UNIVERSITY OF CENTRAL FLORIDA

Assessment of Pedestrian-Vehicle Conflicts with Different Potential Risk Factors at Midblock Crossings based on Driving Simulator Data

Jiawei Wu, PhD. Student
Essam Radwan, PhD., P.E.
Hatem Abou-Senna, PhD., P.E.

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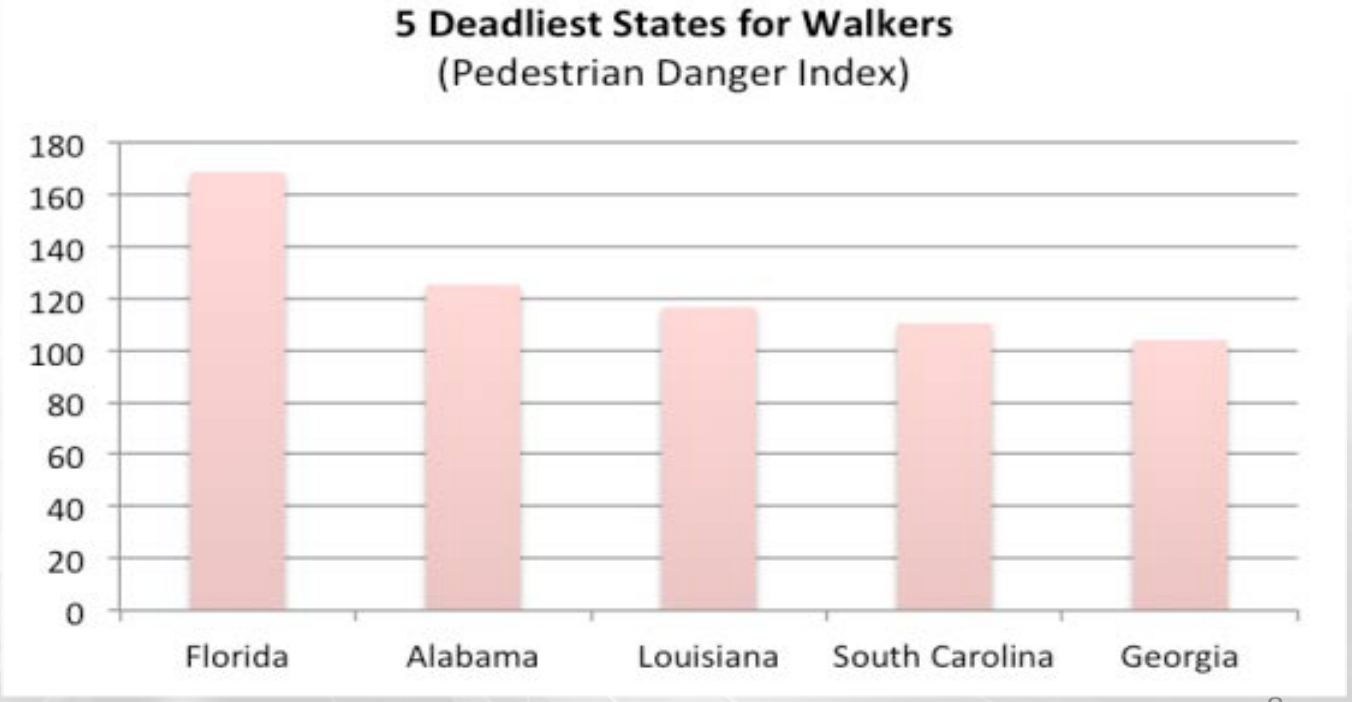
TRB

Background

- The State of Florida has consistently ranked as one of the worst states in terms of pedestrian crashes, injuries and fatalities (NHTSA, 2012).
- FL currently tops the list among all states with four metro areas as the most dangerous for peds (Ernst et al., 2014).

- **Orlando**
- **Tampa**
- **Jacksonville**
- **Miami**



Dangerous by Design Report, 2014

Background

- The main challenge in analyzing pedestrian crashes is to identify a practical and reliable exposure measure.
- Traffic conflict analyses provided an alternative to investigate safety using surrogate measures.
- VISSIM/SSAM are two promising softwares that can simulate these surrogate safety measures.
- Driving simulator data coupled with field and microsimulation data can assist with decision making.
- The main objective is to determine PET & TTC thresholds to assess the vehicle-pedestrian conflict at midblock crossings in driving simulator using surrogate safety measures after collecting field data and validating a simulation model.

