4237
2019-05-22 01:06:05 PM	23	40.793559	-82.845044	34.675424	2.187786	-82.843210	34.673552	877.20171	2.881576	-82.8433	34.67357	857.4517
2019-05-22 01:06:06 PM	24	41.307803	-82.844931	34.675294	2.302768	-82.843217	34.673558	815.7599	2.943572	-82.8433	34.67358	795.2437
2019-05-22 01:06:07 PM	25	41.760316	-82.844806	34.675150	2.226454	-82.843225	34.673565	747.88794	2.869112	-82.8433	34.67359	726.3966
2019-05-22 01:06:08 PM	26	41.869556	-82.844688	34.675017	2.275029	-82.843233	34.673570	685.01113	2.772389	-82.8433	34.67359	662.6624
2019-05-22 01:06:09 PM	27	42.078290	-82.844571	34.674886	2.309543	-82.843244	34.673576	622.13843	2.693348	-82.8433	34.6736	599.1206
2019-05-22 01:06:10 PM	28	42.111525	-82.844436	34.674739	2.312738	-82.843253	34.673582	551.57847	2.698461	-82.8433	34.67361	528.2133
2019-05-22 01:06:11 PM	29	42.090646	-82.844318	34.674612	2.439076	-82.843260	34.673589	489.77067	2.578941	-82.8433	34.67362	465.6526
2019-05-22 01:06:12 PM	30	41.877599	-82.844197	34.674482	2.351087	-82.843267	34.673597	426.8536	2.398703	-82.8434	34.67362	402.4194
2019-05-22 01:06:13 PM	31	41.114782	-82.844062	34.674339	2.198332	-82.843276	34.673604	357.15439	2.352578	-82.8434	34.67363	333.1159
2019-05-22 01:06:14 PM	32	39.468882	-82.843949	34.674224	2.237959	-82.843284	34.673611	299.50465	2.561685	-82.8434	34.67364	275.6227
2019-05-22 01:06:15 PM	33	37.769828	-82.843832	34.674108	2.403284	-82.843292	34.673617	241.4237	2.535799	-82.8434	34.67364	217.0032
2019-05-22 01:06:16 PM	34	35.234348	-82.843709	34.673991	2.360994	-82.843301	34.673624	181.56874	2.634866	-82.8434	34.67365	156.7446
2019-05-22 01:06:17 PM	35	32.157195	-82.843594	34.673892	2.378251	-82.843310	34.673631	127.64812	2.751883	-82.8434	34.67366	103.3683
2019-05-22 01:06:18 PM	36	30.853077	-82.843487	34.673806	2.307093	-82.843319	34.673637	79.449864	2.574467	-82.8434	34.67366	56.50797
2019-05-22 01:06:19 PM	37	30.532493	-82.843383	34.673723	1.905604	-82.843327	34.673644	33.289162	2.451432	-82.8434	34.67367	21.48449
2019-05-22 01:06:20 PM	38	31.377121	-82.843265	34.673628	1.279884	-82.843333	34.673650	21.94907	2.476679	-82.8434	34.67368	51.78797
2019-05-22 01:06:21 PM	39	32.130777	-82.843158	34.673544	0.845959	-82.843337	34.673653	66.943059	2.240515	-82.8434	34.67369	98.2896
2019-05-22 01:06:22 PM	40	32.181802	-82.843042	34.673457	1.045318	-82.843342	34.673656	115.61278	2.159025	-82.8434	34.67369	148.1509
2019-05-22 01:06:23 PM	41	31.748463	-82.842918	34.673367	1.229711	-82.843347	34.673659	166.81579	2.39881	-82.8434	34.6737	200.7478
2019-05-22 01:06:24 PM	42	31.596134	-82.842806	34.673290	1.432426	-82.843352	34.673662	212.78384	2.198971	-82.8435	34.67371	247.9673
2019-05-22 01:06:25 PM	43	31.876291	-82.842685	34.673211	1.173147	-82.843360	34.673665	261.49252	1.819001	-82.8435	34.67371	297.4181
2019-05-22 01:06:26 PM	44	32.188513	-82.842553	34.673129	0.282182	-82.843363	34.673667	312.34121	0.457307	-82.8435	34.67371	348.5863
2019-05-22 01:06:27 PM	45	32.233679	-82.842431	34.673057	0.030040	-82.843364	34.673667	357.35194	0.326922	-82.8435	34.67372	394.6011
2019-05-22 01:06:28 PM	46	31.730886	-82.842299	34.672983	0.041757	-82.843364	34.673667	405.16382	0.82737	-82.8435	34.67372	443.0584
2019-05-22 01:06:29 PM	47	30.537287	-82.842168	34.672914	0.044740	-82.843364	34.673667	452.02663	0.916052	-82.8435	34.67372	488.5523
2019-05-22 01:06:30 PM	48	29.148110	-82.842050	34.672854	0.030200	-82.843365	34.673667	493.51506	1.21565	-82.8435	34.67372	528.1747
2019-05-22 01:06:31 PM	49	27.304375	-82.841951	34.672804	2.587889	-82.843592	34.673856	624.11758	0.729709	-82.8435	34.67372	561.7185

Appendix B - PEMDs along Roadway in a Connected Environment (Case-B)

Case B - Scenario 1 - Trial 1

Real Time	Travel Time (sec)	Vehicle-Trial-1			Pedestrian-Trial-1			Distance vehicle - Ped. (ft.)
		speed	longitude	latitude	speed	longitude	latitude	
2019-05-22 12:23:20 PM	0	4.144415	-82.847097	34.677654				
2019-05-22 12:23:21 PM	1	6.931504	-82.847075	34.677657				
2019-05-22 12:23:22 PM	2	10.358908	-82.847031	34.677652				
2019-05-22 12:23:23 PM	3	14.115790	-82.846977	34.677626				
2019-05-22 12:23:24 PM	4	17.725988	-82.846921	34.677579				
2019-05-22 12:23:25 PM	5	20.915204	-82.846865	34.677518				
2019-05-22 12:23:26 PM	6	23.933983	-82.846801	34.677444				
2019-05-22 12:23:27 PM	7	26.596332	-82.846726	34.677358				
2019-05-22 12:23:28 PM	8	28.880629	-82.846642	34.677265				
2019-05-22 12:23:29 PM	9	30.718857	-82.846565	34.677179				
2019-05-22 12:23:30 PM	10	32.652850	-82.846471	34.677073				
2019-05-22 12:23:31 PM	11	34.159949	-82.846372	34.676960				
2019-05-22 12:23:32 PM	12	35.160207	-82.846269	34.676844				
2019-05-22 12:23:33 PM	13	36.033916	-82.846166	34.676727				
2019-05-22 12:23:34 PM	14	36.383527	-82.846060	34.676605				
2019-05-22 12:23:35 PM	15	36.205472	-82.845968	34.676500				
2019-05-22 12:23:36 PM	16	36.594763	-82.845856	34.676371				
2019-05-22 12:23:37 PM	17	37.238380	-82.845750	34.676251				
2019-05-22 12:23:38 PM	18	37.954806	-82.845647	34.676135	0.083216	-82.843397	34.673717	1110.8198
2019-05-22 12:23:39 PM	19	38.938500	-82.845533	34.676007	0.126231	-82.843399	34.673717	1052.6017
2019-05-22 12:23:40 PM	20	39.823713	-82.845416	34.675875	0.134540	-82.843400	34.673718	992.45411
2019-05-22 12:23:41 PM	21	40.282778	-82.845301	34.675741	0.219599	-82.843400	34.673717	933.06375
2019-05-22 12:23:42 PM	22	40.354521	-82.845189	34.675610	1.036370	-82.843401	34.673719	874.13065
2019-05-22 12:23:43 PM	23	40.532523	-82.845075	34.675477	1.376075	-82.843399	34.673718	815.29907
2019-05-22 12:23:44 PM	24	40.953132	-82.844965	34.675351	2.048453	-82.843394	34.673715	760.43302
2019-05-22 12:23:45 PM	25	41.638240	-82.844848	34.675216	1.979372	-82.843387	34.673709	703.11888
2019-05-22 12:23:46 PM	26	42.058796	-82.844722	34.675071	1.900491	-82.843381	34.673704	640.93947
2019-05-22 12:23:47 PM	27	42.341563	-82.844610	34.674946	1.945870	-82.843375	34.673698	587.19352
2019-05-22 12:23:48 PM	28	42.548699	-82.844483	34.674805	1.749334	-82.843369	34.673692	525.74509
2019-05-22 12:23:49 PM	29	42.492135	-82.844351	34.674660	1.784753	-82.843365	34.673687	462.00241
2019-05-22 12:23:50 PM	30	42.313228	-82.844233	34.674531	1.707470	-82.843361	34.673683	405.13317
2019-05-22 12:23:51 PM	31	41.894536	-82.844109	34.674398	1.866031	-82.843355	34.673679	346.15506
2019-05-22 12:23:52 PM	32	41.367243	-82.843979	34.674263	2.023207	-82.843349	34.673674	286.02963
2019-05-22 12:23:53 PM	33	40.829724	-82.843846	34.674133	2.053939	-82.843343	34.673669	226.68075
2019-05-22 12:23:54 PM	34	39.905843	-82.843724	34.674017	1.862462	-82.843337	34.673664	173.26751
2019-05-22 12:23:55 PM	35	36.742086	-82.843599	34.673904	2.036309	-82.843330	34.673658	120.74741
2019-05-22 12:23:56 PM	36	32.688003	-82.843475	34.673801	1.703635	-82.843323	34.673652	70.787462
2019-05-22 12:23:57 PM	37	31.407853	-82.843373	34.673720	1.833701	-82.843318	34.673647	31.382575
2019-05-22 12:23:58 PM	38	31.289558	-82.843256	34.673634	1.764620	-82.843313	34.673642	17.336183
2019-05-22 12:23:59 PM	39	32.066756	-82.843135	34.673543	1.263585	-82.843309	34.673637	62.347988
2019-05-22 12:24:00 PM	40	32.774607	-82.843014	34.673453	0.688676	-82.843309	34.673633	110.17324
2019-05-22 12:24:01 PM	41	32.152028	-82.842897	34.673367	0.622845	-82.843310	34.673631	156.87516
2019-05-22 12:24:02 PM	42	29.306298	-82.842785	34.673289	0.774002	-82.843313	34.673629	201.43787
2019-05-22 12:24:03 PM	43	24.338240	-82.842685	34.673221	0.536241	-82.843315	34.673628	240.42993
2019-05-22 12:24:04 PM	44	19.516035	-82.842614	34.673174	0.599516	-82.843317	34.673628	268.14423

