Characterization of Pedestrian Fatalities in Urban Arterial Corridors in Puerto Rico

Benjamín Colucci Ríos, PhD, PE, PTOE, FITE, PAE, JD
Professor
Spokesperson for the Decade of Action for Road Safety – Commonwealth of Puerto Rico
Abertis Chair
University of Puerto Rico

Dafne Valle Javier, ME
Graduate Student
University of Puerto Rico

Presentation Index

0. CONTENT

1. BACKGROUND AND INTRODUCTION:

- Pedestrian fatalities are a major concern to local and federal government officials.
- Puerto Rico has the highest pedestrian fatality rates in the United States with a total of 2.71 fatalities per 100,000 population (NHTSA 2012).
- The island pedestrian fatalities represent 31% of all traffic fatalities, which is almost 300% as compared to the national figure of 11% in the United States.

1. BACKGROUND AND INTRODUCTION (Cont.):

Year	Puerto Rico			United States		
	Total Fatalities	Pedestrian		Total Fatalities	Pedestrian	
		Fatalities	Percent (%)		Fatalities	Percent (%)
2002	519	177	34	43,005	4,851	11
2003	495	150	30	42,884	4,774	11
2004	495	162	33	42,836	4,675	11
2005	457	134	29	43,510	4,892	11
2006	508	140	28	42,708	4,795	11
2007	452	145	32	41,259	4,699	11
2008	406	130	32	37,423	4,414	12
2009	365	109	30	33,883	4,092	12
2010	340	101	30	32,885	4,280	13
2011	361	111	31	-	-	-
Total	4,398	1,359	31%*	360,393	41,472	11%*

* The average pedestrian fatalities in the last 10 years in PR represents 31% of the total of all crash fatalities versus 11% in the USA.

1. BACKGROUND AND INTRODUCTION (Cont.):

- Based upon this alarming pedestrian fatality statistic, a research study was conducted as part of the Dwight D. Eisenhower Fellowship Program for Hispanic Serving Institutions funded by the Federal Highway Administration.
- This pilot study concentrated on the Western Region, including its surrounding 9 municipalities and focusing on the PR-2 Urban Corridor which is part of the National Highway System.

1. BACKGROUND AND INTRODUCTION (Cont.):

Study Location and Main Characteristics:

Western Region of Puerto Rico:

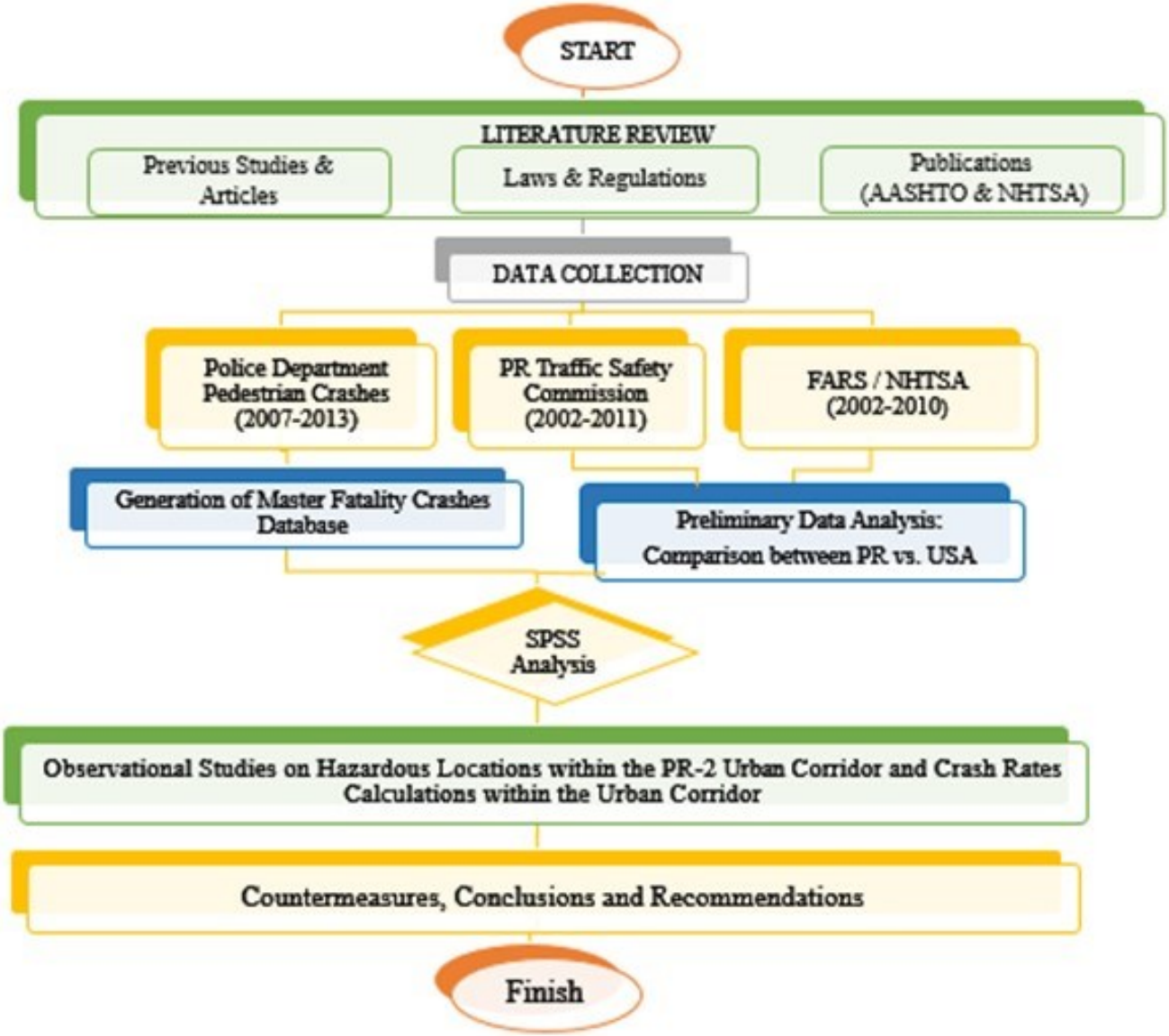
- Consist of 9 municipalities
- Total Population of 282,214 people
- Ranked among the top best coastal destination for tourism.

