MRI-2: Integrated Simulation and Safety

Year 3 Quarterly Report

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Chapter 1: Introduction

1.1 Background

Pedestrian and bicyclist fatalities and injuries are of major concern to transportation engineers, planners, and the public. In 2011, 4,432 pedestrians were killed and an estimated 69,000 were injured in traffic crashes in the United States. This fatality rate represents an increase of 3 percent from 2010. For this same year, pedestrian deaths accounted for 14 percent of all traffic fatalities, and made up 3 percent of all the people injured in traffic crashes. Almost three-fourths (73%) of pedestrian fatalities occurred in an urban setting versus a rural setting. Over two-thirds (70%) of pedestrian fatalities occurred at non-intersections versus at intersections.

In 2011, 677 bicyclist deaths and 38,000 injuries were reported (www.nthsa.gov 2013). The total cost of bicyclist injury and death is over $4 billion per year. In 2009 the average age of bicyclists killed in crashes with motor vehicles was 41 years. 87 percent of those killed were male, and 64 percent of those killed were between the ages of 25 and 64. 13 percent of those killed in 2008 were under age 16. The average age of bicyclists injured in crashes with motor vehicles was 31 years and 80 percent of those injured were male. 51 percent of those injured were between the ages of 25 and 64; 20 percent of those injured were under age 16. The bicyclist fatality rates calculated as fatality per million population were reported to be 6.56, 0.78, and 0.46 for Florida, Tennessee, and Kentucky; respectively. The US average is reported to be 2.17.

1.2 Objectives

The fundamental objective of this research is to simulate the vehicle-pedestrian conflicts process at midblock crossings in the driving simulator and to assess the vehicle-pedestrian conflicts. Some potential risk factors were selected as the independent variables and a full factorial experiment was designed for the pedestrian-vehicle conflicts in the driving simulator. In order to analyze pedestrian-vehicle conflicts from the driver's point of view, the surrogate safety measures were examined to evaluate these pedestrian-vehicle conflicts. Specifically, this part of the major research initiative #2 (MRI-2), sponsored by the Southeast Transportation Center at the University of Tennessee as part of the University Transportation Center, is aimed at exploring the use of simulation and simulator to evaluate vehicular/pedestrian safety surrogate measures. The third year quarterly report includes the tasks 1-2.

1.3 Summary of Project Tasks

The third year STC project was designed around the following tasks:

- Task 1 Literature Search

- Task 2 Pedestrian-vehicle Prediction Model Development
- Task 3 Field Data, Simulator and Microsimulation Association
- Task 4 Final Report

Chapter 2: Literature Research

Over years, a lot of research has been conducted on identifying the significant factors that affect the pedestrian safety, including environmental factors, roadway characteristics factors, and vehicle characteristics factors, and pedestrian characteristic factors. Environmental factors included time of day, lighting conditions, etc. Chang et al. found that 26% of pedestrian crashes occurred from 3 p.m. to 6 p.m. in Chicago, which was the period with most occurrences (Chang, 2008). However, NHTSA found that 24.7% percent of pedestrian deaths were between 6 p.m. and 9 p.m. which was the highest number of pedestrian deaths of the whole day (NHTSA, 2011). Weather and lighting condition factors were also of common concerns. Other studies showed that poor lighting conditions lead to increase the likelihood of pedestrian injuries (Clifton et al., 2009; Mohamed et al., 2013). Roadway characteristic factors include locations, roadway type, speed limit, pavement marking, etc. Turner et al. investigated roadway factors in an urban area in New Zealand (Tuner et al., 2006). They found that 56% of accidents occurred at mid-block locations, which were the highest among urban pedestrian accident locations. Lee and Abdel-Aty used four years of vehicle-pedestrian crashes data from 1999 to 2002 in Florida to identify roadway characteristics that were correlated with high pedestrian crashes using a log-linear model (Lee & Abdel-Aty, 2005). They found that undivided roads with a greater number of lanes were more dangerous than divided roads with fewer lanes. Ukkusuri et al. developed pedestrian accident frequency models for New York City and found that more pedestrian crashes were associated with larger road width and road width was related to operating speeds, length of crosswalks and traffic volume (Ukkusuri et al., 2012). In addition, some studies pointed out that certain treatments such as yield pavement marking were effective in improve the pedestrian safety (Turner et al., 2006; Huybers & Van, 2004). Vehicle characteristics factors included vehicle type, vehicle speed, etc. 68% of the involved vehicles were passenger cars and 32% were other light vehicles, including light trucks, vans, and utility vehicles (Chidester & Isenerg, 2001). However, although the truck was not the highest number in vehicle types, the influence of truck flow at intersections with high pedestrian activity was found to be one of the crash factors associated with the most severe injuries (Mohamed et al., 2013). Many studies have focused on the vehicle speed for pedestrian crashes and pedestrian injury severities. Han et al. used two finite element pedestrian models and four finite element models for vehicles with different front-end shapes to evaluate pedestrian injury severities (Han et al., 2012). The authors found that vehicle speed was the significant factor in injury severity and the speed below 30 km/h can reduce all injury parameters, which is similar to the findings of Pitt et al. (1990). Pedestrian characteristic factors included age, gender, dressing color. Harrell found that vehicles were more likely to yield pedestrians with bright color clothes than dark color clothes (Harrell, 1994). The similar result was found by Porter (2016). In this study, four factors were selected from the literature above to analyse the drivers' behavior during the pedestrian-vehicle conflict period. They are time of day, roadway type, pavement marking, and pedestrian dressing color.