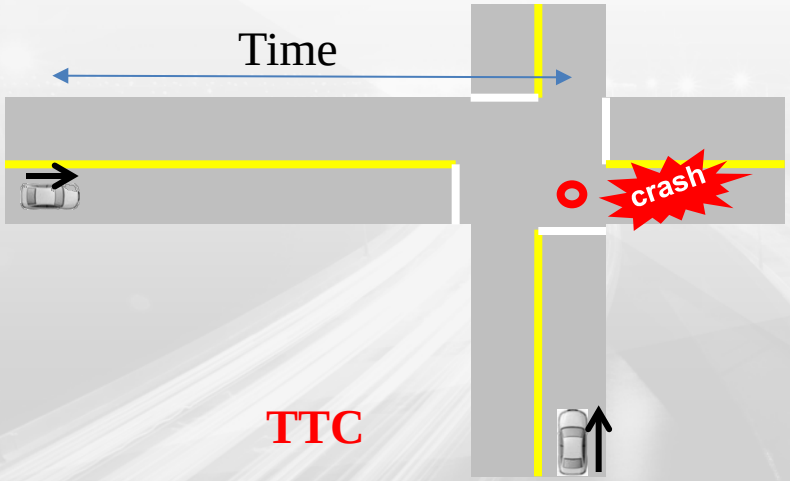
Field & Micro-Simulation Application

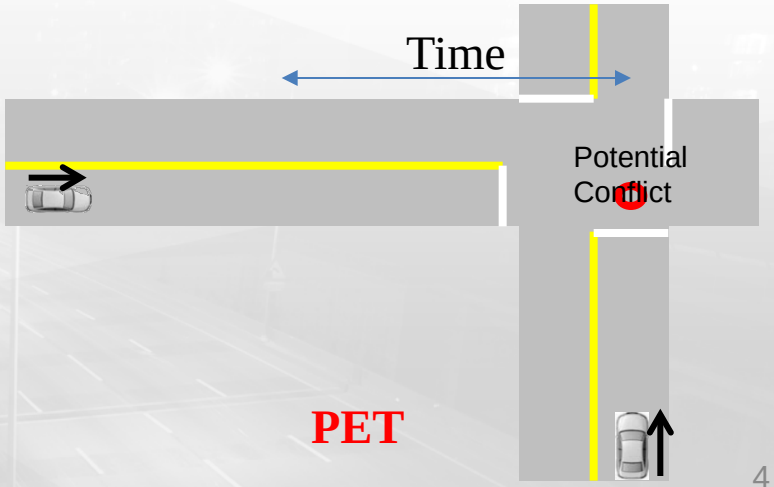
Field Data:

- 24-hr video data were collected at 2 mid-block crossings
- Veh Vol, Ped Vol, Ped Xing time, Ped Xing Speed, Ped-Veh Conflicts **(PET)**
- **Preliminary conflict observations indicated PET ranges from 6-9 sec.**

SSAM (Vehicle to Vehicle Model):

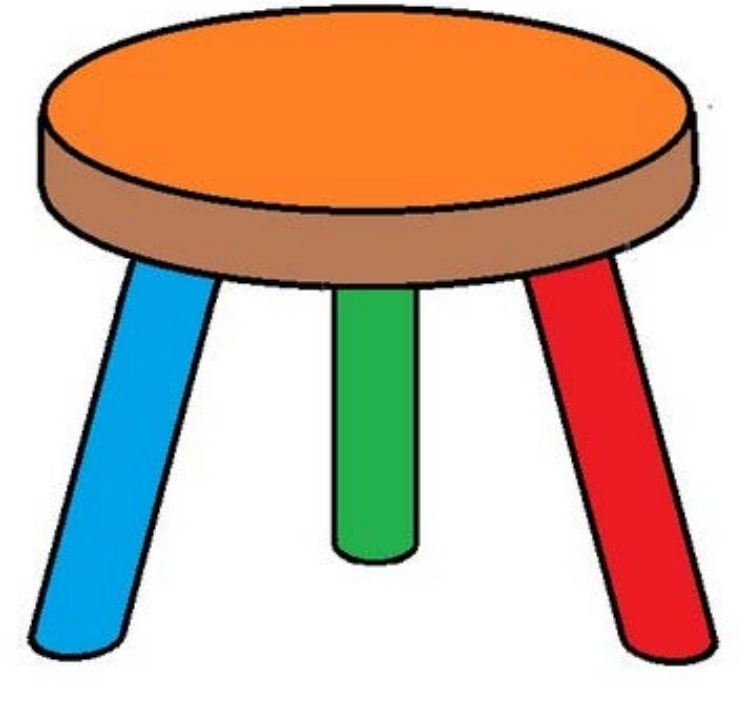
- Ped were modeled as vehicles in Vissim and calibrated
- **TTC** is defined as the time to collision of two road users if they keep their directions and velocities. Calibrated model resulted in **3-5 sec.**
- **PET** is defined as the period of time from the moment when the first road user is leaving the conflict area until the second road user reaches it.