2. OBJECTIVES

- Create a database using the information gathered from the crash reports from the Puerto Rico Police Department.
- Characterize pedestrian crash data of the Western Region, which is located on the southwest corner of the island.
- Identify potential hazardous sites based on observation and pedestrian crash data.

Note: The study period covers the period from 2007 to 2013.

3. METHODOLOGY

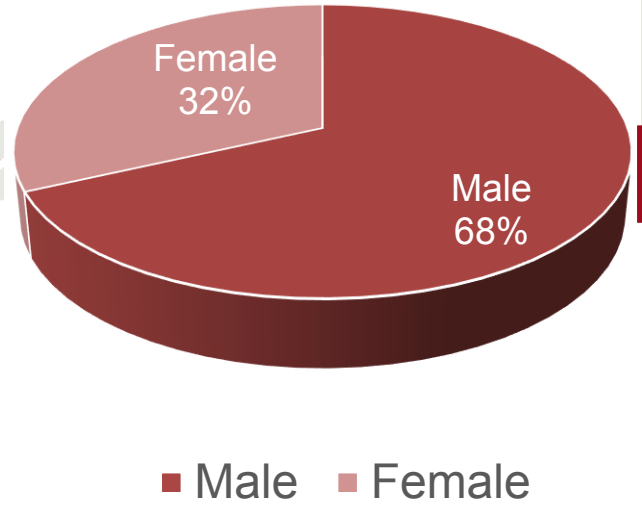


4. DATA ANALYSIS:
PEDESTRIAN CRASH ANALYSIS IN THE WESTERN REGION

Municipality	Population	Total Pedestrian Fatalities	Pedestrian Fatalities per 10,000 Population	Percentage (%)
Añasco	29,261	4	1.37	8
Cabo Rojo	50,197	14	2.79	28
Hormigueros	17,250	3	1.74	6
Lajas	25,753	3	1.16	6
Las Marías	9,881	1	1.01	2
Mayagüez	89,080	21	2.36	42
Sabana Grande	25,265	2	0.79	4
San Germán	35,527	2	0.56	4
Total	282,214	50	-	100%

- A total of 50 pedestrian fatalities occurred during the period covering from 2007 through February of 2013.
- The city of Mayagüez has the highest frequency of pedestrian fatalities with 42%.