Case B - Scenario 1 - Trial 2

Real Time	Travel Time (sec)	Vehicle-Trial-2			Pedestrian-Trial-2			Distance vehicle - Ped. (ft.)
		speed	longitude	latitude	speed	longitude	latitude	
2019-05-22 12:28:11 PM	0	2.785811	-82.847095	34.677667				
2019-05-22 12:28:12 PM	1	5.350265	-82.847078	34.677668				
2019-05-22 12:28:13 PM	2	9.128238	-82.847040	34.677663				
2019-05-22 12:28:14 PM	3	12.785733	-82.846990	34.677641				
2019-05-22 12:28:15 PM	4	16.186293	-82.846936	34.677598				
2019-05-22 12:28:16 PM	5	19.135298	-82.846880	34.677539				
2019-05-22 12:28:17 PM	6	21.615013	-82.846825	34.677478				
2019-05-22 12:28:18 PM	7	23.845142	-82.846761	34.677405				
2019-05-22 12:28:19 PM	8	25.995857	-82.846687	34.677320				
2019-05-22 12:28:20 PM	9	27.942367	-82.846610	34.677231				
2019-05-22 12:28:21 PM	10	29.855322	-82.846521	34.677131				
2019-05-22 12:28:22 PM	11	31.624469	-82.846428	34.677027				
2019-05-22 12:28:23 PM	12	32.786218	-82.846342	34.676931				
2019-05-22 12:28:24 PM	13	33.729486	-82.846251	34.676828				
2019-05-22 12:28:25 PM	14	34.845429	-82.846151	34.676712				
2019-05-22 12:28:26 PM	15	35.787846	-82.846051	34.676595				
2019-05-22 12:28:27 PM	16	36.346456	-82.845945	34.676473	1.634129	-82.843366	34.673680	1279.5529

Real Time	Travel Time (sec)	Vehicle-Trial-2			Pedestrian-Trial-2			Distance vehicle - Ped. (ft.)
		speed	longitude	latitude	speed	longitude	latitude	
2019-05-22 12:28:28 PM	17	36.864801	-82.845833	34.676347	2.078173	-82.843361	34.673676	1224.7015
2019-05-22 12:28:29 PM	18	37.734355	-82.845729	34.676229	2.050770	-82.843352	34.673668	1175.4875
2019-05-22 12:28:30 PM	19	38.105431	-82.845623	34.676109	1.841051	-82.843346	34.673663	1123.6929
2019-05-22 12:28:31 PM	20	38.880019	-82.845518	34.675990	2.028639	-82.843339	34.673656	1073.583
2019-05-22 12:28:32 PM	21	39.826589	-82.845396	34.675850	1.981236	-82.843331	34.673649	1014.1527
2019-05-22 12:28:33 PM	22	40.400859	-82.845275	34.675710	1.834340	-82.843324	34.673642	955.00971
2019-05-22 12:28:34 PM	23	40.864025	-82.845166	34.675584	1.958653	-82.843317	34.673635	901.86592
2019-05-22 12:28:35 PM	24	41.401437	-82.845050	34.675449	2.049838	-82.843310	34.673628	845.00525
2019-05-22 12:28:36 PM	25	42.035467	-82.844924	34.675305	2.189703	-82.843300	34.673620	784.35698
2019-05-22 12:28:37 PM	26	42.557434	-82.844813	34.675178	2.083286	-82.843291	34.673612	731.39286
2019-05-22 12:28:38 PM	27	43.005686	-82.844695	34.675041	1.814846	-82.843281	34.673603	674.75886
2019-05-22 12:28:39 PM	28	43.296176	-82.844568	34.674896	1.409310	-82.843276	34.673596	612.67657
2019-05-22 12:28:40 PM	29	43.396522	-82.844435	34.674748	1.422732	-82.843269	34.673592	547.90448
2019-05-22 12:28:41 PM	30	43.345390	-82.844303	34.674605	1.679028	-82.843262	34.673587	485.48426
2019-05-22 12:28:42 PM	31	42.810215	-82.844182	34.674474	1.856390	-82.843255	34.673580	428.84316
2019-05-22 12:28:43 PM	32	41.596056	-82.844057	34.674341	1.927655	-82.843248	34.673575	369.93256
2019-05-22 12:28:44 PM	33	40.106534	-82.843929	34.674209	1.804620	-82.843240	34.673569	311.68252
2019-05-22 12:28:45 PM	34	39.085983	-82.843810	34.674095	1.778415	-82.843232	34.673563	260.3861
2019-05-22 12:28:46 PM	35	38.360715	-82.843682	34.673975	1.921583	-82.843224	34.673557	205.11691
2019-05-22 12:28:47 PM	36	38.000558	-82.843551	34.673860	1.729201	-82.843216	34.673552	150.8217
2019-05-22 12:28:48 PM	37	36.799769	-82.843429	34.673759	1.893141	-82.843207	34.673545	102.4411
2019-05-22 12:28:49 PM	38	32.204491	-82.843311	34.673667	1.857456	-82.843199	34.673540	57.155776
2019-05-22 12:28:50 PM	39	30.328607	-82.843188	34.673579	1.839773	-82.843191	34.673534	16.10019
2019-05-22 12:28:51 PM	40	29.669704	-82.843084	34.673504	1.458844	-82.843184	34.673529	31.52753
2019-05-22 12:28:52 PM	41	29.681155	-82.842975	34.673425	0.804361	-82.843177	34.673528	71.26415
2019-05-22 12:28:53 PM	42	29.139801	-82.842860	34.673343	0.946624	-82.843177	34.673529	116.83645
2019-05-22 12:28:54 PM	43	27.326074	-82.842756	34.673272	2.142087	-82.843185	34.673532	159.78921
2019-05-22 12:28:55 PM	44	23.452069	-82.842667	34.673212	2.408610	-82.843196	34.673534	197.43847
2019-05-22 12:28:56 PM	45	16.450898	-82.842584	34.673158	2.129624	-82.843206	34.673540	232.97021

Case B - Scenario 1 - Trial 3

Real Time	Travel Time (sec)	Vehicle-Trial-3			Pedestrian-Trial-3			Distance vehicle - Ped. (ft.)
		speed	longitude	latitude	speed	longitude	latitude	
2019-05-22 12:32:06 PM	0	13.747707	-82.846969	34.677623				
2019-05-22 12:32:07 PM	1	16.499473	-82.846927	34.677583				
2019-05-22 12:32:08 PM	2	19.350423	-82.846875	34.677528				
2019-05-22 12:32:09 PM	3	22.022945	-82.846814	34.677460				
2019-05-22 12:32:10 PM	4	24.179733	-82.846744	34.677380				
2019-05-22 12:32:11 PM	5	25.932582	-82.846672	34.677297				
2019-05-22 12:32:12 PM	6	27.579653	-82.846593	34.677210				
2019-05-22 12:32:13 PM	7	29.041054	-82.846510	34.677118				
2019-05-22 12:32:14 PM	8	30.422082	-82.846428	34.677026				
2019-05-22 12:32:15 PM	9	31.632778	-82.846338	34.676926				
2019-05-22 12:32:16 PM	10	32.811038	-82.846242	34.676818				
2019-05-22 12:32:17 PM	11	33.524641	-82.846143	34.676706				
2019-05-22 12:32:18 PM	12	33.881602	-82.846047	34.676595				
2019-05-22 12:32:19 PM	13	34.645910	-82.845958	34.676493				
2019-05-22 12:32:20 PM	14	36.044781	-82.845856	34.676377				
2019-05-22 12:32:21 PM	15	37.958375	-82.845739	34.676246	0.079637	-82.843416	34.673730	1152.5562
2019-05-22 12:32:22 PM	16	38.961190	-82.845624	34.676117	0.231689	-82.843418	34.673731	1093.5904
2019-05-22 12:32:23 PM	17	39.477458	-82.845525	34.676004	0.079573	-82.843420	34.673731	1042.122
2019-05-22 12:32:24 PM	18	39.747655	-82.845416	34.675877	0.121118	-82.843422	34.673730	985.75658
2019-05-22 12:32:25 PM	19	39.883473	-82.845297	34.675739	0.588331	-82.843422	34.673731	923.81073
2019-05-22 12:32:26 PM	20	39.798147	-82.845177	34.675601	1.243772	-82.843416	34.673730	863.18952
2019-05-22 12:32:27 PM	21	40.085762	-82.845064	34.675470	1.602651	-82.843406	34.673726	807.79821
2019-05-22 12:32:28 PM	22	40.815184	-82.844956	34.675344	1.624382	-82.843401	34.673720	754.0888
2019-05-22 12:32:29 PM	23	41.463754	-82.844839	34.675210	1.951783	-82.843392	34.673716	696.85859
2019-05-22 12:32:30 PM	24	41.681382	-82.844714	34.675066	1.576126	-82.843387	34.673711	634.59748
2019-05-22 12:32:31 PM	25	41.570491	-82.844594	34.674930	2.009146	-82.843381	34.673704	576.83466
2019-05-22 12:32:32 PM	26	41.204049	-82.844480	34.674804	2.055803	-82.843374	34.673697	522.60603
2019-05-22 12:32:33 PM	27	40.708287	-82.844359	34.674674	1.995404	-82.843368	34.673691	465.86588
2019-05-22 12:32:34 PM	28	40.482350	-82.844232	34.674537	1.861184	-82.843362	34.673683	406.30028
2019-05-22 12:32:35 PM	29	40.179396	-82.844112	34.674408	1.978999	-82.843355	34.673676	350.47142
2019-05-22 12:32:36 PM	30	39.889811	-82.844002	34.674292	2.136015	-82.843347	34.673669	300.28409
2019-05-22 12:32:37 PM	31	39.527151	-82.843884	34.674171	2.081688	-82.843340	34.673663	246.80455
2019-05-22 12:32:38 PM	32	38.973973	-82.843756	34.674048	1.740386	-82.843334	34.673658	190.2702
2019-05-22 12:32:39 PM	33	37.692811	-82.843619	34.673924	1.854153	-82.843328	34.673651	132.5308
2019-05-22 12:32:40 PM	34	35.219967	-82.843491	34.673817	1.895059	-82.843320	34.673642	81.820568
2019-05-22 12:32:41 PM	35	32.101323	-82.843382	34.673733	2.097560	-82.843311	34.673633	42.177119
2019-05-22 12:32:42 PM	36	31.164286	-82.843264	34.673643	1.968880	-82.843305	34.673626	13.662032

Real Time	Travel Time (sec)	Vehicle-Trial-3			Pedestrian-Trial-3			Distance vehicle - Ped. (ft.)
		speed	longitude	latitude	speed	longitude	latitude	
2019-05-22 12:32:43 PM	37	31.354431	-82.843150	34.673559	1.743582	-82.843298	34.673619	49.267034
2019-05-22 12:32:44 PM	38	32.176635	-82.843041	34.673478	0.897037	-82.843292	34.673612	89.848528
2019-05-22 12:32:45 PM	39	33.368690	-82.842913	34.673386	0.359411	-82.843288	34.673609	138.63069
2019-05-22 12:32:46 PM	40	34.364794	-82.842793	34.673303	1.380229	-82.843285	34.673605	184.36825
2019-05-22 12:32:47 PM	41	34.608307	-82.842661	34.673217	2.096069	-82.843280	34.673598	231.93228
2019-05-22 12:32:48 PM	42	34.302605	-82.842541	34.673142	2.186891	-82.843275	34.673590	274.28849