3-Legged Stool

Better Understanding of Pedestrian Safety

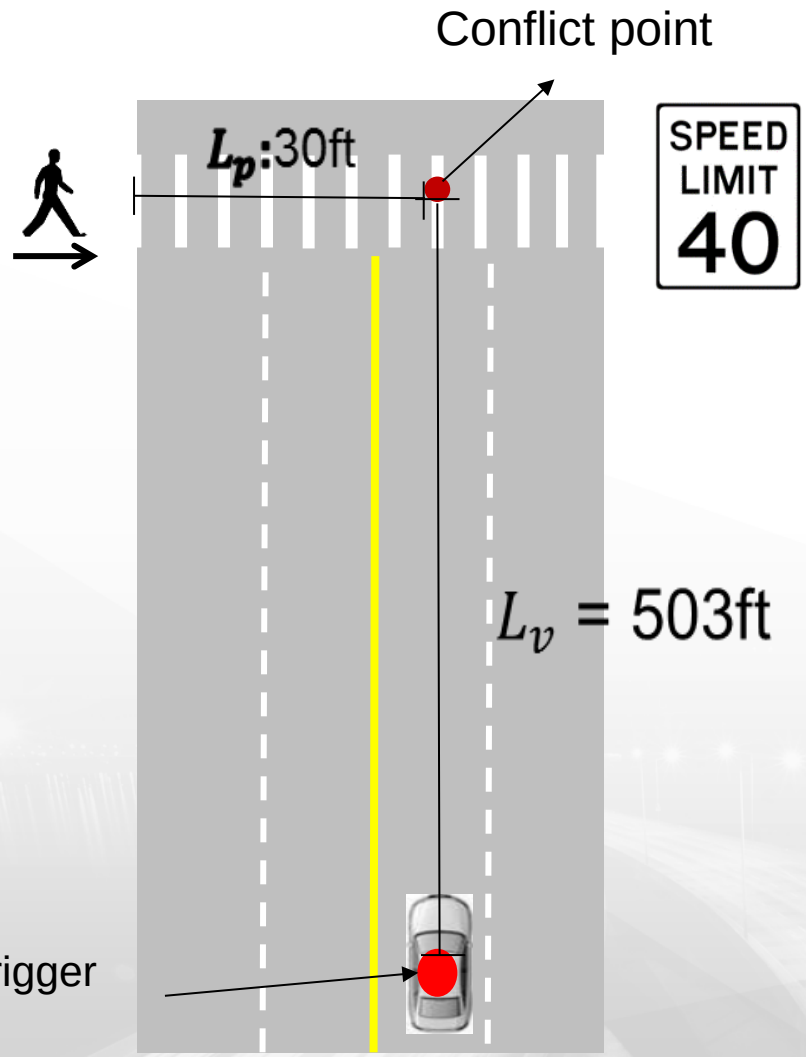


Field Data

Micro-Simulation

Driving Simulator

Design of Experiment



UCF driving simulator (NADS minisim)

Pedestrian:

$$t_{ped} = \frac{30ft}{3.5ft/s} = 8.57s$$

Vehicle:

$$L_v = t_{ped} * V = 8.57s * 40\ mph = 503\ ft$$

Potential Risk Factors

Factor	Description	Levels	
		Low Value (-1)	High Value (+1)
Time of day	The time in the scenario	Night	Daytime
Crosswalk marking	Whether the pedestrian uses crosswalk to cross the street	No	Yes
Roadway type	The roadway type when participants meet the pedestrian	One traveling lane with one parking lane for each direction	Two lanes for each direction
Pedestrian visibility	The color of the pedestrian clothes	Dark	Bright