4. DATA ANALYSIS (Cont.): PEDESTRIAN CRASH ANALYSIS IN THE WESTERN REGION

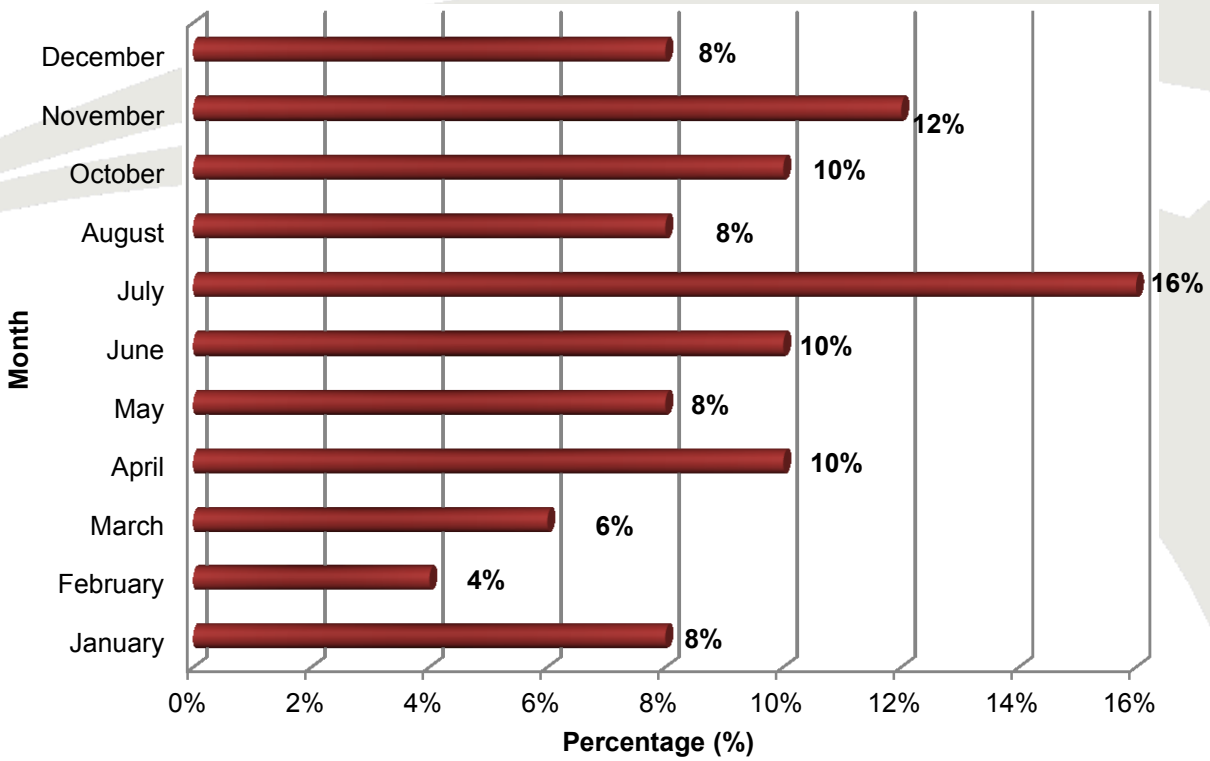


Male Age Distribution

- 0-15 years: 15%
- 16-25 years: 15%
- 26-35 years: 3.5%
- 36-45 years: 3.5%
- 46-55 years: 15%
- 56-65 years: 33%
- More than 66 years: 15%