Case B - Scenario 2 - Trial 1

Real Time	Travel Time (sec)	Vehicle-Trial-1			Pedestrian-Trial-1			Distance vehicle - Ped. (ft.)
		speed	longitude	latitude	speed	longitude	latitude	
2019-05-22 12:12:53 PM	0	7.071903	-82.847070	34.677663				
2019-05-22 12:12:54 PM	1	10.543620	-82.847027	34.677657				
2019-05-22 12:12:55 PM	2	14.278771	-82.846972	34.677631				
2019-05-22 12:12:56 PM	3	17.756933	-82.846918	34.677588				
2019-05-22 12:12:57 PM	4	21.075097	-82.846858	34.677527				
2019-05-22 12:12:58 PM	5	24.529664	-82.846788	34.677447				
2019-05-22 12:12:59 PM	6	27.119790	-82.846713	34.677362				
2019-05-22 12:13:00 PM	7	29.843497	-82.846628	34.677266				
2019-05-22 12:13:01 PM	8	32.319058	-82.846539	34.677166				
2019-05-22 12:13:02 PM	9	34.057366	-82.846444	34.677059				
2019-05-22 12:13:03 PM	10	35.614638	-82.846343	34.676945				
2019-05-22 12:13:04 PM	11	36.421236	-82.846237	34.676823				
2019-05-22 12:13:05 PM	12	36.453779	-82.846135	34.676706				
2019-05-22 12:13:06 PM	13	36.999660	-82.846033	34.676587				
2019-05-22 12:13:07 PM	14	37.807537	-82.845926	34.676465				
2019-05-22 12:13:08 PM	15	38.624042	-82.845822	34.676346				
2019-05-22 12:13:09 PM	16	39.395168	-82.845713	34.676223				
2019-05-22 12:13:10 PM	17	40.233084	-82.845593	34.676086	1.993167	-82.843502	34.673802	1042.85
2019-05-22 12:13:11 PM	18	40.563521	-82.845475	34.675949	2.558569	-82.843506	34.673804	980.53508
2019-05-22 12:13:12 PM	19	40.283576	-82.845358	34.675813	2.138892	-82.843515	34.673812	915.66456
2019-05-22 12:13:13 PM	20	40.194043	-82.845249	34.675688	2.672842	-82.843525	34.673820	855.56336
2019-05-22 12:13:14 PM	21	40.525812	-82.845133	34.675553	2.338224	-82.843537	34.673830	790.2033
2019-05-22 12:13:15 PM	22	40.939710	-82.845017	34.675417	2.586718	-82.843548	34.673837	725.44617
2019-05-22 12:13:16 PM	23	41.445219	-82.844905	34.675288	1.916789	-82.843556	34.673843	664.40323
2019-05-22 12:13:17 PM	24	42.011979	-82.844785	34.675150	2.466772	-82.843567	34.673850	598.63888
2019-05-22 12:13:18 PM	25	42.385717	-82.844660	34.675010	2.746290	-82.843578	34.673858	531.27814
2019-05-22 12:13:19 PM	26	42.624757	-82.844536	34.674873	2.354602	-82.843589	34.673866	464.57321
2019-05-22 12:13:20 PM	27	42.685475	-82.844407	34.674733	2.517584	-82.843601	34.673873	396.08089
2019-05-22 12:13:21 PM	28	42.704330	-82.844286	34.674602	2.607064	-82.843611	34.673882	331.86949
2019-05-22 12:13:22 PM	29	42.443879	-82.844164	34.674472	2.727542	-82.843622	34.673890	267.48406
2019-05-22 12:13:23 PM	30	41.064289	-82.844031	34.674332	2.726530	-82.843631	34.673898	198.73434
2019-05-22 12:13:24 PM	31	37.873688	-82.843906	34.674207	2.650845	-82.843641	34.673905	135.79948
2019-05-22 12:13:25 PM	32	35.709977	-82.843795	34.674101	2.311460	-82.843650	34.673912	81.60568
2019-05-22 12:13:26 PM	33	34.793978	-82.843679	34.673994	2.321260	-82.843658	34.673919	28.199424
2019-05-22 12:13:27 PM	34	34.110096	-82.843565	34.673892	1.942675	-82.843668	34.673924	32.944961
2019-05-22 12:13:28 PM	35	33.775824	-82.843447	34.673791	0.800207	-82.843675	34.673926	84.263335
2019-05-22 12:13:29 PM	36	33.729486	-82.843332	34.673697	2.039398	-82.843672	34.673925	131.66532
2019-05-22 12:13:30 PM	37	33.593349	-82.843214	34.673606	2.164138	-82.843663	34.673918	176.43694
2019-05-22 12:13:31 PM	38	33.555373	-82.843095	34.673517	2.365148	-82.843656	34.673909	220.8364
2019-05-22 12:13:32 PM	39	33.998565	-82.842972	34.673429	2.379529	-82.843648	34.673901	266.09755
2019-05-22 12:13:33 PM	40	34.658480	-82.842839	34.673337	2.401792	-82.843640	34.673893	314.3462
2019-05-22 12:13:34 PM	41	35.113230	-82.842702	34.673247	2.362911	-82.843632	34.673885	363.17968
2019-05-22 12:13:35 PM	42	35.274135	-82.842568	34.673162	2.258997	-82.843624	34.673878	410.66329
2019-05-22 12:13:36 PM	43	35.060821	-82.842430	34.673081	2.390075	-82.843615	34.673871	457.73944
2019-05-22 12:13:37 PM	44	34.733899	-82.842344	34.673032	2.166535	-82.843610	34.673867	486.97018

Case B - Scenario 2 - Trial 2

Real Time	Travel Time (sec)	Vehicle-Trial-2			Pedestrian-Trial-2			Distance vehicle - Ped. (ft.)
		speed	longitude	latitude	speed	longitude	latitude	
2019-05-22 12:16:28 PM	0	7.523031	-82.847064	34.677670				
2019-05-22 12:16:29 PM	1	9.777288	-82.847034	34.677664				
2019-05-22 12:16:30 PM	2	13.167302	-82.846984	34.677641				
2019-05-22 12:16:31 PM	3	16.465598	-82.846935	34.677596				
2019-05-22 12:16:32 PM	4	19.382859	-82.846883	34.677539				
2019-05-22 12:16:33 PM	5	21.958392	-82.846825	34.677473				
2019-05-22 12:16:34 PM	6	24.789795	-82.846753	34.677392				
2019-05-22 12:16:35 PM	7	27.348284	-82.846675	34.677307				
2019-05-22 12:16:36 PM	8	29.581449	-82.846591	34.677215				
2019-05-22 12:16:37 PM	9	31.416108	-82.846502	34.677115				

Real Time	Travel Time (sec)	Vehicle-Trial-2			Pedestrian-Trial-2			Distance vehicle - Ped. (ft.)
		speed	longitude	latitude	speed	longitude	latitude	
2019-05-22 12:16:38 PM	10	32.920012	-82.846406	34.677007				
2019-05-22 12:16:39 PM	11	34.277178	-82.846309	34.676899				
2019-05-22 12:16:40 PM	12	35.258955	-82.846213	34.676791				
2019-05-22 12:16:41 PM	13	35.394773	-82.846112	34.676675				
2019-05-22 12:16:42 PM	14	35.474346	-82.846012	34.676558				
2019-05-22 12:16:43 PM	15	36.028483	-82.845909	34.676438	2.682163	-82.843380	34.673732	1244.8139
2019-05-22 12:16:44 PM	16	37.015319	-82.845802	34.676314	1.402599	-82.843383	34.673736	1187.7904
2019-05-22 12:16:45 PM	17	38.110278	-82.845706	34.676206	0.897037	-82.843387	34.673738	1137.648
2019-05-22 12:16:46 PM	18	39.318471	-82.845594	34.676079	0.827690	-82.843391	34.673735	1081.0235
2019-05-22 12:16:47 PM	19	40.498648	-82.845472	34.675942	0.723510	-82.843393	34.673734	1018.7065
2019-05-22 12:16:48 PM	20	41.636322	-82.845350	34.675804	1.647923	-82.843398	34.673738	954.35255
2019-05-22 12:16:49 PM	21	42.045054	-82.845230	34.675667	1.921956	-82.843408	34.673742	889.98671
2019-05-22 12:16:50 PM	22	42.261777	-82.845112	34.675532	2.017774	-82.843418	34.673748	825.79139
2019-05-22 12:16:51 PM	23	42.138049	-82.844997	34.675399	1.900332	-82.843427	34.673752	763.20323
2019-05-22 12:16:52 PM	24	41.410705	-82.844873	34.675253	1.570374	-82.843434	34.673755	696.35445
2019-05-22 12:16:53 PM	25	40.564160	-82.844758	34.675119	1.636206	-82.843439	34.673761	634.0645
2019-05-22 12:16:54 PM	26	40.717235	-82.844638	34.674982	1.794074	-82.843445	34.673767	569.73651
2019-05-22 12:16:55 PM	27	40.978485	-82.844522	34.674851	2.072101	-82.843451	34.673773	507.65212
2019-05-22 12:16:56 PM	28	41.020189	-82.844403	34.674720	1.923074	-82.843459	34.673780	444.93907
2019-05-22 12:16:57 PM	29	40.941894	-82.844282	34.674588	1.710027	-82.843465	34.673786	381.76975
2019-05-22 12:16:58 PM	30	40.765490	-82.844158	34.674453	1.630453	-82.843471	34.673791	317.63671
2019-05-22 12:16:59 PM	31	40.519154	-82.844038	34.674326	1.640041	-82.843479	34.673796	255.82616
2019-05-22 12:17:00 PM	32	39.390055	-82.843917	34.674203	1.659108	-82.843486	34.673801	195.33807
2019-05-22 12:17:01 PM	33	37.181816	-82.843795	34.674086	2.079132	-82.843495	34.673808	135.83627
2019-05-22 12:17:02 PM	34	34.437869	-82.843676	34.673979	2.083606	-82.843505	34.673815	78.822209
2019-05-22 12:17:03 PM	35	33.022594	-82.843564	34.673883	2.115456	-82.843514	34.673822	26.876597
2019-05-22 12:17:04 PM	36	32.850025	-82.843447	34.673787	1.963447	-82.843525	34.673828	27.764321
2019-05-22 12:17:05 PM	37	33.728368	-82.843332	34.673694	0.997329	-82.843538	34.673832	79.669959
2019-05-22 12:17:06 PM	38	34.415606	-82.843213	34.673600	1.711944	-82.843541	34.673832	129.48361
2019-05-22 12:17:07 PM	39	34.609266	-82.843089	34.673506	1.942835	-82.843539	34.673828	178.95917
2019-05-22 12:17:08 PM	40	34.616297	-82.842963	34.673413	1.918707	-82.843534	34.673823	227.39838
2019-05-22 12:17:09 PM	41	34.229935	-82.842834	34.673324	2.088399	-82.843531	34.673818	276.02894
2019-05-22 12:17:10 PM	42	33.801070	-82.842708	34.673239	2.128026	-82.843528	34.673813	322.92679
2019-05-22 12:17:11 PM	43	33.659021	-82.842626	34.673187	2.213512	-82.843525	34.673810	352.94273