Due to the difficulty of data acquisition and data quality of collision based safety analysis, the traffic conflicts technique has been widely used for evaluating safety issues (Ismail et sl., 2009). To do such analysis, the trajectory data are the most important sources (De Blasiis et al, 2017; Adler & Jenkins, 1993). A number of researchers used simulation models for obtaining the trajectory data and evaluating the pedestrian safety due to their robustness (Huang et al., 2013; Wu et al., 2016; Zhou et al., 2010). However, since the interactions between vehicles and pedestrians are very complicated and some of the factors cannot be reflected in the simulation model, there is no simulation models that were well developed for pedestrian-vehicle conflicts. For example, VISSIM and SSAM are widely used in traffic conflict analysis. However, they only allow users to define the priority rule for pedestrians and vehicle. Some important factors, such as time of day, pavement marking, pedestrian dressing color, cannot be applied in these simulation models (Lu et al., 2016). In addition, computer vision technology also made it possible to apply automated conflict analysis to pedestrian safety evaluation by using the real videos (Saunier & Sayed, 2007). Although this method could acquire the accurate data, it cannot obtain the drivers' information and pedestrian's information, such as gender, age. Therefore, this study uses the driving simulator to acquire the pedestrian-vehicle conflicts data. Several studies addressed vehicle-vehicle conflicts, but there is no research about the pedestrian-vehicle conflicts by using the driving simulator.

The modern driving simulator is usually built with the simulation software using a sophisticated driving environment which can give drivers on board impression that drivers feel that they drive in an actual vehicle. The biggest advantage of the driving simulator is that it has the ability to simulate dangerous driving situations in a safe environment, which make it easier for researchers to test driving behaviors (Underwood et al., 2011; Yan et al., 2016; Tu et al., 2015). Several studies show the high potential and reliability of driving simulator for studying the pedestrian safety. Chrysler et al. (2015) tested pedestrian crash scenarios for drivers' behavior evaluations in the driving simulator. The significant results proved that virtual scenarios in the driving simulator could serve as safe tool to test drivers' response to pedestrian crossings. Bella & Silvestri (2015) conducted a multi-factorial experiment in the driving simulator and test the three safety countermeasures at pedestrian crossings. They analyzed the drivers' speed and came to the conclusion that the curb extension was the best countermeasures, which was accordance with the questionnaire results. Yuan et al. (2013) combined driving simulator and computer simulation to reconstruct the process of pedestrian-vehicle crash. The purpose of this study was to find out the relation between drivers' various emergency measures and pedestrians' injury severity. The findings indicated that the most effective way to reduce injury severity was steering with braking. Boot et al. (2003) invited 63 participants to do the driving simulator experiment in order to test the new pedestrian marking, which was called special emphasis marking. All the participants were divided into three different age groups and a 3D model of an intersection was created in the driving simulator. The results showed that drivers could recognize the special emphasis marking much more quickly than the normal crosswalk marking.

Moreover, when there was a pedestrian crossing the street, drivers were not affected by the special emphasis marking.

Chapter 3: Methodology

3.1 Driving Simulator

The driving simulator used in this study was located in University of Central Florida (UCF), in the United States (see Figure 1). This driving simulator is produced by NADS – the National Advanced Driving Simulator group from the University of Iowa, which provides a high fidelity driving testing environment. It is composed of a visual system (three 42” flat panel displays), a quarter-cab of actual vehicle hardware including a steering wheel, pedals, adjustable seat, and shifter from a real vehicle, a digital sound simulation system and the central console. The software, including Tile Mosaic Tool (TMT), Interactive Scenario Authoring Tool (ISAT) and Minisim, is provided for modelling the virtual road network and driving scenarios. In addition, four cameras were installed around the driving simulator to supervise the experimental process. The data sampling frequency is up to 60 Hz.