4. DATA ANALYSIS (Cont.): PEDESTRIAN CRASH ANALYSIS IN THE WESTERN REGION

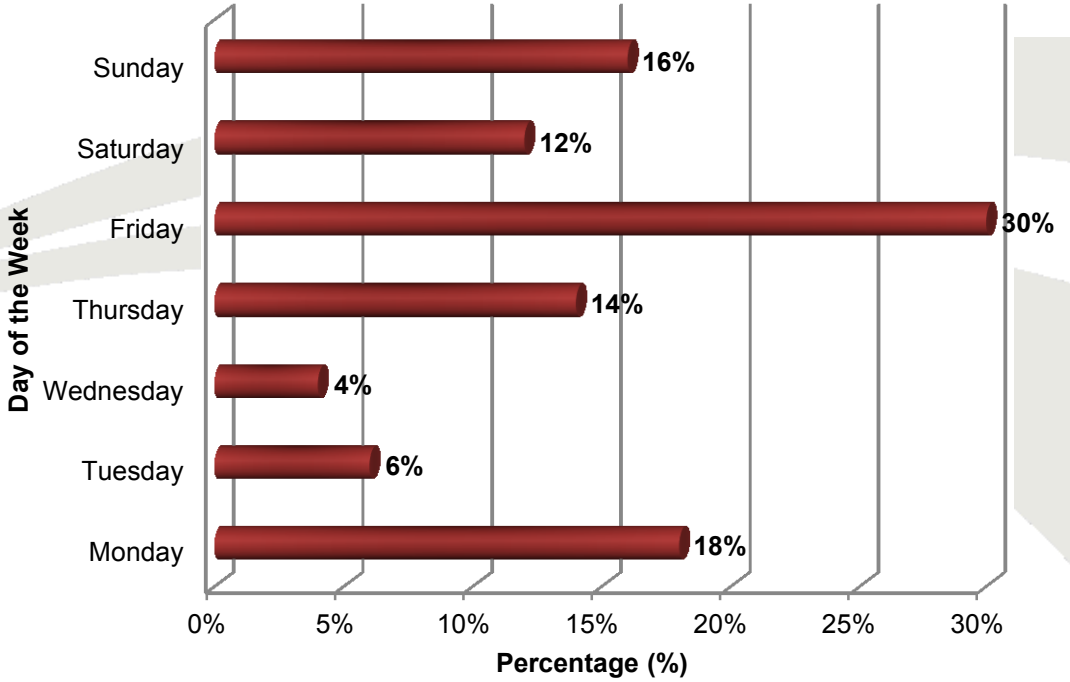
Pedestrian Crash Analysis - Month



The highest frequency of crash occurred on July which coincide with summer season in the West Region.