Case B - Scenario 2 - Trial 3

Real Time	Travel Time (sec)	Vehicle-Trial-3			Pedestrian-Trial-3			Distance vehicle - Ped. (ft.)
		speed	longitude	latitude	speed	longitude	latitude	
2019-05-22 12:19:54 PM	0	7.464869	-82.847052	34.677660				
2019-05-22 12:19:55 PM	1	10.754005	-82.847014	34.677651				
2019-05-22 12:19:56 PM	2	14.047721	-82.846962	34.677622				
2019-05-22 12:19:57 PM	3	17.369346	-82.846910	34.677572				
2019-05-22 12:19:58 PM	4	20.239417	-82.846856	34.677509				
2019-05-22 12:19:59 PM	5	22.733033	-82.846795	34.677437				
2019-05-22 12:20:00 PM	6	25.022762	-82.846726	34.677355				
2019-05-22 12:20:01 PM	7	26.983440	-82.846655	34.677274				
2019-05-22 12:20:02 PM	8	28.931121	-82.846574	34.677183				
2019-05-22 12:20:03 PM	9	30.836725	-82.846484	34.677082				
2019-05-22 12:20:04 PM	10	32.113413	-82.846390	34.676977				
2019-05-22 12:20:05 PM	11	33.196441	-82.846298	34.676873				
2019-05-22 12:20:06 PM	12	34.406924	-82.846206	34.676768				
2019-05-22 12:20:07 PM	13	35.803185	-82.846106	34.676654				
2019-05-22 12:20:08 PM	14	37.007969	-82.845996	34.676528				
2019-05-22 12:20:09 PM	15	37.896058	-82.845888	34.676405				
2019-05-22 12:20:10 PM	16	37.812970	-82.845776	34.676278				
2019-05-22 12:20:11 PM	17	37.189007	-82.845678	34.676166	2.666504	-82.843400	34.673693	1131.895
2019-05-22 12:20:12 PM	18	36.837957	-82.845576	34.676050	2.178838	-82.843411	34.673703	1074.6049
2019-05-22 12:20:13 PM	19	37.310284	-82.845466	34.675926	2.590446	-82.843417	34.673710	1015.7225
2019-05-22 12:20:14 PM	20	38.356880	-82.845351	34.675796	2.583735	-82.843427	34.673719	952.29095
2019-05-22 12:20:15 PM	21	39.085823	-82.845240	34.675669	2.398064	-82.843437	34.673729	890.75132
2019-05-22 12:20:16 PM	22	39.757242	-82.845125	34.675536	2.376014	-82.843447	34.673739	826.49983
2019-05-22 12:20:17 PM	23	40.319688	-82.845014	34.675405	2.054685	-82.843455	34.673746	765.06442
2019-05-22 12:20:18 PM	24	40.801921	-82.844898	34.675270	2.386240	-82.843465	34.673755	700.29273
2019-05-22 12:20:19 PM	25	41.151479	-82.844791	34.675146	2.355561	-82.843475	34.673763	640.71534
2019-05-22 12:20:20 PM	26	41.313555	-82.844670	34.675009	2.157107	-82.843483	34.673771	575.25024
2019-05-22 12:20:21 PM	27	41.398295	-82.844544	34.674869	2.203072	-82.843490	34.673778	508.66223
2019-05-22 12:20:22 PM	28	40.933265	-82.844425	34.674739	1.961210	-82.843495	34.673788	445.32482
2019-05-22 12:20:23 PM	29	40.139982	-82.844308	34.674612	2.180116	-82.843501	34.673797	383.51911
2019-05-22 12:20:24 PM	30	39.098286	-82.844190	34.674482	2.292605	-82.843509	34.673806	320.3705
2019-05-22 12:20:25 PM	31	37.884554	-82.844075	34.674360	2.169517	-82.843519	34.673814	259.93714

Real Time	Travel Time (sec)	Vehicle-Trial-3			Pedestrian-Trial-3			Distance vehicle - Ped. (ft.)
		speed	longitude	latitude	speed	longitude	latitude	
2019-05-22 12:20:26 PM	32	36.418999	-82.843959	34.674241	2.170849	-82.843526	34.673822	200.38282
2019-05-22 12:20:27 PM	33	35.532508	-82.843848	34.674132	2.081901	-82.843534	34.673829	145.06832
2019-05-22 12:20:28 PM	34	34.914776	-82.843742	34.674034	2.293564	-82.843544	34.673837	93.052714
2019-05-22 12:20:29 PM	35	34.065995	-82.843621	34.673926	2.217506	-82.843553	34.673846	35.901277
2019-05-22 12:20:30 PM	36	33.427171	-82.843506	34.673829	2.047601	-82.843561	34.673853	18.513332
2019-05-22 12:20:31 PM	37	33.125869	-82.843393	34.673737	1.181775	-82.843568	34.673855	68.032664
2019-05-22 12:20:32 PM	38	32.643582	-82.843275	34.673643	1.031577	-82.843568	34.673854	116.81444
2019-05-22 12:20:33 PM	39	32.551333	-82.843166	34.673558	1.980704	-82.843564	34.673852	160.37946
2019-05-22 12:20:34 PM	40	33.227120	-82.843047	34.673470	2.139531	-82.843561	34.673845	206.30439
2019-05-22 12:20:35 PM	41	34.188071	-82.842915	34.673376	2.055057	-82.843559	34.673838	256.35594
2019-05-22 12:20:36 PM	42	35.017039	-82.842780	34.673285	2.030876	-82.843553	34.673831	305.8389
2019-05-22 12:20:37 PM	43	35.493733	-82.842647	34.673198	2.114711	-82.843548	34.673826	354.32987
2019-05-22 12:20:38 PM	44	35.500631	-82.842536	34.673130	2.031643	-82.843542	34.673819	393.00883

Case B - Scenario 3

Real Time	Travel Time (sec)	Vehicle			Pedestrian			Distance vehicle - Ped. (ft.)	hoverboard			Distance vehicle - Hov. (ft.)
		speed	longitude	latitude	speed	longitude	latitude		speed	longitude	latitude	
2019-05-22 01:14:14 PM	0	10.540744	-82.845578	34.675896	0.041385	-82.843464	34.673739	1010.5035	0.182875	-82.8434	34.67376	1009.332
2019-05-22 01:14:15 PM	1	13.386954	-82.845547	34.675870	0.066151	-82.843465	34.673741	996.8697	0.401701	-82.8434	34.67376	996.1294
2019-05-22 01:14:16 PM	2	17.206365	-82.845489	34.675828	0.068388	-82.843465	34.673742	973.56746	0.113767	-82.8434	34.67376	973.454
2019-05-22 01:14:17 PM	3	20.520321	-82.845411	34.675771	0.062263	-82.843466	34.673744	942.02177	0.632751	-82.8434	34.67376	943.0942
2019-05-22 01:14:18 PM	4	23.219314	-82.845340	34.675715	0.074460	-82.843467	34.673744	912.56859	0.815546	-82.8434	34.67375	915.0345
2019-05-22 01:14:19 PM	5	26.213805	-82.845257	34.675642	0.321010	-82.843467	34.673744	876.28386	1.124252	-82.8434	34.67375	880.1643
2019-05-22 01:14:20 PM	6	29.260919	-82.845165	34.675550	1.116902	-82.843463	34.673743	834.05943	1.630134	-82.8434	34.67375	838.8426
2019-05-22 01:14:21 PM	7	31.898129	-82.845079	34.675457	1.500281	-82.843457	34.673739	793.54566	2.043979	-82.8434	34.67374	799.4491
2019-05-22 01:14:22 PM	8	34.567083	-82.844981	34.675349	1.401640	-82.843452	34.673735	746.51898	2.478596	-82.8434	34.67374	753.2071
2019-05-22 01:14:23 PM	9	36.633112	-82.844878	34.675232	1.735912	-82.843447	34.673731	695.96197	2.556252	-82.8434	34.67373	704.168
2019-05-22 01:14:24 PM	10	38.597837	-82.844770	34.675108	1.726325	-82.843443	34.673727	642.34376	2.509275	-82.8434	34.67372	652.3332
2019-05-22 01:14:25 PM	11	40.283896	-82.844656	34.674979	1.931650	-82.843438	34.673723	586.34305	2.90778	-82.8434	34.67371	598.4489
2019-05-22 01:14:26 PM	12	41.620344	-82.844527	34.674835	1.740066	-82.843434	34.673718	523.07482	3.154543	-82.8434	34.67371	537.1506
2019-05-22 01:14:27 PM	13	42.375811	-82.844404	34.674699	1.710559	-82.843429	34.673714	463.38015	3.282957	-82.8434	34.6737	480.1772
2019-05-22 01:14:28 PM	14	42.959721	-82.844285	34.674569	1.784806	-82.843423	34.673709	406.49292	3.346552	-82.8434	34.67369	425.7344
2019-05-22 01:14:29 PM	15	43.247601	-82.844165	34.674440	1.633756	-82.843419	34.673705	349.02462	3.307564	-82.8433	34.67368	371.1901
2019-05-22 01:14:30 PM	16	43.060972	-82.844027	34.674295	1.946190	-82.843412	34.673699	285.16821	3.060536	-82.8433	34.67367	308.9959
2019-05-22 01:14:31 PM	17	42.149927	-82.843899	34.674166	1.793115	-82.843404	34.673694	227.38964	2.956036	-82.8433	34.67367	252.6652
2019-05-22 01:14:32 PM	18	40.457423	-82.843771	34.674045	1.862675	-82.843397	34.673690	171.20517	2.954757	-82.8433	34.67366	197.9856
2019-05-22 01:14:33 PM	19	36.059162	-82.843642	34.673929	1.565261	-82.843391	34.673686	116.17321	2.857288	-82.8433	34.67365	144.9365
2019-05-22 01:14:34 PM	20	31.835386	-82.843518	34.673825	1.913274	-82.843385	34.673683	65.633236	3.020323	-82.8433	34.67364	95.86928
2019-05-22 01:14:35 PM	21	29.629811	-82.843417	34.673744	1.929892	-82.843377	34.673678	27.147749	3.22895	-82.8433	34.67364	57.96811
2019-05-22 01:14:36 PM	22	28.290380	-82.843320	34.673670	1.911889	-82.843370	34.673672	15.111793	3.189962	-82.8433	34.67363	23.16196
2019-05-22 01:14:37 PM	23	26.562777	-82.843212	34.673587	1.740066	-82.843363	34.673666	53.688184	3.223837	-82.8433	34.67362	16.63948
2019-05-22 01:14:38 PM	24	25.874261	-82.843125	34.673518	1.332613	-82.843357	34.673661	86.985915	3.138884	-82.8432	34.67361	48.68468
2019-05-22 01:14:39 PM	25	26.258865	-82.843034	34.673450	1.039459	-82.843353	34.673658	122.10997	3.168231	-82.8432	34.6736	80.81487
2019-05-22 01:14:40 PM	26	27.288524	-82.842926	34.673374	0.666626	-82.843350	34.673656	163.74011	3.162798	-82.8432	34.67359	118.7186
2019-05-22 01:14:41 PM	27	28.283882	-82.842827	34.673305	0.760900	-82.843346	34.673654	201.18753	2.964984	-82.8432	34.67358	152.6982
2019-05-22 01:14:42 PM	28	29.196685	-82.842721	34.673235	1.172508	-82.843342	34.673651	240.41238	2.992786	-82.8432	34.67358	189.1531
2019-05-22 01:14:43 PM	29	30.085093	-82.842599	34.673157	1.545394	-82.843336	34.673647	284.46075	2.835238	-82.8432	34.67357	230.7993
2019-05-22 01:14:44 PM	30	30.639816	-82.842482	34.673086	1.694368	-82.843330	34.673642	325.43378	2.449888	-82.8432	34.67356	270.5832
2019-05-22 01:14:45 PM	31	30.256703	-82.842363	34.673019	1.891384	-82.843323	34.673636	365.54506	1.358179	-82.8432	34.67356	310.8827
2019-05-22 01:14:46 PM	32	29.674444	-82.842230	34.672948	1.532025	-82.843316	34.673632	410.50403	0.676213	-82.8432	34.67355	357.4459
2019-05-22 01:14:47 PM	33	29.123130	-82.842118	34.672891	2.050370	-82.843308	34.673627	446.69949	0.190145	-82.8432	34.67355	396.8122
2019-05-22 01:14:48 PM	34	28.004364	-82.841995	34.672830	2.120676	-82.843300	34.673622	486.48415	0.609583	-82.8432	34.67355	440.1169
2019-05-22 01:14:49 PM	35	26.087574	-82.841881	34.672775	1.783848	-82.843294	34.673616	523.1401	0.906305	-82.8432	34.67355	479.1185
2019-05-22 01:14:50 PM	36				2.384642	-82.843290	34.673613		1.377992	-82.8432	34.67355	