Figure 1: UCF driving simulator

3.2 Experiment Scenario Design

Previous studies in year 1 and 2 investigated some potential risk factors that affected the pedestrian safety. In this study, four potential risk factors were selected from the literature, including time of day, crosswalk marking, roadway type, and pedestrian dressing color. Each factor has two levels. Time of day include night time and daytime. Crosswalk marking represents whether the pedestrian uses crosswalk or not. Roadway type are classified into two levels, including one traveling lane with one parking lane for each direction, and two traveling lanes for each direction. Pedestrians dressing color refers to dark color clothes or bright color clothes for pedestrians.

The road network created for this study was around 3.5 miles long with the speed limit of 40 mph in urban area. The environmental vehicle flow was designed in the roadway network to make the driving scenario more realistic. In order to exclude the outside interference, there is no other vehicle in front of the simulator vehicle. This experiment utilized a within-subjects full factorial design to test four potential risk factors. There were two sub-scenarios, including daytime driving scenario and night time driving scenario. Each sub-scenario has 8 midblock crossings and drivers will encounter the pedestrian 8 times for each sub-scenario. To ensure the same approaching conditions, the distance between each midblock crossing was around 1,500 ft, which allowed drivers to reach a congruous speed for the midblock crossings.

Each pedestrian-vehicle conflict event was designed to investigate driver's avoidance behavior when drivers reacted to the pedestrian crossing. Figure 2 illustrated the pedestrian-vehicle conflict design. The road trigger was set on the road in order to realize the potential conflicts between pedestrian and simulator vehicle. When the simulator passed by this sensor, the pedestrian start to cross the street with a speed of 3.5 ft/s, which was based on Manual on Uniform Traffic Control Devices. Since each lane is 12ft wide, the distance between the pedestrian starting point and the potential conflict point is 30 ft. Based on the equation 1, the estimated distance between road trigger and the potential conflict point was 503 ft.

$$L_v = t_{ped} * V = \frac{30ft}{3.5ft/s} * 40mph = 503ft \qquad (1)$$

Therefore, when drivers passed by 503ft from the crosswalk, the road trigger is activated. The roadside pedestrian starts to cross the street. If drivers noticed the pedestrian and made a deceleration, there would be a pedestrian-vehicle conflict. In addition, participants were asked to keep in the inner lane and not to change the lane during the whole experiment period.

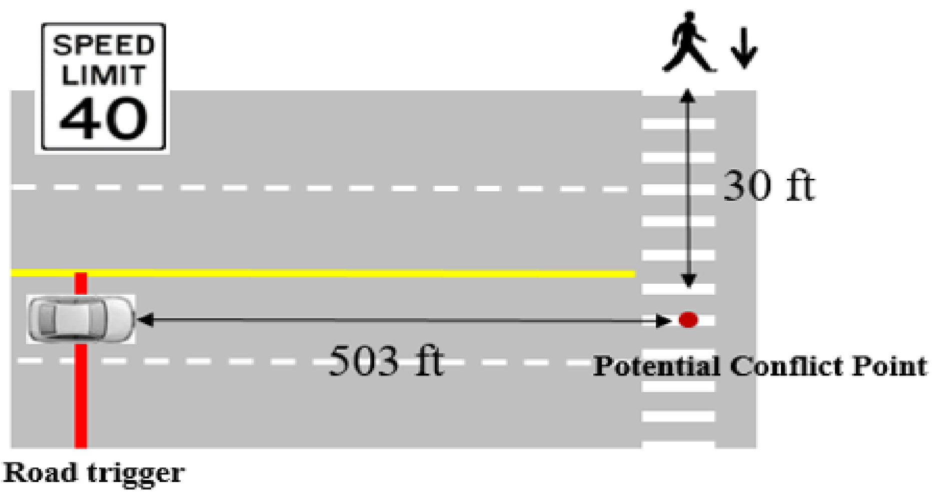

Figure 2: Scenario design for each pedestrian-vehicle conflict

3.3 Participants and Experiment Procedure

A total of 67 drivers, who had regular driver licenses, were selected to participate in this experiment. They were chosen from students, faculty, and staff of the University of Central Florida and volunteers from outside of the university. Since 8 drivers could not complete the experiment because of the motion sickness, finally, 59 drivers (28 Males and 31 females) finished the experiment successfully. In addition, all the participants were divided into two age groups. The age of the younger group ranges from 20 to 40 years. The age of the older group ranges from 40 to 60 years. Finally, 36 participants are in the younger group and 23 participants are in the older group.