4. DATA ANALYSIS (Cont.): PEDESTRIAN CRASH ANALYSIS IN THE WESTERN REGION

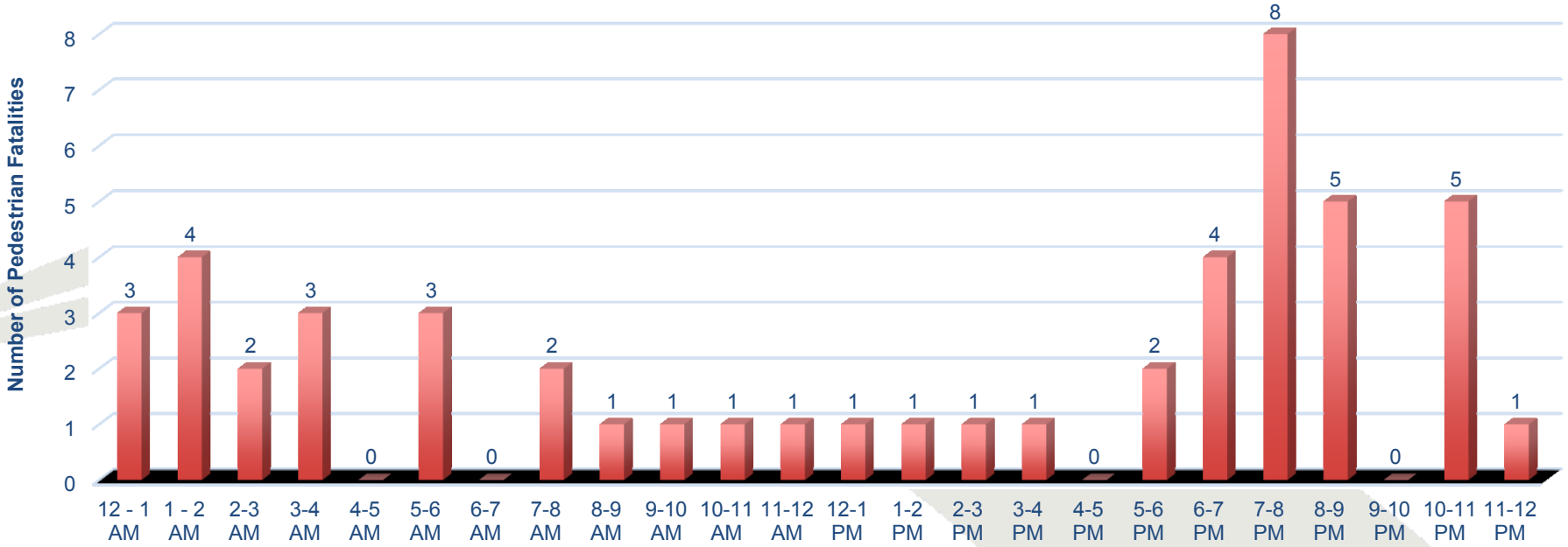
Day of the Week

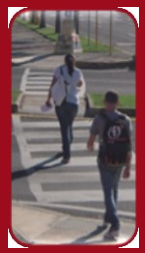


Almost 46% of the pedestrian fatalities occurred during weekends. (Friday Night, Saturday and Sunday)

4. DATA ANALYSIS (Cont.): PEDESTRIAN CRASH ANALYSIS IN THE WESTERN REGION

Pedestrian Fatal Crashes by Time of the Day

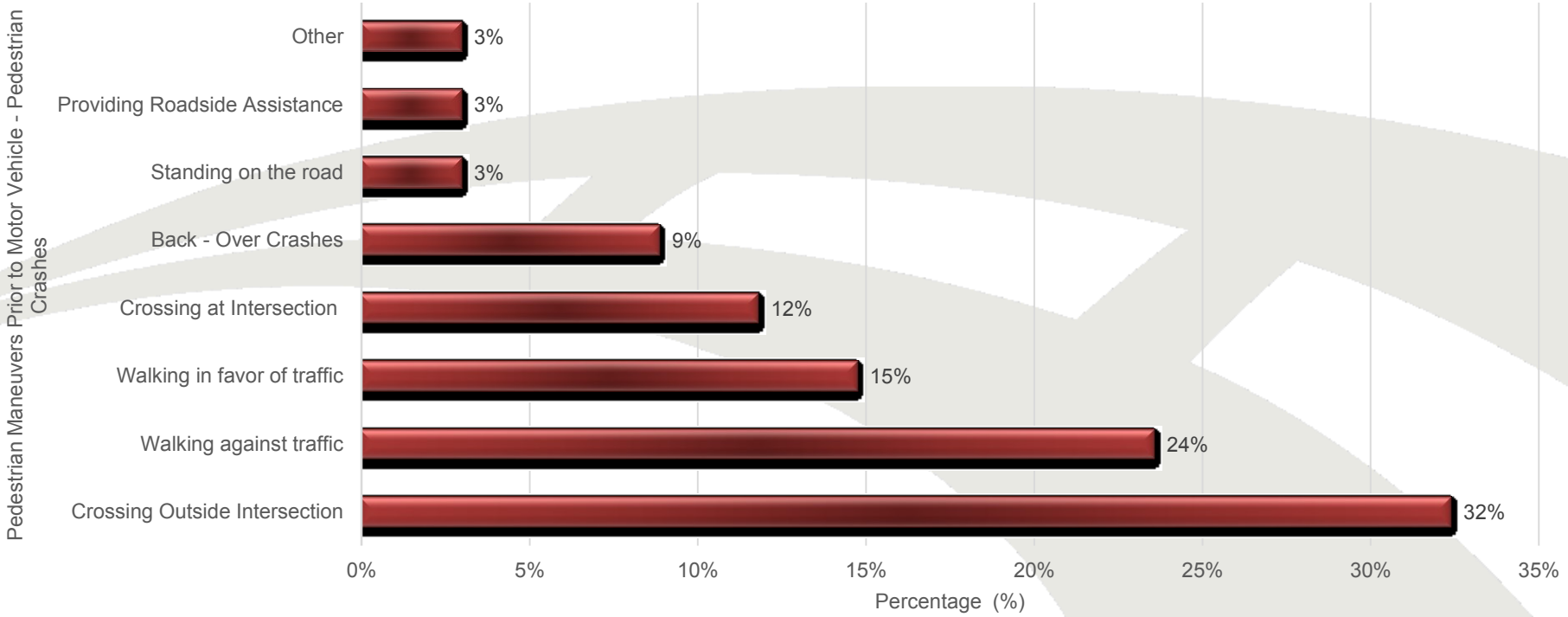




Two significant peak hour periods of pedestrian fatalities were found:
5:00 – 9:00 PM and 12:00 – 4:00 AM