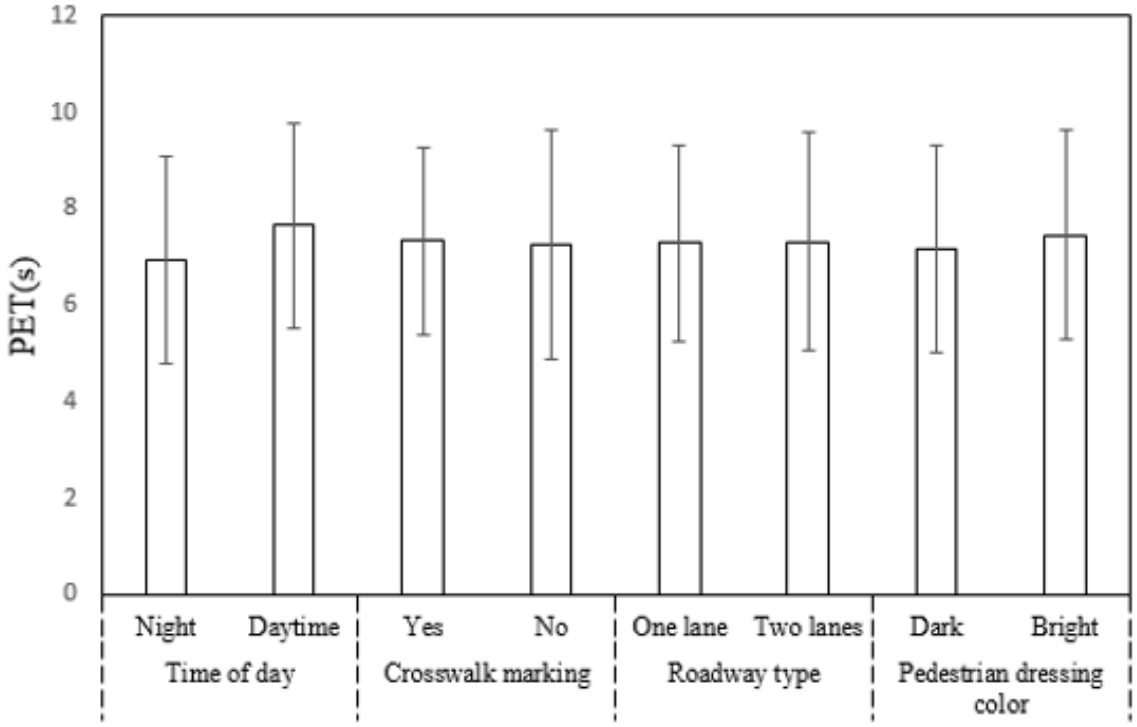
$2^4 = 16$ midblock crossings in the midblock scenario

Driving Simulator

- 36 drivers (19 Males and 17 females) successfully completed 576 scenarios
- The age of the participants ranged from 20 to 40 years.