Upon arrival, all participants were asked to read and sign an informed consent form (per IRB). Each participant in this study was asked to take a short training session, including the Traffic Regulation Education, the Safety Notice and the Familiarity Training. In the Traffic Regulation Education session, all participants were advised to drive and behave as they normally did and would also need to follow traffic rules as they did in real-life situations. In the Safety Notice session, each participant was told that they could quit the experiment at any time if they had any motion sickness symptoms or any kind of discomfort. In the Familiarity Training session, each participant was given at least 10 minutes training to familiarize them with the driving simulator operation, such as straight driving, acceleration, deceleration, left/right turn, and other basic driving behaviors.

After completing the short training course, participants would start the formal experiment and test two scenarios in a random sequence so as to eliminate the time order effect. In addition, all participants were recommended to rest at least 15 minutes between the scenarios.

3.4 Data Collection

To collect the data during the pedestrian-vehicle conflicts, researchers extracted the data from 500 ft in advance of each midblock crossing. There are two conditions that are excluded based on the pedestrian-vehicle conflict definition. First, drives didn't yield to the pedestrian and they accelerated to pass the conflict point before the pedestrian arrived at the conflict point. Second, there is a crash between vehicle and pedestrian without the deceleration. Therefore, 850 observations were recorded out of 944 conflict events.

3.5 Driver's avoidance pattern

During the pedestrian-vehicle conflict period, drivers adjust their speed by changing the deceleration rate to avoid the crash. Figure 3 shows the typical examples of drivers' deceleration rate and the location changes. These examples exhibited a clear avoidance pattern which can be summarized into four stages, as shown in Figure 4.

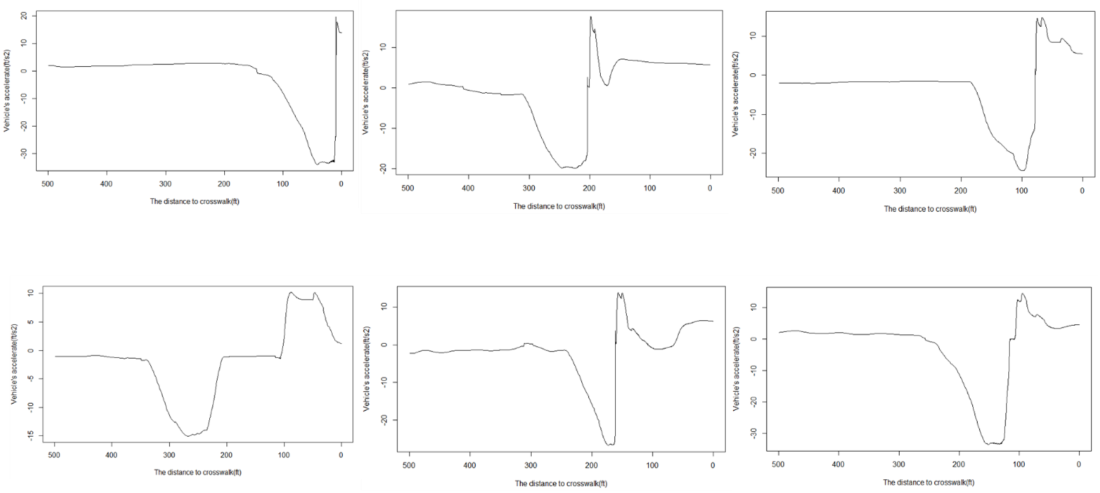

Figure 3: Drivers' deceleration rate and the distance to crosswalk during the avoidance period