4. DATA ANALYSIS (Cont.): PEDESTRIAN CRASH ANALYSIS IN THE WESTERN REGION

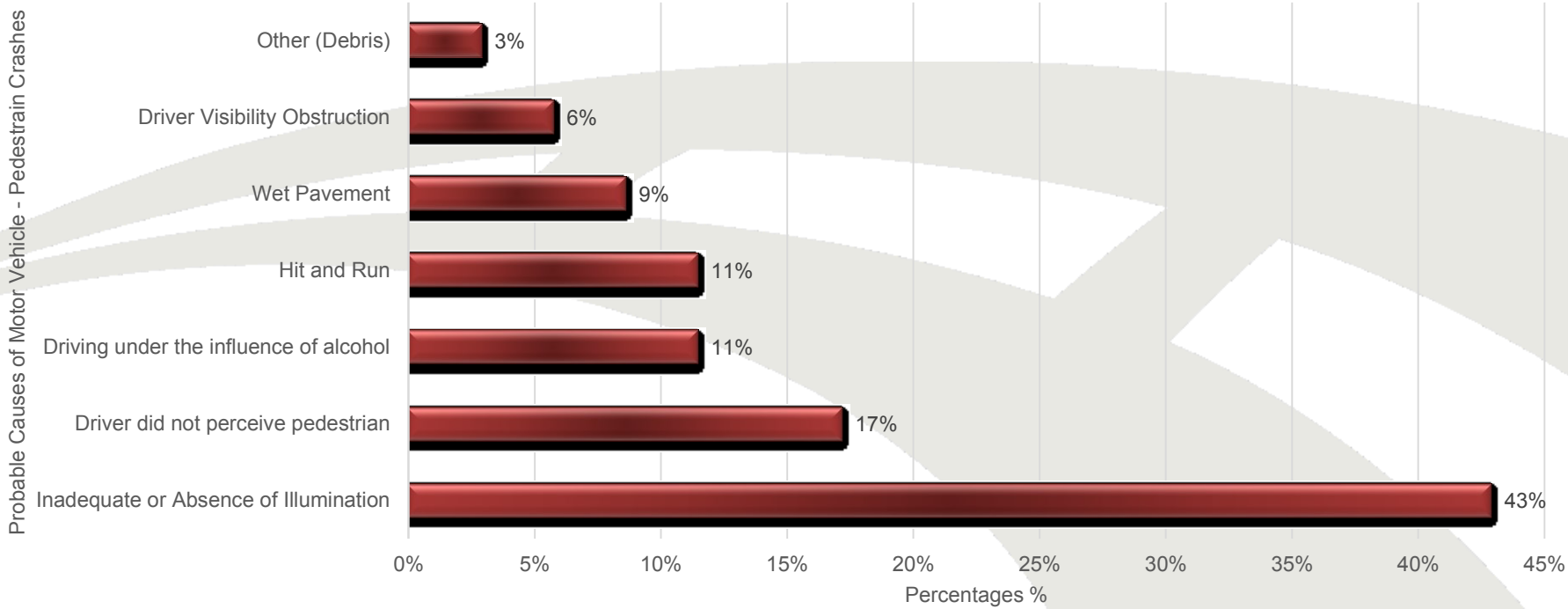
Pedestrian Maneuvers Prior to Motor Vehicle - Pedestrian Crash



The highest frequency corresponded to Crossing Outside Intersection with 32%.

4. DATA ANALYSIS (Cont.): PEDESTRIAN CRASH ANALYSIS IN THE WESTERN REGION

Probable Causes of Motor Vehicle - Pedestrian Crashes



The highest frequency corresponded to Inadequate or Absence of Illumination with 43%.

4. DATA ANALYSIS (Cont.): CRASH RATES FOR SEGMENTS IN THE PR-2 CORRIDOR IN MAYAGÜEZ

❖ Crash rates for segments are calculated using the fallowing formula:

$$R=(C \times 100{,}000{,}000)/(V \times 365 \times N \times L)$$

Where,

R= Crash Rates for Road Segments expressed as Crashes per 100 million vehicle – kilometers of travel

C = Number of Pedestrian Fatal Crashes in the Study Period

V = Average Annual Daily Traffic (AADT)