Case B - Scenario 4

Real Time	Travel Time (sec)	Vehicle			Pedestrian			Distance vehicle - Ped. (ft.)	hoverboard			Distance vehicle - Hov. (ft.)
		speed	longitude	latitude	speed	longitude	latitude		speed	longitude	latitude	
2019-05-22 01:02:15 PM	0	14.381673	-82.846983	34.677627								
2019-05-22 01:02:16 PM	1	16.709751	-82.846947	34.677595								
2019-05-22 01:02:17 PM	2	20.044159	-82.846890	34.677533								
2019-05-22 01:02:18 PM	3	23.121632	-82.846823	34.677455								
2019-05-22 01:02:19 PM	4	25.628670	-82.846753	34.677374								
2019-05-22 01:02:20 PM	5	27.965483	-82.846678	34.677291								
2019-05-22 01:02:21 PM	6	30.155080	-82.846596	34.677199								
2019-05-22 01:02:22 PM	7	32.174771	-82.846501	34.677095								
2019-05-22 01:02:23 PM	8	33.880324	-82.846398	34.676981								
2019-05-22 01:02:24 PM	9	35.053790	-82.846304	34.676874								
2019-05-22 01:02:25 PM	10	35.910881	-82.846209	34.676765								

Real Time	Travel Time (sec)	Vehicle			Pedestrian			Distance vehicle - Ped. (ft.)	hoverboard			Distance vehicle - Hov. (ft.)
		speed	longitude	latitude	speed	longitude	latitude		speed	longitude	latitude	
2019-05-22 01:02:26 PM	11	36.966105	-82.846099	34.676639								
2019-05-22 01:02:27 PM	12	38.110491	-82.845987	34.676513								
2019-05-22 01:02:28 PM	13	38.852962	-82.845882	34.676394								
2019-05-22 01:02:29 PM	14	38.373178	-82.845775	34.676272					1.772263	-82.8432	34.67354	1254.915
2019-05-22 01:02:30 PM	15	37.954220	-82.845666	34.676147					1.712583	-82.8432	34.67355	1196.987
2019-05-22 01:02:31 PM	16	37.946231	-82.845548	34.676013	1.738149	-82.843175	34.673526	1153.3299	1.690213	-82.8432	34.67355	1134.23
2019-05-22 01:02:32 PM	17	38.062555	-82.845442	34.675892	1.837323	-82.843179	34.673529	1097.179	1.928614	-82.8432	34.67356	1077.216
2019-05-22 01:02:33 PM	18	38.243432	-82.845340	34.675774	2.097859	-82.843187	34.673534	1041.7462	2.124404	-82.8433	34.67356	1022.045
2019-05-22 01:02:34 PM	19	38.222021	-82.845228	34.675645	2.120676	-82.843194	34.673540	980.89016	1.93117	-82.8433	34.67357	961.8021
2019-05-22 01:02:35 PM	20	38.220636	-82.845120	34.675520	2.044618	-82.843201	34.673545	922.17197	2.027681	-82.8433	34.67357	902.8858
2019-05-22 01:02:36 PM	21	38.416640	-82.845014	34.675398	1.895059	-82.843209	34.673551	864.64338	2.163818	-82.8433	34.67358	845.4454
2019-05-22 01:02:37 PM	22	38.932748	-82.844894	34.675260	1.915319	-82.843214	34.673555	800.68226	2.241794	-82.8433	34.67358	780.5551
2019-05-22 01:02:38 PM	23	39.054185	-82.844780	34.675129	2.226454	-82.843222	34.673561	738.74575	2.311567	-82.8433	34.67359	718.7212
2019-05-22 01:02:39 PM	24	39.136688	-82.844678	34.675012	1.916150	-82.843228	34.673567	683.56052	2.205043	-82.8433	34.67359	663.3003
2019-05-22 01:02:40 PM	25	39.433836	-82.844564	34.674885	2.028000	-82.843234	34.673573	622.97445	2.292925	-82.8433	34.6736	602.2907
2019-05-22 01:02:41 PM	26	39.481452	-82.844449	34.674757	2.124032	-82.843240	34.673579	562.40927	2.368663	-82.8433	34.6736	540.981
2019-05-22 01:02:42 PM	27	39.578868	-82.844332	34.674630	2.110769	-82.843247	34.673585	501.45168	2.083606	-82.8433	34.67361	479.9283
2019-05-22 01:02:43 PM	28	39.462597	-82.844216	34.674503	2.015857	-82.843254	34.673590	440.79797	2.232899	-82.8433	34.67362	418.964
2019-05-22 01:02:44 PM	29	39.181055	-82.844090	34.674367	1.895698	-82.843260	34.673595	375.73054	2.603548	-82.8433	34.67362	352.8568
2019-05-22 01:02:45 PM	30	38.804493	-82.843982	34.674254	1.905924	-82.843267	34.673600	320.81639	2.767489	-82.8433	34.67363	296.3544
2019-05-22 01:02:46 PM	31	38.022289	-82.843866	34.674138	2.083606	-82.843273	34.673604	263.70909	2.770045	-82.8434	34.67364	237.565
2019-05-22 01:02:47 PM	32	36.005154	-82.843745	34.674021	1.777137	-82.843279	34.673609	205.24741	2.461446	-82.8434	34.67365	177.9385
2019-05-22 01:02:48 PM	33	32.295889	-82.843624	34.673914	2.014259	-82.843286	34.673613	149.11522	2.666184	-82.8434	34.67365	121.0179
2019-05-22 01:02:49 PM	34	30.121578	-82.843523	34.673830	2.033060	-82.843292	34.673618	103.77432	2.468157	-82.8434	34.67366	74.90648

Appendix C - PEMDs crossing the Roadway in a Non-connected Environment (Case-C)

Case C - Scenario 1 - Trial 1

Real Time	Travel Time (sec)	Vehicle-Trial-1			Pedestrian-Trial-1			Distance vehicle - Ped. (ft.)
		speed	longitude	latitude	Speed	longitude	latitude	
2019-05-22 01:22:17 PM	0	27.365221	-82.843042	34.673453	2.243338	-82.842380	34.673099	236.81386
2019-05-22 01:22:18 PM	1	26.520913	-82.842949	34.673387	2.086482	-82.842385	34.673092	200.44429
2019-05-22 01:22:19 PM	2	25.283533	-82.842851	34.673321	2.082274	-82.842390	34.673086	162.55919
2019-05-22 01:22:20 PM	3	22.565897	-82.842755	34.673257	2.050370	-82.842396	34.673080	125.66084
2019-05-22 01:22:21 PM	4	19.613643	-82.842678	34.673206	2.181395	-82.842402	34.673073	96.041151
2019-05-22 01:22:22 PM	5	16.441311	-82.842611	34.673163	2.272153	-82.842407	34.673064	71.12107
2019-05-22 01:22:23 PM	6	12.473192	-82.842554	34.673128	2.339529	-82.842411	34.673056	50.174315
2019-05-22 01:22:24 PM	7	8.087075	-82.842512	34.673102	2.077214	-82.842416	34.673049	34.571492
2019-05-22 01:22:25 PM	8	4.302870	-82.842489	34.673089	1.972075	-82.842422	34.673042	26.403188
2019-05-22 01:22:26 PM	9	0.829927	-82.842481	34.673084	1.751251	-82.842427	34.673037	23.459522
2019-05-22 01:22:27 PM	10	0.029081	-82.842481	34.673083	1.487978	-82.842434	34.673033	23.103249
2019-05-22 01:22:28 PM	11	0.012676	-82.842481	34.673083	0.998661	-82.842437	34.673030	23.548263
2019-05-22 01:22:29 PM	12	0.013422	-82.842480	34.673083	0.673976	-82.842440	34.673026	24.214472
2019-05-22 01:22:30 PM	13	0.016778	-82.842480	34.673083	0.388120	-82.842441	34.673026	23.88369
2019-05-22 01:22:31 PM	14	0.013102	-82.842480	34.673083	0.079893	-82.842442	34.673026	23.655133
2019-05-22 01:22:32 PM	15	0.012463	-82.842480	34.673083	0.067430	-82.842444	34.673025	23.7411
2019-05-22 01:22:33 PM	16	0.016937	-82.842480	34.673083	0.064553	-82.842446	34.673024	24.10002

Case C - Scenario 1 - Trial 2

Real Time	Travel Time (sec)	Vehicle-Trial-2			Pedestrian-Trial-2			Distance vehicle - Ped. (ft.)
		speed	longitude	latitude	Speed	longitude	latitude	
2019-05-22 01:24:54 PM	0	2.054908	-82.844327	34.674533	0.475139	-82.842331	34.673199	771.657
2019-05-22 01:24:55 PM	1	6.481228	-82.844310	34.674522	0.223700	-82.842331	34.673199	765.24991
2019-05-22 01:24:56 PM	2	12.227122	-82.844267	34.674496	0.103541	-82.842330	34.673199	749.203
2019-05-22 01:24:57 PM	3	16.892706	-82.844211	34.674461	0.054583	-82.842332	34.673200	727.79524
2019-05-22 01:24:58 PM	4	20.795791	-82.844145	34.674413	0.089480	-82.842333	34.673200	700.7633
2019-05-22 01:24:59 PM	5	24.799062	-82.844065	34.674342	0.103275	-82.842333	34.673201	666.10124
2019-05-22 01:25:00 PM	6	29.043930	-82.843970	34.674251	1.310243	-82.842335	34.673200	622.60698
2019-05-22 01:25:01 PM	7	31.658770	-82.843878	34.674162	1.484409	-82.842341	34.673198	579.80121
2019-05-22 01:25:02 PM	8	32.724753	-82.843776	34.674062	2.187040	-82.842347	34.673195	533.03042
2019-05-22 01:25:03 PM	9	32.528217	-82.843675	34.673965	3.396405	-82.842357	34.673187	486.72818
2019-05-22 01:25:04 PM	10	32.144092	-82.843572	34.673871	2.797209	-82.842367	34.673178	441.16623
2019-05-22 01:25:05 PM	11	31.560555	-82.843465	34.673778	2.522697	-82.842374	34.673170	395.3037
2019-05-22 01:25:06 PM	12	30.786233	-82.843357	34.673689	2.732655	-82.842380	34.673161	350.76332
2019-05-22 01:25:07 PM	13	29.824643	-82.843243	34.673601	2.169144	-82.842386	34.673154	304.47157
2019-05-22 01:25:08 PM	14	28.708540	-82.843141	34.673524	2.181714	-82.842394	34.673148	262.84058
2019-05-22 01:25:09 PM	15	27.498163	-82.843041	34.673452	2.208239	-82.842401	34.673140	223.15295
2019-05-22 01:25:10 PM	16	26.706265	-82.842930	34.673383	2.107627	-82.842408	34.673133	181.34419
2019-05-22 01:25:11 PM	17	25.525448	-82.842817	34.673322	2.389755	-82.842413	34.673125	140.92933
2019-05-22 01:25:12 PM	18	21.617409	-82.842721	34.673270	2.014898	-82.842420	34.673117	106.30948
2019-05-22 01:25:13 PM	19	17.007911	-82.842650	34.673229	2.131541	-82.842426	34.673109	80.067148
2019-05-22 01:25:14 PM	20	14.357066	-82.842589	34.673193	2.375694	-82.842432	34.673101	57.681229
2019-05-22 01:25:15 PM	21	11.620097	-82.842539	34.673164	2.345015	-82.842438	34.673092	40.028121
2019-05-22 01:25:16 PM	22	7.810006	-82.842502	34.673143	2.172127	-82.842444	34.673083	27.704857
2019-05-22 01:25:17 PM	23	1.870452	-82.842484	34.673132	2.176974	-82.842450	34.673076	22.807421
2019-05-22 01:25:18 PM	24	0.024287	-82.842483	34.673131	2.537397	-82.842456	34.673068	24.346323
2019-05-22 01:25:19 PM	25	0.015339	-82.842483	34.673130	2.003074	-82.842462	34.673059	26.76628
2019-05-22 01:25:20 PM	26	0.010812	-82.842483	34.673130	1.960731	-82.842465	34.673051	29.15509
2019-05-22 01:25:21 PM	27	0.014061	-82.842483	34.673130	1.473224	-82.842469	34.673045	31.106235
2019-05-22 01:25:22 PM	28	0.011824	-82.842483	34.673130	1.372240	-82.842473	34.673040	32.927288
2019-05-22 01:25:23 PM	29	0.070945	-82.842483	34.673130	0.219546	-82.842475	34.673039	33.14313
2019-05-22 01:25:24 PM	30	0.768037	-82.842482	34.673129	0.110359	-82.842475	34.673039	32.86831
2019-05-22 01:25:25 PM	31	3.781489	-82.842471	34.673123	0.098428	-82.842475	34.673039	30.520639
2019-05-22 01:25:26 PM	32	6.957965	-82.842451	34.673111	0.095744	-82.842476	34.673039	27.377269