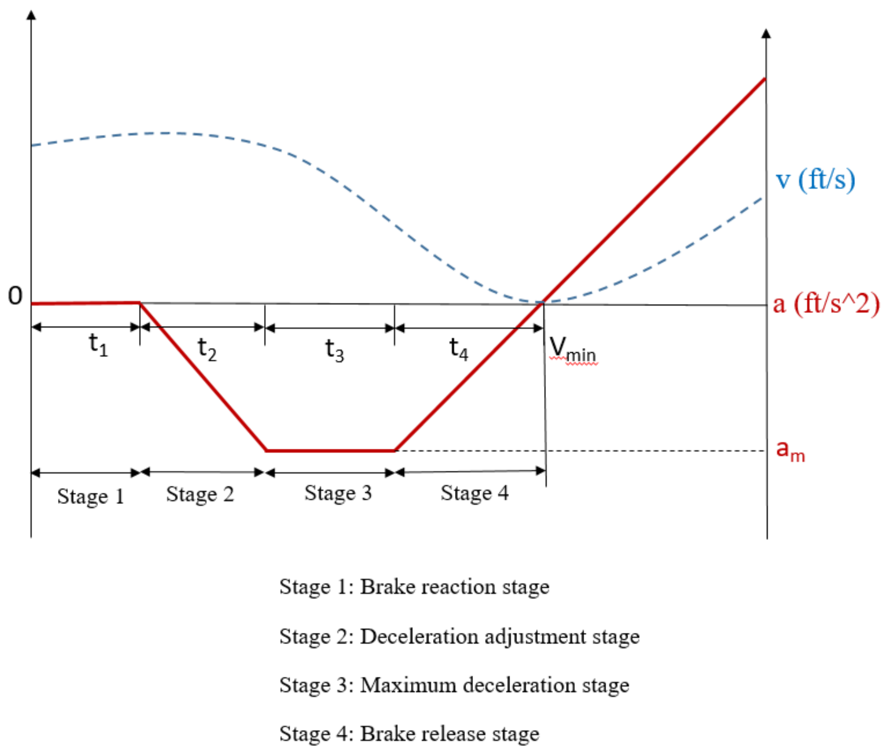

Figure 4: Drivers' avoidance pattern during the pedestrian-vehicle conflict

Stage 1: Brake reaction stage.

This stage starts from the time when drivers noticed the pedestrian crossing the street, and ended as the driver start to brake. The time duration of this stage was t_1, which was also called brake reaction time. The driver usually kept a constant initial speed during this stage. In order to get t_1, the eye tracker was usually needed. However, because of the equipment limitation, t_1 is not discussed in this study.

Stage 2: Deceleration adjustment stage

In this stage, drivers perceived the crash risk because of the sudden pedestrian appearance and then start to brake until the maximum deceleration. The time duration of this stage was t_2. In addition, the deceleration rate was assumed to be linearly increased.

Stage 3: Maximum deceleration stage

In this stage, drivers reached the maximum deceleration and stayed for a while. Drivers would release the brake until they could make sure that they won't hit the pedestrian. The duration time of this stage was t_3 and the maximum deceleration rate was d_m.

Stage 4: Break release stage

In this stage, drivers started to release the break. Finally, drivers completely stopped the car or drivers started to accelerate. The duration time of this stage was t_4.

Based on the drivers' avoidance pattern, the key variables during the pedestrian-vehicle conflict period were summarized, which include t_2 (deceleration adjustment time), t_3 (maximum deceleration time), d_m (maximum deceleration rate), and t_4 (brake release time).

Chapter 4: Driving Simulator Experiment Results and Data Analyses

In this study, analysis of variance (ANOVA) was used to analyse the drivers' behavior during the pedestrian-vehicle conflicts period. Two driver's characteristic (age and gender) and four potential risk factors were selected as the independent variables and four key variables summarized above (t_2, t_3, d_m, and t_4) are chosen as the dependent variables. The hypothesis testing in the following analyses are based on a 0.05 significance level.

4.1 Deceleration adjustment time (t_2)

The ANOVA results of deceleration adjustment time are listed in Table 1. The AVOVA results show that four variables are significant, including age, gender, roadway type, and dressing color. Time of day and marking are not significant factors. The difference of age, gender, roadway type, and dressing color on deceleration adjustment time are shown in Figure 5. Based on the results, drivers who are under 40 years old (M = 1.44s, S.D.=1.28) had a higher deceleration adjustment time than drivers who are over 40 years old (M = 1.22s, S.D.=1.17). It seems that drivers under 40 years old are more aggressive than those over 40 years, that's why they need more deceleration time. For the gender, it appears that the mean of deceleration adjustment time for male drivers (M = 1.42s, S.D.=1.37) is higher than that for female drivers (M = 1.28s, S.D.=1.08). In other words, females drive an increased proclivity of quickly braking than male drivers. The reason is that female drivers react late in urgent situations than male drivers so that the deceleration adjustment time of female drivers become smaller than male drivers (Li et al., 2016). As for the potential risk factors, roadway type and dressing color are found to be significant with deceleration adjustment time. The deceleration adjustment time of one travelling lane with one parking lane (M = 1.39s, S.D.=1.27) is significantly higher than that of two travelling lanes (M = 1.32s, S.D.=1.22). The possible explanation is that two travelling lanes road provide the driver with more space to react than one lane road with one parking lane. Similarly, dark color clothes (M = 1.44s, S.D.=1.05) increased the deceleration adjustment time than the bright color (M = 1.27s, S.D.=1.40). When pedestrians wear the dark color clothes, drivers are difficult to find the pedestrians. Therefore, drivers need more time at the deceleration adjustment stage when pedestrian wear dark color clothes.