Key Findings

- **Post-Encroachment time (PET)**

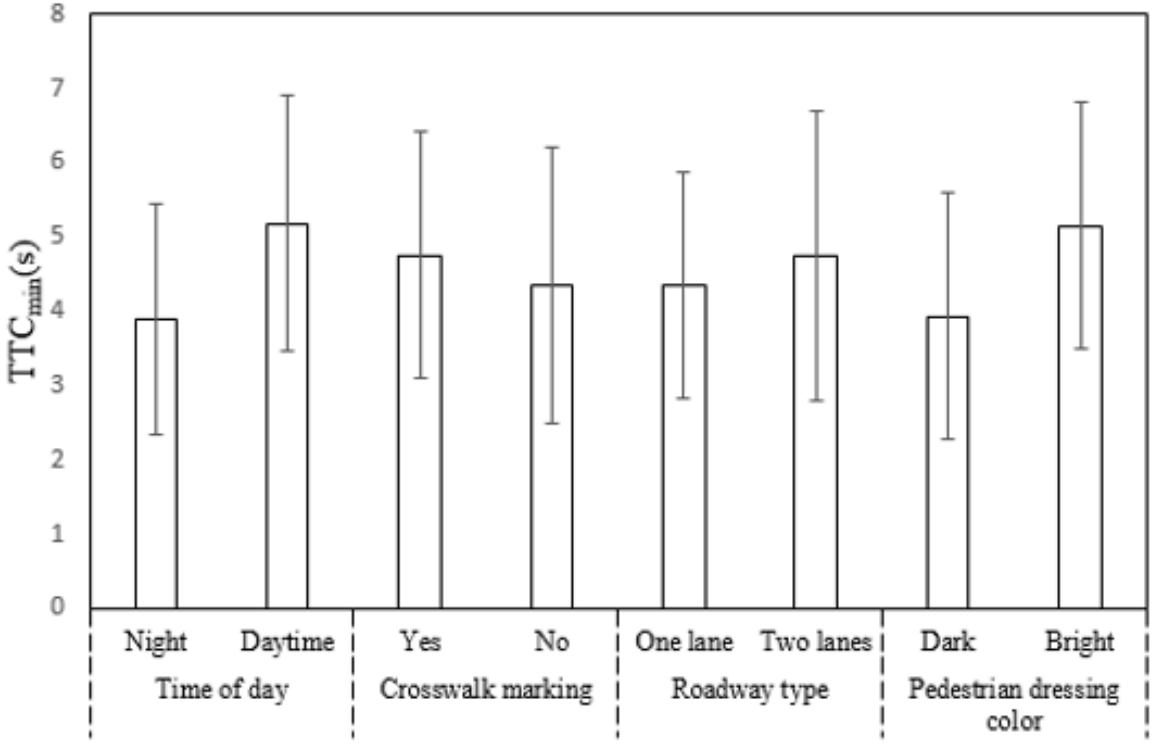


Factor	t-value
Time of day	-5.27*
Crosswalk marking	0.22
Roadway type	0.10
Pedestrian dressing color	-2.85*

- The results showed that time of day and the pedestrian dressing color exhibited significant influences on PET.
  - The conflict severity of daytime driving was lower than that of night time driving
  - The pedestrian with dark color also increased the conflict severity.

Key Findings

Time to Collision (TTC)

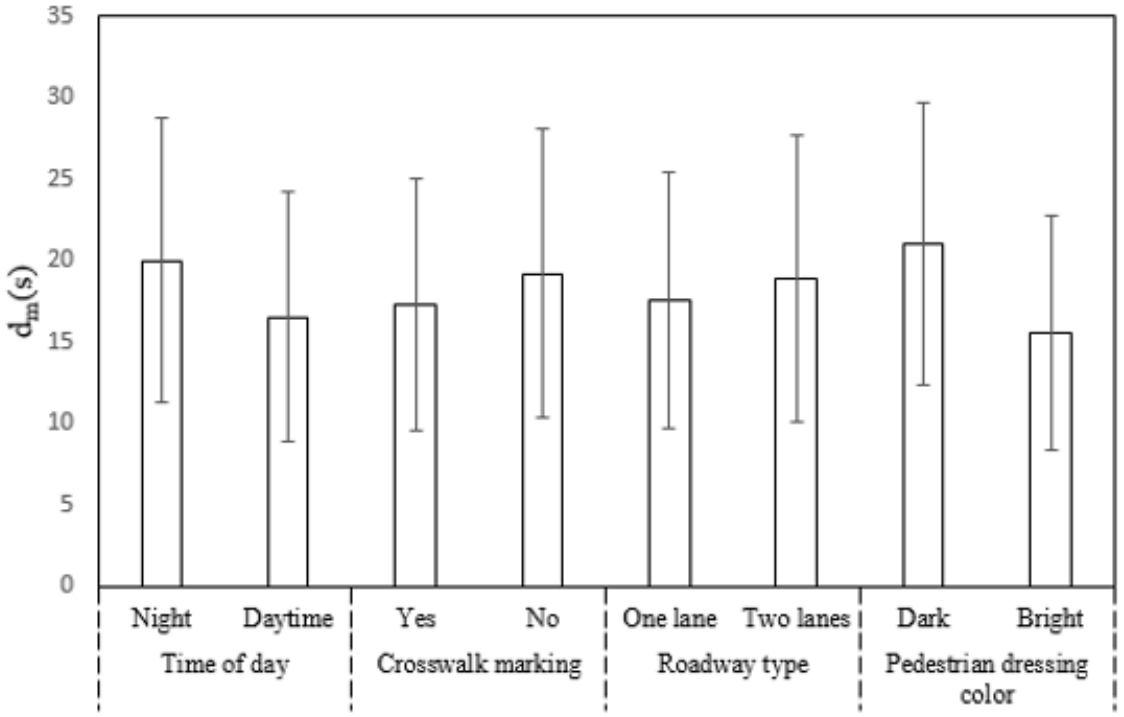


Factor	t-value
Time of day	-12.71*
Crosswalk marking	3.53*
Roadway type	-3.48*
Pedestrian dressing color	-11.79*

- All four potential risk factors illustrated significant impacts on TTC.
  - Nighttime driving, absence of crosswalk, one lane roadway, and ped wearing dark colors increased the conflict severity and significantly reduced the average minimum TTC to 3.9 seconds.

Key Findings

Maximum Deceleration



Factor	t-value
Time of day	-6.91*
Crosswalk marking	3.64*
Roadway type	2.59*
Pedestrian dressing color	-10.78*

- All four potential risk factors illustrated significant impacts on Max Dec.
  - Nighttime driving, absence of crosswalk, one lane roadway, and ped wearing dark colors increased the conflict severity and significantly increased the maximum deceleration to 20 ft/sec^2.