Case C - Scenario 2 - Trial 1

Real Time	Travel Time (sec)	Vehicle-Trial-1			Pedestrian-Trial-1			Distance vehicle - Ped. (ft.)	hoverboard-Trial-1			Distance vehicle - Ped. (ft.)
		speed	longitude	latitude	speed	longitude	latitude		speed	longitude	latitude	
2019-05-22 12:41:38 PM	0	22.193277	-82.844147	34.674411	2.769406	-82.842378	34.673135	705.80108				
2019-05-22 12:41:39 PM	1	24.356083	-82.844111	34.674376	2.966262	-82.842383	34.673128	689.91174	1.149179	-82.842451	34.673063	691.2615
2019-05-22 12:41:40 PM	2	28.501617	-82.844026	34.674291	2.955397	-82.842391	34.673118	650.97964	1.966323	-82.842446	34.673069	650.723
2019-05-22 12:41:41 PM	3	31.629689	-82.843934	34.674203	2.903253	-82.842399	34.673108	609.62032	2.481472	-82.842440	34.673077	608.0791
2019-05-22 12:41:42 PM	4	34.805856	-82.843826	34.674101	2.837475	-82.842407	34.673098	561.35703	2.577024	-82.842434	34.673085	558.4832
2019-05-22 12:41:43 PM	5	37.123015	-82.843710	34.673992	2.575426	-82.842416	34.673087	509.61189	2.580859	-82.842427	34.673094	505.358
2019-05-22 12:41:44 PM	6	38.989951	-82.843576	34.673872	2.548689	-82.842421	34.673077	451.95118	2.716837	-82.842421	34.673102	445.9541
2019-05-22 12:41:45 PM	7	38.943933	-82.843446	34.673761	2.121635	-82.842425	34.673068	396.91486	2.923759	-82.842414	34.673111	389.7371
2019-05-22 12:41:46 PM	8	37.747777	-82.843309	34.673651	2.087760	-82.842429	34.673060	340.943	3.089297	-82.842408	34.673120	332.7056
2019-05-22 12:41:47 PM	9	36.743045	-82.843177	34.673549	0.866039	-82.842433	34.673054	287.13083	3.081627	-82.842400	34.673131	278.4199
2019-05-22 12:41:48 PM	10	35.039622	-82.843053	34.673458	0.546148	-82.842436	34.673053	236.80464	2.978566	-82.842394	34.673141	229.0919
2019-05-22 12:41:49 PM	11	31.181223	-82.842926	34.673372	0.216669	-82.842438	34.673050	187.58699	2.850258	-82.842387	34.673150	180.772
2019-05-22 12:41:50 PM	12	26.439103	-82.842815	34.673297	0.058162	-82.842440	34.673048	144.64774	2.670019	-82.842380	34.673160	139.6035
2019-05-22 12:41:51 PM	13	20.767190	-82.842728	34.673241	0.057203	-82.842441	34.673047	111.46709	2.540273	-82.842374	34.673169	109.3539
2019-05-22 12:41:52 PM	14	15.846269	-82.842657	34.673197	0.036112	-82.842442	34.673047	84.744355	2.421180	-82.842368	34.673176	87.11185
2019-05-22 12:41:53 PM	15	12.296150	-82.842604	34.673164	0.029081	-82.842443	34.673047	64.604551	1.638123	-82.842363	34.673182	72.74617
2019-05-22 12:41:54 PM	16	10.194648	-82.842560	34.673138	0.045060	-82.842443	34.673048	48.029666	1.294584	-82.842360	34.673186	62.70175
2019-05-22 12:41:55 PM	17	10.164928	-82.842521	34.673115	0.081491	-82.842443	34.673049	33.412786	1.749334	-82.842353	34.673190	57.43177
2019-05-22 12:41:56 PM	18	12.645122	-82.842474	34.673089	0.046338	-82.842442	34.673050	17.054091	0.956477	-82.842350	34.673191	52.52639
2019-05-22 12:41:57 PM	19	15.772767	-82.842415	34.673057	0.093208	-82.842442	34.673052	8.3575506	0.233926	-82.842347	34.673191	52.96413
2019-05-22 12:41:58 PM	20	18.250192	-82.842348	34.673020	0.216350	-82.842442	34.673052	30.266888	1.130005	-82.842346	34.673190	61.92332
2019-05-22 12:41:59 PM	21	20.772782	-82.842268	34.672976	0.256935	-82.842442	34.673052	58.926659	3.343037	-82.842352	34.673199	85.16914
2019-05-22 12:42:00 PM	22	22.896068	-82.842180	34.672929	0.290490	-82.842442	34.673052	90.378194	1.881956	-82.842356	34.673209	114.8821
2019-05-22 12:42:01 PM	23	23.976166	-82.842080	34.672876	0.082396	-82.842441	34.673052	125.95925	1.663582	-82.842352	34.673211	147.0193
2019-05-22 12:42:02 PM	24	23.410525	-82.841976	34.672823	0.047936	-82.842442	34.673053	162.91985	0.369425	-82.842350	34.673212	180.8988
2019-05-22 12:42:03 PM	25	22.581769	-82.841907	34.672789	0.073821	-82.842442	34.673053	187.30078	0.116883	-82.842351	34.673211	203.5821

Case C - Scenario 2 - Trial 2

Real Time	Travel Time (sec)	Vehicle-Trial-2			Pedestrian-Trial-2			Distance vehicle - Ped. (ft.)	hoverboard-Trial-2			Distance vehicle - Ped. (ft.)
		speed	longitude	latitude	speed	longitude	latitude		speed	longitude	latitude	
2019-05-22 12:44:50 PM	0	12.467121	-82.844243	34.674488	0.024927	-82.842449	34.673033	755.96947	0.041544	-82.842312	34.673155	756.4563
2019-05-22 12:44:51 PM	1	16.669006	-82.844190	34.674451	0.401382	-82.842449	34.673033	735.28953	0.062956	-82.842311	34.673156	735.5272
2019-05-22 12:44:52 PM	2	20.712703	-82.844123	34.674395	1.901770	-82.842445	34.673037	706.31742	0.151157	-82.842310	34.673156	707.4218
2019-05-22 12:44:53 PM	3	24.883749	-82.844046	34.674323	2.105017	-82.842440	34.673044	670.63355	0.851019	-82.842308	34.673155	673.3588
2019-05-22 12:44:54 PM	4	28.547103	-82.843961	34.674241	2.398384	-82.842434	34.673052	631.21658	1.478284	-82.842307	34.673153	635.8416
2019-05-22 12:44:55 PM	5	31.914001	-82.843868	34.674151	2.275402	-82.842427	34.673060	587.70414	1.602651	-82.842305	34.673148	594.8288
2019-05-22 12:44:56 PM	6	34.875469	-82.843755	34.674042	2.448876	-82.842421	34.673068	535.19039	1.997961	-82.842305	34.673141	545.2112
2019-05-22 12:44:57 PM	7	37.019740	-82.843641	34.673934	2.753108	-82.842415	34.673078	482.71437	1.959292	-82.842308	34.673135	494.8359
2019-05-22 12:44:58 PM	8	37.847164	-82.843516	34.673825	2.744479	-82.842411	34.673089	426.6631	2.283604	-82.842312	34.673128	441.7301
2019-05-22 12:44:59 PM	9	37.807857	-82.843382	34.673715	2.676571	-82.842409	34.673099	368.23866	3.008765	-82.842316	34.673119	386.6654
2019-05-22 12:45:00 PM	10	37.742984	-82.843244	34.673606	2.508316	-82.842405	34.673110	310.10295	3.138831	-82.842324	34.673109	330.5043
2019-05-22 12:45:01 PM	11	36.973882	-82.843116	34.673510	2.600672	-82.842399	34.673121	257.75118	3.152253	-82.842330	34.673097	279.9925
2019-05-22 12:45:02 PM	12	36.235885	-82.842987	34.673416	2.795291	-82.842390	34.673131	207.21839	3.389801	-82.842339	34.673086	228.7531
2019-05-22 12:45:03 PM	13	32.233892	-82.842852	34.673322	2.979684	-82.842380	34.673140	156.31822	3.267937	-82.842349	34.673076	175.4815
2019-05-22 12:45:04 PM	14	24.338880	-82.842744	34.673251	3.030176	-82.842370	34.673150	118.13573	3.309162	-82.842356	34.673063	135.1471
2019-05-22 12:45:05 PM	15	18.436608	-82.842671	34.673204	2.996834	-82.842361	34.673161	94.118353	3.253876	-82.842363	34.673051	107.8775
2019-05-22 12:45:06 PM	16	14.048680	-82.842611	34.673167	2.766210	-82.842354	34.673171	76.905993	2.886050	-82.842371	34.673040	85.55214
2019-05-22 12:45:07 PM	17	10.583247	-82.842561	34.673137	2.581498	-82.842347	34.673180	66.27016	2.570952	-82.842378	34.673029	67.63508
2019-05-22 12:45:08 PM	18	7.651659	-82.842528	34.673117	2.067947	-82.842340	34.673188	62.240533	2.100916	-82.842381	34.673021	56.33775
2019-05-22 12:45:09 PM	19	4.572748	-82.842506	34.673104	1.623689	-82.842334	34.673193	60.926742	1.656339	-82.842380	34.673014	49.69835
2019-05-22 12:45:10 PM	20	0.947529	-82.842496	34.673098	1.479296	-82.842329	34.673198	62.209352	0.737251	-82.842378	34.673014	46.85076
2019-05-22 12:45:11 PM	21	0.027483	-82.842497	34.673098	1.056610	-82.842324	34.673201	63.947248	0.838555	-82.842382	34.673016	45.51691
2019-05-22 12:45:12 PM	22	0.016778	-82.842498	34.673098	1.042762	-82.842321	34.673203	65.440802	0.476481	-82.842385	34.673019	44.31385
2019-05-22 12:45:13 PM	23	0.018535	-82.842499	34.673098	0.881005	-82.842316	34.673203	66.983624	1.192321	-82.842393	34.673021	42.24607
2019-05-22 12:45:14 PM	24	0.025566	-82.842499	34.673098	0.807237	-82.842313	34.673203	67.984877	0.605588	-82.842401	34.673025	39.70081
2019-05-22 12:45:15 PM	25	0.016778	-82.842500	34.673098	0.814268	-82.842308	34.673203	69.079817	0.130705	-82.842406	34.673029	37.90958
2019-05-22 12:45:16 PM	26	0.022690	-82.842502	34.673099	0.540076	-82.842310	34.673201	68.727834	0.099387	-82.842410	34.673032	36.89806
2019-05-22 12:45:17 PM	27	0.140931	-82.842502	34.673099	1.473224	-82.842469	34.673045	22.026282				