Table 1: Analysis of variance (ANOVA) results of deceleration adjustment time (t_2)

Variables	Df	Mean Square	F-Value	Sig.
Age	1	6.7	7.986	0.00483
Gender	1	3.8	4.534	0.03352
Time of day	1	0.3	0.382	0.53671
Marking	1	1.2	1.465	0.22650
Roadway Type	1	3.4	4.091	0.04342

Dressing Color	1	7.5	8.967	0.00283

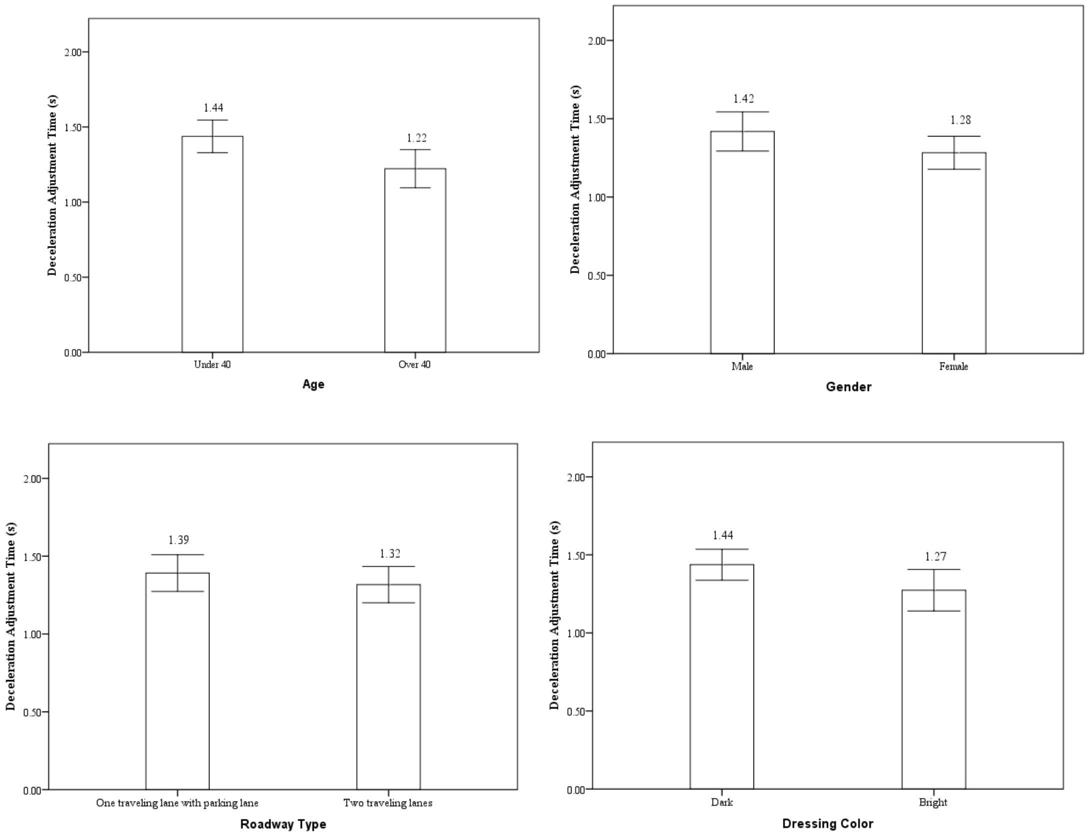

Figure 5: Relationship between deceleration adjustment time and significant factors

4.2 Maximum deceleration time (t_3) and maximum deceleration rate (d_m)

The basic statistical descriptions of independent variables for t_3 and d_m are listed in Table 2. Table 3 shows the ANOVA results for the maximum deceleration time and maximum deceleration rate. The ANOVA results indicate that age, gender, time of day, crosswalk marking, and dressing color have significant effect on the maximum deceleration time. However, all factors are found to be significantly associated with the maximum deceleration rate. From Table 2, it is found that if one group has a higher maximum deceleration rate, this group have a lower maximum deceleration time. For example, drivers who are over 40 years old has a higher maximum deceleration rate than drivers who are under 40 years old. However, drivers who are over 40 years old has a lower maximum deceleration time than drivers who are under 40 years old. This finding is appropriate for all variables. The lower t_3 and higher d_m implies that drivers have a relatively hard brake so that they don’t need to keep the maximum deceleration for a long time. For male drivers, t_3 is 2.05 seconds and d_m is 17.04 ft/s^2. For female drivers, t_3 is 1.61 seconds and d_m is 20.00 ft/s^2. In addition, night time driving has a lower t_3 and a higher d_m than the day time driving, which indicates that drivers driving at night are more likely to have a hard brake than driving in the daytime. For the crosswalk marking, t_3 has a higher value with the marking and a lower value without a marking. Similarly, d_m has higher value without the marking and lower value with the marking. Roadway type only affects d_m, but it didn't affect t_3. Based on the results, drivers on the two lanes road have a higher maximum deceleration rate than those on the one lane with one parking lane. As for the dressing color, pedestrian with dark color clothes has a lower maximum deceleration time and a higher maximum deceleration rate. The possible reason is that when pedestrians wear bright color clothes, drivers are much easier to notice them. Therefore, they are more likely to have a hard brake, but keep a shorter period of maximum deceleration time.