N= Number of Years within the Period of Study

L = Segment Lenght in kilometers

4. DATA ANALYSIS (Cont.):
PEDESTRIAN CRASH RATES FOR SEGMENTS IN THE PR-2 CORRIDOR IN MAYAGÜEZ

Study Period 2007-2013

Segment	Number of Crashes	Length (km)	AADT (veh/day)	Crash Rates
1. Sultana to Carolina Street	1	1.5	66,650	0.46
2. Carolina Street to Centro Médico Entrance	1	0.5	77,300	1.18
3. Centro Médico Entrance to Duscombe Avenue	1	1.1	77,300	0.54
4. Duscombe Avenue to Nenadich Street	2	0.8	68,700	1.66
5. Nenadich Street to Viaduct	3	0.31	59,800	**7.39**
6. Viaduct to Llorens Torres Avenue	3	1	51,500	2.66
7. Llorens Torres Avenue to Chardon Street	1	0.7	54,600	1.19
8. Chardon Street to PR-3108	1	0.8	51,000	1.12

5. PROPOSED SOLUTIONS

- The pedestrian crash analysis showed that the PR-2 Urban Corridor in the City of Mayagüez has the highest incidence of pedestrian fatalities of the Western Region.
- The PR-2 Urban Corridor is classified as a high speed, urban arterial that crosses the city from north to south.
- The urban corridor has frontage roads in several segments which provide access to traffic generators such as commercial, industrial, governmental and housing developments.
- As part of this study an inventory of pedestrian fatalities in the urban corridor was performed to better assess the situation in this hazardous corridor.

6. SOLUTION IMPLEMENTATION: FINDINGS OF THE PEDESTRIAN FACILITY INVENTORY ON PR-2 CORRIDOR

Sidewalks- 7% of the segments did not comply with the 1.52 meters minimum sidewalk width.

Crosswalks- 14% of the intersections had crosswalks that did not comply with the 1.83 meters minimum width.

Pedestrian Refuge Island – 43% of the intersections did not provide pedestrian storage areas.

Pedestrian Push Buttons – 21% of the intersections had pedestrian push buttons that were installed improperly pointing in the wrong direction.

Pedestrian Traffic Signals – 7% of the intersections had Pedestrian Traffic Signals that were not operating.

7. EVALUATION OF RESULTS AND NEXT STEPS

- The City of Mayagüez has the highest frequency of pedestrian fatal crashes with a total of 42%.
- The pedestrian crash analysis showed that the PR-2 Urban Corridor in the City of Mayagüez has the highest incidence of pedestrian fatalities with an approximate 26% of the total fatalities of the Western Region.
- A major achievement was to identify a hazardous segment within the PR-2 Urban Corridor. Cross tabulations and crash rate analysis determined that the segment between Nenadich Street and the viaduct had the highest incidence of pedestrian fatalities on the Corridor.
- In terms of traffic control devices, the observational studies performed showed a lack of a pedestrian refuge island and only 12 seconds for pedestrians to clear the crosswalk. During the night, the illumination provided by light poles were not uniform in the vicinity of the intersections evaluated.

7. EVALUATION OF RESULTS AND NEXT STEPS (cont.)

- Lack of enforcement of pedestrian crossing in crosswalks is a contributory factor for this high pedestrian fatality rate.
- Short term improvements for the corridor include the optimization of the traffic lights without increasing traffic delays. According to the HSM Crash Modification Factors, implementing this countermeasure can reduce the motor vehicle – pedestrian crashes by 50%.
- Other recommended countermeasures are the construction of a pedestrian refuge island and improvements on the illumination system along the corridor.
- Awareness campaigns are also recommended to move toward a culture of safety with zero pedestrian fatalities in Puerto Rico.

7. EVALUATION OF RESULTS AND NEXT STEPS (cont.)

- The inventory of the condition of the pedestrian facilities, and an analysis of potential countermeasures for each intersection on the PR-2 Urban Corridor was submitted to Puerto Rico Highway and Transportation Authority for evaluation and implementation.
- This assessment could potentially assist in the improvement of pedestrian facility conditions, and reducing pedestrian fatalities along the corridor.

8. ACKNOWLEDGEMENTS

❖ Special acknowledgement to the Puerto Rico Police Department personnel, to the Dwight D. Eisenhower Fellowship Program for Hispanic Serving Institutions sponsored by the Federal Highway Administration (FHWA) for the awarded fellowship and to the personnel of the Transportation Technology Transfer Center at the University of Puerto Rico at Mayagüez Campus.