Appendix D - PEMDs crossing the Roadway in a Connected Environment (Case-D)

Case D - Scenario 1 - Trial 1

Real Time	Travel Time (sec)	Vehicle-Trial-1			Pedestrian-Trial-1			Distance vehicle - Ped. (ft.)
		speed	longitude	latitude	speed	longitude	latitude	
2019-05-22 01:19:05 PM	0	29.446750	-82.843941	34.674236	2.277266	-82.842345	34.673128	626.57667
2019-05-22 01:19:06 PM	1	31.114753	-82.843874	34.674169	2.336706	-82.842349	34.673122	595.79406
2019-05-22 01:19:07 PM	2	32.753036	-82.843772	34.674071	2.313378	-82.842355	34.673115	549.83476
2019-05-22 01:19:08 PM	3	34.654006	-82.843667	34.673970	2.220223	-82.842360	34.673107	502.93827
2019-05-22 01:19:09 PM	4	36.271091	-82.843551	34.673864	2.030557	-82.842364	34.673099	452.49189
2019-05-22 01:19:10 PM	5	37.593424	-82.843425	34.673756	2.400301	-82.842369	34.673091	399.14511
2019-05-22 01:19:11 PM	6	37.302614	-82.843292	34.673646	2.304749	-82.842373	34.673083	343.74163
2019-05-22 01:19:12 PM	7	36.148322	-82.843150	34.673536	2.243391	-82.842378	34.673075	286.404
2019-05-22 01:19:13 PM	8	34.708919	-82.843028	34.673446	2.153113	-82.842382	34.673068	238.02946
2019-05-22 01:19:14 PM	9	30.662559	-82.842915	34.673367	2.066988	-82.842388	34.673060	193.87396
2019-05-22 01:19:15 PM	10	25.519057	-82.842808	34.673294	2.257453	-82.842393	34.673052	152.75442
2019-05-22 01:19:16 PM	11	20.050231	-82.842723	34.673238	2.088399	-82.842397	34.673044	120.85743
2019-05-22 01:19:17 PM	12	15.484194	-82.842658	34.673196	2.427891	-82.842402	34.673036	96.335651
2019-05-22 01:19:18 PM	13	12.309252	-82.842602	34.673160	2.376972	-82.842407	34.673028	75.636603
2019-05-22 01:19:19 PM	14	10.294301	-82.842561	34.673134	2.267200	-82.842413	34.673020	61.001533
2019-05-22 01:19:20 PM	15	8.906456	-82.842526	34.673113	1.809413	-82.842418	34.673014	48.6468
2019-05-22 01:19:21 PM	16	4.722946	-82.842499	34.673096	1.865019	-82.842425	34.673008	39.257266
2019-05-22 01:19:22 PM	17	0.259812	-82.842493	34.673092	1.353385	-82.842428	34.673002	38.271235
2019-05-22 01:19:23 PM	18	0.017257	-82.842493	34.673092	0.978315	-82.842429	34.672997	39.609069
2019-05-22 01:19:24 PM	19	0.016032	-82.842493	34.673092	0.805959	-82.842431	34.672994	40.464414
2019-05-22 01:19:25 PM	20	0.017257	-82.842493	34.673092	0.539437	-82.842432	34.672991	41.101913
2019-05-22 01:19:26 PM	21	0.015339	-82.842493	34.673092	0.102902	-82.842433	34.672991	40.748714
2019-05-22 01:19:27 PM	22	0.014541	-82.842493	34.673091	0.109166	-82.842435	34.672995	39.262208

Case D - Scenario 2 - Trial 1

Real Time	Travel Time (sec)	Vehicle-Trial-1			Pedestrian-Trial-1			Distance vehicle - Ped. (ft.)	hoverboard-Trial-1			Distance vehicle - Ped. (ft.)
		speed	longitude	latitude	speed	longitude	latitude		speed	longitude	latitude	
2019-05-22 12:52:41 PM	0	11.296850	-82.844271	34.674514	0.073821	-82.842447	34.673027	770.75494	0.096191	-82.842263	34.673137	784.5029
2019-05-22 12:52:42 PM	1	14.132248	-82.844242	34.674495	0.062316	-82.842447	34.673027	759.55939	0.146364	-82.842263	34.673137	773.1887
2019-05-22 12:52:43 PM	2	18.579883	-82.844179	34.674451	0.024607	-82.842446	34.673027	735.18793	0.085965	-82.842263	34.673137	748.6062
2019-05-22 12:52:44 PM	3	22.916787	-82.844105	34.674389	0.212195	-82.842445	34.673027	703.42994	0.127509	-82.842263	34.673136	717.0685
2019-05-22 12:52:45 PM	4	26.209811	-82.844028	34.674318	0.741406	-82.842443	34.673028	668.90404	0.066151	-82.842262	34.673136	682.8957
2019-05-22 12:52:46 PM	5	28.867846	-82.843946	34.674237	1.575807	-82.842438	34.673031	630.92865	0.071264	-82.842261	34.673136	645.5157
2019-05-22 12:52:47 PM	6	31.018242	-82.843848	34.674141	1.759401	-82.842434	34.673036	585.20554	0.869554	-82.842261	34.673134	601.4589
2019-05-22 12:52:48 PM	7	31.892909	-82.843745	34.674042	2.215589	-82.842426	34.673044	537.5361	1.915192	-82.842263	34.673130	555.0402
2019-05-22 12:52:49 PM	8	32.677350	-82.843644	34.673946	2.210529	-82.842420	34.673051	491.51194	1.964406	-82.842265	34.673123	511.2565
2019-05-22 12:52:50 PM	9	33.754413	-82.843537	34.673850	2.271194	-82.842413	34.673059	443.80526	2.468306	-82.842265	34.673116	466.2017
2019-05-22 12:52:51 PM	10	34.811076	-82.843420	34.673752	2.441526	-82.842407	34.673068	393.24943	2.569674	-82.842267	34.673108	418.3074
2019-05-22 12:52:52 PM	11	34.855975	-82.843296	34.673654	2.459209	-82.842401	34.673077	341.36016	3.415260	-82.842273	34.673097	368.3872
2019-05-22 12:52:53 PM	12	33.577690	-82.843163	34.673553	2.324882	-82.842395	34.673086	286.53522	4.156985	-82.842275	34.673080	317.4244
2019-05-22 12:52:54 PM	13	30.606314	-82.843040	34.673462	2.310501	-82.842389	34.673094	236.87387	3.911554	-82.842283	34.673065	269.363
2019-05-22 12:52:55 PM	14	27.265302	-82.842939	34.673390	2.429062	-82.842383	34.673103	197.19584	3.251639	-82.842294	34.673053	229.3235
2019-05-22 12:52:56 PM	15	24.342075	-82.842847	34.673328	2.532284	-82.842376	34.673112	161.74914	3.746975	-82.842304	34.673043	193.3704
2019-05-22 12:52:57 PM	16	20.844366	-82.842757	34.673268	2.540114	-82.842371	34.673121	127.68877	3.388096	-82.842314	34.673031	158.6171
2019-05-22 12:52:58 PM	17	16.490791	-82.842690	34.673225	2.412125	-82.842365	34.673131	103.33308	3.051588	-82.842323	34.673021	132.9598
2019-05-22 12:52:59 PM	18	11.362043	-82.842637	34.673192	2.430501	-82.842361	34.673140	85.067135	2.419316	-82.842331	34.673012	112.8037
2019-05-22 12:53:00 PM	19	6.463332	-82.842603	34.673170	2.513429	-82.842356	34.673149	74.432267	2.018413	-82.842337	34.673005	99.93789
2019-05-22 12:53:01 PM	20	3.272731	-82.842587	34.673160	2.244350	-82.842351	34.673158	70.60358	1.756365	-82.842339	34.672997	94.99708
2019-05-22 12:53:02 PM	21	0.593125	-82.842581	34.673156	2.427784	-82.842346	34.673167	70.687347	1.607125	-82.842341	34.672992	93.51965
2019-05-22 12:53:03 PM	22	0.022370	-82.842581	34.673156	2.096442	-82.842341	34.673175	72.105236	0.940179	-82.842342	34.672990	93.54713
2019-05-22 12:53:04 PM	23	0.017257	-82.842581	34.673156	1.589548	-82.842340	34.673182	72.831471	0.167029	-82.842345	34.672993	92.3983
2019-05-22 12:53:05 PM	24	0.013049	-82.842580	34.673156	1.219911	-82.842339	34.673187	73.187578	0.194299	-82.842347	34.672995	91.30728
2019-05-22 12:53:06 PM	25	0.013742	-82.842580	34.673156	1.166116	-82.842338	34.673191	73.893331	0.552859	-82.842354	34.672997	89.14938
2019-05-22 12:53:07 PM	26	0.009587	-82.842580	34.673156	1.392533	-82.842333	34.673194	75.413742	1.004093	-82.842360	34.672998	87.67797
2019-05-22 12:53:08 PM	27	0.010226	-82.842581	34.673156	1.120737	-82.842329	34.673196	76.864354	0.806918	-82.842364	34.672999	86.52857
2019-05-22 12:53:09 PM	28	0.014168	-82.842581	34.673155	1.217887	-82.842324	34.673198	78.515767	0.296243	-82.842369	34.673000	85.06885
2019-05-22 12:53:10 PM	29	0.156270	-82.842580	34.673155	0.919087	-82.842319	34.673200	79.988959	0.137096	-82.842373	34.673002	83.68455
2019-05-22 12:53:11 PM	30	1.182734	-82.842578	34.673153	0.793017	-82.842317	34.673202	80.202736	0.296775	-82.842375	34.673005	81.54205
2019-05-22 12:53:12 PM	31	3.844764	-82.842567	34.673147	0.301356	-82.842317	34.673201	77.645424	0.690274	-82.842374	34.673007	77.26027
2019-05-22 12:53:13 PM	32	7.083833	-82.842545	34.673134	0.206763	-82.842316	34.673201	73.126578	0.425989	-82.842377	34.673007	68.57097
2019-05-22 12:53:14 PM	33	10.362743	-82.842511	34.673115	0.339385	-82.842317	34.673201	65.998785	0.175125	-82.842379	34.673009	55.18691
2019-05-22 12:53:15 PM	34	13.647617	-82.842456	34.673085	0.187535	-82.842319	34.673198	58.478805	0.103861	-82.842382	34.673010	35.29354
2019-05-22 12:53:16 PM	35	16.305120	-82.842397	34.673051	0.128148	-82.842318	34.673195	57.72158	0.159200	-82.842383	34.673010	15.24601
2019-05-22 12:53:17 PM	36	19.125391	-82.842320	34.673007	0.080212	-82.842317	34.673193	67.678818	0.147003	-82.842383	34.673011	18.94583
2019-05-22 12:53:18 PM	37	21.523775	-82.842236	34.672962	0.150199	-82.842316	34.673191	87.07509	0.119839	-82.842383	34.673013	47.8232
2019-05-22 12:53:19 PM	38	22.887866	-82.842149	34.672916	0.130865	-82.842315	34.673191	112.20355	0.149240	-82.842382	34.673015	78.77974