Table 2: Descriptive statistics of six factors related to the t_3 and d_m

Variables		t_3		d_m	
		Mean	Std.Deviation	Mean	Std.Deviation
Age	Under 40	1.98	1.82	-17.37	8.02
	Over 40	1.64	1.51	-20.10	8.37
Gender	Male	2.05	1.84	-17.04	7.98
	Female	1.61	1.54	-20.00	8.52
Time of day	Night	1.64	1.43	-19.47	8.76
	Day	2.07	1.95	-17.32	7.79
Marking	Yes	1.95	1.69	-17.81	7.81
	No	1.74	1.74	-19.06	8.87
Roadway Type	One lane with one parking lane	1.89	1.68	-17.65	7.97
	Two lanes	1.80	1.75	-19.23	8.70
Dressing Color	Dark	1.53	1.35	-20.55	8.84
	Bright	2.16	1.97	-16.29	7.27

Table 3: Analysis of variance (ANOVA) results of maximum deceleration time (t_3) and maximum deceleration rate (d_m)

	Variables	Df	Mean Square	F-Value	Sig.
t_3	Age	1	25.47	12.806	0.0003
	Gender	1	41.63	20.824	0.0001
	Time of day	1	24.75	12.439	0.0004

	Marking	1	17.39	8.744	0.0032
	Roadway Type	1	1.57	0.787	0.3751
	Dressing Color	1	72.46	36.426	0.0001
d_m	Age	1	1493	25.283	0.0001
	Gender	1	1643	27.819	0.0001
	Time of day	1	712	12.064	0.00054
	Marking	1	462	7.816	0.00530
	Roadway Type	1	510	8.629	0.00340
	Dressing Color	1	4052	68.623	0.0001

4.3 Brake Release Time (t_4)

The brake release time is the time between starting to release the break and the time the driver completely stops or starts to accelerate for normal driving. Table 4 represents the ANOVA results of the deceleration adjustment time. The ANOVA results show that age and dressing color are the only two factors that affect the brake release time (t_4). The difference of age and dressing color on t_4 is shown in Figure 6. Drivers who are under 40 years old have an average of 1.50s t_4 with a standard deviation of 1.23. In comparison, drivers who are over 40 years old have an average of 1.29s t_4 with a standard deviation of 0.91. It indicates that younger drivers are more likely to release the brake faster than older drivers. Moreover, dressing color is also a significant factor that influence the t_4. From Figure 6, it is found that pedestrians with dark color clothes has an average of 1.27s t_4, which is significantly lower than pedestrian with bright color.

Table 4: Analysis of variance (ANOVA) results of deceleration adjustment time (t_4)

Variables	Df	Mean Square	F-Value	Sig.
Age	1	8.827	7.198	0.007
Gender	1	3.460	2.821	0.093
Time of day	1	0.018	0.015	0.903
Marking	1	1.772	1.445	0.230
Roadway Type	1	2.403	1.959	0.162
Dressing Color	1	18.883	15.398	0.000

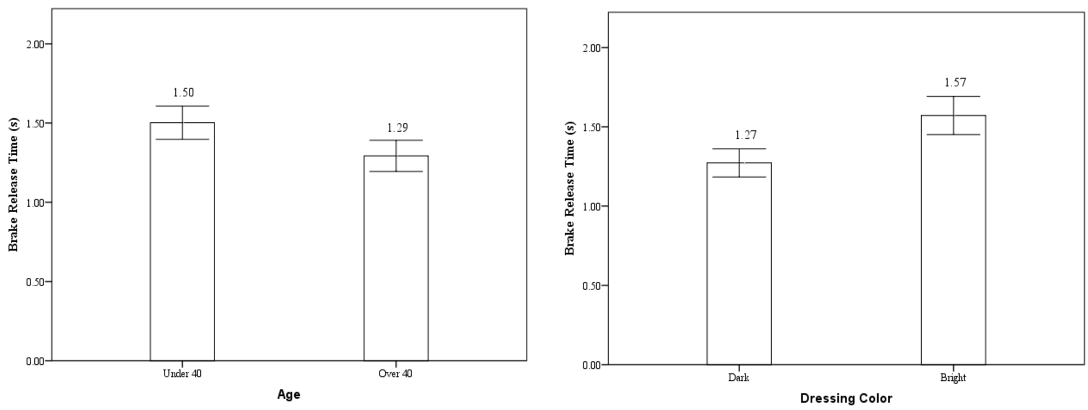

Figure 6: Relationship between brake release time and significant factors

Chapter 5: Conclusions

Pedestrian-vehicle crashes happen infrequently, so it is hard to capture how pedestrian-vehicle crash occurs. However, the pedestrian-vehicle conflict methodology is an improved way to study this phenomenon. Therefore, this study investigated drivers' behaviors of the pedestrian-vehicle conflict at midblock crossings in the driving simulator. The scenarios were designed for the pedestrian-vehicle conflict with different potential risk factors. Finally, 59 subjects finished the driving simulator experiment and data were collected and analyzed.

First, driver's avoidance behavior pattern was summarized during the pedestrian-vehicle conflict. There are four stages showing that how drivers react to the pedestrian conflict, including brake reaction stage, deceleration adjustment stage, maximum deceleration stage, and brake release stage. Based on the driver's avoidance behavior pattern, four key variables are elected from the data, which include deceleration adjustment time, maximum deceleration rate, maximum deceleration time, and brake release time. Then, driver's characteristics variables (age and gender) and potential risk factors (time of day, marking, roadway type, and dressing color) were analysed to study their effect on the four key variables using the ANOVA. The results indicate that age, gender, roadway type, and dressing color have significant effect on the deceleration adjustment time. However, Time of day, and crosswalk marking has no effect on the deceleration adjustment time. In addition, age, gender, time of day, marking, and dressing color impact the maximum deceleration time. Among those, under 40 years old group, male drivers, daylight driving, crosswalk with marking, and bright color clothes increase the maximum deceleration time. On the contrary, under 40 years old group, male drivers, daylight driving, crosswalk with marking, and bright color clothes decreased the maximum deceleration rate. However, the roadway type only affects the maximum deceleration rate, and doesn't influence the maximum deceleration time. One lane with parking lane road has a higher deceleration rate than two-lane road. Last, age and dressing color are found to be significantly associated with the brake release time. Drivers who are over 40 years old have a lower brake release time than drivers who are under 40 years old. In addition, pedestrians with dark color clothes increased the brake release time than pedestrian with bright color clothes.

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Appendix A: IRB Approval Letter

University of Central Florida Institutional Review Board
Office of Research & Commercialization
12201 Research Parkway, Suite 501
Orlando, Florida 32826-3246
Telephone: 407-823-2901 or 407-882-2276
www.research.ucf.edu/compliance/irb.html

Approval of Human Research

From: **UCF Institutional Review Board #1**
FWA00000351, IRB00001138

To: **Ahmed E. Radwan and Co-PI: Hatem Ahmed Yassin Abou-Senna, Jiawei Wu**

Date: **February 22, 2016**

Dear Researcher:

On 02/22/2016, the IRB approved the following human participant research until 02/21/2017 inclusive:

Type of Review:	UCF Initial Review Submission Form
Project Title:	Evaluating Pedestrian-vehicle Conflict Using Driving Simulation
Investigator:	Ahmed E Radwan
IRB Number:	SBE-16-12032
Funding Agency:	
Grant Title:	N/A
Research ID:	1057178

The scientific merit of the research was considered during the IRB review. The Continuing Review Application must be submitted 30days prior to the expiration date for studies that were previously expedited, and 60 days prior to the expiration date for research that was previously reviewed at a convened meeting. Do not make changes to the study (i.e., protocol, methodology, consent form, personnel, site, etc.) before obtaining IRB approval. A Modification Form **cannot** be used to extend the approval period of a study. All forms may be completed and submitted online at https://iris.research.ucf.edu .

If continuing review approval is not granted before the expiration date of 02/21/2017, approval of this research expires on that date. When you have completed your research, please submit a Study Closure request in iRIS so that IRB records will be accurate.

Use of the approved, stamped consent document(s) is required. The new form supersedes all previous versions, which are now invalid for further use. Only approved investigators (or other approved key study personnel) may solicit consent for research participation. Participants or their representatives must receive a copy of the consent form(s).

All data, including signed consent forms if applicable, must be retained and secured per protocol for a minimum of five years (six if HIPAA applies) past the completion of this research. Any links to the identification of participants should be maintained and secured per protocol. Additional requirements may be imposed by your funding agency, your department, or other entities. Access to data is limited to authorized individuals listed as key study personnel.

In the conduct of this research, you are responsible to follow the requirements of the Investigator Manual.

On behalf of Sophia Dziegielewski, Ph.D., L.C.S.W., UCF IRB Chair, this letter is signed by:

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Joanne Muratori

Signature applied by Joanne Muratori on 02/22/2016 04:56:10 PM EST

IRB Manager