Real Time	Travel Time (sec)	Vehicle-Trial-1			Pedestrian-Trial-1			Distance vehicle - Ped. (ft.)	hoverboard-Trial-1			Distance vehicle - Ped. (ft.)
		speed	longitude	latitude	speed	longitude	latitude		speed	longitude	latitude	
2019-05-22 12:53:20 PM	39	22.811967	-82.842056	34.672869	0.155631	-82.842314	34.673190	140.457	0.128148	-82.842382	34.673016	111.5206
2019-05-22 12:53:21 PM	40	21.011502	-82.841959	34.672823	0.082130	-82.842314	34.673189	171.00843	0.084686	-82.842382	34.673016	145.2838
2019-05-22 12:53:22 PM	41	19.319478	-82.841877	34.672783	0.181836	-82.842314	34.673188	197.59	0.074940	-82.842382	34.673017	173.9529
2019-05-22 12:53:23 PM	42	17.488866	-82.841803	34.672746	0.174486	-82.842314	34.673186	222.11063	0.121118	-82.842383	34.673017	200.1665
2019-05-22 12:53:24 PM	43	14.515573	-82.841738	34.672703	0.156217	-82.842313	34.673187	246.90182	0.046657	-82.842385	34.673018	225.7701
2019-05-22 12:53:25 PM	44	11.560070	-82.841702	34.672665	0.131024	-82.842313	34.673186	263.95122	0.243194	-82.842388	34.673019	242.8912
2019-05-22 12:53:26 PM	45	9.978937	-82.841686	34.672625	0.072330	-82.842312	34.673185	277.39868	0.439730	-82.842392	34.673020	256.0314
2019-05-22 12:53:27 PM	46	8.959185	-82.841689	34.672587	0.069667	-82.842311	34.673185	286.91197	0.287455	-82.842394	34.673022	264.3323
2019-05-22 12:53:28 PM	47	9.822347	-82.841705	34.672551	0.048575	-82.842309	34.673185	293.7654	0.277388	-82.842396	34.673022	269.2117
2019-05-22 12:53:29 PM	48	9.680777	-82.841727	34.672515	0.158188	-82.842307	34.673185	300.35128	0.357920	-82.842403	34.673027	275.8941
2019-05-22 12:53:30 PM	49	10.261492	-82.841746	34.672480	0.166816	-82.842307	34.673186	307.93602	1.401960	-82.842401	34.673026	280.0188
2019-05-22 12:53:31 PM	50	11.338394	-82.841764	34.672441	0.200584	-82.842306	34.673188	317.42636	1.784008	-82.842403	34.673028	287.5326
2019-05-22 12:53:32 PM	51	11.006040	-82.841783	34.672394	0.179706	-82.842307	34.673189	329.80543				
2019-05-22 12:53:33 PM	52	10.720450	-82.841796	34.672365								

Case D - Scenario 2 - Trial 2

Real Time	Travel Time (sec)	Vehicle-Trial-2			Pedestrian-Trial-2			Distance vehicle - Ped. (ft.)	hoverboard-Trial-2			Distance vehicle - Ped. (ft.)
		speed	longitude	latitude	speed	longitude	latitude		speed	longitude	latitude	
2019-05-22 12:56:45 PM	0	13.329963	-82.844270	34.674509	0.536880	-82.842442	34.673027	770.17498	0.158507	-82.842267	34.673157	777.4546
2019-05-22 12:56:46 PM	1	17.593259	-82.844211	34.674471	0.464657	-82.842442	34.673029	747.03744	0.340024	-82.842267	34.673157	754.7996
2019-05-22 12:56:47 PM	2	21.569793	-82.844141	34.674414	0.242235	-82.842439	34.673031	717.66909	0.182795	-82.842267	34.673156	725.8684
2019-05-22 12:56:48 PM	3	25.345530	-82.844061	34.674340	1.638123	-82.842435	34.673036	681.35171	0.116004	-82.842265	34.673155	690.5777
2019-05-22 12:56:49 PM	4	28.044523	-82.843981	34.674261	2.252286	-82.842428	34.673042	644.26122	0.667904	-82.842264	34.673153	654.8353
2019-05-22 12:56:50 PM	5	30.633478	-82.843888	34.674169	1.753808	-82.842420	34.673049	600.72736	1.025505	-82.842263	34.673150	613.0255
2019-05-22 12:56:51 PM	6	32.272240	-82.843788	34.674071	1.064492	-82.842415	34.673054	554.49985	1.640999	-82.842266	34.673144	568.157
2019-05-22 12:56:52 PM	7	32.977215	-82.843676	34.673966	0.651287	-82.842413	34.673058	503.5485	1.178260	-82.842270	34.673140	518.4852
2019-05-22 12:56:53 PM	8	32.953567	-82.843564	34.673866	0.807184	-82.842413	34.673062	453.17636	1.890265	-82.842273	34.673146	467.897
2019-05-22 12:56:54 PM	9	32.282893	-82.843461	34.673776	1.143746	-82.842413	34.673061	408.52287	1.542252	-82.842280	34.673148	422.0369
2019-05-22 12:56:55 PM	10	31.259838	-82.843352	34.673685	1.783848	-82.842416	34.673055	363.0827	0.941777	-82.842280	34.673147	376.8057
2019-05-22 12:56:56 PM	11	30.286743	-82.843248	34.673601	1.967282	-82.842421	34.673047	319.9237	0.706892	-82.842278	34.673144	335.2268
2019-05-22 12:56:57 PM	12	29.023477	-82.843138	34.673518	1.740386	-82.842428	34.673041	275.11029	0.440689	-82.842279	34.673142	292.0587
2019-05-22 12:56:58 PM	13	27.632063	-82.843027	34.673441	1.586992	-82.842434	34.673037	230.86699	1.283399	-82.842276	34.673139	250.7374
2019-05-22 12:56:59 PM	14	25.740041	-82.842930	34.673373	1.547045	-82.842439	34.673032	192.98373	1.419856	-82.842274	34.673135	215.3077
2019-05-22 12:57:00 PM	15	23.476356	-82.842844	34.673315	1.297140	-82.842441	34.673026	160.32713	0.405856	-82.842272	34.673133	183.9679
2019-05-22 12:57:01 PM	16	19.876704	-82.842762	34.673261	0.295657	-82.842439	34.673023	130.0376	0.482553	-82.842269	34.673134	154.8971
2019-05-22 12:57:02 PM	17	16.123018	-82.842687	34.673214	0.329798	-82.842441	34.673023	101.60241	0.308386	-82.842265	34.673135	130.0025
2019-05-22 12:57:03 PM	18	13.103228	-82.842632	34.673181	0.077336	-82.842442	34.673023	80.751222	0.910139	-82.842264	34.673133	111.8871
2019-05-22 12:57:04 PM	19	10.113477	-82.842587	34.673154	0.045859	-82.842444	34.673023	64.186497	1.851490	-82.842265	34.673127	97.09697
2019-05-22 12:57:05 PM	20	7.854853	-82.842553	34.673134	0.054008	-82.842445	34.673023	51.825425	2.493935	-82.842272	34.673119	84.63553
2019-05-22 12:57:06 PM	21	5.125287	-82.842529	34.673120	0.078295	-82.842447	34.673023	43.218855	2.768128	-82.842281	34.673109	74.61581
2019-05-22 12:57:07 PM	22	1.001217	-82.842518	34.673113	0.060026	-82.842448	34.673022	39.389252	3.018033	-82.842290	34.673099	68.48179
2019-05-22 12:57:08 PM	23	0.024927	-82.842517	34.673113	0.036751	-82.842448	34.673022	39.301722	3.525512	-82.842300	34.673088	65.79857
2019-05-22 12:57:09 PM	24	0.014168	-82.842517	34.673113	0.037390	-82.842448	34.673021	39.249852	4.050568	-82.842311	34.673074	63.28695
2019-05-22 12:57:10 PM	25	0.015020	-82.842517	34.673113	0.041225	-82.842448	34.673022	39.096309	3.953152	-82.842322	34.673061	61.38992
2019-05-22 12:57:11 PM	26	0.011824	-82.842516	34.673113	0.061890	-82.842448	34.673022	38.932194	3.444980	-82.842332	34.673048	60.08256
2019-05-22 12:57:12 PM	27	0.011931	-82.842516	34.673113	0.044740	-82.842448	34.673023	38.618205	3.509853	-82.842342	34.673035	59.33681
2019-05-22 12:57:13 PM	28	0.017257	-82.842515	34.673113	0.037709	-82.842447	34.673023	38.616949	3.123172	-82.842350	34.673023	59.43483
2019-05-22 12:57:14 PM	29	0.020453	-82.842515	34.673113	0.038402	-82.842445	34.673024	38.611924	2.392951	-82.842354	34.673014	60.23656
2019-05-22 12:57:15 PM	30	0.284099	-82.842514	34.673113	0.050812	-82.842444	34.673025	38.521368	1.440255	-82.842356	34.673007	61.25704
2019-05-22 12:57:16 PM	31	1.506620	-82.842511	34.673111	0.048575	-82.842442	34.673025	37.552186	0.380929	-82.842356	34.673004	60.51294
2019-05-22 12:57:17 PM	32	4.185747	-82.842499	34.673104	0.040639	-82.842441	34.673026	33.564871	0.825773	-82.842359	34.673006	55.40621
2019-05-22 12:57:18 PM	33	7.274085	-82.842473	34.673090	0.054966	-82.842440	34.673026	25.345879	0.324685	-82.842363	34.673008	44.60841
2019-05-22 12:57:19 PM	34	10.233157	-82.842436	34.673072	0.056245	-82.842439	34.673027	16.404613	0.362074	-82.842364	34.673009	31.2773
2019-05-22 12:57:20 PM	35	12.766559	-82.842390	34.673047	0.039307	-82.842438	34.673028	15.991363	0.793389	-82.842369	34.673009	15.46711
2019-05-22 12:57:21 PM	36	15.658680	-82.842326	34.673009	0.053049	-82.842438	34.673028	34.394252	1.235463	-82.842371	34.673006	13.68332
2019-05-22 12:57:22 PM	37	17.707719	-82.842263	34.672974	0.180079	-82.842437	34.673028	55.824852	0.238081	-82.842375	34.673006	35.42661
2019-05-22 12:57:23 PM	38	19.099506	-82.842203	34.672941	0.213261	-82.842436	34.673029	77.035181	0.158081	-82.842376	34.673007	57.3574